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A STUDY ON EARTHQUAKE RESISTANT TALL STRUCTURE WITH LATERAL FORCE METHOD

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Abstract: Earthquake resistant structures are capable of resisting lateral and vertical forces acting on the structures. But no structures can entirely survive during earthquake without any damages. According to codes, earthquake resistant structures are designed to withstand expected earthquake at least to occur once during the design life of the structure. Reinforced concrete buildings are analyzed and designed to meet the requirements of relevant codes of practice. Such buildings designed as per codal provision will survive during earthquake with minor damages of structural elements. Many of the countries have their own codes of practice for Earthquake Resistant structures. The buildings are designed and detailed as per codes. This paper gives the review on performance of buildings towards seismic load for various designs. The review explains the need of improvement in codes, thus improve the performance of structures better during earthquake.

The framework was also tested for P-analysis and adjustments required from time to time have been made after the IBC code .When the steel resistance frame was developed in accordance with IS-800: 2007 based on these analytical methods. In the process of naming this stage it has been repeated many times until all the standards specified in IS 800 have been met. The developed framework was then analyzed and the results were compared according to the categories used. The cost-effectiveness of both methods has been compared. Also the basic design that contains the base plate is made according to IS 800: 2007. Important statistics are calculated and statistics are created.

The software used for analyze and design is STAAD Pro. Both at the time of design and analysis the calculations performed were performed and compared.

Keywords: Base shear, Displacement, Seismic analysis, Storey drift, stiffness.

1. PROBLEM STATEMENT

A six-story structure with three biscuits on the straight side and 6 bays on the latest side was taken and analyzed by both the same methods for measuring and viewing the views and designed.

The height with the storey is 3 meters so the open space between the bays is 8 meters and the consecutive spaces of ditches are 6 meters

The following earthquake vibration parameters follows Seismic zone: 3

- Zone factor ‘Z’:0.16
- Structure frame: steel moment performing frame designed as per IS 456:2000
- Calculation reduction factor: 5
- Importance factor: 1.5
- Damping ratio: 3%

2. METHODOLOGY

The scanning process can enable it to use a team-based team approach or a visual response approach.

1. Beam category selection.
2. The classification of columns assesses „weakness of solid column formation‟.
3. Check the compression / binding at low levels under download.
4. Calculation of seismic weight.
5. Strict analysis of structure 1 plane under lateral loads.
6. Strict analysis under load gravity.
7. Strength test using the results of P-Δ (parameter ϴ) within the context of an earthquake load.
8. Deflection check underground loading.
9. With the visual response of scene 5 it is replaced by the visual appearance of the plane of 1 plane to reciprocate the effects of earthquake actions

3. RESPONSE & SPECTRUM ANALYSIS

In the field of seismic analysis this is often among the most used and calculating methods. using visual editing graphic to work. The concept used is that the weight is illuminated at diaphragm levels on the roof and at ground levels. Diaphragms are considered immutable and as a result the column is not stable but later flexible. The rotating response of a mirror is represented by a type of weight-related migration illuminated by degrees of flexible flexibility (or vibration modes n) sufficient for the weight value.

Unstructured analysis of the structure is usually carried out in accordance with standard mechanical methods using the appropriate victim and the rigidity of the structural system, and as a result the natural time (T) and mode (Ø) of vibration methods are usually obtained. The distribution of weight and therefore the strength of the structure determine the composition of the mode.

Since the ground foundation is used under a multi-level system, the distorted structure is simply a mixture of all sorts of modes, which are usually achieved by vibrating vibrations of each illuminated sound. The modal analysis process is used to determine the dynamic response of the multi-degreeof-freedom system. Modal analysis as suggested by IS 1893 is discussed in this regard. Each vibration mode has its own unique vibration time (with its own so-called status mode created by the detection of multi-diverted poles.)

The answer lies in the use of various combining methods such as the square-root-of-sum-of-square method (SRSS) or the entire quadratic method (CQC) used when the natural periods of the various methods are well divided (when they are 10% different of low frequency so the pumping rate does not exceed 5% .CQC may be the reporting method for modal integration methods recommended by IS 1893.

Table 4.2: Analysis by response spectrum method.

