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BEHAVIOR OF MULTI STORIED RC BUILDING UNDER THE ACTION OF DYNAMIC LOADING WITH AND WITHOUT SOFT STOREY AND SHEAR WALLS

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ABSTRACT

The case study which involves the function of RC structure, an investigation has done to study the optimum location & Shapes of SW in multistoried building & also the investigation has been performed to see the behavior of structure with soft storey & without Soft storey at different stages in the structure. The multistory structure have been analyzed using the ETABS software which has guided in a adequate manner to examine the various parameters like, Storey drifts, SD, BS & TP.The obtained results have been performed by using, ESA, RSA, THA methods and have been plotted in graphs and charts.

I. INTRODUCTION

A) GENERAL

We are active in a modern era, where the construction companies have been predominant over many other aspects. As the time has progressed various engineering techniques have been used to make enormous and gigantic structures. This structures which has to sustain the consequence of Gravity loadings and the dynamic loadings have been drafted in a way that it will be not fragile or brittle that they decline under the activity of small intensity of earthquakes.

The earthquakes are the major cause of destruction for human life & property. These Eqs arises to the predominate shaking of ground, which in turn release a extensive amount of strain energy producing distinct types of waves which in turn effect the stability of the building. The Earthquake effects impacts are wait to the Path of load distributed, source of Eq generated and site conditions.

As a method of easy for knowing the model changes of SS RC framed building is sudden change in lateral stiffness of storey within the structure. The most common structural system with soft storey is provided to have parking spaces below which helps for space utilization within the building.

B) OBJECTIVE OF THE STUDY

- To perform analysis on G+15 story building & determine the activities of RC framed multistory building
- Adopting different locations of SW and studying the structural activities.
- Adopting SW and CW to analysis the outcome of the loading on structure.
- Performing analysis by removing infill walls and making it a soft storey on different storey to identify the behavior.
- Studying the comparative results by performing ESM, RSA, THA methods.
- Identifying the TP, BS, Storey Drift & Displacement of the structure.

C) SCOPE OF THE STUDY

The scope of the study is to identify the activities of the RC framed multistory Building under the process of Dynamic loadings & also to check the seismic essential of the building.

II. METHODS OF SEISMIC ANALYSIS

A) EQUIVALENT STATIC METHOD (EQS):

This method is simple method for the earthquake analysis and for the building it is commonly used for common structures meeting regularity condition. EQS is also called as lateral force method as the earthquake effects are same as those resulting from the statically transverse loading. This method requires less effort and this is based on the formulae shown in the code IS 1893: 2002. The method or technique of substituting the dynamic loading of an EQ by static force by distributing it laterally on a structure for analysis is Eqviuleant static method.

B) RESPONSE SPECTRUM ANALYSIS (RSA):

This method is a dynamic analysis method which is basically performed on a structure which in turn provides the estimate of the contribution of the natural vibrations which in return provides the Behavior of an elastic structure. This Response which is higher is compared with natural TP of the structure. This method calculates the higher values of displacements and there vibrations modes are drawn on the chart using spectrum chart.

C) TIME HISTORY ANALYSIS (THA):

This method is also a dynamic analysis method, this method is suitably used now a days , as this method is very effectively performing analysis under the action of dynamic loading . THA performs analysis up till the material has reached the ductile limits which in turn makes easy to design the members effectively. THA is a unique method in which step wise analysis is performed at different loading which can vary with time. A building which is less efficient in seismic performance is always subjected to in elastic condition during an EQ. At this time where the structure is subjected to strong vibration weak portions of the structures begin to show. The weakness & post elastic properties caused by an EQ can be easily estimated using THA.

