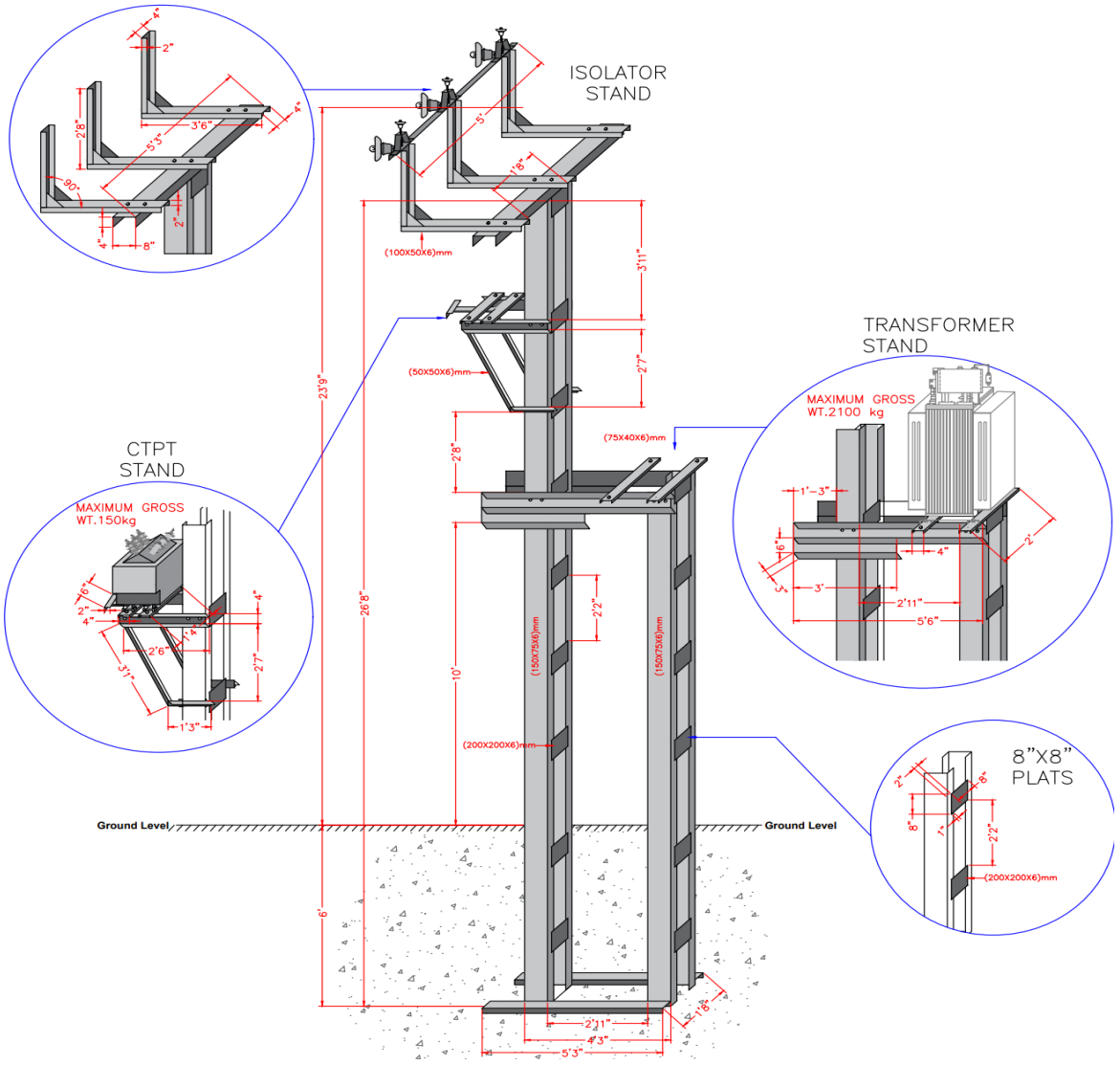
Finite Element Analysis of Single Pole Mounted Transformer structure

