

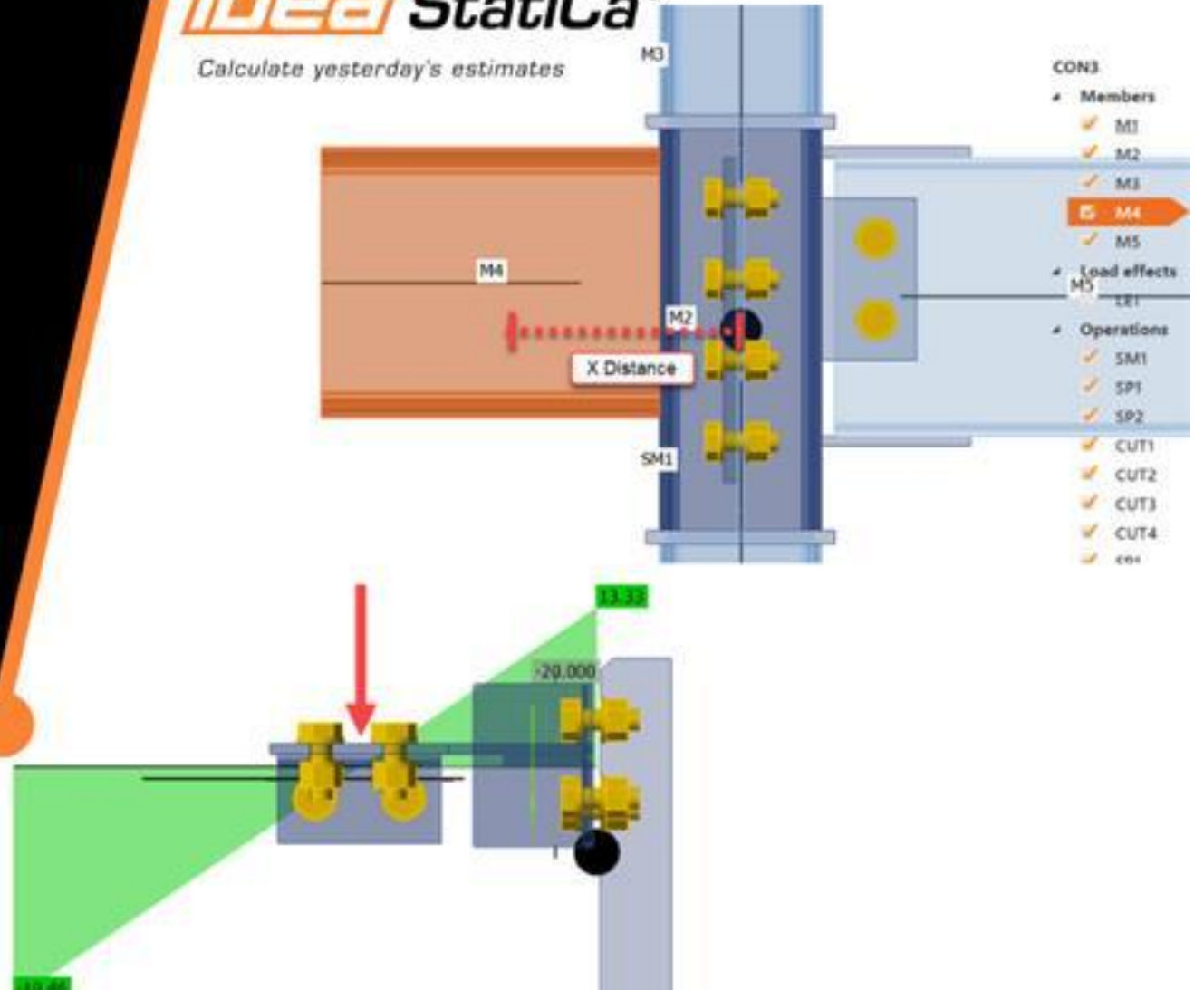
US Webinar

Structural loads in steel connection design

March 29th, 2023

IDEA StatiCa[®]

Calculate yesterday's estimates

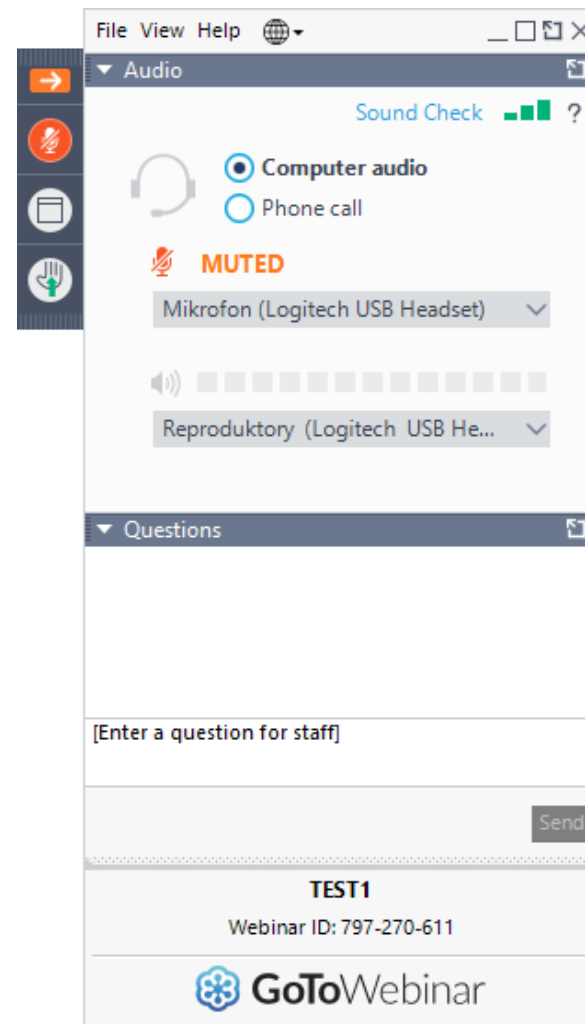


Control Panel

When you first join a session, the Control Panel appears on the right side of your screen. Use the Control Panel to manage your session. To free up space on your desktop, you can collapse the Control Panel and use the Grab Tab to continue to manage your session.

- **Grab Tab:** From the Grab Tab, you can hide the Control Panel, mute yourself (if you have been unmuted by the organizer), view the webinar in full screen and raise your hand.
- **Audio Pane:** Use the Audio pane to switch between Telephone and Mic & Speakers.
- **Questions Pane:** Ask questions for the staff.

QUESTIONS



Agenda

How IDEA loads the FEA Model?