III. ANALYTICAL MODELING

A) GENERAL DESCRIPTION OF MODELS

Model 1: Regular Model G+15 Storey, in this model infill masonry is considered & analysis has been performed by Etabs (dynamic analysis)

Model 2: Regular Model G+15, in this model infilled with masonry frame along with Shear wall at the corner edges have been performed by Etabs (dynamic analysis)

Model 3: Regular Model G+15, in this model infilled with masonry framed along with Shear wall at the X-direction have been performed by Etabs (dynamic analysis)

Model 4: Regular model G+15, in this model infilled with masonry framed along with Shear wall at the Y-direction have been performed by Etabs (dynamic analysis)

Model 5: Regular model G+15, in this model infilled with masonry framed along with Shear wall along Corner edges & Core wall at the center have been performed by Etabs (dynamic analysis)

Model 6: Regular model G+15, in this model infilled with masonry framed along with Shear wall along X-Dir & Core wall at the center have been performed by Etabs (dynamic analysis)

B) PLAN USED IN ANALYSIS AND MODELING

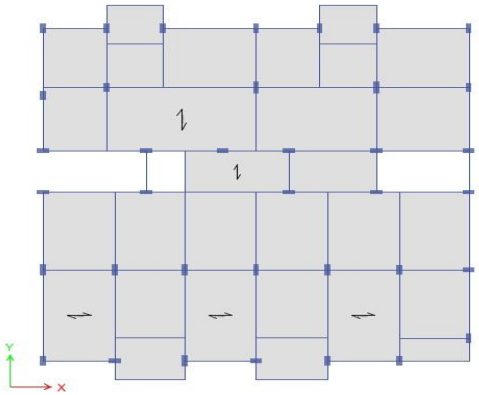


Fig 3.1: Plan

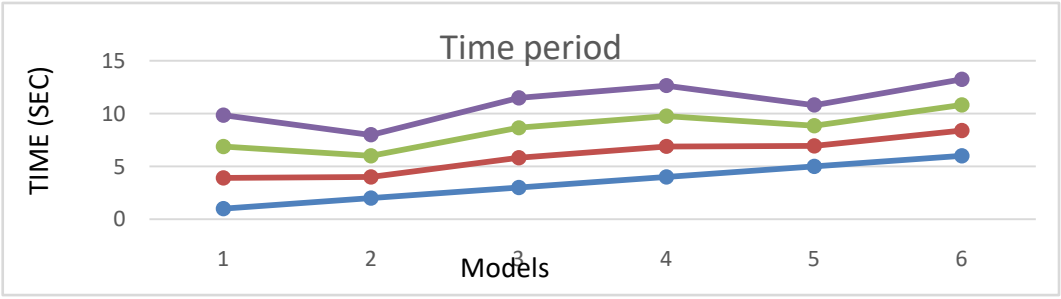
IV. ANALYSIS RESULTS & DISCUSSIONS

A) TIME PERIOD:

It is nothing but the free vibration of the structure which is undammed. The values of time period obtained by the analysis using Etabs. The table Shows that time period is gradually changes with the different analysis method. As the structure is not similar and hence time period varies. It is observed that model 8 has the highest time period as it consists of Soft storey & comparison is made with other values of the model.

TABLE 1: TIME PERIOD CALACULATIONS

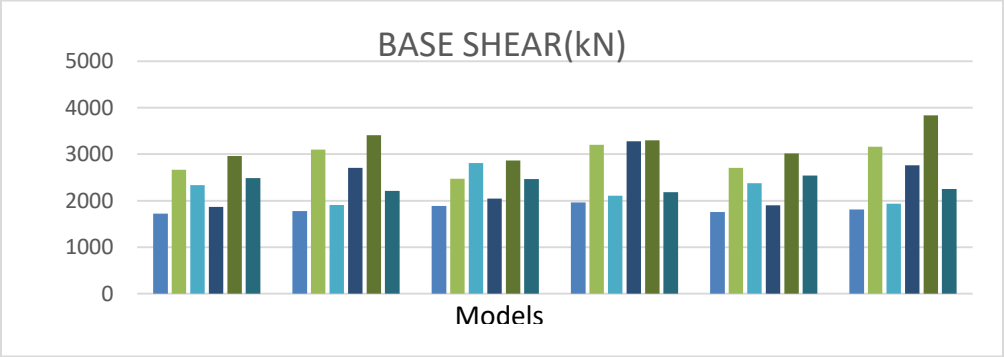
Time Period Calculation			
Model no	**Equivalent Static Method**	**Time History Analysis**	**Response Spectrum Method**
1	2.898	2.971	2.982
2	1.996	1.996	1.996
3	2.828	2.828	2.828
4	2.896	2.854	2.896
5	1.954	1.897	1.954
6	2.413	2.413	2.413



B) DESIGN SEISMIC BASE SHEAR

Base Shear is nothing but the identification of the expected maximum lateral forces which can occur because of the ground shaking at the bottom of the structure. The below table shows the values of seismic base shear for various models obtained by the 3 different analysis methods like, EQS, THA, RSA. The base shear relay on the condition of the site on which the structure has to stand and also the soil strata which is responsible for transferring load and bearing the loads.

