ANSYS analysis and structural calculation for Large glass window

1. Importing of Window 3D model from SOLID EDGE

We use ANSYS 17.0. ANSYS can import almost format of 3D model from Solid edge. After converting 3D model into igs 3D file in solid edge ANSYS can use igs 3D model as geometrical model.

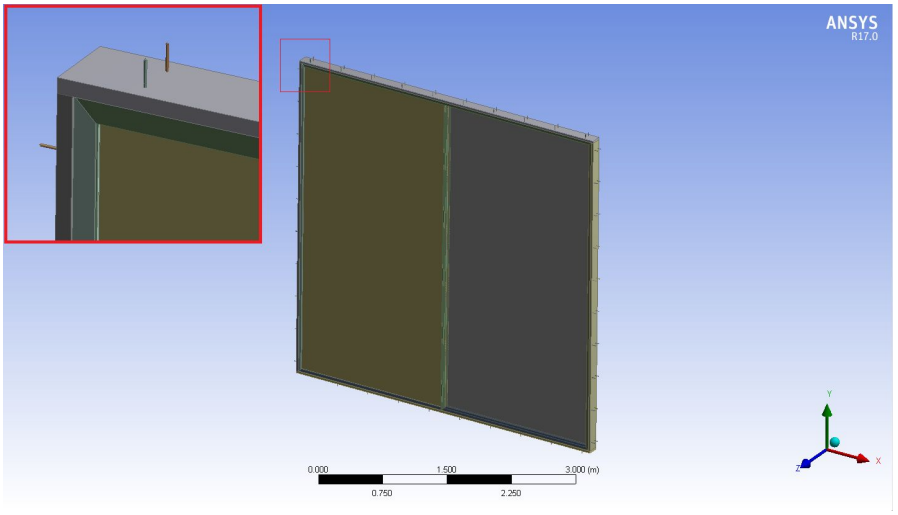

Figure 1. Importing 3D geometrical model from Solid Edge

2. Material properties [1, 2]

Density	2500 $\frac{Kg}{m^3}$
Young's modulus	70Gpa
Poisson's ratio	0.23
Compress strength	880-930MPa
Tensile strength	30-90 MPa
Bending strength	30-100MPA

[1] EN 572-1:2004. Glass in Building – Basic Soda Lime Silicate Glass Products – Part 1: Definitions and General Physical and Mechanical Properties. CEN, 2004.

[2] Glafo, Glasforskningsinstitutet. Boken om glas. Allkopia, Växjö, Sweden, (2005)

3. Determination of wind load

Wind flow is stopped at surface of window. The pressure can be expressed from wind velocity

$$P = \frac{1}{2}\rho v^2 \quad (1)$$

where $\rho = 1.29\frac{Kg}{m^3}$, $v = 100\frac{Km}{h} = 27.78\frac{m}{s}$

Substituting these value into Eq. (1)

$$P = \frac{1}{2}\rho v^2 = \frac{1}{2}\rho v^2 = 498Pa \quad (2)$$

The total force F can be written as

$$F = A \times P = 4 \times 4 \times 498 = 7.97KN \quad (3)$$

4. The analysis of Glass

Two side, thus bottom and top sides are fixed and pressure load of 498Pa acted on glass surface. Glass widow is composed of three layers.

