SDC VERIFIER

Tutorial

Optimization

Updated on: 05.10.2021

Tested with: SDC Verifier 2021R1.1

Ansys Workbench 2020R2

Content

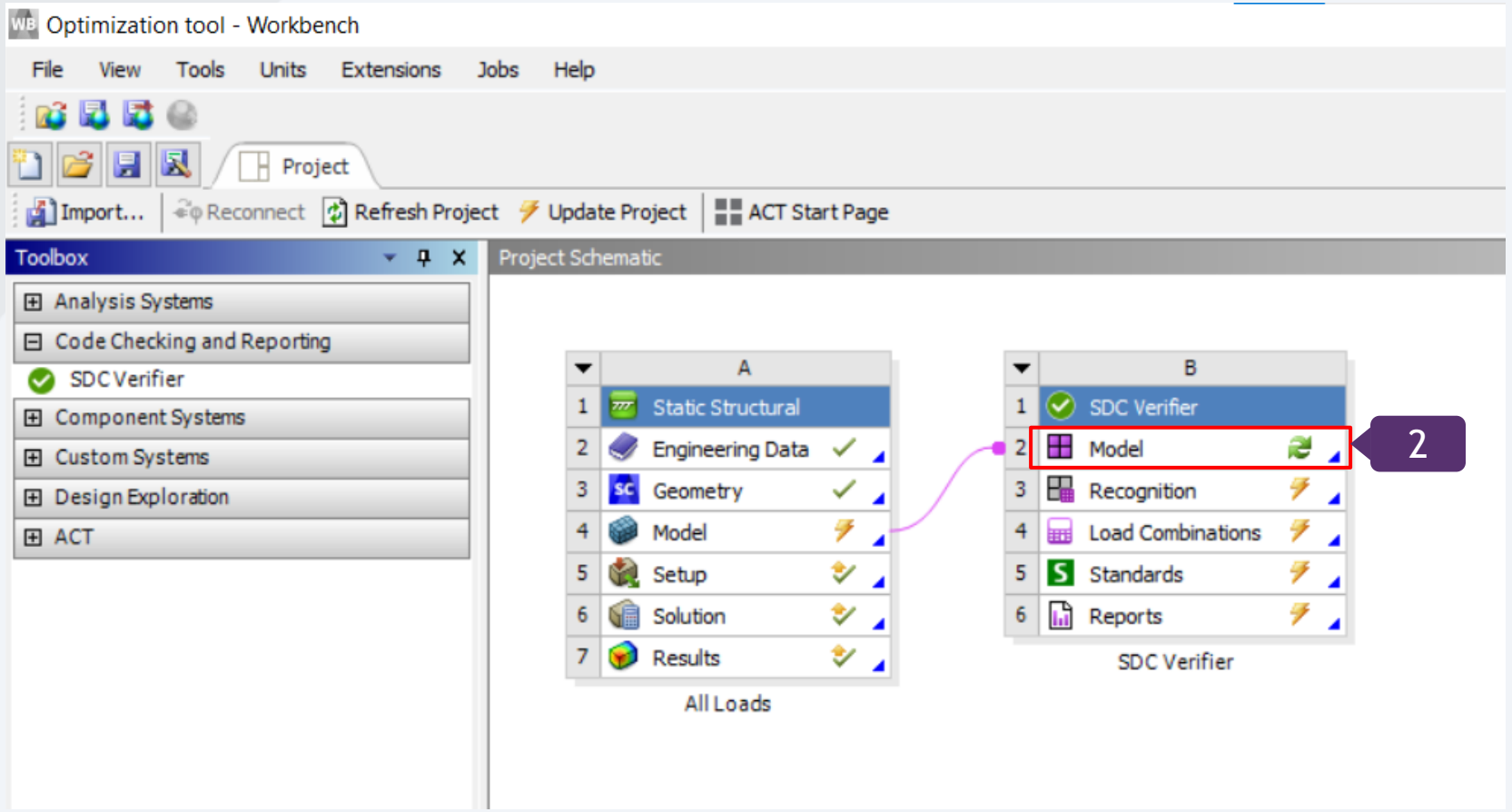
- This step-by-step tutorial demonstrates the interface of SDC Verifier Optimization
- Jacket Model members are Optimized based on AISC 360-10 results;
- Shape Library Overview;
- Optimization Rules Overview;
- Results Comparison;
- Automatic Beam Cross Section Change.

Open the starter model

1. Open in **ANSYS Workbench** the following file **Optimization_tool.wbpz**

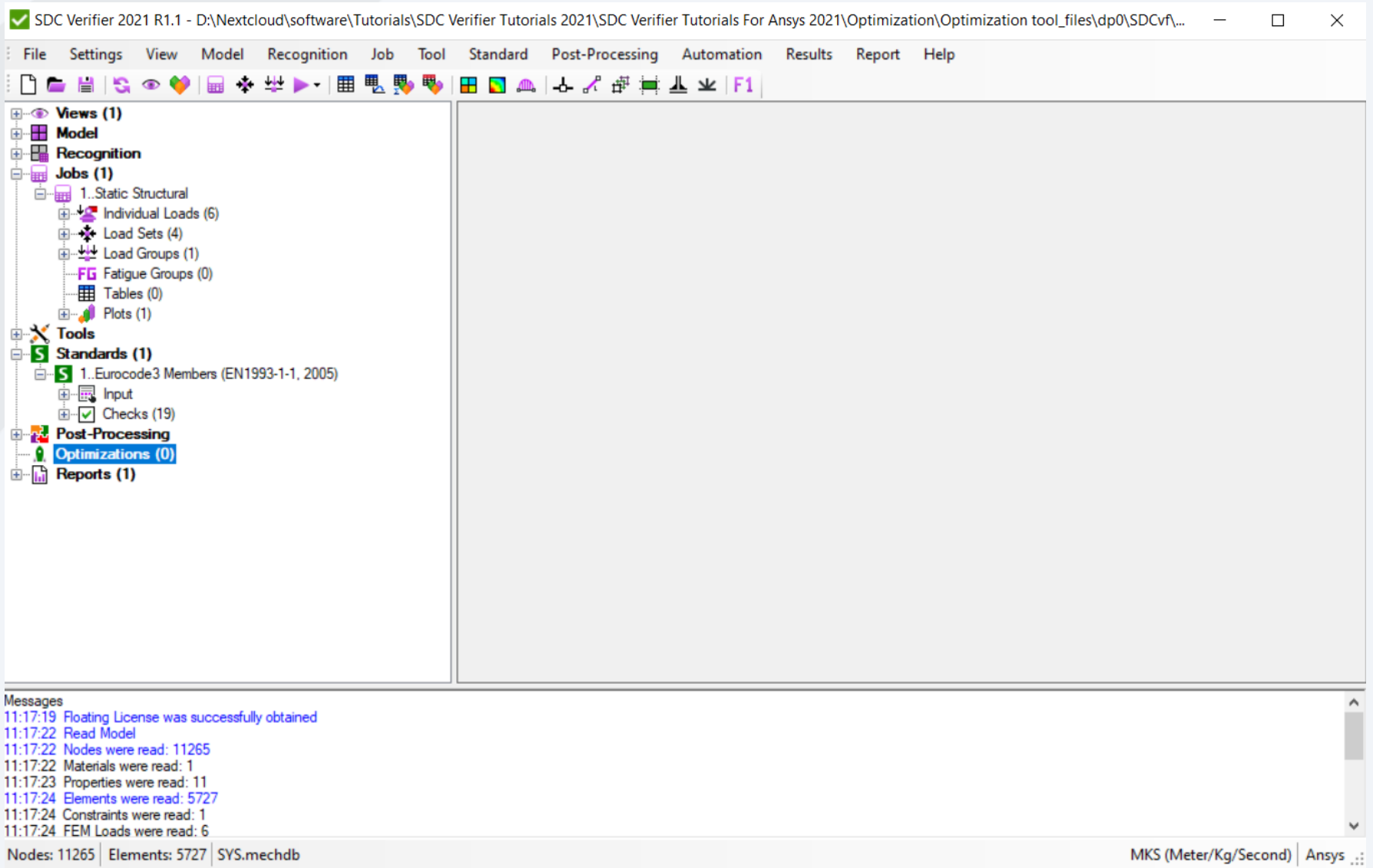
2. Double Click on 

or in context menu click Edit



Project Description

Ansys analysis in this file is already solved. This SDC Verifier project has predefined loading combinations, recognition of beam members, and AISC 360-10 Members check.

