Parametric study on R.C.C. building with non-linear coupled and single shear wall using linear and non-linear static analysis

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Abstract: Shear walls have been used in the R.C.C. buildings as a part of lateral load resisting system, mostly because of their capacity to control the displacement of members of building. now, the concept of design codes has been changed from strength-based to performance-based, analysis of nonlinear behavior of different types of lateral load resisting system became important parameter to study for engineers. And, coupled shear wall became very popular day by day because of architect design building with lots of irregularity and openings. In this dissertation analysis is carried out by static (seismic coefficient) and nonlinear static (pushover) analysis of a G+10, G+15, G+20 story R.C.C. building with nonlinear coupled shear walls and normal shear wall, using three different patterns taken as shear wall, wide column analogous and multilayer shell element in CSI SAP2000.

***Index Terms* –Coupled Midpier Element Modelling Frame, coupled multilayered shell element Frame, Pushover analysis, Storey Drift, Storey Displacement.**

I. INTRODUCTION

Coupled Shear wall

Reinforced concrete Shear walls are known to be an efficient lateral load resisting system in the mid-rise-to-high-rise buildings, and play an important role in controlling the lateral displacements of the buildings. Because of architectural demands, sometimes, there is an urgent need to create openings in shear walls. The resultant shear wall with an opening is called Coupled wall, and the beams which connect these shear walls throughout the height of structure are called Coupling beams or lintels. Designing coupled walls in high-rise buildings is usually challenging because of high shear demand of coupling beams due to shear deformation. In addition, in many occasions, coupling beams are over stressed, because the shear force exceeds limits of design codes. To solve this problem, numerous studies have been conducted. Engineers introduced diagonal reinforcement layout as a solution for coupling beams' design, and since 1976, and different types of reinforcement layouts have been proposed for coupling beams by researchers to overcome shear stress and dissipate more energy throughout severe earthquakes

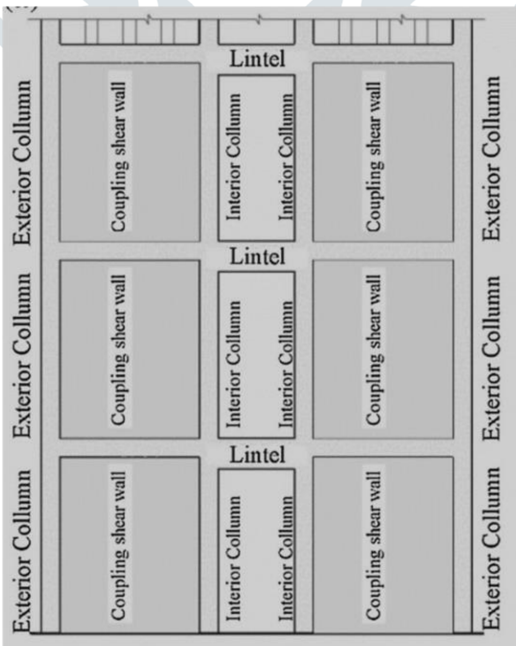

Fig.1: Coupled Shear wall

II. Description of structural system

2.1 Building Description

Table.1 Data of Regular Building

Type of frame	:G+10 Storey space Frame	G+15 storey space frame	G+20 storey space frame
Zone	: V (0.36)	: V (0.36)	: V (0.36)
Response Reduction Factor(R)	: 5	: 5	: 5
Mass source	: DL + 0.25 LL	: DL + 0.25 LL	: DL + 0.25 LL
Importance Factor(I)	: 1	: 1	: 1
Soil type	: II(Medium)	: II(Medium)	: II(Medium)
concrete	M25	M25	M25
Steel	HYSD500	HYSD500	HYSD500
Beam	230 x 500	230 X 550	400 X 600
column	600 x 600	750 X 750	925 X 925
Slab thickness	150	150	150
Wall	5230 x 300	5230 X 450	5230 X 550
Coupled shear wall Building Data			
Beam	0.3 x 0.5	0.3 x 0.5	0.3 x 0.5
Column	0.6 x 0.6	0.8 x 0.8	1.10 x 1.10
Coupled beam	0.3 x 0.8	0.45 x 0.8	0.55 x 1.2
Coupled wall	0.3 x 2.5	0.45 x 2.5	0.55 x 2.5

