P: ISSN No. 0976 - 8602 RNI No.UPENG/2012/42622 VOL.-IV, ISSUE-III, July-2015
E: ISSN No. 2349 - 9443
Asian Resonance

Comparative Studies of RCC Column of Different Multistoried Building

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Abstract

Civil engineering is a professional engineering discipline that deals with the design, construction and maintenance of the physical and naturally built environment including buildings. In structural engineering, A reinforced concrete column is a structural members designed to carry compressive loads, composed of concrete with an embedded steel frame to provide reinforcement. A column is supposed to be a vertical member starting from foundation level and transfer the structural load to the ground through foundation. In this paper the RCC column of G+3, G+5 and G+ 10 structures are analyzed. Comparison will be done on bending moment and shear force between these structures. This paper presents the analysis of RCC column by using STAAD PRO V8i.

Keywords: RCC Column, Shear Force and Bending Moment.

1. Introduction

Column in structural engineering is a structural element that transmits the weight of the structure to its lower structural elements. In other words, compression members are often termed "columns" because of the stress conditions. Columns are frequently used to support beams or arches on which the upper parts of walls or ceilings rest. This paper presents the column analysis on multistoried building and analyzed by STAAD PRO V8i. Here G+3, G+5 and G+ 10 structures are analyzed and compared with parameters shear force and bending moment.

2. Building Description

The study is carried out on a building with columns. The layout of the building is shown in the figure. The building considered is a multistory building having G+3, G+5 and G+ 10 structures.

2.1 G+3 Structure

It is a three storey building with one roof. The span of these structures is 6m. The length and width of each floor is 3m. The total height of structure is 12m.This model has been analyzed by creating fixed support on ground storey, by assigning dead load and live load for normal column.

2.2 G+5 Structure

It is a five storey building with one roof. The span of these structures is 6m. The length and width of each floor is 3m. The total height of structure is 18 m. This model has been analyzed by creating fixed support on ground storey, by assigning dead load and live load for normal column.

2.3 G+10 Structure

It is a ten storey building with one roof. The span of these structures is 6m. The length and width of each floor is 3m. The total height of structure is 36 m. This model has been analyzed by creating fixed support on ground storey, by assigning dead load and live load for normal column**.**

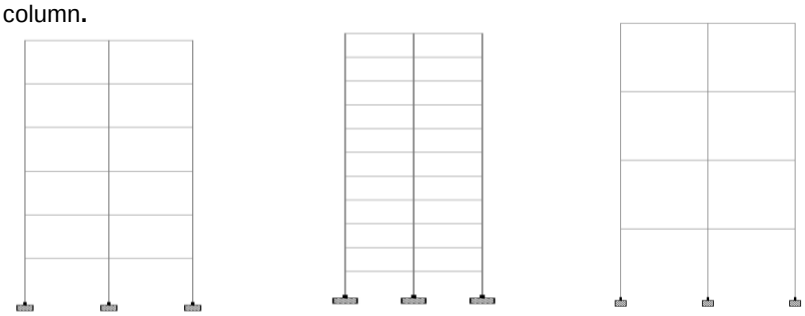


Figure 2.1: Front view of G+ 3, G+ 5, G+ 10 structures

3. Load Combination

For design of reinforced concrete structures, the load combination 1.5(DL + LL) should be used. Because in this paper DL and LL loads are only taken into consideration.

4. Load Considered

The dead load on which self weight of factor in Y direction and live load of uniform force 3KN/m are assigned on each floor as shown below:

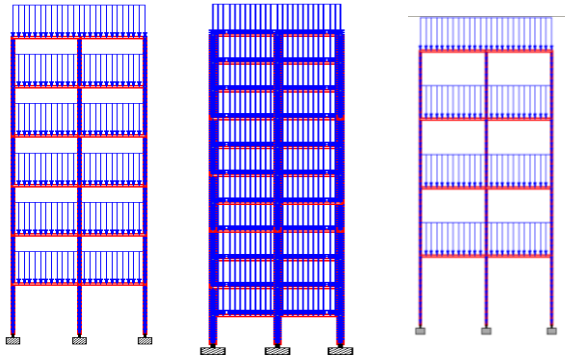


Figure 4.1: Loads taken on different Structure

5. Analysis of G+3, G+5 AND G+10 Structures on Staad Pro V8I

5.1 Analysis on Structures:

After the dead load and live load are assigned the analysis on shear force and bending moment are as shown below:

Shear force: Shear force of G+3 structure on which ground and first floor column is selected and the table as shown below:

Table 5.1: Shear force of normal column of G+ 3 structures

Column	Load	Node	Shear force in X direction (Fx) KN	Shear force in Y direction (Fy) KN	Shear force in Z direction (Fz) KN
77	1 DL	31	7.657	-0.038	-0.043
		34	-6.738	0.038	0.043
	2 LL	31	69.798	-0.319	-0.368
		34	60.798	0.319	0.368
79	1 DL	35	7.657	0.038	-0.043
		36	-6.738	-0.038	0.043
	2 LL	35	69.798	0.319	-0.368
		36	60.798	-0.319	0.368

Shear force of G+5 structure on which ground and first floor column is selected and the table as shown below

Table 5.2: Shear Force of G+ 5 structures for normal column

Column	Load	Node	Shear Force in X direction (Fx) KN	Shear force in Y direction (Fy) KN	Shear force in Z direction (Fz) in KN
109	1 DL	43	11.567	-0.038	-0.044
	2 LL	43	105.387	-0.323	-0.372
111	1DL	45	11.567	0.038	-0.044
	2 LL	45	105.387	0.323	-0.372
114	1 DL	46	9.652	-0.071	-0.080
	2 LL	46	87.934	-0.599	-0.680
116	1 DL	48	9.652	0.071	-0.080
	2 LL	48	87.934	0.599	-0.680

Shear force of G+ 10 structures for normal column if the on which ground and first floor columns is selected as shown and the diagram and table are shown below:

Column	Load	Node	Fx KN	Fy KN	Fz KN
189	1 DL	73	21.611	-0.039	-0.044
	2 LL	73	196.642	-0.327	-0.378
191	1 DL	75	21.611	0.039	-0.044
	2 LL	75	196.642	0.327	-0.378
194	1 DL	76	19.691	-0.072	-0.082
	2 LL	76	179.148	-0.614	-0.695
196	1 DL	78	19.691	0.072	-0.082
	2 LL	78	179.148	0.614	-0.695

Bending Moment

Bending moment diagram of G+3 structure for normal column has been analyzed and the on which ground and first floor column is selected as shown below

Table 5.4: Bending moment for normal column in G+ 3 structures for Columns.

Column	Load	Node	BM in X direction (Mx) KN-m	BM in Y direction (My) KN-m	BM in Z direction (Mz) KN-m
77	1 DL	31	0	0.043	-0.038
		34	-0	0.087	-0.075
	2 LL	31	-0	0.387	-0.319
		34	0	0.737	-0.639
79	1 DL	33	0	0.043	0.038
		36	-0	0.087	0.075
	2 LL	33	-0	0.387	0.319
		36	0	0.737	0.639

Bending moment diagram of G+5 structure for normal column has been analyzed and the on which ground and first floor column is selected as shown below:

Table 5.5: BM of G+ 5 structures for normal column on columns

Column	Load	Node	BM in X direction (Mx) KN-m	BM in Y direction (My) KN-m	BM in Z direction (Mz) in KN-m
109	1 DL	43	-0	0.044	-0.038
	2 LL	43	-0	0.372	-0.322
111	1DL	45	-0	0.044	0.038
	2 LL	45	-0	0.372	0.322
114	1 DL	46	-0	0.124	-0.109
	2 LL	46	-0	1.052	-0.922
116	1 DL	48	-0	0.124	0.109
	2 LL	48	-0	1.052	0.922

