IJCRT.ORG ISSN : 2320-2882
INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)
An International Open Access, Peer-reviewed, Refereed Journal

ANALYSIS AND DESIGN OF G+1 DUPLEX HOUSE USING STAAD PRO

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Abstract: The aim of our work is to design the G+1 building according to Indian Standard codes. The design can be done manually (or) with the help of Software. We have selected to do our project with Software because designing manually consumes a lot of time, effort and can contain mistakes whereas by using software we can save time and obtain results without errors. Now a days there are several Software's are available in market for analysis and design of Civil Engineering structures‟ like ETABS, Staad Pro etc. At present work we used software named "Staad Pro"‟‟ abbreviated as "Structural Analysis Design and Detailing Software". The reason for using this is that user friendly and has exceptional features like it designs the structural components individually along with their analysis and results. Additional useful feature of this software is that we can view the Shear force, Bending moment, Torsion diagrams at each level of the building. We prepared the drawing plans along with its specifications for the building plan. After preparing the plan ready we have commenced by designing the structural components of building namely slabs, beams, columns and footings etc.

Index Terms- Shear Force, Bending Moment, Deflection, Slabs, Beams, Columns, Footings, Staad Pro.

I. INTRODUCTION

For static or dynamic analysis of bridges, containment structures, embedded structures (tunnels and culverts), pipe racks, steel, concrete, aluminum or timber buildings, transmission towers, stadiums or any other simple or complex structure, STAAD Pro has been the choice of design professionals around the world for their specific analysis needs.

Our project involves analysis and design of g+1 duplex house using a very popular designing software STAAD Pro (V8i).

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.

II LITERATURE REVIEW

Analysis and design of a G+21 multi storied building (2007):

2.1 Bedabrata Bhattacharjee & A.S.V. Nagender (NIT Rourkela):

They used STAAD pro for the analysis and design of a G+21 multi storied building. The dead loads acting on the slab were calculated manually while live load, seismic load and wind load have been entered by following respective IS Codes. The design was done using limit state of design according to IS 456:2000. They showed how efficiently and easily such a high rise building can be designed within a very short span of time.

2.2 Design and Analysis (G+5) of Residential Building:

Dr V. Ramesh Babu, K.Vishnu Vardhan, K.Peeraiah:

They modeled the structure through the Staad Pro Software and designed in the Robot Structural Analysis. They presented the results and calculations on the Columns, finally they concluded the structure was planned according to building bye laws and principles of planning.

2.3 Analysis and Design of Multi storey building by using STAAD Pro:

Aman, Manjunath Nalwadgi, T.Vishal, Gajendra:

They modeled the C+G+5 Residential / Commercial Building in Staad Pro. They focused on the structural member's i.e.., Slabs (one- way and two-way slab); Beams (single and double), Columns; footings; staircases. They concluded Short term deflection of all horizontal members is with in 20mm. The structural components of the buildings are safe in shear and flexure.

2.4 Design and Analysis of RCC Framed Structure (G+5) by using Staad Pro:

M.Siva Naga Kanya, A. Meghana Reddy, A. Pujitha, M. Dheeraj:

Objective of their project is to Design and Analysis on the wind and seismic forces on G+5 Multi Storey Building. They presented the manual calculations for the structural members and the analysis was done in Staad Pro Software. Finally, they compared the area of steel reinforcement values to the software analysis on the structural component.

2.5 Analysis and Design of a Residential Building by using STAAD PRO:

Author Name:-Kunal Wailkar et al (2021)

In this paper, the Author tried to focus on a residential building. The project aims to analyze and design for constructing a structure capable of overcoming all applied loads without failure during its intended life. The process of structural design involves various stages such as computation of loads, member design, detailing and many more. The conventional method of structural design and analysis leads to a lot of complications and tedious calculations which are time-consuming. Now-a-days to complete a design and analysis efficiently, fast software's used. Computer-aided design of the residential building by using STAAD PRO includes- Generating a structural framing plan, getting a model, Analysis of the structure, and Designing of structure. (Wailkar et al., 2021).

2.6 Analysis and Design of Multi storey Building G+4:

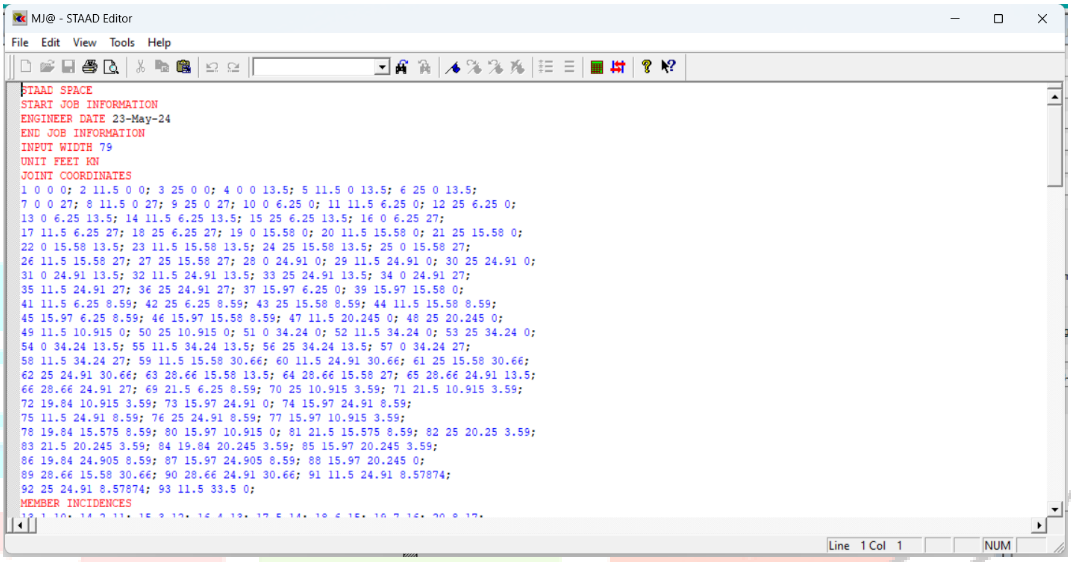
Author Name: - Mohd.Zohair (2018)

The author tried to study, a building that has multiple floors above the ground. It can be a residential or commercial building. This project deals with the analysis and design of the multi-storey building G+4. In general, the analysis of multi-storey is elaborate and rigorous because those are statically indeterminate structures. Shears and moments due to different loading conditions are determined by many methods such as the portal method, moment distribution method and matrix method. The dead load & live loads are applied and the design for beams, columns, and the footing is obtained manually. The Analysis part of the structure is done using Kani's Method and the values are taken for design. (Zohair, 2018)

III WORKING WITH STAAD.Pro

3.1 Input Generation:

The GUI (or user) communicates with the STAAD analysis engine through the STAAD input file. That input file is a text file consisting of a series of commands which are executed sequentially. The commands contain either instructions or data pertaining to analysis and/or design. The STAAD input file can be created through a text editor or the GUI Modeling facility. In general, any text editor may be utilized to edit/create the STAAD input file. The GUI Modeling facility creates the input file through an interactive menu-driven graphics oriented procedure.

