

# Workshop - CSV Export and Import for Design Variables, Responses and Constraints

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AN MSC NASTRAN SOL 200 TUTORIAL

# Optimization Problem Statement

## Design Variables

$$y1 \quad \text{--->} \quad A1 = \frac{\pi y1^2}{10} \quad \text{of PROD 1}$$

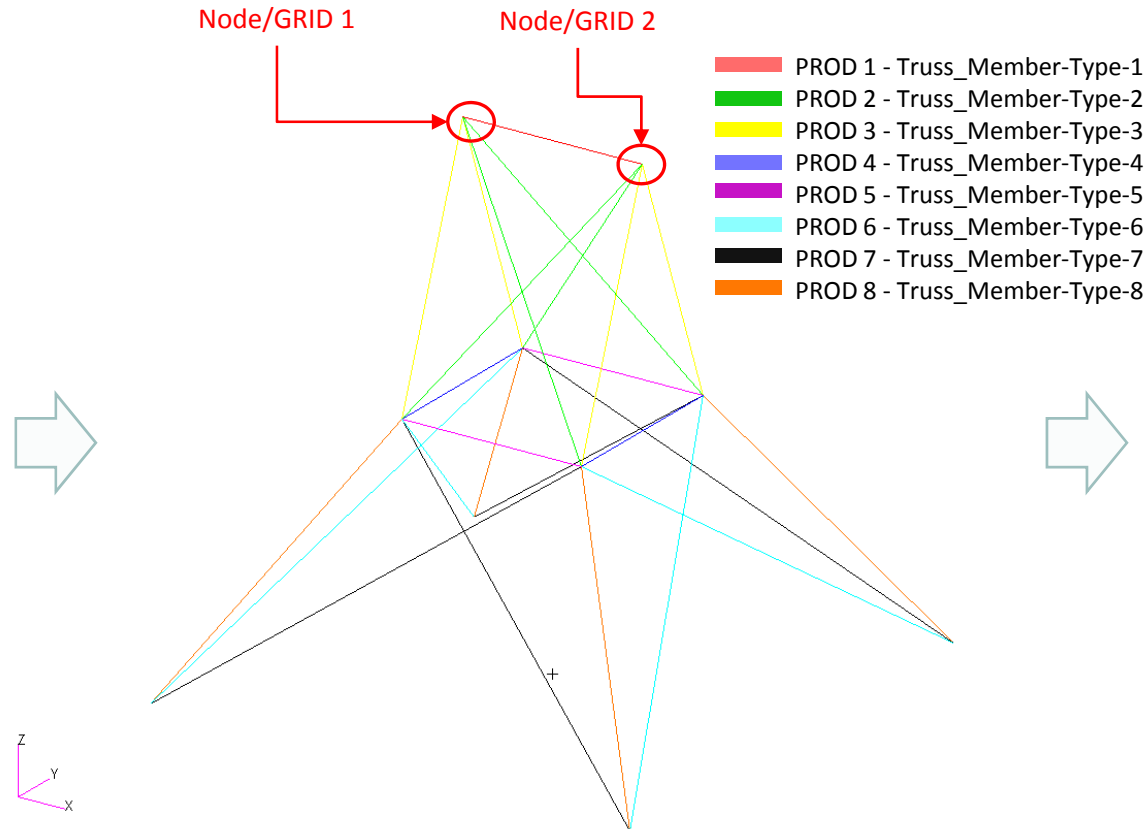
....

$$y8 \quad \text{--->} \quad A8 = \frac{\pi y8^2}{10} \quad \text{of PROD 8}$$

yi\_initial= 2.52

.01 < yi < 100.

Allowed values for design variables: .1, .5, 1.0, 2.0, ... 100.



## Design Objective

r0: Minimize weight

## Design Constraints

r1: Axial stress of elements related to PROD 1

...

r8: Axial stress of elements related to PROD 8

$$-40,000 < r1, \dots r8 < 40,000$$

r9: x, y component of displacement at nodes 1 and 2

$$-.35 < r9 < .35$$

## Design Constraints, Equation

$$Ri = F_s \frac{-7.69 \cdot ri \cdot Li^2}{\pi^2 \cdot 1.0E7 \cdot yi^2} < 1.0$$

Number	Label	L	Variable
1	r1	75.	y1
2	r2	130.5	y2
3	r3	106.8	y3
4	r4	75.	y4
5	r5	75.	y5
6	r6	181.14	y6
7	r7	181.14	y7
8	r8	133.46	y8

# Contact me

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

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# Tutorial

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# SOL 200 Web App Capabilities

The Post-processor Web App and HDF5 Explorer are free to MSC Nastran users.

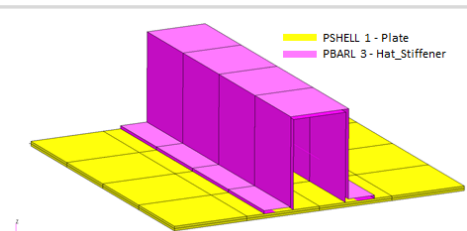
## Compatibility

- Google Chrome, Mozilla Firefox or Microsoft Edge
- Windows and Red Hat Linux
- Installable on a company laptop, workstation or server. All data remains within your company.

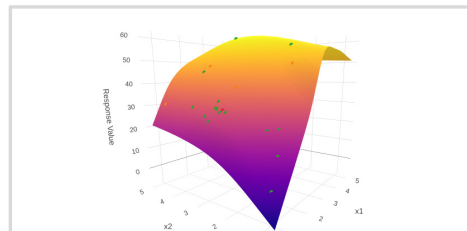
## Web Apps

## Benefits

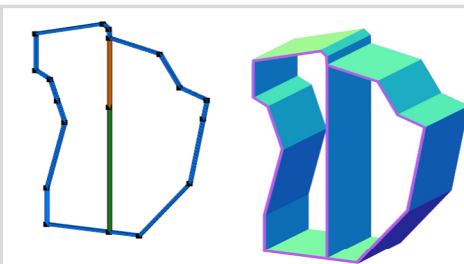
- REAL TIME error detection. 200+ error validations.
- REAL TIME creation of bulk data entries.
- Web browser accessible
- Free Post-processor web apps
- +80 tutorials



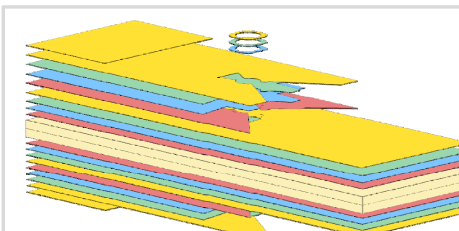
**Web Apps for MSC Nastran SOL 200**  
Pre/post for MSC Nastran SOL 200.  
Support for size, topology, topometry, topography, multi-model optimization.



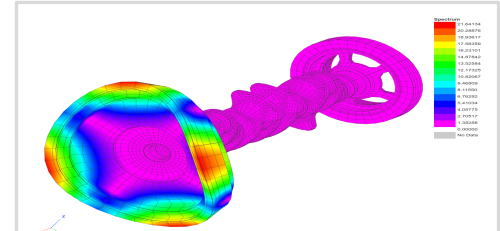
**Machine Learning Web App**  
Bayesian Optimization for nonlinear response optimization (SOL 400)



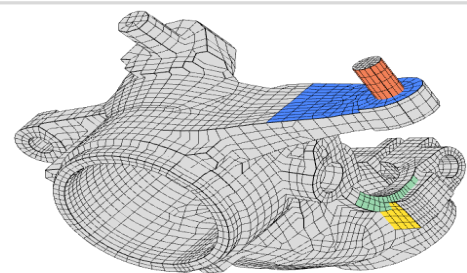
**PBMSECT Web App**  
Generate PBMSECT and PBRSECT entries graphically



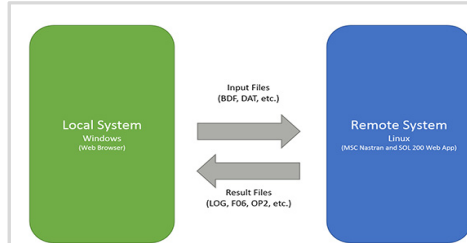
**Ply Shape Optimization Web App**  
Optimize composite ply drop-off locations, and generate new PCOMPG entries



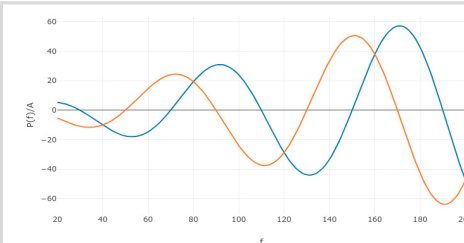
**Post-processor Web App**  
View MSC Nastran results in a web browser on Windows and Linux



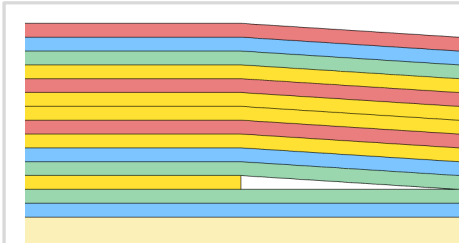
**Shape Optimization Web App**  
Use a web application to configure and perform shape optimization.



