Pogressive Collapse Analysis of Multi Storey (G+10) Building by Staad Pro. using Column Removal

SurapuRamlal, PonnanaRamprasad, ChVasudevarao

Abstract: This project presents an attempt to do progressive collapse analysis of multistory (G+10) residential building by STAAD Pro (Structural Analysis and Design Software Application). STAAD Pro is software that helps to analysis and design of low and high-rise buildings and portal frame structures. In this project G+10 RC frame building is analysis statically (linear method) along with Progressive Collapse analysis. In progressive collapse the weight of the building transfers to the neighbour columns in the structure causes to the failure of adjoining members and finally to the failure of partial or whole structure. All the members of the project are analyzed as per Indian codes IS 456:2000, IS 800:2007, and IS 1893:2002 (part1) code using this software. Here the result for is compared between the shear force, bending moment variations value of corner column, Zone1, Zone2, Zone 3 by STAAD Pro. With medium soil type and for Progressive Collapse analysis GSA guidelines are followed.
As per GSA guidelines three column removal cases for each case1, case2, case3 one at a time has studied, namely Corner column removal, Exterior column removal and interior column removal all at ground floor.

Key Words: Progressive collapse analysis, GSA Guidelines, Column removal cases.

I. INTRODUCTION

Generally, we consider Self weight, dead loads, Live Loads, wind loads and Earthquake loads for Static and dynamic Analysis. However, after doing static and dynamic analysis also we not sure the structure is safe against local failure due to sudden loss of Column in the structure or abnormal loading like blast of cylinder or due to terrorist attack. So, we have move one step further and check our building against failure of Column at different location in ground floor as per General Service Administration (GSA) guidelines.

Now a day in advance countries, the building is built considering the progressive collapse. Progressive collapse results help to know the behavior of the building generally Progressive Collapse occurs when one of the major load carrying element failed due to some reason such as blast of cylinder or terrorist attack, due to failure of major element load carried by major element is distributed to adjacent elements which increases load on adjacent member more than its capacity and due to which adjacent member also get

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failed and transfers loads to its adjacent member. The process is continuing until all the structure gets failed.

1.1 GUIDELINES OF GSA

1.1.1 Facility security levels (FSL):

The facility security level resolve to define the norms and process for determining the FSL of a federal facility, which categorizes facilities, depend on the analysis of several security-related facility factors, including its target attractiveness, as well as its value or criticality.

1.1.2 FSL I & II:

Specified the low occupancy and risk level correlated with these types of facilities, progressive collapse design is not preferred for FSL I and II, irrespective of the number of floors.

1.1.3 FSL III &IV:

These Guidelines are relevant to FSL III and IV buildings with four stories or more sustained from the lowest point of exterior grade to the highest point of elevation. Uninhabited floors such as mechanical penthouses or parking shall not be considered a story. It shall implement both the Alternate Path and Redundancy design procedures.

1.1.4 FSL V:

These Guidelines are used for all FSL V buildings regardless of number of floors. FSL V facilities shall implement the Alternate Path method for identification of vertical load resisting element removal area. Redundancy design procedures not required for FSL V facilities.

II. LITRATURE REVIEW

- S. Mahesh et al (2014)[11] has published a journal on "Comparison of analysis and design of regular and irregular configuration of multi-Story building in various seismic zones and various types of soils using ETABS and STAAD" to know the behavior of G+11 multi story building of regular and irregular configuration under earth quake is complex and it varies of wind loads are assumed to act simultaneously with earth quake loads. In that paper a residential of G+11 multi story building was studied for earth quake and wind load using ETABS and STAAD PRO V8i. Assuming that material property is linear static and dynamic analysis ware performed. These analyses were

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carried out by considering different seismic zones and for each zone the behavior was assessed by taking three different types of soils namely Hard, Medium and Soft. Different response like story drift, displacements base shear was plotted for different zones and different types of soils.

- S.S. Patil et al (2013)[10]has published a journal "Seismic Analysis of High-Rise Building by Response Spectrum Method" to analyzed high rise buildings by response spectrum method using STAADPRO with various conditions of lateral stiffness system. Analysis was done with response spectrum method. Analysis produced the effect of higher modes of vibration & actual distribution of forces in elastic range in a better way. Test results including base shear, story drift and story deflections were presented and got effective lateral load resisting system.

III. METHODOLOGY

To meets the basic requirements such as safety, durability, economy, aesthetic appearance, feasibility, practicability and acceptability following methodology is followed.
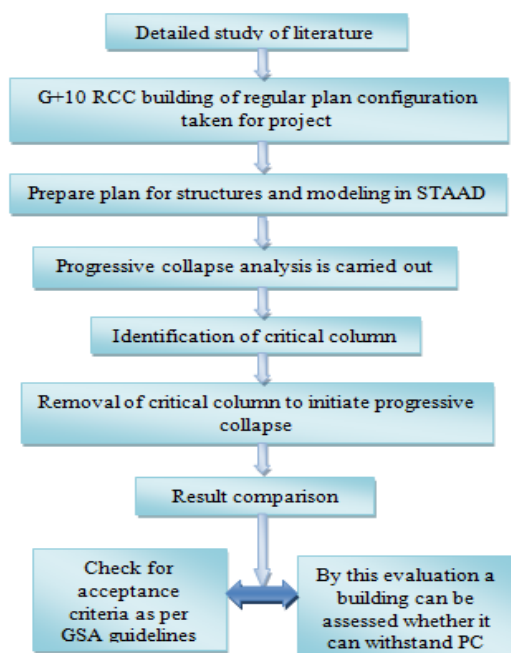
3.1. Modeling and Loading:

In STAAD PRO. First Modeling of multistory building which is to be analysis is done. In modeling material to be used to build the structure is defined. The input data used for modeling are as follows:

- Building type: G+10 Residential Building
- Plan area: 25(m)*25(m)
- Beam size: 300(mm)*300 (mm)
- Column size: 350(mm)*350 (mm)
- Slab thickness: 150mm
- Typical story height: 3m
- Bottom story height: 3m
- Live load, LL: 3kN/m² External Wall load: 10.4 KN/m
- Partition and floor finishing load, FL: 1.5kN/m^2

- Soil type: Type II (Medium Soil)
- Materials: M25 and Fe415 Grade
- Soil Bearing Capacity 200 KN/m^2
- Earthquake Direction: X and Y Seismic is defined
  - Zone: III -Zone factor 0.16,
- For Progressive Collapse Analysis: In Each Cases further there are 3 Cases they are:
  i) Corner Column Removal.
  ii) Exterior Column Removal.
  iii) Interior Column Removal.
- First a Response Spectrum function is defined for above 4 different Zones with Function Damping Ratio as 0.05.
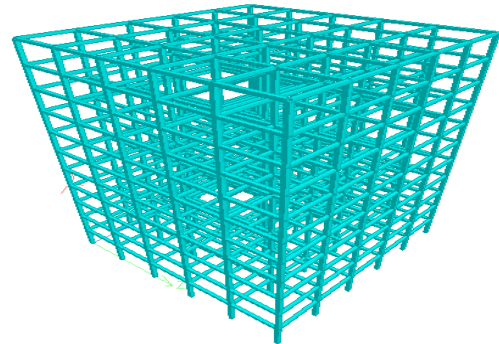
Fig 1.1 G+10 modeling using STAAD PRO.

IV. RESULT AND DISCUSSIONS

The result obtained for the Shear force, bending moment, for different column removal cases are shown in respective Table and Graph and with discussions.

4.1. CORNER COLUMN

SHEAR FORCE VARIATIONS:-
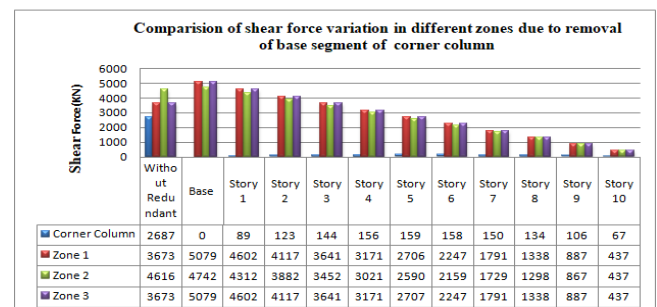
	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	2687	0	89	123	144	156	159	158	150	134	106	67
Zone 1	3673	5079	4602	4117	3641	3171	2706	2247	1791	1338	887	437
Zone 2	4616	4742	4312	3882	3452	3021	2590	2159	1729	1298	867	437
Zone 3	3673	5079	4602	4117	3641	3171	2707	2247	1791	1338	887	437

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 38.27%, 2.73% and 38.27% in zone-1, zone-2 and zone-3 columns respectively when compared with the base segment was removed.

Due to removal of ground floor column mostly effected zones are zone1 and zone3.
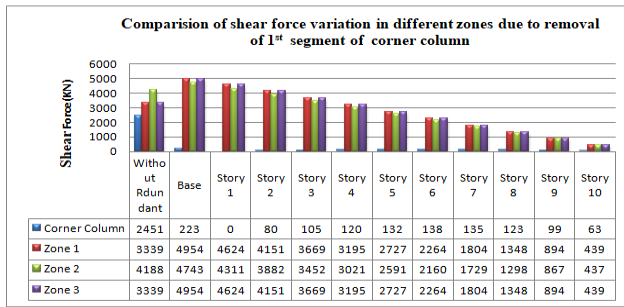
Comparision of shear force variation in different zones due to removal of 1st segment of corner column

	Without Rdundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	2451	223	0	80	105	120	132	138	135	123	99	63
Zone 1	3339	4954	4624	4151	3669	3195	2727	2264	1804	1348	894	439
Zone 2	4188	4743	4311	3882	3452	3021	2591	2160	1729	1298	867	437
Zone 3	3339	4954	4624	4151	3669	3195	2727	2264	1804	1348	894	439

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 48.37%, 13.26% and 48.37% in zone-1, zone-2 and zone-3 columns respectively when compared with the 1st segment was removed.

Due to removal of 1st floor column mostly effected zones are zone1 and zone3.

Comparision of shear force variation in different zones due to removal of 2nd segment of cornercolumn

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	2212	470	135	0	72	91	108	118	119	111	91	60
Zone 1	3005	4818	4493	4169	3699	3219	2748	2281	1818	1358	900	442
Zone 2	3763	4739	4308	3878	3449	3019	2589	2158	1728	1297	866	437
Zone 3	3005	4818	4493	4169	3699	3220	2748	2281	1818	1358	900	442

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 60.34%, 25.94% and 60.34% in zone-1, zone-2 and zone-3 columns respectively when compared with the 2nd segment was removed.

Due to removal of 2nd floor column mostly effected zones are zone1 and zone3.

Comparision of shear force variation in different zones due to removal of 3rd segment of corner column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	1917	727	491	244	0	66	85	98	103	99	84	56
Zone 1	2671	4678	4352	4033	3714	3246	2769	2298	1831	1368	906	445
Zone 2	3341	4732	4301	3872	3442	3014	2584	2155	1725	1295	865	436
Zone 3	2671	4678	4352	4033	3714	3246	2769	2298	1837	1368	906	445

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 75.15%, 41.64% and 75.15% in zone-1, zone-2 and zone-3 columns respectively when compared with the 3rd segment was removed.

Due to removal of 3rd floor column mostly effected zones are zone1 and zone3.

Comparision of shear force variation in different zones due to removal of 4th segment of corner column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	1728	990	752	505	251	0	62	78	87	87	76	53
Zone 1	2337	4538	4211	3890	3575	3259	2793	2316	1846	1378	913	449
Zone 2	2920	4722	4292	3863	3434	3005	2578	2149	1721	1292	863	435
Zone 3	2337	4538	4211	4722	3575	3259	2793	2316	1846	1378	913	449

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 94.19%, 61.72% and 94.19% in zone-1, zone-2 and zone-3 columns respectively when compared with the 4th segment was removed.

Due to removal of 4th floor column mostly effected zones are zone1 and zone3.

Comparision of shear force variation in different zones due to removal of 5th segment of corner column

	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	1255	1015	768	515	255	0	58	71	74	67	49
Zone 1	4400	4072	3748	3430	3118	2802	2337	1861	1389	921	452
Zone 2	4709	4279	3851	3424	2996	2568	2142	1715	1288	860	434
Zone 3	4398	4072	3748	3430	3118	2802	2337	1861	1389	921	452

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 7.46%, 9.14% and 7.42% in zone-1, zone-2 and zone-3 columns respectively when compared with the 5th segment was removed.

Due to removal of 5th floor column mostly effected zones are zone2.

Comparision of shear force variation in different zones due to removal of 6th segment of corner column

	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	1516	1277	1030	777	520	256	0	54	62	59	45
Zone 1	4264	3935	3609	3288	2971	2659	2343	1878	1401	928	456
Zone 2	4695	4265	3838	3411	2985	2559	2133	1708	1283	857	232
Zone 3	4264	3935	3609	3288	2971	2659	2343	1878	1401	928	456

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 7.72%, 9.16% and 7.72% in zone-1, zone-2 and zone-3 columns respectively when compared with the 6th segment was removed.

Due to removal of 6th floor column mostly effected zones are zone2.