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END JOB INFORMATION
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JOINT COORDINATES
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7 0 0 27; 8 11.5 0 27; 9 25 0 27; 10 0 6.25 0; 11 11.5 6.25 0; 12 25 6.25 0;
13 0 6.25 13.5; 14 11.5 6.25 13.5; 15 25 6.25 13.5; 16 0 6.25 27;
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45 15.97 6.25 8.59; 46 15.97 15.58 8.59; 47 11.5 20.245 0; 48 25 20.245 0;
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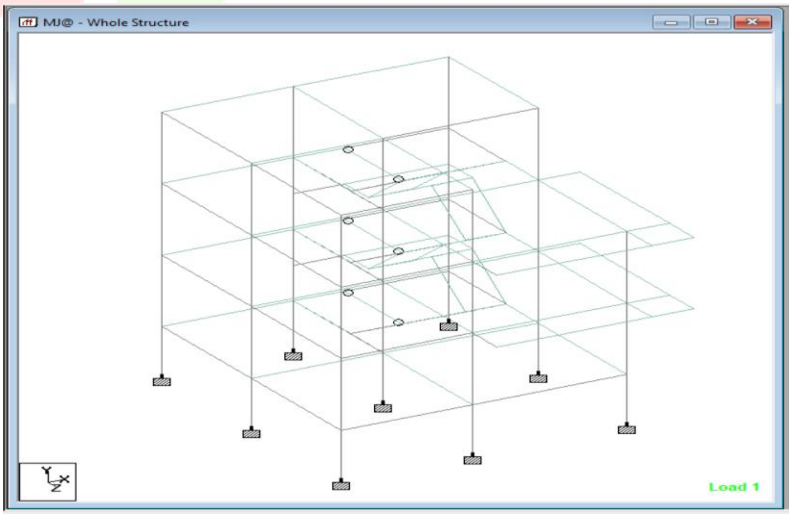
75 11.5 24.91 8.59; 76 25 24.91 8.59; 77 15.97 10.915 3.59;
78 19.84 15.575 8.59; 80 15.97 10.915 0; 81 21.5 15.575 8.59; 82 25 20.25 3.59;
83 21.5 20.245 3.59; 84 19.84 20.245 3.59; 85 15.97 20.245 3.59;
86 19.84 24.905 8.59; 87 15.97 24.905 8.59; 88 15.97 20.245 0;
89 28.66 15.58 30.66; 90 28.66 24.91 30.66; 91 11.5 24.91 8.57874;
92 25 24.91 8.57874; 93 11.5 33.5 0;
MEMBER INCIDENCES
```

3.2 Generation of the structure:

The structure may be generated from the input file or mentioning the co-ordinates in the GUI. The figure below shows the GUI generation method.



3.3 Material Constants:

The material constants are: modulus of elasticity (E); weight density (DEN); Poisson's ratio (POISS); co-efficient of thermal expansion (ALPHA), Composite Damping Ratio, and beta angle (BETA) or coordinates for any reference (REF) point. E value for members must be provided or the analysis will not be performed. Weight density (DEN) is used only when self-weight of the structure is to be taken into account. Poisson's ratio (POISS) is used to calculate the shear modulus (commonly known as G) by the formula,

$$G = 0.5 \times E / (1 + POISS)$$

3.4 Supports:

Supports are specified as PINNED, FIXED or FIXED with different releases (known as FIXED BUT). A pinned support has restraints against all translational movement and none against rotational movement. In other words, a pinned support will have reactions for all forces but will resist no moments.

3.5 Section Types for Concrete Design:

The following types of cross sections for concrete members can be designed. For Beams Prismatic (Rectangular & Square) & T-shape For Columns Prismatic (Rectangular, Square and Circular).

3.6 Design Parameters:

The program contains a number of parameters that are needed to perform design as per IS: 13920. It accepts all parameters that are needed to perform design as per IS: 456. Over and above it has some other parameters that are required only when designed is performed as per IS: 13920. Default parameter values have been selected such that they are frequently used numbers for conventional design requirements. These values may be changed to suit the particular design being performed by this manual contains a complete list of the available parameters and their default values. It is necessary to declare length and force units as Millimeter and Newton before performing the concrete design.

3.7 Beam Design:

Beams are designed for flexure, shear and torsion. If required the effect of the axial force may be taken into consideration. For all these forces, all active beam loadings are pre- scanned to identify the critical load cases at different sections of the beams. For design to be performed as per IS: 13920 the width of the member shall not be less than 200mm. Also the member shall preferably have a width-to depth ratio of more than 0.3.

Design for Flexure:

Design procedure is same as that for IS: 456. However while designing following criteria are satisfied as per IS: 13920,

1. The minimum grade of concrete shall preferably be M25.
2. Steel reinforcements of grade Fe415 or less only shall be used.
3. The minimum tension steel ratio on any face, at any section, is given by:

$$\rho \min = 0.24\sqrt{fck}/fy$$

3.8 Column Design:

Columns are designed for axial forces and biaxial moments per IS 456:2000. Columns are also designed for shear forces. All major criteria for selecting longitudinal and transverse reinforcement as stipulated by IS: 456 have been taken care of in the column design of STAAD. However following clauses have been satisfied to incorporate provisions of IS: 13920

1. The minimum grade of concrete shall preferably be M25.
2. Steel reinforcements of grade Fe415 or less only shall be used.
3. The minimum dimension of column member shall not be less than 200 mm. For columns having unsupported length exceeding 4m, the shortest dimension of column shall not be less than 300 mm.
4. The ratio of the shortest cross-sectional dimension to the perpendicular dimension shall preferably be not less than 0.
5. The spacing of hoops shall not exceed half the least lateral dimension of the column, except where special confining reinforcement is provided.

6. Special confining reinforcement shall be provided over a length lo from each joint face, towards mid span, and on either side of any section, where flexural yielding may occur. The length lo shall not be less than a) larger lateral dimension of the member at the section where yielding occurs, b) 1/6 of clear span of the member, and c) 450 mm.

7. The spacing of hoops used as special confining reinforcement shall not exceed ¼ of minimum member dimension but need not be less than 75 mm nor > 100 mm.

3.9 Design Operations:

STAAD contains a broad set of facilities for designing structural members as individual components of an analyzed structure. The member design facilities provide the user with the ability to carry out a number of different design operations. These facilities may design problem. The operations to perform a design are:

- Specify the members and the load cases to be considered in the design.
- Specify whether to perform code checking or member selection.
- Specify design parameter values, if different from the default values.
- Specify whether to perform member selection by optimization.]

These operations may be repeated by the user any number of times depending upon the design requirements.

3.10 General Comments:

This section presents some general statements regarding the implementation of Indian Standard code of practice (IS: 800 - 1984) for structural steel design in STAAD.

Allowable Stresses:

Multiple Analyses:

3.11 Post Processing Facilities:

All output from the STAAD run may be utilized for further processing by the STAAD.Pro GUI.

Stability Requirements

Deflection Check

Code Checking

IV ANALYSIS AND DESIGN OF G+1 DUPLEX HOUSE USING STAAD

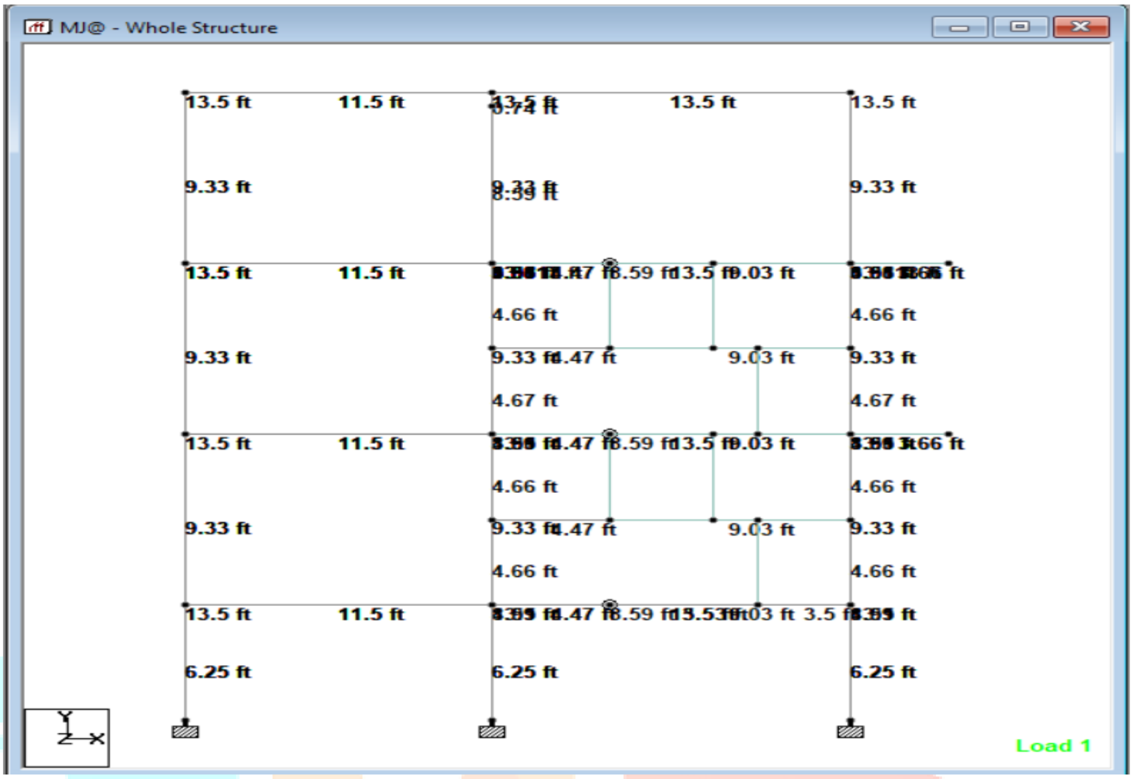


Fig.4.1 Plan of the G+1 DUPLEX HOUSE USING

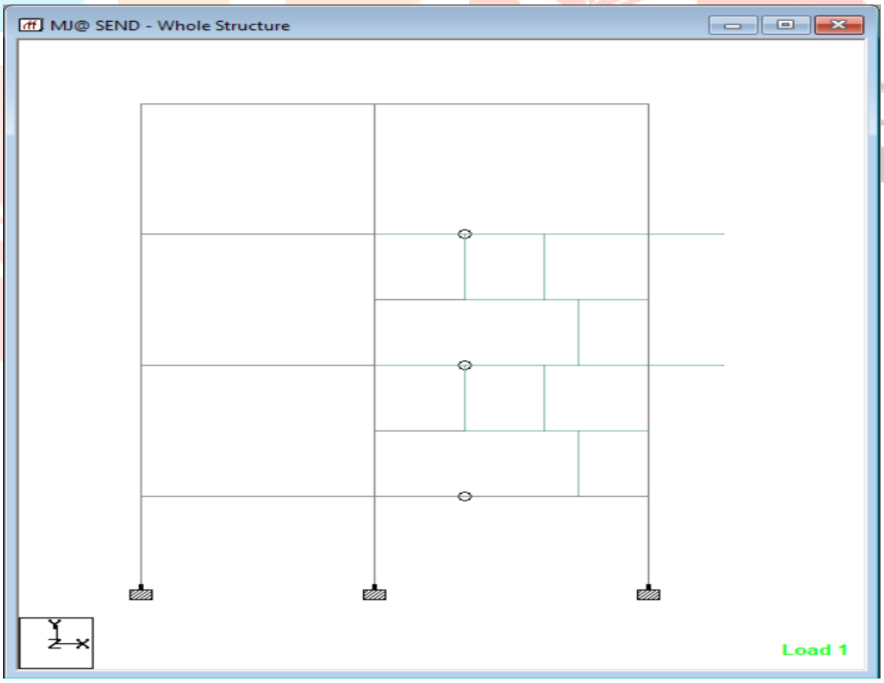


Fig.4.2 Elevation of the G+1 DUPLEX HOUSE USING

All Columns:

Column section = 0.304 * 0.304 m

All beams = 0.228 * 0.353 m

All slabs = 0.101 m thick

4.1 Physical parameters of building:

Length along X-Axis = 7.92 m

Width along Z-Axis = 8.53 m

Height along Y-Axis = 2.84 m ~ 3m @ G+1 house = 8.53m

Live load on the floors = 2.00 kN/m2

Grade of concrete and steel used:

Used M25 concrete and Fe 415 steel

4.3 Generation of Member

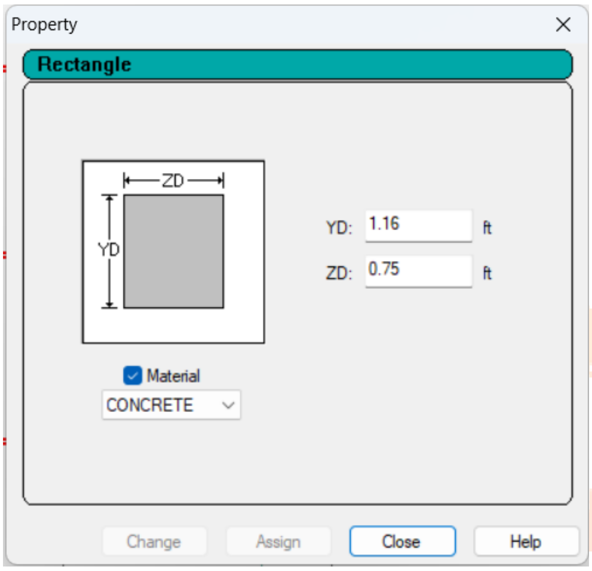


Fig 4.3 material properties for rectangular c/s

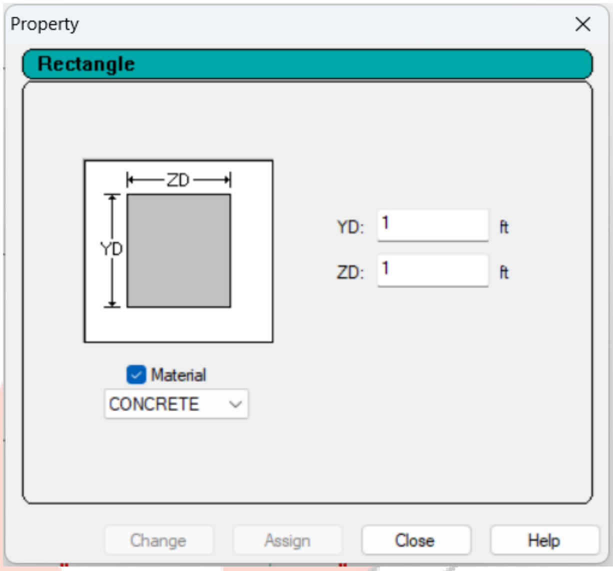


Fig 4.4 material properties for rectangular c/s

4.3 Materials for the structure:

The materials for the structure were specified as concrete with their various constants as per Standard IS code of practice.

4.4 Loading:

The loadings were calculated partially manually and rest was generated using STAAD.Pro Load generator. The loading cases were categorized as:

