Influence of Support Reactions on RCC Building Frames a Computational Method

Y. Kamala Raju, S. VenkatCharyulu, T. Srikanth

***Abstract*—High-rised structures, when planned, are ready to Satisfy essential angles and workableness. While Vigor of construction relies upon burdens forced, it requires consideration. The plan includes load computations and breaking down the entire structure. The structure strategies utilized in STAAD.Pro and ETABS investigation are Cutoff state configuration adjusting to Indian standard code of training. In this paper we have broke down and structured the G+3 multi-story building utilizing STAAD.Pro and ETABS independently and the adjustments in configuration results shear power, bowing minute and redirection of individuals from RCC building examined by utilizing STAAD.Pro and ETABS are thought about. This investigation draws out the benefits of utilizing ETABS over STAAD.Pro.**

***Keywords* : G+3 multi-storey building, shear force, bending moment and deflection of members.**

I. INTRODUCTION

The fortification is generally inserted inactively in concrete earlier than the solid set. The fortification desires the accompanying property in any event for the solid and tough development: High relation quality, High tolerates of elastic damage, Great cling to solid, independent of pH, dampness, comparative feature. Warm similarity, not making unsatisfactory worries accordingly changing temperatures.

II. REVIEW OF LITERATURE

Varikuppala Krishna, Chandrashekhar et.al(2015) "Analysis, Design of multi storied building with ETABS software. The study stated that geotechnical engineering cannot be neglected while building high rise buildings and ETABS is more user friendly and is more detailed compared to STAAD.Pro.

Sanghani (2011) contemplated to conduct of shaft and segment at different story levels. It was discovered that the greatest pivotal power created.

Poonam (2012) Consequences of the mathematical investigation demonstrated the story, particularly the primary story, must not be milder/more fragile than the story's above or beneath. Mass circulation likewise adds to the expanded reaction of the structures. The anomalies, whenever required to be given, should be given by suitable and broad investigation and configuration forms.

Prashanth.P (2012) Examined to conducted ordinary and unpredictable multi story house construction in STAAD.Pro and ETABS. Examination and configuration was found in IS: 456 and IS: 1893. Additionally physically computations analyzed outcome. It was discovered the ETABS gave the steel region in STAAD Pro. Stacking mixes were not considered in the investigation and impact of story stature on the auxiliary conduct was not depicted.

SaqibHabib (2010), "Correlation of structure of a structure utilizing ETABS and STAAD.Pro" In their investigation it was seen that It was discovered that the ETABS gave the smaller steel zone as that of STAAD Pro. Loading combinations were not measured in the analysis and impact of story tallness on the basic conduct was not depicted.

Yahyaei (2011)"Relative investigation of the static and dynamic examination of multi-story unpredictable structure". Their study stated that by comparing the results of two structure, the frame element of regular is maximum bending moments, shear forces and axial forces for different loading conditions in both softwares.

S.K Dubey (2012), "Examination of configuration consequences of a structure planned utilizing STAAD.Pro and ETABS programming .Their investigation expressed that in the two virtual products, the design results shows 0.4%-0.5% more steel in ETABS.

III. BASIC DATA FOR BUILDINGS MODEL

1. Plan : 18x 18 m
2. Height of each storey: 3 m
3 Number of storeys: G+ 3 storeys
4. Column: (450 X 230) mm
5. Beam: (230 X450) mm
6. Walls Thickness: (230) mm thick
7. Grade of the concrete: M 25
8. Grade of the steel: Fe-415
9. Type of Soil: Type II, Medium Soil
10. Seismic Zone: II
11.Building Frame : Ordinary RC moment-resisting
12. Live Load on Typical Floor: 2000N/m^2
13 Wind speed: 44 m/s
14. Support: Fixed

Live load:

Load 3.5 KN/m^2 is considered, zone: 5, type of soil: II, reaction decrease factor: 5.0, Importance factor: 1.0, Damping : 5.0%. Individuals are stacked with dead load, live burden.

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Earthquake burdens as indicated by IS code 875 (Part-1, Part -2) and IS: 1893 (Part-1) : 2002.

Self weights

Self-weight contains the heaviness of shafts, sections and chunk of the structure.

Dead loads

Every perpetual development of the structure dead load.

