Civil Engineering Software Subject Code: 66466

Presented By:-

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Structural Analysis And Design



Calculation of the response of structures to actions

INTRODUCTION TO STAAD. Pro

- STAAD.Pro is a structural analysis design program software.
- It includes a state of the art user interface, visualization tools and international design codes.
- It is used for 3D model generation, analysis and multi-material design.
- The commercial version of STAAD.Pro supports several steel, concrete and timber design codes.
- It is one of the software applications created to help structural engineers to automate their tasks and to remove the tedious and long procedures of the manual methods.

HSTORY OF STAAD. Pro

- STAAD.Pro was originally developed by Research Engineers International in Yorba Linda, CA.
- In late 2005, Research Engineer International was bought by Bentley Systems.

STRUCTURE

A STRUCTURE can be defined as an assemblage of elements. STAAD is capable of analyzing and designing structures consisting of both frame, and Finite elements. Almost any type of structure can be analyzed by STAAD.

Frame elements – Beam elements – 2 nodes Finite elements – 1.) Plate – 3 or 4 nodes

- 2.) Solid 4 to 8 nodes
- In case of STAAD
 Node becomes Joint
 Beam becomes Member
 Plate becomes Element

it has a number and xyz coordinates it has a number and nodes at its ends it has a number and node at its corners

TYPES OF STRUCTURE

- ATRUSS structure consists of truss members which can have only axial member forces and no bending in the members
- APLANE is bound by a global X-Y coordinate system with loads in the sstructure ameplane
- ASPACE structure, which is a three dimensional framed structure with loads applied in any plane, is the most general.
 - A FLOOR structure is a two or three dimensional structure having no horizontal (global Xor Z) movement of the structure [FX, FZ& MY are restrained at every joint]. The floor framing (in global X-Z plane) of a building is an ideal example of a FLOOR structure. Columns can also be modelled with the floor in a FLOOR structure as long as the structure has no horizontal loading. If there is any horizontal load, it must be analyzed as a SPACE structure.

Project Tasks

Help Topics

STAAD.ProV8i



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GETTING STARTED

STAAD WINDOW





All this options is used to see the view of structure from various side

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Rotation can be done by rotating the option

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To zoom the structure and return to previous these are required

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If you want to return the whole structure use this

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To see the 3D render view use



VARIOUS TYPESOF CLASOFS

(4)Various Selection: Selections are found for various part such as node, beam, surface, plate, solid.





PAGE CONTROL IN VARIOUS MODES

Page Control in Modeling Mode



Page Control in Post-Processing Mode



Model generation and analysis

Input Geometry –Nodes, Beams, Plates

Input Properties

Input Specs, Constant, Supports

Input Loading System

Specify Analysis Type

Run Analysis

View and Verify Results

Design

Verify

MODEL GENERATION

- There are basically 3 methods of generating a model
- 1. Snap node method
- 2. Coordinate method
- 3. Copy paste method
- Out of these three methods most commonly used is copy paste method
- By using these three methods a structure of any geometry can be created
- STAAD.Pro also contains a command wizard which is its library of structures such as frames, trusses are present which can be merged with the STAAD.Promodel







Assigning a property means to provide dimensions such as width, thickness etc to beams columns slabs etc



SUPPORTS

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12)	FZ	EL MZ	
		C	7

- 1. There are three types of supports provided to astructure
- Fixed support
- Pinned support
- Roller support

2. There are options provided in Staad for pinned and fixed supports while roller support has to be created by releasing the Fx and Mz components using fixed but.



- Any structure is subjected to basically these types of loads-
 - 1. Dead load
 - 2. Live Load
- Dead load includes the self weight of the structure while live load consists of superimposed load.
- In addition to a structure is also subjected to wind and seismic or earthquake forces
- While designing a structure subjected to wind and earthquake forces we also have to provide definitions along with various load cases

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•After creating various load cases we have to assign them to the structure . For this we have to first select that part of the structure on which load has to be assigned and then assign it to that part

Continued...

 In case of structures subjected to wind and earthquake forces wind and seismic definitions need to be provided.

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After providing these definitions only the load cases should be entered.

ANALYSIS

- After all the above stated steps a structure has to be analyzed.
- Analysis of a structure means to find out the reactions and displacements and deflections at various nodes of a structure.
- After analysis we are able to see shear moment and deflection for each member.

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Design	Perform Imperfection Analysis		
Miscellaneous	Perform Pushover Analysis		
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After performing analysis another window which contains a report of analysis gets opened . This window shows the warnings and errors which might have occurred.

