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THE INFLUENCE OF SOIL CONDITIONS ON THE SEISMIC FORCE IN RC BUILDING BY USING ETABS

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1. ABSTRACT

The rapid development of urban population and the pressure on limited liberty considerably influence the residential/commercial development of the city. The price of the land is high, the aspiration to keep away from uneven and uncontrolled developing of urban area and tolerate on the land for wants of important agricultural production activity have all lead to route building upwards. An attempt is through in this project to study the effect of Soil-structure interaction on multi storied buildings by means of various groundwork systems. Also to study the response of multi storied buildings subjected to seismic forces through Rigid and Flexible basics subjected to seismic forces are analyzed under dissimilar soil conditions like hard, medium and soft. A multi-storied RC frame structure rests on different soils is chosen for the analytical model part. The influence of soil-structure interaction is compared to the results obtained when the society is supposed to be fixed at the base.

KEYWORDS: Local site conditions, RC buildings, Standard codes, Seismic analysis, Parametric study.

2. INTRODUCTION

The aspire of this document is to consider the pressure of soil- structure interaction in the analysis of an asymmetric public building consisting of 5-storey and structured as reinforced concrete frames using E-TABS software. Earthquake is a

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major vulnerability to the world. Most of the structures absorb some type of structural constituent with direct contact with the ground. Hence design the structure considering the effects of seismic ground trembling.This study examine the property of local site conditions on the base shear, overturning moments are the limb forces of a moment resisting framed buildings. A model multi storey building is first analysed using IS 1893:2002. Next, the similar building is analysed by the International Building Code (IBC:2006). A multi-storeyed RC frame construction rests on different soil is chosen for the study. The present Indian code of observe for seismic analysis IS 1893:2002, specifies seismic zones to think different levels of strength of ground trembling. India having divergent soil conditions and diverse earthquake intensity places with more than 60% area is flat to earthquakes, must develop earthquake resistant structures in concern to IS:1893(part: I):2002. India secret into 4 seismic zones namely zone II, III, IV, V, have unlike types of soils which increases the substance of understanding of effect of base shear in reflection to various types of soils in same zone also. Rejoinder of structures to earth's surface atmosphere is a purpose of nature of soil presented at location conditions. Response increase of velocity coefficient (Sa/g) for 5% damping is considered for rock, medium, soft soils. Zone factor value indicates normal intensity of earthquake in altered seismic zones.

3.NEED FOR PROJECT

India having dissimilar earth environment and different seismic activity intensity places with more than 60% area is prone to earthquakes, should expand earthquake anti structures in reflection to IS:1893(part: I):2002. India classified into four seismic zones specifically zone II, III, IV, V, having different types of soils which increases the importance of understanding of consequence of base shave in reflection to various types of soils in same zone also**.** Response of structures to earth's exterior vibrations is a purpose of type of soil available at site conditions. Response increase of velocity coefficient (Sa/g) for 5% damping is considered for rock, medium, soft soils. Zone factor value indicates accepted strength of earthquake in diverse seismic zones

4. LITERATURE REVIEW

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Anand. N et al, (2009) based on their work finished that the Shear walls raise the solidity of the frames and this result in reduction of range of beams and columns. It is recommended to provide trim wall for building frames which are placed in high seismic zone.

Ashraf. M et al (2008) deliberate the effect of spot on shear wall on axial and trim forces along with meandering and distortion moments of beams and columns. It was reported that introduction shear wall away from centre of gravity resulted in enlarge in most of the members forces. For minimizing the forces in the members, the shear wall must be placed such that center of gravity and centric of the building correspond with each other.

J.Ushakranti The current study deals with the association of base shear of multi storied buildings with area 20x20mts, 30x30mts,40x40mts,60x60mts at different zones and different types of soils as per IS:1893(part: I):2002. A whole of 224 multi storied buildings be analyzed intended for this paper. This work helps in considerate the effect of earthquake with raises in area and height of multi storied buildings and also the increase of base shear for dissimilar zones and soil conditions.

A Prof.G.Ghalimath During earthquake the behaviour of any construction is influenced not only from side to side the react of the superstructure, except also by the rejoinder of the soil beneath. Structural failures in past have shown the signification of soil-structure interaction (SSI) effects. The current study focuses on SSI analysis of a symmetric 13 story RC hole frame shear wall building over soft soil and subjected to seismic loading. The transient analysis of structure -soil-foundation arrangement is agreed out by ETAB software. Earthquake motion in time province equivalent to Zone V of IS 1893:2002 design. Seismic coefficient technique is used to excite the model of soil - structure system. For integrating the SSI consequence, solitary type of soils based on values of elastic modulus of soil, Poisson ratio and shear modulus are measured. Responses in provisions of deviation in natural period, base shear, deflection, and column forces, obtained commencing the investigation of the SSI representation are compared with that obtained commencing conservative

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technique presumptuous inflexibility at the foundation of the structure.

Sekhar Chandra Dutta, et al. (2004) [1] The present revision attempt to tax the impact of soil–structure interface on regulating the design might quantities below seismic loading together in flexible and inelastic collection of vibration for low-rise buildings. The study may lead to the subsequent expansive conclusions:

1. The learning shows that the effect of soil–structure dealings may play a significant role to enlarge the seismic base shear of low-rise building frames.

2.The learn also shows that this effect may powerfully be influenced by the frequency of content the earthquake ground movement.

3. Increase in seismic base shear due to soil flexibility usually decreases with increasing hardness of soil and rising number of stories. Introduction of tie beam also lessens the chance of increasing base shear due to soil–structure contact.

4. Inelastic range stress of lateral load resisting structural basics may experience significant raise due to the consequence of soil–structure interaction.