Comparision of shear force variation in different zones due to removal of 7th segment of corner column

	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	1772	1533	1287	1036	781	521	257	0	51	51	43
Zone 1	4132	3801	3474	3150	2829	2512	2199	1880	1414	935	459
Zone 2	4679	4249	3823	3397	2972	2548	2124	1699	1277	853	430
Zone 3	4132	3801	3474	3150	2829	2512	2199	1880	1414	935	459

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 8.02%, 9.19% and 8.02% in zone-1, zone-2 and zone-3 columns respectively when compared with the 7th segment was removed.

Due to removal of 7th floor column mostly effected zones are zone2.

Comparison of shear force variation in different zones due to removal of 8th segment of corner column

Shear Force(KN)

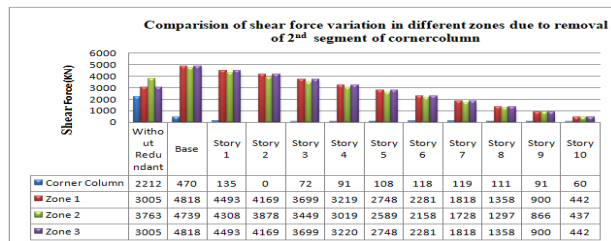|	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	2019	1781	1537	1288	1035	779	519	255	0	46	42
Zone 1	4003	3671	3342	3015	2691	2369	2050	1733	1411	944	462
Zone 2	4662	4233	3807	3382	2958	2535	2113	1691	1269	848	428
Zone 3	4003	3671	3342	3015	2691	2369	2050	1733	1411	944	462

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 8.30%, 9.21% and 8.30% in zone-1, zone-2 and zone-3 columns respectively when compared with the 8th segment was removed.

Due to removal of 8th floor column mostly effected zones are zone2.

Comparison of shear force variation in different zones due to removal of 9th segment of corner column

Shear Force(KN)

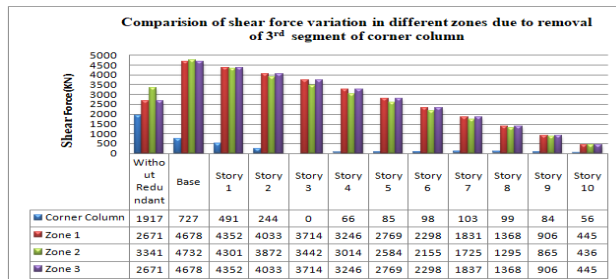|	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	492	2256	2018	1776	1530	1280	1027	772	514	253	0	45
Zone 1	667	3879	3546	3215	2885	2557	2231	1907	1583	1262	935	466
Zone 2	836	4645	4216	3791	3367	2944	2523	2102	1682	1263	843	426
Zone 3	667	3878	3545	3214	2885	2557	2231	1907	1583	1262	935	466

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 481.56%, 9.14% and 481.5% in zone-1, zone-2 and zone-3 columns respectively when compared with the 9th segment was removed.

Due to removal of 9th floor column mostly effected zones are zone1 and zone3.

Comparision of shear force variation in different zones due to removal of 10th segment of corner column

Shear Force(KN)

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	242	2478	2141	2001	1757	1511	1262	1011	758	504	247	0
Zone 1	334	3762	3429	3096	2764	2433	2102	1773	1444	1116	789	455
Zone 2	424	4623	4195	3770	3346	2925	2505	2085	1667	1250	833	415
Zone 3	334	3762	3429	3096	2764	2433	2102	1773	1444	1116	789	455
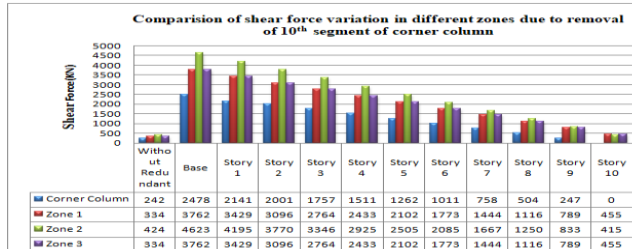
From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 1026.35%, 990.34% and 1026.35% in zone-1, zone-2 and zone-3 columns respectively when compared with the 10th segment was removed.

Due to removal of 10th floor column mostly effected zones are zone1 and zone3.
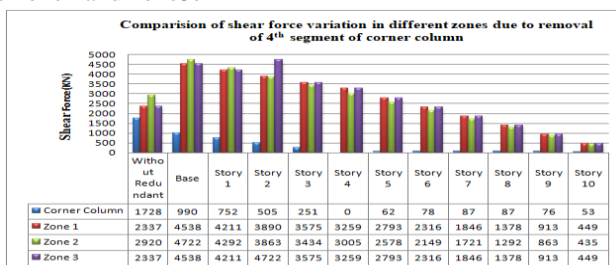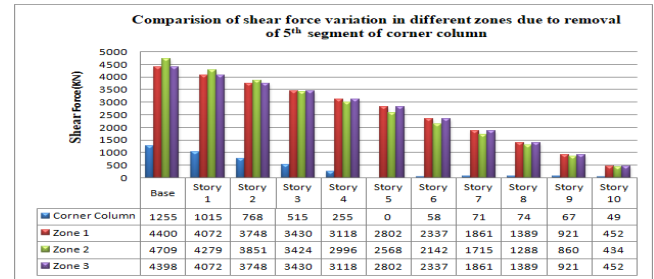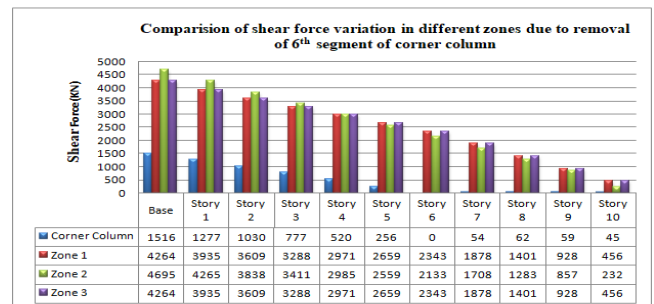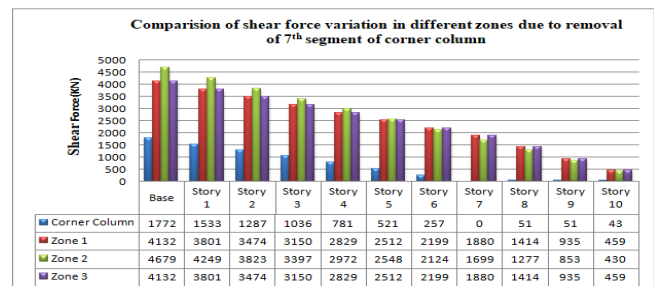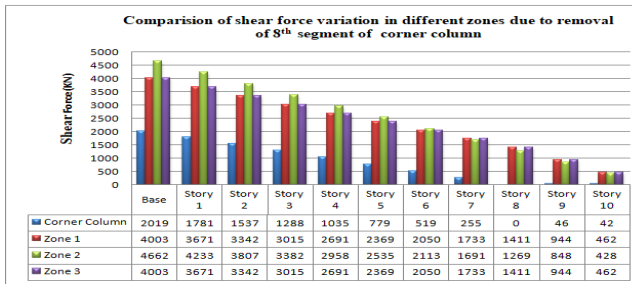
BENDING MOMENT VARIATIONS:-

Comparison of bending moment variation in different zones due to removal of base segment of column

Bending Moment (KNm)

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	124	0	222	126	126	122	117	112	106	98	91	124
Zone 1	151	221	192	205	194	190	183	174	162	147	123	148
Zone 2	153	150	121	112	110	108	103	96	86	73	53	37
Zone 3	124	124	45	35	34	33	31	28	24	17	12	26

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 46.36%, 1.97% and 0% in zone-1, zone-2 and zone-3 columns respectively when compared with the base segment was removed.

Due to removal of base floor column mostly effected zones are zone1.

Comparision of bending moment variation in different zones due to removal of 1st segment of corner column

Bending Moment (KNm)

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	45	153	0	218	123	124	119	114	108	101	94	130
Zone 1	124	158	200	185	200	190	184	176	164	149	124	151
Zone 2	124	154	124	112	110	107	103	96	86	73	53	37
Zone 3	44	126	45	37	34	33	31	28	24	17	12	25

From the above graphical representation, it was observed that the bending moment My was increased to maximum by 27.42%, 24.20% and 186.37% in zone-1, zone-2 and zone-3 columns respectively when compared with the 1st segment was removed.

Due to removal of 1st floor column mostly effected zones are zone3.

Comparision of bending moment variation in different zones due to removal of 2nd segment of corner column

Bending Moment (KNm)

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	36	132	54	0	214	121	121	116	110	104	97	134
Zone 1	113	165	126	203	183	194	184	177	165	151	126	154
Zone 2	115	157	128	116	112	107	102	95	85	72	52	37
Zone 3	35	128	45	41	35	33	31	28	24	17	12	25

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 46.02%, 36.53% and 265.72% in zone-1, zone-2 and zone-3 columns respectively when compared with the 2nd segment was removed.

Due to removal of 2nd floor column mostly effected zones are zone3.

Comparision of bending moment variation in different zones due to removal of 3rd segment of corner column

Bending Moment (KNm)

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	32	130	45	48	0	208	119	118	112	106	99	138
Zone 1	110	158	130	113	201	179	186	177	167	152	128	156
Zone 2	112	156	129	117	116	109	102	94	84	72	52	36
Zone 3	32	128	46	37	42	34	30	27	23	16	11	27

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 43.64%, 39.29% and 300% in zone-1, zone-2 and zone-3 columns respectively when compared with the 3rd segment was removed.

Due to removal of 3rd floor column mostly effected zones are zone3.

Comparision of bending moment variation in different zones due to removal of 4th segment of corner column

Bending Moment (KNm)

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	31	127	45	33	41	0	202	116	115	107	101	142
Zone 1	107	155	126	117	120	197	174	179	166	154	130	157
Zone 2	109	156	128	118	117	113	103	94	84	71	51	36
Zone 3	31	127	46	202	36	40	32	27	23	16	11	26

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 44.86%, 43.12% and 309.68% in zone-1, zone-2 and zone-3 columns respectively when compared with the 4th segment was removed.

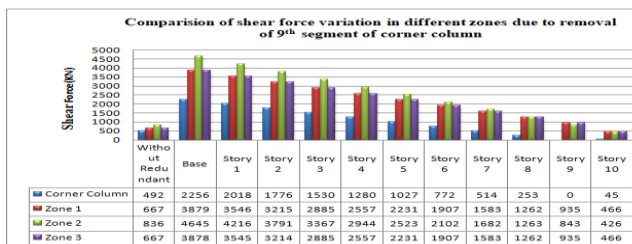Due to removal of 4th floor column mostly effected zones are zone3.

Comparision of bending moment variation in different zones due to removal of 5th segment of corner column

	Witho ut Redu ndant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	28	125	44	33	26	34	0	194	113	110	102	145
Zone 1	101	153	125	114	112	100	190	167	169	153	131	158
Zone 2	104	155	128	118	117	114	108	96	83	70	50	35
Zone 3	29	126	46	38	35	35	38	29	22	15	10	27

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 51.49%, 49.04% and 334.49% in zone-1, zone-2 and zone-3 columns respectively when compared with the 5th segment was removed.

Due to removal of 5th floor column mostly effected zones are zone3.

Comparision of bending moment variation in different zones due to removal of 6th segment of corner column

	Witho ut Redu ndant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	25	124	125	33	26	22	26	0	184	108	103	148
Zone 1	98	152	124	113	108	107	92	182	157	155	131	158
Zone 2	97	154	127	117	115	113	107	100	85	70	49	34
Zone 3	25	125	45	37	35	34	35	34	24	15	10	28

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 55.11%, 58.77% and 400% in zone-1, zone-2 and zone-3 columns respectively when compared with the6th segment was removed.
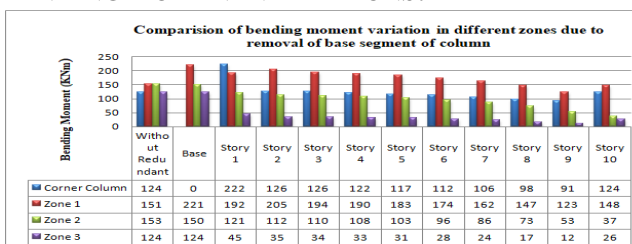
Due to removal of 6th floor column mostly effected zones are zone3.

Comparision of bending moment variation in different zones due to removal of 7th segment of corner column

	Witho ut Redu ndant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	13	124	43	33	27	24	21	17	0	177	100	450
Zone 1	83	151	123	112	108	104	101	83	171	144	132	156
Zone 2	87	153	127	117	115	112	108	101	89	71	49	33
Zone 3	21	125	45	37	34	33	32	29	29	16	9	29

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 81.93%, 75.87% and 495.24% in zone-1, zone-2 and zone-3 columns respectively when compared with the 7th segment was removed.
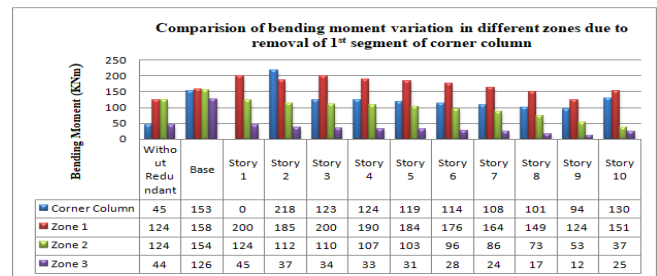
Due to removal of 7th floor column mostly effected zones are zone3.