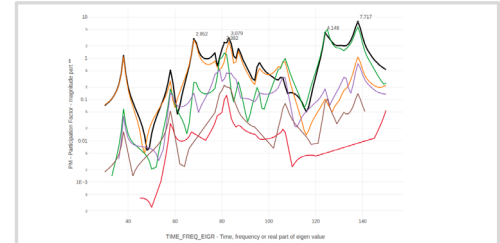
**Remote Execution Web App**  
Run MSC Nastran jobs on remote Linux or Windows systems available on the local network



**Dynamic Loads Web App**  
Generate RLOAD1, RLOAD2 and DLOAD entries graphically



**Stacking Sequence Web App**  
Optimize the stacking sequence of composite laminate plies

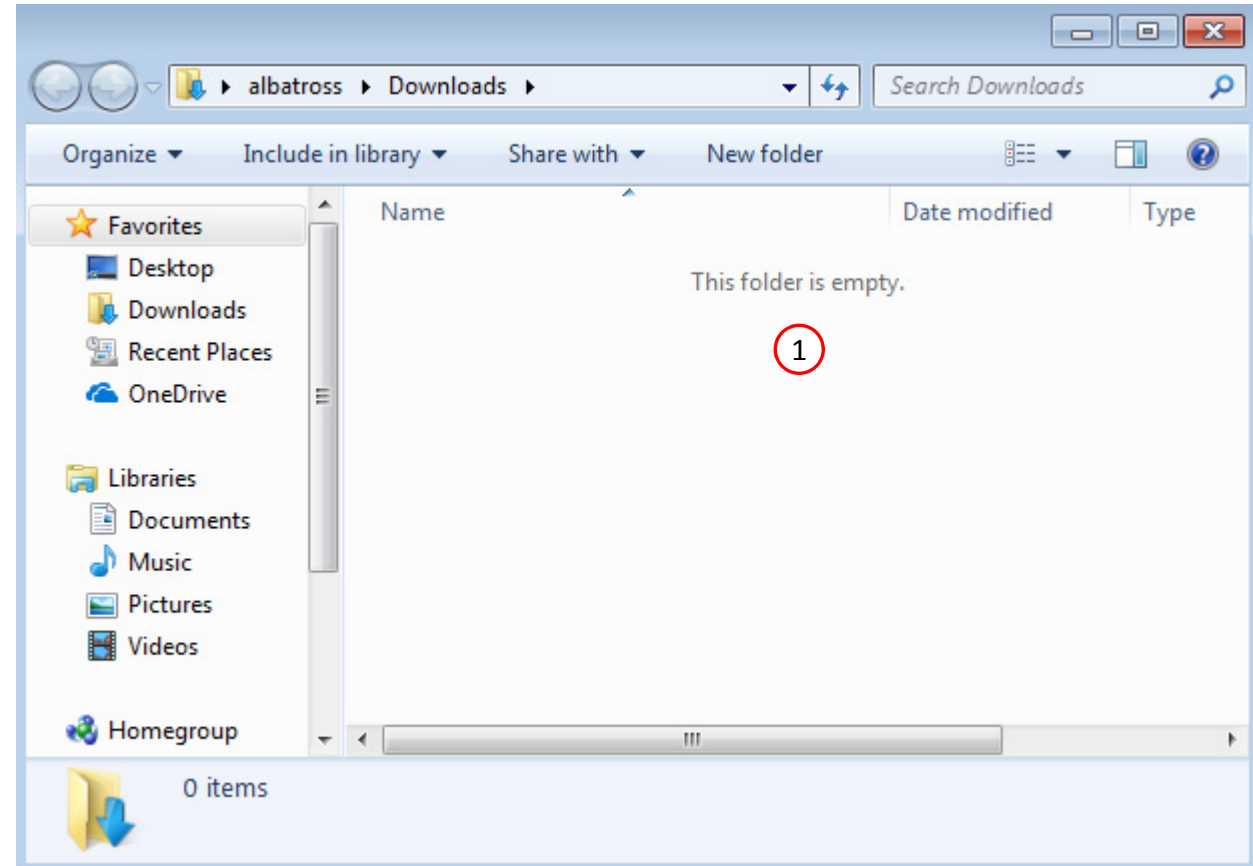


**HDF5 Explorer Web App**  
Create graphs (XY plots) using data from the H5 file

# 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.



# 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.



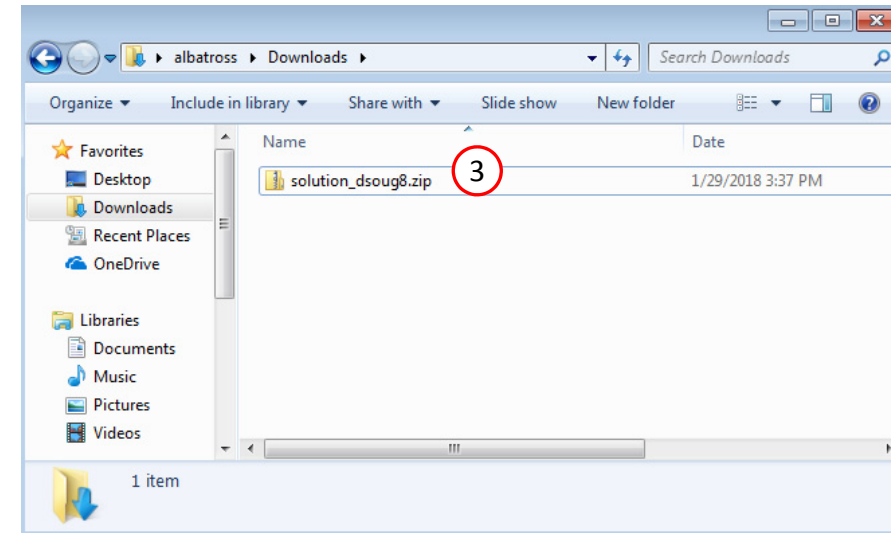
**1** **Optimizing for Buckling - Twenty-Five Bar Truss with MSC Nastran Optimization**

This example is from the MSC Nastran Design Sensitivity and Optimization User's Guide.

"This problem, often seen in the early design optimization literature, calls for a minimum weight structure subject to member stress, Euler buckling, and joint displacement constraints. The structure is shown in Figure 8-25 . The formulation of the buckling constraints is a good example of constructing normalized constraints based on user-defined structural responses."

— *MSC Nastran 2016 Design Sensitivity and Optimization User's Guide. Chapter 8: Example Problems. Twenty-Five Bar Truss, Superelement and Discrete Variable Optimization*