Storey no.	Absolute displacement of storey D_i (m)	Design inter storey drift D_r (m)	Storey lateral force V_{tot} (KN)	Shear at storeyP_{tot} (KN)
1	0.00491	0.00491	1.877	120.981
2	0.0115	0.0066	6.112	119.104
3	0.0161	0.0046	10.651	112.992
4	0.0196	0.0035	17.331	102.341
5	0.0219	0.0023	29.98	85.01
6	0.0234	0.0015	55.03	55.03

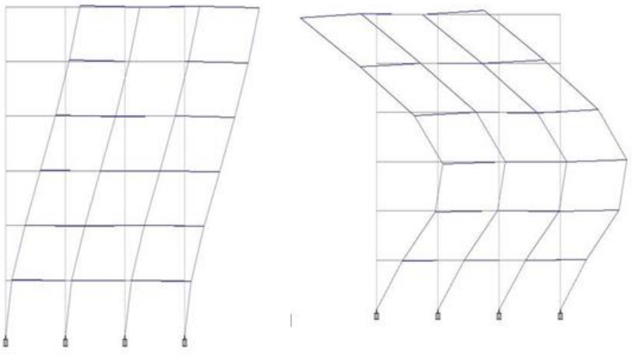
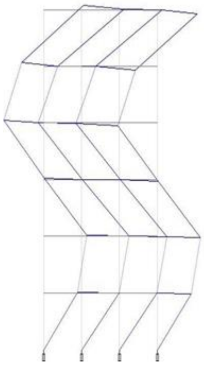
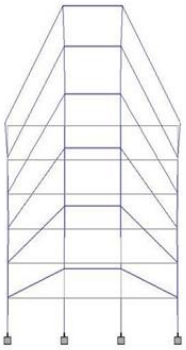


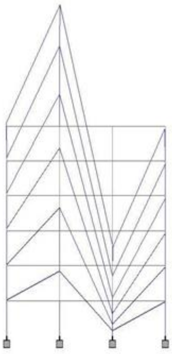
Fig. SHAPES: (4.1)
‘Mode1’(1.592hz), ‘mode 2’(5.224hz), Modal
& Participation factor
MPFiz=85.33 MPFiz=8.13



‘Mode3’ (9.525hz)
MPF0



‘mode4’ (12.796hz)
MPF0.01



‘mode5’ (13.294hz)
MPF2.04

Table 4.3 :Base shear & mass participation factor is shown as:

MODE	BASE SHEAR(KN)	Mass participation factor
1	252.75	85.33
2	27.8	8.13
3	12.1	3.54
4	0	0
5	0.02	0.01
6	5.85	2.04

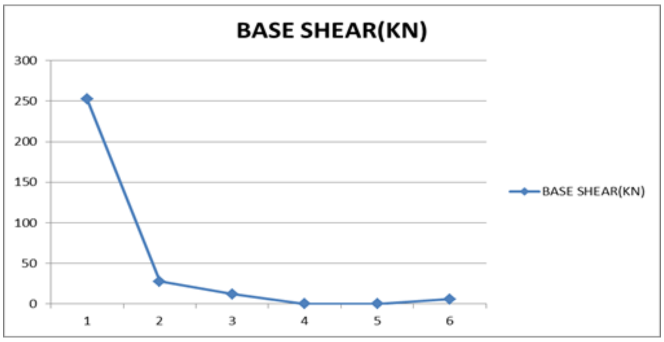
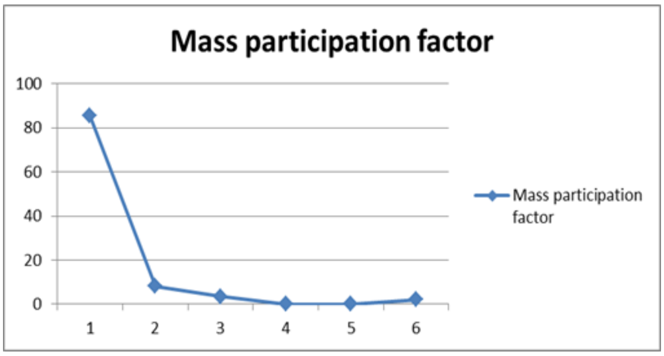


Fig (4.2) graph of modes Vs base shear



Fig(4.3) Graph of mass participation factor

4. RESULTS OF LATERAL FORCE METHOD

Max.bending moment, shear Force etc. Available in load combination1.7 (EQ+DL)