Comparision of bending moment variation in different zones due to removal of 8th segment of corner column

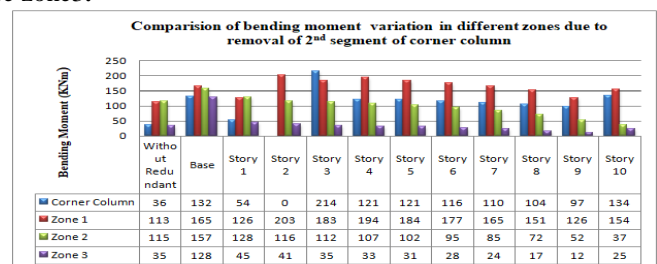|	Witho ut Redu ndant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	13	123	44	34	28	26	22	19	6	0	171	149
Zone 1	70	151	123	112	108	104	99	93	75	156	122	153
Zone 2	74	153	126	116	114	111	107	100	90	75	50	32
Zone 3	14	125	44	36	33	32	31	28	24	21	10	30

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 55.11%, 58.77% and 400% in zone-1, zone-2 and zone-3 columns respectively when compared with the 8th segment was removed.

Due to removal of 8th floor column mostly effected zones are zone3.

Comparision of bending moment variation in different zones due to removal of 9th segment of corner column

	Witho ut Redu ndant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	9	123	44	34	30	27	24	20	17	8	0	165
Zone 1	51	151	123	112	109	105	99	92	82	65	129	144
Zone 2	55	153	126	115	113	110	106	99	89	76	54	33
Zone 3	10	124	44	36	33	32	30	27	23	16	15	31

From the above graphical representation, it was observed that the bending moment My was increased to maximum by 196.08%, 178.19% and 1140% in zone-1, zone-2 and zone-3 columns respectively when compared with the 9th segment was removed.

Due to removal of 9th floor column mostly effected zones are zone3.

Comparision of bending moment variation in different zones due to removal of 10th segment of corner column

	Witho ut Redu ndant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	35	123	44	35	31	29	26	22	17	14	21	0
Zone 1	32	151	123	112	109	106	100	92	82	69	40	177
Zone 2	36	153	125	115	113	110	105	98	88	75	57	33
Zone 3	35	124	44	36	32	31	29	26	22	16	6	4

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 371.88%, 325% and 254.29% in zone-1, zone-2 and zone-3 columns respectively when compared with the 10th segment was removed.

Due to removal of 10th floor column mostly effected zones are zone1.

4.2. EXTERIOR COLUMN

SHEAR FORCE VARIATIONS:-

Comparision of shear force variation in different zones due to removal of base segment of exterior column

	Witho ut Redun dant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	3706	0	120	167	195	207	207	195	174	150	115	72
ZONE 1	3705	4976	4497	4024	3558	3100	2647	2199	1755	1313	873	434
ZONE 2	4644	4756	4327	3898	3467	3036	2604	2171	1738	1305	871	438
ZONE 3	4644	5723	5175	4626	4088	3559	3037	2522	2010	1504	1001	498
ZONE 4	4616	4728	4298	3868	3439	3009	2580	2150	1721	1293	864	437
ZONE 5	3673	4949	4468	3995	3530	3072	2623	2178	1737	1300	865	432

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 35.31%, 2.42%, 23.24%, 2.43% and 34.74% in zone-1, zone-2, zone-3, zone-4and zone-5 columns respectively when compared with the base segment was removed.

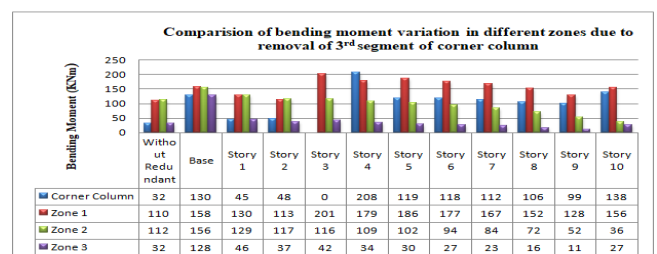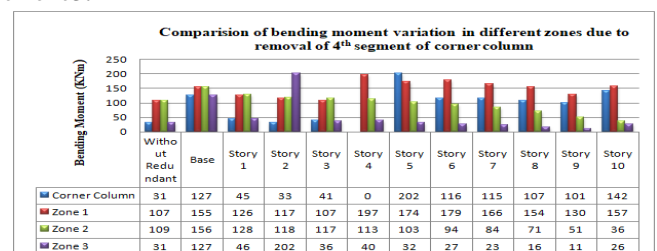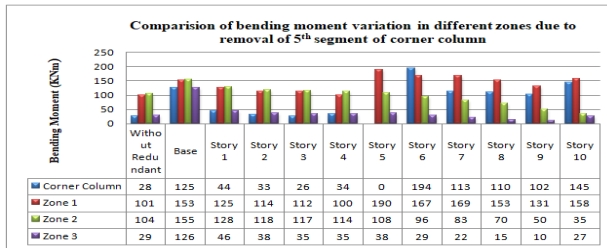Due to removal of base floor column mostly effected zones are zone1.

Comparision of shear force variation in different zones due to removal of 1st segment of exterior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	3374	338	0	106	142	161	167	163	154	135	106	67
ZONE 1	3374	4846	4524	4049	3581	3119	2663	2212	1765	1320	878	437
ZONE 2	4217	4755	4326	3897	3467	3036	2604	2171	1738	1305	871	438
ZONE 3	4216	5612	5191	4649	4107	3576	3051	2533	2020	1511	1005	500
ZONE 4	4188	4728	4297	3868	3438	3009	2580	2151	1722	1293	864	437
ZONE 5	3339	4820	4495	4019	3552	3092	2638	2190	1747	1307	870	435

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 30.38%, 12.76%, 33.12%, 12.92% and 44.39% in zone-1, zone-2, zone-3, zone-4and zone-5 columns respectively when compared with the 1st segment was removed.

Due to removal of 1st floor column mostly affected zones are zone5.

Comparision of shear force variation in different zones due to removal of 2nd segment of exterior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	3039	703	355	0	45	121	133	137	133	120	96	63
ZONE 1	3039	4714	4391	4074	3603	3138	2679	2225	1775	1328	883	439
ZONE 2	3793	4751	4322	3893	3464	3033	2602	2169	1737	1304	870	437
ZONE 3	3793	5493	5077	4665	4130	3593	3066	2546	2030	1518	1009	503
ZONE 4	3763	4724	4293	3864	3435	3006	2578	2149	1720	1292	863	436
ZONE 5	3005	4686	4361	4044	3574	3111	2654	2204	1475	1315	875	437

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 55.12%, 25.26%, 44.82%, 25.54% and 55.95% in zone-1, zone-2, zone-3, zone-4and zone-5 columns respectively when compared with the 2nd segment was removed.

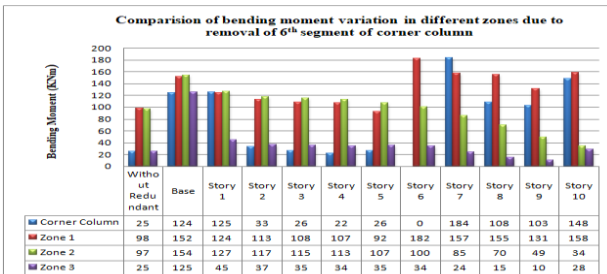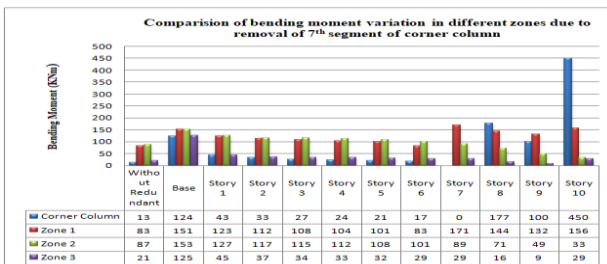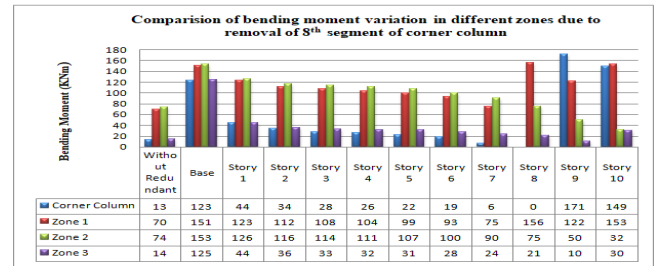Due to removal of 2nd floor column mostly effected zones are zone 5.

Comparision of shear force variation in different zones due to removal of 3rd segment of exterior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	2704	1076	730	367	0	85	103	111	113	106	86	58
ZONE 1	2704	4580	4256	3938	3625	3158	2696	2239	1786	1336	889	442
ZONE 2	3369	4744	4316	3887	3458	3028	2598	2166	1734	1302	869	437
ZONE 3	3369	5377	4958	4550	4145	3614	3083	2559	2040	1526	1015	505
ZONE 4	3341	4716	4286	3858	3429	3002	2574	2146	1718	1290	861	436
ZONE 5	2671	4551	4225	3907	3596	3131	2671	2217	1768	1323	880	440

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 69.36%, 40.82%, 37.35%, 41.16% and 70.39% in zone-1, zone-2, zone-3, zone-4and zone-5 columns respectively when compared with the 3rd segment was removed.

Due to removal of 3rd floor column mostly effected zones are zone 5.

Comparision of shear variation in different zones due to removal of 4th segment of exterior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	2368	1452	1107	748	375	0	76	88	95	92	77	54
ZONE 1	2368	4449	4123	3803	3488	3178	2714	2253	1797	1344	894	444
ZONE 2	2947	4734	4306	3878	3450	3021	2592	2160	1731	1299	867	436
ZONE 3	2947	5263	4844	4432	4629	3628	3102	2573	2052	1534	1020	508
ZONE 4	2920	4707	4277	3849	3422	2994	2568	2141	1714	1287	860	435
ZONE 5	2337	4419	4092	3772	3458	3150	2688	2232	1780	1331	886	443

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 87.89%, 60.64%, 78.59%, 61.20% and 89.09% in zone-1, zone-2, zone-3, zone-4and zone-5 columns respectively when compared with the 4th segment was removed.

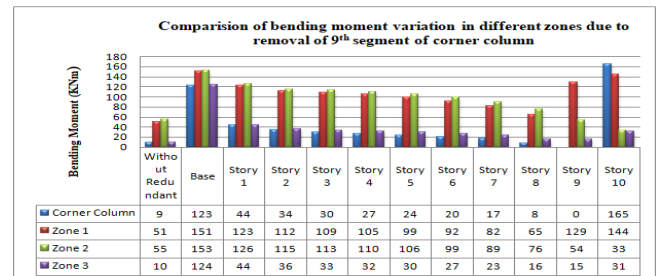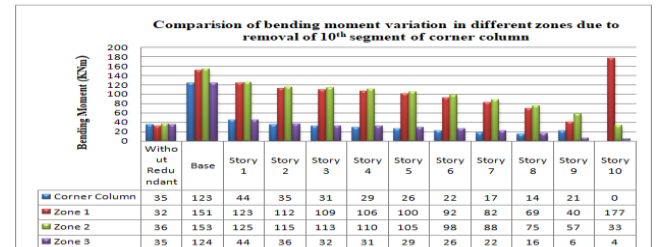Due to removal of 4th floor column mostly effected zones are zone 5.

Comparision of shear force variation in different zones due to removal of 5th segment of exterior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	2030	1822	1479	1124	757	379	0	69	77	78	69	49
ZONE 1	2030	4321	3994	3672	3353	3040	2730	2268	1809	1353	900	446
ZONE 2	2525	4722	4295	3868	3440	3010	2584	2155	1726	1296	865	435
ZONE 3	2525	5154	4733	4320	3913	3513	3114	2590	2064	1544	1026	511
ZONE 4	2501	4695	4265	3838	3412	2986	2560	2135	1709	1284	858	434
ZONE 5	2003	4291	3963	3640	3323	3011	2705	2259	1791	1340	892	445

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 112.86%, 87.01%, 104.12%, 87.73% and 114.23% in zone-1, zone-2, zone-3, zone-4 and zone-5 columns respectively when compared with the5th segment was removed.

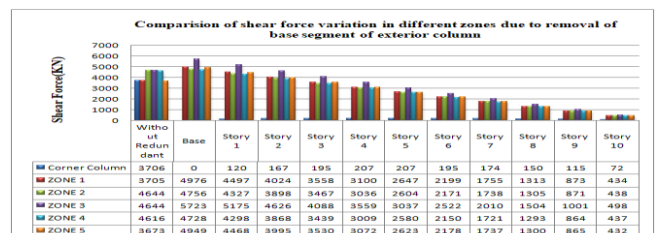Due to removal of 5th floor column mostly effected zones are zone 5.

