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COMPARISION OF PERFORMANCE OF STEEL PLATE SHEAR WALL WITH R.C.C SHEAR WALL IN TALL BUILDING

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Abstract-*The Present Study is an attempt to understand the performance of Steel plate shear wall System and RCC Shear wall System in Tall building with analysis and design of RCC tall building with different structural system is studied through the study of analysis and design of two models of RCC tall building consisting of [15-20-30-40] stories, with two structural system [RCC Shear wall system, Steel plate Shear wall system], the study is to be carried out to examine the structural system used under the action of dynamic analysis, comparing the system, thus determining the best structural system for the specific height.*

Keywords *– Plan, RCC Shear wall system, Steel Plate Shear wall system*

I. INTRODUCTION

Steel plate shear wall is a Special Structural System which is used to resist the lateral load but its use in construction is limited to an extent compared to R.C.C shear wall. The steel plate shear wall system consists of Vertical steel plate which is connected to the Horizontal Boundary element (HBE) and Vertical Boundary element (VBE). In HBE, the Flooring beams are used, and in VBE columns are used. The vertical steel plate which is used in this system, it is selected for their ability to resist buckling. In this type of walls, the compressive strength is negligible and the diagonal tension field action resists the lateral load.

The advantage of steel plate shear wall is that, it resists the earthquake lateral forces in building and transfers it to the foundation of building. In this Study, the analysis and design of steel plate shear wall and RCC Shear wall in the tall buildings is to be studied to resist lateral loads also the analysis of the Steel plate Shear wall and RCC Shear wall in tall building at different locations and at various floor levels dynamic analysis with ETABS software is to be carried out.

In this Study two major systems used for the tall buildings are:
1. RCC Shear wall system.
2. Steel Plate Shear wall system.

Necessity of Shear wall

- Shear wall are one of the excellent means for providing earthquake resistance for multi-storey structure.
- Shear wall resist the wind and earthquake forces and transfer that load to foundation. Well designed system of shear wall in the building frame improves its seismic performance significantly.
- Shear walls are used to resist the lateral loads due to wind and earthquake.
- They are provided between the columns lines.

Purpose of Shear wall

- To improve the behaviour of the very flexible frames, which are more prone to earthquake, by stiffening them with shear walls.
- To avoid column shear failures due to inter-storey distortion.
- To reduce lateral drift.

II. OBJECTIVES AND SCOPE

- The main objective of present work is to investigate the performance of RCC shear wall and steel plate shear wall with vary of storey height. .
- To model RCC Shear wall system and Steel Plate Shear wall System and the analysis and design of each one should be done separately and compared to one another.

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III. CHARACTERISATION OF PROBLEM

- The overall plan of 35.25m x12.75m for different stories (15-20-30-40) frame structure with 3.5m Ground floor storey height, and 3m height for 1st storey to top storey of building.
- Consider specific models of RCC tall buildings consisting of (15- 20-30-40) and for the two type of structural systems in resisting earthquake forces (RCC Shear wall system –Steel Plate Shear wall system) by using computerized software ETABS.
- Providing Core Shear Wall in building model and analyzed using dynamic analysis.
- The analysis results for different models are represented in graphical form for analysing, comparison and understanding.

Table 1: Shows the geometric characteristic of the Problem

Sr.No	Specification	Details
1	Concrete and Steel	M30 and FY500
2	Slab	150 mm
3	Load combination	As per IS code
4	Zone	3
5	Plan Dimension	35.25m × 12.75 m
6	Storey height	3 m
7	Ground Floor height	3.5 m
8	Live load	2 Kn/m²
9	Floor finish	1 Kn/m²
10	Wind speed	44 m/s [Vadodara city]
11	Terrain Category	1
12	Analysis [Dynamic Analysis]	Time history analysis
13	Time history Data	Chamoli [Uttarakhand]

Table 2: Shows the Beam & Column dimension storey wise

System	Storeys	Beam	Column
RCC Shear Wall System	15	350*700	700*700
	20		700*700
	30		700*700
	40		800*800
Steel plate Shear Wall System	15	350*700	700*700
	20		700*700
	30		700*700
	40		800*800

As per above table 1 & 2 the models of [15- 20-30-40] stories of specified system is modelled as shown in figure.Fig1 shows the S.W system and Fig2 Shows the S.P.S.W system.

