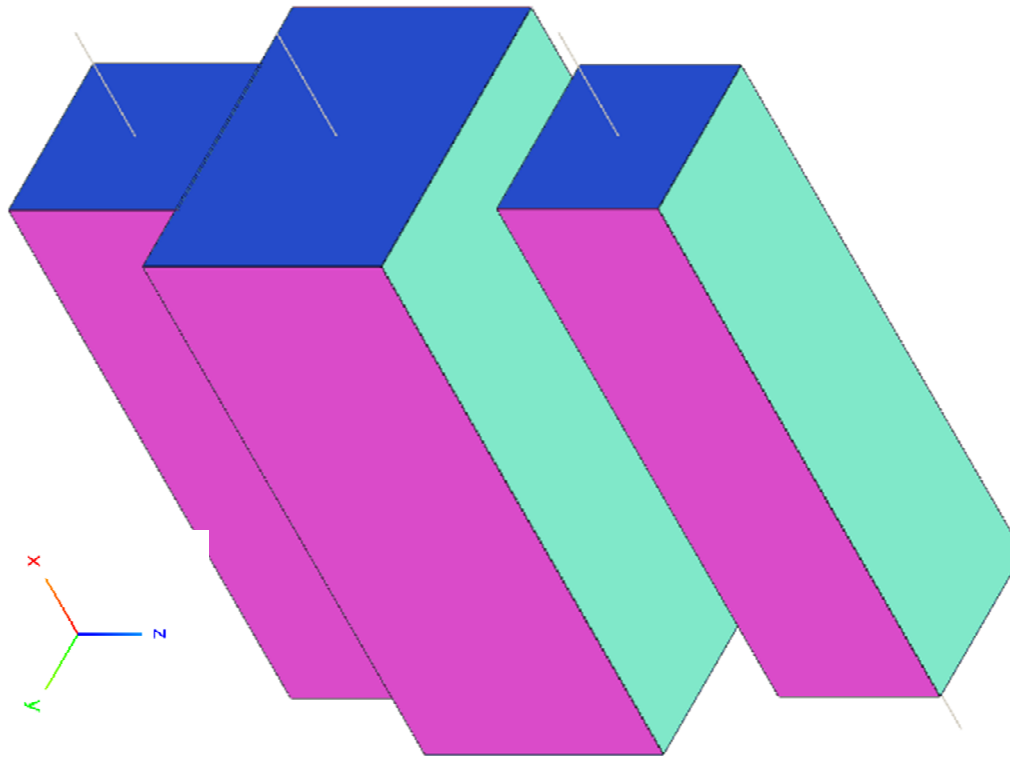


Workshop – Examples of arbitrary beam cross sections with PBMSECT and PBRSECT

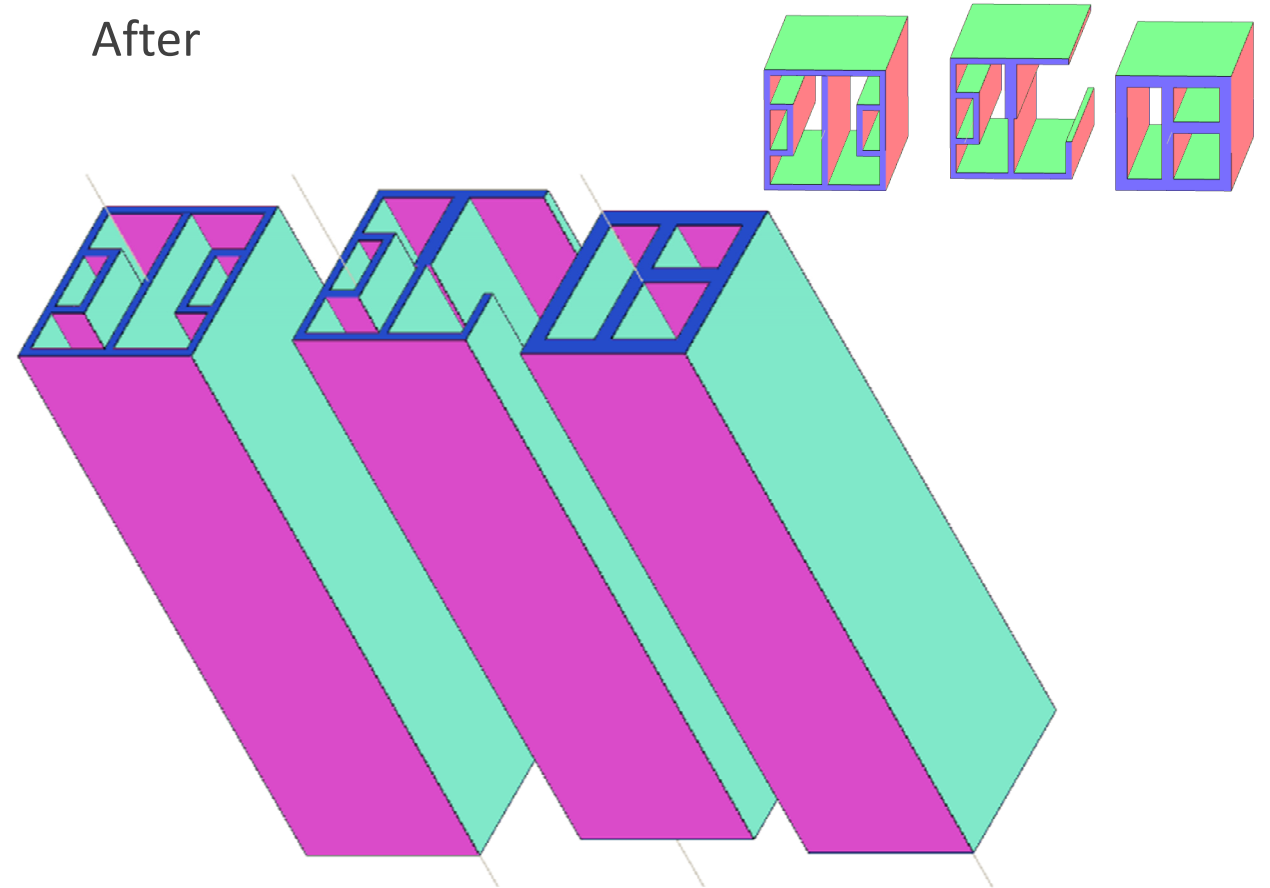
A PBMSECT/PBRSECT TUTORIAL

Goal: Create multiple arbitrary beam cross sections

Before



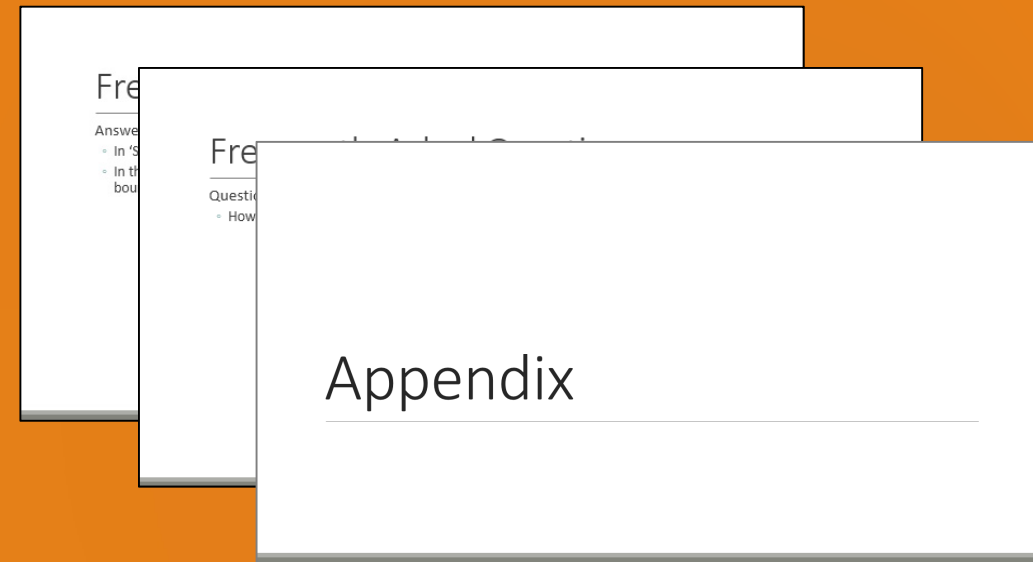
After



More Information Available in the Appendix

The Appendix includes information regarding the following:

- Avoid T Keyword and SET1 Conflicts



Contact me

- Nastran SOL 200 training
- Nastran SOL 200 questions
- Structural or mechanical optimization questions
- Access to the SOL 200 Web App

christian@ the-engineering-lab.com

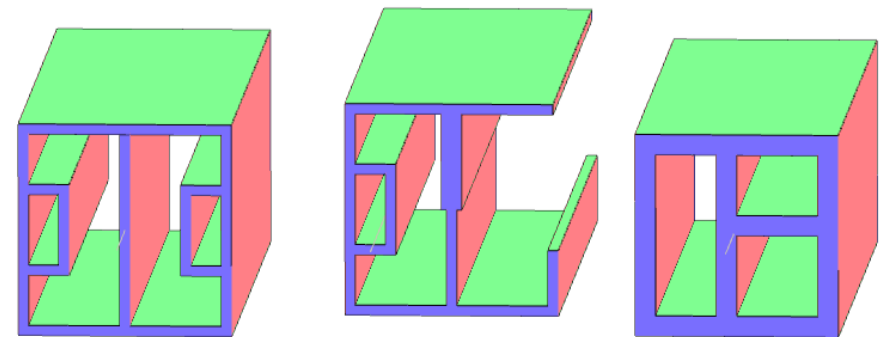
Tutorial

Tutorial Overview

1. Start with a .bdf or .dat file
2. Use the PBMSECT Web App to:
 - Create multiple arbitrary beam cross sections (ABCS)
 - Run MSC Nastran to confirm the ABCS is created properly
 - Download an updated BDF file
3. Use the Beams Viewer to view the updated beam elements with the newest ABCSs

Special Topics Covered

Closed Profile, Open Profile and General Section - MSC Nastran's PBMSECT and PBRSECT entries have a great level of flexibility to create various types of beam cross sections. This tutorial describes the procedure to create closed and open profile sections.



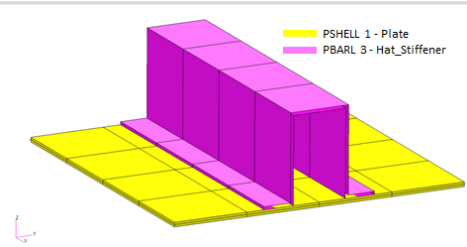
Closed Profile

Open Profile

General Section

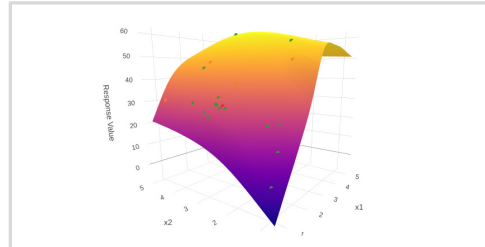
SOL 200 Web App Capabilities

Capabilities



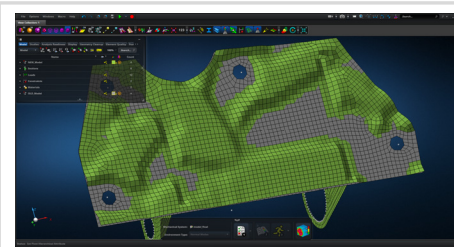
Web Apps for SOL 200

Pre/post for MSC Nastran SOL 200.
Support for size, topology,
topometry and topography.



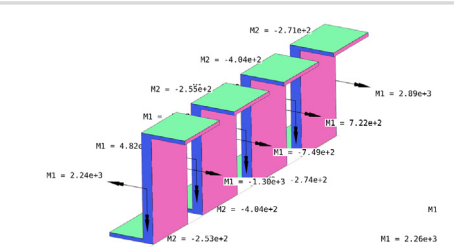
Machine Learning Web App

Bayesian Optimization for nonlinear
response optimization (SOL 400)



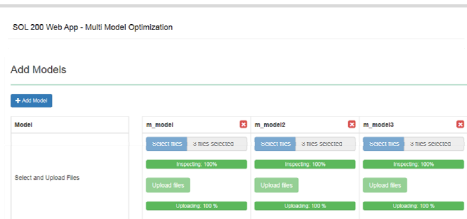
MSC Apex Post Processing Support

View the newly optimized model
after an optimization



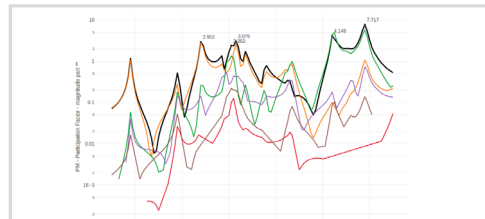
Beams Viewer Web App

Post process 1D element forces,
including shear forces, moments,
torque and axial forces



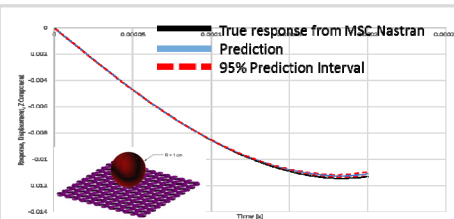
Multi-model Optimization Web App

Pre/post for multi model
optimization



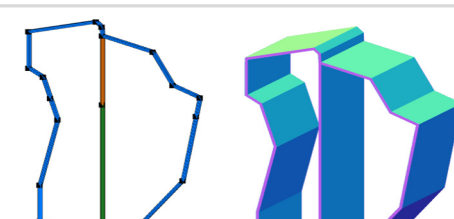
HDF5 Explorer Web App

Create XY plots using data from the
H5 file



Prediction Analysis Web App

Gaussian process regression to
predict output of MSC Nastran
without time consuming analyses



PBMSECT Web App

Generate PBMSECT and PBRSECT
entries graphically

Benefits

- 200+ error validations
(real time)
- Web browser accessible
- Automated creation of
entries (real time)
- Automatic post-
processing
- 50+ tutorials

Locating the Web Apps

Throughout this tutorial the following web apps will be used

- Beams Viewer
- PBMSECT web app

The following slides detail where to locate these web apps

Beams Viewer and PBMSECT Web App

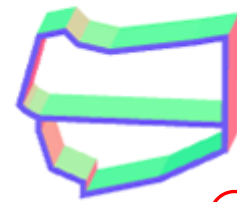
1. Navigate to the homepage
2. Click on the indicated link



Beams Viewer and PBMSECT Web App

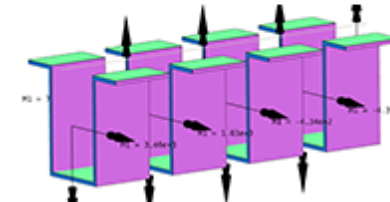
1. Click the icon titled Beams Viewer to open the Beams Viewer
2. Click the icon titled PBMSECT to open the PBMSECT web app

Beams



2

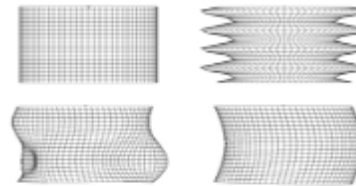
PBMSECT



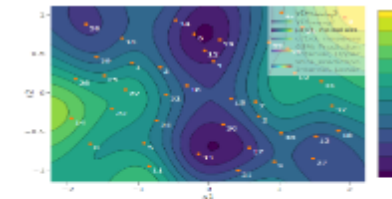
1

Beams Viewer

Machine Learning



Machine Learning

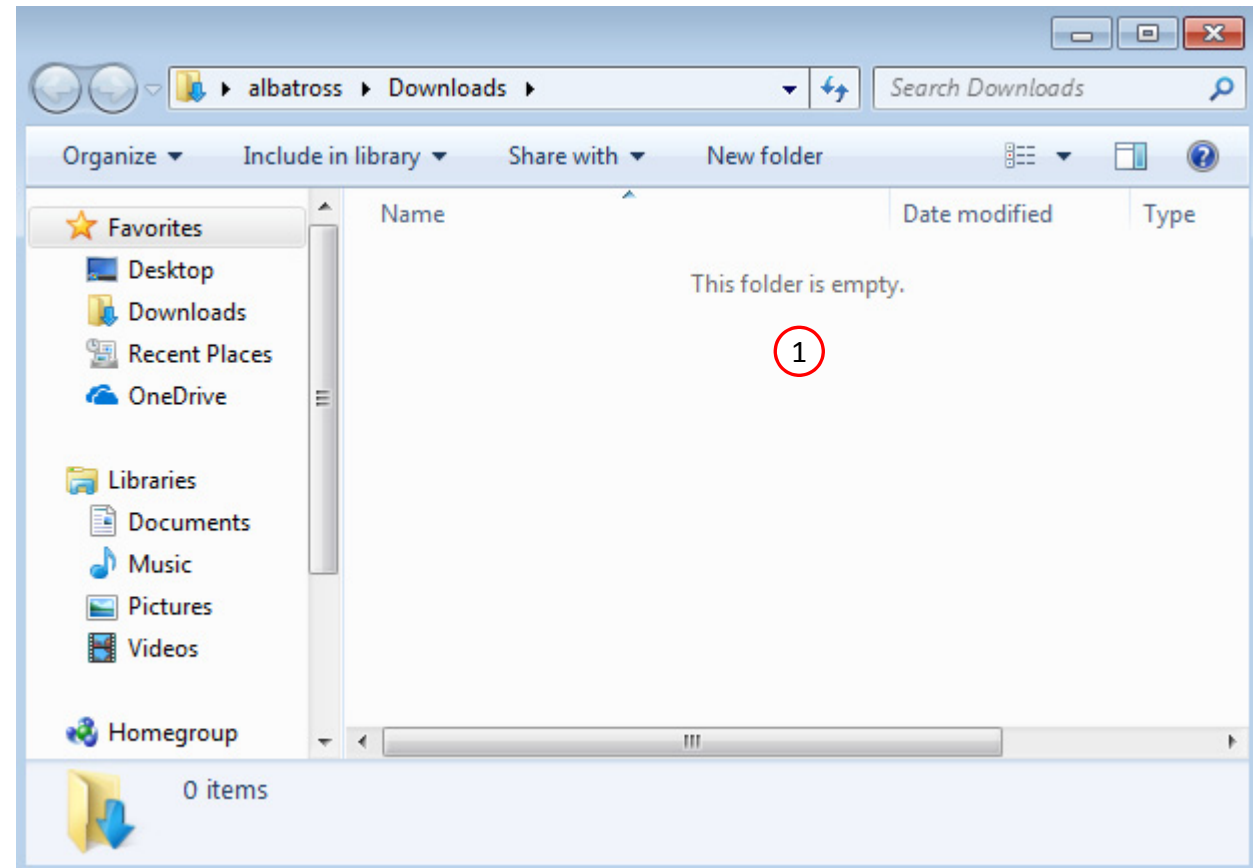


Prediction Analysis

Before Starting

1. Ensure the Downloads directory is empty in order to prevent confusion with other files

- Throughout this workshop, you will be working with multiple file types and directories such as:
 - .bdf/.dat
 - nastran_working_directory
 - .f06, .log, .pch, .h5, etc.
- To minimize confusion with files and folders, it is encouraged to start with a clean directory.



Go to the User's Guide

1. Click on the indicated link

- The necessary BDF files for this tutorial are available in the Tutorials section of the User's Guide.

The screenshot displays the SOL 200 Web App interface. At the top, it says "SOL 200 Web App" and "Select a web app to begin". Below this, there are five main categories of web apps, each with a representative image and a label:

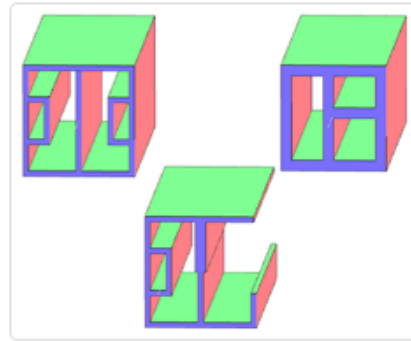
- Optimization for SOL 200**: Shows a 3D model of a mechanical part with "Before" and "After" states.
- Multi Model Optimization**: Shows a 3D model of a mechanical part with a graph of optimization results.
- Machine Learning | Parameter Study**: Shows four small plots representing different machine learning or parameter study results.
- HDF5 Explorer**: Shows a line graph with multiple data series.
- Remote Execution**: Shows a diagram of data flow between a "Remote System" and a "Local System", with "Input Files" and "Results Files" labels.

At the bottom center, there is a red-bordered button labeled "Tutorials and User's Guide" with a circled "1" next to it. Below this button, the text "Full list of web apps" is visible.

Obtain Starting Files

1. Find the indicated example
2. Click Link
3. The starting file has been downloaded

- When starting the procedure, all the necessary BDF files must be collected together.



1

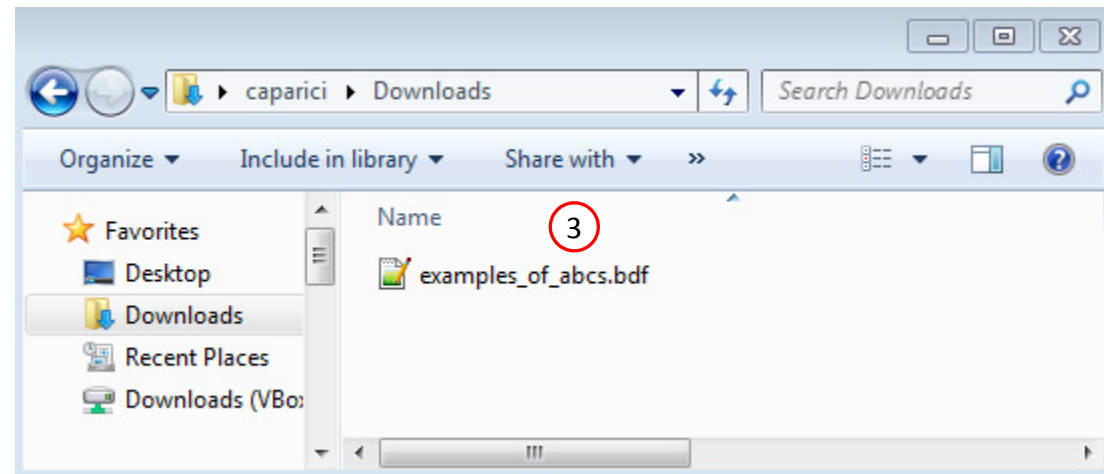
Examples of arbitrary beam cross sections with PBMSECT and PBRSECT

This tutorial describes the procedure to generate different types of arbitrary beam cross sections, including open or closed profiles.

