iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** VII **Month of publication:** July 2023

DOI: https://doi.org/10.22214/ijraset.2023.54933

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VII Jul 2023- Available at www.ijraset.com

Comparative Study on Seismic Analysis of Multistorey Building Using STAD Pro

Shruti Diliprao Raut[1], Prof. Vishal Sapate[2]
[1]*PG Scholar,* [2]*Assistant Professor, Department of Civil Engineering, G H Raisoni University, Amravati*

Abstract: ***In this study, a comparative analysis of the seismic performance of a number of different building models was made using the STAAD.Pro software. The main purpose is to measure and compare the behavior of different buildings under seismic loads. The decision model includes changes in external properties such as shear walls at different locations, and analyzes are made for the link between horizontal and vertical forces, reactions and moments. The results provide useful information regarding the behavior of each structure under seismic forces. The maximum combined horizontal displacement (X) for the Model-2 is 165 mm, indicating significant movement in the X direction. The Model-5's maximum combined horizontal displacement (Z) is 171mm, meaning there is more horizontal movement in the Z direction. For Combined Vertical Displacement (Y), the Model-2 experienced the highest vertical displacement at 21.7mm. The results of this comparison provide important guidance for improving building configurations to improve their seismic performance. The results can assist in decision making during design and construction, making construction safer and stronger than many buildings in earthquake zones.***
Keywords: STAAD, multistory, seismic, displacement and shear wall

I. INTRODUCTION

As part of this analysis, the maximum lateral slip for each wing should be calculated for concave angles. The sum of these values is equal to the space required between the blades for the blades to deflect in the worst possible way without impact. In this case, expansion joints are used to connect the blades. When each wing is treated as a separate model, the angle is often neglected [6]. When considering the vertical and lateral loads of the individual blades, the result of the angle of the force is not considered, making it difficult to change the difference between the angles without special connections and joints in the design [7].

Another design method currently used to appeal to soldiers at concave corners is to use the eight shape instead of the traditional 90° concave corner. When changing the angle of the angle, the resulting force decreases. "Securely interconnect the building between the tension lines and the resistor location to reduce torsion" [8]. Although this method addresses the re-entry issue more directly than the other methods above, it is not an adequate method to consider all the consequences. This is because the current design cannot fully determine the effect of the re-entry angle created on the load side.

These designs and simple designs are allowed by current building codes as they help improve sound or designs [9]. According to ASCE 7-10 , "Rotating irregularity is defined as the two planar planes of a structure being more than 15% of the overall structure of the structure in one direction. The diaphragm causes the diaphragm beams or buttresses to fail when the main line of the wall is moved by a portion of the outer wall [10]. When an irregularity such as an angle occurs, the law states that the force must be sent in the opposite direction through rotation.

The challenge with concave angles is to determine the exact amount of power transferred. There are many reasons why it is difficult to determine the magnitude of the strength of the angle. The first is the hardness difference due to the width of the sample. The second important problem is that the torsional forces applied to the structure cause significant distortions at different locations throughout the structure [11]. These two problems occur simultaneously and increase complexity.

The difference in hardness is due to the width of the specimen. While one part of the structure is bent around its strong axis, the other part is bent around its weak axis. This concept is illustrated in Figure 1.

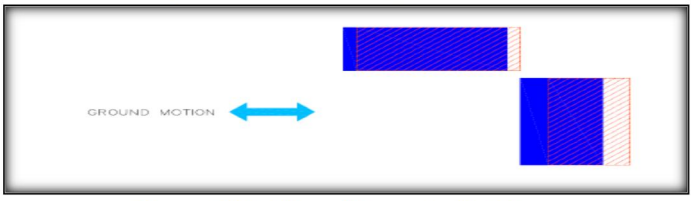


Figure 1:Rigidity of Separate Buildings

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In this interpretation, ground motion occurs in the east-west direction. The structure on the left side of the diagram is east-west oriented (strong axis) and will therefore respond more tightly than other structures oriented north-south (weak axis). The way the pattern deviates also affects the difference in motion between the patterns. The stiffness of the gap between the difference in motion and the structure causes stress in the area of "notches" at the concave corners [13].

