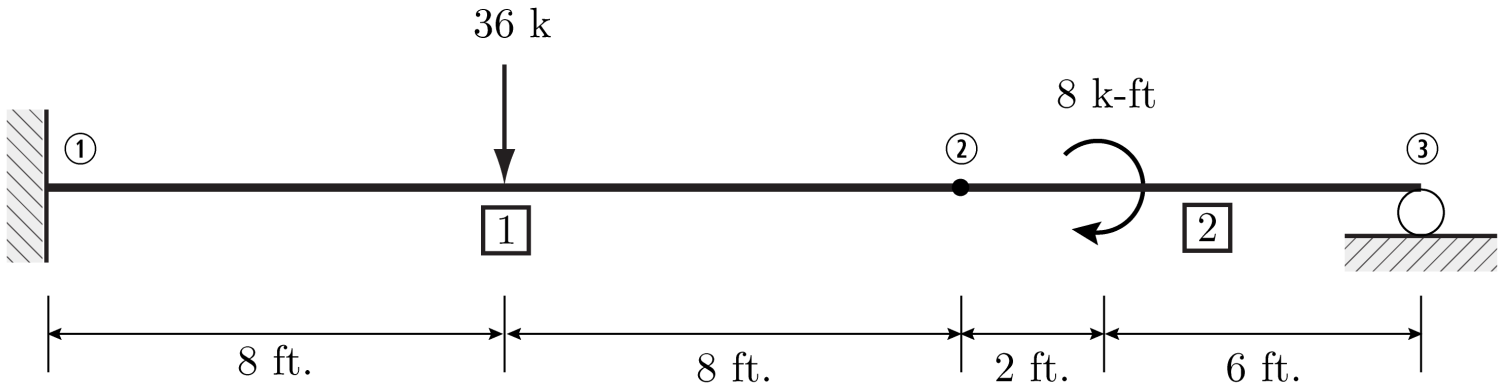
Beam with Member Loads Analysis Walkthrough Using SAP2000

CE 525 – Advanced Structural Analysis

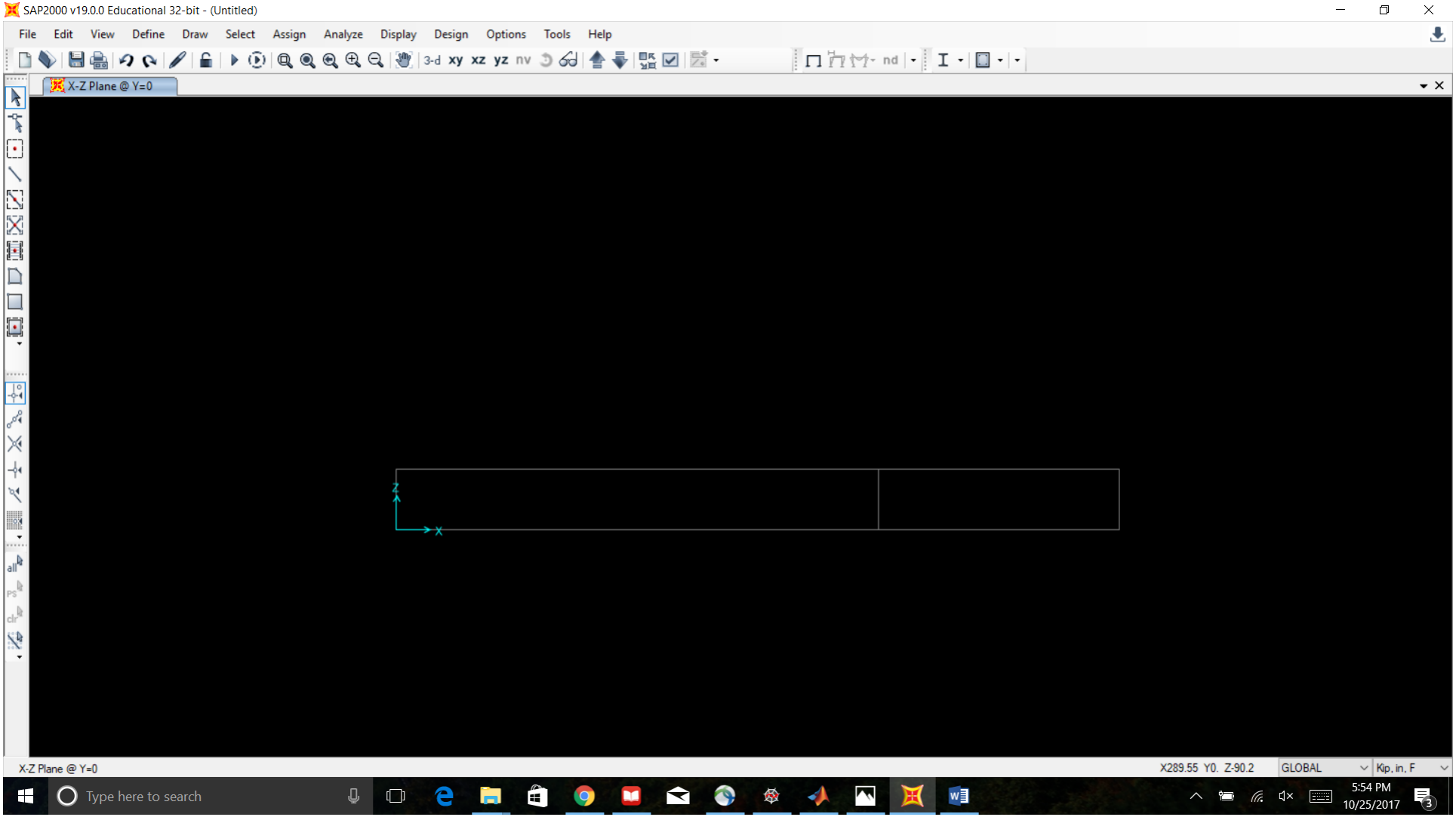
North Carolina State University

Beam Example



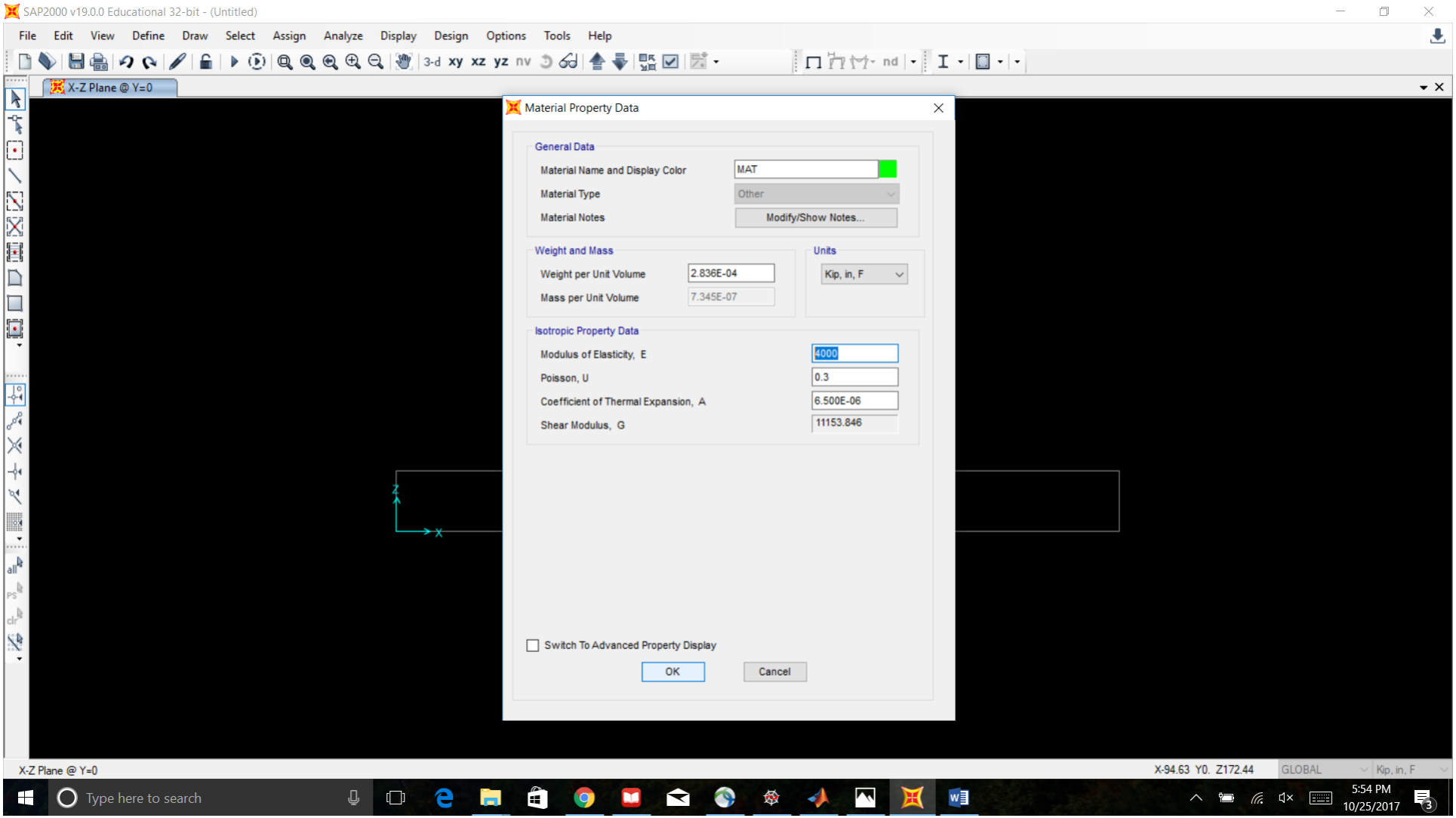
E = 4000 ksi; I = 1500 $in.^4$ for all members