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 In the post processing mode we are able to see the reactions, displacements, deflections, shear force and bending moments for various members

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- After analysis a structure has to be designed to carry loads acting on it considering a certain factor of safety.
- In India structures are designed by using various Indian codes for both concrete and steel structures.
- The design in STAAD.Pro supports over 70 international codes and over 20 U.S. codes in 7 languages.
- After designing the structure it is again analyzed and results of analysis for each beam and column is shown in the output file

STATEMENT OF THE PROJECT

- 1.Utility of building :Residential building
- 2.No of storeys:G+4
- 3.No.of staircases :5 no's
- 4. Shape of the building : rectangular
- 5.Type of construction : R.C.Cframed structure
- 5.Type of walls :brick wall

Geometric

- Ground floor :3.0M
- Floor height :3.0M
- Height of plinth :1.5M from below foundation
 - Depth of foundation :500MM

Material

details:

Concrete Grade

• All steel grade

• Type of steel bars

• Bearing capacity of Soil

: M25

: Fe500 grade

: HYSD

:>180 KN/M2

DIFFERENT TYPES OF LOADS ON THE STRUCTURES

• Dead loads

Imposed loads

• Wind loads

DIFFERENT TYPES OF LOADS ON THE STRUCTURES

• Dead loads

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Dead loads

- Involves self weight of
- RCCslab
- Beams & columns
- Plinth
- Walls

Imposed loads

- Imposed also known live loads
- Loads over the floor i.e. Load of persons it is calculated as 1 KN/m2
- This load is applied over the length of structure

Wind loads

• Wind is air in motion

 Wind loads are calculated according to IS:875(part 3)

 Intensity of wind and exposure are applied in the direction as required

Load combinations

- The structures should be analysed for combination of loads as in practice we have numbers of loads in various directions act
- Some of the combinations to be checked are
- 1.5(DL+LL)
- 1.5(DL+WL)
- 1.5(DL+LL+WL)

OBJECTIVES OF STRUCURAL DEIGN

- Structure designed should satisfy the criteration of ultimate strength.
- Structures should satisfy the servicablity
- It should satisfy the stability against overturning, sliding, and buckling

The main objective of the design

are

- Foundation design
- Column design
- Beam design
- Slab design

DESIGN PRINCIPLE, ASSUMPTION AND NOTATION ASSUMED

- The notation adopted through out the work is same as in B456-2000
- Using partial safety factors for loads inaccordance with clause 36.4 of 5456-2000
- Partial safety factor for material in accordance with clause 36.4.2 IS456-2000 is taken as 1.5 for concrete and 1.15 for steel
- Using partial safety factors in accordance with clause

▶ 36.4 of 5456-2000 combination of load

▶ (D.L+L.L) 1.5

(D.L+L.L+W.L) 1.2

Density of materials

MATERIAL 1.Plain concrete 2.Reinforced 3.Flooring material(c.m) 4.Brick masonry 5.Fly ash

Density 24.0 kn /m3 25.0 k /m3 20.0kn/m3 19.0kn/m3 5.0kn/m3

LIVE LOADS: In accordance with IS875-86

Live load on slab
 Live load on passage
 Live load on stair

=3.0kn/m3 =3.0kn/m3 =3.0kn/m3



Gesign
 For slab, depth is 125 mm provided.

 For beams, after calculations are done . the dimensions of beam is 230*530mm factored load on beam is 15.87kn/m

- Shape of column is rectangular
- For columns, the dimension of column is 300*600mm
- Factored load on column 1090.10kn
- For footings, the bearing capacity of soil is 175kn/m2
- Toprovide the dimensions of footing is 12.5m*2.7m

ANALYSIS

- Analysis is done using STAD PRO developed by BENTLEY
- Once the loads and load combinations are assigned to the structures, analysis is to bedone
- Analysis is done for RCCstructure

Assign the properties of structures





ASSIGN LOADS ON THE SLAB





Load1

LOAD ASSIGN ON THE WALLS





Load2

ASSIGN WIND LOADON THE STRUCTURES (X+VE DIRECTION)



Load 3

ASSIGN WIND LOADON THE STRUCTURES (X-VE DIRECTION)





ASSIGN WIND LOADON THE STRUCTURES (Z+VE DIRECTION)





Load 5

ASSIGN WIND LOADON THE STRUCTURES (Z-VE DIRECTION)





Load 6

CONCLUSIONS:

- The design of slab, beam, column, rectangular footing and staircase are done in limit statemethod which is safe at control of deflection and in all aspects
- Using staad.pro software, the design consideration has been taken as per the is codes. The design is safe in all conditions
- On comparison with drawing, manual design and the geometrical model using staad.pro the area of AST required for the beam, column, footing and slab are comparatively similar to that of the requriment

ADVANTAGES OF STAAD. Pro

Following are the advantages of STAAD.Pro

- 1. Covers all aspects of structural engineering
- 2. Broad spectra of design codes
- 3. International codes
- 4. Quality assurance
- 5. Reports and documentation

<u>Firms</u>

- Structural engineering
- Structural consultant
- Multi-discipline E/A and A/E
- Departments in construction companies, owner/operators, and government agencies

CONCLUSION

- Staad pro is widely used by most of the organization for their construction needs.
- Unfortunately, well skilled staad pro engineers are very hard to search.
- If we believe in the prediction of the industry experts then those students who will be getting trained on staad pro in the current and upcoming two years will have bright and successful career ahead in the real estate and construction domain
- By attending this training in STAAD.Prowe were able to learn various features of STAAD.Pro which will be very helpful in the near future