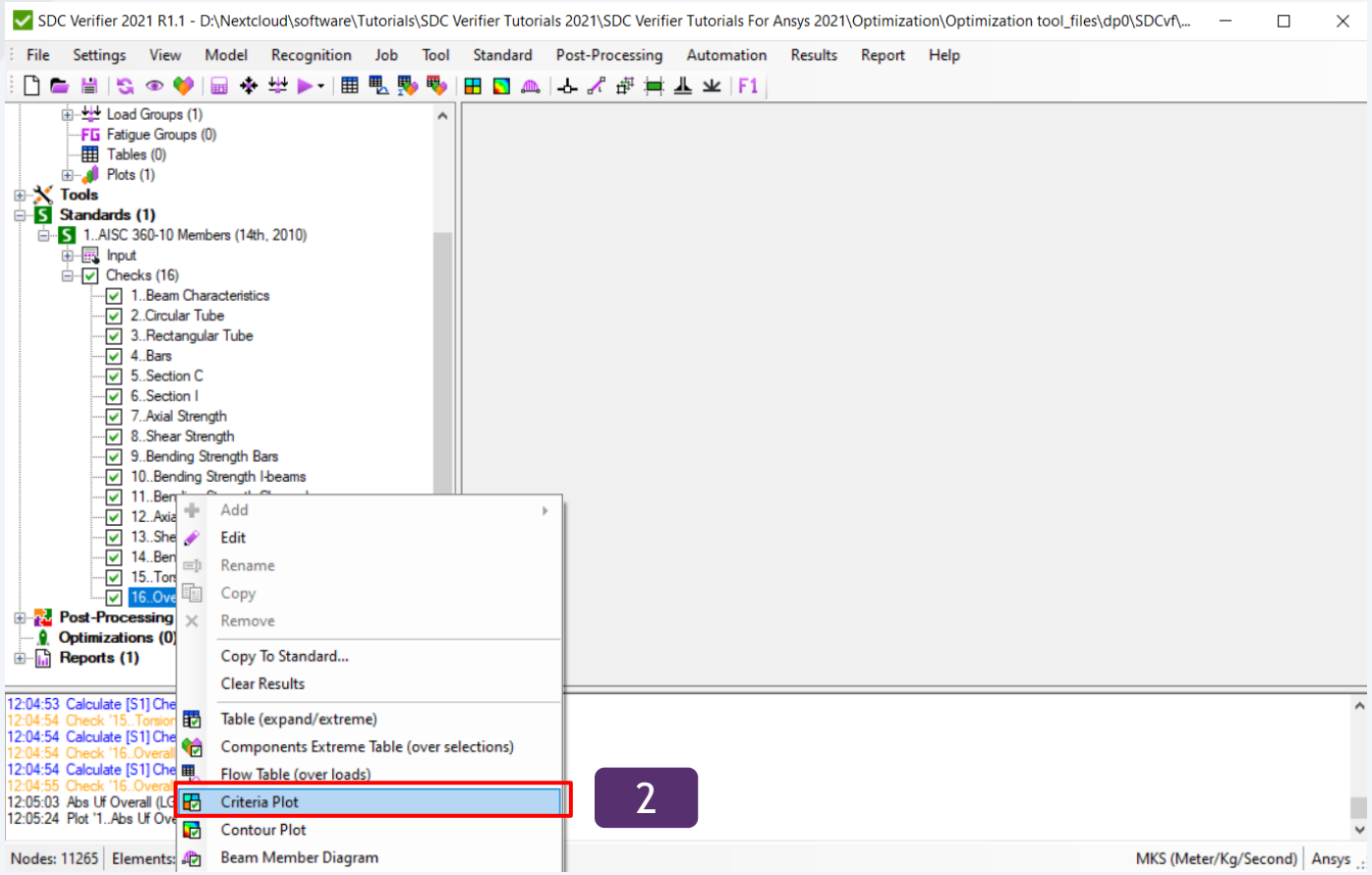


AISC Results Plot

1. Select **AISC 360-10 Members > Checks > Overall**

2. Right Click and Select Criteria Plot

Let's create a plot to preview the results of AISC Members check and pick the members for Optimization



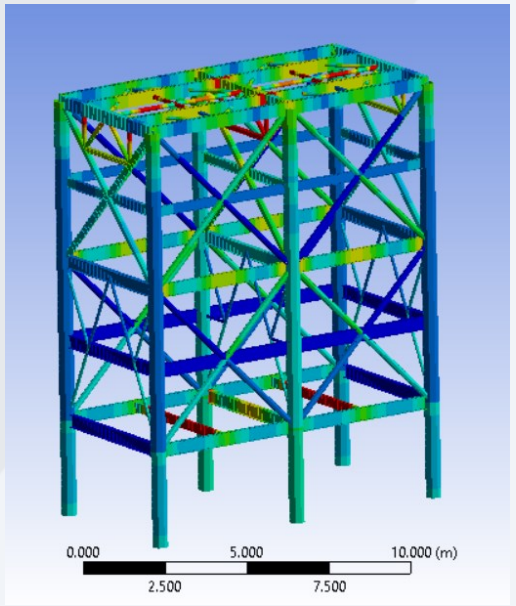
AISC Results Plot

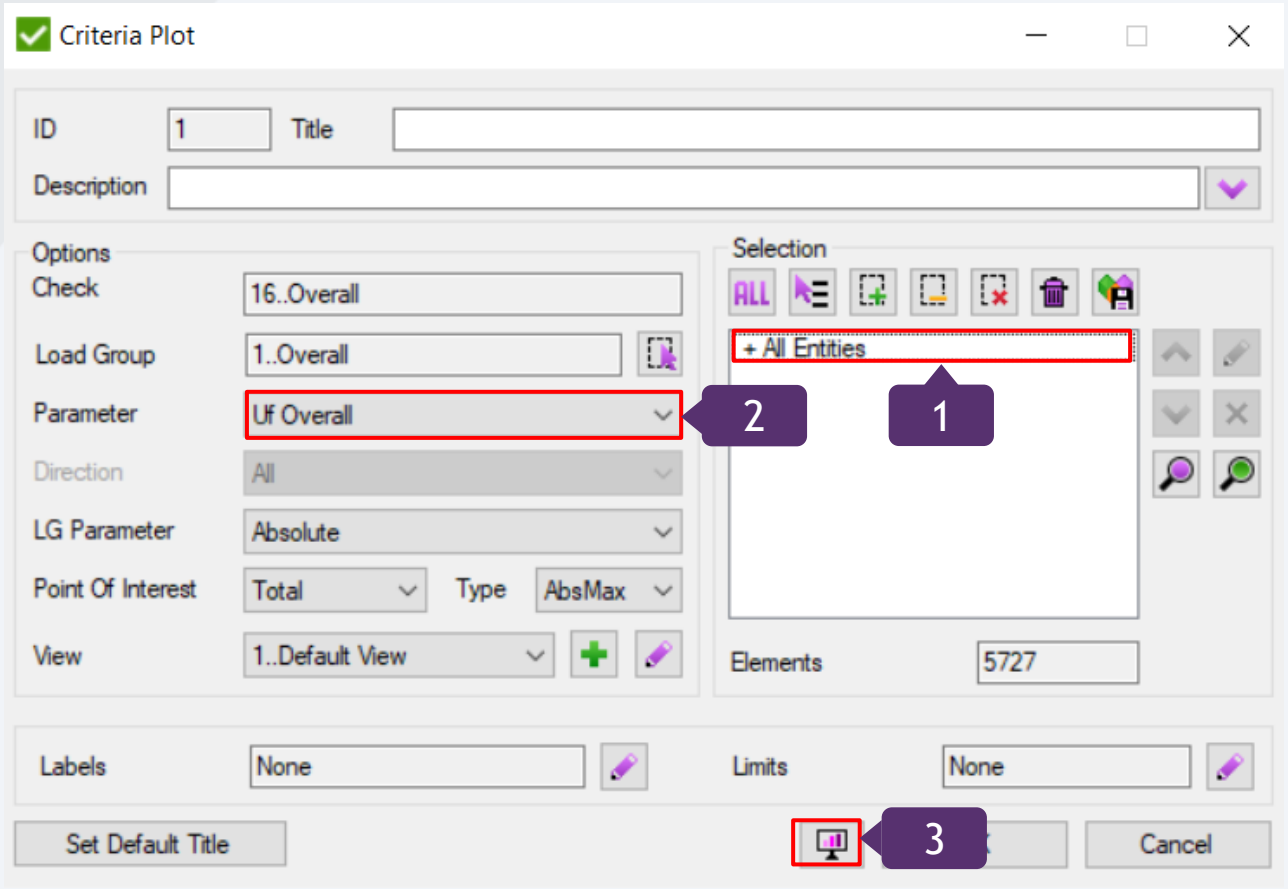
1. Selection: **All Entities**
2. Parameter: **UF Overall**