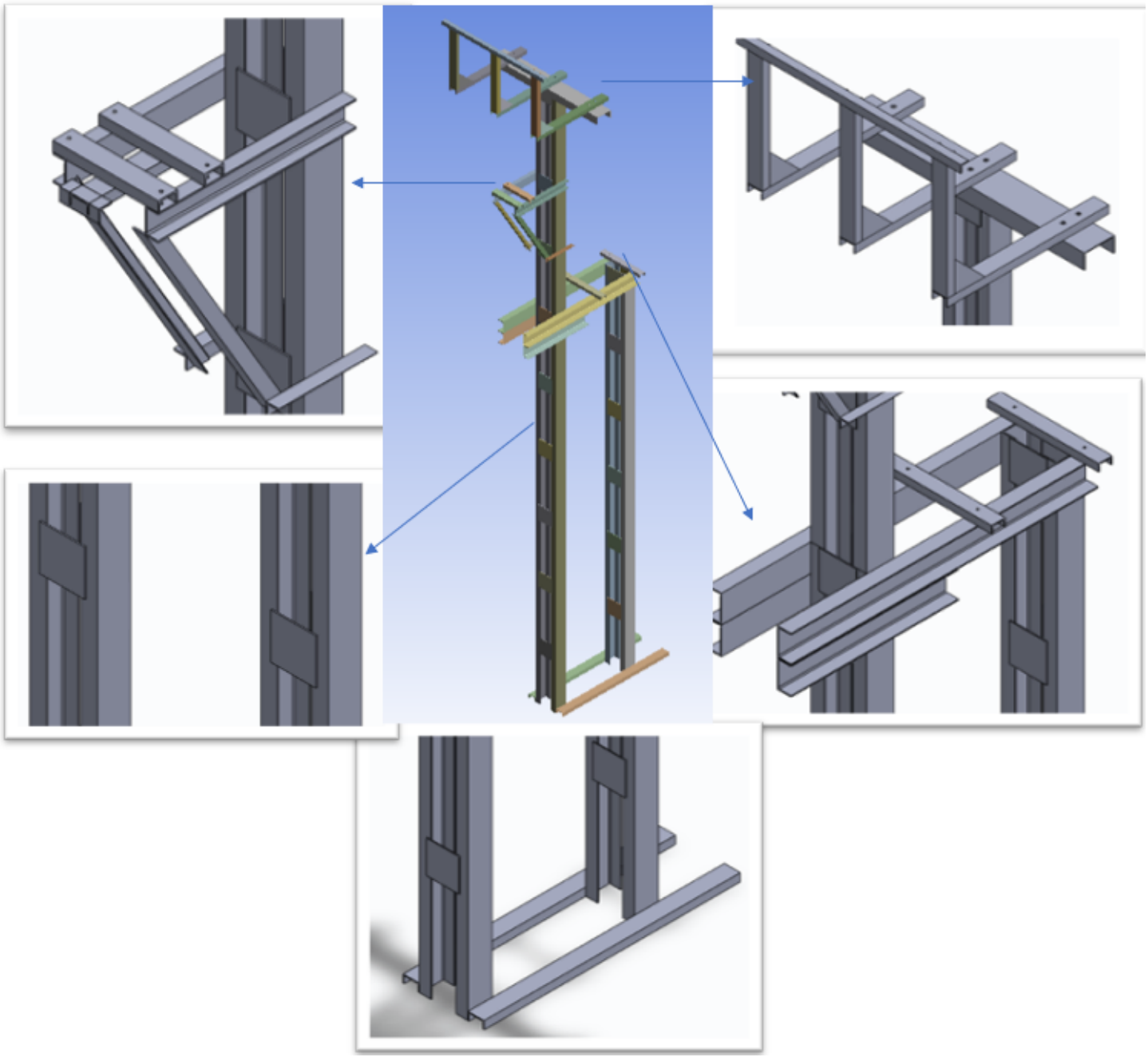
Problem Statement

Finite Element Analysis of Single Pole Mounted Transformer Structure (Drawing Ver 3.0). It is for having a maximum approx weight of 2100 kg on the transformer stand & 150 kg on CTPT stand.

