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COMPARATIVE ANALYSIS OF BEHAVIOUR OF HORIZONTAL AND VERTICAL IRREGULAR BUILDINGS WITH AND WITHOUT USING SHEAR WALLS BY ETABS SOFTWARE

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ABSTRACT

Modern residential structure are going higher and higher these days. The impact of lateral loads in the form of wind/Earthquakes affects the performance of these structures dramatically. It is often a common practice among structural engineers to use shear walls in place of columns.

Shear walls are very common in high rise reinforced concrete building. In this study, comparative analysis of high-rise reinforced concrete irregular building with shear walls are present. The frame type of proposed building is used the special RC moment resisting frame. It belongs to seismic zone 2 This is why, seismic forces are essentially considered in the analysis of this building and shear walls are also provided to resist seismic forces.

Structural members are designed according to IS456-2000. The structure is analyzed by using ETABS v 9.7.1 software. Load consideration is based on Indian code. All necessary load combinations are considered in shear walls analysis and frame analysis. In addition wind load, seismic load is considered as external lateral load in the dynamic analysis. In dynamic analysis; Response Spectrum method is used.

For this purpose four multi storey building plans are considered that are horizontal irregular and vertical irregular models with and without shear walls .All the four buildings were analyzed for zone II. Modal Period with different configuration of building, Storey Displacement of structure with different configuration of building, Storey Drift with different configuration of building were studied and their comparison was done.

I. INTRODUCTION

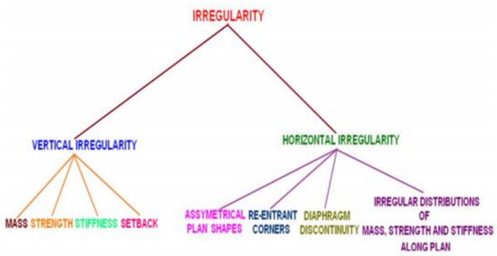
1.1 GENERAL

The forces acting on the structure must be described in order to build it to withstand earthquake and wind loads. It is impossible to predict the precise forces that will exist throughout the structure's lifetime. According to the boundary circumstances of each structure taken into consideration in the study to provide for life safety, the majority of National structure Codes specify certain variables. While it's necessary to have a reasonable estimate for these aspects, the project's economic feasibility and construction cost are crucial. The Egyptian Codes 1993 and 2003 place more emphasis on estimating these lateral loads and the related extra stresses that must be taken into consideration in the construction of the buildings since there are no earthquake or wind forecasting centres.

Points of weakness are where a building begins to collapse during an earthquake. This weakness results from discontinuities in the structure's mass, stiffness, and shape. Irregular structures are those that exhibit this discontinuity. A significant amount of urban infrastructure is made up of irregular structures. One of the main causes of structural collapses during earthquakes is vertical abnormalities. For instance, the most prominent constructions that fell were those with soft storeys. Thus, the impact of vertical abnormalities on a structure's seismic performance becomes crucial. These structures' dynamic properties vary from those of "regular" buildings due to height-wise variations in mass and stiffness. The definition of vertically irregular structures in IS 1893 is as follows:

Inconsistent mass, strength, and stiffness distributions across the building's height might be the cause of the irregularities in the structures. The analysis and design of such structures become more complex when they are built in seismically active areas. There are two different kinds of irregularities. The lateral force resisting system (L.F.R.S.) is the part of the structure that withstands seismic forces. The building's L.F.R.S. might be of several kinds. Shear walls, frame-shear wall dual systems, and special moment-resisting frames are the most prevalent types of these systems in a building. The position of the structurally weak planes in the building systems is often where deterioration to a structure begins. These flaws cause further structural degradation, which ultimately results in the collapse of the structure. These flaws are often brought on by structural abnormalities in a building system's mass, stiffness, and strength. Plan and vertical irregularities are two general categories for the structural irregularity. If a structure has an uneven distribution of mass, strength, and stiffness across the building height, it may be categorised as vertically irregular. According to IS 1893:2002, a storey is considered to have mass irregularity if its mass is more than 200% that of the storey next to it. A storey is said to be "weak" if its stiffness is less than 60% of that of the storey next to it. A storey is referred described as a "soft storey" if its stiffness is 70% or less than that of the storey next to it.

In actuality, there are irregularities in a lot of existing structures, and some of them were originally intended to be irregular in order to serve various purposes, such as commercial basements made possible by the removal of central columns. Additionally, the beams and columns in the top stories are being reduced in size to meet functional needs and for additional commercial uses, such as storing large mechanical equipment. Uneven mass, stiffness, and strength distributions across the building height are the consequence of a particular floor's use differing from that of the floors next to it. Furthermore, a lot of other structures are inadvertently made irregular by a number of causes, such as variations in the materials and construction methods. Along the design, the building may also have inconsistent mass, strength, and stiffness distributions. One may say that the building has a horizontal irregularity in this situation. Figure 1.1 provides a thorough categorisation of structural irregularities, whereas Tables 1.1 and 1.2 provide code limitations. It is evident from a survey of code restrictions that most codes prescribe comparable standards for abnormalities based on size, neglecting the impractical factor of irregularity location. It is clear from the actual examples of existing irregular structures in Figures 1.2 to 1.4 that irregular buildings are chosen for both practical and aesthetic reasons. As will be covered in the following section, historical earthquake data demonstrate these constructions' poor seismic performance during earthquakes. Figures 1.5 through 1.8 show the many kinds of anomalies.