The dead burden contains the loads of dividers, parcel floor completions, floors at other changeless developments in the structure. Dead burden comprises

a) Wall loads = (Density of block stone work X divider thickness x divider tallness)

= 21000 N/m^3 * 0.250m * 3.1m

= 13.8 kN/m (following up bar)

b) Wall load in because of Parapet divider at highest floor

= (unit weight of block stone work * parapet divider thickness * Height)

= 21000 N/m^3 X 0.115mtrs X 950mm

= 2090 N/m (following up bars)

c) Floor load (because of floor thickness)

unit weight of solid * floor thickness

= 24000 N/m^3 * 1350mm

= 3255 N/m^2 (Acts on the beam)

Live load

Live loads incorporate heaviness of the portable segments, disseminated and thought load, load because of effect and vibration of residue loads. Live loads do exclude stacks because of wind, seismic movement, day off burdens because of heat changes to which the structure exposed to and so on. Live burden changes acc. to sort of structure.

Live load= 3 kN/m2 every floor.

Earth quake loading.

Sesmic burden can be determined taking the perspective on quickening reaction of the ground to the superstructure. As per the seriousness of seismic tremor power they are isolated into 4 zones.

As per the IS : 1893 (part-1):2002, flat Seismic Coefficient Ah for a Structure can be figured, the accompanying articulation

Ah= (ZISa)/(2Rg)

Where Z= Zone factor contingent on the zone the structure has a place with.

For Zone 2: for Z is 0.110

For Zone 3: for Z is 0.160

For Zone 4: for Z is 0.241

For Zone 5: for Z is 0.360

I= 1.50

R= Response decrease aspect

Sa/g = Average reaction Acceleration Coefficient, Here Seismic weight is taken Equivalent Length & Equivalent Width

LOAD DUE TO WIND CALCULATION

Design Wind force PZ= 0.6*(VZ_2)

Configuration Wind rate $V_z= V_b*K_1*K_2*K_3$

Hazard Coefficient K1 = 1.08

IS: 875-1987 (part3), sec 5.3.1, Table -1

Terrain & Height Factor K_2 = varies with height table 3.1

IS: 875-1987 part-3, sec 5.3.2, Table -2

According To Table -2

K_2 = 1.1055

K_2 is Values are linearly interpolated

Topography Factor

K_3 =1.00

IS: 875-part-3, sec 5.3.3.1)

Basic Wind speed

VB=44m/sec (Hyderabad)

Design Wind Speed

$Vz = Vb*K_1*K_2*K_3$

= 44*1.08*1.1055*1.00*1

= 48.802m/sec

Design Wind Pressure Pz = 0.6 *VZ_2

= 0.6* $(48.81)^2$

= 2375 N/m^2

Loads and Factors Calculation

Calculating the loads and factors values which are using in the software STAAD. Pro program:

A. Live Load:

Live load for the Residential building in each storey = (2) kN/m2 as per IS: 875 (part 2) – 1987.

B. Dead loads:

Dead loads which include Slabs, beams, columns, Floor finish and Wall Load are taken as prescribed by the IS: 875 -1987 Part-1 Code of Practice Design Loads (other than earthquake) for Buildings and structure.

C. Seismic Loading:

In this study, the building is located in Hyderabad which comes under

1. Zone-II,
2. Response reduction factor- 3, I
3. Importance factor- 1,
4. Soil Type is medium,

using the IS 1893 (Part-1) -2002 the following are the various values for the building considered

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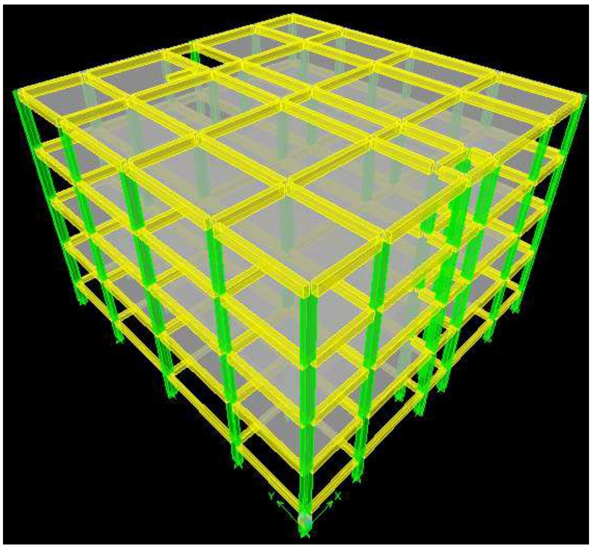

