International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Articles available online http://www.ijoer.in; editorijoer@gmail.com

Vol.5., Issue.5, 2017
Sept-Oct

RESEARCH ARTICLE

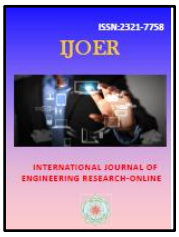
ISSN: 2321-7758

STUDY OF SEISMIC POUNDING OF MULTI STORIED STRUCTURE IN VARIOUS EARTHQUAKE ZONES AND SOIL CONDITIONS

PAPPULA SRIDEVI[1], CHANDANA SUKESH[2]

[1]PG Scholar, Dept of Civil Engineering, Vasireddy Venkatadri Institute of Technology, Nambur(V), Pedakakani(M), Guntur, AP, India, E-mail: psridevi45678@gmail.com

[2]Assistant Professor, Dept of Civil Engineering, Vasireddy Venkatadri Institute of Technology, Nambur(V), Pedakakani(M), Guntur, AP, India.



ABSTRACT

The conduct of G+12 multi-story working of customary and sporadic setup under earth shudder is mind boggling and it changes of wind burdens are accepted to act at the same time with earth shake loads. In this paper a private of G+12 multi-story building is contemplated for earth shake and wind stack utilizing ETABS and STAAD PRO V8i. Accepting that material property is straight static and dynamic analysis are performed. These analyses are done by considering diverse seismic zones and for each zone the conduct is surveyed by taking three distinct sorts of soils in particular Hard, Medium and Soft. Different reaction like story float, relocations, base shear are plotted for various zones and diverse sorts of soils.

Keywords: ETABS; Base Shear; Earthquake; Ductile Behavior; Seismic Zones;

1. INTRODUCTION

1.1 Earthquake

A seismic tremor (otherwise called a shudder, tremor or quake) is the shaking of the surface of the Earth, coming about because of the sudden arrival of vitality in the Earth's lithosphere that makes seismic waves. Quakes can extend in size from those that are weak to the point that they can't be felt to those sufficiently vicious to hurl individuals around and decimate entire urban areas. The seismicity or seismic action of a territory alludes to the recurrence, sort and size of quakes experienced over a time frame, Quakes are measured utilizing estimations from seismometers. The minute size is the most well-known scale on which tremors bigger than roughly 5 are accounted for the whole globe. The more various quakes littler than greatness 5 detailed by national seismological observatories are measured generally on the neighborhood size scale, likewise alluded to as the Richter extent scale. These two scales are numerically comparable over their scope of legitimacy. Greatness 3 or lower tremors are for the most part indistinct or powerless and extent 7 and over possibly causes genuine harm over bigger regions, contingent upon their profundity. The biggest seismic tremors in memorable circumstances have been of greatness somewhat more than 9, despite the fact that there is no restriction to the conceivable size. Force of shaking is measured on the adjusted Mercalli scale. The shallower a tremor, the more harm to structures it causes, all else being equivalent.

1.2. Types of seismic waves

There are three essential sorts of seismic waves – P-waves, S-waves and surface waves. P-waves and S-waves are some of the time on the whole called body waves. P-waves, otherwise called essential waves or weight waves, go at the best speed through the Earth. When they go through air, they appear as sound waves – they go at the speed of sound (330 ms-1) through air however may go at 5000 ms-1 in stone. In view of their speed, they are the primary waves to be recorded by a seismograph

amid a tremor. They contrast from S-waves in that they engender through a material by on the other hand packing and growing the medium, where molecule movement is parallel to the course of wave spread – this is somewhat similar to a smooth that is halfway extended and laid level and its curls are compacted toward one side and after that discharged.