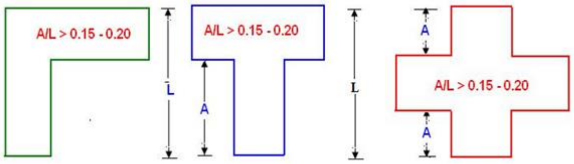


Figure 1.1 irregularity in the re-entrant corner

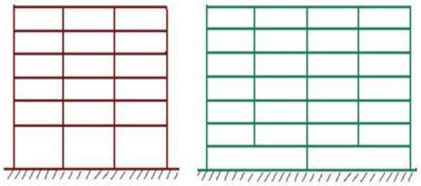


Figure 1.2 Uneven stiffness distribution in the building system

1.2 ETABS

A comprehensive coordinated programming bundle for the auxiliary study and outline of structures is the innovative and forward-thinking new ETABS. This most recent ETABS, which joins 40 years of relentlessly innovative work, offers unparalleled 3D protest-based demonstration and representation tools, lightning-fast straight and nonlinear explanatory power, sophisticated and comprehensive plan capacities for a wide range of materials, and clever realistic showcases, reports, and schematic illustrations that allow clients to quickly and easily translate and understand examination and configuration results.

Every step of the building configuration process is included by ETABS, from the beginning of outline generation to the production of schematic representations. Model creation has never been easier thanks to natural illustration fees that account for the rapidly evolving floor and rising surrounding. Computer-aided design drawings may be used as formats that can be layered with ETABS elements or converted directly into ETABS models. The industry-leading SAPFire 64-bit solver supports nonlinear exhibiting processes, such as development sequencing and temporal effects (e.g., creep and shrinkage), and makes it possible to swiftly analyse very large and complicated models.

1.3 FRAME:

Rectangular parts, beams, and columns joined in the same plane by stiff joints make up a rigid jointed R.C. frame. The construction stiffness of the columns, beams, and connections in the plane determines the lateral stiffness of such a frame. The frame might be in line with the façade or with one of the building's inner walls. The main benefit of rigid frames is their open, rectangular layout, which permits fast door and window installation and design flexibility. Up to around 25 storeys for steel framing and up to 15 stories for concrete framing, the rigid frame theory seems to be cost-effective. In order to limit drift, economical large numbers are required above these relatively modest lateral flexibilities of the frame.

The bending resistance of the girders, columns, and connections, as well as the axial rigidity of the columns in tall frames, are the primary factors that determine the horizontal stiffness of a rigid frame. The shear produces the cumulative horizontal shear above any story of ridig frames that are resisted by shear in columns. At mid-story height levels, the story-height columns will bend in a double curve with points of contraflexure. Attached girders, which likewise bend in double curvature, with points of contraflexure at around mid-span, resist the moments imparted to a junction from the column above and below.

1.4 MASONRY IN FILLED FRAMES

When designing a multistory structure, the main factor to be taken into account is the lateral stiffness against forces caused by wind or earthquakes. Using the composite stiffness and strength of the structural framework and the infill walls is one way to improve the lateral stiffness of a multistory structure. The most popular material for building in-filled frames is brick masonry. The way an in-filled frame interacts with the frame determines how it behaves. Panel proportion and the calibre of an infill job serve as the behavior's guiding principles. The system's behaviour is also significantly influenced by the infill's placement.

The mortar fractures under lateral stresses, resulting in separation and sliding at the frame-infill contact. The structural behaviour changes as a consequence of the stiffness loss brought on by this infill cracking. Failure arises from the constant reduction of stiffness and moment of inertia caused by cracking.

1.5 SHEAR WALL

Vertical stiffening components called shear walls are designed to withstand lateral stresses from earthquakes and winds. Shear walls' structural behaviour under lateral pressures is greatly influenced by their placement and form. Parallel to the force of action, lateral loads are dispersed to the shear walls via the structure functioning as a horizontal diaphragm. Because of their great stiffness as deep beams, these shear walls respond to shear and flexure to prevent overturning and withstand horizontal stresses. A core that is eccentrically positioned in relation to the building forms must be able to support tension in addition to bending and direct shear. However, when wind hits on the facades with direct surface textures (i.e., roughness) or when wind does not act via the centre of the building's mass, torsion may also emerge in buildings with symmetrical shear wall configurations (Schueller, 1977).

Compared to horizontal rigid frames, shear walls are much more rigid. Shear walls are thus cost-effective up to 35 floors. When shear walls and frames are coupled in low- to medium-rise structures, it is acceptable to assume that the shear walls will absorb all lateral stress, allowing the frame to be built for gravity loads alone.

1.6 OBJECTIVE OF THE STUDY

The project's primary goals are as follows:

1. To use IS 1893:2002 to investigate the seismic behaviour of multistory buildings
2. To evaluate the differences between regular and irregular multistory structures with and without shear walls.
3. To compare the story drift, shear force, bending moment, and building torsion outcomes of regular and irregular structures with and without shear walls.
4. To examine the structures using time history analysis in ETABS V9.7.4.

1.7 SUMMARY:

An overview of shear walls and their ability to withstand wind and seismic stresses is given in this section. Vertical components of the horizontal force-resisting system are called shear walls. Every level of the building, including the crawl area, should have shear walls. Shear walls of the same length should be symmetrically positioned on each of the building's four external walls to create an efficient box construction. When the outer walls are unable to offer enough strength and stiffness, or when the floor or roof diaphragm's permitted span-width ratio is exceeded, shear walls should be added to the inside of the structure. The span-width ratio for subfloors with traditional diagonal sheathing is 3:1. Accordingly, unless the external shear walls are insufficiently strong or rigid, a structure that is 25 feet wide and has this subfloor won't need interior shear walls until it is more than 75 feet long.