Base Shear (kN)						
Model No	Equivalent Static Method (Etabs)		Time History Analysis (Etabs)		Response Spectrum Analysis (Etabs)	
	UX	UY	UX	UY	UX	UY
1	1725	1774	1883	1965	1756	1808
2	2668	3102	2475	3199	2705	3161
3	2334	1909	2809	2105	2377	1938
4	1867	2709	2046	3279	1902	2761
5	2962	3408	2862	3295	3018	3839
6	2487	2210	2468	2181	2543	2253

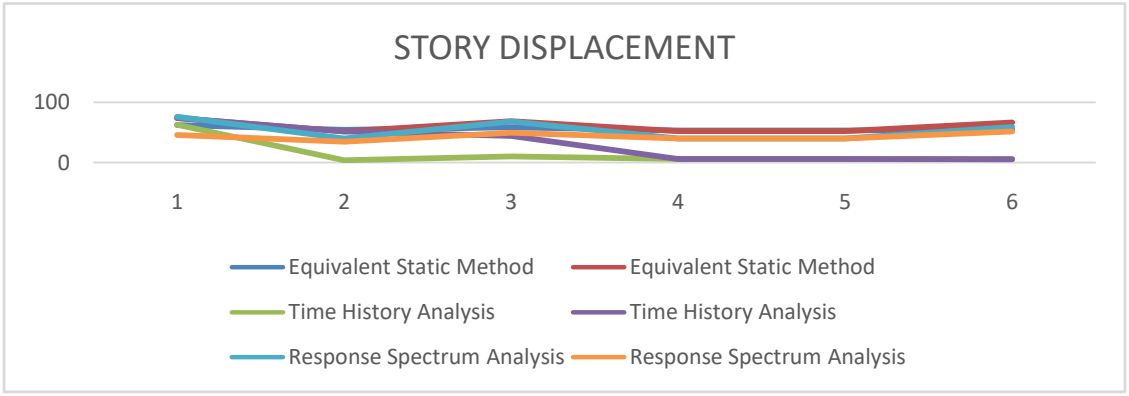


BASE SHEAR CALCULATION

C) STORY DISPLACEMENT

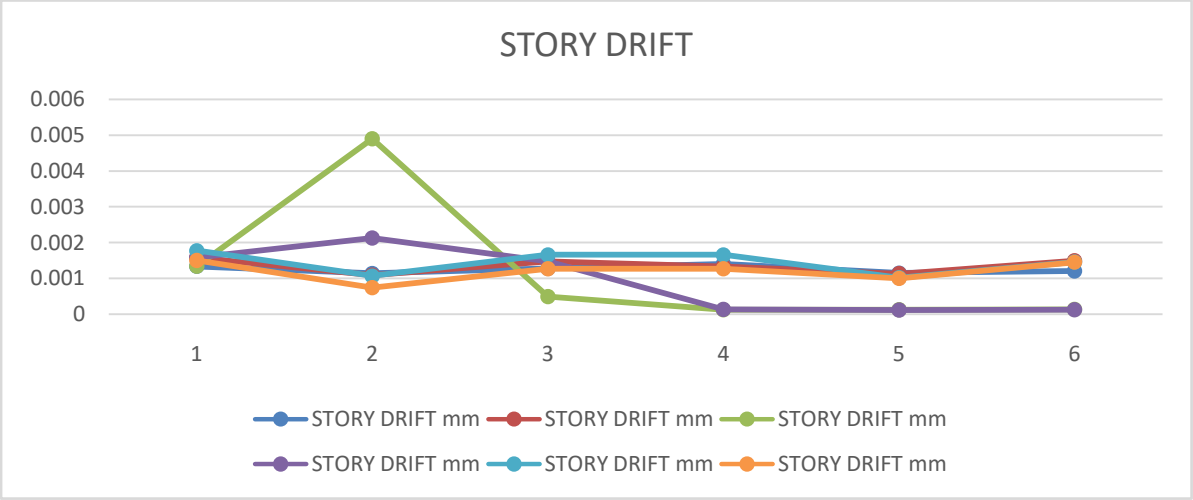
Storey displacement, movement of the story laterally with respect to the base. It is total displacement of its storey with respect to ground. The different displacement values for the different models have been plotted and noted below. This Story displacement is obtained by perfuming analysis using ETABS with application of different analysis procedures. It is seen that the displacement under EQA method is higher compared to the other two methods for different models, as the models consists of different aspects like SW, CW & SS.

