

Department of Civil Engineering

Report on Poster Presentation by
M.Tech Students (Structural Engineering)

2nd International Conference on Emerging
Research in Civil, Aeronautical & Mechanical
Engineering-ERCAM 2019

Name of students & Guide

Hemish V. Parmar

Nilay K. Patel

Himesh R. Rana

Prof. Anuj K. Chandiwala



An Autonomous Institution Affiliated to Visvesvaraya Technological University.
Approved by UGC/AICTE/Govt. of Karnataka, Accredited by NAAC (Grade 'A')
Bangalore-560064, Karnataka, INDIA

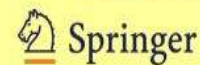
ORGANIZED BY

NITTE MEENAKSHI
INSTITUTE OF TECHNOLOGY



ERCAM

PUBLICATION PARTNERS



A Paper has been selected from **M.Tech 1st year (Structural Engineering) students** as a poster presentation in **2nd International Conference on Emerging Research in Civil, Aeronautical & Mechanical Engineering-ERCAM 2019** at **NITTE Meenakshi Institute of Technology, Bengaluru, India** on **25th & 26th July 2019**. The detailed schedule is attached separately.

The Paper is published in AIP journal (American Institute of Physics).



Hemish V. Parmar, Nilay K. Patel and Himesh R. Rana at NITTE- Bangalore (Poster Presentation)



Memories with Dr. Bharathi Ganesh (Professor & Head, Department of Civil Engineering, NITTE, Bangaluru)



2nd International Conference on Emerging Research in Civil, Aeronautical & Mechanical Engineering-ERCAM 2019

25th & 26th JULY 2019



SOUVENIR

Publication Partners

 Springer 



NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

An Autonomous Institution Affiliated to Visvesvaraya Technological University.
Approved by UGC/AICTE/Govt. of Karnataka, Accredited by NAAC (Grade 'A')
Bangalore-560084, Karnataka, INDIA



Study on Soil-Structure Interaction of Raft Foundation for a Vertically Irregular structure

Hemish.V. Parmar^{a)}, Nilay.K. Patel^{b)}, Himesh.R. Rana^{c)} and Anuj Chandiwala^{d)}

Department of Civil Engineering, Chhotubhai Gopalbhai Patel Institute of Technology, Uka Tarasadia University, Bardoli.

*Corresponding author: ^{a)}parmarhemish@gmail.com,
^{b)}nilay091996@gmail.com,^{c)}himeshrana27@gmail.com,
^{d)}anuj.chandiwala@utu.ac.in*

Abstract: The contemporary situation shows that the influence of soil structural interface (SSI) might be adverse to the seismic reaction of structure and abandoning soil structural interface in the analysis may lead to a risky strategy. Although this, the customary design procedure usually involves a postulation of the fixed condition at the base of foundation avoiding the flexibility of the base of the structure, the contractibility of soil mass and as a result, the effects of foundation settlement on additional rearrange of bending moment and shear force demands. The effects of SSI are examined for G+15 story vertical irregularity high-rise RC building resting on a raft foundation. Two methods are used to evaluate the target MRF RC building: Equivalent Static Load Method (ESLM), Response Spectrum Method (RCM). To acquire the statistical result by using SSI modal situation are those consistent to fixed-base support condition and the ultimate response of story shear, story displacement, and story drift are analyzed.

Abstract- Study on Soil-Structure Interaction of Raft Foundation for a Vertically Irregular Structure



Group photo with *Mr. Sridhar R.* (General Manager, India Technical Center, Federal Mogul Goetze, India) & *Prof. Virupaxi Auradi* (Mechanical Department, Siddaganga Institute of Technology, Tumkur)

**2nd International Conference on
Emerging Research in Civil, Aeronautical and Mechanical Engineering
ERCAM-2019**

Study on Soil-Structure Interaction of Raft Foundation for a Vertically Irregular Structure

Hemish .V. Parmar, Nilay .K. Patel, Himesh .R. Rana and Anuj Chandiwala
Department of Civil Engineering, Chhotubhai Gopalbhai Patel Institute of Technology, Uka Tarasadia University,
Bardoli-394 350, India
Corresponding author: chandiwalaanuj@gmail.com

