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A Review Paper on Analysis of Highrise Building (G+15) with Vertical irregularities Using ETABS

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ABSTRACT:Seismic forces are very harmful to damage or destroy the structure. We all are aware of multi-story RC building has been subjected to the most dangerous earthquakes. It was found that the main reason forthe failure of RC buildings is the presence of irregularity in it. The building on vertical irregularitydiffers from other buildings. These buildings are much more vulnerable to the seismic environment. In this project, 3D analytical models of highrisebuildings have been generated for irregular buildings. The analysis is done using the structural analysis tool "ETABS" to study the effect of various vertical irregularities on the building. The seismic analysis will be carried out according to per IS codes. The parameters like storey displacement, storey drift, and base shear are compared and studied.

KEYWORDS: Vertical irregularity, Irregular building, high rise building.

I. INTRODUCTION

At present time it is necessary to build multi-storeyed irregular structures due to shortage of space and non-accessibility of uniform ground conditions. During an earthquake, the failure of the structure starts at points of weakness.

The structures are having this discontinuity are termed irregular structures. Irregular structures are largely seen in urban infrastructure. Irregularities in a structure are very important factors that significantly decrease the seismic performance of any structure, as extra shear and torsion are introduced in irregular structures due to earthquake loads.

It is observed that the existing structures are frequently irregular as perfect regularity is an idealization that rarely occurred in the practice.At present time it is necessary to build multi-storeyed irregular structures due toshortage of space and non-accessibility of uniform ground conditions. Irregularities in a structure are very important factors that significantly decrease the seismic performance of any structure, as extra shear and torsion are introduced in irregular structures due toearthquake loads. It is seen that those irregular structural alignments in an elevation or a plan were frequently recognized as one of the major actions of the collapse through a precedent seismic motion.

Structural irregularities are a combination of plan irregularity and vertical irregularity, but major seismic codes distinguish between both.

The horizontal irregularity (plan irregularity) may be classified based on-

- Torsional irregularity
- Re-entrant corner
- Floor slabs having excessive cut-out and openings
- Out of plane offset in vertical element
- Non-parallel lateral force system

The vertical irregularity may be classified based on-

- Stiffness irregularity
- Mass irregularity
- Vertical geometric irregularity
- In plane discontinuity in vertical elements resisting lateral force
- Strength irregularity
- Floating or stub column
- Irregular modes of oscillation in two principal plan direction

Massive destruction of high-rise and low-rise buildings in recent devastating earthquakes proves

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that in developing counties like India, such investigation is the need of the hour. Hence, the seismic behaviour of asymmetric building structures has become a topic of worldwide active research. Many Investigations have been conducted on elastic and inelastic seismic behaviour of asymmetric systems to find out the cause of seismic vulnerability of such structures.

The ELF method is,however, based on several assumptions. These assumptions are true for regularstructures, namely, structures with uniform distributions of stiffness, strength, and massover the height. Irregular distribution of these characteristics in common in realbuilding structures. Therefore, it is important to develop criteria that will enable the useof the ELF method in the analysis of irregular structures. "It is true that research is needed to verify these limits. However, without suchlimits, there cannot be unambiguous enforceable provisions".

Many buildings in the present scenario have irregular configurations both in a plan and the elevation. They may be subject to devastating earthquakes in the future. Therefore, it is necessary to identify the performance of the structures to withstand against the disaster for both new and existing ones.

II. OBJECTIVE

Objectives of the present study are as follows:

1. To describe the philosophy of structuralbehaviour.
2. To introduce various aspects of structuralbehaviour which changes with irregularity.
3. To design vertical irregular building having structural complexity into consideration.
4. To study the highrise structure and analyse the structure by Response spectrum analysis.
5. To compare the result between normal highrise building and vertical irregular building which majority includes deflection, base shear, frame displacement, storey drift, time period, and effect of lateral force on building in Etabs.

III. LITERATURE REVIEW

[1]. The purpose of the paper is to perform a non-linear static pushover analysis of medium height RC buildings and investigate the changes in structural behaviour due to consideration of shear walls. In this paper, Multi-storied buildings i.e. Eight Storied building located in zone III of medium soil sites has been analyzed by Linear Static and Linear Dynamic method given in Indian code and evaluated using pushover analysis as per the procedure prescribed in ATC-40 and FEMA-356.The analysis is carried out using the Etabs analysis package.