Figure 2 shows FE mesh

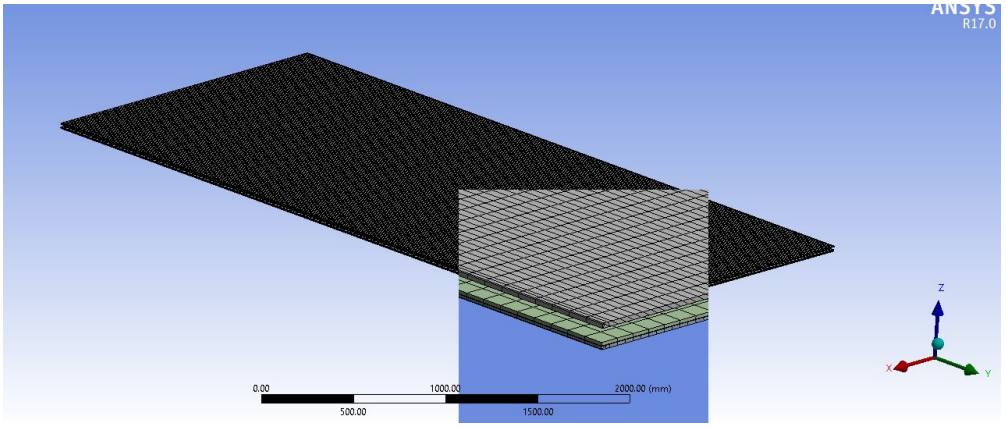

Figure 2 FE mesh of Glass layer

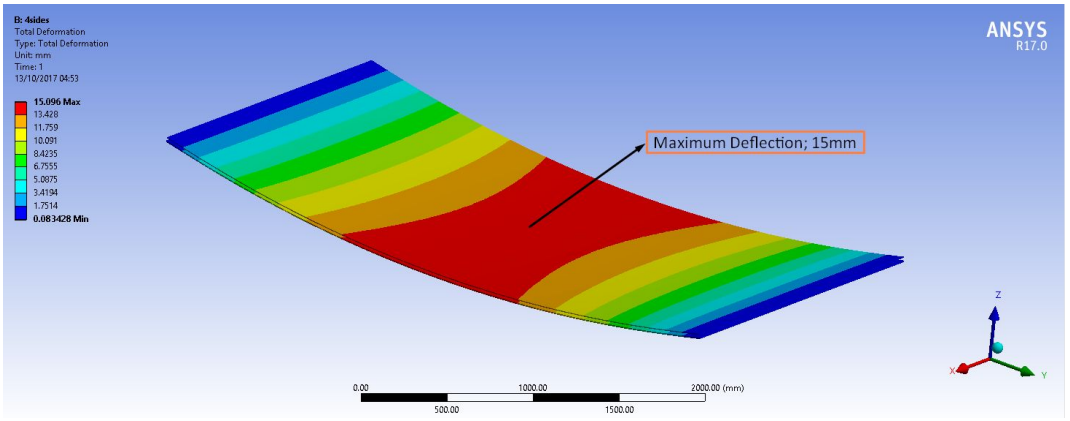

Figure 3. Deflection plot (Maximum deflection; 15mm)

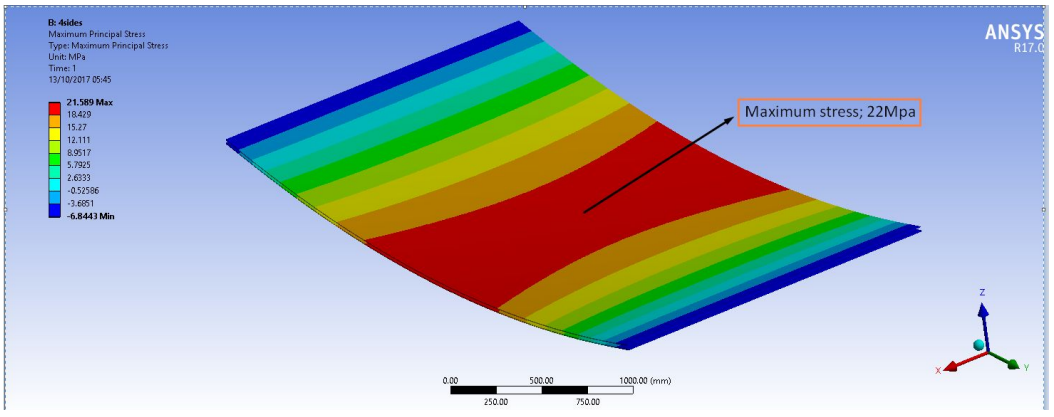

Figure 4. Maximum principal stress plot (Maximum stress; 22MPa)

Therefore, Glass is sufficiently safe.

5. The analysis of frame

We consider only one of bottom and top frame due to symmetricity.

One of frame is acted by $F = 7.97KN$.