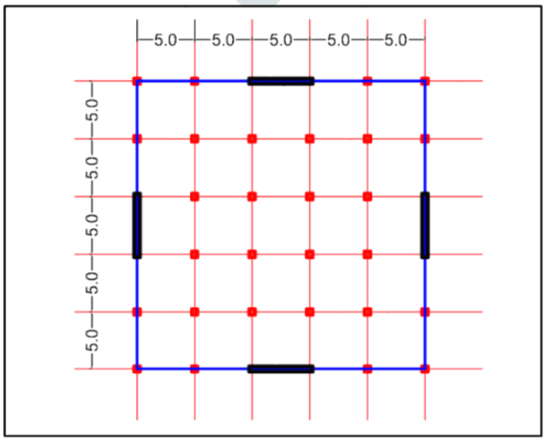

Fig.2 Typical Plan of building with single shear wall

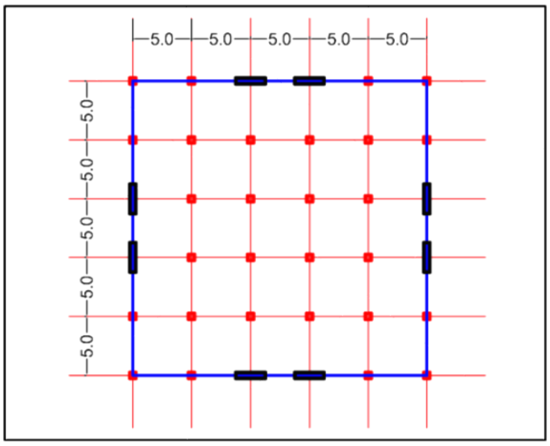

Fig.3 Typical plan for building with coupled shear wall

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III. ANALYSIS RESULTS

After Performing the analysis, the following result will come are as follows :