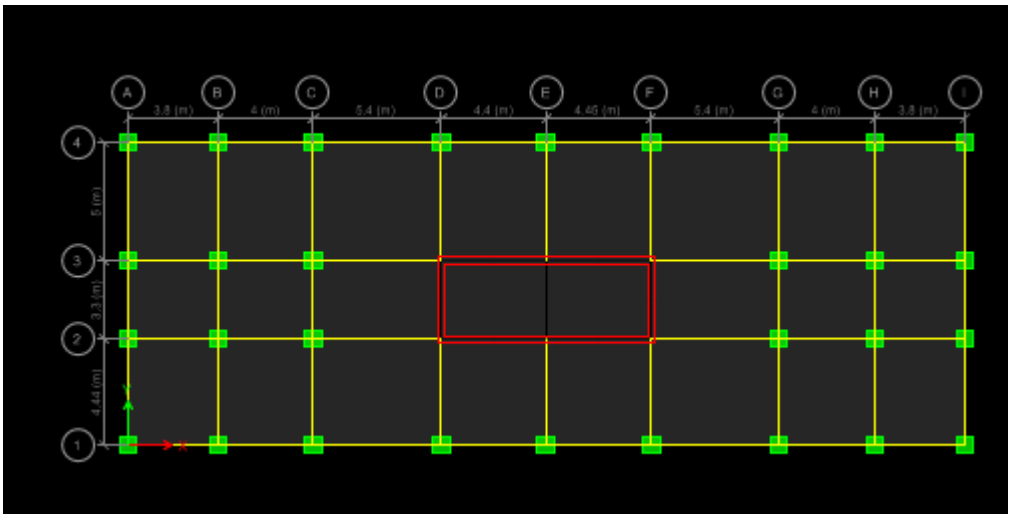


Fig1: Plan of Core S.W.

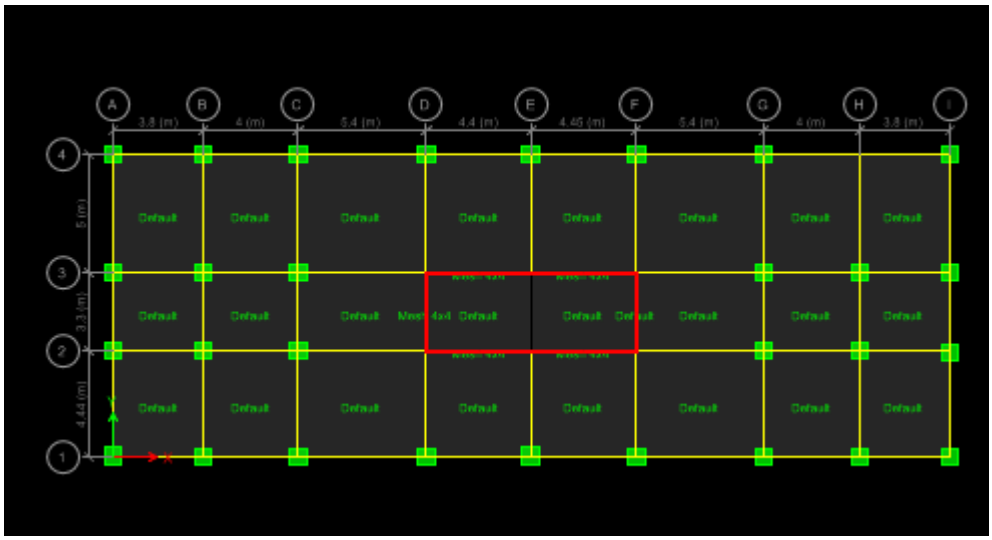


Fig2: Plan of Core SPSW

IV. Analysis

- Time history analysis

  To perform such an analysis, a representative earthquake time history is required for a structure being evaluated. Below shown in fig3 the Chamoli Uttarakhand data is taken for time history analysis.