Fig. 1*: 3-D View of the G+3 storey building in ETABS*

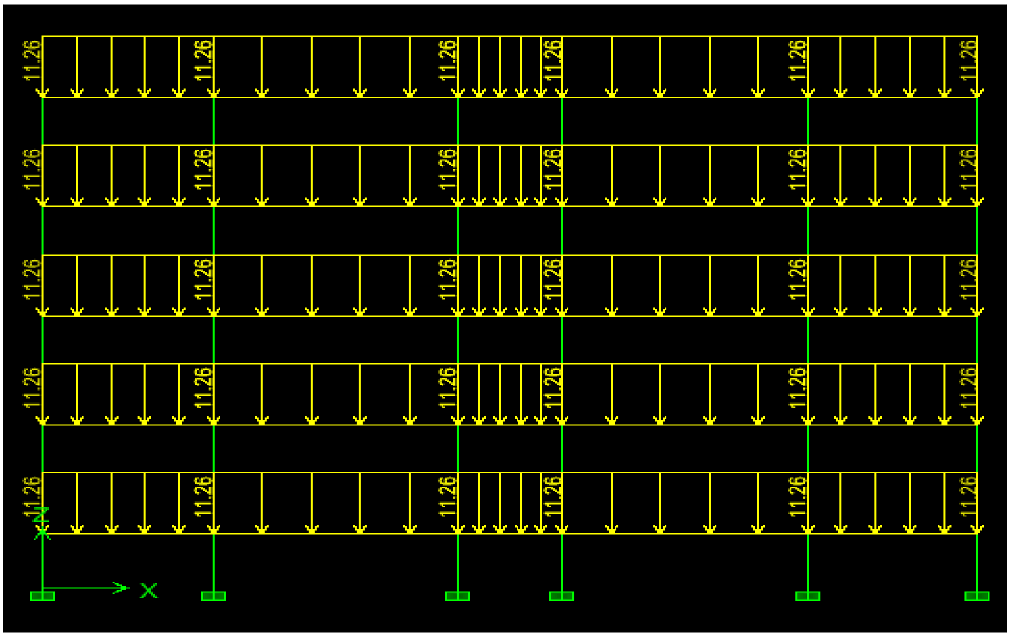

Fig. 2: Wall and Parapet load distribution in ETABS

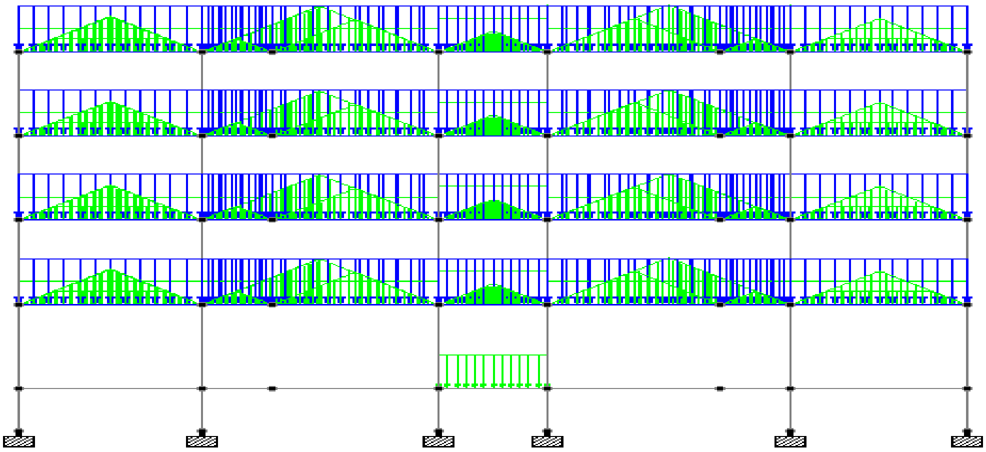

Fig. 3: Modeling In Staad.Pro

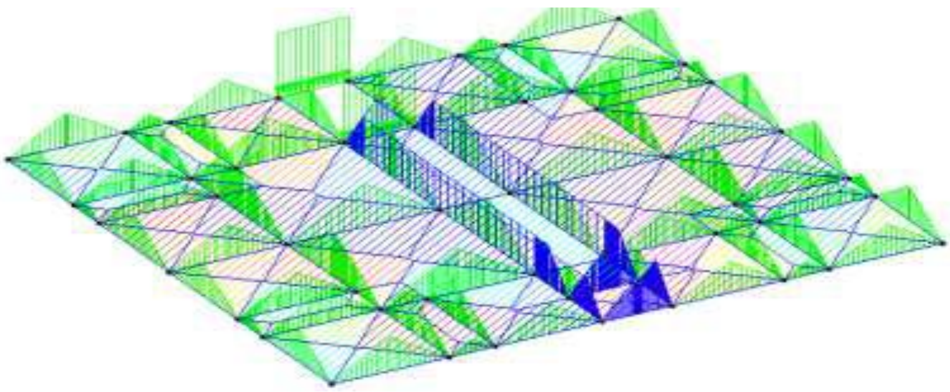

