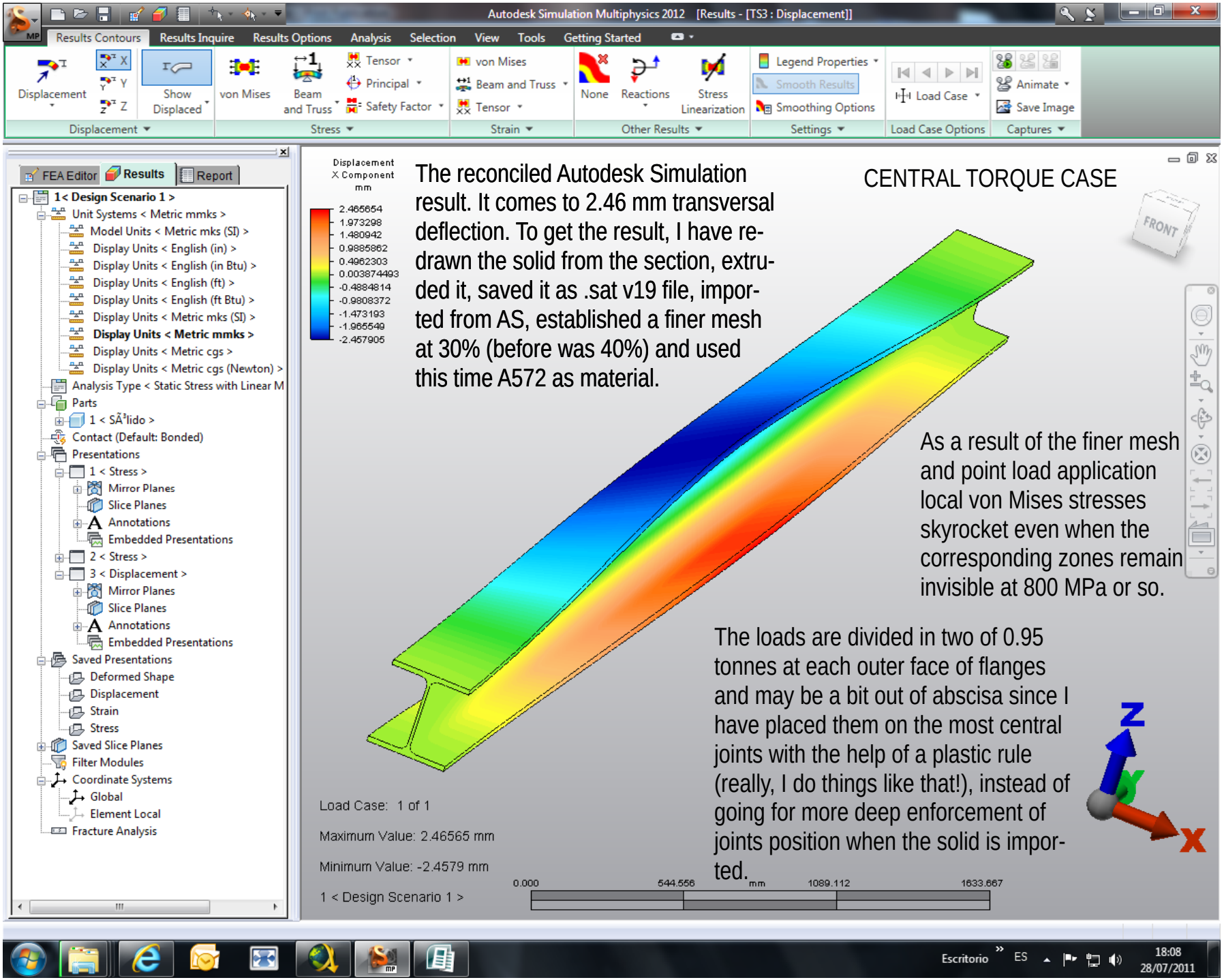
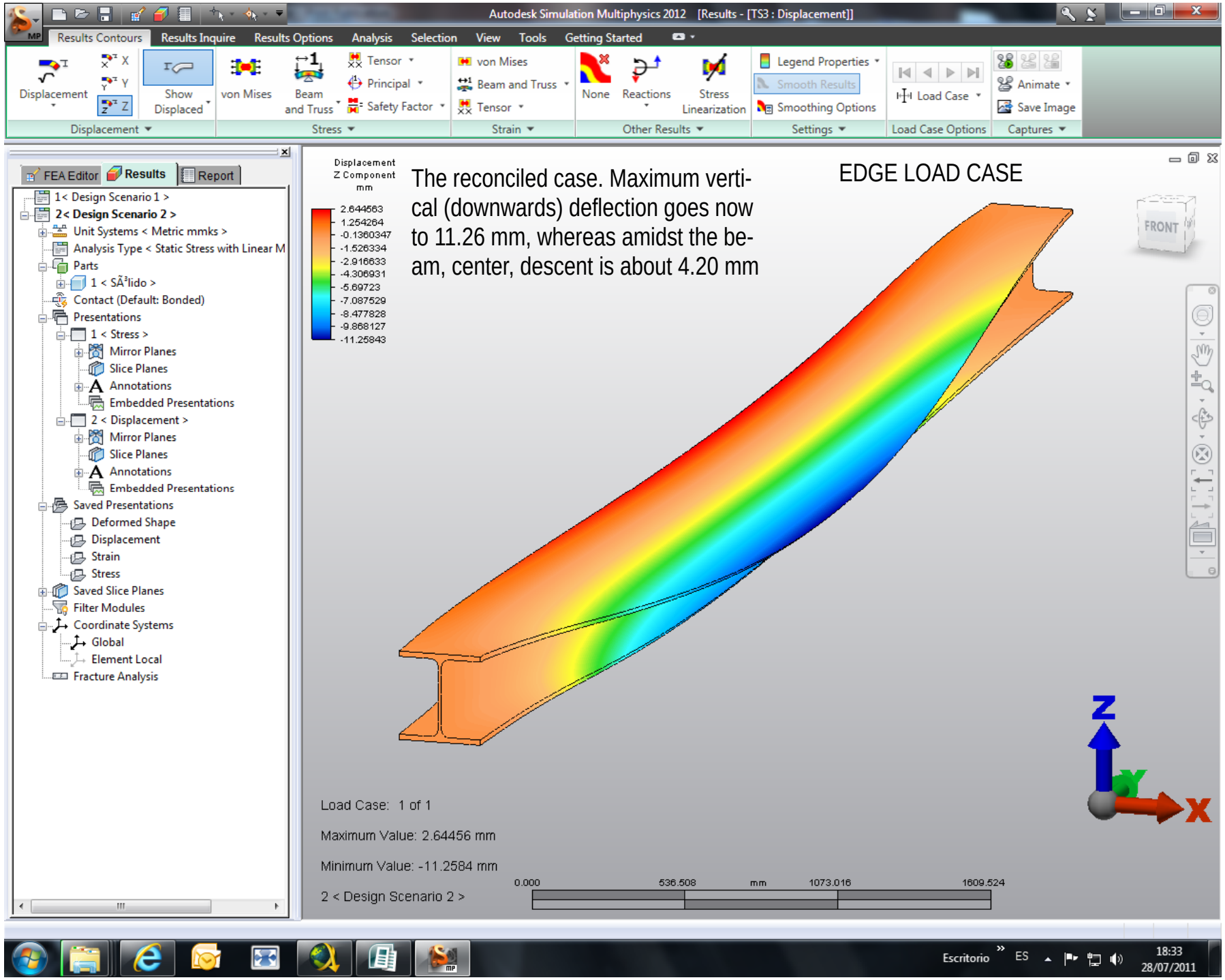
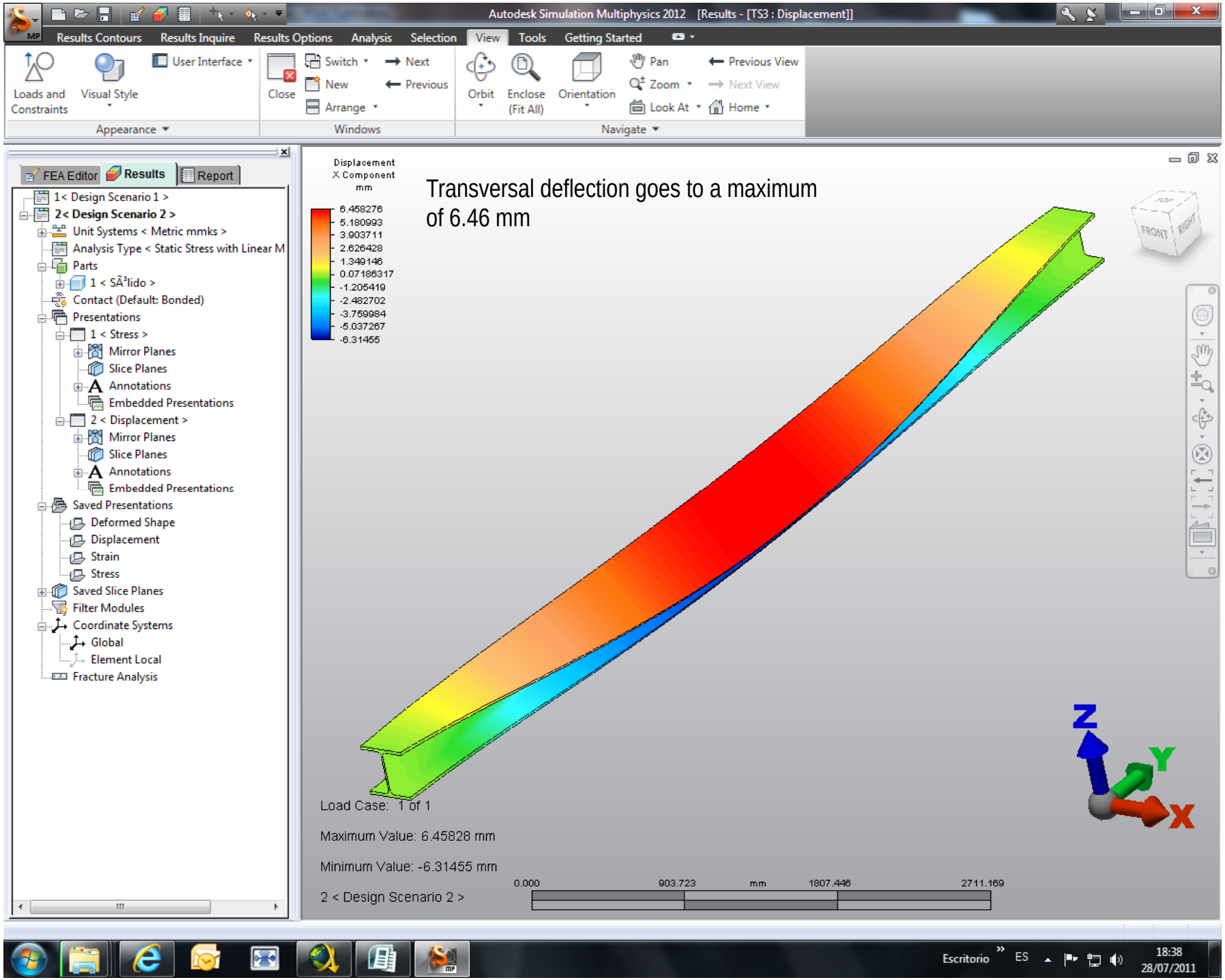
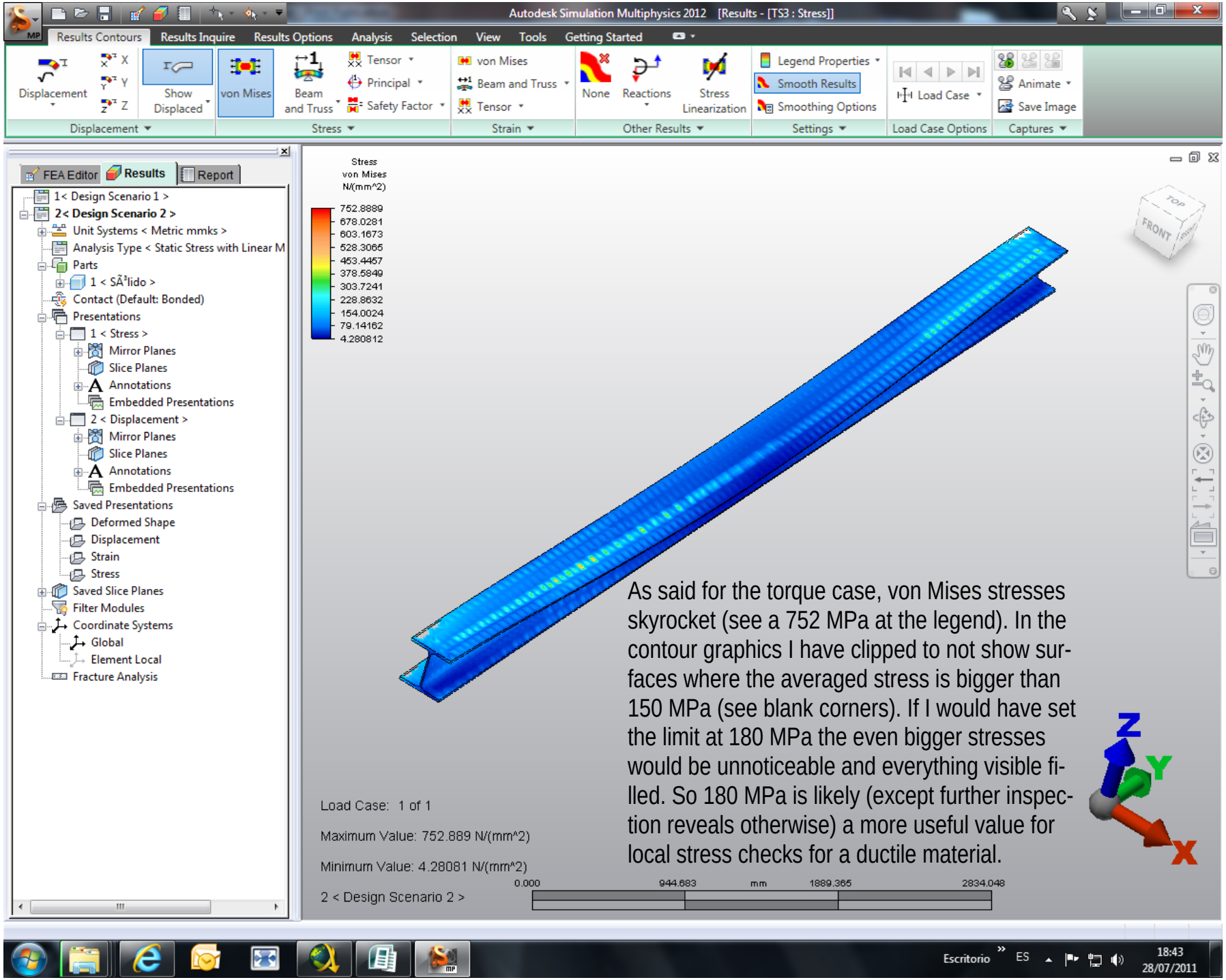

Autodesk Simulation Multiphysics 2012 [Results - [TS3 : Displacement]]
Results Contours
Results Inquire
Results Options
Analysis
Selection
View
Tools
Getting Started
Displacement
Show Displaced
von Mises
Beam and Truss
Tensor
Principal
Safety Factor
von Mises
Beam and Truss
Tensor
None
Reactions
Stress Linearization
Legend Properties
Smooth Results
Smoothing Options
Load Case
Animate
Save Image
Displacement
Stress
Strain
Other Results
Settings
Load Case Options
Captures
FEA Editor
Results
Report
1< Design Scenario 1 >
Unit Systems < Metric mmks >
Model Units < Metric mks (SI) >
Display Units < English (in) >
Display Units < English (in Btu) >
Display Units < English (ft) >
Display Units < English (ft Btu) >
Display Units < Metric mks (SI) >
Display Units < Metric mmks >
Display Units < Metric cgs >
Display Units < Metric cgs (Newton) >
Analysis Type < Static Stress with Linear M
Parts
1 < SÃ³lido >
Contact (Default: Bonded)
Presentations
1 < Stress >
Mirror Planes
Slice Planes
Annotations
Embedded Presentations
