© 2016 IJSRSET | Volume 2 | Issue 3 | Print ISSN : 2395-1990 | Online ISSN : 2394-4099
Themed Section: Engineering and Technology

Strengthening of High Rise Building with Outrigger System

Abhishek Arora, Ravi Kumar

Department of Civil Engineering, Swami Devi Dayal Institute of Engineering and Technology, Barwala, Haryana, India

ABSTRACT

Outrigger is rigid horizontal structure designed to improve building overturning stiffness and strength by connecting the building core or spine to distant columns. Outrigger systems function by tying together two structurally systems typically a core system and a perimeter system to yield whole building structural behavior that are much better than those of the component system. Outrigger system performance is affected by outrigger locations through the height of a building, the number of levels of outrigger provided, their plan locations, and the presence of belt truss to engage adjacent perimeter columns versus standalone mega columns, outrigger truss path a primary structural material used.

Keywords: Outrigger System, Gravity Force Transfer, Foundation Forces

I. INTRODUCTION

A Core and outrigger system is frequently selected for the lateral load resisting system of tall or slender building where the overturning moment is large compared to shear and where overall building flexural deformation is major contributors to lateral deflection such as story drift. In such situation, outrigger reduces building drift and core wind moments. Because of the increased stiffness they provide outrigger system is very efficient and effective solution to reduce building acceleration which improves occupant comfort during high winds.

II. METHODS AND MATERIAL

1. Benefits of an Outrigger System

- Deformation reduction – in a building with a central core braced frame or shear wall an outrigger system engages perimeter columns to efficiently reduce building deformation from overturning moments and the resulting lateral displacement at upper floor.
- Efficiency - for the system with belt trusses that engage all perimeter columns, columns already sized for gravity load may be capable of resisting outrigger forces with minimal change in size and reinforcement.
- Foundation forces – a separate but related advantage is force reduction at core foundation. Outrigger system help to effectively distribute overturning load on foundation.
- Gravity force transfer – outrigger and belt truss can help reduce differential vertical shortening between columns. This reduction is achieved by forces transfer between adjacent columns through belt truss or between the column and core through outrigger.

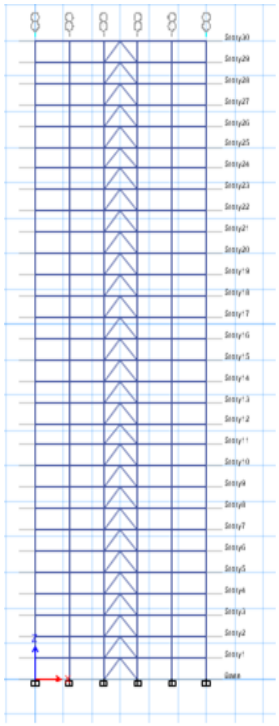
2. Determining Location of Outrigger In Elevation

The degree to which an outrigger system provides improvement of building stiffening and reduction of building drift depends in part on the number and location of outrigger. Modeling for checking the drift at roof level with different outrigger location

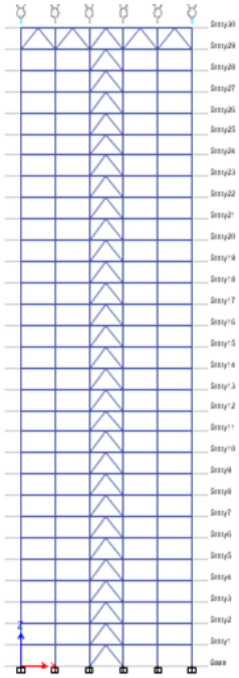
- Model 1- CENTRALLY BRACED CORE
- MODEL 2 – TOP FLOOR WITH FULL OUTRIGGER DEPTH
- MODEL 3- TOP FLOOR WITH 2/3 OUTRIGGER DEPTH
- MODEL 4- TOP FLOOR WITH 1/3 OUTRIGGER DEPTH