S-waves, otherwise called auxiliary waves, shear waves or shaking waves, are transverse waves that travel slower than P-waves. For this situation, molecule movement is opposite to the heading of wave proliferation. Once more, envision a smooth in part extended, aside from this time, lift an area and after that discharge it, a transverse wave will go along the length of the smooth. Earth waves, Seismic waves will be waves that go through or over Earth. They are normally created by developments of the Earth's structural plates (quakes) however may likewise be brought about by blasts, volcanoes and avalanches. They can reveal to us much about the Earth's structure. S-waves can't go through air or water however are more damaging than P-waves in view of their bigger amplitudes. Surface waves are comparative in nature to water waves and travel simply under the Earth's surface. They are ordinarily produced when the wellspring of the seismic tremor is near the Earth's surface. Albeit surface waves travel more gradually than S-waves, they can be considerably bigger in adequacy and can be the most dangerous kind of seismic wave. There are two essential sorts of surface waves. Rayleigh waves, additionally called ground move, fly out as swells like those on the surface of water. Individuals have asserted to have watched Rayleigh waves amid a seismic tremor in open spaces, for example, parking garages where the autos climb and down with the waves. Adore waves cause level shearing of the ground. They typically travel somewhat speedier than Rayleigh waves.

1.3. Soil structure interaction

The sub structuring procedure and the control execution related with the constant sub structuring testing for SSI were performed. Furthermore, the impact of SSI on a long-traverse extension was tried by this novel testing technique. In the seismic investigation of a structure established on ground, the ground movement goes to the base of structure and after that heaps on structure. The reaction of the establishment framework influences the reaction of the structure and the other way around, which is called dynamical soil-structure communication (SSI). Hypothetical outcomes show that SSI is here and there gainful and some of the time impeding to auxiliary execution. Along these lines, the impact of soil can't be dismissed, in light of the fact that SSI marvel is firmly identified with its dynamic qualities, particularly the damping of the entire framework. To investigate the impact of SSI on the seismic execution of designing structures, the limited component techniques and hypothetical examination are frequently utilized. Nonetheless, the vulnerabilities and limit condition existing in SSI framework have not been reenacted appropriately by these strategies. At present, test confirm identifying with SSI framework is rare.

1.4 Behavior of Soil under Earthquake Loads

1.4.1. Liquefaction

Liquefaction is a marvel in which the quality and firmness of a dirt is diminished by seismic tremor shaking or other quick stacking. Liquefaction and related wonders have been in charge of enormous measures of harm in chronicled tremors far and wide. Liquefaction happens in immersed soils, that is, soils in which the space between individual particles is totally loaded with water. This water applies a weight on the dirt particles that impacts how firmly the particles themselves are squeezed together. Before a seismic tremor, the water weight is moderately low. In any case, seismic tremor shaking can bring about the water weight to increment to the point where the dirt particles can promptly move as for each other.

The weights created amid vast seismic tremors with many cycles of shaking can make the melted sand and abundance water compel its way to the ground surface from a few meters underneath the ground. This is regularly seen as "sand bubbles" likewise called "sand blows" or "sand volcanoes" (as they seem to shape little volcanic pits) at the ground surface. The wonder may fuse both stream of effectively melted sand from a layer subterranean, and a sand trap impact whereby upward stream of water starts liquefaction

in overlying non-condensed sandy stores because of lightness.

The impacts of soil liquefaction on the manufactured condition can be to a great degree harming. Structures whose establishments bear specifically on sand which melts will encounter a sudden loss of support, which will bring about intense and unpredictable settlement of the building creating basic harm, including splitting of establishments and harm to the building structure itself, or may leave the structure unserviceable thereafter, even without basic harm. Where a thin covering of non-condensed soil exists between building establishment and melted soil, a 'punching shear' sort establishment disappointment may happen. The unpredictable settlement of ground may likewise break underground utility lines. The upward weight connected by the development of condensed soil through the outside layer can split frail establishment pieces and enter structures through administration pipes, and may enable water to harm the building substance and electrical administrations. Extensions and vast structures developed on heap establishments may lose bolster from the contiguous soil and clasp, or stopped at a tilt subsequent to shaking. Slanting ground and ground by waterways and lakes may slide on a melted soil layer (named 'sidelong spreading'), opening extensive breaks or gaps in the ground, and can make critical harm structures, scaffolds, streets and administrations, for example, water, flammable gas, sewerage, power and broadcast communications introduced in the influenced ground. Covered tanks and sewer vents may drift in the melted soil because of lightness. Earth banks, for example, surge levees and earth dams may lose dependability or crumple if the material involving the dike or its establishment condenses. Over geologic time, liquefaction of soil material because of seismic tremors could give a thick parent material in which the fragipan may create through pedogenesis.