Starting BDF Files: [Link](#)

2

Solution BDF Files: [Link](#)



PBMSECT Web App

The PBMSECT web app will be used to define an arbitrary beam cross section by defining a PBMSECT, POINT and SET1 entries

1. Open the PBMSECT web app
2. Click Select files
3. Select examples_of_abcs.bdf
4. Click Open
5. Click Upload files

- The selected BDF file was created by a separate pre processor. The PBMSECT Web App only generates the following entries: PBMSECT, PBRSECT, POINT and SET1.

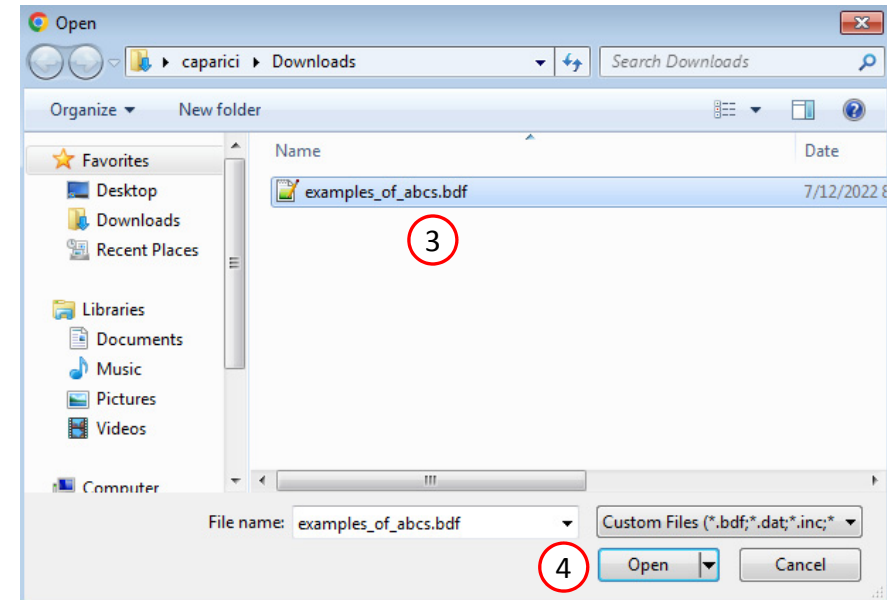
Select BDF Files

- 2 1. Select files examples_of_abcs.bdf

Inspecting: 100%

- 5 2. Upload files

Uploading: 100 %



Cross Section 1

Create a New PBMSECT Entry

1. Click Create New Entry
2. Configure the Cross Section Options follows:
 - Entry: PBRSECT
 - PID: 8
 - MID: 1, MAT1
 - FORM: CP Closed Profile

Existing PBMSECT/PBRSECT Entries

Select a PBMSECT/PBRSECT ID to edit

8

+ Create New Entry

✕ Delete Selected Entry

1

Cross Section Options

Entry	PBRSECT
PID	8
MID	1, MAT1
FORM	CP Closed Profile
CORE	No - Do not use CORE
NSM	

2

Points

1. Click Create Points (The button should be blue)
2. Adjust the Grid Helper as follows
 1. Width and Height: 20
 2. Number of Divisions: 10
3. Click on the points on the Grid Helper to create 15 white points approximately in the same locations as shown in the image.

Points

Actions

1

☒ Create Points

☐ Create Points on Line

☐ Remove Points

Settings - Grid Helper

2

Width and Height

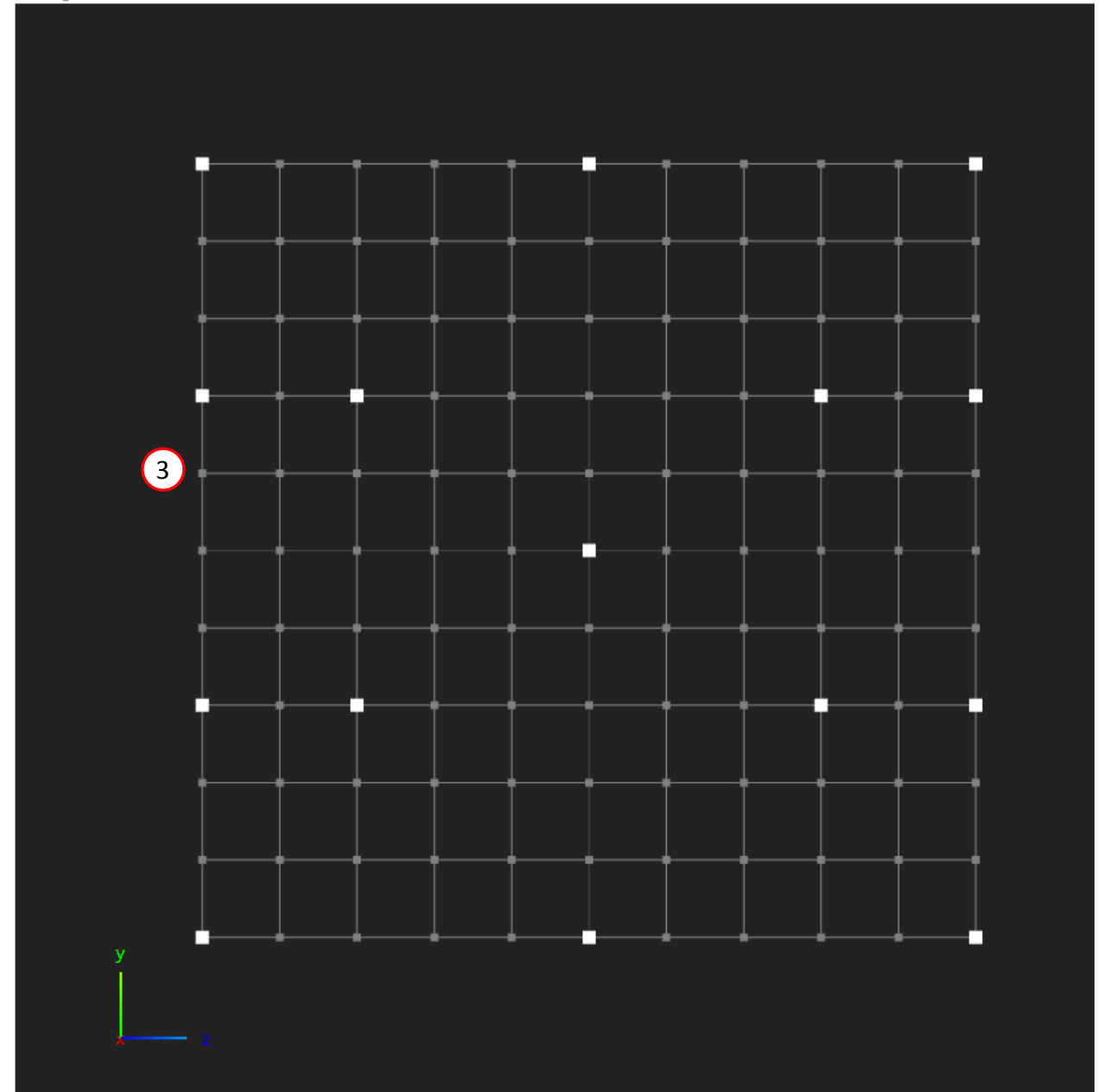
20

Number of Divisions

10

Max allowable divisions: 50

Editing PBRSECT 8



Lines

1. Click Create Lines
2. Click on 2 points to create one line
3. Repeat the process to create a total of 18 lines


Lines


Actions

1

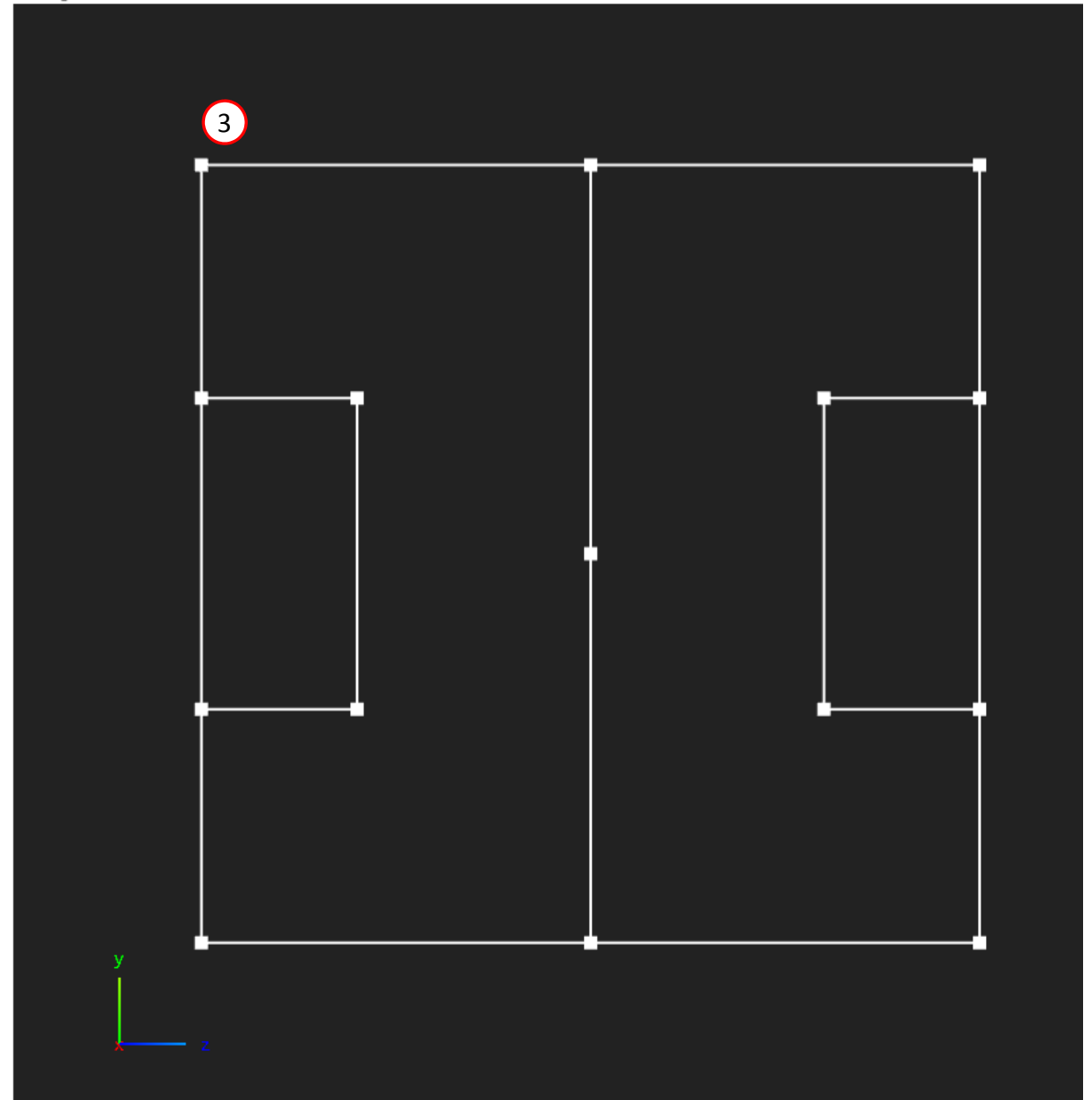
— Create Lines

✕ Remove Lines

 Select Lines of Outer Perimeter

 Deselect Lines of Outer Perimeter

Editing PBRSECT 8



Outer Perimeter

On this slide, the outer perimeter is defined, which corresponds to the OUTP keyword on the PBRSECT entry

1. Click Select Lines of Outer Perimeter
2. Click on the indicated lines to select the lines as part of the Outer Perimeter. Successful selection is indicated by a blue color.

IMPORTANT!

Defining the outer perimeter is the most critical step in defining the PBMSECT/PBRSECT entry. Constantly inspect the outer perimeter. Only one continuous outer perimeters is valid.

Lines

Actions

1




— Create Lines

✕ Remove Lines

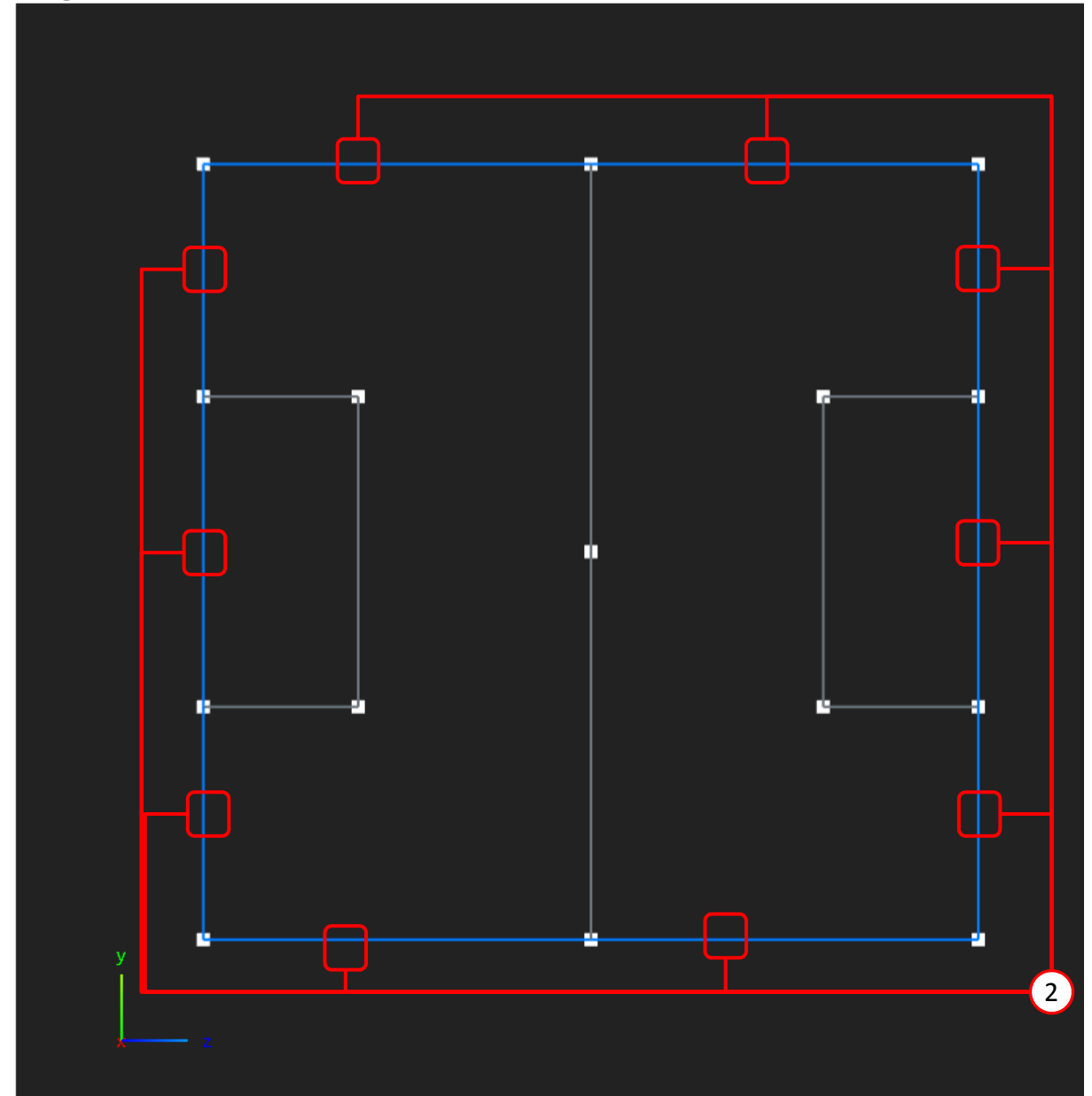
Select Lines of Outer Perimeter

⌵ Deselect Lines of Outer Perimeter

Legend

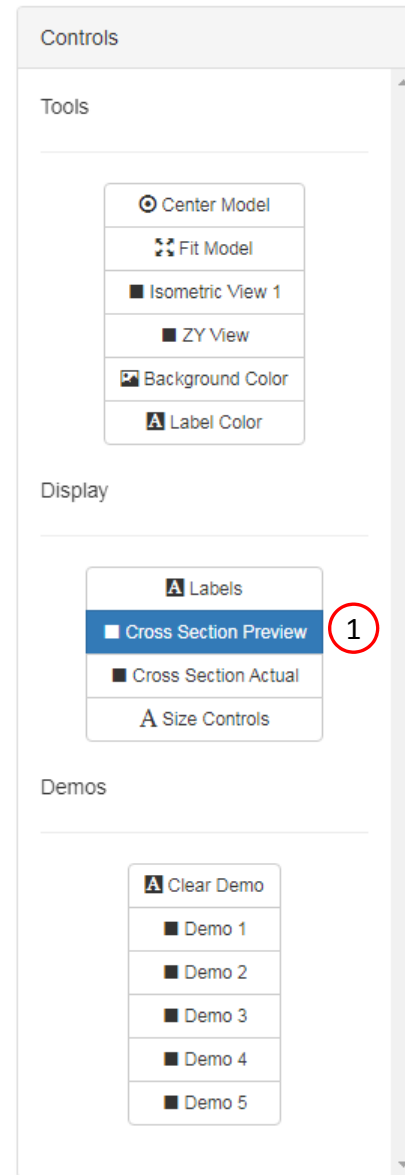
Color	Description
	Outer Perimeter (OUTP)
	Possible lines for OUTP
	Critical Points

Editing PBRSECT 8

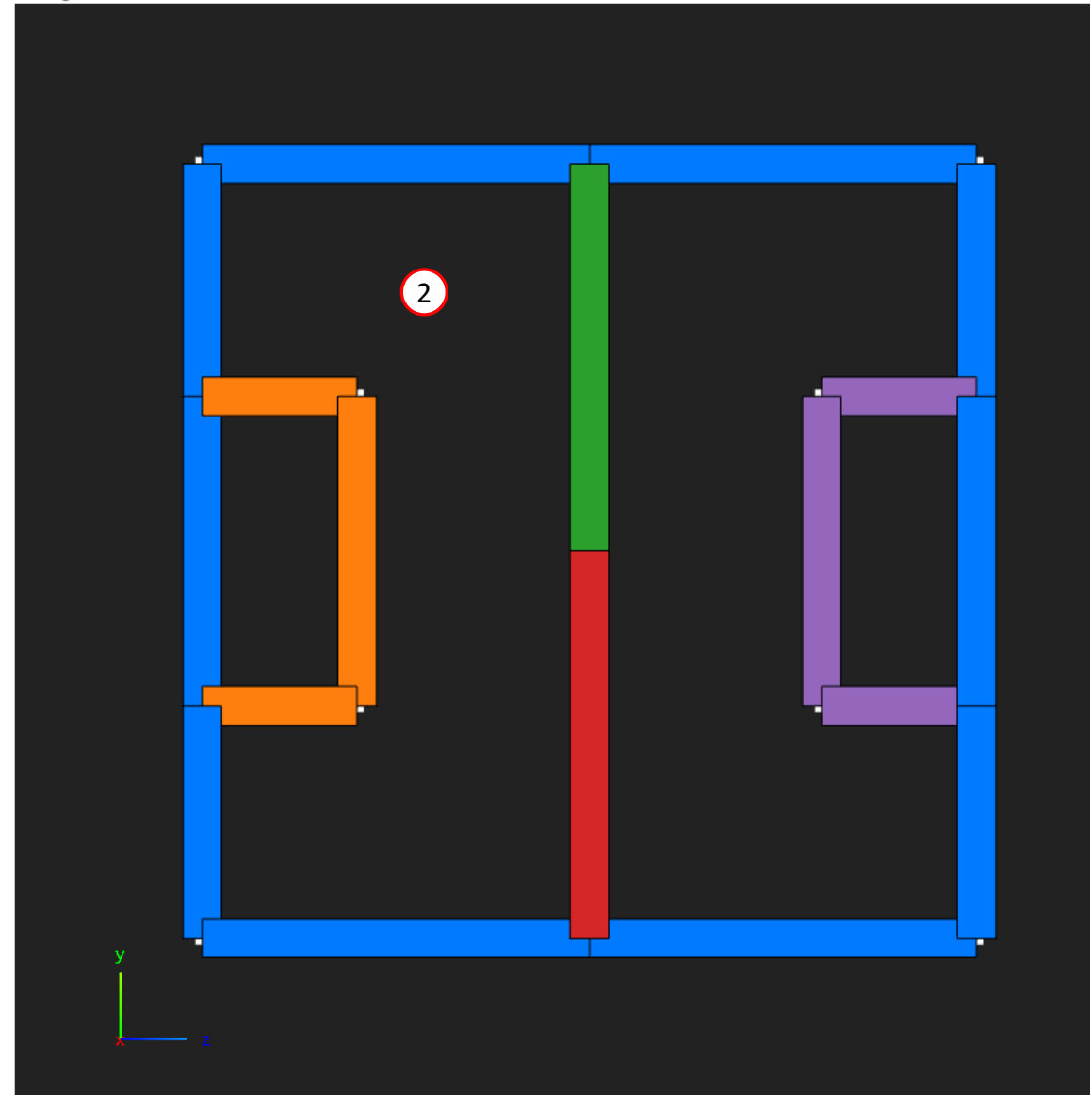


Cross Section Preview

1. Click Cross Section Preview
2. A preview of the arbitrary beam cross section is displayed



Editing PBRSECT 8



Run MSC Nastran to Generate the Cross Section

The following requires MSC Nastran to be installed on the same machine as the SOL 200 Web App.

