Chapter 1

INTRODUCTION

1.1 Overview

In the past, numerous primary earthquakes have exposed the shortcomings in buildings that had triggered them to wreck or damage. In the multistoried buildings damages because of earthquake are typically at the weak points. The weakness is due to various discontinuities in the structure. Discontinuities like variation in mass, stiffness, strength, geometry etc. creates the point of weakness and thus the structures having these discontinuities are said to be Irregular structures. It has been found that the structures having no irregularity or regular structures perform well during earthquake. The irregularity in the structures can be categorized mainly in two types:

1. Plan Irregularity
2. Vertical Irregularity

Plan Irregularity : A structure can be categorized in Plan Irregularity if there is irregular variation of mass, strength and stiffness along plan. Following are the various types of plan irregular buildings as per IS 1893(Part 1):2002.

(i) Torsion Irregularity : Torsional irregularity is to be measured when the maximum storey drift at one end of the structure calculated with design eccentricity perpendicular to an axis is greater than 1.2 times the average of the storey drifts at the two other ends of the structure.

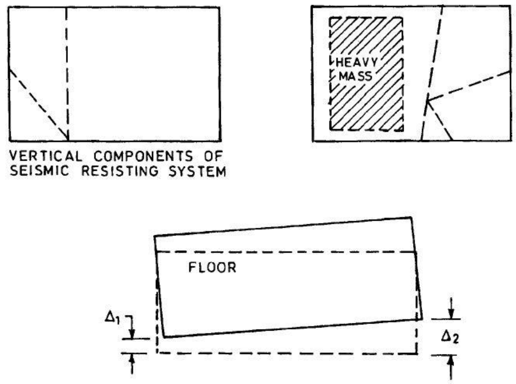

Fig 1.1 Torsional Irregularity

(ii) Re-entrant corner : Re-entrant corner irregularity in the structure is there if both projections or outcrops of the structure beyond the re-entrant corner are larger than 15 % of its plan dimension in that direction.

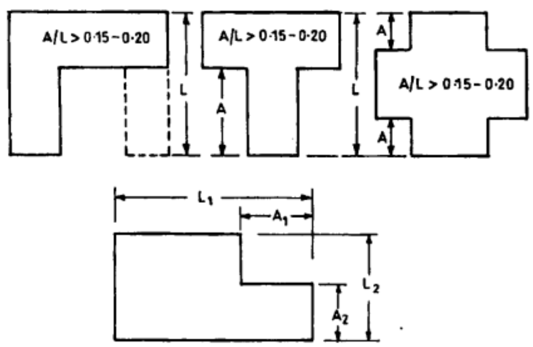

Fig:1.2 Re-entrant corner Irregularity

(iii) Diaphragm Irregularity: Diaphragm Irregularity is there in the structure when there is cut-out or open areas are larger than 50 % of gross diaphragm area or when there is effective diaphragm stiffness change between two adjacent storeys are more than 50%.

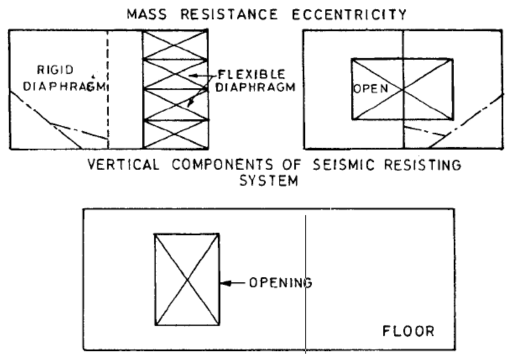

Fig: 1.3 Diaphragm Irregularity

(iv) Out of plane offset Irregularity: This type of irregularity is there when discontinuity in lateral force resistance system(LFRS) like out of plane offsets of Shear wall in differnet storeys.

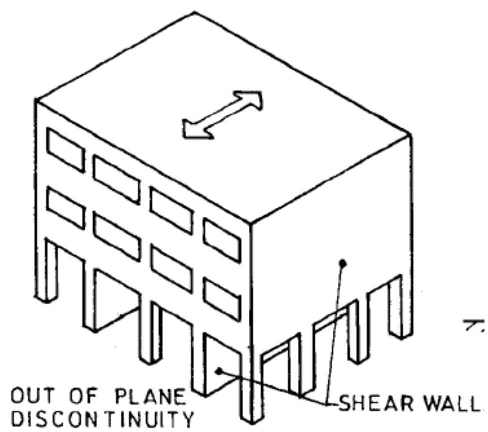

Fig: 1.4 Out of plane offset Irregularity

(v) Non parallel Systems: This type of irregularity is there in the structure when lateral force resisting system (LFRS) are not parallel to the major orthogonal axis.

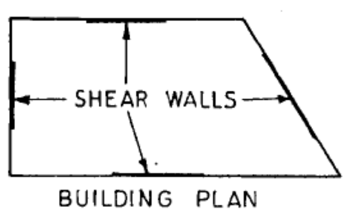

Fig:1.5 Non-Parallel System Irregularity

Vertical Irregularity: A structure can be categorized in Vertical Irregularity if there is irregular variation of strength, mass, stiffness along the height of the structure. Following are the various types of Vertical irregular buildings as per IS 1893(Part 1):2002.

(i) Stiffness Irregularity-Soft storey : A storey is said to be stiffness irregular or soft storey if lateral stiffness of a storey is less than 70 % of the lateral stiffness of storey above or 80% of the avg. stiffness of above 3 storeys.

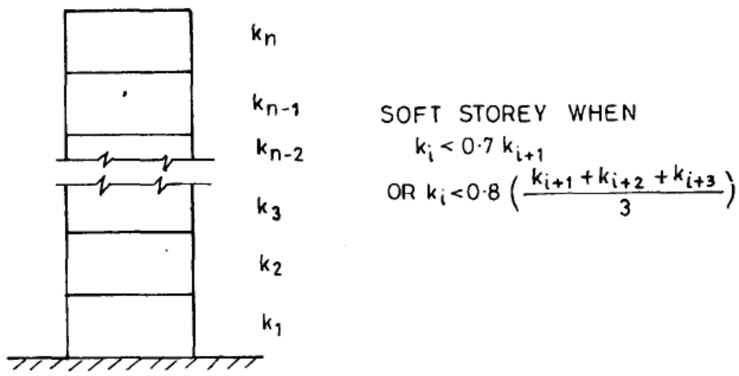

Fig: 1.6 Stiffness Irregularity

(ii) Mass Irregularity: A building is said to be mass irregular if any storey exceeds the mass by 200 % of its adjacent storey.

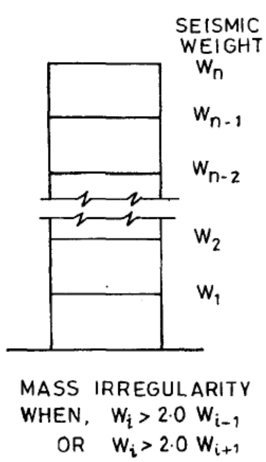

Fig: 1.7 Mass Irregularity

(iii) Vertical Geometry Irregularity: A building is deemed to be Vertical geometric irregular if the horizontal dimension of the lateral force resisting system (LFRS) of any storey is greater than 150 % of the adjacent storey.

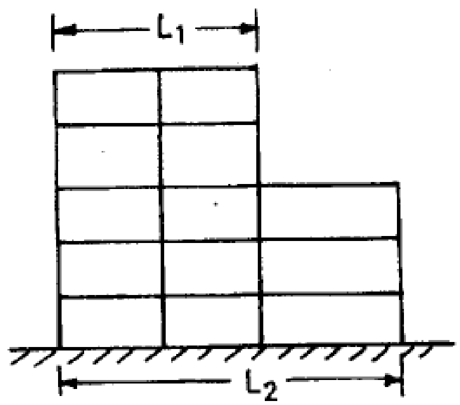

Fig: 1.8 Vertical Geometric Iregularity when $L_2 > 1.5\ L_1$

(iv) In plane offset Irregularity: This type of irregularity is there when the length of offset elements is less than the lateral force resisting element.

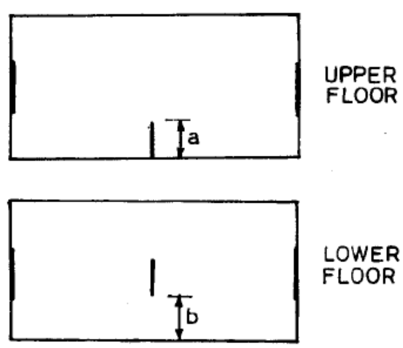

Fig: 1.9 In-Plane Discontinuity when b > a

(v) Discontinuity in Capacity or Weak storey : A storey is said to be weak if the storey lateral strength is less than 80 % of above storey.

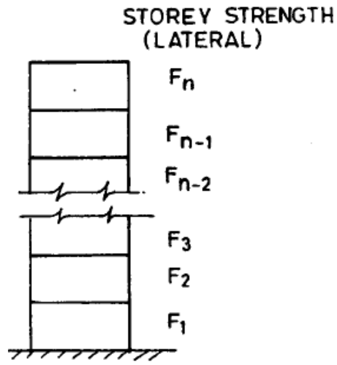

Fig : 1.10 Weak Storey $F_i < F_{i+1}$

1.2 **Objective and Scope**

The objective of the project is to study all types irregularities in the structure which are categorized in section 1.1 and to find out the peak shear storey forces and displacement on regular and irregular structures using Response spectrum analysis with help of Staad Pro software & to compare the results of Regular and various Irregular structures. The Scope of the project – column was modeled fixed to the base, only RC buildings considered, loading due to infill was considered but effect of stiffness due to infill wall was not considerd.

1.3 **Organization**

The thesis is organized in five chapters. The first chapter of thesis covers the introduction, objectives of the project & scope of study. The second chapter of thesis covers the literature survey carried out to gain knowledge about research work done by various researchers and scientists on topics related to the project. The third chapter of thesis involves the structural modeling of regular & various irregular models designed by using staad pro software. The fourth of thesis covers analysis results obtained for all the structures considered in chapter third. In the fifth & final chapter covers the comparison of results & conclusion from the comparison.

Chapter 2

LITERATURE REVIEW

There are many study papers on seismic analysis of regular and irregular RC building frames using various soft wares. Hence, various conclusions were drawn for all studies after the analysis. The present chapter covers some research work done by some researchers about the same subject.

Sarkar et al. offered a fresh technique in vertically irregular building frames of quantifying irregularity accounting for dynamic features which are featuring as under:
'Regularity index' is proposed which accounts for the variation in mass & stiffness along height of structure suitable for stepped buildings & an empirical formula is offered to evaluate the fundamental time period of stepped building as fn of regularity index.

Lee and Ko exposed three 1:12 scale 17-story RC wall building models having different types of irregularity at the bottom two stories .The 1st model was having a symmetrical moment-resisting frame, the 2nd was having an infill shear wall in the central frame, and the 3rd was having an infill shear wall in only one of the exterior frames at the bottom two stories. The entire quantities of energy absorption by damage are alike irrespective of the existence and location of the infill shear wall. The major energy absorption was due to overturning, trailed by the shear deformation.

Poonam et al. - Outcomes of the numerical analysis showed that specially the first storey need not be softer and weaker than the storeys above or below. Irregularity in mass variation also leads to the increased response of the structure. The irregularities if compulsory to be provided need to be provided by proper and wide analysis and design of the structure.

S.K.Dubey & P.D.Sangamnerkar have evaluated the performance of irregular RC buildings. The chief purpose of their study is to understand different irregularity and torsional response because of plan and vertical irregularity while earthquake forces are acting and to find out extra shear because of torsion in the column. Extra shear because of torsional moments are considered because this rise in shear forces causes columns to fail, so in design procedure extra shear is also considered.

Soni A. talk over the performance assessment of RC Buildings with various frames with various irregularities & verifies that irregularities in structures are damaging & it is significant to have simpler and regular shapes of frames along with uniform load distribution.

S. Mahesh & Rao B.P. Study the performance of multistory building of regular & irregular structures considering earthquake. The problem considered is residential12 storey building is used. Supposing the material is linear static and dynamic by considering altered seismic zones and the analysis were done by two software ETABS and STAAD PRO & shows STAAD PRO is showing higher values

Chapter 3

STRUCTURAL MODELLING

The various models for analysis and comparison are generated in Staad pro.The specifications for the base model i.e. Regular structure which doesn't have any discontinuity or Irregularity are as follows:

- Type of frame: Special RC moment resisting frame fixed at the base(Response reduction factor = 5)
- Seismic zone: IV
- Number of storey: Twelve
- Floor height: 3.5 m
- Depth of Slab: 150 mm
- Size of beam: (230 × 450) mm
- Size of column: (230 × 600) mm
- Spacing between frames: 5 m along both directions
- Live load on floor: 3 KN/m^2
- Floor finish: 0.6 KN/m^2
- Terrace water proofing: 1.5 KN/m^2
- Materials: M 20 concrete, Fe 415 steel and Brick infill
- Thickness of infill wall: 230 mm
- Density of concrete: 25 KN/m^3
- Density of infill: 20 KN/m^3
- Type of soil: Medium
- Damping of structure: 5 percent

In the various structures modelled , the specification which creates irregularity in the model has been mentioned in the particular section detail of that model.

3.1 Regular Structure(12 storeys)

In the regular 12 storey structure , 6 bay x 4 bay of equal length of 5 metre having plan dimension 30m x 20m & 42m structure height.