Fig. 4: Loading Display

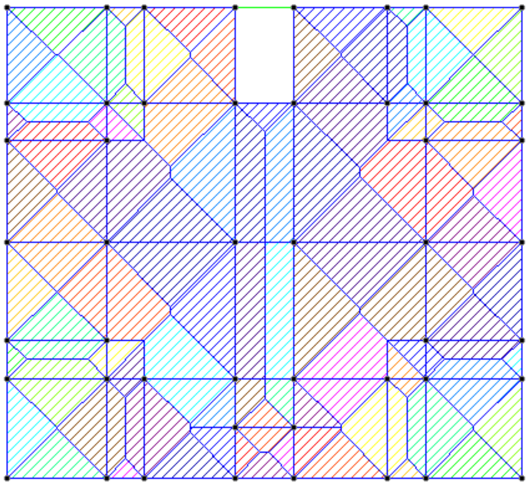

Fig. 5: Floor load (Plan View)

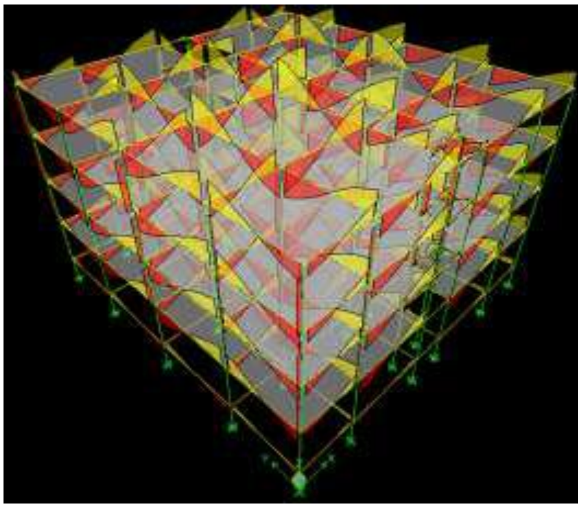

Fig. 8: Shows that controlling load combination for flexural and shear is DCON2(1.5 Self +1.5Dead)

