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Effect of Core and Outrigger Structural System for Different Soil Type

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***Abstract*: Tall building is more affected by lateral loads so design and analysis of high rise building is difficult so to minimize this effects of load now a day new different systems like outrigger system, belt truss system. In this present study outrigger system is used with rigid core of G+30 floor building is considered in which outrigger is provided at 30th and 15th floor of the building. And analyze by considering Wind load and seismic loads are considered with three type of soil such as soil type I, soil type II and soil type III and analysis and 3D modeling is done in Etabs2015 software. For comparison is done for building considering with outrigger and by considering without outrigger for all three soil conditions by considering parameters like story drift. This study concludes that the story drift for soil type II and soil type III is decreases by approximately 23% in building provided with outrigger and outrigger provided at top story will be more efficient.**

***Keywords*: Outrigger system, response spectrum analysis, story drift, soil type.**

1. Introduction

The design of tall building is predicated on analysis of models with experience and fundamental mechanics. As the height of the building increases with increase in the danger of horizontal and vertical load forces. The moment resisting frames and braced core at certain height becomes not efficient to supply stiffness against wind and seismic loads. In the outrigger system the cores are normally located at the centre of the building and the outriggers extend bent the outer columns because of that the outriggers and the outer columns work together as an additional restrain to the core wall. In this present study concrete outrigger system is used.

2. Literature Survey

Literature survey gives the information about structural systems used in building and some literature paper gives below. Akshay Khanorkar, et.al [1]. In this paper belt truss system and outrigger system considered. And their result gives the optimum location of outrigger is mid height of building and outrigger and belt truss system decreases the lateral displacement. Xinzheng Lu,et.al [2] In this paper building consist of sacrificial energy dissipation outrigger system to check the effect of seismic resilience of the tall building by nonlinear time history analysis method.Their conclusion is the energy dissipating part provide more stable energy dissipation. Reza Kamgar et.al [3] in this paper in this paper the cantilever beam with box cross section is modelled with frame tube system and the effect of outrigger system on frame tube system is determined under lateral loading. Their conclusion is outrigger system increases the stiffness in outer column under lateral loading. Akbar Vasseghi.et.al [4] in this study G+40 story building is analyze using steel plate shear wall system with outrigger and without outrigger. The outrigger panel is placed at 20th, 30th and 40th story and their seismic behavior is studied by nonlinear time history analysis. The conclusion is when steel plate outrigger panal is augmented with building gives less lateral drift in vertical boundary elements. Mohsenali Shayanfar et.al [5]in this paper the earthquake the steel plate shear wall provide good performance for lateral loading so the steel plate shear wall is combined with outrigger system. And effect of this combined system is determined. Their conclusion is this combined system decreases lateral drift in tall building. Goman W. M. Ho [6] this paper shows outrigger system in tall building in development history and application of outrigger system in tall building review on this. In this paper some parameters are consider like optimum position, design and construction consideration. The conclusion of this paper is the axial shortening effect had to be minimized by means of releasing the outriggers from the shortening effect during construction and life cycle of the building.

3. Methodology

The methodology of this study is on comparison of behavior of structural systems on tall building for different soil condition with Concrete core and outrigger system and normal core frame system is considering in this project. Their three type of soil conditions is considering for this project they are hard strata, medium soil, soft soil and model of building for three type of soil condition with outrigger system and without outrigger system is made in ETABs software of 2015 version and their

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comparison is determined. The model is a regular-shaped symmetrical plan with dimensions 38.5mx38.5m. In all structural modelling, slab spans are assumed to be 5.5m, arranged in seven bays in each direction, as shown in Fig. 1. The plan has a 5.5x5.5m central core opening of 600mm thick wall. And live load is consider as 3.5KN/m2. And outrigger and normal beam size is 230x600mm and column size is600x600mm of M40 grade.

4. Result and Discussion

According to Clause 7.11.1 of IS 1893-Part I: 2002 and Clause IS 456:2000, the maximum allowable drift is 0.04h where h is the storey height and partial safety factor of 1.0 and results are shown by graphs.