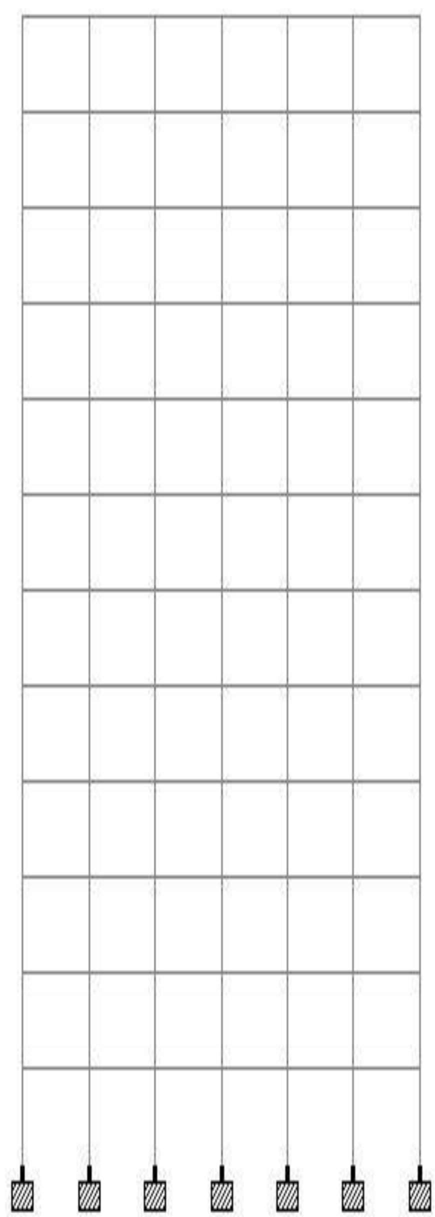

Fig: 3.1 XY Plane of Regular structure

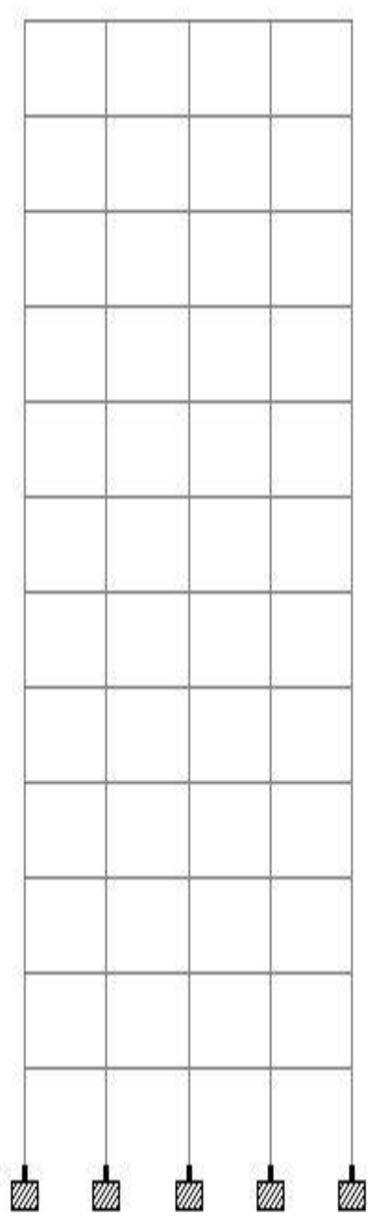

Fig: 3.2 YZ Plane of Regular Structure

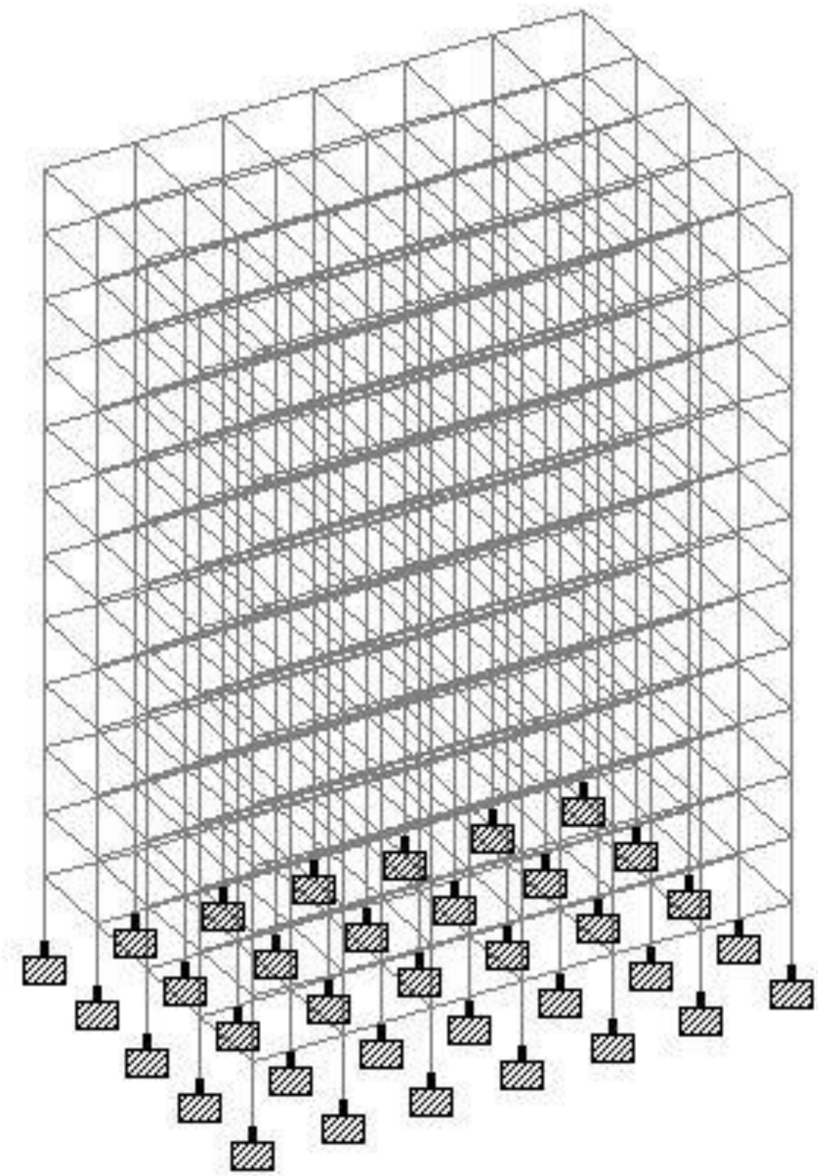

Fig: 3.3 3D View of Regular Structure (12 Storeys)

3.2 Mass Irregular Structure(12 storeys)

In the Mass Irregular structure, it is modeled similar as that of regular structure except the loading. An additional loading is considered which is provided at the fourth and eighth floor. Height of loading considered is 1.8m & Density of the loading is 10Kn/m^3. Floor load to be provided at fourth & eighth is 18kN/m^2 which may be due to water pool on the floors.

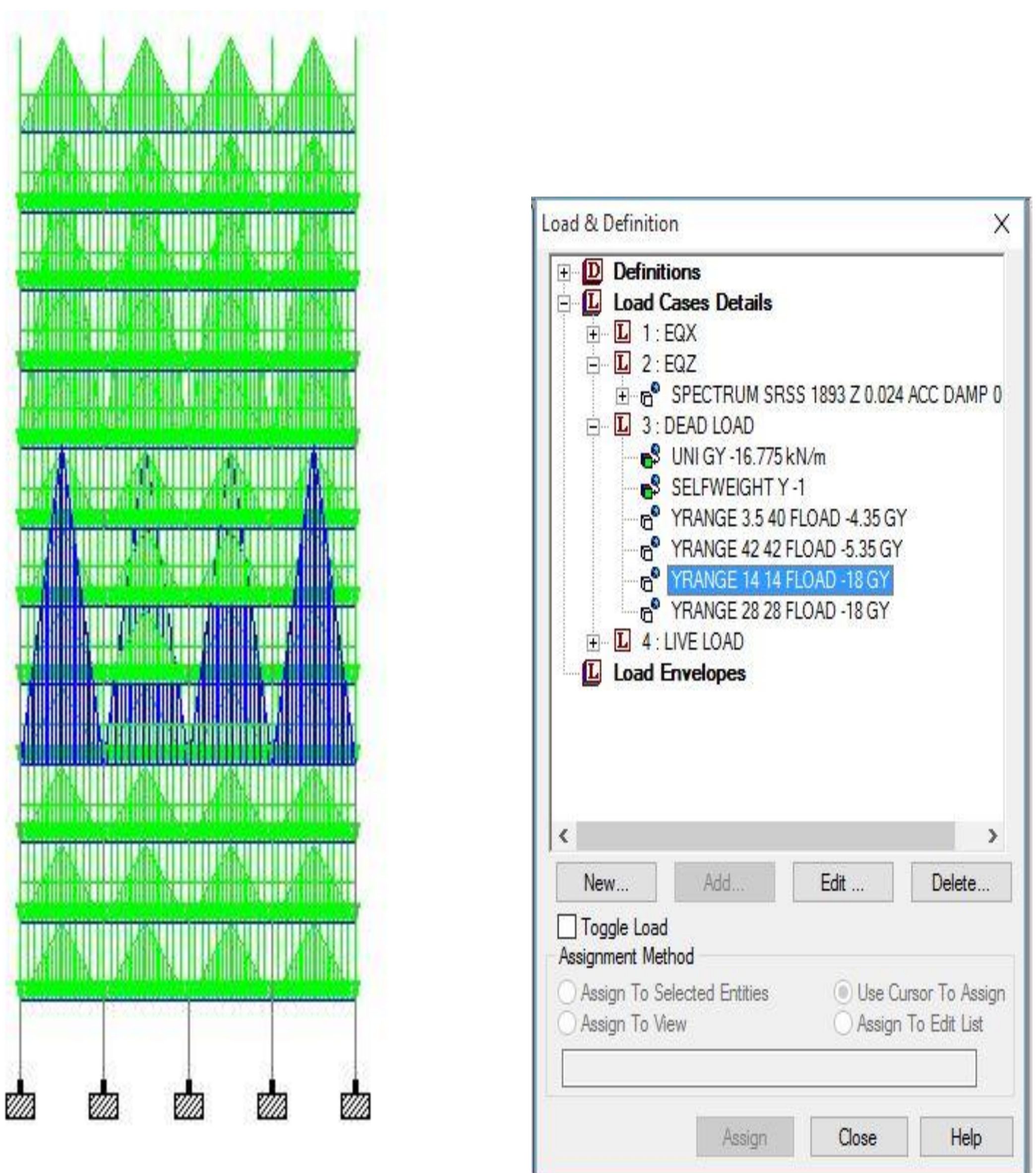

Fig: 3.4 Loading Due To Water Pool At 4^{th} Floor

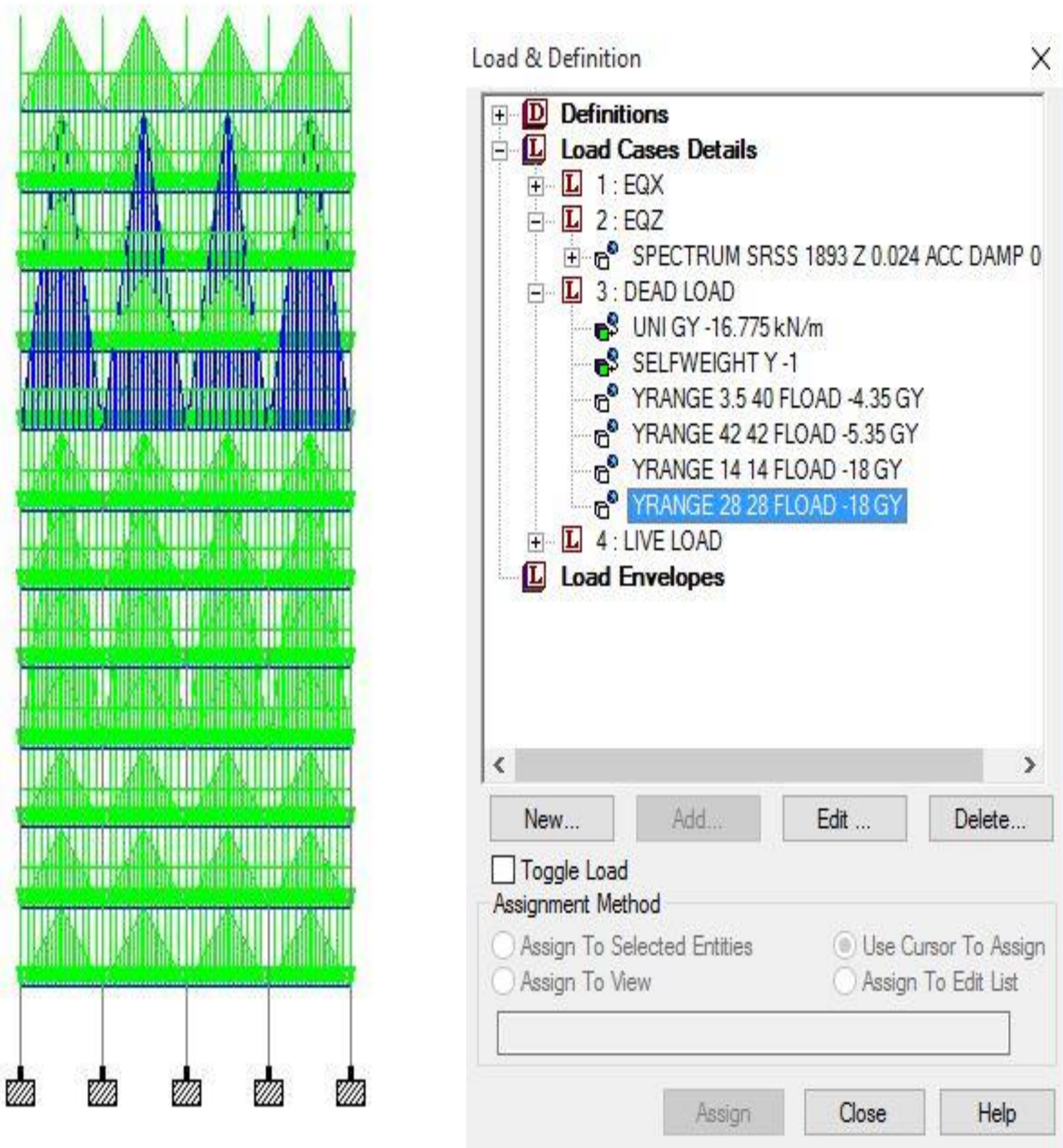

Fig:3.5 Loading Due To Water Pool At 8^{th} Floor

3.3 Stiffness Irregular Structure(12 storeys)

In the Stiffness Irregular structure, it is modeled similar as that of regular structure but with only one difference i.e. ground storey has a height of 4.5 metre instead of 3.5 metre height.

Stiffness of each column= $12EI/L^3$

(EI is constant for all columns)

Therefore Stiffness is inversely proportional to L^3.

Stiffness of ground floor/stiffness of other floors= $(3.5/4.5)^3$

=0.47<0.7 & Hence as per IS 1893 (Part 1):2002 the structure is stiffness Irregular in which the lateral stiffness is less than 70 percent of the storey above.

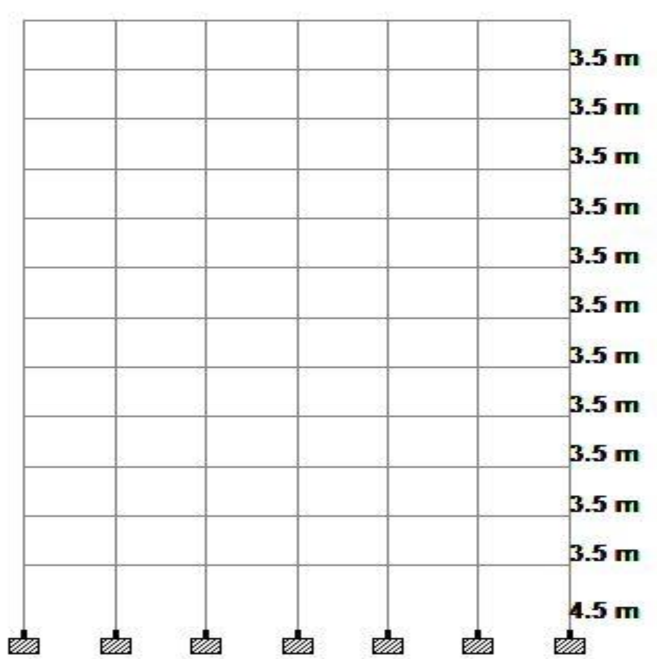

Fig: 3.6 Stiffness Irregular Structure (XY Plane) (12 Storeys)

3.4 Vertical Geometric Irregular Structure(12 storeys)

In the Vertical Geometric Irregular structure is 12 storeyed as regular strructure but steps in 4th and 8th floor. The setback is along X direction.

Width of ninth storey in X direction is 10m

Width of Eighth storey in X direction is 20m

20/10=2>1.5

Hence, as per IS 1893(Part 1) :2002 the structure is vertically geometric irregular structure when the horizontal dimension of the lateral force resisting system in any storey is more than 150 percent of that in its adjacent storey.