Drawing



CAD Model of Structure

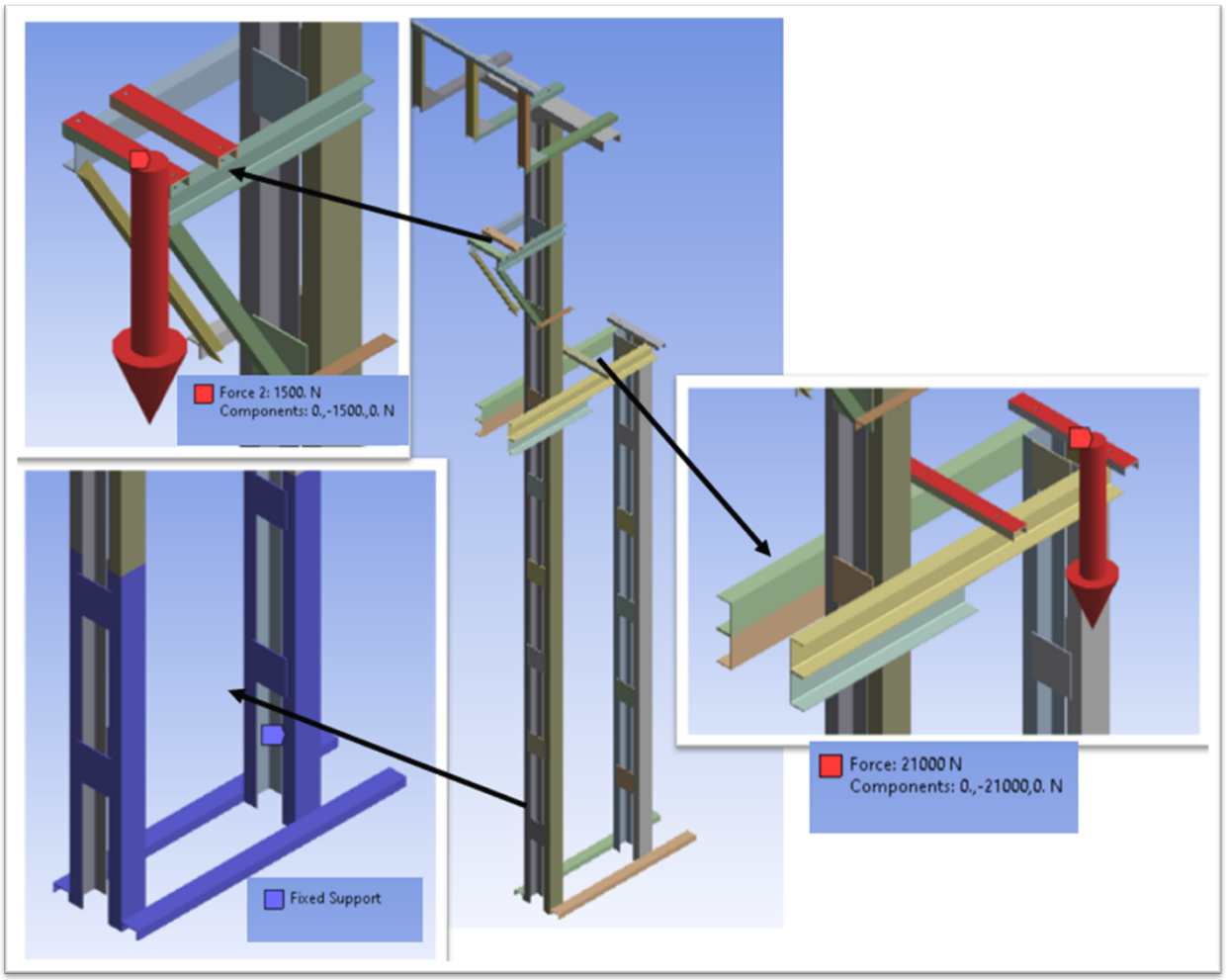


Material Properties

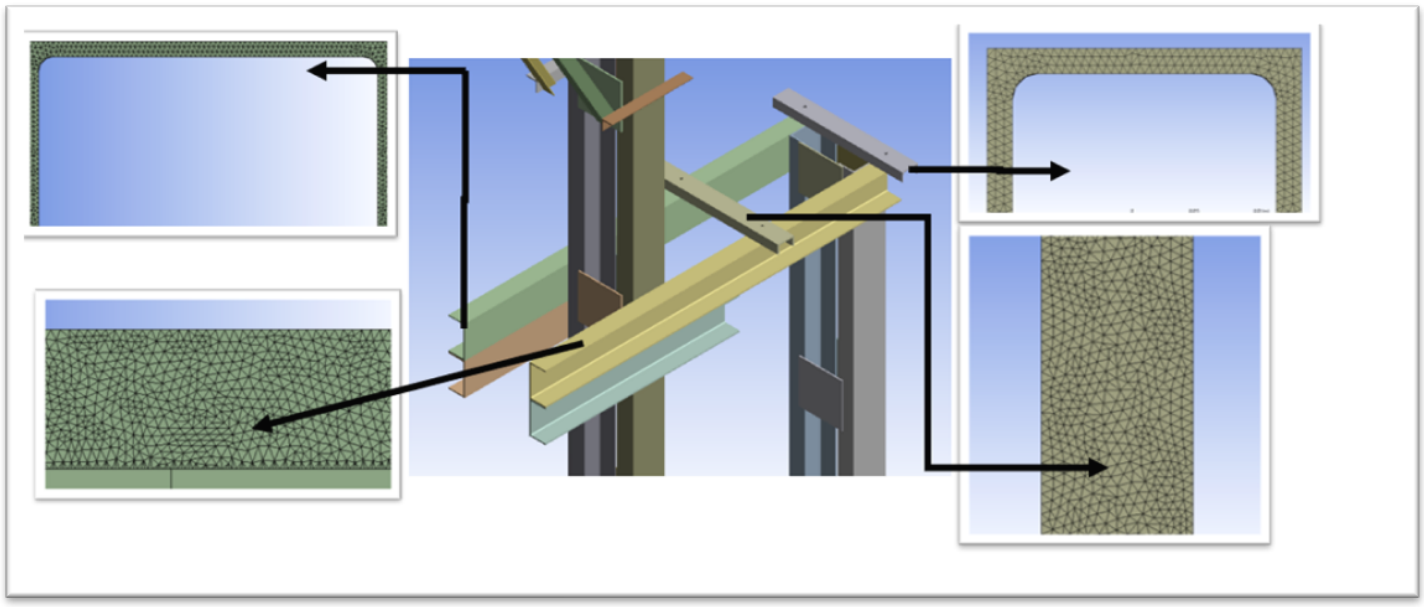
Structural Steel

Density	7850	kg/m³
Young's Modulus	2e+11	Pa
Poisson's Ratio	0.3	
Bulk Modulus	1.6667e+11	Pa
Shear Modulus	7.6923e+10	Pa
Isotropic Secant Coefficient of Thermal Expansion	1.2e-05	1/°C
Compressive Ultimate Strength	0	Pa
Compressive Yield Strength	2.5e+08	Pa
Tensile Ultimate Strength	4.6e+08	Pa
Tensile Yield Strength	2.5e+08	Pa

