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A SEISMIC STUDY ON IRREGULAR MULTI-STORIED RC AND STEEL BUILDING (G+21) HAVING TORSIONAL IRREGULARITIES

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ABSTRACT-*Structures encounter lateral deflections under quake loads. Extent of these parallel lateral deflections is identified with numerous factors, for example, auxiliary framework, mass of structure & mechanical properties of basic materials. Structures should be designed such that they can resist seismic tremor actuated deflections & internal forces. Structural irregularities are very important factors variables which diminish the seismic execution of structures. Structures which have ShearWall, Core Wall and Dampers, abnormalities may encounter distinctive drifts of adjacent stories, excessive torsion, & so forth as indicated by inconsistency compose & come up short amid a seismic tremor. In this paper, impacts of torsional irregularity on structures are examined. Building models, which have distinctive number of floors & floor regions, are produced by a PC program & calculations are made. Results are compared & safeguards are given with avoid harms caused by torsional abnormality under seismic tremor loads. Likewise, statements in various seismic tremor codes about torsional inconsistency are analyzed. Calculations demonstrate that isolating huge building areas from each other with appropriate partition separates & increasing lateral rigidity unbending nature on weak direction of structures diminish the impact of torsion. The performance of structure is found as per procedure that is prescribed in Indian Stamdard 1893:2002 Code Book.

Keywords: Shear wall, Displacement, Drift, Equivalent static method, Response spectrum method

I. INTRODUCTION

Due to the Earthquake ground movements occurs, structures are more often will not experience torsional vibrations not withst&ing parallel motions. A huge torsional responses hotspot is because of mass or flat loads restricting segments in arrangement of structure which normally refers to asymmetrical distribution of load. Distinctive types of torsional responses can occur in the general structures, if there occur an event of inconsistency of ground development along basement of structure or inelastic execution of restricting segments or the losses of quality in such a segment. These exploration focus for most of part around the last case that can likewise happen amid direct seismic tremor development. In case of inelastic performance or direct seismic tremors, greater the part of structural work inelastecally.In perspective ofse inelastic completion, level combine torsional shaking of structure might be by large unrivaled than expected by the direct versatile examination. When any one of horizontaly opposing segments produce, situation of point of convergence of unbending nature can change & these can yield basic changes in eccentrecity of complete structure.

Torsional irregularity is the basic parameter which can measure extend of torsional effect on structures. this can be translated as extent of most highest drift to the mean drift of each story . Torsional irregularities must be considered when highest storey drift on one side or the part of structure horizontal to axis is in excess of 1.2x mean of story drift at the two points of structure

A) OBJECTIVES OF STUDY

The objectives of current study are as listed/follows below:

- Creation of 3D model of multistory (G+21) RC Building & Steel Frame Building for "Elastic & Inelastic" analysis.
- To examine the Siesmic Response of Multistory (G+21) RCC Frame Building & Steel Frame Building with, without Shear Wall & Dampers at different locations for same geometry & loading, using ESA & RSA.
- To examine the siesmic response of multistory (G+21) RCC Frame Building & Steel Frame Building with & without Dampers at different locations for same loading & geometry using ESA & RSA.
- To find deflections out at every storey using ESA & RSA.
- To find the storey drifts at every storey, applying ESA & RSA.
- To get the base shear, applying ESA & RSA.
- To find out time period by applying ESA & RSA.
- To find out frequency by applying ESA & RSA.

B) SCOPE OF STUDY:

The present examination is done in the conditions of seismic assessment/evaluation of multistoried RC & steel confined building by providing the Shear wall at different position, Core wall at center & Dampers at corners to identify the Seismic Parameters of building such as Storey Drift, Storey Displacement, Time period, & Frequency utilizing ESA & RSA. Finally appropriate arrangement of working to be utilized is recommended.

C) Analysis Method Used

As mentioned in Indian Standard Code 1893:2002 after technique for examination have been prescribed to discover the plan sidelong loads,

a. Equivalent Static Analysis (ESA)
b. Response Spectrum Analysis (RSA)

D) Modeling Method :

The software ETABs V-2016 is used for analysis & investigation. Displaying of R.C & STEEL MULTI-STOREYED BUILDING model is used

II. GENERAL

Since from long time various researches & test experiments have been performed at all around the world on Shear Walls(SWs), Core Walls & Fluid Viscous Dampers & it is introduced as Seismic/Lateral load resisting systems. It is expected in future in order, to form the concept of modeling & analysis techniques & efficient seismic design method for convenient practical purposes of SWs & FVD will greatly increase by an effective cooperation among practicing engineers, researchers & code writers

Model 1: The structure being modelled as 21 storied RC Bare Frame

Model 2: The structure being modelled as 21 storied RC Bare Frame, with "Shearwall in Both X & Y Direction".