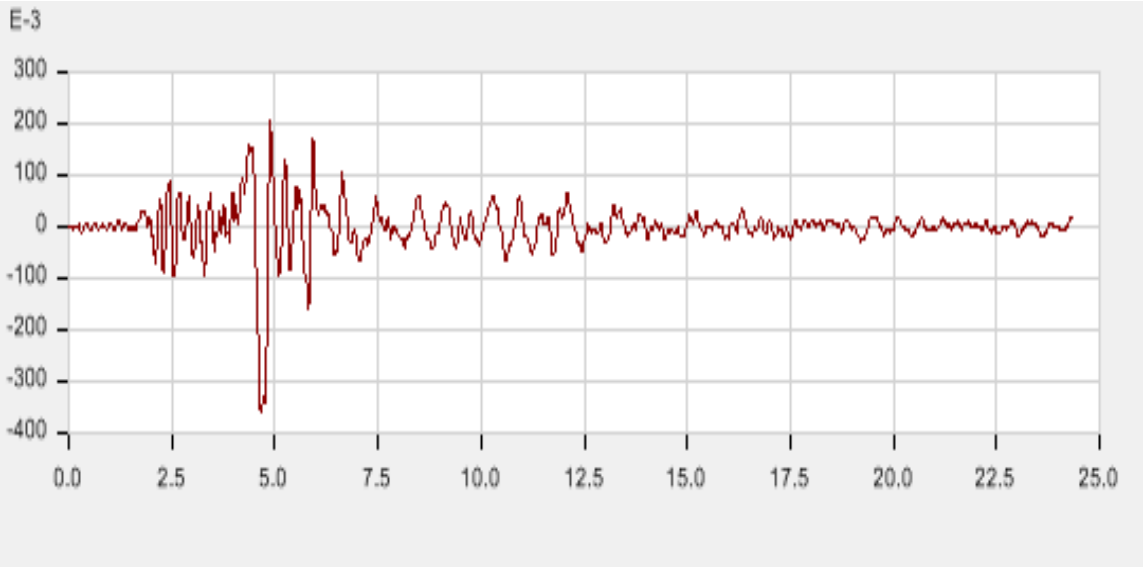
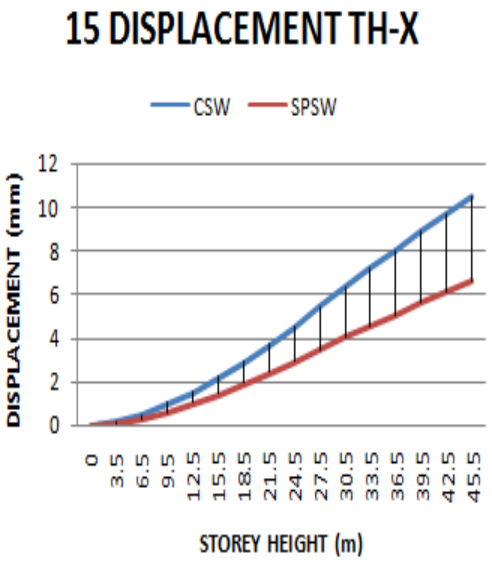
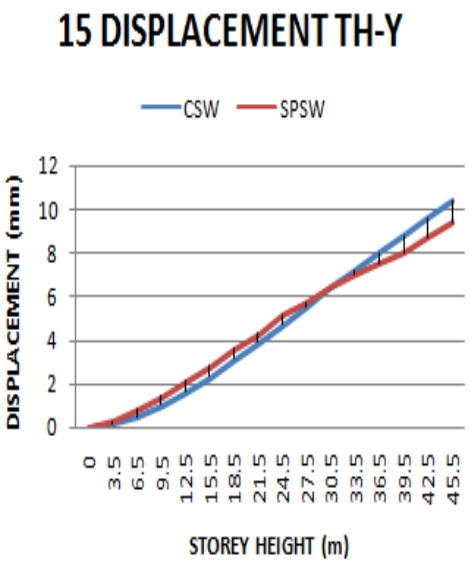