Shear walls are resistant to both shear and uplift pressures. The shear wall receives horizontal pressures from connections to the structure above. Between the top and bottom shear wall connections, this transfer produces shear pressures throughout the wall's height. The wall will break or "shear" apart if the timber, sheathing, and fasteners are not strong enough to withstand these shear pressures.

For shear walls to withstand horizontal seismic stresses, they must have the lateral strength required. Shear walls will transmit these horizontal forces to the subsequent element in the load path underneath them if they are sufficiently strong. These additional elements in the load stream might be slabs, footings, foundation walls, floors, or additional shear walls. Additionally, shear walls provide lateral rigidity to stop excessive side-swaying of the floor or roof above. Shear walls will keep components of the roof and floor framing from slipping off their supports if they are sufficiently rigid. Additionally, structures that are adequately rigid will often sustain less nonstructural damage.

II. LITERATURE REVIEW

Ramancharla Pradeep Kumar and Ravikanth Chittiprolu, "The Importance of Shear Walls in Highrise Irregular Buildings"

In order to comprehend lateral loads, story drifts, and torsion effects, an irregular high-rise structure with and without shear walls was the subject of this study. The findings suggest that in an irregular construction, shear walls are more resilient to lateral stresses.

According to the findings of this study, lateral load analysis and dynamic linear analysis utilising the response spectrum technique are carried out for both shear wall-equipped and non-shear wall structures. The outcomes for both examples' tale drifts and frame lateral pressures are contrasted. Additionally, when shear walls are introduced to frames with little lateral stresses at the proper places, lateral forces are shown to decrease. It follows that in an irregular construction, shear walls are more resilient to lateral stresses. They may also be utilised to lessen torsion's effects.

In 2018, Siva Naveen, Nimmy Miryam Abraham, and colleagues conducted an analysis of irregular structures subjected to seismic loads.

In order to create 34 configurations with a single irregularity and 20 instances with combinations of irregularities, a nine-story regular frame is altered in this work by adding irregularities in different forms in both plan and elevation. 54 unusual configurations are examined and contrasted with the regular configuration. Seismic loads are applied to each frame, and the structures' responses are calculated mathematically. Unevenness has been shown to significantly impact the seismic response. The configuration with mass, stiffness, and vertical geometric abnormalities has shown the highest reaction among the instances with combinations of irregularities, while stiffness irregularity has the greatest impact among the many kinds of single irregularities examined.

The structural behaviour of multi-story frames with single and multiple abnormalities is being examined, according to the study's findings. The findings show that the structural response is significantly impacted by irregularity. For frames with one or more anomalies relative to the standard arrangement, a change in response is shown in every example examined. According to the current research, the reaction is not always amplified when abnormalities are present. The structural response is reduced by certain combinations of imperfections. When compared to the standard arrangement under seismic stresses, every single irregularity instance that was examined shown an increase in reaction. The arrangements with vertical geometric irregularity have responded the best among these situations. Stiffness and vertical geometric irregularities have shown the greatest displacement reaction, whereas re-entrant corners and vertical geometric irregularities have demonstrated the least displacement response. Combinations of irregularities in architecture are unavoidable in the contemporary society, since individuals are unwilling to compromise on their requirements. The kind, position, and degree of irregularity all affect the structural response, therefore these aspects must be considered while constructing any building. This would make it easier to add abnormalities to structures without affecting how well they work.

"Seismic Analysis of Regular & Vertical Geometric Irregular RCC Framed Building," Dileshwar Rana, Prof. Juned Raheem, et al. (2015)

The performance and behaviour of regular and vertical geometric irregular RCC-framed structures under seismic motion are shown in this article. This project uses five different architectural geometry types: four irregular frames and one conventional frame. All of these building layouts are compared in terms of height and bay. The program Staad. Pro V8i is used to model and analyse every construction frame. Shear force, bending moment, storey drift, storey displacement, and other earthquake reactions are measured. The seismic analysis follows section (1) of IS 1893:2002. For every scenario, medium soil strata and seismic zone IV are used. Along varying heights, a difference in the seismic reaction is seen.

The study's findings indicated that as setback grows, so does the critical shear force. The shear stress of regular building frames is much lower than that of setback irregular structures. For all building heights, irregular frames have a greater critical bending moment than regular frames. This is because setbacks cause building frames to become less rigid. Therefore, more reinforcement is required for uneven frames. It is evident that, up to an eight-story building height, the essential seismic parameter of four-bay building frames is lower than that of comparable eight-bay building frames. As a result, four-bay buildings are suitable for lower construction heights. Because 8 bay layouts often have lower values of important seismic characteristics than 4 bay, they should be used for higher story buildings (12 and 16 stories). Therefore, our research showed that both regular and setback buildings' seismic performance improves as the number of bays increases. In almost every instance, regular frame R's seismic performance is shown to be superior to that of equivalent irregular frames. Thus, it ought to be built with the least amount of seismic impact in mind. According to Hema Mukundan, S. Manivel, et al. (2015), "Effect of Vertical Stiffness Irregularity on Multi-Storey Shear Wall-framed Structures using Response Spectrum Analysis," Type V1 building design is superior to other setback frame configurations.

This study presents a ten-story building in Zone IV that uses reinforced concrete shear wall-framed constructions to lessen the impact of earthquakes. Response spectrum analysis was performed using ETABS version 9.7.4 to tabulate the data in the form of storey drifts, mode shapes, maximum storey displacements, and base shear responses. By making holes in the shear wall and altering its thickness along the story, the effect of irregularity was investigated.

