WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Earthquake Resisting Structure in Indian Continent

[1]Uday Vivek Amte, [2]Prof. Vishal Gajghate.

[1]Student M-Tech Structural Engineering, Civil Engineering Department G H Raisoni University Saikheda.
[2]Assistant Professor Civil Engineering Department G H Raisoni University Saikheda

ABSTRACT:-

Where earthquake activity occurs our country has had engineering for more than 35 years. Indian earthquake engineers have made significant contributions to the seismic security of several significant structures throughout the nation. The performance of typical structures during earlier Indian earthquakes, however, has been less than ideal, as evidenced by the most recent earthquakes. This is primarily because most practising engineers are unaware of the precise guidelines that must be followed in earthquake resistant design and later in construction.

Limited prescriptive or performance-based guidance on analysis and design to protect against mega earthquake and progressive collapse is provided by the present design standards and building codes. Building collapse is the most tragic and lethal outcome of an earthquake, hence collapse prevention in a major or "megaearthquake" should come first in a structure's design. Also Progressive collapse assessments are used to assess a structure's ability to withstand abnormal loading while maintaining the vital elements' load carrying capability or to transfer gravity loads in the event that a critical load-bearing element is eliminated.

Keywords: - Building Resistant to Earthquakes, Economically

Introduction:-

Our planet is prone to many natural disasters, such as floods, tornadoes, tsunamis, volcanic eruptions, earthquakes, and storms. It is extremely harmful to both live beings and nature. It iserratic and unpredictable. Earthquake, often known as quake or tremor, is one of the perilous calamities. The most serious harm happens in densely inhabited areas. According to popular belief, it is not the earthquake that kills people, but rather poor engineering. The most difficult duty is to assess the seismic safety of the structure and conduct the required retrofitting actions to safeguard it from future earthquakes. The built environment has been identified as seismically unstable, with the majority of these structures lacking earthquake resistance measures. Tectonic plates are like riddles that spread all across the world, gently churning andfalling and colliding with one another. Plate boundaries are the edges of these plates. Many faults run along the plate borders. At times, the faults become glued to each other while the remainder of the plate continues to move, resulting in energy storage at the faults.

When the force overcomes the friction of the jagged fault, a quick release of energy spreads forth from the fault in all directions, like a ripple in a pond. These waves shook the surface, causing anything on it to move. The shaking of the earth's surface is known as an earthquake. Some experts believe that present seismic design features, both for new buildings and for reinforced existing structures, may be improved to withstand mega earthquakes and gradual collapse. However, little attempts have been made to quantify such gains. The goal of this project is to estimate and evaluate the seismic susceptibility of progressive collapse with non-progressive collapse using a five-story building structure as a case study. The intensity and frequency of shaking are determined by the building's orientation. When compared to smaller buildings, high-rise structures have a propensity to exaggerate the size of long-term periodic

movements. Every structure has a resonant predominance, which is one of its features. Taller structures tend to be exposed for longer periods of time than shorter ones, making them more vulnerable to harm. As a result, while analysing a towering building, one must use caution. Certain preventative measures must be implemented during the building of earthquake- resistant structures. Earthquake resistant structures are those that are built to withstand the effects of an earthquake. Earthquake Resistant Construction is a style of construction in whichthe influence of an earthquake is either non-existent or insignificant. Although no structure canbe completely impervious to seismic harm. However, the main purpose of earthquake resistant building is to establish structures that can endure seismic activity or circumstances better thanconventional structures, hence minimising loss of life by implementing preventive steps duringthe construction stage.

Literature Review:-

Agarwal J, 2009 In 1960, the Bureau of Indian Standards (BIS) formed a multi- disciplinary group comprising engineers, geologists, and seismologists to develop a code of practise for earthquake resistant structural design. The above-mentioned group, comprised of representatives from numerous organisations dealing with earthquake physics and mitigation measures, generated the first complete seismic zoning map. Given the scarcity of data on previous earthquakes in the nation, the committee determined that zoning map evolution based only on statistical approaches is unlikely to produce a realistic seismic hazard evaluation. The seismic zoning was based on the country's broad seismotectonics framework. This was supplemented by GSI's preliminary tectonic map.

