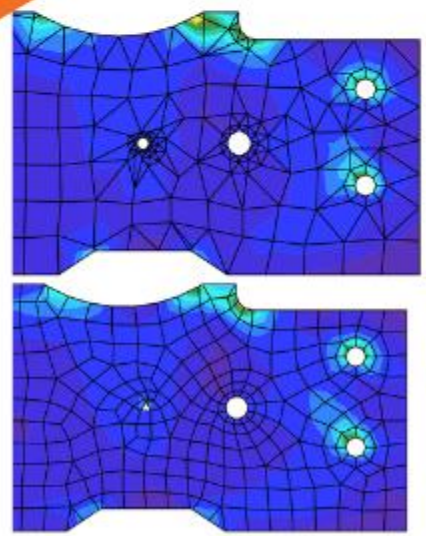
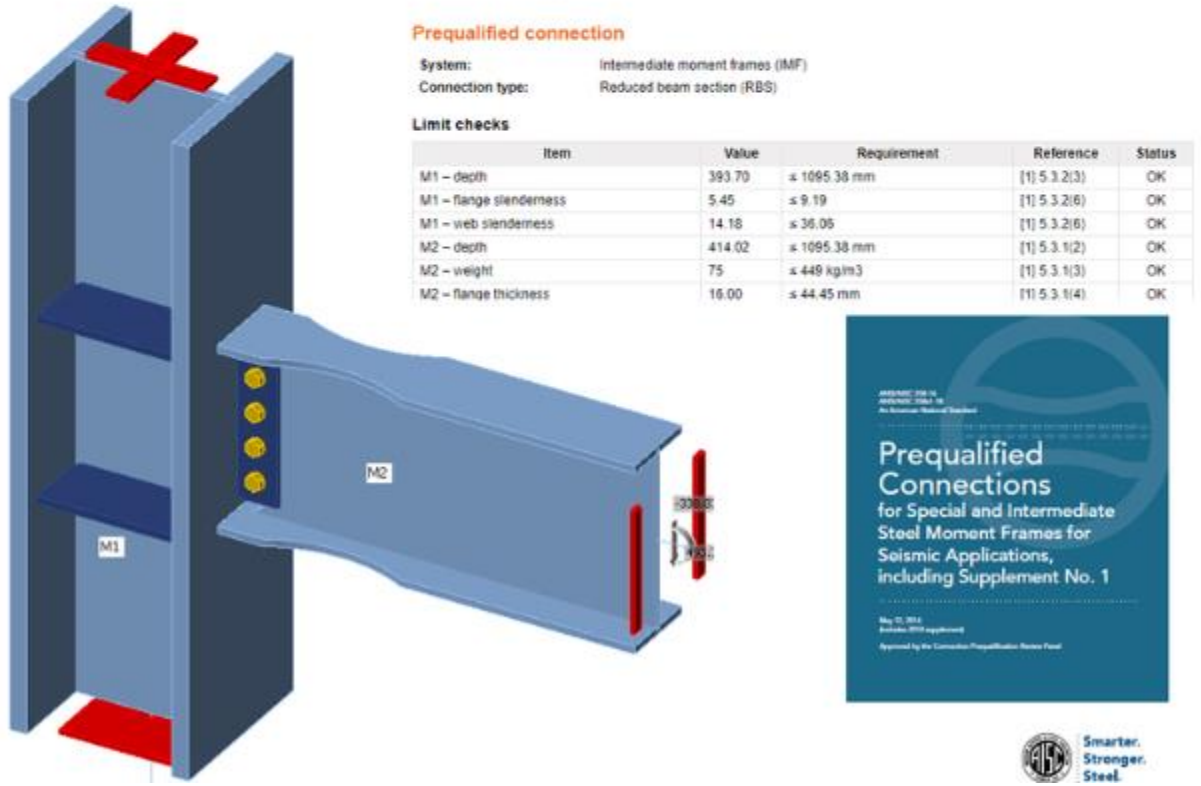
IDEA StatiCa 23 Release Webinar

IDEA StatiCa®
Calculate yesterday's estimates

Wednesday
May 31st
Noon EST





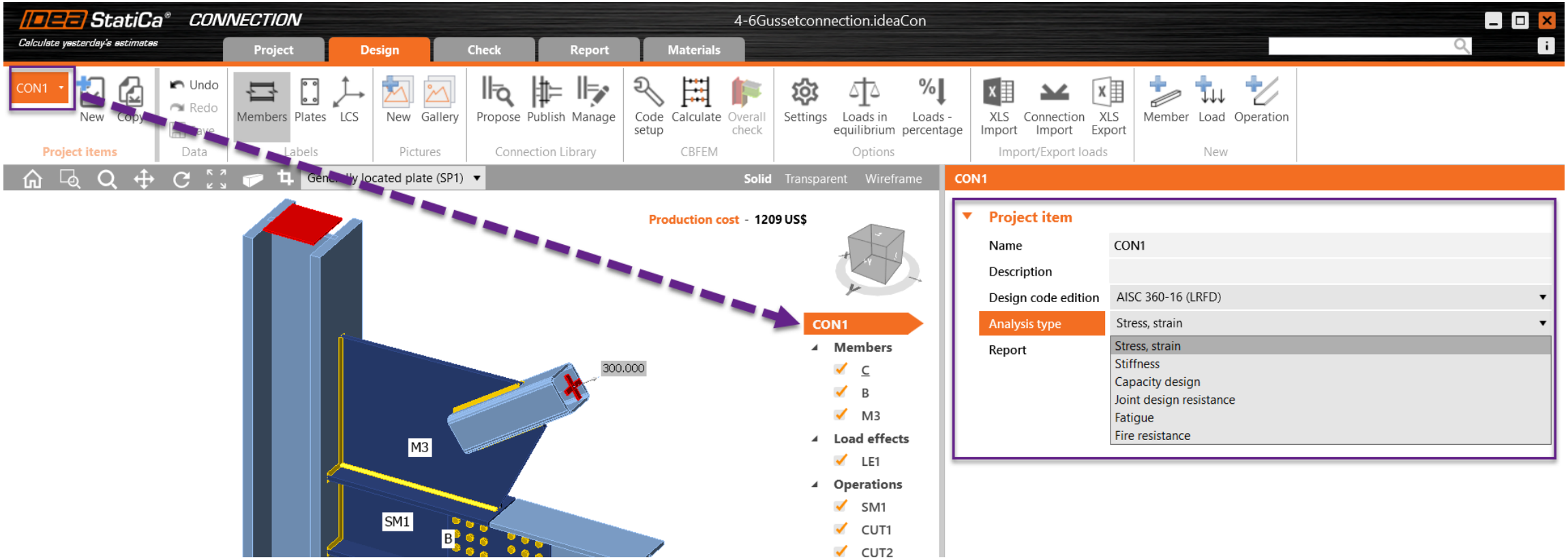
Smarter. Stronger. Steel.

Agenda

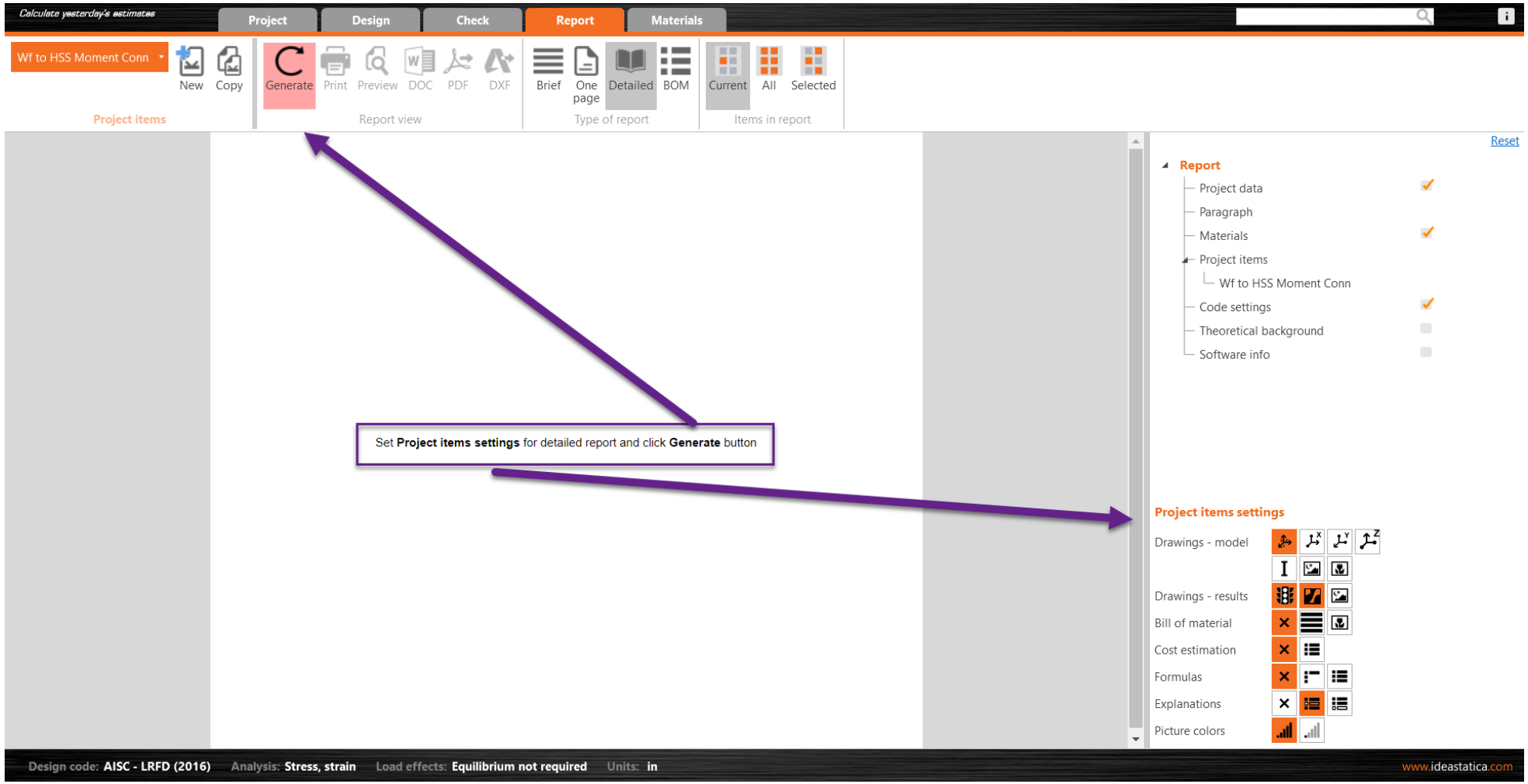
1. Miscellaneous Enhancements
2. Prequalified moment connection checks per AISC 358
3. Welded built-up sections
4. No directional strength increase for HSS members
5. Moment calculation on stand-off anchors
6. Concrete Detail app: New ACI templates