The findings suggest that shear walls in regular or irregular structures are more resilient to lateral stresses. When a shear wall was added to the construction, the moments in the columns decreased. When a shear wall is installed, the building's maximum storey displacement is decreased by 50%. The most distorted shape is shown by mode shape 2. Even with holes and different thicknesses, shear walls are sturdy and stable enough to withstand earthquake stresses. The shear wall's thickness should be between 150 and 400 mm for a safer design.

III. MODELLING OF SHEAR WALL

Shear wall models created for the lateral load analysis of multistory buildings in elastic regions are shown in this chapter. because building structural modelling techniques are examined independently. Studies on shear wall modelling may also be conducted using two- and three-dimensional methods.

3.1 TWO DIMENSIONAL (PLANAR) SHEAR WALL MODELS

Several shear wall models that were created for the two-dimensional elastic analysis of multistory building structures are mentioned in the literature. This section provides a review of various models.

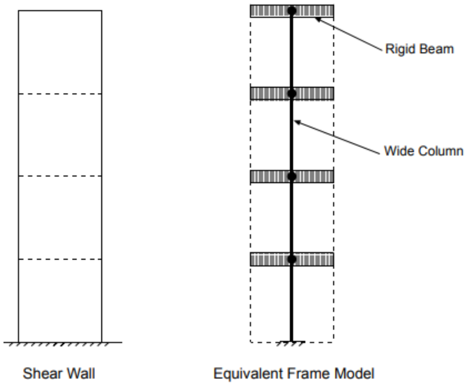


Fig :3.1 Equivalent Frame Model of a Shear Wall

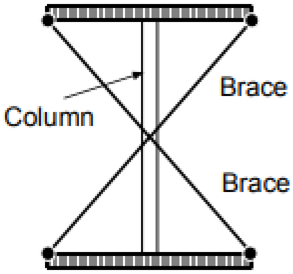


Fig :3.2 Braced Wide Column Module

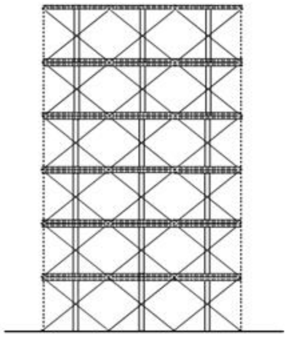


Fig :3.3 A Planar Shear Wall Modelled by Braced Wide Column Analogy

3.1.3 FINITE ELEMENT MODELS

A two-dimensional shear wall is broken up into smaller, finite-size, and finite-number components for finite element modelling. These components might be quadrilateral, rectangular, or triangular. The two-dimensional shell element is the most often utilised plane stress element for shear wall analysis. At each node, it has three degrees of freedom: two translations and one rotation. The finite element approach is frequently utilised for a variety of engineering challenges, not only designing multistory buildings. A finite element model of a connected shear wall is shown in Figure 3.5. Figure 3.6 shows a rectangular shell element.

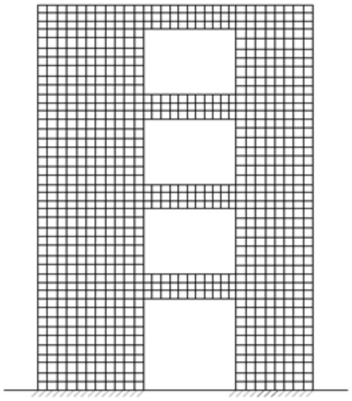


Fig :3.5 Finite Element Model of a Coupled Shear Wall

The choice of how many elements will be utilised to simulate the shear walls is a crucial one in finite element analysis. A finer mesh may provide more accurate results, but it may take longer to run overall. Analysis should have an ideal number of finite elements.

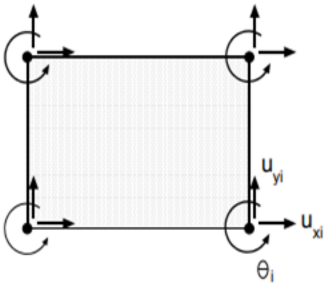


Fig :3.6 A Rectangular Shell Element with Three D.O.F. at Each Node

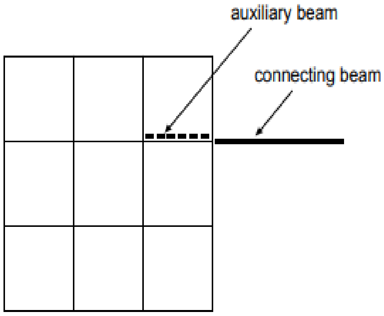


Fig :3.7 Plane Stress Elements with Horizontal Auxiliary Beam

3.2 SHEAR WALL MODELS FOR THREE DIMENSIONAL ANALYSIS

Shear wall models are often modified versions of two-dimensional models that are utilised in three-dimensional structural research. The most popular of these models are examined in the pages that follow.

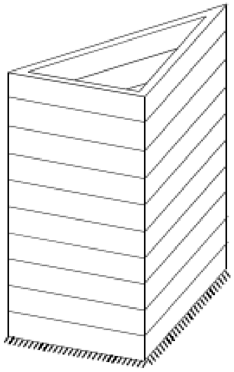


Fig :3.10 Triangular Core [66]

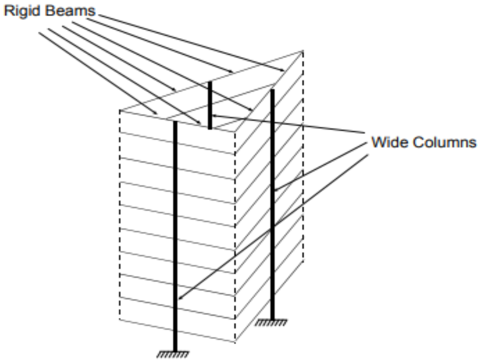
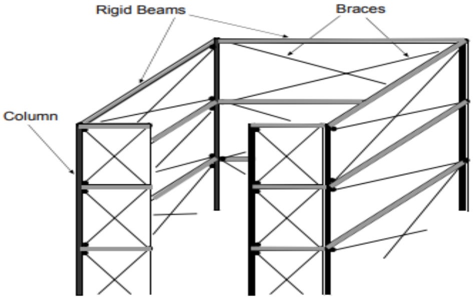


Fig :3.11 Equivalent Frame Model of a Triangular Core [66] of core structures.

