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Comparative Study of Response of Staad.Pro Model with and Without Modeling Plate Element Considering Plan Irregularity: A Review

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Abstract: ***Nowadays, modelling is done on a lot of software in the world, and in India, some of the software is used among all other software. In this research, we have compared the outcome of the different software including STAAD.Pro and ETABS analysis. Many researchers have made efforts to get the best possible results. But our motive is to model plate elements by considering regular and irregular structures to achieve the best possible results. We are going to compare the structure based on maximum storey Displacement, Axial Forces, overturning moments and shear criteria.***
Keywords: STAAD Pro software, Plate Elements, Axial Force, Shear Force, bending moment,

I. INTRODUCTION

There is lots of software, which is used nowadays for modelling and designing purposes, and STAAD.pro is one of them. However, because of its various analytical mechanisms and methods of conducting structural analysis, this programme will produce various designs and practical results for the common structural arrangements. It makes it compulsory to compare both unique software to determine their true advantages and drawbacks. It is much more necessary to compare the design outcomes of various structural design programmes when analysing and designing structures with geometric differences to develop safe and economical structures.

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II. LITERATURE REVIEW

Swagato Biswas Ankon. et, al. (2020): - For civil engineers, making a high-rise building earthquake-resistant is one of the biggest construction challenges. The form and structural system of the building have a major impact on this resistance. A study of comparative analysis has been done in this article regarding the behaviour and outcome of buildings to earthquakes that have various orientation plans. Each of the five building models taken into consideration in this study has fifteen stories, the same area, and the same weight. Two of the five building models have regular plans (squares and rectangles), while the other three have irregular plans (re-entrant corners). The ETABS 2015 programme is used to model each one for the capital of Bangladesh having zone-II. Every model takes into account static, wind, and seismic loads, and the dynamic feedback under the National Building Code of Bangladesh (NBCB) 2006 feedback spectrum has been thoroughly Investigated. A contrast of the models' active response spectrum has been established and investigated for story deflection, foundation shear, story displacement, and frequency. The findings indicate that structures exhibiting irregularities are subjected to harm at the time earth shakes or other calamities because they have higher values for time period, drift, and displacement.

Yogita K. Kamble, et. al. (2019): - People are killed by defective structures, not by earthquakes. The main cause for concern in any high-rise building is the structure's stiffness and stability. Shear walls are structural components that withstand lateral forces that are primarily applied to moment-resisting frames.

Akash Raut. et. al. (2018): - In the current scenario, many buildings have asymmetrical elevation and plan layouts. This could cause destructive earthquakes in the future. Thus, a structural analysis is required. According to clause 7.1 of the IS 1893 (part 1) 2002 code, the three types of irregularities that are the subject of this paper are vertical, mass, and plan irregularities. The examination of RCC buildings with upward irregularity is covered in this article. The overall goal of the study is to compare three parameters like Bending moment, bending shear and deflection in respect to assess the impact of upward irregularity on RCC buildings.

V. Ramanjaneyulu, et. al. (2018): - The article explains various analysis and design software used by professionals. So, this work mainly incorporates the differential analysis of the results obtained from the design of a regular as well as irregular plan as per IS 1893 multi-storey building structure when designed using STAAD.Pro and ETABS software one by one.

The main objective of this research is a comparative study of the design and analysis of multistoried buildings up to eighth floor by structural analysis software (STAAD) and ETABS software. STAAD is one of the most used software for the design of structures. In this research, they analyze the ground to eight-floor building to determine the shear strength, bending parameters & reinforcement details for the structural components of the building. ETABS is design software preferred by different designers in recent times.

Dhananjay Shrivastava, et. al. (2017): - The article focuses on the structural behaviour of multi-story buildings with various plan configurations, including normal buildings and L- and I-shaped buildings, in compliance with the seismic regulations recommended by IS: 1893-2002 to analyze the performance of existing buildings if exposed to seismic loads. In this modelling of ground plus 25 storeys reinforced framed building is being observed closely for earthquake load using Structural analysis and design software. On the material, linear static and dynamic analysis is being done. These assessments are carried out by considering several seismic zones, such as Zones IV and V. The behaviour of each zone is closely examined by utilizing three distinct soil types: Hard, Medium, and Soft. Post analysis of the structure, lateral shift, story and base shear and ultimate bending moment and design results are also evaluated for all possible cases.

