International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 04 | Apr 2021 www.irjet.net p-ISSN: 2395-0072

Research Paper on Planning, Design and Analysis of G+8 Hospital Building using Staad Pro v8i

Amit Kumar Sharma[1], Akash Malik[2]

[1]PG Student, Department of Civil Engineering, Galgotias University, Gr. Noida, Uttar Pradesh.
[2]Assitant professor, Department of Civil Engineering, Galgotias University, Gr. Noida, Uttar Pradesh

---

ABSTRACT – *The aim of the Structural engineers are to design the structures safe, durable and economical. The main aim of my project is to apply knowledge in the real world designing of Hospital building that requires large and clear unobstructed by columns. Here the hospital building is of Eight storey structure with 350 number of beds and capacity of 23500sq.m and the building is located in Gurugram. which is planned by auto and design and analysis by staad pro.*

The hospital building will follow up by IS (Indian standard) codes for better output.

Key Words: Hospital building, AUTOCAD, STAAD PRO, planning, design and analysis, shear force & bending moment deflection.

1. INTRODUCTION

As we know that the hospital building is a health care institution which providing patients treatment with medical and nursing staff with medical equipment. The main aim of designing and analysis of hospital building is that the structure should be safe and durable and also economical with respect to initial and maintenance cost. Software like auto cad and staad pro helps the structural engineers to solve the problems in short period of time. Structural engineering is a field of engineering which deals with design and analysis of structures that resist or support loads which is considered a speciality.

2. METHODOLOGY

The methodology for the planning of building should be spacious and green environment and software that used for analysis for the planed building by various loads condition.

- MODELLING: G+8 Hospital building.
- ANALYSIS: - Calculation of Shear force & bending moment., deflection & Analysis of RCC framed structure.
- DESIGN: - Design of footing, Column, beam, slab, staircase using code IS 456-2000

3. GEOMETRIC PARAMETER

- Size of Beam = 450x450mm.
- Size of Column= 600x450mm.
- thickness of Slab= 150mm

3.1 GEOMATRIC DETAILS

- Ground floor height: 3.5m
- First and the rest of floor height: 3.5m
- Depth of Foundation: 2m
- Total build up area: 23500sq.m

3.2 MATERIAL DETAILS

- Grade of Concrete: M25
- Grade for All steel: Fe500
- Types of Steel bar: HYSD
- Bearing capacity of soil: 200KN/m^2

3.3 TYPE OF LOADS ON THE STRUCTURE

DEAD LOAD

- Self-weight of -1.5KN/m^2
- RCC slab
- Beam and Column
- Plinth
- Walls

LIVE LOAD

- For floor slabs: 2KN/m^2
- For roof slabs: 1.5KN/m^2
- For staircase: 4KN/m^2

4. INTRODUCTION TO STAAD PRO

Staad pro is the software which is used to design and analysis of structure by the engineers.

This software gives us accurate result than the manual techniques.

The features of the Staad pro are,

- Analysing and designing tools,
- GUI modelling,
- Input & Output files,
- Results as per other standards & Indian standard.
- Generating reports.

5. RCC ELEMENTS

The RCC elements are Footing, Columns, Beams, Slabs and Stairs case etc.

5.1 DESIGN OF FOOTING

Footings are structural elements which transfer the loads from building to the Earth. They typically made of concrete with rebar reinforcement. And the purpose of design footings is to support the foundation.

5.2 DESIGN OF COLUMN

Columns are defined as and elements that used to support axial compressive loads or columns are vertical structural member which that loads in compression it can transfer loads from floor, slab, roof slab, ceiling, beam, etc.

5.2 DESIGN OF BEAM

As the beam is structural elements that resists loads applied axis to beams. Its mode of deflections is primarily by bending. As the beam result in reactions forces for the support point of the beam. Beams are used to support the floors weight, roofs weight, ceilings weight, of the building and to transfer the load to the vertical load member.