1. Seismic load
2. Dead load
3. Live load
4. Load combinations

4.4.1 Seismic load:

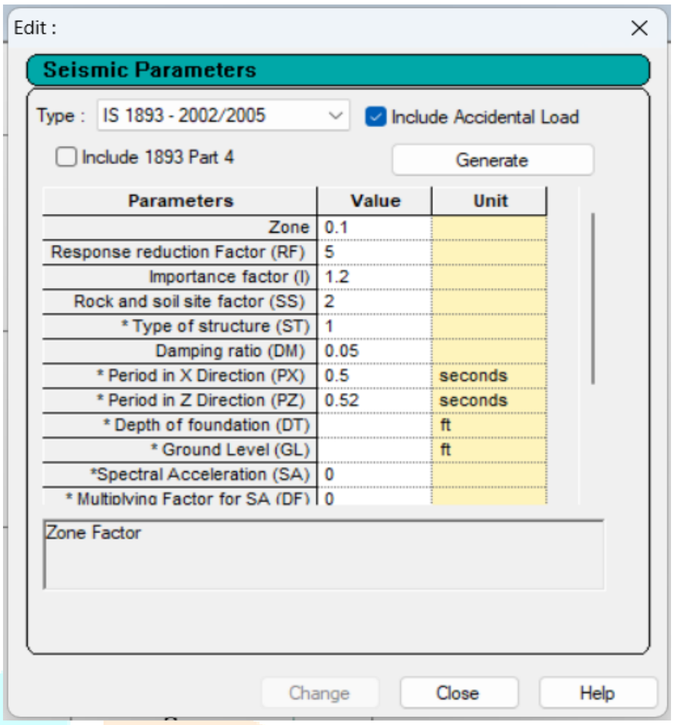


Fig.4.5 STAAD generate the Lateral Seismic Loads.

The seismic load values were calculated as per IS 1893-2016. STAAD.Pro has a seismic Load generator in accordance with the IS code mentioned.

Table 3 Seismic Zone Factor *Z*
(*Clause* 6.4.2)

Seismic Zone Factor	***II***	***II***	***IV***	***V***
Z	0.10	0.16	0.24	0.36

4.5 Bending Moment and Shear Force:

Two shear walls are provided to resist the seismic the forces in each direction. Therefore, lateral forces acting on one shear wall will be half the calculated shears and is shown in

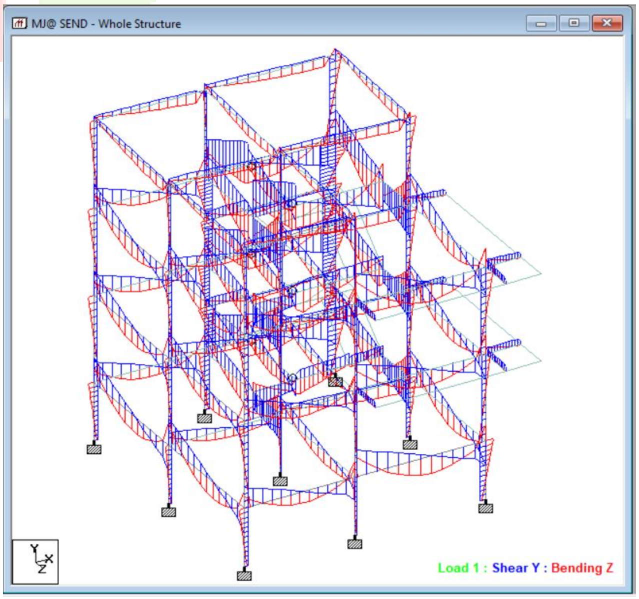


Fig.4.6: Bending Moment and Shear Force

4.5.1 DEAD LOAD

Self-weight:

The self-weight of the structure can be generated by STAAD.Pro itself with the self-weight command given in the load case column.

Dead load from walls

Dead load from walls can also be generated by STAAD.Pro by specifying the wall thickness. Calculation of the load per m was done considering the weight of wall. While considering the stair case or lift, the weight of the walls will be taken as double the weight of the outer walls.

Weight of the wall = density of the wall x volume of wall per unit run

Table.4.2: Calculation of Dead Loads

Walls	Thickness (m)	Height (m)	Density (KN/m^3)	Load (KN/m)
Outer walls	0.229	2.487	20	11.44
Inner walls	0.101	2.487	20	5.1

4.5.2 LIVE LOAD

The live load considered in each floor was 2.0 kN/m^2 and for the terrace level it was considered to be 1.0 kN/m^2. The live loads were generated in a similar manner as done in the earlier case for dead load in each floor. This may be done from the member load button from the load case column.

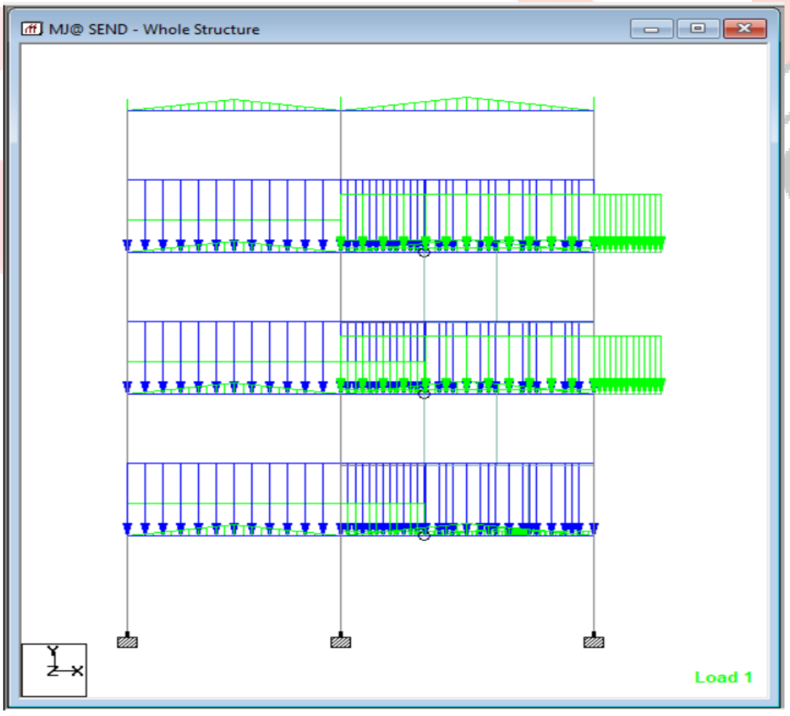


Fig.4.7: The structure elevation under Dead Load

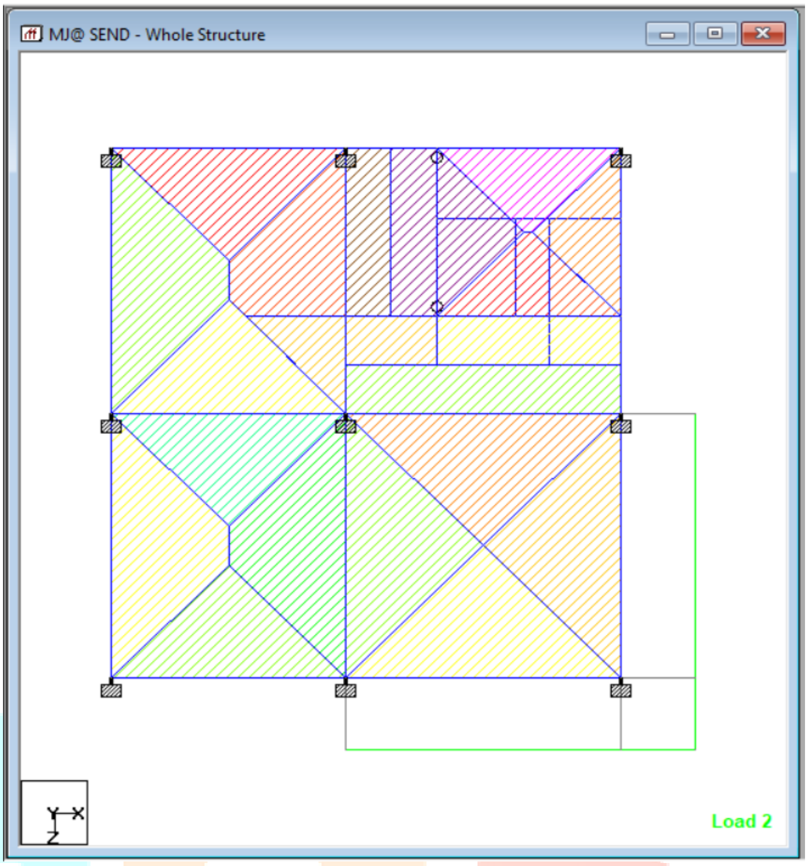


Fig.4.8: The plan of the structure under live load

4.5.3 Load combination:

The structure has been analysed for auto load combination considering all the previous loads in proper ratio and generates load combination code as per Indian code under load combination category of general structures.

Combination Rules:

For each Code/Category, each load category can be set with one of three rules:-

a. Combine all cases together

b. Separate combination for each case

c. All possible combinations.

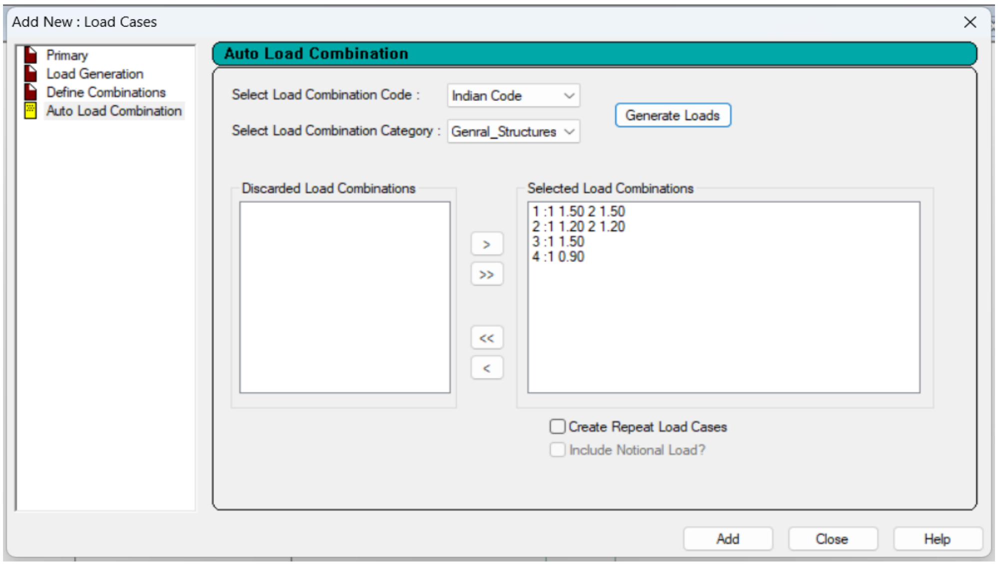
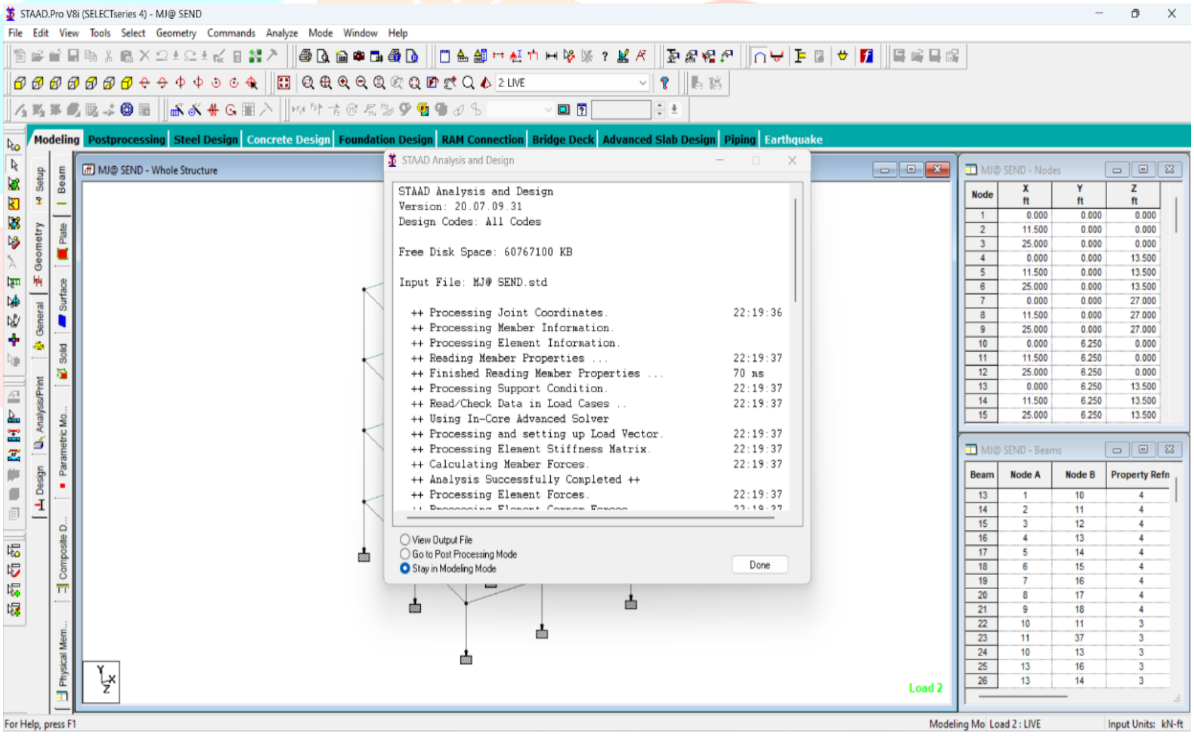


Fig.4.9 : GUI showing Auto Load Combination with Indian Code

Fig.4.12: GUI showing the analysing window

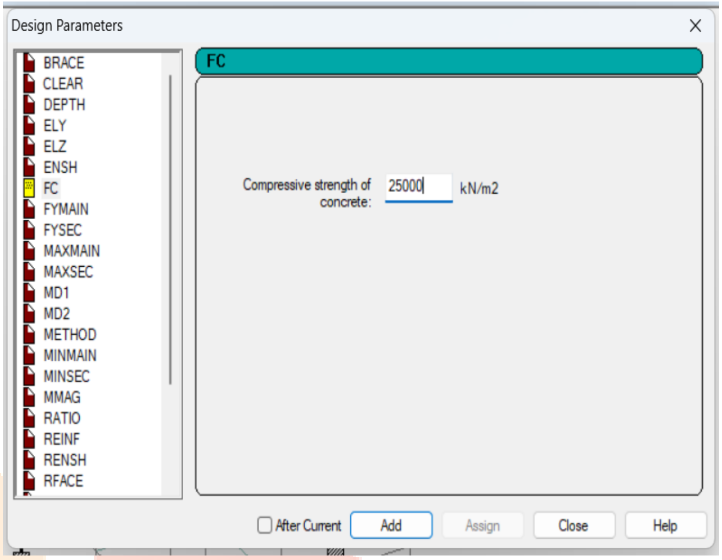


V DESIGN OF G+1 DUPLEX HOUSE USING STAAD.PRO

The structure was designed for concrete in accordance with IS: 456 codes. The Parameters such as F_y, F_c, etc were specified. The window shown below is the input window for the design purpose. Then it has to be specified which members are to be designed as beams and which member are to be designed as columns.

Design Parameters:

Fig.5.1: Input Windows for Design Purpose



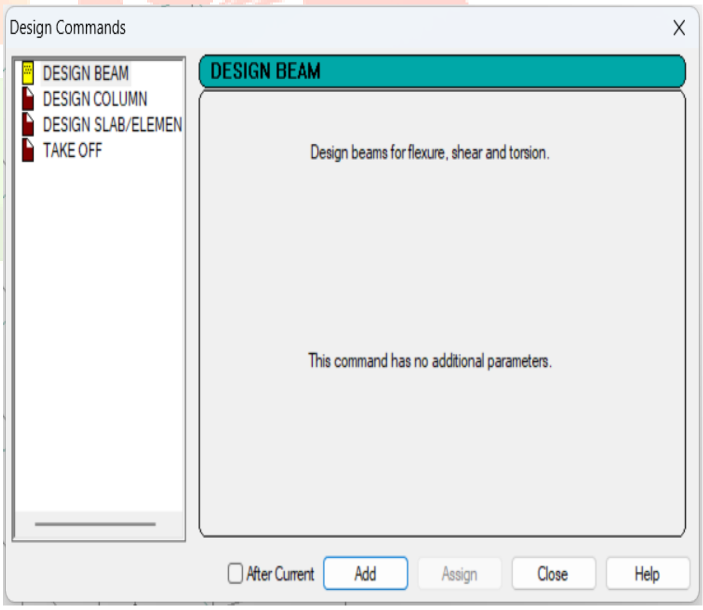
FC: Compressive Strength of concrete

FYMAIN: Yield Strength for main reinforcement steel (For slabs, it the reinforcement used in both directions).

FYSEC: Yield Strength for main reinforcement steel (Only used in beam design).

Design Commands:

Fig.5.2 Design Specifications in STAAD.Pro



DESIGN BEAM: Design beams for flexure, shear and torsion

DESIGN COLUMN: Design columns for axial load plus biaxial bending

TAKE OFF: Print the total volume of concrete and weight of steel reinforcement for the beams, columns and elements designed.

VI STAAD.PRO INPUT COMMAND FILE