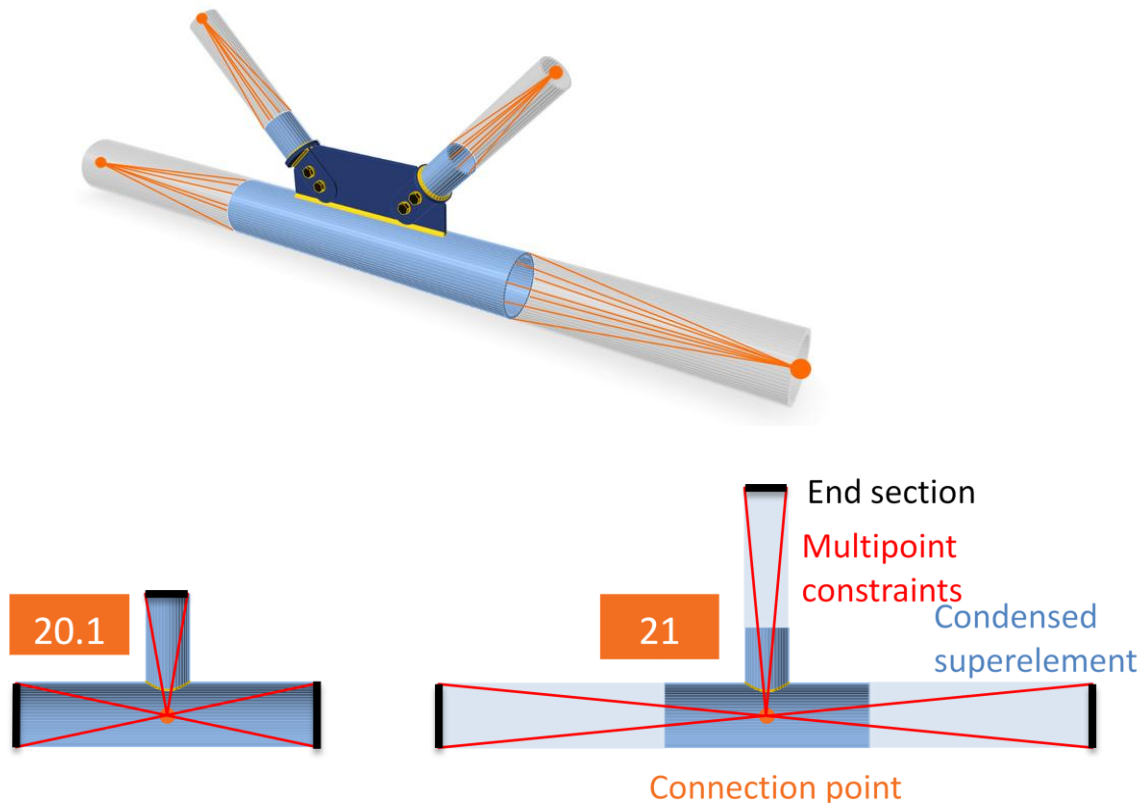
Load position

Loads in equilibrium

Loads as percentage of member capacity

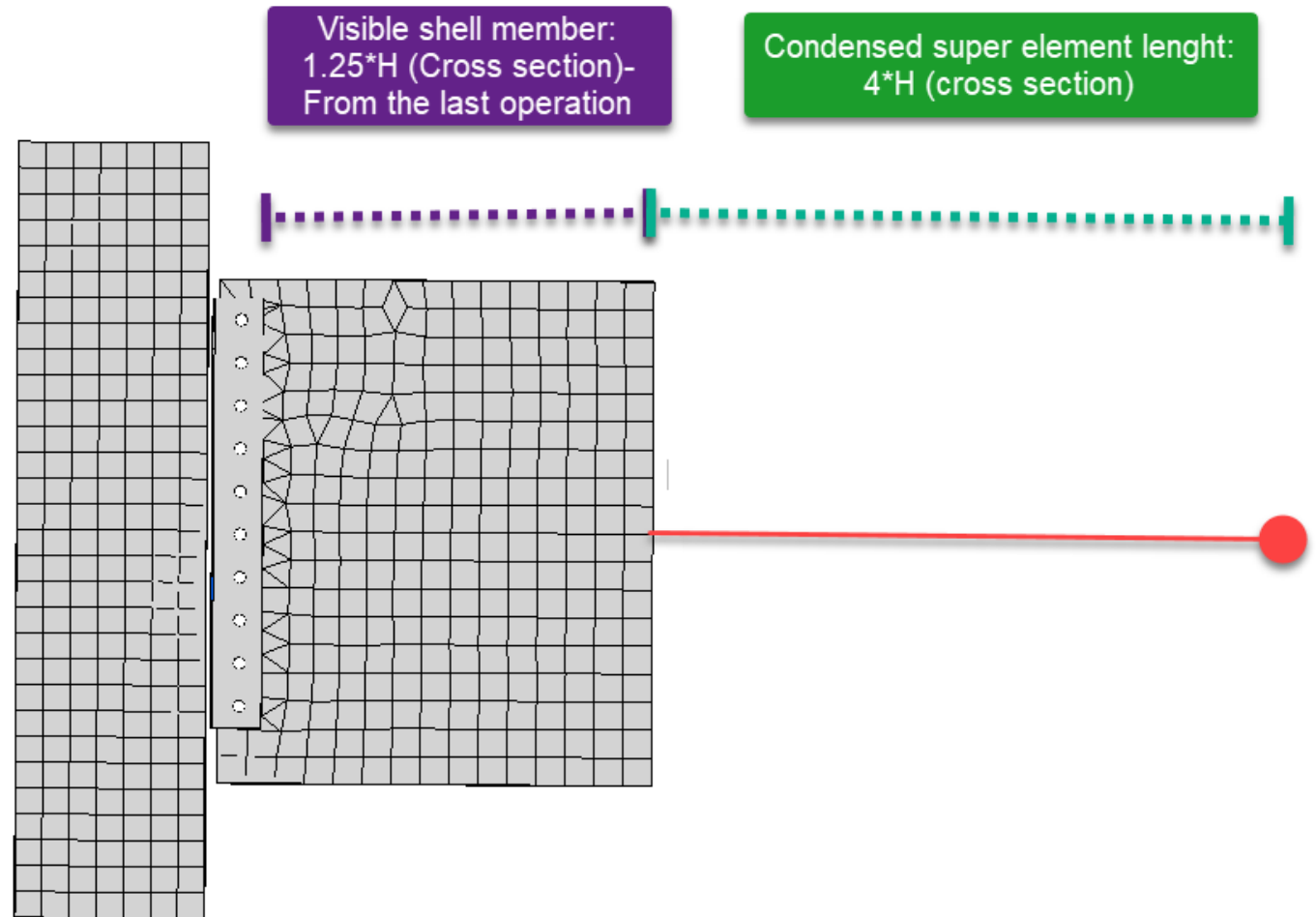
Import load combination from Excel

Condensed super elements



- The real length of the analyzed member is not shown
- Accurate stress/strain and deformation of members
- **Results show better compliance with experimental tests and design code formulations.**
- [Knowledge base](#)

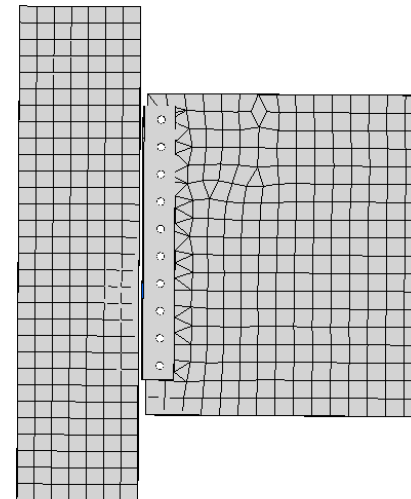
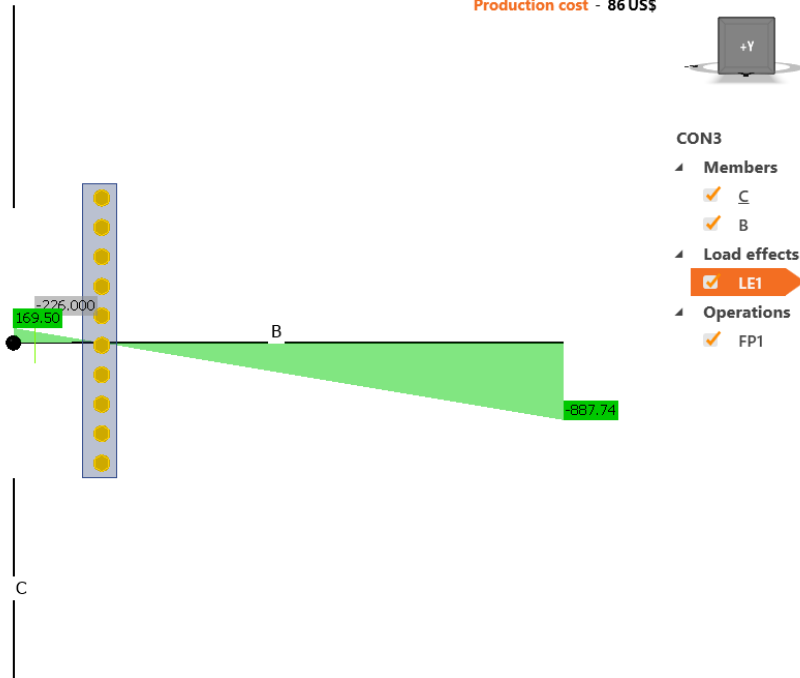
Member lengths



How IDEA loads the model?

