

# Dynamic Analysis of 3D Building Frames Considering Seismic Effect-A Review Paper

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## ABSTRACT

Disasters are most natural nowadays. Earthquakes are unpredictable and natural disasters that can't be avoided. The sudden movement of land is called Earthquake. Earthquakes will happen through natural and manmade activities. Most Earthquakes are due to the movement of tectonic plates. An earthquake is measured by its intensity. The

## INTRODUCTION

Design of most Civil Engineering structures is designed as the base of the structures fixed. When an earthquake occurs, the seismic waves pass from the foundation to the structures. The response of foundation and structure is interdependent.

Midrise buildings are types of buildings whose height of stories is 4 to 12. In general, elevators are not included in this type of building. Nowadays most of the building is midrise, in this journal more journal, are considered regarding this type.

Structure displacement will vary by considering the base as a fixed and considering the foundation with soil structure interaction as a continuum model. In conventional design

Magnitude of the Earthquake will tell the impact of Earthquakes.

Most of the earthquakes will occur due to natural and manmade activities. As Earthquakes are natural disasters care has to be taken while designing the structures. In most civil engineering, structures are analyzed considering the base of the foundation fixed which can affect the results of the structures. As most of the structures will rest on the ground, Earthquake waves pass on soil structures. Soil Structure Interaction (SSI) is the phenomenon of the motion of the soil affecting the response of the structure and the response of the structure affects the motion of the soil. Modelling of structures is done using various analysis software like SAP, ETABS etc. The effect of SSI is effected more in a high-rise building, soft soil and zone v. Structure considering soil-structure interaction is modelled as a continuum as a mathematical model. Soil structure interaction has more effect on a high-rise building and soft soil

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methods soil structure interaction is neglected by considering the base of the structure as fixed. The effect of structures without considering soil structure interaction may affect slightly hard soil and low rise structure. The effect of soil structure interaction will affect more soft soil and high-rise structure. In this review paper, we aim at recent advancements in numerical models in SSI.

Soil structure interaction analysis evaluates the collective response of the structure, foundation, and subsoil. The response of the structure depends on the type of soil present below the structure. Soil structure interaction mainly depends on kinematic interaction, Kinematic interaction: Seismic waves propagate to the soil that is present below the foundation and soil deformation varies based on the type of soil below the foundation

The number of seismic waves will vary based on the type of soil beneath. This interaction of soil with foundation is known as kinematic interaction.

Inertial interaction: Mass of the superstructure that transmits the inertial force to the soil causing deformation in the soil. This interaction is inertial

### Review of literature:

**Table1. Parameters considered**

1	Type of structure	Mid rise
2	Code books for seismic analysis	Is 1893 Part 1
3	The type of soil considered	Stiff, medium, soft
3	Modelling of structure	Analytical using various software
4	Results Compared	Natural frequency, Base shear, Lateral displacement

#### 1. H.K Chinmayi, B.R Jayalekshmi (2013)

The journal is modelled with an RC frame building with a shear wall resting over a raft foundation considering soil structure interaction. The building frames considered are 2, 3, 6, and 12 stories with and without a shear wall. The buildings are located in zone V as per IS1893:2002. Results are compared with conventional design and design considering SSI. The results compared are lateral natural period, base shear, shear force, and bending moment. The effect of SSI is less impact on 2,3 stories, the effect of SSI had more variation in results in 12-story buildings..

#### 2. B. Pallavi Ravishankar and Neelima Satyam (2013)

This journal deals with the modelling of asymmetric tall buildings and unbounded soil modelled with Finite analysis. In this research paper, a 150m and base dimension 40mx20m building is modelled resting on a raft and pile foundation, soil considered is homogeneous and results are studied for the input of Bhuj ground motion. Modelling of the building is done by

fem software of Ansys-13 response of the building is done by a nonlinear pushover analysis. The response of the structure and soil structure parameters give dynamic loading for the building modelled on a raft and pile foundation. Response of the building at different locations is measured. Displacement increases in X and Y directions but displacement is less in z directions.