II. LITERATURE REVIEW

Research and comparative seismic requirements for vertically irregular and "orderly" frames determined by strict nonlinear behavioral history analysis (RHA) due to a group of Lohith gambling B C 20 ground motions. 48 inconsistencies, all with 12 floors, strong lines and weak beams, were designed with a combination of three types of inconsistency, strength and stiffness, and eight different locations along the elevation were demonstrated using two modifications.

Madan Singh et al. Observation results of vertical irregularities in storey drift and average storey displacement are recorded. Next, the mean and distribution of storey slip demand rates determined by modal thrust analysis (MPA) and nonlinear RHA are calculated to measure the deviation and distribution of the (MPA) estimates, resulting in: Although irregularities in stiffness, strength or stiffness and strength, the deviation in the MPA process does not increase, e.e. middle or top,

Mehmed Causevic et al. The study found that the MPA program was less accurate than the model used in the seismic prediction required for strong or rigid and strong front frames; soft, weak or soft under the body; Hard and strong or hard and weak. The study found that high-rise concrete walls are often supported near or below the ground by ground diaphragms attached to the perimeter foundation walls. When most of the overturning moment in the wall is transferred to the foundation wall by several or more rigid floor diaphragms, the maximum bending moment of the plastic hinge is above the diaphragm and the shear force returns to the base of the hinge. According to the rigidity of the base of the diaphragm and the shear and bending stiffness of the chest wall, the back shear under the hinge will be greater than the base shear above the hinge.

Rajiv Banerjee et al. It has been determined that the nonlinear shear model can be used to determine whether the yielding of the wall diagonal and horizontal wall reinforcement will reduce the reverse shear forces without causing shear failure. A different design solution is required as increasing the amount of horizontal reinforcement in a wall above a certain limit will not prevent shear failure. In order not to underestimate the shear stress required in high walls, upper bound estimates of soil diaphragm stiffness should be used. This study provides the latest information on the seismic behavior of vertically irregular building frames. Methods for identifying vertical irregularities under current building codes are discussed. Investigations and findings on the seismic behavior of irregular vertical structures are reviewed. It has been shown that the building code provides a method for the distribution of vertical irregularities and proposes dynamic analysis to obtain the exterior design. Most studies agree on the need for more towers for lower models and the increased seismic needs of buildings with uneven mass, stiffness and strength distribution.

Ravi Kanth et al. were analyzed and it was found that the greatest seismic demand was coupled with irregularities in stress and strength. It can be concluded that general research and building codes address the effects of vertical irregularities. The building code provides a method for the distribution of irregular vertical structures and proposes time history analysis or elastic field spectrum analysis to obtain the lateral force design. The authors are conducting a detailed study of the importance of diaphragm stiffness for the seismic response of structures. Although rigid ground diaphragms are a good assumption for seismic analysis of most buildings, some building configurations may require flexible soil diaphragms.

III. SYSTEM DEVELOPMENT

A. General

This chapter is including the method of the analysis of the building with re-entrant corners and the provision of the bracings and shear wall at different locations have been identified. The different models are modeled using STAAD-PRO as follows.

1) Model-I: Multistoried Building without Shear Wall & Bracings
2) Model-II: Multistoried Building with Bracings location-1
3) Model-III: Multistoried Building with Shear wall location-1
4) Model-IV: Multistoried Building with Shear wall - bracing location-1
5) Model-V: Multistoried Building with Bracings location-2
6) Model-VI: Multistoried Building with Shear wall location-2
7) Model-VII: Multistoried Building with Shear wall-bracing location-2
8) Model-VIII: Multistoried Building with Bracings location-3
9) Model-IX: Multistoried Building with Shear wall location-3

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10) Model-X: Multistoried Building with Shear wall-bracings location-3