ABSTRACT

The contemporary situation shows that the influence of soil structural interaction (SSI) might be adverse to the seismic reaction of structure and disturbing soil structural interface to the analysis may lead to a risky strategy. Although this, the customary design procedure usually involves a provision of the fixed condition at the base of foundation ignoring the flexibility of the base of the structure, the contractibility of soil mass and as a result, the effects of foundation settlement on additional rearrange of bending moment and shear force demands. The effects of SSI are examined for G+15 story vertical irregularity high-rise RC building resting on a raft foundation. Two methods are used to evaluate the target MRF/RC building: Equivalent Static Load Method (ESLM), Response Spectrum Method (RSM). To acquire the statistical result by using 500 model situation are those consistent to fixed-base support condition and the ultimate response of story shear, story displacement, and story drift are analyzed.

Key words -Soil Structure Interaction, Fixed Raft Foundation, Story drift, Story shear, Story Displacement

1. INTRODUCTION

Today's world is fast growing and developing the world. In every country has to face a more and more structural problems, either they were developed or developing. The growth of the Indian economy is fast growing. Now a day the urban area is developed with a high-income level, therefore people migrated to big cities for employment, increasing migration from a rural area to an urban area. Due to this, India is all residential, commercial, aesthetic requirement the only solution is a vertical expansion of the structure. In India, soil condition is different in different regions which play an important role during earthquake shaking. Soil having a number of layers at various depths at a different location doesn't show the same response on the structure during an earthquake. Irregularities are of different types such as different irregularities, vertical, geometric, irregularities, weight (mass) irregularities, discontinuity irregularities in a capacity, etc. As the structure, irregular plan causes structural irregularities in terms of stiffness. In India, most of the building tend to collapse under lateral forces due to structural irregularities.

In the current study, Vertical irregularities of building with consideration of soil structure interaction under seismic loading with the response spectrum analysis was carried out.

2. SEISMIC ANALYSIS PROCEDURE

In the initial strategy of seismic analysis is done by the equivalent static method and response spectrum method. To determine the internal force of structural member using linear elastic analysis of the structure and also define the member strength demand.

Structural Properties

Description	Dimension with unit
X-direction grid no.	10
Y-direction grid no.	4
X-direction grid spacing	5 m
Y-direction grid spacing	5 m
No. of floor in a building	5, 12, and 15
Story height	3 m
Basement height	3.5 m
Material type for steel	Fy-415
Material type for concrete	M20
Size of beam	300 mm X 450 mm
Size of column	
G to 5 th floor	300 mm X 600 mm
6 th to 10 th floor	300 mm X 575 mm
11 th to 15 th floor	300 mm X 525 mm
Live load	2 kN/m ²
Thickness of slab	120 mm
Floor finish	1 kN/m ²

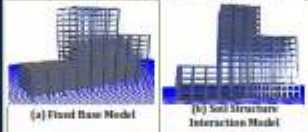
To understand the importance of soil interaction on the structure on the high-rise building.

In current study attention focus on the estimation of seismic response of high-rise reinforced concrete building on raft foundation with a depth equal to 500 mm for 15th story building. The soil modulus of elasticity of range from 240007, 120033 and 60017 kN/m² for stiff, medium and soft soil for Winkler spring approach with equivalent static stiffness.

Soil Types of Soil Area Spring Component

Soil Type	k_x (kN/m ²)	k_y (kN/m ²)	k_z (kN/m ²)
Stiff Soil	11272.1	11272.1	14172.9
Soft Soil	5636	5636	7086.4
Medium Soil	2818	2818	3543.2

Configuration of 15-Story Building 3d Model

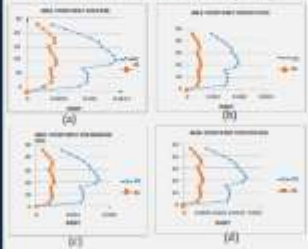


3. RESULTS & DISCUSSIONS

To calculate the design parameters effect on the structure seismic demand in different methodologies to analysis and to evaluate the base shear and displacement for Equivalent static load (ESL) method and Response Spectrum (RS) Method, the design parameters increase the soil structure interaction with stiff, medium and soft type of soil and raft thickness.

