International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 07 | July 2021 www.irjet.net p-ISSN: 2395-0072

A Report on

ANALYSIS OF REGULAR AND IRREGULAR SEISMIC RESPONSE OF MULTISTORIED RC STRUCTURE FOR DIFFERENT SEISMIC ZONE AND SOIL CRITERIA

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Abstract: For the time being the nature force causing hazards for human life although the human has come with many innovative methods and resource to overcome on these situations. the one of major hazard is caused due to the earthquakes as its frequent appearance.in this research four models of plan irregular and regular are analyzed for the time history ground motion data with respective zone and soil type. The time history analyses are carried on these modals using the ETABS software. All the outcome such as base shear, displacement and story stiffness are compared.

The outcome data such as base shear, displacement and story stiffness are arranged in tabulated format. The time history analysis outcome of all models is plotted in graphs of comparisons. The conclusions are made on base of results outcomes of graphs.

Key Words: regular structure, irregular structure, earth quake, ground motion, displacement, base shear, stiffness, BHUJ earthquake, Time history.

1.INTRODUCTION

Earthquake-resistant or a seismic structure are designed to protect buildings to some or greater extent from earthquakes. Earthquake-resistant structures are intended to withstand the largest earthquake of a certain probability that is likely to occur at their location. Resist minor earthquakes without damage that might occur several times during the life of the structure. The structure should not collapse or cause loose of human lives even in the event major earthquakes of small probability of occurrence. Intermediate design levels may also be defined for which some degree of damage may be accepted as long as the structure remains stable and intact then only if human lives are safe.

1.1 Plan Irregularity (IS 1893 (Part 1): 2002)

2 1. Torsional irregularity 4. Out-of-plane offsets
3 2. Re-entrant corners 5. Non parallel systems
4 3. Diaphragm discontinuity

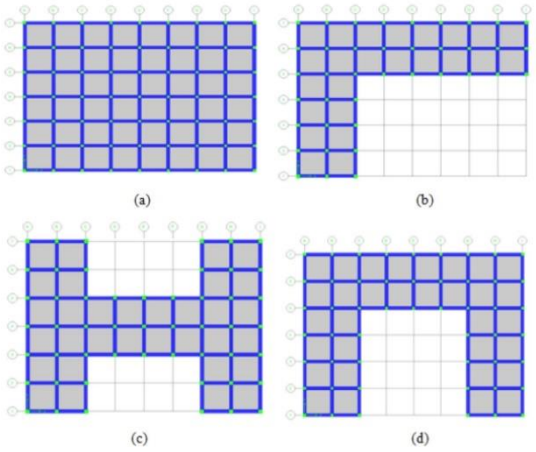

Fig-1: types of Irregularity

1.2 DIFFERENT SEISMIC ZONES OF INDIA

The earthquake zoning map of India divides India into 4 seismic zones (Zone 2, 3, 4 and 5). According to the present zoning map, Zone 5 expects the highest level of seismicity whereas Zone 2 is associated with the lowest level of seismicity

1.3 Earthquake magnitude on Richter scale

- 2.0 on less: this can be felt very little, it's so less that even the object in a building are not affected.
- Over 5.0: this can be felt as it causes damage to the object they may fall and some minor cracks may occur on a weak building.
- Over 6.0: this is very strong earthquake; the causes of destruction are more. collapse of weak

buildings are seen and causes of death is also seen.

- Over 7.0: this is major earthquake it as very high intensity even can observed on major buildings. the death and the destruction are more in these earthquakes

1.4 BHUJ as the case study

The earthquake in Bhuj Gujrat was occur on 26th January 2001 at 8.45 am the recorded time period was about 110sec and the intensity measured was 6.9 magnitude on the Richter scale. The Bhuj come under Kutch region which is known for its seismic behavior, the epicenter of this earthquake was in the Bhachau which was 80km from Bhuj was measured 7.7 on the Richter scale. The intensity was so high that it was felt for the radius 250 km, the city of Gujrat Ahmedabad and the neighboring countries Pakistan, Afghanistan also felt energy of this earthquake. The occurrence of this earthquake was later found out that it was because of a present of Blind Thrust Fault in that region.

