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DESIGN ANALYSIS & MODELLING OF STEEL STRUCTURES SIMULTANEOUSLY

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Abstract - *Steel offers the Various advantages to the construction Industry. The versatility of steel gives architects the freedom to achieve their most ambitious visions. Structural steel is an essential component of stadiums, shopping centers and commercial developments. steel is also one of the most sustainable construction materials, building owners naturally value the flexibility of steel buildings and the value benefits they provide. Steel is ideal for modernization, reconfiguring, extending or adapting with minimal disruption. The concept of design analysis and modelling of steel structures is the latest version in the civil engineering field. It is necessary to model a steel structure but if it is also analyzed during its modelling then there will not be any chances of failure. It will be a very handy process to analyze the design during modelling.*

1. INTRODUCTION

Modelling is a general process in steel structure. If steel structure has to be fabricated in an economic way then modelling and detailing is the key to achieve this. Sometimes because of a human error a structural engineer may design a wrong connection due to which it may fail and the structure may collapse. So to minimize the human errors or other errors the structure has to be analyzed during modelling and rectify the all chances of errors. Here is the analysis of shear plate connection with column and beam. If the connection is designed for a particular load but because of an error connection can not carry that much load, then the connection will fail so while modelling that particular connection, part of that connection turns red signaling it fails and if it is safe or can carry that much load then part of that connection turns green, which means safe. In that way analysis of design can be done while modelling. It will be boon to the steel structures in civil engineering.

2.1 SHEAR PLATE CONNECTION OF COLUMN & BEAM AND DESIGN ANALYSIS IN STEEL BUILDING (SAFE CONNECTION) :-

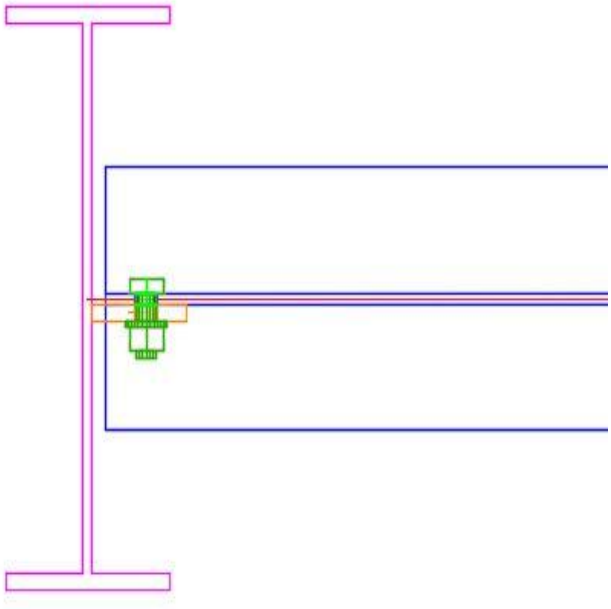

Fig -1: Plan view of Column & Beam shear plate connection in 2D wireframe.

Fig -1 shows the plan view of shear plate connection. In **Fig -1** yellow color shows the plate, magenta color shows the column, blue color shows the beam and green color shows the bolts. In this shear plate connection, Column size is W18x40 , Beam size is W14x48 and plate size is 9x 3 1/2x 1/2. But from the view it is not clear that how many bolts have been used so we have to see the connection in elevation which has been shown in **Fig-2.**

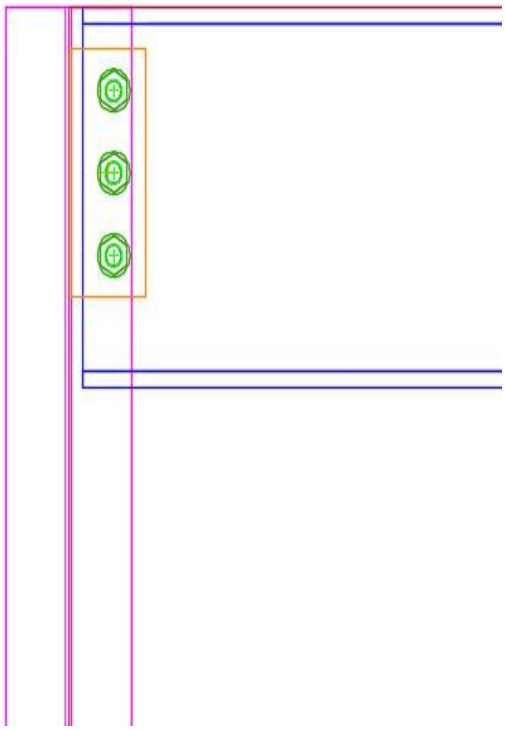

Fig -2: Elevation of Column & Beam shear plate connection in 2D wireframe.