Analysis 100.0%
Plates 0.0 < 5.0%
Bolts 97.4 < 100%
Welds 89.2 < 100%
Buckling Not calculated

Production cost - 86 US\$



IDEA transfers deformation through the condensed super element and that deformation is transmitted to the shell element visible model

Moment diagram

IDEA StatiCa CONNECTION Shear connections.ideaCon

Project | Design | Check | Report | Materials

CON3 | EPS ST CD DR FAT FIR HT | New Copy | Undo Redo Save | Members Plates LCS | Data Labels Pictures | Propose Publish Manage | Code setup Calculate Overall check | Settings | LRFD 2016 | XLS Import Connection Import XLS Export | Member Load Operation

Project Items | Solid Transparent Wireframe | LE1 [Load] | Copy Delete

Analysis 100.0%
 Plates 0.0 < 5.0%
 Bolts 97.4 < 100%
 Welds 89.2 < 100%
 Buckling Not calculated

Production cost - 86 US\$

CON3

- Members
 - C
 - B
- Load effects
 - LE1
- Operations
 - FP1

Member	N [kip]	Vy [kip]	Vz [kip]	Mx [kip.ft]	My [kip.ft]	Mz [kip.ft]
C / Begin	0.000	0.000	0.000	0.00	0.00	0.00
C / End	0.000	0.000	0.000	0.00	0.00	0.00
> B / End	0.000	0.000	-226.000	0.00	0.00	0.00

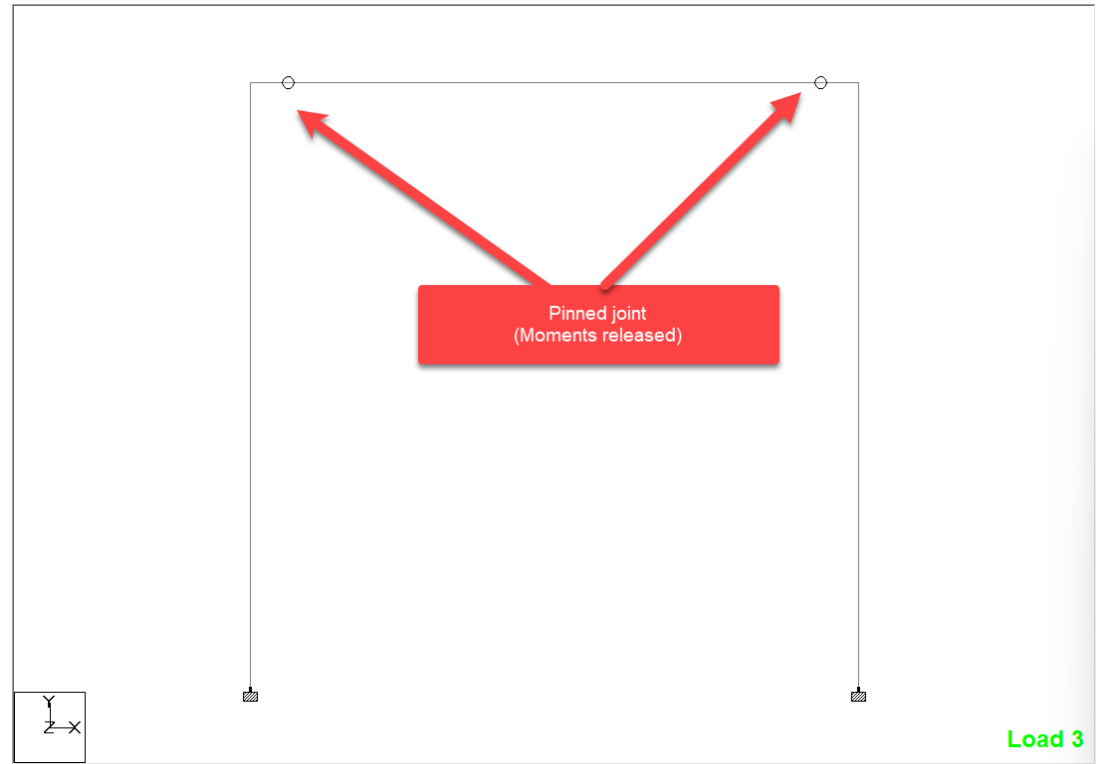
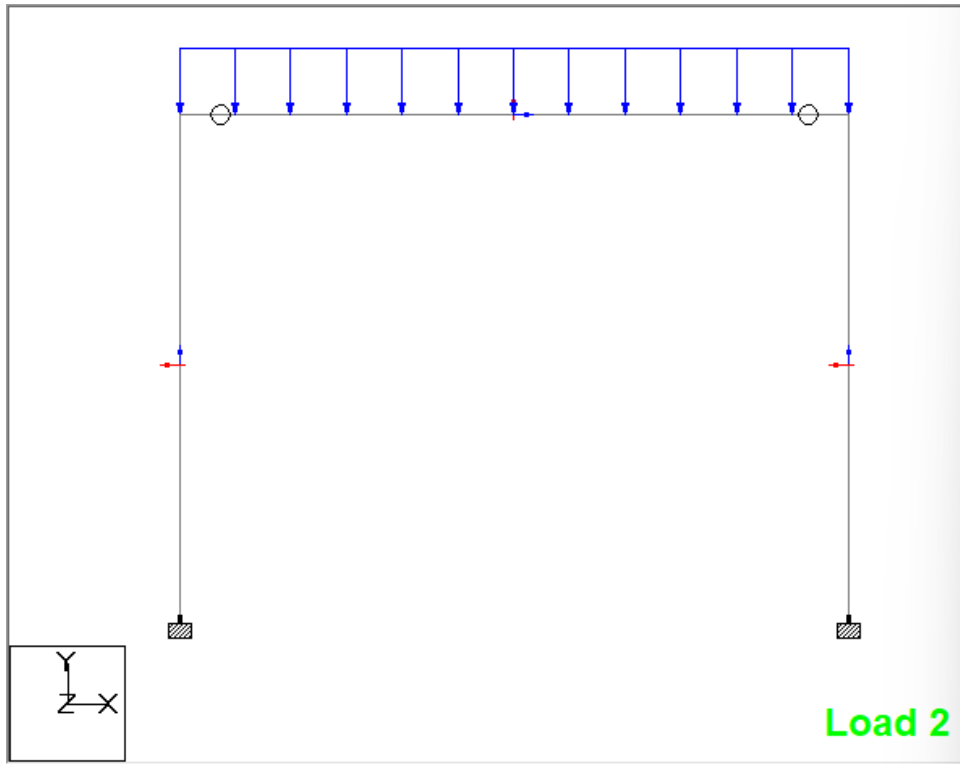
Values in disabled cells are not taken into account in CBFEM analysis. Members can be loaded only by that components of internal forces which are defined in member "Model type".