5.2 DESIGN OF SLAB

Slabs are structural elements made of concrete, that used to form floor and roof. Slabs support transverse load and transfer them to supports by bending actions one direction or more than one direction. A slab is generally several inches thick which supported by columns, beams, walls.

Conventional slab: - (4'' or 10cm or 5'' to 6'')

- One way slab
- Two-way slab

5.3 DESIGN OF STAIRCASE

The purpose of stairs is giving access to different floors of the building. The horizontally upper portion of a step called tread and the front or vertical portion called riser.

6. RESULTS AND DISCUSSION

The analysis and design of hospital building (G+8) were obtained manually and also the staad pro v8i has been used to analyzing the structure to get proper results on shear force and bending moment. The analysis and design were obtained manually and also the STAAD.PROV8i has been used for analyzing the planned structure to get a result of bending moment in Fig. 4 & 5 diagrams were mentioned below.

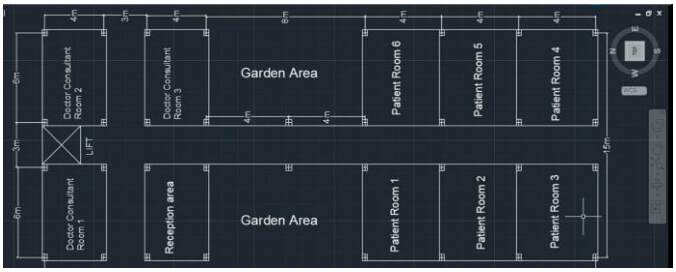

Fig- 1: Hospital building plan

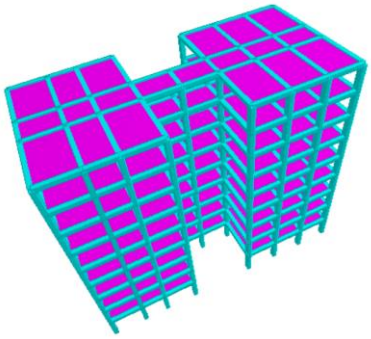

Fig- 2: 3D modeling in staad pro v8i

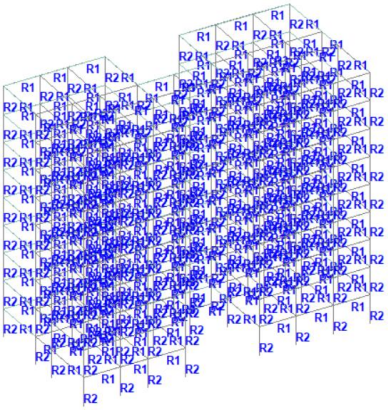

Fig- 3: Beams & column parallels to x , z & y directions.