The major effect of the Bhuj earthquake:

1. More than 20 thousand deaths which included 184 students and 18 teachers, 10 lakhs injured ,4 lakhs family lost their houses, 6 lakhs building where destroyed.
2. All the emergency service like transportation roads, communication line, water supply pipes and electricity line where completely destroyed.
3. The multi-storeyed building, commercial complex, schools, hospitals got destroyed. the general hospital which had hundred plus patients got collapsed. It was not the earthquake which took lives of peoples, those were the building which took their lives.
4. Due to collapse of hospitals the injures where treated on roads and open areas they even converted cricket ground as their treatment centre.
5. Due to the lake of transportation, communication and the power supply the people got stuck in buildings for more than 3 days. it took 48 hours for international rescue squad to reach the spot.
6. It took 30500 soldiers, 17500 labours and the rescue international squad 6 days of mission.
7. The total of 2000 metric ton of concrete dust was removed to rescue people.
8. The earthquake was so worst that the Bhuj was short wood to burn the dead bodies.

1.5 Soil types

Type I - Rock or Hard Soil is defined as well graded gravel and sand gravel and sand gravel mixtures with or without clay binder and clayey sands poorly graded or sand clay mixtures shaving N above 30 where N is the standard penetration value.

Type II – Medium Soil is defined as all soils with N between 10 and 30 and poorly graded sands or gravelly sands with little or no fines (SP) with N>15.

Type III - Soft Soil is defined as all soils other than SP, with N<10.

2.OBJECTIVES: -

1. To model and analysis 11 story regular and irregular building. The modelling and the analysis are carried out by using ETABS software.
2. Study is carried out for various earth quake zone of India and for various soil type.
3. To carry out dynamic time history analysis as per IS 1893 (part 1): 2016 specification using ETABS software.
4. To know the response of the RC regular and irregular structures for applied seismic intensity.

2.1 METHODOLOGY: -

1. Analysis of regular and irregular RCC building of G+10 stories by means of ETABS modelling.
2. To run analysis on selected structure for different zone and soil variation.
3. To run time history analysis for BHUJ time history ground motion data.
4. To carry out the comparative analysis for the following parameters.
   a. Base shear
   b. Storey stiffness
   c. Storey displacement

3. RESULTS:

3.1 Base share(Time history analysis)

IRREGULAR BUILDING

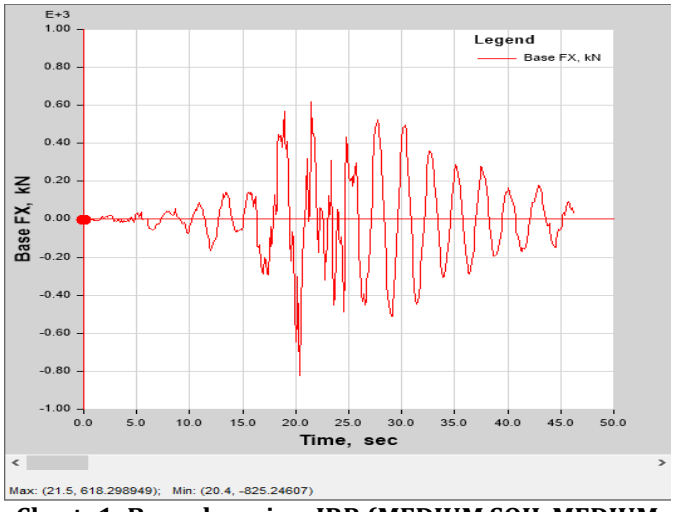

Chart -1: Base share in x IRR (MEDIUM SOIL MEDIUM INTENSITY)

