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WIND & SEISMIC ANALYSIS AND DESIGN OF MULTISTORIED BUILDING (G+30) BY USING ETABS 2015

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Abstract:

In 21st century due to huge population the No.of areas in units are decreasing day by day. Few years back the populations were not so vast so they used to stay in Horizontal system(due to large area available per person).But now a day's people preferring Vertical System(high rise building due to shortage of area).In high rise buildings we should concern about all the forces that act on a building ,its own weight as well as the soil bearing capacity .For external forces that act on the building the beam, column and reinforcement should be good enough to counteract these forces successfully. And the soil should be good enough to pass the load successfully to the foundation. For loose soil we preferred deep foundation (pile).If we will do so much calculation for a high rise building manually then it will take more time as well as human errors can be occurred. So the use of ETABS will make it easy. ETABS can solve typical problem like Static analysis, Seismic analysis and Natural frequency. This type of problem can be solved by ETABS along with IS-CODE. Moreover ETABS has a greater advantage than the manual technique as it gives more accurate and precise result than the manual technique.

Keywords: ETABS, IS-CODE, Vertical system.

1. INTRODUCTION

Earthquake shaking is random and time variant. But, most design codes represent the earthquake-induced inertia forces as the net effect of such random shaking in the form of design equivalent static lateral force. This force is called as the Seismic Design Base Shear VB and remains the primary quantity involved in force-based earthquake-resistant design of buildings. This force depends on the seismic hazard at the site of the building represented by the Seismic Zone Factor Z. Also, in keeping with the philosophy of increasing design forces to increase the elastic range of the building and thereby reduce the damage in it, codes tend to adopt the Importance Factor I for effecting such decisions. live load need not be considered on the roofs of buildings in the calculation of design earthquake force. While there is lesser control on design acceleration spectrum value Ah, designers can consciously reduce seismic weight W though the mass of the building. Choosing light materials and efficiently using the materials together help reducing the source of design earthquake force on the building. Also, the distribution of this mass in plan and elevation of the building renders earthquake-induced inertia forces to be uniformly distributed throughout the building, instead of being localized at a few parts of the building.

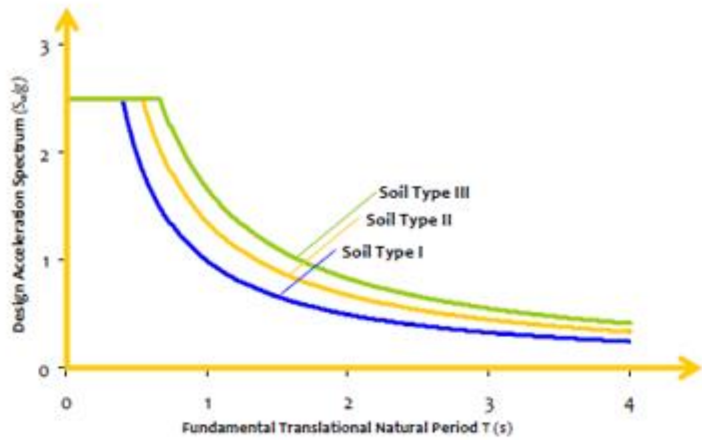

Fig.1.Fundamental Periode

2. RELATED WORK

Buildings oscillate during earthquake shaking. The oscillation causes inertia force to be induced in the building. The intensity and duration of oscillation, and the amount of inertia force induced in a building depend on features of buildings, called their dynamic characteristics, in addition to the characteristics of the earthquake shaking itself. The important dynamic characteristics of buildings are modes of oscillation and damping. A mode of oscillation of a building is defined by associated Natural Period and Deformed Shape in which it oscillates.

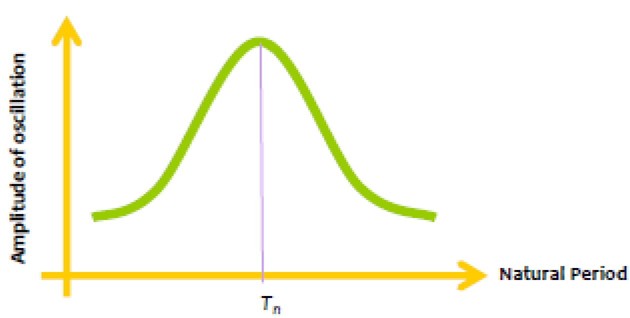

Fig.2.Natural Frequency

The reciprocal (1/Tn) of natural period of a building is called the Natural Frequency fn; its unit is Hertz (Hz). The building offers least resistance when shaken at its natural frequency (or natural period). Hence, it undergoes larger oscillation when shaken at its natural frequency than at other frequencies (Figure 2.4). Usually, natural periods (Tn) of 1 to 20 storey normal reinforced concrete and steel buildings are in the