Mohammad Noor Jan Ahmadi, et. al. (2017): - A structure is "regular" to ground shaking when its mass, strength, and stiffness are distributed so that it will sway consistently under specific conditions. This means that there will be about equal lateral movement in each story and on each side of the building. Regular building layouts offer a continuous load path for both gravity and lateral loads since they are substantially identical (in front and top view) and have a regular distribution of the lateral force-resisting structure along the axis. An irregular building lacks symmetry and features discontinuities in weight, shape, and size. Stress concentrations and disruptions in force flow may result from these irregularities. A significant torsional force can lead from asymmetrical arrangements of an element's mass and stiffness because the center of mass and rigidity do not line up. The G+7-storey reinforced concrete building's L-shape plan has been chosen for this study. The models undergo two phases of analysis: in phase-I, they evaluate the building in absence shear walls and soft-storey on the ground floor and phase-II evaluate the same building considering shear walls & soft-storey on the lower storey. To determine the ideal location for shear walls in the building, shear walls are also added to the model in two various cases during Phase II. The International Building Code 2012 (IBC-2012(9) code is used to analyse the models adopting the linear static method in STAAD software. Since Afghanistan uses the IBC-2012 Draft Code (Afghanistan Building Code-2012) for structures, the IBC-2012 code has been set aside for examination. This article compares the response of irregular buildings with shear walls to irregular buildings without shear walls to examine the impact of shear walls on soft-storey construction. Based on the building's response, the results are summed up.

V. Rajendra Kumar, et. al. (2017): -The comparison between the response spectrum technique and the equivalent static technique is the focus of this paper. The effects of the earthquake caused property damage and numerous fatalities. Therefore, before construction, one must confirm and conduct the performance of structures under earthquake load. This method uses the corresponding static and response spectrum methods to evaluate the model for the current investigation and track the structure's lateral movement in both regular and irregular structures across various zones.

Gauri G. Kakpure, et. al. (2017): - In India's cities, (RCC) building skeleton (frames) is the most common kind of construction. Throughout their lives, these are subjected to a variety of forces, including dynamic forces from earthquakes and static forces from dead and live loads. The current study uses ETAB 15 software to analyze two high rise buildings (a ground plus ten and a ground plus five structures) that are thought to be in earthquake zone III using two different methods: the equivalent static analysis method and the response spectrum method. The parameters for a comparative study, such as storey displacement, storey drift, axial load, and bending moments, are determined from the analysis results. Observations were made and concluded that the Response spectrum approach is better than the equivalent static method of analysis.

M.Z. Habib, et. al. (2016): - Currently, architects are primarily designing buildings with irregular shapes, which yield greater aesthetic appeal. This irregularity could be vertical or planar. Structures that exhibit planar or vertical irregularities are susceptible to seismic loading. An abrupt rise in torsional irregularity or overturning moment can cause structural irregularity. For this reason, while constructing a structure, the influence of irregularity is an important consideration. According to the Bangladesh National Building Code (BNBC) of 2006, practically all multi-story structures must be analyzed as three-dimensional systems. This is due to irregularities in the plan, the elevation, or both. Six buildings of various shapes have been selected for the current study and analysis by selecting earthquake loads using FEM software (ETABS v 9.7.4). The structures are shaped like this: square, rectangle, L inverted, T, U, and L. Each building in seismic zone I of the BNBC 2006 has a G+6 number of storey's. The current study covers the performance assessment of reinforced concrete (RC) structures with irregular layouts. One of the main things that reduce a structure's seismic performance is structural irregularities.