Model 3: The structure being modelled 21 as storied RC Bare Frame, with "Shearwall in only Y Direction".

Model 4: The structure being modelled as 21 storied RC Bare Frame, with "Shearwall in only X Direction".

Model 5: The structure being modelled as 21 storied RC Bare Frame with "Core wall at Centre".

Model 6: The structure being modelled as 21 storied RC Bare Frame, with "Dampers at corners in both X & Y Direction".

Model 7: The structure being modelled as 21 storied "Steel Bare Frame".

Model 8: The structure being modelled as 21 storied Steel Bare Frame, with "Shearwall in X Direction"

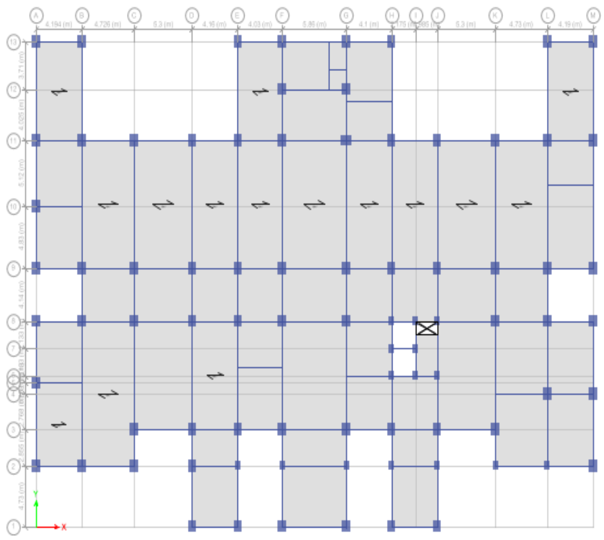
Model 9: The structure being modelled as 21 storied Steel Bare Frame with "Shearwall in only Y Direction"

Model 10: The structure being modelled 21 as storied Steel Bare Frame with "shearwall in only X & Y Direction"

Model 11: The structure being modelled as 21 storied RC Bare Frame with "Core wall at centre"

Model 12: The structure being modelled as 21 storied RC Bare Frame, with "Dampers at corners in both X & Y Direction".

II. PLAN USED IN ANALYSIS



Structure Data

The structural plan layout of RC & Steel frame building of 21 storied is shown in above Fig. In this study, the plan layout is purposely kept similar for all building models to study the effect of (SP)Shear Wall located at different positions, Core Wall at Center & Fluid Viscous Dampers at Corners. The height of bottom storey is kept 3m & typical height of upper storey's i.e., GF to 21th storey is 3.2m in all building models. The structure is considered to be placed in seismic Zone-V and Medium Soil Condition. 25% of Floor Live Load(LL) is considered in calculating of seismic weight. The structural data provided for the structure is detailed below.

Materials Used & Geometrical Properties

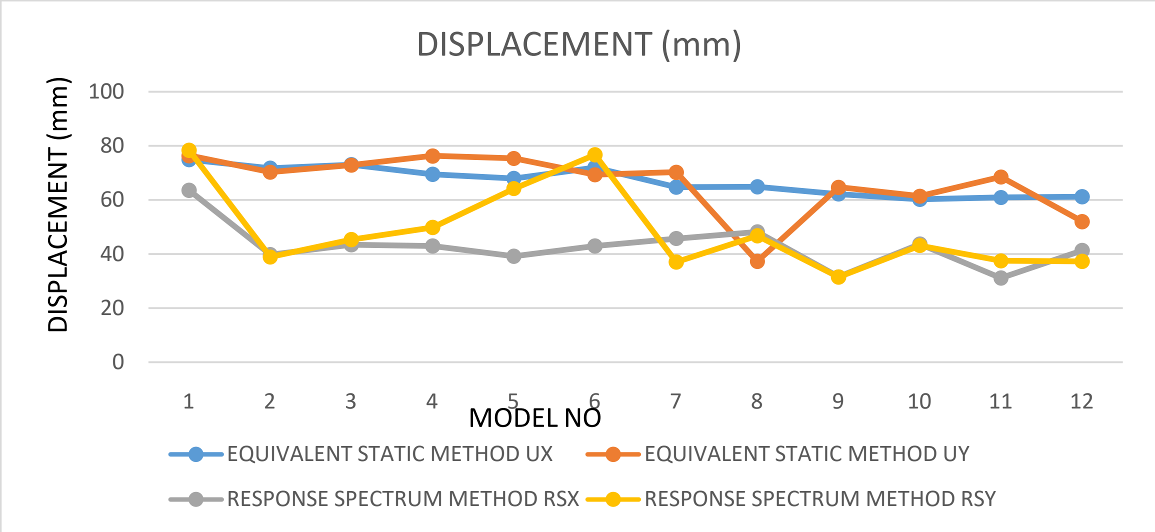
Depth of foundation	3m
Floor to floor height	3.2m
Building dimension	37.77m x 50.75m
Type of steel	Fe-500 M-345
Grade of concrete	M-35
Column size	500mmx700mm 800mmx950mm BOX 800 x 800
Beam size	400mmx600mm ISWB 600-2
Thickness of masonry wall	230mm
Slab thickness	150mm
Live load	3 kN/m²
Floor finishes	1.5kN/m²
Wall load	11kN/m
Seismic zone, Z	IV
Importance factor, I	1
Response reduction factor, R	5
Soil type	Medium
Building height	73.5m