Comparision of shear force variation in different zones due to removal of 6th segment of exterior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	1693	2183	1842	1490	1129	759	378	0	62	65	60	45
ZONE 1	1693	4199	3871	3546	3224	2906	2592	2281	1820	1362	905	450
ZONE 2	2104	4709	4282	3855	3429	3002	2575	2147	1720	1291	862	433
ZONE 3	2104	5050	4628	4212	3802	3397	2999	2600	2007	1553	1033	514
ZONE 4	2083	4682	4252	3826	3400	2975	2551	2127	1703	1279	855	432
ZONE 5	1669	4168	3838	3514	3193	2877	2567	2259	1802	1348	897	448

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 148.03%, 123.82%, 140.01%, 124.78% and 149.74% in zone-1, zone-2, zone-3, zone-4 and zone-5 columns respectively when compared with the 6th segment was removed.

Due to removal of 6th floor column mostly effected zones are zone 5.

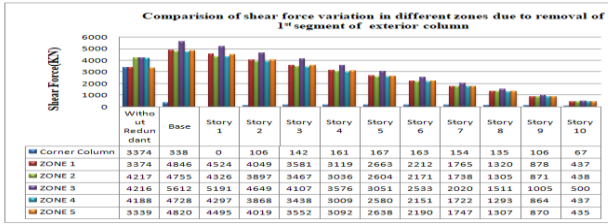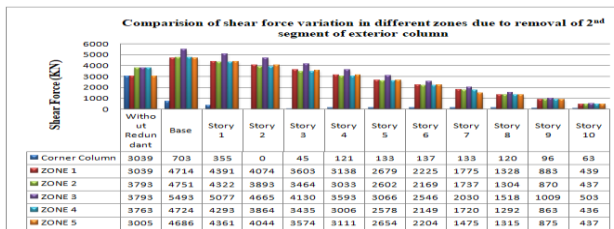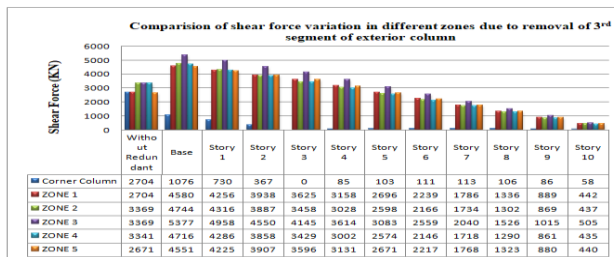**Comparision of shear force variation in different zones due to removal of 7th segment of exterior column**

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Column1	1354	2529	2190	1842	1486	1124	753	375	0	56	52	42
ZONE 1	1354	4083	3754	3427	3102	2780	2460	2144	1830	1370	911	452
ZONE 2	1683	4695	4268	3842	3416	2991	2565	2139	1712	1286	859	432
ZONE 3	1683	4952	4529	4111	3698	3289	2885	2486	2084	1564	1039	517
ZONE 4	1667	4668	4239	3813	3388	2964	2541	2118	1696	1274	851	431
ZONE 5	1335	4051	3721	3394	3070	2750	2434	2122	1812	1356	902	450

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 201.56%, 179.97%, 194.24%, 180.03% and 203.45% in zone-1, zone-2, zone-3, zone-4 and zone-5 columns respectively when compared with the 7th segment was removed.

Due to removal of 7th floor column mostly effected zones are zone 5.

Comparision of shear force variation in different zones due to removal of 8th segment of exterior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	1015	2856	2519	2175	1825	1469	1108	741	368	0	50	42
ZONE 1	1015	3974	3644	3315	2987	2661	2336	2014	1694	1375	915	454
ZONE 2	1268	4681	4254	3829	3403	2979	2554	2130	1704	1280	855	430
ZONE 3	1263	4860	4437	4017	3601	3188	2779	2373	1971	1566	1046	519
ZONE 4	1251	4654	4225	3799	3375	2952	2530	2109	1688	1268	848	430
ZONE 5	1001	3942	3610	3281	2955	2631	2310	1991	1676	1362	907	452

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 292.53%, 269.25%, 284.80%, 272.03% and 293.81% in zone-1, zone-2, zone-3, zone-4 and zone-5 columns respectively when compared with the 8th segment was removed.

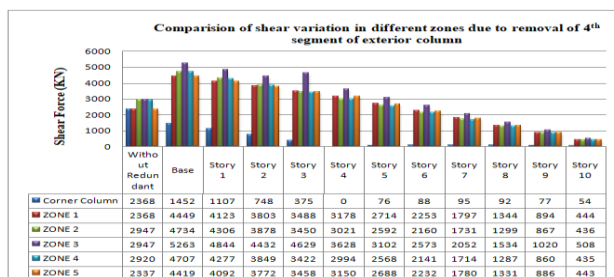Due to removal of 8th floor column mostly effected zones are zone 5.

Comparision of shear force variation in different zones due to removal of 9th segment of exterior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Column1	676	3162	2827	2486	2142	1793	1440	1084	724	359	0	44
ZONE 1	676	3872	3541	3210	2879	2549	2220	1892	1566	1240	915	555
ZONE 2	844	4667	4240	3815	3391	2967	2543	2120	1697	1274	850	428
ZONE 3	844	4776	4351	3930	3511	3094	2680	2269	1860	1454	1043	523
ZONE 4	836	4640	4211	3786	3362	2940	2519	2100	1680	1262	843	427
ZONE 5	667	3840	3507	3176	2847	2519	2193	1869	1547	1226	907	453

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 472.79%, 452.97%, 465.88%, 455.03% and 475.72% in zone-1, zone-2, zone-3, zone-4 and zone-5 columns respectively when compared with the 9th segment was removed.

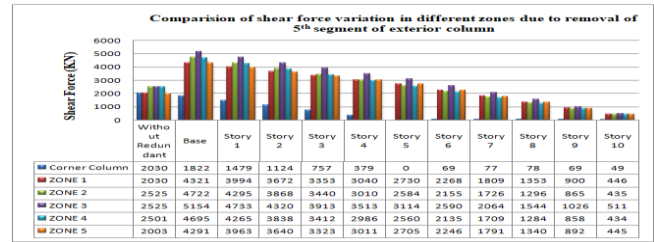Due to removal of 9th floor column mostly effected zones are zone 5.

Comparision of shear force variation in different zones due to removal of 10th segment of exterior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	336	3442	3108	2771	2431	2089	1745	1348	1049	698	343	0
ZONE 2	336	3784	3452	3119	2786	2453	2119	1786	1454	1121	789	458
ZONE 3	425	4653	4226	3801	3378	2954	2532	2110	1688	1267	846	424
ZONE 4	425	4691	4265	3840	3420	3000	2582	2165	1749	1335	923	505
ZONE 5	424	4625	4197	3772	3343	2928	2508	2089	1672	1255	838	455
ZONE 6	334	3751	3418	3085	2753	2423	2092	1763	1435	1108	781	455

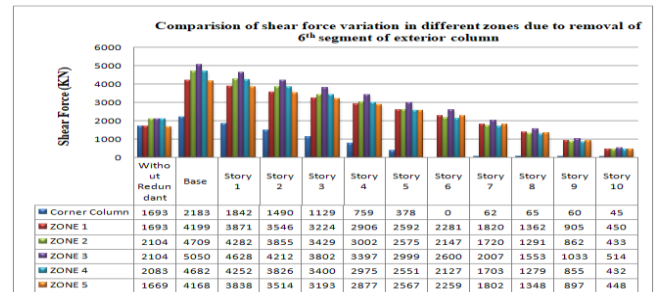From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 1026.20%, 995.06%, 988.24%, 990.81% and 1024.06% in zone-1, zone-2, zone-3, zone-4 and zone-5 columns respectively when compared with the 10th segment was removed.

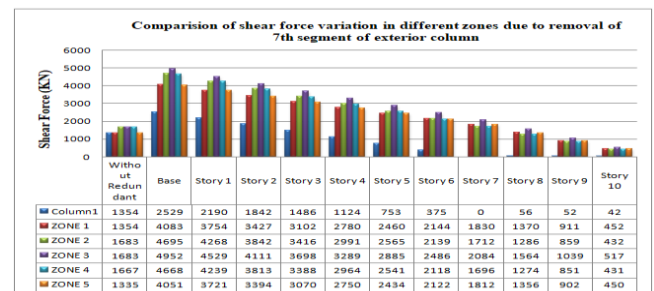Due to removal of 10th floor column mostly effected zones are zone 1.

BENDING MOMENT VARIATIONS:-

Comparision of bending moment variation in different zones due to removal of base segment of exterior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	151	0	352	107	110	107	103	97	87	74	58	37
ZONE 1	151	126	9	13	12	13	10	6	3	16	24	83
ZONE 2	152	153	119	110	107	104	99	92	83	70	54	27
ZONE 3	152	155	123	114	112	110	106	99	90	78	61	40
ZONE 4	153	156	127	120	119	118	114	108	99	86	70	53
ZONE 5	152	213	226	215	210	205	199	191	179	167	143	197

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 16.56%, 0.66%, 1.98%, 1.97% and 40.14% in zone-1, zone-2, zone-3, zone-4 and zone-5 columns respectively when compared with the base segment was removed.

Due to removal of base floor column mostly effected zones are zone 5.

Comparision of bending moment variation in different zones due to removal of 1st segment of exterior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	121	179	0	160	106	108	103	97	87	74	58	38
ZONE 1	121	146	114	3	13	10	9	4	5	18	25	85
ZONE 2	123	153	122	109	107	104	100	93	83	70	54	27
ZONE 3	122	154	126	116	112	110	106	99	90	78	61	40
ZONE 4	123	154	126	120	119	118	114	108	99	81	70	53
ZONE 5	123	130	199	216	212	207	201	192	181	168	145	200

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 20.67%, 24.40%, 26.23%, 25.21% and 5.70% in zone-1, zone-2, zone-3, zone-4 and zone-5 columns respectively when compared with the 1st segment was removed.

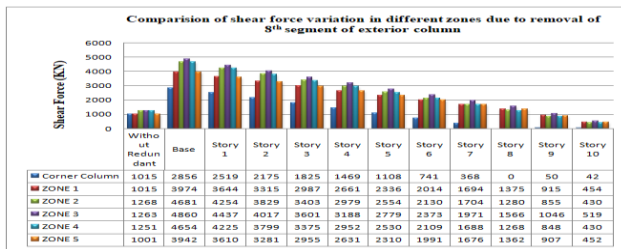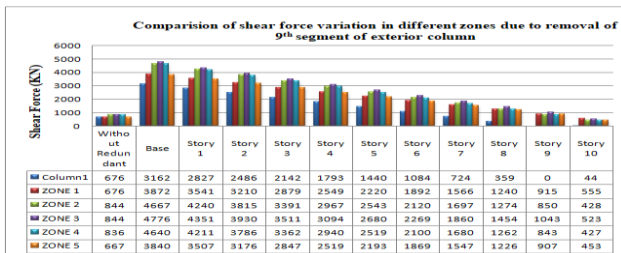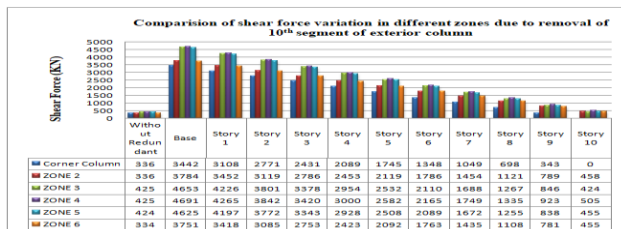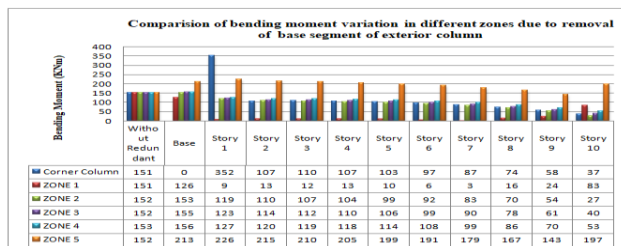Due to removal of 1st floor column mostly effected zones are zone 3.

Comparision of bending moment variation in different zones due to removal of 2nd segment of exterior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	113	143	164	0	169	104	104	97	87	75	58	38
ZONE 1	113	150	123	109	1	11	7	3	6	19	26	87
ZONE 2	115	152	122	113	108	105	100	93	83	70	54	27
ZONE 3	115	152	123	119	114	111	106	100	90	78	61	40
ZONE 4	116	153	125	120	120	118	114	108	99	86	70	53
ZONE 5	116	151	106	207	211	209	202	194	183	170	146	204

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 20.67%, 24.40%, 26.23%, 25.21% and 5.70% in zone-1, zone-2, zone-3, zone-4 and zone-5 columns respectively when compared with the 2nd segment was removed.

Due to removal of 2nd floor column mostly effected zones are zone 3.

Comparision of bending moment variation in different zones due to removal of 3rd segment of exterior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	112	150	116	171	0	165	100	97	87	75	58	38
ZONE 1	112	150	124	118	108	2	8	1	7	20	27	88
ZONE 2	113	151	121	114	110	106	101	93	83	70	54	28
ZONE 3	113	152	122	115	117	112	106	100	90	78	61	40
ZONE 4	115	153	124	119	120	119	114	108	99	86	70	52
ZONE 5	114	148	119	97	206	208	203	195	184	171	147	206

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 33.93%, 33.63%, 34.52%, 33.05% and 29.83% in zone-1, zone-2, zone-3, zone-4 and zone-5 columns respectively when compared with the 3rd segment was removed.

Due to removal of 3rd floor column mostly effected zones are zone 3.