Creating a plot to see the Overall UF result on a full model

3. Press *Plot* 

Plot will be displayed in Ansys Mechanical Window



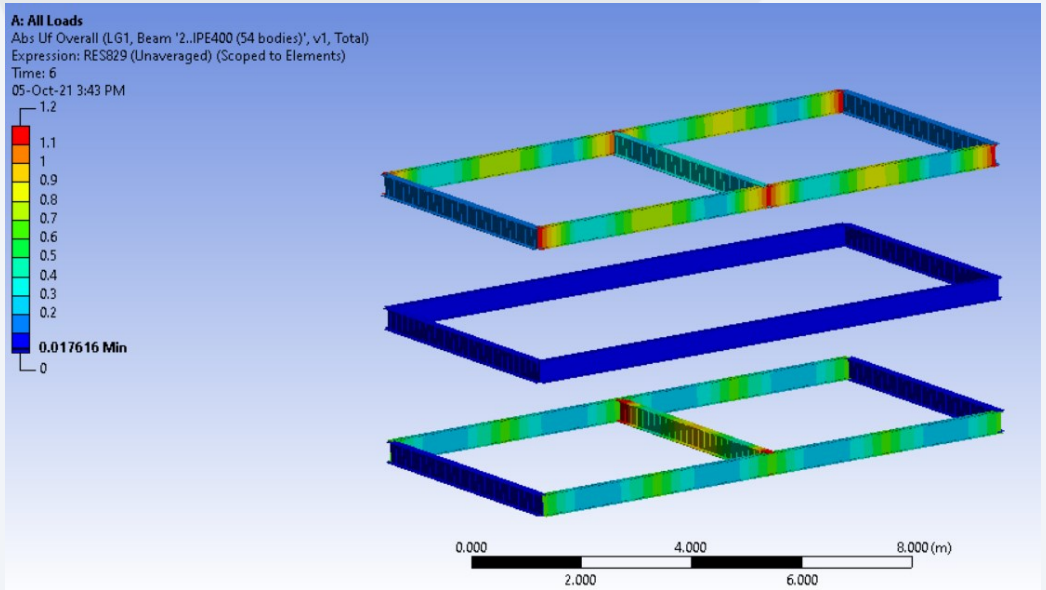


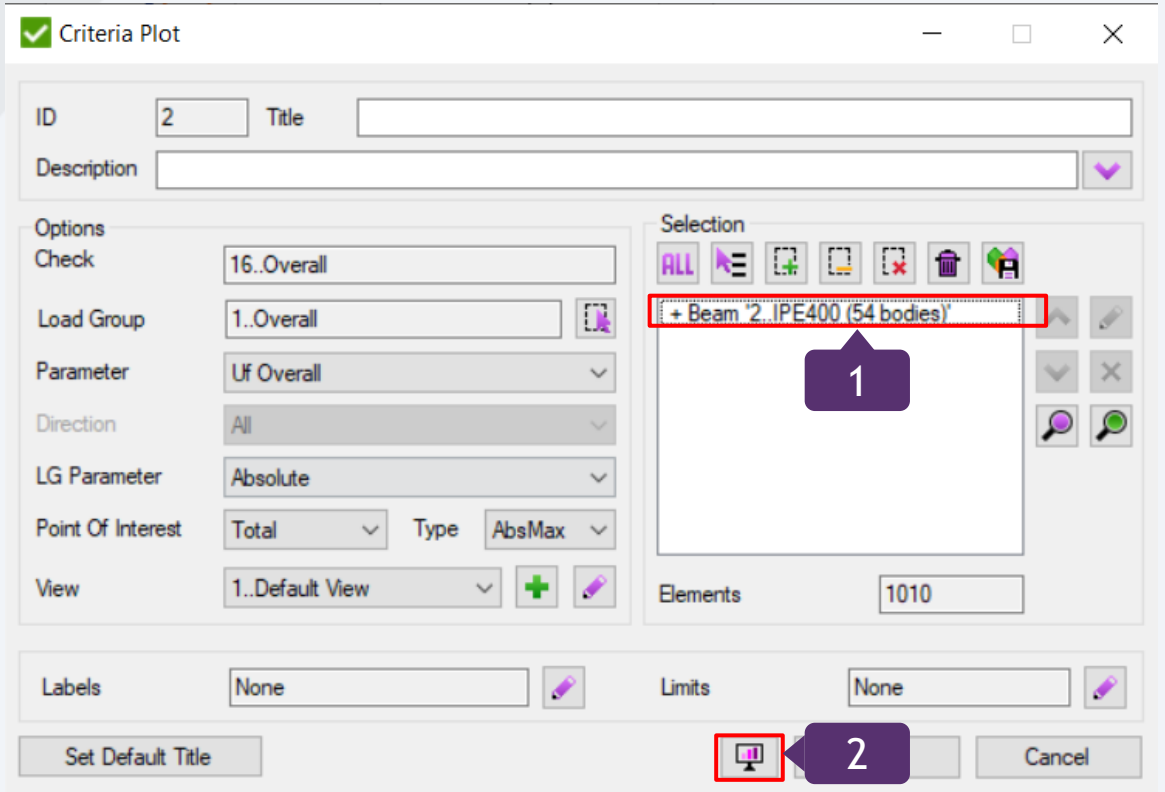
AISC Results Plot

Let’s preview the plot for one property

1. Selection: **Property Beam 2..IPE400**
2. Press *Plot* 

Plot will be displayed in Ansys Mechanical Window

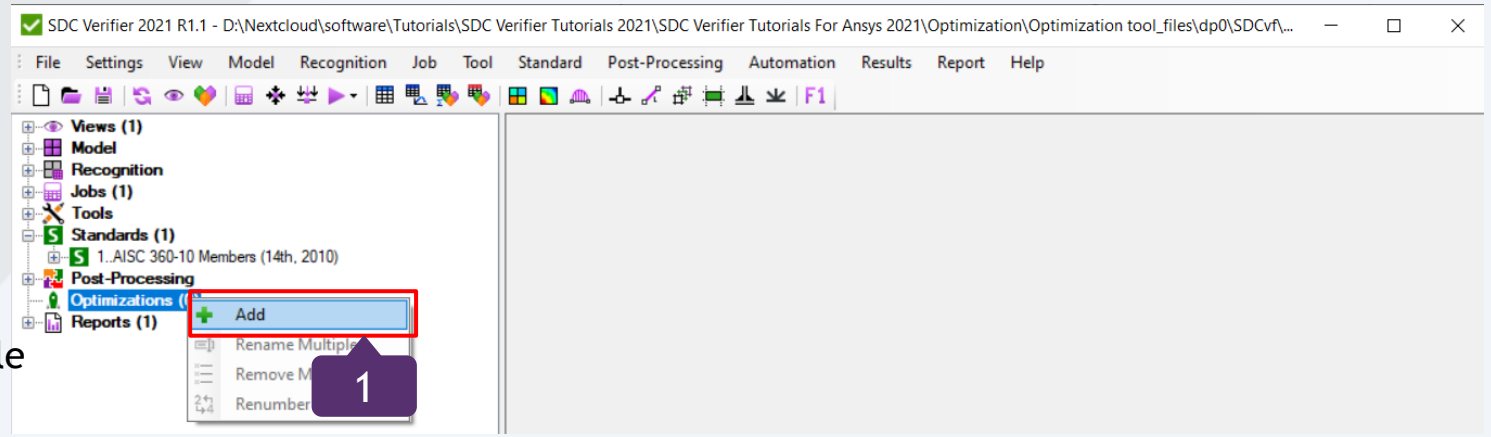


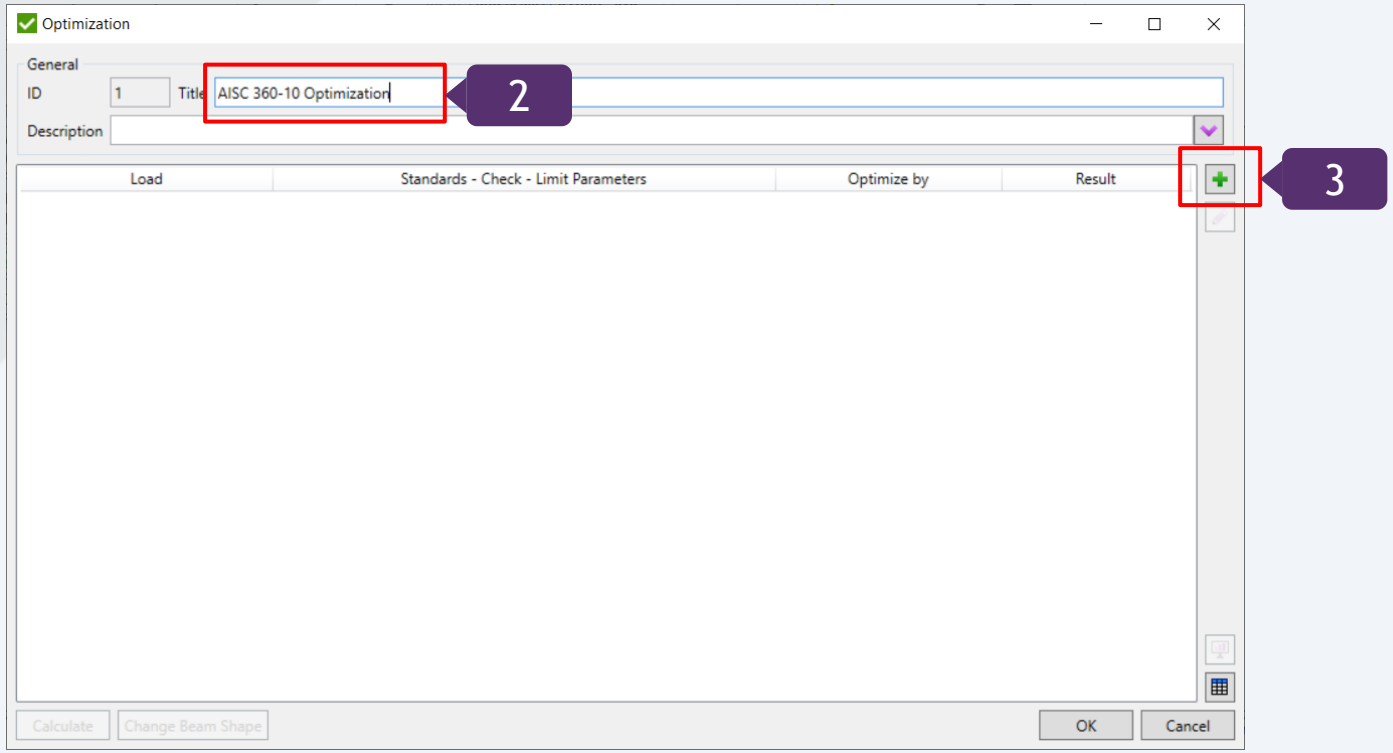


Some members of property ‘2..IPE400’ have UF Overall value above 1. We’re now going to create an Optimization rule for this members

Optimization Rule

1. Select **Optimizations > Add**
2. Title: **AISC 360-10 Optimization**
3. Press  To create your first Optimization Rule