Release notes v23

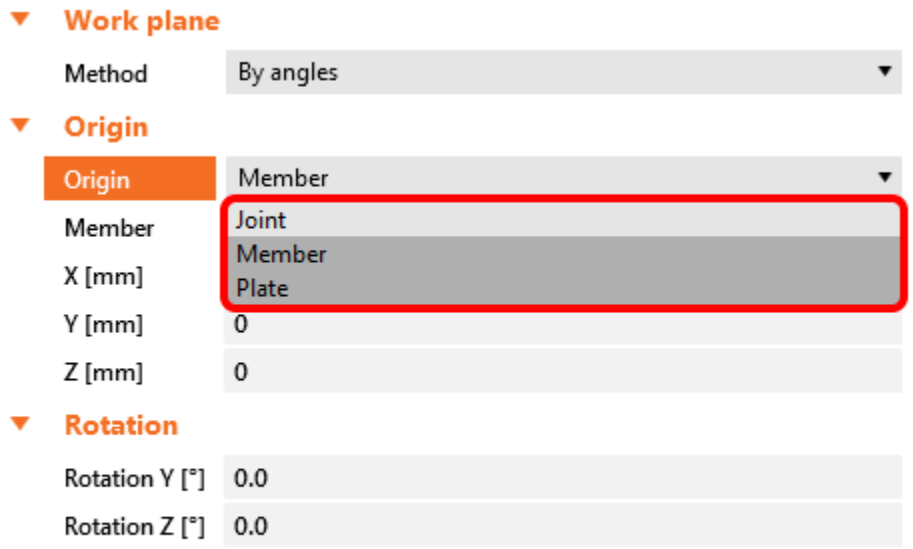
Connection details and analysis type



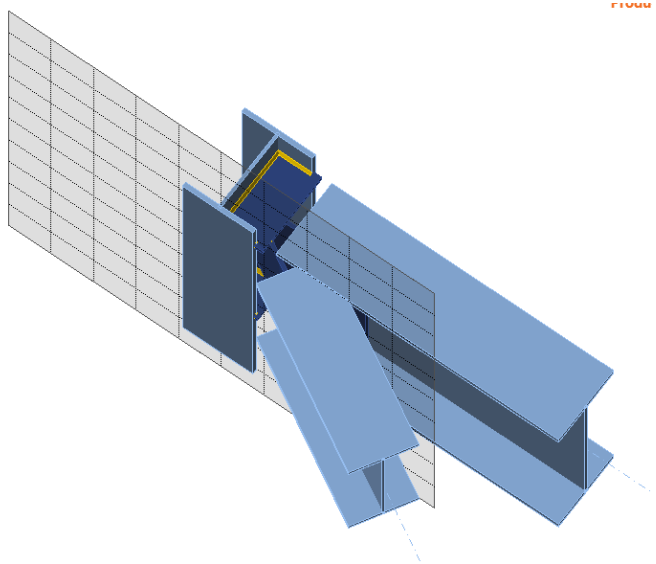
Report generation



Working plane reference



- Notch by other members
- Member cut
- Bracing position



IDEA StatiCa® CONNECTION
Calculate yesterday's estimates

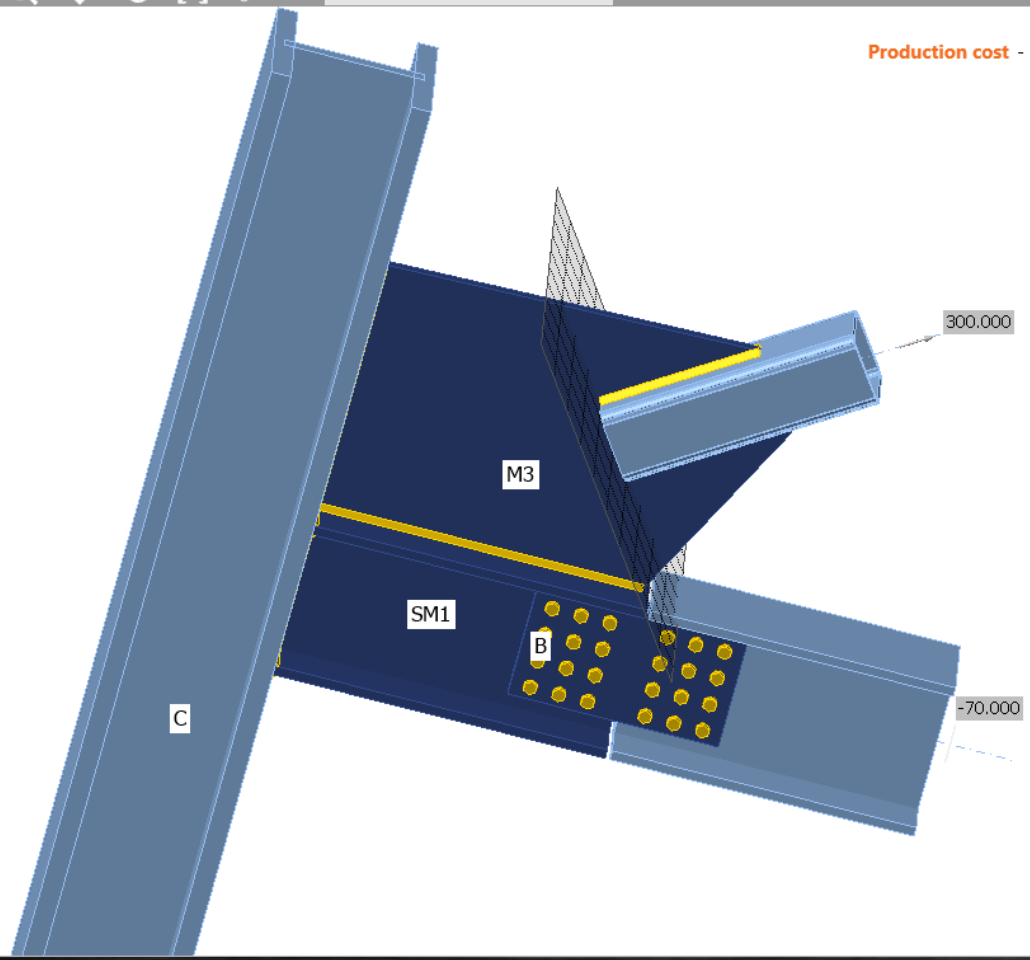
4-6Gussetconnection.ideaCon

Project | Design | Check | Report | Materials

CON1 | New | Copy | Project items
Undo | Redo | Save | Data
Members | Plates | LCS | Labels
New | Gallery | Pictures
Propose | Publish | Manage | Connection Library
Code setup | Calculate | Overall check | CBFEM
Settings | Loads in equilibrium | Loads - percentage | Options
XLS Import | Connection Import | XLS Export | Import/Export loads
Member | Load | Operation | New

Generally located plate (SP1) | Solid | Transparent | Wireframe

Production cost - 1209 US$



CON1
- Members
  - C
  - B
  - M3
- Load effects
  - LE1
- Operations
  - SM1
  - CUT1
  - CUT2
  - SPL1
  - SP1
  - PCUT1
  - PCUT2
  - CUT3
  - WPLN1
  - CUT4

