DESIGN AND ANALYSIS OF AN INDOOR STADIUM BY USING STAAD PRO

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Abstract - In this growing world, as a civil engineering student one needs to be fully aware of structural elements and the safety parameters before and during execution of project. Indoor stadium is a closed area which is usually used for indoor sports like basketball, ice hockey, volleyball etc., Indira Gandhi Arena (New Delhi), Dandamudi Indoor Stadium (Vijayawada), Saroornagar Indoor Stadium (Hyderabad) etc., are the examples of indoor stadiums. Indoor stadium is usually designed to accommodate multitude number of spectators, so the sitting arrangement is provided for that.

This project mainly deals with analysis and design of Indoor stadium consists of G+2 floors using STAAD PRO. The ground floor consists of volleyball court, the first floor consists of badminton court and the second floor consists of yoga, carroms, table tennis, gym and office room. The guidelines being followed are as per IS 456: 2000. All the structural elements are designed as per codal provisions, STAAD PRO and AUTOCAD features contains powerful graphical interface with modelling, analytical, and design procedures. It is quick and very easy for simple structures. It can handle the largest and most complex building models.

Keywords — Analysis, AutoCAD, Codal Provisions, Design, Indoor Stadium , STAAD PRO,

I. INTRODUCTION

Now a days everyone is using mobile phones. They are sitting in the same room and playing games, using social media, browsing net. They are becoming lazy and neglecting the fitness of body. They have an intention to play games or sports but they don't have suitable place for playing and players also. That's why we proposed this project.

An Indoor Stadium is an enclosed area. It is composed of a large open space surrounded on most or all sides by tiered seating for spectators, and may be covered by a roof. The first indoor arena was Madison Square Garden in New York city. It was completed in 1890 to replace a converted railroad terminal that had been used for public events since 1874.

The principle objective of this project is to Plan, analyze and design of an educational building manually and also compare the manually obtained results with the results obtained by using the **STAAD Pro** software. We propose use M30 concrete and Fe415 bars for all structural components like slabs, beams, columns and Foundation. We have used the AUTO CAD for effective representation of the plans.

Thus we feel that structure fulfils the basic requirements of good designing and planning by using effectively every inch of space available and also justifies its name by increasing the beauty of landscape.

II. AIM OF THE PROJECT

The primary objective of this project is to gain sufficient knowledge in analysis, and design of building. Our project deals with the Design and Analysis of an indoor stadium which was done using Auto CAD and Staad Pro. It is a reinforced concrete framed structure consisting of G+2. The ground floor consists of volleyball court, the first floor consists of badminton court and the second floor consists of yoga, caroms, table tennis, gym and office room. IS 456:2000 codes is the basic code for general construction in concrete structures, hence all the structural members are designed using limit state method in accordance with the IS 456:2000 code and design aids.

III. PRESENTATION OF PROBLEM

Building planning is mostly done by architects. But even Engineers some time have to perform this job. Hence knowledge of building planning in its board prospective is essential for all the civil engineers also. There may be two conditions of planning for a architect or engineer.

- When site plan is given

 DOI : 10.35291/2454-9150.2020.0600

- When site plan is yet to be decided in the latter case, architect can show his full competence by suitably selecting the site, orientation, planning and designing the building.

The plan and detailing was drawn using Auto CAD. An Indoor Stadium consists of G+2. The floor height of Ground Floor and First Floor is 8.5 m. The Floor Height of Second Floor is 4.2m. The height of the parapet wall is 1m.The staircase is provided including lift with enough space.