3.2.3 TWO – COLUMN ANALOGY

Smith and Jesien [70] suggested using the two-column analogy to analyse single core walls or cores, which are components of larger surrounding structures that are exposed to lateral stress. Two columns, representing the warping and St. Venant torsional modes, are positioned on opposing sides of the shear centre and on one of the primary bending axes of the core to form the model. Each of the two columns shares the core's attributes. Figure 3.13 provides an illustration of this concept for a U-shaped core. According to a study [70], when compared to the data obtained from shell elements, the deflections and stresses achieved by the suggested approach were within 10% and 20%, respectively.

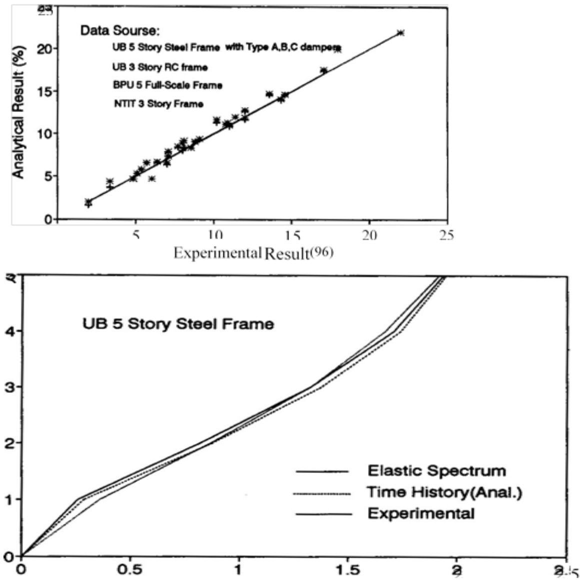


IV. METHODOLOGY AND MODELLING OF BUILDING

4.1 METHODOLOGY

Time History Analysis

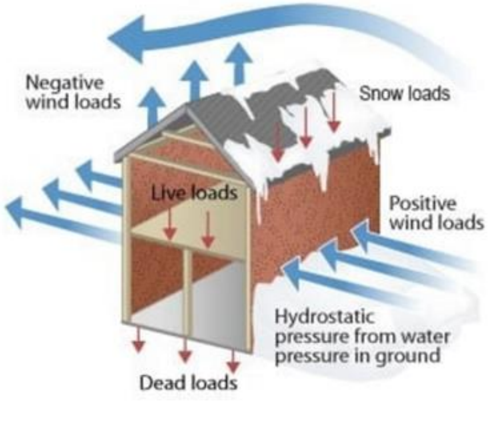
Seismic response evaluations may be performed using the available dynamic analysis packages once the damping ratios of the viscoelastically damped structure have been assessed. A five-story model's average time history response prediction and test result under the 0.6-g Hachinohe earthquake are shown in Figure 6 (Chang et al. 1995). In this work, the modal strain energy approach is added to the modified computer software ETABS, which models the VE damper assemblies as truss components. Numerous such research have been conducted, and the findings indicate that if the damping ratios of the structure can be precisely anticipated initially, the elastic time-history response of viscoelastically damped structures may be well predicted.



Analysis of the response spectrum, 0.6g El Centro, lateral displacement, 15% dampening Graph 2.

4.2 DIFFERENT TYPES OF LOADS ACTING ON THE STRUCTURE

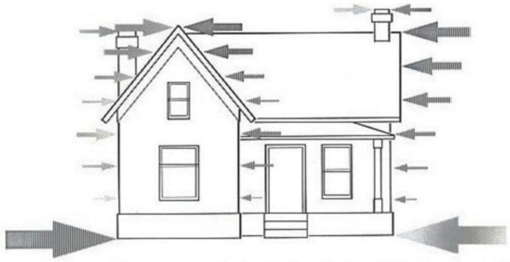
Vertical, horizontal, and longitudinal loads are the three general categories of loads that are applied to buildings and other structures. Dead loads, living loads, and impact loads make up the vertical loads. Wind and seismic loads are included in the horizontal loads. When designing bridges, gantry girders, and other structures, longitudinal loads—that is, tractive and braking forces—are taken into account.



Earthquake loads (EL)

Both vertical and horizontal forces acting on the structure are caused by earthquakes. Three mutually perpendicular directions—typically interpreted as vertical and two horizontal—can be distinguished from the entire vibration induced by an earthquake.

There are no appreciable forces in the superstructure as a result of vertical motions. However, while planning, the building's horizontal displacement during an earthquake must be taken into account.



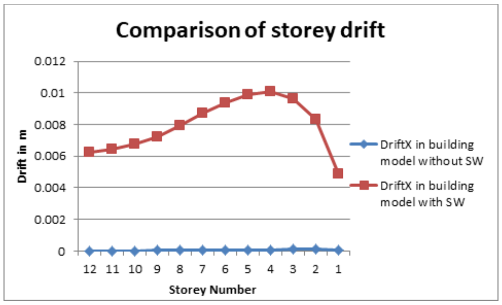
All parties of a structure experience "whipping" forces as a result of horizontal earthquake forces, or back-and-forth shaking. These pressures have to go from the building's many components to the foundation.