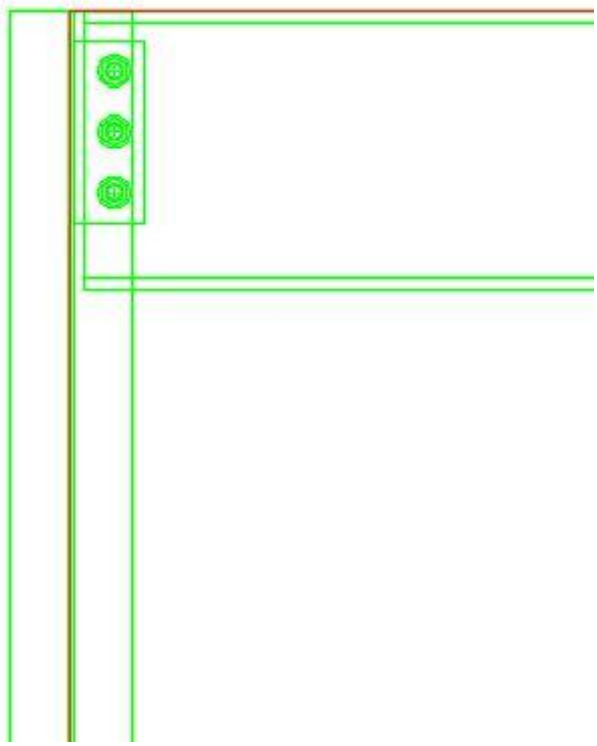

Fig -3: Analysis of shear plate connection in 2D wireframe(Elevation) when connection is safe.

In **Fig -2** it is clear that 3 bolts have been used in the connection. As per the standard for a beam of size W14x48, 3 bolts are to be used and hence the connection can bear the design load as per the standard. So connection is safe and hence designing of connection is correct. A green color will appear all over the connection when connection is safe which is shown in **Fig-3** and a red color will appear when connection is failed on all over the assembly.

Fig-3 shows the elevation of shear plate connection of column and beam in 2D wireframe when connection can bear the design load as per the standard.

Fig-4 shows the orthographic view of shear plate connection of column and beam in shaded mode when connection can bear the design load as per the standard. It all turned green which is signaling that the connection is safe under that load and there will be no chances of failure. It is a very good platform to analyze the design and rectify the errors. This also rectifies the human error.

Fig -5 shows the shear plate connection in shaded mode. It is a normal view when connection has been done in model and no design analysis is worked out.

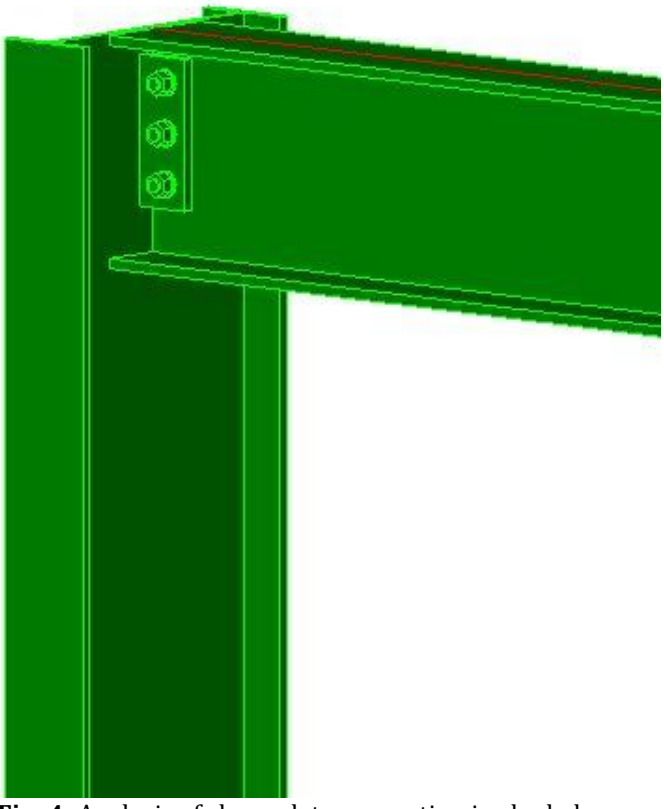

Fig -4: Analysis of shear plate connection in shaded mode(Orthographic View) when connection is safe.