WPLN1 [Work plane] | Copy | Delete

Work plane

Method	By angles

Origin

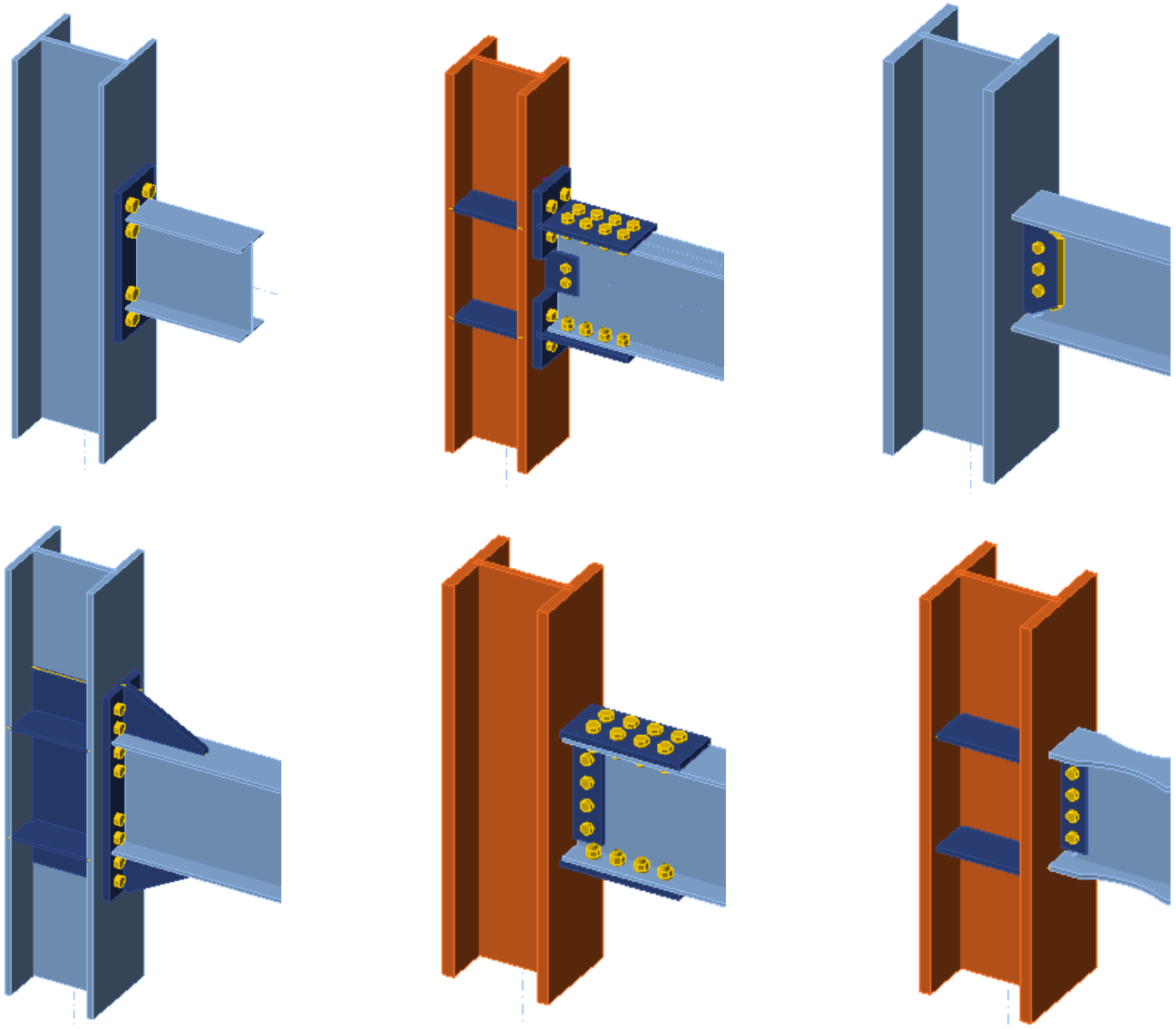
Origin	Member
Member	M3
X [in]	3'-7"
Y [in]	0"
Z [in]	0"

Rotation

Rotation Y [°]	0.0
Rotation Z [°]	0.0

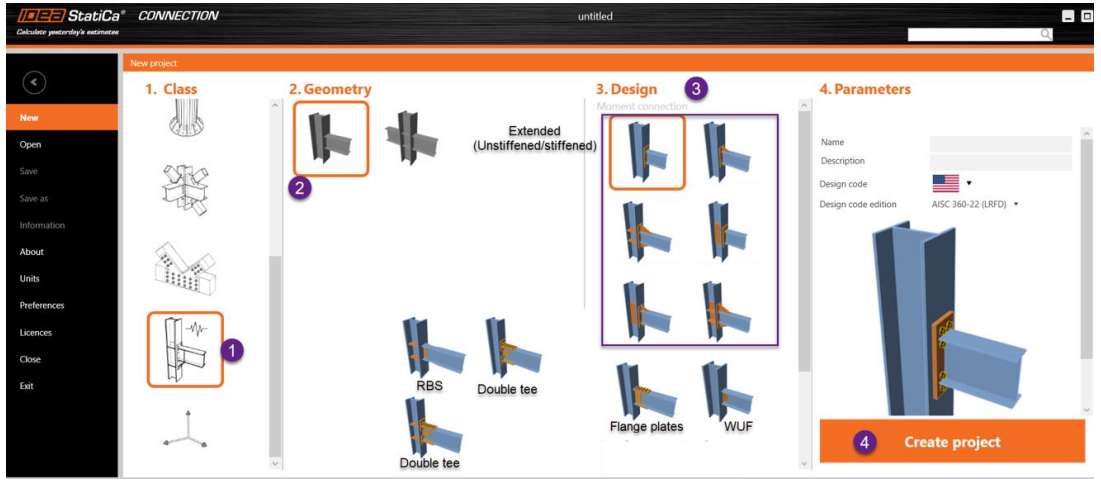
Design code: AISC - LRFD (2016) | Analysis: Stress, strain | Load effects: Equilibrium not required | Units: in

2. Prequalified connections AISC 358



Prequalified connections AISC 358

- **Model and code check** the AISC 358 detailing limits
- **Confirm** the plastic hinge location considering Ry and Cpr
- **Design** all the other components in the joint



Prequalified connections AISC 358

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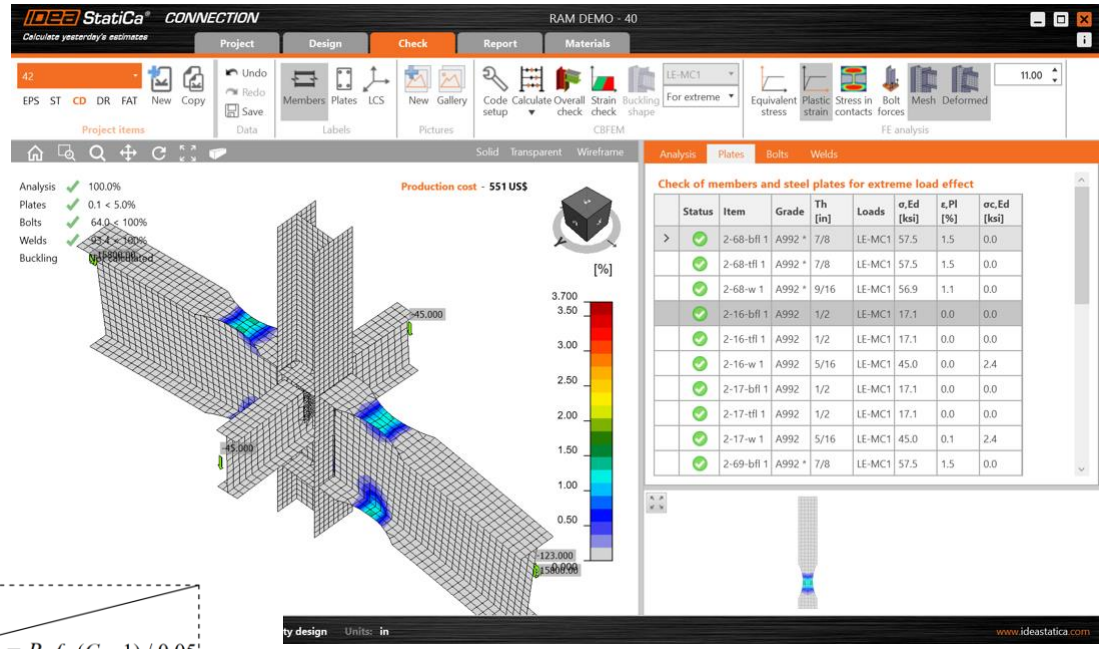