1. The respective entries that define the arbitrary beam cross section are displayed
2. Click Run MSC Nastran
 - The web app will run MSC Nastran in the background and determine the cross section generated by MSC Nastran. This MSC Nastran run should take no more than 10 seconds. MSC Nastran must be installed on the machine as the SOL 200 Web App.
3. If the run is successful, the MSC Nastran generated cross section is displayed
4. Inspect the F06 file to inspect the result of the run
5. The test BDF file used for this test run may be downloaded by clicking Download Test BDF File

Run MSC Nastran and Bulk Data Entries

5

Download Test BDF File

Run MSC Nastran

2

Complete

Corresponding Bulk Data Entries

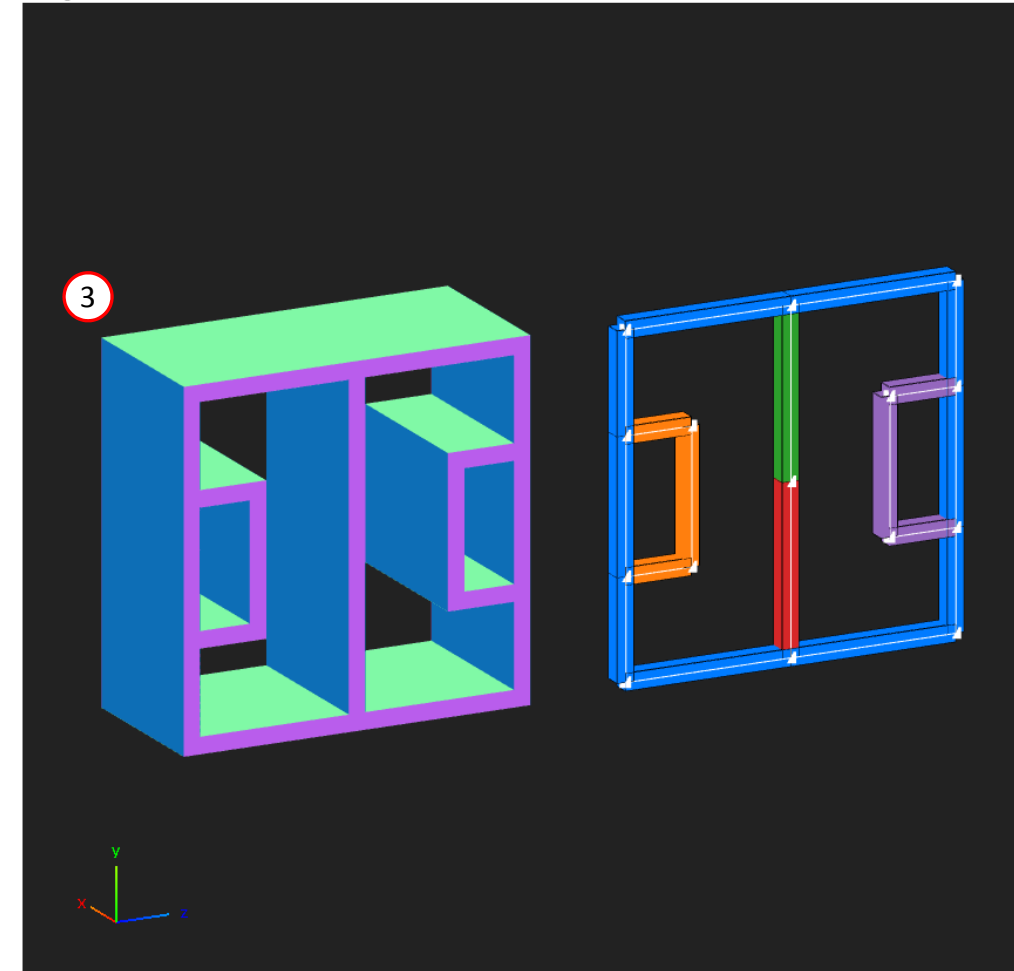
```
$ 1 || 2 || 3 || 4 || 5 || 6 || 7 || 8 || 9 || 10 ||
PBRSECT 8      1      CP
      OUTP=801,BRP(1)=802,BRP(2)=803,BRP(3)=804,BRP(4)=805,T=1.0
POINT 8000001      0.0      10.
POINT 8000002     -10.      10.
POINT 8000003     -10.       4.
POINT 8000004     -10.     -4.
POINT 8000005     -10.    -10.
POINT 8000006       0.0    -10.
POINT 8000007       10.    -10.
POINT 8000008       10.     -4.
POINT 8000009       10.       4.
POINT 8000010       10.      10.
POINT 8000011      -6.       4.
POINT 8000012      -6.     -4.
POINT 8000013       0.0       0.
POINT 8000014       6.       4.
POINT 8000015       6.     -4.
SET1 801 8000001 8000002 8000003 8000004 8000005 8000006 8000007
      8000008 8000009 8000010
SET1 802 8000003 8000011 8000012 8000004
SET1 803 8000001 8000013
SET1 804 8000013 8000006
SET1 805 8000009 8000014 8000015 8000008
```

F06

```
Command executed: /msc/MSC_Nastran/2022.1/bin/msc20221 nastran ./tmp/854e82ee40045805a441ff1e2
1
Warning: This computer program is protected by copyright law and interna
Unauthorized use, reproduction or distribution of this computer program, or
result in severe civil and criminal penalties.
Copyright (C) 2022 Hexagon AB and/or its subsidiaries. All rights res

*****
*****
**
**
Hexagon AB
**
```

Editing PBRSECT 8



Run MSC Nastran to Generate the Cross Section

1. If the MSC Nastran run was a success, an equivalent PBAR entry is generated and listed in the F06 file. This PBAR entry displays cross section information such as the cross sectional area and moments of inertia.
 - If a PBRSECT entry is created, a PBAR entry is generated.
 - If a PBMSECT is created with the CORE keyword, which is used for a composite section, a PBEAM3 entry is generated.
 - If a regular PBMSECT entry is created, a PBEAM entry is generated.

```

***
*** USER INFORMATION MESSAGE 4379 (IFP9A)
    THE USER SUPPLIED PBARL/PBRSECT BULK DATA ENTRIES ARE REPLACED BY THE FOLLOWING PBAR ENTR
    CONVERSION METHOD FOR PBARL/PBEAML - FINITE ELEMENT METHOD.
PBAR      8      1  1.2900E+02  6.2328E+03  6.7748E+03  8.3118E+03  0.0000E+00
          1.0500E+01  1.0500E+01  4.0000E+00 -1.0500E+01 -1.0500E+01 -1.0500E+01 -1.0500E+01
          5.1710E-01  2.0901E-01  0.0000E+00
  
```

1

PBAR

Simple Beam Property

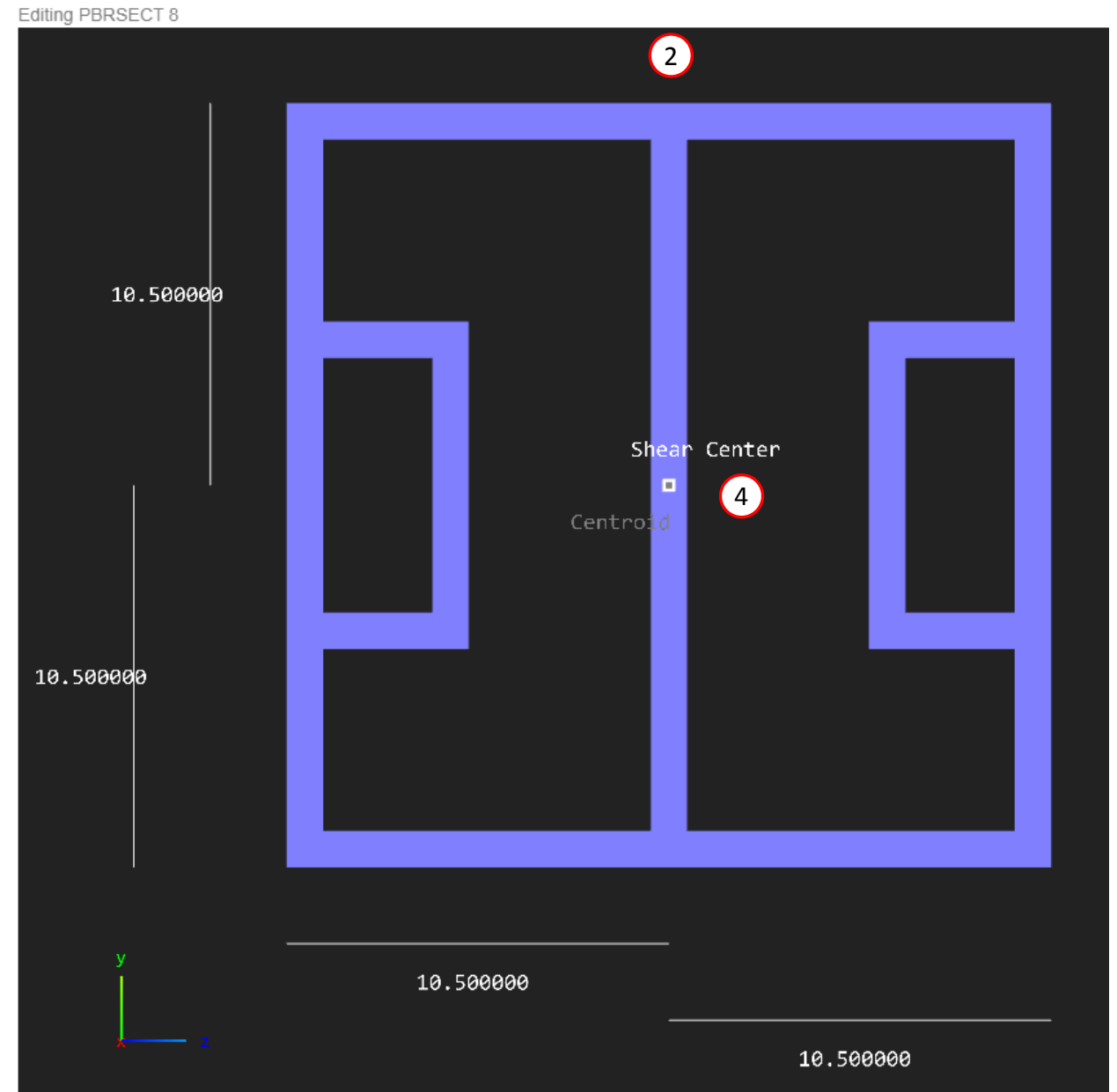
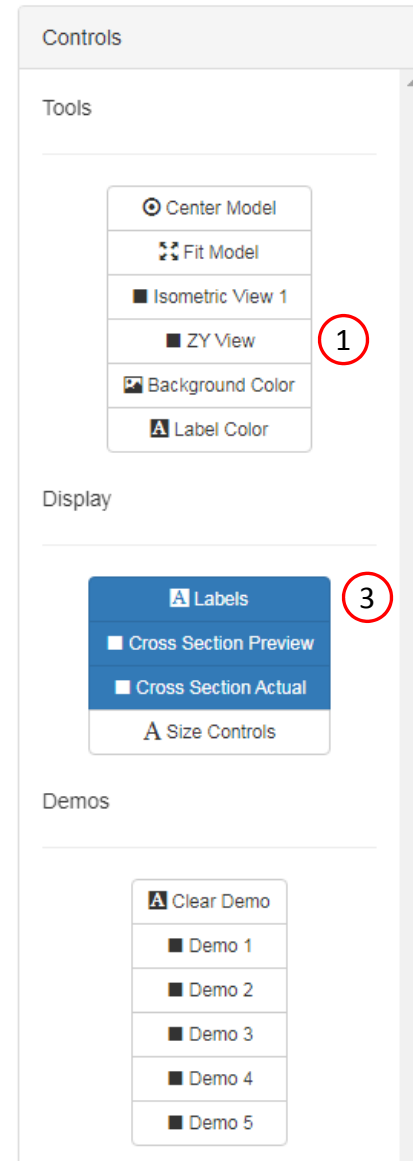
Defines the properties of a simple beam element (CBAR entry).

Format:

1	2	3	4	5	6	7	8	9	10
PBAR	PID	MID	A	I1	I2	J	NSM		
	C1	C2	D1	D2	E1	E2	F1	F2	
	K1	K2	I12						

Cross Section Preview

1. Click ZY View
2. Zoom in and center the cross section generated by MSC Nastran
3. Click Labels
4. Note the following:
 - Since the cross section is symmetric, the shear center and centroid coincide
 - CBAR elements are limited to cross sections that have coinciding shear center and centroid, so it is recommended that the arbitrary beam cross section, through the use of the PBRSECT entry, should be symmetric.



Cross Section 2

Create a New PBMSECT Entry

1. Click Create New Entry
2. Configure the Cross Section Options follows:
 - Entry: PBMSECT
 - PID: 9
 - MID: 1, MAT1
 - FORM: OP Open Profile
 - CORE: No – Do not use CORE
 - NSM: Blank

Existing PBMSECT/PBRSECT Entries

Select a PBMSECT/PBRSECT ID to edit

+ Create New Entry

✕ Delete Selected Entry

1

Cross Section Options

Entry	<input type="text" value="PBMSECT"/>
PID	<input type="text" value="9"/>
MID	<input type="text" value="1, MAT1"/>
FORM	<input type="text" value="OP Open Profile"/>
CORE	<input type="text" value="No - Do not use CORE"/>
NSM	<input type="text"/>

2

Points

1. Click Create Points (The button should be blue)
2. Adjust the Grid Helper as follows
 1. Width and Height: 20
 2. Number of Divisions: 10
3. Click on the points on the Grid Helper to create 12 white points approximately in the same locations as shown in the image.

Points

Actions

1

☒ Create Points

☐ Create Points on Line

☐ Remove Points

Settings - Grid Helper

2

Width and Height

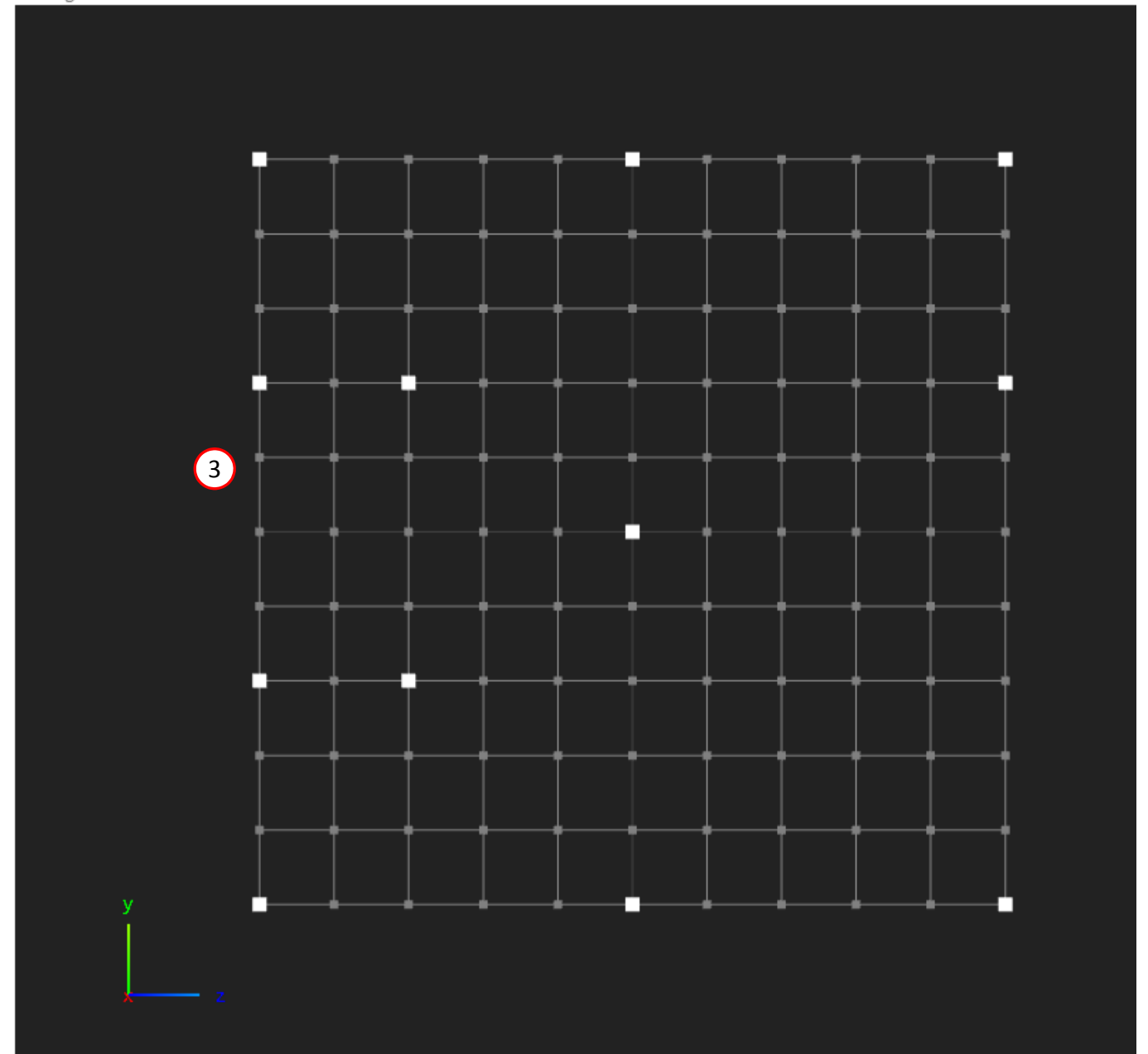
20

Number of Divisions

10

Max allowable divisions: 50

Editing PBMSECT 9



Lines

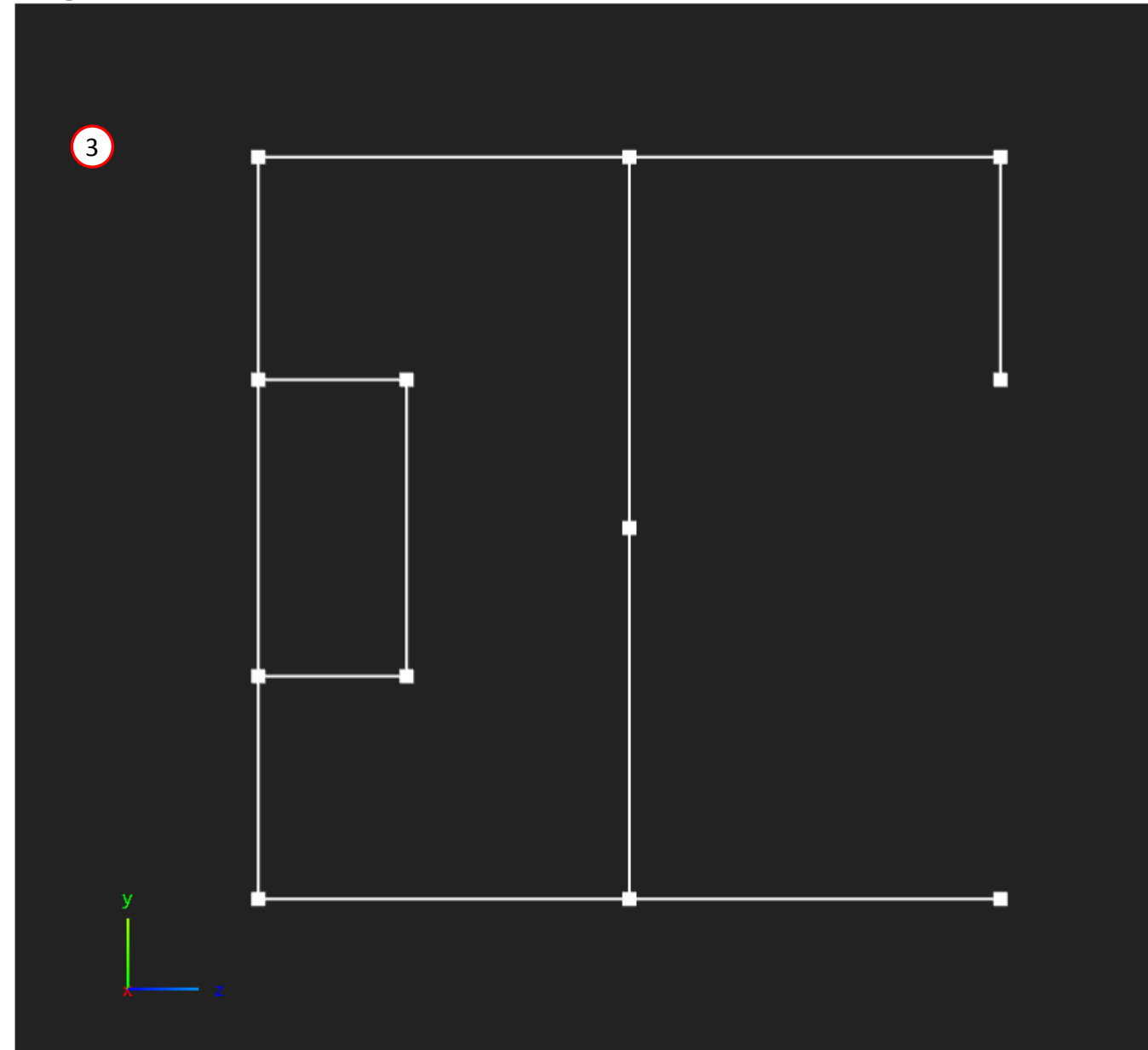
1. Click Create Lines
2. Click on 2 points to create one line
3. Repeat the process to create a total of 13 lines

Lines

Actions

- 1
- Create Lines
 - ✕ Remove Lines
 - ☞ Select Lines of Outer Perimeter
 - ☞ Deselect Lines of Outer Perimeter

Editing PBMSECT 9



Outer Perimeter

On this slide, the outer perimeter is defined, which corresponds to the OUTP keyword on the PBMSECT entry

1. Click Select Lines of Outer Perimeter
2. Click on the indicated lines to select the lines as part of the Outer Perimeter. Successful selection is indicated by a blue color.

