International Journal of Multidisciplinary Engineering in Current Research - IJMEC
Volume 9, Issue 6, June-2024, http://ijmec.com/, ISSN: 2456-4265

DESIGN AND PLANNAING OF AUDITORIUM

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Abstract: The Auditorium helps for large meetings, presentations, and performances. Auditorium includes assembly halls, exhibit halls, auditoriums, and theaters. This project is about designing an auditorium using STAAD Pro tool. This tool saves time for calculations and analyzing the structure. Project is based on limit state concept, the structure shall be designed to withstand, it should bare all loads liable to act on it throughout its life; it shall also satisfy the serviceability requirements, such as limitations on deflection and cracking. The acceptable limit for the safety and serviceability requirements before failure occurs is called a "Limit State". The aim of design is to achieve acceptable probabilities that the structure will not unfit for the use. For which it is intended, that it will not reach a limit state.

INTRODUCTION

The Auditorium space types are areas for large meetings, presentations, and performances. Auditorium space type facilities may include assembly halls, exhibit halls, auditoriums, and theaters. Auditorium space types do not include such features as sound reinforcement systems, audiovisual systems and projection screens, food service facilities , proscenium stages with heights greater than 50'- 0" or fly gallery, orchestra pits, revolving or hydraulic stage platforms, Flying balconies, movable seating, or billboard systems. Auditorium spaces are designed to accommodate large audiences. As such, they tend to have wide spans and are multiple-stories high in order to accommodate seating, sightline, and acoustical requirements. Raised stage/dais floors and special lighting equipment are often required as well. Typical features of Auditorium space types include the list of applicable design objectives elements as outlined below.

Sloped Floors

Sloped floors, with level terraces for each row of seating, help provide the proper sightlines from the audience to the stage. Note that the bottom and intermediate rows should be directly accessible from entry levels to allow for Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) compliant accessible seating positions.

Fixed Seats:

Typically, fixed seats with tilting upholstered seat and back, integral arm and tablet arm are provided with articulated back for maximum occupant passage space between rows. The seats may be fully upholstered or wood contoured outer back and seat shells with wood armrests with tablet arm option and aisle light option at row ends. Seat number/row letters should be Americans with Disabilities Act (ADA) compliant. Wheelchair access option-removable seats in sections of two and accessible end chairs for mobility limited occupants should be provided.

Special Lighting:

Dramatic lighting systems include front lighting, foot lighting, spot lights, follow spot lights, beam lights, and flood lights, and a projection room/booth with manual and programmable lighting controls, and space for the spot light operator space. Lighting systems should be flexible to accommodate various performance venues (e.g., lectures, plays, musical performances, etc.) in the Auditorium.

Occupancy:

Occupancy Group Classification is Assembly A1 or A3 as per IBC, with sprinkler protected construction, and GSA Acoustical Class A space requiring special acoustical design.

Productive

Special Acoustical Design:

Quality acoustical characteristics are important in Auditorium spaces so that performances and presentations can be clearly heard and understood. For performance spaces and general presentation spaces, recommended noise criteria (NC) rating ranges from NC-20 to NC-30; recommended sound transmission class (STC) rating ranges from STC 40 to STC 50. Strategies to achieve the recommended NC and STC ranges include, for example: Type II vinyl wall covering and fabric covered acoustical wall panels for the interior wall finish in the auditorium; Type II vinyl wall covering for the stage area; Type II vinyl wall coverings for 1/3 of the front of the orchestra (audience) sidewalls and fabric covered acoustical panels for 2/3 of the back of the orchestra (audience) sidewalls; fabric covered acoustical panels for rear walls; and a plaster and plywood combination—because of their reverberation characteristics—for the ceiling. For more information, see WBDG Productive -Provide Comfortable Environments.

Sustainable

Increased Cooling Capacity:

Heating, ventilating, and air-conditioning (HVAC) systems for Auditorium spaces are sized and zoned to accommodate varying internal loads, which are a function of audience sizes, performance lighting loads, and projection equipment. Particularly, air handling units (AHUs) with increased cooling capacity should be zoned separately for the auditorium, lobby, projection spaces, stage areas, and audience seating areas. Also, the Auditorium typically has a separate AHU constant volume with modulated temperature control for ventilation.

Raised Floor:

The recommended system for distribution of HVAC in auditorium spaces is ducted supply through floor vents with ducted ceiling return air vents in auditorium and lobby. In other spaces, ducted ceiling supply with return air ceiling plenum is recommended. Note that there should be transfer ducts at all acoustically rated partitions.

Secure/Safe

Fire and Life Safety:

Proper notification systems, lighting, and signage are required to facilitate safe and speedy evacuations during an emergency in the Auditorium spaces. Step lights recessed into floor risers at each seating tier and wall mounted low light level sconce lights along side walls are typical. Sprinklers should be provided per code and under stage platforms to suppress fires.

STRUCTURAL DESIGN

METHODS OF DESIGN:

Reinforced Cement Concrete structures and structural elements may be way any one of the following methods:

- Working Stress Method
- Limit State Method

- Methods based on Experimental investigations.

LIMIT STATE METHODS:

In this, the method of design based on limit state concept, the structure shall be designed to withstand it shall safety all loads liable to act on it throughout its life; it shall also satisfy the serviceability requirements, such as limitations on deflection and cracking. The acceptable limit for the safety and serviceability requirements before failure occurs is called a "Limit State". The aim of design is to achieve acceptable probabilities that the structure will not unfit for the use. For which it is intended, that is, that it will not reach a limit state.

