Study of Moment and Shear force in Building with various Location of Lift Core Shear wall under Earthquake Load

Rupali Goud
Department of Civil Engineering
Alpine institute of technology, Ujjain

Sumit Pahwa
Department of Civil Engineering
Alpine institute of technology, Ujjain

Abstract- Shear wall is the best way to control deflection during earthquake. But the providing shear wall is sometimes not feasible and hence avoided. Lift core, which are the mandatory to be used in multi-storey building and are frequently used as core type shear wall can be best option. In general, lift cores are provided with convenience of users. In most of research storey drift is one of main factor. In this paper, Various positions of lift core are modelled and were analysed for moment and shear under static earthquake loading in V earthquake zone of India. The results were compared with bare frame.

Key words: Earthquake loading, Shear wall, Lift core, Static analysis, Moment and Shear

I. INTRODUCTION

The design of a multi-storey building is governed by lateral loads and it should be prime concern of the designer to provide adequately safe structure against lateral loads. The modern buildings are heaving light curtain walls, lightweight flexible partitions along with high strength concrete and steel reinforcement. This reduces the safety margins provided by non-structural components. Shear wall system is one of the most commonly used lateral load resisting system in high rise buildings. A shear wall is a structural system providing stability against wind, earthquake and blast deriving its stiffness from inherent structural forms. The shear wall can be either planar, open sections, or closed sections around elevators and stair cores.

II. NEED OF STUDY

Shear walls are provided for lateral strength to resist horizontal forces arises due to earthquake Due to earthquake, two things may happen to building due to which a building may fail to serve as it functioned to be. These are: 1. Heavy storey drift which cause the formation of plastic hinge at joint and 2. Increase in moment and shear force in columns of building. For earthquake designing strong column weak beam concept is being used. Hence it is very necessary to study the effect of earthquake forces in moment and shear in bare frame and frame with lift core shear wall at various positions.

III METHODOLOGY

Method of analysis:

Equivalent Lateral Force Procedure: The equivalent lateral force procedure is the simplest method of analysis and requires less computational effort because the forces depend on the code based fundamental period of structures with some empirical modifier. The design base shear shall first be computed as a whole, then be distributed along the height of the buildings based on simple formulas for buildings with regular distribution of mass and stiffness. The design lateral force obtained at each floor level shall then be distributed to individual lateral load resisting elements depending upon floor diaphragm action. The following are the major steps for determining the forces by equivalent static procedure.