Starting BDF Files: [Link](#)  
Solution BDF Files: [Link](#) **2**

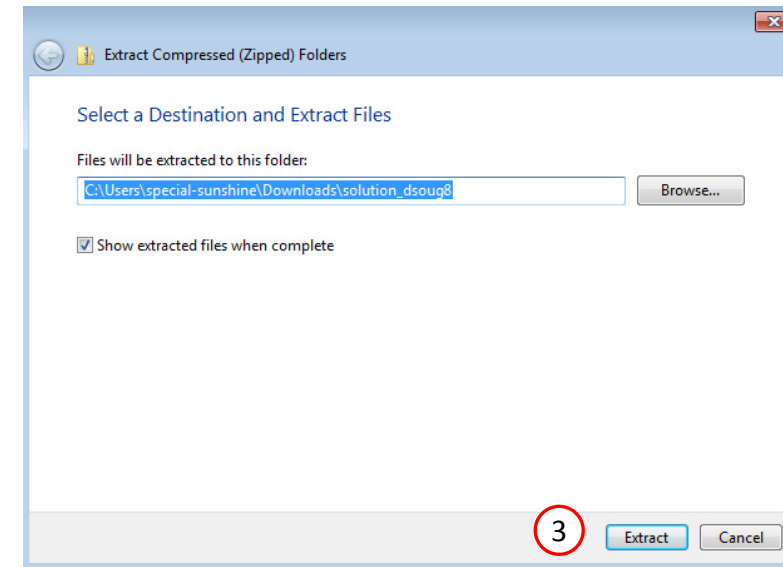
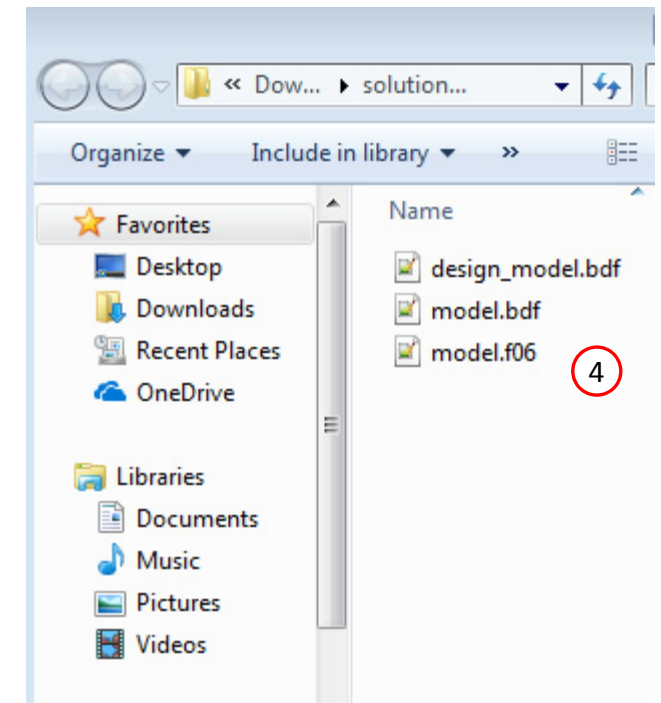
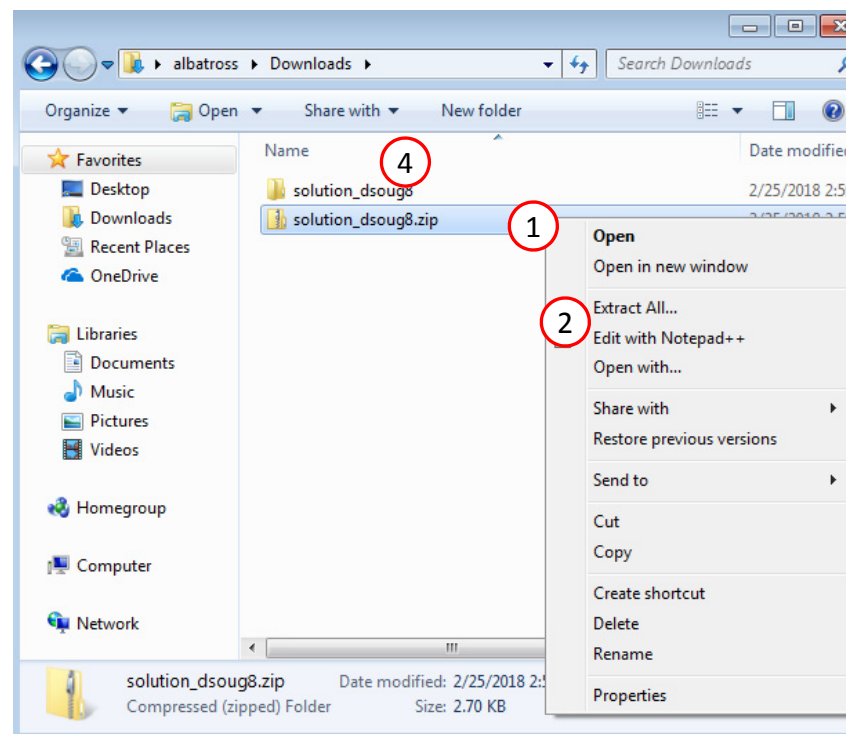




# Obtain Starting Files

1. Right click on the zip file
2. Select Extract All...
3. Click Extract
4. The starting files are now available in a folder

- This example is using a previously created design model. The design model is a model that has been converted to SOL 200 and contains bulk data entries describing the optimization problem statement, e.g. variables, objective and constraints.



# Open the Correct Page

1. Click on the indicated link

- MSC Nastran can perform many optimization types. The SOL 200 Web App includes dedicated web apps for the following:
  - Optimization for SOL 200 (Size, Topology, Topometry, Topography, Local Optimization, Sensitivity Analysis and Global Optimization)
  - Multi Model Optimization
  - Machine Learning
- The web app also features the HDF5 Explorer, a web application to extract results from the H5 file type.



# Upload BDF Files

1. Click 1. Select Files and select model.bdf and design\_model.bdf
2. Click Upload Files

- The process starts by uploading all the necessary BDF files. The BDF files can be files of your own or files found in the Tutorials section of the User's Guide.

## Step 1 - Upload .BDF Files

The screenshot shows a two-step process for uploading files. Step 1, '1. Select files', is highlighted with a blue bar and indicates '2 files selected'. Below it is a green progress bar labeled 'Inspecting: 100%'. Step 2, '2. Upload files', is highlighted with a green bar. Below it is another green progress bar labeled 'Uploading: 100 %'. At the bottom, there is a checkbox labeled 'List of Selected Files' which is currently unchecked.

1. Select files 2 files selected

Inspecting: 100%

2. Upload files

Uploading: 100 %

☐ List of Selected Files

# CSV Change of Variables

1. Scroll to section: Step 4 - Adjust design variables
2. Click + Options
3. Click Export
4. A new .csv file is downloaded

- Numerous tables have the option to export and import a CSV file. The option is hidden by default, but can be found by clicking +Options.

## Step 4 - Adjust design variables 1

+ Options 2

☐ Label Comments

CSV Export

Export 3

CSV Import

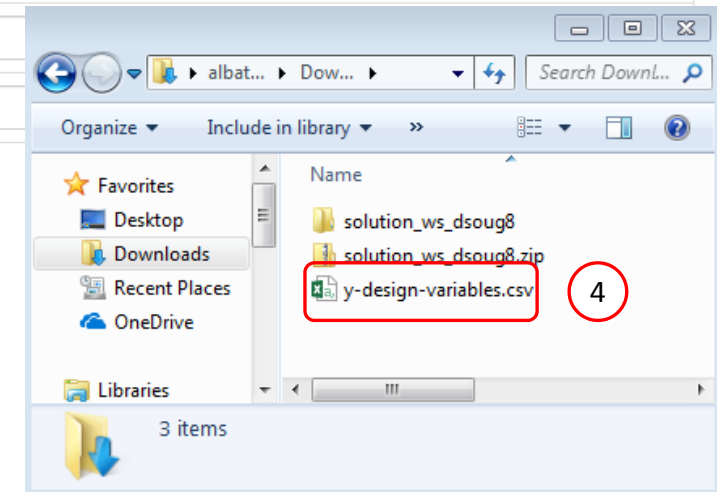
Select files

Select a CSV File

Import

+ Create Variable

	Label ▾	Status ▾	Initial Value	Lower Bound	Upper Bound	Allowed Discrete Values
	<input type="text" value="Search"/>	<input type="text" value="Search"/>				
<input checked="" type="checkbox"/>	y1	<input checked="" type="checkbox"/>	<input type="text" value="2.52"/>	<input type="text" value=".01"/>	<input type="text" value="100."/>	<input type="text" value=".1, .5, 1.0, THRU, 100., BY, 1.0"/>
<input checked="" type="checkbox"/>	y2	<input checked="" type="checkbox"/>	<input type="text" value="2.52"/>	<input type="text" value=".01"/>	<input type="text" value="100."/>	<input type="text" value=".1, .5, 1.0, THRU, 100., BY, 1.0"/>
<input checked="" type="checkbox"/>	y3	<input checked="" type="checkbox"/>	<input type="text" value="2.52"/>	<input type="text" value=".01"/>	<input type="text" value="100."/>	<input type="text" value=".1, .5, 1.0, THRU, 100., BY, 1.0"/>
<input checked="" type="checkbox"/>	y4	<input checked="" type="checkbox"/>	<input type="text" value="2.52"/>	<input type="text" value=".01"/>	<input type="text" value="100."/>	<input type="text" value=".1, .5, 1.0, THRU, 100., BY, 1.0"/>
<input checked="" type="checkbox"/>	y5	<input checked="" type="checkbox"/>	<input type="text" value="2.52"/>	<input type="text" value=".01"/>	<input type="text" value="100."/>	<input type="text" value=".1, .5, 1.0, THRU, 100., BY, 1.0"/>



# CSV Change of Variables

1. Open the CSV file in Excel

Perform the following edits:

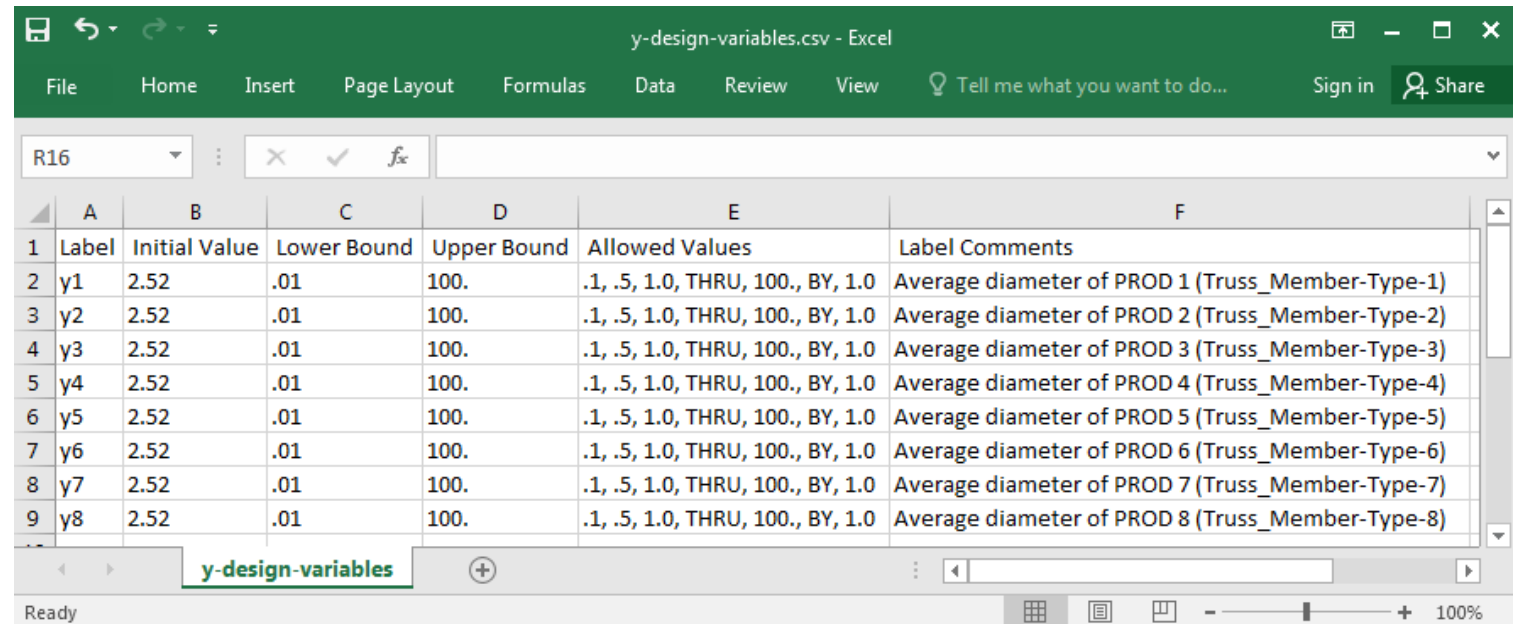
2. The Lower Bound for each variable is "1"

3. The Upper Bound for each variable is "8.00E+00"

4. Save the file

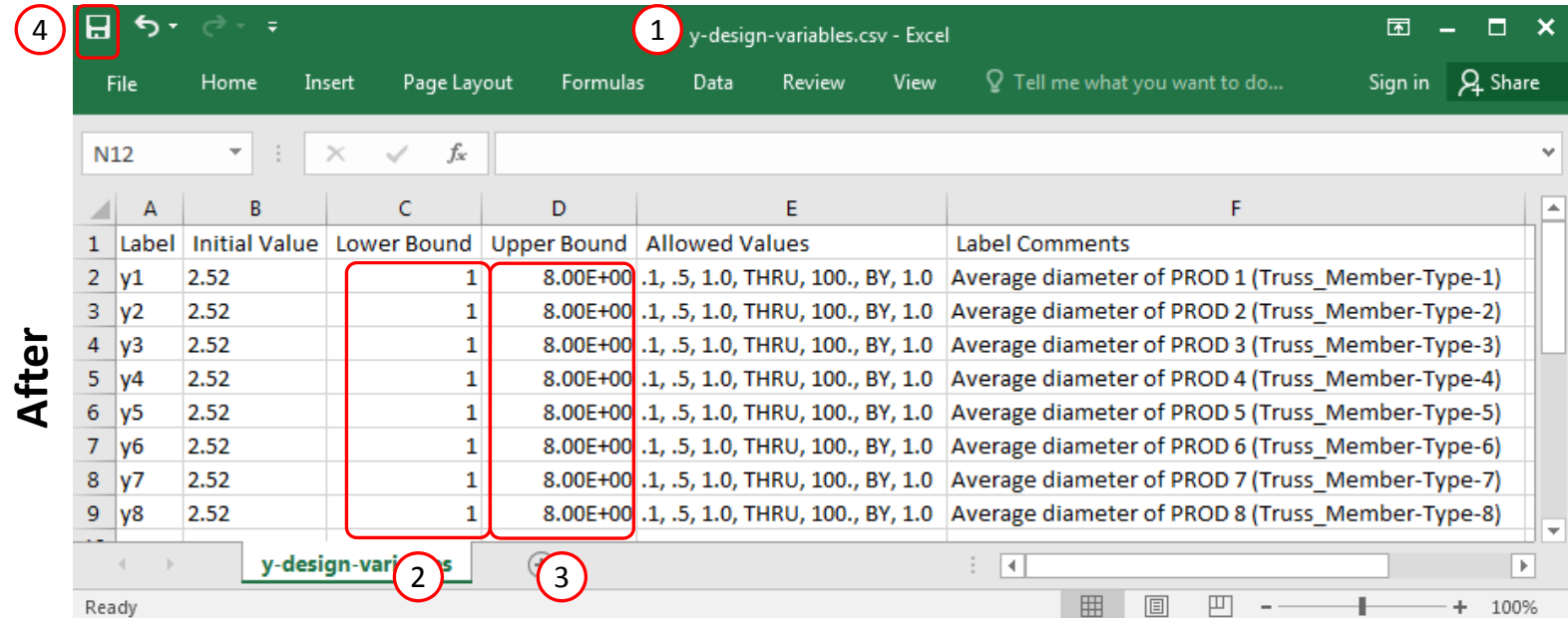
- The web app uses either xi or yi to label design variables. This is usually not sufficient to differentiate design variables. The Label Comments column can be used to add custom comments for each variable, e.g. Truss member A-101. The label comments are visible in the Size app and the Local Optimization Results app when the design variable history is plotted.

Before



	A	B	C	D	E	F
1	Label	Initial Value	Lower Bound	Upper Bound	Allowed Values	Label Comments
2	y1	2.52	.01	100.	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 1 (Truss_Member-Type-1)
3	y2	2.52	.01	100.	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 2 (Truss_Member-Type-2)
4	y3	2.52	.01	100.	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 3 (Truss_Member-Type-3)
5	y4	2.52	.01	100.	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 4 (Truss_Member-Type-4)
6	y5	2.52	.01	100.	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 5 (Truss_Member-Type-5)
7	y6	2.52	.01	100.	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 6 (Truss_Member-Type-6)
8	y7	2.52	.01	100.	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 7 (Truss_Member-Type-7)
9	y8	2.52	.01	100.	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 8 (Truss_Member-Type-8)

After



	A	B	C	D	E	F
1	Label	Initial Value	Lower Bound	Upper Bound	Allowed Values	Label Comments
2	y1	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 1 (Truss_Member-Type-1)
3	y2	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 2 (Truss_Member-Type-2)
4	y3	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 3 (Truss_Member-Type-3)
5	y4	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 4 (Truss_Member-Type-4)
6	y5	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 5 (Truss_Member-Type-5)
7	y6	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 6 (Truss_Member-Type-6)
8	y7	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 7 (Truss_Member-Type-7)
9	y8	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 8 (Truss_Member-Type-8)

# CSV Change of Variables

Return to the web app

1. Select the .csv file that was modified on the previous slide.
2. Click Import.
3. A summary of changes are shown.
4. Click +Options to hide the CSV section

- The reader is encouraged to review the summary thoroughly to confirm the intended changes have been performed.

## Step 4 - Adjust design variables

+ Options 4

☐ Label Comments

CSV Export

Export

CSV Import

1 Select files y-design-variables.csv

Import 2 CSV imported

Summary of successful updates. All other data untouched.

Label	Field	Previous Value	New Value
y1	Lower Bound	.01	1.
y1	Upper Bound	100.	8.00E00
y2	Lower Bound	.01	1.
y2	Upper Bound	100.	8.00E00
y3	Lower Bound	.01	1.
y3	Upper Bound	100.	8.00E00
y4	Lower Bound	.01	1.
y4	Upper Bound	100.	8.00E00
y5	Lower Bound	.01	1.
y5	Upper Bound	100.	8.00E00

# CSV Change of Variables

- Note that the bounds have been updated.

- The other inputs, e.g. Initial Value, Lower Bound, etc., can be changed in the web app or in the CSV file.