MAX: 21.5sec (618.29 kN) in x

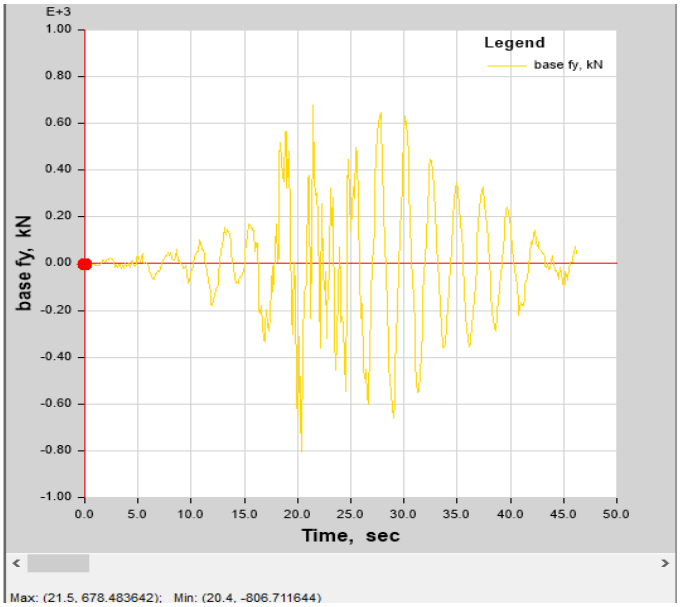

Chart -2: Base share in Y IRR (MEDIUM SOIL MEDIUM INTENSITY)

MAX: 21.5sec (678.483 kN) in x

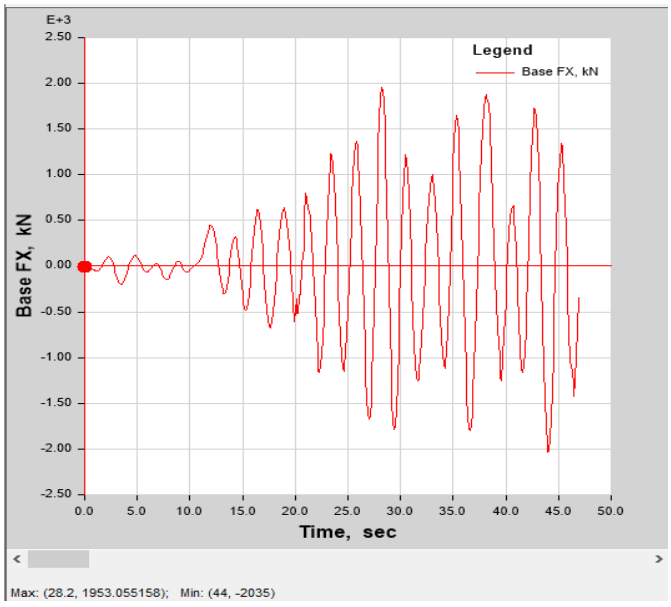

Chart -3: Base share in x IRR (LOW SOIL WITH HIGH INTENSITY)

MAX: 28.2sec (1953.55 kN) in x

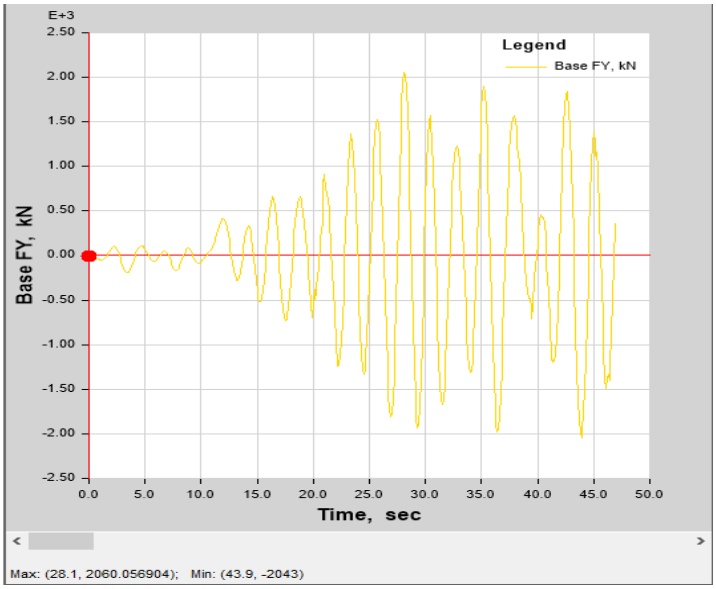

Chart -4: Base share in Y IRR (LOW SOIL WITH HIGH INTENSITY)