IV. LINE DIAGRAM

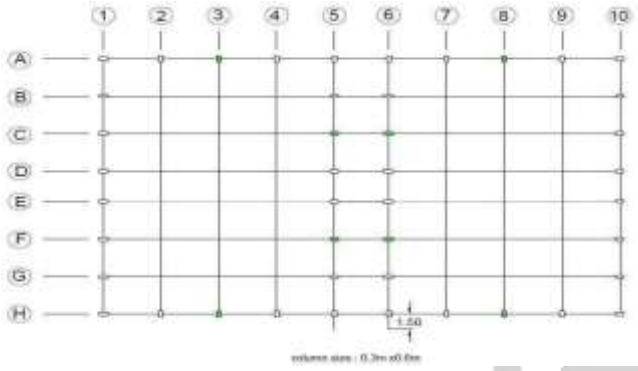


Figure 1 : Line Diagram

1. GROUND FLOOR PLAN

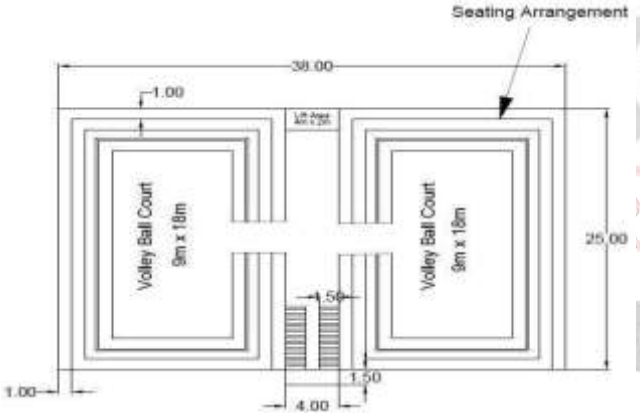


Figure 2 : Ground Floor Plan

2. FIRST FLOOR PLAN

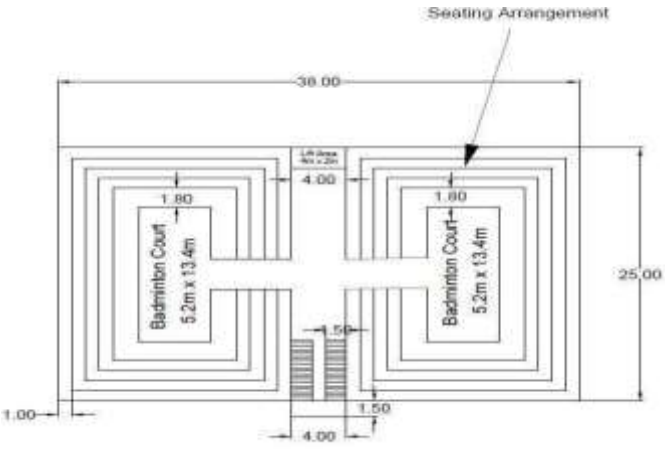


Figure 3 : First Floor Plan

3. SECOND FLOOR PLAN

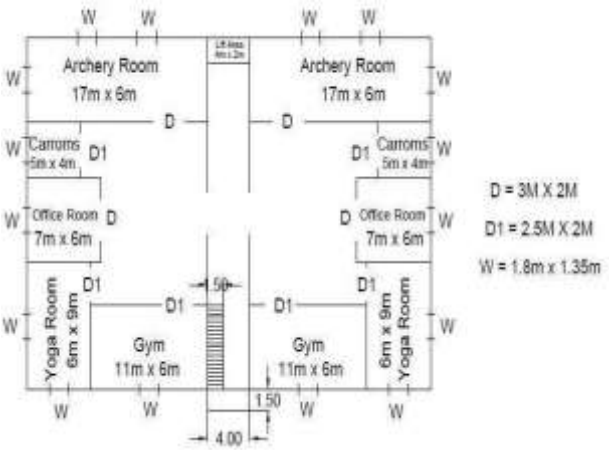


Figure 4 : Second Floor Plan

V. STAAD PRO MODELLING AND ANALYSIS

1. BENDING MOMENT DIAGRAM

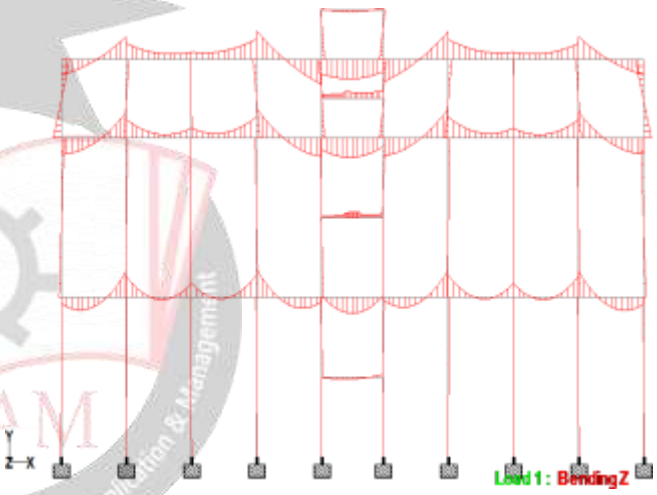


Figure 5 : Bending Moment Diagram

2. SHEAR FORCE DIAGRAM

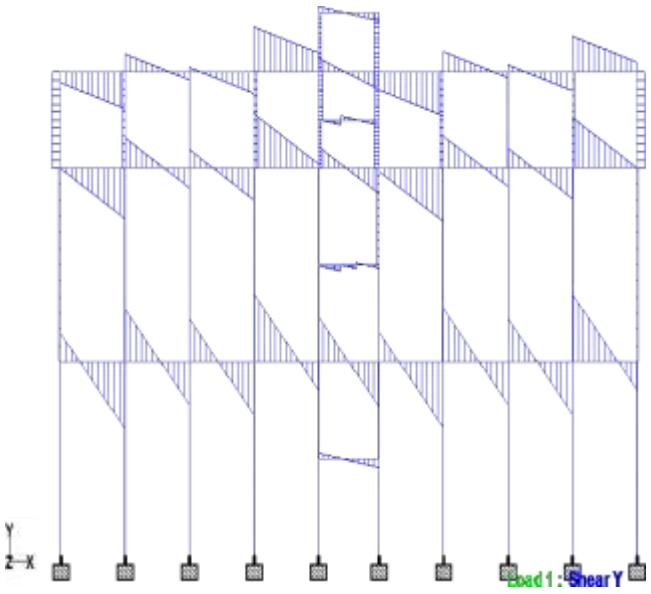


Figure 6 : Shear Force Diagram