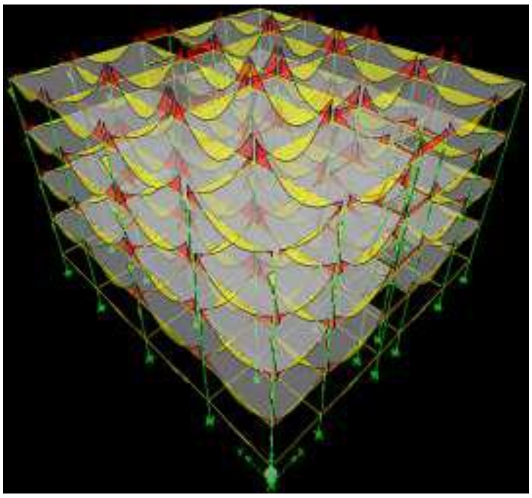

Fig. 6: B.M. Diagram for Self weight

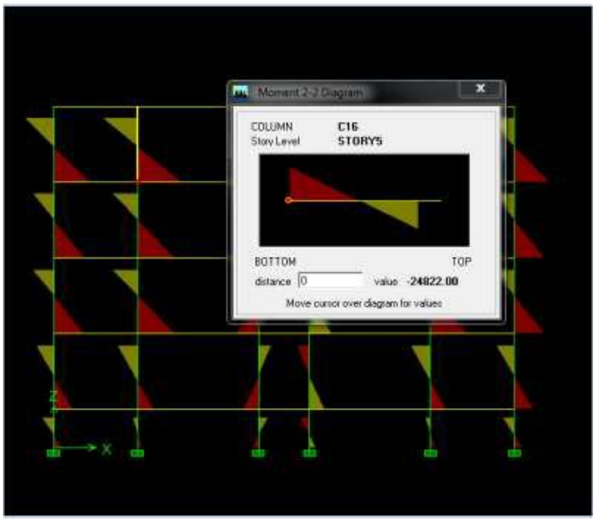

Fig. 9: Axial Force (b) B.M. Diagram for load 1.5(Self +Dead load +EQ length)

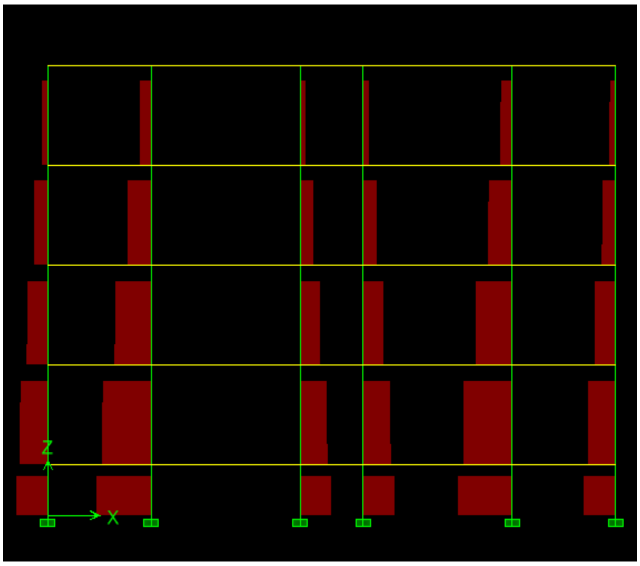

Fig. 7: Shear Force diagram for Self weight

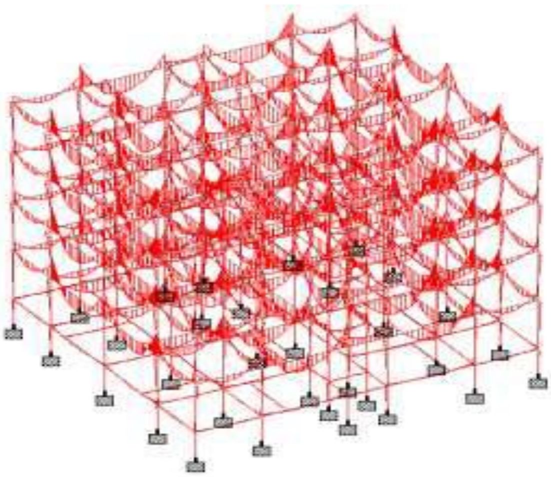

Fig. 10: BM diagram for load 1.5(Self +Dead)

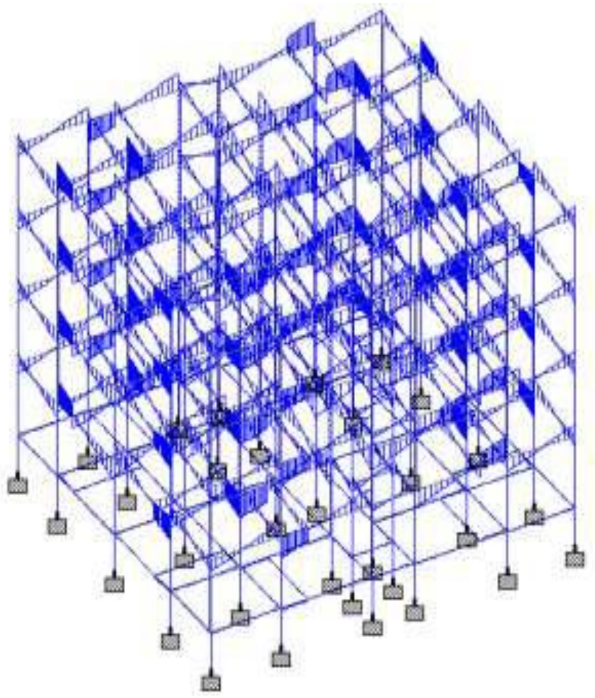

Fig. 11: Shear Force diagram for load 1.5(Self +Dead)