ASSUMPTIONS FOR DESIGN OF MEMBERS:

1. Place sections normal to the axis remain plain after bending.
2. The maximum strain in concrete at the outermost compression fiber is taken as 0.0035 in bending.
3. The tensile strength of the concrete is ignored.
4. The stresses in the reinforcement are derived from representative stress. Strain curve for the type of steel used, for design purposes the partial safety factor fm, equals to 1.5 shall be applied.
5. The maximum compressive strain in concrete in axial compression is taken as 0.002.
6. The maximum compressive strain at the highly compressed extreme fiber in concrete subjected to axial compression and bending and when there is no tension on the section shall be 0.0035 minus 0.75 times the strain at the least compressed extreme fiber.

STAAD Pro DESIGN AND ANALYSIS

STAAD Pro Introduction:

The STAAD Pro 2007 Graphical User Interface (GUI) is normally used to create all input specifications and all output reports and displays (See the Graphical Environment manual). These structural modeling and analysis input specifications are stored in a text file with extension ". STD". When the GUI does a File Open to start a session with an existing model, it gets all of its information from the STD file. A user may edit/create this STD file and have the GUI and the analysis engine both reflect the changes.

The STD file is processed by the STAAD analysis "engine" to produce results that are stored in several files with extensions such as ANL, BMD, TMH, etc. The ANL text file contains the printable output as created by the specifications in this manual. The other files contain the results (displacements, member/element forces, mode shapes, section forces/moments/displacements, etc.) that are used by the GUI in post processing mode.

This section of the manual contains a general description of the analysis and design facilities available in the STAAD engine. Specific information on steel, concrete, and timber design is available in different Sections respectively. Detailed STAAD engine STD file command formats and other specific user information is presented.

The objective of this section is to familiarize the user with the basic principles involved in the implementation of the various Sections.

General Description:

Analysis/design facilities offered by the STAAD engine. As a general rule, the sequence in which the facilities are discussed follows the recommended sequence of their usage in the STD input file.