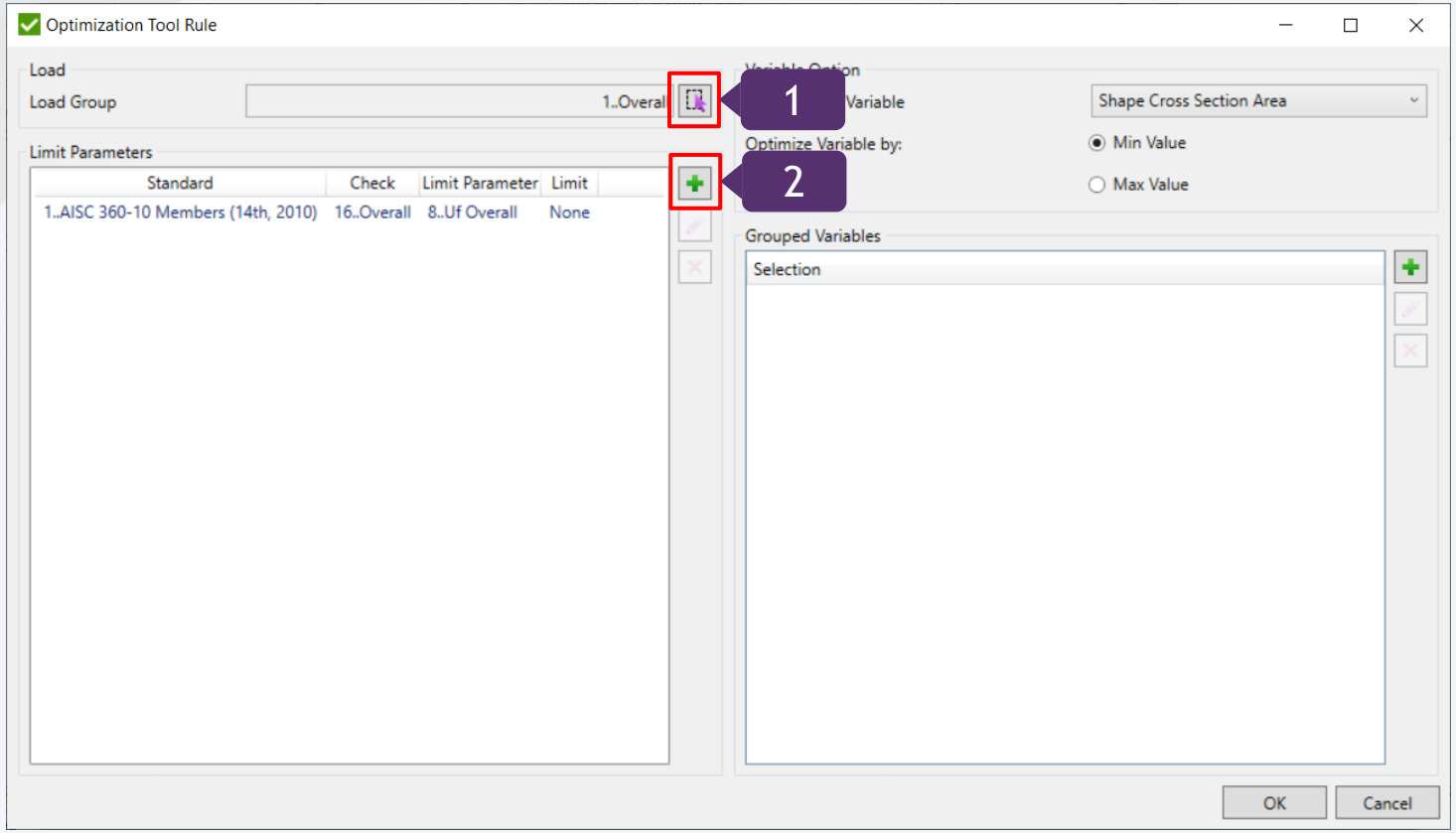
Optimization Rule

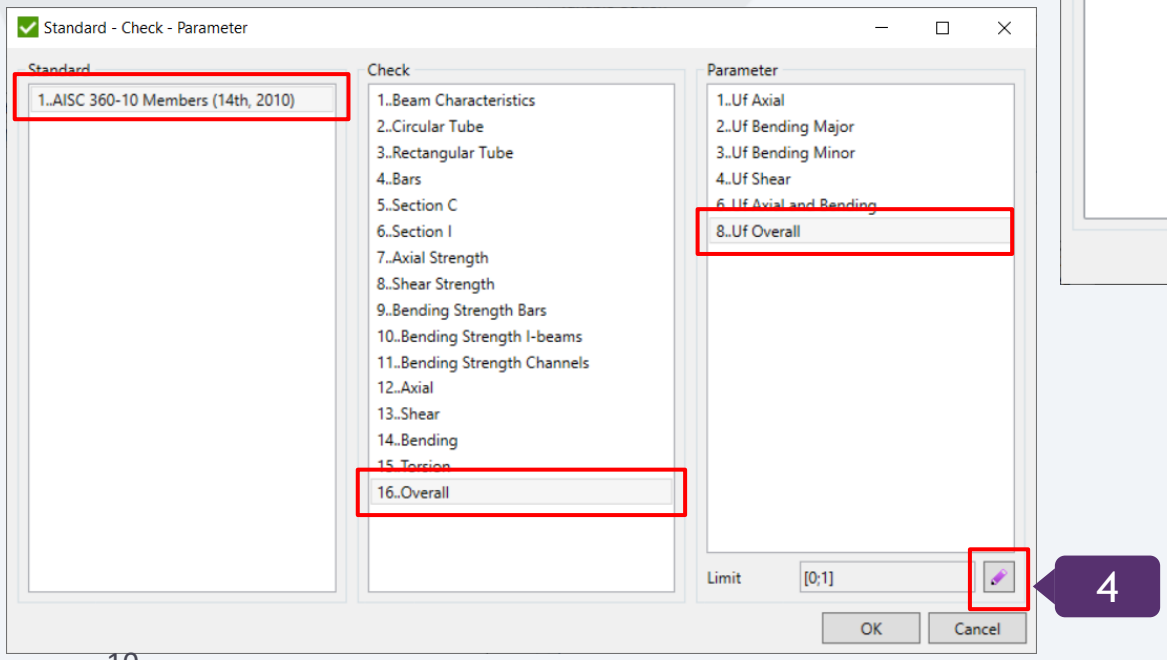
1. Click on ***Select Load*** 
   In the opened window select Load Group 1

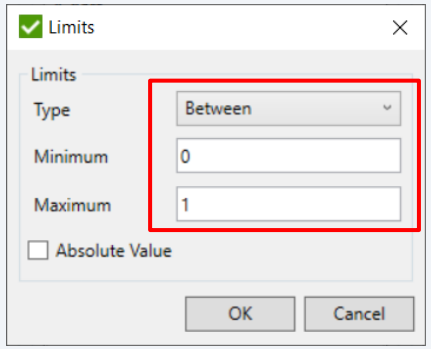
2. Click on ***Select Limit Parameters*** 

3. In the opened window select Standard / Check / Parameter as shown below

4. Click on ***Limits***. Set Between 0 and 1



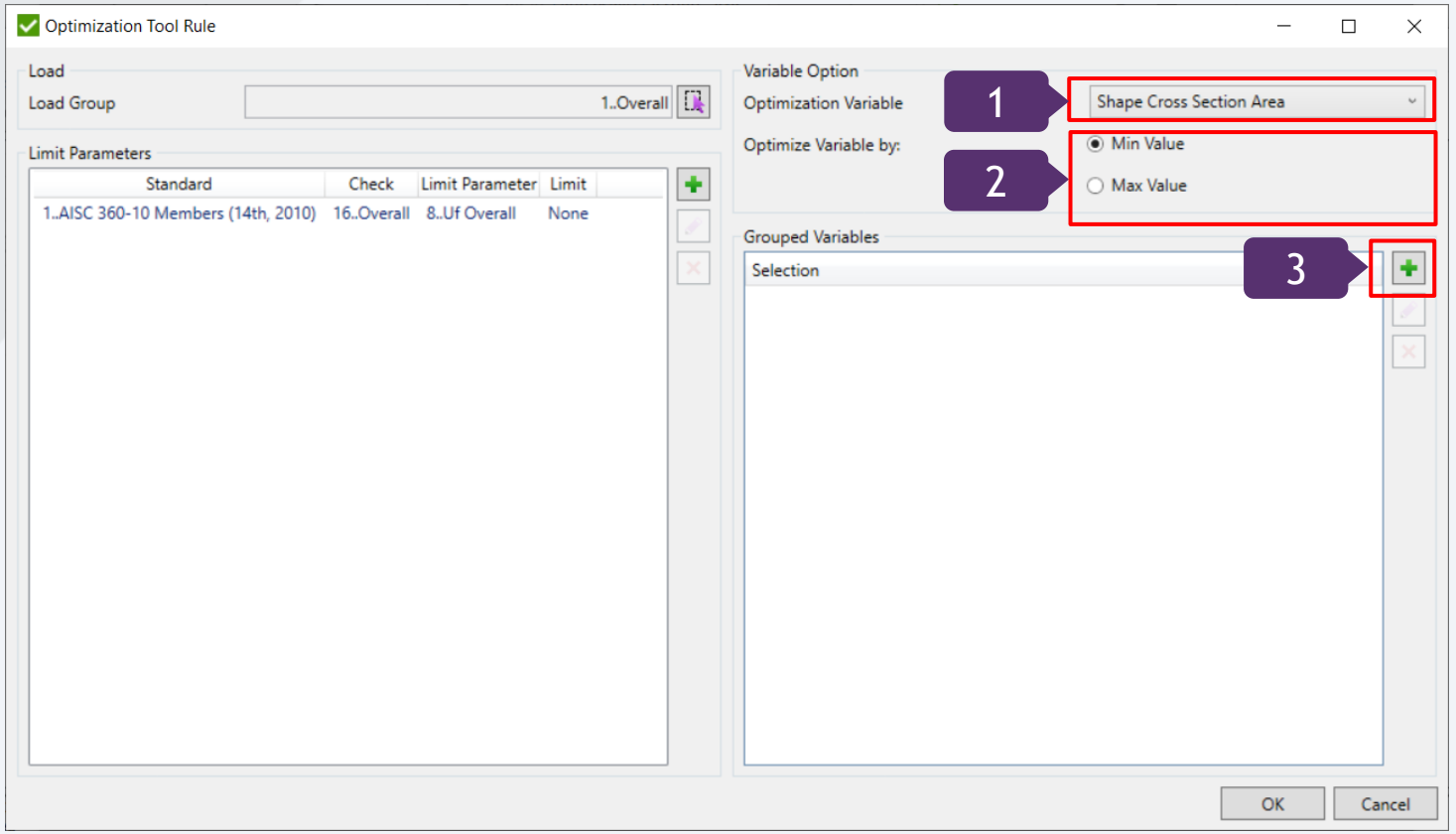




Note: If you have multiple Standards calculated in your SDC Verifier Project you will have all of them listed in ***Select Limit Parameters***