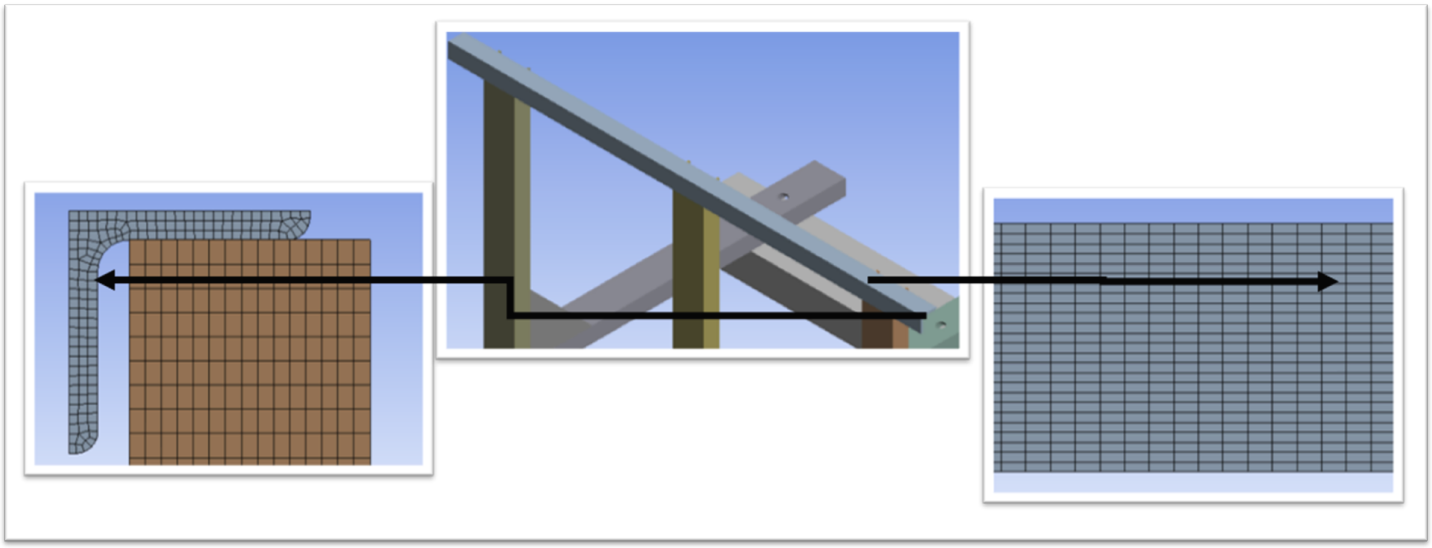
Boundary conditions and Loads



Meshing



Transformer Stand
Mesh size = 0.25 mm

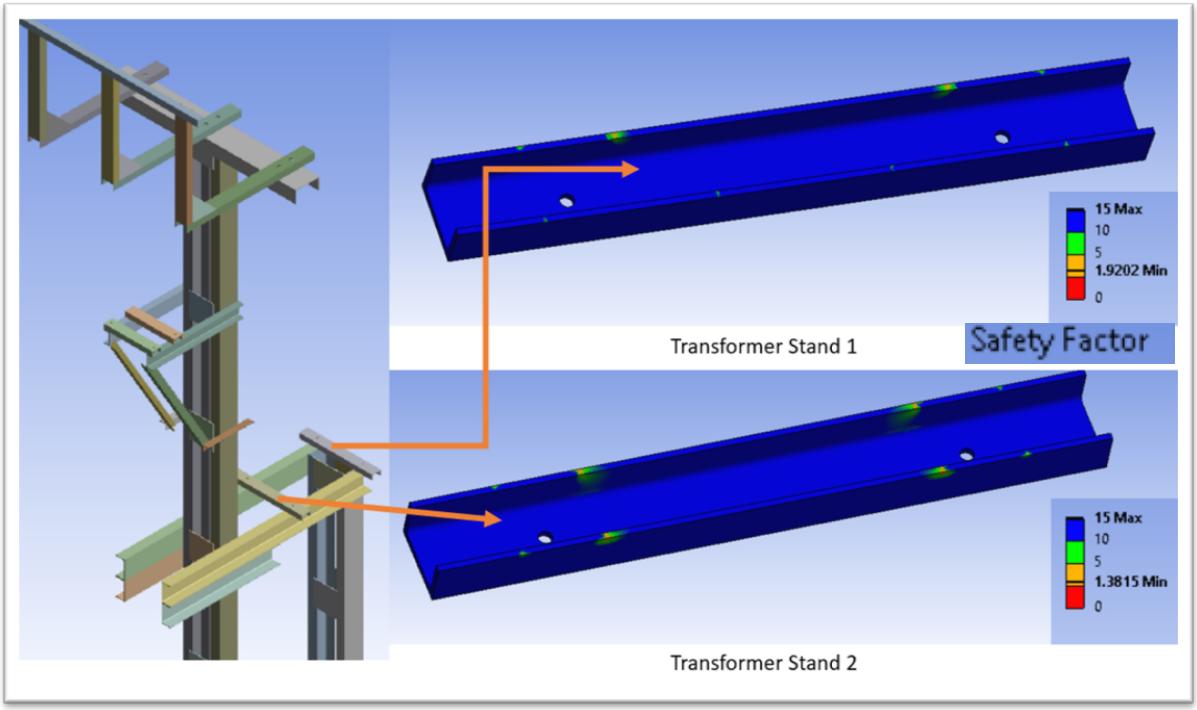


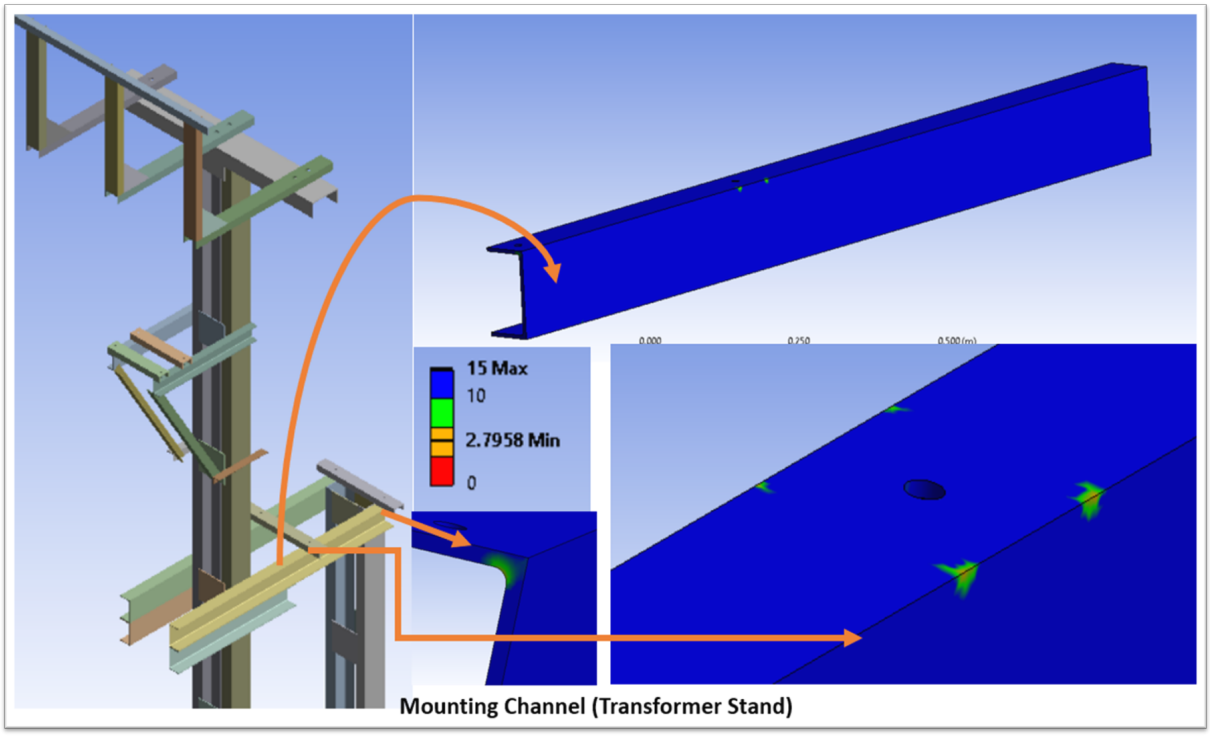
Upper L-rod (Isolator Stand)
Mesh size = 0.25 mm

Results

Analysis of factor of safety and deformation in critical regions.