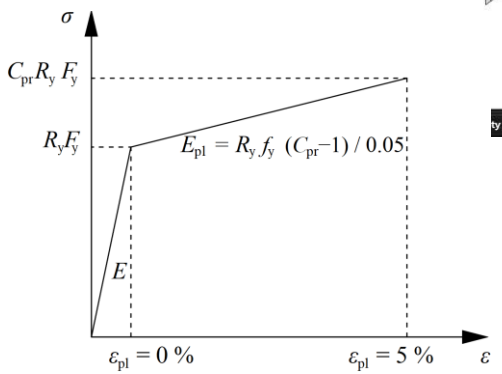

Prequalified connections AISC 358

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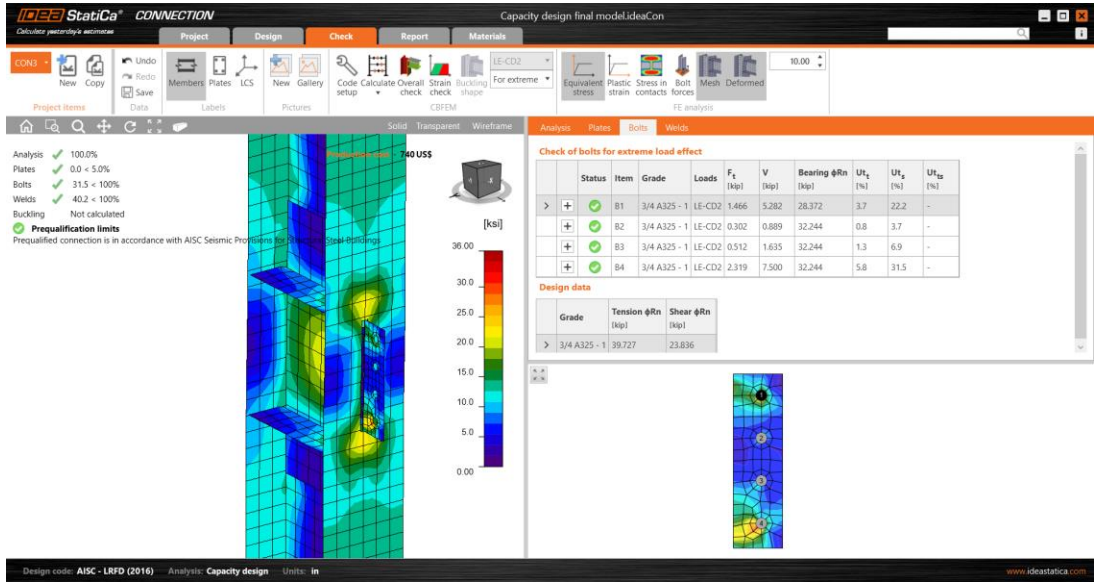
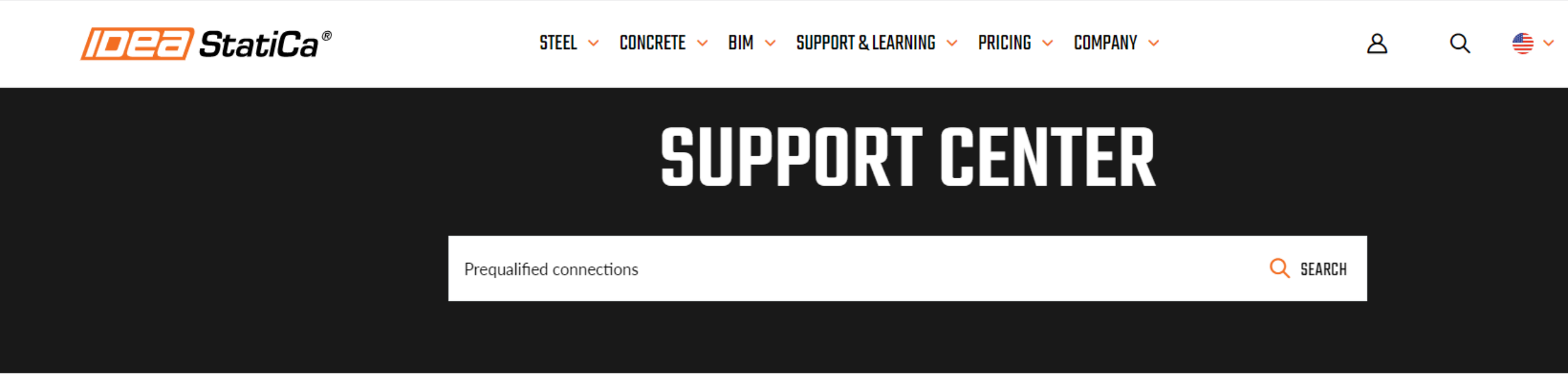


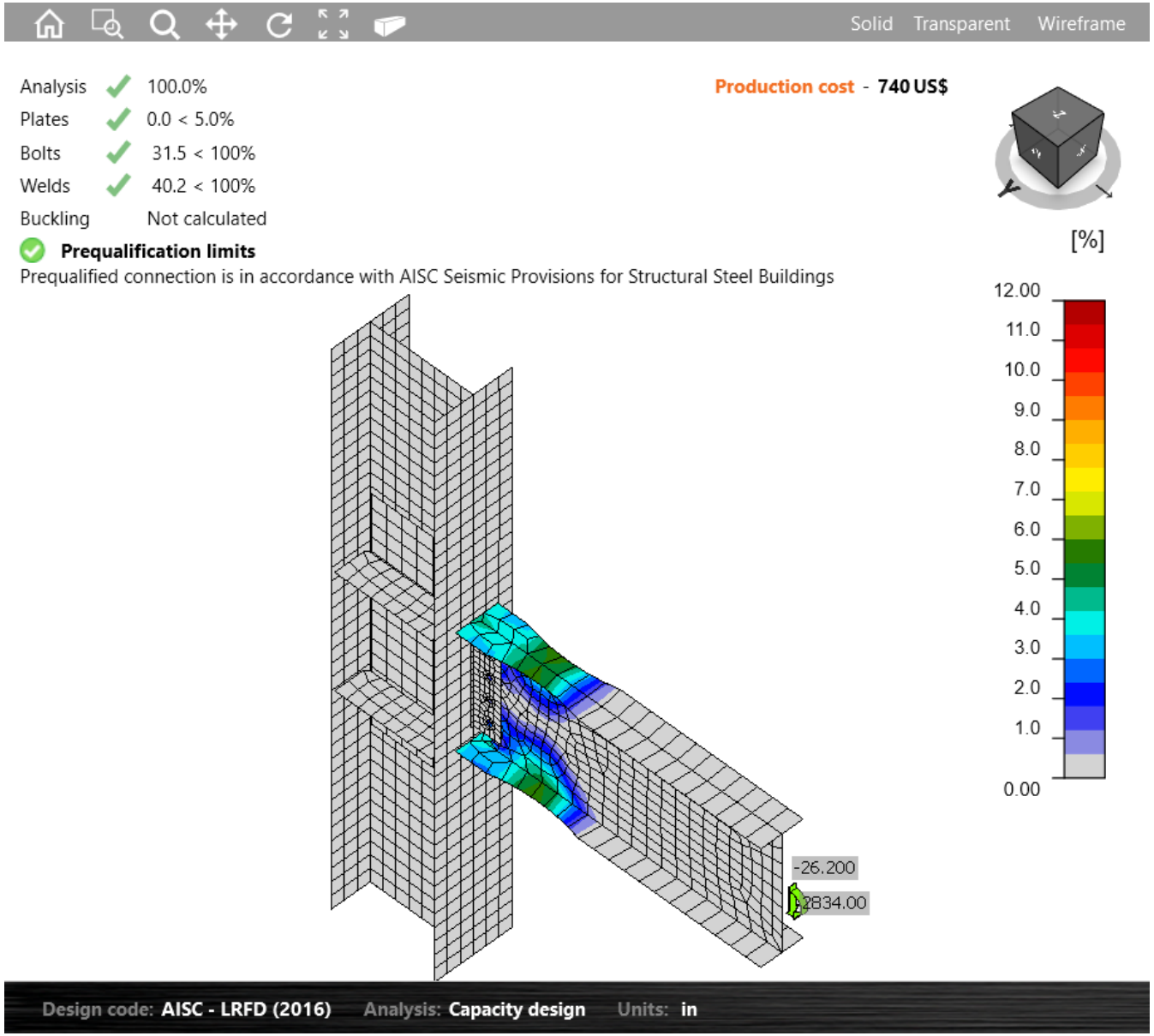


Resources

- Blog post: AISC 358 Prequalified Moment Connection Checks are here!
- Theoretical background
- Capacity design tutorial

Live demo Reduced beam section (RBS)