Define grid lines



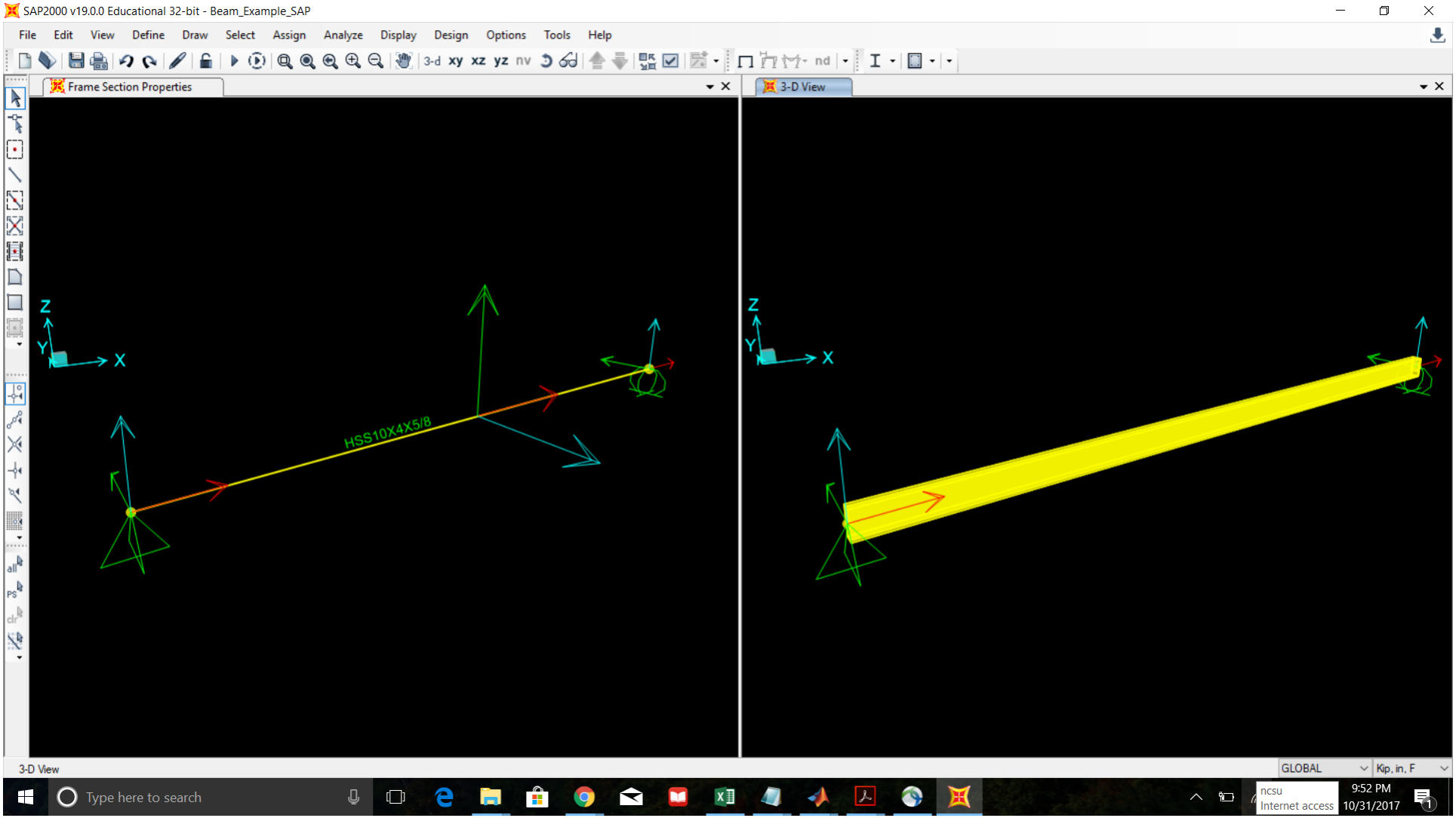
Define material properties

E = 4000 ksi

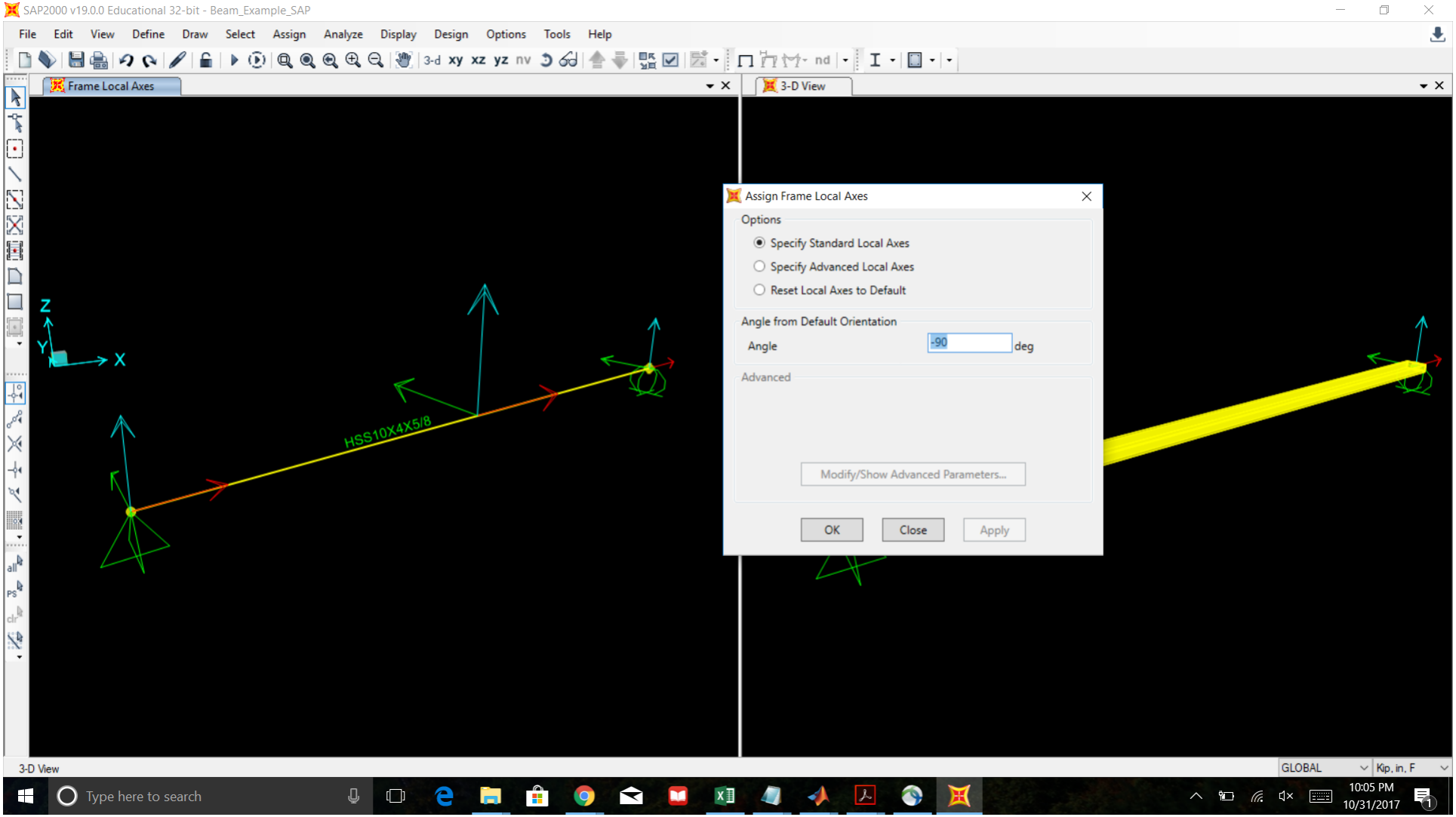


SIDE NOTE: SAP Global Axis vs SAP Local Axis

Every joint and frame object in SAP has its own local axis coordinate system (123/RGB).
As you can see in the HSS frame model below, the default **joint** local axes match the global axes, but the **frame** local axes do not.
(to see the extruded view on the right, go to "Display Options"->"General Options" Tab -> Select "Extrude" under "View Type")



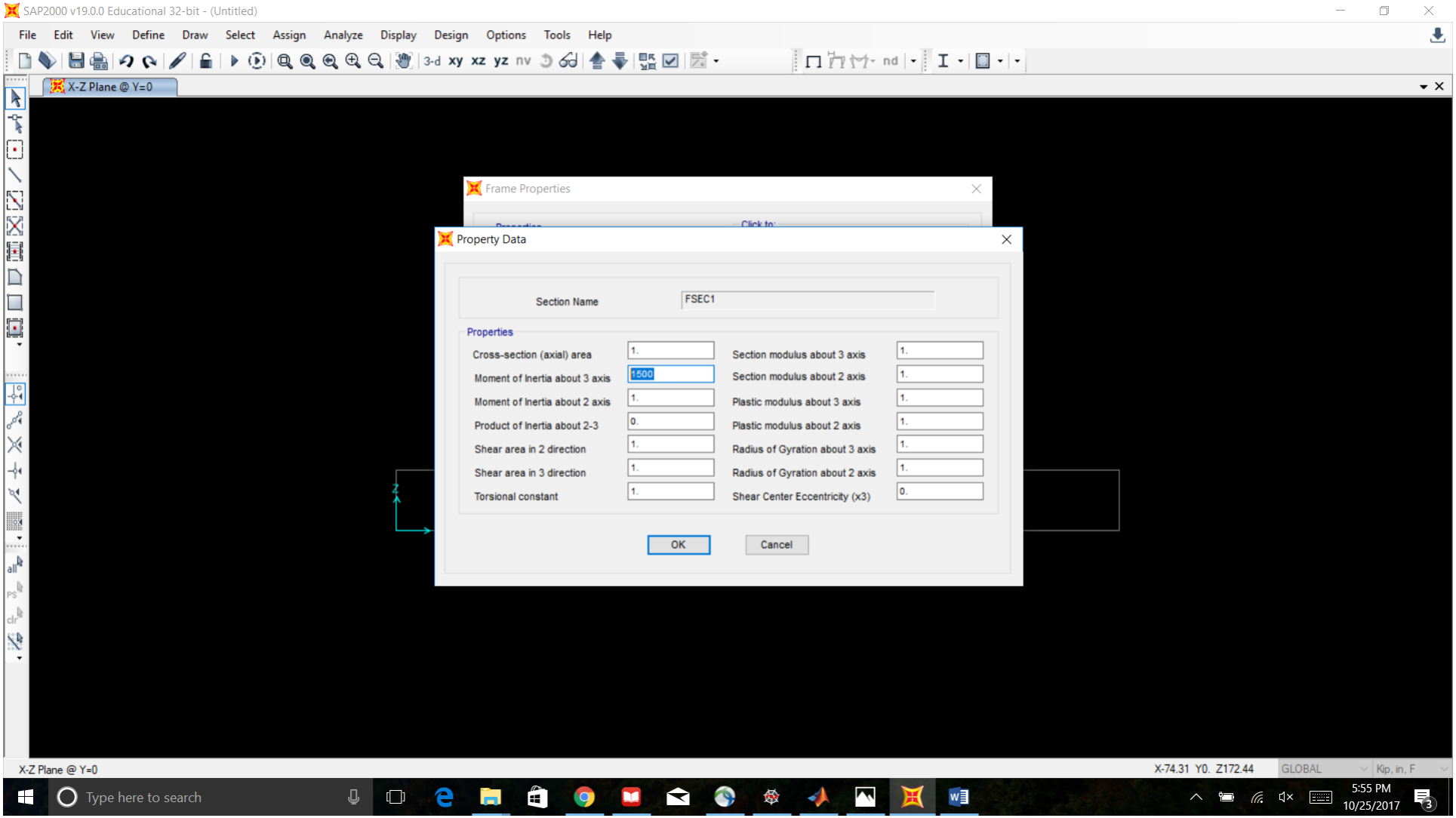
You can manually change the direction of the default local axes for selected frames by going to "Assign"->"Frame"->"Local Axes".
You can do the same thing for joints.



