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Seismic Analysis of Irregular Building Frames with Soil Structure Interaction

Sumit S. Chaudhari[1], M. R. Nikhar[2], V. A. Kalmegh[2]

[1]PG Student, [2]Professor,

[1,2]Department of Civil Engineering, Bapurao Deshmukh College of Engineering, Sevagram, Maharashtra, India

ABSTRACT

Seismic response of structure is extremely complex because of non linear behaviour soil during earth quakes. Seismic design of structure is generally carried out assuming fixed based ignoring the flexibility of soil. The purpose of the study is to describe and investigate different approaches of considering soil flexibility in the soil structure interaction (SSI) with regard to response in the super structure. In the present work, to illustrate the effect of soil – stricture interaction on the seismic response of frame structure, irregular frame 15 storey having consider with based supported as fixed with an without considering the soil structure interaction. Building are model in SAP 2000. Three type of soil i.e. hard, medium hard, soft soil are used to in SSI – study. the soil is model as spring model or elastic continuum (FEM), and stiffness is calculated by using the gerorge gazettes equation. The effect of SSI on various structural parameter i.e. natural time period, based shear, roof displacement, are studed and discuss. The main objective in using this earthquake was, to find out of the structure when heat by long duration and see the how the response of modified, when the soil effect are taken into considerate.

KEYWORD: *Seismic analysis, structure, soil structure, frames with soil structure, irregular buildings, plan of buildings*

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INTRODUCTION

conventional seismic design and analysis practice do not take into account the flexibility of foundation and adjustable soil. The foundation and supersturctural typically design as to indiscipline system, and the super structure is constrained at the bottom. The evaluated seismic performance of building only depend on the super structure. This method simple and convenient, but the dynamic characteristic as seismic performance of building without considering the flexibility of the foundation. The adjacency soil may be significantly different from this of the actual building which may lead to unsafe design, especially for the seismic design and analysis of important structure, such as superb all buildings. This study is to made understand the effect of soil flexibility in the performance of building irregular RC frame raisting on isolated foundation. The purpose of the study is to describe and investigate different approaches of considering soil structure interaction analysis with regard to the response in the superstructure For the study of soil structure interaction three types of soil are considered soft, medium and hard. The study is underpaid.

AIM & OBJECTIVE

Aim: To Analysis Irregular building with Soil Structures Interaction Subjected to Seismic Force.

Objectives:

- To study performance based seismic design of regular building and irregular building in various seismic zones.
- To study parameters such as pushover curves, base shear, storey drifts, in various seismic zones.
- To study comparative analysis of regular and irregular Building

LITERATURE SURVEY

For comfort, aesthetic and usage reasons, building plans are designed in various geometries. Complex building plans lead to non symmetrical and irregular structural systems, which is the main reason of torsion under earthquake loads.

V. RejendraKumar [Feb 2017]: This paper deals with the comparison between equivalent static technique &response spectrum technique. The earthquake effect lead to the damage the property and many people loss of life. So we have to know the structural performance under seismic load before construction. Method of analysis: Adopt the equivalent static and response spectrum techniques to analyze the model for the present study and observe the lateral displacement of the structure in a regular and irregular structure in various zones. Finding: The major parameters considered in this study to observe the seismic conduct of various zones i.e. ZONE-II, Zone-III, ZONE-IV&ZONE-V and the base shear, lateral displacements in various levels. According to IS-1893-2002 seismic loads are calculated. The lateral forces are calculated by using the STAAD Pro and the results are compared between two Zones in both response spectrum and seismic coefficient technique.

Applications: To analyze the building as per code IS 1893-2002 part I criteria for earthquake resistant structure. Dynamic analysis of the building using response spectrum method. Building with different lateral stiffness systems. To get economical and efficient lateral stiffness system.