When constructing open profile cross sections, one guideline is to ensure the outer perimeter goes through the critical points.

IMPORTANT!

Defining the outer perimeter is the most critical step in defining the PBMSECT/PBRSECT entry. Constantly inspect the outer perimeter. Only one continuous outer perimeters is valid.




Lines

Actions

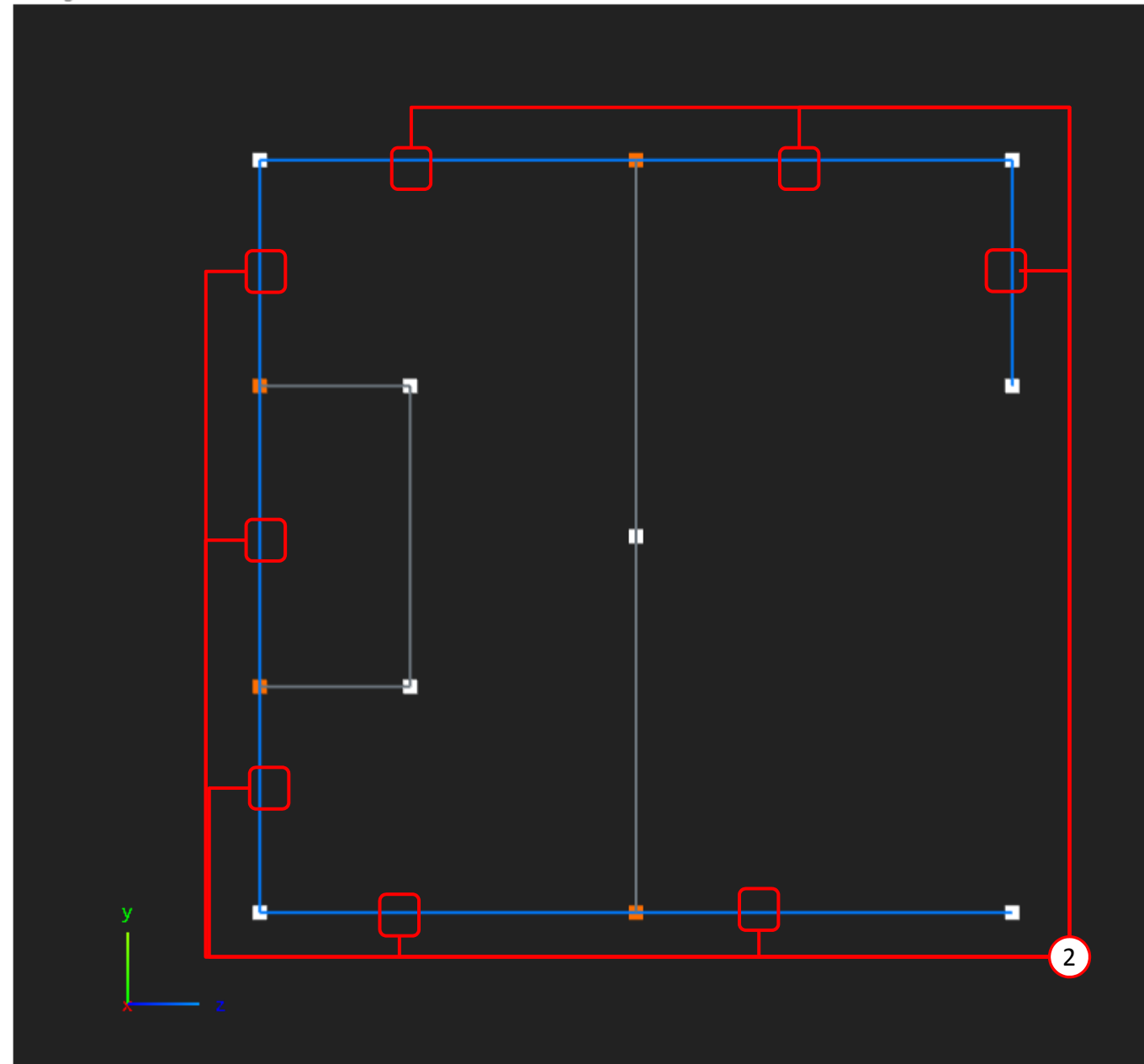
1

- Create Lines
- ✕ Remove Lines
- Select Lines of Outer Perimeter**
- Deselect Lines of Outer Perimeter

Legend

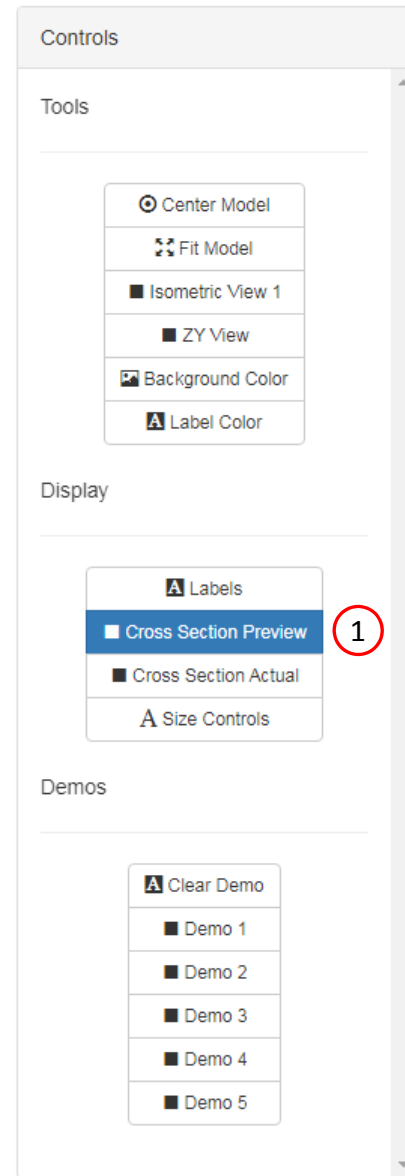
Color	Description
	Outer Perimeter (OUTP)
	Possible lines for OUTP
	Critical Points

Editing PBMSECT 9

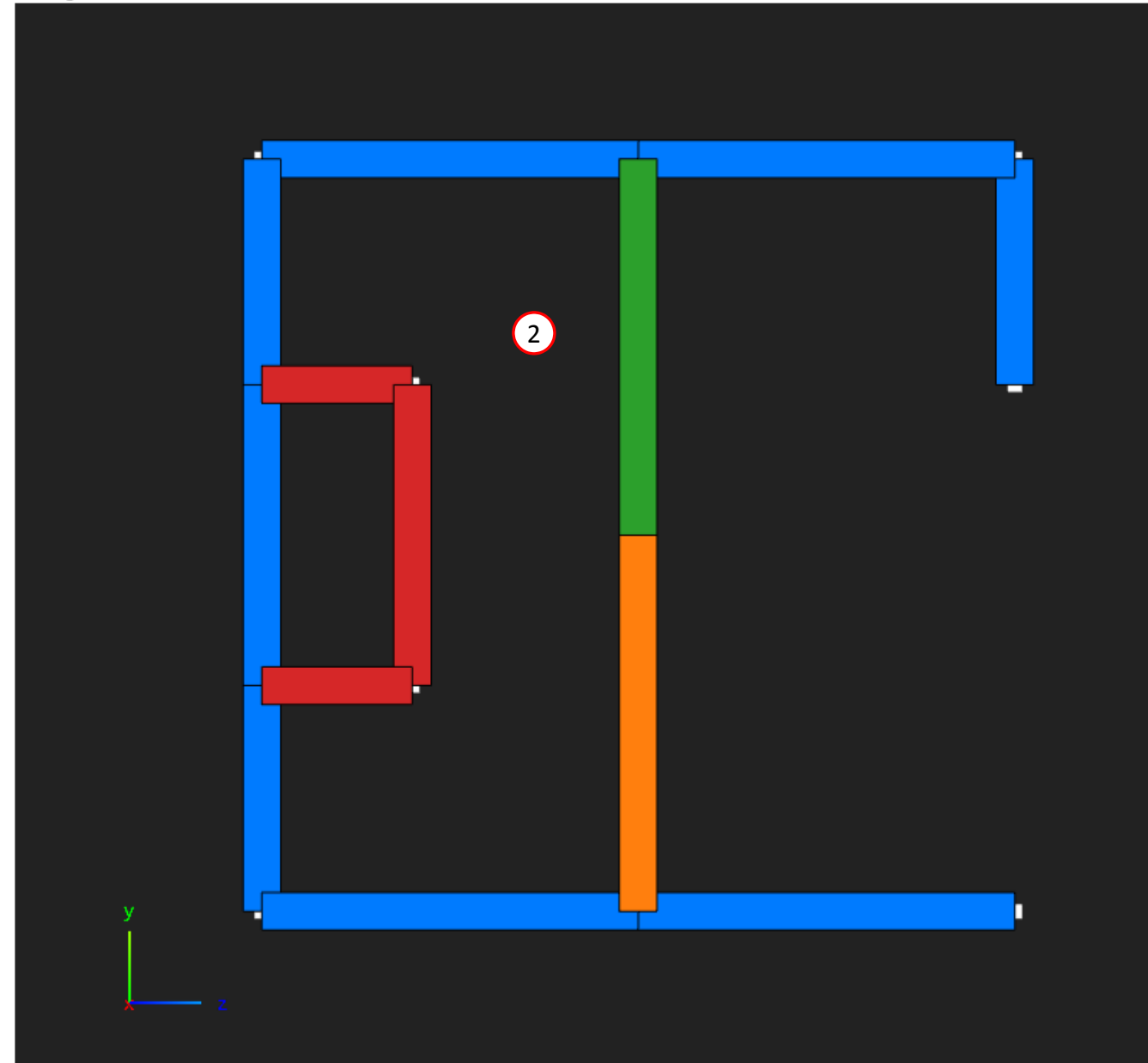


Cross Section Preview

1. Click Cross Section Preview
2. A preview of the arbitrary beam cross section is displayed



Editing PBMSECT 9



Cross Section Preview

1. Set the default thickness for all the line segments to 1.0
2. Set the thickness to one of the BRP line segments to 2.0
3. The preview is updated with the latest thickness values

Lines

Actions

- Create Lines
- ✕ Remove Lines
- Select Lines of Outer Perimeter
- Deselect Lines of Outer Perimeter

Status:

Legend

Color	Description
	Outer Perimeter (OUTP)
	Possible lines for OUTP
	Critical Points

Adjustments

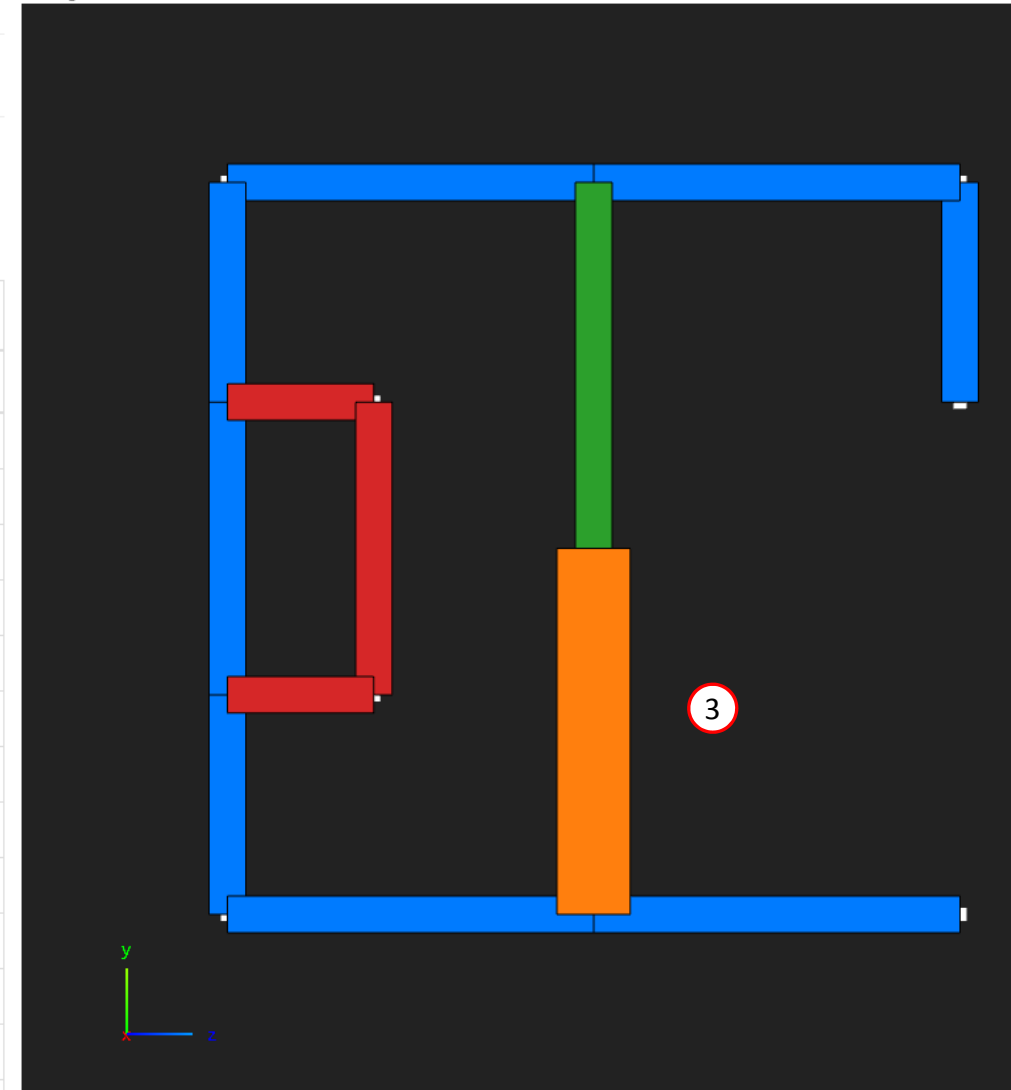
Default Thickness

1.0

Line Segments

Line ID	Type	Thickness
1	OUTP	
2	OUTP	
3	OUTP	
4	OUTP	
5	OUTP	
6	OUTP	
7	OUTP	
8	OUTP	
9	BRP 1	2.0
10	BRP 2	
11	BRP 3	
12	BRP 3	
13	BRP 3	

Editing PBMSECT 9



Run MSC Nastran to Generate the Cross Section

The following requires MSC Nastran to be installed on the same machine as the SOL 200 Web App.

1. The respective entries that define the arbitrary beam cross section are displayed
2. Click Run MSC Nastran
 - The web app will run MSC Nastran in the background and determine the cross section generated by MSC Nastran. This MSC Nastran run should take no more than 10 seconds. MSC Nastran must be installed on the machine as the SOL 200 Web App.
3. If the run is successful, the MSC Nastran generated cross section is displayed
4. Inspect the F06 file to inspect the result of the run
5. The test BDF file used for this test run may be downloaded by clicking Download Test BDF File

Run MSC Nastran and Bulk Data Entries

5

Download Test BDF File

Run MSC Nastran

2

Complete

Corresponding Bulk Data Entries

```

$ 1 || 2 || 3 || 4 || 5 || 6 || 7 || 8 || 9 || 10 ||
PBMSECT 9      1      OP
OUTP=901,BRP(1)=902,BRP(2)=903,BRP(3)=904,T=1.0,T(1)=[2.,PT=(900
0008,9000010)]
POINT 9000001      10.      4.
POINT 9000002      10.      10.
POINT 9000003      0.0      10.
POINT 9000004      -10.      10.
POINT 9000005      -10.      4.
POINT 9000006      -10.      -4.
POINT 9000007      -10.      -10.
POINT 9000008      0.0      -10.
POINT 9000009      10.      -10.
POINT 9000010      0.0      0.0
POINT 9000011      -6.      4.
POINT 9000012      -6.      -4.
SET1 901 9000001 9000002 9000003 9000004 9000005 9000006 9000007
9000008 9000009
SET1 902 9000008 9000010
SET1 903 9000010 9000003
SET1 904 9000005 9000011 9000012 9000006
  
```

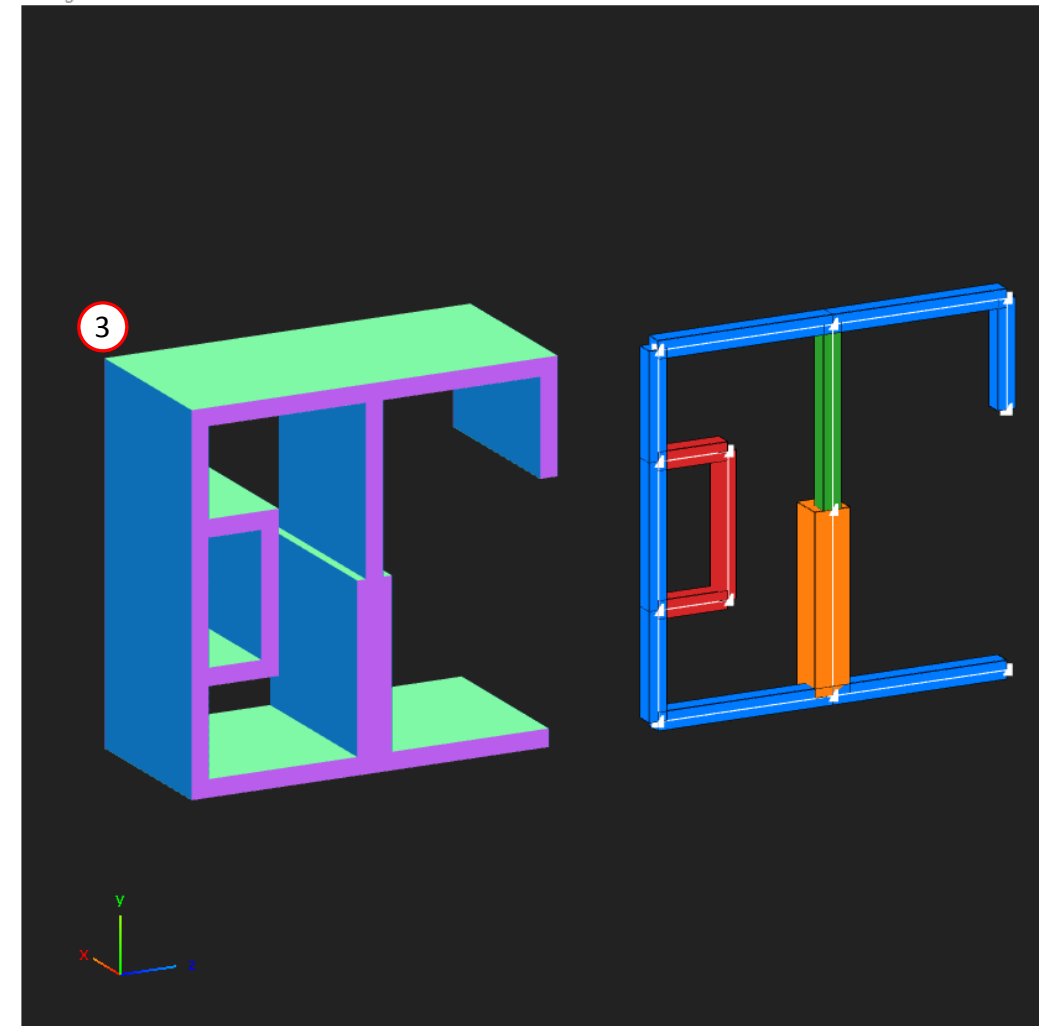
F06

```

Command executed: /msc/MSC_Nastran/2022.1/bin/msc20221 nastran ./tmp/854e82ee40045005a441ff1e2
1
Warning: This computer program is protected by copyright law and interna
Unauthorized use, reproduction or distribution of this computer program, or
result in severe civil and criminal penalties.
Copyright (C) 2022 Hexagon AB and/or its subsidiaries. All rights res

*****
*****
**
**
Hexagon AB
  
```

Editing PBMSECT 9



Run MSC Nastran to Generate the Cross Section

1. If the MSC Nastran run was a success, an equivalent PBEAM entry is generated and listed in the F06 file. This PBEAM entry displays cross section information such as the cross sectional area and moments of inertia.
 - If a PBRSECT entry is created, a PBAR entry is generated.
 - If a PBMSECT is created with the CORE keyword, which is used for a composite section, a PBEAM3 entry is generated.
 - If a regular PBMSECT entry is created, a PBEAM entry is generated.

```

*** USER INFORMATION MESSAGE 4379 (IFP9A)
      THE USER SUPPLIED PBEAML/PBMSECT BULK DATA ENTRIES ARE REPLACED BY THE FOLLOWING PBEAM ENTRIES
      CONVERSION METHOD FOR PBARL/PBEAML - FINITE ELEMENT METHOD.
PBEAM      9      1  1.0950E+02  6.0040E+03  4.1280E+03  4.1587E+02  3.0625E+03  0.0000E+00
      7.2773E+00  1.6693E+01  1.7773E+00  1.7693E+01 -1.2723E+01  1.7193E+01 -1.1723E+01  1.0000E+00
      3.7010E-01  2.4948E-01  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  1.6612E+05  1.0000E+00
      0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00 -2.2501E+00  4.9818E+00 -2.2501E+00  4.0000E+00
  
```

PBEAM

Beam Property

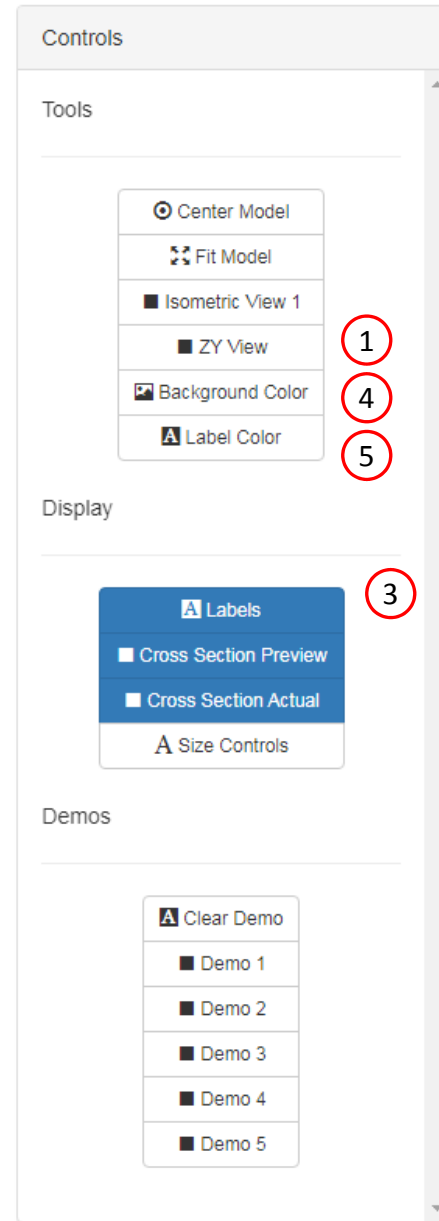
Defines the properties of a beam element (CBEAM entry). This element may be used to model tapered beams.