In this chapter, the results of analytical building models studied are presented & discussed. The results are included for building models & the response results are computed using the equivalnt static & response spectroum analysis. The analyses of models are achieved through ETABS analysis package.

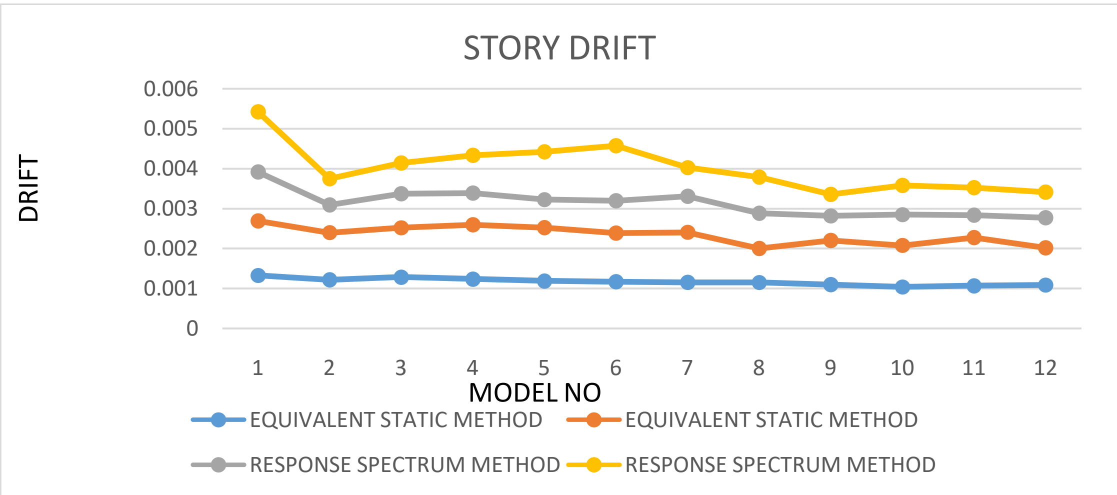
The results of, lateral displacements, storey drifts & base shear for the distinctive building models for each of above analyses are presented & compared. An exertion has been done to concentrate the influence of SW positioned at X & Y Direction & core wall in center on RC & Steel Framed Multistorey Building.