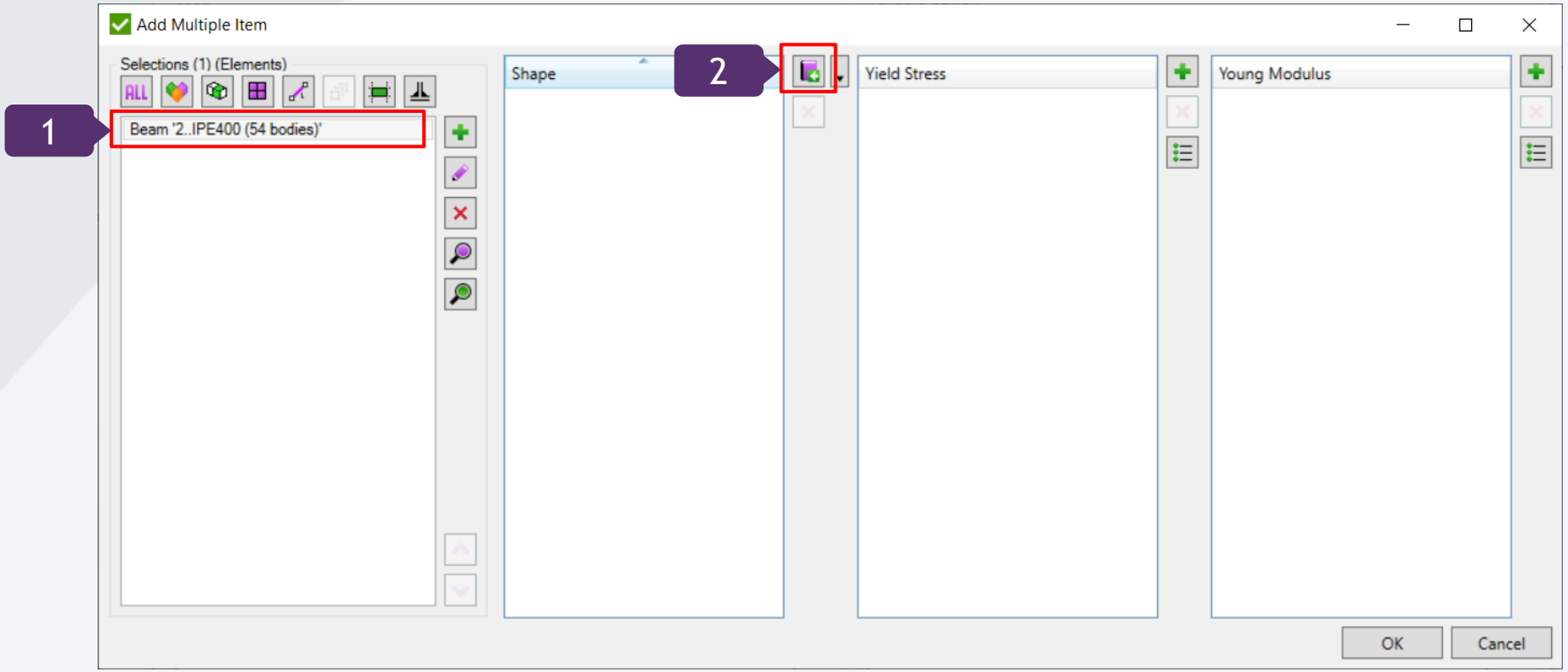
Optimization Rule

1. Set ***Optimization Variable:*** Shape Cross Section Area
2. Set ***Optimize Variable By:*** Min Value
3. Click on  to Select the Variables to be Optimized



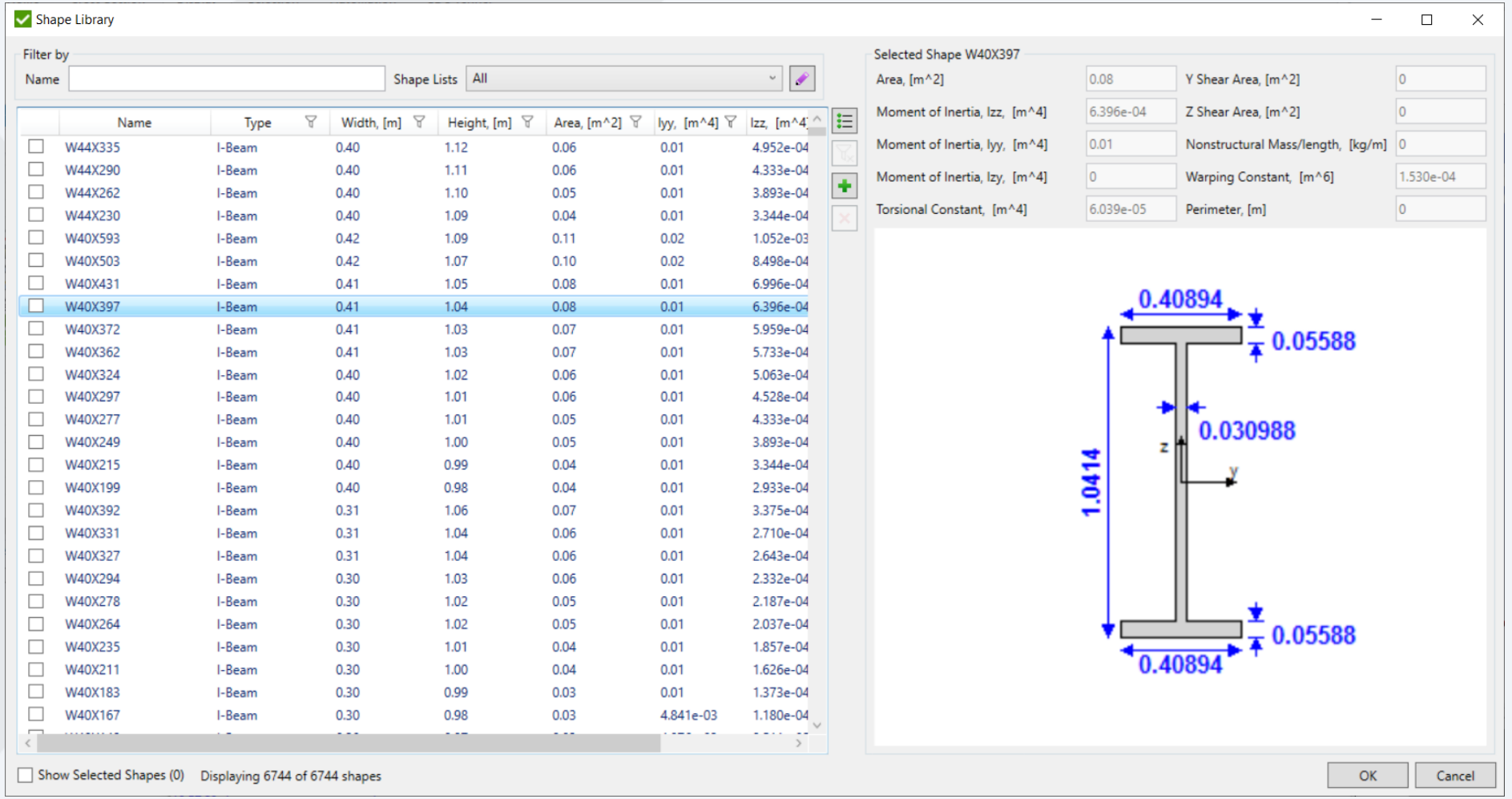
Optimization Rule

1. Using ***Rule Based Selector***
   Pick *Property '2..IPE400'*
2. Click on  to open
   Shape Library



Shape Library

Shape Library contains a list of predefined or user defined shapes that can be used in the Optimization, Shapes can be filtered, Organized in Lists, Added or Modified.



Shape Library

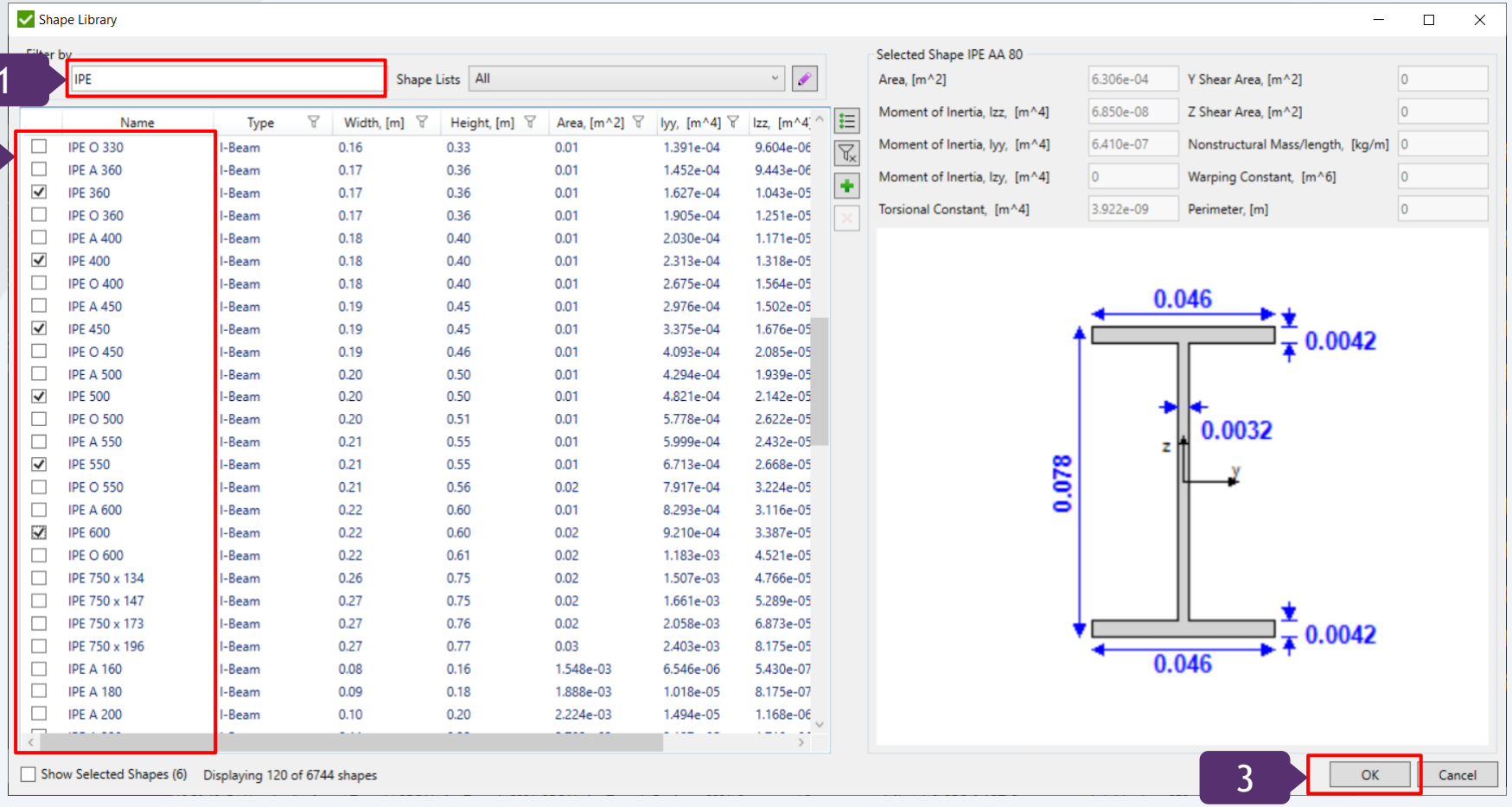
1. Type In ***Filter by Name:*** IPE
(With the SPACE after E, to filter out the Pipe sections)