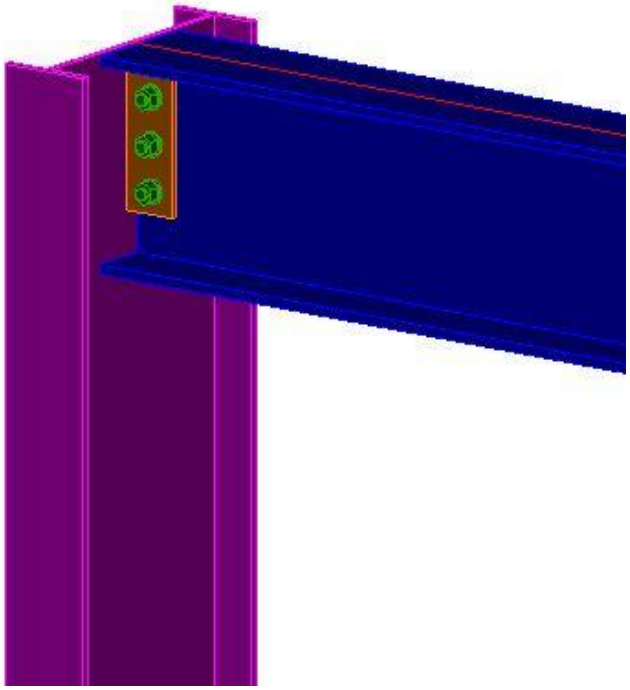

Fig -5: shear plate connection in shaded mode(Orthographic View).

2.2 SHEAR PLATE CONNECTION OF COLUMN & BEAM AND DESIGN ANALYSIS IN STEEL BUILDING (FAILED CONNECTION) :-

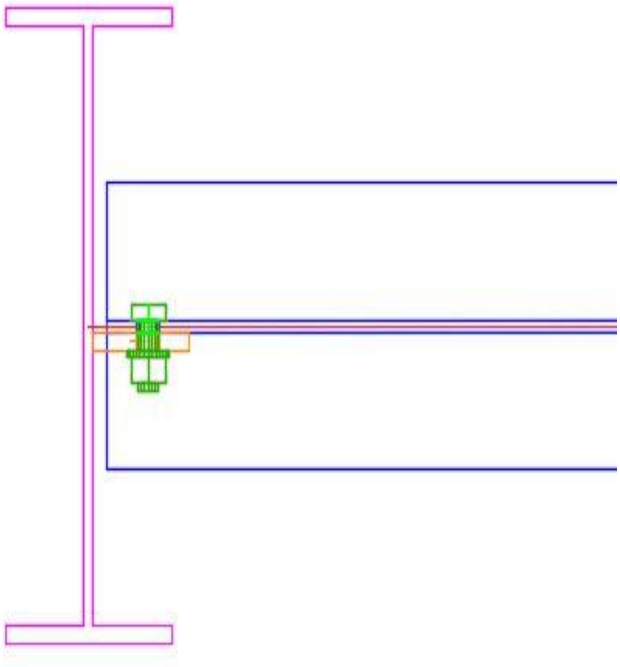

Fig -6: Plan view of Column & Beam shear plate connection in 2D wireframe.