Comparision of bending moment variation in different zones due to removal of 4th segment of exterior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	109	150	121	109	169	0	157	93	88	75	58	38
ZONE 1	109	151	124	118	120	104	5	2	8	21	28	89
ZONE 2	111	151	121	113	111	107	102	94	84	71	55	28
ZONE 3	111	152	122	115	114	115	108	100	91	78	61	40
ZONE 4	113	153	124	118	116	119	115	108	99	86	69	52
ZONE 5	112	150	118	111	92	201	202	196	184	171	148	208

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 38.54%, 36.04%, 36.94%, 35.40% and 33.93% in zone-1, zone-2, zone-3, zone-4 and zone-5 columns respectively when compared with the 4th segment was removed.

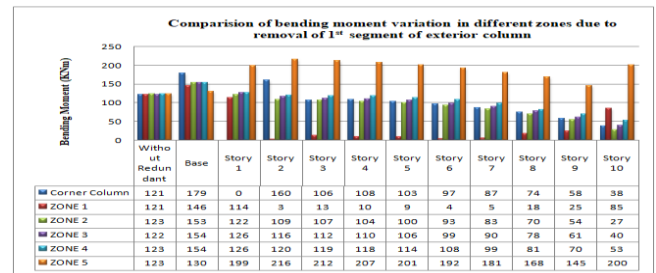Due to removal of 4th floor column mostly effected zones are zone 1.

Comparision of bending moment variation in different zones due to removal of 5th segment of exterior column

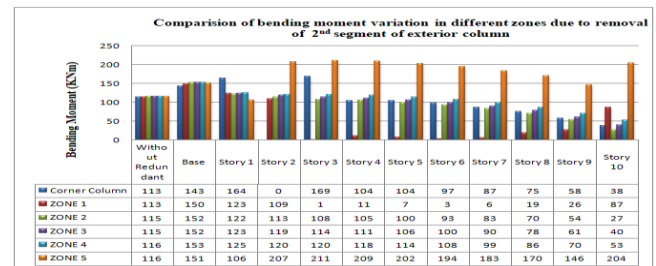|	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	105	151	121	113	105	163	0	145	84	75	58	38
ZONE 1	105	151	124	117	119	119	97	9	7	21	28	89
ZONE 2	107	151	122	113	111	109	103	95	85	72	55	29
ZONE 3	107	152	122	114	112	112	111	101	91	78	61	40
ZONE 4	108	153	124	117	116	114	114	108	98	85	69	51
ZONE 5	108	150	119	109	111	68	195	194	485	172	148	209

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 43.81%, 41.13%, 42.06%, 41.67% and 39.89% in zone-1, zone-2, zone-3, zone-4 and zone-5 columns respectively when compared with the 5th segment was removed.

Due to removal of 5th floor column mostly effected zones are zone 1.

Comparision of bending moment variation in different zones due to removal of 6th segment of exterior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	98	151	121	113	113	101	153	0	129	72	59	38
ZONE 1	98	151	123	117	117	117	115	86	16	20	28	89
ZONE 2	100	152	122	113	115	109	105	97	86	73	56	30
ZONE 3	100	152	122	114	113	110	108	104	92	78	61	40
ZONE 4	102	153	124	117	116	115	110	108	98	85	68	50
ZONE 5	101	151	120	111	106	108	81	185	183	172	148	209

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 54.09%, 52%, 52%, 50% and 49.51% in zone-1, zone-2, zone-3, zone-4 and zone-5 columns respectively when compared with the 6th segment was removed.

Due to removal of 6th floor column mostly effected zones are zone 1.

Comparision of bending moment variation in different zones due to removal of 7th segment of exterior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	88	151	121	113	111	110	97	140	0	107	56	38
ZONE 1	88	151	123	116	116	115	112	109	72	28	26	89
ZONE 2	91	152	122	114	112	109	105	98	88	74	57	32
ZONE 3	91	151	122	114	113	111	106	101	94	79	61	41
ZONE 4	93	153	124	117	115	114	110	103	98	85	68	49
ZONE 5	92	151	121	112	109	104	104	74	172	172	148	208

From the above graphical representation, it was observed that the axial load M_y was increased to maximum by 71.60%, 67.04%, 65.94%, 64.52% and 64.14% in zone-1, zone-2, zone-3, zone-4 and zone-5 columns respectively when compared with the CF7 was removed.

Due to removal of 7th floor column mostly effected zones are zone 1.

Comparision of bending moment variation in different zones due to removal of 8th segment of exterior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	76	151	121	113	111	109	106	91	121	0	81	37
ZONE 1	76	151	123	115	115	114	110	104	100	52	33	83
ZONE 2	78	152	122	114	112	110	105	94	89	75	58	33
ZONE 3	78	152	122	115	113	111	107	100	92	81	62	41
ZONE 4	79	153	123	117	115	113	110	104	94	84	68	48
ZONE 5	78	151	121	113	110	107	3	98	63	157	154	206

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 96.16%, 94.88%, 94.88%, 93.68% and 93.59% in zone-1, zone-2, zone-3, zone-4 and zone-5 columns respectively when compared with the 8th segment was removed.

Due to removal of 8th floor column mostly effected zones are zone 1.

Comparision of bending moment variation in different zones due to removal of 9th segment of exterior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	59	151	121	113	111	109	105	98	84	97	0	50
ZONE 1	58	151	122	115	114	112	108	102	92	86	31	102
ZONE 2	61	152	122	114	112	110	106	99	89	77	59	35
ZONE 3	61	151	122	115	113	111	107	100	90	79	63	41
ZONE 4	64	153	123	116	115	113	109	103	94	80	66	46
ZONE 5	62	151	122	114	112	109	104	96	89	54	127	205

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 160.35%, 149.19%, 147.55%, 139.07% and 143.55% in zone-1, zone-2, zone-3, zone-4 and zone-5 columns respectively when compared with the 9th segment was removed.

Due to removal of 9th floor column mostly effected zones are zone 1.

Comparision of bending moment variation in different zones due to removal of 10th segment of exterior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column		151	121	113	111	109	105	98	89	73	69	0
ZONE 1	39	151	122	114	112	110	106	100	91	75	78	11
ZONE 2	41	152	122	114	113	111	106	100	90	77	62	36
ZONE 3	41	152	122	115	113	111	107	100	91	75	61	43
ZONE 4	39	153	123	116	115	113	109	102	93	80	63	179
ZONE 5	39	151	122	115	113	110	106	99	88	79	35	179

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 287.18%, 270.74%, 270.74%, 292.31% and 287.18% in zone-1, zone-2, zone-3, zone-4 and zone-5 columns respectively when compared with the 9th segment was removed.

Due to removal of 9th floor column mostly effected zones are zone 4.

4.3. INTERIOR COLUMN

SHEAR FORCE VARIATIONS:-

Comparison of shear force variation in different zones due to removal of base segment of column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	4670	0	133	203	246	267	267	251	223	181	133	81
ZONE 1	4644	5713	5151	4603	4065	3538	3018	2506	1999	1497	998	502
ZONE 2	4616	4724	4293	3864	3434	3005	2576	2147	1719	1291	863	437
ZONE 3	4644	4752	4323	3895	3463	3032	2600	2168	1734	1303	870	438
ZONE 4	4670	4778	4351	3922	3491	3058	2623	2188	1752	1315	877	439
ZONE 5	4670	5740	5180	4631	4093	3564	3044	2526	2015	1509	1005	503
ZONE 6	4670	5740	5180	4631	4093	3564	3042	2526	2015	1509	1005	503
ZONE 7	4670	4752	4323	3895	3463	3032	2600	2168	1734	1303	870	438
ZONE 8												

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 23.02%, 2.34%, 23.02%, 2.33%, 22.92% , 2.32% , 22.92% and 2.33% in zone-1, zone-2, zone-3, zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the base segment was removed.

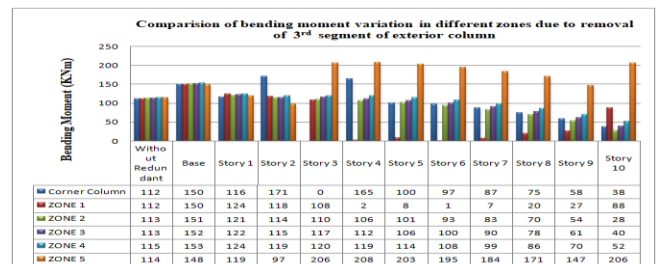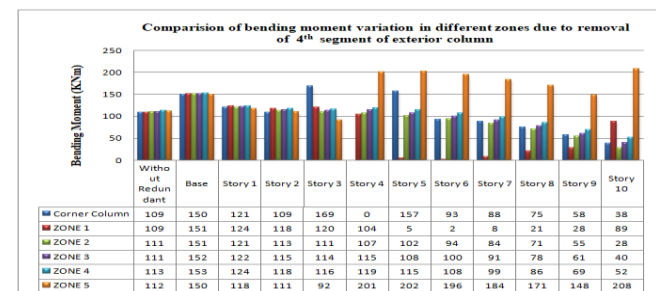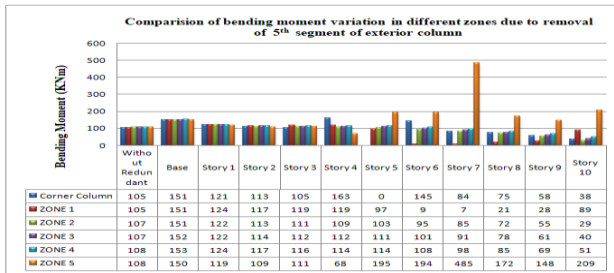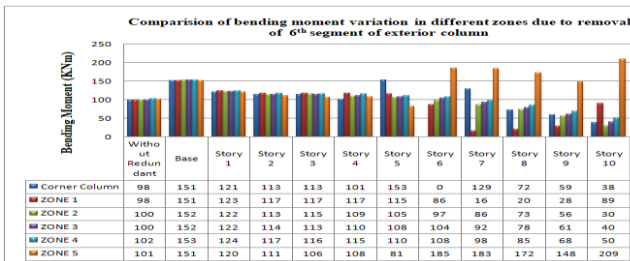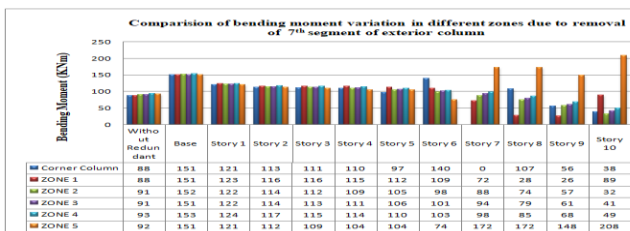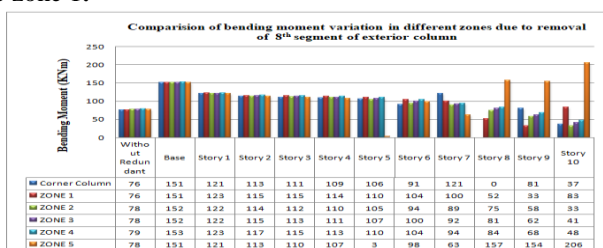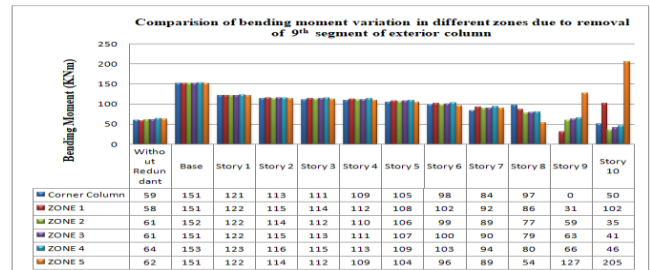Due to removal of base floor column mostly effected zones are zone 1.

Comparision of shear force variation in different zones due to removal of 1st segment of interior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	4246	446	0	113	169	200	211	205	185	155	115	75
ZONE 1	4217	5594	5179	4627	4086	3555	3033	2518	2009	1504	1003	505
ZONE 2	4188	4724	4293	3864	3434	3005	2576	2148	1719	1291	863	437
ZONE 3	4217	5594	5179	4627	4086	3555	3033	2518	2009	1504	1003	505
ZONE 4	4217	4751	4322	3893	3463	3032	2600	2168	1736	1303	871	438
ZONE 5	4246	5620	5208	4656	4114	3581	3057	2538	2025	1516	1010	506
ZONE 6	4246	4777	4351	3922	3491	3058	2624	2188	1752	1315	877	439
ZONE 7	4246	5620	5208	4656	4114	3581	3057	2538	2025	1516	1010	506
ZONE 8	4217	4751	4322	3893	3463	3032	2600	2168	1736	1303	871	438

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 32.66%, 12.80%, 32.66%, 12.67%, 32.36% , 12.51% , 32.36% and 12.67% in zone-1, zone-2, zone-3, zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the 1st segment was removed.

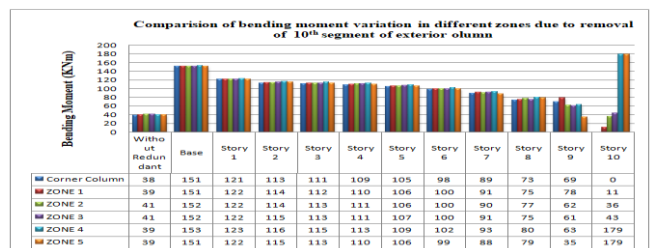Due to removal of 1st floor column mostly effected zones are zone 1.