2. Select Following Cross Sections:
IPE 360, 400, 450, 500, 550, 600

3. Click OK to close the Shape Library

4. Click OK to close the Variables Selector And OK to close Optimization Rule

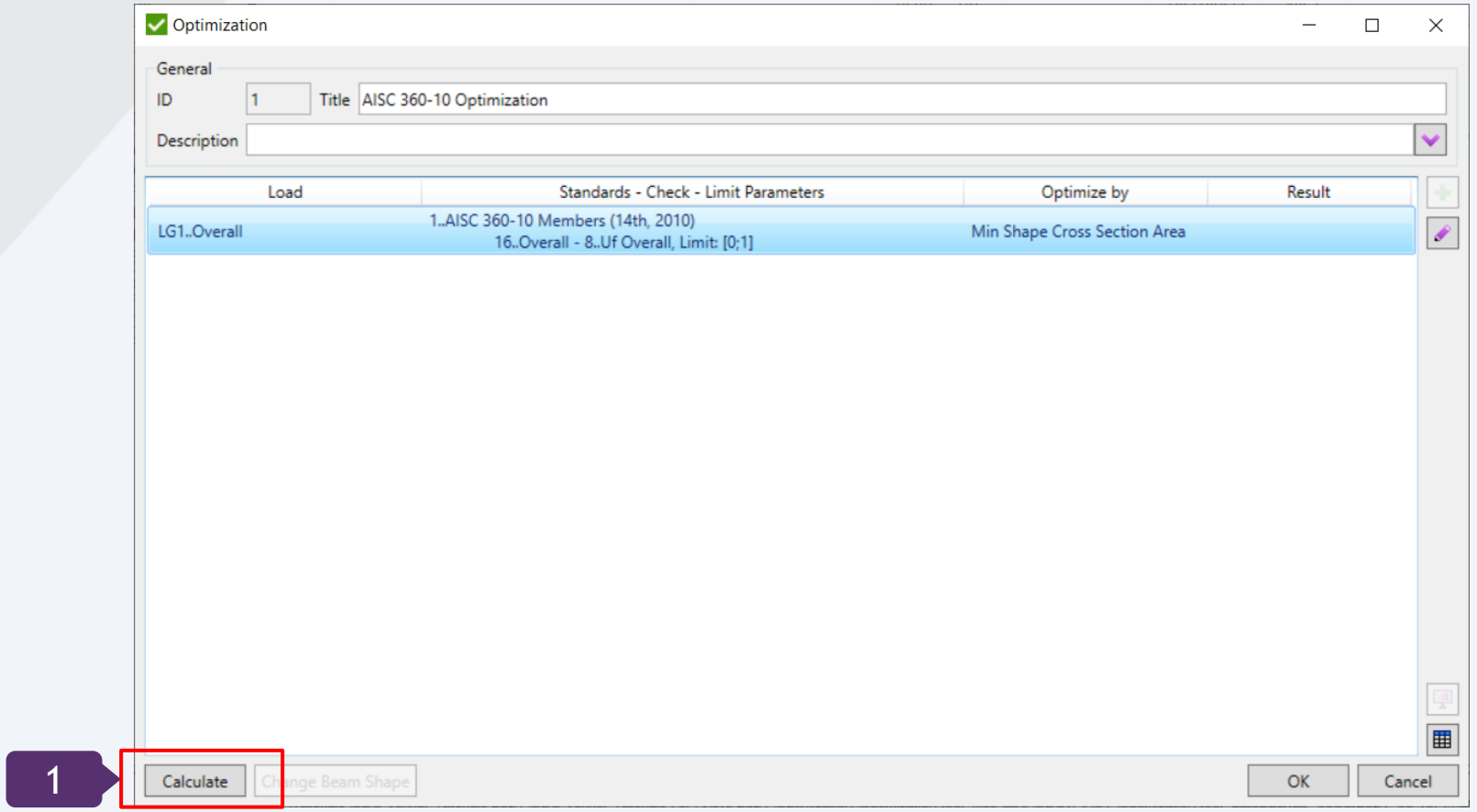
Now Optimization Rule is ready to be calculated



Name	Type	Width, [m]	Height, [m]	Area, [m^2]	Iyy, [m^4]	Izz, [m^4]
IPE O 330	I-Beam	0.16	0.33	0.01	1.391e-04	9.604e-06
IPE A 360	I-Beam	0.17	0.36	0.01	1.452e-04	9.443e-06
IPE 360	I-Beam	0.17	0.36	0.01	1.627e-04	1.043e-05
IPE O 360	I-Beam	0.17	0.36	0.01	1.905e-04	1.251e-05
IPE A 400	I-Beam	0.18	0.40	0.01	2.030e-04	1.171e-05
IPE 400	I-Beam	0.18	0.40	0.01	2.313e-04	1.318e-05
IPE O 400	I-Beam	0.18	0.40	0.01	2.675e-04	1.564e-05
IPE A 450	I-Beam	0.19	0.45	0.01	2.976e-04	1.502e-05
IPE 450	I-Beam	0.19	0.45	0.01	3.375e-04	1.676e-05
IPE O 450	I-Beam	0.19	0.46	0.01	4.093e-04	2.085e-05
IPE A 500	I-Beam	0.20	0.50	0.01	4.294e-04	1.939e-05
IPE 500	I-Beam	0.20	0.50	0.01	4.821e-04	2.142e-05
IPE O 500	I-Beam	0.20	0.51	0.01	5.778e-04	2.622e-05
IPE A 550	I-Beam	0.21	0.55	0.01	5.999e-04	2.432e-05
IPE 550	I-Beam	0.21	0.55	0.01	6.713e-04	2.668e-05
IPE O 550	I-Beam	0.21	0.56	0.02	7.917e-04	3.224e-05
IPE A 600	I-Beam	0.22	0.60	0.01	8.293e-04	3.116e-05
IPE 600	I-Beam	0.22	0.60	0.02	9.210e-04	3.387e-05
IPE O 600	I-Beam	0.22	0.61	0.02	1.183e-03	4.521e-05
IPE 750 x 134	I-Beam	0.26	0.75	0.02	1.507e-03	4.766e-05
IPE 750 x 147	I-Beam	0.27	0.75	0.02	1.661e-03	5.289e-05
IPE 750 x 173	I-Beam	0.27	0.76	0.02	2.058e-03	6.873e-05
IPE 750 x 196	I-Beam	0.27	0.77	0.03	2.403e-03	8.175e-05
IPE A 160	I-Beam	0.08	0.16	1.548e-03	6.546e-06	5.430e-07
IPE A 180	I-Beam	0.09	0.18	1.888e-03	1.018e-05	8.175e-07
IPE A 200	I-Beam	0.10	0.20	2.224e-03	1.494e-05	1.168e-06

Calculating the Optimization

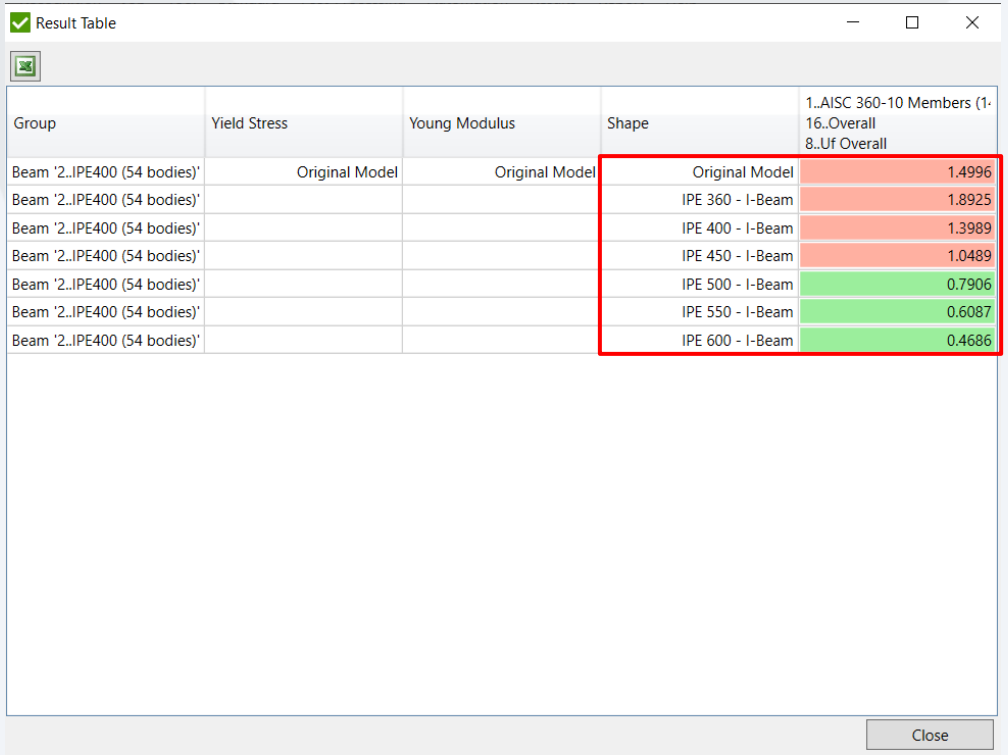
1 Execute ***Calculate*** to run the Optimization

