



Article Title: Planning Analysis and Design of Multi Storied Building by Staad.Pro.v8i

Planning Analysis and Design of Multi Storied Building by Staad.Pro.v8i

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ABSTRACT

The aim of the project is to design a multi storied building of G+5 floors, at Avanavan cherry about 2 km from Attingal. The design is done by taking in to account the requirements and standards recommended by IS code, Kerala building rules and national building rules.

Planning is done using the 3D modeling software Revit 2018 with the help of Auto CAD 2017. The structure analysis and design is done using STAAD.PRO.V8i and a cross check is done for selected members using limit state method of design as per IS 456-2000. STAAD.Pro uses a command language based input format, which can be created through an editor called the editor file, the powerful STAAD.Pro graphics input generator or through CAD based input generators like AutoCAD. Output generated by staad.pro consists of detailed numerical results for analysis and design.

Keyword: Multistoried, Planning, Analysis and Design, Staad.Pro.

1 Introduction

Buildings are an important indicator of social progress of the country. A building frame is a three dimensional structure or space structure consist of column, beams and slabs. Nowadays, high rise buildings are in high demand due to the world population boom. Earlier, modeling and structural analysis of buildings were carried out using hand calculation method based on simplified assumptions and understanding the whole behavior of the structure. But it seems to be time consuming and complicated for high rise buildings. At present, computer hardware's and software's for modeling and analysis of structure is widely available. We need to know how the knowledge secured in the class room are applied in these practical side of work. When we got this project, we come into practical field to collect construction techniques and to meet the various difficulties in the construction. Also it is necessary to have sufficient knowledge regarding the various software's currently used in planning analysis and design of structure.



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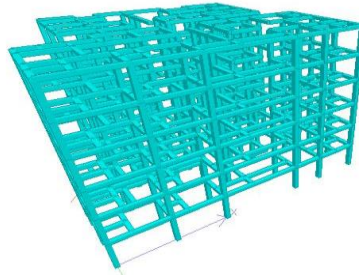


Figure 1: *Three dimensional rendered view of the building from Staad pro*

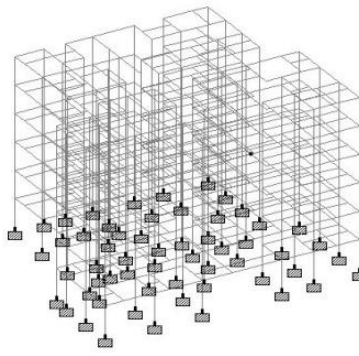


Figure 2: *Three dimensional line diagram of the building with fixed support*

2 Literature Survey

High rise buildings are in high demand because of the world population boom and development of technology during past decades. Various structural forms and construction materials were developed along with a diverse assemblage of structural and nonstructural components. The real performance of the high rise structures depends greatly on the integrated interaction of structure and nonstructural components. This makes the behavior of high rise structures complicated.

In current design practice, the lateral load resisting system of a high rise building is considered vital to the whole structure. It is commonly recognized by engineers that the load resisting system of a multi storied building is a system including mainly structural components such as columns, beams, and shear walls. In fact, through, nonstructural components also contribute to the lateral performance of high rise building. Observable gaps exist between the real performance of buildings and the behavior predicted by design theory. In practice, buildings perform as an integrated system of structural and nonstructural components but the nonstructural components are considered non load bearing and are not included during the design process of the primary structure. Since the 1990s specialist software has become available to aid in the design of structure with the functionality to assist the drawing, analyzing and designing of structures with maximum precision, example



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includes AutoCAD, Staad. Pro, ETABS, Prokon, Revit structure, etc. such software may also take into consideration environmental loads such as from earth quakes and wind.

3 Building data for analysis

1	Type of building	Multi storey flat building
2	Number of storeyes	G+5 (6 storey's)
3	Floor height	3.5m
4	Material	Concrete (M20)and Reinforcement (FE415)
5	Size of column	.4mX.5m
6	Size of beam	.4mx.4m
7	Dead load	Self-weight : -1 Member load:- -14KN/m Floor load :.4KN/mm ²
8	Live load	3KN/m ²
9	Wind load	4KN/M ²
10	Seismic zone	II,III,IV,V (Table 2, IS 1893 (Part I): 2002)
11	Size of wall	20cm thick

4 Analysis and design of building

Step 1: Creation of nodal points. Based on the column positioning of plan we entered the node points into the STAAD file.

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.

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.



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Step 5: 3D rendering view. After assigning the property the 3d rendering view of the structure can be shown

Step 6: Assigning of seismic loads. In order to assign Seismic loads firstly we have defined the seismic loads according to the code **IS1893:2002** with proper floor weights. Loads are added in load case details in +X,-X, +Z,-Z directions with specified seismic factor.

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.

Step 8: 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.