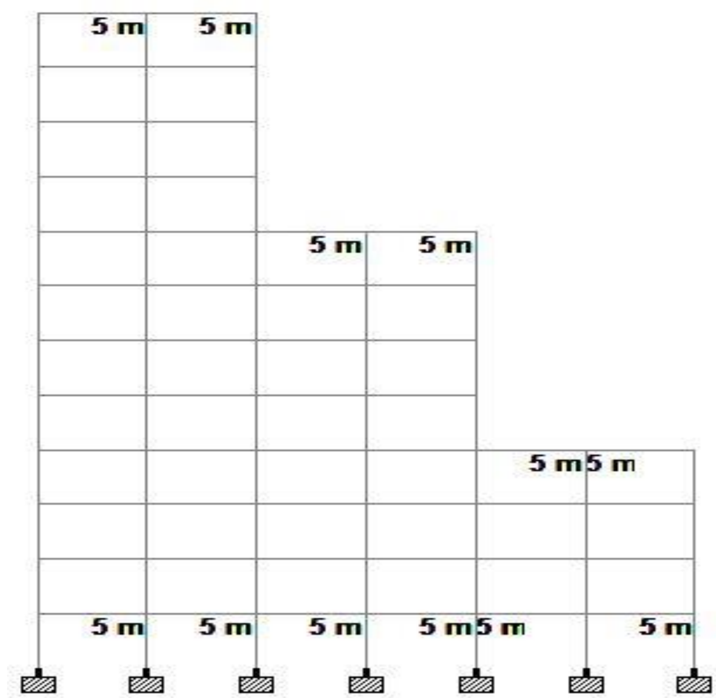

Fig: 3.7 Vertical Geometric Irregular Frame (XY Plane)

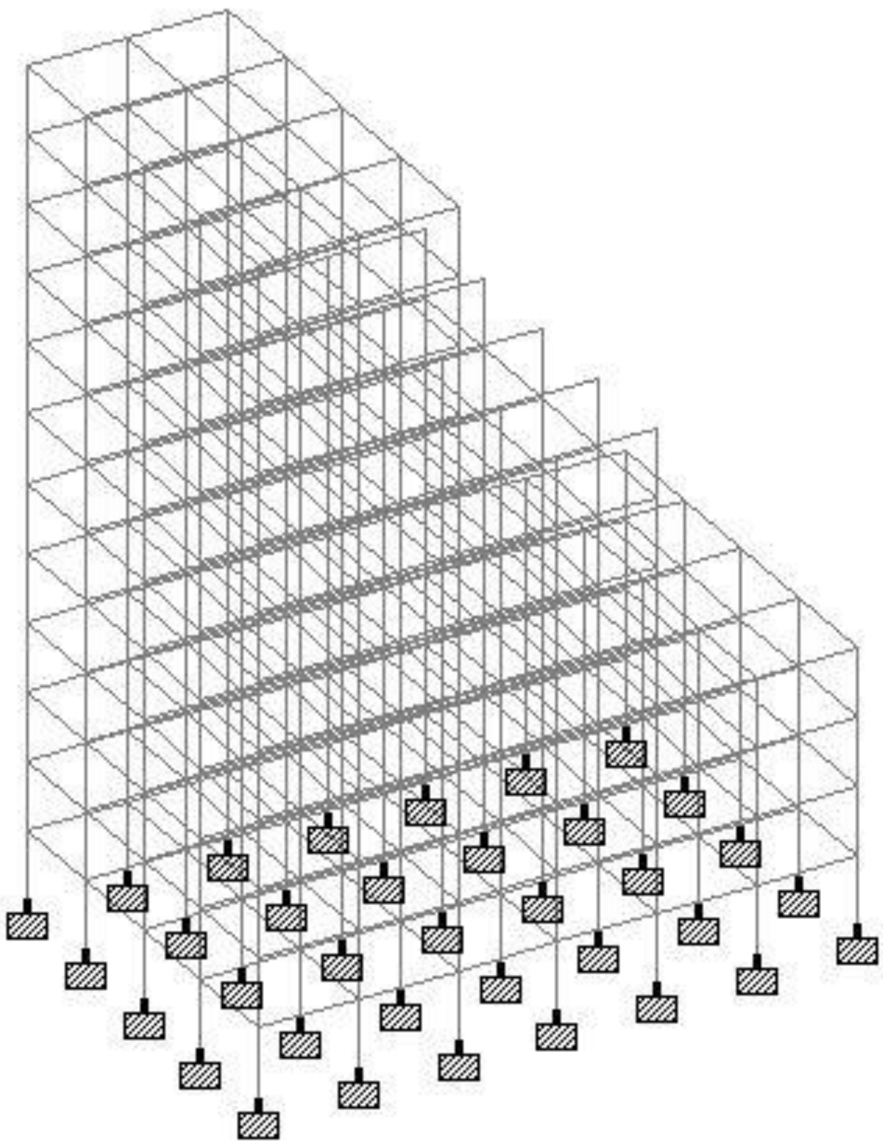

Fig: 3.8 3D Vertical Geometric Irregular Frame

3.5 Torsion Irregular Structure(12 storeys)

In the Torsion Irregular structure, the structure is modeled as similar to that of regular structure except the loading. Heavy loading (-10 kn/m^2) is considered on each floor on one side of axis of symmetry (Y axis) of the structure.

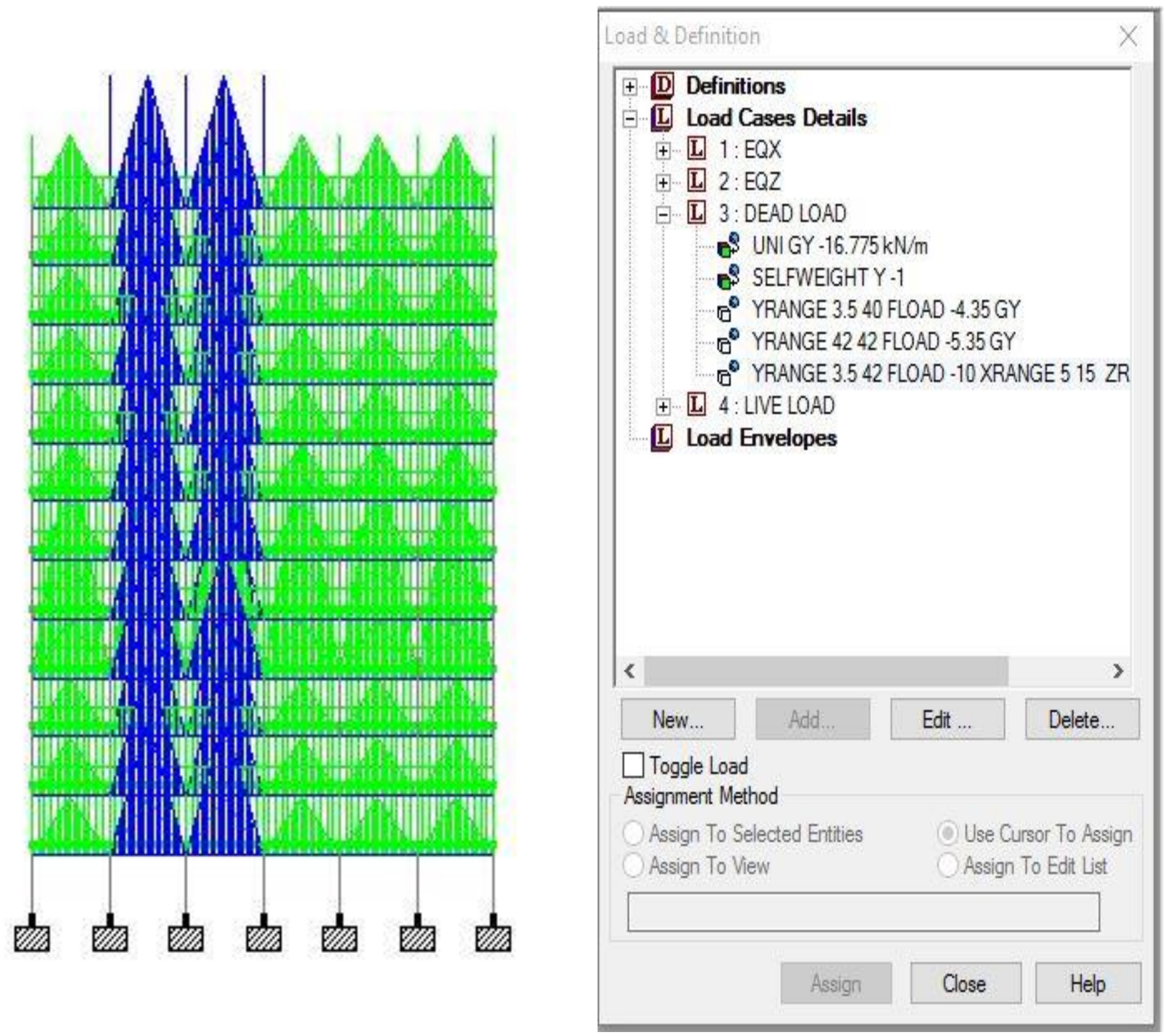

Fig: 3.9 Loading diagram showing -10Kn/m^2 on one side of axis of symmetry

3.6 Re-entrant Corner Irregular Structure(12 storeys)

In the Re-entrant Corner Irregular Structure, Further three Irregular shapes of Structures are considered i.e. L shaped Re-entrant corner Irregular Structure, T shaped Re-entrant Corner Irregular Structure and + shaped Reentrant Corner .

1) L shaped

In the L Shaped Re-entrant Corner, the projection provided is as shown in figure below.

Projection for the L shaped Re-entrant corner = A/L.

In z direction Projection = 10/20 = 0.5>0.15

In x direction Projection = 15/30 = 0.5>0.15

Hence it satisfies with the condition of IS 1893 (Part 1) : 2002 where both projections of the plan are greater than 15 percent of its plan dimension in the given direction.

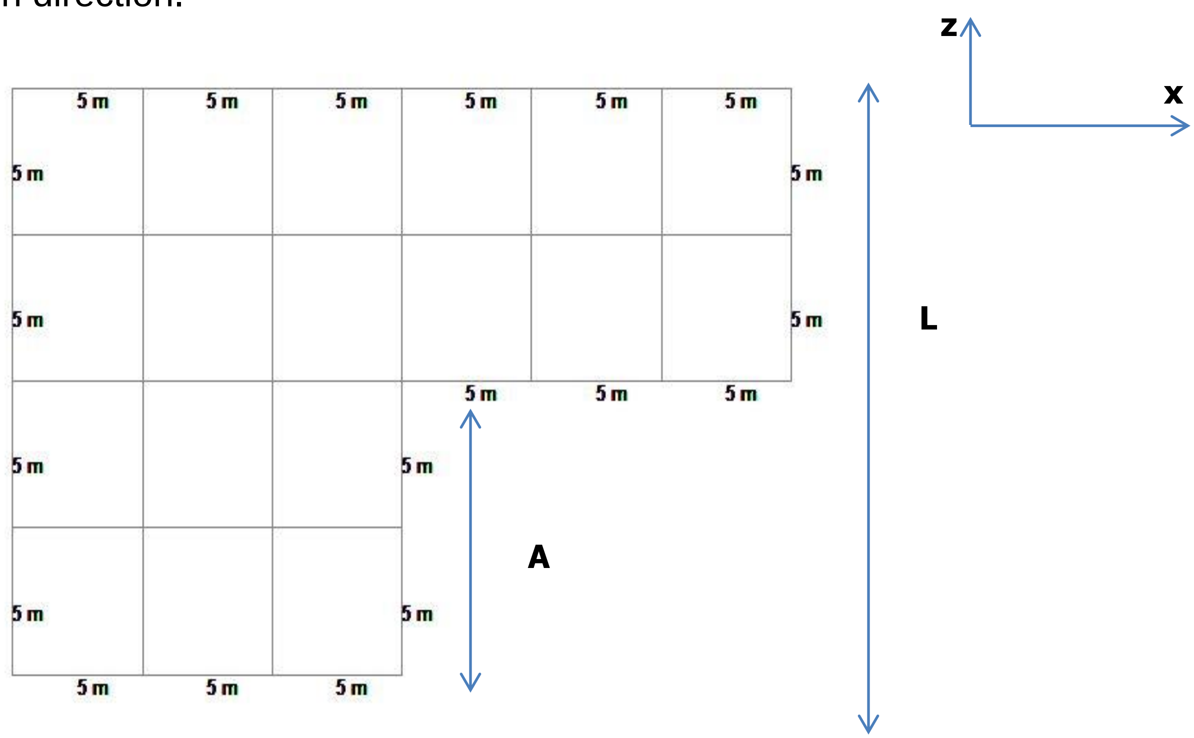

Fig: 3.10 : Plan of L shaped Re-entrant corner Structure(12 Storeys)

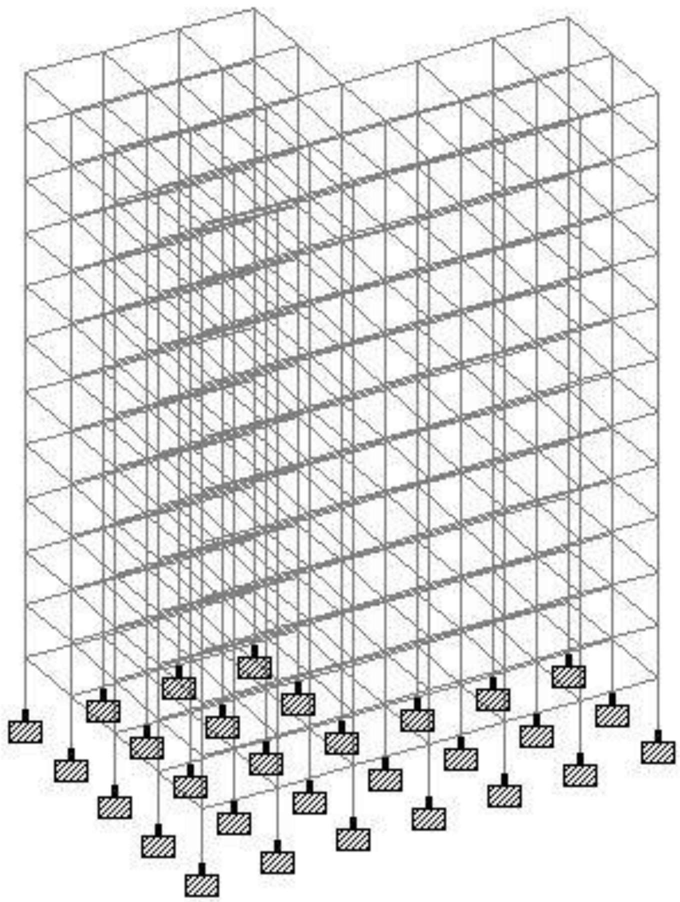

Fig : 3.11 3D view of of L shaped Re-entrant corner Structure(12 Storeys)

2) T SHAPED

In the T Shaped Re-entrant Corner, the projection provided is as shown in figure below.

Projection for the T shaped Re-entrant corner = A/L.

In z direction, Projection = 10/20 = 0.5>0.15

In x direction, Projection = 10/30 = 0.33>0.15

Hence it satisfies with the condition of IS 1893 (Part 1): 2002 where both projections of the plan are greater than 15 percent of its plan dimension in the given direction.

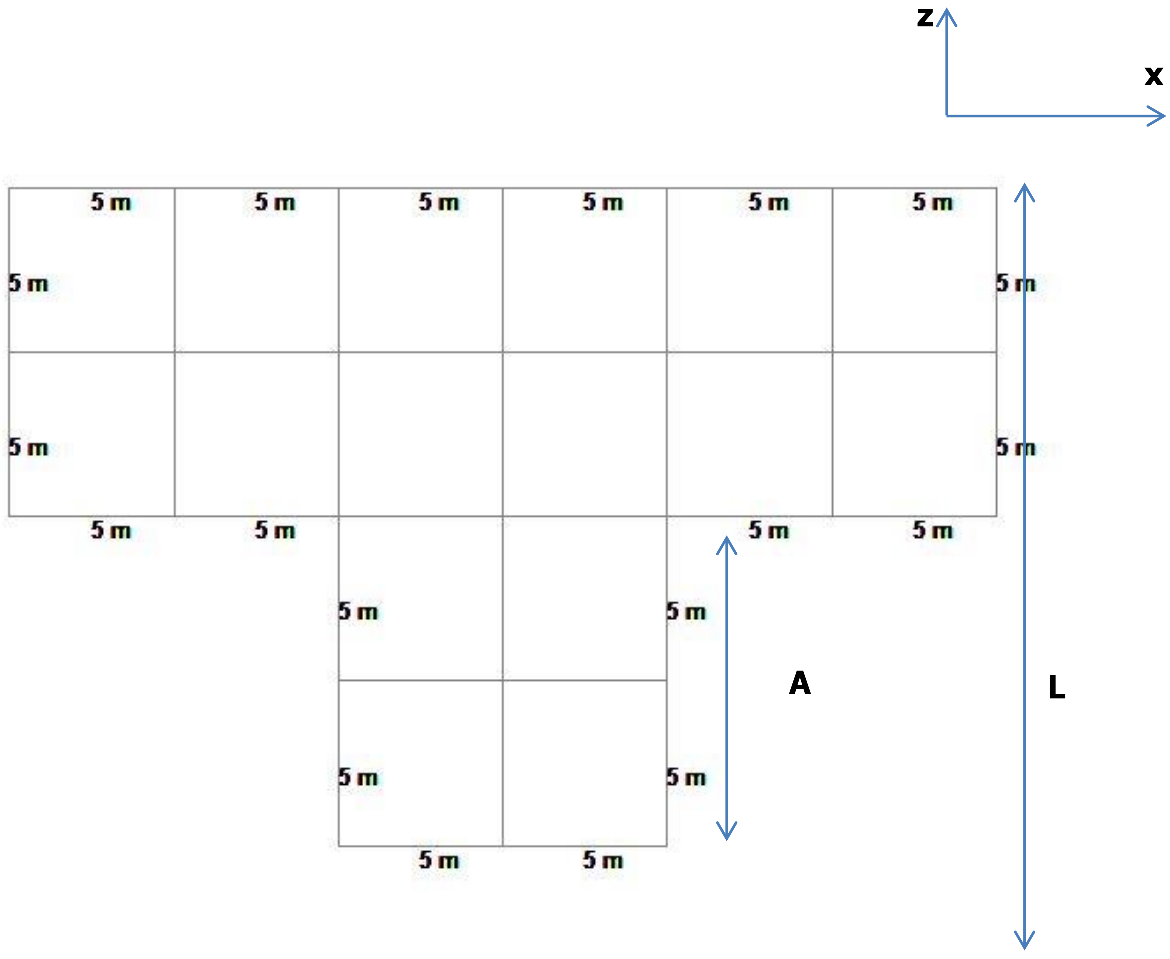

Fig: 3.12 : Plan of T shaped Re-entrant corner Structure(12 Storeys)