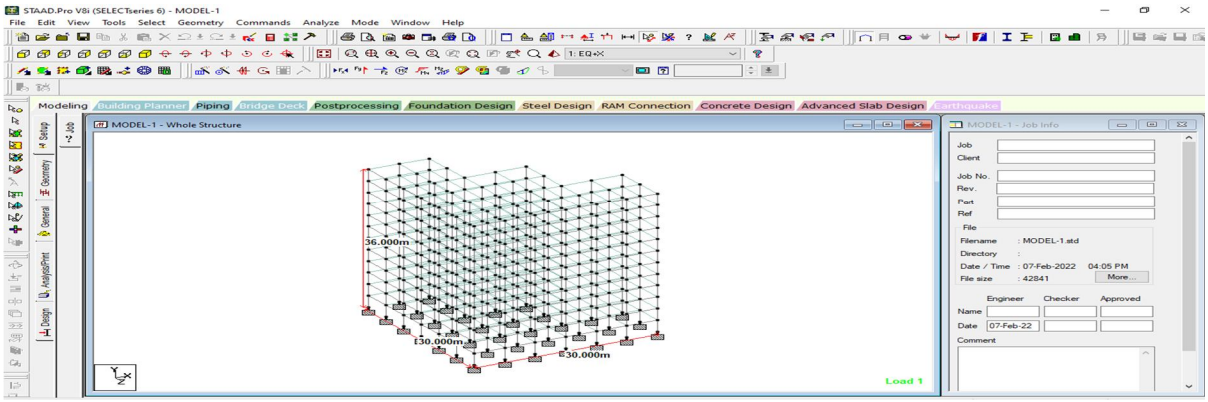


Figure 1: Elevation of model-I

The above figures is related to elevation of the model-I, the geometry once created using STAAD-PRO software, the elevation can be easily known.

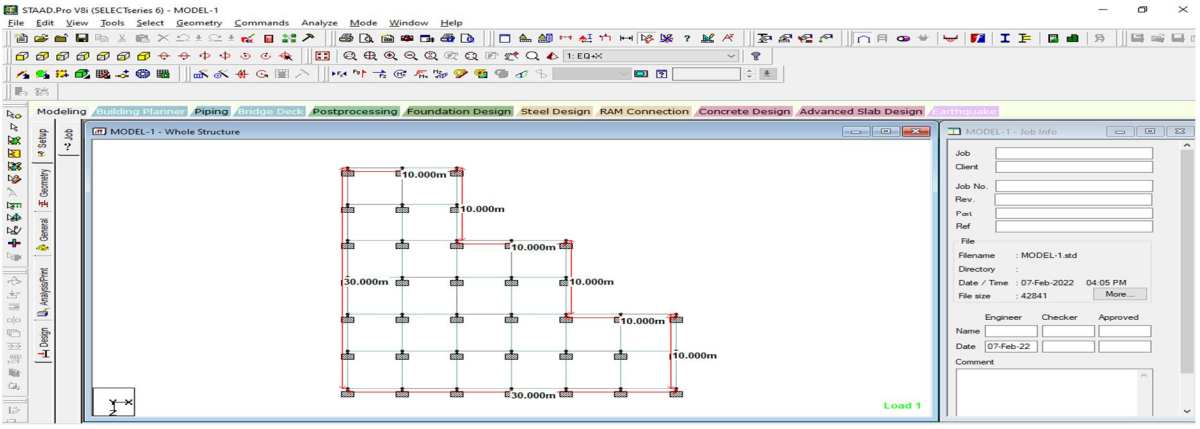


Figure 2: Plan of model-I

The above figures is related to plan of the model-I, the geometry once created using STAAD-PRO software, the plan can be easily known.