Before

## Step 4 - Adjust design variables

+ Options

+ Create Variable

	Label ⇅	Status ⇅	Initial Value	Lower Bound	Upper Bound	Allowed Discrete Values
	<input type="text" value="Search"/>	<input type="text" value="Search"/>				
✖	y1	✓	2.52	.01	100.	.1, .5, 1.0, THRU, 100., BY, 1.0
✖	y2	✓	2.52	.01	100.	.1, .5, 1.0, THRU, 100., BY, 1.0
✖	y3	✓	2.52	.01	100.	.1, .5, 1.0, THRU, 100., BY, 1.0
✖	y4	✓	2.52	.01	100.	.1, .5, 1.0, THRU, 100., BY, 1.0
✖	y5	✓	2.52	.01	100.	.1, .5, 1.0, THRU, 100., BY, 1.0

After

## Step 4 - Adjust design variables

+ Options

+ Create Variable

	Label ⇅	Status ⇅	Initial Value	Lower Bound	Upper Bound	Allowed Discrete Values
	<input type="text" value="Search"/>	<input type="text" value="Search"/>				
✖	y1	✓	2.52	1.	8.00E00	.1, .5, 1.0, THRU, 100., BY, 1.0
✖	y2	✓	2.52	1.	8.00E00	.1, .5, 1.0, THRU, 100., BY, 1.0
✖	y3	✓	2.52	1.	8.00E00	.1, .5, 1.0, THRU, 100., BY, 1.0
✖	y4	✓	2.52	1.	8.00E00	.1, .5, 1.0, THRU, 100., BY, 1.0
✖	y5	✓	2.52	1.	8.00E00	.1, .5, 1.0, THRU, 100., BY, 1.0



# CSV Change of Variables

1. Navigate to the section titled Step 5 – Adjust DVXREL2
2. Click +Options
  - A CSV file may be exported, edited and imported for DVPREL2, DVCREL2 and DVMREL2 entries

## Step 5 - Adjust DVXREL2 ①

✕ Delete Visible Rows

+ Options ②

☐ Entry Name ☐ Show All Labels

CSV Export

Export

CSV Import

Select files

Select a CSV File

Import

	Label ⇅	Status ⇅	Property ⇅	Property Description ⇅	Entry ⇅	Entry ID ⇅	Initial Value ⇅	Lower Bound	Upper Bound	Equation
	<input type="text" value="Search"/>	<input type="text" value="Search"/>	<input type="text" value="Search"/>	<input type="text" value="Search"/>	<input type="text" value="Search"/>	<input type="text" value="Search"/>	<input type="text" value="Search"/>	<input type="text" value="Search"/>	<input type="text" value="Search"/>	<input type="text" value="Search"/>
✕	P1	✓	A	Area of the rod	PROD	1	2.0	.001	Maximum	$3.14 * y1^{**2} / 10.0$
✕	P2	✓	A	Area of the rod	PROD	2	2.0	.001	Maximum	$3.14 * y2^{**2} / 10.0$
✕	P3	✓	A	Area of the rod	PROD	3	2.0	.001	Maximum	$3.14 * y3^{**2} / 10.0$
✕	P4	✓	A	Area of the rod	PROD	4	2.0	.001	Maximum	$3.14 * y4^{**2} / 10.0$
✕	P5	✓	A	Area of the rod	PROD	5	2.0	.001	Maximum	$3.14 * y5^{**2} / 10.0$



# CSV Export/Import for Constraints

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# CSV Change of Constraints

Return to the existing web app session.

1. Click Constraints
2. Navigate to the section titled Step 2 – Adjust constraints
3. Click Options
4. Click Export

- Constraints use labels of the form ri, e.g. r1, r2, r3, ... There are other responses that use labels of the form ai and bi, e.g. a1, a2, b1, b2, ... The CSV Export/Import functionality exists for ri, ai and bi.

Constraints	Equation Constraints
	Displacement
	Strain
	Element Strain Energy
	STRAIN
	ESE

« 1 2 3 4 5 »

5 10 20 30 40 50

## 2 Step 2 - Adjust constraints

### 3 + Options

☐ Overwrite PTYP ☒ Property Type ☐ Element Type ☐ Overwrite ATTA ☒ ATTA ☐ Frequency Bounds

#### CSV Export

#### CSV Import

4

Select files Select a CSV File

	Label	Status	Response Type	Property Type	ATTA	ATTB	ATTi	Lower Allowed Limit	Upper Allowed Limit
	Si	Seal	Search	Search	Search	Search	Search	Search	Search
	r1		STRESS	PROD	2 - Axial stress		1	-40000.	40000.
	r2		STRESS	PROD	2 - Axial stress		2	-40000.	40000.
	r3		STRESS	PROD	2 - Axial stress		3	-40000.	40000.
	r4		STRESS	PROD	2 - Axial stress		4	-40000.	40000.
	r5		STRESS	PROD	2 - Axial stress		5	-40000.	40000.

« 1 2 »

5 10 20 30 40 50

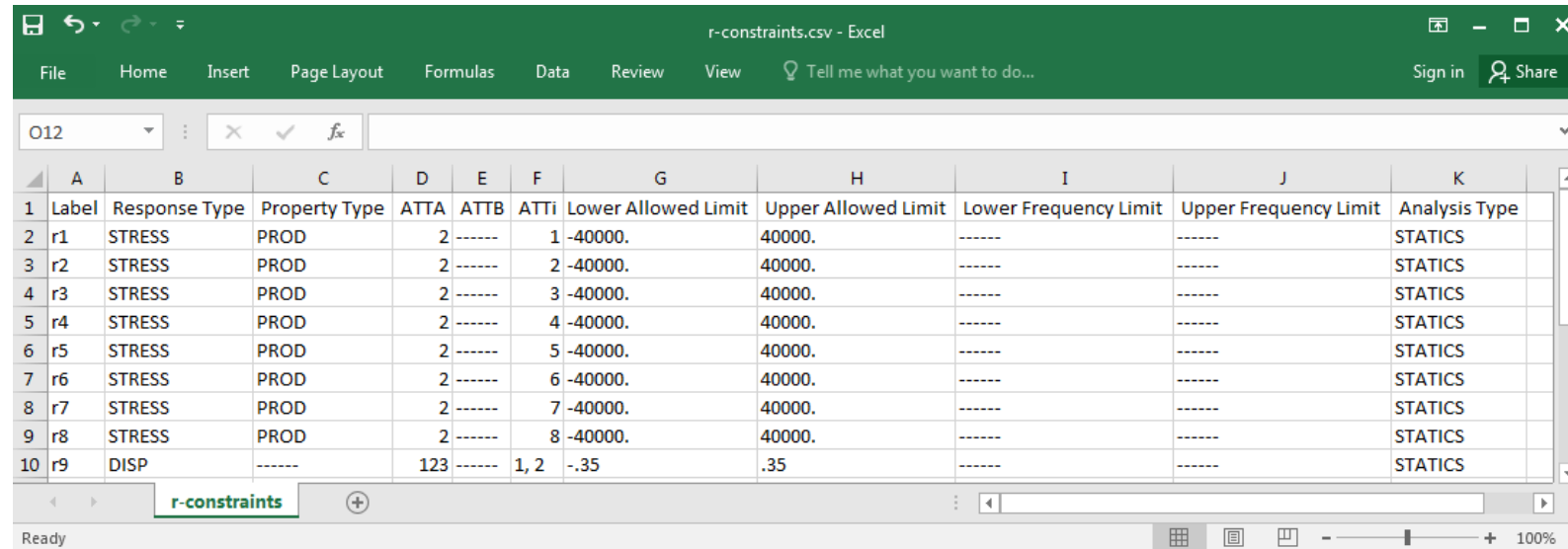
# CSV Change of Constraints

The following changes must be performed:

- These constraints will be deleted: r6, r7 and r8
- New constraints r600, r700 and r800 will be created

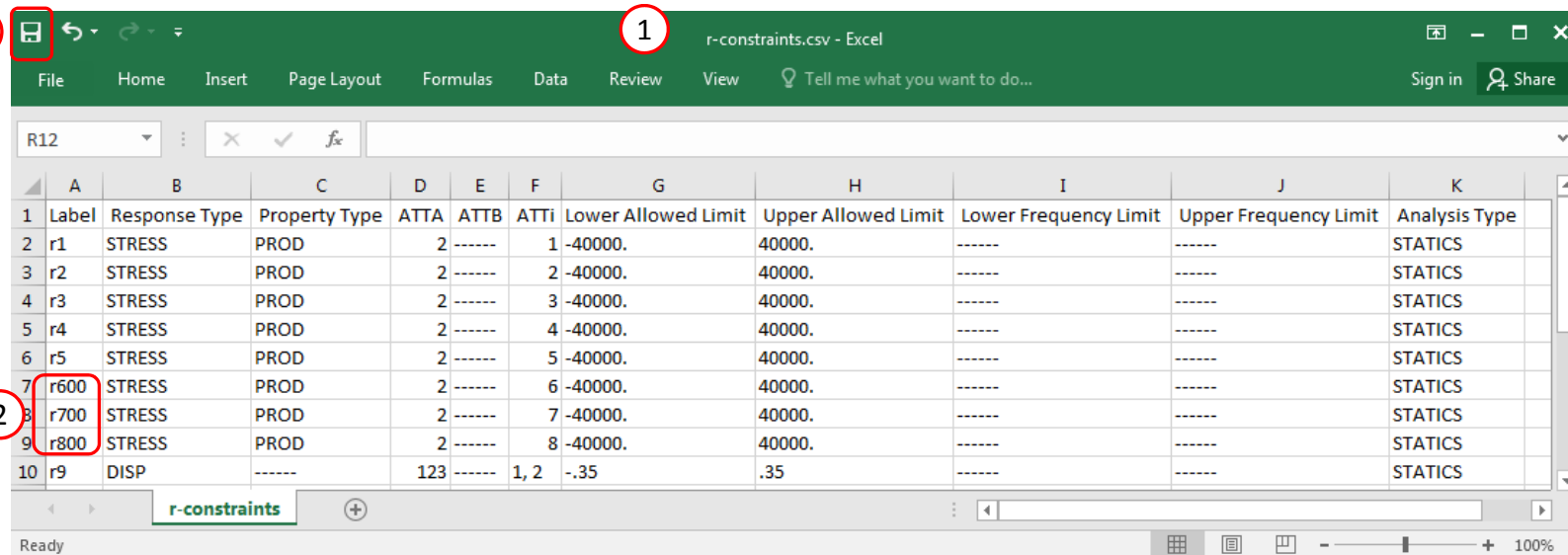
1. Open the downloaded file in Excel
2. Make the following edits
  - Rename r6 to r600
  - Rename r7 to r700
  - Rename r8 to r800
3. Save the file