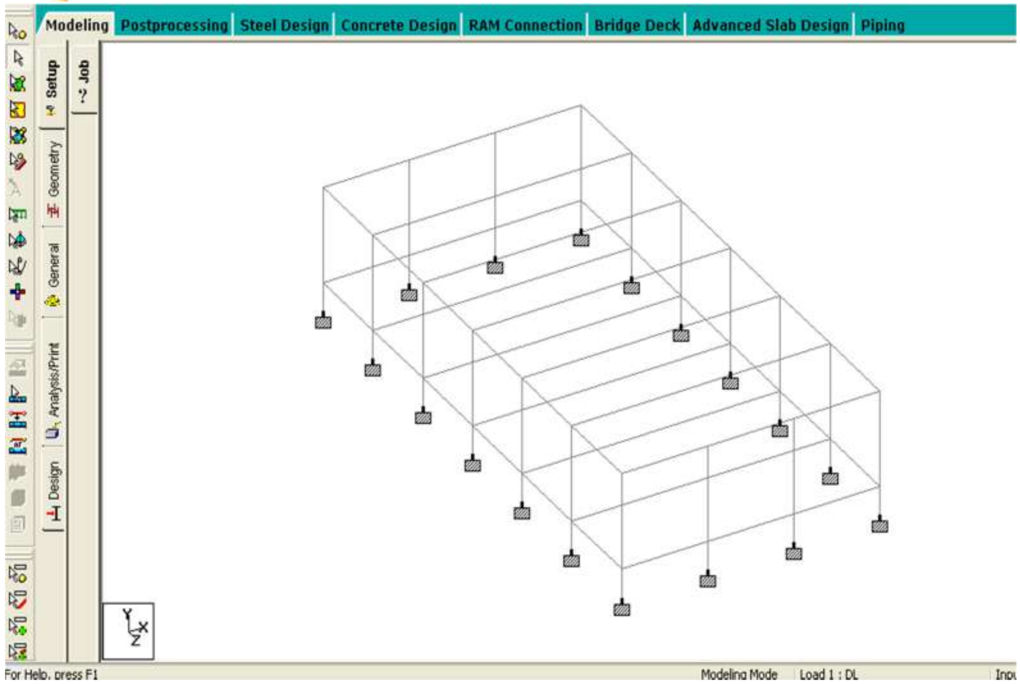

Fig. 2.1.1 MODELING

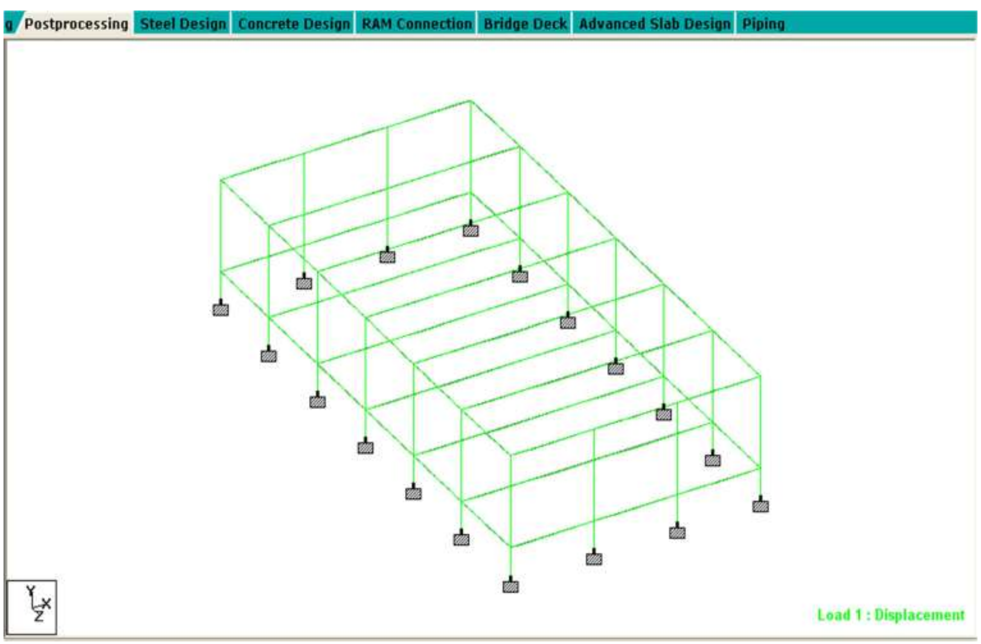

Fig.2.1.2 DISPLACEMENT

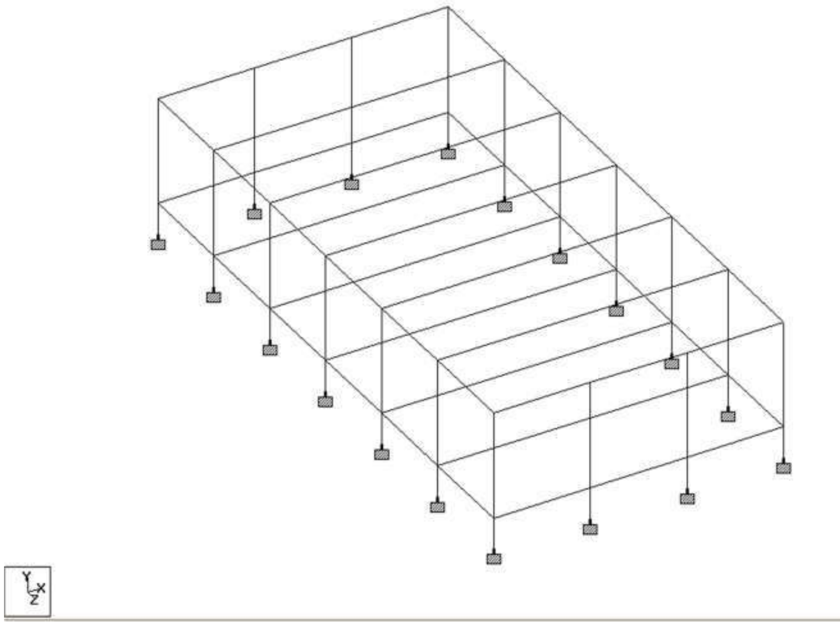

Fig. 2.1.3 STRUCTURE VIEW