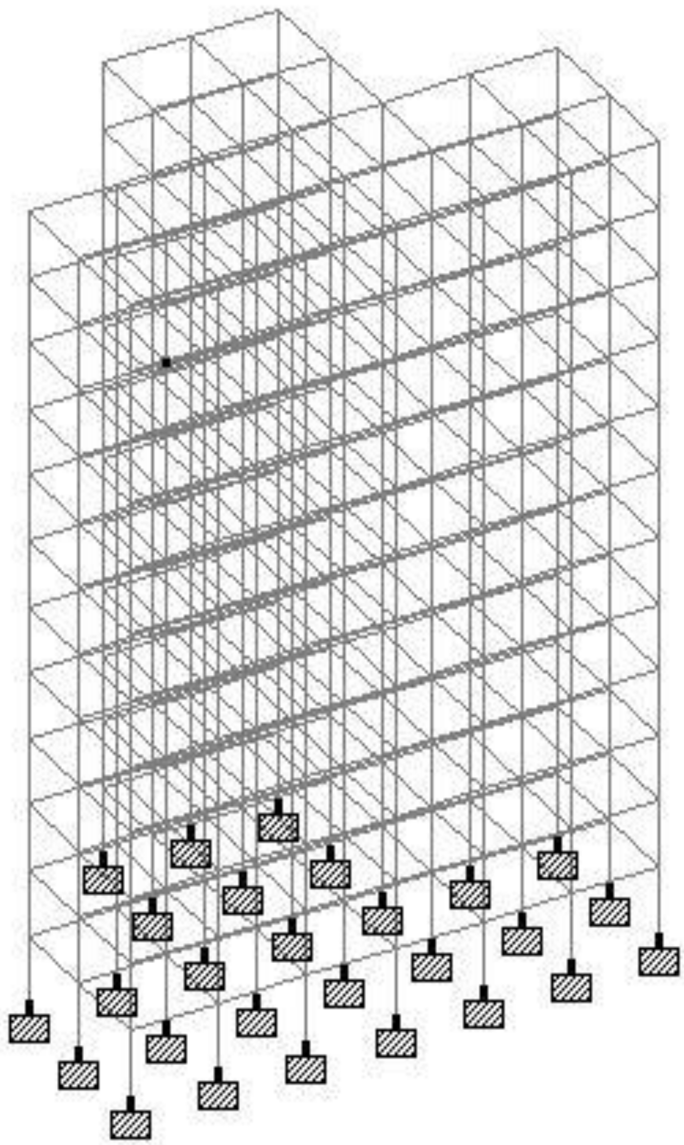

Fig : 3.13 3D view of T shaped Re-entrant corner Structure(12 Storeys)

3) + SHAPED

In the + Shaped Re-entrant Corner, the projection provided is as shown in figure below.

Projection for the + shaped Re-entrant corner = A/L.

In z direction, Projection = 5/20 = 0.25>0.15

In x direction, Projection = 5/30 = 0.167>0.15

Hence it satisfies with the condition of IS 1893 (Part 1) : 2002 where both projections of the plan are greater than 15 percent of its plan dimension in the given direction.

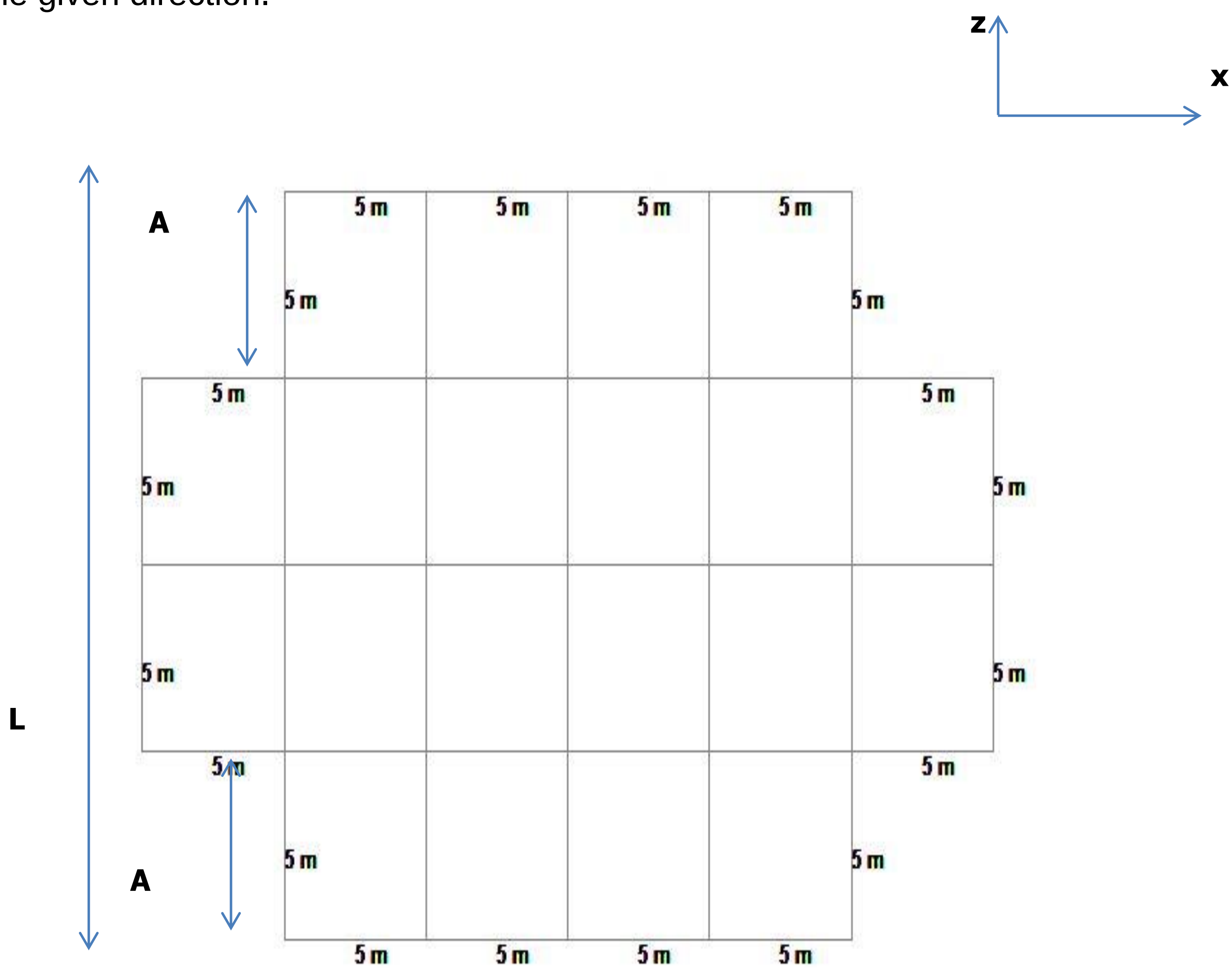

Fig: 3.14 : Plan of + shaped Re-entrant corner Structure(12 Storeys)

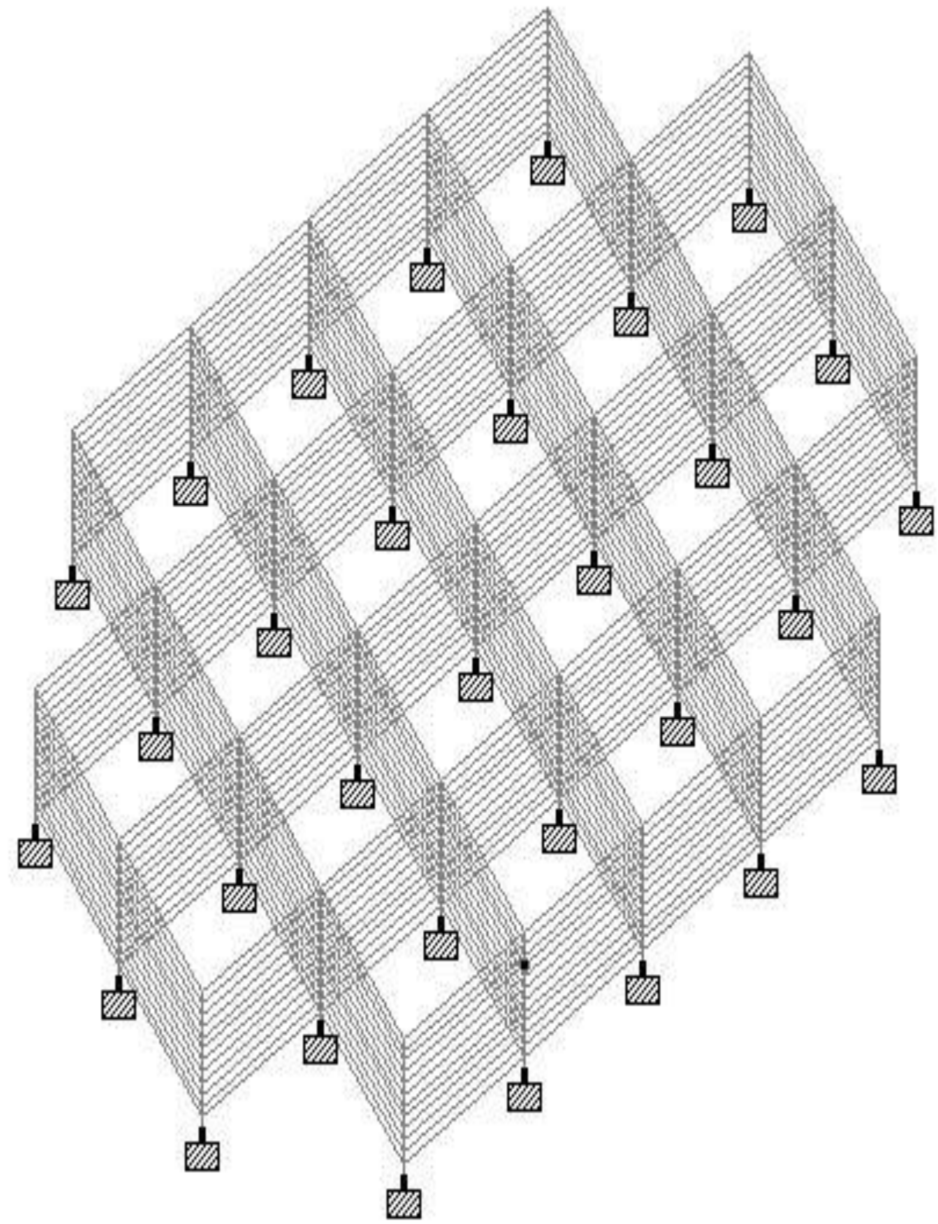

Fig : 3.15 3D view of of + shaped Re-entrant corner Structure(12 Storeys)

3.7 Diaphragm Irregular Structure(12 storeys)

In the Diaphragm Irregular Structure, An Open area is considered in center of the gross enclosed diaphragm area throughout the structure as shown in below figure.

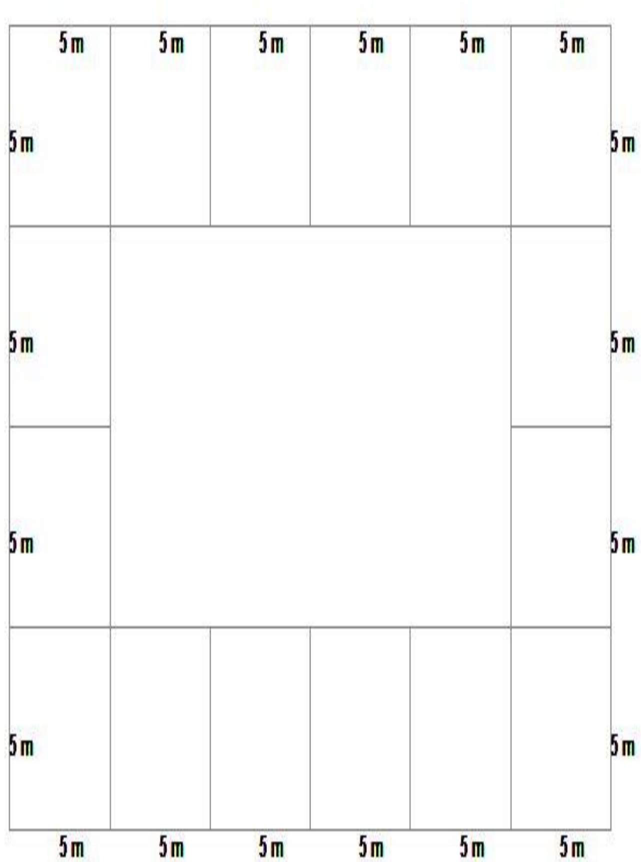

Fig: 3.16 Plan of Diaphragm Irregular structure

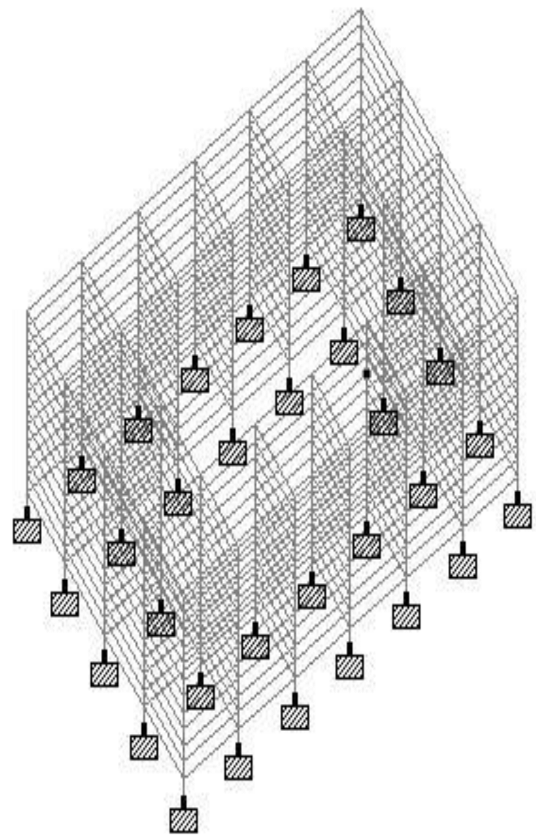

Fig: 3.17 3D view of Diaphragm Irregular structure

3.8 Regular Structure with Shear wall(12 storeys)

In the regular 12 storey structure with shear walls , 6 bay x 4 bay of equal length of 5 metre having plan dimension 30m x 20m & 42m structure height.Shear walls are provided in the middle 10 metre span in both the x and z direction with pairing so that there is no irregularity in the structure.For shear walls , Plate member are used with thickness 0.23 metre with material property as concrete in the software.Here the shear walls are the main lateral force resisting components.The structure is as shown below.