1.5. Structure behavior during earthquake

1.5.1 Axial load

A compel with its resultant going through the centroid of a specific area and being opposite to the plane of the segment. Hub compel is the pressure or strain constrain acting in a part. On the off chance that the hub constrain acts through the centroid of the part it is called concentric stacking. On the off chance that the constrain is not acting through the centroid it's called unconventional stacking. Unconventional stacking produces a minute in the bar thus of the heap being a separation far from centroid.

A fascinating case of hub stacking can be found in the underneath picture . Envision a pogo stick individual who is attempting to bounce with just a single foot, what might happen? Well they wouldn't remain upright. The perfect approach to bounce on a pogo stick is to guarantee that the drive is acting concentric to the pogo sticks centroid. In the event that you are off by even a bit the minute will bring about the pogo stick to respond and you won't hop straight.

1.5.2. Base Shear

Base shear is a gauge of the most extreme expected parallel drive that will happen because of seismic ground movement at the base of a structure. Estimations of base shear (V) rely on upon: 1)soil conditions at the site. 2)proximity to potential wellsprings of seismic action, (for example, geographical issues). 3)probability of huge seismic ground movement. 4)the level of pliability and over quality related with different basic designs and the aggregate weight of the structure. 5)the crucial (regular) time of vibration of the structure when subjected to dynamic stacking.

1.6 soil structure interaction during an earthquake loads

The examination on the vitality exchange component from soils to structures amid quakes is basic for the plan of seismic tremor safe structures and for overhauling existing structures. Subsequently the requirement for research into Soil-Structure Interaction (SSI) issues is more prominent than at any other time. Besides, late reviews demonstrate that the impacts of SSI might be unfavorable to the seismic reaction of structure and disregarding SSI in examination may prompt un-traditionalist plan. Regardless of this, the regular plan system more often than not includes suspicion of fixity at the base of establishment ignoring the adaptability of the establishment, the compressibility of soil mass and thusly the impact of establishment settlement on further redistribution

of bowing minute and shear drive requests. Consequently the dirt structure cooperation examination of multi-story structures is the fundamental concentration of this review; the impacts of SSI are dissected for common multi-story building laying on pontoon establishment. Three techniques for investigation are utilized for seismic requests assessment of the objective minute safe casing structures: equal static load (ESL); reaction range (RS) strategies and nonlinear time history (TH) examination with suit of nine time history records. Three-dimensional FEM model is built to dissect the impacts of various soil conditions and number of stories on the vibration attributes and seismic reaction requests of building structures. Numerical outcomes got utilizing soil structure association demonstrate conditions are contrasted with those comparing to settled base bolster conditions. The pinnacle reactions of story shear, story minute, story removal, story float, minutes at shaft closes, and additionally drive of internal segments are broke down. The investigation consequences of various methodologies are utilized to assess the focal points, confinements, and simplicity of utilization of each approach for seismic examination.