Before



	A	B	C	D	E	F	G	H	I	J	K
1	Label	Response Type	Property Type	ATTA	ATTB	ATTI	Lower Allowed Limit	Upper Allowed Limit	Lower Frequency Limit	Upper Frequency Limit	Analysis Type
2	r1	STRESS	PROD	2	----	1	-40000.	40000.	----	----	STATICS
3	r2	STRESS	PROD	2	----	2	-40000.	40000.	----	----	STATICS
4	r3	STRESS	PROD	2	----	3	-40000.	40000.	----	----	STATICS
5	r4	STRESS	PROD	2	----	4	-40000.	40000.	----	----	STATICS
6	r5	STRESS	PROD	2	----	5	-40000.	40000.	----	----	STATICS
7	r6	STRESS	PROD	2	----	6	-40000.	40000.	----	----	STATICS
8	r7	STRESS	PROD	2	----	7	-40000.	40000.	----	----	STATICS
9	r8	STRESS	PROD	2	----	8	-40000.	40000.	----	----	STATICS
10	r9	DISP	----	123	----	1, 2	-.35	.35	----	----	STATICS

After



	A	B	C	D	E	F	G	H	I	J	K
1	Label	Response Type	Property Type	ATTA	ATTB	ATTI	Lower Allowed Limit	Upper Allowed Limit	Lower Frequency Limit	Upper Frequency Limit	Analysis Type
2	r1	STRESS	PROD	2	----	1	-40000.	40000.	----	----	STATICS
3	r2	STRESS	PROD	2	----	2	-40000.	40000.	----	----	STATICS
4	r3	STRESS	PROD	2	----	3	-40000.	40000.	----	----	STATICS
5	r4	STRESS	PROD	2	----	4	-40000.	40000.	----	----	STATICS
6	r5	STRESS	PROD	2	----	5	-40000.	40000.	----	----	STATICS
7	r600	STRESS	PROD	2	----	6	-40000.	40000.	----	----	STATICS
8	r700	STRESS	PROD	2	----	7	-40000.	40000.	----	----	STATICS
9	r800	STRESS	PROD	2	----	8	-40000.	40000.	----	----	STATICS
10	r9	DISP	----	123	----	1, 2	-.35	.35	----	----	STATICS

# CSV Change of Constraints

Return to the web app

1. Select the .csv file that was modified on the previous slide
2. Click Import
3. A summary of changes are shown
4. Note that responses r6, r7 and r8 no longer exist and have been deleted.
5. Responses r600, r700, and r800 are seen as new responses, so new entries are created for these responses.
6. Click +Options to hide the CSV section

## Step 2 - Adjust constraints

+ Options 6

☐ Overwrite PTYPE ☒ Property Type ☐ Element Type ☐ Overwrite ATTA ☒ ATTA ☐ Frequency Bounds

CSV Export

Export

CSV Import

1

Select files

r-constraints.csv

Import 2

CSV imported

3

Summary of successful updates. All other data untouched.

Label	Field	Previous Value	New Value
Created r600			
Created r700			
Created r800			
Deleted r6			
Deleted r7			
Deleted r8			
r600	Property Type		PROD
r600	ATTA		2
r600	ATTi		6
r600	Frequency Bounds		10000

5

4

# CSV Change of Constraints

1. On the pagination bar, click 20 to display at most 20 rows in the table
2. The 3 deleted constraints are absent, the 3 new constraints are shown and the inputs from the CSV file have been imported

- Note that 4 constraints (r6, r7, r8) have been deleted and 3 new constraints (r600, r700, r800) have been created. On CSV import, the web app will match what is in the CSV file.

Before

## Step 2 - Adjust constraints

+ Options

	Label	Status	Response Type	Property Type	ATTA	ATTB	ATTI	Lower Allowed Limit	Upper Allowed Limit
	Si	Seal	Search	Search	Search	Search	Search	Search	Search
✖	r1	✓	STRESS	PROD	2 - Axial stress		1	-40000.	40000.
✖	r2	✓	STRESS	PROD	2 - Axial stress		2	-40000.	40000.
✖	r3	✓	STRESS	PROD	2 - Axial stress		3	-40000.	40000.
✖	r4	✓	STRESS	PROD	2 - Axial stress		4	-40000.	40000.
✖	r5	✓	STRESS	PROD	2 - Axial stress		5	-40000.	40000.
✖	r6	✓	STRESS	PROD	2 - Axial stress		6	-40000.	40000.
✖	r7	✓	STRESS	PROD	2 - Axial stress		7	-40000.	40000.
✖	r8	✓	STRESS	PROD	2 - Axial stress		8	-40000.	40000.
✖	r9	✓	DISP		123 - T1, T2, T3		1, 2	-.35	.35

## Step 2 - Adjust constraints

After

+ Options

	Label	Status	Response Type	Property Type	ATTA	ATTB	ATTI	Lower Allowed Limit	Upper Allowed Limit
	Si	Seal	Search	Search	Search	Search	Search	Search	Search
✖	r1	✓	STRESS	PROD	2 - Axial stress		1	-40000.	40000.
✖	r2	✓	STRESS	PROD	2 - Axial stress		2	-40000.	40000.
✖	r3	✓	STRESS	PROD	2 - Axial stress		3	-40000.	40000.
✖	r4	✓	STRESS	PROD	2 - Axial stress		4	-40000.	40000.
✖	r5	✓	STRESS	PROD	2 - Axial stress		5	-40000.	40000.
✖	r9	✓	DISP		123 - T1, T2, T3		1, 2	-.35	.35
✖	r600	✓	STRESS	PROD	2 - Axial stress		6	-40000.	40000.
✖	r700	✓	STRESS	PROD	2 - Axial stress		7	-40000.	40000.
✖	r800	✓	STRESS	PROD	2 - Axial stress		8	-40000.	40000.

5 10 20 30 40 50

1

# CSV Change of Constraints

## 1. Click Exporter

The validation reveals that additional actions are required

## 2. The newly created constraints r600, r700 and r800 are not assigned to subcases

## 3. Click Jump to table

```
SOL 200
CEND

TITLE   = OPTIMAL SIZING OF A 25-BAR TRUSS -          DSOUG8
SUBTITLE = EIGHT INDEPENDENT ROD DIAMETERS
ECHO    = NONE
OLOAD   = ALL
DISP    = ALL
SPCFORCE = ALL
ELFORCE = ALL
STRESS  = ALL
SPC     = 100
        DESOBJ(MIN) = 8000000
        $ DESGLB Slot
        $ DSAPRT(FORMATTED, EXPORT, END=SENS) = ALL
SUBCASE 1
ANALYSIS = STATICS
DESSUB = 40000001
$ DRSPAN Slot
LABEL = LOAD CONDITION 1
LOAD = 300
SUBCASE 2
ANALYSIS = STATICS
DESSUB = 40000001
$ DRSPAN Slot
LABEL = LOAD CONDITION 2
```

## Download BDF Files

[Download BDF Files](#)

**Errors detected!** Check the Status column of the following tables.

Correct: Incorrect:

[Constraints](#) [Jump to table](#) Step 3 - Optional - Create equation constraints

2

**Caution!** Not all constraints have been assigned to a subcase. Check the Status column of the following tables.

Correct: Incorrect:

[Constraints](#) [Jump to table](#) Step 1 - Assign constraints to subcases

3

# Assign Constraints to Load Cases (SUBCASES)

The newly created constraints (r600, r700, r800) must be assigned to load cases.