2 < Stress >
3 < Displacement >
Mirror Planes
Slice Planes
Annotations
Embedded Presentations
Saved Presentations
Deformed Shape
Displacement
Strain
Stress
Saved Slice Planes
Filter Modules
Coordinate Systems
Global
Element Local
Fracture Analysis
Displacement
X Component
mm
2.465654
1.973298
1.480942
0.9885862
0.4962303
0.003874493
-0.4884814
-0.9808372
-1.473193
-1.965549
-2.457905
The reconciled Autodesk Simulation result. It comes to 2.46 mm transversal deflection. To get the result, I have re-drawn the solid from the section, extru-ded it, saved it as .sat v19 file, impor-ted from AS, established a finer mesh at 30% (before was 40%) and used this time A572 as material.
CENTRAL TORQUE CASE
FRONT
As a result of the finer mesh and point load application local von Mises stresses skyrocket even when the corresponding zones remain invisible at 800 MPa or so.
The loads are divided in two of 0.95 tonnes at each outer face of flanges and may be a bit out of abscisa since I have placed them on the most central joints with the help of a plastic rule (really, I do things like that!), instead of going for more deep enforcement of joints position when the solid is impor-ted.
Z
Y
X
Load Case: 1 of 1
Maximum Value: 2.46565 mm
Minimum Value: -2.4579 mm
1 < Design Scenario 1 >
0.000
544.556
mm
1089.112
1633.667
Escritorio
ES
18:08
28/07/2011


Autodesk Simulation Multiphysics 2012 [Results - [TS3 : Displacement]]
Results Contours
Results Inquire
Results Options
Analysis
Selection
View
Tools
Getting Started
Displacement
Show Displaced
von Mises
Beam and Truss
Tensor
Principal
Safety Factor
Stress Linearization
Legend Properties
Smooth Results
Smoothing Options
Load Case
Animate
Save Image
FEA Editor
Results
Report
1< Design Scenario 1 >
2< Design Scenario 2 >
Unit Systems < Metric mmks >
Analysis Type < Static Stress with Linear M
Parts
Contact (Default: Bonded)
Presentations
1 < Stress >
Mirror Planes
Slice Planes
Annotations
Embedded Presentations
2 < Displacement >
Saved Presentations
Deformed Shape
Displacement
Strain
Stress
Saved Slice Planes
Filter Modules
Coordinate Systems
Global
Element Local
Fracture Analysis
Displacement
Z Component
mm
2.644563
1.254264
-0.1360347
-1.526334
-2.916633
-4.306931
-5.69723
-7.087529
-8.477828
-9.868127
-11.25843
The reconciled case. Maximum vertical (downwards) deflection goes now to 11.26 mm, whereas amidst the beam, center, descent is about 4.20 mm