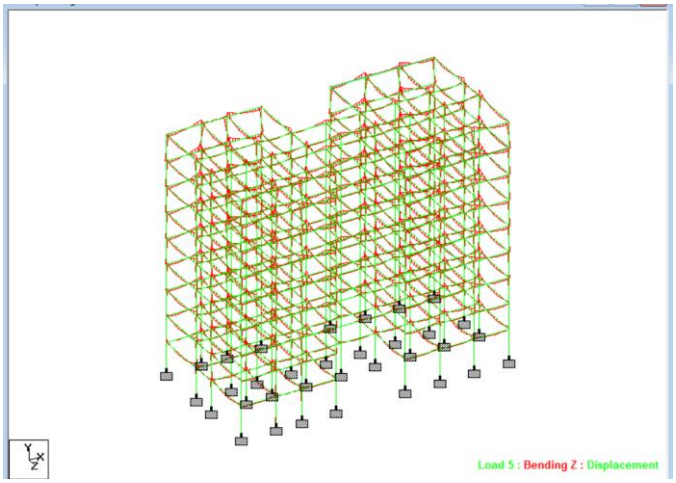

Fig- 4: Bending moment diagram

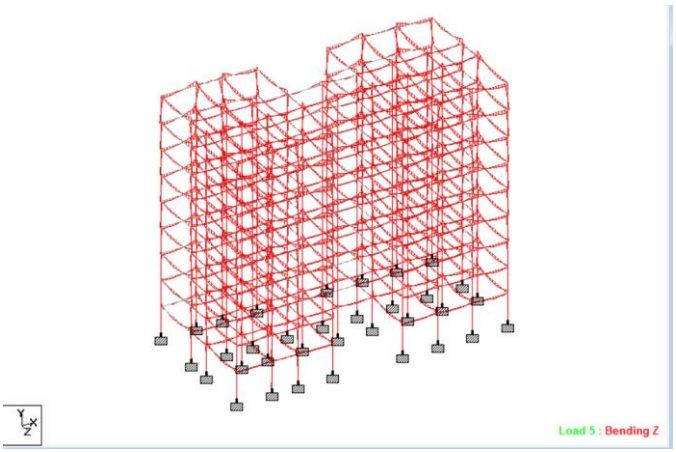

Fig- 5: Deflection diagram

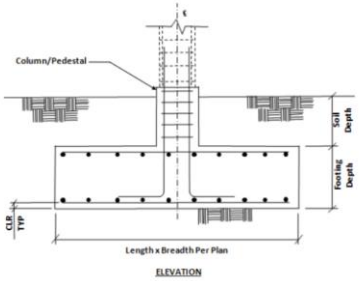

Fig- 7: Design of footing.

```
                C O L U M N   N O.      9   D E S I G N   R E S U L T S

      M30                    Fe600 (Main)              Fe600 (Sec.)

LENGTH:  3000.0 mm   CROSS SECTION:  600.0 mm X  450.0 mm  COVER: 40.0 mm

** GUIDING LOAD CASE:     4 END JOINT:      1   SHORT COLUMN


REQD. STEEL AREA    :      1529.36 Sq.mm.
REQD. CONCRETE AREA:    191169.73 Sq.mm.
MAIN REINFORCEMENT : Provide   8 - 16 dia. (0.60%,    1608.50 Sq.mm.)
                     (Equally distributed)
TIE REINFORCEMENT  : Provide  8 mm dia. rectangular ties @ 255 mm c/c

SECTION CAPACITY BASED ON REINFORCEMENT REQUIRED (KNS-MET)
-----------------------------------------------------------
Puz :    4312.56   Muz1 :     235.25   Muy1 :     321.17

INTERACTION RATIO: 0.16 (as per Cl. 39.6, IS456:2000)

SECTION CAPACITY BASED ON REINFORCEMENT PROVIDED (KNS-MET)
----------------------------------------------------------
WORST LOAD CASE:      4
END JOINT:      1 Puz :    4347.11   Muz :     242.67   Muy :     332.50   IR: 0.15
```

