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Analysis and Design of Multi-Storey Building by using STAAD-Pro V8i

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Abstract:- Unique structures need more time for its time consuming calculations, if we use manual methods. STAAD Pro provides us a quick results. It is easy to use for analyze and design any structure for more accuracy. In the STAAD Pro limit state method is use as per Indian Standard Code and Practices. We can conclude that this software can save much time and very accurate in designs .In this project G+3 structure is consider and dead, live ,combination, wind are applied. Then results are studied and compared by manual calculations. For this purpose this project has been selected. In the STAAD Pro the designing is done by Better technique for creating Geometry, Defining the cross sections for column and beam etc, Creating specification and supports, then the Loads are defined. After that the model is analyzed by 'run analysis'. Then reviewing (whether beam column passed in loads or failed) results.

Keywords:- *multistoried, planning, analysis, design, staad.pro, residential building, manual.*

I. INTRODUCTION

Construction of high rise building is basic need because of population and land scarcity. If we use conventional method of manual design of building is time consuming and more possibility of human errors. So it is necessary to use of software for getting more accurate result. STAAD Pro is structural software accepted by much civil engineering. Which can solve typical problem like wind analysis seismic analysis using various load combination to confirm various code like IS456:2000, 1893:2002,IS875:1987etc.

Fig 1

The full form of STAAD is "STRUCTURAL AIDED ANALYSIS AND DESIGN". We have chosen STAAD Pro because of its following advantages:-

- Easy for handle,
- conformation with the Indian Standard Codes,
- versatile nature of solving any type of problem,
- Accuracy of the solution.

STAAD-Pro is the professional's choice for steel, concrete, timber, aluminum and cold-formed steel design of low and high-rise buildings, culverts, petrochemical plants, tunnels, bridges, piles and much more.

To perform an accurate analysis we must determine such information as structural loads, geometry, support conditions, and materials properties. The results of such an analysis typically include support reactions, stresses and displacements. This information is then compared to criteria that indicate the conditions of failure.

II. LITERATUREREVIEW

- D.Ramya and A.V.S.Saikumar:- Design and analysis of G+10 Multistoried building . The study includes the comparative study of building using two software i.e STAAD-Pro and ETABS. In this design Live, Dead and wind load is taken under consideration.
- Annop .A, Hussian F, Neeraja R, Chandran Rahul , S Shabina and S Varsha :-Design a multistoried building of G+5 floors, at kalakode,Kerala ,India.the design is done by taking into account standards recommended by IS code , Kerala building and national building rules. And also includes requirements for sesmic and wind load.
- Aman, Nalwadgi M, Vishal T and Gajendra :-Analysis and Design of multi-storey building at Gulbarga city , Karnataka ,India. The study includes design of colums , beams , footings and slabs by well known civil engineeringsoftware named as STAAD-PRO.
- Deshmukh D.R, Yadav.A.K , Supekar S.N , Thakur A.B, Sonawane H.P and Jain I.M :- Analysis and Design of G+19Multistoried Building .The study includes designing of multistory bulding by well known civil engineering software named as STAAD-PRO and it also includes

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wind and Sesmic load. They also compare the results of earthquake load applied on structure by STAAD-Pro and manual calculations both by sesmic coefficient method.

III. METHODOLOGY

Step - 1 : Importing of centre-line plan from Auto-cad in .dxf format.

Step - 2: Representation of beams and columns.

By using add beam command we had drawn the beams and columns between the corresponding node points.

Step - 3: 3D view of structure Here we have used the Transitional repeat command in Y direction to get the 3D view of structure.

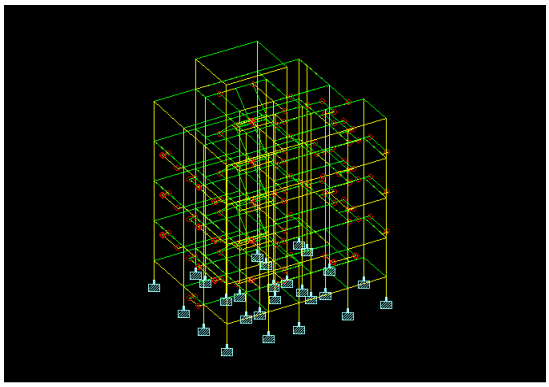

Fig 2

Step - 4: Supports and property assigning.

After the creation of structure the supports at the base of structure are specified as fixed. Also the Materials were specified and cross section of beams and columns members was assigned.

Step - 5: Assigning of dead loads. Dead loads are calculated as per IS 875 PART 1 for external walls, internal walls, parapet wall including self -weight of structure.

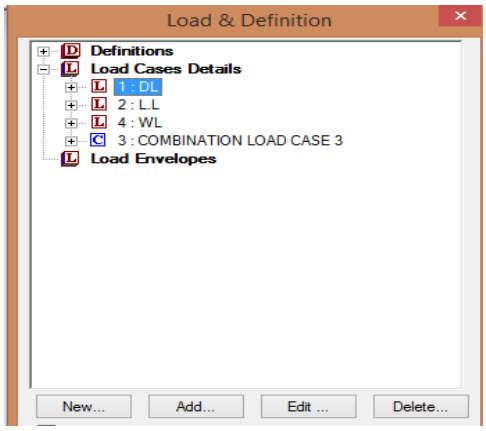

Fig 3

Step - 6: Assigning of live loads.

Live loads are assigned for every floor as 3KN/m2 based on IS 875 PART 2.

Step - 7: Assigning of wind loads.