MAX: 28.1sec (2060.05 kN) in y

REGULAR BUILDING

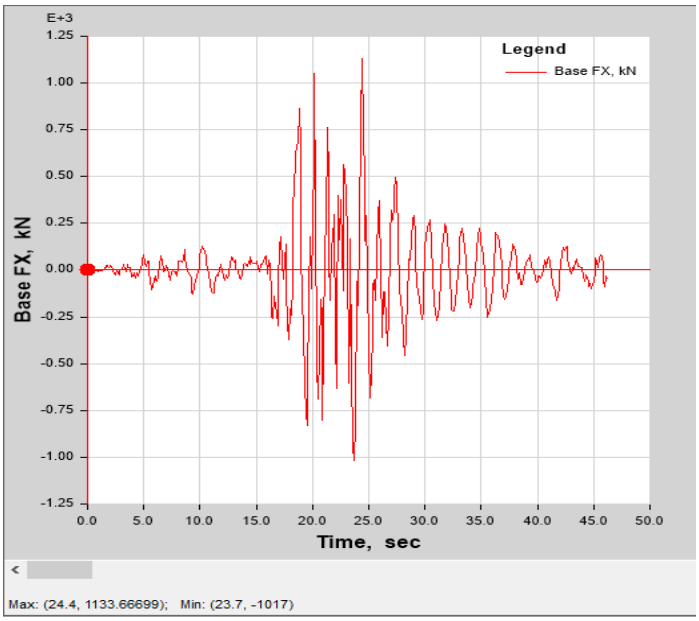

Chart -5: Base share in x RE (LOW SOIL WITH HIGH INTENSITY)