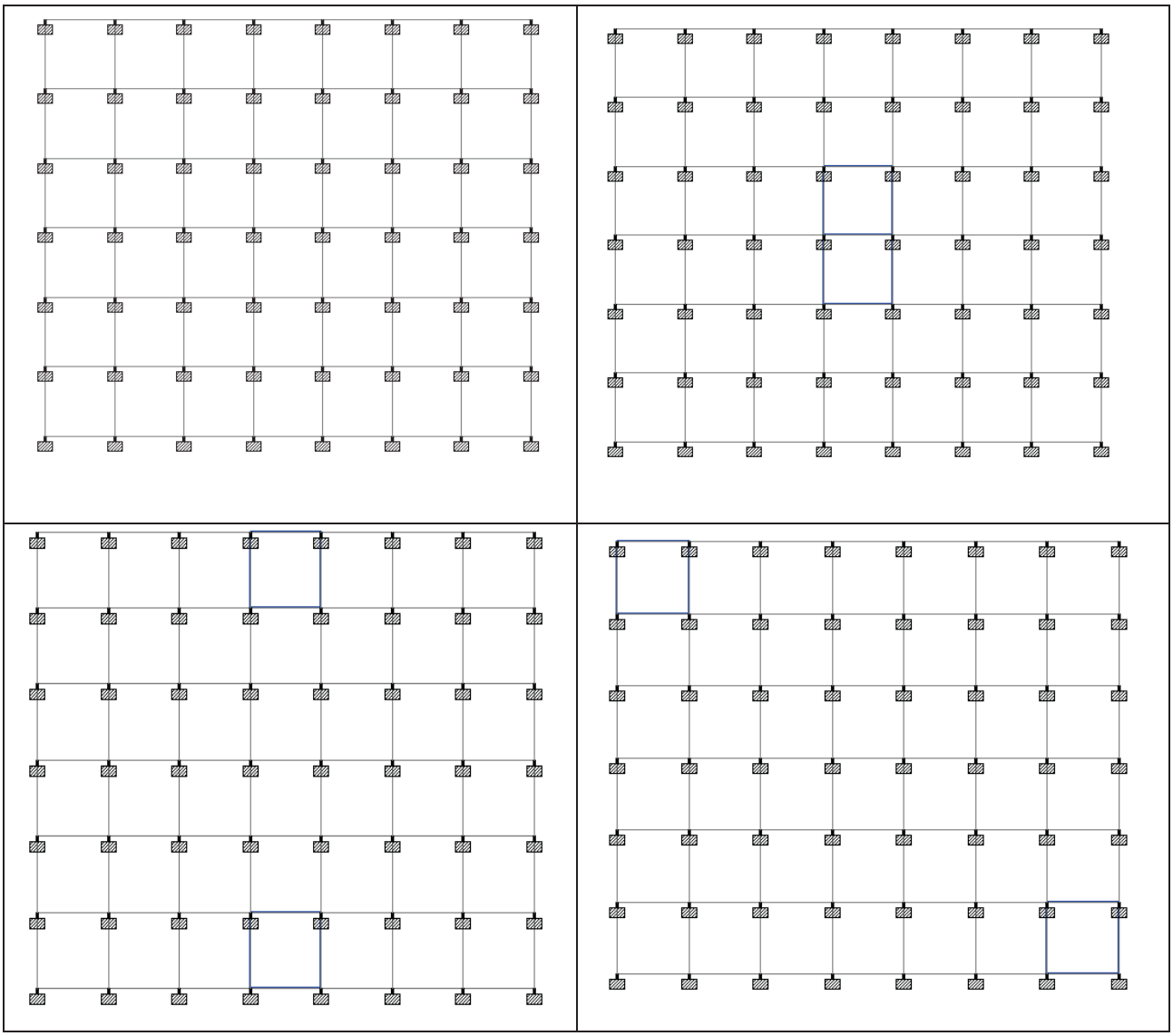


Figure1. Top view of Staad Models

For the study, three models were considered:

1. Simple bare frame without any shear wall
2. Simple frame with Lift core at centre of building
3. Simple frame with lift core at the edge of building
4. Simple frame with lift core at corner of building

Nomenclature:

SF= Simple Frame

SWC1= shear wall configuration 1 (lift core at centre)

SWC2= Shear wall configuration 2(Lift core at edge of building)

SWC3= Shear wall configuration 3(Lift core at alternate corners of building)

All models are of 10 storey each having standard height of 3m and hence height of building will be 30m.

Plan of all building is 35m X 30m.

Section properties:

Element	Thickness/ width (mm)	Depth (mm)
Beam section	450	550
Column Section	500	500
Shear wall	300	--

All supports are taken as Fixed.

Loadings Considered:

The static earthquake force is considered from X and Z direction for zone IV and V of IS1893:2002[1]

Following load combinations were used:

1. Live Load – 3 KN/m2 on all the floors.
2. Dead load for floor = -4kN/m2
3. Self weight of building
4. Dead load of curtain wall = -15kN/m of the peripheral wall only
5. Earthquake Load – As per IS 1893 (Part-I):2002

Load Combinations:

Load Combinations considered for static analysis are as follows:

1. 1.5(DL + LL)
2. 1.2(DL + LL + EQX)
3. 1.2(DL + LL - EQZ)
4. 1.2(DL + LL + EQZ)
5. 1.2(DL + LL – EQZ)
6. 1.5(DL + EQX)
7. 1.5(DL – EQX)
8. 1.5(DL + EQZ)
9. 1.5(DL – EQZ)
10. 0.9DL + 1.5EQX
11. 0.9DL - 1.5EQX
12. 0.9DL + 1.5EQZ
13. 0.9DL – 1.5EQZ

Parameters and different aspects of study:

Bending Moments in Column : A bending moment is the reaction induced in elements of structure when an external force is applied to the element causing the element to bend.