```
****************************************************
*        STAAD.Pro V8i SELECTseries4                *
*        Version 20.07.09.31                        *
*        Proprietary Program of                     *
*        Bentley Systems, Inc.                      *
*        Date=    MAY 25, 2024                      *
*        Time=    21:49:15                          *
*     USER ID:                                      *
****************************************************
```

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INPUT FILE: MJ@ SEND.STD
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4. END JOB INFORMATION
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51. 146 20 39 46 44; 147 44 43 24 23; 148 22 23 26 25; 149 23 24 27 26
52. 150 24 63 64 27; 151 26 27 61 59; 152 27 64 89 61; 153 28 29 32 31
53. 154 29 73 87 75; 155 75 76 33 32; 156 31 32 35 34; 157 32 33 36 35
54. 158 33 65 66 36; 159 36 66 90 62; 160 35 36 62 60; 161 51 52 55 54
55. 162 52 53 56 55; 163 54 55 58 57
56. ELEMENT PROPERTY
57. 134 137 140 TO 163 THICKNESS 0.33
58. 127 135 138 139 THICKNESS 0.575
59. DEFINE MATERIAL START
60. ISOTROPIC CONCRETE
61. E 2.01771E+006
62. POISSON 0.17
63. DENSITY 0.668728
64. ALPHA 5E-006
65. DAMP 0.05
66. TYPE CONCRETE
67. STRENGTH FCU 2562.18
68. END DEFINE MATERIAL
69. CONSTANTS
70. MATERIAL CONCRETE ALL
71. MEMBER PROPERTY AMERICAN
72. 22 TO 26 28 TO 33 43 TO 47 49 TO 54 64 TO 76 78 79 81 TO 87 89 91 TO 93 96
73. 99 108 TO 126 128 130 131 133 136 164 TO 167 169 PRIS YD 1.16 ZD 0.75
74. 13 TO 21 34 TO 42 55 TO 63 94 95 97 98 100 TO 107 168 PRIS YD 1 ZD 1
75. MEMBER RELEASE
76. 78 81 166 START MX MY MZ
77. 78 81 166 END MX MY MZ
78. SUPPORTS
79. 1 TO 9 FIXED
80. DEFINE 1893 ACCIDENTAL LOAD
81. ZONE 0.1 RF 5 I 1.2 SS 2 ST 1 DM 0.05 PX 0.5 PZ 0.52
82. SELFWEIGHT 1
83. LOAD 1 LOADTYPE DEAD TITLE DEAD
84. SELFWEIGHT Y -1
85. UNIT METER KN
86. MEMBER LOAD
87. 22 TO 25 28 29 32 33 43 TO 46 49 50 53 54 64 TO 67 70 71 74 TO 76 78 79 81

88. 83 85 128 131 165 TO 167 169 UNI Y -11.5
89. 26 30 31 47 51 52 68 72 73 82 86 89 91 130 164 UNI Y -5.1
90. FLOOR LOAD
91. YRANGE 1.905 10.436 FLOAD -1 XRANGE 0 3.505 ZRANGE 0 4.115 GY
92. YRANGE 1.905 10.436 FLOAD -1 XRANGE 0 3.505 ZRANGE 4.115 8.23 GY
93. YRANGE 1.905 7.593 FLOAD -1 XRANGE 3.505 7.62 ZRANGE 4.115 8.23 GY
94. FLOOR LOAD
95. YRANGE 10.436 10.436 FLOAD -1 XRANGE 3.505 7.62 ZRANGE 0 4.115 GY
96. ONEWAY LOAD
97. YRANGE 1.905 7.593 ONE -1 XRANGE 3.505 4.868 ZRANGE 0 2.618 GY
98. YRANGE 1.905 7.593 ONE -1 XRANGE 3.505 7.62 ZRANGE 2.618 4.115 GY
99. FLOOR LOAD
100. YRANGE 1.905 1.905 FLOAD -1 XRANGE 4.868 7.62 ZRANGE 0 2.618 GY
101. ELEMENT LOAD