Format:

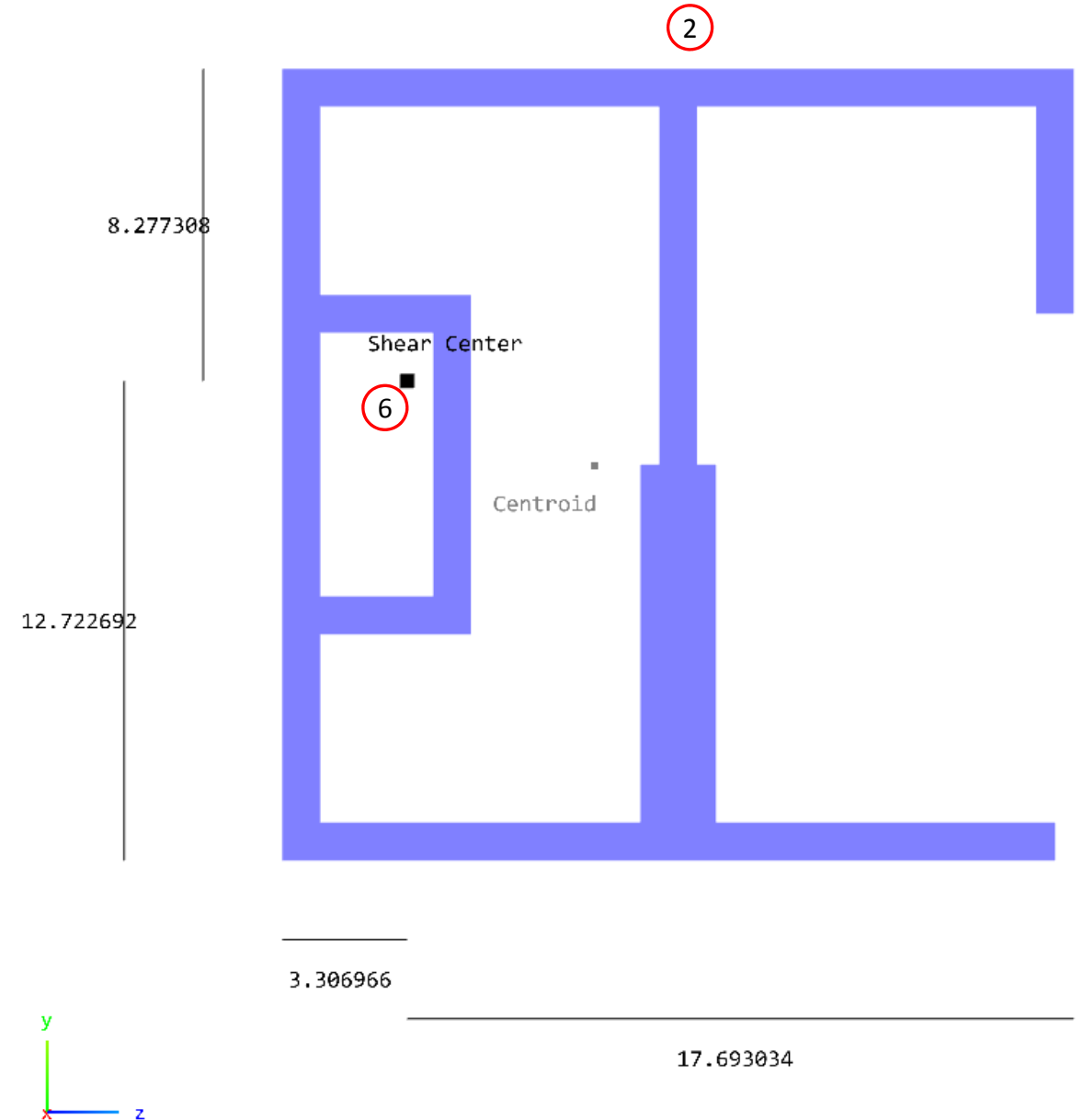
1	2	3	4	5	6	7	8	9	10
PBEAM	PID	MID	A(A)	I1(A)	I2(A)	I12(A)	J(A)	NSM(A)	
	C1 (A)	C2 (A)	D1 (A)	D2 (A)	E1 (A)	E2 (A)	F1 (A)	F2 (A)	

Cross Section Preview

1. Click ZY View
2. Zoom in and center the cross section generated by MSC Nastran
3. Click Labels
4. Click Background Color to change the background to a white color
5. Click Label Color multiple times to change the font color to your liking
6. Note the following:
 - Since the cross section is unsymmetric, the shear center and centroid do not coincide
 - CBEAM elements support cross sections that do not have coinciding shear center and centroid

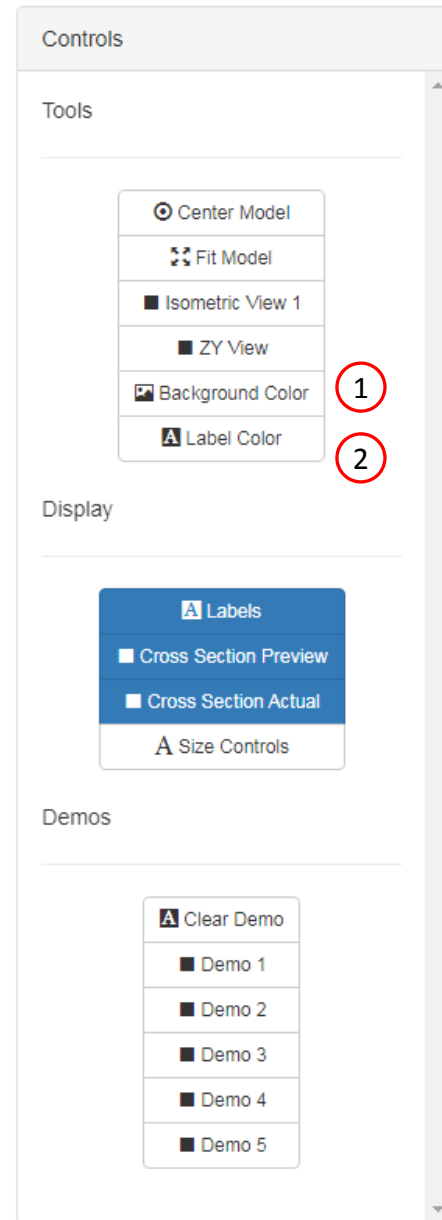


Editing PBMSECT 9

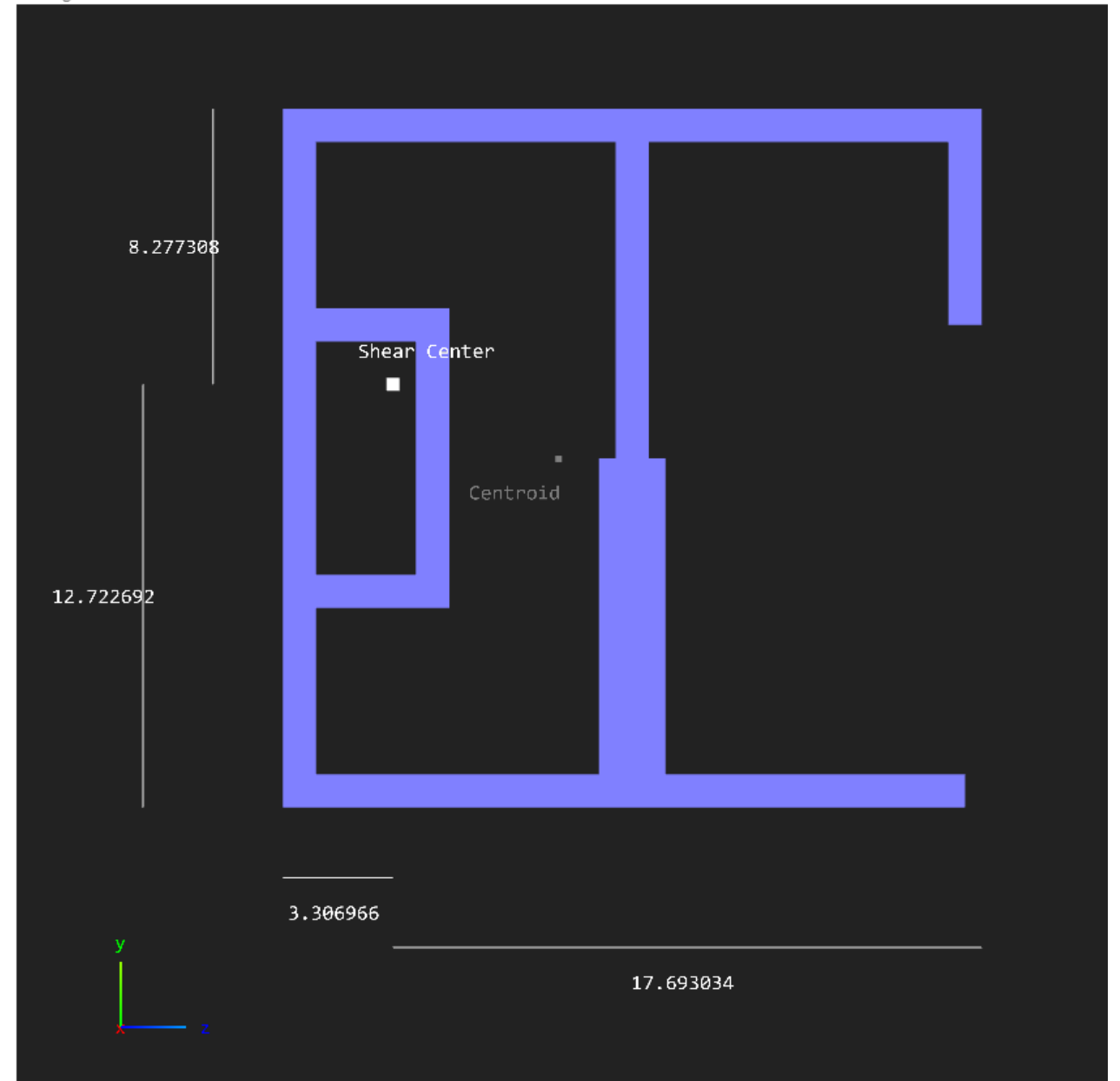


Cross Section Preview

1. Click Background Color to change the background to a black color
2. Click Label Color multiple times to change the font color to your liking



Editing PBMSECT 9



Cross Section 3

Create a New PBMSECT Entry

1. Click Create New Entry
2. Configure the Cross Section Options follows:
 - Entry: PBMSECT
 - PID: 10
 - MID: 1, MAT1
 - FORM: GS General Section
 - CORE: No – Do not use CORE
 - NSM: Blank

Existing PBMSECT/PBRSECT Entries

Select a PBMSECT/PBRSECT ID to edit

10

+ Create New Entry

✕ Delete Selected Entry

1

Cross Section Options

Entry PBMSECT

PID 10

MID 1, MAT1

FORM GS General Section

CORE No - Do not use CORE

NSM

2

Points

1. Click Create Points (The button should be blue)
2. Adjust the Grid Helper as follows
 1. Width and Height: 20
 2. Number of Divisions: 10
3. Click on the points on the Grid Helper to create 16 white points approximately in the same locations as shown in the image.

Points

Actions

1

- ☒ Create Points
- ☐ Create Points on Line
- ☐ Remove Points

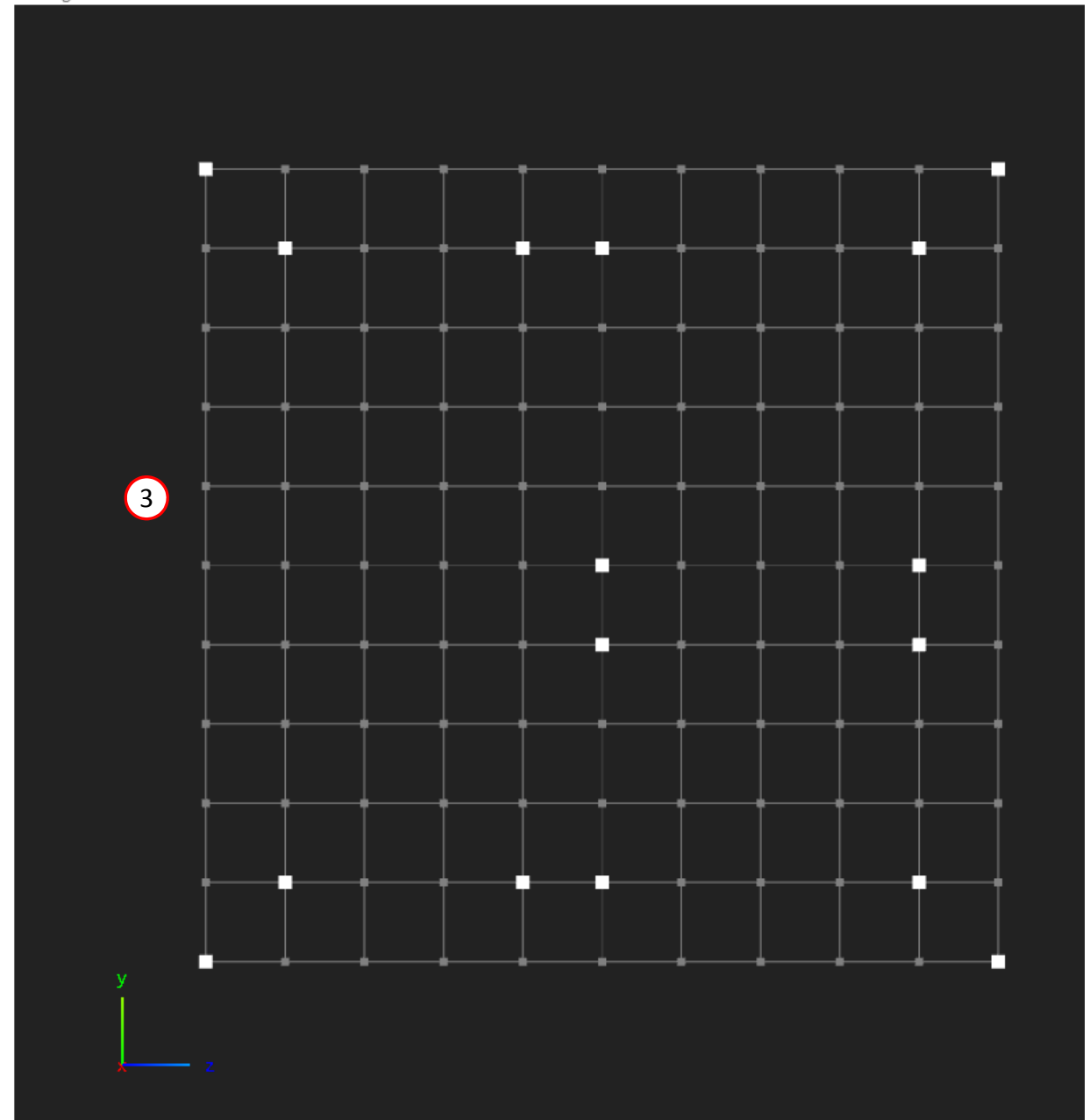
Settings - Grid Helper

2

Width and Height	<input type="text" value="20"/>
Number of Divisions	<input type="text" value="10"/>

Max allowable divisions: 50

Editing PBMSECT 10



Lines

1. Click Create Lines
2. Click on 2 points to create one line
3. Repeat the process to create a total of 16 lines

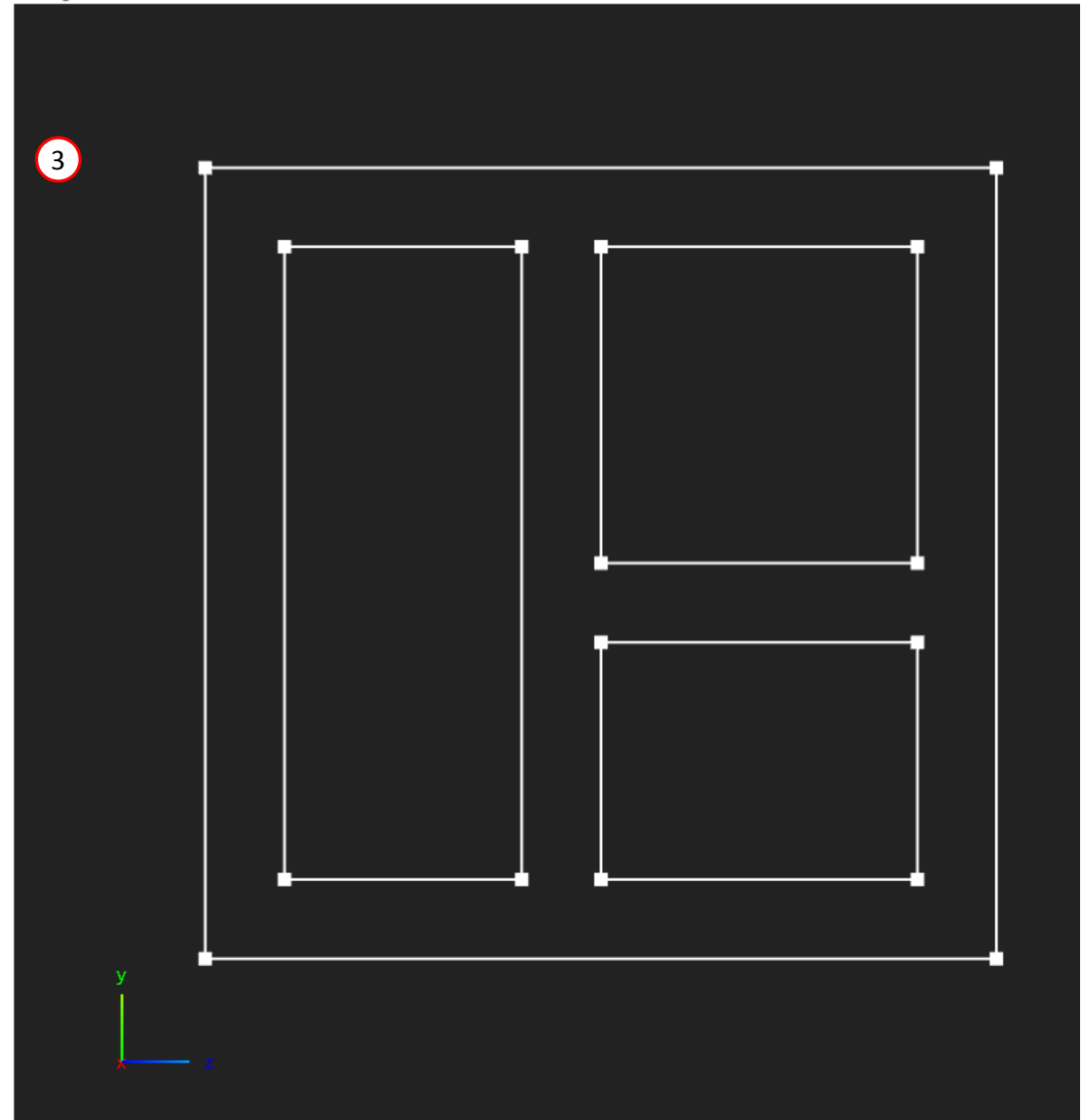
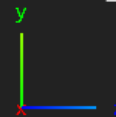
Lines

Actions

1

- Create Lines
- ✕ Remove Lines
- ☞ Select Lines of Outer Perimeter
- ☞ Deselect Lines of Outer Perimeter

3



Outer Perimeter

On this slide, the outer perimeter is defined, which corresponds to the OUTP keyword on the PBMSECT entry

1. Click Select Lines of Outer Perimeter
2. Click on the indicated lines to select the lines as part of the Outer Perimeter. Successful selection is indicated by a blue color.

When constructing open profile cross sections, one guideline is to ensure the outer perimeter goes through the critical points.

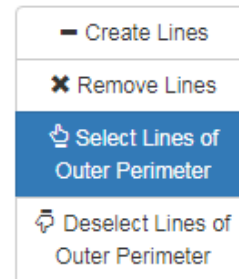
IMPORTANT!

Defining the outer perimeter is the most critical step in defining the PBMSECT/PBRSECT entry. Constantly inspect the outer perimeter. Only one continuous outer perimeters is valid.