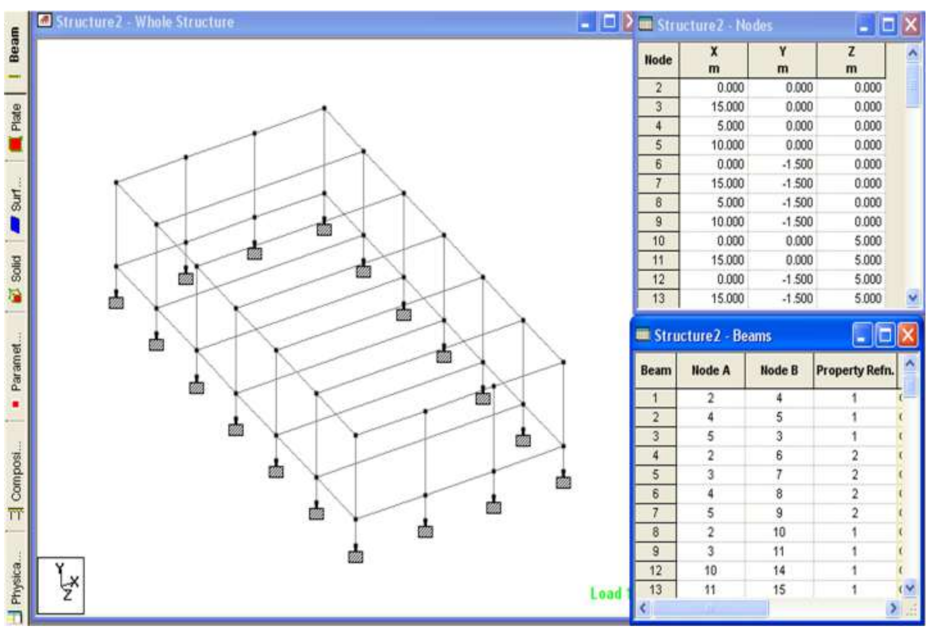

Fig.2.1.4 WHOLE STRUCTURE

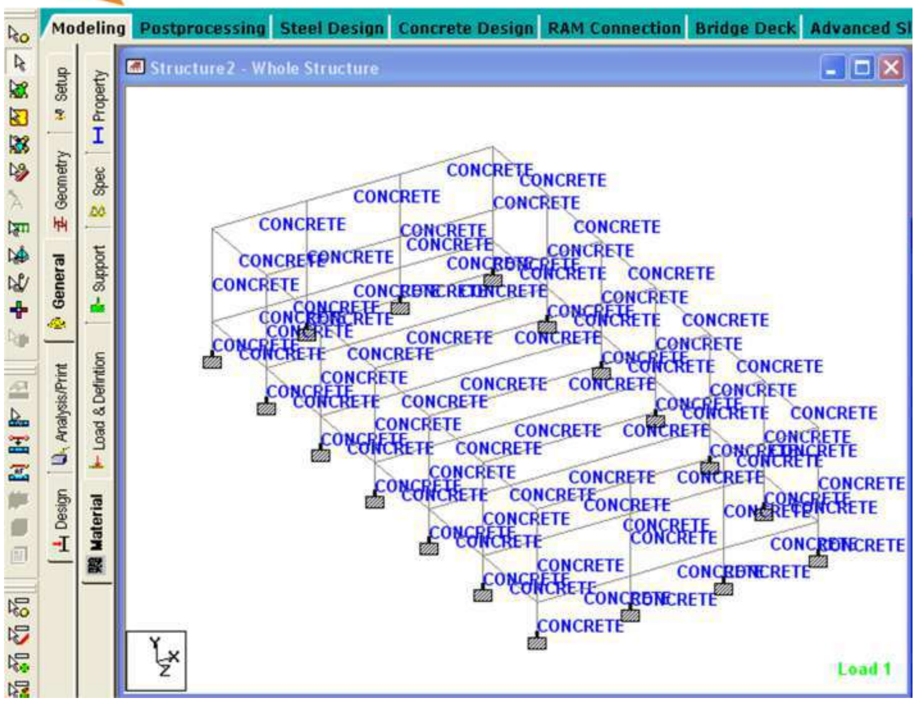

Fig.2.1.5 CONCRETE DESIGN

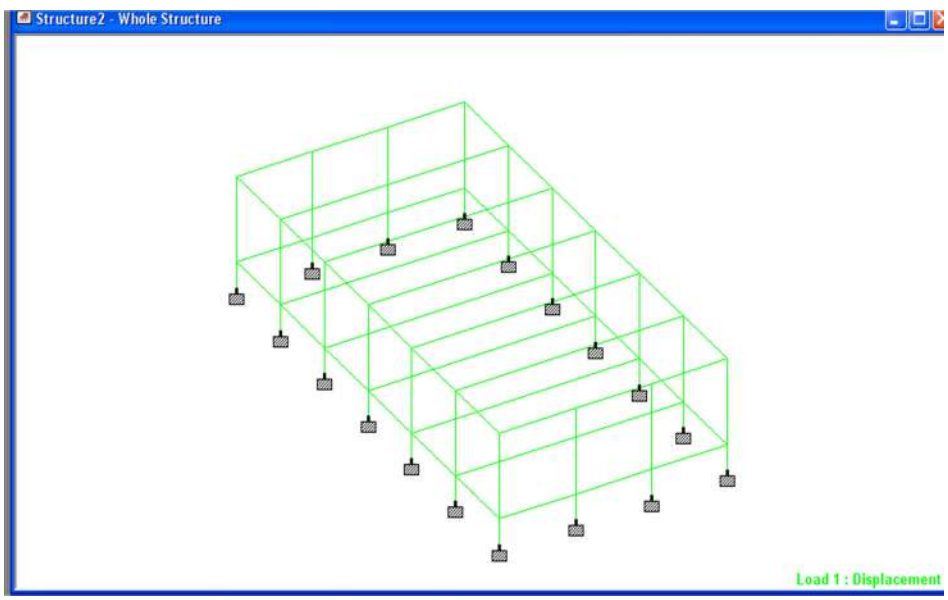

Fig.2.1.6 DISPLACEMENT VIEW