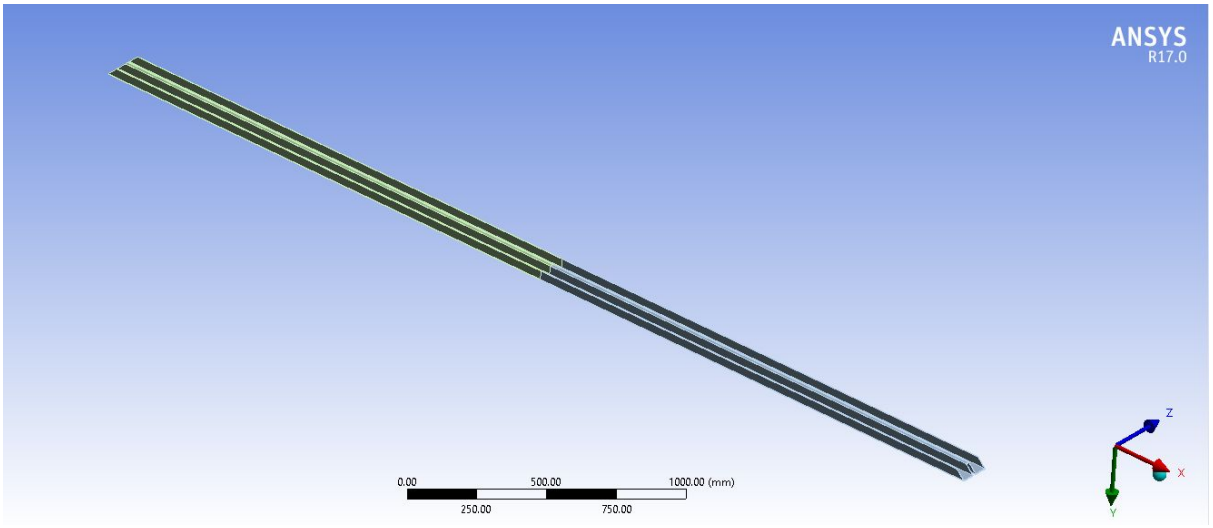

Figure 5. Geometry for frame (bottom)