Comparison of shear force variation in different zones due to removal of 2nd segment of interior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	3821	924	472	0	84	89	118	129	125	110	86	61
ZONE 1	3793	5462	5046	4643	4125	3588	3061	2541	2026	1517	1012	509
ZONE 2	3763	4719	4289	3860	3432	3003	2575	2147	1719	1291	863	437
ZONE 3	3793	5462	5046	4643	4125	3588	3061	2541	2026	1517	1012	509
ZONE 4	3793	4746	4318	3890	3460	3030	2599	2167	1735	1303	870	438
ZONE 5	3821	5488	5075	4672	4153	3614	3083	2561	2043	1529	1019	510
ZONE 6	3821	4773	4347	3919	3488	3055	2622	2187	1751	1314	877	439
ZONE 7	3821	5488	5075	4672	4153	3614	3084	2561	2043	1529	1019	510
ZONE 8	3793	4746	4318	3890	3460	3030	2599	2167	1735	1303	870	438

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 44.01%, 25.41%, 44.01%, 25.13%, 43.63% , 24.92% , 43.63% and 25.13% in zone-1, zone-2, zone-3, zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the 2nd segment was removed.

Due to removal of 2nd floor column mostly effected zones are zone 1 and zone 3.
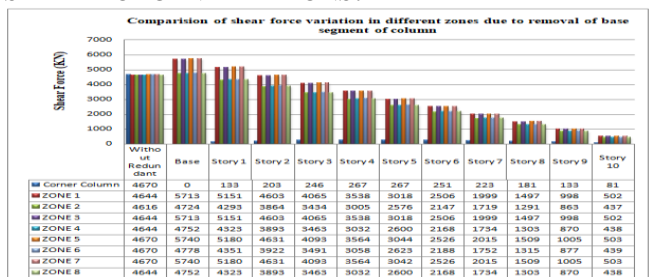

Comparision of shear force variation in different zones due to removal of 3rd segment of interior column

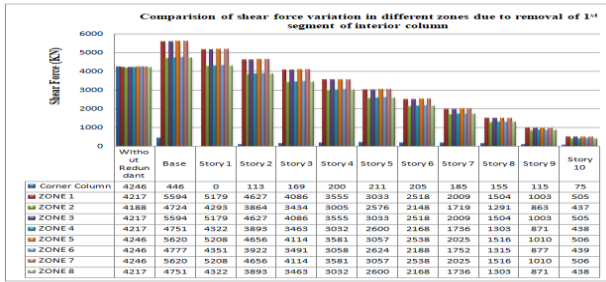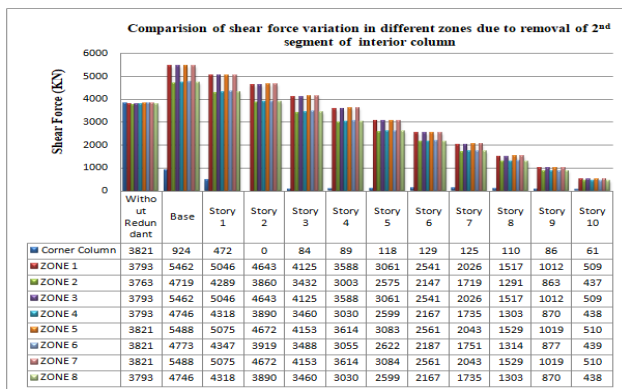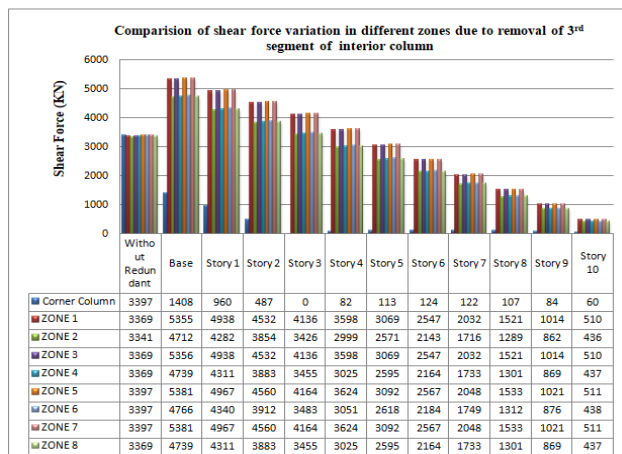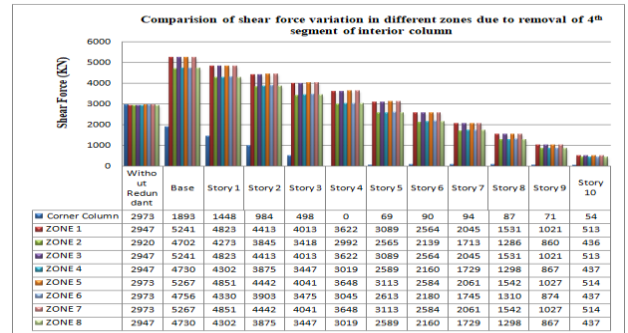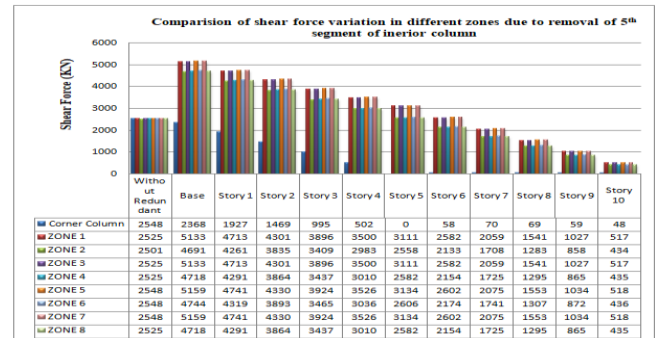|	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	3397	1408	960	487	0	82	113	124	122	107	84	60
ZONE 1	3369	5355	4938	4532	4136	3598	3069	2547	2032	1521	1014	510
ZONE 2	3341	4712	4282	3854	3426	2999	2571	2143	1716	1289	862	436
ZONE 3	3369	5356	4938	4532	4136	3598	3069	2547	2032	1521	1014	510
ZONE 4	3369	4739	4311	3883	3455	3025	2595	2164	1733	1301	869	437
ZONE 5	3397	5381	4967	4560	4164	3624	3092	2567	2048	1533	1021	511
ZONE 6	3397	4766	4340	3912	3483	3051	2618	2184	1749	1314	876	438
ZONE 7	3397	5381	4967	4560	4164	3624	3092	2567	2048	1533	1021	511
ZONE 8	3369	4739	4311	3883	3455	3025	2595	2164	1733	1301	869	437

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 58.95%, 41.04%, 58.98%, 40.67%, 58.41% , 40.31% , 58.41% and 40.67% in zone-1, zone-2, zone-3, zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the 3rd segment was removed.

Due to removal of 3rd floor column mostly effected zones are zone 1.

Comparision of shear force variation in different zones due to removal of 4th segment of interior column

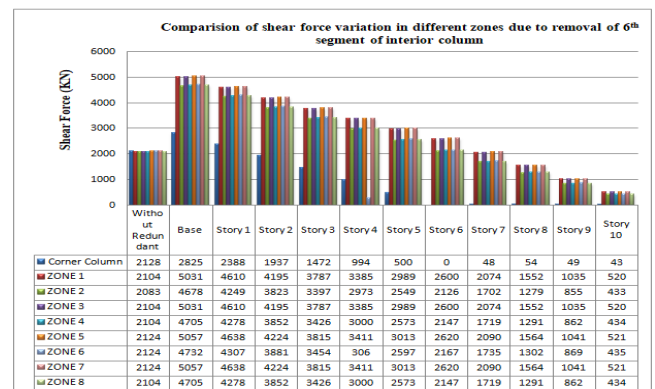|	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	2973	1448	984	498		0	69	90	94	87	71	54
ZONE 1	2947	5241	4823	4413	4013	3622	3089	2564	2045	1531	1021	513
ZONE 2	2920	4702	4273	3845	3418	2992	2565	2139	1713	1286	860	436
ZONE 3	2947	5241	4823	4413	4013	3622	3089	2564	2045	1531	1021	513
ZONE 4	2947	4730	4302	3875	3447	3019	2589	2160	1729	1298	867	437
ZONE 5	2973	5267	4851	4442	4041	3648	3113	2584	2061	1542	1027	514
ZONE 6	2973	4756	4330	3903	3475	3045	2613	2180	1745	1310	874	437
ZONE 7	2973	5267	4851	4442	4041	3648	3113	2584	2061	1542	1027	514
ZONE 8	2947	4730	4302	3875	3447	3019	2589	2160	1729	1298	867	437

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 77.85%, 61.03%, 77.85%, 60.51%, 77.17% , 59.98% , 77.17% and 60.51% in zone-1, zone-2, zone-3, zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the 4th segment was removed.

Due to removal of 4th floor column mostly effected zones are zone 1 and zone 3.

Comparision of shear force variation in different zones due to removal of 5th segment of inerior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	2548	2368	1927	1469	995	502	0	58	70	69	59	48
ZONE 1	2525	5133	4713	4301	3896	3500	3111	2582	2059	1541	1027	517
ZONE 2	2501	4691	4261	3835	3409	2983	2558	2133	1708	1283	858	434
ZONE 3	2525	5133	4713	4301	3896	3500	3111	2582	2059	1541	1027	517
ZONE 4	2525	4718	4291	3864	3437	3010	2582	2154	1725	1295	865	435
ZONE 5	2548	5159	4741	4330	3924	3526	3134	2602	2075	1553	1034	518
ZONE 6	2548	4744	4319	3893	3465	3036	2606	2174	1741	1307	872	436
ZONE 7	2548	5159	4741	4330	3924	3526	3134	2602	2075	1553	1034	518
ZONE 8	2525	4718	4291	3864	3437	3010	2582	2154	1725	1295	865	435

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 104.28%, 87.57%, 104.28%, 86.86%, 102.48% , 86.19% 102.48% and 86.86% in zone-1, zone-2, zone-3, zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the 5th segment was removed.

Due to removal of 5th floor column mostly effected zones are zone 1 and zone 3.

Comparision of shear force variation in different zones due to removal of 6th segment of interior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	2128	2825	2388	1937	1472	994	500	0	48	54	49	43
ZONE 1	2104	5031	4610	4195	3787	3385	2989	2600	2074	1552	1035	520
ZONE 2	2083	4678	4249	3823	3397	2973	2549	2126	1702	1279	855	433
ZONE 3	2104	5031	4610	4195	3787	3385	2989	2600	2074	1552	1035	520
ZONE 4	2104	4705	4278	3852	3426	3000	2573	2147	1719	1291	862	434
ZONE 5	2124	5057	4638	4224	3815	3411	3013	2620	2090	1564	1041	521
ZONE 6	2124	4732	4307	3881	3454	3024	2597	2167	1735	1302	869	435
ZONE 7	2124	5057	4638	4224	3815	3411	3013	2620	2090	1564	1041	521
ZONE 8	2104	4705	4278	3852	3426	3000	2573	2147	1719	1291	862	434

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 139.12%, 124.58%, 139.12%, 123.63%, 138.09% , 122.79% , 138.09% and 123.63% in zone-1, zone-2, zone-3, zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the 6th segment was removed.

Due to removal of 6th floor column mostly effected zones are zone 1 and zone 3.

Comparison of shear force variation in different zones due to removal of 7th segment of interior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	1699	3258	2824	2379	1924	1458	982	492	0	41	41	39
ZONE 1	1683	4937	4514	4097	3686	3279	2877	2480	2089	1563	1042	524
ZONE 2	1667	4665	4236	3810	3385	2962	2540	2118	1696	1274	852	431
ZONE 3	1683	4937	4514	4097	3686	3279	2877	2480	2089	1563	1042	524
ZONE 4	1683	4692	4265	3840	3414	2989	2564	2138	1712	1286	859	432
ZONE 5	1699	4963	4543	4126	3713	3305	2900	2500	2105	1575	1049	525
ZONE 6	1699	4719	4294	3868	3442	3015	2587	2158	1728	1298	866	433
ZONE 7	1699	4963	4543	4126	3713	3305	2900	2500	2105	1575	1049	525
ZONE 8	1683	4692	4265	3840	3414	2989	2564	2138	1712	1286	859	432

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 193.35%,179.85%, 193.35%, 178.79%, 192.12% , 192.12% , 192.12% and 178.79% in zone-1, zone-2, zone-3,

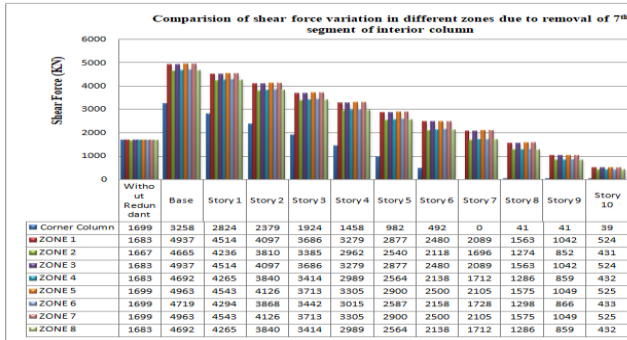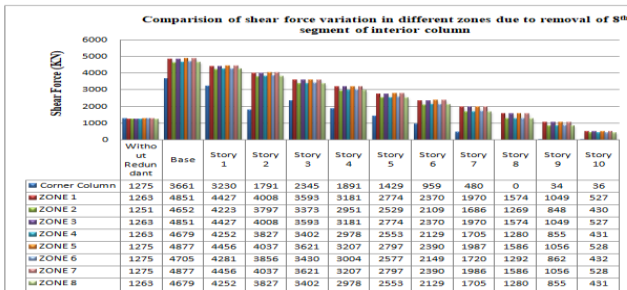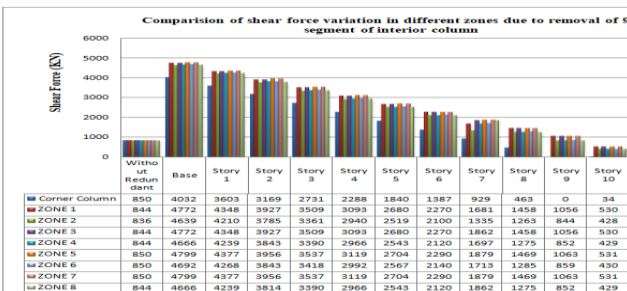zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the 7th segment was removed.