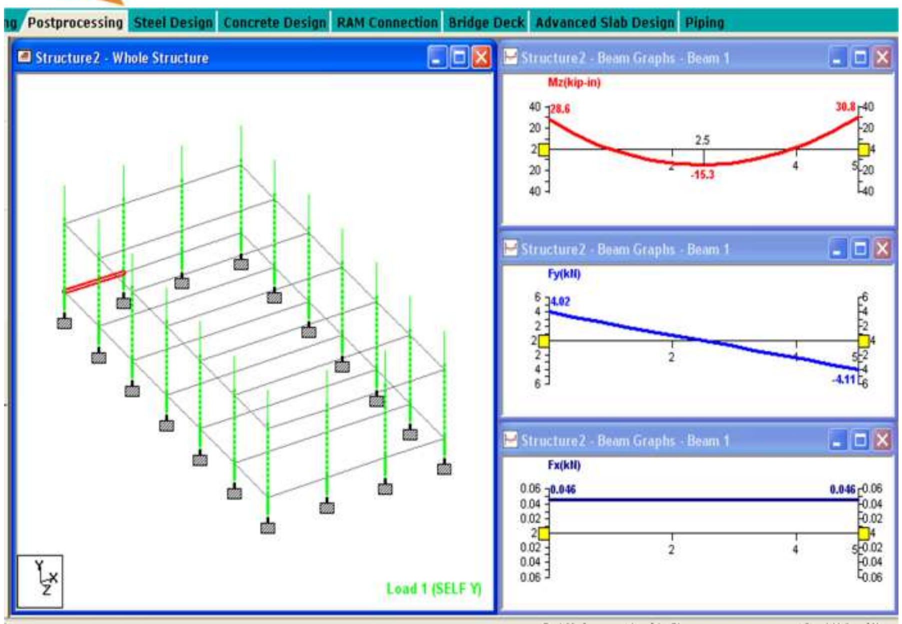

Fig. 2.1.7 VIEW OF LOAD 1(SELF Y)

STAAD Pro DESIGN AND ANALYSIS

STAAD Pro Introduction:

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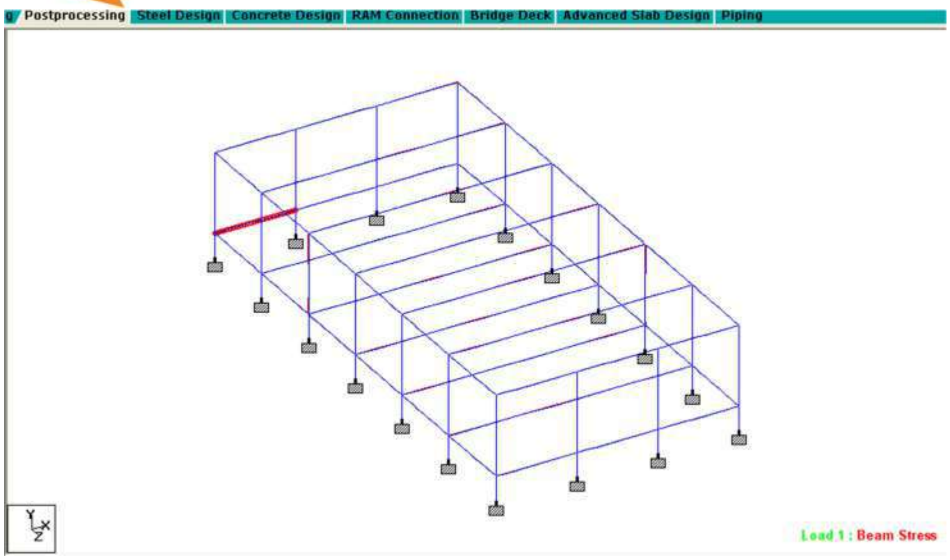