102. 150 TO 152 158 TO 160 PR GY -1.
103. MEMBER LOAD
104. 71 75 120 121 123 124 UNI GY -1.846
105. UNIT FEET KN
106. LOAD 2 LOADTYPE LIVE REDUCIBLE TITLE LIVE
107. UNIT METER KN
108. ELEMENT LOAD
109. 127 134 135 137 TO 139 PR GY -3
110. FLOOR LOAD
111. YRANGE 1.905 7.593 FLOAD -2 XRANGE 0 3.505 ZRANGE 0 4.115 GY
112. YRANGE 1.905 7.593 FLOAD -2 XRANGE 0 3.505 ZRANGE 4.115 8.23 GY
113. ONEWAY LOAD
114. YRANGE 1.905 7.591 ONE -2 XRANGE 3.505 4.868 ZRANGE 0 2.618 GY
115. ONEWAY LOAD
116. YRANGE 1.905 7.593 ONE -2 XRANGE 3.505 7.62 ZRANGE 2.618 4.115 GY
117. FLOOR LOAD
118. YRANGE 1.905 1.905 FLOAD -2 XRANGE 4.868 7.62 ZRANGE 0 2.618 GY
119. YRANGE 7.593 7.593 FLOAD -3 XRANGE 3.505 7.62 ZRANGE 4.115 8.23 GY
120. ELEMENT LOAD
121. 150 TO 152 158 TO 160 PR GY -3
122. FLOOR LOAD
123. YRANGE 1.905 4.749 FLOAD -2 XRANGE 3.505 7.62 ZRANGE 4.115 8.23 GY
124. LOAD COMB 3 1.5(DEAD+LIVE)
125. 1 1.5 2 1.5
126. UNIT FEET KN
127. LOAD COMB 4 1(DEAD+LIVE)
128. 2 1.0 1 1.0
129. UNIT METER KN
130. PERFORM ANALYSIS

VII DESIGN OF SLABS, FOOTINGS AND STAIRCASES

7.1 DESIGN OF SLABS:

General:

Slabs are the plate elements forming floor and roof of building and carrying distributed loads primarily by flexure. A slab is a flat, two-dimensional planar structural element having a smaller thickness compared to its other two dimensions. It provides a working flat surface or a covering shelter to buildings.

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Depending on the direction of spacing (direction of distribution of loads), the slabs are classified as following:

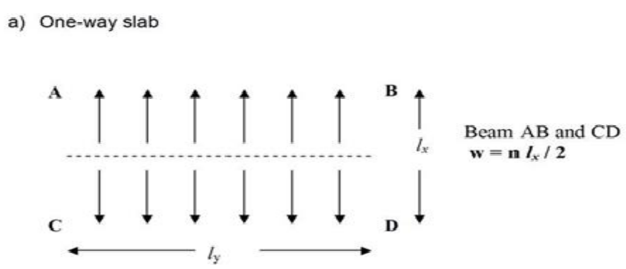
a. One way slabs and

b. Two way slabs

One way slabs:

Slabs supported on two parallel sides and carrying loads by bending in the direction perpendicular to the support are known as one way slab.

Fig.7.1: One way slab



Two Way Slabs:

Rectangular slabs with length not very large as compared to its width (or) square slabs supported on four sides carry loads by bending in two perpendicular directions are known as two way slabs.

In our project the slabs we used are two way slabs and they are designated as S1, S2, and S3… Sn. The typical design of two-way slab is presented below and the design of other slabs is performed on the same steps.

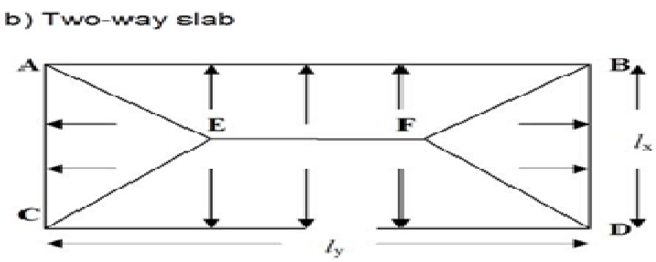


Fig.7.2: Two - Way Slab

7.2 DESIGN OF FOOTINGS:

General:

Footing is the bottom most but the most important compound of a structure which lies before the ground level it has to be well planned and carefully designed to ensure the safety and stability of the structure the function of the footing is to safely transfer loads from the super structure to the ground.