Transformer Stand

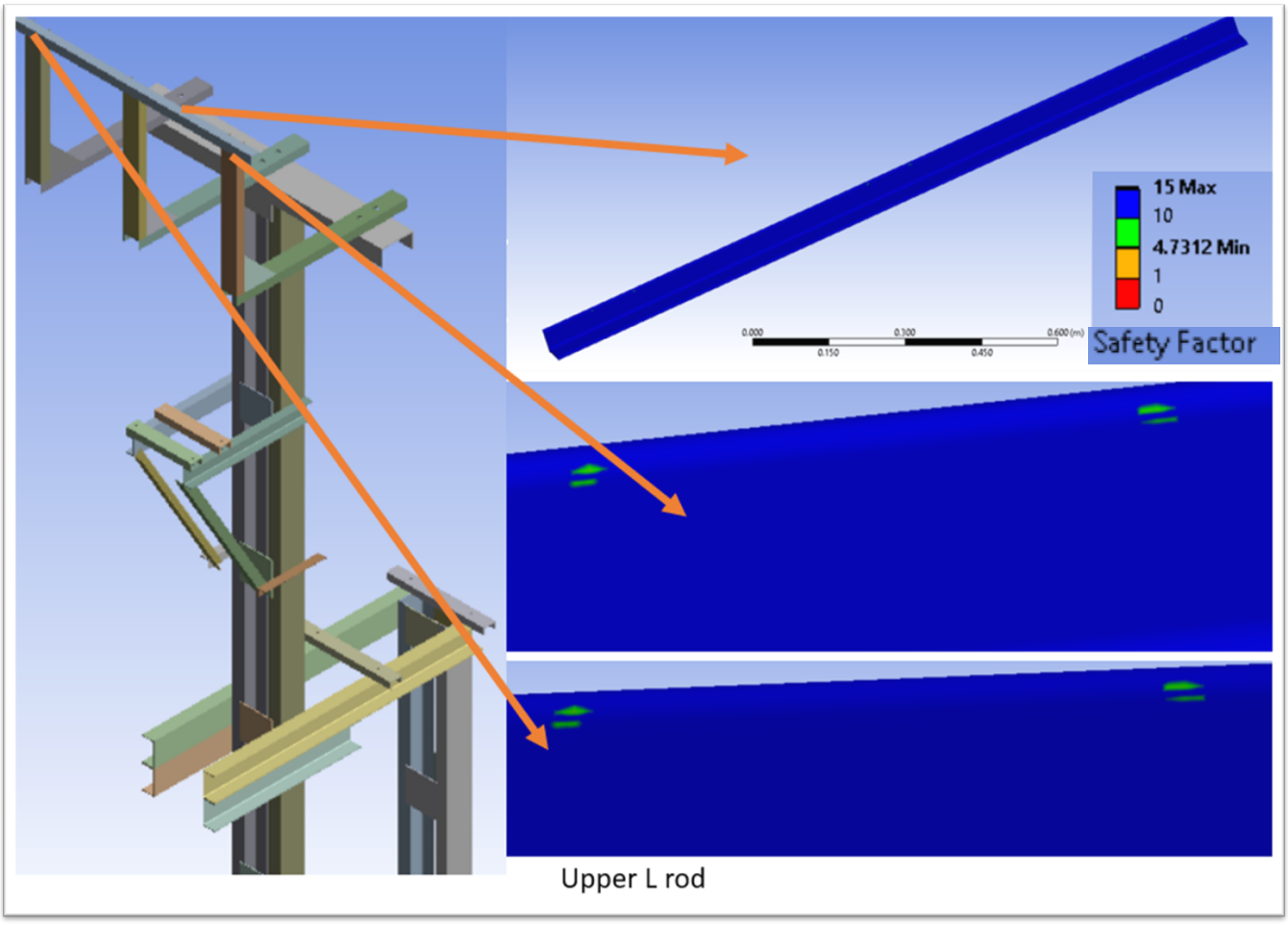


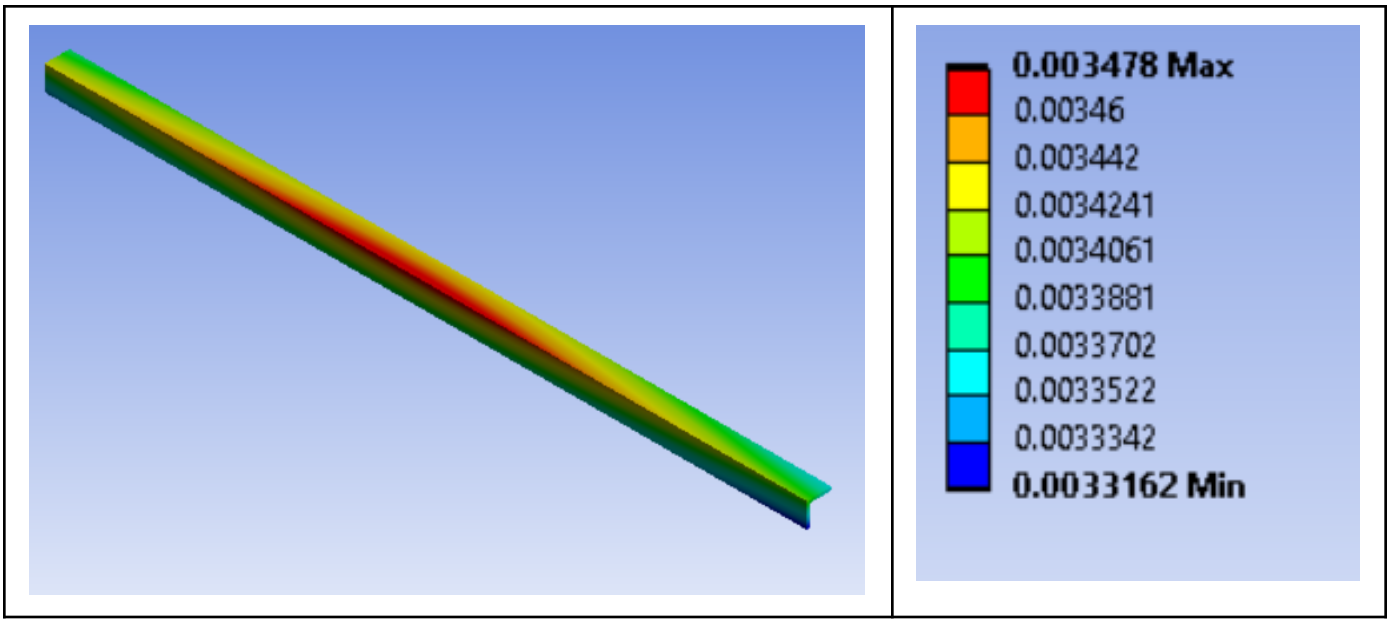


Observations

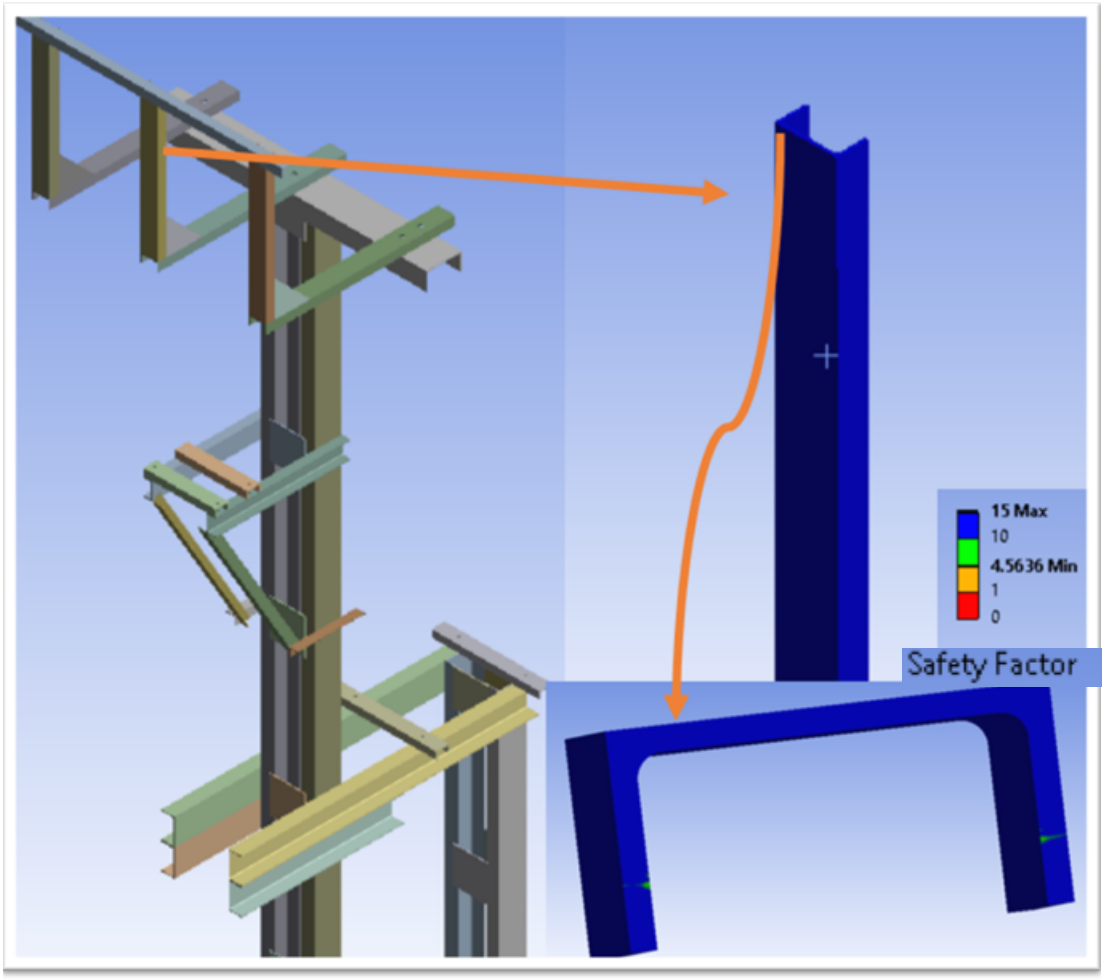
- Transformer Stand 2 has maximum stress of 180.97 MPa(Mega Pascal) that occurs at the contact between the part and the mounting channel on which it is mounted. Transformer stand 1 is also one of the critical regions where maximum stress of 130.19 MPa occurs at the contact between the part and the supporting channel on which it is mounted. These parts have a load of 2100 kg.
- Mounting Channels have less stress than transformer stands but still have significant stress 89.42Mpa compared to other parts of the structure, which occurs at contact with the transformer stand.
- Deformations at these parts are much smaller as compared to maximum deformation. Maximum deformation at these parts is 0.15-0.18 mm compared to the overall maximum deformation of 3.47 mm.
- These parts have a lowest factor of safety in some regions (minimum 1.38).
- The factor of safety in most of the region is above 10.