Mr. S.Mahesh, Mr. Dr.B.Panduranga Rao [Dec. 2014] :- The behaviour of G+11 multi story building of regular and irregular configuration under earth quake is complex and it varies of wind loads are assumed to act simultaneously with earth quake loads. In this paper a residential of G+11 multi story building is studied for earth quake and wind load using ETABS and STAAS PRO V8i .Assuming that material property is linear static and dynamic analysis are performed. These analysis are carried out by considering different seismic zones and for each zone the behaviour is assessed by taking three different types of soils namely Hard, Medium and Soft. Different response like story drift, displacements base shear are plotted for different zones .

Ravi Kiran Sridhar: It's a very big challenge that building or structure must withstand lateral forces such as earthquake and wind load. In the present work, the comparative analysis of various structures is performed using SAP 2000. The main aim of the project is comparative study of the stiffness of the structure by considering the three models that is Regular Structure, Plan irregular structure and Vertical irregular structure. All these three models are analyzed with static and dynamic earthquake loading for the Zones II, III, IV & V. The results are tabulated and graphs are plotted for displacement, drift, base shear and time period. Based on the results and discussion the structural behavior and stiffness is concluded for regular and irregular structures, among these structures regular structure shown maximum displacement and drift for all the zones in both static and dynamic analysis.

Sudhanshu: Presents a study of two R.C. building one symmetrical and one unsymmetrical in plan (designed according to IS 456:2000) are analyzed using pushover analysis and redesigning by changing the main reinforcement of various frame elements and again analyzing. The results of analysis are compared in terms of base shear, storey drift, spectral acceleration, spectral displacement and storey displacement. Also they studied the performance of R. C. Building by providing shear wall. They conclude that performance increases on increasing reinforcement of columns only resulting into an appreciable decrease in the maximum roof displacement both symmetrical as well as unsymmetrical building. They also conclude that performance of the building decreases when the sectional size of beams and columns are reduced while keeping same reinforcement.

H. Gokdemir*et.al* (2013): Presents paper on effect of torsional irregularity on buildings. Structural irregularities are important factors which decrease the seismic performance of the structures. Buildings which have structural irregularities may experience different drifts of adjacent stories, excessive torsion, etc. according to irregularity type and fail during an earthquake. In this study building models, which have different number of floors and floor areas, are generated by a computer program and calculations are made. Results are compared and precautions are given to prevent damages caused by torsional irregularity under earthquake loads. They concluded that, separating big building sections from each other with proper separation distances and increasing lateral rigidity on the weak direction of the structures decrease the effect of torsion. In addition, torsional irregularity may cause pounding of adjacent buildings which are not separated from each other properly. Simply, increasing strength of structural elements on the weak direction of the building or decreasing strength of structural elements on the strong direction can prevent effects of torsion on structures.

ATC-40 (1996) document: Affixes some modifications to the approach proposed by Freeman. The ATC-40 method is base on idealistic hysteric models for the structure, and spectra are modified based on various equivalents – damping ratios. To use the ATC-40 capacity spectrum method, the capacity curve (which relates base shear to roof displacements) and the demand response spectrum are converted into Acceleration-Displacement Response Spectra (ADRS) format. For this to be achieved, both curves are plotted as spectral acceleration vs. spectral displacement. The expected performance point is determined as the intersection of the capacity spectrum and the reduced seismic demand curve. ATC-40 provides three different procedures to estimate the earthquake-induced deformation demands. Two of the method are iterative and require direct calculations where as the third is an entirely graphical method.

Chopra and Goel (2004): Developed an improved pushover analysis procedure named as Modal Pushover Analysis (MPA) which is based on structural dynamics theory. Firstly, the procedure was applied to linearly elastic buildings and it was shown that the procedure is equivalent to the well known response spectrum analysis. Then, the procedure was extended to estimate the seismic demands of inelastic systems by describing the assumptions and approximations involved. Earthquake induced demands for a 9-story SAC building were determined by MPA, nonlinear dynamic analysis and pushover analysis using uniform, "code" and multi-modal load patterns. The comparison of results indicated that pushover analysis for all load patterns greatly underestimates the story drift demands and lead to large errors in plastic hinge rotations. The MPA was more accurate than all pushover analyses in estimating floor displacements, story drifts, plastic hinge rotations and plastic hinge locations. MPA results were also shown to be weakly dependent on ground motion intensity based on the results obtained from El Centro ground motion scaled by factors varying from 0.25 to 3.0. It was concluded that by including the contributions of a sufficient number of modes (two or three), the height-wise distribution of responses estimated by MPA is generally similar to the 'exact' results from nonlinear dynamic analysis.