EDGE LOAD CASE
FRONT
Load Case: 1 of 1
Maximum Value: 2.64456 mm
Minimum Value: -11.2584 mm
2 < Design Scenario 2 >
0.000
536.508
mm
1073.016
1609.524
Z
Y
X
Escritorio
ES
18:33
28/07/2011


Autodesk Simulation Multiphysics 2012 [Results - [TS3 : Displacement]]
Results Contours
Results Inquire
Results Options
Analysis
Selection
View
Tools
Getting Started
Loads and Constraints
Visual Style
User Interface
Close
Switch
New
Arrange
Next
Previous
Orbit
Enclose (Fit All)
Orientation
Pan
Zoom
Look At
Previous View
Next View
Home
Appearance
Windows
Navigate
FEA Editor
Results
Report
1< Design Scenario 1 >
2< Design Scenario 2 >
Unit Systems < Metric mmks >
Analysis Type < Static Stress with Linear M
Parts
1 < SÃ³lido >
Contact (Default: Bonded)
Presentations
1 < Stress >
Mirror Planes
Slice Planes
Annotations
Embedded Presentations
2 < Displacement >
Mirror Planes
Slice Planes
Annotations
Embedded Presentations
Saved Presentations
Deformed Shape
Displacement
Strain
Stress
Saved Slice Planes
Filter Modules
Coordinate Systems
Global
Element Local
Fracture Analysis
Displacement
X Component
mm
6.458276
5.180993
3.903711
2.626428
1.349146
0.07186317