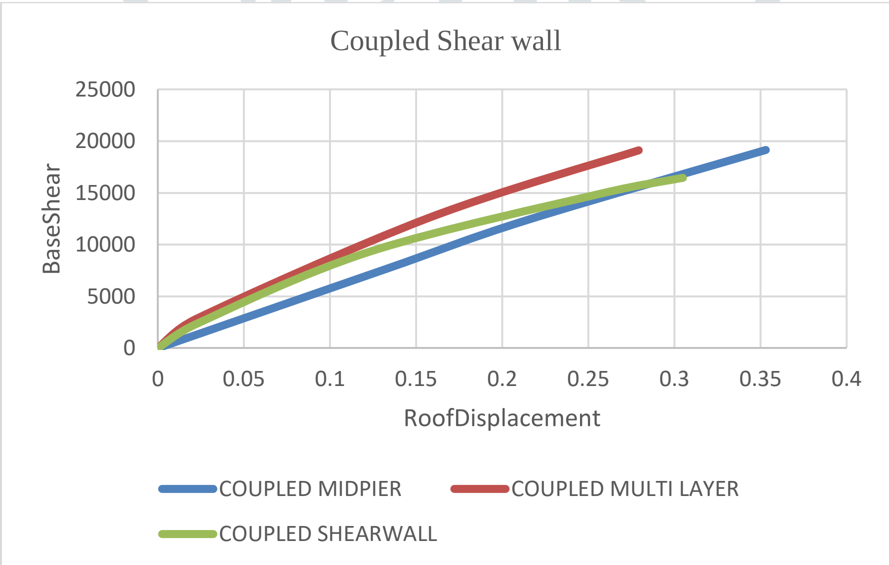

Fig.4 Pushover curve of G+10 coupled shear wall

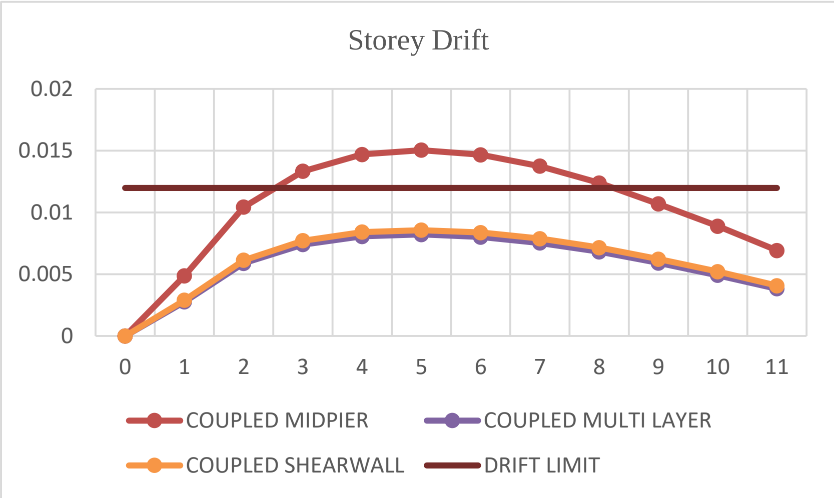

Fig.5 Storey Displacement of G+10 coupled shear wall

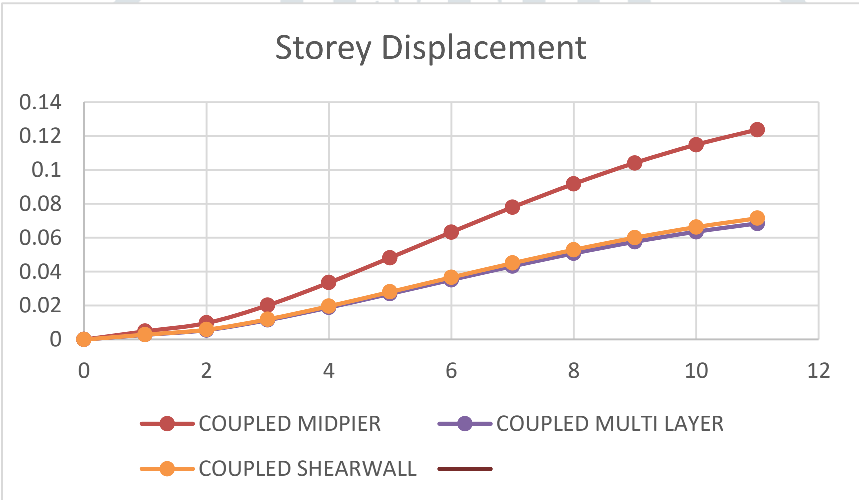

Fig.6 Storey Displacement of G+10 coupled shear wall

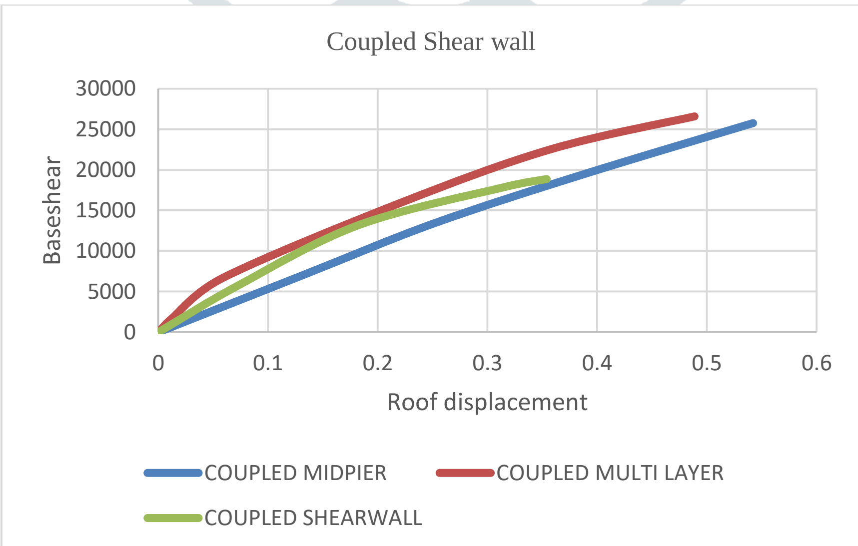

Fig.7 Pushover curve of G+15 coupled shear wall

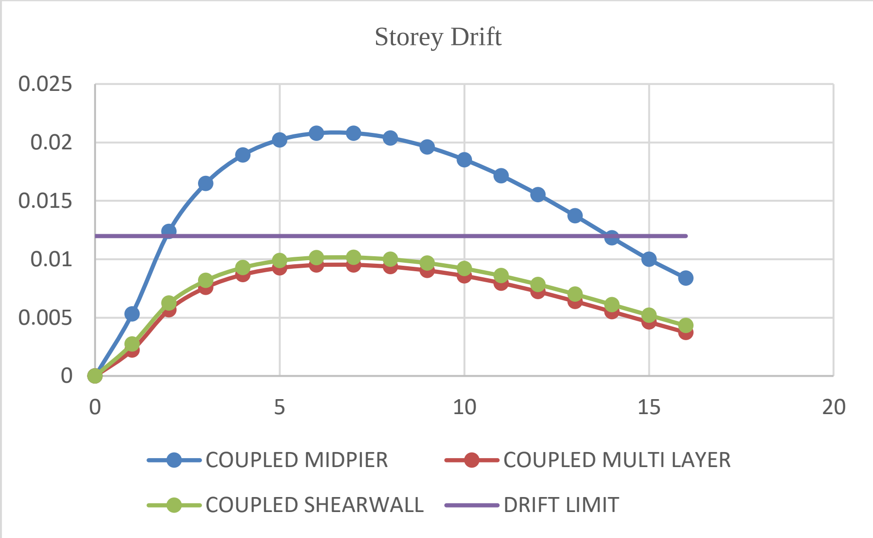

Fig.8 Storey Drift of G+15 coupled shear wall

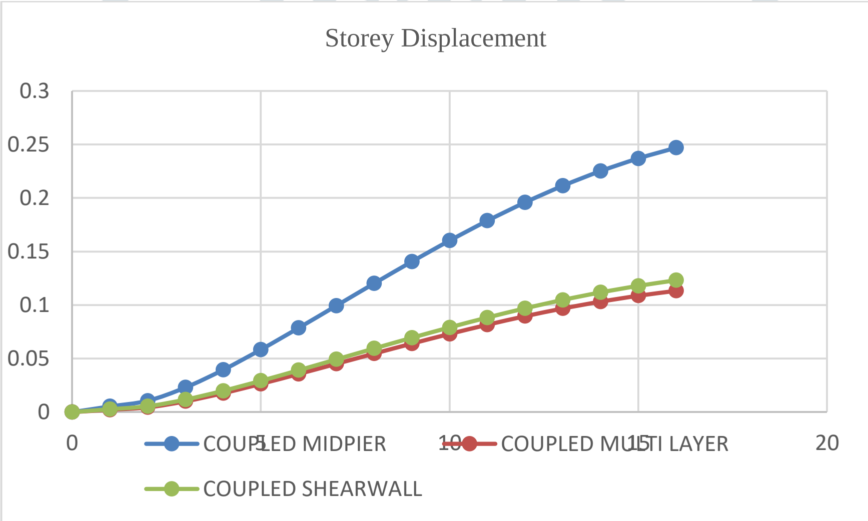