MAX :24.4sec (1133.666 KN) in x

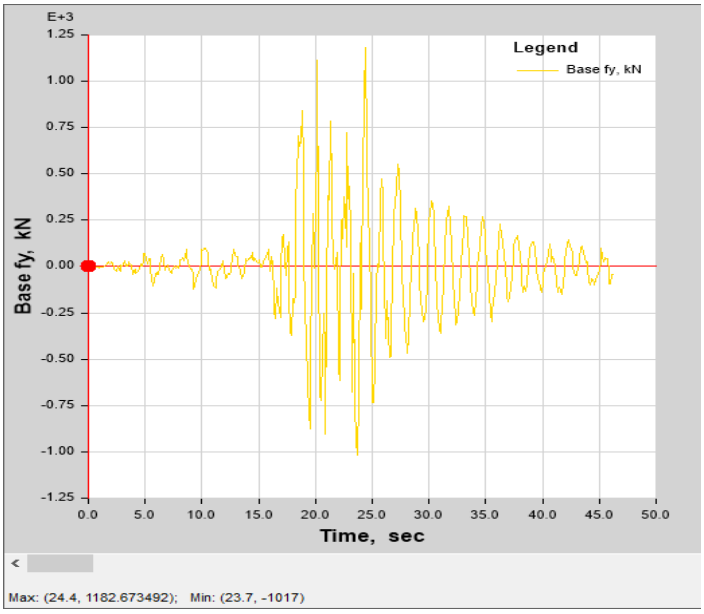

Chart -6: Base share in Y RE (LOW SOIL WITH HIGH INTENSITY

MAX: 24.4 sec (1182.673 KN) in y

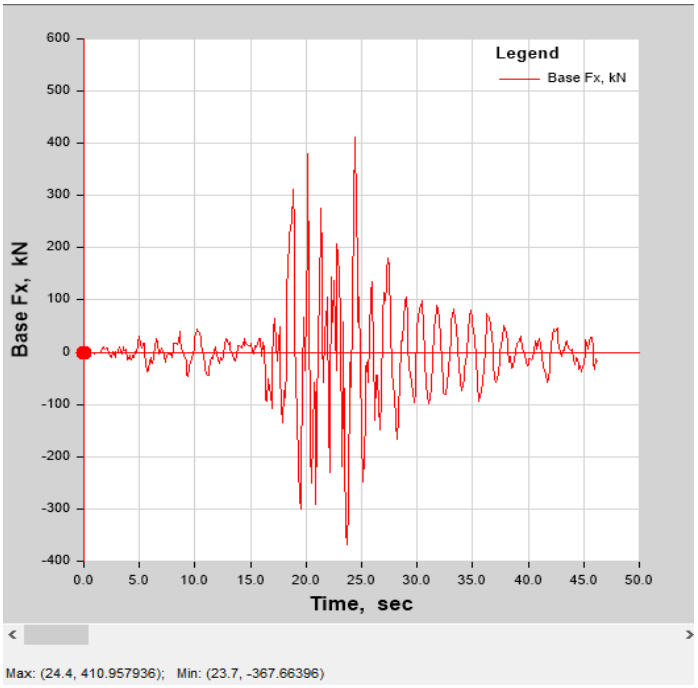

Chart -7: Base share in x RE (MEDIUM SOIL MEDIUM INTENSITY)

MAX: 24.4 sec (410.957 KN) in x

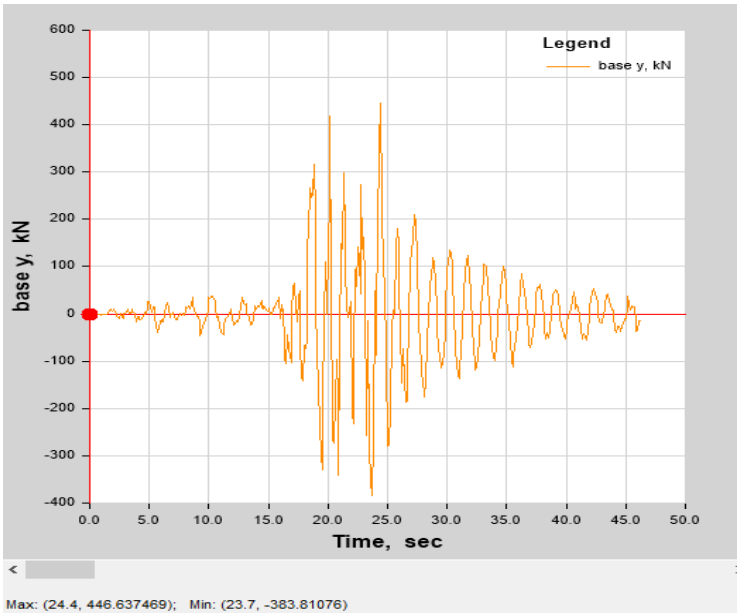

Chart -8: Base share in Y IRR (MEDIUM SOIL MEDIUM INTENSITY)
MAX: 24.4 sec (446.637 KN) in y

Results: the maximum value of base shear is found at 28.1sec (2060.05 kN) in y and 28.2 sec (1953.55 kN) in x for
Irregular building with low soil of high intensity.

3.2 Maximum displacement

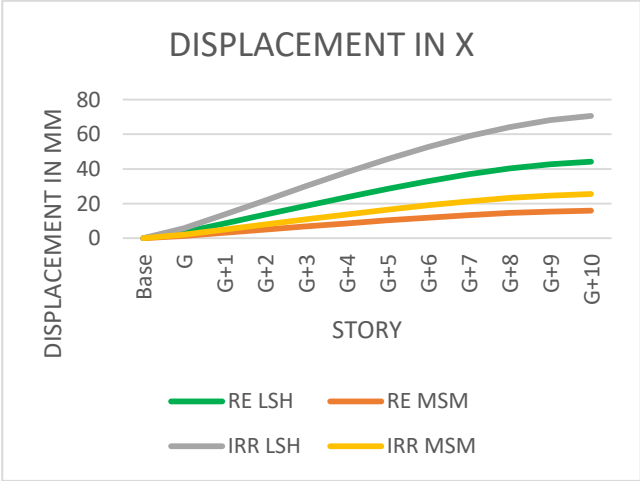

Chart -9: Displacement in x

	Displacement in x			
Story	RE LSH	RE MSM	IRR LSH	IRR MSM
Base	0	0	0	0
G	3.486	1.271	5.681	2.056
G+1	8.485	3.078	13.682	4.952
G+2	13.63	4.937	21.893	7.924
G+3	18.747	6.786	30.047	10.875
G+4	23.745	8.591	38.001	13.754
G+5	28.521	10.317	45.596	16.503
G+6	32.954	11.918	52.641	19.053
G+7	36.902	13.345	58.915	21.324
G+8	40.207	14.539	64.17	23.226
G+9	42.694	15.437	68.127	24.658
G+10	44.225	15.99	70.562	25.54