STORY DISPLACEMENT mm						
Model 1	Equivalent Static Method		Time History Analysis		Response Spectrum Analysis	
	X-Dir	**Y-Dir**	**X-Dir**	**Y-Dir**	**X-dir**	**Y-Dir**
1	62.4	73.7	62.6	73.7	76.2	45.5
2	54.2	51.4	3.88	51.3	40.1	34.7
3	58.4	68.3	10	44	68.1	49.1
4	53.1	51.9	5.94	5.66	40.1	40.1
5	53.1	51.9	5.94	5.66	40.1	40.1
6	55.2	66.4	6.13	5.21	59.3	51.4



D) STORY DRIFT

STORY DRIFT mm						
Model	Equivalent Static Method		Time History Analysis		Response Spectrum Analysis	
	X-Dir	**Y-Dir**	**X-Dir**	**Y-Dir**	**X-dir**	**Y-Dir**
1	0.001339	0.001589	0.001343	0.001589	0.001778	0.001508
2	0.001144	0.001097	0.0049	0.00213	0.001071	0.000746
3	0.001278	0.001478	0.000493	0.001478	0.001659	0.001276
4	0.00141	0.001335	0.000131	0.00014	0.001659	0.001276
5	0.001153	0.001135	0.000128	0.00012	0.001022	0.001007
6	0.001209	0.001497	0.000139	0.000132	0.001461	0.001458



Story Drift is nothing but the difference in level which can be above or below in terms of displacements. it is basically explain as the inner storey movement between two stories.

The drift values are plotted and noted below, these values are obtained by performing analysis by different methods using Etabs. It is seen that the drift values differ as the structure model is changed by adding or positioning of SW & CW.

IV. SUMMARY AND CONCLUSION

A) SUMMARY

As the topic states that the effect of dynamic loading on Multistoried RC structure with shear wall at different locations along with soft stories under the action of Dynamic loading, a study have been done to understand the various parameters like BS, TP, DS & DR.

The above analysis is the attempt to understand the behavior of the RC structure under the seismic loadings, which involves Shear walls, Core wall & soft stories at different locations.

The BS, TP, DS & DR have been performed by Etabs software under which Equivalent Static Analysis, Time History Analysis & Response Spectrum Analysis method have been opted and their data & graphs have been plotted above.

B) CONCLUSION

- The structure subjected to dynamic loading are to be designed carefully & effectively.
- The dynamic loading effects changes as the structure modal changes.
- The position of shear walls and core wall adds sufficient lateral strength to the structure and hence provide much resistance.
- The change in SW & CW also effects the behavior of structure.
- The structure with SW at corners & CW at the center has the minimum drift and displacements, as it is providing lateral stability to withstand the Seismic loads.
- As the structure stiffness is changed like in case of a softstorey, there are more plastic hinges developing which causes the structure to become weak, hence the model with softstoery shall be designed carefully and with more care.
- Base shear and the time period are also higher in case of a Softstoery analyzed by all the 3 methods, hence softstoery or a parking storey needs to be very carefully and shall be countered for all the forces which acts on it .
- Storey drift and displacements are carefully formulated and it is found lower in case of model structure with SW at corners & CW at centers.

C) SCOPE OF FURTHER STUDIES

- Further studies can be carried out by adopting SW & CW positions at different locations.
- Dynamic loadings can be varied by using Wind Loads and one can study the behavior of structure.
- Soft storey with different locations and by varying the Live load on the soft storey can be studied.

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