Fig. 2.2.1 BEAM STRESS

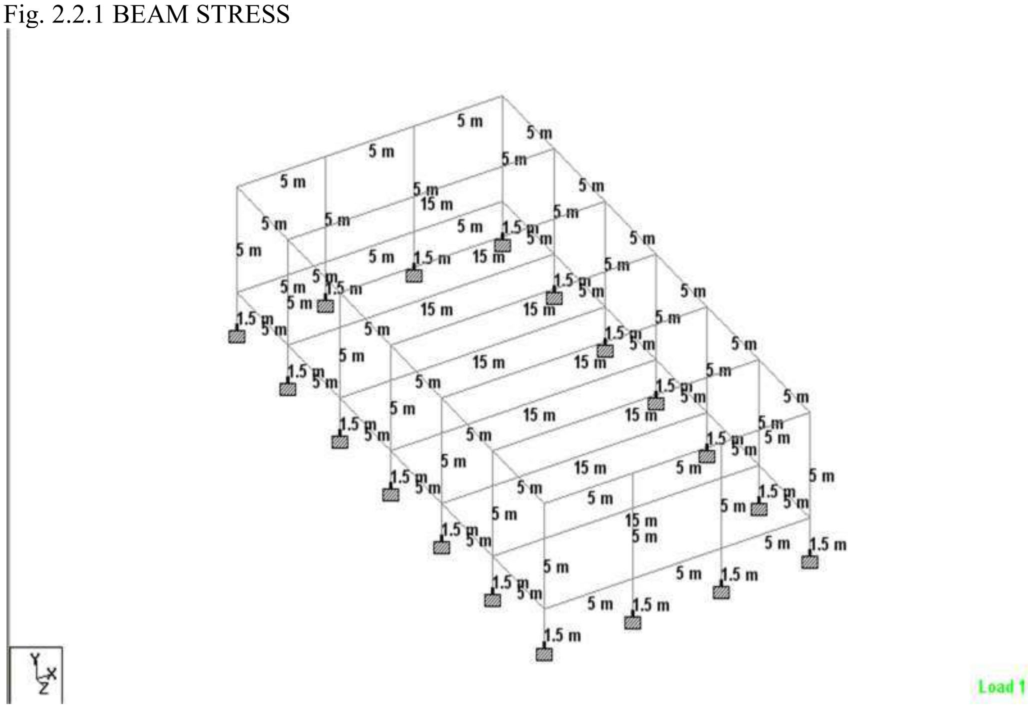


Fig. 2.2.2 VIEW OF BEAM STRESS

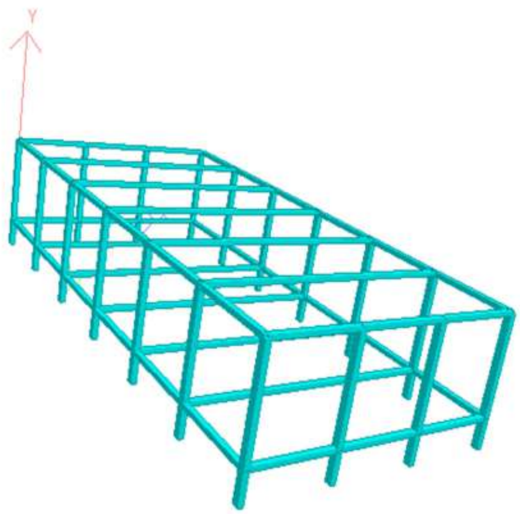
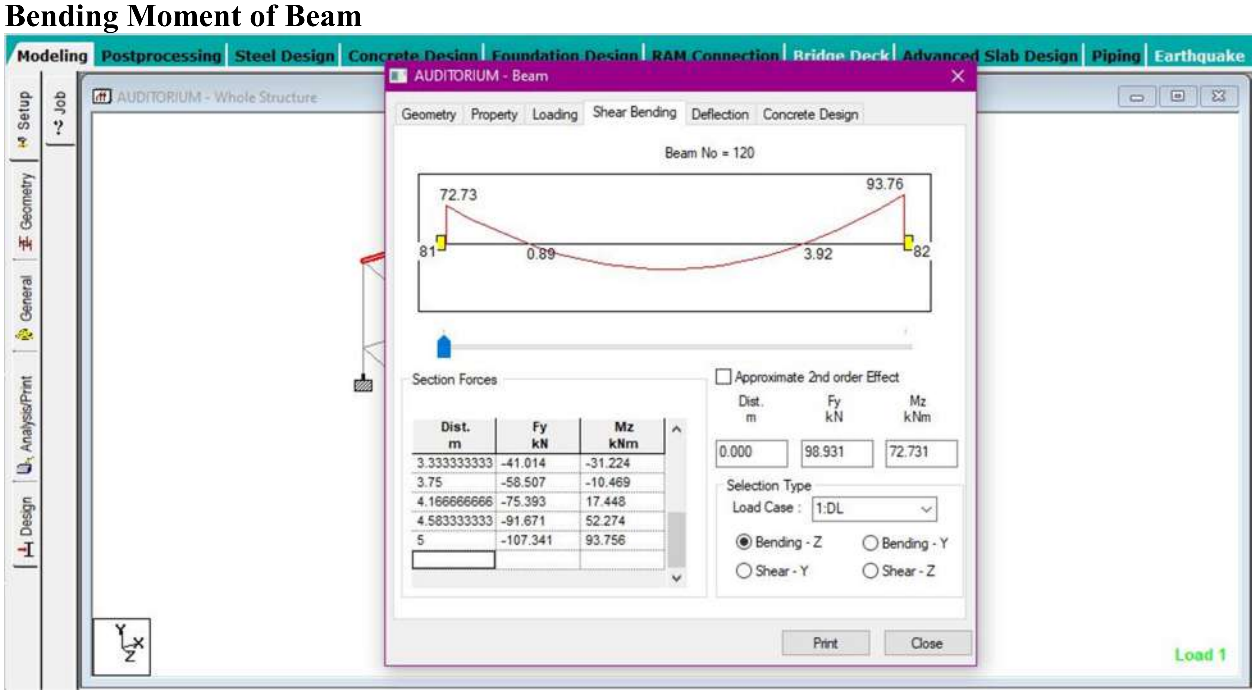