ISOLATOR STAND

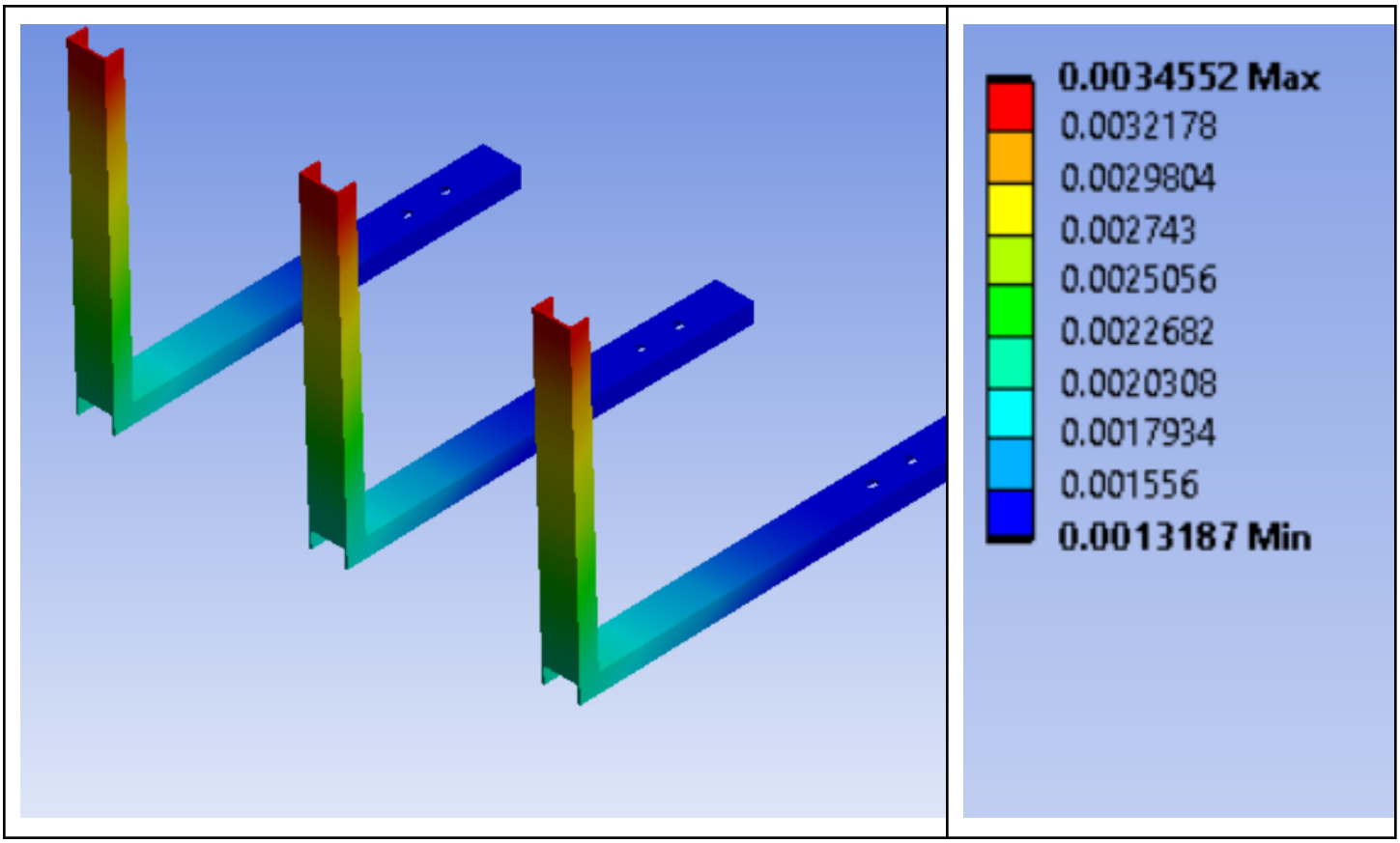




Deformation(upper L-rod)



