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A Review of Seismic Analysis of High Rise Buildings using Etabs Software

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ABSTRACT

The insulator concept in the building at base level reduces the possibility of structure resonance and increases the structure lifespan resulting in better seismic performance of the building. This study is carried out to compare the effectiveness of fixed and insulated multi-story RC framed building. Base insulation of structures is one of the most desirable means of protecting it from seismic forces. The term base isolation has two words: first is 'base', its meaning is a part that supports underneath or functions as the foundation of a structure, and the second is 'isolation', its meaning of the state of being disparate. During seismic attacks, traditional building structures, where the base is fixed to the ground, respond with a gradual rise from ground level to the top of the building, like an amplifier.

KEY WORD- Multistory Buildings, Seismic Analysis, Displacement.

1. INTRODUCTION

This can result in severe damage or complete collapse of structures. To avoid these results and at the same time satisfy the functional requirements in service, flexibility is built into the base of the structure, usually by placing lead rubber bearing insulators between the structure and its foundation. Seismic base isolation is one of the best methods among side load resistance systems. The term base insulation uses the word insulation in its meaning of the state of separation and base as a part that supports underneath or serves as a foundation for an object or structure. The Lead Rubber Bearing (LRB) system selected for this study includes samples of materials such as plate, rubber and central core. It was selected to establish an innovative simplified design procedure for insulators incorporated into multi-story building structures. Recent studies have shown that most insulated buildings are important to use multi-layer laminated rubber bearings with steel reinforcement layers.

The population increase by which land deficit occurs and to overcome this, skyscraper structure is opted. These types of skyscrapers are affected by natural phenomena. Such as earthquakes are the most dangerous through the damage and effects caused to structural components, which cannot be controlled. These natural calamities caused structural damage and disruptions in normal life cycle development. Because it is a global concern, most of the analysis must be discovered and provided with the results to prepare the framework for reaching the time frame. With technological advances, man sought to combat these natural phenomena through various ways, such as developing early warning systems for disasters, adopting new prevention measures, adequate relief and rescue measures. But, however, it is not true of all natural disasters.

Structural analysis mainly involves the act of discovering a structure when something happens. Such behavior can be due to the weight of objects such as people, furniture, wind and snow, or other forms of excitation such as earthquakes, ground tremors caused by nearby explosions and the like. In essence, all these loads are dynamic, including the weight of the structure, as at some point these loads do not exist. The distinction between dynamic and static analysis is based on whether the applied motion has sufficient acceleration compared to the natural frequency of the structure.

The main parameters of seismic analysis of structures are load capacity, ductility, stiffness, damping and mass. The selected structural model type is based on external action, structure behavior or structural materials, selected structural model type.

High Rise Building-A building which is more than 15m in height as per the National Building Code2005 of India is called a High Rise Building. The materials used for the structural system of skyscrapers are reinforced concrete and steel. Most North American-style skyscrapers have a steel structure, while residential blocks are generally constructed of concrete. There is no clear definition of any difference between a tower block and a skyscraper, although a building with fifty or more stores is generally considered a skyscraper. High-rise structures pose specific design challenges for structural and geotechnical engineers, especially if located in a seismically active region or if the underlying soils have geotechnical risk factors such as high compressibility.

2. LETERATURE REVIEW

Pardeshi Sameer and Prof. N. G. Gore (2016): This article deals with the effects of various vertical irregularities on the seismic response of a structure. The aim of the project is to perform response spectrum analysis (RSA) of regular and irregular RC construction frames and time history analysis (THA) of regular RC construction frames and perform ductility based design using IS 13920 corresponding to the response spectrum analysis . The results of the analysis of irregular structures are compared with regular structures.

Vinayak BKulkarni, Mahesh VT atikondab (2016) : Dynamic analysis is performed using STAAD Pro software. Loads on the structure were considered according to IS standards. Dynamic analysis can be the response spectrum method or the time history analysis method. The response spectrum method uses rules set out in IS 1893 (part 1) 2002 and time history analysis can be performed using data from previous earthquakes. In this article, the El Centro earthquake occurred in 1940, data is used. The results in terms of lateral displacements in relation to each floor are determined and compared by floor.

Dr.Okay.R.C.Reddy, Sandip A. Tupat et.,al. (2014): Their research stated that the hundreds of wind and earthquake masses are estimated for a twelve-story RC framed constitution. Based on the obtained results, the following conclusions are made. The earthquake and wind hundreds increase with the height of the constitution. Wind loads are more valuable for tall structures than earthquake loads. Buildings will have to be designed to recommend loads regardless of important wind or earthquake forces.

Ali Kadhim Sallal (2018): The main purpose of this software is to design and analyze multi-storey buildings in a systematic process. This work presents a building where it was designed and analyzed under earthquake and wind pressure using ETABS software. In this case, (18m x 18m) and eight-story structure are modeled using ETABS software. Ten stories are considered to be (3m) high and make up the total height of the structure (31m).