 DOI : 10.35291/2454-9150.2020.0600

3. DISPLACEMENT DIAGRAM

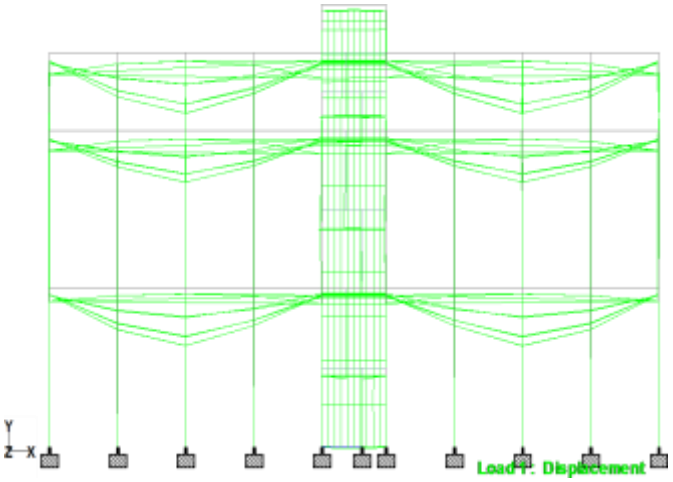


Figure 7 : Displacement Diagram

VI. DESIGN OF BEAMS AND COLUMN

1. DESIGN OF BEAM

- Sectional area: 300mm x 900mm
- Concrete grade: M_{30}
- Steel used: Fe415

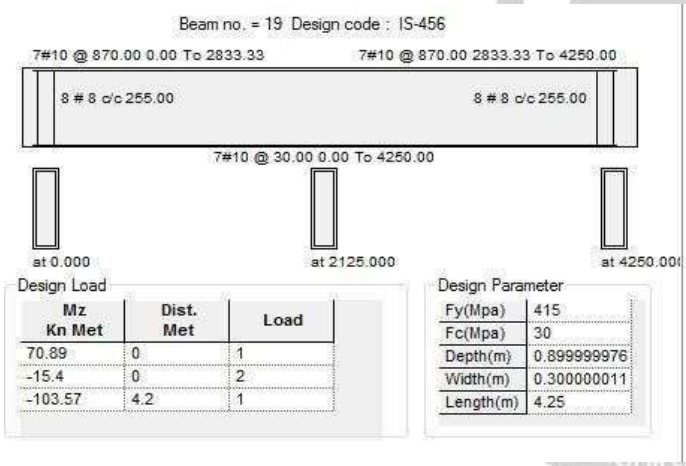


Figure 8 : Reinforcement Details of Beam

2. DESIGN OF COLUMN

- Sectional area: 600mm x 900mm
- Concrete grade: M_{30}
- Steel used: Fe415

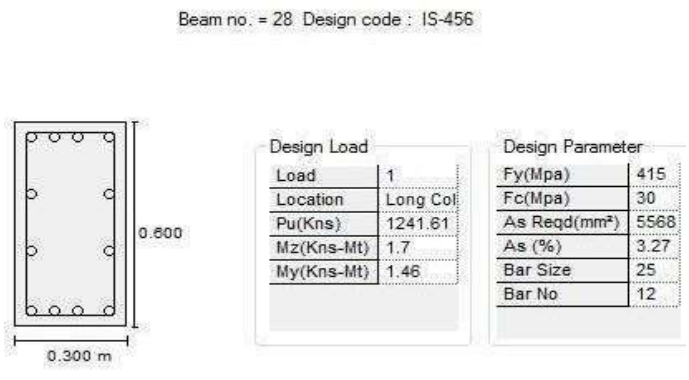


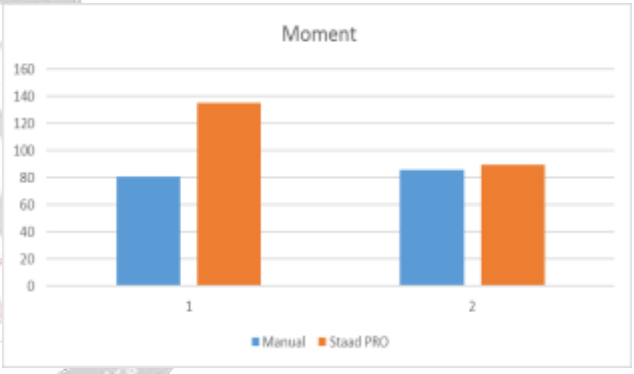
Figure 9 : Reinforcement Details of Column