Columns and beams are modelled using three-dimensional frame elements. Slabs are modelled as rigid diaphragms. The beam-column joints are assumed to be rigid. Default hinge properties available in ETABS. Different building components are modelled as described Using Software**.**

Three distinct analyses are carried out on eight storied building models on plain ground and on sloping ground, which are as follows:

1. Equivalent Static Analysis
2. Response Spectrum Analysis
3. Pushover analysis

In this study,furthervarious modelsare created and worked on it to find the parameters.

[2]. The primary LFRS designed for the buildings is the special moment-resisting frame(SMRF). The buildings are typically cast-in-place reinforced concrete structures withbeams cast monolithically with slabs and supported by columns.

All buildings have three bays in the direction of the earthquake. The bay sizes arevaried within practical limits to study its influence on the seismic response. Also, buildingsof three different height categories are considered and include 5-, 10-, and 20-storysystems. The beams and columns are designed with normal-weight concrete with a 28-daycylinder strength of 5 KSI and A615 Grade 60 reinforcement.

[3]. In the present paper seismic response of regular and vertically irregular multi-storeybuilding frames has been studied using an equivalent static method. G+2, G+5, G+11storey frames shown in the paper have been analyzed using ETABS 16.1.0 (2016).

A total 9 number of models have been analyzed and zone 5 has been used to evaluate theeffects on storey displacement, storey drift, and storey shear of buildings. The comparisonof results obtained from analysis of all the building frames has been shown in it.

[4]. The methodology will of work to be carried out to achieve the goals is as follows:-

1. Various Indian Design Codes for earthquakesresistant analysis and a design will be studied and various code provisions for an irregular building will be studied.
2. The detailed study will be done on all theparameters of a building such as floating a column, types of irregularities in a building, effects of pounding on a structure, and effect of an earthquake on RC structure.
3. All general parameters are of a building like framing a material, their material constants, types, and intensities of a loading and loading combinations will be decided.
4. The manual calculation is for a base shear was by using the seismic coefficient method will be done.
5. A reliable software (STAAD PRO) will be selected and the modelingand analysis will be done. After analyzing all the selected models with selected materials required results will be studied and compared.

[5]. Steel-concrete composite structures are highly efficient than conventional RCC structures from cost and performance aspects. Thus composite structures must be analyzed with irregularities and must be compared to RCC structures for performance.

This paper deals with 10 storey RCC and composite structures with different vertical irregularities.individual models with irregularities positioned at the lower, middle, and top portion are modelled for analysis, irregularities are placed at the 2nd, 5^{th}, and 9th floor of the structure. Each model carries an irregularity placed at a level of a structure. As per code, irregularities are not positioned at roof level.

In order to examine the effect of irregularities Response Spectrum analysis was performed on building model using Etabs. The results are compared and effects of different vertical irregularities over the RCC and composite structures are observed.

IV. CONCLUSION

1. It was also observed that vertical irregularityincreased in the building, corresponding base shear of the structure decreased due to reduction in mass of the structure, and the corresponding capacity to resist seismic forces decrease due to reduction in base shear of building.
2. It has been observed that with the change in irregularity location the behavior of structure changes rapidly. Composite structure has overall better performance when irregularities are imparted in them.
3. It is found that the plastic hinges are more in the case of buildings resting on the sloping ground as compared to buildings resting on plain ground, the formation of Plastic hingesis more along the direction of the asymmetry in the building.
4. The presence of shear wall influences the overall behaviour of the structure.

It also be said thatdue to the architectural aspect and from an elevation point of view, irregularities are necessary for building so its effect should be analyzed in the behaviour of structure to provide sufficient provisions for designing.

REFERENCES

[1]. Mohammad Umar Farooque, A.V.Kulkarni, Nayemulla Inamdar,"A performance study and seismic evaluation of RC framebuilding on sloping ground", IOSR Journal of Mechanical and Civil Engineering(IOSR-JMCE).
[2]. Satrajit Das, a) M.ERRI, James M. Nau, b) M.EERI, "Seismic Design Aspects Of Vertically Irregular Reinforced Concrete Building", Earthquake Spectra, Volume 19, No.-3.
[3]. Sanyogita, Babita Saini, "Seismic Analysis Of Vertical Irregularities In Buildings", Springer Nature Switzerland AG 2019.
[4]. Gokulesh C. Chopde, Dr. Abinandan R. Gupta, "Seismic Analysis Of RCC Structure With Change In Vertical Irregularities Floor Wise", International Organization Of Research & Development (IORD).
[5]. S. Prabhu Booshan, S. Sindhu Nachiar, S. Anandh, " Comparative Analysis Of R.C.C. And Composite Structure With Different Vertical Irregularities", Pak. J. Biotechnol Volume 14 (3) 279282(2017).