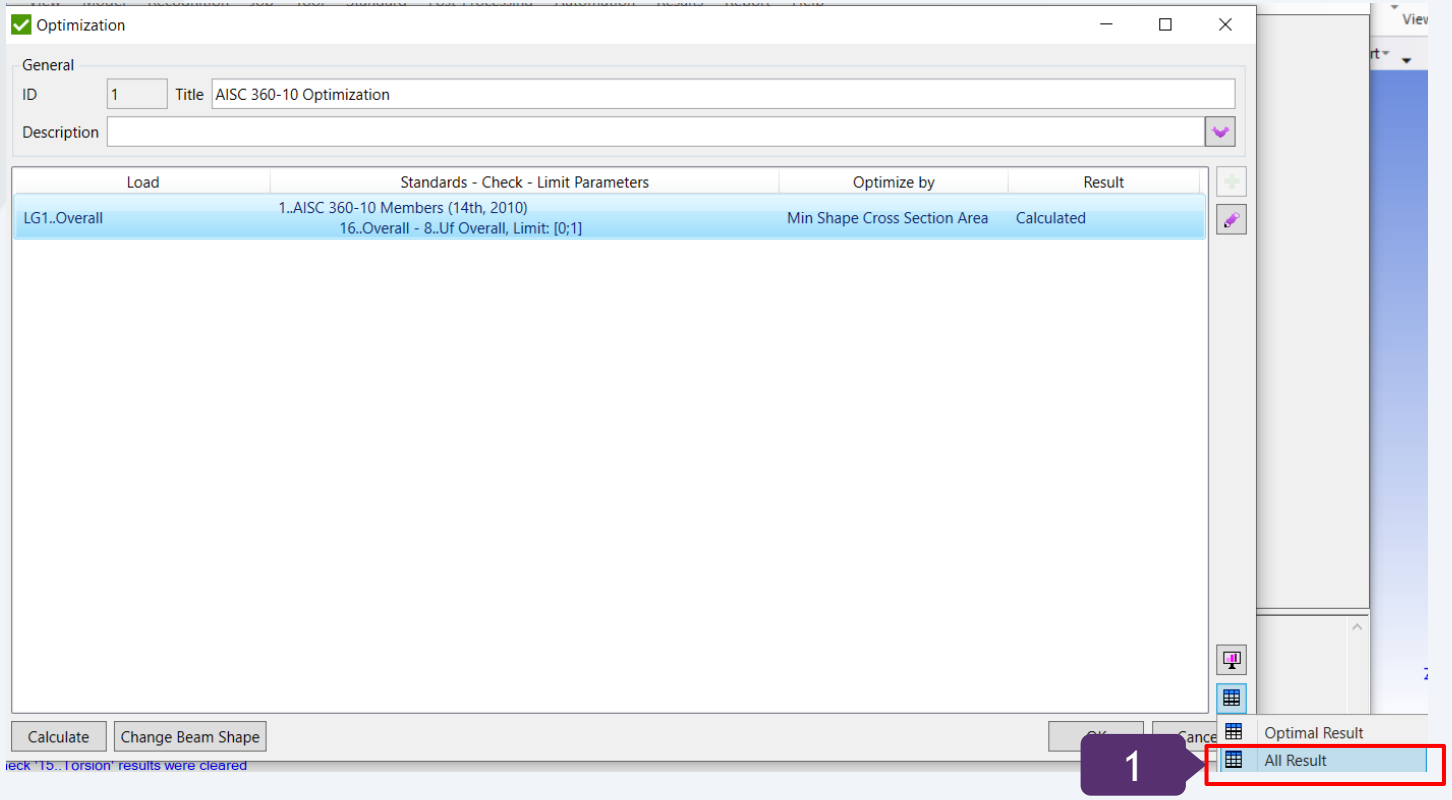


Optimization Results

1 Click on ***Table > All results***

Results for all variables

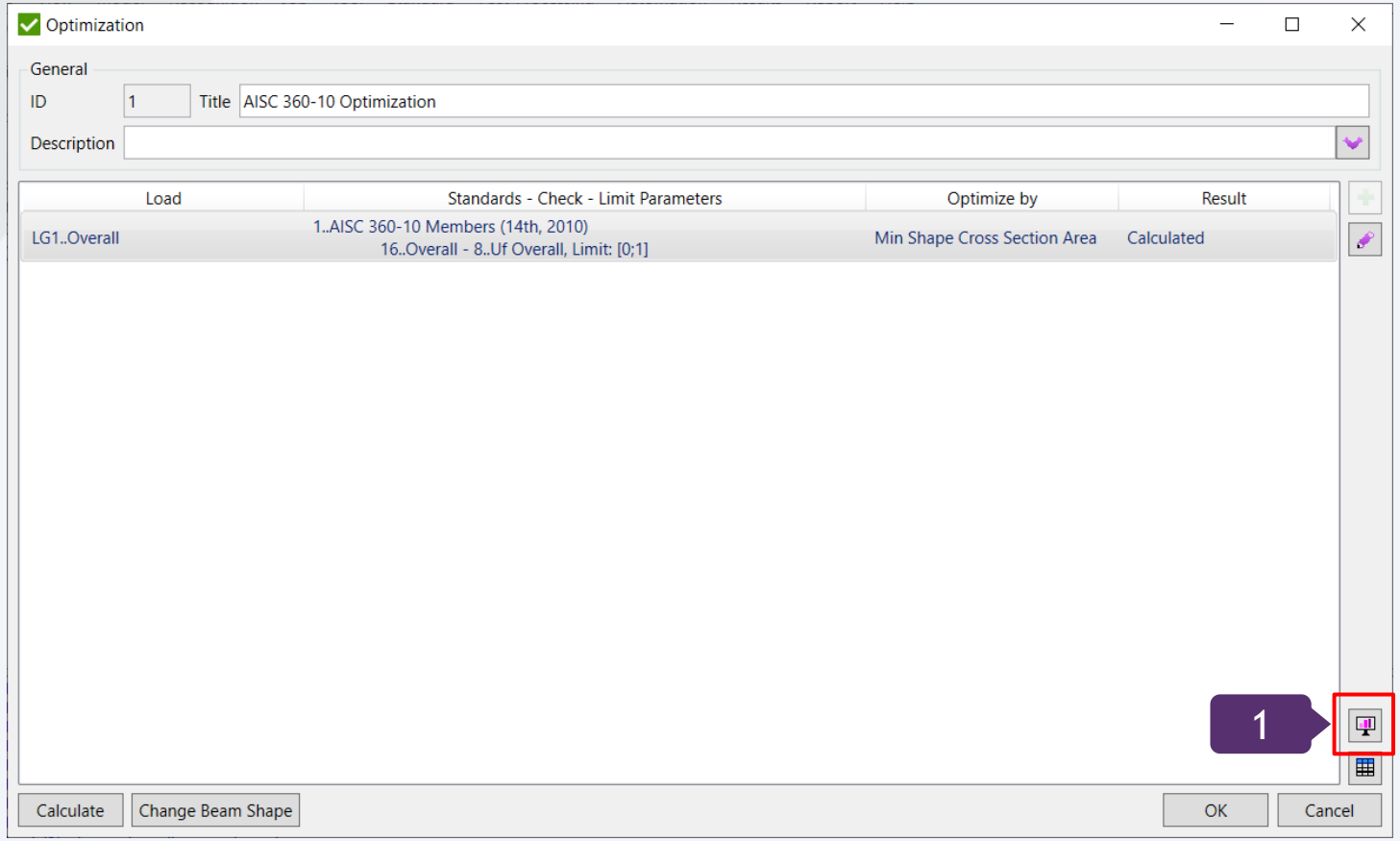




Optimal result is Beam IPE 500. It will be used for changing the Beam shape

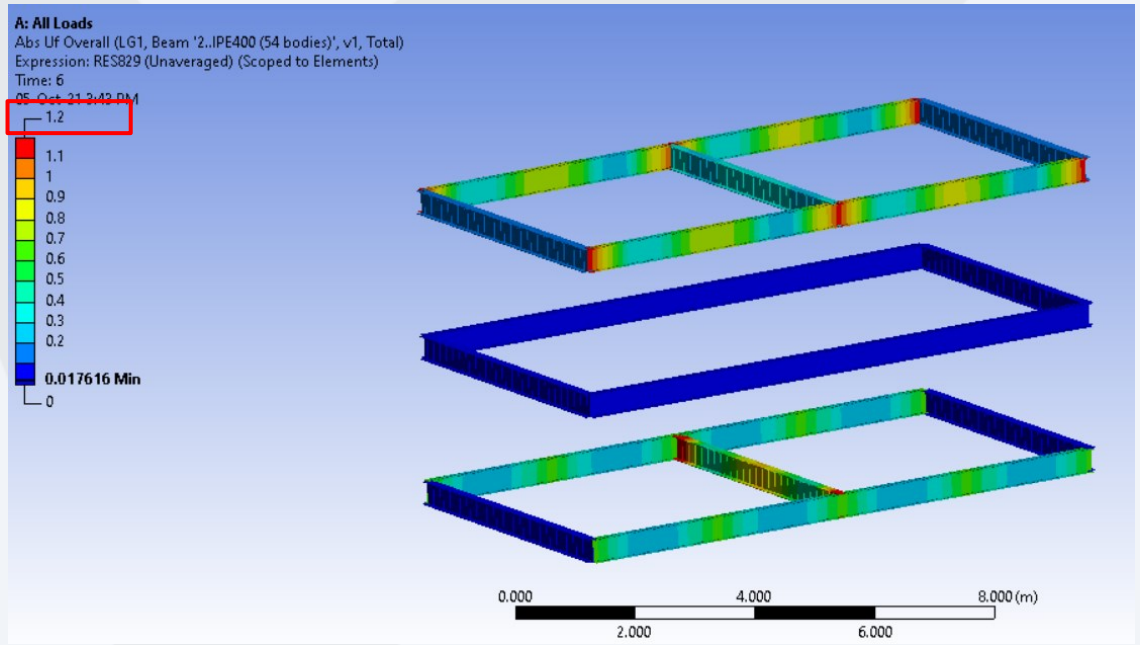
Optimization Results

1 Click on ***Plot Optimal Result***

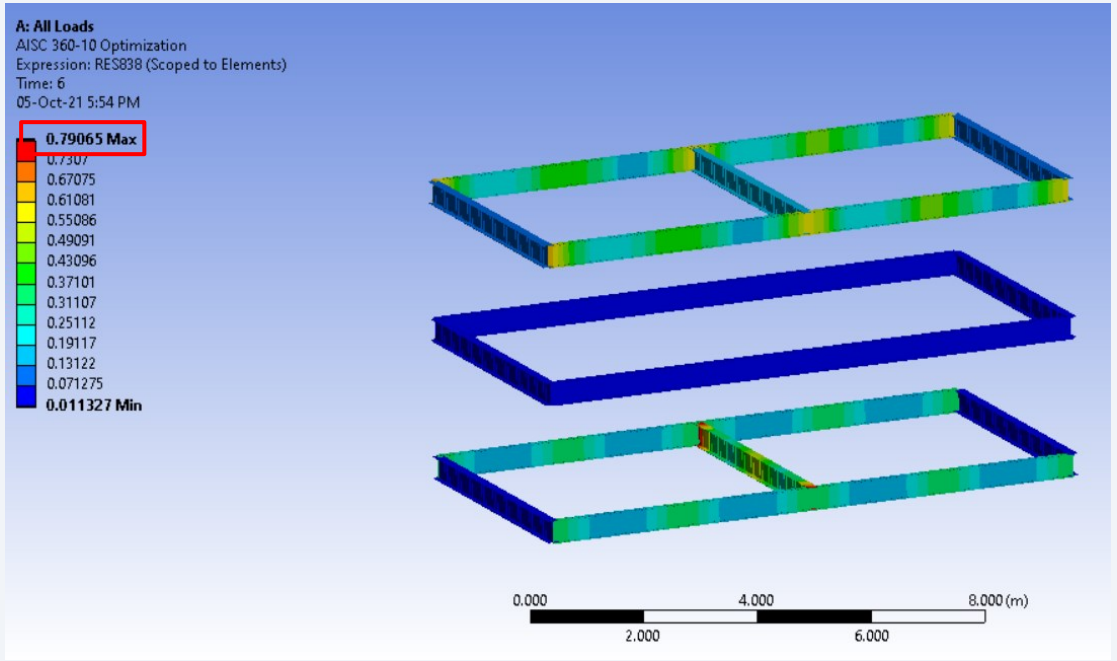


Optimization Results

Result Before the Optimization



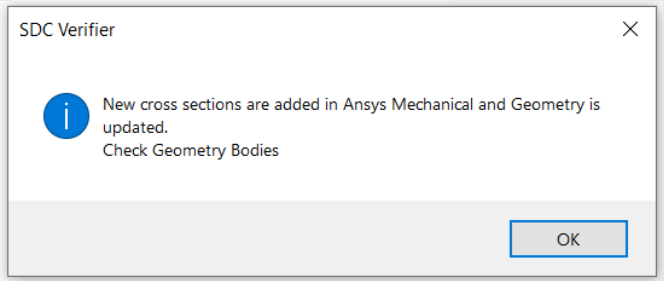
Result After the Optimization