-1.205419
-2.482702
-3.759984
-5.037267
-6.31455
Transversal deflection goes to a maximum of 6.46 mm
FRONT
RIGHT
Z
Y
X
Load Case: 1 of 1
Maximum Value: 6.45828 mm
Minimum Value: -6.31455 mm
2 < Design Scenario 2 >
0.000
903.723
mm
1807.446
2711.169
Escritorio
ES
18:38
28/07/2011



As said for the torque case, von Mises stresses skyrocket (see a 752 MPa at the legend). In the contour graphics I have clipped to not show surfaces where the averaged stress is bigger than 150 MPa (see blank corners). If I would have set the limit at 180 MPa the even bigger stresses would be unnoticeable and everything visible filled. So 180 MPa is likely (except further inspection reveals otherwise) a more useful value for local stress checks for a ductile material.

CONCENTRATED TORQUE MODEL		AS	RISA 3D	SAP2000	INVENTOR
MAXIMUM DETECTED VON MISES STRESS Mpa	WITHOUT STIFFENERS		44	46	55
MAXIMUM DETECTED VON MISES STRESS Mpa	WITH STIFFENERS	46	39.9	46	61
MAXIMUM TRANSVERSAL DEFLECTION mm	WITHOUT STIFFENERS	2.46	2.78	2.3	2.4
MAXIMUM TRANSVERSAL DEFLECTION mm	WITH STIFFENERS	2.08	2.19	2.2	2

EDGE LOAD MODEL		AS MODEL	RISA 3D MODEL	SAP2000	INVENTOR
MAXIMUM DETECTED VON MISES STRESS Mpa	WITHOUT STIFFENERS		257		270
MAXIMUM DETECTED VON MISES STRESS Mpa	WITH STIFFENERS	202	196		232
MAXIMUM VERTICAL DEFLECTION mm	WITHOUT STIFFENERS	4.2	16		12.18
MAXIMUM VERTICAL DEFLECTION mm	WITH STIFFENERS	9	12		10.36
MAXIMUM TRANSVERSAL DEFLECTION mm	WITHOUT STIFFENERS	6.46	8.12		7.13
MAXIMUM TRANSVERSAL DEFLECTION mm	WITH STIFFENERS	4.55	6.41		6.13

CONCLUSIONS

We have managed after some reworking of the discording AS model to get consistent results from the models for the cases in 4 programs, enough to ascertain that for the stated cases, addition of stiffeners signify a moderate betterment of torsional response of the beam, that shows less rotation. The effect will be even far bigger if something that is able to provide restraint of rotation -even the element imparting the loading- takes hold of the stiffeners, that then will further prevent rotation and local deformation. As Pilkey's quotes Jefferson in the frontispice of his monumental book of closed form solutions, "all is demonstration, and satisfaction". Surely a mathematician could get a good laugh with this "demonstration" but well, this is technical matter, and if I remember well the original greek meaning for teknos is ART.