5. If the effect of soil flexibility is built-in the power design, then the improved strength provided through the communication effect in short period systems may help to condense the inelastic variety anxiety of the interactive systems considerably.

5. METHODOLOGY

Seismic analysis and design has been carried out for RC Multi-strayed building frames with and without Shear wall using ETABS Software. One to five storied 3D Space building frames were analyzed and measured to understand the activities of building frames subjected in the direction of seismic forces through and without shear wall. The results of single storied building were compared with physical calculation and ETABS results. The following Codes were used for the current study.

IS 1893 (Part 1): 2002 – standard for Earthquake. Opposed to Design of Structures.

General Provisions and buildings

IS 13920:1993 - yielding Detailing of resistant solid Structures Subjected

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to Seismic Forces.

6. SOIL-STRUCTURE INTERACTION

As waves from an earthquake attain a structure, they produce motion in the structure itself. Thus the physical property of the foundation intermediate is an important factor in the earthquake response of structures supported on it. There are two aspects of building foundation interface during earthquakes, which are of major importance to earthquake engineering. Observations of the rejoinder of the buildings during earthquake have shown that the response of representative structures can be markedly inclined by the soil properties if the soils are satisfactorily soft. In expressions of the dynamic properties of building foundation system. Even though all these things may be present in some degree for each structure, the imperative point is to enterprise beneath what conditions the effects are of practical significance.

7. MODELLING AND ANALYSIS

In the current study, vertical asymmetrical three dimensional building of varying storey and of plan size 29.45x 29.45m is considered with the beam size 0.3mx0.4m and column size varying from 0.4mx0.5m. The slab is in use to subsist of 0.15m thick in addition to is careful to be modeled as membrane. Here the building is first modeled as fixed end conditions and subsequently the springs are assigned based happening the magnitude of footing in the fixed case, to counter act for soil structure communication. The shear walls be provided in two behavior i.e. through the shear walls by the side of the four corners as well as the supplementary by shear walls at four corners beside among shear wall then to the centre. The shear walls of special magnitude are worn with 0.15m thickness in case of five storey building, 0.20m thickness in case of five storey building, and 0.25m thickness in case of five storey building and analyzed for different load belongings as for each convention requirement in ETABS software.

8. RESPONSE SPECTRUM

The graph showing the variation of the highest rejoinder (maximum displacement, velocity, acceleration, or any other quantity) with the natural frequency (or natural period) of a solitary degree of freedom coordination to a individual

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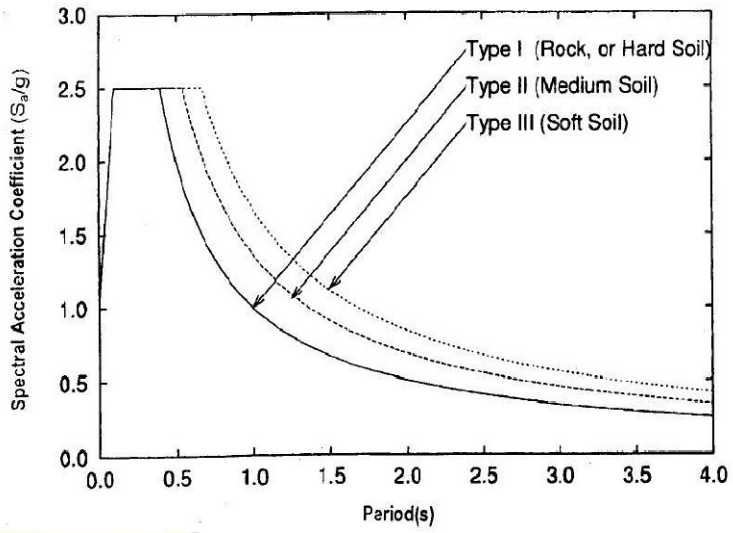
forcing function is known as the response spectrum. Since the greatest reaction is plotted aligned with the expected frequency, the response spectrum gives the maximum response of all potential particular degree of freedom systems. The effect spectrum is widely used in earthquake engineering. Once the response spectrum consequent to a individual forcing function is available, we need to recognize presently the ordinary frequency of the coordination to discover its maximum response. The flexibility of soil is usually modeled by inserting springs connecting the foundation component and soil intermediate. Although modeling, the number of degree of freedom should be selected carefully taking into consideration the intention of the analysis. During earthquake a inflexible base could survive subjected toward a dislocation in six degrees of freedom, and consequently conflict of soil can be articulated by the six corresponding resultant force components.



RESPONSE SPECTRA FOR ROCK AND SOIL SITES FOR 5% DAMPING

9. CONCLUSION

The study helps that the effects of soil-structure interaction significantly alter the lateral natural periods as well as foundation shear of any structural organization. Thus evaluation of these parameters without considering soil-structure interaction may cause seismic errors in seismic design. Soil-structure interaction has greater influence on the building footing resting on soft soil and this influenced decreases as the soil becomes hard. Fundamental natural period of the flexible building system is more when compared to conventional fixed base. It also increases with the soft soil i.e.,

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with flexibility and increases in storey and decreases with adding of shear wall. The base shear and spectral acceleration coefficient values are smaller in case of flexible base compared to fixed case which is highly expected. The study of the important vulnerability methods clearly shows that there is no unique or best solution for assess susceptibility off preferred building accumulation user should adopt the appropriate method depending on the importance of the project. It was seen in old and conventional fixed base the base shear value was increasing with increase in elasticity of soil excluding where as it is diminishing for fear that of flexible base. Storey displacement and storey drifts are highest incase of exposed frame building with or without soil-structure interaction. Since the base shear, axial force, bending force and lateral displacement increase as the soil type charges, soil structure interaction must be suitably well thought-out while designing frames for seismic forces.

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