Alexander S (2004) Following the Wenchuan earthquake, both the academic and technical sectors focused on "mega-earthquake" collapse prevention. Obviously, if design regulations simply increase the strength requirements of all components, building costs will skyrocket. To withstand the earthquake, the entire building functions as an organic system. If the structural system's potential strength is completely mobilised, the collapse possibilities in a "mega-earthquake" can be successfully mitigated.

Shailesh Kr. Agrawal (2009) Concludes Good engineering practise entails looking beyond minimal prescriptive code requirements and taking into account the risk of low likelihood, high-consequence occurrences, regardless of whether the incident is "accidental" or "normal" 18 load. However, structural design that reduces the danger of progressive collapse to an acceptable level is now possible and would increase the value of the structure. Understanding the technical challenges involved in coping with low likelihood, high-consequence catastrophes is critical for structural engineers.

Terala Srikanth & Ramancharla Pradeep Kumar (2010) States The collapse of allor a major portion of a structure caused by damage or failure of a relatively small portion of it is known as progressive collapse. Only if the collapse is likewise excessivecan the vulnerability of a building be of special concern. In general, there are three approaches to designing structures to reduce their susceptibility to disproportionate collapse: redundancy or alternate load paths, where the structure is designed so that if

any one component fails, alternate paths for the load that was in that component are available and a general collapse does not occur; local resistance, where susceptibility to disproportionate collapse is reduced by providing critical components that may be subject to disproportionate collapse; and global resistance, where susceptibility to disproportionate collapse is reduced by providing critical components that may be subject.

Dimistris Diamantidis (2012) A macromodel-based technique is used to numerically predict the potential for progressive collapse of a conventional reinforced concrete
_RC_ moment frame structure caused by the loss of one or more first-story columns. The simulation model was created with the realisation that characterisation of nonlinearbehaviour associated with force transmission through the joint is crucial for predictingthe substantial deformation response associated with progressive collapse. To simulatecrucial and vital activities in the floor beams and the transfer of these forces via the joint region to the vertical parts, a simplified simulation model of a beam-column jointis utilised.

Jain, S. K., Murthy (2017) This study provides an overview of structural collapse andstructural robustness principles. In general, three techniques to disproportionate collapse resistant design are available: enhanced connectivity or continuity, notional element elimination, and critical element design. These strategies are detailed in detail,as well as their drawbacks. The robustness treatment in the Structural Eurocodes is alsosummarised. Because the principles discussed in this article are not material specific, they may be applied to any materials and structures.

Dunn, J. A (2019) The evaluation of earthquake susceptibility and seismic risk for the city of Chania on the island of Crete is tackled through the construction of a GIS-basedapplication that takes into account the structural and geological domain of the region. Using a localised model, the various structural and geomorphologic attributes of the region were assigned specific weights of significance, allowing the development of a modular application that was tested for the city of Chania and validated using the area'srecent seismic activity. The suggested risk map and model might be a valuable tool fordealing with problems caused by future earthquakes.

Kumar, S. L. (2010) Reviewed Building robustness standards as specified in current codes. Aspects of methodologies are briefly presented. The state of the art in terms of robustness in various types of structures, such as offshore structures, bridges, and tunnels, is next described. Finally, limitations in the code requirements and a prognosisfor future standards development are presented.

Methodology:

It has been noticed that earthquakes inflict significant damage owing to either conventional procedures or ways that do not adhere to the design ideas of earthquake resistant building. Asa result, the earthquake factor must be considered during building.

Earthquake Resistant Design Principles are classified into three basic categories:

- The position of rooms, walls, openings (doors, windows, and story), site, andfoundation elements must all be considered.
- The arrangement and overall design must be considered to provide lateral resistance.
- Consideration of highly loaded and vital portions, with strengthening provisions whereneeded.