Isolator Stand

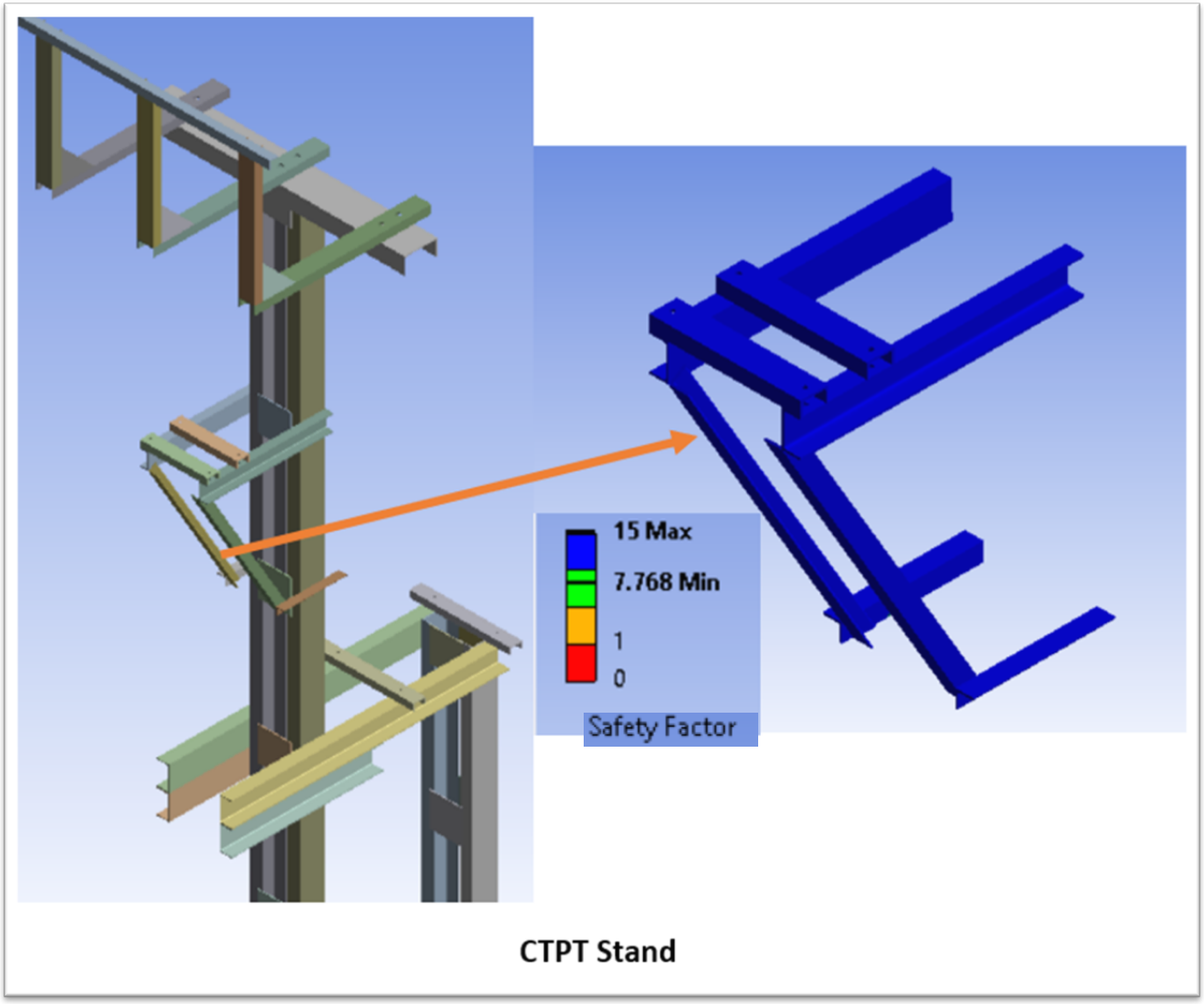


Deformation (Isolator stand)

Observations

- Stress at the upper L-rod is maximum at the middle, which is in contact with the L-shape structure. But this stress(52.8 MPa) is less than the overall maximum stress(180.97 MPa) of the structure.
- Deformation at this part is maximum(3.478mm). Maximum deformation occurs at the joint with the isolator stand.
- In the isolator stand, stress at the middle part is maximum. Maximum stress occurs at contact with the top upper L-Rod.
- Deformation at the isolator stand is one of the maxima in the whole structure. It is 3.4552 mm. Maximum deformation occurs at the joint with the upper L-Rod.
- Minimum factor of safety for this part is around 4.5, which occurs at the contact of the upper L-rod and the isolator stand.
- The average factor of safety is greater than 10.

CTPT Stand



CTPT Stand

Observation

- Stress at this part is maximum at its joint with the central channel. But its stress(32.18MPa) is much smaller than maximum stress(180.97 MPa).
- Deformation at this part(0.69mm) is also much smaller compared to the maximum deformation (3.478mm).
- Its Minimum factor of safety is 7.768. But the average factor of safety is greater than 10.

All the other parts have a higher factor of safety than 5 and much lesser deformation as compared to the maximum deformation in the structure.