Table- I Support Reactioms from ETABS

Storey	Point	Load	F_x	F_y	F_z	M_x	M_y	M_z
BASE	1	DCON2	8.14	-5.7	1114.64	2.799	4.022	-0.027
BASE	2	DCON2	-8.14	-5.7	1114.64	2.799	-4.022	0.027
BASE	3	DCON2	4.66	-4.1	1173.12	0.832	2.554	-0.004
BASE	4	DCON2	3.38	-2.54	1883.03	1.176	2.565	-0.012
BASE	5	DCON2	-3.38	-2.54	1883.03	1.176	-2.565	0.012
BASE	6	DCON2	-4.66	-4.1	1173.12	0.832	-2.554	0.004
BASE	7	DCON2	3.51	0.28	1984.28	-0.338	2.714	-0.012
BASE	8	DCON2	-3.21	-0.73	1972.2	0.364	-1.422	-0.01
BASE	9	DCON2	3.21	-0.73	1972.2	0.364	1.422	0.01
BASE	10	DCON2	-3.51	0.28	1984.28	-0.338	-2.714	0.012
BASE	11	DCON2	-7.77	6.05	1102.89	-3.377	-3.736	-0.014
BASE	12	DCON2	-2.93	3.27	1860.31	-1.935	-2.136	0.004
BASE	13	DCON2	4.45	5.25	1172.16	-2.994	2.399	0
BASE	14	DCON2	8.14	-11.72	643.35	5.367	4.03	-0.024
BASE	15	DCON2	7.91	12.17	650.25	-6.018	3.82	0.027
BASE	16	DCON2	7.77	6.05	1102.89	-3.377	3.736	0.014
BASE	17	DCON2	-10.3	1.42	642.31	-1.427	-4.944	-0.075
BASE	18	DCON2	-0.75	5.07	675.42	-2.998	-0.168	-0.05
BASE	19	DCON2	0.75	5.07	675.42	-2.998	0.168	0.05
BASE	20	DCON2	10.3	1.42	642.31	-1.427	4.944	0.075
BASE	21	DCON2	-7.91	12.17	650.25	-6.018	-3.82	-0.027
BASE	22	DCON2	-4.45	5.25	1172.16	-2.994	-2.399	0
BASE	23	DCON2	3.54	10.15	1599.96	-5.042	1.613	-0.016
BASE	24	DCON2	-3.54	10.15	1599.96	-5.042	-1.613	0.016
BASE	25	DCON2	5.69	0.31	1276.12	-0.367	3.878	-0.001
BASE	26	DCON2	-5.69	0.31	1276.12	-0.367	-3.878	0.001
BASE	27	DCON2	-5.5	-4.98	1647.18	2.832	-2.623	-0.012
BASE	28	DCON2	5.5	-4.98	1647.18	2.832	2.623	0.012
BASE	29	DCON2	-11.7	-14.2	978.43	6.774	-5.595	-0.003
BASE	30	DCON2	11.7	-14.2	978.43	6.774	5.595	0.003
BASE	31	DCON2	-8.14	-11.72	643.35	5.367	-4.03	0.024
BASE	32	DCON2	2.93	3.27	1860.31	-1.935	2.136	-0.004