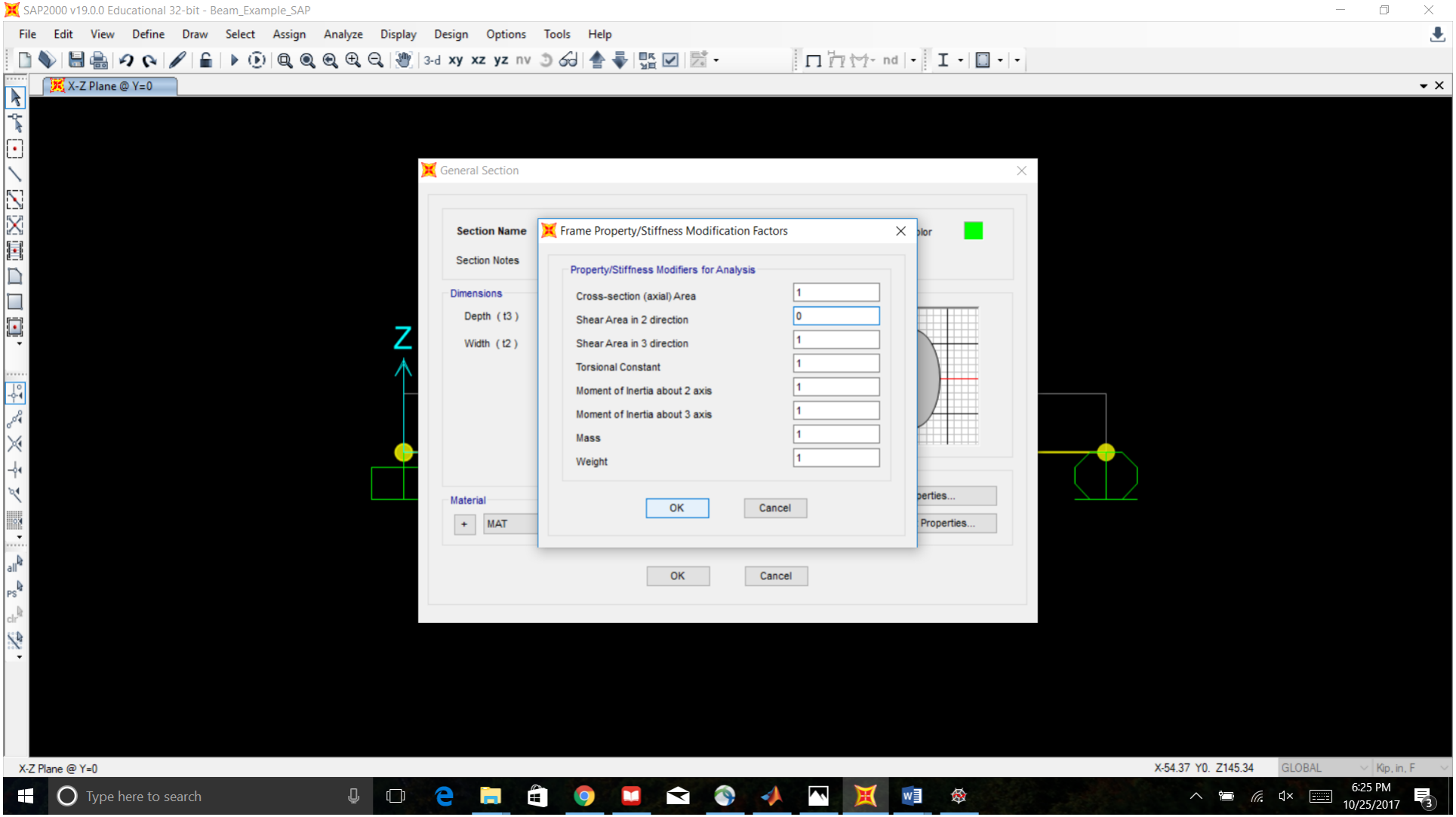
Define section properties

I = 1500 in^4

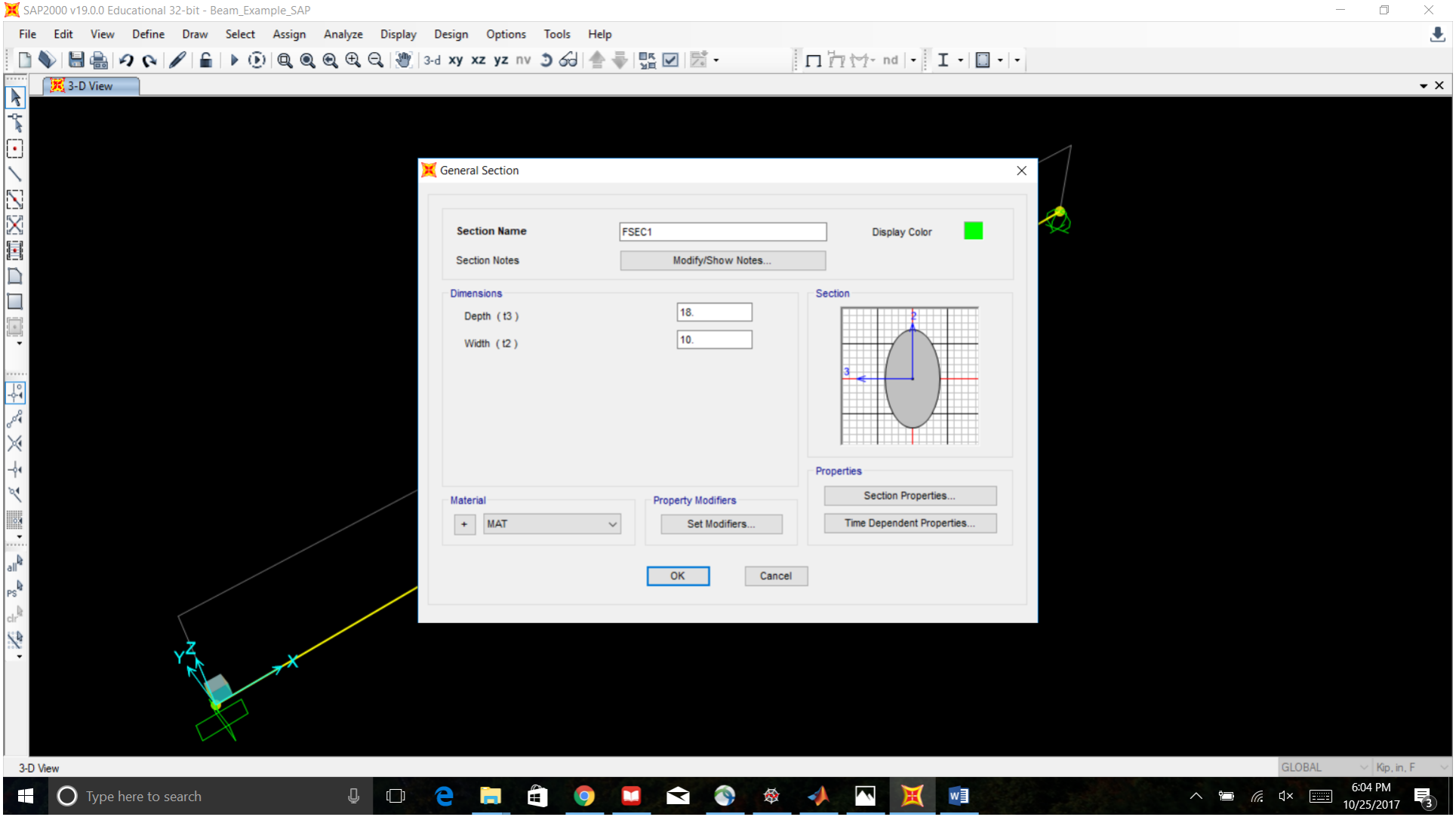
NOTE: moment of inertia is about the 3-axis



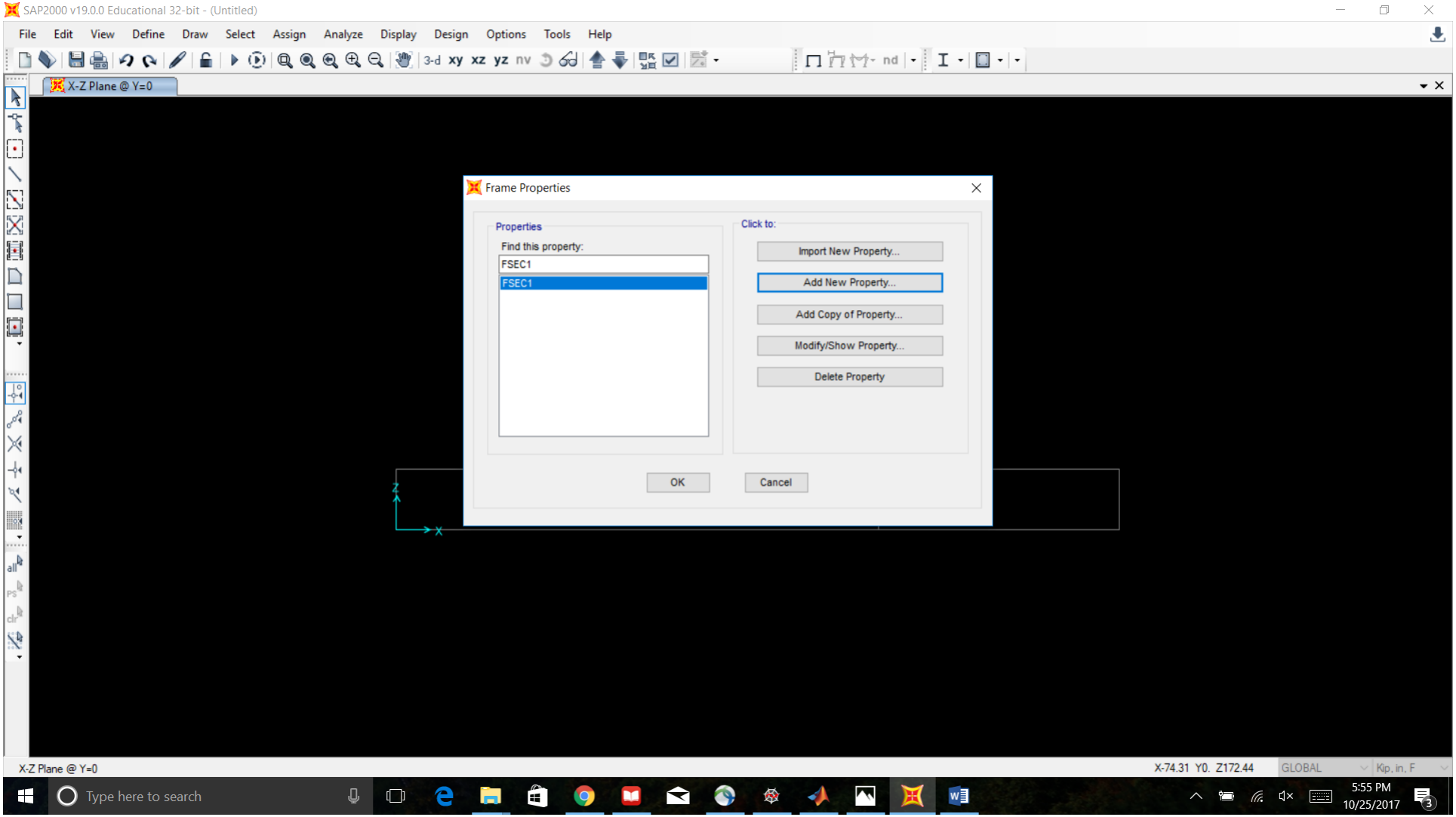
Turn off shearing deformation in the 2 direction