Pushkar Rathod and Rahul Chandrashekar (2017): With the help of seismic analysis, the structure can be designed and built to withstand the high lateral movement of the Earth's crust during an earthquake. Any type of basic or highly advanced structure that is under static or dynamic conditions can be evaluated using ETABS. ETABS is a coordinated and productive tool for analysis and design ranging from simple 2D charts to modern skyscrapers, making it one of the best structural software for building systems.

Pardeshi Sameer and Prof. N. G. Gore (2016): This article deals with the effects of various vertical irregularities on the seismic response of a structure. The aim of the project is to perform Response Spectrum Analysis (RSA) of regular and irregular RC frames and Time History Analysis (THA) of regular RC frames and perform ductility based design using IS 13920 corresponding to the response spectrum analysis. response. The results of the analysis of irregular structures are compared with regular structures.

Vijaya Bhaskar red. To define. al. (2015): This article presents the illustration of a comparative study of static loads for multi-storey structures of 5 and 10 floors. The importance of this work is to estimate the design loads of a structure. They conclude that limb deflection is high with an increase in n. of floors. It can be seen that the axial force is high in 10-story buildings compared to 5-story buildings.

Abhay Guleria (2014): The case study in this article mainly emphasizes the structural behavior of multi-storey buildings for different floor plan configurations such as rectangular, C, L and I-shaped. Modeling of 15 floors R.C.C. the framed construction is done in ETABS software for analysis. After the analysis of the structure, the maximum shear forces, the bending moments and the maximum displacement of the floor are calculated and compared for all analyzed cases. The analysis of the multi-storey building reflected that the floor toppling moment varies inversely with the height of the floor. From the dynamic analysis, shapes of modes are generated and it can be concluded that asymmetric planes suffer more deformations than symmetric planes.

3. MODELLING AND DESIGNING OF BUILDING

The time period of the proposed structures is estimated in the application software, ie ETABS. The prototype structure model of given geometry and element sizes is prepared in ETABS. The analysis provides the time period of the structure. The ETABS building is idealized as a set of area, line and point objects. These objects are used to represent physical wall, floor, column, beam and brace and link/spring members. The frame's basic geometry is defined with reference to a simple three-dimensional grid system. Material properties like concrete, rebar and section properties like beams, columns are defined as frame element and slab element defined as area element.

4. ANALYSIS LOADS ACTING ON MULTI-STOREY G+10

Loading in tall buildings is different from low-rise buildings in many aspects, such as greater accumulation of gravity loads from top to bottom floors, increased importance of wind loading, and greater importance of dynamic effects. Thus, tall structures need a correct assessment of the loads for a safe and economical design. Except permanent loads, the evaluation of loads cannot be done accurately. Live loads can be roughly anticipated from a combination of experience and past field observations. Wind and earthquake loads are random in nature and difficult to predict. They are estimated based on a probabilistic approach. The following discussion describes some of the more common types of loads on elevated structures.

a. Dead loads

b. Live loads (or) Imposed Loads

c. Gravity loads

d. Wind loads

e. Earthquake loads.

5. SEISMIC ANALYSIS

It is necessary to carry out a seismic analysis of the structure to determine the seismic responses. The analysis can be done depending on the external action, structure or behavior of the structural material and the type of structural model selected.

6. DYNAMIC ANALYSIS

For regular structure with limited height, linear static analysis or equivalent static method can be used. Linear dynamic analysis can be done by the response spectrum method. The main difference between linear static analysis and linear dynamic analysis is the level of forces and their distribution along the height of the structure. Nonlinear static analysis is an improvement over linear or dynamic static analysis in that it allows for nonlinear structure behavior. A non-linear dynamic analysis is the only way to describe the real behavior of a structure during an earthquake. The method is based on the direct numerical integration of the differential equations of motion considering the elastoplastic deformation of the structural element.

7. EQUIVALENT STATIC ANALYSIS

This process does not require dynamic analysis, however, as it takes into account building dynamics roughly. The static method is the simplest - it requires less computational effort and is based on the formulation provided in the exercise code. First, the base design shear is calculated for the entire building, and then it is distributed along the height of the building. At each floor level thus obtained, the lateral forces are distributed to the individuals on the elements resistant to lateral loads.

8. STOREY DRIFT

The amount of sway between two adjacent stories of a building caused due to lateral loads in a structure is known as Storey Drift which is used for the design of partition walls or curtain walls.

9. CONCLUSIONS

A G+10 storey tall building subjected to seismic, wind and live loads was analyzed using ETABS software. The behavior of the tall building was clearly shown using the graphs and lateral displacements. The behavior of the tall building was clearly shown using the graphs and lateral displacements. All members were designed using ETABS. Members that are not appropriate will be fetched and suitable sections are recommended by the software. Better analysis accuracy can be achieved using this software.

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