Bending moment in the elements of a building is an important aspect for the design of the building elements

Shear force in column: Shearing forces are unaligned forces pushing one part of a body in one direction, and another part of the body in the opposite direction. When the forces are aligned into each other, they are called compression forces.

IV. RESULT AND DISCUSSION

The study examines the performance of shear walls in multi-storey buildings, cases studied are buildings without shear wall and with shear wall at centre, edge and centre location. In present study we have been compared bare frame with system having different cases of shear wall for moment and shear force in corner column. Corner column is most vulnerable during earthquake.

Figure 2. Maximum M_y in corner Column

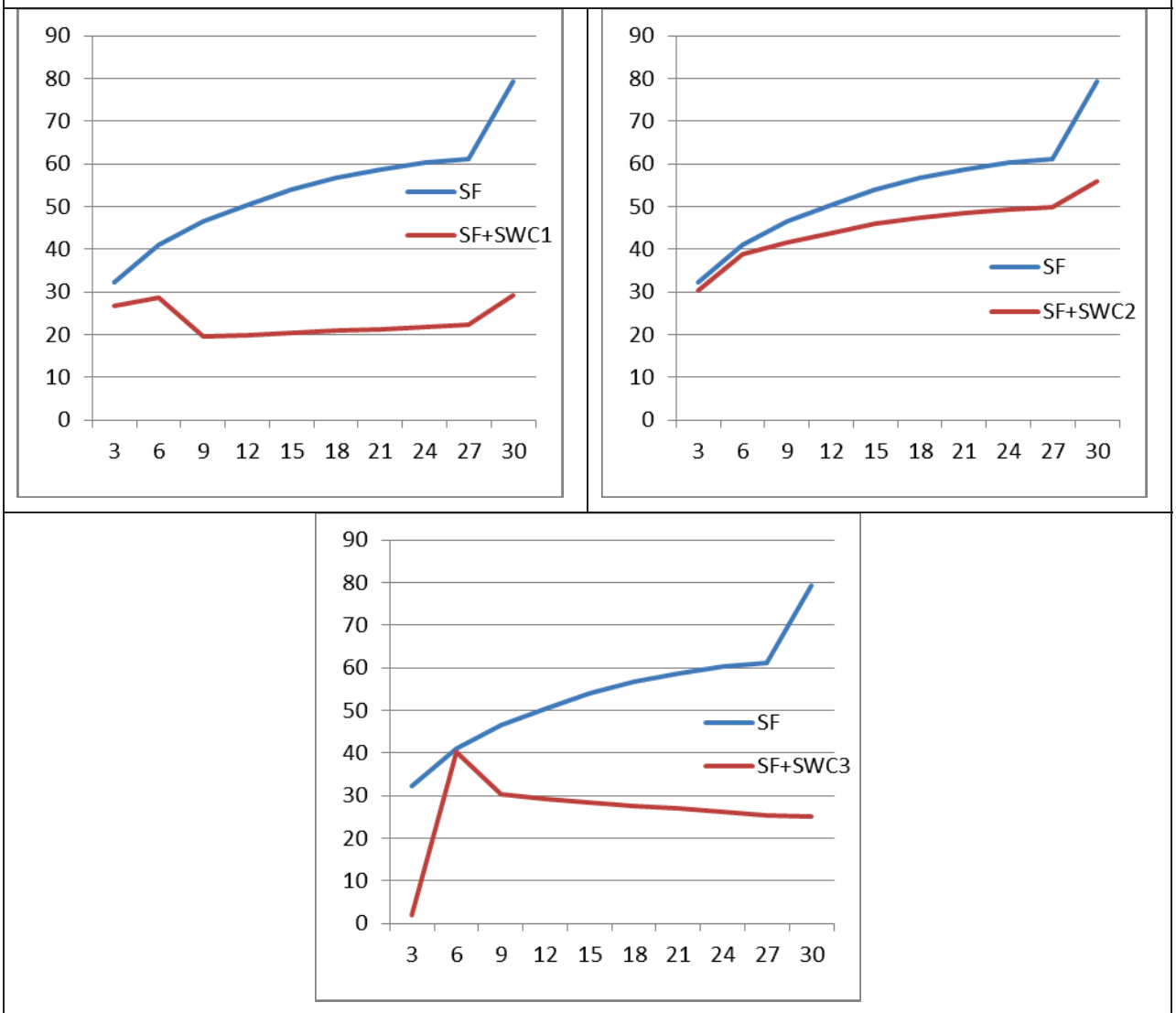


Figure 3. Maximum Mz in corner Column