The parameters like lateral displacement, storey drift, time period, base shear, torsional irregularity ratio, and overturning moment whose impacts are managed. In due course, it is evident that the rectangular building has undergone maximum lateral displacement and drift in both directions. The time frame hasn't changed as a result of modifications to the building plan. For T-shaped structures, the maximum values of overturning moment and base shear are found. Studies have indicated that uneven torsion is exhibited by rectangular-shaped structures.

K. Venu Manikanta, et. al. (2016): - The primary methods for identifying serious risks to a structure's integrity and stability are structural analysis and design. When multistory buildings are designed, they are made to meet fundamental requirements and be functional. The robustness of the structure necessitates attention because it depends on the loads imposed. The difficulties structural engineers faced were all used as a springboard to create user-friendly software like SAP, ETABS & SAFE, STAAD PRO, and others. The most popular commercial structural analysis software packages worldwide are ETABS and STAAD-pro. The design outcomes for both regular and irregular plan configurations of a rectangular RCC building are obtained and compared using the two mentioned software. ETABS and STAAD, two simulation tools that are widely used for the analysis and design of multi-floor buildings with rectangular plans that are vertically regular and irregular in geometry, are the focus of this study. This study aims to resemble the benefits of ETABS compared to STAAD versions as they are currently used. In comparison to STAAD, it was found that ETABS is more accurate, user-adaptable, and in more harmony with the results of the analysis. Many more benefits will be covered in this study. This study will also discuss the benefits and drawbacks of using these programmes.

Anvesh N, et. al. (2015): - While irregularities in building construction are unavoidable, it is still necessary to research how these irregularities will behave in an earthquake. Enough safety measures can be implemented. For behavior and design, it is essential to understand the behavior of the buildings with irregularities. The primary purpose of civil engineering structures is to withstand static loads. Usually, the effect of dynamic loads operating on the structure is disregarded. There are times when catastrophes result from this propensity to disregard dynamic factors. Over the past 20 years, wind engineering has concentrated more on modest low rise and high-rise structures because these types of normally engineered buildings suffer most of the damage and financial loss associated with extreme wind incidents. The wind engineering community must step up its role in this area to successfully transfer our technical knowledge to the designer and the builder. The current study analyses the ground plus 10 storey's RCC building with major irregularity in 3^{rd} and 6^{th} floors, as well as the building without mass irregularities. The effects of different loads (mass irregularity) on the floors of multistory structures are the main topic of this study.

Himanshu Bansal, et. al. (2014):- The purpose of the article is to carry out the ductility-based design and Response spectrum analysis (RSA) and Time history analysis (THA) of vertically uneven RC building frames using IS 13920, which stands for Equivalent static analysis and Time history analysis. The stiffness irregular structure has larger inter-storey drifts and less base shear. The actual displacements from the regular structure were found to be smaller than the smaller displacements from the geometric irregular structure's time history analysis at the same nodes for the higher storey's.

Mahesh S, et. al. (2014): - The action of a multistory skyscraper that has a regular or irregular configuration, such as the G+11, is complicated during an earthquake. It is assumed that wind loads and earthquake loads act simultaneously. In this paper, ETABS and STAAS PRO V8i are used to study the seismic and wind loads of a residential G+11 multistorey building. Analyses are conducted, supposing linearity for the material properties in both static and dynamic terms. These assessments include several earthquake zones, and three different types of soils namely hard, medium and soft to assess the behaviour of each zone. For different zones and soil types, plots of various reactions are created, such as narrative drift and base shear displacements.

III.EXPECTED RESULTS

To get comments either positive or negative on the results of the comparison between the different models by using plate elements considering regular and irregular structures to achieve the best possible results. while accounting for various factors to become skilled at modelling buildings with plan abnormalities and to decide whether and when to represent the structure's slab element

IV.CONCLUSION

Some of the studies have found that the value of bending moment is becoming more in case of irregular plan constructions. The storey displacement is rising with the storey height. The uppermost level contains the maximum displacement values in both X and Y direction. In dynamic analysis, the observed storey displacement for multi-storey building is between 22 % and 26 % which is lower than the static analysis value. A rectangular building's displacement for an axial load in its smaller direction is more than that of its larger dimensions. The structures' shapes cause the shear force that is determined at the base to alter.