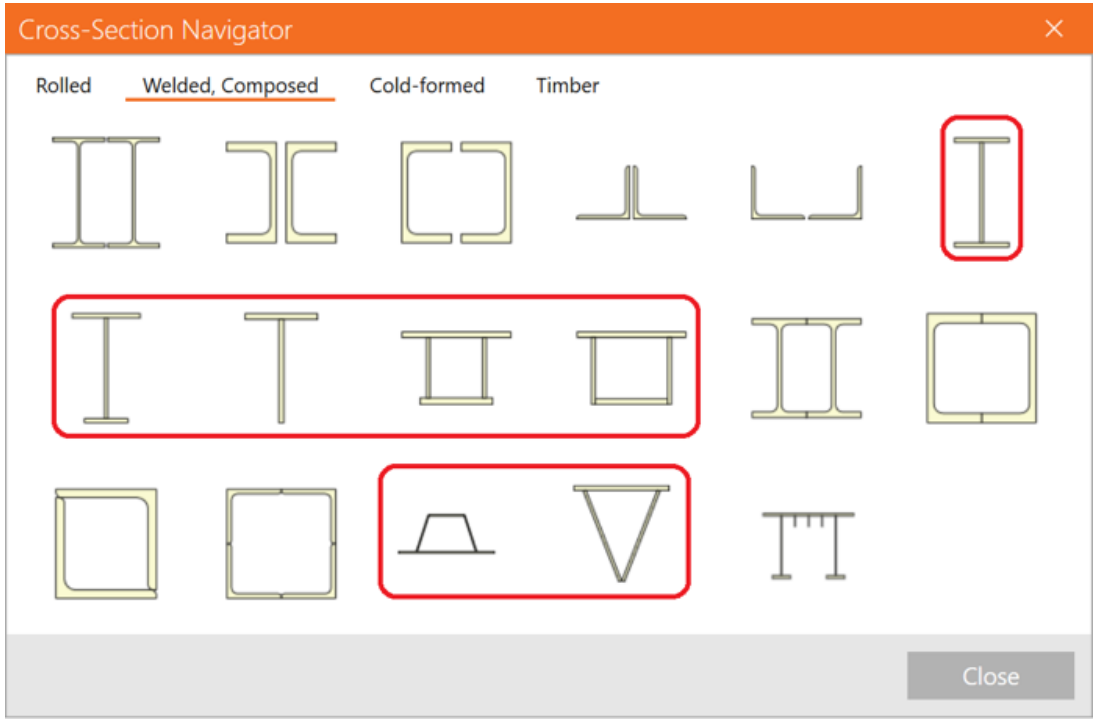
- Capacity design tutorial AISC
- File to download

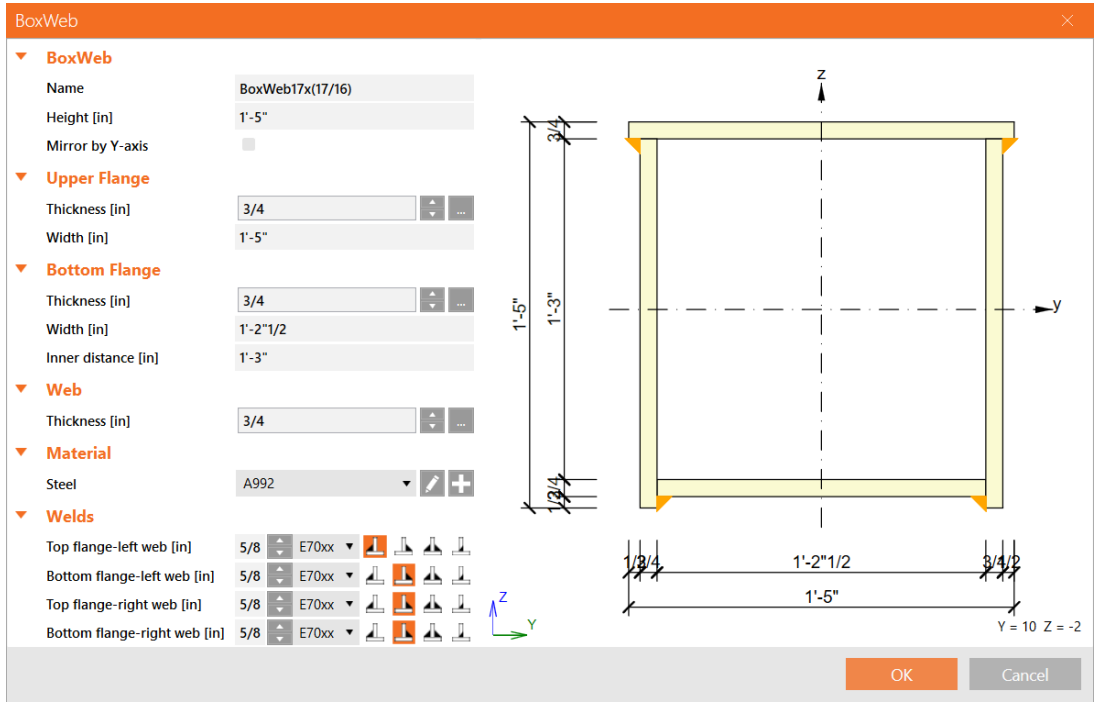


Design workflow

1. Select Capacity design, Type of moment frame, and prequalified connection. Assign dissipative item.
2. Model and comply with the detailing limits based on AISC 358
3. Calculate the probable maximum moment at plastic hinge (MPr) and Shear force at plastic hinge location (Vh).
4. Determine the beam plastic hinge location depending on the Preq conn type and input the force position
5. Change resistance factors
6. Run the analysis and verify the plastic strain is happening at the planned location calculated in step 4.
7. Pull out the report with the prequalification details

3. Welds on built up sections





IDEA StatiCa CONNECTION

Calculate yesterday's estimates

Built up.ideaCon

Project | Design | Check | Report | Materials

Fillet1 | New | Copy | Undo | Redo | Save | Members | Plates | LCS | New | Gallery | Code setup | Calculate | Overall check | Strain check | Buckling shape | LE1 | For extreme | Equivalent stress | Plastic strain | Stress in contacts | Bolt forces | Mesh | Deformed | 10.00

Project items | Data | Labels | Pictures | CBFEM | FE analysis

Solid | Transparent | Wireframe

Analysis ✓ 100.0%
Plates ✓ 0.3 < 5.0%
Bolts ✓ 45.0 < 100%
Welds ✓ 80.6 < 100%
Buckling Not calculated

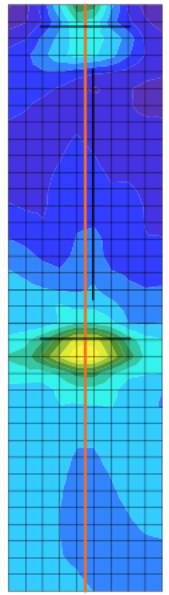
Production cost 642 US$

[ksi]
45.00
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.00

Weld (CUT1):Material E70xx, Leg size 5/16 in

Analysis | Plates | Bolts | Welds

	+	✓	Column-tfl 1	FP12	E70xx	◢ 1/4 ◣	◢ 3/8 ◣	1'-5"15/16	7/8	LE1	7.465	9.930	75.2
	+	✓			E70xx	◢ 1/4 ◣	◢ 3/8 ◣	1'-5"15/16	7/8	LE1	6.908	9.196	75.1
	+	✓	Column-tfl 1	Column-w 1	E70xx	◢ 1/4 ◣	◢ 5/16 ◣	3'-9"5/8	1"5/16	LE1	10.363	13.557	76.4
	+	✓			E70xx	◢ 1/4 ◣	◢ 5/16 ◣	3'-9"5/8	1"5/16	LE1	10.349	13.544	76.4
	+	✓	Column-bfl 1	Column-w 1	E70xx	◢ 1/4 ◣	◢ 5/16 ◣	3'-9"5/8	1"5/16	LE1	10.349	13.544	76.4
>	+	✓			E70xx	◢ 1/4 ◣	◢ 5/16 ◣	3'-9"5/8	1"5/16	LE1	10.364	13.557	76.4



Equivalent stress [ksi]
24.1
0.2

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

www.ideastatica.com

4. AISC 360-2022

No directional strength increase for fillet welds on rectangular HSS

4. Strength

(a) The design strength, ϕR_n, and the allowable strength, R_n/Ω, of welded joints shall be the lower value of the base material strength determined according to the limit states of tensile rupture and shear rupture and the weld metal strength determined according to the limit state of rupture as follows.

For the base metal

$$R_n = F_{nBM}A_{BM} \quad \text{(J2-2)}$$

For complete-joint-penetration and partial-joint-penetration groove welds, and plug and slot welds

$$R_n = F_{nw}A_{we} \quad \text{(J2-3)}$$

For fillet welds

$$R_n = F_{nw}A_{we}k_{ds} \quad \text{(J2-4)}$$

where

A_{BM} = area of the base metal, in.^{2} (mm^2)
A_{we} = effective area of the weld, in.^{2} (mm^2)
F_{nBM} = nominal stress of the base metal, ksi (MPa)
F_{nw} = nominal stress of the weld metal, ksi (MPa)
k_{ds} = directional strength increase factor