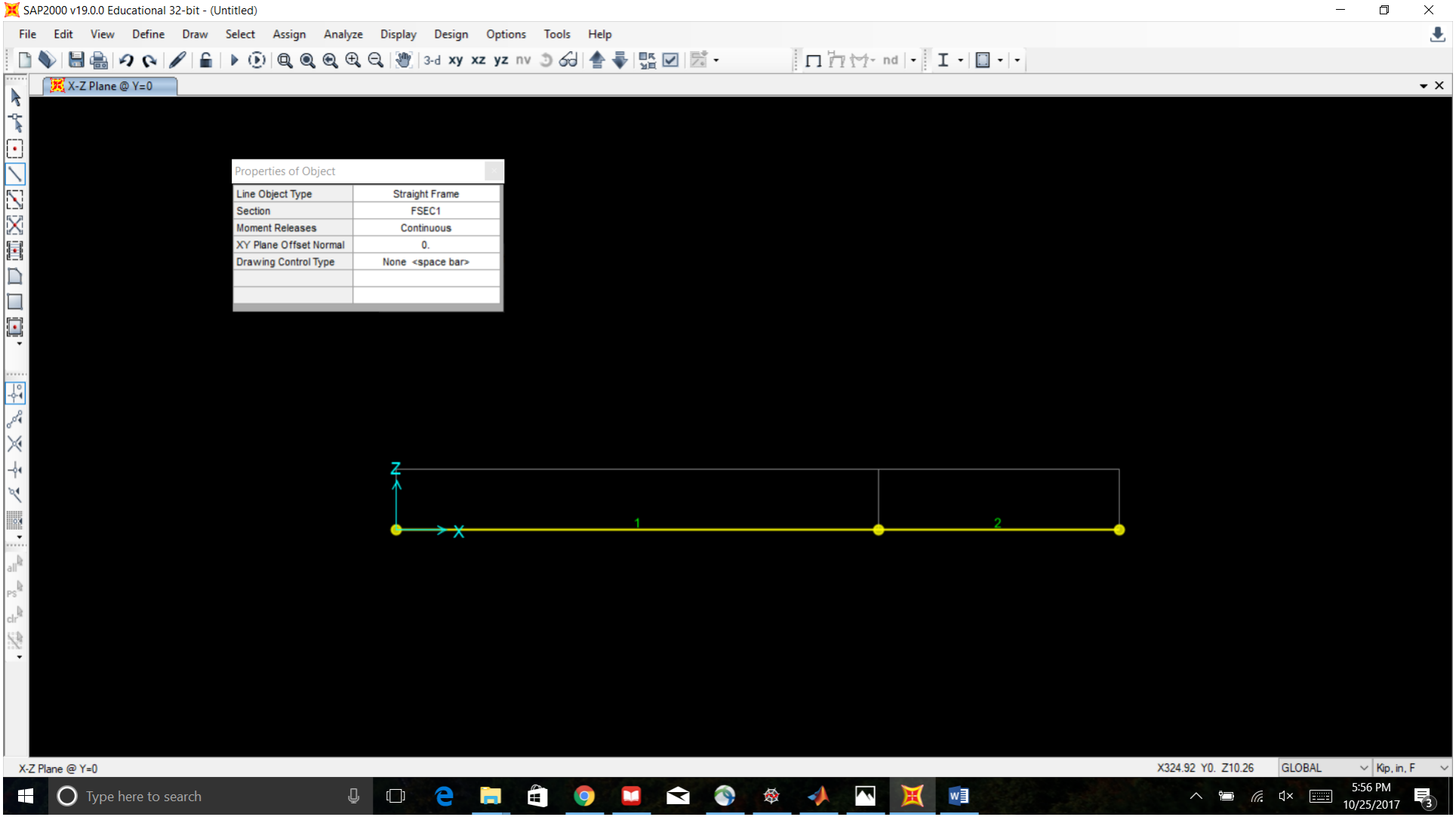
Make sure material property is correctly assigned



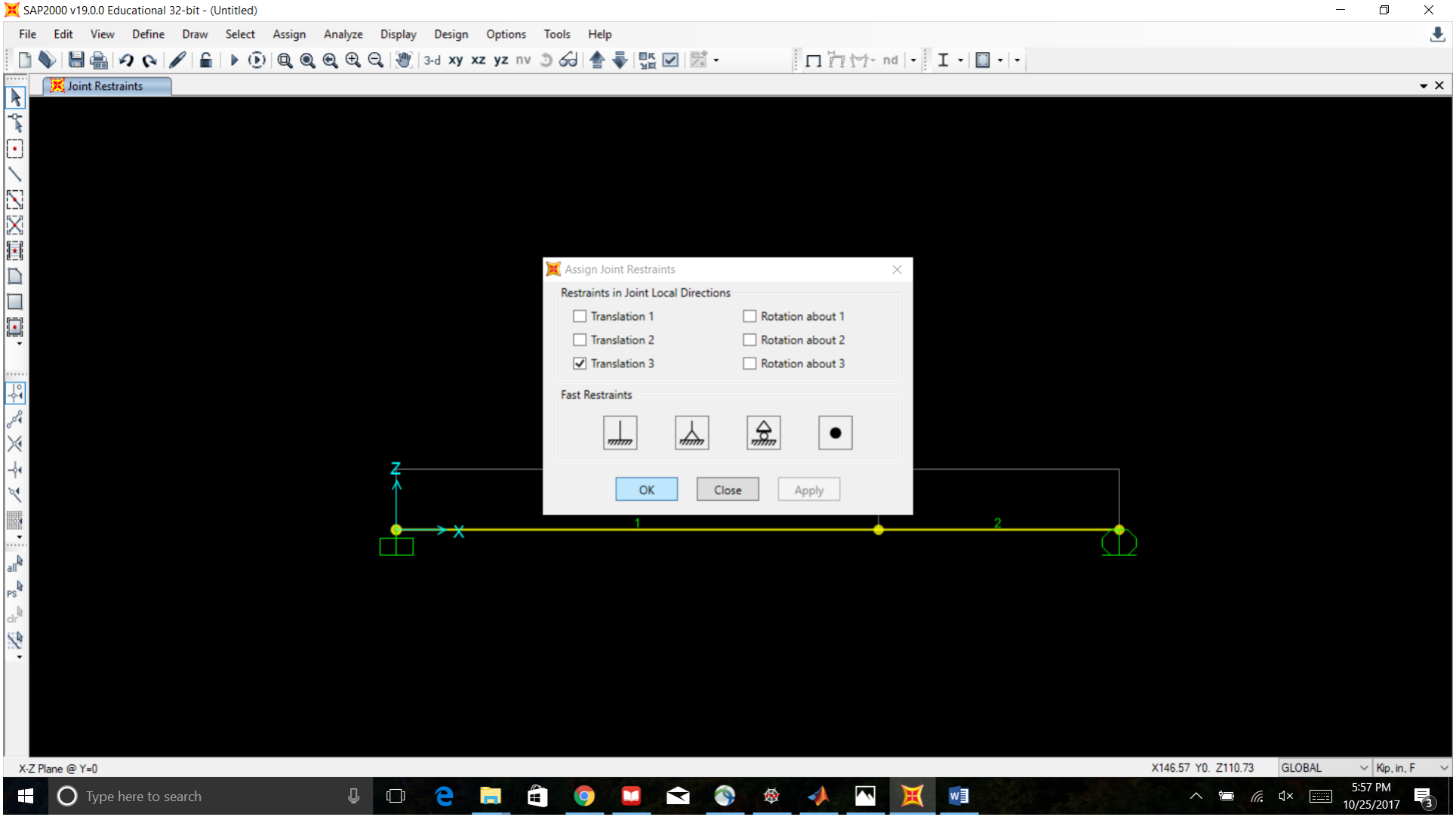
Both members have the same section properties, so one defined frame section is adequate



