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Comparative Analysis between R.C.C. Structure & Steel Structure with STAAD.Pro

Ankit Dongre , Vighnesh suryawanshi

P.G. Student, Project and construction Management, Swami Vivekananda Subharti University, Meerut (UP), India
P.G. Student, Project and construction Management, Swami Vivekananda Subharti University, Meerut (UP), India

ABSTRACT: The main objective of our project is to design and compare RCC AND STEEL STRUCTURE FOR G+1 BUILDING using STAAD for various parameters such as shear, bending, deflection, cost. These parameters can be easily calculated using STAAD pro.

KEYWORDS: STAAD pro.

I. INTRODUCTION

Nowadays, Construction of high rise building is a basic need because of scarcity of land. Conventional method of manual design of high rise building is time consuming as well as possibility of human errors. So, it is necessary to use some computer based software which gives more accurate results and reduce the time. STAAD-PRO is the structural software is nowadays accepted by structural engineers which can solve typical problem like static analysis, wind analysis, seismic analysis using various load combination to confirms various codes such as IS 456:2000, 1893:2002, IS 875:1987 etc.

II. WHY STAAD PRO

STAAD Pro is comprehensive structural engineering software that addresses all aspects of structural engineering including model development, verification, analysis, design and review of results We have chosen STAAD. Pro because of its following advantages:

- Easy to use interface,
- Conformation with the Indian Standard Codes,
- Versatile nature of solving any type of problem,
- Accuracy of the solution.

LOAD CONSIDERATIONS

1. Dead load
2. Live load
3. Load combination

III.DESIGN FOR RCC STRUCTURE

Geometry of structure

1)The geometry of the structure as a whole is defined by the nodes at the ends of the various structural members, and each node has a unique number.
2)The location of each node is defined relative to a global coordinate system.

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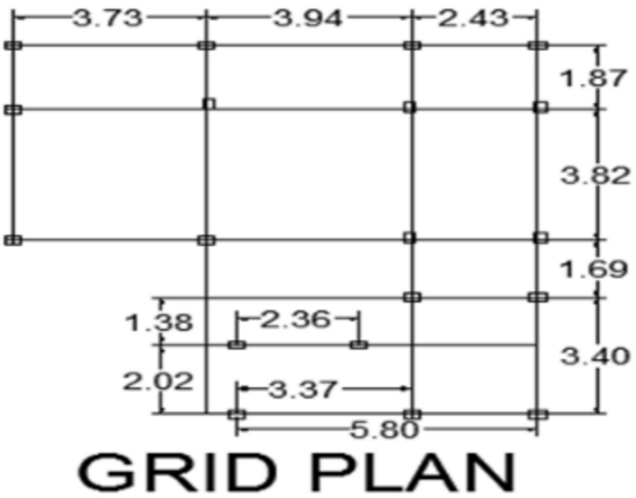