Unbalanced forces

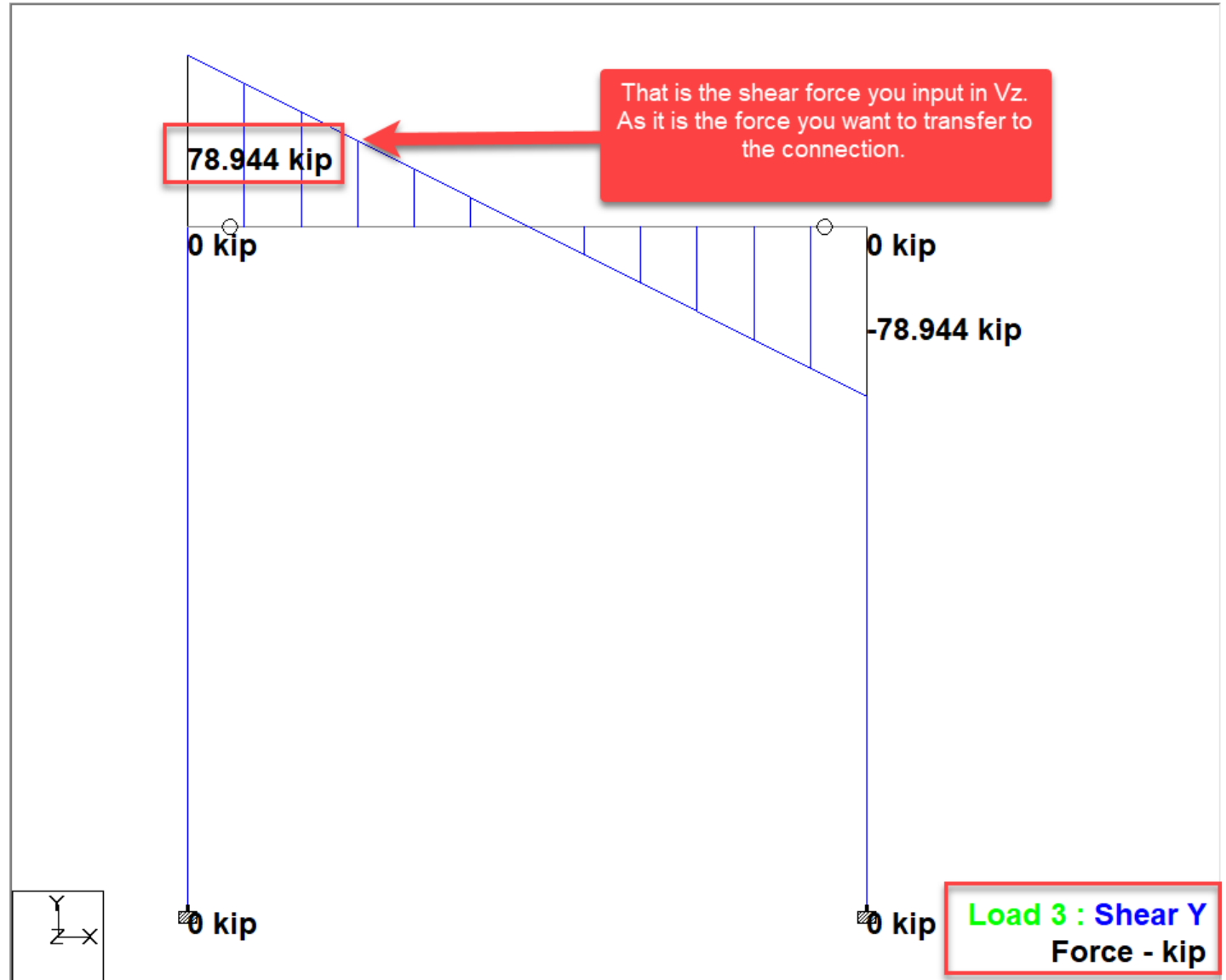
X [kip]	Y [kip]	Z [kip]	Mx [kip.ft]	My [kip.ft]	Mz [kip.ft]
0.000	0.000	-226.000	0.00	169.50	0.00

Design code: AISC - LRFD (2016) | Analysis: Stress, strain | Load effects: In equilibrium | Units: in | www.ideastatica.com

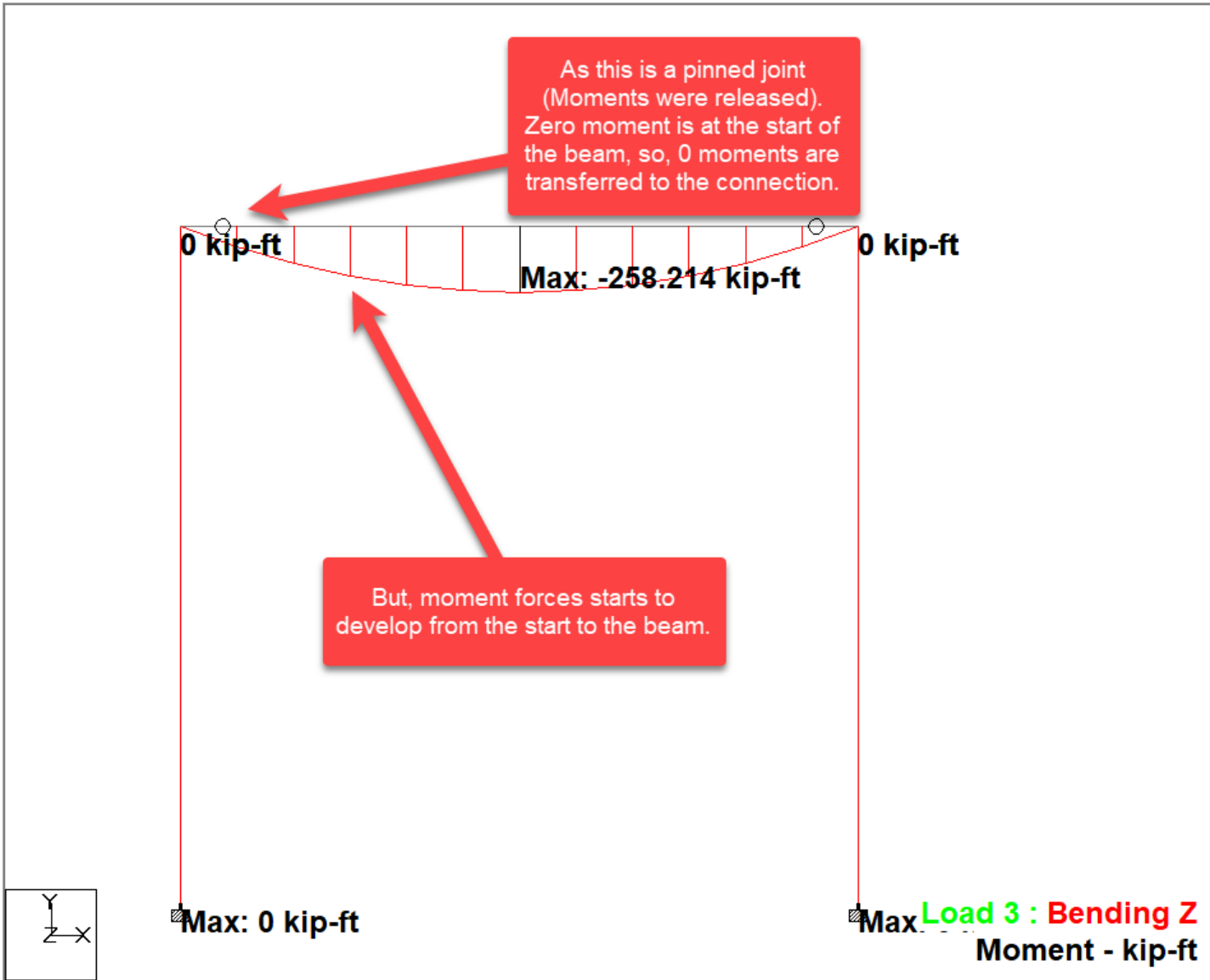
Example: Frame with released moments and uniform load