Table -1: Displacement in x

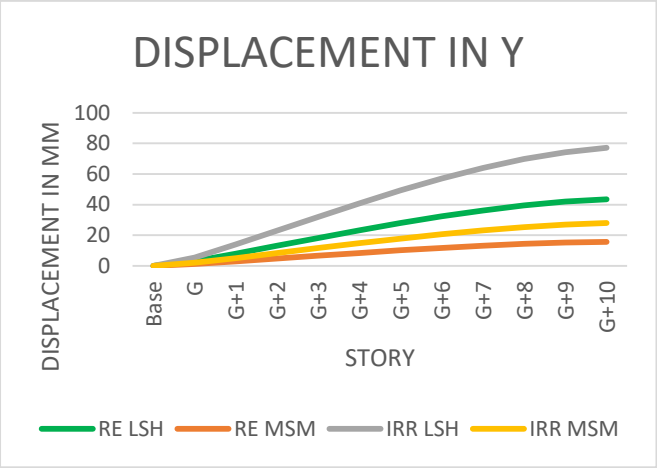

chart -10: Displacement in y

`	Displacement in Y			
Story	RE LSH	RE MSM	IRR LSH	IRR MSM
Base	0	0	0	0
G	3.054	1.109	5.374	1.945
G+1	7.914	2.869	13.923	5.039
G+2	13.042	4.726	22.959	8.31
G+3	18.158	6.579	31.987	11.578
G+4	23.148	8.385	40.807	14.77
G+5	27.907	10.108	49.232	17.819
G+6	32.313	11.703	57.051	20.649
G+7	36.225	13.12	64.019	23.171
G+8	39.486	14.3	69.86	25.285
G+9	41.927	15.184	74.282	26.886
G+10	43.446	15.734	77.092	27.903

Table -2: Displacement in y

Results: from the above graph and table the maximum value displacement found for irregular structure (low soil with high intensity) at G+10 (77.092 mm) in y direction.

3.3 Story stiffness

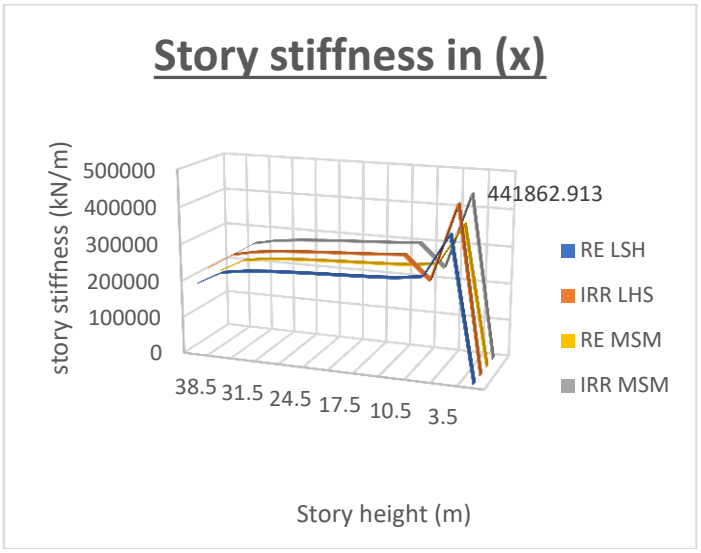

Chart -11: Story Stiffness in x

		Story stiffness in (x)			
Story	Height(m)	RE MSM	RE LSH	IRR LHS	IRR MSM
Story10	38.5	190979.219	190979.219	217114.795	217114.795
Story9	35	225098.339	225098.339	257453.179	257453.179
Story8	31.5	235086.519	235086.519	270743.271	270743.271
Story7	28	240298.362	240298.362	277920.764	277920.764
Story6	24.5	243747.653	243747.653	282757.087	282757.087
Story5	21	246489.554	246489.554	286636.38	286636.38
Story4	17.5	249019.304	249019.304	290228.879	290228.879
Story3	14	251667.473	251667.473	293983.887	293983.887
Story2	10.5	255113.14	255113.14	298775.43	298775.43
Story1	7	264586.01	264586.01	237290.025	237290.025
g	3.5	376157.793	376157.793	441862.913	441862.913
Base	0	0	0	0	0