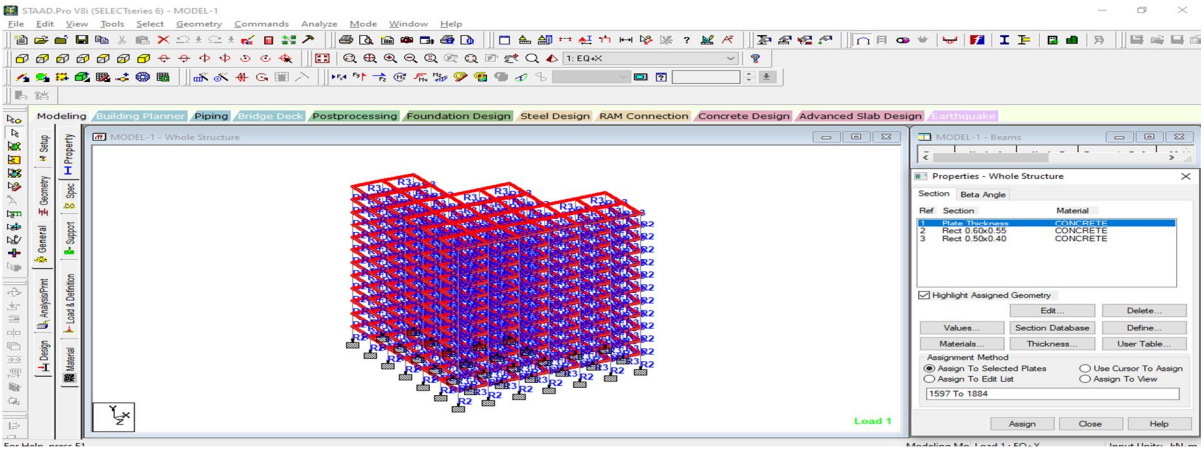


Figure 3: Properties assigned to model-I

The above figure is related to Properties assigned to model-I, after the geometry is created then the properties can be assigned to the model.

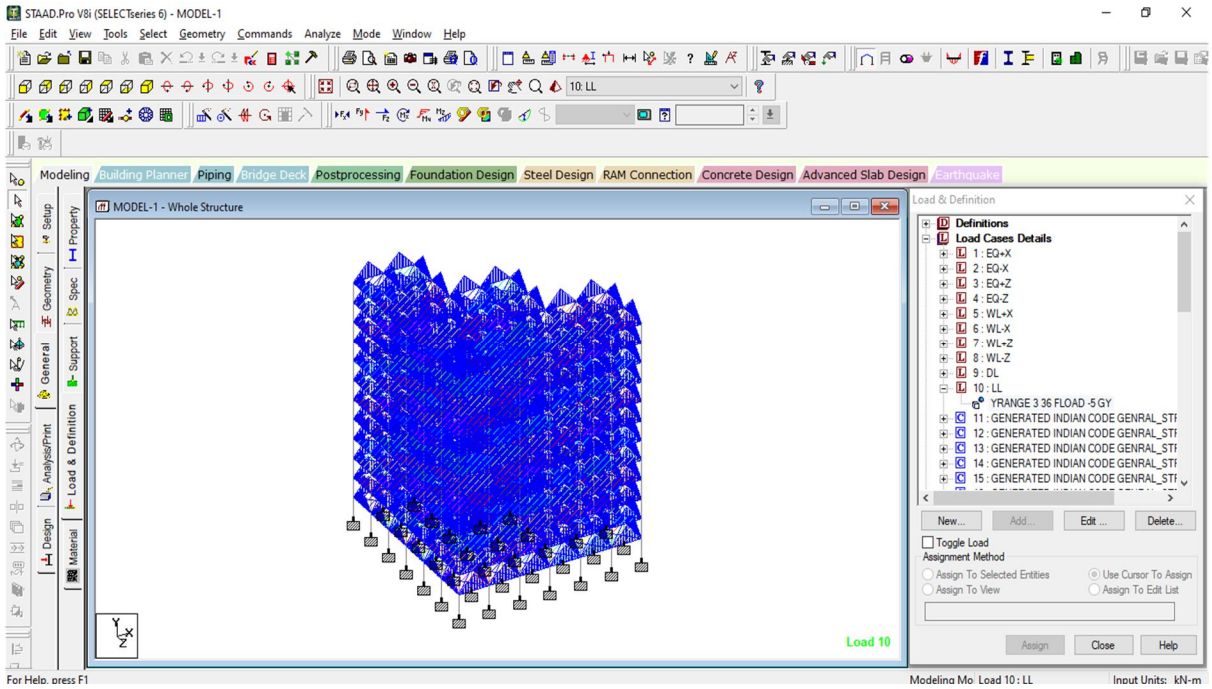


Figure 4: Loads assigned to model-I

The above figure is related to Loads assigned to model-I, after the geometry is created then the loads can be assigned to the model.

IV. PERFORMANCE ANALYSIS

The results obtained in terms of the displacement, reactions, beam forces and plate stresses for all the models.