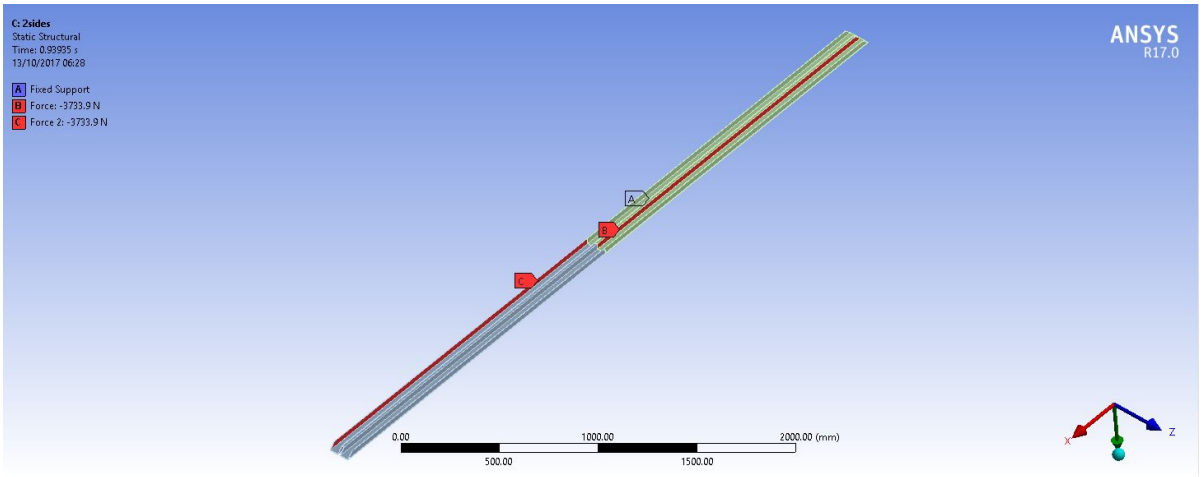

Figure 6. Boundary and loading condition

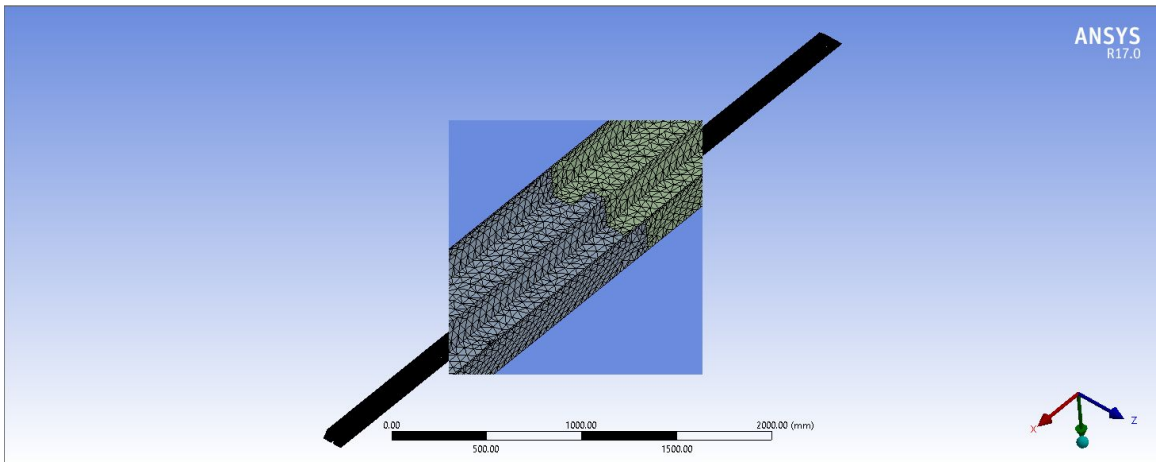

Figure 7. FE model

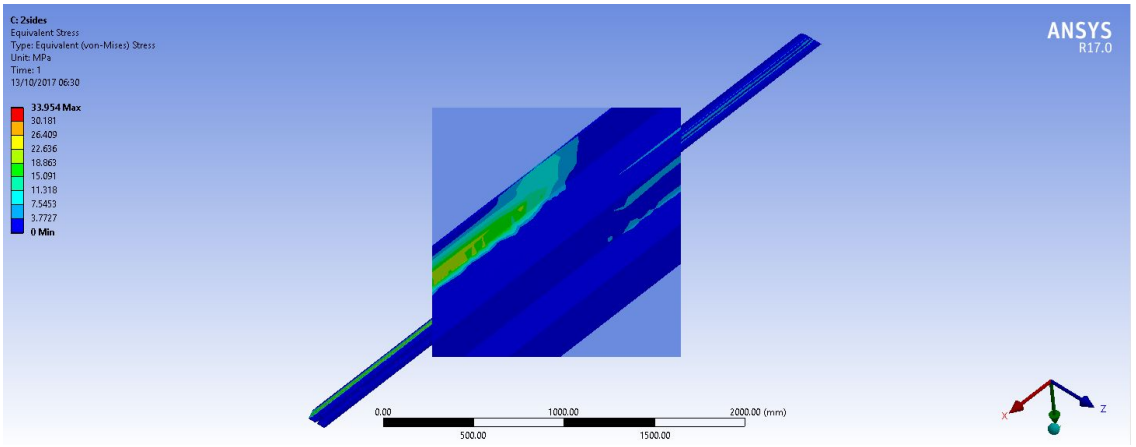

Figure 8. Von-Mises stress plot (Maximum stress; 33.5Mpa)

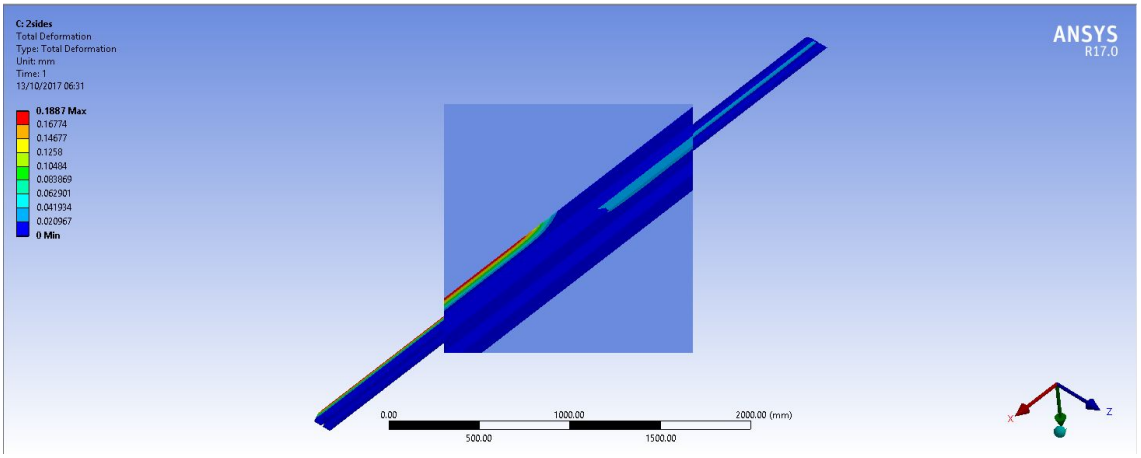

Figure 9. Displacement plot (Maximum displacement; 0.2mm)

6. Conclusion

Table 1. Safety of glass

Maximum stress(MPa)	Strength	Maximum deflection(mm)	Safety
21	30-90Mpa	15	Safe

Table 2. Safety of frame (Aluminium)

Maximum stress(MPa)	Strength	Maximum deflection(mm)	Safety
33.5	200Mpa	0.2	Safe