Step 9: Assigning of live loads. Live loads are assigned for every floor as 4 kN/m² based on **IS 875 PART 2**.

Step 10: Adding of load combinations. After assigning all the loads, the load combinations are given with suitable factor of safety as per **IS 875PART 5**.

Step 11: Analysis. After the completion of all the above steps we have performed the analysis and checked for errors.

Step 12: 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.

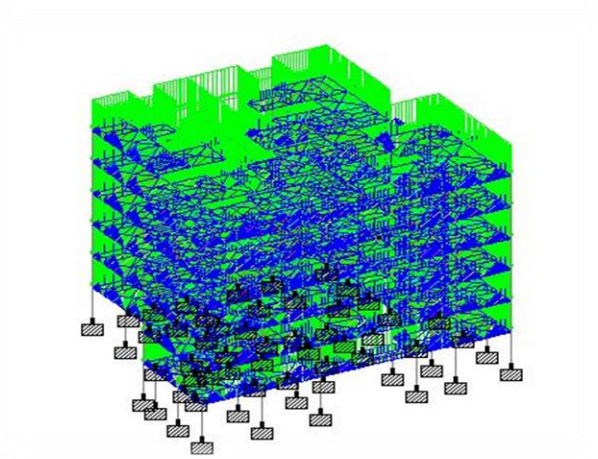


Figure 3: *When dead load is applied*



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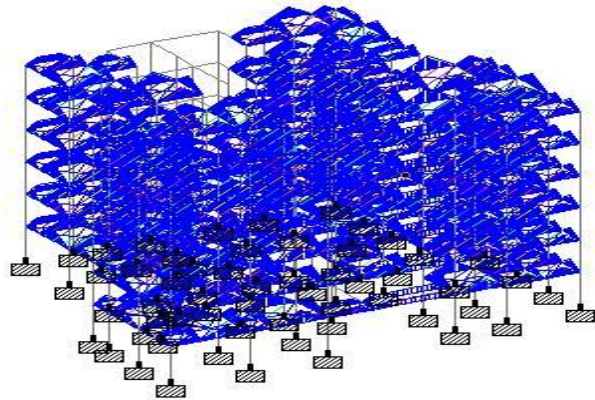