Due to removal of 7th floor column mostly effected zones are zone 1and zone 3.

Comparision of shear force variation in different zones due to removal of 8th segment of interior column

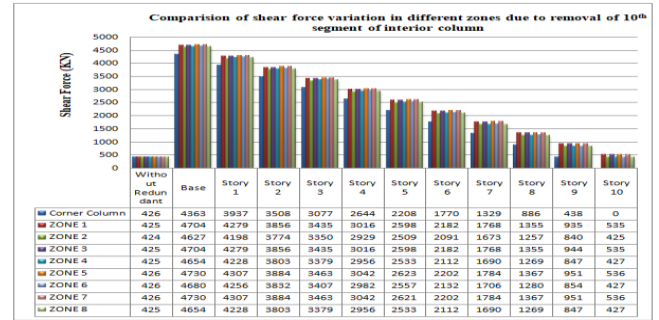|	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	1275	3661	3230	1791	2345	1891	1429	959	480	0	34	36
ZONE 1	1263	4851	4427	4008	3593	3181	2774	2370	1970	1574	1049	527
ZONE 2	1251	4652	4223	3797	3373	2951	2529	2109	1686	1269	848	430
ZONE 3	1263	4851	4427	4008	3593	3181	2774	2370	1970	1574	1049	527
ZONE 4	1263	4679	4252	3827	3402	2978	2553	2129	1705	1280	855	431
ZONE 5	1275	4877	4456	4037	3621	3207	2797	2390	1987	1586	1056	528
ZONE 6	1275	4705	4281	3856	3430	3004	2577	2149	1720	1292	862	432
ZONE 7	1275	4877	4456	4037	3621	3207	2797	2390	1987	1586	1056	528
ZONE 8	1263	4679	4252	3827	3402	2978	2553	2129	1705	1280	855	431

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 284.09%,271.87%, 284.09%, 270.47%, 282.51% , 270.47% , 282.51% and 270.47% in zone-1, zone-2, zone-3, zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the 8th segment was removed.

Due to removal of 8th floor column mostly effected zones are zone 1and zone 3.

Comparision of shear force variation in different zones due to removal of 9th segment of interior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	850	4032	3603	3169	2731	2288	1840	1387	929	463	0	34
ZONE 1	844	4772	4348	3927	3509	3093	2680	2270	1681	1458	1056	530
ZONE 2	836	4639	4210	3785	3361	2940	2519	2100	1335	1263	844	428
ZONE 3	844	4772	4348	3927	3509	3093	2680	2270	1862	1458	1056	530
ZONE 4	844	4666	4239	3843	3390	2966	2543	2120	1697	1275	852	429
ZONE 5	850	4799	4377	3956	3537	3119	2704	2290	1879	1469	1063	531
ZONE 6	850	4692	4268	3843	3418	2992	2567	2140	1713	1285	859	430
ZONE 7	850	4799	4377	3956	3537	3119	2704	2290	1879	1469	1063	531
ZONE 8	844	4666	4239	3814	3390	2966	2543	2120	1862	1275	852	429

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 465.41%,454.91%, 465.41%, 452.85%, 464.59% , 452% , 464.59% and 452.85% in zone-1, zone-2, zone-3, zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the 9th segment was removed.

Due to removal of 9th floor column mostly effected zones are zone 1and zone 3.

Comparison of shear force variation in different zones due to removal of 10th segment of interior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	426	3937	3508	3077	2644	2208	1770	1329	886	438	0	
ZONE 1	425	4704	4279	3856	3435	3016	2598	2182	1768	1355	935	535
ZONE 2	424	4627	4198	3774	3350	2929	2509	2091	1673	1257	840	425
ZONE 3	425	4704	4279	3856	3435	3016	2598	2182	1768	1355	944	535
ZONE 4	425	4654	4228	3803	3379	2956	2533	2112	1690	1269	847	427
ZONE 5	426	4730	4307	3884	3463	3042	2623	2202	1784	1367	951	536
ZONE 6	426	4680	4256	3832	3407	2982	2557	2132	1706	1280	854	427
ZONE 7	426	4730	4307	3884	3463	3042	2621	2202	1784	1367	951	536
ZONE 8	425	4654	4228	3803	3379	2956	2533	2112	1690	1269	847	427

From the above graphical representation, it was observed that the axial load F_y was increased to maximum by 1006.83%,991.28%, 1006.83%, 995.06%, 1010.33% , 998.60% , 1010.33%and 995.06% in zone-1, zone-2, zone-3, zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the 10th segment was removed.
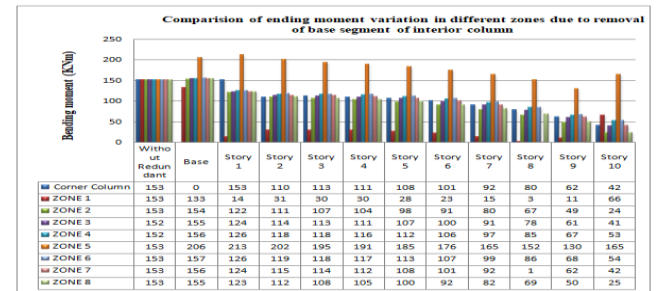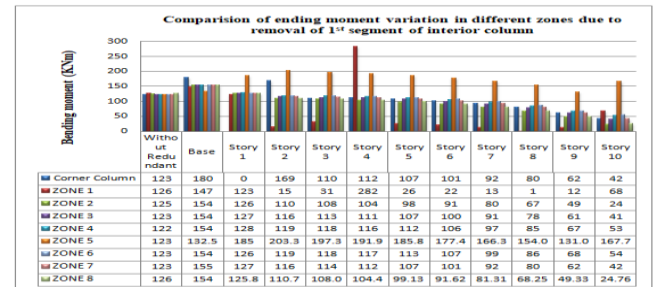
Due to removal of 10th floor column mostly effected zones are zone 5and zone7.

BENDING MOMENT VARIATIONS:-

Comparision of ending moment variation in different zones due to removal of base segment of interior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	153	0	153	110	113	111	108	101	92	80	62	42
ZONE 1	153	133	14	31	30	30	28	23	15	3	11	66
ZONE 2	153	154	122	111	107	104	98	91	80	67	49	24
ZONE 3	152	155	124	114	113	111	107	100	91	78	61	41
ZONE 4	152	156	126	118	118	116	112	106	97	85	67	53
ZONE 5	153	206	213	202	195	191	185	176	165	152	130	165
ZONE 6	153	157	126	119	118	117	113	107	99	86	68	54
ZONE 7	153	156	124	115	114	112	108	101	92	1	62	42
ZONE 8	153	155	123	112	108	105	100	92	82	69	50	25

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 13.08%, 0.66%, 1.98%,2.64%, 34.65%, 2.62%, 1.97% and 1.31% in zone-1, zone-2, zone-3, zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the base segment was removed.
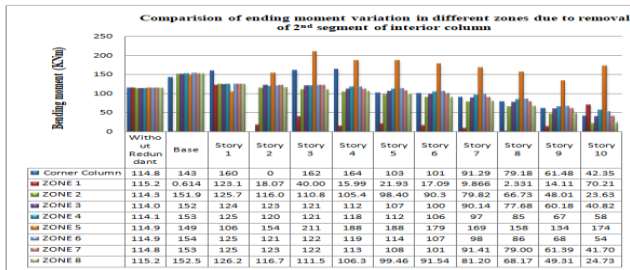
Due to removal of base floor column mostly effected zones are zone1.

Comparision of ending moment variation in different zones due to removal of 1st segment of interior column

	Without Redundant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	123	180	0	169	110	112	107	101	92	80	62	42
ZONE 1	126	147	123	15	31	282	26	22	13	1	12	68
ZONE 2	125	154	126	110	108	104	98	91	80	67	49	24
ZONE 3	123	154	127	116	113	111	107	100	91	78	61	41
ZONE 4	122	154	128	119	118	116	112	106	97	85	67	53
ZONE 5	123	132.5	185	203.3	197.3	191.9	185.8	177.4	166.3	154.0	131.0	167.7
ZONE 6	123	154	126	119	118	117	113	107	99	86	68	54
ZONE 7	123	155	127	116	114	112	107	101	92	80	62	42
ZONE 8	126	154	125.8	110.7	108.0	104.4	99.13	91.62	81.31	68.25	49.33	24.76

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 16.67%, 23.21%, 25.22%,26.23%, 8.14%, 25.21%, 26.02% and 22.23% in zone-1, zone-2, zone-3, zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the 1st segment was removed.
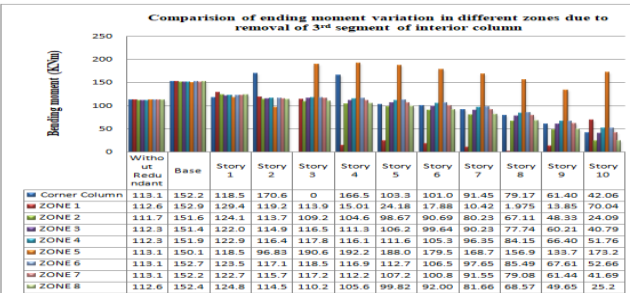
Due to removal of 1st floor column mostly effected zones are zone7.

Comparision of ending moment variation in different zones due to removal of 2nd segment of interior column

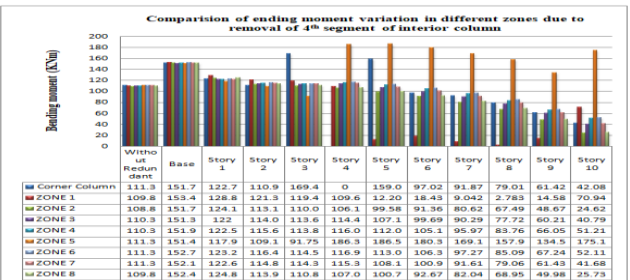|	Witho ut Redun dant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	114.8	143	160	0	162	164	103	101	91.29	79.18	61.48	42.35
ZONE 1	115.2	0.614	123.1	18.07	40.00	15.99	21.93	17.09	9.866	2.331	14.11	70.21
ZONE 2	114.3	151.9	125.7	116.0	110.8	105.4	98.40	90.3	79.82	66.73	48.01	23.63
ZONE 3	114.0	152	124	123	121	112	107	100	90.14	77.68	60.18	40.82
ZONE 4	114.1	153	125	120	121	118	112	106	97	85	67	58
ZONE 5	114.9	149	106	154	211	188	188	179	169	158	134	174
ZONE 6	114.9	154	125	121	122	119	114	107	98	86	68	54
ZONE 7	114.8	153	125	123	122	113	108	101	91.41	79.00	61.39	41.70
ZONE 8	115.2	152.5	126.2	116.7	111.5	106.3	99.46	91.54	81.20	68.17	49.31	24.73

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 3.46%, 32.18%, 32.18%,33.05%, 29.57%, 33.92%, 33.05% and 31.9% in zone-1, zone-2, zone-3, zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the 2nd segment was removed.

Due to removal of 2nd floor column mostly effected zones are zone6.