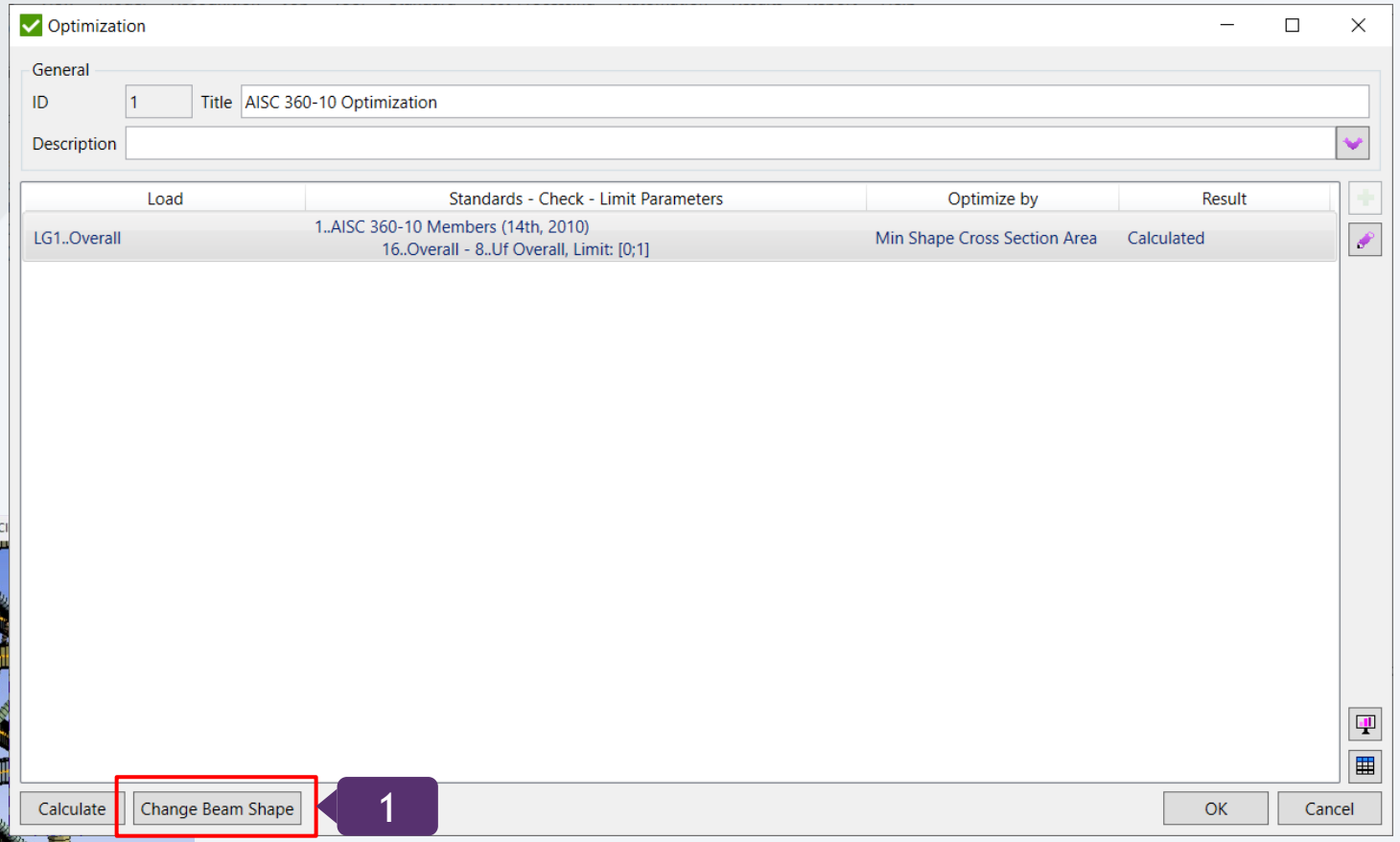


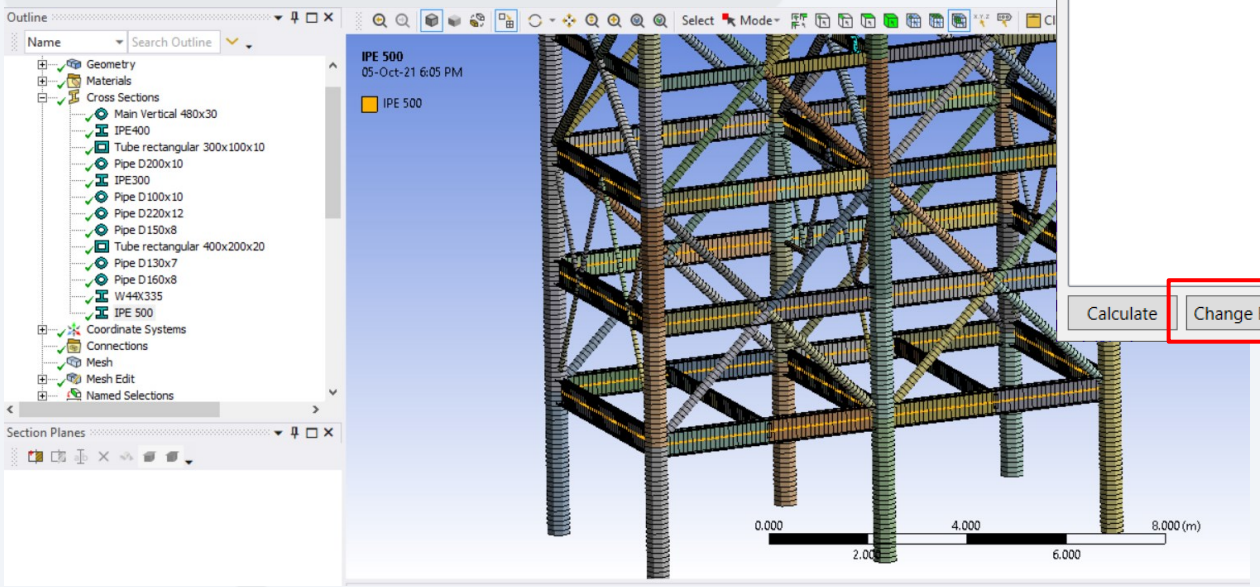
This Tutorial only demonstrates the workflow with Optimization Tool.
Optimization rule can be set more precisely. For Example, using the Peak Finder you can group only the overshooting elements into a Component and run the optimization on this Component. Multiple rules with different variables can be set.

Changing the Beam Shape

1 Click on ***Change Beam Shape***







Property IPE400 is automatically replaced by IPE 500 (Optimal Result)