(1) For fillet welds where strain compatibility of the various weld elements is considered

$$k_{ds} = (1.0 + 0.50\sin^{1.5}\theta) \quad \text{(J2-5)}$$

(2) For fillet welds to the ends of rectangular HSS loaded in tension

$$k_{ds} = 1.0$$

(3) For all other conditions

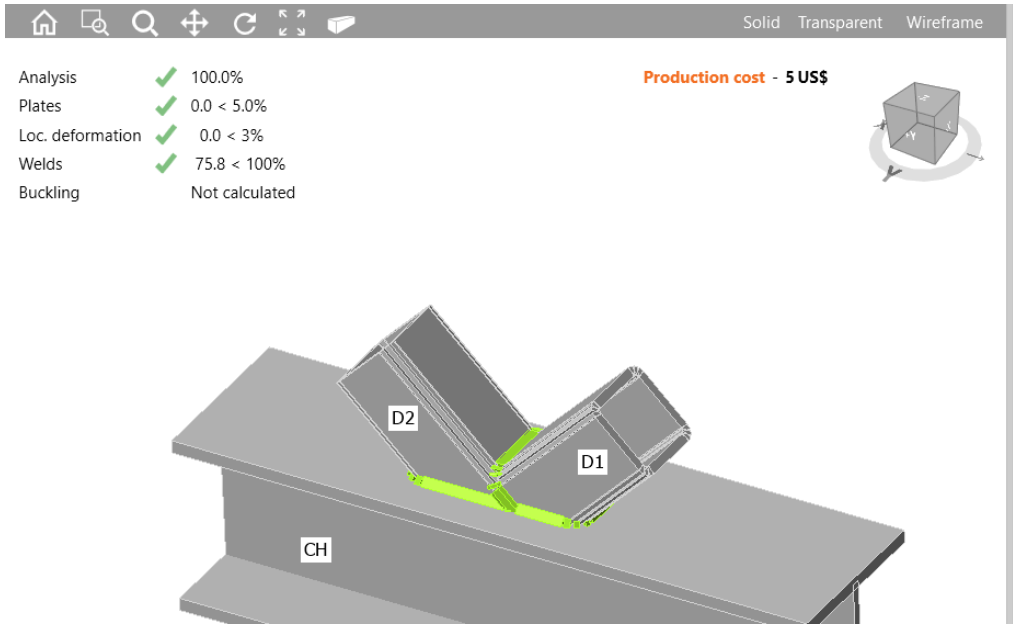
$$k_{ds} = 1.0$$

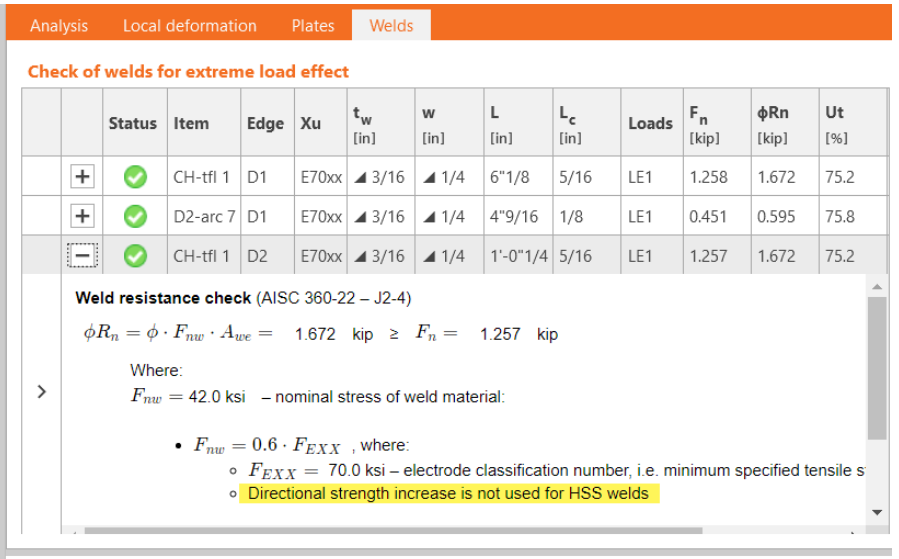
θ = angle between the line of action of the required force and the weld longitudinal axis, degrees

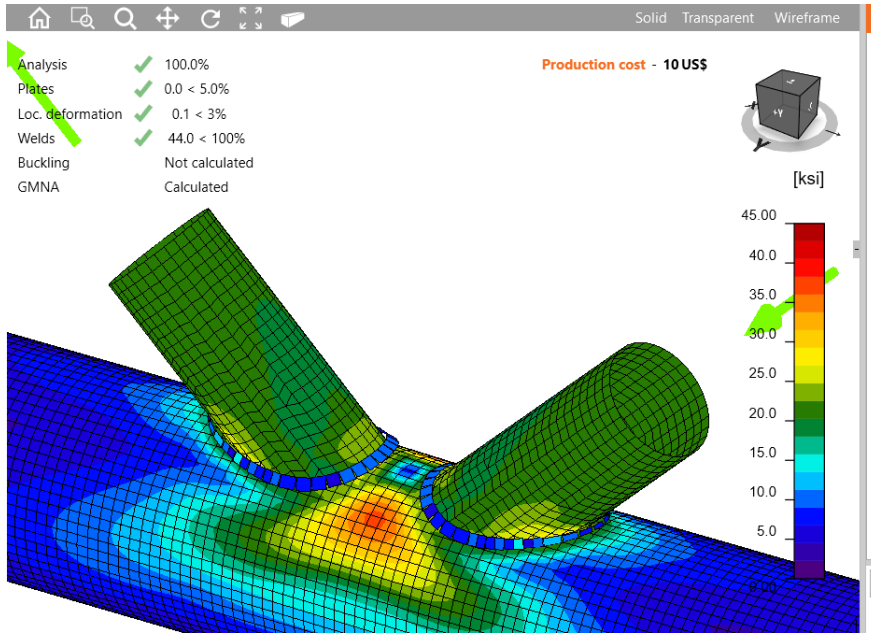
The values of ϕ, Ω, F_{nBM}, and F_{nw}, and limitations thereon, are given in Table J2.5.

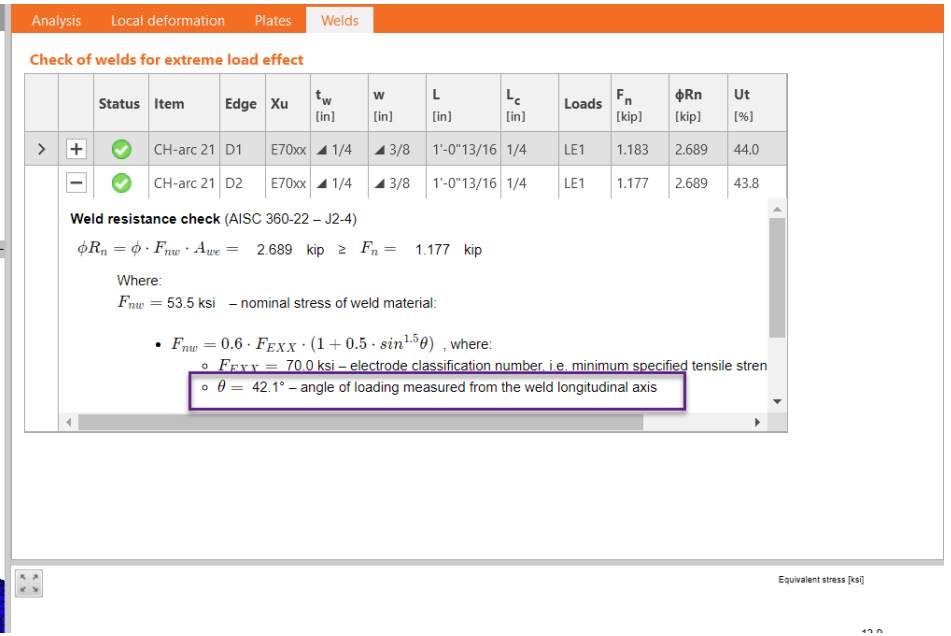
User Note: The base metal check need not be performed for fillet welds as

- [Steel tube institute: Directionality Increase for Fillet Welds to HSS]

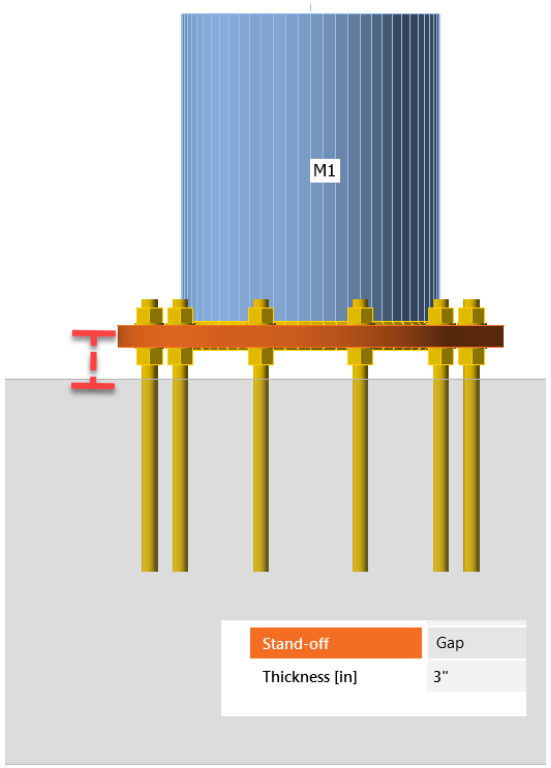

Solid Transparent Wireframe
Analysis 100.0%
Plates 0.0 < 5.0%
Loc. deformation 0.0 < 3%
Welds 75.8 < 100%
Buckling Not calculated
Production cost - 5 US$
D2
D1
CH