Fig3: Time history data

V. Results and Discussion

After time history analysis for all models the results showing displacement & storey drift comparison graphs are listed below:





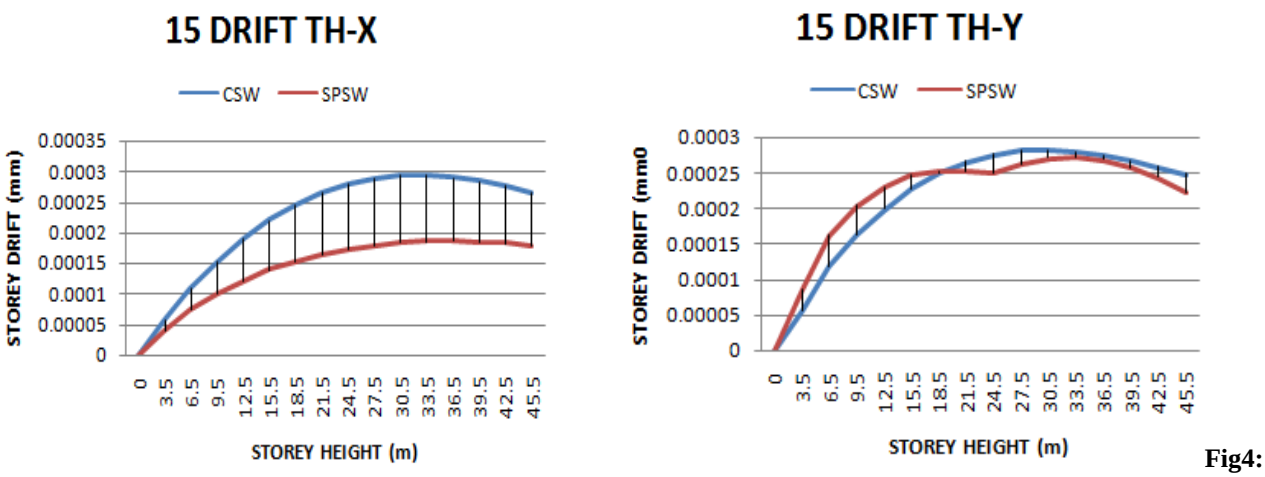


Fig4:

Shows the comparison result of displacement & storey drift of three models 15 storey time history

The result shown in above figure-4, the reduction of displacement 37% in SPSW system to compare with CSW system in X direction. but at the same time in Y direction, the displacement reduction 10% in SPSW system to compare with CSW system. And in storey drift result, the reduction of storey drift 33% in SPSW system to compare with CSW system in X direction. and in Y direction, the reduction of storey drift 10% in SPSW system to compare with CSW system.