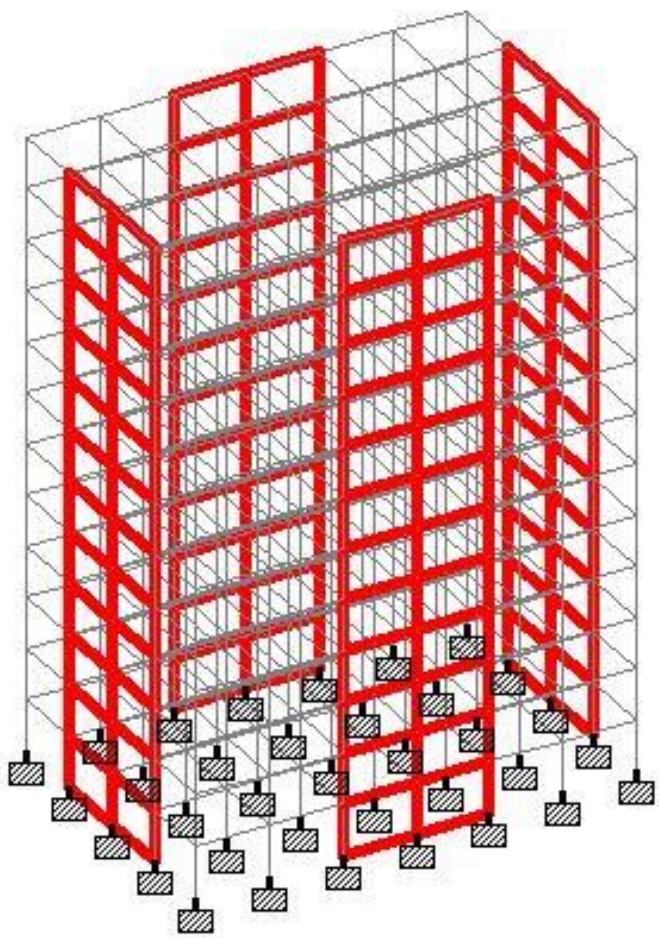

Fig : 3.18 3D view of of Regular Structure with Shear Wall(12 Storeys)

3.9 Out-of-Plane Offsets Discontinuity structure with Shear wall(12 storeys)

In the out of plane offset Discontinuity Strucure with shear wall , the Frame is modelled same as Regular structure with shear wall but the only change is with location of shear wall. For the Ground storey shear wall location is at inner frame but for above storeys the location of shear wall is at outer frames which creates out of plane offset Discontinuity as per IS 1893 (Part 1):2002.

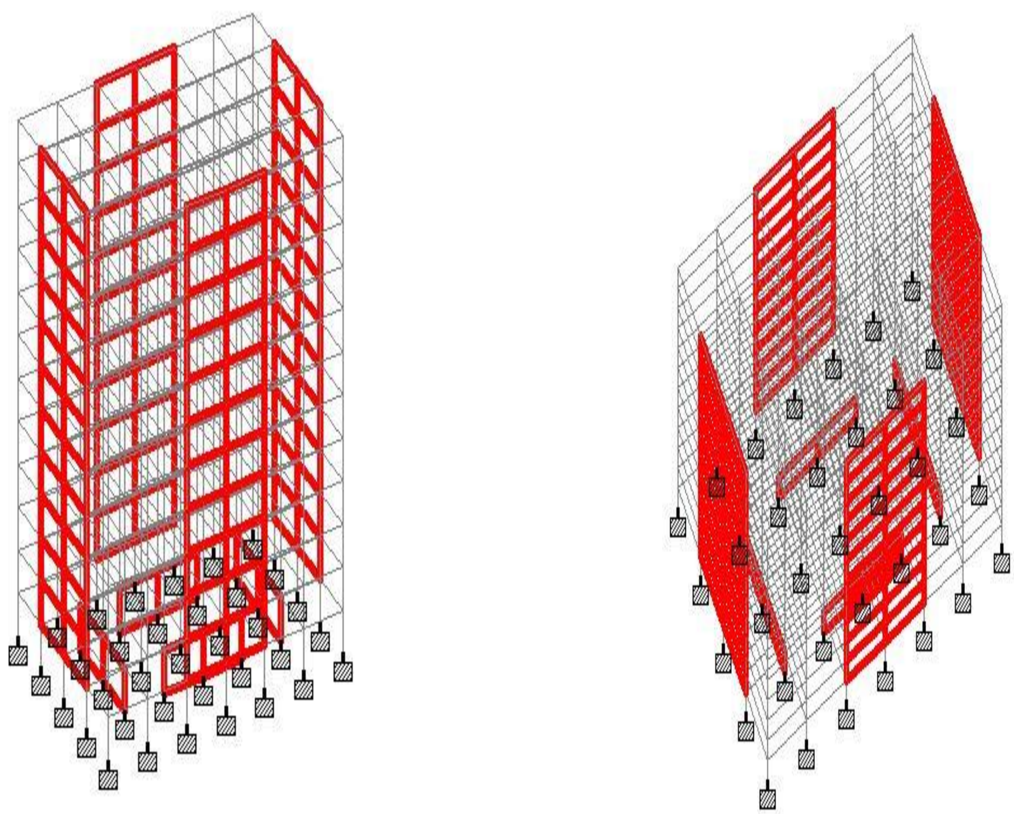

Fig : 3.19 3D view of Out-of-Plane Offsets Discontinuity structure with Shear wall(12 storeys)

3.10 Non-parallel Systems with Shear wall(12 storeys)

In the Non parallel System Strucure with shear wall, the vertical elements or say shear wall are not parallel to other that creates Irregularity.The Irregularity in the figure as shown below.

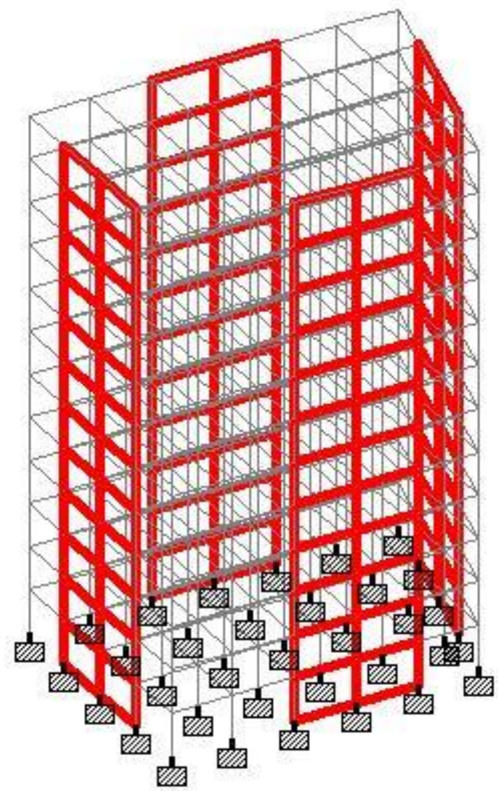

Fig : 3.20 3D view of Non parallel System Irregular structure with Shear wall(12 storeys)

3.11 In-Plane Discontinuity with Shear wall(12 storeys)

In the In-plane Discontinuity , the shear walls are located at the center of frame for the bottom six storeys & for above six storeys the shear walls are displaced by 5 metre from center location which creates In-plane discontinuity.

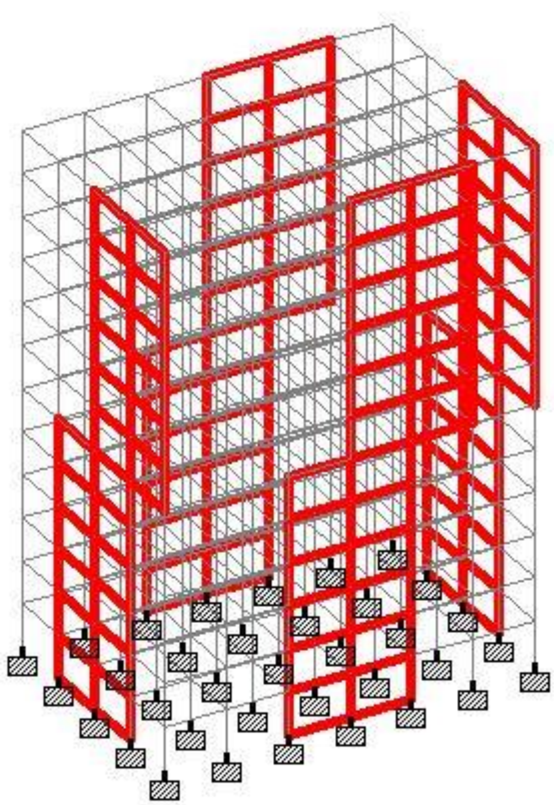

Fig : 3.21 3D view of Inplane Discontinuity Irregular structure with Shear wall(12 storeys)

3.12 Discontinuity in Capacity with Shear wall(12 storeys)

In the Discontinuity in Capacity or weak storey structure with shear wall , it is similar to Regular structure with shear wall but here Irregularity is due to Shear walls are not provided for ground storey. Due to this there is reduction in the strength at ground storey as compared to above adjacent storey which is shown in model as shown below.

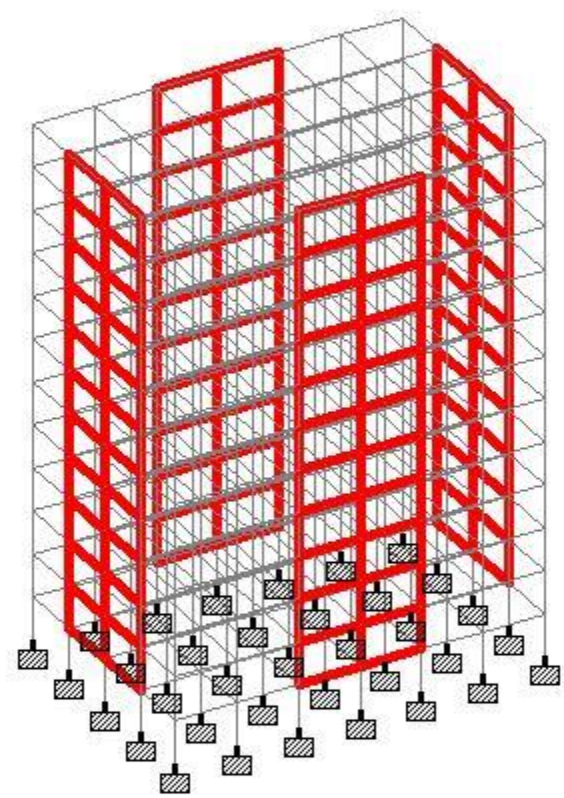

Fig : 3.22 3D view of Discontinuity in Capacity with Shear wall(12 storeys)

For all above models , there are two sets of models for comparison i.e. the models which are without shear walls (3.1 to 3.7) for which the base model or regular model is 3.1 Regular structure (12 storeys) and the other models which are having shear walls (3.8 to 3.12) for which the base model is 3.8 Regular structure with shear wall (12 storeys).

Chapter 4

ANALYSIS AND RESULTS

Analysis of all the models Regular and Various Irregular models was performed by using the Response spectrum analysis method using Staad-pro software. The peak storey shear forces and absolute displacement along X direction was find out & comparison has been made between regular and Irregular structures.

Response Spectrum Analysis

The Response Spectrum is a technique to estimate of maximum responses of a group of SDOF systems subjected to a prescribed ground excitation. The Response Spectrum method utilizes the response spectra to give a set of possible forces and deformations a real structure would experience under earthquake forces.

As per IS 1893, the structure with irregular shape or with irregular distribution of mass and stiffness in horizontal or vertical plane shall be analyzed as per Response Spectrum Method

4.1 Results for Regular Structure(12 storeys)

4.1.1 Peak Storey Shear Forces of Regular Structure:

IN X DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	48.34	3.6507	176.43
11	149.69		546.37
10	238.20		869.43
9	308.96		1127.70
8	361.50		1319.84
7	400.60		1462.20
6	433.64		1582.77
5	467.74		1707.26
4	505.19		1843.94
3	542.19		1978.98
2	571.42		2085.68
1	586.08		2139.18
BASE	586.08		2139.18

IN Z DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	50.39	2.7334	137.73
11	159.52		436.01
10	264.84		723.89
9	364.51		996.34
8	456.75		1248.44
7	539.88		1475.66
6	612.42		1673.93
5	673.09		1839.78
4	720.88		1970.39
3	755.04		2063.79
2	775.35		2119.29
1	772.76		2139.53
BASE	782.86		2139.53

4.1.2 Absolute Displacement Along X Direction of Regular Structure

FLOOR NO.	Displacement (mm)
12	191.724
11	189.139
10	183.35
9	174.399
8	162.636
7	148.398
6	131.922
5	113.328
4	92.683
3	70.107
2	45.890
1	20.693
BASE	0

4.2 Results for Mass Irregular Structure(12 storeys)

4.2.1 Peak Storey Shear Forces of Mass irregular Structure:

IN X DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	42.36	4.2393	179.51
11	132.62		561.96
10	213.53		904.81
9	281.08		1191.07
8	399.57		1693.17
7	440.84		1868.08
6	472.59		2002.59
5	500.25		2119.81
4	572.03		2423.99
3	606.22		2568.88
2	631.74		2676.99
1	644.14		2729.55
BASE	644.14		2729.55

IN Z DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	45.09	3.1263	140.92
11	143.58		448.69
10	239.10		747.18
9	330.18		1031.83
8	517.10		1615.93
7	593.87		1855.85
6	660.98		2065.56
5	717.35		2241.71
4	815.59		2548.72
3	847.56		2648.64
2	866.55		2707.97
1	873.47		2729.60
BASE	873.47		2729.60

4.2.2 Absolute Displacement Along X Direction of Mass irregular Structure

FLOOR NO.	Displacement (mm)
12	246.539
11	243.614
10	237.156
9	227.091
8	213.413
7	194.718
6	173.115
5	149.135
4	122.726
3	92.635
2	60.442
1	27.194
BASE	0

4.3 Results for Stiffness Irregular Structure(12 storeys)

4.3.1 Peak Storey Shear Forces of Stiffness Irregular Structure:

IN X DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	42.70	3.5632	152.11
11	133.47		475.50
10	214.45		763.98
9	281.60		1003.21
8	334.02		1189.93
7	374.21		1333.13
6	407.33		1451.11
5	438.98		1563.86
4	472.41		1682.97
3	506.80		1805.47
2	537.79		1915.88
1	559.65		1993.76
BASE	559.65		1993.76

IN Z DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	47.19	2.6099	123.09
11	150.14		391.62
10	249.72		651.36
9	344.33		898.12
8	432.38		1127.78
7	512.40		1336.52
6	583.08		1520.87
5	643.26		1677.84
4	691.99		1804.94
3	728.54		1900.27
2	752.49		1962.74
1	764.05		1992.91
BASE	764.05		1992.91

4.3.2 Absolute Displacement Along X Direction of Stiffness Irregular Structure

FLOOR NO.	Displacement (mm)
12	200.465
11	198.070
10	192.738
9	184.464
8	173.53
7	160.225
6	144.778
5	127.334
4	107.976
3	86.792
2	63.953
1	39.245
BASE	0

4.4 Results for Vertical Geometric Irregular Structure(12 storeys)

4.4.1 Peak Storey Shear Forces of Vertical Geometric Irregular Structure:

IN X DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	28.28	2.9213	82.60
11	90.54		264.45
10	143.20		418.26
9	182.33		532.55
8	216.42		632.13
7	255.18		745.33
6	288.62		843.01
5	320.05		934.82
4	366.93		1071.74
3	414.45		1210.53
2	451.66		1319.23
1	470.13		1373.17
BASE	470.13		1373.17

IN Z DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	18.80	3.5137	66.03
11	61.65		216.53
10	102.09		358.60
9	139.07		488.49
8	173.24		608.49
7	209.30		735.18
6	247.90		870.75
5	285.23		1001.86
4	326.25		1145.96
3	360.32		1265.61
2	382.42		1343.26
1	390.87		1372.93
BASE	390.87		1372.93

4.4.2 Absolute Displacement Along X Direction of Vertical Geometric Irregular Structure

FLOOR NO.	Displacement (mm)
12	144.774
11	141.249
10	133.679
9	122.471
8	109.765
7	99.915
6	87.834
5	73.539
4	58.143
3	44.673
2	29.657
1	13.484
BASE	0

4.5 Results for Torsion Irregular Structure(12 storeys)

4.5.1 Peak Storey Shear Forces of Torsion Irregular Structure:

IN X DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	42.36	4.2393	179.5767
11	132.62		562.216
10	213.53		905.2177
9	281.08		1191.582
8	399.57		1693.897
7	440.84		1868.853
6	472.59		2003.451
5	500.25		2120.71
4	572.03		2425.007
3	606.22		2569.948
2	631.74		2678.135
1	644.14		2730.703
BASE	644.14		2730.703

IN Z DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	45.09	3.1263	140.9649
11	143.58		448.8742
10	239.10		747.4983
9	330.18		1032.242
8	517.10		1616.61
7	593.87		1856.616
6	660.98		2066.422
5	717.35		2242.651
4	815.59		2549.779
3	847.56		2649.727
2	866.55		2709.095
1	873.47		2730.729
BASE	873.47		2730.729