V. RESULTS AND ANALYSIS

Horizontal irregularity

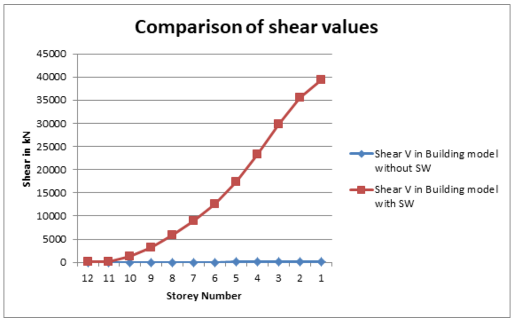
Storey drift

Storey Number	Load	Drift X in building model without SW	Drift X in building model with SW
12	TH	0.000011	0.006268
11	TH	0.000016	0.006472
10	TH	0.000022	0.006786
9	TH	0.000028	0.007236
8	TH	0.000034	0.007948
7	TH	0.000042	0.008711
6	TH	0.000053	0.009396
5	TH	0.000068	0.009903
4	TH	0.000087	0.010076
3	TH	0.000106	0.009662
2	TH	0.000116	0.008329
1	TH	0.000085	0.004901



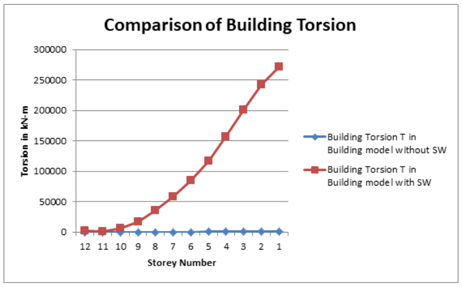
Storey shear

Storey Number	Load	Shear V in Building model without SW	Shear V in Building model with SW
12	TH	2.3	46.06
11	TH	5.44	66.86
10	TH	8.92	1248.31
9	TH	12.31	3276.04
8	TH	15.39	5865.01
7	TH	18.76	8899.19
6	TH	23.77	12588.19
5	TH	31.82	17328.82
4	TH	43.16	23251.46
3	TH	56.18	29751.94
2	TH	67.68	35465.43
1	TH	74.63	39342.2



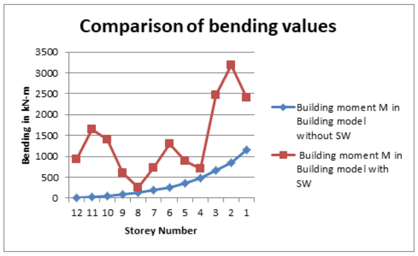
Storey bending

Storey Number	Load	Building Torsion T in Building model without SW	Building Torsion T in Building model with SW
12	TH	12.927	1825.724
11	TH	32.292	1311.517
10	TH	55.578	6044.313
9	TH	79.729	17393.08
8	TH	102.861	35247.04
7	TH	128.371	57986.004
6	TH	165.2	84707.543
5	TH	222.716	116859.202
4	TH	302.69	156352.379
3	TH	393.846	200991.439
2	TH	473.853	241977.704
1	TH	521.755	270892.993



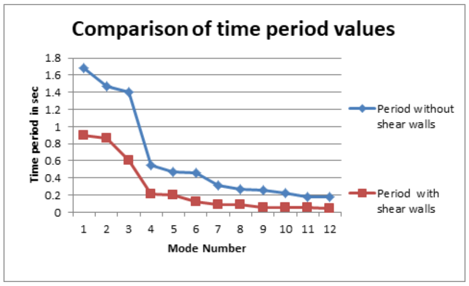
Story moment

Storey Number	Load	Building moment M in Building model without SW	Building moment M in Building model with SW
12	TH	6.914	921.884
11	TH	23.243	1646.243
10	TH	50.005	1400.799
9	TH	86.922	602.239
8	TH	133.1	254.339
7	TH	189.382	734.579
6	TH	260.704	1302.741
5	TH	356.164	886.691
4	TH	485.647	702.744
3	TH	654.196	2465.554
2	TH	857.242	3184.758
1	TH	1155.748	2396.963



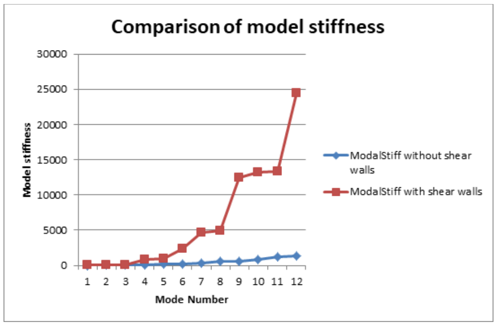
Time period

Mode	Period without shear walls	Period with shear walls
1	1.684245	0.899068
2	1.467016	0.861993
3	1.401821	0.604059
4	0.553039	0.20862
5	0.472709	0.202902
6	0.455704	0.127639
7	0.318777	0.092346
8	0.265322	0.089557
9	0.258801	0.056351
10	0.220338	0.054543
11	0.178972	0.054444
12	0.173529	0.040222