Bending moment diagram of G+10 Structure for normal column and the on which ground and first floor columns are selected and the results are as follows:

Table 5.6: BM of G+ 10 structures for normal column on columns

Column	Load	Node	Mx KN-m	My KN-m	Mz KN-m
189	1 DL	73	-0	0.044	-0.039
	2 LL	73	-0	0.377	-0.327
191	1 DL	75	-0	0.044	0.039
	2 LL	75	-0	0.377	0.327
194	1 DL	76	-0	0.126	-0.111
	2 LL	76	-0	1.073	-0.941

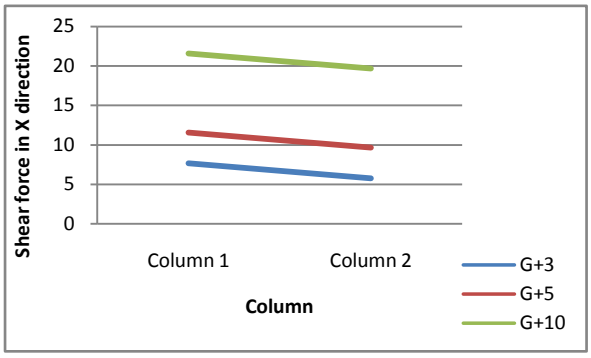
196	1 DL	78	-0	0.126	0.111
	2 LL	78	-0	1.073	0.941

Result and Discussion

The G+3, G+5 and G+ 10 structures are compared with tables and graphs of shear force and bending moment as shown below:

Table 6.1: Shear force in X direction

Column	G+3	G+5	G+10
Column 1	7.657	11.567	21.611
Column 2	5.745	9.652	19.691

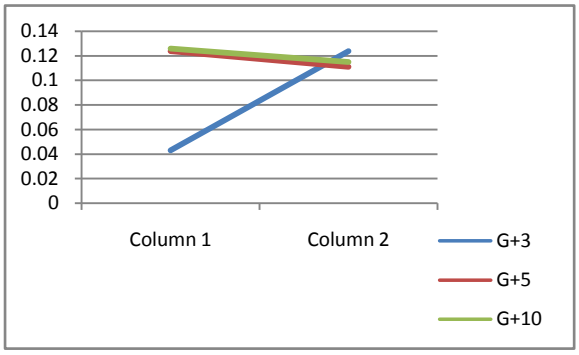


Graph 6.1: Variation of shear force in X direction

here column1 is considered as ground floor and column 2 is first floor column. The variation in shear force shows that the shear force is maximum in column1 for G+10 structure and the shear force increases by 86.8% for G+ 10 structures in column1 and in column2 it increases by 50% for G+10 structure. This means that if the height of structure increases the shear force also increases.

Table 6.3: Bending moment in Y direction

Column	G+3	G+5	G+10
Column 1	0.043	0.124	0.126
Column 2	0.124	0.111	0.115



Graph 6.2: Variation of bending moment in Y direction

The variation in bending moment shows that the bending moment is maximum for column 1 in G+ 10 structures. The bending moment increases by 1.61% in column1 and increases by 3.6% for G+ 10 structures. This means that if the height increases the bending moment also increases.

7. Conclusion

The analysis on normal column for G+3, G+5 and G+ 10 structures shows that if the height of the structure increases to the shear force and bending moment also increases. Following are some conclusion as done on above study:

1. The column shear varies according to the situation and the orientation of columns.
2. The moment at every floor increases and shear force increases but it is same for each floor column.
3. The variation in shear force shows that the shear force is maximum in column1 for G+10 structure and the shear force increases by 86.8% for G+ 10 structures in column1 and in column2 it increases by 50% for G+10 structure. This means that if the height of structure increases the shear force also increases.
4. The variation in bending moment shows that the bending moment is maximum for column 1 in G+ 10 structures. The bending moment increases by 1.61% in column1 and increases by 3.6% for G+ 10 structures. This means that if the height increases the bending moment also increases.

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