IV. RESULTS OF ANALYSIS

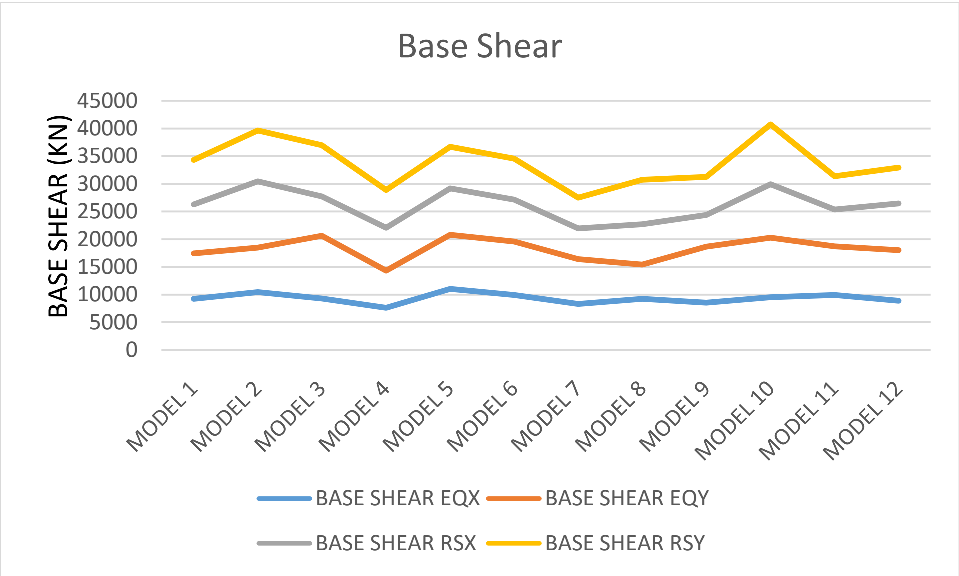
DISPLACEMENT				
	EQUIVALENT STATIC METHOD		**RESPONSE SPECTRUM METHOD**	
MODEL NO	**UX**	**UY**	**RSX**	**RSY**
1	74.966	76.444	63.589	78.387
2	71.741	70.345	39.841	38.946
3	73.116	72.948	43.45	45.369
4	69.484	76.288	43.021	49.898
5	68.017	75.411	39.235	64.252
6	72.012	69.395	43.039	76.745
7	64.762	70.303	45.799	37.117
8	64.93	37.325	48.187	46.788
9	62.242	64.685	31.622	31.551
10	60.292	61.463	43.745	43.198
11	60.946	68.542	31.201	37.53
12	61.235	52.058	41.349	37.353



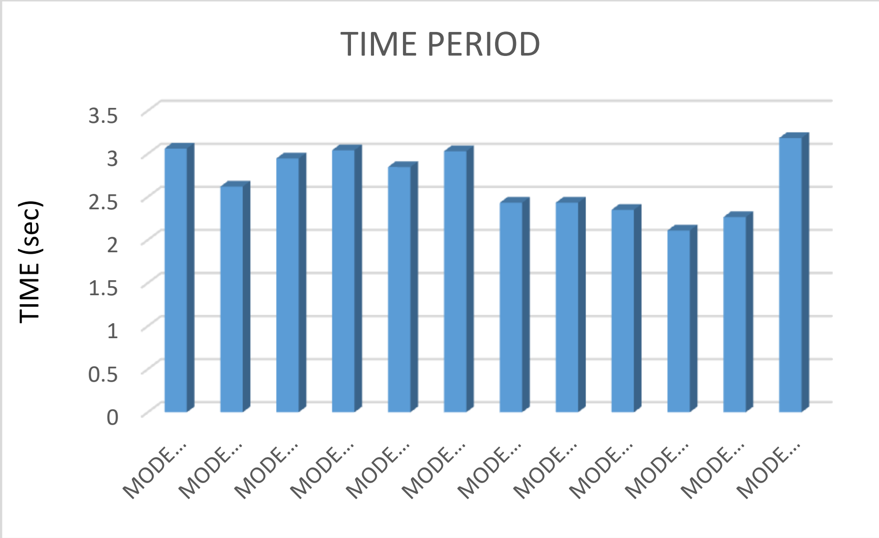
STOREY DRIFT				
	EQUIVALENT STATIC METHOD		RESPONSE SPECTRUM METHOD	
MODEL NO	UX	UY	RSX	RSY
1	0.001327	0.001363	0.001228	0.001505
2	0.001219	0.001178	0.000693	0.000659
3	0.001285	0.001233	0.000854	0.000771
4	0.001236	0.001358	0.000794	0.000946
5	0.001188	0.001333	0.000702	0.001198
6	0.001171	0.001213	0.00081	0.001378
7	0.001155	0.001249	0.000901	0.00072
8	0.001152	0.000848	0.000881	0.000906
9	0.001098	0.001102	0.000614	0.000541
10	0.00104	0.001036	0.000771	0.000733
11	0.001068	0.001207	0.000561	0.000687
12	0.001088	0.000928	0.000753	0.000642