Shear force results

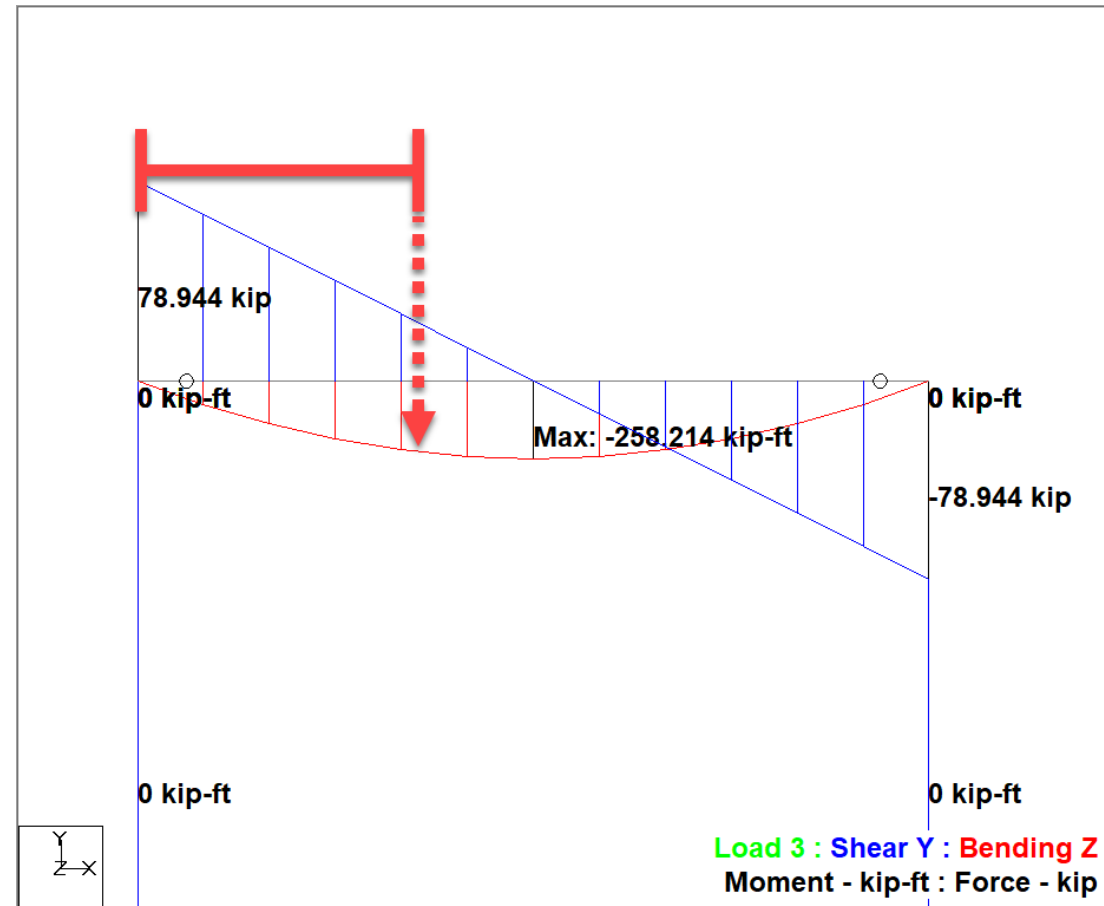
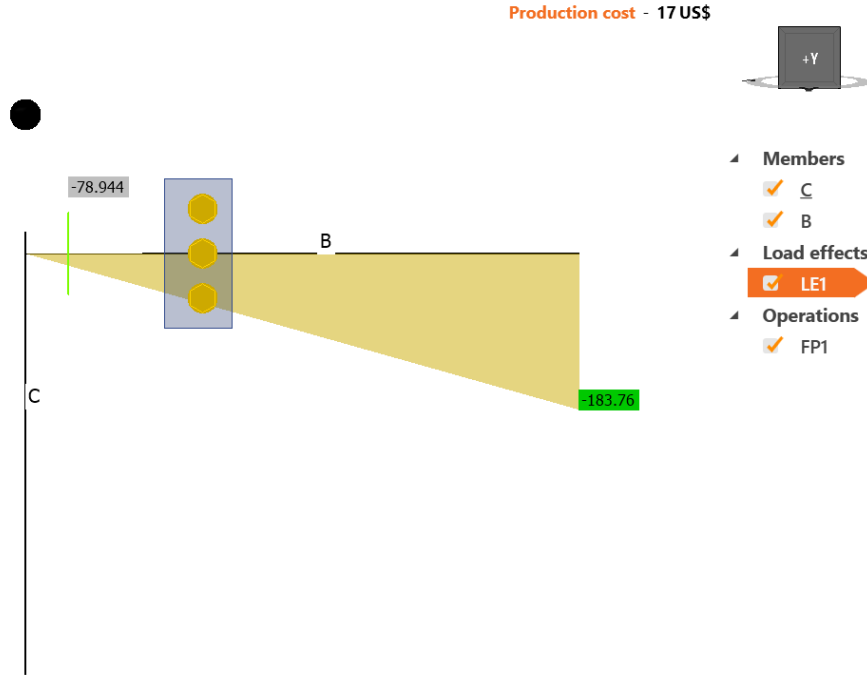


Moment results



Moments at the end of the member

- $L \cdot \text{Shear} = 2.33\text{ft} \cdot 78.944\text{kips} = 183.93$



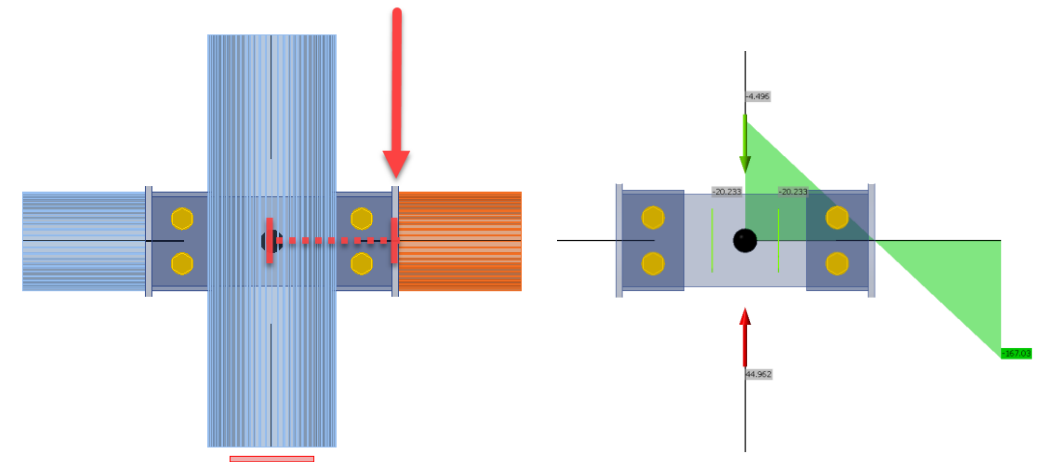
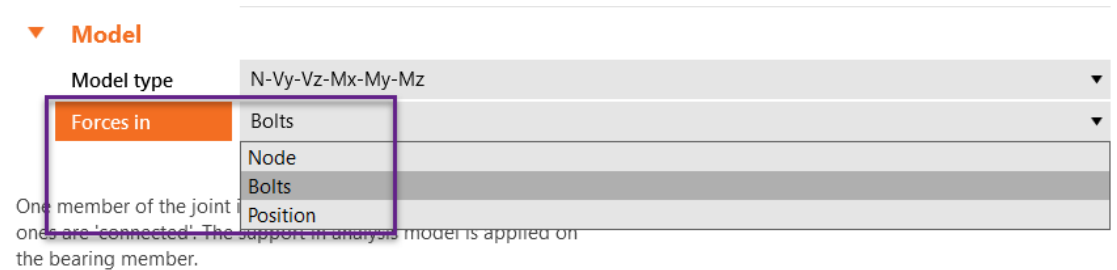
Load position

Distance along the member to place a shear force, it is taken from the start of the member

By default, member starting point is on the node (unless you modify the ex offset)