Fig.9 Storey Displacement of G+15 coupled shear wall

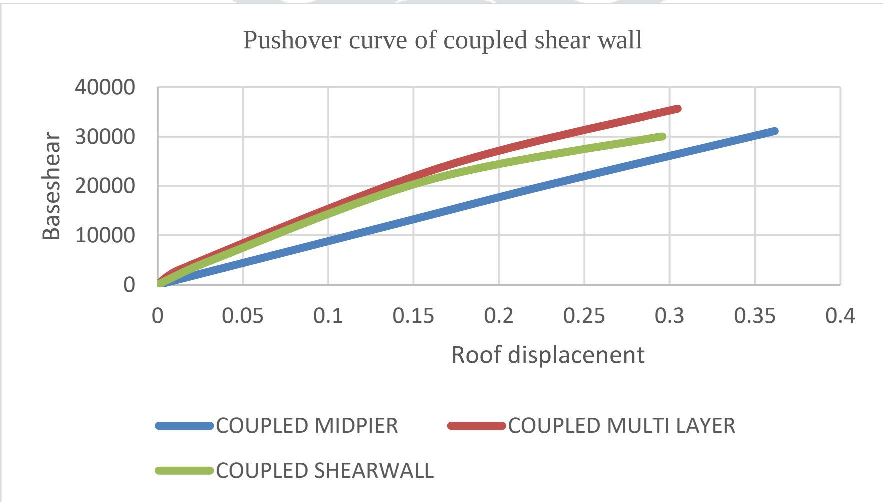

Fig.10 Pushover curve of G+20 coupled shear wall

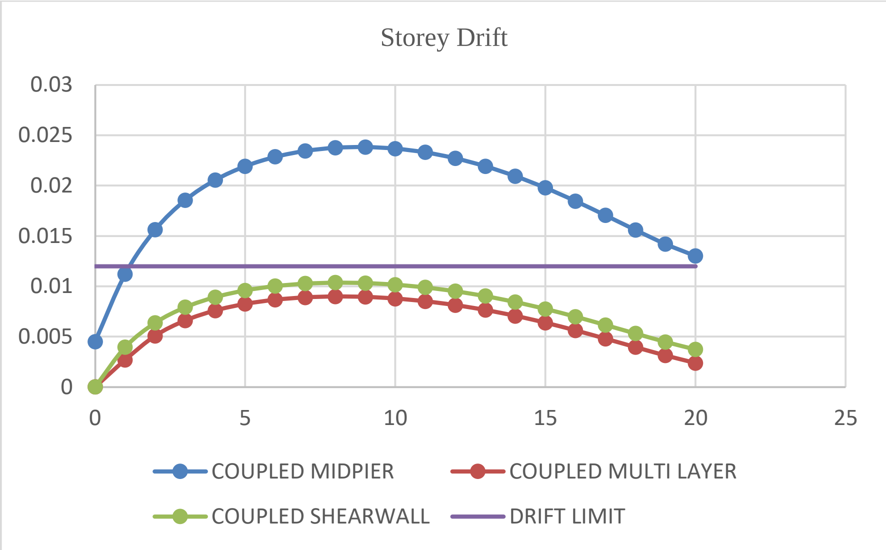

Fig.11 Storey Drift of G+20 coupled shear wall

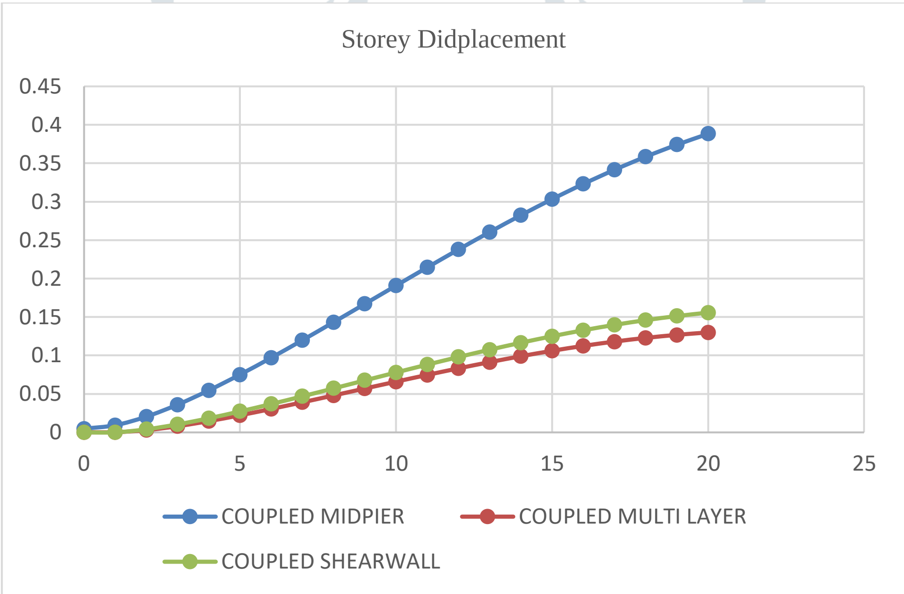

Fig.12 Storey Displacement of G+20 coupled shear wall

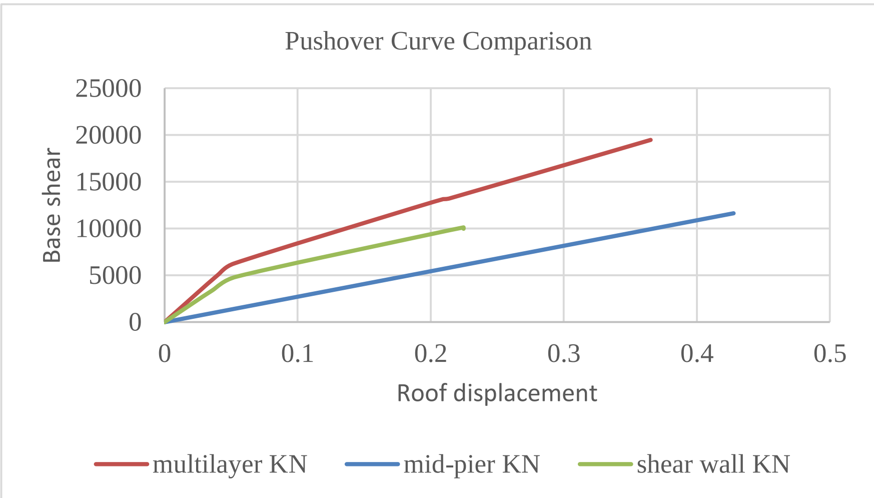

Fig.13 Pushover curve comparison of G+10 regular building

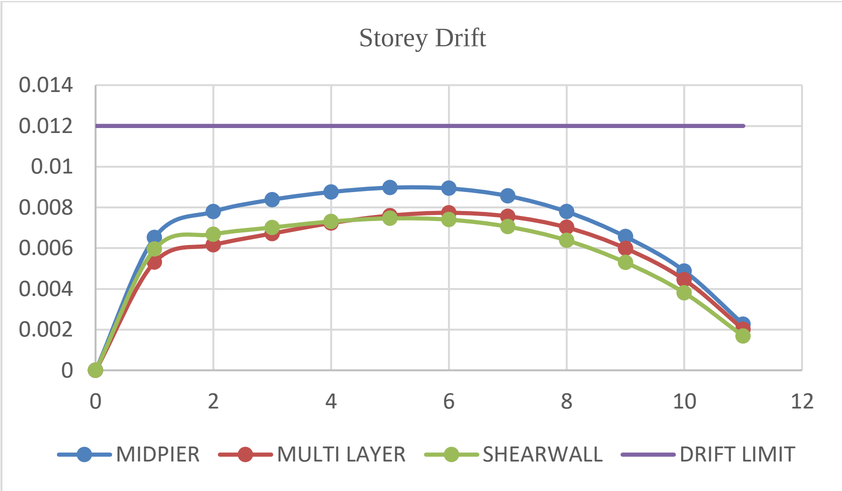

Fig.14 Storey Drift of G+10 regular building