1. Click Subcases
2. Select only SUBCASE 1 and SUBCASE 2
3. Mark the indicated checkmarks

- The following constraints are now assigned to SUBCASE 1 and 2: r600, r700, r800

1

## Step 1 - Assign constraints to subcases

Display Columns

Global Constraints

SUBCASE 1

SUBCASE 2

2

☐ Uncheck visible boxes

☒ Check visible boxes

+ Options

	Status	Label	Response Type	Description	SUBCASE 1	SUBCASE 2
		<input type="text" value="Search"/>	<input type="text" value="Search"/>	<input type="text" value="Search"/>		
	<input checked="" type="checkbox"/>	r600	STRESS	Stress, Axial stress, of elements associated with PROD 6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>	r700	STRESS	Stress, Axial stress, of elements associated with PROD 7	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>	r800	STRESS	Stress, Axial stress, of elements associated with PROD 8	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>	r1	STRESS	Stress, Axial stress, of elements associated with PROD 1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>	r2	STRESS	Stress, Axial stress, of elements associated with PROD 2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	<input checked="" type="checkbox"/>	r3	STRESS	Stress, Axial stress, of elements associated with PROD 3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

3

# CSV Export/Import for Equation Constraints

---



# CSV Change of Constraints

1. Click Exporter

The validation reveals that additional actions are required

2. The change in labels, e.g. r6 to r600, has rendered some entries to be outdated and must be updated
3. Click Jump to table

```
SOL 200
CEND

TITLE   = OPTIMAL SIZING OF A 25-BAR TRUSS -          DSOU68
SUBTITLE = EIGHT INDEPENDENT ROD DIAMETERS
ECHO    = NONE
OLOAD   = ALL
DISP    = ALL
SPCFORCE = ALL
ELFORCE = ALL
STRESS  = ALL
SPC     = 100
        DESOBJ(MIN) = 8000000
        $ DESGLB Slot
        $ DSAPRT(FORMATTED, EXPORT, END=SENS) = ALL
SUBCASE 1
ANALYSIS = STATICS
DESSUB = 40000001
$ DRSPAN Slot
LABEL = LOAD CONDITION 1
LOAD = 300
SUBCASE 2
ANALYSIS = STATICS
DESSUB = 40000001
$ DRSPAN Slot
LABEL = LOAD CONDITION 2
```

## Download BDF Files

Download BDF Files

2

**Errors detected!** Check the Status column of the following tables.

Correct: Incorrect:

Constraints [Jump to table](#)

Step 3 - Optional - Create equation constraints

3

# CSV Change of Equation Constraints

A. Suppose the goal is to update the labels of the indicated equations. The equations can be modified either directly in the web app or via CSV. The CSV method is used. In this example, the labels r6, r7, r8 may or may not exist. The status markers may either be blue or red. Regardless of your situation, the goal is to modify the labels in the equation.

1. Find the section title Step 1 – Create equation constraints
2. Click Options
3. Click Export

• The CSV Export/Import capability also applies to equations.

## 1 Step 1 - Create equation constraints

+ Add Equation Constraint

## 2 + Options

- ☐ Frequency Bounds    ☐ Show All Labels  
☐ Show TABLED1

CSV Export

CSV Import

3 Export

Select files    Select a CSV File

Import

A

	Label ▾	Status ▴	Equation ▾	Lower Allowed Limit	Upper Allowed Limit
	<input type="text" value="Search"/>	<input type="text" value="Search"/>	<input type="text" value="Search"/>	<input type="text" value="Search"/>	<input type="text" value="Search"/>
	R6		$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r6 * 181.14^{**2} / y6^{**2}$ The following labels do not exist: <span style="color: red;">r6</span> . <a href="#">+ Details</a>	Lower  1.0	1.0
	R7		$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r7 * 181.14^{**2} / y7^{**2}$ The following labels do not exist: <span style="color: red;">r7</span> . <a href="#">+ Details</a>	Lower  1.0	1.0
	R8		$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r8 * 133.46^{**2} / y8^{**2}$ The following labels do not exist: <span style="color: red;">r8</span> . <a href="#">+ Details</a>	Lower  1.0	1.0
	R1		$1.25 * ((-7.69 * r1 * 75.0^{**2}) / (3.14^{**2} * 1.0E7 * y1^{**2}))$	Lower  1.0	1.0
	R2		$-7.69 * r2 * 130.5^{**2}; G2 = 3.14^{**2} * 1.0E7 * y2^{**2}; G3 = g / G2 * 1.25$	Lower  1.0	1.0

« 1 2 »    5 10 20 30 40 50

# CSV Change of Equation Constraints

1. Open the downloaded file in Excel
2. Perform the indicated changes
  1. Rename r6 to r600
  2. Rename r7 to r700
  3. Rename r8 to r800
3. Save the file

Before

	A	B	C	D	E	F
1	Label	Equation	Lower Allowed Limit	Upper Allowed Limit	Lower Frequency Limit	Upper Frequency Limit
2	R1	$1.25 * ((-7.69 * r1 * 75.0^{**2}) / (3.14^{**2} * 1.0E7 * y1^{**2}))$		1.0		
3	R2	$-7.69 * r2 * 130.5^{**2}; G2 = 3.14^{**2} * 1.0E7 * y2^{**2}; G3 = g / G2 * 1.25$		1.0		
4	R3	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r3 * 106.8^{**2} / y3^{**2}$		1.0		
5	R4	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r4 * 75.0^{**2} / y4^{**2}$		1.0		
6	R5	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r5 * 75.0^{**2} / y5^{**2}$		1.0		
7	R6	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r6 * 181.14^{**2} / y6^{**2}$		1.0		
8	R7	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r7 * 181.14^{**2} / y7^{**2}$		1.0		
9	R8	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r8 * 133.46^{**2} / y8^{**2}$		1.0		

After

	A	B	C	D	E	F
1	Label	Equation	Lower Allowed Limit	Upper Allowed Limit	Lower Frequency Limit	Upper Frequency Limit
2	R1	$1.25 * ((-7.69 * r1 * 75.0^{**2}) / (3.14^{**2} * 1.0E7 * y1^{**2}))$		1.0		
3	R2	$-7.69 * r2 * 130.5^{**2}; G2 = 3.14^{**2} * 1.0E7 * y2^{**2}; G3 = g / G2 * 1.25$		1.0		
4	R3	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r3 * 106.8^{**2} / y3^{**2}$		1.0		
5	R4	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r4 * 75.0^{**2} / y4^{**2}$		1.0		
6	R5	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r5 * 75.0^{**2} / y5^{**2}$		1.0		
7	R6	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r600 * 181.14^{**2} / y6^{**2}$		1.0		
8	R7	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r700 * 181.14^{**2} / y7^{**2}$		1.0		
9	R8	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r800 * 133.46^{**2} / y8^{**2}$		1.0		

# CSV Change of Equation Constraints

Return to the web app

1. Select the .csv file that was modified on the previous slide
2. Click Import
3. A summary of changes are shown
4. Click +Options to hide the CSV section

- The reader is encouraged to review the summary thoroughly to confirm the intended changes have been performed.

## Step 1 - Create equation constraints

+ Options 4

☐ Frequency Bounds ☐ Show All Labels  
☐ Show TABLED1

CSV Export  
Export

CSV Import  
1 Select files R-equation-constraints.csv 2 Import

CSV imported

Summary of successful updates. All other data untouched.

Label	3 Field	Previous Value	New Value
R6	Equation	1.25 * -7.69 / (3.1...	1.25 * -7.69 / (3.1...
R7	Equation	1.25 * -7.69 / (3.1...	1.25 * -7.69 / (3.1...
R8	Equation	1.25 * -7.69 / (3.1...	1.25 * -7.69 / (3.1...

# CSV Change of Equation Constraints

1. Click Label to sort the column
2. On the pagination bar, click 10 to display at most 10 rows
3. Note that 3 of the equation constraints now have the changes that were included in the CSV file

- While not shown, it should be noted that the respective DEQATN entries are automatically updated when the CSV file is imported.

Before

## Step 1 - Create equation constraints

					+ Add Equation Constraint	
+ Options						
	Label ▾	Status ▾	Equation ▾	Lower Allowed Limit	Upper Allowed Limit	
	Search	Search	Search	Search	Search	
✖	R1	✓	$1.25 * ((-7.69 * r1 * 75.0^{**2}) / (3.14^{**2} * 1.0E7 * y1^{**2}))$	Lower	1.0	
✖	R2	✓	$-7.69 * r2 * 130.5^{**2}; G2 = 3.14^{**2} * 1.0E7 * y2^{**2}; G3 = g / G2 * 1.25$	Lower	1.0	
✖	R3	✓	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r3 * 106.8^{**2} / y3^{**2}$	Lower	1.0	
✖	R4	✓	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r4 * 75.^{**2} / y4^{**2}$	Lower	1.0	
✖	R5	✓	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r5 * 75.^{**2} / y5^{**2}$	Lower	1.0	
✖	R6	⚠	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r6 * 181.14^{**2} / y6^{**2}$ The following labels do not exist: <b>r6</b> . + Details	Lower	1.0	
✖	R7	⚠	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r7 * 181.14^{**2} / y7^{**2}$ The following labels do not exist: <b>r7</b> . + Details	Lower	1.0	
✖	R8	⚠	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r8 * 133.46^{**2} / y8^{**2}$ The following labels do not exist: <b>r8</b> . + Details	Lower	1.0	

## Step 1 - Create equation constraints

After

					+ Add Equation Constraint	
+ Options						
	Label ▾	Status ▾	Equation ▾	Lower Allowed Limit	Upper Allowed Limit	
	Search	Search	Search	Search	Search	
✖	R1	✓	$1.25 * ((-7.69 * r1 * 75.0^{**2}) / (3.14^{**2} * 1.0E7 * y1^{**2}))$	Lower	1.0	
✖	R2	✓	$-7.69 * r2 * 130.5^{**2}; G2 = 3.14^{**2} * 1.0E7 * y2^{**2}; G3 = g / G2 * 1.25$	Lower	1.0	
✖	R3	✓	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r3 * 106.8^{**2} / y3^{**2}$	Lower	1.0	
✖	R4	✓	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r4 * 75.^{**2} / y4^{**2}$	Lower	1.0	
✖	R5	✓	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r5 * 75.^{**2} / y5^{**2}$	Lower	1.0	
✖	R6	✓	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r600 * 181.14^{**2} / y6^{**2}$	Lower	1.0	
✖	R7	✓	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r700 * 181.14^{**2} / y7^{**2}$	Lower	1.0	
✖	R8	✓	$1.25 * -7.69 / (3.14^{**2} * 1.0E7); G1 = g * r800 * 133.46^{**2} / y8^{**2}$	Lower	1.0	

2	10	20	30	40	50
---	----	----	----	----	----

# Supplemental Slides

---

# CSV Export/Import Guidelines

## Editing Existing Entries

1. Cells with '-----' are not required and can be left as is or blank
2. All other cells can be edited

## Deleting and Creating Existing Entries

Creating and deleting entries is only supported for the following:

- DLINK Entries
- Other Responses
- Constraints
- Equation Constraints
- If the entry is not listed, then the CSV Export/Import capability cannot be used to create or delete for that particular entry.