Comparision of ending moment variation in different zones due to removal of 3rd segment of interior column

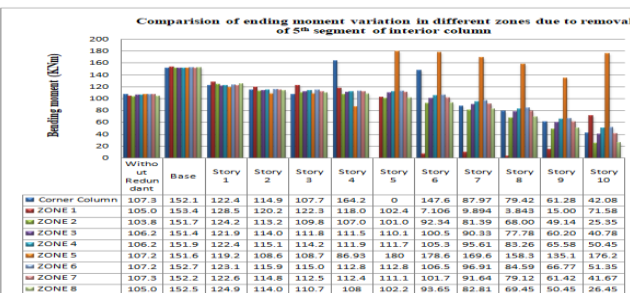|	Witho ut Redu ndant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	113.1	152.2	118.5	170.6	0	166.5	103.3	101.0	91.45	79.17	61.40	42.06
ZONE 1	112.6	152.9	129.4	119.2	113.9	15.03	24.18	17.88	10.42	1.975	13.85	70.04
ZONE 2	111.7	151.6	124.1	113.7	109.2	104.6	98.67	90.69	80.23	67.11	48.33	24.09
ZONE 3	112.3	151.4	122.0	114.9	116.5	111.3	106.2	99.64	90.23	77.74	60.21	40.79
ZONE 4	112.3	151.9	122.9	116.4	117.8	116.1	111.6	105.3	96.35	84.15	66.40	51.76
ZONE 5	113.1	150.1	118.5	96.83	190.6	192.2	188.0	179.5	168.7	156.9	133.7	173.2
ZONE 6	113.1	152.7	123.5	117.1	118.5	116.9	112.7	106.5	97.65	85.49	67.61	52.66
ZONE 7	113.1	152.2	122.7	115.7	117.2	112.2	107.2	100.8	91.55	79.08	61.44	41.69
ZONE 8	112.6	152.4	124.8	114.5	110.2	105.6	99.82	92.00	81.66	68.57	49.65	25.2

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 35.4%, 35.72%, 34.52%,34.52%, 32.46%, 34.22%, 34.22% and 35.4% in zone-1, zone-2, zone-3, zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the 3rd segment was removed.

Due to removal of 3rd floor column mostly effected zones are zone2.

Comparision of ending moment variation in different zones due to removal of 4th segment of interior column

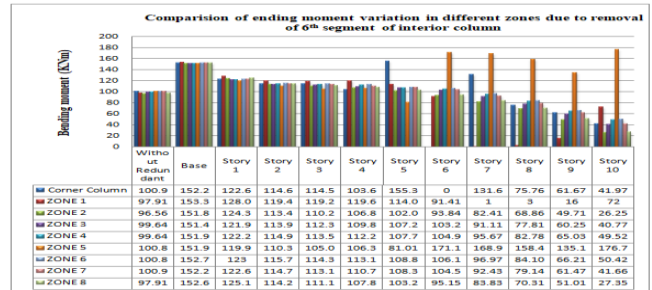|	Witho ut Redun dant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	111.3	151.7	122.7	110.9	169.4	0	159.0	97.02	91.87	79.01	61.42	42.08
ZONE 1	109.8	153.4	128.8	121.3	119.4	109.6	12.20	18.43	9.042	2.783	14.58	70.94
ZONE 2	108.8	151.7	124.1	113.1	110.0	106.1	99.58	91.36	80.62	67.49	48.67	24.62
ZONE 3	110.3	151.3	122	114.0	113.6	114.4	107.1	99.69	90.29	77.72	60.21	40.79
ZONE 4	110.3	151.9	122.5	115.6	113.8	116.0	112.0	105.1	95.97	83.76	66.05	51.21
ZONE 5	111.3	151.4	117.9	109.1	91.75	186.3	186.5	180.3	169.6	158.3	157.9	175.1
ZONE 6	111.3	152.7	123.2	114.4	114.5	116.9	113.0	106.3	97.27	85.09	67.24	52.11
ZONE 7	111.3	152.1	122.6	114.8	114.3	113.5	108.1	100.9	91.61	79.05	61.43	41.68
ZONE 8	109.8	152.4	124.8	113.9	110.8	107.0	100.7	92.67	82.04	68.95	49.98	25.73

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 40%, 39.45%, 36.94%,36.94%, 35.75%, 36.60%, 36.60% and 39.1% in zone-1, zone-2, zone-3, zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the 4th segment was removed.

Due to removal of 4th floor column mostly effected zones are zone1.

Comparision of ending moment variation in different zones due to removal of 5th segment of interior column

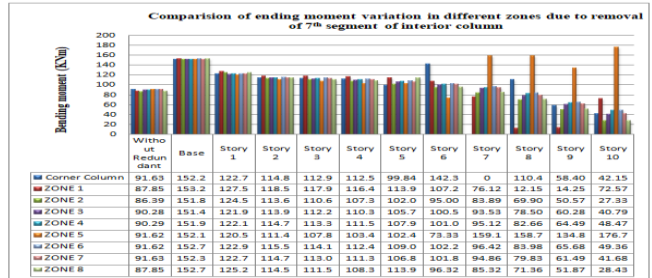|	Witho ut Redun dant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	107.3	152.1	122.4	114.9	107.7	164.2	0	147.6	87.97	79.42	61.28	42.08
ZONE 1	105.3	153.4	128.5	120.2	122.3	118.0	102.4	7.106	9.894	3.843	15.00	71.58
ZONE 2	103.8	151.7	124.2	113.2	109.8	107.0	101.0	92.34	81.39	68.00	49.14	25.35
ZONE 3	106.2	151.4	121.9	114.0	111.8	111.5	110.1	100.5	90.33	77.78	60.20	40.78
ZONE 4	106.2	151.9	122.4	115.1	114.2	111.9	111.7	105.3	95.61	83.26	65.58	50.45
ZONE 5	107.2	151.6	119.2	108.7	86.95	180	178.6	169.6	158.5	135.1	176.2
ZONE 6	107.3	152.2	123.1	115.9	115.0	112.8	112.8	106.5	96.91	84.59	66.77	51.35
ZONE 7	107.3	152.2	122.6	114.8	112.5	112.4	111.1	101.7	91.64	79.12	61.42	41.67
ZONE 8	105.0	152.5	124.9	114.0	110.7	108	102.2	93.65	82.81	69.45	50.45	26.45

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 45.29%, 46.16%, 42.06%,42.06%, 40.74%, 40.75%, 40.75% and 44.34% in zone-1, zone-2, zone-3, zone-4 , zone-6 , zone-7 and zone-8 columns respectively when compared with the 5th segment was removed.

Due to removal of 5th floor column mostly effected zones are zone2.

Comparision of ending moment variation in different zones due to removal of 6th segment of interior column

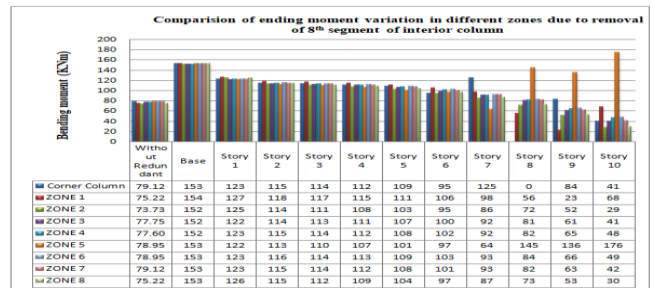|	Witho ut Redun dant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	100.9	152.2	122.6	114.6	114.5	103.6	155.3	0	131.6	75.76	61.67	41.97
ZONE 1	97.91	153.3	128.0	119.4	119.2	119.6	114.0	91.41	1	3	16	72
ZONE 2	96.56	151.8	124.3	113.4	110.2	106.8	102.0	93.84	82.41	68.86	49.71	26.25
ZONE 3	99.64	151.4	121.9	113.9	112.3	109.8	107.2	103.2	93.11	77.81	60.25	40.77
ZONE 4	99.64	151.9	122.2	114.9	115.2	113.5	112.2	107.7	104.9	95.67	82.78	65.03	49.52
ZONE 5	100.8	151.9	119.9	110.3	105.0	106.3	81.01	171.1	168.9	158.4	135.1	176.7
ZONE 6	100.8	152.7	123	115.7	114.3	113.1	108.8	106.1	96.97	84.10	66.73	51.55
ZONE 7	100.9	152.2	122.6	114.7	113.1	110.7	108.3	104.5	92.43	79.14	61.47	41.66
ZONE 8	97.91	152.6	125.1	114.2	111.1	107.8	103.2	95.15	83.83	70.31	51.01	27.35

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by57.15%, 56.71%, 52%,52%, 51.49%, 51.49%, 56.13% and 56.21% in zone-1, zone-2, zone-3, zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the 6th segment was removed.

Due to removal of 6th floor column mostly effected zones are zone1.

Comparision of ending moment variation in different zones due to removal of 7th segment of interior column

	Witho ut Redun dant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	91.63	152.2	122.7	114.8	112.9	112.5	99.84	142.3	0	110.4	58.40	42.15
ZONE 1	87.85	153.2	127.5	118.5	117.9	116.4	113.9	107.2	76.12	12.15	14.25	72.57
ZONE 2	86.39	151.8	124.5	113.6	110.6	107.3	102.0	95.00	83.89	69.90	50.57	27.33
ZONE 3	90.28	151.4	121.9	113.9	112.2	110.3	105.7	100.5	93.53	78.50	60.28	40.79
ZONE 4	90.29	151.9	122.1	114.7	113.3	111.5	107.9	101.0	95.12	82.66	64.49	48.47
ZONE 5	91.62	152.1	120.5	111.4	107.8	109.4	102.4	73.33	159.1	158.7	134.8	176.7
ZONE 6	91.62	152.7	122.9	115.5	114.1	112.4	109.0	102.2	96.42	83.98	65.68	49.36
ZONE 7	91.63	152.3	122.7	114.7	113.0	111.3	106.8	101.8	94.86	79.83	61.49	41.68
ZONE 8	87.85	152.7	125.2	114.5	111.5	108.3	113.9	96.32	85.32	71.36	51.87	28.43

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by75%, 74%,67.04%, 67.04%, 66.31%, 66.31%, 66.31% and 73% in zone-1, zone-2, zone-3, zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the 7th segment was removed.

Due to removal of 7th floor column mostly effected zones are zone1.

Comparision of ending moment variation in different zones due to removal of 8th segment of interior column

	Witho ut Redun dant	Base	Story 1	Story 2	Story 3	Story 4	Story 5	Story 6	Story 7	Story 8	Story 9	Story 10
Corner Column	79.12	153	123	115	114	112	109	95	125	0	84	41
ZONE 1	75.22	154	127	118	117	115	111	106	98	56	23	68
ZONE 2	73.73	152	125	114	111	108	103	95	86	72	52	29
ZONE 3	77.75	152	122	114	113	111	107	100	92	81	61	41
ZONE 4	77.60	152	123	115	114	112	108	102	92	82	65	48
ZONE 5	78.95	153	122	113	110	107	101	97	64	145	136	176
ZONE 6	78.95	153	123	116	114	114	110	103	93	84	66	49
ZONE 7	79.12	153	123	115	114	112	108	101	93	82	63	42
ZONE 8	75.22	153	126	115	112	109	104	97	87	73	53	30

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 102.63%, 105.22%,94.88%, 94.88%, 93.68%, 93.68%, 91.26%, and 101.32% in zone-1, zone-2, zone-3, zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the 8th segment was removed.
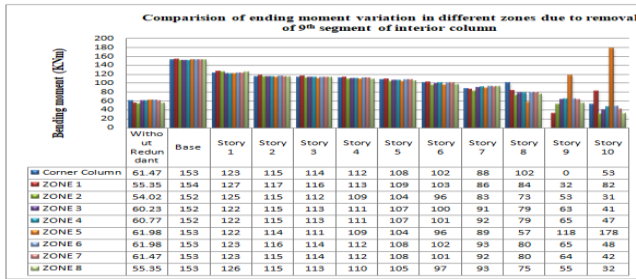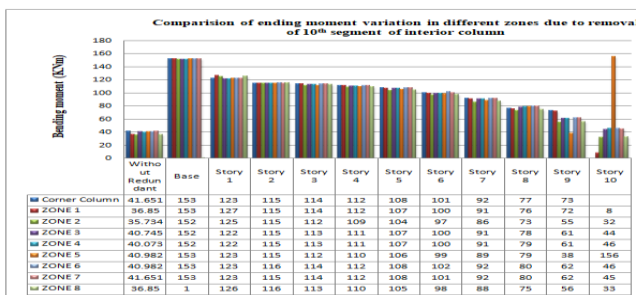
Due to removal of 8th floor column mostly effected zones are zone2.

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 175%, 186.54%,149.18%, 149.18%, 146.78%,146.78%, 146.76% and 173.22% in zone-1, zone-2, zone-3, zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the 9th segment was removed.

Due to removal of 9th floor column mostly effected zones are zone2.

From the above graphical representation, it was observed that the bending moment M_y was increased to maximum by 264.29%, 313.52%,322.23%, 265.29%, 270.73%, 273.17%, 264.29% and 97.23% in zone-1, zone-2, zone-3, zone-4, zone-5 , zone-6 , zone-7 and zone-8 columns respectively when compared with the 10th segment was removed.

Due to removal of 10th floor column mostly effected zones are zone3.

V. CONCLUSION

After doing progressive Analysis following conclusion were made:

- It was observed that there is continuous decrease in the value from bottom Story to top Story, which concludes that the failure is more at bottom Story than top Story.

- It was also found that by removing of corner columns individually, the values are decreasing according to the bottom to top story that concludes for Corner Column Removal Case, beam in the base ,1st ,2nd, 3rd, 4th ,5th , 6th story face progressive collapse but from 7th to 10Th Story is safe against Progressive Collapse.

- It was also observed that during removal of Exterior Column Removal case, beams in 1st and 5th story of building more affected by progressive collapse rather than the top stories.

- It was also observed that in Case of Interior Column Removal Case, beam in 3rd ,4th,5th ,8th ,9th and 10th Story were safe against Progressive Collapse.

- The Special Moment Resistance Frame (SMRF) by IS 456:2000 does not provide resistance to progressive Collapse. This is because of that SMRF is designed for

Lateral loads and in Progressive Collapse the Failure is due to gravity Loads.

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