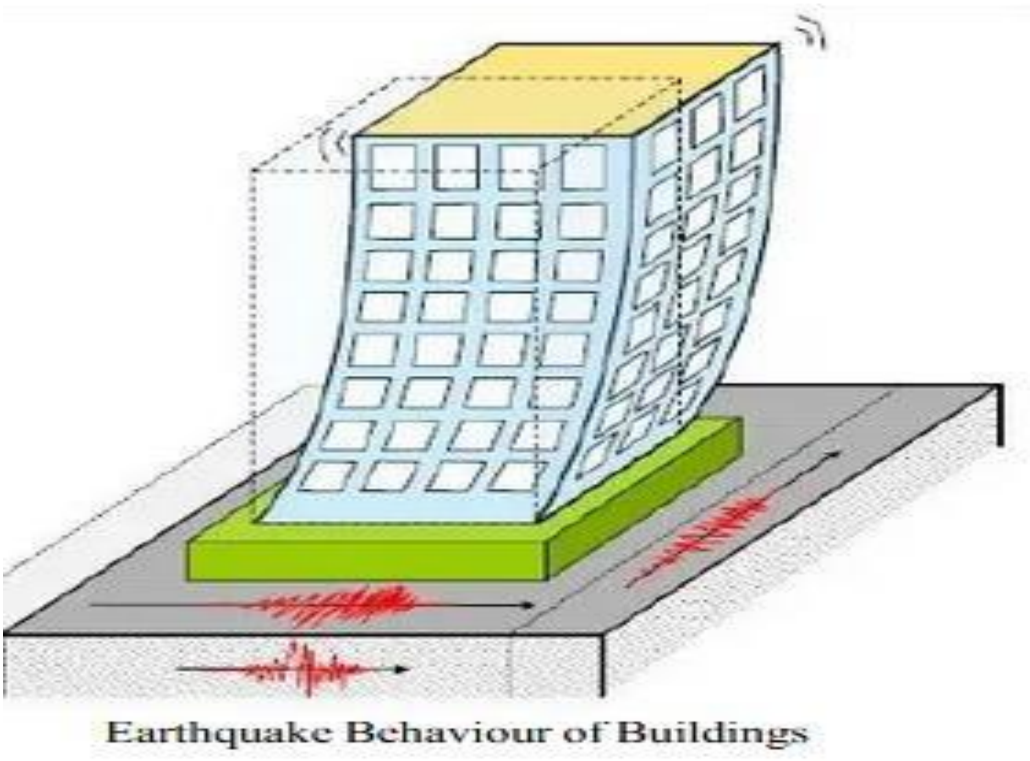
ANALYSIS METHODS:-

Equivalent Static Analysis

Equivalent static analysis is a type of seismic response spectrum. It may also be described as the forces acting on a structure, and it depicts the ground motion impact caused by an earthquake. The structure is assumed to respond with the fundamental mode in this approach. To do this, the building should be shorter and should not twist considerably as the earth moves.This sort of study is used to estimate structural displacements. This methodology is best suitedfor structures and individual frames. The earthquake load will be considered to be a static andhorizontal equivalent force delivered to the individual frames. The provided force is equal to the product of the acceleration response spectrum and its weight.

Response Spectrum Analysis:

Response spectrum analysis is a type of linear-dynamic statistical analysis. It determines the mode of vibration and the maximal seismic response of an elastic structure. It is based on structural dynamics theory and is developed from fundamental concepts. With the use of velocity, acceleration, displacement, measurement as a structural period function for a particular damping level, and time history, this study provides insight into dynamic behaviour.



Because response spectrum analysis ties structural type selection to dynamic performance, it is extremely valuable for design decision-making. The resultant graphic can be used to determine the response of a linear system. Except for extremely basic and highly complicated buildings, this study incorporates the numerous modes of reaction of a building. This analysis is essentialin many situations. Response spectrum analysis is a type of linear-dynamic statistical analysis.It measures the mode of vibration and shows the The outcome of this analysis differs greatly from that determined from an examination of ground motion. As a result, phase information islost throughout the response spectrum generation procedure.

Modelling Of Soil-Structure Interaction:-

Advanced numerical approaches such as FEM, BEM, and hybrid methods are used to study soil-structure interaction from a variety of perspectives. With certain simplifications, all of theapproaches include approximate models of the genuine soil-structure interaction. Each technique has advantages in simulating soil and the soil-structure interaction. These approachescan be classified into the following categories.