Footing under walls are called one way footings and those under columns are two way footings present we designed two way footings.

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7.3 DESIGN OF STAIRCASE:

General:

Staircase is a space where steps for going (rising) from one floor (height) to another are arranged systematically in stairs (flights). A staircase may be of different types depending upon the available space, convenience of users, architectural considerations, etc. Functionally, staircase is an important component of a building, and often the only means of access between the various floors in the building. It consists of flights of steps, usually with one or more intermediate landings (horizontal slab platforms) provided between the floor levels. The horizontal top portion of a step (where the foot rests) is termed thread and the vertical projection of the step (i.e., the vertical distance between two neighbouring steps) is called riser.

Usually, the staircase may be provided near the main entrance of the building. All staircases should be adequately ventilated and properly designed.

Types of stair cases:

a) Straight stairs
b) Dog-legged stairs
c) Open-well stair case

length being 6.22 m. The complete design of the staircase is presented. The staircase has 2 flights and one intermediate landing. One edge of the flight is supported on the floor beam and the other on the intermediate landing. The thickness of the waist slab is 250mm.

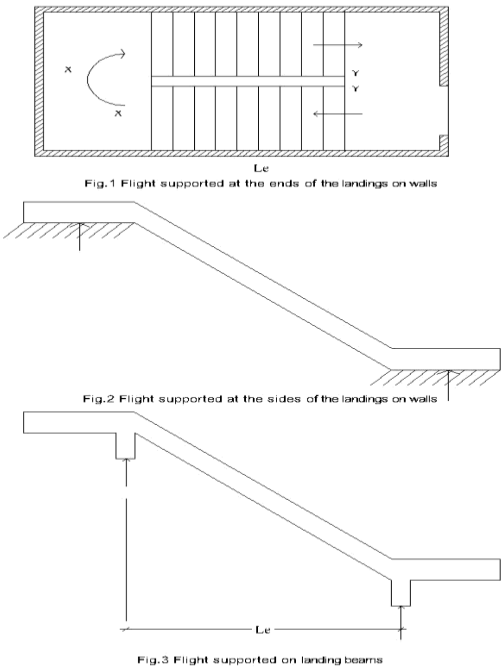


Fig.7.3 Details of Dog-Legged Staircase

VIII ANALYSIS AND DESIGN RESULTS

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

SHEAR DESIGN RESULTS AT 471.0 mm AWAY FROM START SUPPORT

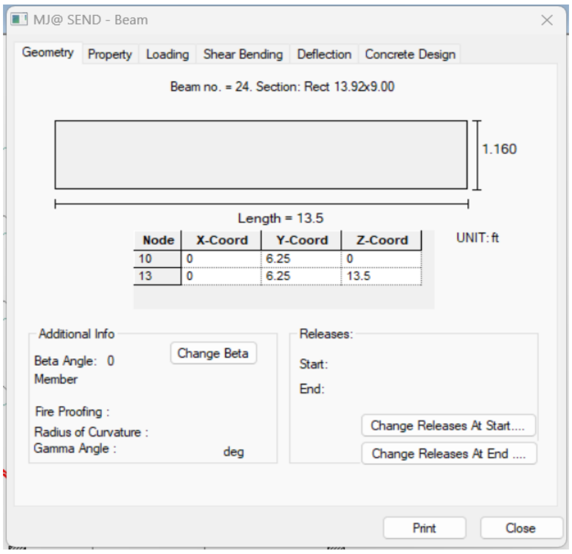
VY = 37.91 MX = -0.04 LD= 3

Provide 2 Legged 8í @ 110 mm c/c

SHEAR DESIGN RESULTS AT 471.0 mm AWAY FROM END SUPPORT

VY = -44.01 MX = -0.04 LD= 3

Provide 2 Legged 8í @ 110 mm c/c



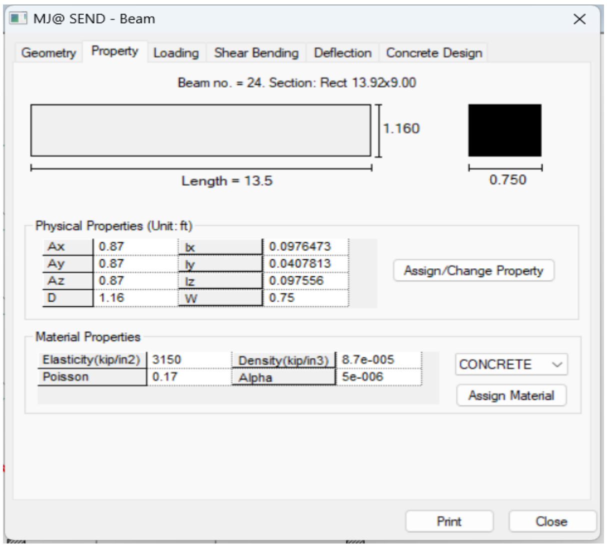


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Fig.8.1 Geometry of beam no. 24

Fig.8.2 Property of beam no. 24

Fig.8.3: Shear bending of beam no. 24

Fig.8.4: Deflection of beam no. 24

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C O L U M N N O. 40 D E S I G N R E S U L T S

M30 Fe415 (Main) Fe415 (Sec.)

LENGTH: 2843.8 mm CROSS SECTION: 304.8 mm X 304.8 mm COVER: 40.0 mm

** GUIDING LOAD CASE: 3 END JOINT: 16 SHORT COLUMN

REQD. STEEL AREA : 157.56 Sq.mm.

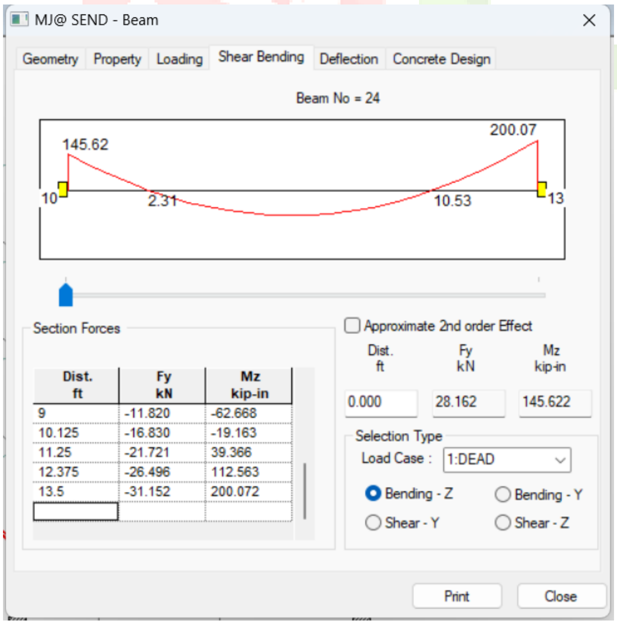
REQD. CONCRETE AREA: 19694.74 Sq.mm.

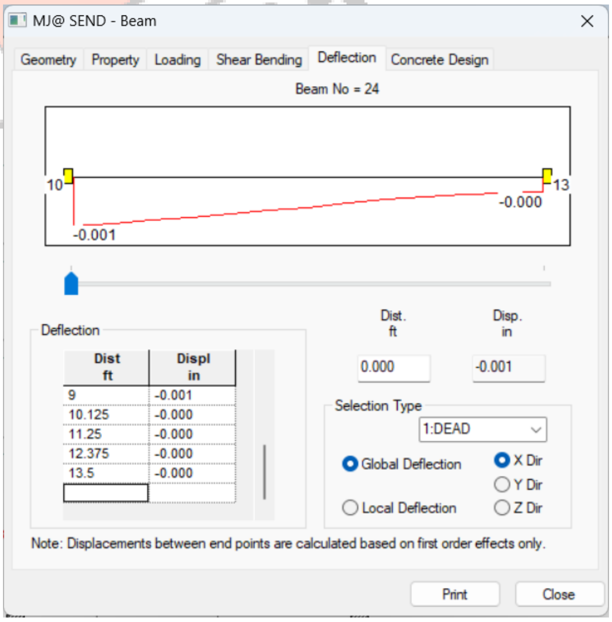
MAIN REINFORCEMENT: Provide 4 - 12 dia. (0.49%, 452.39 Sq.mm.)