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range of 0.05 - 2.00s. In building design practice, engineers usually work with Tn and not fn. Resonance will occur in a building, only if frequency at which ground shakes is steady at or near any of the natural frequencies of building and applied over an extended period of time. But, earthquake ground motion has departures from these two conditions. First, the ground motion contains a basket of frequencies that are continually and randomly changing at each instant of time. Every building has a number of natural frequencies, at which it offers minimum resistance to shaking induced by external effects (like earthquakes and wind) and internal effects.

3. PROPOSED SYSTEM

Building has to perform many functions satisfactorily. Amongst these functions are the utility of the building for the intended use and occupancy. Structural safety, fire safety; and compliance- with hygienic. Sanitation, ventilation and daylight standards. The design of the building is dependent upon the minimum requirements prescribed for each of the above functions.

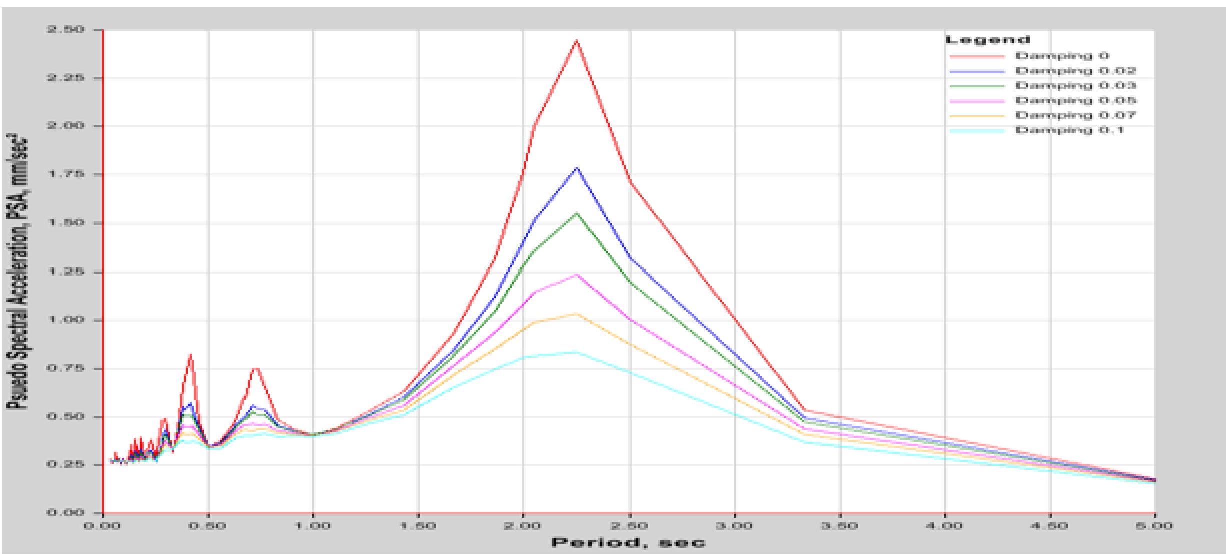

Fig.3. Tabulated plot coordinates

The minimum requirements pertaining to the structural safety of buildings are being covered in this code by way of laying down minimum design loads which have to be assumed for dead loads, imposed loads, snow loads and other external loads, the structure would be required to bear.Strict conformity to loading standards recommended in this code, it is hoped. Will not only ensure the structural safety of the buildings which are being designed and constructed in the country and thereby reduce the hazards to life and property caused by unsafe structures, but also eliminate the wastage caused by assuming unnecessarily heavy loadings. This is a linear static analysis. This approach defines a way to represent the effect of the earthquake ground motion when forces of the series are to act on a building, across a seismic design response spectrum. This method assumes that the building meets in its fundamental mode. The applicability of this method is extended in many building codes by applying factors to account for the rise buildings with higher modes, and for low torque levels. To take account of effects due to a "yield" of the structure, many codes apply modification factors that reduce design forces. In the equivalent static method, the lateral force equivalent to the design basis earthquake is applied statically. Lateral forces equivalent to the level of each stage are applied to the design "center of mass places. It is located to the eccentricity of the design of the "center of rigidity (or stiffness)" calculated.