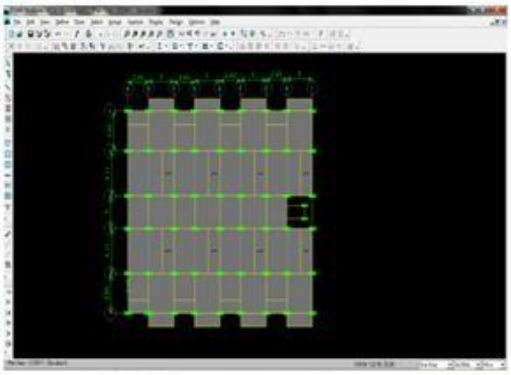


Fig.1.3D view of the building

II.METHODOLOGY

To do well within an earth quake a structure should possess four primary attributes namely easy and regular configuration and sufficient lateral Strength, stiffness and ductility. Structures getting simple regular geometry and uniformly distributed mass and stiffness in plan in addition to elevation, suffer significantly less damage than structures with irregular configuration. A structure will be regarded as irregular for that purpose of this standard, if a minimum of one from the weather is relevant. Straight line Static Procedure, Straight line dynamic Procedure, Response Spectrum method, Time history method, Nonlinear Static Procedure and Nonlinear dynamic procedure. Straight line static procedure: The straight line static process of building is modeled using their linearly elastic stiffness from the building. The same viscous damps the approximate values for that lateral loads to close the yield point. Design earthquake calls for the LSP are symbolized by static lateral forces whose sum is equivalent to the pseudo lateral load. When it's put on the linearly elastic type of your building it can lead to design displacement amplitudes approximating maximum displacements which are expected throughout the design earthquake. To create our planet quake loads to calculate the interior forces is going to be reasonable approximate of expected during to create earth quake. Response spectrum method: The representation from the maximum response of idealized single degree freedom system getting certain period and damping, during earthquake ground motions . The utmost response plotted against of united nations-damped natural period as well as for various damping values and could be expressed when it comes to maximum absolute acceleration, maximum relative velocity or maximum relative displacement. Aftereffect of Drift around the Structure: When it comes to seismic design, lateral deflection and drift can impact both structural factors that are members of the lateral pressure fighting off system and structural elements that aren't area of the lateral pressure fighting off system. With regards to the lateral pressure fighting off system, once the lateral forces are put around the structure, the dwelling responds and moves because of individual's forces Consequently, there's rapport between your lateral pressure fighting off system and it is movement under lateral loads this relationship could be examined by hands or by computer. While using outcomes of this analysis, estimates of other design criteria, for example rotations of joints in eccentric braced frames and rotations of joints in special moment fighting off frames could be acquired. Similarly, the lateral analysis may also be used and really should be employed to estimate the result of lateral

movements on structural elements that aren't area of the lateral pressure fighting off system, for example beams and posts that aren't clearly regarded as being a member of the lateral pressure fighting off system. Design provisions for moment frame and eccentric braced frame structures have needs to guarantee the ability from the structure to sustain inelastic rotations caused by deformation and drift. Without correct thought on the expected movement from the structure, the lateral pressure fighting off system might experience premature failure along with a corresponding lack of strength . Additionally, when the lateral deflections associated with a structure become too big, P-? Effects may cause instability from the structure and potentially lead to collapse. Center Of Mass: The middle of mass may be the unique point in the center of the distribution of mass wide which has the home the weighted position vectors relative up to now sum to zero. In example to statistics, the middle of mass may be the mean location of the distribution of mass wide. Center Of Rigidity: Center of rigidity may be the stiffness centric inside a floor-diaphragm plan. When the middle of rigidity is exposed to lateral loading, the ground diaphragm is experiencing only translational displacement. Other levels can translate and rotate since behavior is coupled in plan and along height. Like a purpose of structural qualities, center of rigidity is separate from loading. Certain building codes require center of rigidity for multistory-building design-eccentricity needs . Seismic weight of creating: The seismic weight from the building implies that is calculated around the entire floors weight from the building Fundamental Natural period according to IS 1893(part1): The approximate fundamental natural duration of vibration (Ta)within minutes of the moment fighting off frame building without brick infill panels might be believed through the empirical expression.