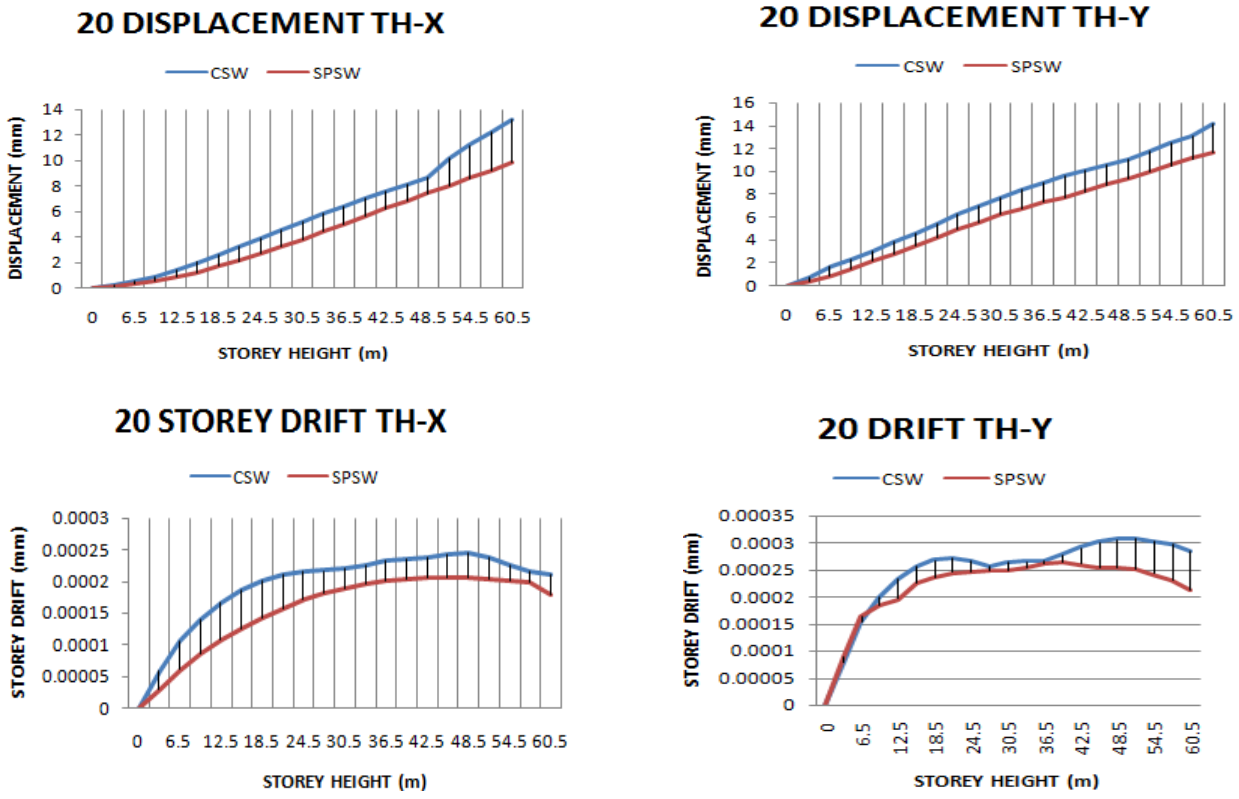


Fig5: Shows the comparison result of displacement & storey drift of three models 20 storey time history

The result shown in above figure-5, the reduction of displacement 20% in SPSW system to compare with CSW system in X direction. but at the same time in Y direction, the displacement reduction 18% in SPSW system to compare with CSW system . And in storey drift result, the reduction of storey drift 14% in SPSW system to compare with CSW system in X direction. and in Y direction, the reduction of storey drift 25% in SPSW system to compare with CSW system.