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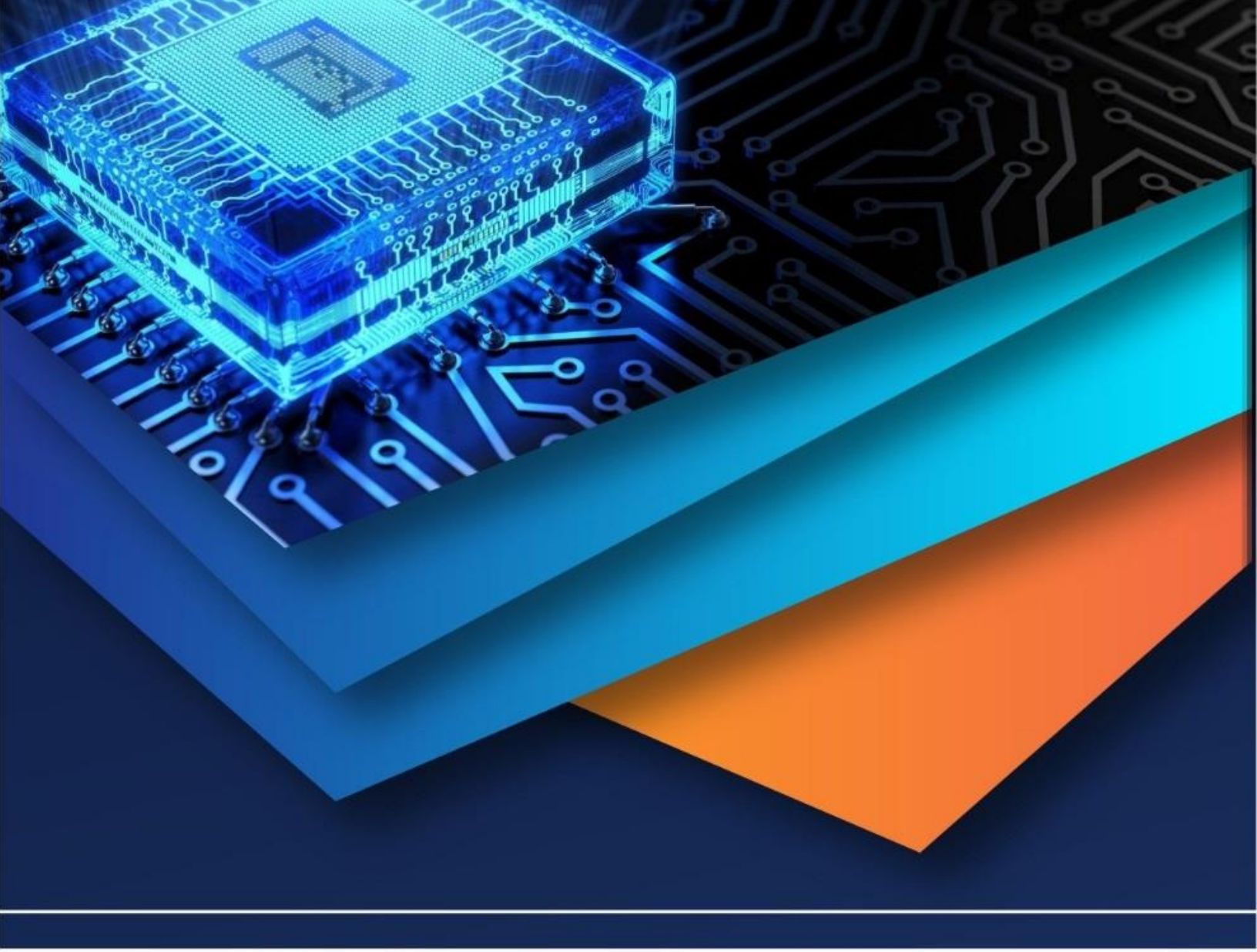

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