Lines

Actions

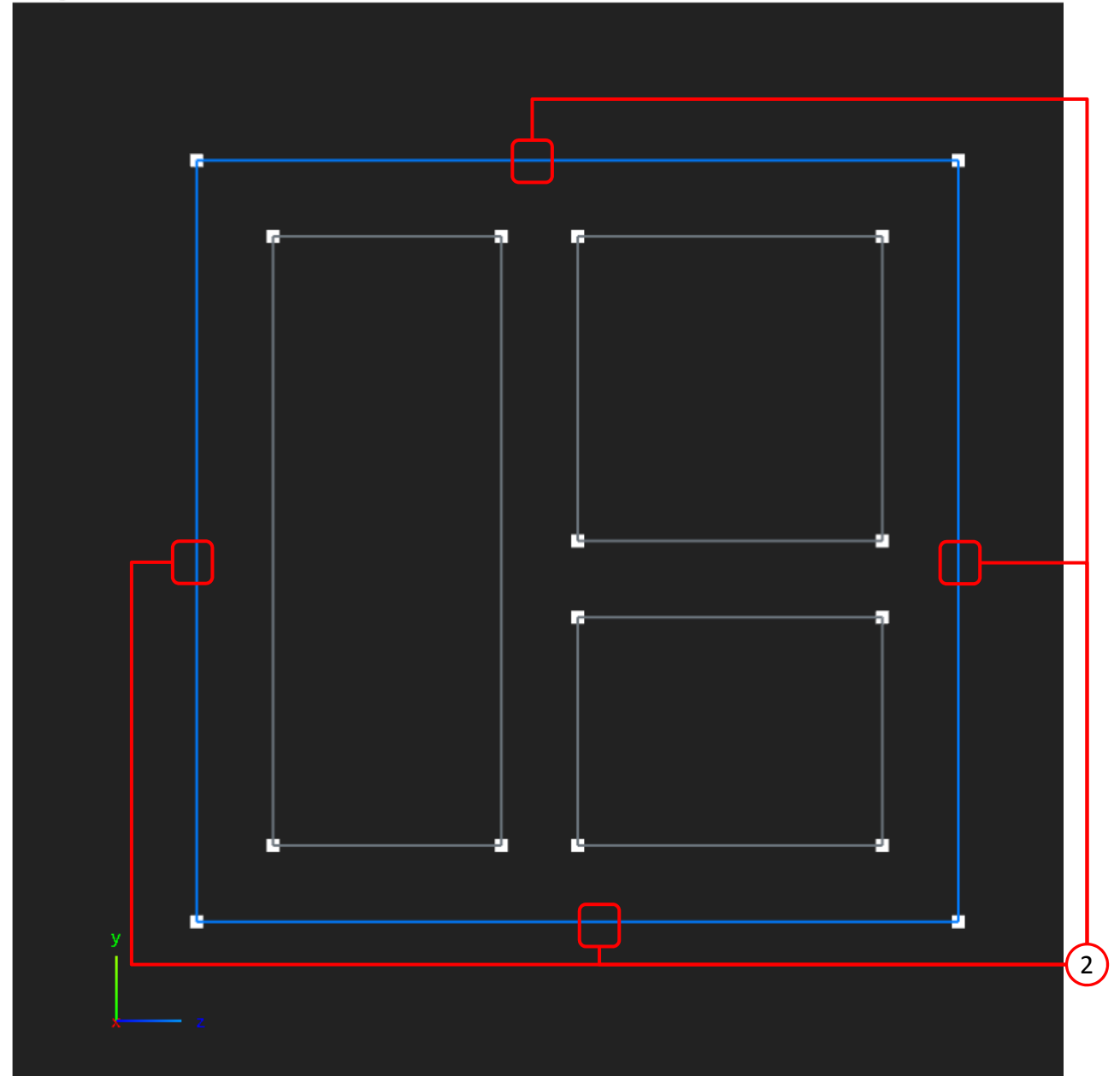
1



Legend

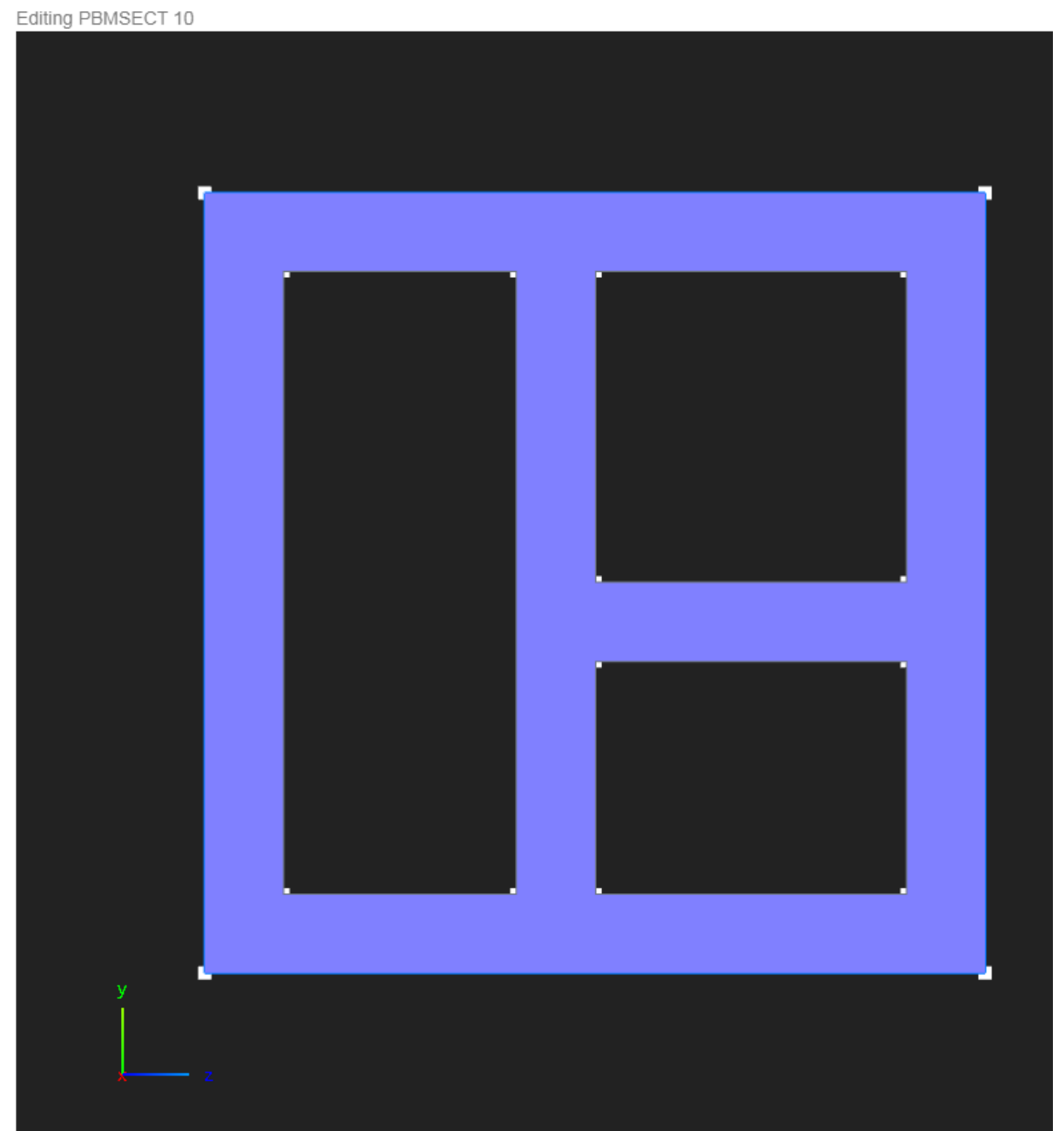
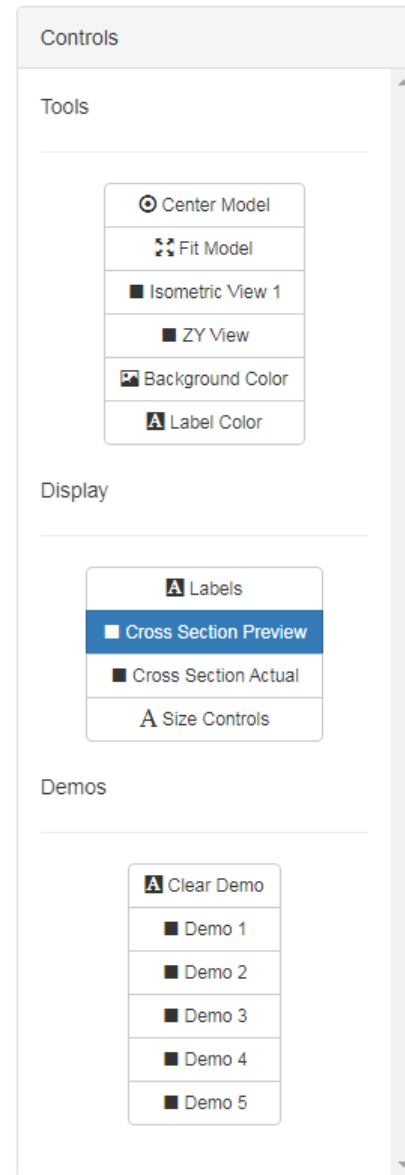
Color	Description
	Outer Perimeter (OUTP)
	Possible lines for OUTP
	Critical Points

Editing PBMSECT 10



Cross Section Preview

1. Click Cross Section Preview
2. A preview of the arbitrary beam cross section is displayed



Run MSC Nastran to Generate the Cross Section

The following requires MSC Nastran to be installed on the same machine as the SOL 200 Web App.

1. The respective entries that define the arbitrary beam cross section are displayed
2. Click Run MSC Nastran
 - The web app will run MSC Nastran in the background and determine the cross section generated by MSC Nastran. This MSC Nastran run should take no more than 10 seconds. MSC Nastran must be installed on the machine as the SOL 200 Web App.
3. If the run is successful, the MSC Nastran generated cross section is displayed
4. Inspect the F06 file to inspect the result of the run
5. The test BDF file used for this test run may be downloaded by clicking Download Test BDF File

Run MSC Nastran and Bulk Data Entries

5

Download Test BDF File

Run MSC Nastran

2

Complete

Corresponding Bulk Data Entries

```

$ 1 || 2 || 3 || 4 || 5 || 6 || 7 || 8 || 9 || 10 |
PBMSECT 10      1      GS
      OUTP=1001,INP(1)=1002,INP(2)=1003,INP(3)=1004
POINT 10000001      10.      10.
POINT 10000002      -10.      10.
POINT 10000003      -10.     -10.
POINT 10000004      10.     -10.
POINT 10000005       -2.       8.
POINT 10000006       -8.       8.
POINT 10000007       -8.     -8.
POINT 10000008       -2.     -8.
POINT 10000009        8.       8.
POINT 10000010        0.       8.
POINT 10000011        0.       0.
POINT 10000012        8.       0.
POINT 10000013        8.     -2.
POINT 10000014        0.     -2.
POINT 10000015        0.     -8.
POINT 10000016        8.     -8.
SET1 1001 10000001100000021000000310000004
SET1 1002 10000005100000061000000710000008
SET1 1003 10000009100000101000001110000012
SET1 1004 10000013100000141000001510000016
  
```

F06

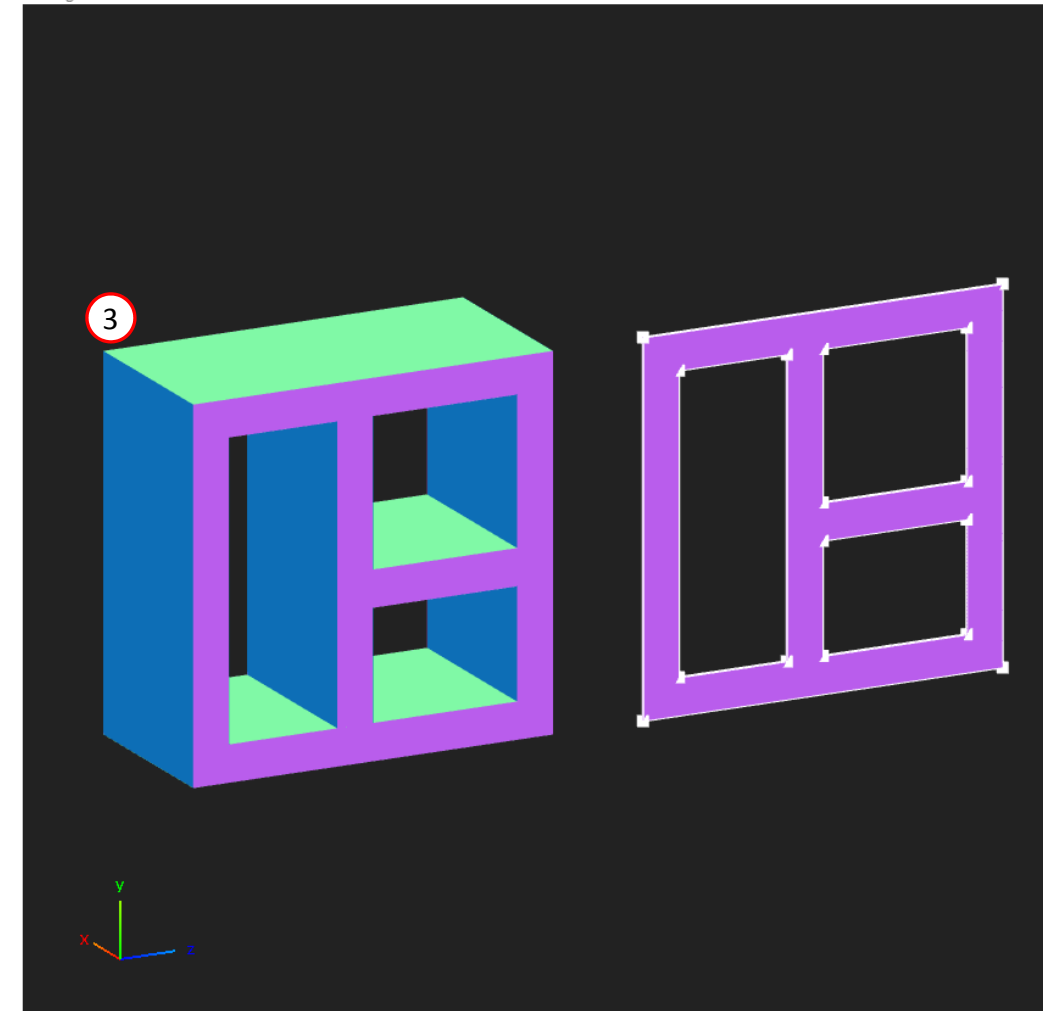
```

Command executed: /msc/MSC_Nastran/2022.1/bin/msc20221 nastran ./tmp/854e82ee40045005a441ff1e2
1
4

Warning: This computer program is protected by copyright law and interna
Unauthorized use, reproduction or distribution of this computer program, or
result in severe civil and criminal penalties.
Copyright (C) 2022 Hexagon AB and/or its subsidiaries. All rights res

*****
*****
**
**
*****
Hexagon AB
  
```

Editing PBMSECT 10



Run MSC Nastran to Generate the Cross Section

1. If the MSC Nastran run was a success, an equivalent PBEAM entry is generated and listed in the F06 file. This PBEAM entry displays cross section information such as the cross sectional area and moments of inertia.

- If a PBRSECT entry is created, a PBAR entry is generated.
- If a PBMSECT is created with the CORE keyword, which is used for a composite section, a PBEAM3 entry is generated.
- If a regular PBMSECT entry is created, a PBEAM entry is generated.

```

^
^
^
*** USER INFORMATION MESSAGE 4379 (IFP9A)
      THE USER SUPPLIED PBEAML/PBMSECT BULK DATA ENTRIES ARE REPLACED BY THE FOLLOWING PBEAM ENTRIES
      CONVERSION METHOD FOR PBARL/PBEAML - FINITE ELEMENT METHOD.
PBEAM      10      1  1.9200E+02  8.5747E+03  8.2507E+03 -6.1333E+01  1.2504E+04  0
      1.0174E+01  1.0284E+01  1.0174E+01 -9.7164E+00 -9.8264E+00 -9.7164E+00 -9.8264E+00 1
      5.5297E-01  4.1815E-01  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  1.9821E+03 1
      0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  9.0228E-02  4.5026E-01  9.0228E-02 4
  
```

PBEAM

Beam Property

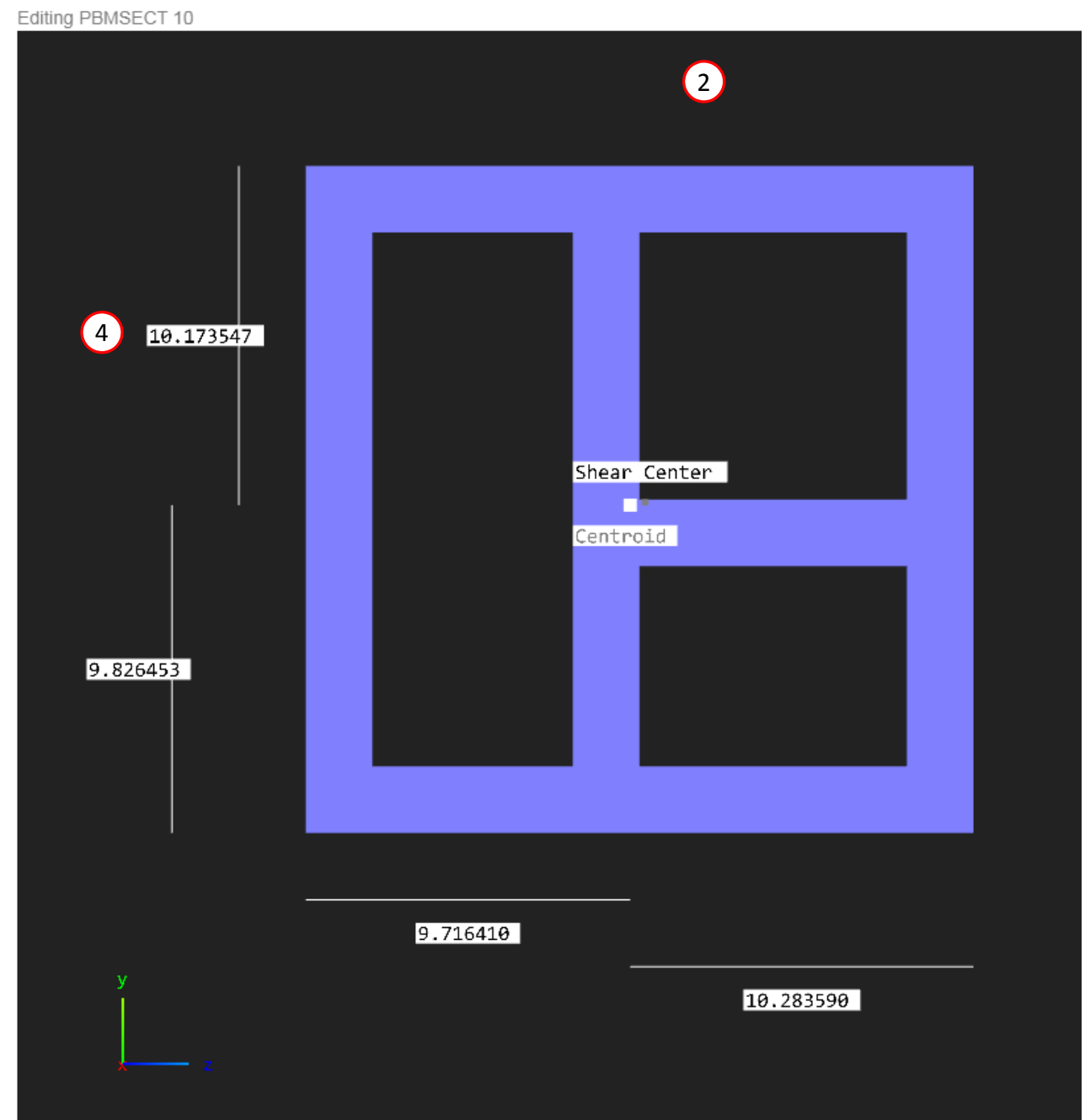
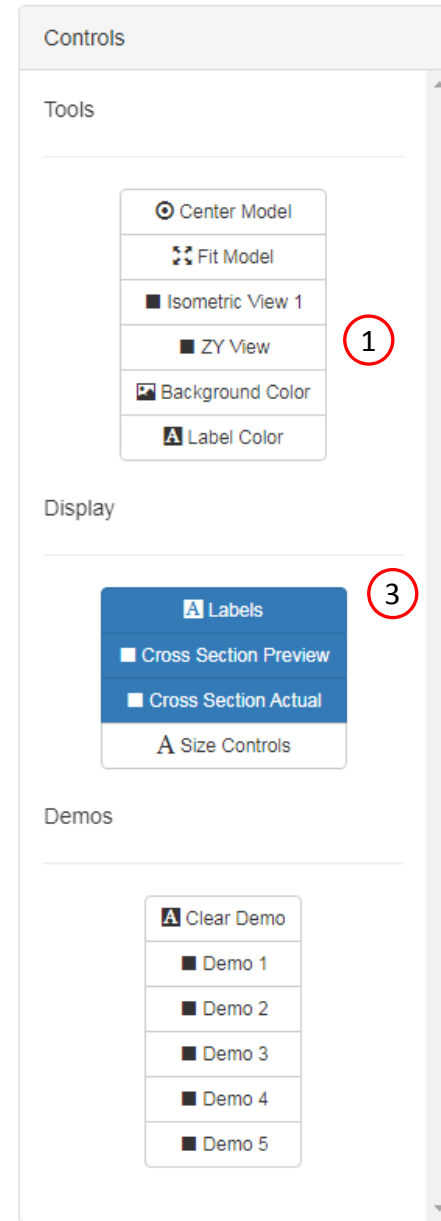
Defines the properties of a beam element (CBEAM entry). This element may be used to model tapered beams.