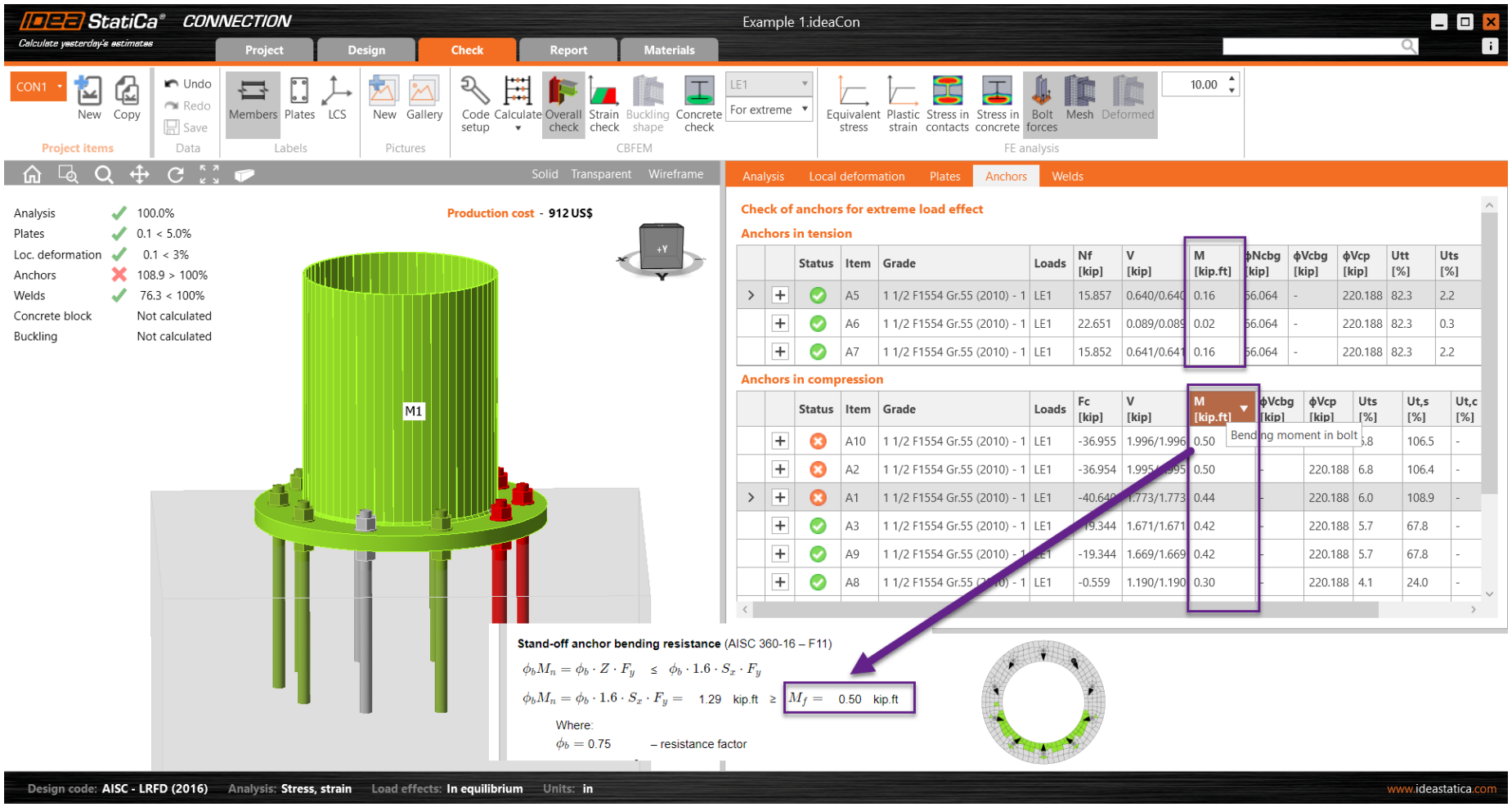

Analysis
Local deformation
Plates
Welds
Check of welds for extreme load effect
Status | Item | Edge | Xu | t_w [in] | w [in] | L [in] | L_c [in] | Loads | F_n [kip] | ϕRn [kip] | Ut [%]
CH-tfl 1 | D1 | E70xx | ◢ 3/16 | ◢ 1/4 | 6"1/8 | 5/16 | LE1 | 1.258 | 1.672 | 75.2
D2-arc 7 | D1 | E70xx | ◢ 3/16 | ◢ 1/4 | 4"9/16 | 1/8 | LE1 | 0.451 | 0.595 | 75.8
CH-tfl 1 | D2 | E70xx | ◢ 3/16 | ◢ 1/4 | 1'-0"1/4 | 5/16 | LE1 | 1.257 | 1.672 | 75.2
Weld resistance check (AISC 360-22 – J2-4)
$\phi R_n = \phi \cdot F_{nw} \cdot A_{we} =$ 1.672 kip ≥ $F_n =$ 1.257 kip
Where:
$F_{nw} =$ 42.0 ksi – nominal stress of weld material:
$F_{nw} = 0.6 \cdot F_{EXX}$, where:
$F_{EXX} =$ 70.0 ksi – electrode classification number, i.e. minimum specified tensile s
Directional strength increase is not used for HSS welds


Solid Transparent Wireframe
Analysis 100.0%
Plates 0.0 < 5.0%
Loc. deformation 0.1 < 3%
Welds 44.0 < 100%
Buckling Not calculated
GMNA Calculated
Production cost - 10 US$
[ksi]
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00

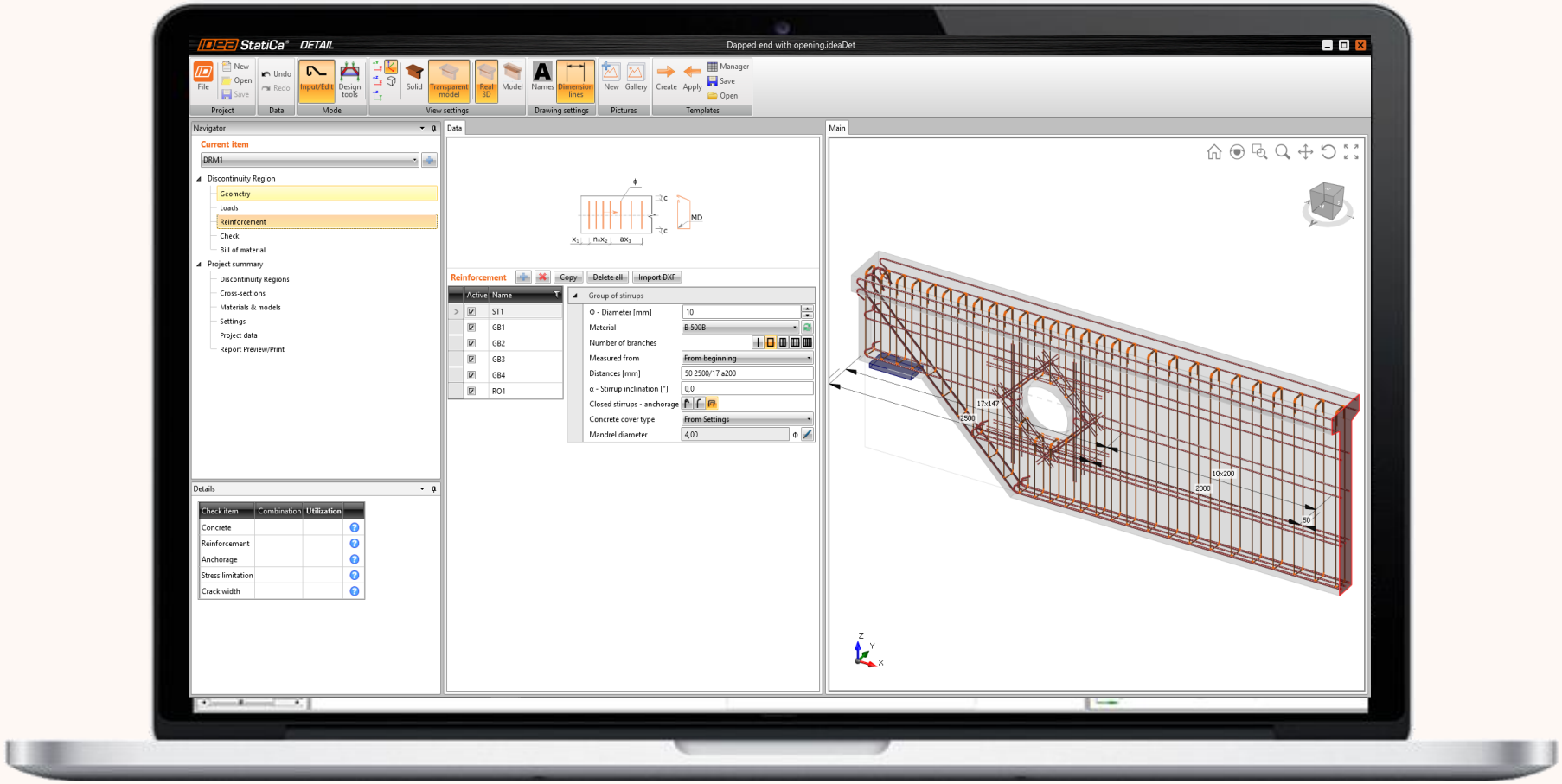

Analysis
Local deformation
Plates
Welds
Check of welds for extreme load effect
Status | Item | Edge | Xu | t_w [in] | w [in] | L [in] | L_c [in] | Loads | F_n [kip] | ϕRn [kip] | Ut [%]
CH-arc 21 | D1 | E70xx | ◢ 1/4 | ◢ 3/8 | 1'-0"13/16 | 1/4 | LE1 | 1.183 | 2.689 | 44.0
CH-arc 21 | D2 | E70xx | ◢ 1/4 | ◢ 3/8 | 1'-0"13/16 | 1/4 | LE1 | 1.177 | 2.689 | 43.8
Weld resistance check (AISC 360-22 – J2-4)
$\phi R_n = \phi \cdot F_{nw} \cdot A_{we} =$ 2.689 kip ≥ $F_n =$ 1.177 kip
Where:
$F_{nw} =$ 53.5 ksi – nominal stress of weld material:
$F_{nw} = 0.6 \cdot F_{EXX} \cdot (1 + 0.5 \cdot sin^{1.5}\theta)$, where:
$F_{EXX} =$ 70.0 ksi – electrode classification number, i.e. minimum specified tensile stren
$\theta =$ 42.1° – angle of loading measured from the weld longitudinal axis
Equivalent stress [ksi]