Draw the members

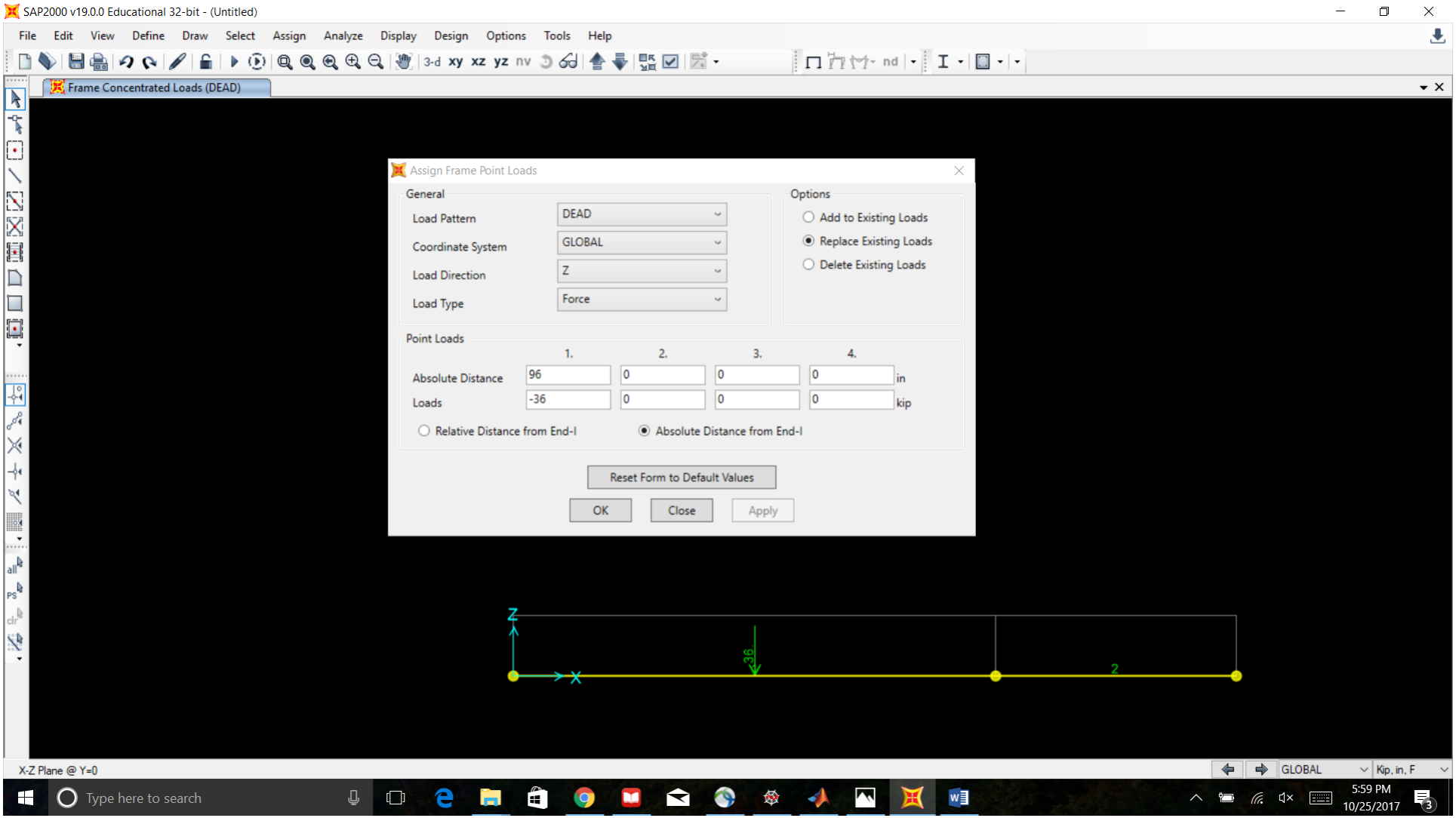


Assign joint restraints

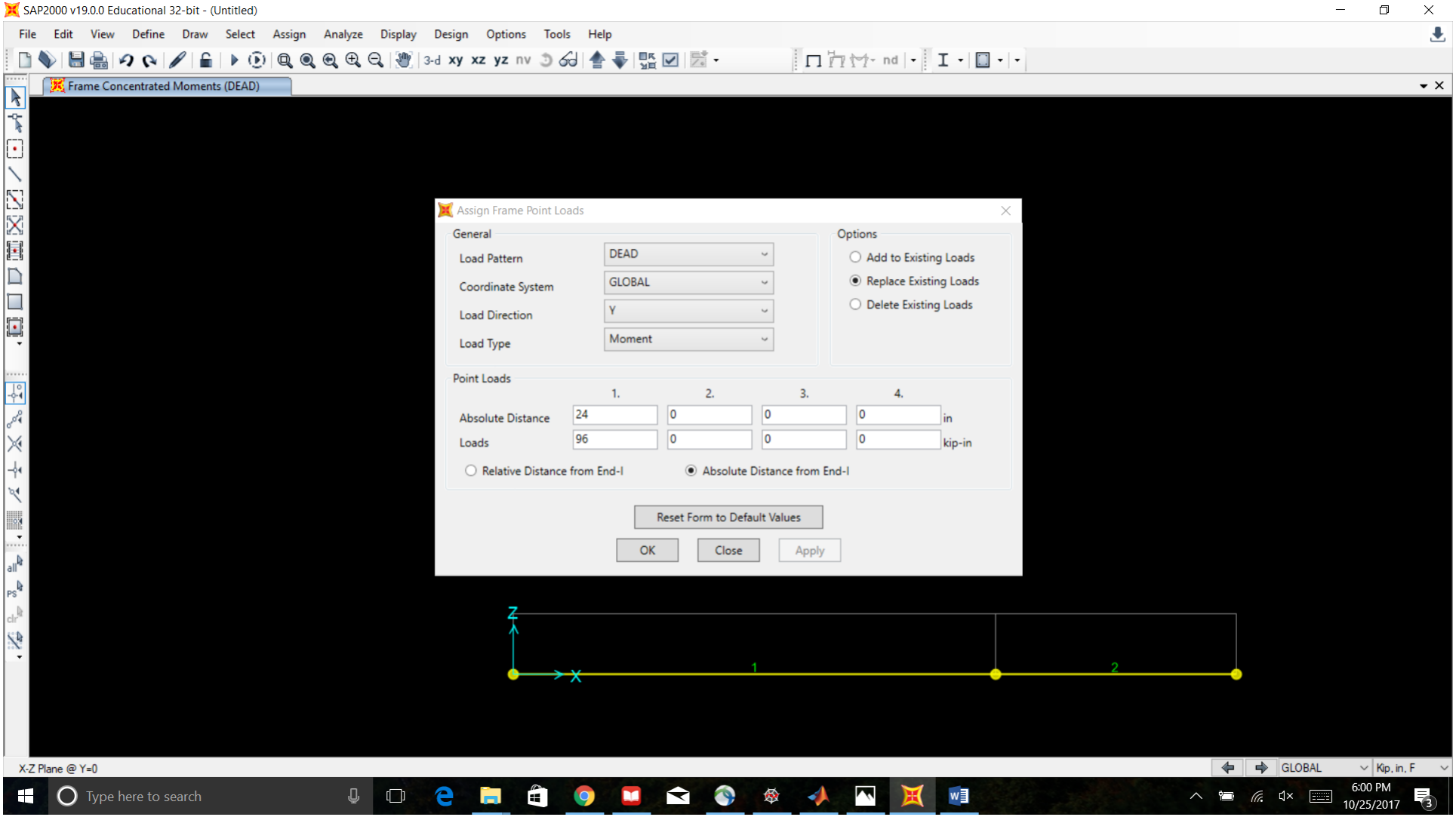


Assign concentrated load of 36 lbs in the -Z direction at the midpoint of Member 1

You may use relative or absolute distance to specify the location of the load



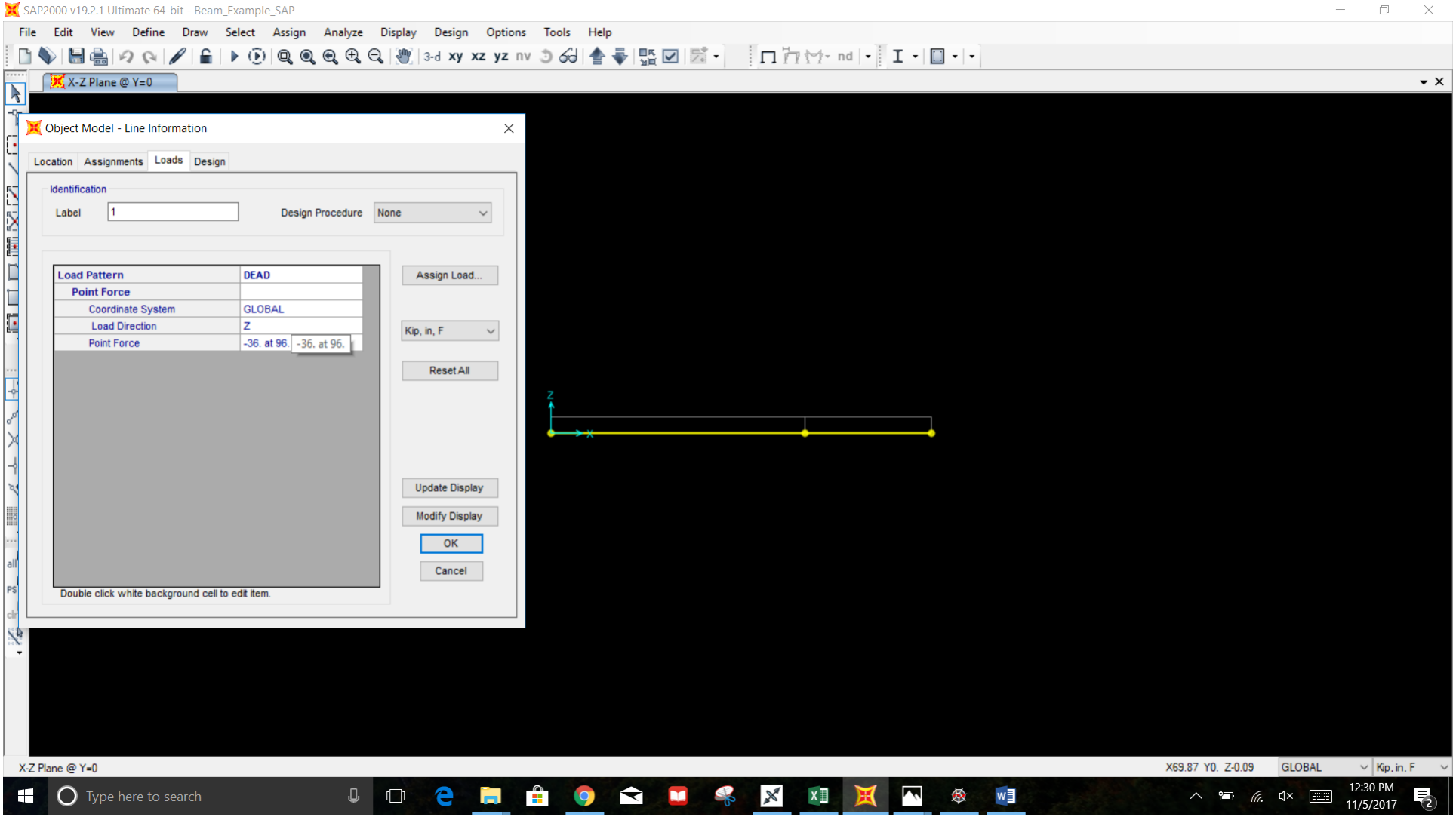
Assign concentrated moment of 8 k*ft (watch units) in +Y direction (remember right hand rule) at 2ft from the left end of Member 2



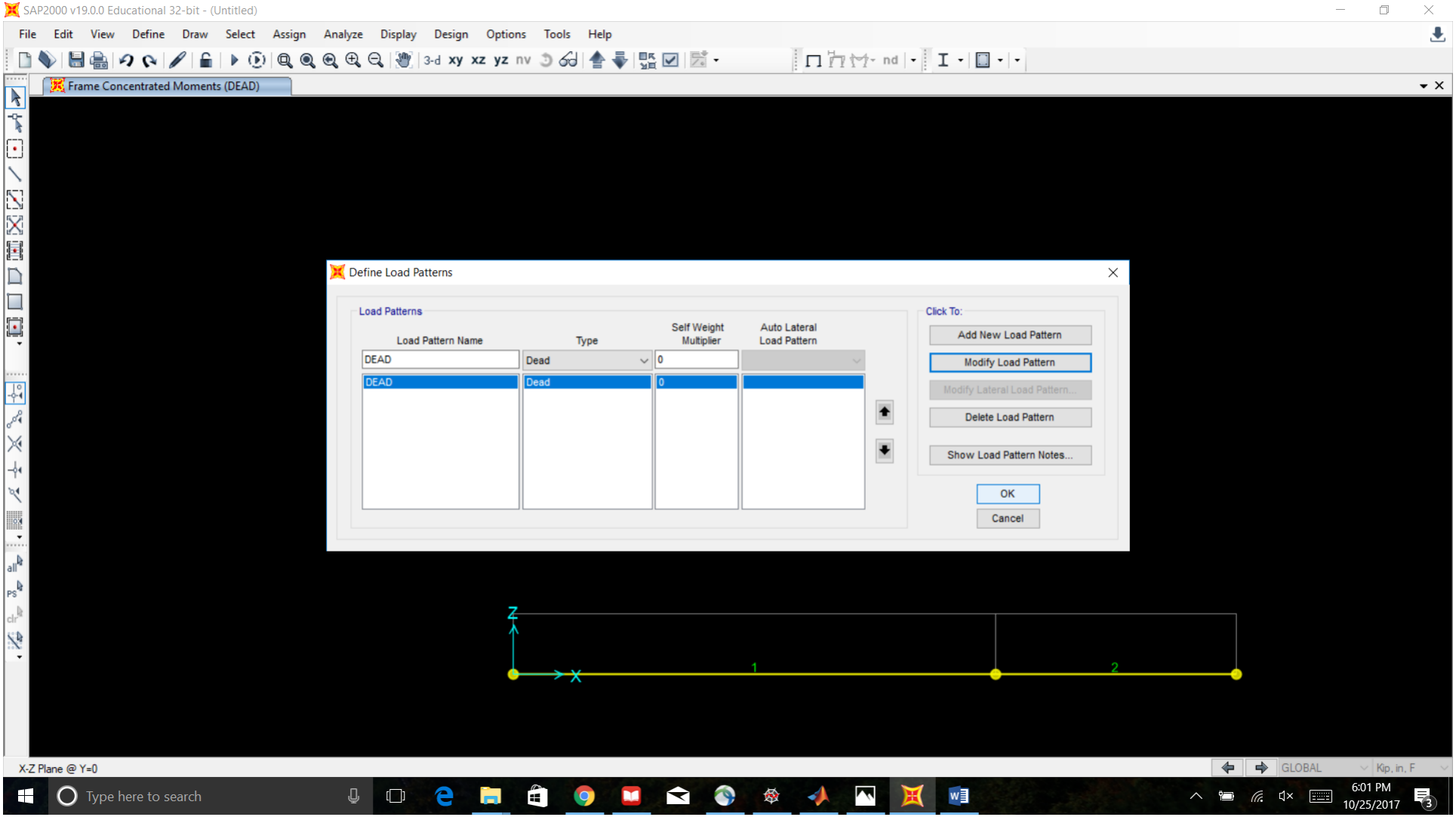
SIDE NOTE: How to check assigned loads

See the loads assigned to any model object in SAP. Right click on the object ->go to “Loads” tab