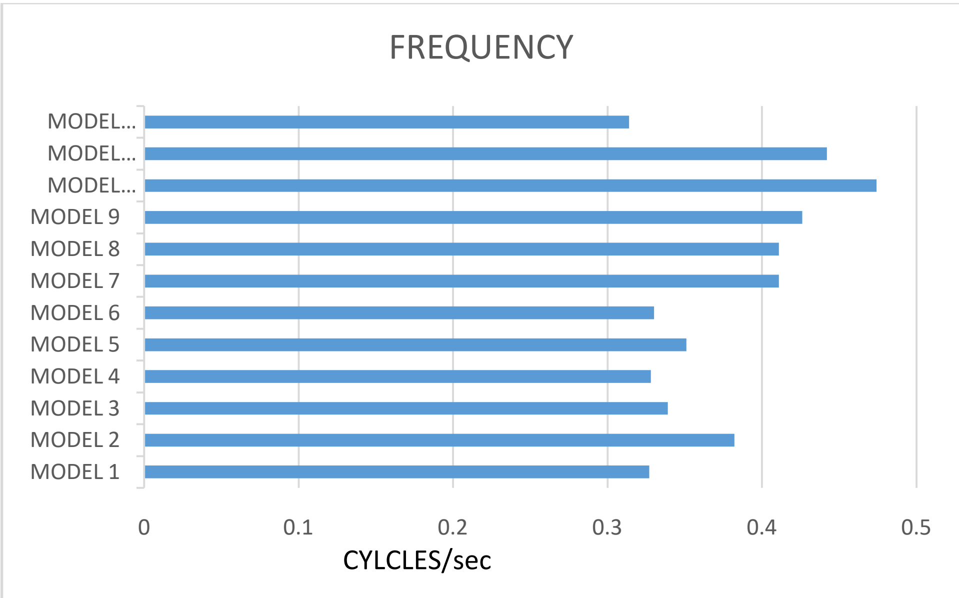
BASE SHEAR				
MODEL NO.	**EQX**	**EQY**	**RSX**	**RSY**
MODEL 1	9221.623	8223.313	8866.70	7974.41
MODEL 2	10462.35	8019.975	11976.3	9171.27
MODEL 3	9273.006	11338.16	7111.76	9262.21
MODEL 4	7586.893	6734.116	7733.50	6841.20
MODEL 5	11015.67	9762.674	8432.53	7480.01
MODEL 6	9908.781	9682.025	7552.79	7418.96
MODEL 7	8261.847	8132.501	5565.77	5527.68
MODEL 8	9224.807	6166.663	7293.84	8014.42
MODEL 9	8491.121	10160.15	5716.04	6876.50
MODEL 10	9504.162	10745.54	9664.26	10802.5
MODEL 11	9906.180	8787.719	6687.42	5965.99
MODEL 12	8849.14	9171.21	8462.9	6433.40



TIME PERIOD	
MODEL NO.	TIME
MODEL 1	3.061
MODEL 2	2.62
MODEL 3	2.946
MODEL 4	3.042
MODEL 5	2.847
MODEL 6	3.03
MODEL 7	2.432
MODEL 8	2.432
MODEL 9	2.35
MODEL 10	2.11
MODEL 11	2.265
MODEL 12	3.184



FREQUENCY	
MODEL NO.	**FREQ**
MODEL 1	0.327
MODEL 2	0.382
MODEL 3	0.339
MODEL 4	0.328
MODEL 5	0.351
MODEL 6	0.33
MODEL 7	0.411
MODEL 8	0.411
MODEL 9	0.426
MODEL 10	0.474
MODEL 11	0.442
MODEL 12	0.314



V. CONCLUSIONS

- Generally, the stiffness of structure is increased by Steel Frame Structure.
- Steel Frame Structure appreciably reduces the displacement in the structure compared to the RC structure.
- As per code, IS 1893-2002(Part-1) Clause No. 7.11.1, the Storey drifts is within the limit in both Equivalent Static as well as Response Spectrum method.
    - Maximum Drift Permitted = 0.004 x h = 0.004 x 3200 = 12.80 mm.
- Core wall shall be taken during the analysis of Multi Storeyed Building
- When the Structure is subjected to Seismic Loading, it is seen that many variations in Time Period, Base Shear, Drift & Displacement are Observed
- The Comparative Analysis for these parameters like time period, base reactions, story drift & displacement are plotted in graph & values are been noted in table above
- It is seen that the Maximum Base shear is found in model no-3 (shear wall in Y- Direction)
- One can work out & can reduce the base shear by havng or providing shear wall at different locations
- With the application of Dampers on Different locations in the structure has provided sufficient lateral strength due to which reduction in base shear has been noticed in model no-6 compared to other models
- It is seen that Time period for model-12 is higher compared to other models because the building is analyzed as steel structure with dampers
- The locations or positioning of shear wall at the corners has provided sufficient lateral strength compared to individual positioning of shear wall

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