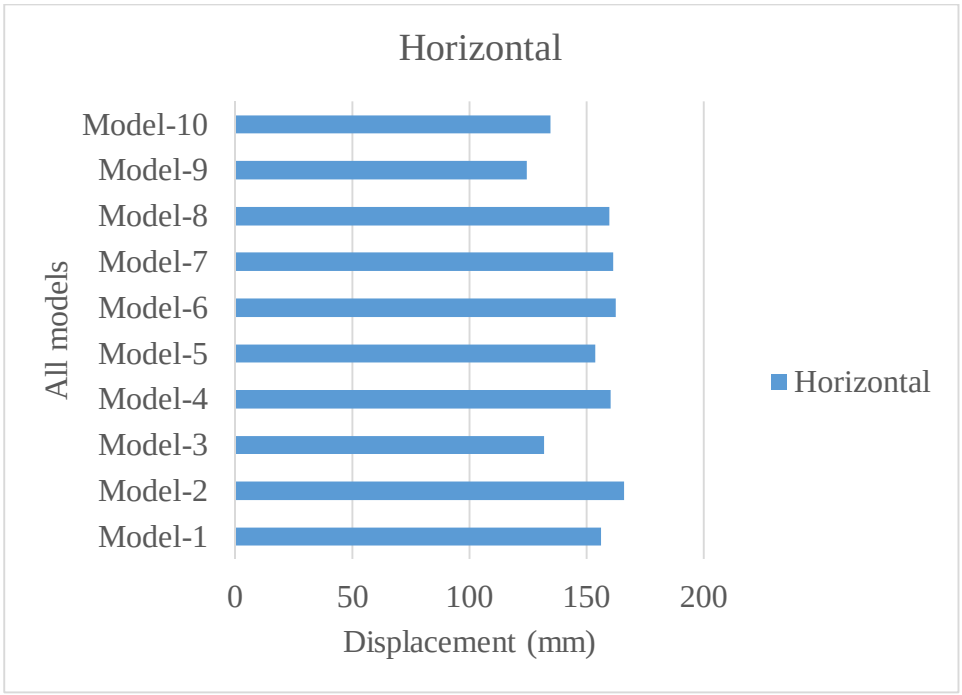


Figure 5: Combined Horizontal (X) Displacement for all the models

The above graph is related to Combined Horizontal (X) Displacement for all the models, the horizontal displacement is maximum for the model-2 with the value of 165 mm.

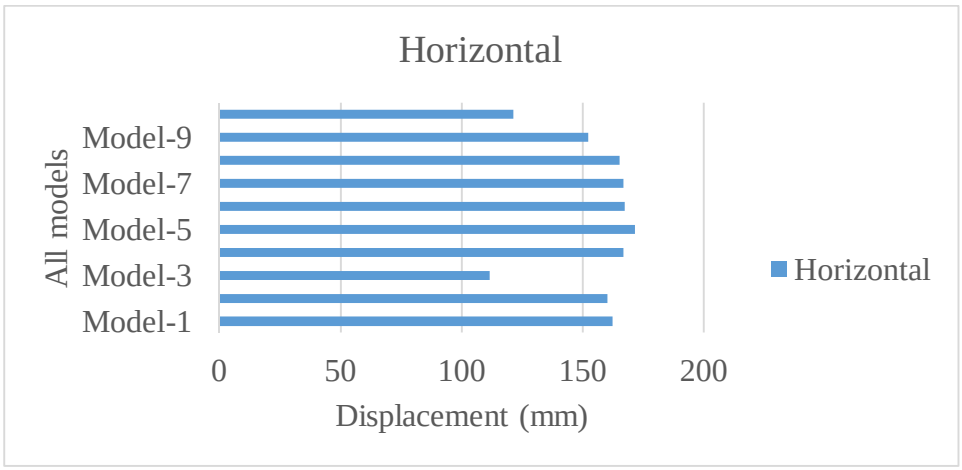


Figure 6: Combined Horizontal (Z) Displacement for all the models

The above graph is related to Combined Horizontal (Z) Displacement for all the models, the horizontal displacement is maximum for the model-5 with the value of 171 mm.