Fig 1: Grid Plan

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STAAD SPACE
START JOB INFORMATION
ENGINEER DATE 02-Mar-15
END JOB INFORMATION
INPUT WIDTH 79
UNIT METER KN
JOINT COORDINATES
1 0 0 0; 2 3.37001 0 0; 3 5.80001 0 0; 4 0 0 2.02; 5 2.36 0 2.02;
6 5.80001 0 2.02; 7 3.37001 0 0; 8 5.80001 0 3.40001; 9 -0.570001 0 5.09001;
10 3.37001 0 5.09001; 11 5.80001 0 5.09001; 12 -4.30001 0 5.09001;
13 -4.30001 0 8.91002; 14 -0.570001 0 8.91002; 15 3.37001 0 8.91002;
16 5.80001 0 8.91002; 17 5.80001 0 10.78; 19 -0.570001 0 10.78;
20 -4.30001 0 10.78; 21 3.37001 0 3.40001; 23 0 3.10001 0;
24 3.37001 3.10001 0; 25 5.80001 3.10001 0; 26 0 3.10001 2.02;
27 2.36 3.10001 2.02; 28 5.80001 3.10001 2.02; 29 5.80001 3.10001 3.40001;
30 -0.570001 3.10001 5.09001; 31 3.37001 3.10001 5.09001;
32 5.80001 3.10001 5.09001; 33 -4.30001 3.10001 5.09001;
34 -4.30001 3.10001 8.91002; 35 -0.570001 3.10001 8.91002;
36 3.37001 3.10001 8.91002; 37 5.80001 3.10001 8.91002;
38 5.80001 3.10001 10.78; 39 3.37001 3.10001 10.78; 40 -0.570001 3.10001 10.78;
41 -4.30001 3.10001 10.78; 42 3.37001 3.10001 3.40001; 43 3.37001 3.10001 2.02;
44 0 6.20001 0; 45 3.37001 6.20001 0; 46 5.80001 6.20001 0; 47 0 6.20001 2.02;
48 2.36 6.20001 2.02; 49 5.80001 6.20001 2.02; 50 5.80001 6.20001 3.40001;
51 -0.570001 6.20001 5.09001; 52 3.37001 6.20001 5.09001;
53 5.80001 6.20001 5.09001; 54 -4.30001 6.20001 5.09001;
55 -4.30001 6.20001 8.91002; 56 -0.570001 6.20001 8.91002;
57 3.37001 6.20001 8.91002; 58 5.80001 6.20001 8.91002;
59 5.80001 6.20001 10.78; 60 3.37001 6.20001 10.78; 61 -0.570001 6.20001 10.78;
62 -4.30001 6.20001 10.78; 63 3.37001 6.20001 3.40001; 64 3.37001 6.20001 2.02;
65 1.56847e-008 6.20001 5.09001; 66 0 -1.5 0; 67 3.37001 -1.5 0;
68 5.80001 -1.5 0; 69 0 -1.5 2.02; 70 2.36 -1.5 2.02; 72 5.80001 -1.5 3.40001;
73 -0.570001 -1.5 5.09001; 74 3.37001 -1.5 5.09001; 75 5.80001 -1.5 5.09001;
76 -4.30001 -1.5 5.09001; 77 -4.30001 -1.5 8.91002; 78 -0.570001 -1.5 8.91002;
79 3.37001 -1.5 8.91002; 80 5.80001 -1.5 8.91002; 81 5.80001 -1.5 10.78;
82 3.37001 -1.5 10.78; 83 -0.570001 -1.5 10.78; 84 -4.30001 -1.5 10.78;
85 3.37001 -1.5 3.40001; 86 1.56847e-008 3.10001 5.09001;
87 1.56847e-008 0 5.09001; 88 3.37001 1.00053e-005 10.78;
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Fig 2: Co-ordinates Generated

IV SPECIFICATION OF RCC STRUCTURE (G+1)

a) BUILT UP AREA=116.79Sq.m.
b) FLOOR HEIGHT=3m
c) WALL THICKNESS
d) Main wall=230mm
e) Parapet wall=115mm
f) Height of parapet wall= 1m.
g) All columns = 0.23x0.3 m
h) All beams = 0.23X0.23 m
i) Used M25concrete and Fe 415 steel

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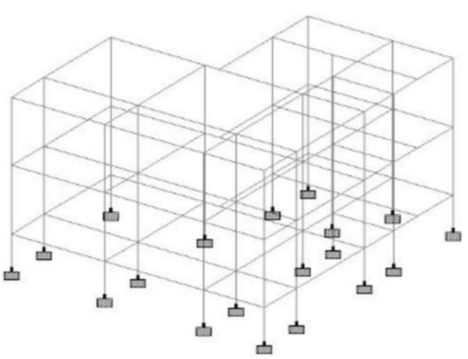

Fig 3 The base supports of the structure were assigned as fixed. The supports weregenerated using the STAAD Pro support generator.

V. LOAD CALCULATION

For each floor or roof, the loading intensity of slab is calculated taking into account thedead load of the slab, finish plaster, etc. including partitions and the live load expectedon the floor, depending on the usage of the floor or roof. The linear loading of beams,columns, walls, parapets, etc. also calculated.
Load calculations for structure are done by STAAD pro itself only the input required isas follows:

a. DEAD LOADself-weight-self weight of member is calculated by STAAD pro itself by inputdimensions.
self-weight of slab --= 0.120*25*1*1=3
Floor finish =1 kN/m2 (assume)
Total=4 kN/m2
wall load -
Main walls=3*0.23*20=13.8 kN/m
Parapet wall=0.115*1*20=2.3 kN/m

b. LIVE LOAD Live load is considered as 2 kN/m (as per IS 875 PART 2 for residential)

c. LOAD COMBINATION After the input for dead load and live load, load combinations are made automatically input window for load