Syed Ahamed, Dr. Jagadish. G. Kori (2013): presented a paper on performance based seismic analysis of unsymmetrical building. In this study, analytical investigation of an unsymmetrical building (SMRF Type) situated in seismic zone v of India, in accordance with IS 1893-2002(part- 1), is taken as an example and the various analytical approaches (linear static and nonlinear static analysis) are performed on the building also Base shear is compared for (G+3) and (G+5) storey building models in both X and Y directions by using finite element software

package ETABs9.7 version. They concluded that the overall performance level for (G+3) and (G+5) storey building models were found between LS-CP (life safety to collapse prevention) also the hinge status and location has been determined and noted that most of the hinges begin to form in B-IO range onwards. Base shear increases with the increase in mass and number of storey of building, also base shear obtained from pushover analysis is much more than the base shear obtained from equivalent static analysis.

Rucha S. Banginwar*et.al* (2012): Presented a study on Effect of Plans Configurations on the Seismic Behaviour of the Structure By Response Spectrum Method. For this Buildings with simple geometry and various Plans Configurations such as U, V, H & + shaped building in plan are evaluated by RSM (response spectrum method). They concluded that the plan configurations of structure have significant impact on the seismic response of structure in terms of displacement, story drift and story shear. Also torsion was observed only in building where level of irregularity is maximum. Large displacements were observed in the building having higher level of irregularity and least displacement was observed in building of lower one. It indicates that building with severe irregularity shows maximum displacement and storey drift.

P. B. Prajapati *et.al* (2014): Presented a study on the influence of plan irregularity on seismic response of buildings. For this 10 storey R.C.C. residential building with different plan configurations was analyzed using SAP 2000 software. To compare the responses, a regular structure is also considered. For seismic analysis of building static analysis as well as dynamic analysis such as response spectrum and time history analysis has been carried out. In Time history analysis three major Indian earthquakes are considered. The response of building in terms of deflection of top joints and time period are studied. From the results of graph of time period it is observed that the time period is approximately same for first five modes but after 5 th mode its value changes and it depends on shape of buildings. They also concluded that, for all the 3 types of building they are getting higher value of storey shear by static method compared to response spectrum method because static method depends only on mass of structure it will not take the effect of dynamic properties of the building.

Obtained from nonlinear dynamic time-history analysis and concluded that in general, for these particular group of structures, all NSPs lead to satisfactory results and suggested for further parametric studies need to be performed in order to expand these conclusions.

CONCLUSION

From the above literature papers conclusion is as follow:
During analysis of structure in case of soft soil the effect of soil is predominant so, must considered soil structure interaction in case of soft soil in savior earthquake zones.

As the number of storey increases in the building the base shear and displacement are increases.

In case of soft soil, soil structure interaction has been recommended as the height of building increases.

RESEARCH METHODOLOGY:

Selection of type of frame structure and plan of buildings.
Take different type of soil and height of frame structure.
Analysis of the result of seismic load.

Presentation of result in the form of graphs and tables.

BARCHART:

Activity	Sept – Oct 2020	Oct – Nov 2020	Dec 2020	Jan – Feb 2021	Mar – Apr 2021
Literature Survey					
Analysis of literature data					
Study of relevant IS codes and other specifications					
Select an RC building and modeling in STAD PRO					
Modal analysis of a Problem and design					
Analysis and comparison of Result					
Conclusions					
Preparation of Project Report					

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