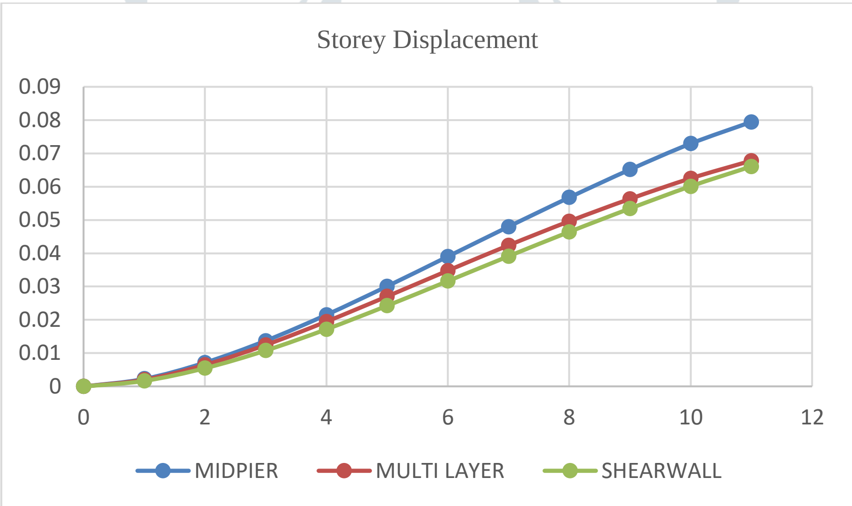

Fig.15 Storey Displacement of G+10 regular building

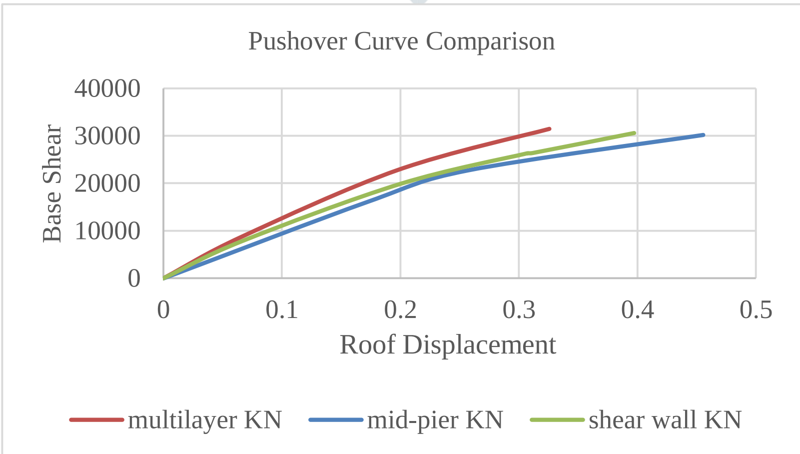

Fig.16 Pushover Curve comparison of G+15 regular building

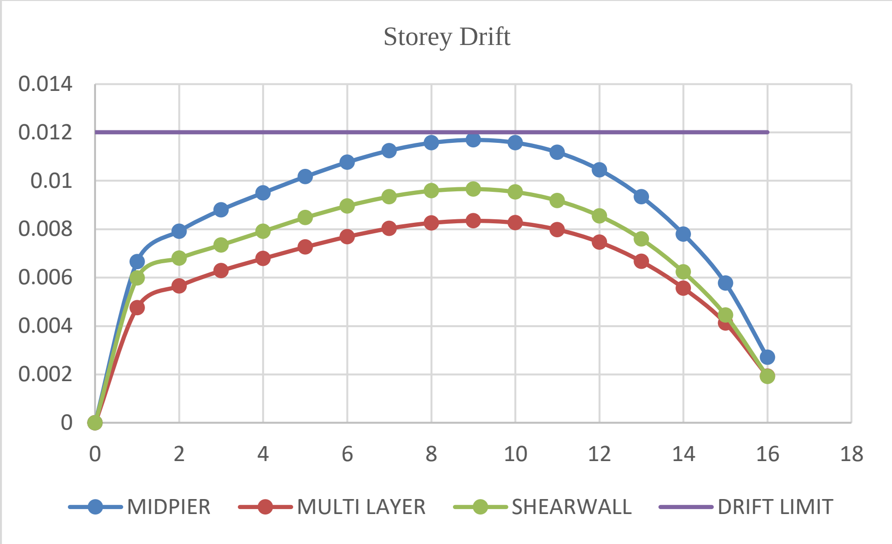

Fig.17 Storey Drift of G+15 regular building

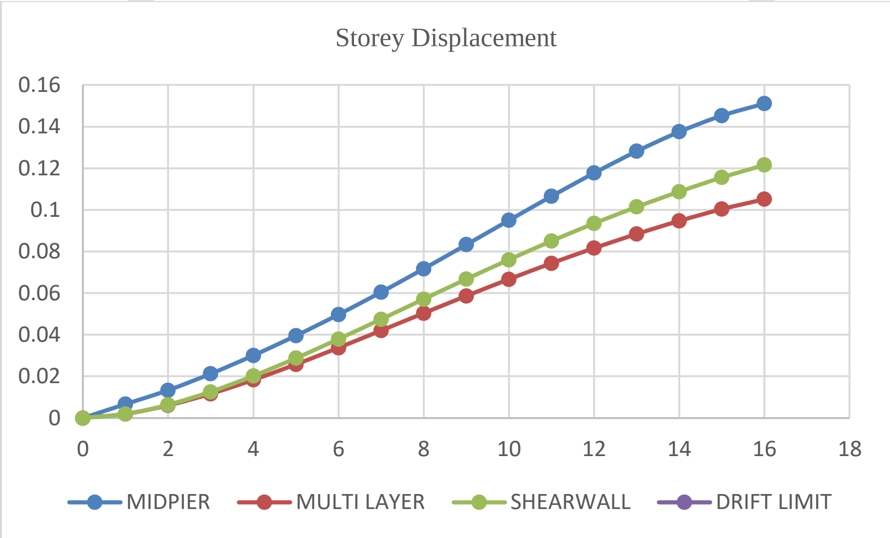

Fig.18 Storey Displacement of G+15 regular building

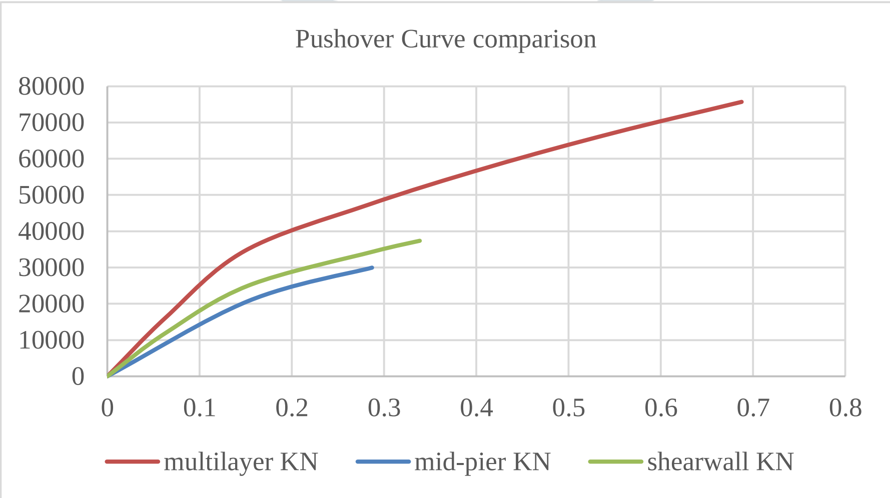

Fig.19 Pushover Curve comparison of G+20 regular building

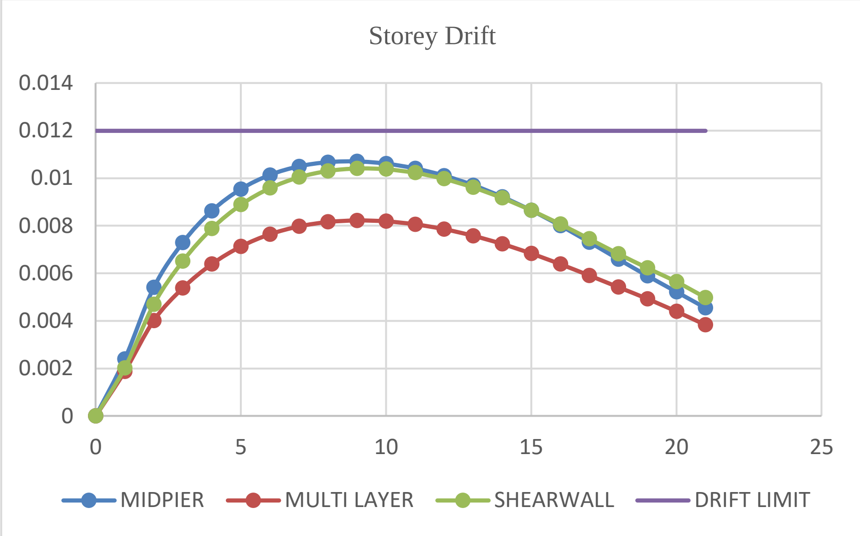