(Equally distributed)

TIE REINFORCEMENT: Provide 8 mm dia. rectangular ties @ 190 mm c/c

SECTION CAPACITY BASED ON REINFORCEMENT REQUIRED (KNS-MET)





Puz: 1301.10 Muz1: 36.83 Muy1: 36.83

INTERACTION RATIO: 0.69 (as per Cl. 39.6, IS456:2000)

SECTION CAPACITY BASED ON REINFORCEMENT PROVIDED (KNS-MET)

WORST LOAD CASE: 3

END JOINT: 25 Puz: 1388.89 Muz: 47.47 Muy: 47.47 IR: 0.54

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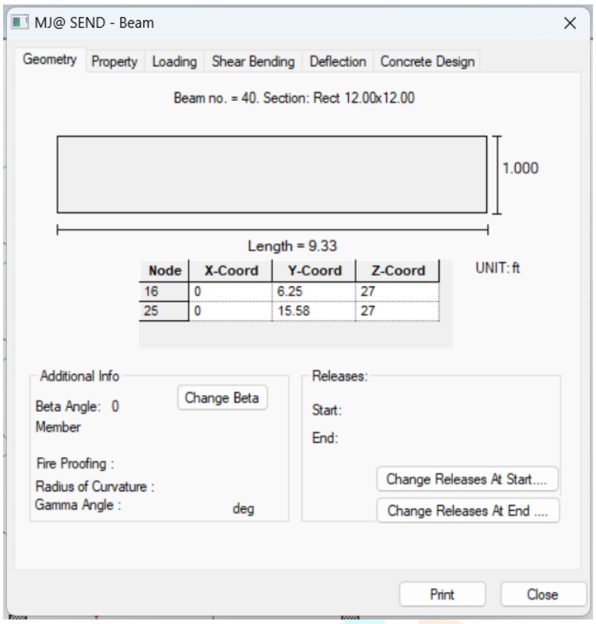


Fig.8.5 Geometry of column no. 24

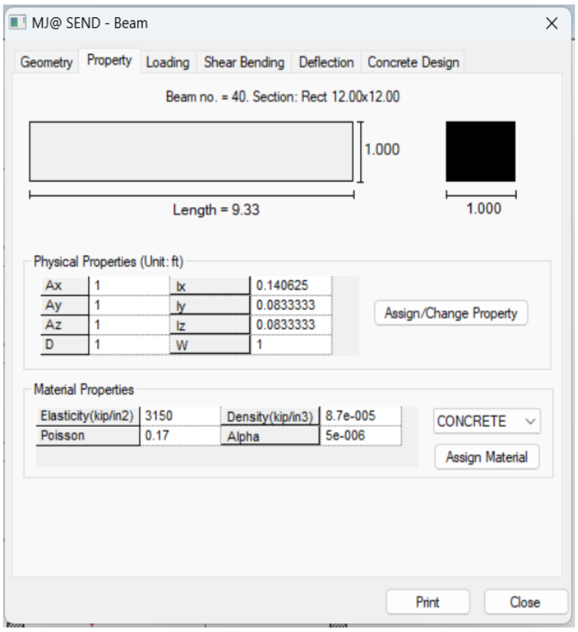


Fig.8.6 Property of column no. 24

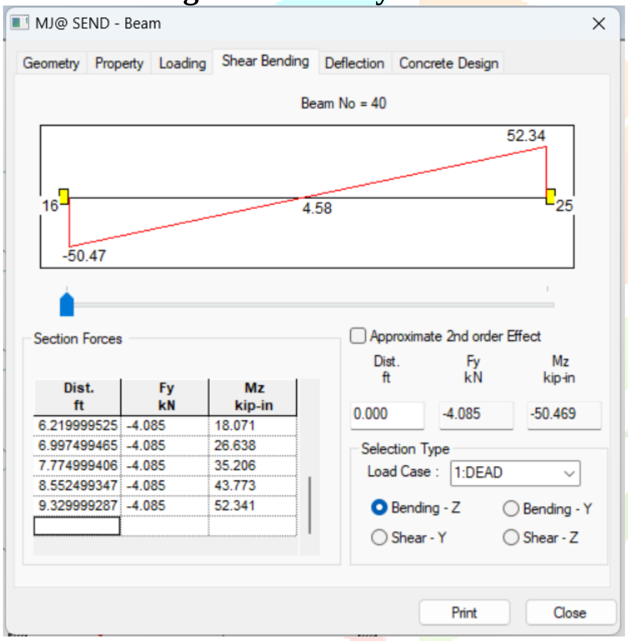


Fig.8.7 shear bending of column no. 40

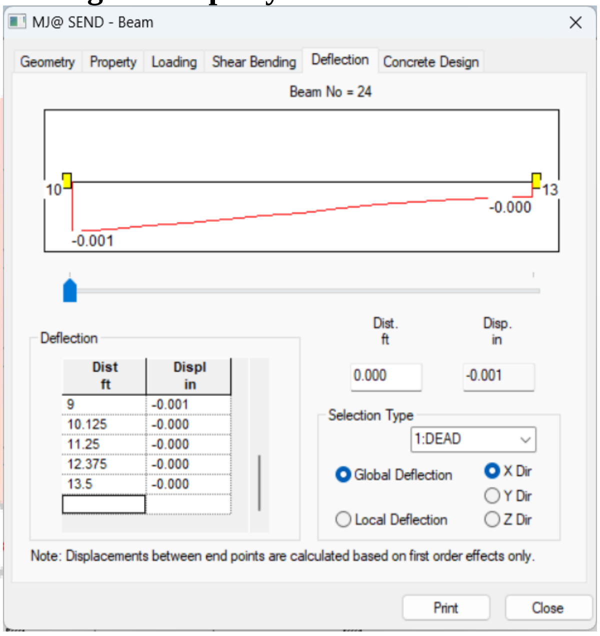


Fig.8.8 deflection of column no. 40

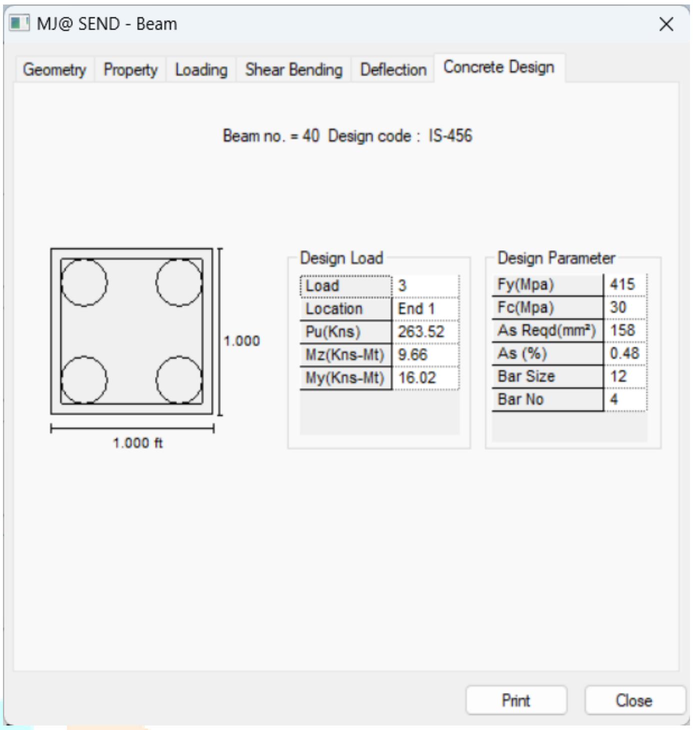


Fig.8.9 concrete design of column no. 40

POST PROCESSING MODE

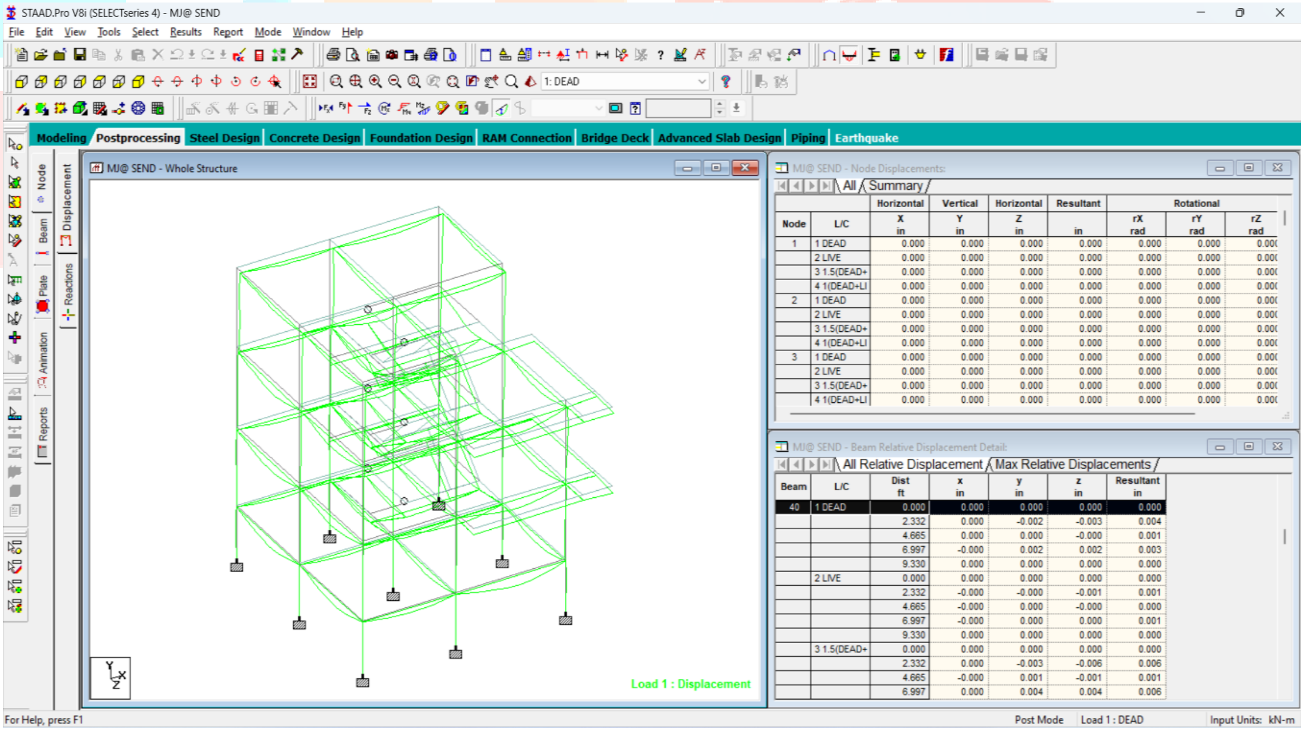


Fig.8.10: Post processing mode in STAAD.Pro

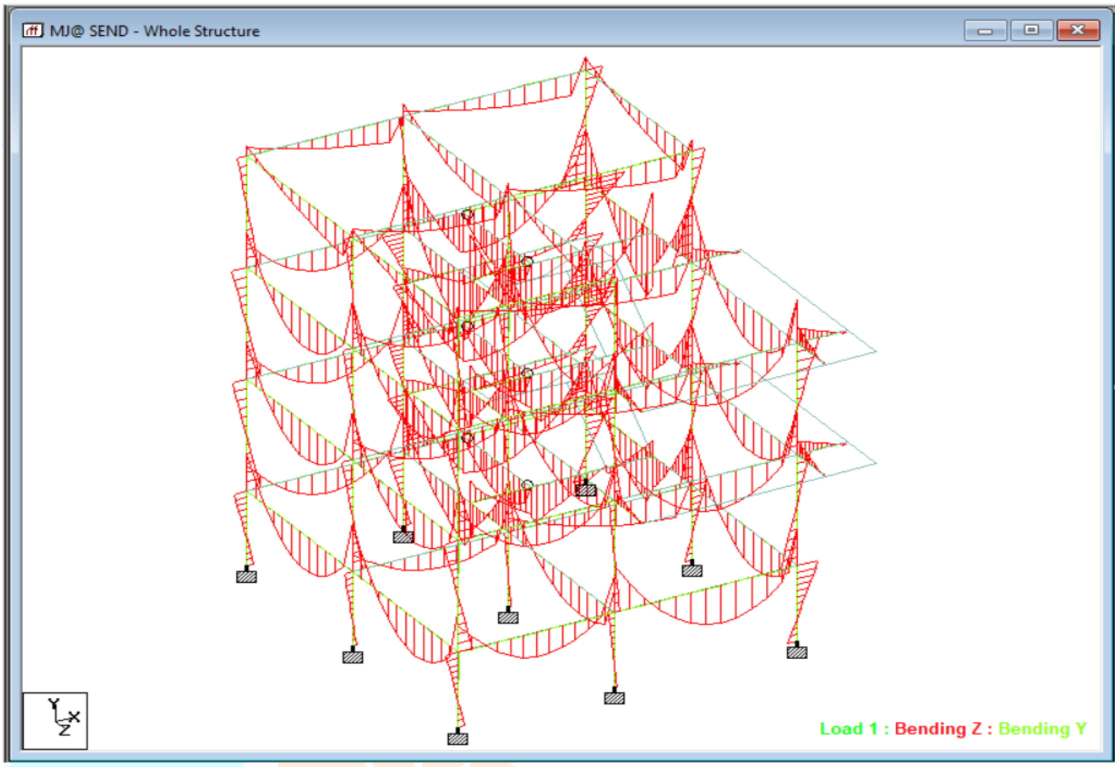


Fig.8.11: Bending in Z direction

The stress at any point of any member can be found out in this mode. The figure below depicts a particular case.

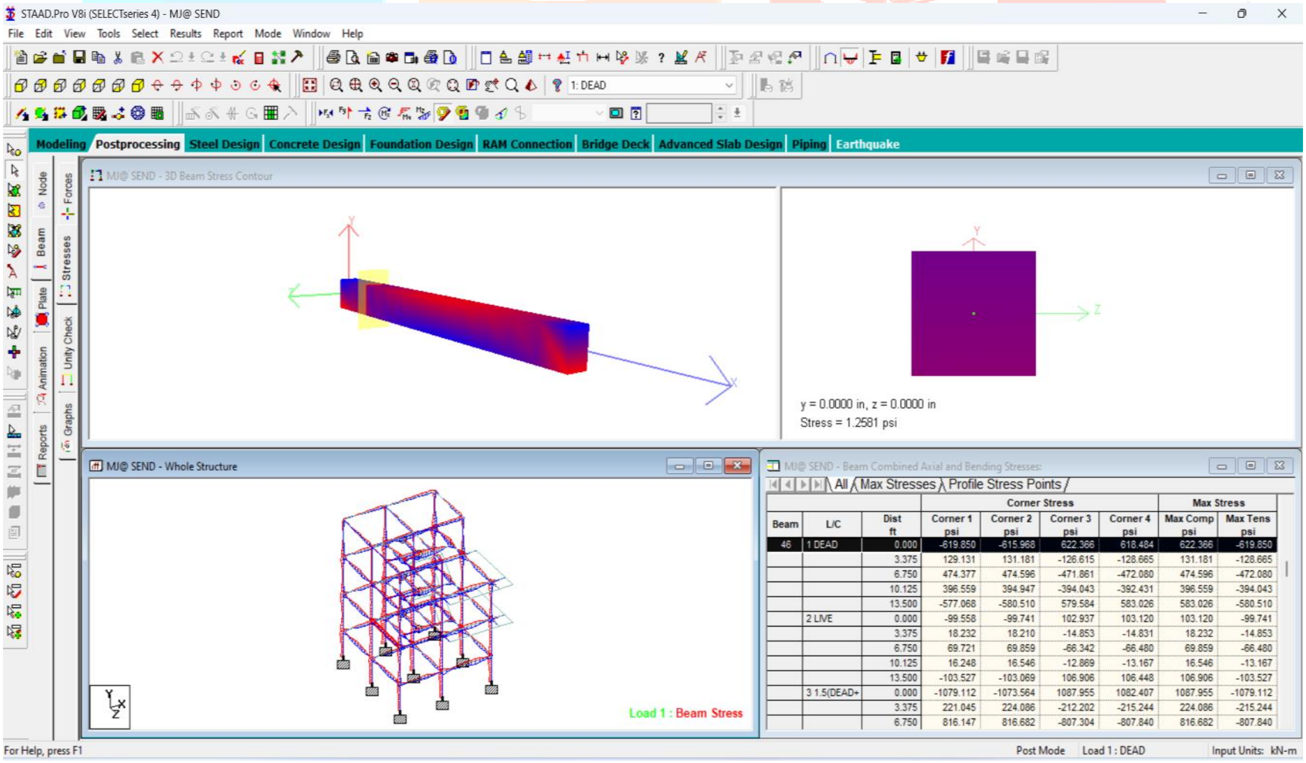


Fig.8.12: Shear stress at any section

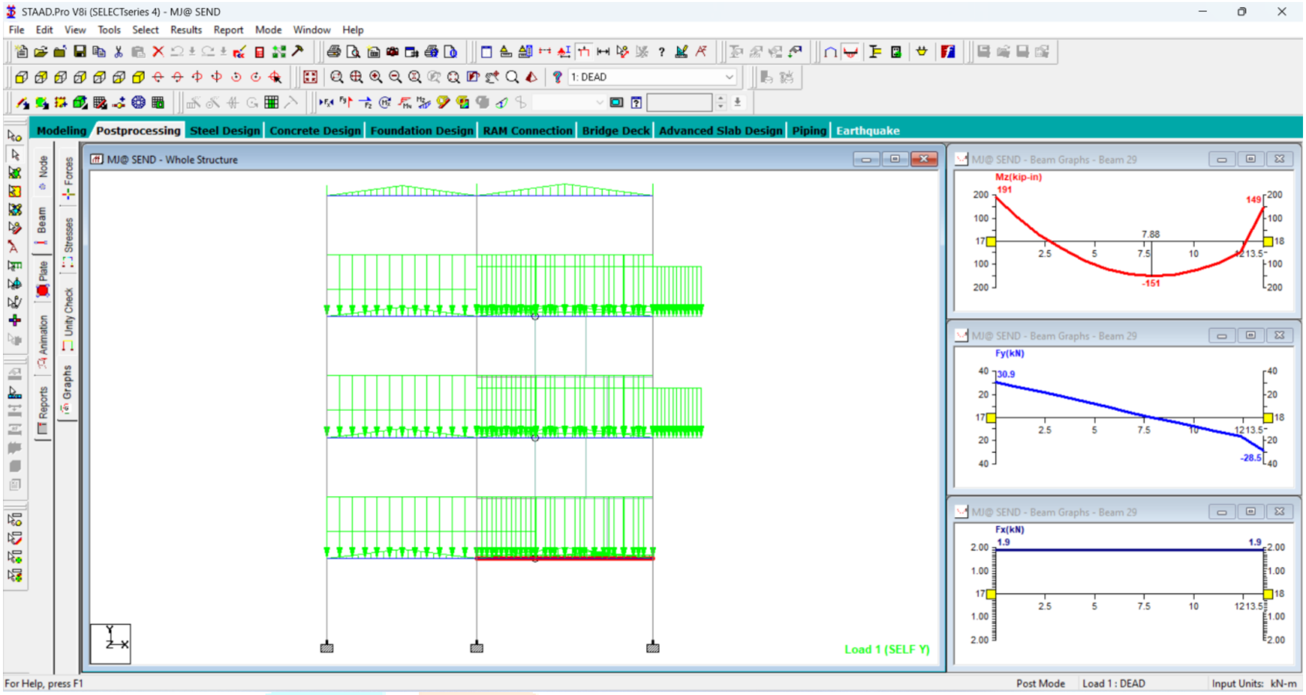


Fig.8.13: Graph for shear force and bending moment for a beam

The above figure shows that the bending moment and the Shear force can be studied from the graphs generated by STAAD.Pro. The whole structure is shown in the screen and we may select any member and at the right side we will get the BMD and SFD for that member. The above figure shows the diagrams for member beam 29.

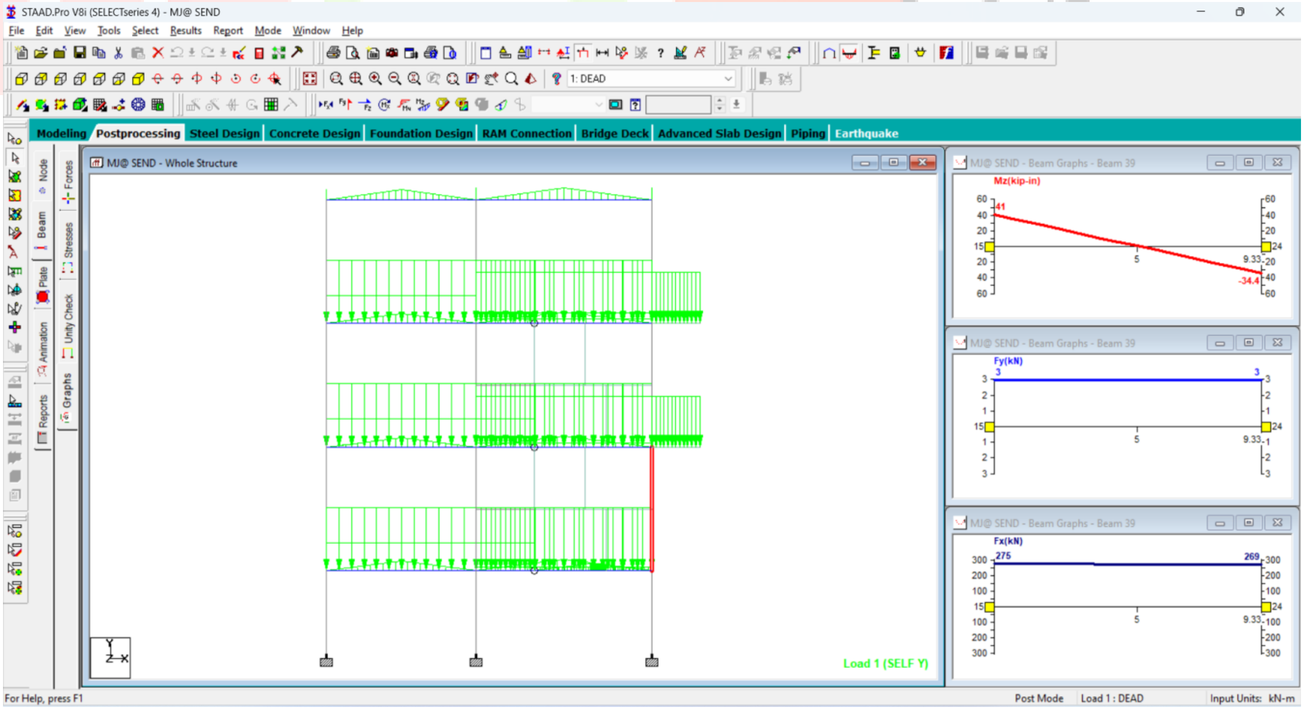
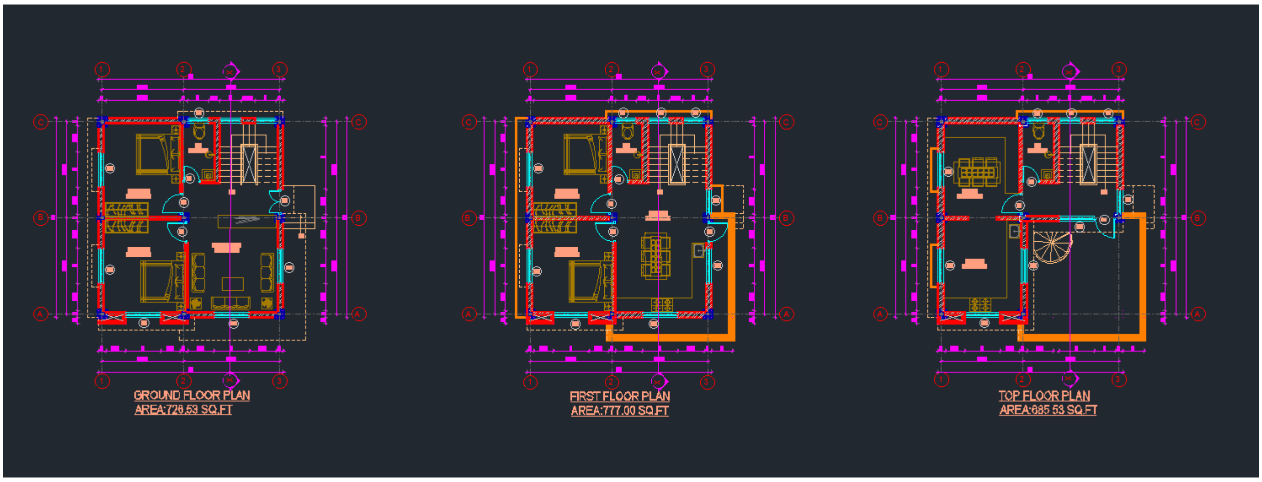
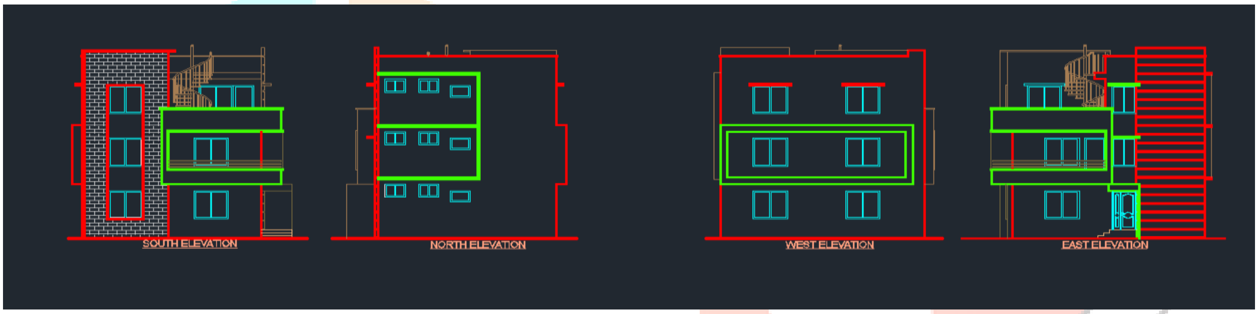
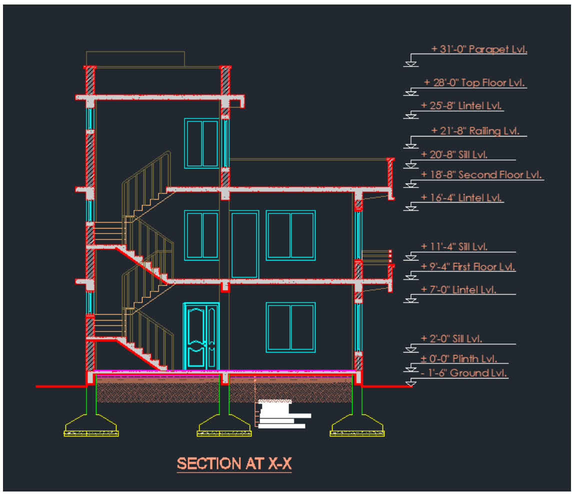


Fig.8.14: Graph for shear force and bending moment for a column

AUTOCAD PALN OF G+1 DUPLEX HOUSE







XI CONCLUSION

1. This project is mainly concentrated with the analysis and design of g+1 duplex house with all possible cases of the loadings using STAAD.Pro Meeting the design challenges are described in conceptual way.
2. We may also check the deflection of various members under the given loading combinations.
3. Further in case of rectification it is simple to change the values at the place where error occurred and the obtained results are generated in the output.
4. Very less space is required for the storage of the data.
5. STAAD.Pro V8i an advanced software which provides us a fast, efficient, easy to use and accurate platform for analyzing and designing structures.

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