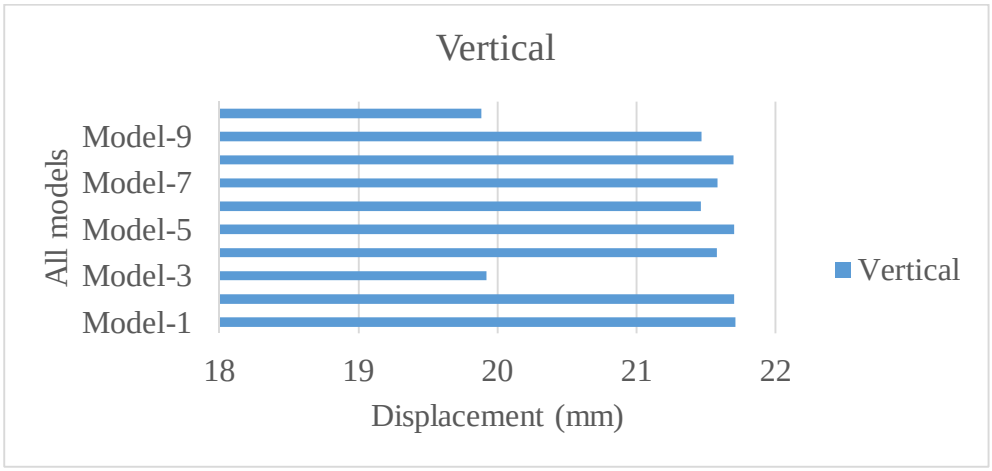


Figure 7: Combined Vertical (Y) Displacement for all the models

The above graph is related to Combined Vertical (Y) Displacement for all the models, the Vertical (Y) displacement is maximum for the model-2 with the value of 21.7 mm.

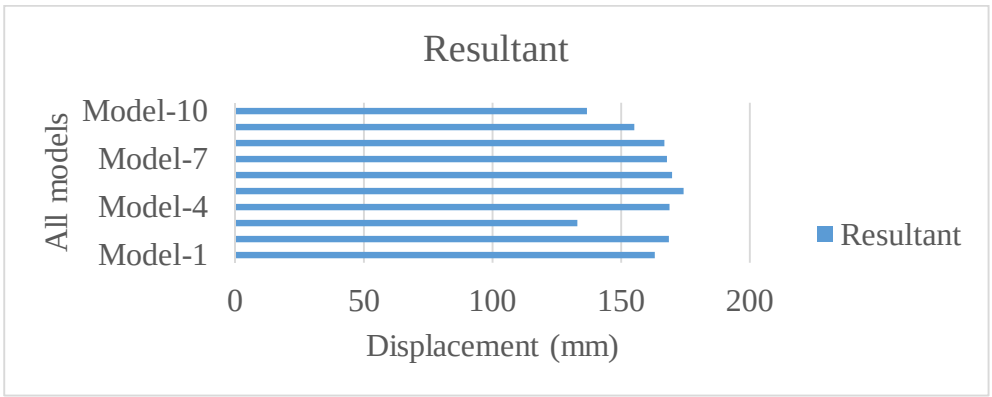


Figure 8: Resultant Displacement for all the models

The above graph is related to Resultant Displacement for all the models, the Resultant Displacement is maximum for the model-5 with the value of 174 mm.

Table 1: Combined Reactions for all the models

	Horizontal	Vertical	Horizontal	Moment		
Models	Fx kN	Fy kN	Fz kN	Mx kNm	My kNm	Mz kNm
Model-1	358.968	8097.33	358.846	721.276	2.14425	753.128
Model-2	597.165	8095.25	359.678	722.435	7.62188	767.529
Model-3	3428.06	18196.5	3335.04	475.954	9.7785	721.636
Model-4	631.152	10565	1817.7	706.212	11.6336	726.264
Model-5	359.9	8094.95	618.426	725.216	7.88175	754.423
Model-6	1818.74	12390.9	1851.41	689.52	10.7708	739.923
Model-7	1794.82	10748.5	650.289	687.947	10.8878	758.923
Model-8	609.602	8093.56	631.054	705.124	6.95363	746.459
Model-9	1979.83	12747.1	1966.42	604.55	8.7885	473.384
Model-10	3197.1	17395.9	3067.12	448.416	10.7708	647.071