Fig -6 shows the plan view of shear plate connection. In **Fig -6** yellow color shows the plate, magenta color shows the column, blue color shows the beam and green color shows the bolts. In this shear plate connection, Column size is W18x40 , Beam size is W14x48 and plate size is 9x3 1/2x1/2. But from the view it is not clear that how many bolts have been used so we have to see the connection in elevation which has been shown in **Fig-7.**

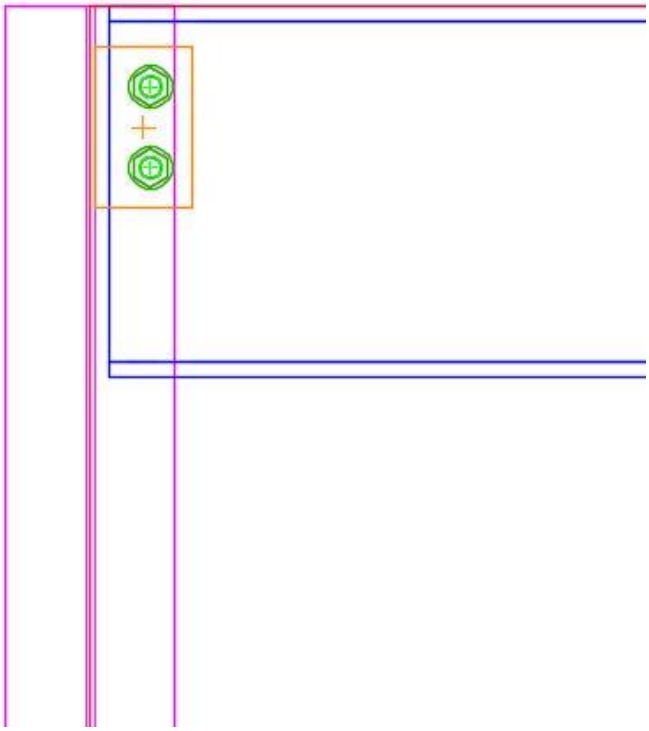

Fig -7: Elevation of Column & Beam shear plate connection in 2D wireframe.

In **Fig -7** it is clear that 2 bolts have been used in the connection. As per the standard for a beam of size W14x48, 3 bolts are to be used and hence the connection can not bear the design load as per the standard. So connection is not safe and hence designing of connection is incorrect. A green color will appear all over the connection when connection is safe and a red color will appear when connection is failed which is shown in **Fig-8** on all over the assembly.

Fig-8 shows the elevation of shear plate connection of column and beam in 2D wireframe when connection can not bear the design load as per the standard and hence failed.

Fig-9 shows the orthographic view of shear plate connection of column and beam in shaded mode when connection can not bear the design load as per the standard. It all turned red which is signaling that the connection is not safe under that load and hence the connection is failed. It is a very good platform to analyze the design and rectify the errors(if any).

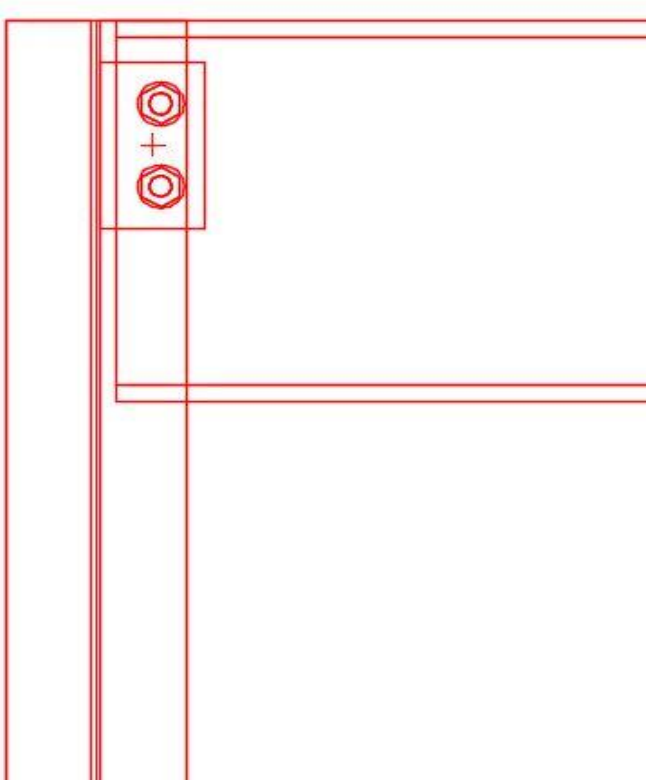

Fig -8: Analysis of shear plate connection in 2D wireframe(Elevation) when connection is failed.