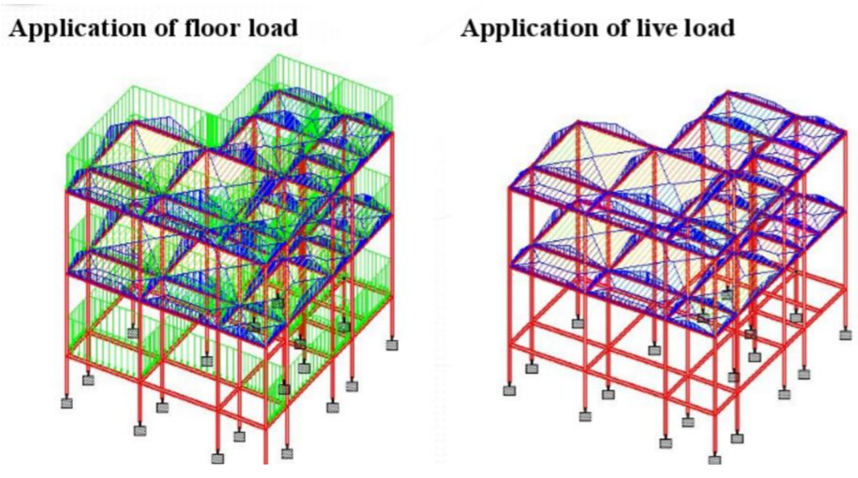

Fig 4 Application of floor load and live load

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MEMBER END FORCES   STRUCTURE TYPE = SPACE

ALL UNITS ARE -- KN METE (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	2	48	0.10	2.23	-0.02	-0.67	0.01	0.52
		79	-0.10	0.32	0.02	0.67	0.01	0.16
115	1	45	1.68	18.64	-0.16	0.17	0.04	4.47
		71	-1.68	-8.93	0.16	-0.17	0.04	2.29
	2	45	0.12	1.56	-0.01	-0.35	0.00	0.56
		71	-0.12	-0.97	0.01	0.35	0.00	0.11
116	1	44	7.26	38.16	0.02	-0.41	-0.03	21.04
		43	-7.26	32.90	-0.02	0.41	-0.05	-14.23
	2	44	0.74	4.36	0.00	0.08	-0.01	2.34
		43	-0.74	2.87	0.00	-0.08	-0.01	-1.55
117	1	43	1.96	16.40	-0.02	-1.39	0.01	3.24
		46	-1.96	24.05	0.02	1.39	0.02	-10.96
	2	43	0.17	1.28	-0.01	-0.30	0.01	0.43
		46	-0.17	1.27	0.01	0.30	0.01	-0.41

Fig 5 Analysis

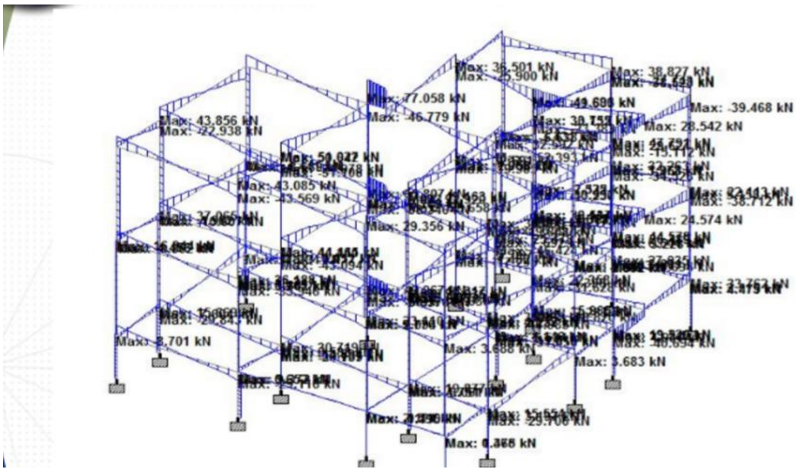

Fig 6. SFD

VI. RESULTS

a) RCC STRUCTURE

i. Maximum value of shear force is 131.639 KN in beam no.119

ii. Maximum value of bending value is 74.225KN-M

iii. Maximum displacement is 9.225 mm in beam no.124

iv. Material required

- Concrete 49. 3cu.meter
- Steel 6840.26 kg

v. Total Cost-

- For M25 Grade concrete, cost of 1cu.m. R.M.C. is 6200Rs.
- So, For 50cum. Concrete =50*6200=310000Rs.
- Gross Total costing of Material required for R.C.C. structure is
  =310000+275000
  =585000Rs.

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b) STEEL STRUCTURE

1. Maximum value of shear force is121.31 KN in beam no.119
2. Maximum value of bending value is71. KN-m
3. Maximum displacement is 4. 529mm in beam no.124
4. Material required
   - Steel 187.623 KN
5. Total Cost-
   - Cost of ISMB per metric ton is 58900 Rs. Per metric tonn.
   - Cost per KN.=58900/9.81= 6004 Rs./KN
   - Total cost for Steel Structure
     = 6004*187.623
     =1126503Rs.

VII. CONCLUSION

From this project, we conclude that for small structures like G+1 structure, R.C.C. structure resulting slightly more Shear, bending, & Deflection as compare to Steel Structure But for economical purpose R.C.C. structure is much more economical than Steel structure.

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