Ta=0.075h^0.75 for RC framed building

Ta=0.075h^0.75 for steel framed building

Where h =height of building

The approximate fundamental natural period of vibration (Ta) in seconds, of all other buildings, including moment –resisting frame buildings with brick infill panels, may be estimated by the empirical expression

Ta= 0.09h/Vd

Where h = height of building d = Base dimensions of the building at the plinth level in m, along the considered direction of lateral force. **Design Seismic Base Shear:** The total design lateral force or design seismic base shear (Vb) along any principal direction shall be determined by the following expression:

Vb = AhXW

Where Ah = Design horizontal acceleration spectrum value as per clause 6.4.2 IS 1893(part1):2002 using the fundamental natural period Ta as per clause 7.6 IS 1893(part 1):2002 in the consider direction of vibration. W = Seismic weight of building

Here Ah =

$$\left(\frac{Z}{2}\right) X \left(\frac{I}{R}\right) \mathrm{X} \left(\frac{S_a}{g}\right)$$

Z = zone factor

I = Importance factor

$\frac{S_a}{g}$ = Depending up on the Ta and type of soil

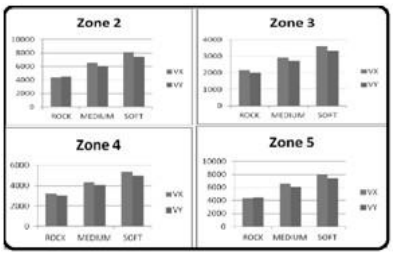


Fig.2.irregular configurations

III.CONCLUSION

In comparison the two the standard and irregular configuration and also the base shear value is much more within the regular configuration. Base shear value is much more within the zone 5 which within the soft soil in irregular configuration. Base shear value is much more within the zone 5 which within the soft soil in regular configuration. Due to the structure convey more symmetrical dimensions. Story drift value is much more within the story 12 within the irregular configuration. Story drift value is much more within the story 13 within the regular configuration. In comparison the two the standard and irregular configuration and also the story drift value is much more within the regular configuration. Finally in comparison the two software's the STAAD PROV8i has more quality. The part of the steel is five to ten

Percent. Due to the structure have more dimensions.

IV. ACKNOWLEDGEMENT

I express my gratitude towards my guide Asst Prof. CHANDANA SUKESH M.tech (structural engineering) VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY, Nambur (V), Pedakakani (M) for his guidance, valuable support and inspiration, constant encouragement throughout this Dissertation. I express my sincere thanks to lab technician of Structural Engineering Laboratory for his kind help and co-operation during my work. I sincerely thanks to my Classmates and Friends for their kind help and co- operation during my experimental work. My sincere thanks to faculty members (teaching and non-teaching), and my parents for giving out valuable suggestions throughout the thesis work. I also express my dispense of gratitude and indebtedness to my esteemed Institute, VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY, Nambur(V),PedaKakani(M),which has provided me an opportunity to fulfill the most cherished desire to reach my goal.

V. REFERENCES

[1]. Agarwal Pankaj and Shrikhande Manish, Earthquake Resistant Design of Structures, Prentice Hall of India Limited, July 2006, 251-336.

[2]. Design Example by Arcelor-Mittal.(www.arcelor-mittal.org)

[3]. IS 1893:2002, Fifth Revision, Criteria For Earthquake Resistant Design of Structures, Part 1 General Provisions and Buildings.

[4]. Prakash Sangamnerkar, Dr. S. K.Dubey. Static and Dynamic Behavior of Reinforced Concrete Framed Building: A Comparative Study

[5]. Design Cell, M. P. Housing and Infrastructure Development Board, Bhopal (M.P.) 462013Professor, Dept. Of Civil Engineering, Maulana Azad National Institute of Technology, Bhopal (M.P.)

[6]. Bureau of Indian Standards:IS-875,part (1) 1987,Dead loads on Buildings and Structures, New Delhi, India

[7]. Bureau of Indian Standards:IS-875,part (2) 1987, Live loads on Buildings and Structures, New Delhi, India

[8]. Subramanian N., Design of steel structures, Oxford University Press,7th edition, 2011, 173-209