4.5.2 Absolute Displacement Along X Direction of Torsion Irregular Structure

FLOOR NO.	Displacement (mm)
12	246.539
11	243.614
10	237.156
9	227.091
8	213.413
7	194.718
6	173.115
5	149.135
4	122.726
3	92.635
2	60.442
1	27.194
BASE	0

4.6 Results for Re-entrant Corner Irregular Structure(12 storeys)

4.6.1 L shaped

4.6.1.1 Peak Storey Shear Forces of Re-entrant Corner Irregular Structure (L shaped):

IN X DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	37.81	3.5366	133.7188
11	118.97		420.7493
10	189.76		671.1052
9	246.21		870.7463
8	288.05		1018.718
7	318.91		1127.857
6	345.01		1220.162
5	372.08		1315.898
4	401.95		1421.536
3	431.55		1526.22
2	454.94		1608.941
1	466.64		1650.319
BASE	466.64		1650.319

IN Z DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	32.2	3.2491	104.621
11	103.36		335.827
10	171.97		558.7477
9	236.84		769.5168
8	296.80		964.3329
7	350.78		1139.719
6	397.84		1292.622
5	437.14		1420.312
4	468.05		1520.741
3	490.11		1592.416
2	503.18		1634.882
1	507.93		1650.315
BASE	507.93		1650.315

4.6.1.2 Absolute Displacement Along X Direction of Re-entrant Corner Irregular Structure (L shaped)

FLOOR NO.	Displacement (mm)
12	185.805
11	183.424
10	177.803
9	169.042
8	157.583
7	143.823
6	127.998
5	110.173
4	90.323
3	68.485
2	44.908
1	20.265
BASE	0

4.6.2 T shaped

4.6.2.1 Peak Storey Shear Forces of Re-entrant Corner Irregular Structure (T shaped):

IN X DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	33.21	3.5069	116.4641
11	105.67		370.5741
10	169.29		593.6831
9	220.75		774.1482
8	259.79		911.0576
7	289.42		1014.967
6	314.69		1103.586
5	340.19		1193.012
4	367.31		1288.119
3	393.51		1380
2	413.94		1451.646
1	424.09		1487.241
BASE	424.09		1487.241

IN Z DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	34.86	2.6816	93.48058
11	112.96		302.9135
10	188.16		504.5699
9	259.17		694.9903
8	324.73		870.796
7	383.69		1028.903
6	435.01		1166.523
5	477.83		1281.349
4	511.43		1371.451
3	535.36		1435.621
2	549.5		1473.539
1	554.6		1487.215
BASE	554.6		1487.215

4.6.2.2 Absolute Displacement Along X Direction of Re-entrant Corner Irregular Structure (T shaped)

FLOOR NO.	Displacement (mm)
12	182.033
11	179.703
10	174.249
9	165.742
8	154.571
7	141.088
6	125.517
5	107.943
4	88.383
3	66.918
2	43.819
1	19.749
BASE	0

4.6.3 + shaped

4.6.3.1 Peak Storey Shear Forces of Re-entrant Corner Irregular Structure (+ shaped):

IN X DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	41.32	3.5771	147.8058
11	129.24		462.3044
10	206.00		736.8826
9	267.30		956.1588
8	312.83		1119.024
7	346.48		1239.394
6	374.96		1341.269
5	404.41		1446.615
4	436.83		1562.585
3	468.90		1677.302
2	494.25		1767.982
1	506.95		1813.411
BASE	506.95		1813.411

IN Z DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	42.64	2.7088	115.5032
11	136.30		369.2094
10	226.62		613.8683
9	312.04		845.254
8	391.02		1059.195
7	462.15		1251.872
6	524.17		1419.872
5	576.00		1560.269
4	616.78		1670.734
3	645.89		1749.587
2	663.16		1796.368
1	669.44		1813.379
BASE	669.44		1813.379

4.6.3.2 Absolute Displacement Along X Direction of Re-entrant Corner Irregular Structure (+ shaped)

FLOOR NO.	Displacement (mm)
12	187.897
11	185.528
10	179.892
9	171.087
8	159.538
7	145.629
6	129.597
5	111.519
4	91.390
3	69.268
2	45.410
1	20.489
BASE	0

4.7 Results for Diaphragm Irregular Structure(12 storeys)

4.7.1 Peak Storey Shear Forces of Diaphragm Irregular Structure:

IN X DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	46.8	3.7030	173.3004
11	136.53		505.5706
10	214.42		793.9973
9	276.35		1023.324
8	322.24		1193.255
7	356.27		1319.268
6	385.3		1426.766
5	415.53		1538.708
4	448.79		1661.869
3	481.59		1783.328
2	507.40		1878.902
1	520.25		1926.486
BASE	520.25		1926.486

IN Z DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	45.89	3.0270	138.909
11	136.22		412.3379
10	222.74		674.234
9	304.04		920.3291
8	378.75		1146.476
7	445.61		1348.861
6	503.52		1524.155
5	551.56		1669.572
4	589.03		1782.994
3	615.50		1863.119
2	630.96		1909.916
1	636.45		1926.534
BASE	636.45		1926.534

4.7.2 Absolute Displacement Along X Direction of Diaphragm Irregular Structure

FLOOR NO.	Displacement (mm)
12	195.545
11	192.788
10	186.718
9	177.423
8	165.289
7	150.677
6	133.832
5	114.877
4	93.881
3	70.964
2	46.425
1	20.928
BASE	0

4.8 Results for Regular Structure with Shear wall(12 storeys)

4.8.1 Peak Storey Shear Forces of Regular Structure with Shear wall:

IN X DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	94.04	1.8934	178.0553
11	290.15		549.37
10	473.07		895.7107
9	636.7		1205.528
8	778.47		1473.955
7	899.23		1702.602
6	1001.77		1896.751
5	1088.67		2061.288
4	1160.54		2197.366
3	1215.59		2301.598
2	1250.78		2368.227
1	1264.63		2394.45
BASE	1264.63		2394.45

IN Z DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	78.88	2.3477	185.1866
11	240.33		564.2227
10	387.47		909.6633
9	515.69		1210.685
8	624.26		1465.575
7	716.14		1681.282
6	795.87		1868.464
5	866.7		2034.752
4	928.35		2179.487
3	977.15		2294.055
2	1008.3		2367.186
1	1019.91		2394.443
BASE	1019.91		2394.443

4.8.2 Absolute Displacement Along X Direction of Regular Structure with Shear wall

FLOOR NO.	Displacement (mm)
12	20.992
11	18.884
10	16.680
9	14.462
8	12.249
7	10.070
6	7.996
5	5.984
4	4.179
3	2.612
2	1.351
1	0.472
BASE	0

4.9 Results for Out-of-Plane Offsets Discontinuity structure with Shear wall(12 storeys)

4.9.1 Peak Storey Shear Forces of Out-of-Plane Offsets Discontinuity structure with Shear wall:

IN X DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	74.9	2.1832	163.5217
11	231.12		504.5812
10	375.73		820.2937
9	504.53		1101.49
8	617.12		1347.296
7	716.47		1564.197
6	806.82		1761.449
5	890.79		1944.773
4	967.23		2111.657
3	1031.21		2251.338
2	1075.95		2349.014
1	1096.73		2394.381
BASE	1096.73		2394.381

IN Z DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	68.8	2.3133	159.155
11	214.45		496.0872
10	354.76		820.6663
9	487.29		1127.248
8	609.63		1410.257
7	719.61		1664.674
6	815.26		1885.941
5	894.91		2070.195
4	957.12		2214.106
3	1000.84		2315.243
2	1025.95		2373.33
1	1035.08		2394.451
BASE	1035.08		2394.451

4.9.2 Absolute Displacement Along X Direction of Out-of-Plane Offsets Discontinuity structure with Shear wall

FLOOR NO.	Displacement (mm)
12	53.191
11	50.615
10	47.926
9	45.222
8	42.511
7	39.816
6	37.166
5	34.598
4	32.155
3	29.878
2	27.902
1	25.619
BASE	0

4.10 Results for Non-parallel Systems with Shear wall(12 storeys)

4.10.1 Peak Storey Shear Forces of Non-parallel Systems with Shear wall:

IN X DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	89.71	1.8573	166.6184
11	279.29		518.7253
10	455.92		846.7802
9	614.33		1140.995
8	752.22		1397.098
7	870.07		1615.981
6	969.9		1801.395
5	1053.65		1956.944
4	1121.78		2083.482
3	1173.03		2178.669
2	1205.32		2238.641
1	1217.95		2262.099
BASE	1217.95		2262.099

IN Z DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	76.78	2.2063	169.3997
11	236.11		520.9295
10	383.15		845.3438
9	513.8		1133.597
8	626.85		1383.019
7	723.8		1596.92
6	807.39		1781.345
5	879.56		1940.573
4	939.98		2073.878
3	986.11		2175.654
2	1014.78		2238.909
1	1025.31		2262.141
BASE	1025.31		2262.141

4.10.2 Absolute Displacement Along X Direction of Non-parallel Systems with Shear wall

FLOOR NO.	Displacement (mm)
12	20.886
11	18.787
10	16.592
9	14.384
8	12.180
7	10.011
6	7.917
5	5.945
4	4.150
3	2.593
2	1.340
1	0.467
BASE	0

4.11 Results for In-Plane Discontinuity with Shear wall(12 storeys)

4.11.1 Peak Storey Shear Forces of In-Plane Discontinuity with Shear wall:

IN X DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	92.53	1.8833	174.2617
11	286.53		539.6219
10	468.39		882.1189
9	631.76		1189.794
8	773.76		1457.222
7	894.86		1685.29
6	997.92		1879.383
5	1087.42		2047.938
4	1162.24		2188.847
3	1219.87		2297.381
2	1256.83		2366.988
1	1271.41		2394.446
BASE	1271.41		2394.446

IN Z DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	79.26	2.3249	184.2716
11	241.6		561.6958
10	389.67		905.9438
9	518.87		1206.321
8	628.39		1460.944
7	721.08		1676.439
6	801.7		1863.872
5	873.77		2031.428
4	936.58		2177.455
3	986.32		2293.095
2	1018.06		2366.888
1	1029.9		2394.415
BASE	1029.9		2394.415

4.11.2 Absolute Displacement Along X Direction of In-Plane Discontinuity with Shear wall

FLOOR NO.	Displacement (mm)
12	16.098
11	14.397
10	12.629
9	10.858
8	9.101
7	7.416
6	5.966
5	4.411
4	3.167
3	2.042
2	1.089
1	0.394
BASE	0

4.12 Results for Discontinuity in Capacity with Shear wall(12 storeys)

4.12.1 Peak Storey Shear Forces of Discontinuity in Capacity with Shear wall:

IN X DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	68.34	2.1724	148.4618
11	211.92		460.375
10	346.68		753.1276
9	469.17		1019.225
8	578.42		1256.56
7	675.9		1468.325
6	764.57		1660.952
5	847.13		1840.305
4	924.39		2008.145
3	994.42		2160.278
2	1052.9		2287.32
1	1092.43		2373.195
BASE	1092.43		2373.195

IN Z DIRECTION

STOREY	PEAK STOREY SHEAR (RSA) IN KN	V_b/V_B	PEAK STOREY SHEAR (IS 1893) IN KN
12	71.28	2.2568	160.8647
11	220.96		498.6625
10	362.98		819.1733
9	494.58		1116.168
8	614		1385.675
7	720.45		1625.912
6	813.61		1836.155
5	893.04		2015.413
4	957.82		2161.608
3	1006.56		2271.605
2	1037.99		2342.536
1	1051.58		2373.206
BASE	1051.58		2373.206

4.12.2 Absolute Displacement Along X Direction of Discontinuity in Capacity with Shear wall:

FLOOR NO.	Displacement (mm)
12	57.679
11	55.177
10	52.567
9	49.943
8	47.311
7	44.692
6	42.114
5	39.612
4	37.227
3	34.997
2	33.081
1	30.678
BASE	0

Chapter 5

COMPARISON AND CONCLUSION

5.1 COMPARISON OF PEAK STOREY SHEAR OF REGULAR AND IRREGULAR STRUCTURES (3.1 to 3.7) IN X DIRECTION (KN)

STOREY	REGULAR STR.	MASS IRRE	STIFFNESS Irr	GEOMETRY IRR	TORSION IRRE	CORNER RE-ENTRANT - L SHAPED	CORNER RE-ENTRANT -T SHAPED	CORNER RE-ENTRANT -H SHAPED	DIAPHRAGM IRREGULAR
12	176.43	179.51	152.11	82.60	179.5767	133.7188	116.4641	147.8058	173.3004
11	546.37	561.96	475.50	264.45	562.216	420.7493	370.5741	462.3044	505.5706
10	869.43	904.81	763.98	418.26	905.2177	671.1052	593.6831	736.8826	793.9973
9	1127.70	1191.07	1003.21	532.55	1191.582	870.7463	774.1482	956.1588	1023.324
8	1319.84	1693.17	1189.93	632.13	1693.897	1018.718	911.0576	1119.024	1193.255
7	1462.20	1868.08	1333.13	745.33	1868.853	1127.857	1014.967	1239.394	1319.268
6	1582.77	2002.59	1451.11	843.01	2003.451	1220.162	1103.586	1341.269	1426.766
5	1707.26	2119.81	1563.86	934.82	2120.71	1315.898	1193.012	1446.615	1538.708
4	1843.94	2423.99	1682.97	1071.74	2425.007	1421.536	1288.119	1562.585	1661.869
3	1978.98	2568.88	1805.47	1210.53	2569.948	1526.22	1380	1677.302	1783.328
2	2085.68	2676.99	1915.88	1319.23	2678.135	1608.941	1451.646	1767.982	1878.902
1	2139.18	2729.55	1993.76	1373.17	2730.703	1650.319	1487.241	1813.411	1926.486
BASE	2139.18	2729.55	1993.76	1373.17	2730.703	1650.319	1487.241	1813.411	1926.486

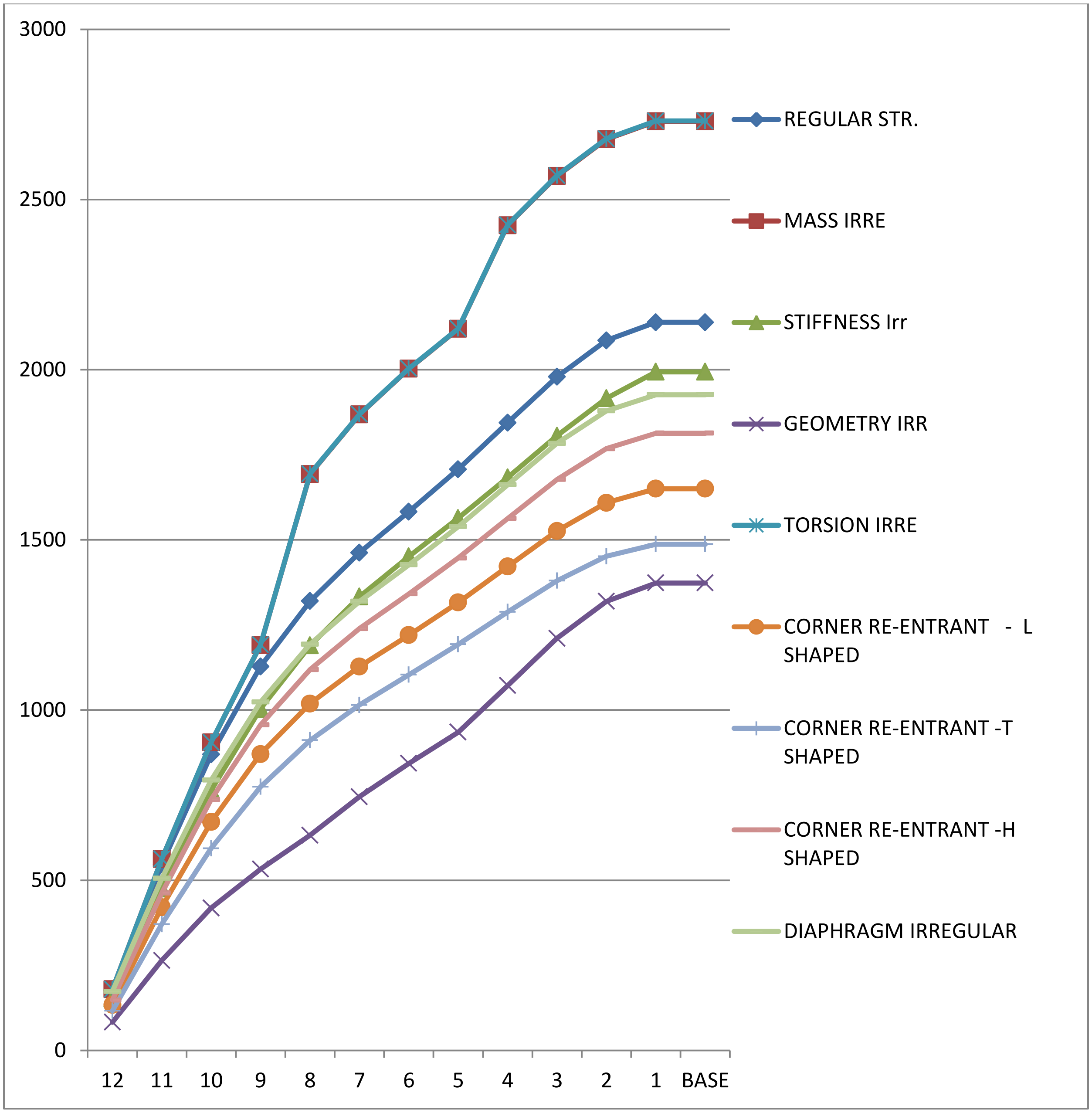

Fig 5.1 COMPARISON OF PEAK STOREY SHEAR OF REGULAR AND IRREGULAR STRUCTURES IN X DIRECTION (KN)