Fig- 8: Reinforcement detail in column.

```
                B E A M   N O.        1   D E S I G N   R E S U L T S

      M30                    Fe600 (Main)              Fe600 (Sec.)

   LENGTH:  4000.0 mm      SIZE:    450.0 mm X  450.0 mm    COVER: 25.0 mm

                        SUMMARY OF REINF. AREA (Sq.mm)
-------------------------------------------------------------------------------
SECTION       0.0 mm      1000.0 mm     2000.0 mm     3000.0 mm     4000.0 mm
-------------------------------------------------------------------------------
 TOP          267.75         0.00          0.00        267.75        286.88
REINF.      (Sq. mm)      (Sq. mm)      (Sq. mm)      (Sq. mm)      (Sq. mm)

BOTTOM       267.75        267.75        267.75        267.75          0.00
REINF.      (Sq. mm)      (Sq. mm)      (Sq. mm)      (Sq. mm)      (Sq. mm)
-------------------------------------------------------------------------------

                      SUMMARY OF PROVIDED REINF. AREA
-------------------------------------------------------------------------------
SECTION       0.0 mm      1000.0 mm     2000.0 mm     3000.0 mm     4000.0 mm
-------------------------------------------------------------------------------
 TOP       13-10i         4-10i         4-10i         13-10i        13-10i
REINF.   1 layer(s)     1 layer(s)    1 layer(s)    1 layer(s)    1 layer(s)

BOTTOM     13-10i        13-10i        13-10i        13-10i         4-10i
REINF.   1 layer(s)     1 layer(s)    1 layer(s)    1 layer(s)    1 layer(s)

SHEAR    2 legged  8i  2 legged  8i  2 legged  8i  2 legged  8i  2 legged  8i
REINF.  @ 200 mm c/c  @ 200 mm c/c  @ 200 mm c/c  @ 200 mm c/c  @ 200 mm c/c
-------------------------------------------------------------------------------


 SHEAR DESIGN RESULTS AT DISTANCE d (EFFECTIVE DEPTH) FROM FACE OF THE SUPPORT
```

```
SHEAR DESIGN RESULTS AT DISTANCE d (EFFECTIVE DEPTH) FROM FACE OF THE SUPPORT
-----------------------------------------------------------------------------

SHEAR DESIGN RESULTS AT    645.0 mm AWAY FROM START SUPPORT
  VY =     11.74 MX =     -0.67 LD=     4
  Provide 2 Legged  8i  @ 200 mm c/c

SHEAR DESIGN RESULTS AT    645.0 mm AWAY FROM END SUPPORT
  VY =    -27.02 MX =     -0.67 LD=     4
  Provide 2 Legged  8i  @ 200 mm c/c

=============================================================================


=============================================================================
                B E A M   N O.        2   D E S I G N   R E S U L T S

      M30                    Fe600 (Main)              Fe600 (Sec.)

   LENGTH:  3000.0 mm      SIZE:    450.0 mm X  450.0 mm    COVER: 25.0 mm

------------------------------<  PAGE 9 Ends Here  >--------------------------
 STAAD SPACE                                                -- PAGE NO.   10
```

Fig- 9: Reinforcement detail in Beam

7. CONCULSION

As the design and analysis of structural elements are inevitable in the field of civil engineering, software like Staad Pro is very important since it gives more accurate result that

too in a lesser time. design and analysis of building using STAAD PRO software reduces a lot of time in the work.

The structural aspects of planning, analysis and design has been done and get an idea for execution of structure by many appropriate rules and regulation under IS codes. By using software, the project of Hospital building (G+8) was analyzed for a clear execution in the field. Here the project was analyzed by both manual and software for a clear idea of structural basis.

8. REFRENCES

[1.] Indian standard code=IS456:2000(Reinforcement concrete code for practice)

[2.] Abhishek Mehta, "method of analysis for lateral loading conditions", National Institute of Technology, Rourkela, 2011.

[3.] Vishal T, Gajendra. "Design & analysis of multistorey building using STAAD Pro", (IRJET), Volume: 03 Issue: 06, 2016.

[4.] Punmia. P. C, 'Design of Concrete Structure', Lakshmi publications

[5.] Divyakmath, Vandana Reddy, "Design & analysis of reinforced concrete building(G+5)". Raju Rangraju, collage of Engineering & Technology, India- 2012.

[6.] Jayachandran and Rajasekhara, "Structural Design of Multistorey Building,", India-2006.

[7.] L.G. Kalurkar, "Design & analysis of multistory building using composite structure "By LG Kalurkr in 2014.

[8.] Ramya, Sasikumar study on analysis & design of (G+10) multistorey building, using staad pro software.

[9.] S. Ramamrutham, design of reinforced concrete structures. pp. 506-1121, 2009.

[10.] Varalakshmi, "design & analysis of residential building(G+5)", Institute of Technology and Management, Dunnigan, Hyderabad.

[11.] "Structural engineering", https://en.wikipedia.org/wiki/Structural_engineering_theory. 2016.

[12.] STAAD.Pro software for design and analysis". Https://en.wikipedia.org/wiki/STAAD.

[13.] Sandeep Singh, Location & Layout of Hospital, 1st SEM MHA Guru NANAK DEV University 2008

[14.] J. E. V. RaghavaRao, Chenakesavulu, Design of hospital building(G+8) for earthquake resistant, IRJET Special Issue 4820Sciences & Research Technology.