The direct technique is used to represent both the soil and a tall construction. To tackle the unbounded soil and the towering building independently, the substructure technique is used. The degrees of freedom can be reduced using the substructure technique. Estimating the divergence condition in the direct technique requires modelling of a significant amount of the soil. The simulated soil barrier is located at various times the width of the structure from the building. The direct technique is often used to estimate just two-dimensional models. However, the substructure technique for three-dimensional models is more successful than the direct method.

Conclusion:-

1. Many research have demonstrated seismic analysis of RCC structures with various irregularities such as mass irregularity, stiffness, and vertical geometry irregularity.
2. When a structure has multiple irregularities, it is required to examine the structure in different earthquake zones.
3. Many previous studies have shown that the effect of earthquakes on structures may be reduced by installing shear walls, base isolation, and other measures.
4. It may be inferred that preventative measures must be implemented throughout the construction phase for earthquake-resistant construction.
5. This involves adopting new approaches for using smart materials. These are thematerials that, as a result of their intrinsic qualities, respond to certain external stimuliand perform specified activities.
6. These materials5 have had a significant influence on the subject of vibration control inearthquakes.

7. The most common application of smart materials is to absorb vibrations in automobilesuspensions.
8. Attempts should be made to adapt this technology, which has so far only been employedexperimentally, to civil engineering.
9. Incorporating new technology necessitates significant investment in the infrastructure sector. However, this must not be neglected at the price of human life.

REFERENCES:

[1]. Li, Q. S., Zhang, Y. H., Wu, J. R., Lin, J. H., "Seismic random vibration analysisof tall buildings".

[2]. Zou, X. K., Chan, C. M., "Optimal seismic performance based design of reinforcedconcrete buildings using nonlinear pushover analysis".

[3]. RangaRajan, T., "Non-linear Static Pushover Analysis".

[4]. Chambers, J., Kelly, T., "Nonlinear dynamic analysis-the only option for irregularstructures".

[5]. Dorheim, H., "Methods for earthquake analysis".

[6]. Calugaru, V., "Earthquake Resilient Tall Reinforced Concrete Buildings at Near-Fault Sites Using Base Isolation and Rocking Core Walls".

[7]. Lee, D. G., Hong, J. M., Kim, J., "Vertical distribution of equivalent static loadsfor the isolated building structures"

[8]. Vulcano, A. "Comparative study of the earthquake and wind dynamic responses ofbase-isolated buildings".

[9]. Cali, I., Marletta, M., Vinciprova, F., "Seismic response of multi-storey buildingsbase-isolated by riction devicees with restoring properties".

[10]. Ribakov, Y., "Reduction of structural response of near fault earthquakes byseismic isolation columns

[11] C.V.R Murty, "How do Earthquakes affect Reinforced Concrete Buildings"

[12] Shailesh Kr. Agrawal and Ajay Chourasia, Methodology for Seismic VulnerabilityAssessment of Building Stock in Mega Cities. Scientist, Central Building Research Institute, Roorkee 247 667. A Workshop on Microzonation ©Interline Publishing, Bangalore.

[13] G. Kaewkulchai1 and E. B. Williamson Modeling the Impact of Failed Members for Progressive Collapse Analysis of Frame Structures, Journal of Performance ofConstructed Facilities, Vol. 20,No. 4, November 1, 2006. ©ASCE, ISSN 0887-3828/2006/4-375–383.

[14] Xin-Zheng Lu, Yi Li, Lie-Ping Ye, Yi-Fei Ma, and Yi Liang, Study On TheDesign Methods To Resist Progressive Collapse For Building Structures, Proceedingsof the Tenth International Symposium on Structural Engineering for Young Experts.

[15] Dimistris Diamantidis, University of applied science Regensburg, Germany, joint work shop of cost action , September 21-22 2009 Ljubljana, Slovenia.

[16] K.A. Seffen, Discussion of "Progressive Collapse of the World Trade Center:ASimple Analysis, February, 2008, Vol. 134, No. 2, pp. 125-132.