5.2 COMPARISON OF PEAK STOREY SHEAR OF REGULAR AND IRREGULAR STRUCTURES (3.1 to 3.7) IN Z DIRECTION (KN)

STOREY	REGULAR STR.	MASS IRRE	STIFFNESS Irr	GEOMETRY IRR	TORSION IRRE	CORNER RE-ENTRANT - L SHAPED	CORNER RE-ENTRANT -T SHAPED	CORNER RE-ENTRANT -H SHAPED	DIAPHRAGM IRREGULAR
12	137.73	140.92	123.09	66.03	140.9649	104.621	93.48058	115.5032	138.909
11	436.01	448.69	391.62	216.53	448.8742	335.827	302.9135	369.2094	412.3379
10	723.89	747.18	651.36	358.60	747.4983	558.7477	504.5699	613.8683	674.234
9	996.34	1031.83	898.12	488.49	1032.242	769.5168	694.9903	845.254	920.3291
8	1248.44	1615.93	1127.78	608.49	1616.61	964.3329	870.796	1059.195	1146.476
7	1475.66	1855.85	1336.52	735.18	1856.616	1139.719	1028.903	1251.872	1348.861
6	1673.93	2065.56	1520.87	870.75	2066.422	1292.622	1166.523	1419.872	1524.155
5	1839.78	2241.71	1677.84	1001.86	2242.651	1420.312	1281.349	1560.269	1669.572
4	1970.39	2548.72	1804.94	1145.96	2549.779	1520.741	1371.451	1670.734	1782.994
3	2063.79	2648.64	1900.27	1265.61	2649.727	1592.416	1435.621	1749.587	1863.119
2	2119.29	2707.97	1962.74	1343.26	2709.095	1634.882	1473.539	1796.368	1909.916
1	2139.53	2729.60	1992.91	1372.93	2730.729	1650.315	1487.215	1813.379	1926.534
BASE	2139.53	2729.60	1992.91	1372.93	2730.729	1650.315	1487.215	1813.379	1926.534

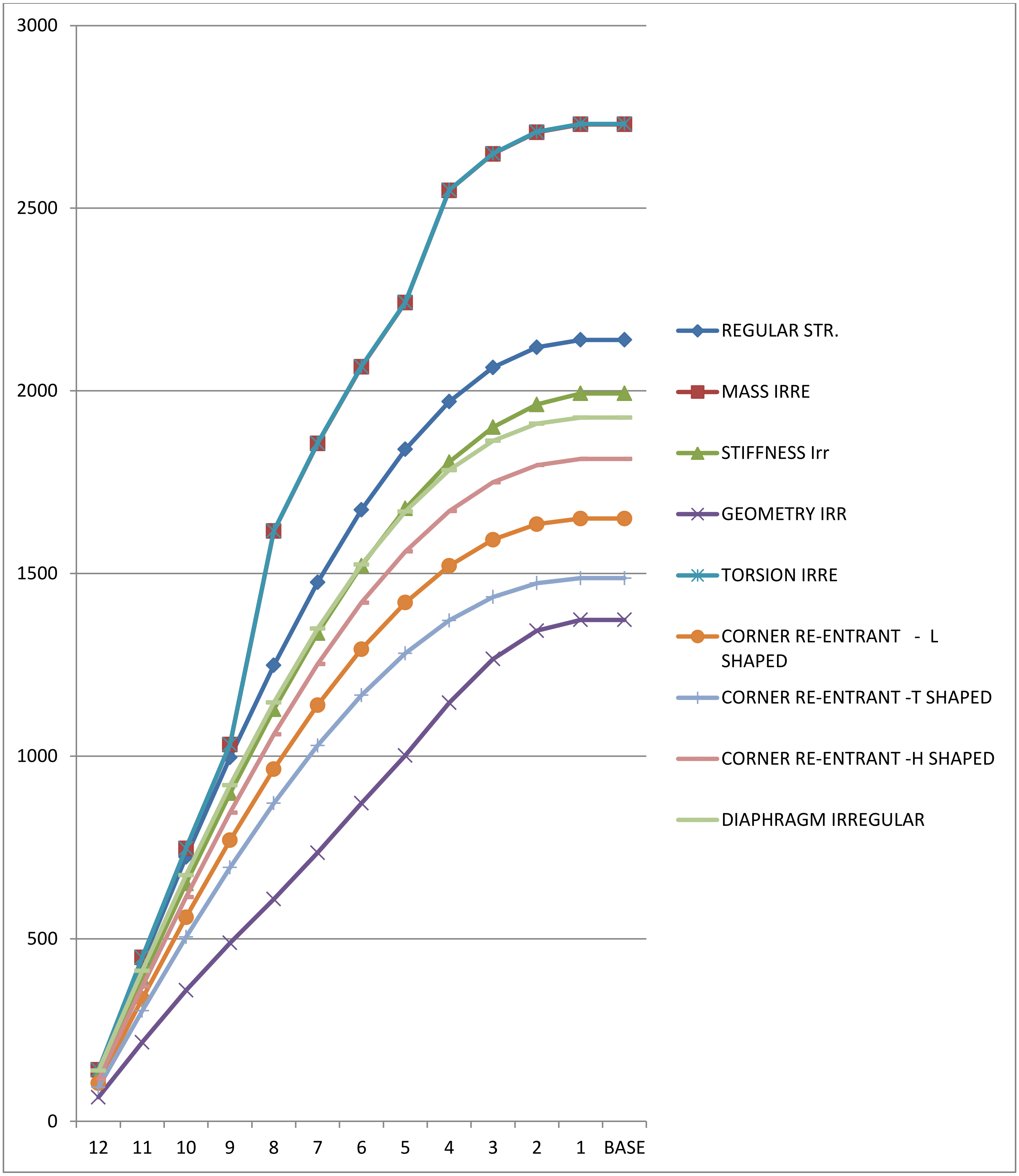

Fig: 5.2 COMPARISON OF PEAK STOREY SHEAR OF REGULAR AND IRREGULAR STRUCTURES IN Z DIRECTION (KN)

5.3 COMPARISON OF ABSOLUTE DISPLACEMENT ALONG X DIRECTION OF REGULAR AND IRREGULAR STRUCTURES (3.1 to 3.7) in (mm)

STOREY	REGULAR STR.	MASS IRRE	STIFFNESS Irr	GEOMETRY IRR	TORSION IRRE	CORNER RE-ENTRANT - L SHAPED	CORNER RE-ENTRANT -T SHAPED	CORNER RE-ENTRANT -H SHAPED	DIAPHRAGM IRREGULAR
12	191.724	246.539	200.465	144.774	246.539	185.805	182.033	187.897	195.545
11	189.139	243.614	198.070	141.249	243.614	183.424	179.703	185.528	192.788
10	183.35	237.156	192.738	133.679	237.156	177.803	174.249	179.892	186.718
9	174.399	227.091	184.464	122.471	227.091	169.042	165.742	171.087	177.423
8	162.636	213.413	173.53	109.765	213.413	157.583	154.571	159.538	165.289
7	148.398	194.718	160.225	99.915	194.718	143.823	141.088	145.629	150.677
6	131.922	173.115	144.778	87.834	173.115	127.998	125.517	129.597	133.832
5	113.328	149.135	127.334	73.539	149.135	110.173	107.943	111.519	114.877
4	92.683	122.726	107.976	58.143	122.726	90.323	88.383	91.390	93.881
3	70.107	92.635	86.792	44.673	92.635	68.485	66.918	69.268	70.964
2	45.890	60.442	63.953	29.657	60.442	44.908	43.819	45.410	46.425
1	20.693	27.194	39.245	13.484	27.194	20.265	19.749	20.489	20.928
BASE	0	0	0	0	0	0	0	0	0

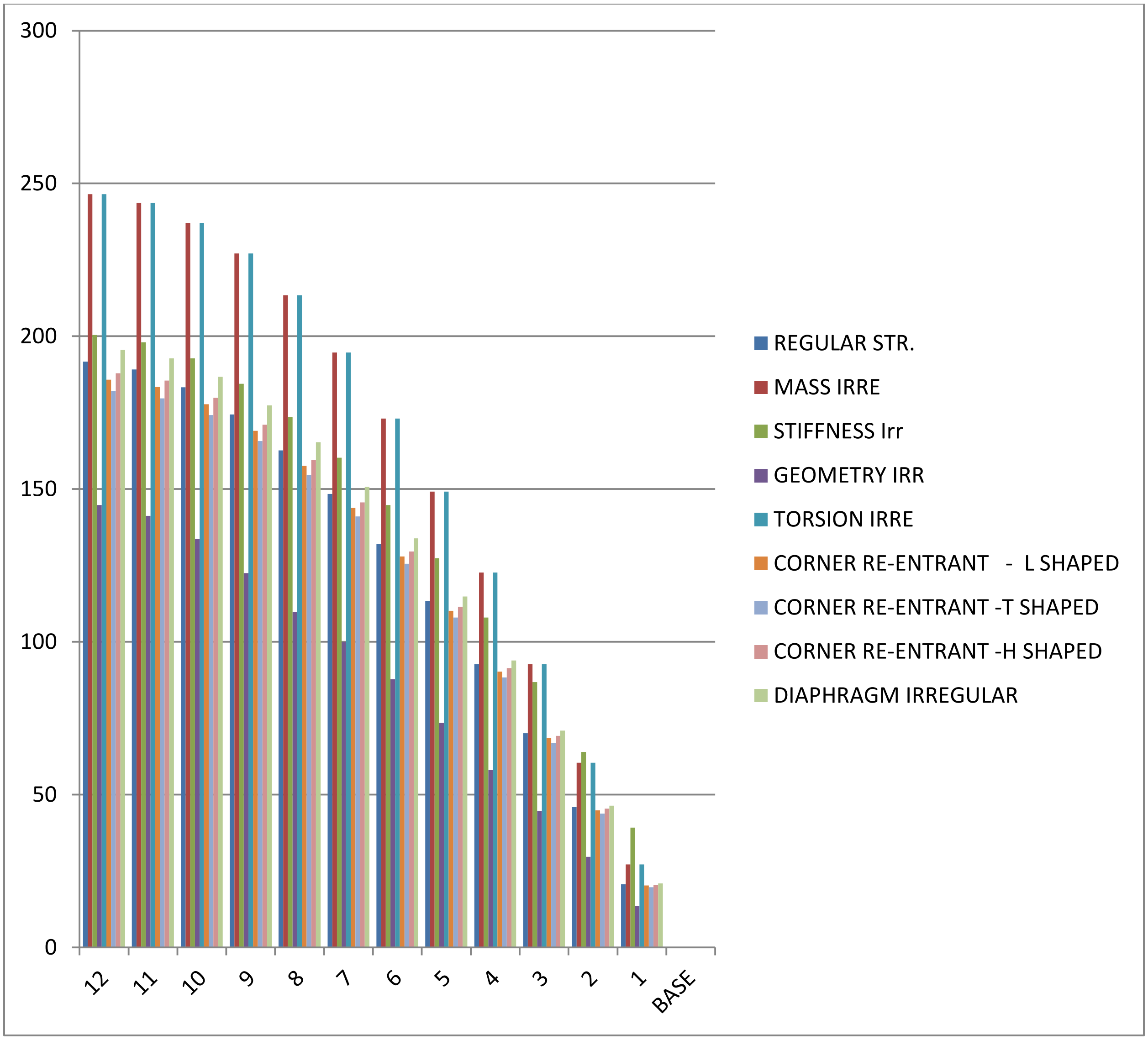

Fig :5.3 COMPARISON OF ABSOLUTE DISPLACEMENT ALONG X DIRECTION OF REGULAR AND IRREGULAR STRUCTURES in (mm)

5.4 COMPARISON OF PEAK STOREY SHEAR OF REGULAR AND IRREGULAR STRUCTURES WITH SHEAR WALL (3.8 to 3.12) IN X DIRECTION (KN)

STOREY	REGULAR STR. WITH SHEAR WALL	OUT OF PLANE OFFSET WITH SHEAR WALL	NON-PARALLEL SYSTEMS WITH SHEAR WALL	IN-PLANE DISCONTINUITY WITH SHEAR WALL	DISCONTINUITY IN CAPACITY WITH SHEAR WALL
12	178.0553	163.5217	166.6184	174.2617	148.4618
11	549.37	504.5812	518.7253	539.6219	460.375
10	895.7107	820.2937	846.7802	882.1189	753.1276
9	1205.528	1101.49	1140.995	1189.794	1019.225
8	1473.955	1347.296	1397.098	1457.222	1256.56
7	1702.602	1564.197	1615.981	1685.29	1468.325
6	1896.751	1761.449	1801.395	1879.383	1660.952
5	2061.288	1944.773	1956.944	2047.938	1840.305
4	2197.366	2111.657	2083.482	2188.847	2008.145
3	2301.598	2251.338	2178.669	2297.381	2160.278
2	2368.227	2349.014	2238.641	2366.988	2287.32
1	2394.45	2394.381	2262.099	2394.446	2373.195
BASE	2394.45	2394.381	2262.099	2394.446	2373.195