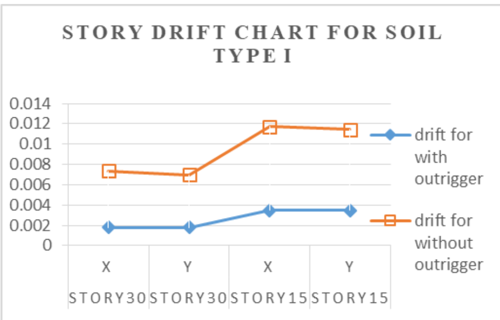

Fig. 1. Story drift for 30th and 15th floor with and without outrigger in X and Y-direction for soil.

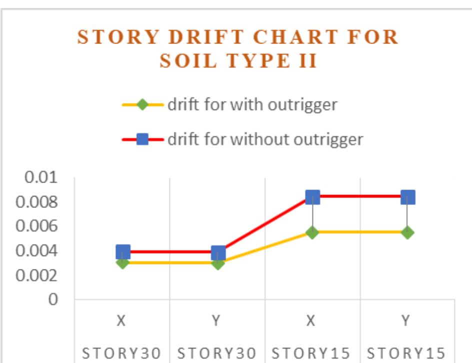

Fig. 2. Story drift for 30th and 15th floor with and without outrigger in X and Y direction for soil type II

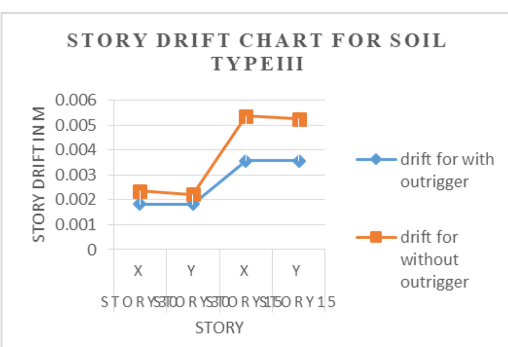

Fig. 3. Story drift for 30th and 15th floor with and without outrigger in X and Y direction for soil type III

Table 1
Story drift result for soil type I building

Story	**Drift for with outrigger**	**Drift for without outrigger**
Story30	0.001771	0.00737
Story30	0.001767	0.006989
Story15	0.003459	0.011744
Story15	0.003455	0.011423

Table 2
Story drift results for story provided with outrigger for soil type II

Story	**Drift for with outrigger**	**Drift for without outrigger**
Story30	0.003019	0.003911
Story30	0.003013	0.003901
Story15	0.005509	0.008413
Story15	0.005503	0.008404

Table 3
Story drift result for soil type III building

Story	Drift for with outrigger	Drift for without outrigger
Story30	0.001836	0.002353
Story30	0.001832	0.002214
Story15	0.003568	0.005365
Story15	0.003564	0.005241

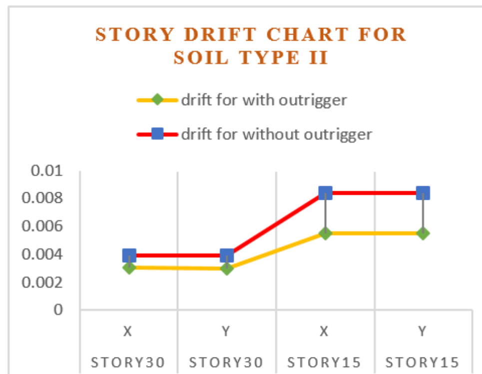

Fig. 4. Story drift chart for soil type II

The above result concludes that the stiffness of high rise building varies with the height of the building. i.e stiffness decrease with height of the building increases. And my comparative study shows that story drift is minimum in building considering outrigger system.

5. Conclusion

The present study compares the building with outrigger with different soil type and the following soil type is drawn on the base of present study is story drift in soil type II and III is 23% decreases in outrigger system. Ads the story drift decreases so the stiffness is increases in building. So the outrigger system is more efficient than the frame system with core only.

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