Wind loads are defined as per IS 875 PART 3 based on intensity calculated and exposure factor. Then loads are added in load case details in +X,-X, +Z,-Z directions.

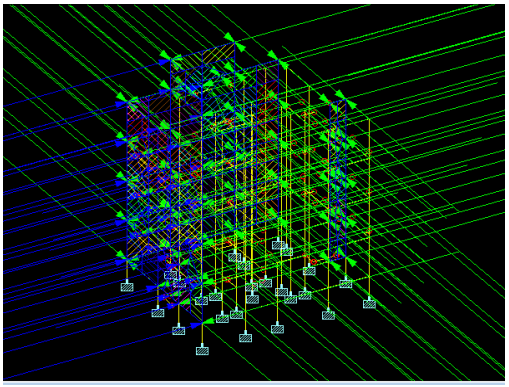

Fig 4

Step-8: Adding of load combinations.

After assigning all the loads, the load combinations are given with suitable factor of safety as per IS 875 PART 5.

Step-9:Analysis After the completion of all the above steps we have performed the analysis and checked for errors.

```
++ Calculating Section Forces3.                    23: 3:52
++ Start Concrete Design ...                       23: 3:52
++ Start Concrete Design ...                       23: 3:53
++ Start Concrete Design ...                       23: 3:54
++ Creating Displacement File (DSP)...             23: 3:54
++ Creating Reaction File (REA)...                 23: 3:54
++ Calculating Section Forces1-110.                23: 3:54
++ Calculating Section Forces2.                    23: 3:56
++ Calculating Section Forces3                     23: 3:56
++ Creating Section Force File (BMD)...            23: 3:56
++ Creating Section Displace File (SCN)...         23: 3:57
++ Creating Element Stress File (EST)...           23: 3:57
++ Creating Element JT Stress File (EJT)...        23: 3:57
++ Creating Element JT Force File (ECF)...         23: 3:57
++ Creating Design information File (DGN)...       23: 3:57
++ Done.                                           23: 3:58

0 Error(s), 0 Warning(s), 1 Note(s)

++ End STAAD.Pro Run Elapsed Time =    17 Secs
                                                   archt.anl
```

Fig 5

Step - 10: Design. Finally concrete design is performed as per IS 456: 2000 by defining suitable design commands for different structural components. After the assigning of commands again we performed analysis for any errors.

IV. MANUAL DESIGN

Manual design of structure is done by as per IS 456:2000 recommendation.

V. RESULTS

Section	Reinforcement Area (A_{st}) in (mm^2)	
	Manual design	Software design
Slab	200.74	120
Beam	392.64	282.51
Column	1030.43(p_t%=1)	1619.20(p_t%=3)

Table 1

Sofware results

```
                    B E A M   N O.     331   D E S I G N   R E S U L T S

      M20                    Fe415 (Main)              Fe415 (Sec.)

 LENGTH:  3210.2 mm     SIZE:   230.0 mm X  300.0 mm   COVER: 25.0 mm


                        SUMMARY OF REINF. AREA (Sq.mm)
-------------------------------------------------------------------------------
 SECTION      0.0 mm      802.6 mm    1605.1 mm    2407.7 mm    3210.2 mm
-------------------------------------------------------------------------------
  TOP         346.51        0.00        0.00         0.00       198.35
 REINF.     (Sq. mm)    (Sq. mm)    (Sq. mm)     (Sq. mm)    (Sq. mm)

 BOTTOM        0.00      127.19      229.51       127.19         0.00
 REINF.     (Sq. mm)    (Sq. mm)    (Sq. mm)     (Sq. mm)    (Sq. mm)


                    SUMMARY OF PROVIDED REINF. AREA
-------------------------------------------------------------------------------
 SECTION      0.0 mm      802.6 mm    1605.1 mm    2407.7 mm    3210.2 mm
-------------------------------------------------------------------------------
  TOP         5-10i       2-10i       2-10i        2-10i        3-10i
 REINF.   1 layer(s)  1 layer(s)  1 layer(s)   1 layer(s)   1 layer(s)

 BOTTOM      2-10i       2-10i       3-10i        2-10i        2-10i
```

```
================================================================================

        C O L U M N   N O.    283   D E S I G N   R E S U L T S

      M20                    Fe415 (Main)              Fe415 (Sec.)

LENGTH:  3000.0 mm   CROSS SECTION:  230.0 mm X  350.0 mm  COVER: 40.0 mm

** GUIDING LOAD CASE:    3  SHORT(Z)        /BRACED LONG(Y)


REQD. STEEL AREA   :     2150.63 Sq.mm.
REQD. CONCRETE AREA:    78349.38 Sq.mm.
MAIN REINFORCEMENT : Provide  12 - 16 dia. (3.00%,   2412.74 Sq.mm.)
                     (Equally distributed)
TIE REINFORCEMENT  : Provide  8 mm dia. rectangular ties @ 230 mm c/c

SECTION CAPACITY BASED ON REINFORCEMENT REQUIRED (KNS-MET)
-----------------------------------------------------------
Puz :   1374.53   Muz1 :     52.65   Muy1 :     30.21

INTERACTION RATIO: 0.95 (as per Cl. 39.6, IS456:2000)

SECTION CAPACITY BASED ON REINFORCEMENT PROVIDED (KNS-MET)
-----------------------------------------------------------
WORST LOAD CASE:     3
Puz :   1453.75   Muz :     61.38   Muy :     34.44   IR: 0.87
================================================================================
```

Fig 6

VI. CONCULSION

STAAD Pro is fast and accurate structural design software.It also provide economical design of the structure. The difference in steel error is due to human error.

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