#### 3. Gaikwad M.V, Ghogare R.B, Vageesha S. Mathada (2015)

This journal deals with the fixity condition of the soil and the effect of infill. In general, for analysis of a structure base is considered as fully fixed it is not true because these consideration results of structures will affect base shear, and bending in beam and column. The soil structure interaction effect is considered. The type of soil considered is stiff, medium, and soft. The effect of infill is considered, and infill considered is brick infill. The cases studied are an Analysis of a bare frame with soil and an analysis of infill with soil. The analysis is carried out with **Ansys** 14.5. The results are compared with and without infill. Analysis of the bay frame without considering soil structure interaction shows less displacement in structure and more shear force and bending moment. Infill frames have less lateral displacement. Infill frames have high strength and stiffness

#### 4. Suhas K S, D. S. Prakash (2017)

this journal deals with how adjacent buildings affect the surrounding soil media. The study was made on how to study the response of the structure modelled on such soil. Two adjacent multi-storied buildings of plan 11 stories, 36 m in height having plan dimensions 16mx16m are considered for this study. STAAD Pro software is used for the analysis of this software. The foundation considered here is a raft foundation and the soil is modelled with 8 nodes with 3 degrees of freedom. The soil mass considered has a size of 1.5m width on both sides and a depth of 30m. The seismic analysis is carried out for all zones using the response spectrum method of IS 1893(part-1). Building models are made based on conventional and soil structure interaction models, results compared here are maximum displacement, base shear, and modal time period. There was significant variation in results in fixed and soil structure interaction

models, models of soil structure interaction had more variation in the results..

#### **5. A Ahmed, A Ali, Hammaad Khalid1 and M Ahmad (2018)**

In this journal, the study was carried out considering the effect of infill. The factors considered for this study are displacement, story drift, base shear, and ground overturning moment of multi-story RC frame structures. For the analysis 4 story building is considered to rest on stiff soil and a seismic zone of 2B according to the building code of Pakistan. For modelling SAP-2000 civil engineering software is used. The results of building with and without infill are compared. Graphs are plotted for various parameters like displacement, story drift, base shear, and ground displacement for building models with and without infill. From the results, it was found that infill plays an important role in a building but in general, it is not considered in building modelling.

#### **6. Muhammad Rizwan Riaz, Hiroki Motoyama, and Muneo Hori (2021)**

This journal deals with a numerical model of soil structure interaction. The method of the model is a continuum model with high-performance computing (HPC) and characteristics the characteristics of a model from soil-structure interaction from a simplified model to a high-fidelity model. In this paper, an NPP building of a height of 80m is modelled with the soil of span 600mx800m horizontally and vertically .linear and nonlinear analysis is carried out. This journal explains continuum models and HPC in modelling

#### **7. Mohd Firoj, Ashish Bahuguna, Aparna Kanth, and Ravindra Agrahan (2022)**

In this journal soil structure interaction (SSI) considered the midrise structure's seismic performance based on the positions of the column. The model was created using ABAQUS finite element-based software package. Nonlinear dynamic analysis is used for analysis, soil mass is incorporated using the spring and boundary conditions are incorporated in Matlab code for the dynamic analysis. A building considered for the analysis is a 4, 8, and 12-story

dual RC structure. The results are expressed in displacement, normalized peak settlement, base shear, normalized peak foundation sliding, and drift ratio. The analysis is carried out in both fixed and soil structure interaction cases. From the results of soil structure interaction effect in midrise structures.

#### **8. Hamid Asadi- Ghoozhdi, Reza Attarnejab, Amir R Masoodi, and Arsalan Majlesi(2022)**

This paper deals with the nonlinear soil structure interaction (SSI) impact seismic response of the vertical irregular reinforced concrete building. This paper modelled RC frames of 5 and 10 stories considering parameters of soil type and vertical safety factor of the foundation. Non-linear winker model is used for modelling shallow foundations resting on semi-infinite sandy soil. The models are subjected to 15 earthquake ground motions for considering nonlinear time history analysis. Results compared are storied drift and story response of foundation is observed. The study considered both regular and irregular stories and results are more predominant in the soft story. The first mode of natural response is also studied, and the irregularity ratio is also studied in this paper.

### **CONCLUSION**

By studying various literary journals, impacting soil structure analysis with a shear wall is having more variation of results in high-rise stories, results are observed like base shear, displacement, bending moment, and shear force Displacement of buildings will be considered in X, Y and Z direction. More displacements can be noticed in the Z direction. Brick infill soil structure model presents less displacement. Building models have more variation of results by considering supports as fixed and flexible. Soil structure models affect midrise buildings. Building model effect infill consideration in results in midrise structures. The continuum model with linear and nonlinear analysis results has more variation in fixed and continuum models. Soil structure interaction has more effect on irregular and soft soil buildings

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