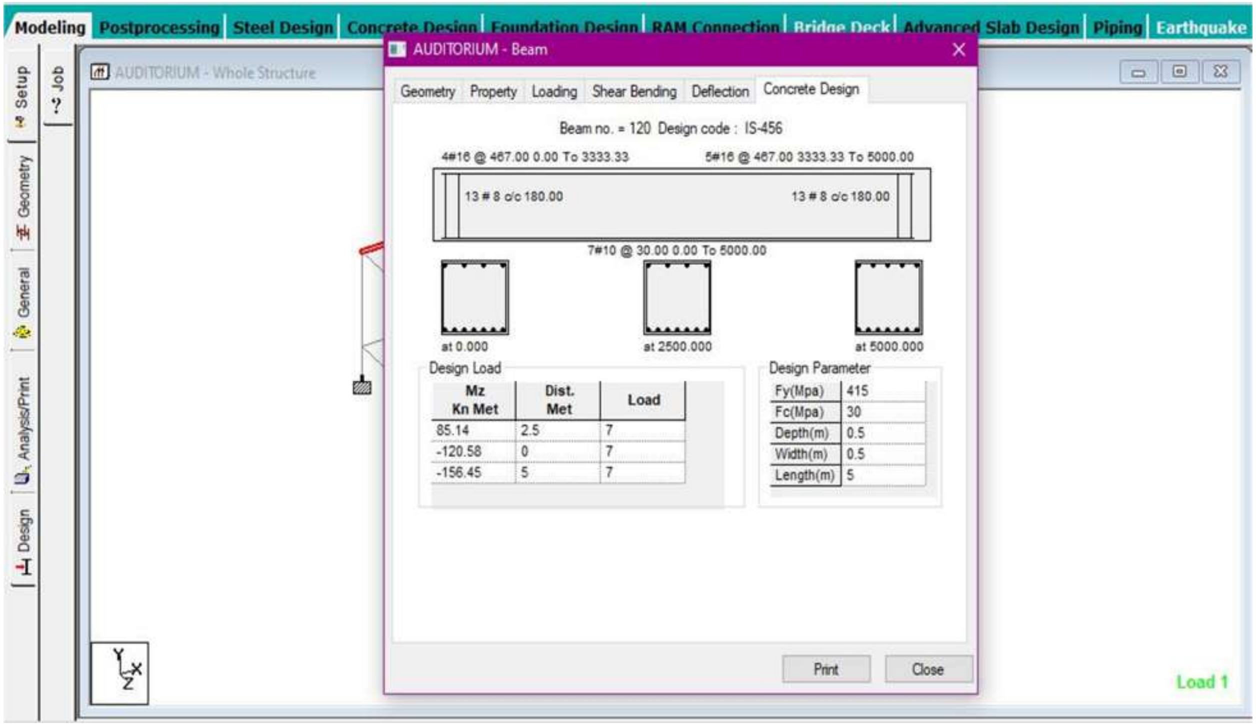
Fig. 2.2.3 3D VIEW

ANALYSIS

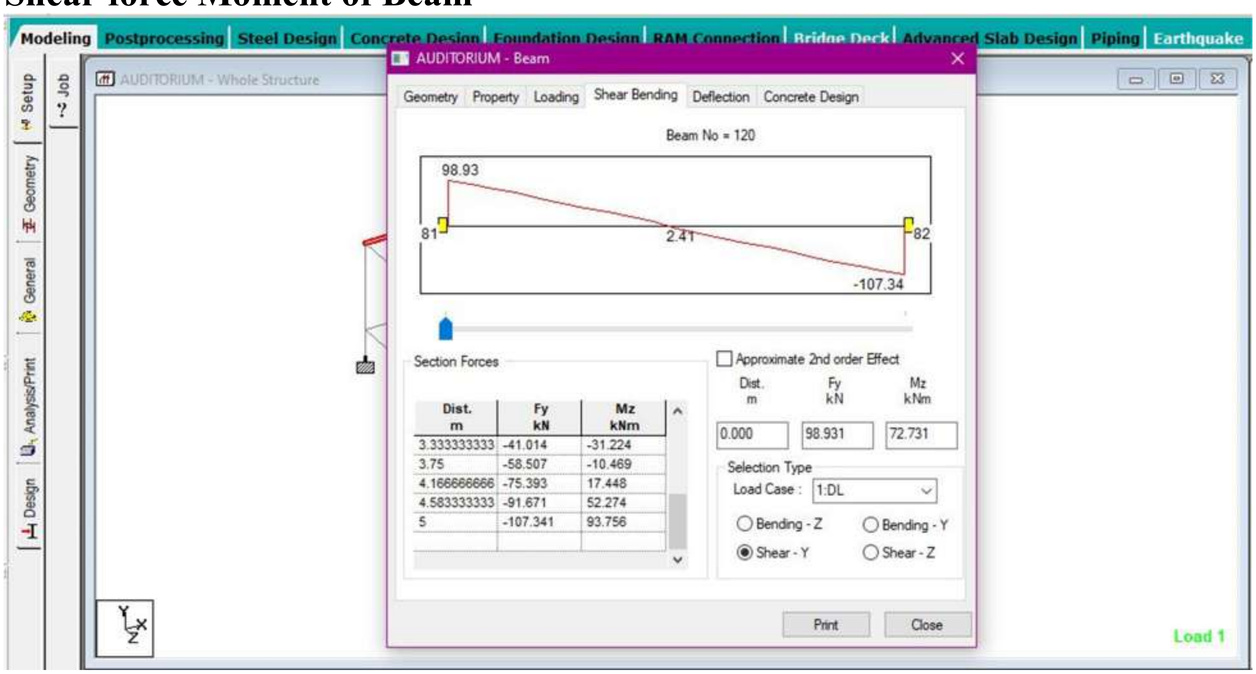
Bending Moment of Beam



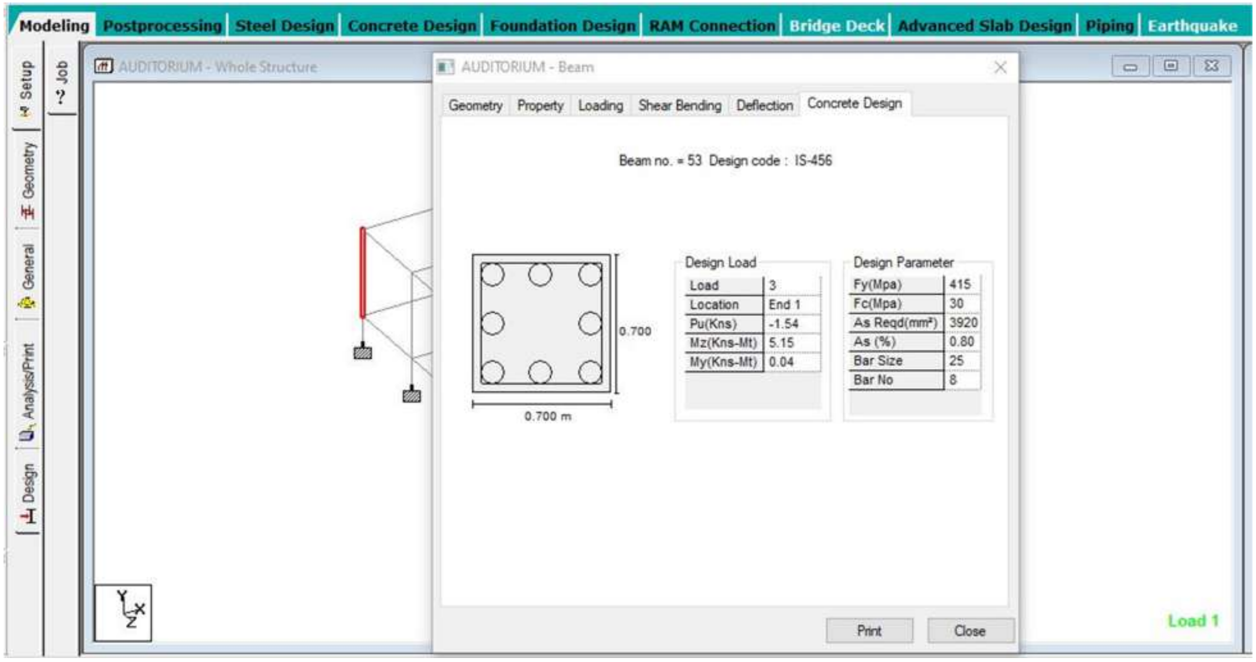
Reinforcement of Beam



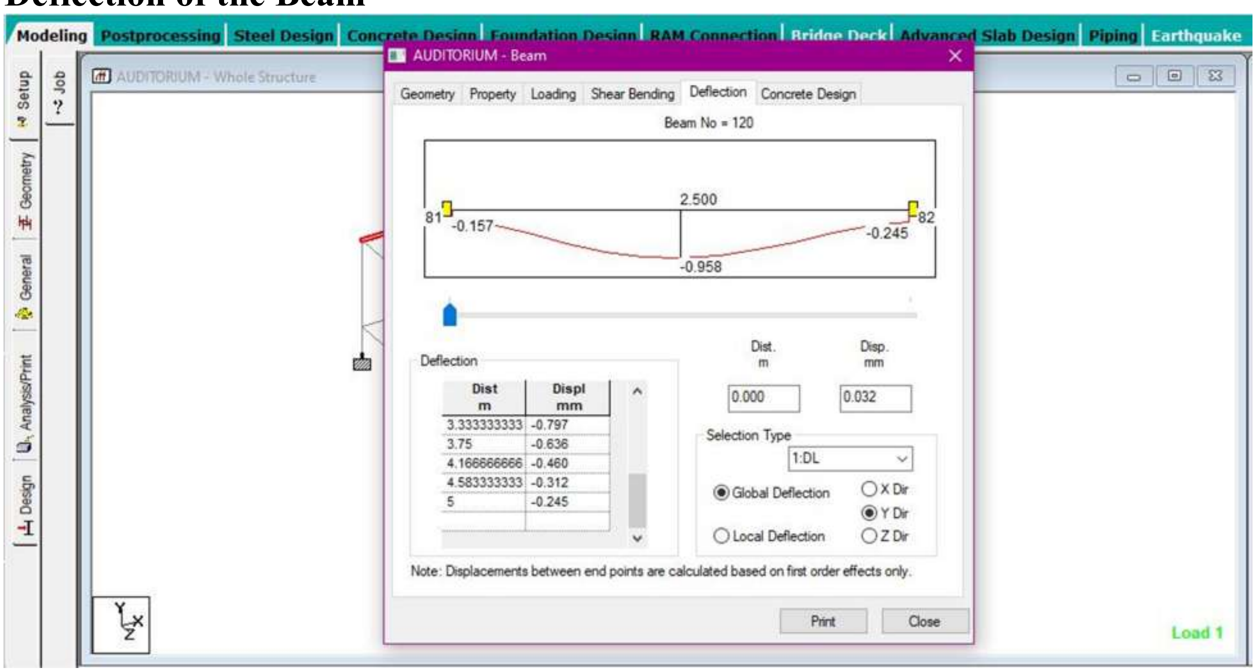
Shear force Moment of Beam



Reinforcement of the Column



Deflection of the Beam



B E AM N O. 57 D E S I G N R E S U L T S

M30 Fe415 (Main) Fe415 (Sec.)

LENGTH: 5000.0 mm SIZE: 500.0 mm X 500.0 mm COVER: 25.0 mm

SUMMARY OF REINF. AREA (Sq.mm)

SECTION	0.0 mm	1250.0 mm	2500.0 mm	3750.0 mm	5000.0 mm
TOP REINF.	787.63 (Sq. mm)	481.33 (Sq. mm)	481.33 (Sq. mm)	481.33 (Sq. mm)	828.86 (Sq. mm)
BOTTOM REINF.	481.33 (Sq. mm)	481.33 (Sq. mm)	481.33 (Sq. mm)	481.33 (Sq. mm)	481.33 (Sq. mm)

SUMMARY OF PROVIDED REINF. AREA

SECTION	0.0 mm	1250.0 mm	2500.0 mm	3750.0 mm	5000.0 mm
TOP REINF.	11-10í 1 layer(s)	7-10í 1 layer(s)	7-10í 1 layer(s)	7-10í 1 layer(s)	11-10í 1 layer(s)
BOTTOM REINF.	7-10í 1 layer(s)	7-10í 1 layer(s)	7-10í 1 layer(s)	7-10í 1 layer(s)	7-10í 1 layer(s)
SHEAR REINF.	2 legged 8í @ 180 mm c/c	2 legged 8í @ 180 mm c/c	2 legged 8í @ 180 mm c/c	2 legged 8í @ 180 mm c/c	2 legged 8í @ 180 mm c/c

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

SHEAR DESIGN RESULTS AT 820.0 mm AWAY FROM START SUPPORT
VY = 103.39 MX = -0.11 LD= 21
Provide 2 Legged 8í @ 180 mm c/c

SHEAR DESIGN RESULTS AT 820.0 mm AWAY FROM END SUPPORT
VY = -106.02 MX = -0.12 LD= 17

Provide 2 Legged 8í @ 180 mm c/c

B E AM N O. 58 D E S I G N R E S U L T S

M30 Fe415 (Main) Fe415 (Sec.)

LENGTH: 5000.0 mm SIZE: 500.0 mm X 500.0 mm COVER: 25.0 mm