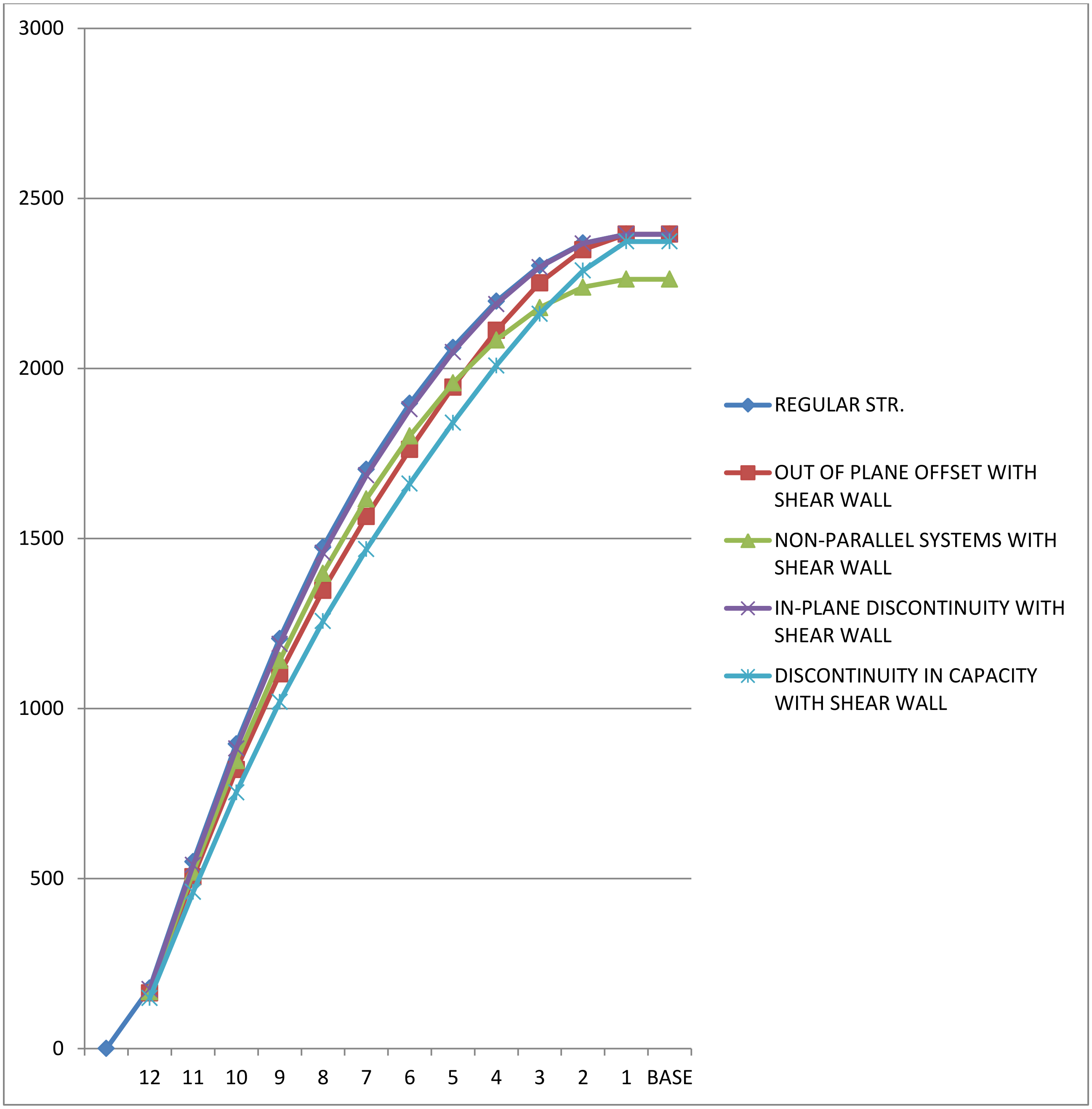

Fig: 5.4 COMPARISON OF PEAK STOREY SHEAR OF REGULAR AND IRREGULAR STRUCTURES WITH SHEAR WALL IN X DIRECTION (KN)

5.5 COMPARISON OF PEAK STOREY SHEAR OF REGULAR AND IRREGULAR STRUCTURES WITH SHEAR WALL (3.8 to 3.12) IN Z DIRECTION (KN)

STOREY	REGULAR STR. WITH SHEAR WALL	OUT OF PLANE OFFSET WITH SHEAR WALL	NON-PARALLEL SYSTEMS WITH SHEAR WALL	IN-PLANE DISCONTINUITY WITH SHEAR WALL	DISCONTINUITY IN CAPACITY WITH SHEAR WALL
12	185.1866	159.155	169.3997	184.2716	160.8647
11	564.2227	496.0872	520.9295	561.6958	498.6625
10	909.6633	820.6663	845.3438	905.9438	819.1733
9	1210.685	1127.248	1133.597	1206.321	1116.168
8	1465.575	1410.257	1383.019	1460.944	1385.675
7	1681.282	1664.674	1596.92	1676.439	1625.912
6	1868.464	1885.941	1781.345	1863.872	1836.155
5	2034.752	2070.195	1940.573	2031.428	2015.413
4	2179.487	2214.106	2073.878	2177.455	2161.608
3	2294.055	2315.243	2175.654	2293.095	2271.605
2	2367.186	2373.33	2238.909	2366.888	2342.536
1	2394.443	2394.451	2262.141	2394.415	2373.206
BASE	2394.443	2394.451	2262.141	2394.415	2373.206

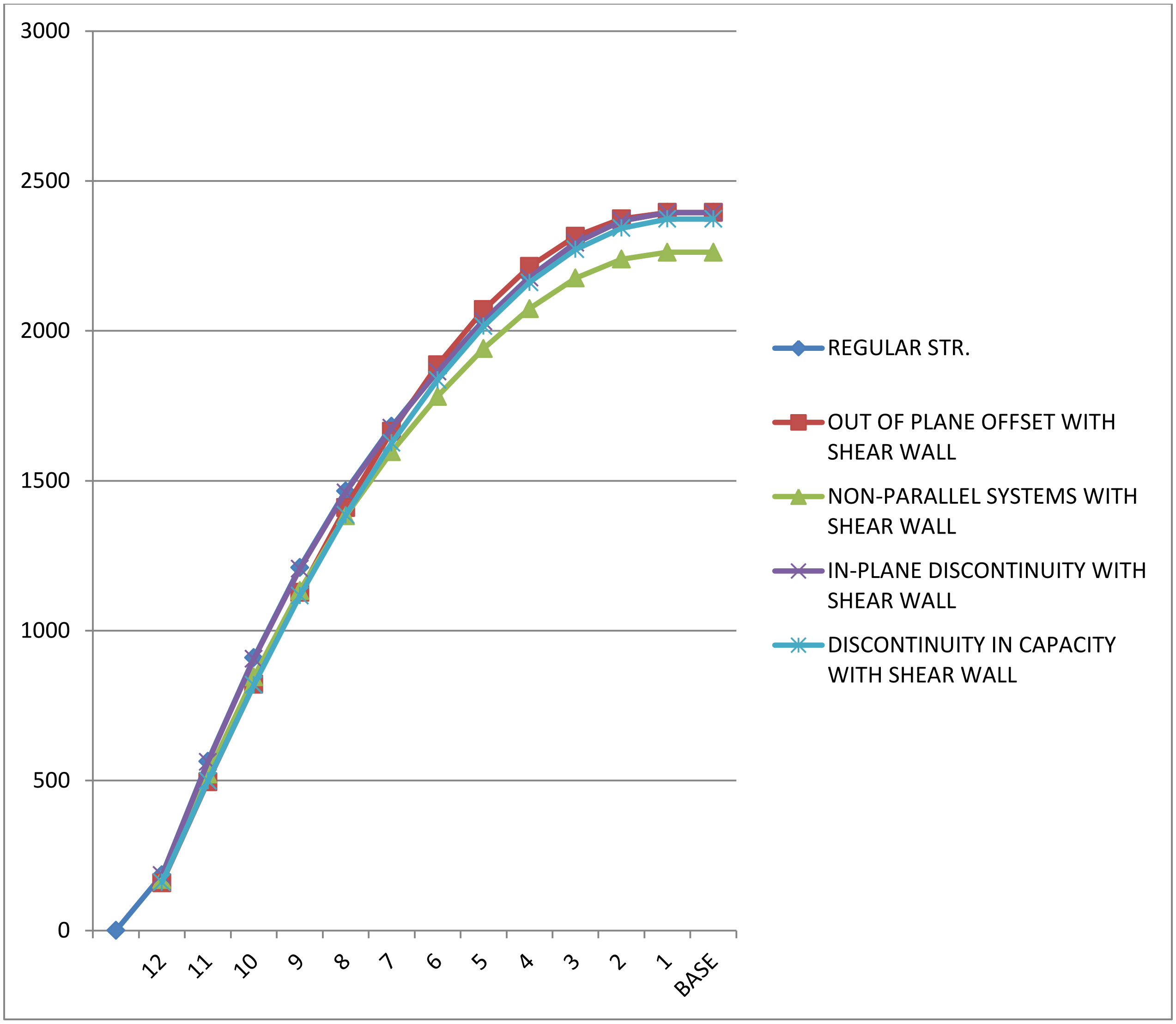

Fig: 5.5 COMPARISON OF PEAK STOREY SHEAR OF REGULAR AND IRREGULAR STRUCTURES WITH SHEAR WALL IN Z DIRECTION (KN)

5.6 COMPARISON OF ABSOLUTE DISPLACEMENT ALONG X DIRECTION OF REGULAR AND IRREGULAR STRUCTURES (3.8 to 3.12) in (mm)

STOREY	REGULAR STR. WITH SHEAR WALL	OUT OF PLANE OFFSET WITH SHEAR WALL	NON-PARALLEL SYSTEMS WITH SHEAR WALL	IN-PLANE DISCONTINUITY WITH SHEAR WALL	DISCONTINUITY IN CAPACITY WITH SHEAR WALL
12	20.992	53.191	20.886	16.098	57.679
11	18.884	50.615	18.787	14.397	55.177
10	16.680	47.926	16.592	12.629	52.567
9	14.462	45.222	14.384	10.858	49.943
8	12.249	42.511	12.180	9.101	47.311
7	10.070	39.816	10.011	7.416	44.692
6	7.996	37.166	7.917	5.966	42.114
5	5.984	34.598	5.945	4.411	39.612
4	4.179	32.155	4.150	3.167	37.227
3	2.612	29.878	2.593	2.042	34.997
2	1.351	27.902	1.340	1.089	33.081
1	0.472	25.619	0.467	0.394	30.678
BASE	0	0	0	0	0

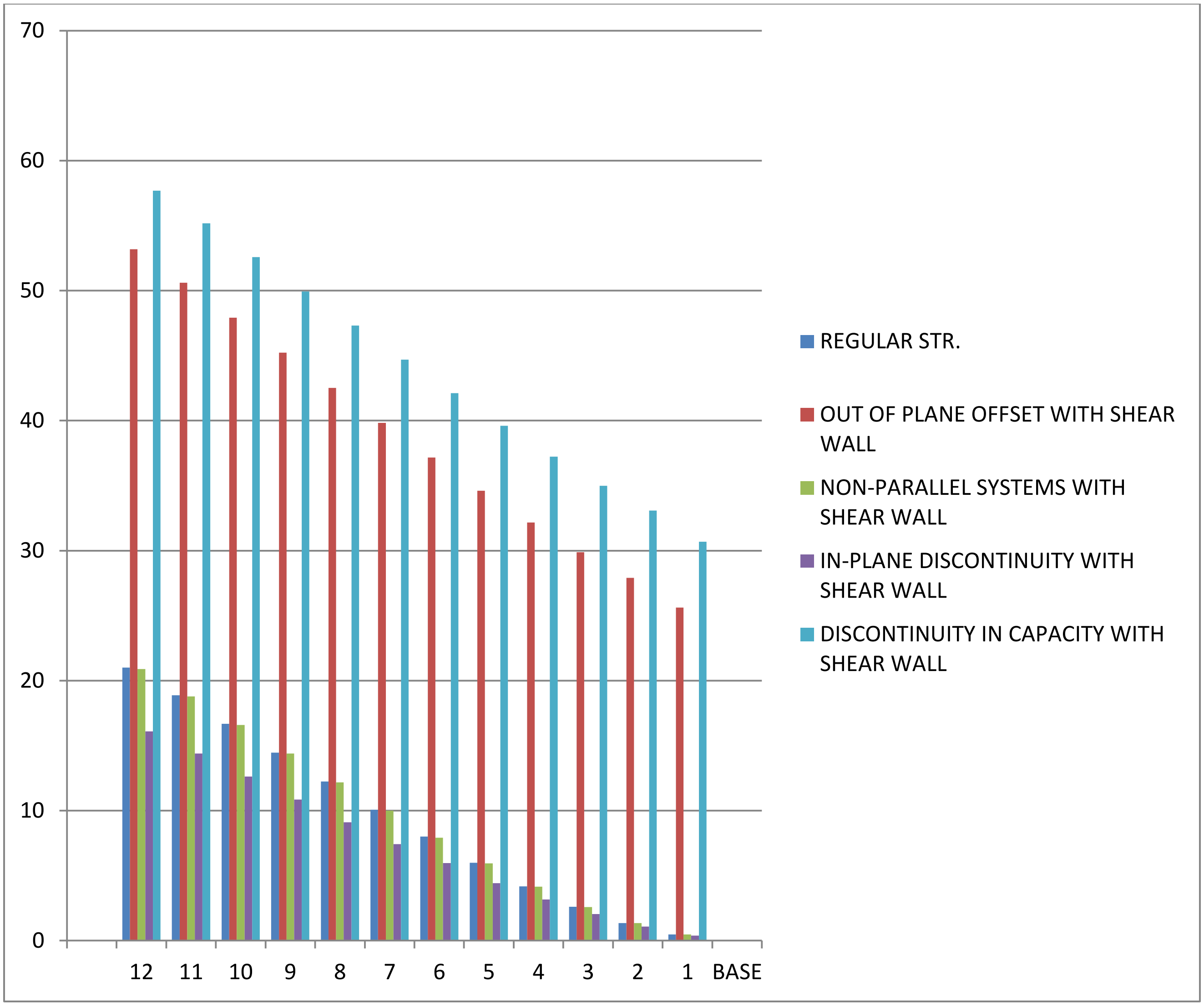

Fig : 5.6 COMPARISON OF ABSOLUTE DISPLACEMENT ALONG X DIRECTION OF REGULAR AND IRREGULAR STRUCTURES in (mm)

5.7 CONCLUSIONS

- In general for all types of structures the storey shear force is maximum in ground storey & it declines as we go up in the building & the graph merges in as we go up the structure.
- In the Mass irregular structure, the storey shear force is more in lower storeys if compared to regular structure. The graph merges in as we go up the structure and the mass irregular storey shear force becomes comparable above 8th storey with regular structure. The displacement are higher for every storey as compared to regular structure.
- In the Stiffness Irregular structure, the ground storey is less stiff than above storeys because of height of 4.5m more than height of the above storeys & hence the storey shear force is less in stiffness irregular structure as compared to regular structure. It was seen that displacements of upper stories did not differ much from regular str however if we moved down to lower stories the absolute displacement of soft storey was on higher side as compared to respective storey in regular structures.
- In the torsion Irregular structure, the storey shear are much on higher sides for lower storeys as compared to regular structure. The displacements are maximum for this type of irregular structure.
- In the Re-entrant corner Irregular str for all shapes L,T,+ and Diaphragm Irregular str, the storey shear are comparable to each other but are less than regular structure and the displacements are also comparable to regular.

- In the out of plane offset having shear walls, storey shear are less for higher storeys but as we move down it is comparable to the regular str having shear walls but dispacements are much on higher side for this type of irregularity as compared to regular.
- In the non-parallel system irregular str, the trend is same as regular but values are less for storey shear and displacements.
- In discontinuity in capacity , the strength for ground storey is less as compared to above storeys & hence the storey shear force is less in discontinuity in cap irregular structure as compared to regular structure. Also the displacements on higher side.
- Thus analysis proves that irregularities are risky for the structures & it's significant to have regular shapes of structures in addition to uniform load distribution.
- So, if possible irregularities in a structure must be evaded. However, if Irregularities in the structure have to be introduce for some reason, they must be correctly designed.

REFRENCES

CODES

1. IS 456-2000 —Indian Standard Code for Practice for Reinforced Concrete for General Building Construction.

2. IS 1893 (PART 1) : 2002 , Criteria For Earthquake Resistant Design Of Structures

BOOKS

1. Agarwal Pankaj and Shrikhande Manish- Earthquake resistant design of structures: New Delhi, PHI Learning Private Limited, 2010

JOURNALS

1. Ashvin g. soni, Prof. D. G. Agrawal, Dr. A.M. Pande —Effect of Irregularities in Buildings and their Consequences

2. Mr. S.Mahesh, Mr. Dr.B.PandurangaRao —Comparison of analysis and design of regular and irregular configuration of multi Storybuilding in various seismic zones and various types of soils using ETABS and STAAD

3. Lee Han Seon ,Dong Woo Kee, 2007, Seismic response characteristics of high-rise RC wall buildings having different

irregularities in lower stories, Engineering Structures 29 (2007):3149–3167

4. Poonam, Kumar Anil and Gupta Ashok K, 2012, Study of Response of Structural Irregular Building Frames to Seismic Excitations, International Journal of Civil, Structural, Environmental and Infrastructure Engineering Research and Development (IJCSEIERD), ISSN 2249-6866 Vol.2, Issue 2 (2012) 25-31

5. S.K.Dubey and P.D.Sangamnekar, "Seismic Behavior of Asymmetric RC Building", International Journal of Advanced Engineering Technology, Vol II October-December 2011.

SOFTWARES USED

1. STAAD PRO V8i
2. MS EXCEL