NO. OF STOREY – 30 EARTHQUAKE ZONE - V

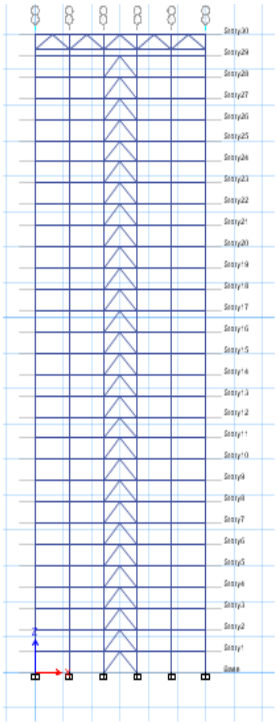
3. ETABS Model



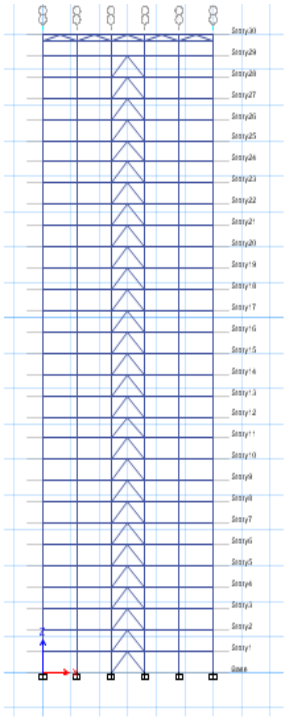
MODEL-1



MODEL -2



MODEL -3



MODEL-4

4. Drift Comparison Between All Models

Story	Load Case/Combo	Item	Drift (MODEL 1)	Drift (MODEL 2)	Drift (MODEL 3)	Drift(MODEL 4)
Story30	WX 1	Max Drift X	0.001153	0.000784	0.000819	0.000879
Story29	WX 1	Max Drift X	0.001235	0.00108	0.00112	0.001179
Story28	WX 1	Max Drift X	0.001308	0.001208	0.001239	0.001287
Story27	WX 1	Max Drift X	0.00139	0.001309	0.001333	0.001373
Story26	WX 1	Max Drift X	0.001476	0.00141	0.00143	0.001463
Story25	WX 1	Max Drift X	0.001567	0.001514	0.00153	0.001556
Story24	WX 1	Max Drift X	0.001661	0.001617	0.00163	0.001652
Story23	WX 1	Max Drift X	0.001756	0.00172	0.001731	0.001749
Story22	WX 1	Max Drift X	0.001851	0.001822	0.001831	0.001845
Story21	WX 1	Max Drift X	0.001945	0.001921	0.001928	0.00194
Story20	WX 1	Max Drift X	0.002037	0.002018	0.002024	0.002033
Story19	WX 1	Max Drift X	0.002126	0.00211	0.002115	0.002123
Story18	WX 1	Max Drift X	0.002211	0.002199	0.002202	0.002209
Story17	WX 1	Max Drift X	0.002292	0.002281	0.002284	0.002289
Story16	WX 1	Max Drift X	0.002366	0.002357	0.00236	0.002364
Story15	WX 1	Max Drift X	0.002432	0.002425	0.002427	0.002431
Story14	WX 1	Max Drift X	0.00249	0.002484	0.002486	0.002489
Story13	WX 1	Max Drift X	0.002537	0.002532	0.002534	0.002536
Story12	WX 1	Max Drift X	0.002572	0.002568	0.00257	0.002571
Story11	WX 1	Max Drift X	0.002593	0.00259	0.002591	0.002592
Story10	WX 1	Max Drift X	0.002597	0.002595	0.002595	0.002597
Story9	WX 1	Max Drift X	0.002581	0.002579	0.00258	0.002581
Story8	WX 1	Max Drift X	0.002541	0.00254	0.00254	0.002541
Story7	WX 1	Max Drift X	0.002474	0.002472	0.002473	0.002473
Story6	WX 1	Max Drift X	0.002372	0.002371	0.002372	0.002372
Story5	WX 1	Max Drift X	0.002232	0.002231	0.002231	0.002232
Story4	WX 1	Max Drift X	0.002044	0.002043	0.002043	0.002044
Story3	WX 1	Max Drift X	0.0018	0.001799	0.001799	0.0018
Story2	WX 1	Max Drift X	0.001485	0.001485	0.001485	0.001485
Story1	WX 1	Max Drift X	0.000896	0.000896	0.000896	0.000896

III. CONCLUSION

MODEL TYPE	MODEL 1	MODEL 2	MODEL 3	MODEL4
DRIFT /DRIFT (MODEL 1)	**1**	**0.67**	**0.71**	**0.76**

Drift decreases with outrigger and increase with reducing outrigger depth

IV. REFERENCES

[1] Shivacharan K, Chandrakala S, Karthik N M (2015) "Optimum Position of Outrigger System for Tall Vertical irregularity Structures".

[2] Kiran Kamath, N.Divya, Asha U Rao (2012) "A Study on Static and Dynamic Behavior of Outrigger Structural System for Tall Buildings.

[3] N. Hearth, N. Haritos, T. Ngo, P.Mendis (2009) "Behaviour of Outrigger Beams in High rise Buildings under Earthquake Loads.

[4] Kiran Kamath, Avinash A.R., Sandesh Upadhyaya K. "A Study on the Performance of Multi-Outrigger Structure Subjected to Seismic Loads.

[5] Junais Ahmed A.K., Yamini Sreevalli (2014) "Application of Outrigger in Slender High Rishe Buildings to Reduce Fundamental Time Period".