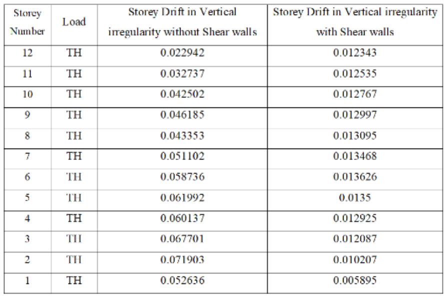
Model stiffness

Mode	Modal Stiffness without shear walls	Modal Stiffness with shear walls
1	13.917118	48.83994
2	18.343819	53.13149
3	20.08976	108.1935
4	129.077041	907.0844
5	176.67363	958.9328
6	190.10555	2423.209
7	388.495924	4629.359
8	560.808195	4922.199
9	589.424522	12432.61
10	813.166652	13270.25
11	1232.503891	13318.8
12	1311.039476	24402.18

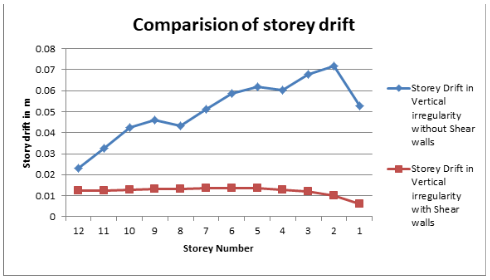


Vertical irregularity

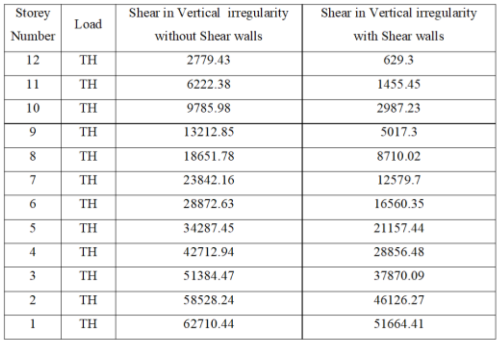
Storey drift



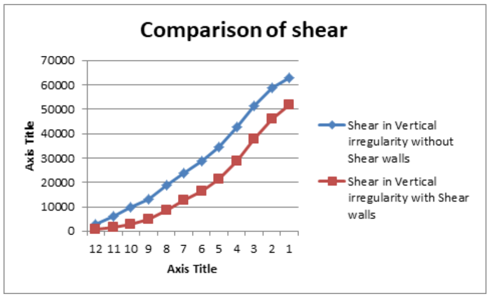
Storey Number	Load	Storey Drift in Vertical irregularity without Shear walls	Storey Drift in Vertical irregularity with Shear walls
12	TH	0.022942	0.012343
11	TH	0.032737	0.012535
10	TH	0.042502	0.012767
9	TH	0.046185	0.012997
8	TH	0.043353	0.013095
7	TH	0.051102	0.013468
6	TH	0.058736	0.013626
5	TH	0.061992	0.0135
4	TH	0.060137	0.012925
3	TH	0.067701	0.012087
2	TH	0.071903	0.010207
1	TH	0.052636	0.005895



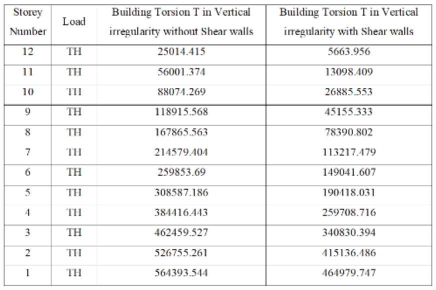
Storey shear



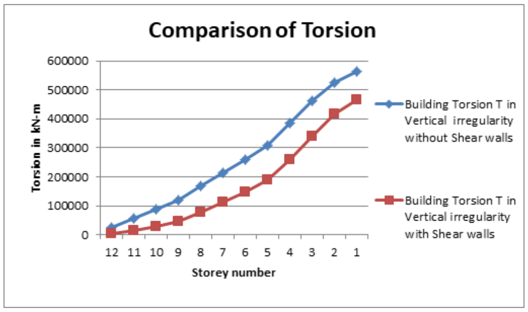
Storey Number	Load	Shear in Vertical irregularity without Shear walls	Shear in Vertical irregularity with Shear walls
12	TH	2779.43	629.3
11	TH	6222.38	1455.45
10	TH	9785.98	2987.23
9	TH	13212.85	5017.3
8	TH	18651.78	8710.02
7	TH	23842.16	12579.7
6	TH	28872.63	16560.35
5	TH	34287.45	21157.44
4	TH	42712.94	28856.48
3	TH	51384.47	37870.09
2	TH	58528.24	46126.27
1	TH	62710.44	51664.41



Storey Torsion

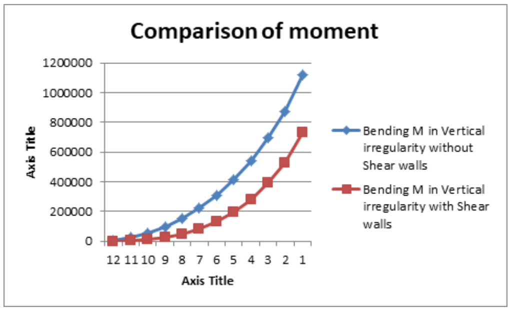


Storey Number	Load	Building Torsion T in Vertical irregularity without Shear walls	Building Torsion T in Vertical irregularity with Shear walls
12	TH	25014.415	5663.956
11	TH	56001.374	13098.409
10	TH	88074.269	26885.553
9	TH	118915.568	45155.333
8	TH	167865.563	78390.802
7	TH	214579.404	113217.479
6	TH	259853.69	149041.607
5	TH	308587.186	190418.031
4	TH	384416.443	259708.716
3	TH	462459.527	340830.394
2	TH	526755.261	415136.486
1	TH	564393.544	464979.747