A. Seismic Response Demands Story Drift Ratio Response

To investigate story drift for studied multi-storied vertical irregular building of 15 stories using different study; story drift ratio over structure height for different soil situation varies from stiff, medium to soft soil. Figure shows that story drift ratio spreading of the 15-story model increases gradual and reduce extreme value in the 7 story. The extreme values in fixed base, stiff, medium, and soft SSI and SSI-ES using ESLM are 0.000466, 0.000842, 0.001139 and 0.001732, RSM is 0.000272, 0.000487, 0.000528 and 0.00081 respectively.



B. Storey Lateral Movement Response

Soil is particularly for moment resisting frame (MRF) RC structure resting on relative soft soils may significantly increase the lateral displacements and inter-story drifts. To evaluate the comprehensive dynamic analysis of the realistic performance of the structure should be considered the effect of SSI. In the current study the effect of SSI on the story lateral displacement of a structure has been considered three different analysis method, which is a different analysis method, which is shown in figure.

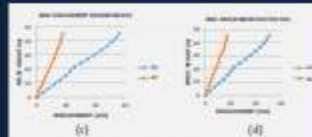
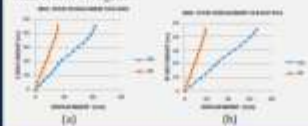


Figure shows that story displacement profile over structure height. The maximum displacement reach for the fixed base, stiff, medium and soft soil using ESLM 41.748 mm, 50.513 mm, 55.99 mm, 60.206 mm and using RSM reach 15.821 mm, 17.842 mm, 17.609 mm, 18.996 mm respectively.

C. Storey Shear Force Response

The story shear is interior forces on the height of the structure element the selected as response parameter of increase as these are generally considered the most important response parameter in seismic design practice. In the current study the effect of soil structure interaction on the story shear response profile over height building has recorded using the different analysis method as shown in figure.

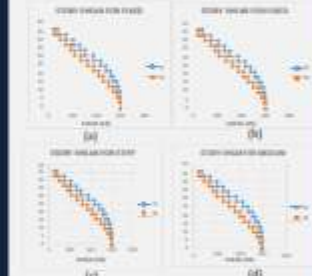


Figure shows that story shear shape over structure height for the fixed base, stiff, medium and soft soil using equivalent static load method in a constant value of 330.5 kN and as the other hand, the response spectrum method 393.84 kN, 508.55 kN, 105.31 kN. For RS analysis as the soil spring get softer the story shear decrease. Story shear from RS analysis is lower than the ESLM study for ESLM analysis story shear is not susceptible to the base soil stiffness.

4. CONCLUSIONS

The study shows prove beneficial in expression strategy approaches for the seismic strategy of structure carrying the consequence of soil flexibility. The story shear response intended from ESLM will governing as of SSI effect in addition calculation of story shear response by RSM system is influenced by on the base in addition beneath soil stiffness. The proportion of story drifts response increase as the stiffness of soil decrease. The analysis demonstrates that soil-structure interaction has a noteworthy consequences on base forces and displacement of top of building associated with the characteristic hypothesis in which interface would be considered. Thus, soil structure interaction effect in the seismic strategy of static moment resisting structure, mostly critical resist when soil is soft soil.

5. REFERENCES

- Anuj K. Chandiwala and Dr. S. A. Yasarwala, "Soil-Raft Foundation-Structure Interaction Effects on Seismic Performance of Multi-Story MRF Building with Vertical Irregularity", Indian Geotechnical Conference 2017 GeoIND conference Proceedings, IIT Guwahati, India, (2017), pp. 1-4.
- Aljay R. Parash, Anuj K. Chandiwala, Umesh D. Shiget, "Seismic analysis of RC building having underground stories with vertical irregularities", International Journal of Advance Engineering and Research Development, India, Vol. 3 No. 12, (2016), pp. 520-524.

Poster on "Study on Soil-Structure interaction of Raft Foundation for a Vertical Irregular Structure".



Certificate- Hemish Parmar



Certificate- Patel Nilay



Certificate- Rana Himesh



Certificate- Anuj Chandiwala