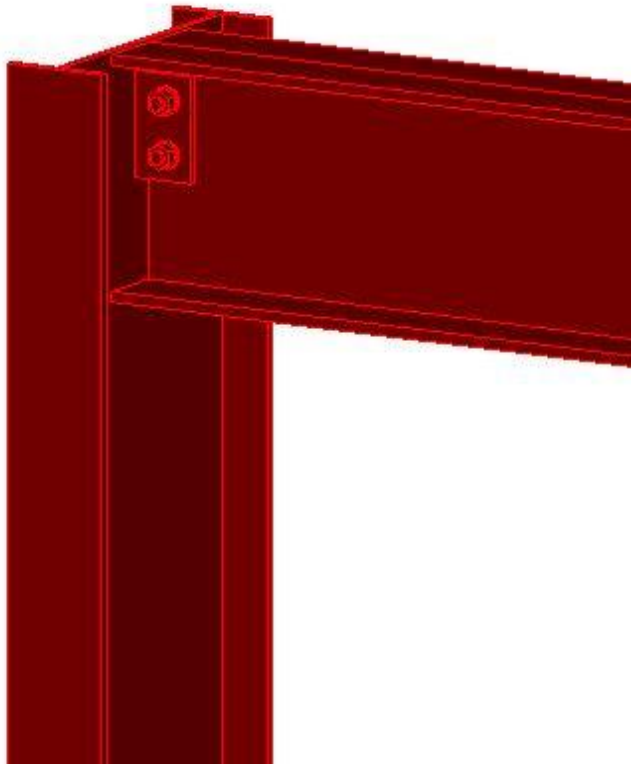

Fig -9: Analysis of shear plate connection in shaded mode(Orthographic View) when connection is failed.

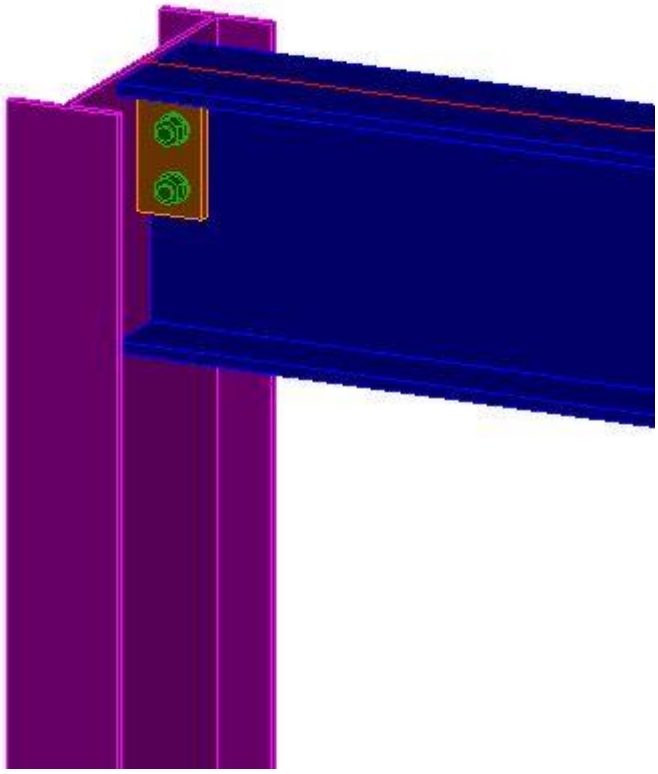

Fig -10: shear plate connection in shaded mode(Orthographic View).

Fig -10 shows the shear plate connection in shaded mode. It is a normal view when connection has been done in model and no design analysis is worked out.

3. CONCLUSIONS

Here the design of a steel building has been analyzed simultaneously while modelling in 3D via Advanced Steel software. Two shear plate connection has been analyzed where in one connection 3 bolts have been used which is safe and can bear the design load as per the standard, On the other hand, 2 bolts have been used, Which has been failed due to incapability of bearing the design load as per the standard and hence building may collapse. Analysis of design and modelling simultaneously is the future of steel structures.

REFERENCES

[1]. S.K Duggal , "Design of Steel Structure", 3rd Edition MC Graw Hill.