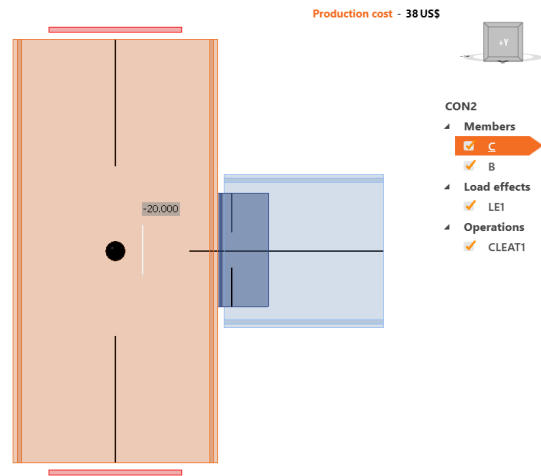
Indicates the inflection point in the moment diagram (hinge)

Each member has its own load position input

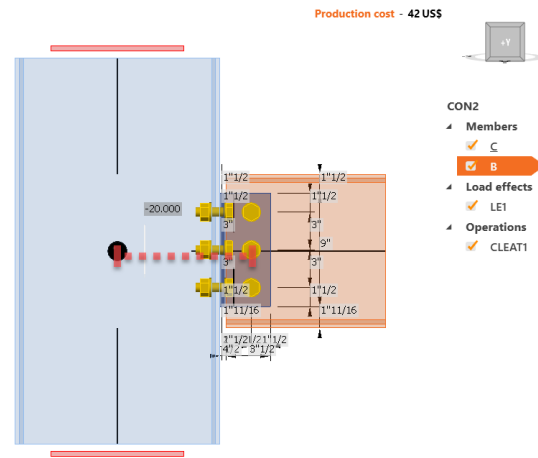


<https://www.ideastatica.com/support-center/how-to-define-correct-load-position>

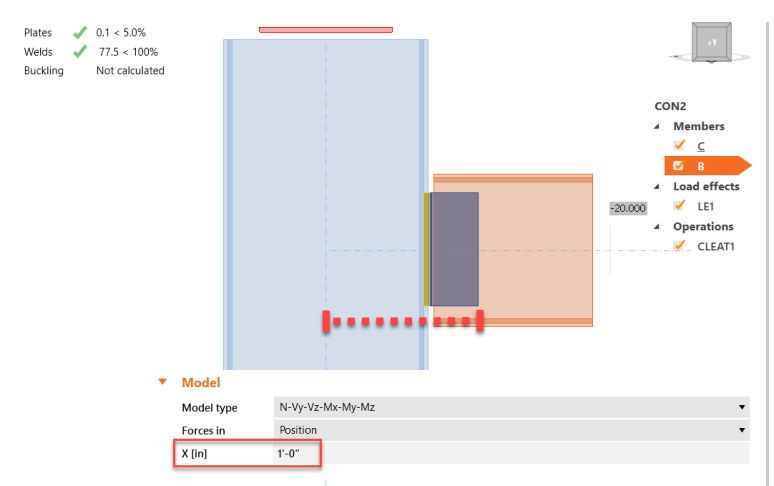
Node, bolts or position?



Node: Starting point of the member, usually at the node unless you modify ex offset



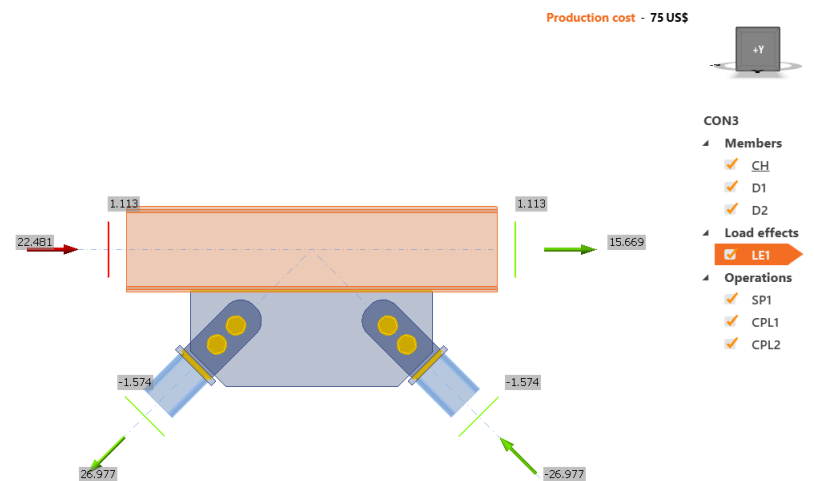
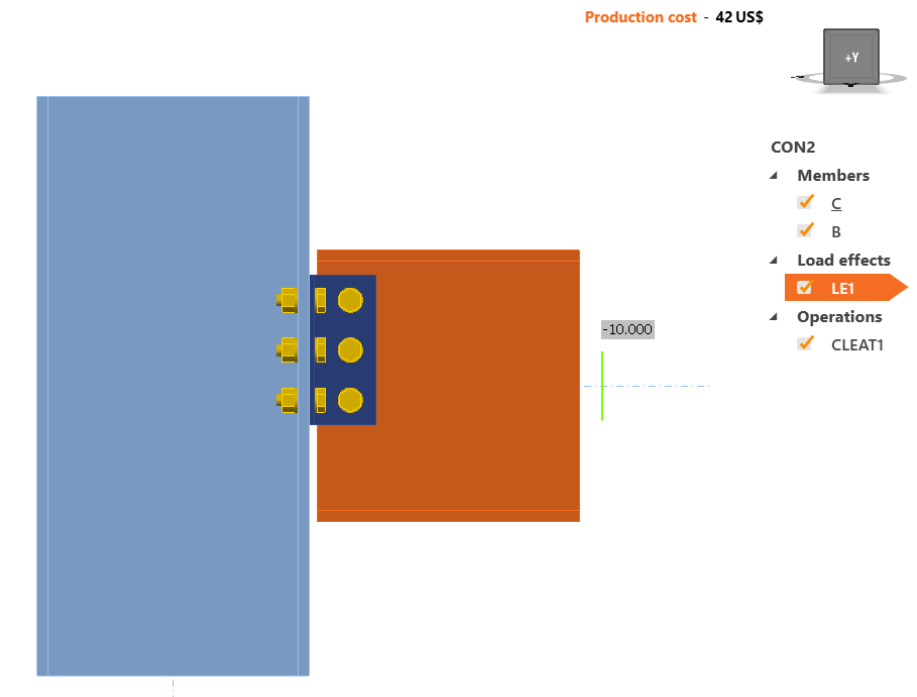
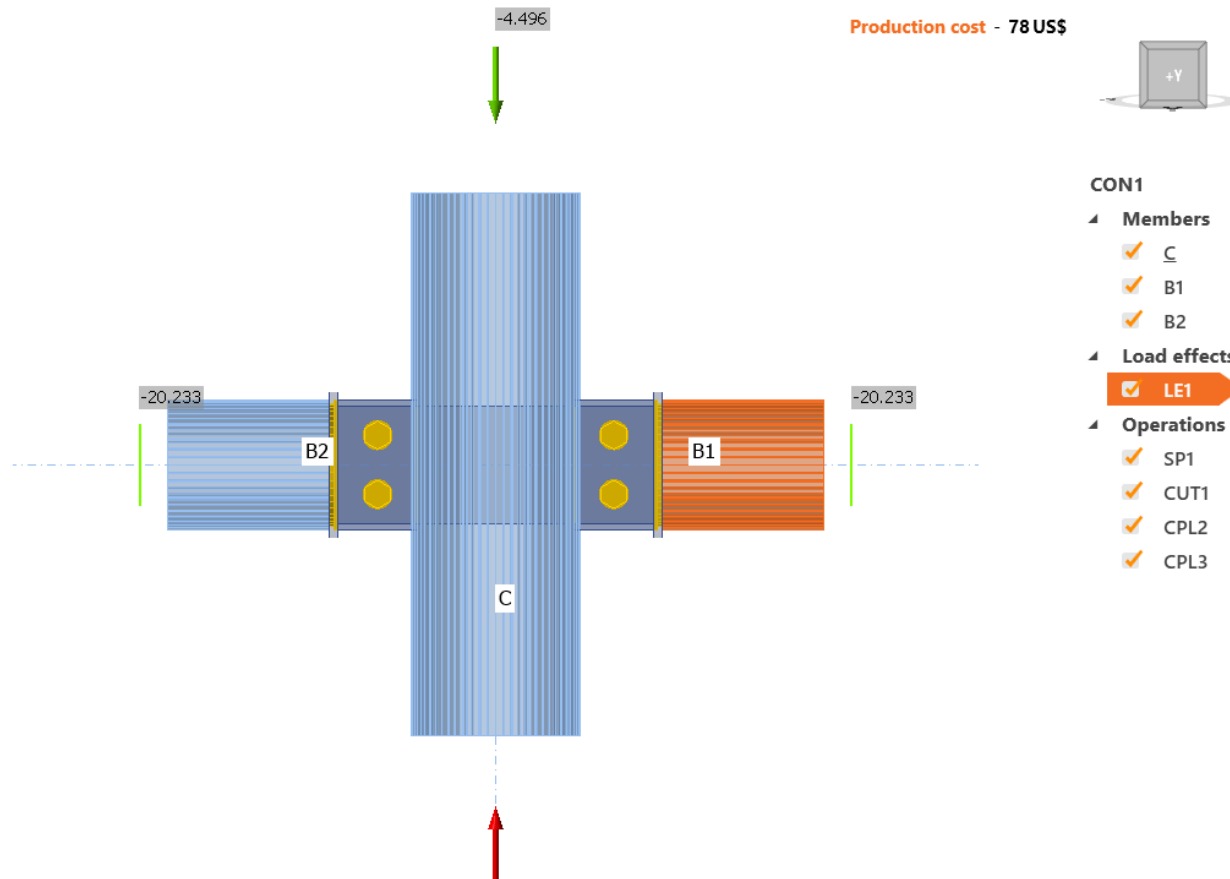
Bolts: Valid when an operation contains bolts (shear plate, cleat, etc)