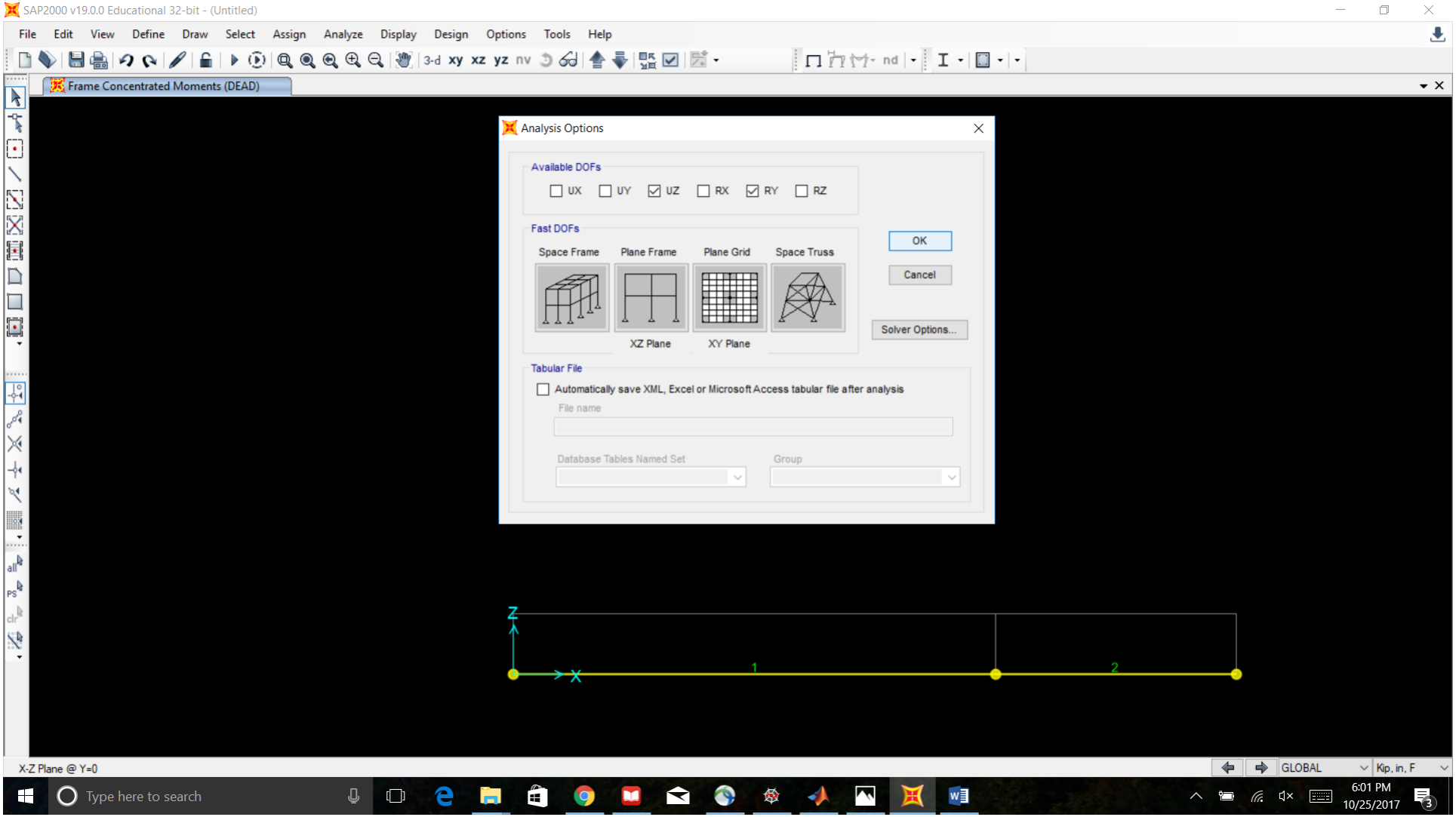
You can change the assigned loads from this menu by double clicking on any fields below “Load Pattern”.