TABLE- II SUPPORT Reactions fromSTAAD PRO

Node	L/C	Force-X kN	Force-Y Kn	Force-Z kN	Moment-X kNm	Moment-Y kNm	Moment-Z kNm
74	12	-0.50	1428.14	-0.20	-0.31	-0.04	-1.15
79	12	1.03	1425.83	-0.20	-0.30	0.04	0.73
64	12	-3.17	1344.38	0.60	0.48	0.06	0.13
69	12	3.08	1327.93	0.59	0.47	-0.06	-0.50
75	12	0.32	1253.50	0.92	0.41	-0.01	-1.02
80	12	-0.42	1251.80	0.91	0.41	0.01	1.15
73	12	-1.69	1235.53	-1.53	-1.06	-0.01	1.03
78	12	1.89	1233.24	-1.51	-1.04	0.00	-1.19
77	12	-2.80	1104.62	1.32	2.13	0.02	1.37
76	12	2.77	1091.16	1.30	2.10	-0.03	-1.35
70	12	0.85	980.48	-0.24	-0.33	-0.02	-2.60
63	12	-0.96	964.20	-0.23	-0.31	0.03	2.34
66	12	-0.82	871.38	-1.17	-0.60	-0.07	-1.22
71	12	0.66	862.66	-1.17	-0.61	0.07	1.11
62	12	1.42	820.66	1.02	0.59	0.00	-0.96
72	12	0.64	817.84	-2.10	-2.42	0.02	-0.30
61	12	-1.60	805.69	1.05	0.61	0.00	1.06
65	12	-0.71	803.44	-2.08	-2.37	-0.02	0.31
58	12	-1.34	769.88	-1.43	-1.05	0.00	1.53
52	12	1.41	768.09	-1.45	-1.06	-0.01	-1.58
57	12	-0.77	766.07	1.13	0.55	0.01	1.28
51	12	0.90	764.10	1.14	0.55	-0.01	-1.44
55	12	-3.12	647.81	3.11	3.06	0.03	1.50
53	12	3.20	637.85	3.09	3.03	-0.04	-1.58
56	12	0.44	539.07	0.24	-0.18	0.03	-0.19
54	12	-0.39	530.94	0.20	-0.22	-0.04	0.15
67	12	-0.24	518.22	-1.36	-0.82	-0.11	0.09
68	12	0.32	514.60	-1.39	-0.85	0.10	-0.17
50	12	1.32	438.82	-1.14	-0.99	0.04	-1.83
60	12	-1.54	429.43	-1.11	-0.97	-0.04	1.84
49	12	1.46	425.03	0.86	0.49	0.00	-1.96
59	12	-1.63	415.41	0.84	0.49	-0.01	1.88

IV. RESULT AND DISCUSSION

1. The maximum vertical responses of a G+3 building max response created is 1984.28kN in ETABS and 1428.24kN in STAAD.Pro because of burden 1.5(Self +Dead +Live).
2. Deformation of members in STAAD.Pro are 0.029mm,0mm and 0.036mm respectively where as in E-TABS are 0.0031mm,0.0039mm and 0.001mm respectively.
3. The maximum displacement is along x- direction and its value is 29 mm in STAAD.Pro. and 31mm in ETABS along x-direction. So, more precise results are generated by ETABS which leads to economical design of the building.
4. Live loads to be considered on stair and lading are specified in IS875-1964 LL on stairs, landings and corridors is taken as 37KN/M2 (not liable to over crowing). When these are liable to overcrowding them the LL is adopted as $56KN/M^2$.
5. In a residential house the tread may be 250mm wide and rise may be160mm height. The number of steps in a flight, at once stretch in a flight may not preferably be more than 12.

V. CONCLUSIONS

The following conclusions are made

1. The change in design results of G+3 multi storey building which is analysed using STAAD.Pro and ETABS are summarized below:

2. Results of max vertical responses of a G+3 customary structure has been reasoned that the maximum response created is 1984.28kN in ETABS and 1428.24kN in STAAD.Pro because of burden 1.5(Self +Dead +Live)

3. Max Deformation of members of G+3 residential building in x,y,z-direction in STAAD.Pro are 0.029mm,0mm and 0.036mm respectively where as in E-TABS are 0.0031mm,0.0039mm, 0.001mm respectively. the max. deformation is along x- axis, its value is 29 mm (in STAAD.Pro.) and 31mm (in ETABS) along x-direction. So, more precise results are generated by ETABS which leads to economical design of the building.

4. Bending moment of beam member 481 of top storey building using STAAD.Pro is 35.932 kN.m whereas for beam B1 in E-TABS is 38.579kN.m for a load combination of1.5 (DL+LL).Here there is an increment of BM by 10% in ETABS which shows more reinforcement is required in ETABS which leads to uneconomical design.

5. Deflection of beam member 481 of top storey building using STAAD.Pro is 2.956mm whereas for beam B1 in E-TABS is 2.241mm for a load combination of 1.5(DL+LL)

6. Shear force of beam member 481 of top storey building using STAAD.Pro is52.565kN.m whereas for beam B1 in E-TABS is 58.78kN.m for a load combination of1.5 (DL+LL)

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