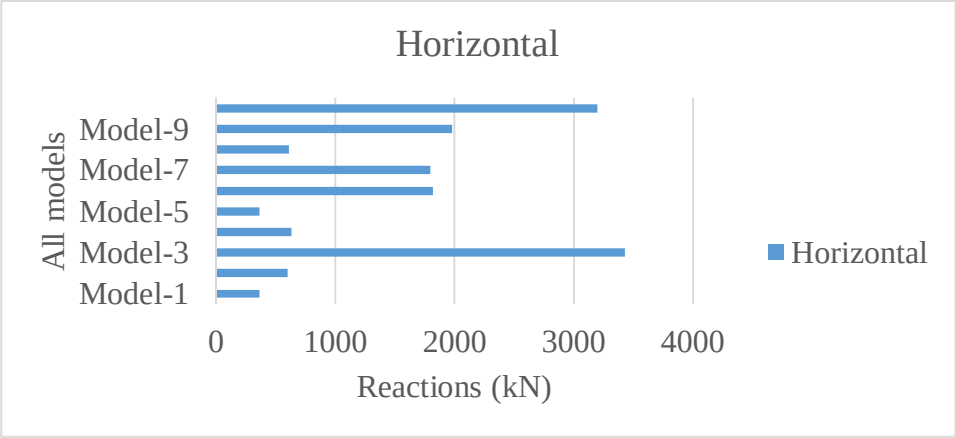


Figure 9: Combined Reactions (Horizontal-Fx) for all the models

The above graph is related to Combined Reactions (Horizontal-Fx) for all the models, the Combined Reactions (Horizontal-Fx) is maximum for the model-3 with the value of 3400 kN.

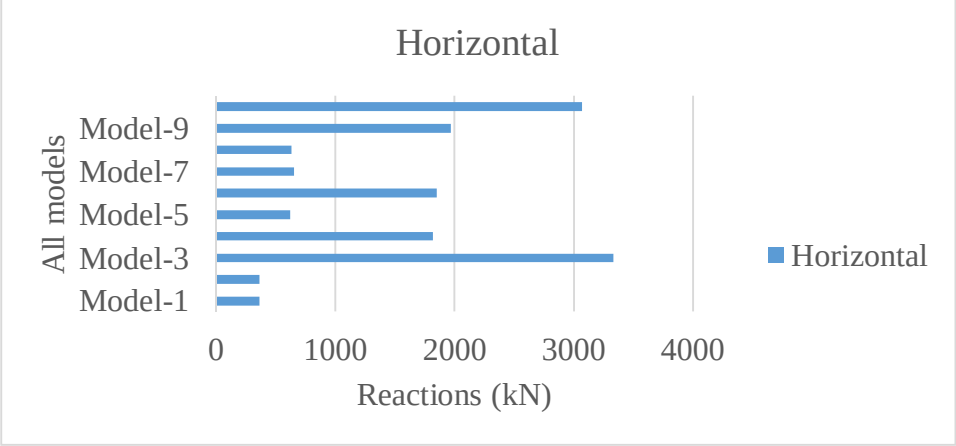


Figure 10: Combined Reactions (Horizontal-Fz) for all the models

The above graph is related to Combined Reactions (Horizontal-Fz) for all the models, the Combined Reactions (Horizontal-Fz) is maximum for the model-3 with the value of 3335 kN.

V. CONCLUSIONS

The following conclusions are drawn based on the present study.

1) In terms of combined horizontal displacement (X), Model-2 exhibits the maximum displacement with a value of 165 mm. This indicates that Model-2 experiences the highest lateral movement among all the models considered.

2) Similarly, for combined horizontal displacement (Z), Model-5 demonstrates the highest displacement of 171 mm. This suggests that Model-5 experiences significant horizontal movement in the Z-direction.