Format:

1	2	3	4	5	6	7	8	9	10
PBEAM	PID	MID	A(A)	I1(A)	I2(A)	I12(A)	J(A)	NSM(A)	
	C1 (A)	C2 (A)	D1 (A)	D2 (A)	E1 (A)	E2 (A)	F1 (A)	F2 (A)	

Cross Section Preview

1. Click ZY View
2. Zoom in and center the cross section generated by MSC Nastran
3. Click Labels
4. Note the following:
 - Distance markers are visible from the shear center to the outer fibers



Download an Updated BDF File

Download BDF Files

1. Navigate to the Download section
2. The Download Information section provides details regarding how the original BDF files will be edited and downloaded
3. Click Download BDF Files

Download Information

The following PBMSECT/PBRSECT entries, and respective POINT and SET1 entries, have been edited in this web app and will be updated in the downloaded BDF files.

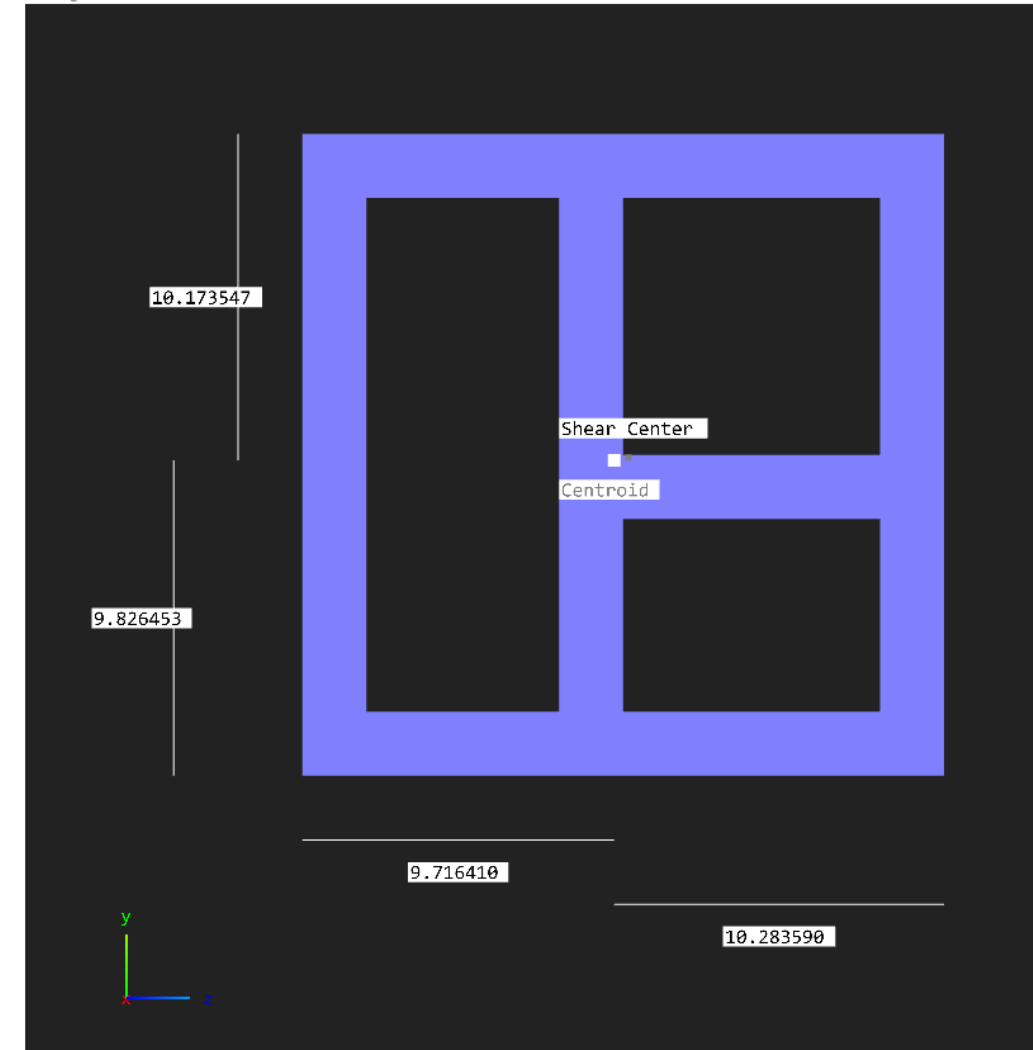
Changes will be made at BEGINBU LK or near lines [12] in file examples_of_abcs.bdf.

Entry	PID
PBRSECT	8
PBMSECT	9
PBMSECT	10

Download

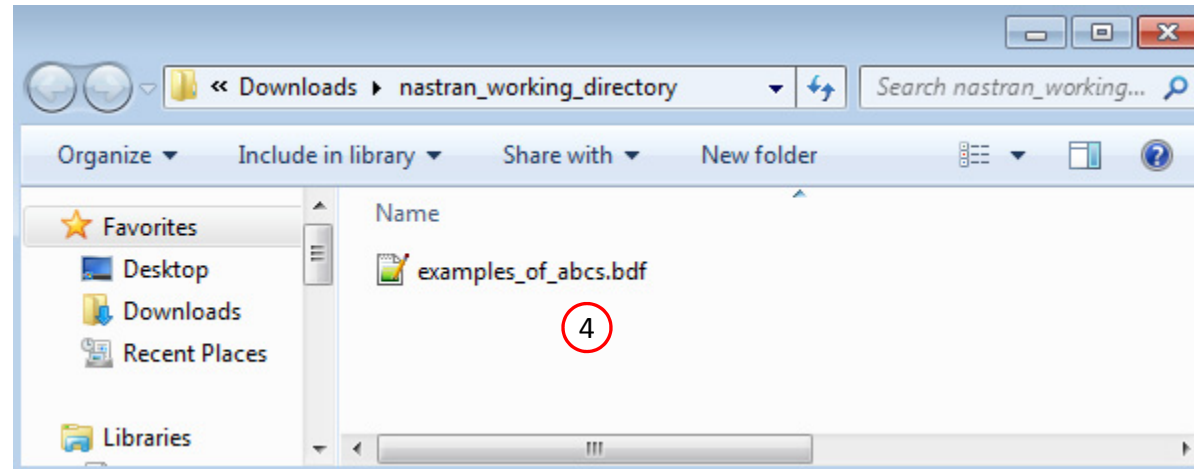
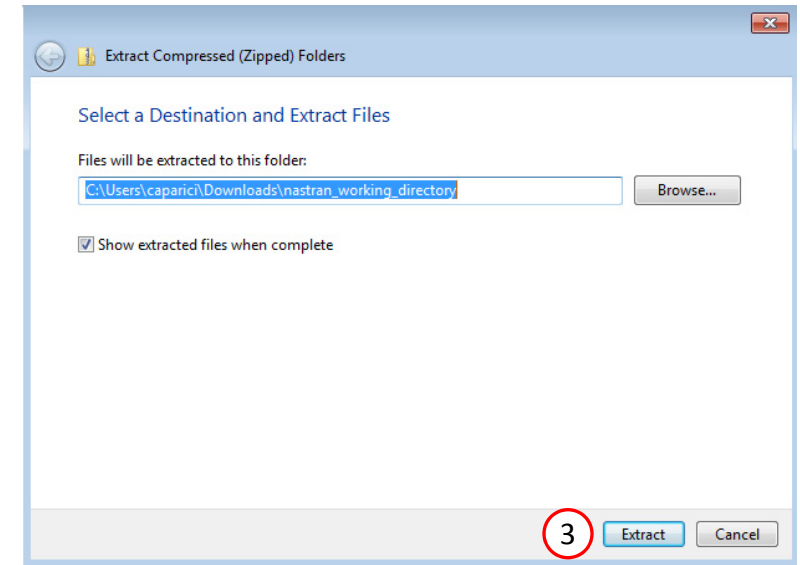
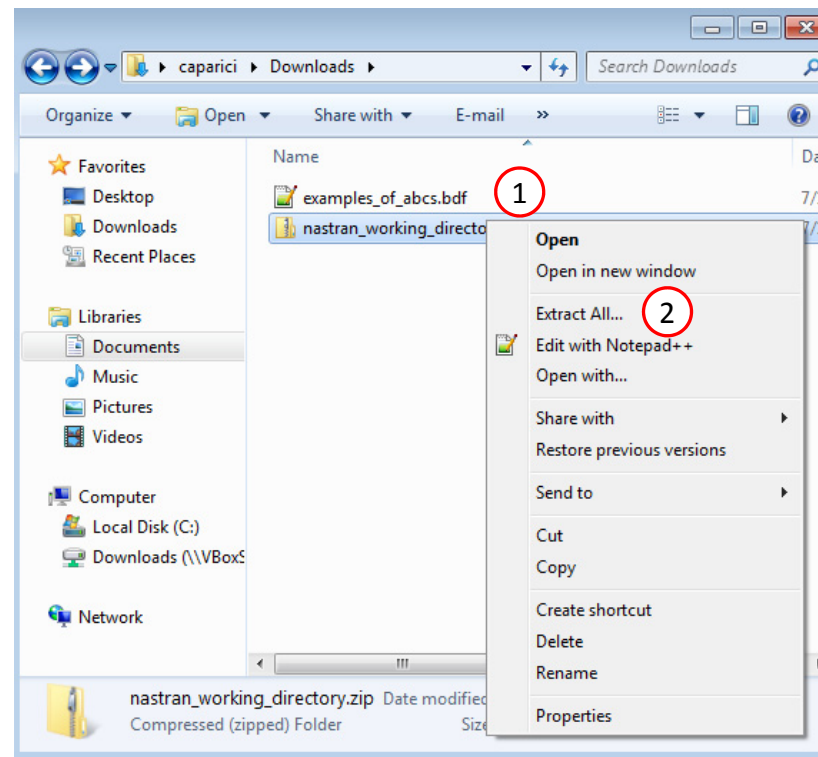
Download BDF Files

Editing PBMSECT 10



Extract the ZIP File

1. A new file `nastran_working_directory.zip` has been downloaded
2. Right click on the ZIP file and click Extract All
3. Click Extract
4. A new folder `nastran_working_directory` is created and inside is the updated `examples_of_abcs.bdf` file



Compare the Original and New BDF Files

The file examples_of_abcs.bdf currently has multiple line elements configured to use PBAR 5, PBEAM 6 and PBEAM 7. The entries will no longer be used and these entries are renumbered.

1. Open the new file examples_of_abcs.bdf in a text editor (Not shown)
2. Change the ID of the PBAR 5 to 1
3. Change the ID of the PBAR 6 to 2
4. Change the ID of the PBAR 7 to 3
5. Save the edits (not shown)

Before

PBAR	5	1	9.90E1	5.91E3	5.34E3	8.22E3	0.0	
	1.05E1	1.05E1	1.05E1	2.07-16	-1.05E1	-1.05E1	-1.05E1	1.05E1
	5.E-1	3.E-1	0.0					
PBEAM	6	1	8.85E1	5.55E3	4.17E3	5.60E2	2.77E3	0.0
	6.1354	1.86E1	-1.48E1	1.81E1	-1.38E1	1.81E1	-3.9212	1.86E1
	3.E-1	3.E-1	0.0	0.0	0.0	0.0	2.73E5	2.73E5
	0.0	0.0	0.0	0.0	-3.7997	7.0130	-3.7997	7.0130
PBEAM	7	1	1.76E2	8.55E3	7.90E3	-8.26-13	1.24E4	0.0
	1.00E1	1.03E1	1.00E1	-9.6507	-9.9995	-9.6507	-9.9995	1.03E1
	5.E-1	3.E-1	0.0	0.0	0.0	0.0	1.75E3	1.75E3
	0.0	0.0	0.0	0.0	5.E-4	1.E-1	5.E-4	1.E-1

ENDDATA

After

PBAR	1	1	9.90E1	5.91E3	5.34E3	8.22E3	0.0	
	1.05E1	1.05E1	1.05E1	2.07-16	-1.05E1	-1.05E1	-1.05E1	1.05E1
	5.E-1	3.E-1	0.0					
PBEAM	2	1	8.85E1	5.55E3	4.17E3	5.60E2	2.77E3	0.0
	6.1354	1.86E1	-1.48E1	1.81E1	-1.38E1	1.81E1	-3.9212	1.86E1
	3.E-1	3.E-1	0.0	0.0	0.0	0.0	2.73E5	2.73E5
	0.0	0.0	0.0	0.0	-3.7997	7.0130	-3.7997	7.0130
PBEAM	3	1	1.76E2	8.55E3	7.90E3	-8.26-13	1.24E4	0.0
	1.00E1	1.03E1	1.00E1	-9.6507	-9.9995	-9.6507	-9.9995	1.03E1
	5.E-1	3.E-1	0.0	0.0	0.0	0.0	1.75E3	1.75E3
	0.0	0.0	0.0	0.0	5.E-4	1.E-1	5.E-4	1.E-1

ENDDATA

Compare the Original and New BDF Files

The newest PBRSECT and PBMSECT entries are renumbered. Once this is done, the existing line elements will use the newest PBRSECT and PBMSECT entries.

1. Open the new file examples_of_abcs.bdf in a text editor (Not shown)
2. Change the ID of the PBRSECT 8 to 5
3. Change the ID of the PBMSECT 9 to 6
4. Change the ID of the PBMSECT 10 to 7
5. Save the edits (not shown)

Before

BEGIN BULK

PBRSECT 8 1 CP
OUTP=801, BRP (1)=802, BRP (2)=803, BRP (3)=804, BRP (4)=805, T=1.0

Some text not shown

PBMSECT 9 1 OP
OUTP=901, BRP (1)=902, BRP (2)=903, BRP (3)=904, T=1.0

Some text not shown

PBMSECT 10 1 GS
OUTP=1001, INP (1)=1002, INP (2)=1003, INP (3)=1004

After

BEGIN BULK

PBRSECT 5 1 CP
OUTP=801, BRP (1)=802, BRP (2)=803, BRP (3)=804, BRP (4)=805, T=1.0

Some text not shown

PBMSECT 6 1 OP
OUTP=901, BRP (1)=902, BRP (2)=903, BRP (3)=904, T=1.0

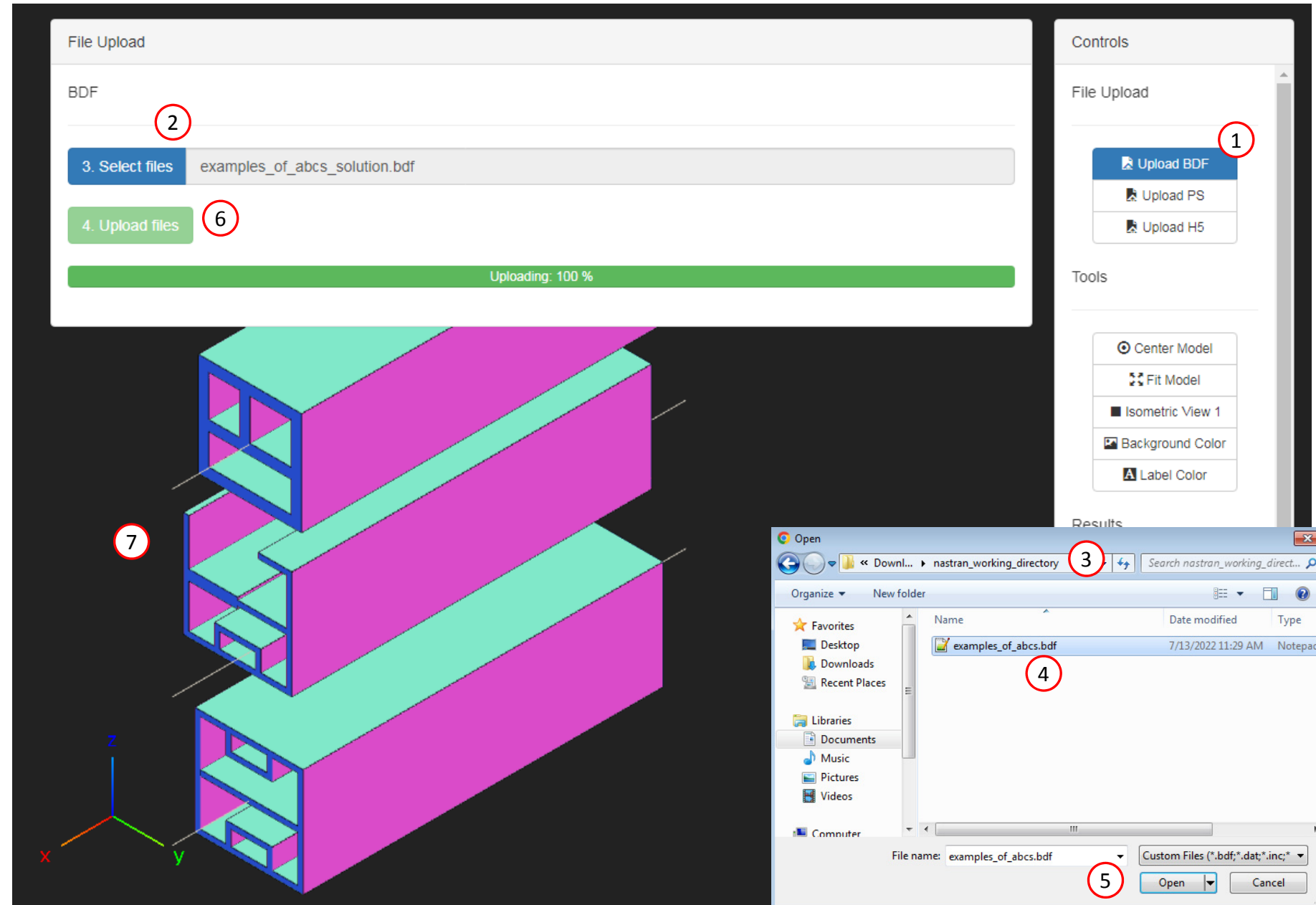
Some text not shown

PBMSECT 7 1 GS
OUTP=1001, INP (1)=1002, INP (2)=1003, INP (3)=1004

View the Model in the Beams Viewer

Open the Beams Viewer in a new web browser tab or window (Not shown)

1. Click Upload BDF
2. Click Select files
3. Navigate to the directory nastran_working_directory
4. Select examples_of_abcs.bdf
5. Click Open
6. Click Upload files
7. The MSC Nastran model has been uploaded to the Beams Viewer
 - Notice the cross section is now the ABCS that was defined in the PBMSECT web app