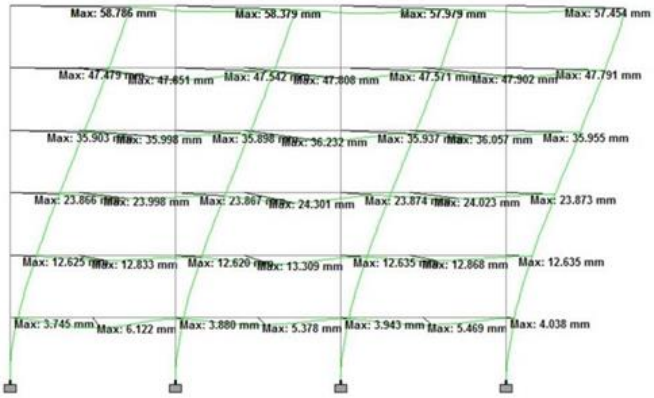
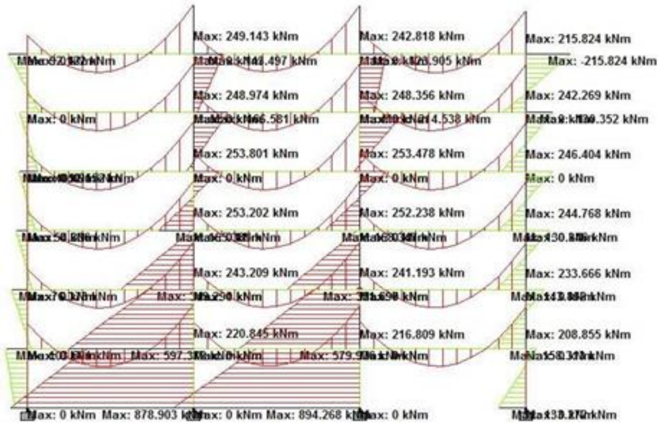


FIG (6.1) Shows the Displacement Figure for load combination 1.7(EQ+DL)

The inner center of the storey visible from the diagram above is within the limits of the



Collapse of the code i.e. is within .004 of storey height = 0.004X3000 = 12mm

FIG (6.2) Shows the Bending moment Figure for load combination 1.7(EQ+DL)

RESULTS OF RESPONSE SPECTRUMANALYSIS

Max bending moment, shear Force etc. Available in load combination1.3 (DL+LL+EQ)

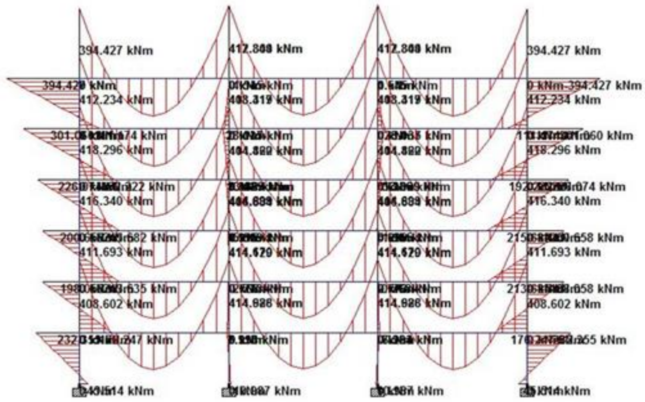
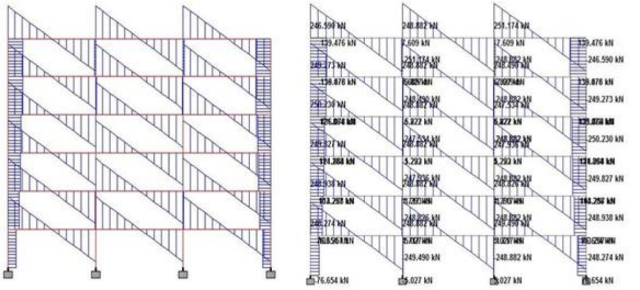


Fig (6.3) shows the Bending moment figure for load combination1.3 (DL+LL+EQ)



Fig(6.4) shows the ‘shear forcediag.inX-axis’‘shear force diag. in Y-axis’

The Load combination is same as both cases of Load ‘case1.3 (DL+LL+EQ)’Comparison analysis of the absolute storey drift in both methods: (table 6.1)

Storey no.	Storey height	LSM(cm)	RSA(cm)
1	3	0.3869	0.491
2	6	1.2595	1.15
3	9	2.3837	1.61
4	12	3.5892	1.96
5	15	4.7566	2.19
6	18	5.8123	2.34