VII. RESULTS AND DISCUSSIONS

DISUSSION

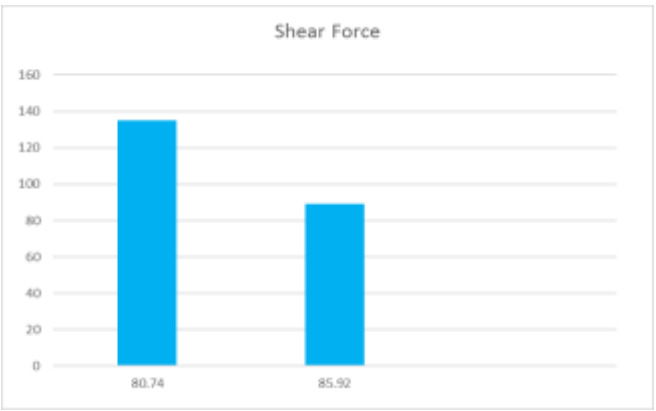
We chosen the particular location that is Vijayawada for Planning, Analyzing and Designing of indoor Stadium. Indoor Stadium is consists of Ground floor plus Two storeys. Ground Floor for Badminton Court, Second Floor for Volleyball Court and Top floor is for small games like caroms, Table Tennis, Yoga Room and Office Room. We calculated Final End moments manually by using Kanis Method and calculated bending moment, shear force, and displacement by using STAAD PRO Software and we also Designed the beams , columns by Manual and by using STAAD PRO Software and compared the both the results.

- We calculated Final End Moments in Longitudinal and Lateral Directions by using kanis method and we got maximum Positive and Negative Final End Moments as 80.74 KN-m and 85.92 KN-m Respectively.
- By using STAAD PRO Software we got maximum Positive and Negative Final End Moments as 135.24 KN-m and 89.190 KN-m



Graph 1 : Graph on variation of Moments

- Maximum Positive and Negative Shear force we got in the STAAD PRO Software is 118.51 KN and 111.48 KN



Graph 2 : Graph on variation of Shear Force

- Maximum Downward Deflection we got in STAAD PRO Software is 6.720mm.

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- We designed Continuous slab by manual and found out the Reinforcement to be provided in the slab
    i. We got 10mm bars at 150mm c/c spacing along X-axis at Supports
    ii. We got 10mm bars at 150mm c/c spacing along X-axis at Mid Span
    iii. We got 10mm bars at 150mm c/c spacing along Y-axis at Supports
    iv. We got 10mm bars at 150mm c/c spacing along Y-axis at Mid Span
    v. We got 8mm dia bars 200mm c/c spacing as Torsional Reinforcement
- We designed T Beam by manual calculations and found out the Reinforcement provided in the Beam as 12no's 32mm dia bars in tension zone and Shear Reinforcement as 2legged 8mm dia stirrups @ 80mm c/c spacing.
- In STAAD PRO Software we got reinforcement provided in Tension Zone as 7 no's 10mm dia bars and in Compression Zone as 7 no's 10mm dia bars.
- In column design by manual calculations we got reinforcement details as 8no's 18mm dia bars and 5mm dia lateral ties provided at 280mm c/c spacing.
- In STAAD PRO Software we got the reinforcement details as
    i. In Ground floor 12no's 25mm dia bars are provided.
    ii. In 1st Floor 12no's 16mm dia bars are provided.
    iii. In 2nd Floor 12no's 8no's 12mm dia bars are provided.

VIII. CONCLUSION

- In this Project we did Planning, Analysis and design for G + 3 Indoor Stadium.
- Materials used are M30 grade Concrete and Fe415 steel.
- Used AutoCAD 2017 for effective representation of drawings and STAAD PRO V8i Advanced Software which provides us a fast, efficient, easy to use and accurate platform for analyzing and designing structure.
- The design of Slab, Beam and Columns are done in Limit State Method which is safe at control of deflection and in all aspects.
- It was observed that the bending moment values obtained from manual calculation is less than the 15% of total average of the bending moment values obtained from Staad PRO. Compared to manual Designs, STAAD PRO designs are more accurate.

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 DOI : 10.35291/2454-9150.2020.0600