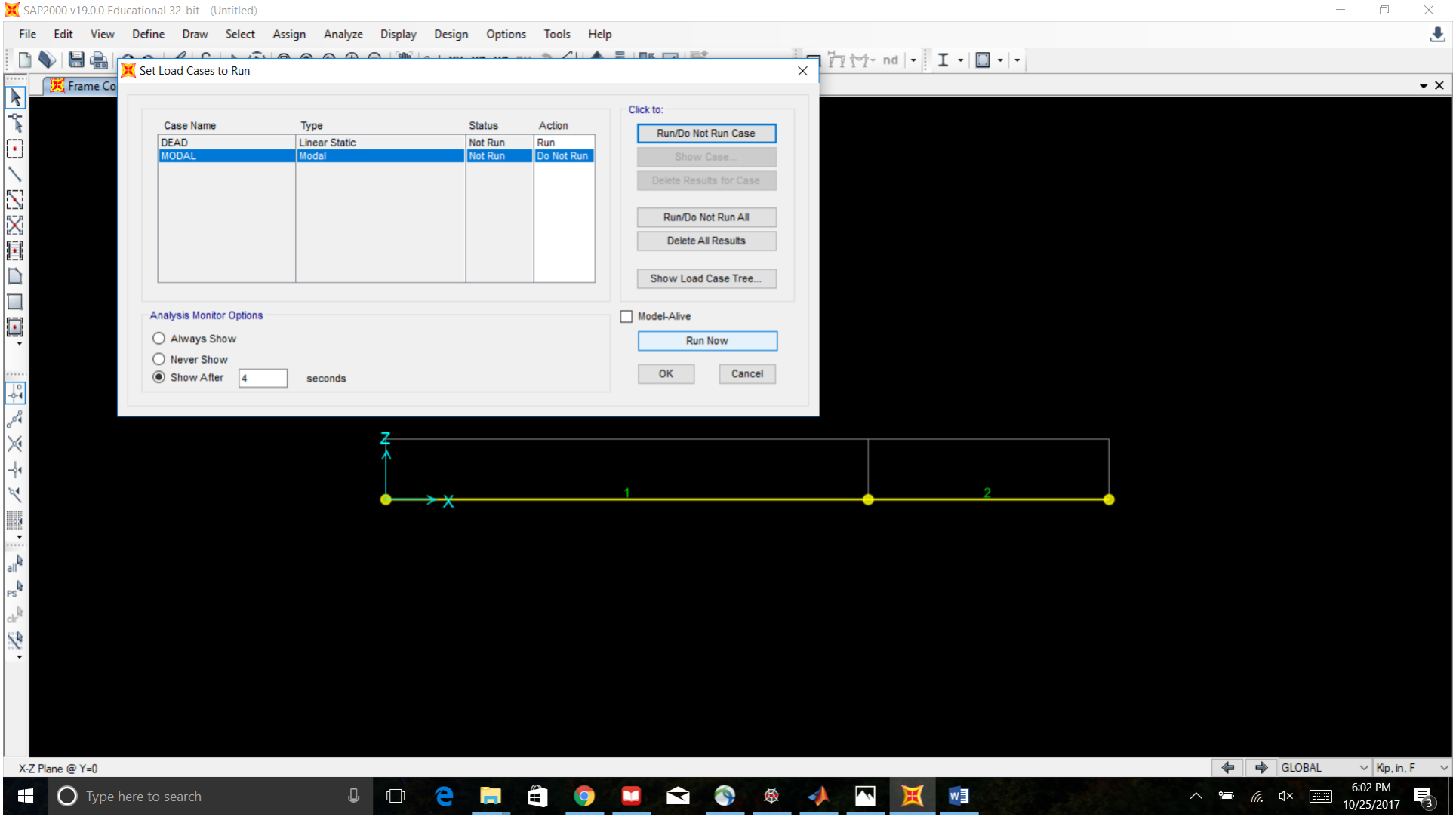
Turn off self-weight



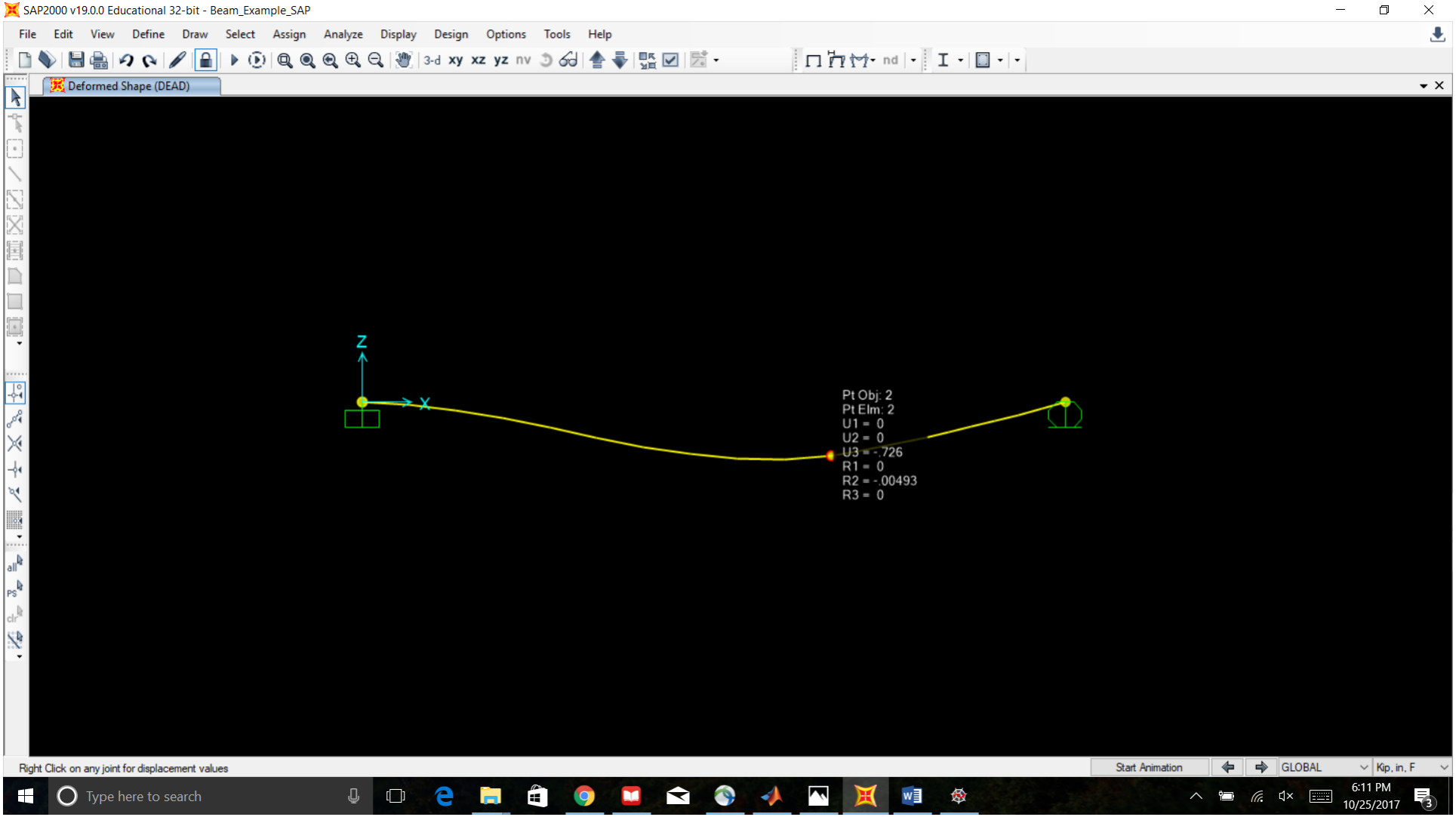
Set available DOFs for UZ and RY directions



Run the analysis



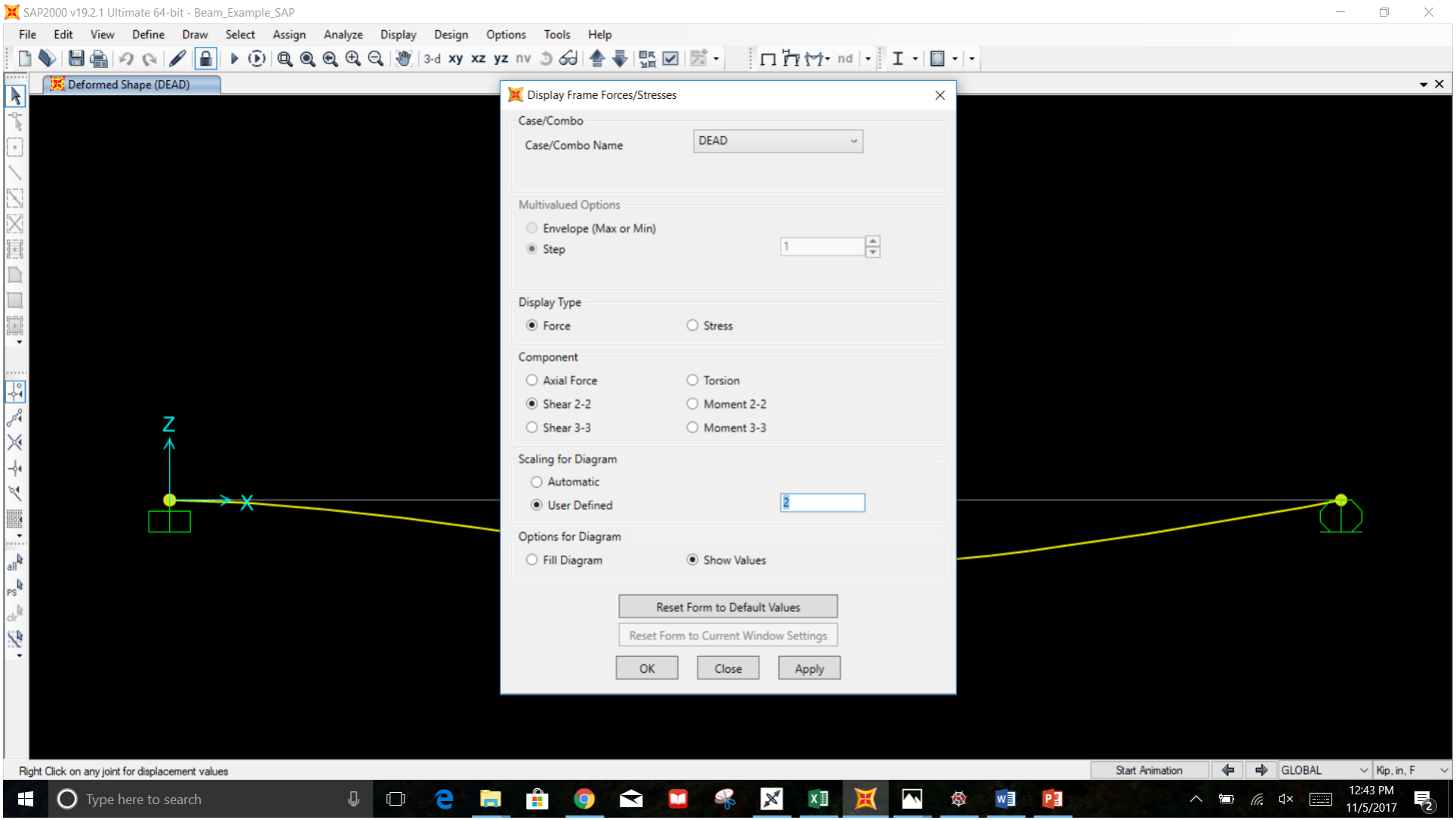
Deformed Shape



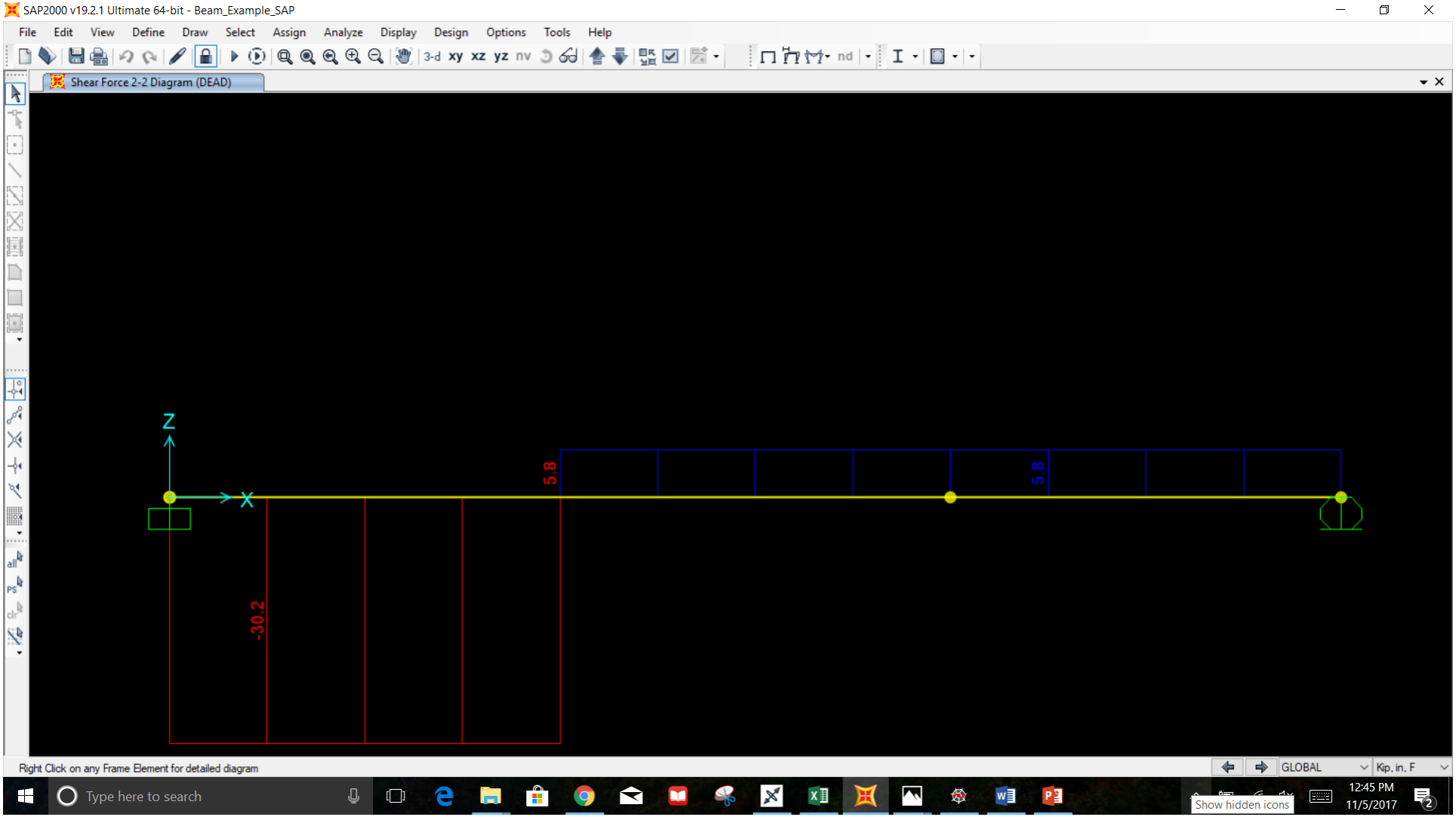
Display shear diagram

Check “Shear 2-2” and “Show Values”

NOTE: You can change the scaling of the diagram using the “Scaling for Diagram”, “User Defined” field