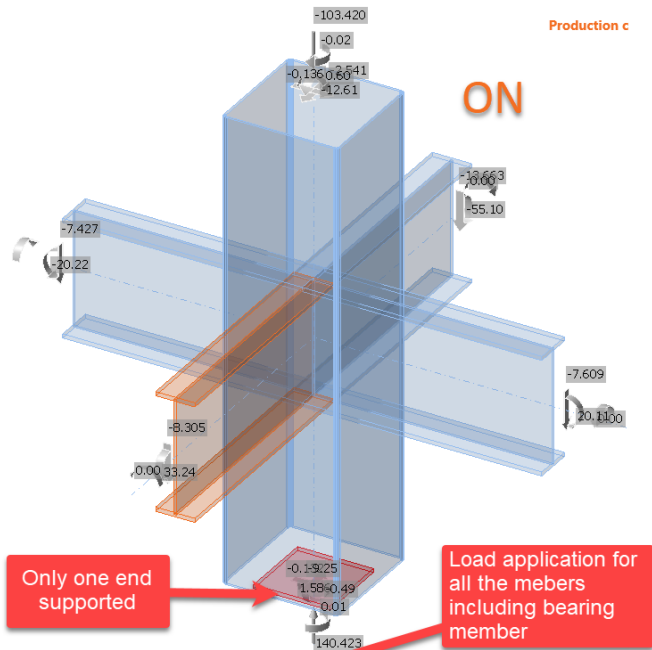


Position: Distance input needed

Location of the hinge investigation

Examples





160:S7 [Load]

Member	N [kip]	Vy [kip]	Vz [kip]	Mx [kip.ft]	My [kip.ft]	Mz [kip.ft]
> M242 / Begin	0.000	0.000	-7.427	0.00	-20.22	0.00
M175 / Begin	140.423	1.586	-0.132	0.01	-0.49	-9.25
M175 / End	-103.421	-2.541	-0.136	-0.02	0.60	-12.61
M238 / End	0.000	0.000	-8.305	0.00	33.24	0.00
M243 / End	0.000	0.000	-7.609	0.00	20.11	0.00
M2662 / Begin	0.000	0.000	-13.663	0.00	-55.10	0.00

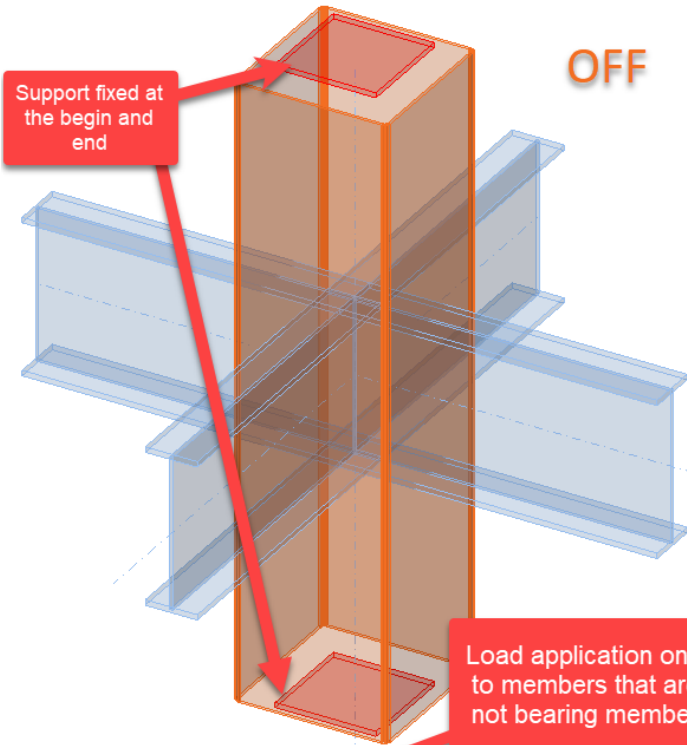
Unbalanced forces

X [kip]	Y [kip]	Z [kip]	Mx [kip.ft]	My [kip.ft]	Mz [kip.ft]
0.268	-0.955	0.000	0.00	0.00	-0.01

Joint statics check

Production c

ON



160:S7 [Load]

Member	N [kip]	Vy [kip]	Vz [kip]	Mx [kip.ft]	My [kip.ft]	Mz [kip.ft]
> M242 / Begin	0.000	0.000	-7.427	0.00	-20.22	0.00
M238 / End	0.000	0.000	-8.305	0.00	33.24	0.00
M243 / End	0.000	0.000	-7.609	0.00	20.11	0.00
M2662 / Begin	0.000	0.000	-13.663	0.00	-55.10	0.00

Loads in equilibrium: On/Off



<https://www.ideastatica.com/support-center/equilibrium-and-supporting-member>

Loads as a percentage of member capacity

The screenshot shows the IDEA StatiCa CONNECTION software interface. The main window displays a 3D model of a truss end connection. A red box highlights the axial force shown in the model in kips, with a value of -367.414. Another red box highlights the axial force in kips, with a value of 171.557. The software interface includes a menu bar (Project, Design, Check, Report, Materials), a toolbar, and a status bar. The status bar shows the current model is a "Generally located plate (Gusset)" and is in "Solid" view. The production cost is listed as 6350 US\$. The software version is LRFD 2016. The interface also shows a list of members (M1, M2, M3) and load effects (LE1). The table of unbalanced forces is shown below the model.