STAAD SPACE -- PAGE NO. 22

SUMMARY OF REINF. AREA (Sq.mm)

SECTION	0.0 mm	1250.0 mm	2500.0 mm	3750.0 mm	5000.0 mm
TOP REINF.	812.17 (Sq. mm)	481.33 (Sq. mm)	481.33 (Sq. mm)	481.33 (Sq. mm)	812.17 (Sq. mm)
BOTTOM REINF.	481.33 (Sq. mm)	481.33 (Sq. mm)	481.33 (Sq. mm)	481.33 (Sq. mm)	481.33 (Sq. mm)

SUMMARY OF PROVIDED REINF. AREA

SECTION	0.0 mm	1250.0 mm	2500.0 mm	3750.0 mm	5000.0 mm
TOP REINF.	11-10í 1 layer(s)	7-10í 1 layer(s)	7-10í 1 layer(s)	7-10í 1 layer(s)	11-10í 1 layer(s)
BOTTOM REINF.	7-10í 1 layer(s)	7-10í 1 layer(s)	7-10í 1 layer(s)	7-10í 1 layer(s)	7-10í 1 layer(s)
SHEAR REINF.	2 legged 8í @ 180 mm c/c	2 legged 8í @ 180 mm c/c	2 legged 8í @ 180 mm c/c	2 legged 8í @ 180 mm c/c	2 legged 8í @ 180 mm c/c

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

SHEAR DESIGN RESULTS AT 820.0 mm AWAY FROM START SUPPORT
VY = 104.51 MX = 0.00 LD= 21
Provide 2 Legged 8í @ 180 mm c/c

SHEAR DESIGN RESULTS AT 820.0 mm AWAY FROM END SUPPORT
VY = -104.51 MX = 0.00 LD= 22
Provide 2 Legged 8í @ 180 mm c/c

CONCLUSION

The project is about "DESIGNING AND PLANNING OF AUDITORIUM". As this is a prayer hall all the members of the staff assemble here. The total project includes designing of structural members like slab, beams, columns, footings. The designing has been done based on reference of IS code 456:2000 for concrete and SP 16 for steel. The software AUTOCAD was used for drawings (plan, section, & elevation) and for drawing reinforcement details of slabs, columns, beams & footings.

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