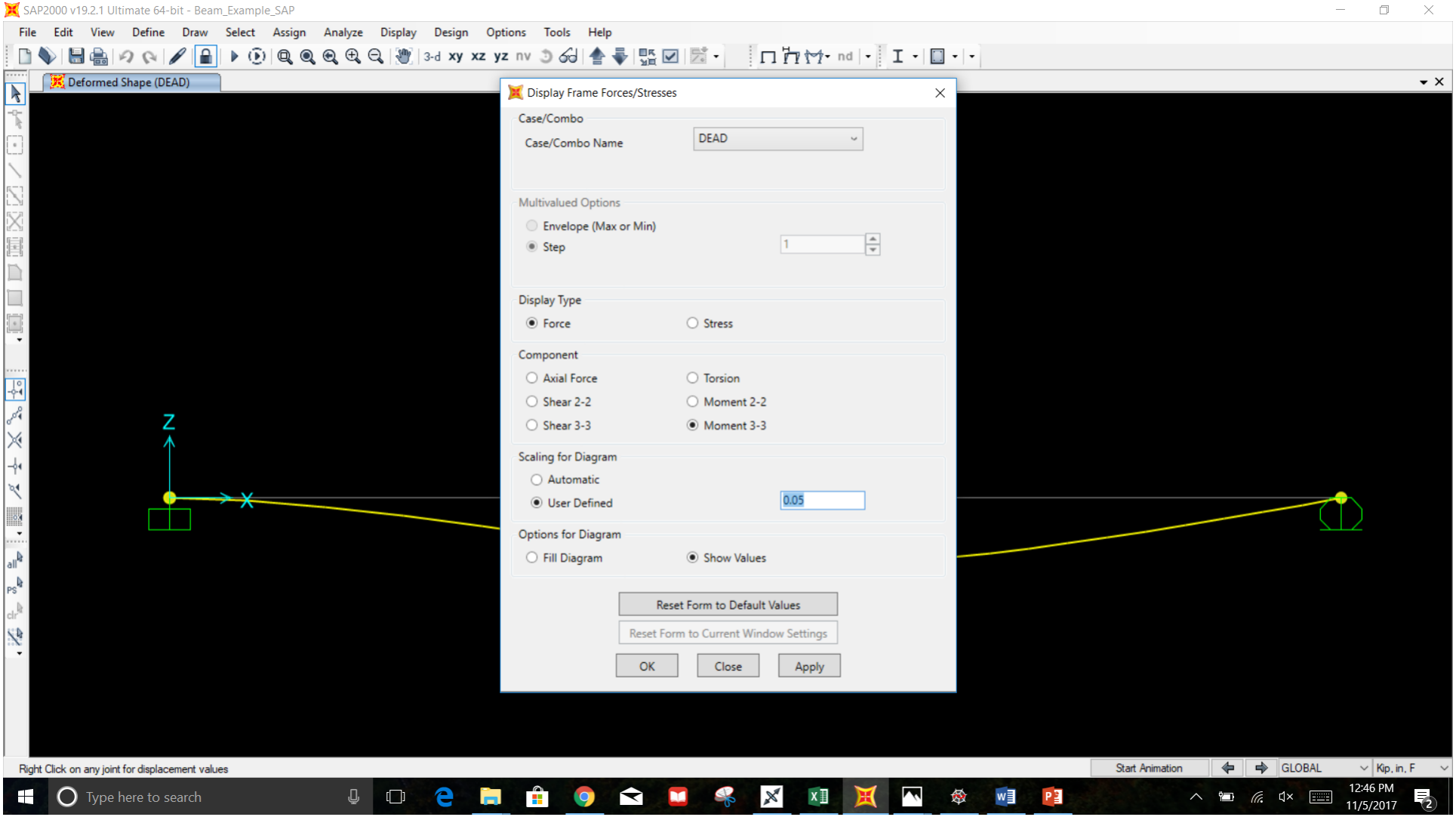


Shear Diagram

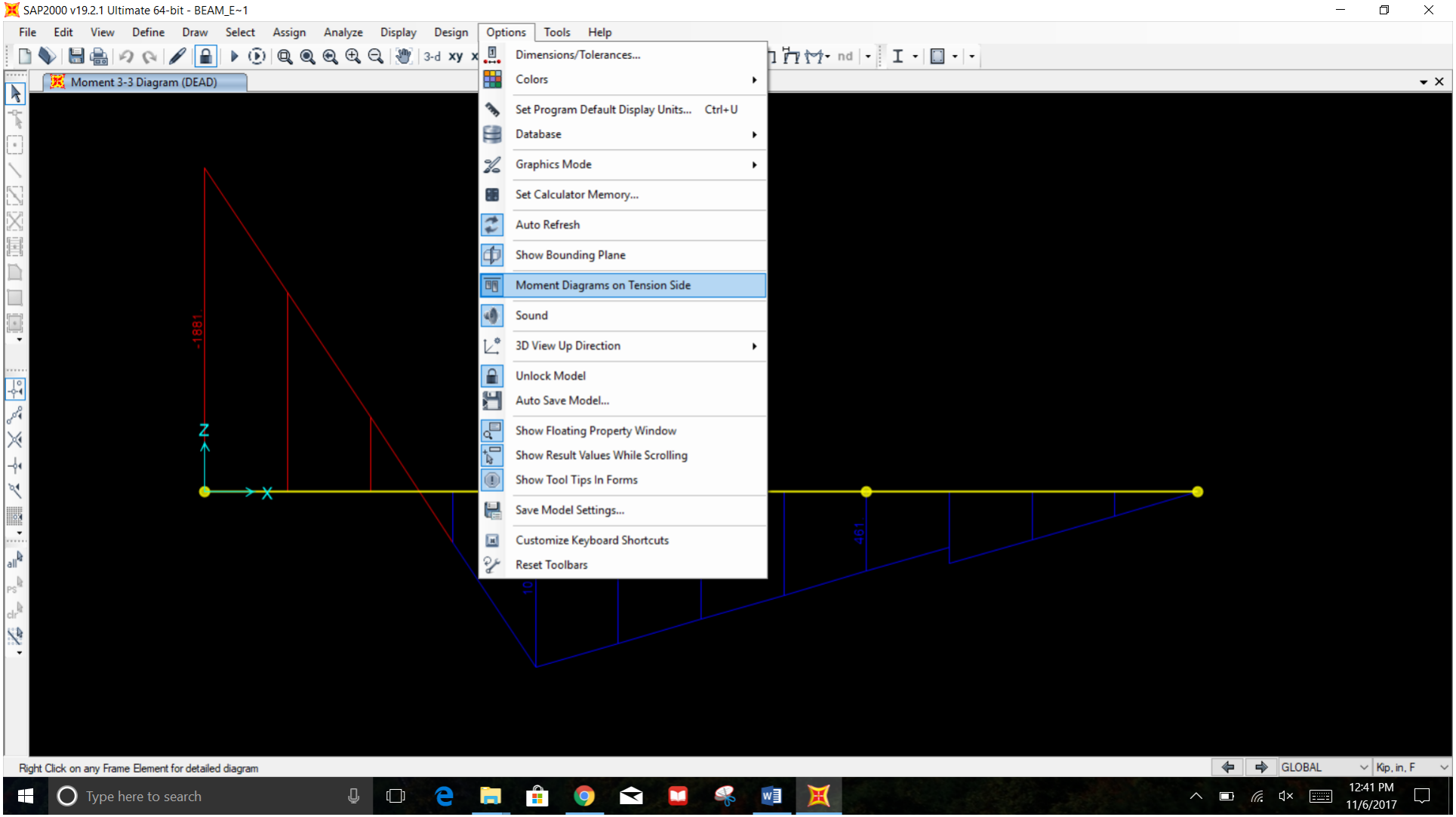


Display moment diagram

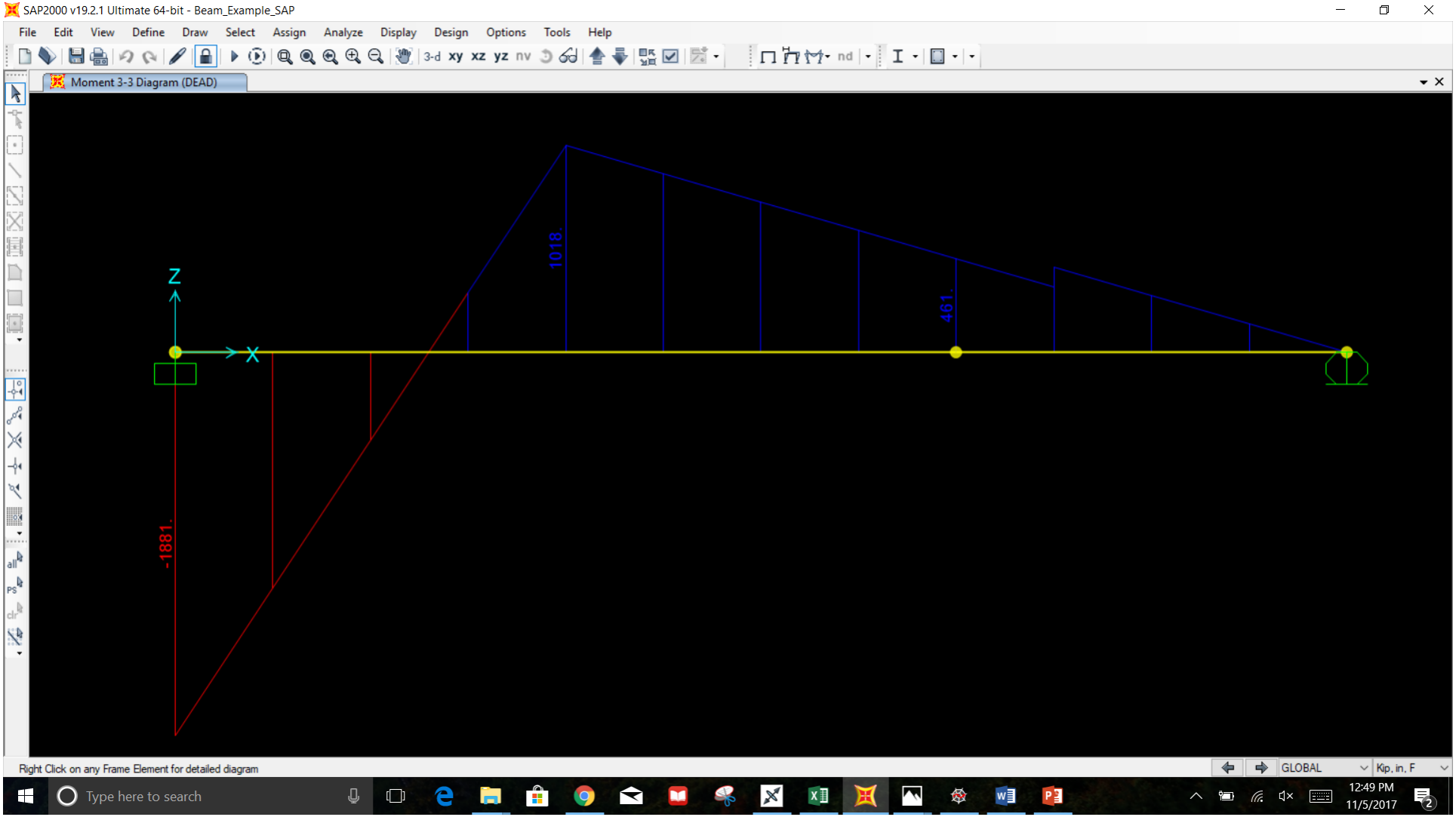
Select “Moment 3-3” and “Show Values"



NOTE: To display positive moment on the compression side of the beam, go to “Options”->Deselect “Moment Diagrams on Tension Side”



Moment Diagram



Display normal stresses (σ)
Select “Stress”, “S11”, and “Show Values"

NOTE: SAP will calculate bending and shear stresses for a generalized section based on geometric properties from the arbitrarily generated dimensions. In order to accurately calculate stresses for a given cross-section one needs to actually define the specific geometry when creating the frame section.