End of Tutorial

Appendix

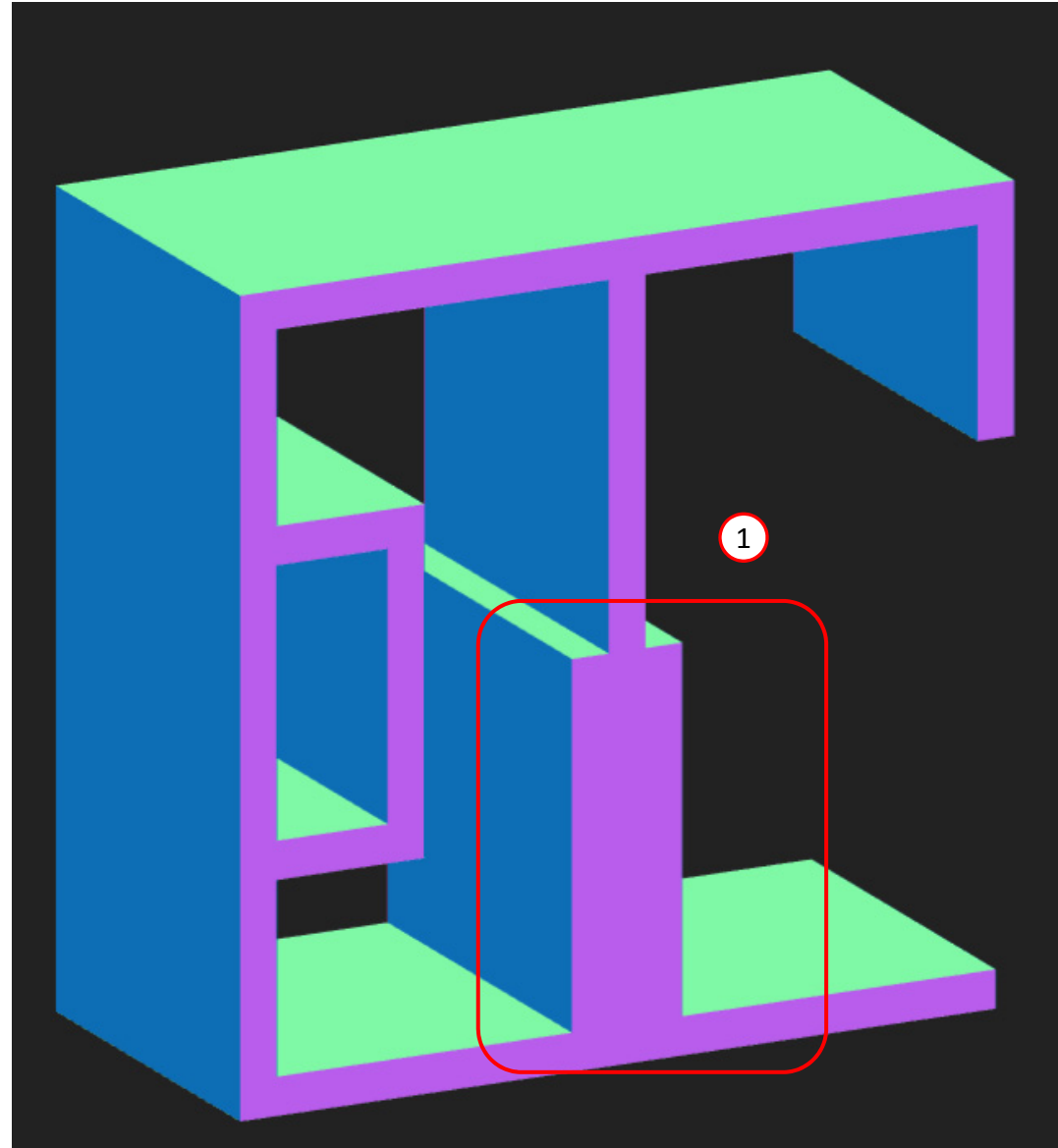
Appendix Contents

- Avoid T Keyword and SET1 Conflicts

Avoid T Keyword and SET1 Conflicts

Avoid T Keyword and SET1 Conflicts

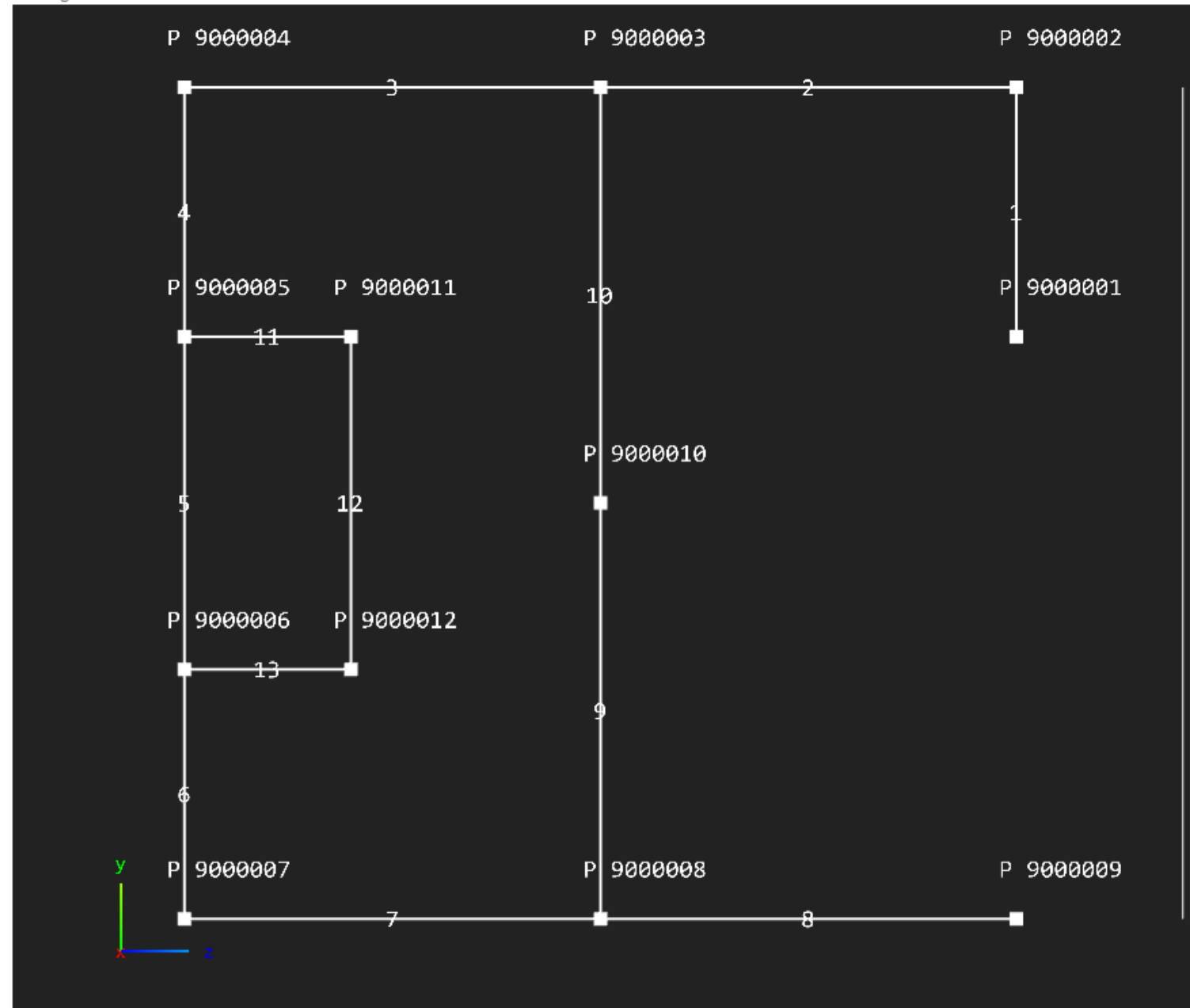
1. Recall that one of the cross sections assigned a thickness value of 2.0 to one of the lines.



Avoid T Keyword and SET1 Conflicts

1. Consider lines 10 and 9. You might ask why do I need 2 lines when 1 line should be sufficient?

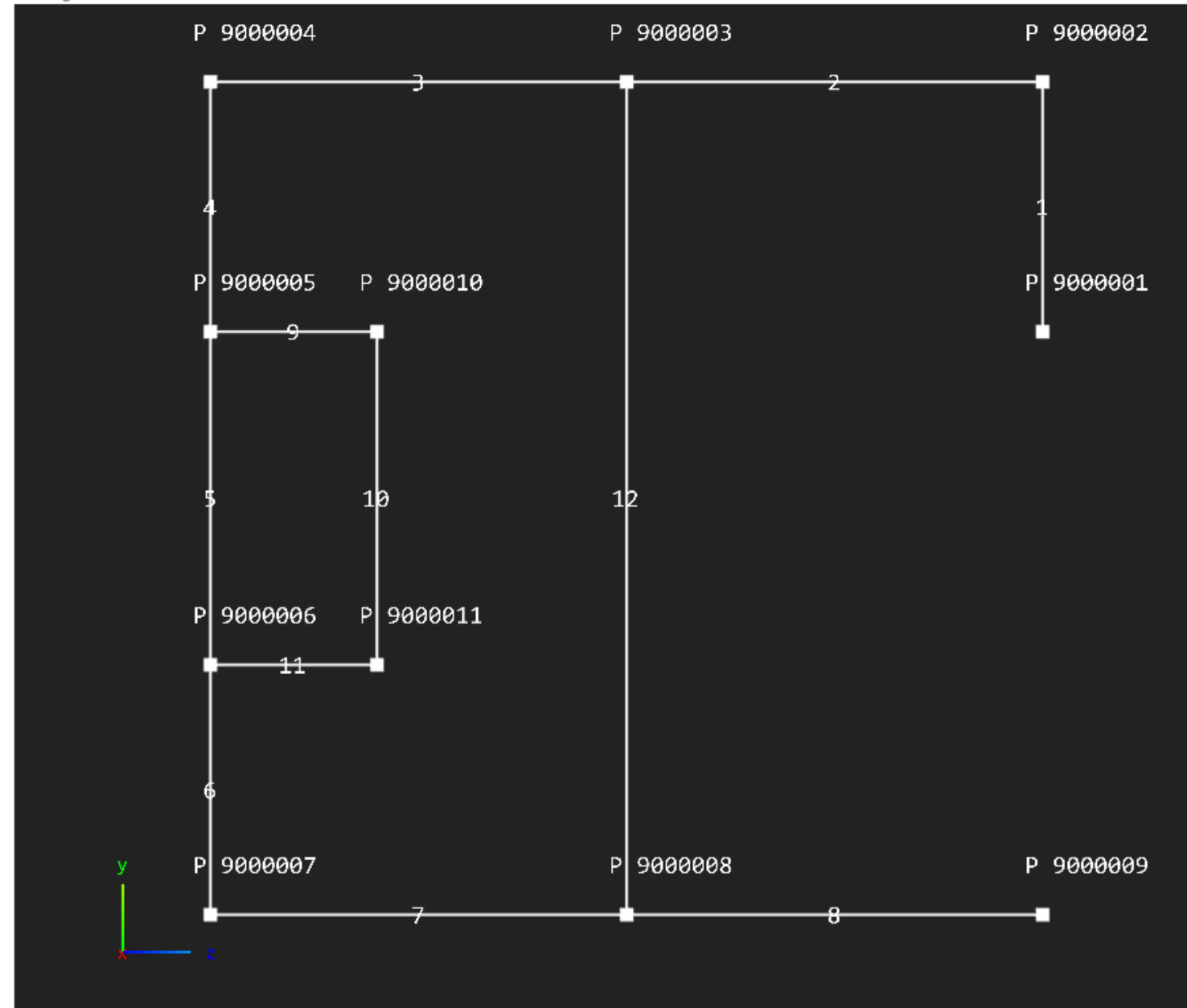
Editing PBMSECT 9



Avoid T Keyword and SET1 Conflicts

1. Suppose this example was repeated with lines 9 and 10 removed and POINT 9000010 removed, and in their place line 12 is added

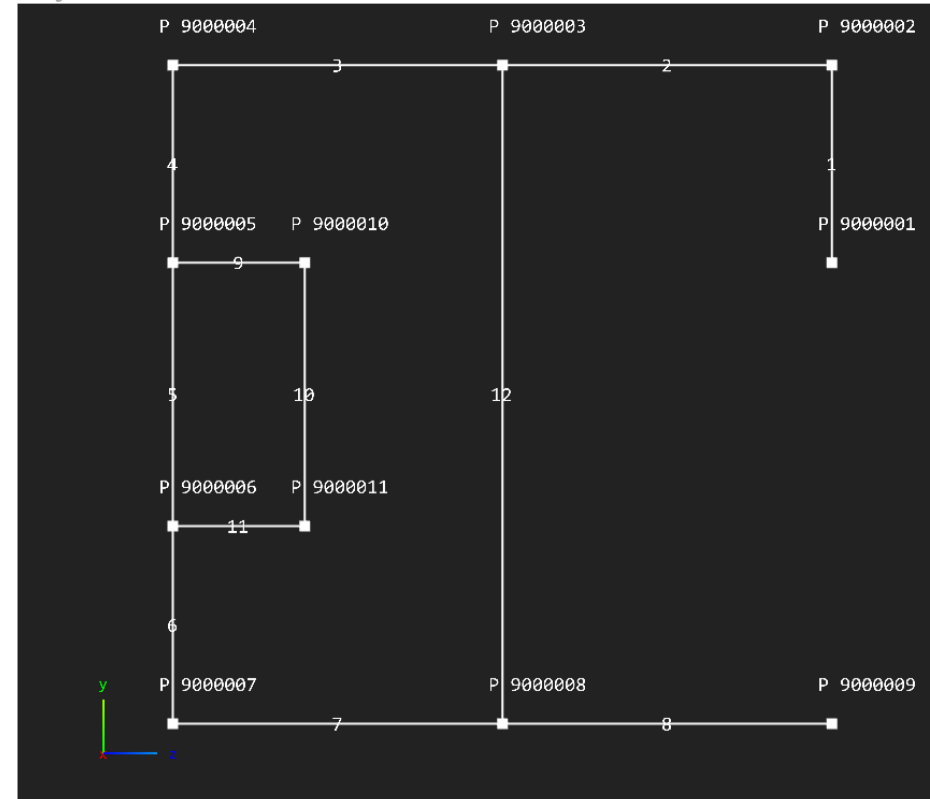
Editing PBMSECT 9



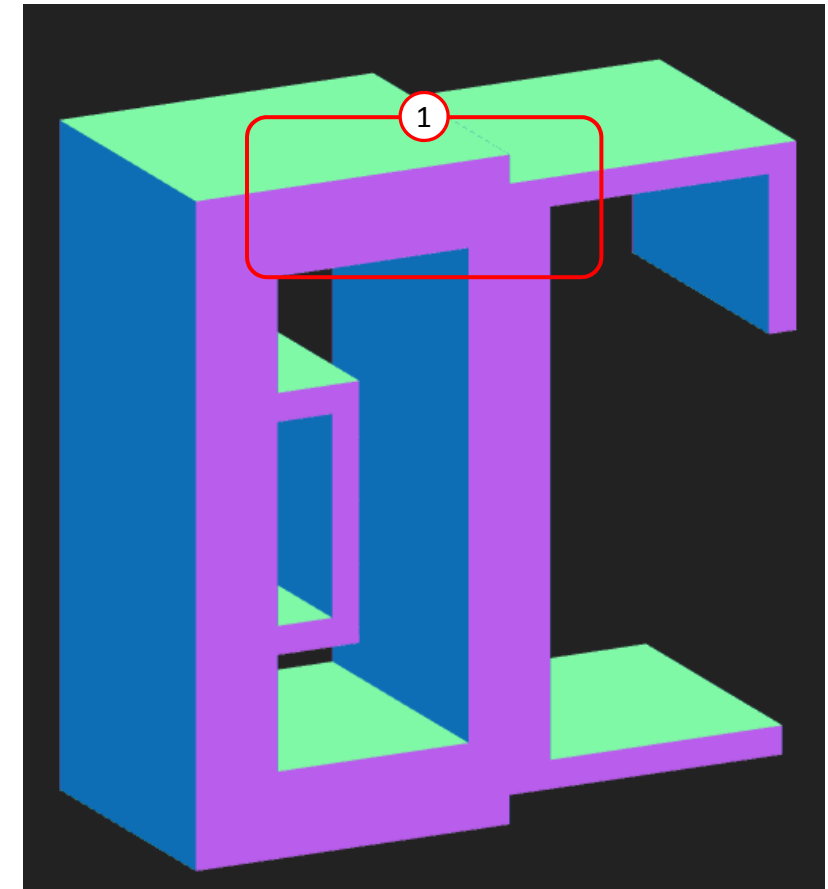
Avoid T Keyword and SET1 Conflicts

1. If only one line is used, the thickness value is applied to the incorrect lines

Editing PBMSECT 9



NOT OK



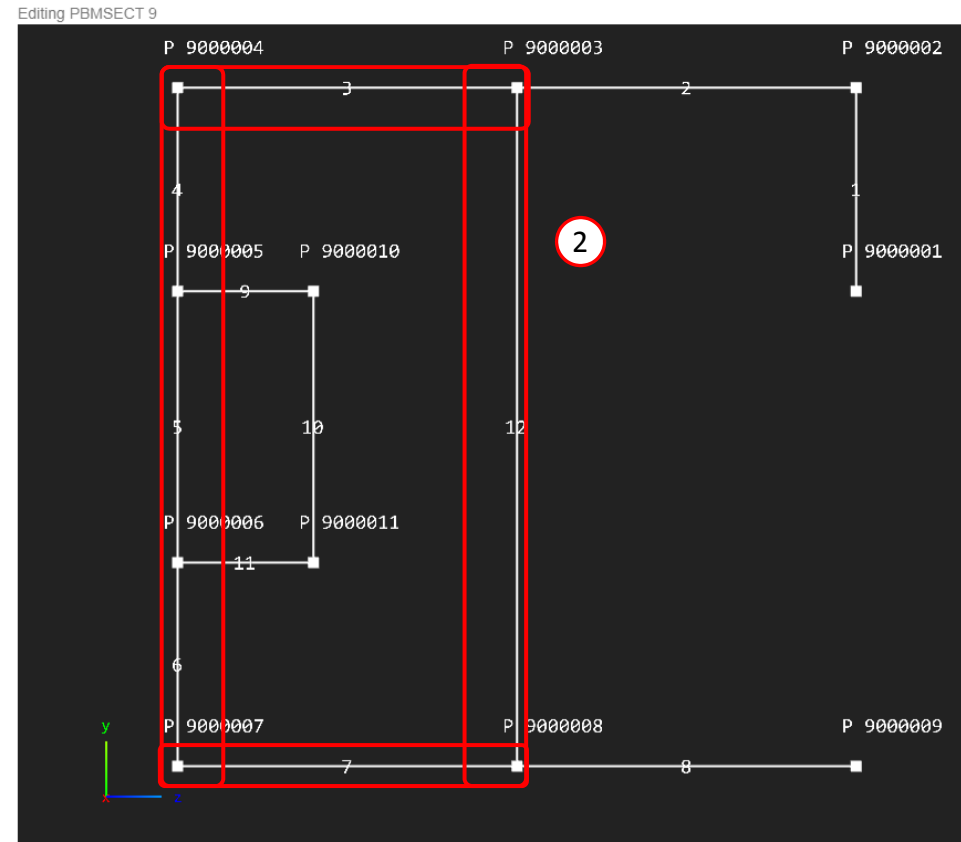
Avoid T Keyword and SET1 Conflicts

This happens for the following reason.

1. T(1), which has a thickness value of 2.0, is to be placed between POINTs 9000003 and 9000008. MSC Nastran's internal algorithm looks through each SET1 for these 2 points. For each SET1 it finds with these 2 points, T(1) is placed along those points.
2. In this example, SET1 901 and 903 have POINTs 9000003 and 9000008, so the algorithm places T(1) along POINTs 9000003, 9000004, 9000005, 9000006, 9000007, 9000008 and 9000003, 9000008.

The intent is to assign T(1) along the vertical line.

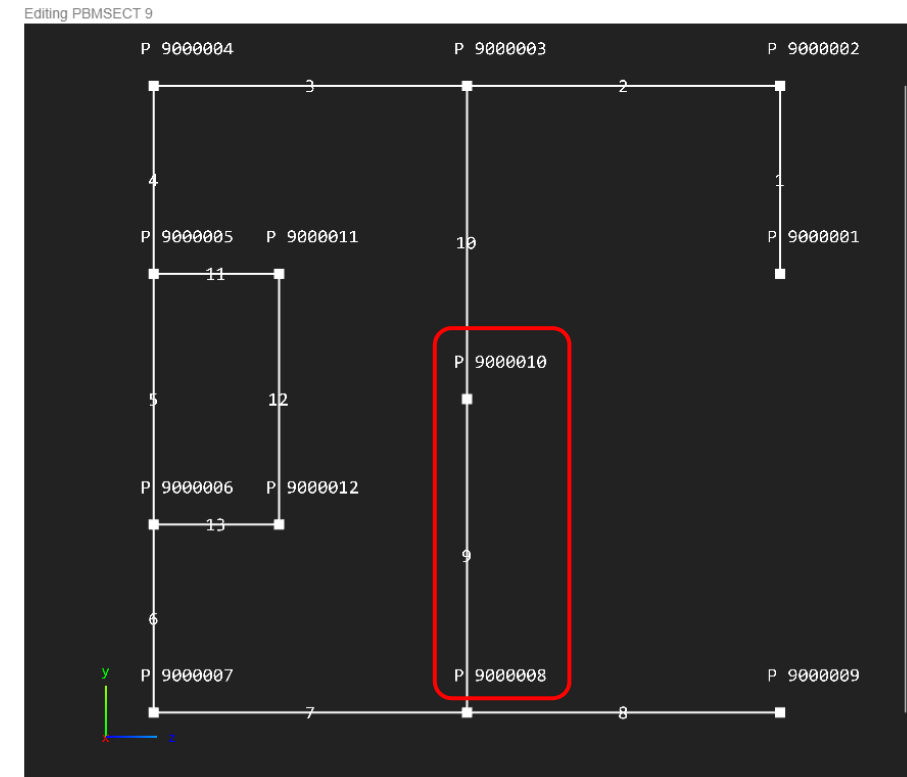
```
PBMSECT 9      1      OP
            OUTP=901, BRP(1)=902, BRP(2)=903, T=1.0,
            T(1)=[2.0, PT=(9000003, 9000008)]
SET1 901      9000001 9000002
          9000003 9000004 9000005 9000006 9000007 9000008 9000009
SET1 902      9000005 9000010 9000011 9000006
SET1 903      9000003 9000008
```



Avoid T Keyword and SET1 Conflicts

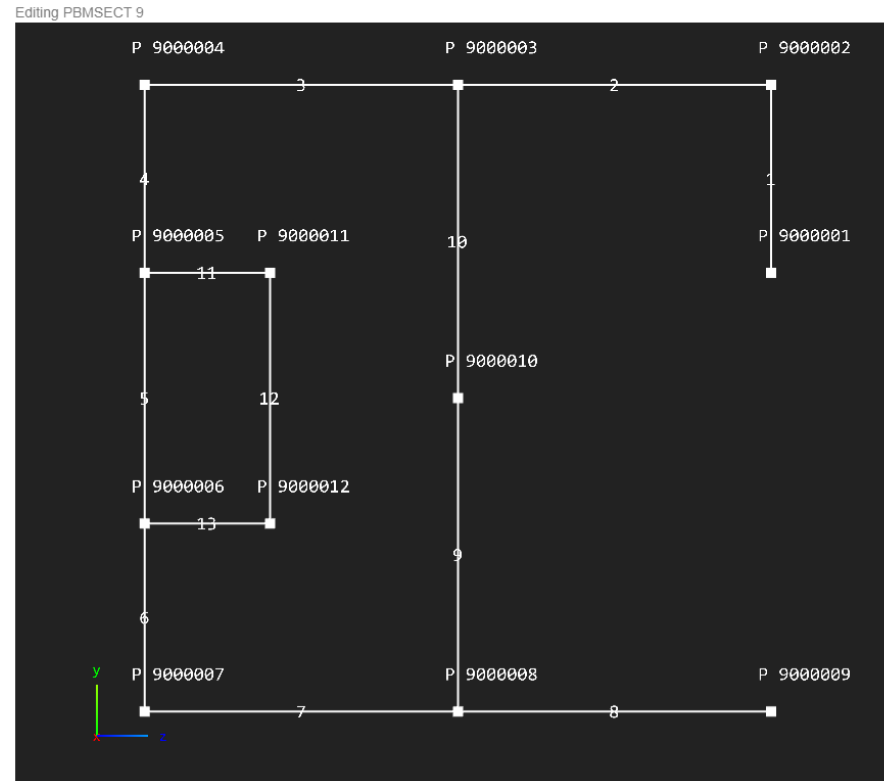
In this tutorial a point is added, e.g. POINT 9000010, so 2 lines are used to create the vertical section.

```
PBMSECT 6      1      OP
            OUTP=901,BRP(1)=902,BRP(2)=903,BRP(3)=904,T=1.0,
            T(1)=[2.0,PT=(9000008,9000010)]
SET1 901      9000001 9000002 9000003 9000004 9000005 9000006 9000007
            9000008 9000009
SET1 902      9000008 9000010
SET1 903      9000010 9000003
SET1 904      9000005 9000011 9000012 9000006
```



Avoid T Keyword and SET1 Conflicts

1. The thickness of one line is now 2.0



OK