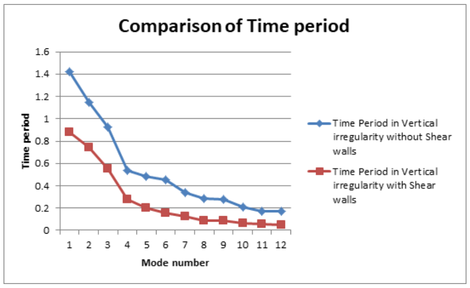
Story moment

Storey Number	Load	Bending M in Vertical irregularity without Shear walls	Bending M in Vertical irregularity with Shear walls
12	TH	8338.275	188.615
11	TH	27005.419	2855.667
10	TH	56363.354	10118.069
9	TH	96001.889	23470.677
8	TH	151957.232	47901.445
7	TH	223483.701	83941.236
6	TH	310101.581	131922.975
5	TH	412963.921	193696.003
4	TH	541102.755	278566.146
3	TH	695256.161	390477.116
2	TH	870840.894	527156.64
1	TH	1121682.648	730793.305



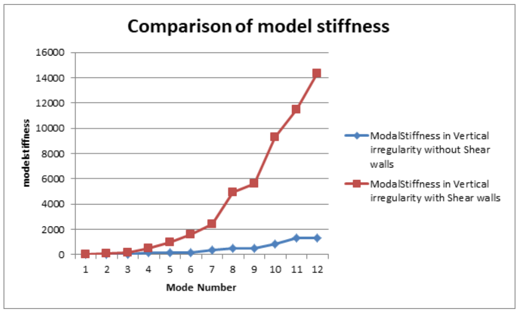
Time period

Mode	Time Period in Vertical irregularity without Shear walls	Time Period in Vertical irregularity with Shear walls
1	1.424853	0.878918
2	1.146968	0.742036
3	0.927542	0.550101
4	0.535682	0.280431
5	0.485372	0.199011
6	0.456301	0.156846
7	0.337367	0.127382
8	0.287446	0.089603
9	0.277901	0.083991
10	0.213323	0.065243
11	0.173597	0.05874
12	0.172108	0.052456



Model stiffness

Mode	ModalStiffness in Vertical irregularity without Shear walls	ModalStiffness in Vertical irregularity with Shear walls
1	19.44551	51.104935
2	30.009393	71.698526
3	45.887354	130.45927
4	137.577087	502.005736
5	167.575598	996.794359
6	189.6081	1604.760192
7	346.860934	2432.989368
8	477.802111	4917.111126
9	511.187403	5596.190627
10	867.527247	9274.447849
11	1310.01898	11441.73154
12	1332.776757	14347.01484



VI. CONCLUSION

The following findings were drawn from this investigation:

1. When a building has horizontal irregularities and a shear wall situation, the storey drift values are found to be considerable.
2. In structures with horizontal irregularity, the shear bending torsion values are higher for those with shear walls than for those without.
3. Time period values are larger in the absence of a shear wall model than in the presence of one, and they decrease from node 1 to node 12.
4. From node 1 to node 12, the model stiffness rises, and its values are larger for buildings without shear walls than for those with shear walls.
5. In the case of vertical irregular buildings, the narrative drift values are larger when there are no shear walls than when there are.
6. In vertical irregularity buildings, the shear bending torsion values are higher for structures without shear walls than for those with shear walls.
7. From node 1 to node 12, time declines, and its values are larger in the absence of a shear wall than in the presence of one.
8. From node 1 to node 12, the model stiffness rises, and its values are larger for buildings with shear wall cases than those without.
9. Compared to horizontal irregularity structures, the vertical stiffness building is more earthquake resistant.

REFERENCES

1. Ravikanth Chittiprolu, Ramancharla Pradeep Kumar, “Significance of Shear Wall in Highrise Irregular Buildings”, IJEAR Vol. 4, Issue Spl-2, Jan - June 2014.
2. Siva Naveen, Nimmy miryam Abraham, et al.,(2018), “Analysis of Irregular Structures under Earthquake Loads”, Procedia Structural Integrity 14 (2019) 806–819
3. Dileshwar Rana, Prof. Juned Raheem, et al.,(2015), “Seismic Analysis of Regular & Vertical Geometric Irregular RCC Framed Building”, International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 02 Issue: 04 | July-2015.

4. Hema Mukundan , S.Manivel, et al.,(2015), "Effect of Vertical Stiffness Irregularity on Multi-Storey Shear Wall-framed Structures using Response Spectrum Analysis", International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Vol. 4, Issue 3, March 2015.
5. Rakesh Sakale, R K Arora1 and Jitendra Chouhan, et al.,(2014), "SEISMIC BEHAVIOR OF BUILDINGS HAVING HORIZONTAL IRREGULARITIES", Int. J. Struct. & Civil Engg. Res. 2014, Vol. 3, No. 4, November 2014
6. Vishal N, Ramesh Kannan M, Keerthika L, et al.,(2020), "Seismic Analysis of Multi-Storey Irregular Building with Different Structural Systems", International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-8 Issue-6, March 2020.
7. Chaitra H N, Dr B Shivakumara Swamy, et al.,(2016), "Study On Performance Of Regular And Vertically Irregular Structure With Dampers, Shear Wall And Infill Wall", "International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 03 Issue: 10 | Oct -2016.
8. Pradeep Pujar, Amaresh, et al.,(2017), "SEISMIC ANALYSIS OF PLAN IRREGULAR MULTI-STORIED BUILDING WITH AND WITHOUT SHEAR WALLS" International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 04 Issue: 08 | Aug -2017
9. Suruchi Mishra , Rizwanullah, et al.,(2017), "Comparative Analysis of Regular and Irregular Buildings With and Without Shear Wall",.