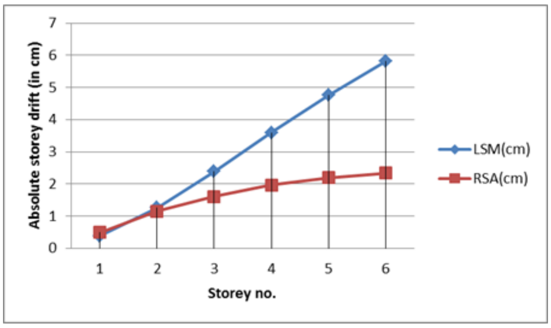


Fig (6.5) Graph of comparison no of absolute storey drift

Table (6.2) Comparison analysis of the storey shear: (using both LSM and RSA)

Storey no.	Storey height	LSM (KN)	RSA (KN)	Difference in %
1	3	179.201	120.981	28.91
2	6	177.232	119.104	32.79
3	9	169.281	112.992	33.25
4	12	151.451	102.341	32.42
5	15	119.794	85.01	28.99
6	18	70.582	55.03	22.033

It is found that the extreme shear difference of these methods is approximately 29.73% somewhere in each yard.

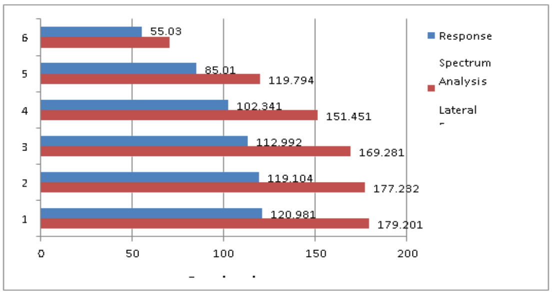


Figure (6.6) Graph of the comparison of shear storey

Final results with compared to initial design result:

Table (6.3) Drift: By Lateral Force Method

Storey no.	Pre design drift (cm)	Post design drift(cm)	Difference in %
1	0.3869	0.2056	46.85
2	1.2595	0.5472	56.55
3	2.3837	0.9052	68.11
4	3.5892	1.2561	65
5	4.7566	1.5729	66.93
6	5.8123	1.8012	69.05

It is evident that the variability in design and pre-delivery variations is approximately 62.08% in the individual retail space.

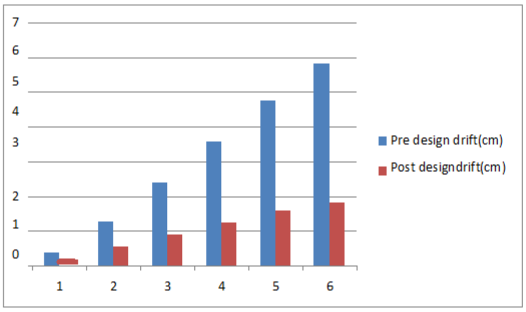


Fig (6.7) Graph of the results of storey drift for final & initial design

Response Spectrum Method
Participation factor

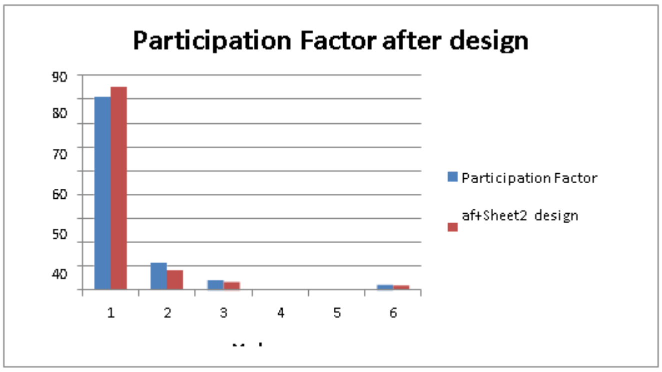


Fig. (6.8) graph of the results of mode participation for final and initial design

The total amount of metal required within the type of connection with the parts of the members is more than the analysis and support style of the support system used rather than the dynamic strength method.

5. CONCLUSION

Frame with shear wall performs better and the base shear increased by 9.82% when compared to the frame without shear wall. Shear wall performs better to lateral displacement and it reduces by 26.7% when compared to the frame without shear wall. The ductility of SMRF buildings is more than the OMRF buildings, the reason being the heavy confinement of concrete due to splicing and usage of more number of stirrups as ductile reinforcement. The base shear capacity of OMRF buildings is 7 to 28% more than that of SMRF buildings. So it is necessary to increase strength and stiffness of building to withstand seismic loads. Finally, it is concluded that the floating column building, will lead to the increase in dimensions of the members in the structure to increase the stiffness and for the earthquake resistant design of the building with various recommendations considered which are more in cost comparing with a normal building cost of construction. But following sustainable measures and recommendations can even give a earthquake resistant design of the building with floating column building built even at the higher seismic zone.

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