4. ANALYSIS

Earthquake originates below the surface of the earth due to rupture of bed-rock. This is associated with release of stored strain energy that spreads out in all directions from the fault region in the form of seismic waves that travel through the body and along the surface of the Earth. These seismic waves, primarily of two types called the body waves and surface waves, together cause shaking of the ground (surface of the Earth) on which the buildings are founded.

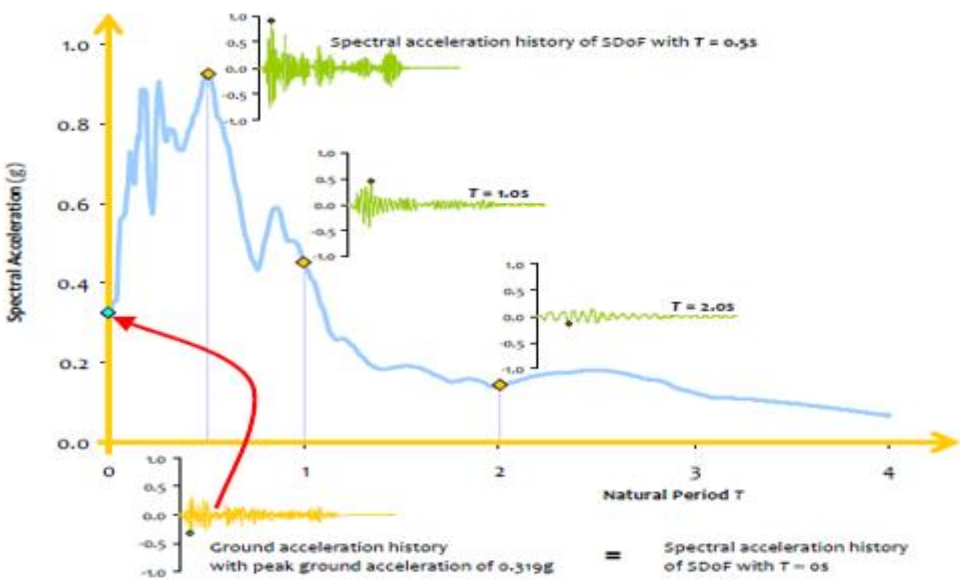

Fig.4.Response Analysis

The characteristics of the ground shaking control earthquake response of buildings, in addition to the building characteristics. The ground motion can be measures in the form of acceleration, velocity or displacement. Earth scientists are interested in capturing the size and origin of earthquakes worldwide, and measure feeble ground displacements even at great distances from the epicenter of the earthquakes. Instruments that measure these low level displacements are called Seismographs. In the vicinity of the epicenters of large earthquakes, the ground shaking is violent. Seismographs get saturated, as their design is such that they get saturated under large displacement shaking, and become ineffective in capturing the displacement of the ground. And, on the other hand, engineers are interested in studying levels of ground shaking at which buildings are damaged, and are conversant with forces (as part of the design process of building). Hence, this motivated the development of instruments called Accelerograph, that record during the earthquake shaking acceleration as a function of time of the location where the instrument is placed.

These instruments successfully capture the ground shaking even in the near field of the earthquake faults, where the shaking is violent.

CONCLUSION

From the above comparison between two 30-storey building taking same beam and column size using different load combination it was clearly visible that the top beams of a building in wind load combination required more reinforcement than the building under seismic load combination (for example beam no 1951 required 5 no of 20 mm Ø and 6 no of 20 mm Ø bars whereas for Seismic load combination it required 13 nos of 10 mm Ø and 21 nos of 10 mm Ø).but the deflection and shear bending is more in wind load combination compare to seismic. But in lower beams more reinforcement is required for wind load combination. For column the area of steel and percentage of steel always greater required for wind load combination than the seismic load combination.(example column no 129 A_{st} required for WL combination is 8371 mm^2 and percentage of steel is 1.56 where as for the SL combination A_{st} required is 1911 mm^2 and percentage of steel is 3.43). The deflection value is more in WL combination than the SL combination.

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