Figure 4: *When live load is applied*

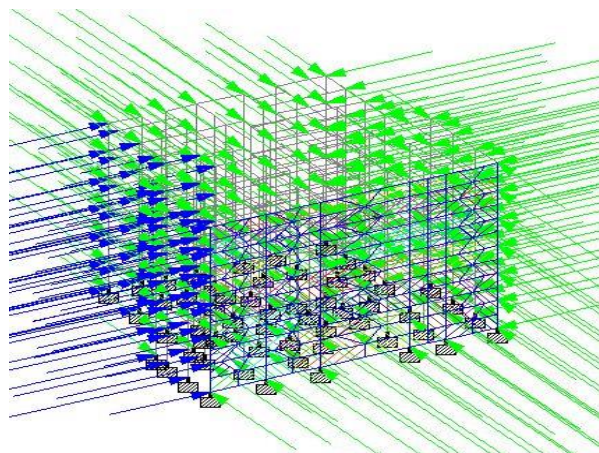


Figure 5: *When wind load is applied*

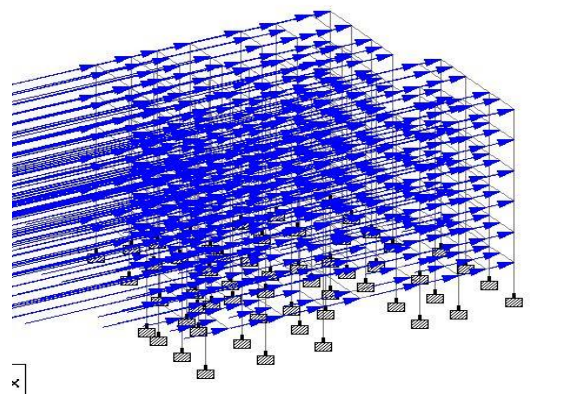


Figure 6: *When seismic load is applied*



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5 Result

START GROUP DEFINITION

JOINT

COLUMNS 22 23 29 34

MEMBERBEAMS 58 TO 206 264 TO 412 470 TO 618 676 TO 824 882 TO 1030 1088 -
1089 TO 1236

COLUMNS1 1 TO 57 207 TO 263 413 TO 469 619 TO 675 825 TO 881 1031 1032 TO
1087

END GROUP DEFINITION

DEFINE MATERIAL START

ISOTROPIC CONCRETE

E 2.17185e+007

POISSON 0.17

DENSITY 23.5616

ALPHA 1e-005

DAMP 0.05

TYPE CONCRETE

STRENGTH FCU 27579

END DEFINE MATERIAL

MEMBER PROPERTY

58 TO 206 264 TO 412 470 TO 618 676 TO 824 882 TO 1030 1088 TO 1235 -
1236 PRIS YD 0.4 ZD 0.4

1 TO 57 207 TO 263 413 TO 469 619 TO 675 825 TO 881 1031 TO 1086 -
1087 PRIS YD 0.4 ZD 0.5

CONSTANTS

MATERIAL CONCRETE ALL

SUPPORTS

1 TO 57 FIXED

DEFINE 1893 LOAD

ZONE 0.16 RF 3 I 1 SS 1 ST 1 DM 0.05 PX 0.5 PZ 0.5

SELFWEIGHT 1

MEMBER WEIGHT

58 TO 206 264 TO 412 470 TO 618 676 TO 824 882 TO 1030 1088 TO 1235 1236 UNI 14

FLOOR WEIGHT

YRANGE 0 21 FLOAD 4.75

DEFINE WIND LOAD

TYPE 1 WIND 1

<! STAAD PRO GENERATED DATA DO NOT MODIFY !!!