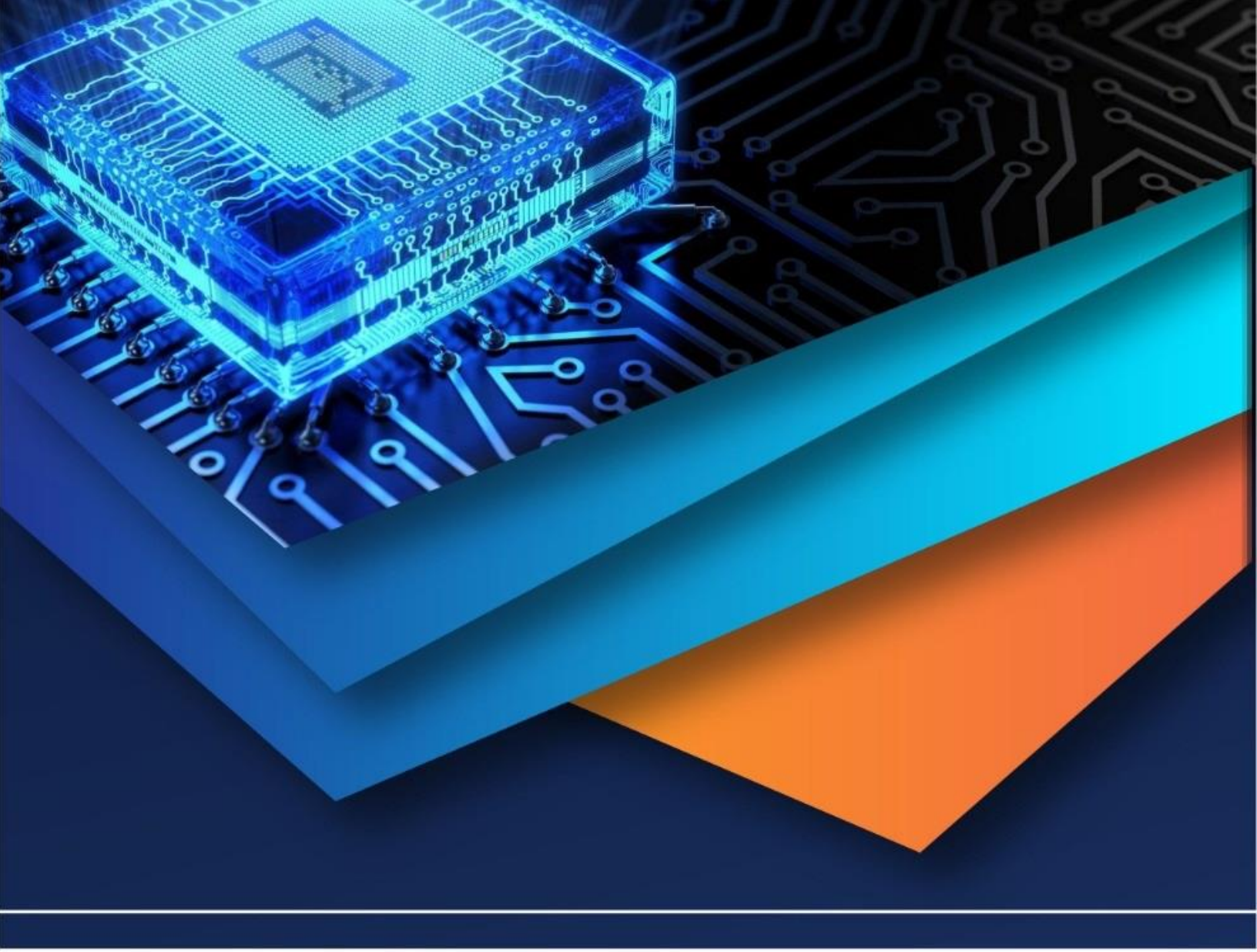
3) Moving on to combined vertical displacement (Y), Model-2 exhibits the highest displacement with a value of 21.7 mm. This indicates that Model-2 experiences the most significant vertical movement compared to the other models.

4) When considering the resultant displacement, which accounts for the combined effects in all directions, Model-5 exhibits the highest displacement of 174 mm. This implies that Model-5 experiences the most overall displacement among the analyzed models.

5) Shifting focus to the combined reactions, Model-3 displays the maximum combined horizontal reaction (Fx) with a value of 3400 kN. This suggests that Model-3 experiences the highest resistance to horizontal forces.

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