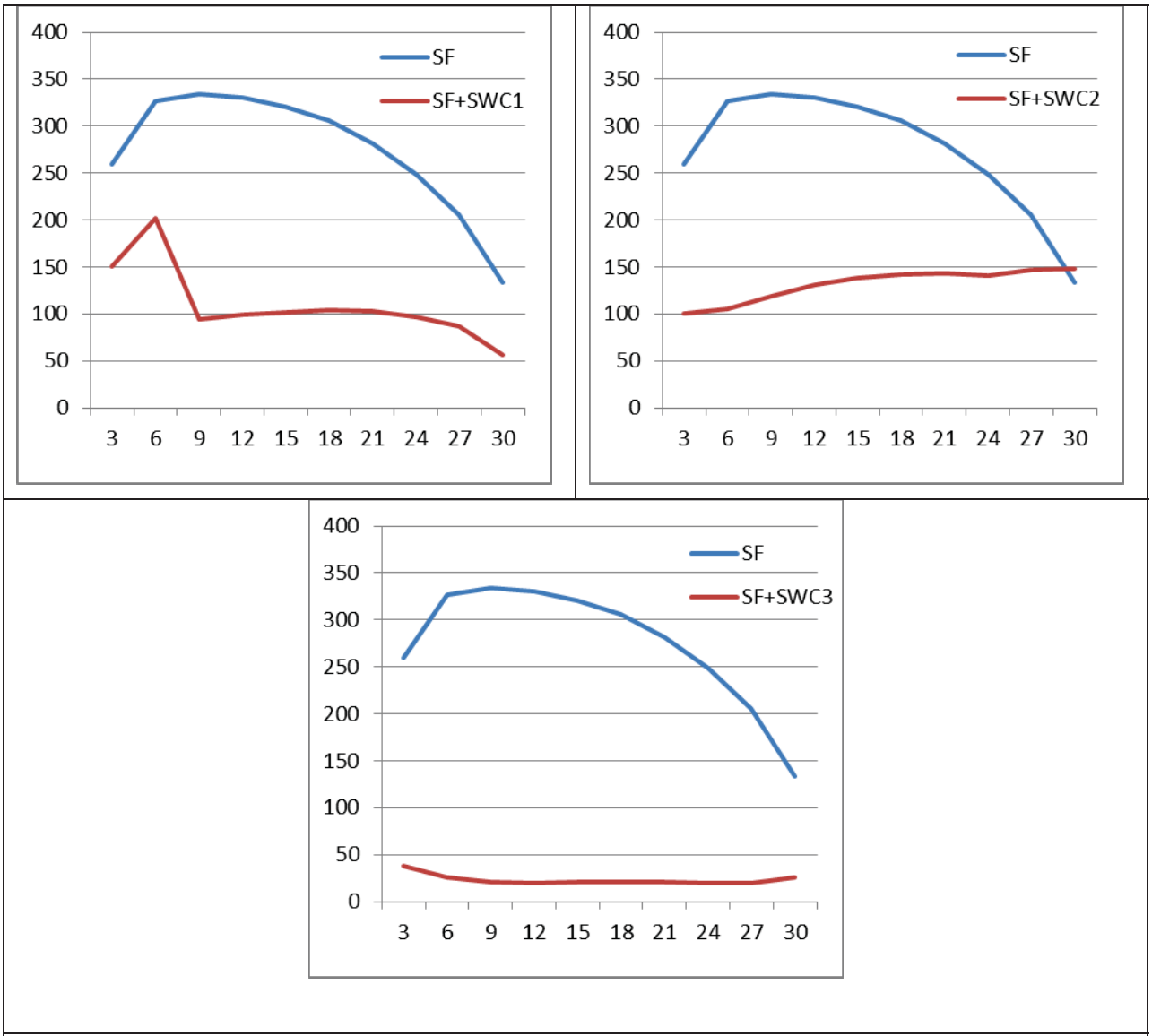


Figure 4. Maximum Fz in corner Column

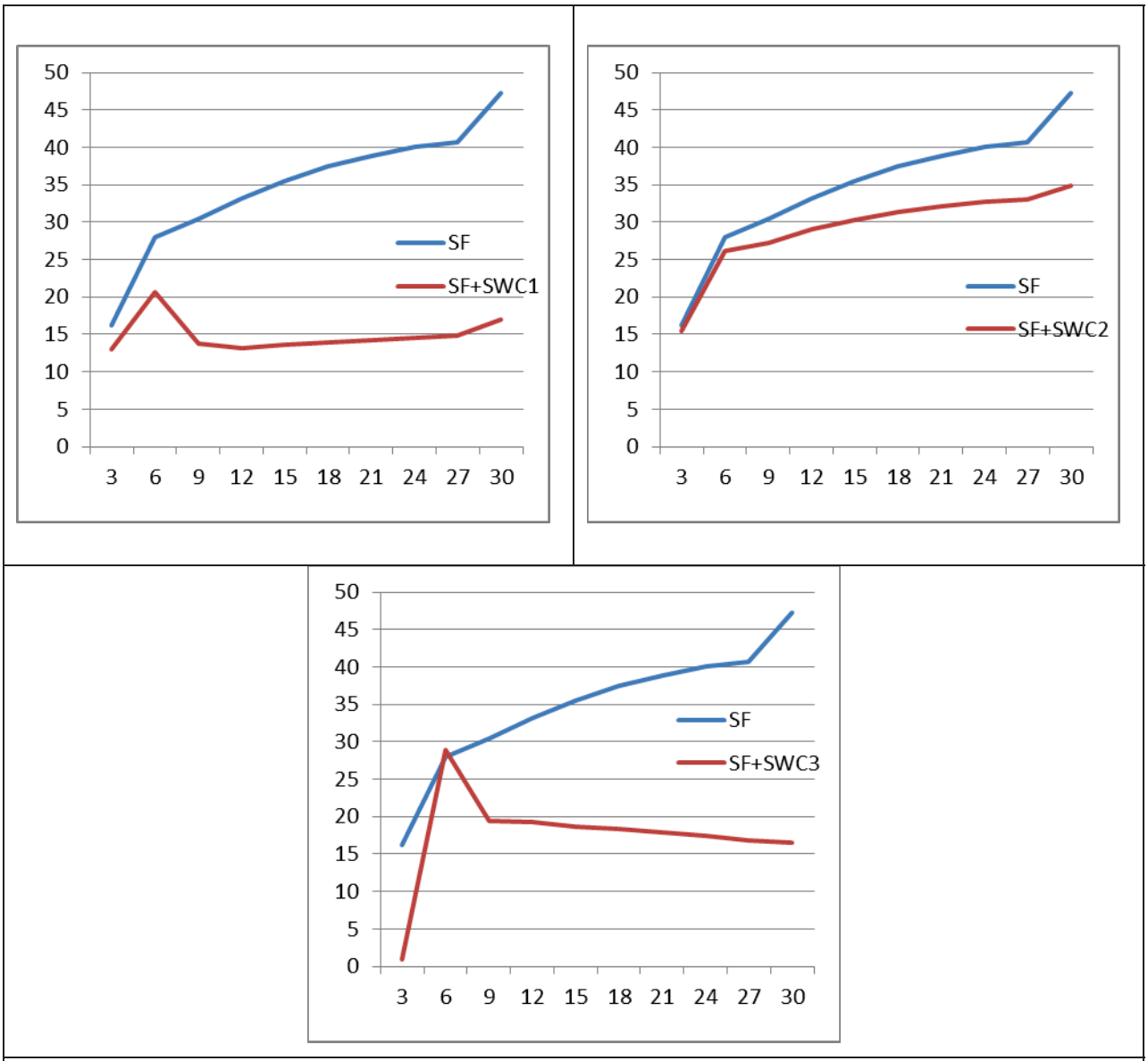
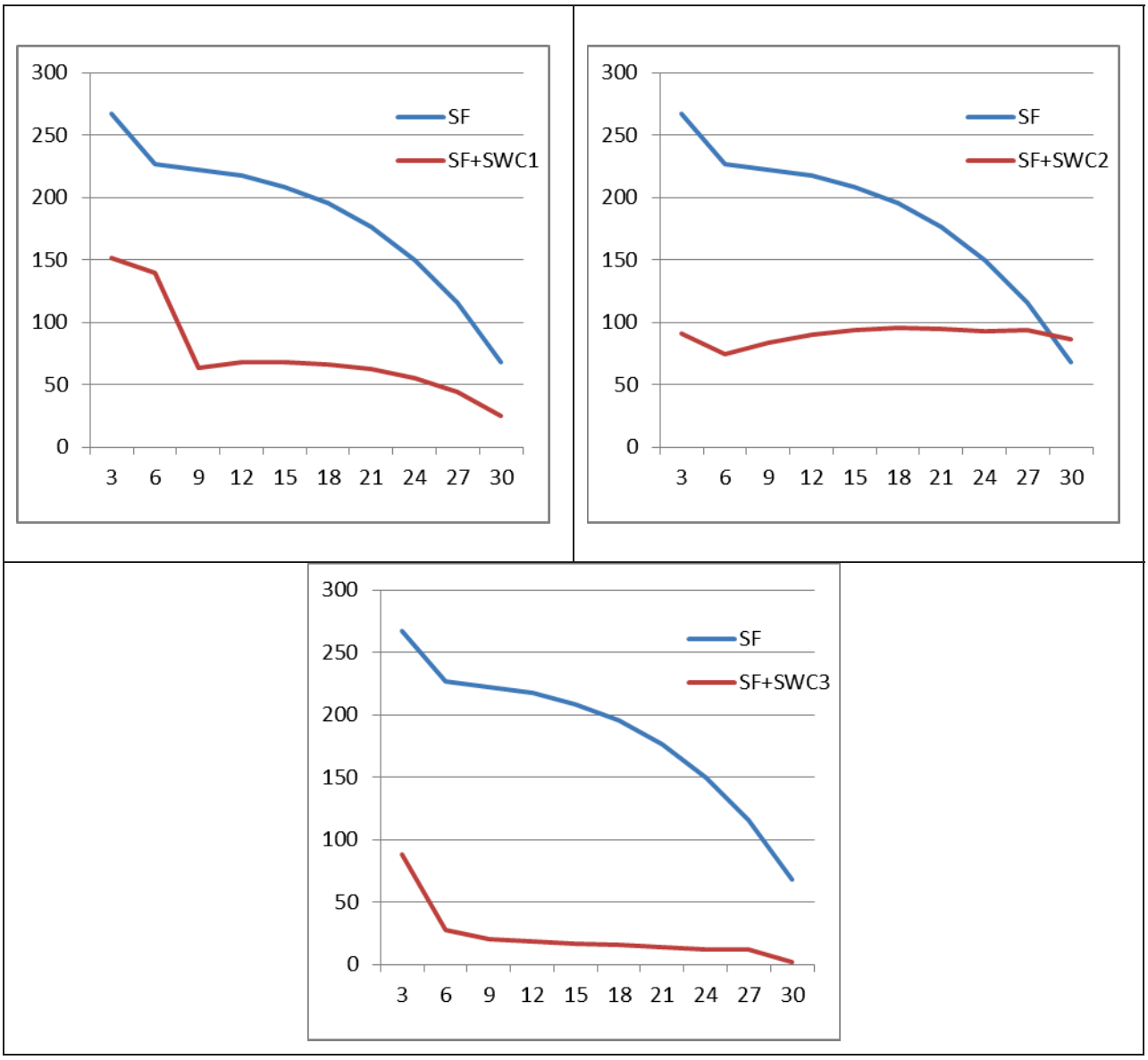


Figure 5. Maximum Fy in corner Column



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V.CONCLUSION

1. Moments and shear forces in both directions are less in all cases, this results in less deign reaction so as to minimize the material requirement.
2. For edge lift core moment increases with height but at centre and corner core it is almost constant and very less as compared to simple frame.
3. Lift core at corner is most desirable position for lift core in reactions point of view, hence one can choose it.

Further scope of research, fetches the need of study of moment and shear force on various column position and various position of lift core. More parameter can be studied

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