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ASCE-7-2010: PARAMS 85.000 mph 0 1 1 0 0.000 ft 0.000 ft 0.000 ft 1 -
1 40.000 ft 30.000 ft 25.000 ft 2.000 0.010 0 -
0 0 0 0 0.761 1.000 1.000 0.850 0 -
0 0 0 0.866 0.800 -0.550
!> END GENERATED DATA BLOCK
INT 0.614555 0.614555 0.625063 0.634749 0.643753 0.652179 0.66011 -
0.667609 0.67473 0.681515 0.688 0.694215 0.700185 0.705932 0.711476 -
HEIG 0 4.572 5.15815 5.74431 6.33046 6.91662 7.50277 8.08892 -
8.67508 9.26123 9.84739 10.4335 11.0197 11.6059 12.192
EXP 0.5 JOINT 1 TO 3 5 7 8 10 11 13 14 19 TO 25 27 29 30 32 33 35 37 -
38 40 41 46 48 51 54 58 TO 60 62 64 65 67 68 70 71 76 TO 82 84 86 -
87 89 90 92 94 95 97 98 103 105 108 111 116 120 121 124 126 130 133 -
135 TO 137 141 144 151 158 159 166 TO 168 170 172 173 175 176 178 -
179 184 TO 190 192 194 195 197 198 200 202 203 205 206 211 213 216 -
219 224 228 229 232 234 238 241 243 TO 245 249 252 259 266 267 274 -
275 TO 276 278 280 281 283 284 286 287 292 TO 298 300 302 303 305 306 -
308 310 311 313 314 319 321 324 327 332 336 337 340 342 346 349 351 -
352 TO 353 357 360 367 374 375 382 TO 384 386 388 389 391 392 394 395 -
400 TO 406 408 410 411 413 414 416 418 419 421 422 427 429 432 435 -
440 444 445 448 450 454 457 459 TO 461 465 468 475 482 483 -
490 TO 492 494 496 497 499 500 502 503 508 TO 514 516 518 519 521 -
522 524 526 527 529 530 535 537 540 543 548 552 553 556 558 562 565 -
567 TO 569 573 576 583 590 591 598 TO 600 602 604 605 607 608 610 -
611 616 TO 622 624 626 627 629 630 632 634 635 637 638 643 645 648 -
651 656 660 661 664 666 670 673 675 TO 677 681 684 691 698 699
LOAD 1 LOADTYPE Seismic TITLE SL X
1893 LOAD X 1
1893 LOAD X 1
PERFORM ANALYSIS
CHANGE
LOAD 2 LOADTYPE Seismic TITLE SL Z
1893 LOAD Z 1
PERFORM ANALYSIS
CHANGE
LOAD 3 LOADTYPE Dead TITLE DL
SELFWEIGHT Y -1 LIST ALL
MEMBER LOAD
58 TO 206 264 TO 412 470 TO 618 676 TO 824 882 TO 1030 1088 TO 1235 -

```



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1236 UNI GY -14
 FLOOR LOAD
 YRANGE 0 21 FLOAD -4 GY
 LOAD 4 LOADTYPE Live TITLE LL
 FLOOR LOAD
 YRANGE 0 21 FLOAD -3 GY
 LOAD 5 LOADTYPE Wind TITLE WL
 WIND LOAD X 1 TYPE 1 YR 0 21
 WIND LOAD Z 1 TYPE 1 YR 0 21
 WIND LOAD X -1 TYPE 1 YR 0 21
 WIND LOAD Z -1 TYPE 1 YR 0 21
 LOAD COMB 6 Generated Indian Code Genral_Structures 1
 3 1.5 4 1.5
 LOAD COMB 7 Generated Indian Code Genral_Structures 2
 3 1.2 4 1.2 5 1.2
 LOAD COMB 8 Generated Indian Code Genral_Structures 3
 3 1.2 4 1.2 5 -1.2
 LOAD COMB 9 Generated Indian Code Genral_Structures 4
 3 1.2 4 1.2 1 1.2
 LOAD COMB 10 Generated Indian Code Genral_Structures 5
 3 1.2 4 1.2 2 1.2
 LOAD COMB 11 Generated Indian Code Genral_Structures 6
 3 1.2 4 1.2 1 -1.2
 LOAD COMB 12 Generated Indian Code Genral_Structures 7
 3 1.2 4 1.2 2 -1.2
 LOAD COMB 13 Generated Indian Code Genral_Structures 8
 3 1.5 5 1.5
 LOAD COMB 14 Generated Indian Code Genral_Structures 9
 3 1.5 5 -1.5
 LOAD COMB 15 Generated Indian Code Genral_Structures 10
 3 1.5 1 1.5
 LOAD COMB 16 Generated Indian Code Genral_Structures 11
 3 1.5 2 1.5
 LOAD COMB 17 Generated Indian Code Genral_Structures 12
 3 1.5 1 -1.5
 LOAD COMB 18 Generated Indian Code Genral_Structures 13
 3 1.5 2 -1.5
 LOAD COMB 19 Generated Indian Code Genral_Structures 14



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3 0.9 1 1.5
LOAD COMB 20 Generated Indian Code Genral_Structures 15
3 0.9 2 1.5
LOAD COMB 21 Generated Indian Code Genral_Structures 16
3 0.9 1 -1.5
LOAD COMB 22 Generated Indian Code Genral_Structures 17
3 0.9 2 -1.5
PERFORM ANALYSIS PRINT ALL
START CONCRETE DESIGN
CODE INDIAN
UNIT MMS NEWTON
CLEAR 25 MEMB 58 TO 206 264 TO 412 470 TO 618 676 TO 824 882 TO 1030 -
1088 TO 1236
CLEAR 40 MEMB 1 TO 57 207 TO 263 413 TO 469 619 TO 675 825 TO 881 1031 -
1032 TO 1087
FC 25 ALL
FYMAIN 415 ALL
FYSEC 415 ALL
MAXMAIN 25 ALL
MAXSEC 12 ALL
MINMAIN 16 ALL
MINSEC 8 ALL
TRACK 0 ALL
DESIGN BEAM 58 TO 206 264 TO 412 470 TO 618 676 TO 824 882 TO 1030 -
1088 TO 1236
DESIGN COLUMN 1 TO 57 207 TO 263 413 TO 469 619 TO 675 825 TO 881 1031 -
1032 TO 1087
CONCRETE TAKE
END CONCRETE DESIGN

6 Conclusion

STAAD. Pro graphical input generation facility allows generation of structural models graphically. A powerful geometry generation algorithm facilitates generation and viewing of structural models both 2D and 3D situations. All other specifications like section properties, material constants, support load, analysis and design requirements, printing, plotting facilities are available. A versatile “query” facility allows generation of customized reports. Powerful icons based graphics tools provide extremely user-friendly navigation and manipulation capabilities



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References

1. Year: 2014, "Design and Practical Limitations in Earthquake Resistant Structures and Feedback", INTERNATIONALJOURNAL OF CIVIL ENGINEERING AND CIVIL ENGINEERING (IJCIET), Vol: 5, no: 6, pp. 89-93
2. Year: 2012, "Comparison of design results of a Structure designed using STAAD and ETABS Software", INTERNATIONALJOURNAL OF CIVIL AND STRUCTURAL ENGINEERING, Vol: 2, no: 3
3. Year: 2013, "Analysis of multi storey building with precast load bearing walls", INTERNATIONAL JOURNAL OF CIVILAND STRUCTURAL ENGINEERING, Vol: 4, no: 2
4. Year: 2014, "Analysis and Design of shopping mall against lateral forces", INTERNATIONAL JOURNAL OFENGINEERING SCIENCE INVENTION, Vol: 3, no: 4
5. Year: 2014, "Lateral Load Analysis of Shear Wall and Concrete Braced Multi-Storeyed R.C Frame with the Effect of Ground Soft Storey", INTERNATIONAL JOURNAL OF APPLIEDSCIENCES AND ENGINEERING RESEARCH, Vol: 2, no: 09
6. Year: 2012, "Behavior of multistoried building under the effect of wind load", INTERNATIONAL JOURNAL OF APPLIEDSCIENCES AND ENGINEERING RESEARCH, Vol: 1, no: 4
7. Year: 1987, IS 875 (Part 2): "Code of Practice for Design Loads (Other than Earthquake) For Buildings and Structures". Part 2: Imposed Loads (Second Revision).