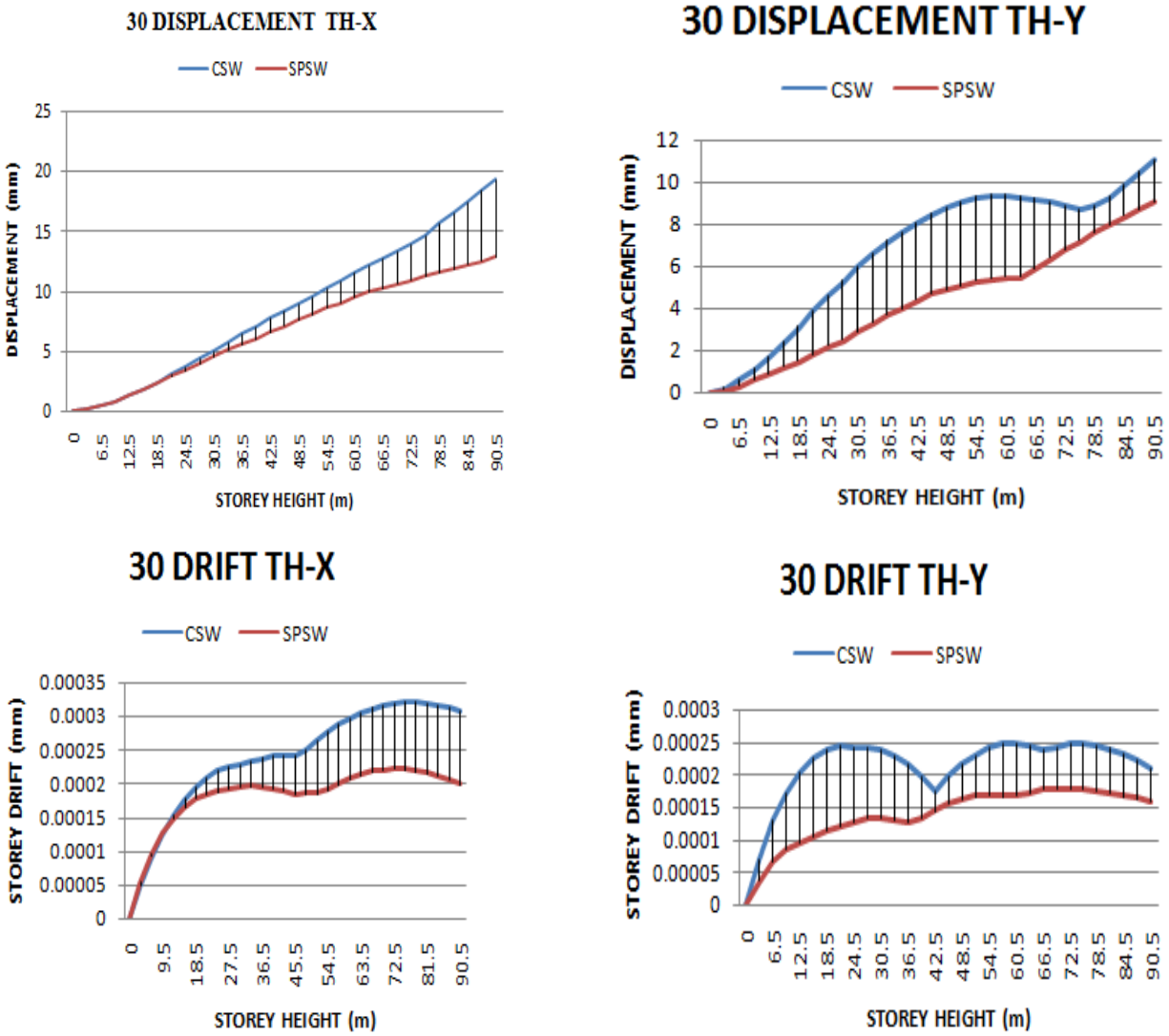


Fig6: Shows the comparison result of displacement & storey drift of three models 30 storey time history

The result shown in above figure-6, the reduction of displacement 33% in SPSW system to compare with CSW system in X direction. but at the same time in Y direction, the displacement reduction 18% in SPSW system to compare with CSW system . And in storey drift result, the reduction of storey drift 36% in SPSW system to compare with CSW system in X direction. and in Y direction, the reduction of storey drift 24% in SPSW system to compare with CSW system.