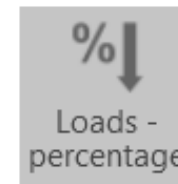
Member	N [%]	Vy [%]	Vz [%]	Mx [%]	My [%]	Mz [%]
M1 / End	0.0	0.0	0.0	0.0	0.0	0.0
M2 / End	-15.0	0.0	0.0	0.0	0.0	0.0
M3 / End	15.0	0.0	0.0	0.0	0.0	0.0

Unbalanced forces

Member	N [%]	Vy [%]	Vz [%]	Mx [%]	My [%]	Mz [%]
M1 / End	0.0	0.0	0.0	0.0	0.0	0.0
M2 / End	-15.0	0.0	0.0	0.0	0.0	0.0
M3 / End	15.0	0.0	0.0	0.0	0.0	0.0

Values in disabled cells are not taken into account in CBFEM analysis due to selected "Model type", missing characteristics, and unknown warping constant.

Percentage input



	Member	N [%]	Vy [%]	Vz [%]	Mx [%]	My [%]	Mz [%]
>	B / End	0.0	0.0	-100.0	0.0	0.0	0.0

Loads as a percentage of member capacity

LRFD

$$N = A * Fy * \phi$$

$$Vy = Ay * Fy * \left(\frac{\phi}{\sqrt{3}}\right)$$

$$Vz = Az * Fy * \left(\frac{\phi}{\sqrt{3}}\right)$$

$$My = Zy * Fy * \phi$$

$$Mz = Zx * Fy * \phi$$

ASD

$$N = \frac{A * Fy}{\Omega}$$

$$Vy = (Ay * Fy / \sqrt{3}) / \Omega$$

$$Vz = (Az * Fy / \sqrt{3}) / \Omega$$

$$My = \frac{Zy * Fy}{\Omega}$$

$$Mz = \frac{Zx * Fy}{\Omega}$$

IdeaStatiCa CONNECTION
IdeaStatiCa - Pipeline Truss Rev7 - Con 55

Project Design Check Report Materials

Con 55

Project items

Analysis 99.6%
Plates 4.0 < 5.0%
Bolts 80.3 < 100%
Welds 76.9 < 100%
Buckling Not calculated

Production cost - 1222 US\$

- SEISMIC LOADS +Z(4)
- SEISMIC LOADS -Z(5)
- GENERATED IBC 201...
- GENERATED IBC 201...
- GENERATED IBC 201...
- GENERATED IBC 201...

Operations

- CUT1
- CUT2
- CUT3
- CUT4
- SP1
- GRD1
- GRD2
- GRD3
- CLEAT1
- OPN1
- OPN2
- GRD4

Member	N [kip]	Vy [kip]	Vz [kip]	Mx [kip.ft]	My [kip.ft]	Mz [kip.ft]
M108 / End	-42.981	0.000	-0.012	0.00	0.00	0.00
M135 / Begin	-74.606	-0.121	0.017	0.00	0.00	0.00
M411 / End	-23.687	-0.474	-5.672	0.00	0.00	0.00
M494 / Begin	-50.801	0.009	-0.096	0.00	0.00	0.00
M495 / End	-0.579	0.009	-0.096	0.00	0.00	0.00
M522 / Begin	-106.20	0.240	-2.173	0.00	1.92	-0.48
M522 / End	98.856	0.231	-1.651	0.00	-1.92	0.48

Values in disabled cells are not taken into account in CBFEM analysis. Members can be loaded only by that components of internal forces which are defined in member "Model type".

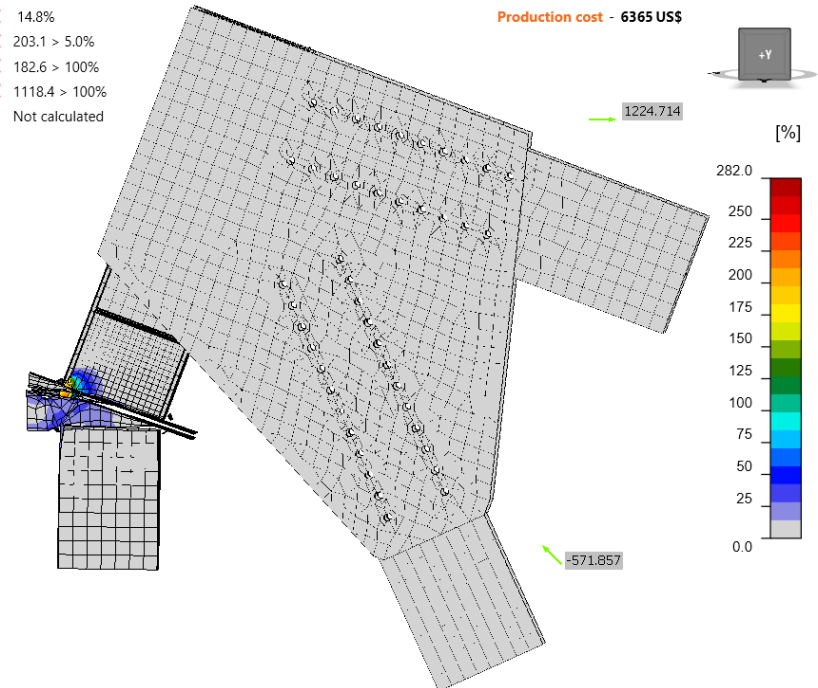
Unbalanced forces

X [kip]	Y [kip]	Z [kip]	Mx [kip.ft]	My [kip.ft]	Mz [kip.ft]
0.474	0.000	0.000	19.96	-21.52	-6.10

Design code: AISC - ASD (2016) Analysis: Stress, strain Load effects: In equilibrium Units: in

www.ideastatica.com

Analysis 14.8%
Plates 203.1 > 5.0%
Bolts 182.6 > 100%
Welds 1118.4 > 100%
Buckling Not calculated



Examples

Import load combination from Excel

1. Match the IDEA members name to the other software naming convention
2. XLS Export
3. Use the template provided by IDEA
4. Data process in Excel to match local axis
5. Verify the units in IDEA and the source
6. Click XLS Import and paste it



	A	B	C	D	E	F	G	H	I
1	Load	Beam	Position	N[kip]	Vy[kip]	Vz[kip]	Mx[kip.ft]	My[kip.ft]	Mz[kip.ft]
2	LE1	M64	End	0	0	0	0	0	0
3	LE1	M73	End	0	0	0	0	0	0
4	LE1	M72	End	0	0	0	0	0	0
5	LE1	M349	End	0	0	0	0	0	0
6									
7									

Example RISA

The screenshot shows the RISA-3D software interface. The top menu bar includes File, Home, Modify, View, Drawing Tools, Spreadsheets, Advanced, and Results. The Results ribbon contains various tools like Filter Results, Node, Wall, TH Trace, Export TH Trace, Contour Diagram, Diagram Report, Clear Results, Warning Log, Suggested Design, and Detailed Report. The Properties panel on the left shows settings for Hot Rolled Steel Members (4), including Section/Shape, Shape, Material, Design List, and Design Rule. The 3D View panel shows a 3D model of a structure with various members labeled M1 through M15. A 'Filter Results' dialog box is open, displaying the following text:

Filter Results

You have requested to Filter Items from Results Spreadsheets. (Nodes, Members, Wall Panels, Plates and Solids will be hidden).

Filter out UnSelected items from Results

Filter out Selected items from Results

Always display this option

Buttons: Yes, No

Combination)						
Member E...	Axial[k]	y Shear...	z Shear[k]	Torque[k-ft]	y-y Moment[k-ft]	z-z Moment[k-ft]
I	0	4.596	0	0	0	20.025
J	0	-2.688	0	0	0	2.855
I	0	3.05	0	0	0	0
J	0	-3.05	0	0	0	0
I	7.181	0.237	0	0	0	0
J	6.513	0.237	0	0	0	-2.842
I	-1.24	0.105	0	0.016	0	0
J	-1.101	-0.105	0	0.016	0	0
I	0	4.511	0	0	0	19.525
J	0	-2.811	0	0	0	4.225
I	0	2.884	0	0	0	0

Q&A



What's next?

Next webinars...

- What's new in **IDEA StatiCa V23**? US Edition – May 3rd
- Stiffness analysis – May 31st

Live events

- NASCC April 12-14
- Booth #1636