Table -3: Story Stiffness in x

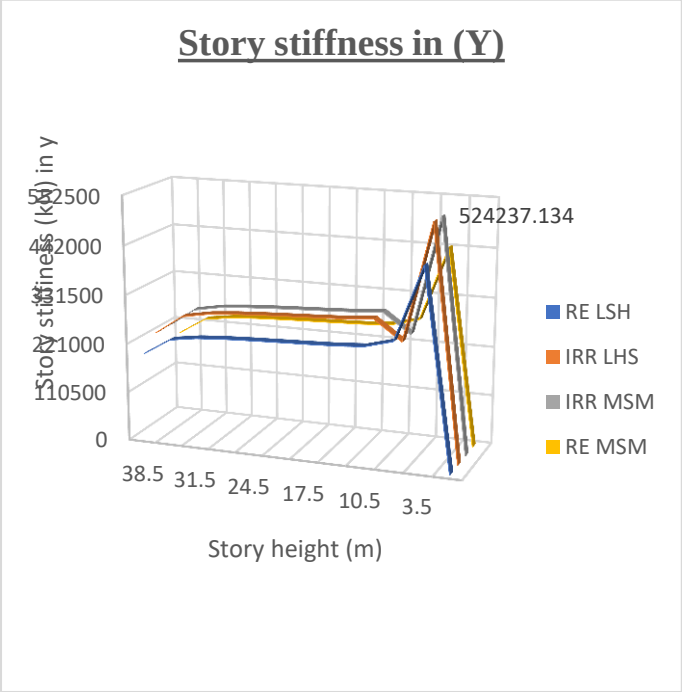

Chart -12: Story Stiffness in y

		Story stiffness in (Y)			
Story	Height(m)	RE MSM	RE LSH	IRR LHS	IRR MSM
Story10	38.5	196861.345	196861.345	228869.087	228869.087
Story9	35	234536.462	234536.462	271452.308	271452.308
Story8	31.5	243722.546	243722.546	282837.123	282837.123
Story7	28	247988.467	247988.467	288339.936	288339.936
Story6	24.5	250721.971	250721.971	291924.961	291924.961
Story5	21	252896.072	252896.072	294795.879	294795.879
Story4	17.5	254947.424	254947.424	297510.738	297510.738
Story3	14	257321.114	257321.114	300634.691	300634.691
Story2	10.5	261657.43	261657.43	306175.842	306175.842
Story1	7	278604.386	278604.386	261619.562	261619.562
g	3.5	444783.437	444783.437	524237.134	524237.134
Base	0	0	0	0	0

Table -4: Story Stiffness in y

Results: from the above table and graph maximum story stiffness is found for irregular structure (low soil with high intensity) at G (524237.134 kN\m) in y direction.

4. CONCLUSIONS

- From analysis of the base shear values and the displacement values of a structure.it is found that the values are depended on the geometry of the structure and also the seismic zone with respective type .as we found maximum value of base shear and the displacement values for irregular structure with (low soil with high intensity). and the minimum value for regular structure with (medium soil with medium intensity).
- From analysis it concludes that the story stiffness values of a structure are only depended on the geometry of the structure. as the maximum values are found at irregular structure with (low soil with high intensity) and irregular structure with (medium soil with medium intensity). where the minimum values are found at regular structure with (low soil with high intensity) and regular structure with (medium soil with medium intensity).
- From the analysis's parameter such as base shear, displacement and the story stiffness it concludes that the regular structures with respective to its seismic zone and soil type are more resistive to seismic action than compared irregular structures.

4.1 Scope of work

- The present work can be extended by check for vertical irregularities.
- The present study can be extended for various ground motion data.
- The present work can be extended for structure with shear wall.

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BIOGRAPHIES

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