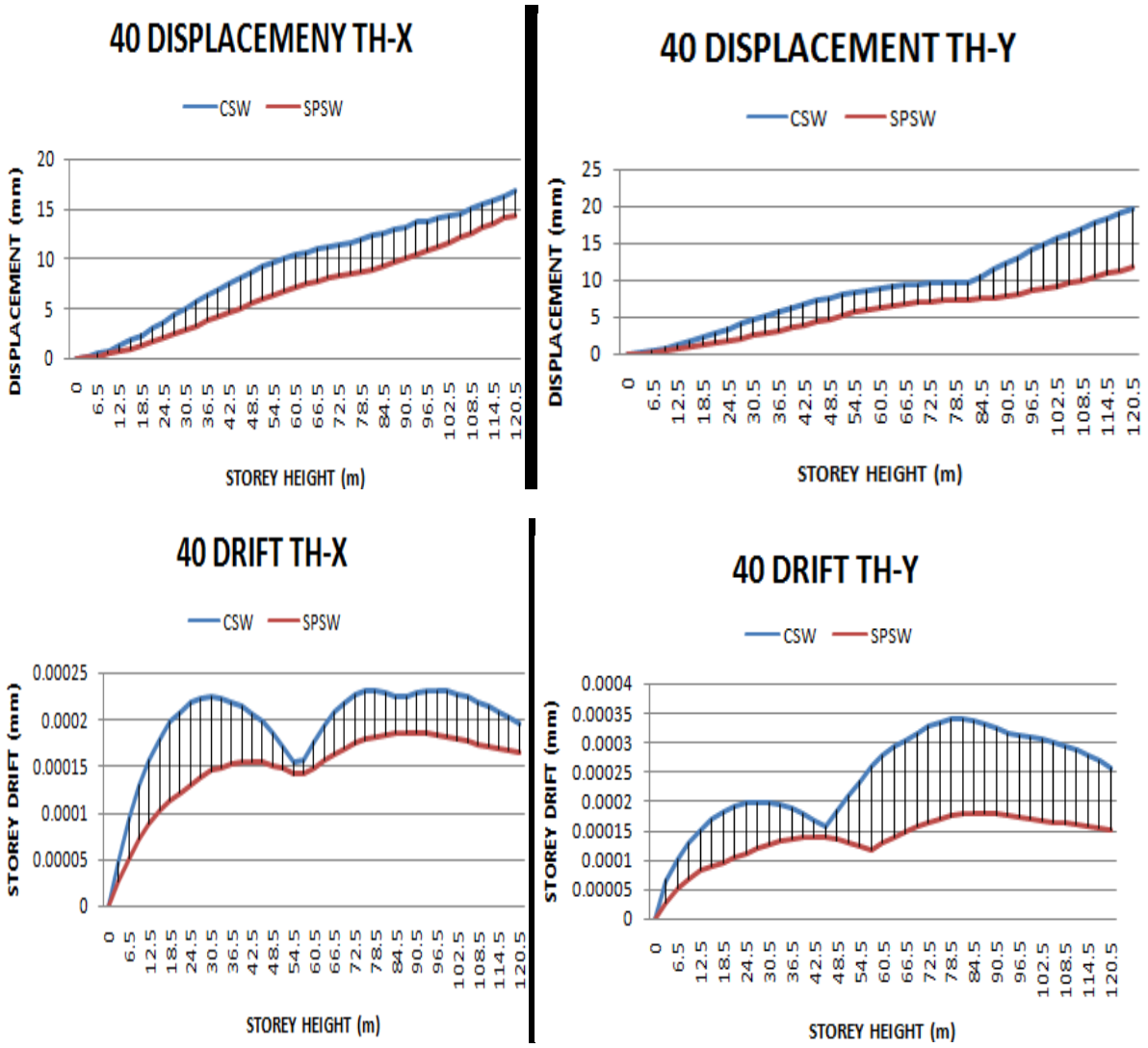


Fig7: Shows the comparison result of displacement & storey drift of three models 40 storey time history

The result shown in above figure-7, the reduction of displacement 15% in SPSW system to compare with CSW system in X direction. But at the same time in Y direction, the displacement reduction 41% in SPSW system to compare with CSW system. And in storey drift result, the reduction of storey drift 16% in SPSW system to compare with CSW system in X direction and in Y direction, the reduction of storey drift 41% in SPSW system to compare with CSW system.

VI. CONCLUSIONS

From the comparison of results, the conclusion is to be carried out that the performance of the steel plate shear wall is better than the RCC shear wall system on the basis of displacement and storey drift of the RCC tall building [15-20-30-40] stories.

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