Fig.20 Storey Drift of G+20 regular building

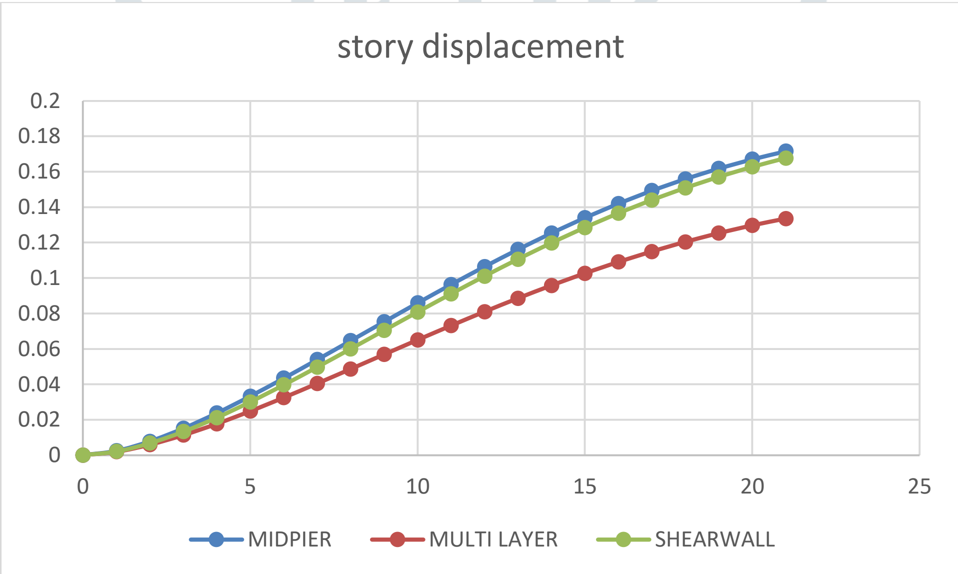

Fig.21 Storey Displacement of G+20 regular building

IV. CONCLUSION

- After analysed all types of model with normal and coupled shear wall, it is clearly shown that the multilayer modelling of shear wall gives better performance in both.
- Story drift of the building is higher in wide column analogues compare to multilayer type of modelling and shear wall in both cases normal and coupled shear wall.
- Story displacement of the building is 199.42% higher in wide column analogues and 19.99% higher in shear wall compare to multilayer type of modelling in G+20, 117.89% higher in wide column analogues and 8.59% higher in shear wall compare to multilayer type of modelling in G+15, 80.88% higher in wide column analogues and 4.63% higher in shear wall compare to multilayer type of modelling in G+10 in normal shear wall.
- Story displacement of the building is 28.51% higher in wide column analogues and 25.57% higher in shear wall compare to multilayer type of modelling in G+20, 43.76% higher in wide column analogues and 15.65% higher in shear wall compare to multilayer type of modelling in G+15, 17.15% higher in wide column analogues and 2.57% higher in shear wall compare to multilayer type of modelling in G+10 in coupled shear wall.
- From the hinge formation at various steps in the analysis is clearly show that, the member is undergoing up to Life of Safety (LS).

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