3. To delete an existing entry, delete the entire row (Not shown)
4. To create a new entry, create a new row, provide a new label, and populate the required cells

	A	B	C	D	E	F	G	H	I	J	K
	Label	Response Type	Property Type	ATTA	ATTB	ATTi	Lower Allowed Limit	Upper Allowed Limit	Lower Frequency Limit	Upper Frequency Limit	Analysis Type
2	r1	STRESS	PROD	2	-----	1	-40000.	40000.	-----	-----	STATICS
3	r2	STRESS	PROD	2	-----	2	-40000.	40000.	-----	-----	STATICS
4	r3	STRESS	PROD	2	-----	3	-40000.	40000.	-----	-----	STATICS
5	r4	STRESS	PROD	2	-----	4	-40000.	40000.	-----	-----	STATICS
6	r5	STRESS	PROD	2	-----	5	-40000.	40000.	-----	-----	STATICS
7	r600	STRESS	PROD	2	-----	6	-40000.	40000.	-----	-----	STATICS
8	r700	STRESS	PROD	2	-----	7	-40000.	40000.	-----	-----	STATICS
9	r800	STRESS	PROD	2	-----	8	-40000.	40000.	-----	-----	STATICS
10	r9	DISP	-----	123	-----	1, 2	-.35	.35	-----	-----	STATICS

# Number Formatting

When a CSV file is uploaded to the web app, numbers that are not Nastran compatible are formatted. In this example, the numbers were formatted as follows:

1. The value of "1" did not have a decimal. The web app added a decimal.
2. The value of "8.00E+00", while Nastran compatible, had the + symbol removed since the symbol is not critical. If the number was "8.00E-00", the minus (-) symbol is kept.

y-design-variables.csv - Excel

File Home Insert Page Layout Formulas Data Review View Tell me what you want to do... Sign in Share

N12

	A	B	C	D	E	F
1	Label	Initial Value	Lower Bound	Upper Bound	Allowed Values	Label Comments
2	y1	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 1 (Truss_Member-Type-1)
3	y2	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 2 (Truss_Member-Type-2)
4	y3	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 3 (Truss_Member-Type-3)
5	y4	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 4 (Truss_Member-Type-4)
6	y5	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 5 (Truss_Member-Type-5)
7	y6	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 6 (Truss_Member-Type-6)
8	y7	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 7 (Truss_Member-Type-7)
9	y8	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 8 (Truss_Member-Type-8)

y-design-variables

Ready

Summary of successful updates. All other data untouched.

Label	Field	Previous Value	New Value
y1	Lower Bound	.01	1.
y1	Upper Bound	100.	8.00E00
y2	Lower Bound	.01	1.
y2	Upper Bound	100.	8.00E00
y3	Lower Bound	.01	1.
y3	Upper Bound	100.	8.00E00



# Number Formatting

1. If the number is formatted such that the number is significantly changed, the number is rejected so as not to import possibly unwanted numbers.
2. When inspecting the CSV file, it is seen that the number has a mix of numbers and letters and explains why the number was rejected.

## Step 4 - Adjust design variables

+ Options

+ Create Variable

☐ Label Comments

CSV Export

Export

CSV Import

Select files

y-design-variables.csv

Import

CSV

imported

### Summary of unsuccessful updates.

The following numbers found in the CSV file are not Nastran compatible. An attempt to format the number resulted in a significant change, and, therefore, the number was not accepted and imported.

Label	Field	Current Value	CSV Value	CSV Value Formatted
y1	Upper Bound	8.00E00	8AAASDF	8.

1

y-design-variables.csv - Excel									
File Home Insert Page Layout Formulas Data Review View Tell me what you want to do... Sign in Share									
	A	B	C	D	E	F	G	H	I
1	Label	Initial Value	Lower Bound	Upper Bound	Allowed Values	Label Comments			
2	y1	2.52		8aaasdf	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 1 (Truss_Member-Type-1)			
3	y2	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 2 (Truss_Member-Type-2)			
4	y3	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 3 (Truss_Member-Type-3)			
5	y4	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 4 (Truss_Member-Type-4)			
6	y5	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 5 (Truss_Member-Type-5)			
7	y6	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 6 (Truss_Member-Type-6)			
8	y7	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 7 (Truss_Member-Type-7)			
9	y8	2.52	1	8.00E+00	.1, .5, 1.0, THRU, 100., BY, 1.0	Average diameter of PROD 8 (Truss_Member-Type-8)			
10									

2

# Number Formatting

This table is a short summary of what is done for various number combinations.

CSV Value	Formatted Value	Action taken
+1	1.	Formatted value accepted
-8.00E-00	-8.00E-00	Formatted value accepted
+8.00E-00	8.00E-00	Formatted value accepted
8.00E+00	8.00E00	Formatted value accepted
+8.00E+00	8.00E00	Formatted value rejected*
1.00ABC5	1.005	Formatted value rejected*
+8.00E+00	8.00E00	Formatted value rejected*
12345678.	12345678	Formatted value rejected*

\* The small field format is limited to 8 characters. If the CSV Value is greater than 8 characters, an attempt to reduce the number of characters is performed by removing redundant or unnecessary characters. If the change in characters is significant, i.e. 2 or more characters are removed, the formatted value is rejected. If the number of characters varies by 1, the formatted number is accepted.

# CSV Support for DLINKs

The section *Step 3 - Create variable links* also supports CSV Export and Import.

While not covered in this tutorial, there are a few thoughts to keep in mind:

- Unsupported characters, such as ! @ # \$ % ^, are removed.
- No number formatting is done.

## Step 3 - Create variable links

+ Create DLINK

+ Options

☐ Show All Labels

CSV Export

Export

CSV Import

Select files

Select a CSV File

Import

	Status ▾	Dependent Design Variables ▾	Equation (Independent Design Variables) ▾
	<input type="checkbox"/>		
✖	✔	x2, x3, x4, x5, x6, x7, x8	$x1 * 1.0$
✖	✔	x10, x16	$x9 * -1.0$
✖	✔	x15	$x9 * 1.0$
✖	✔	x12, x14	$x11 * -1.0$
✖	✔	x13	$x11 * 1.0$

## Summary of Capabilities - CSV Export/Import

Entry Name	DESVAR/DVxREL1	DESVAR	DVxREL2	DLINK	DRESP1/DCONSTR	DRESP2/DCONSTR
Create and Delete Entries	No	No	No	Yes	Yes	Yes
Edit Existing Fields	Yes	Yes	Yes	Yes	Yes	Yes
Fields Supported	<ul style="list-style-type: none"> <li>Lower Bound (XLB)</li> <li>Upper Bound (XUB)</li> <li>Allowed Discrete Values (DDVALi)</li> </ul>	<ul style="list-style-type: none"> <li>Lower Bound (XLB)</li> <li>Upper Bound (XUB)</li> <li>Initial Value (XINIT)</li> <li>Allowed Discrete Values (DDVALi)</li> </ul>	<ul style="list-style-type: none"> <li>Lower Bound (PMIN)</li> <li>Upper Bound (PMAX)</li> <li>Equation (EQUATION)</li> </ul>	<ul style="list-style-type: none"> <li>Dependent Design Variables</li> <li>Equation (Independent Design Variables)</li> </ul>	<ul style="list-style-type: none"> <li>Response Type (RTYPE)</li> <li>Property Type (PTYPE)</li> <li>ATTA</li> <li>ATTB</li> <li>ATTi</li> <li>Lower Allowed Limit (LALLOW)</li> <li>Upper Allowed Limit (UALLOW)</li> <li>Lower Frequency Limit (LOWFQ)</li> <li>Upper Frequency Limit (HIGHFQ)</li> </ul>	<ul style="list-style-type: none"> <li>Equation (EQUATION)</li> <li>Lower Allowed Limit (LALLOW)</li> <li>Upper Allowed Limit (UALLOW)</li> <li>Lower Frequency Limit (LOWFQ)</li> <li>Upper Frequency Limit (HIGHFQ)</li> </ul>
Label Format	xi	yi	Pi, Ci, Mi	Not Applicable	ai, bi, ri	Ri

End of Tutorial