5. Moment calculation in anchors with a gap

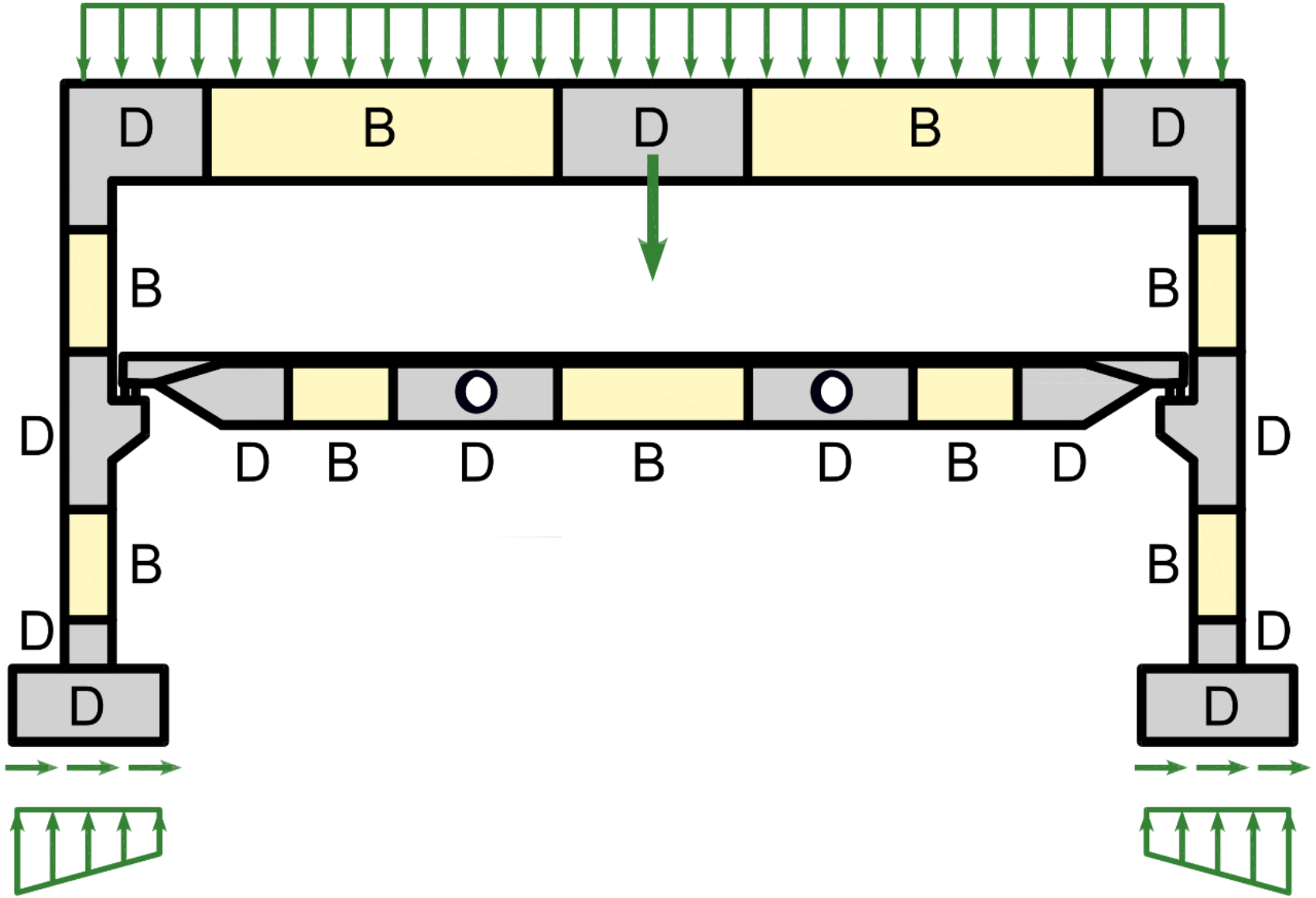




IDEA StatiCa Detail

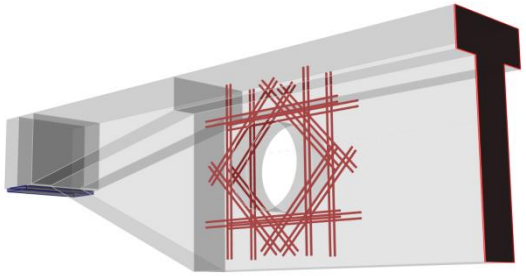


BEAM & COLUMN DETAILS

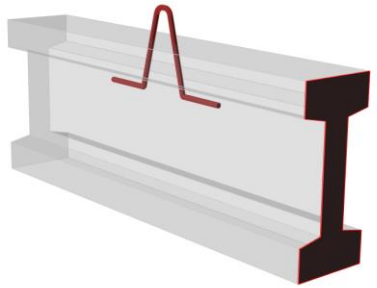


IDEA STATICA DETAIL

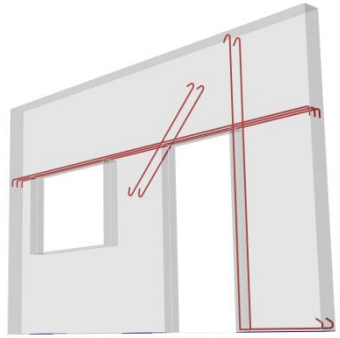
Dapped ends



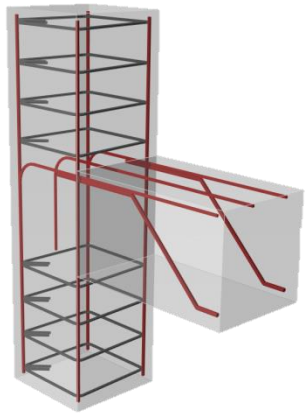
Hangings



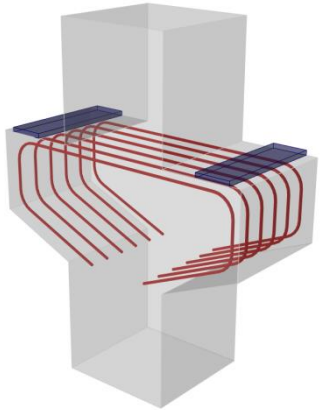
Walls



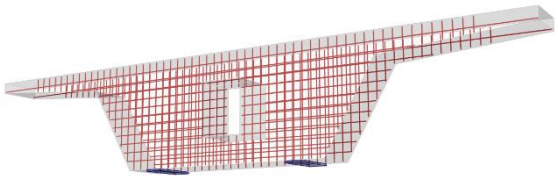
Frame joints



Corbels / Brackets

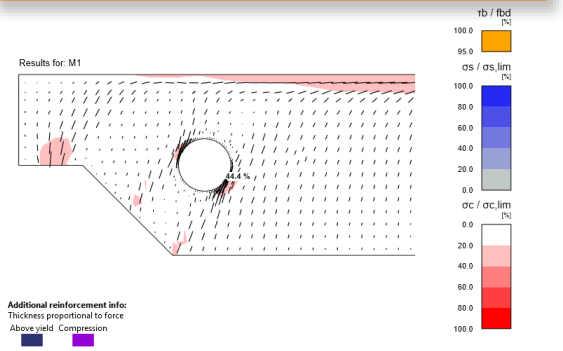


Diaphraghms

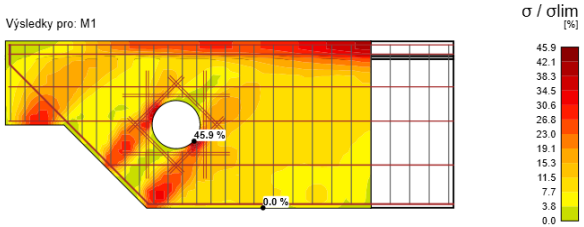


DESIGN AND CODE-CHECK

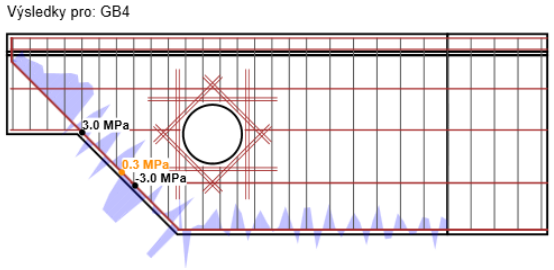
Overall check



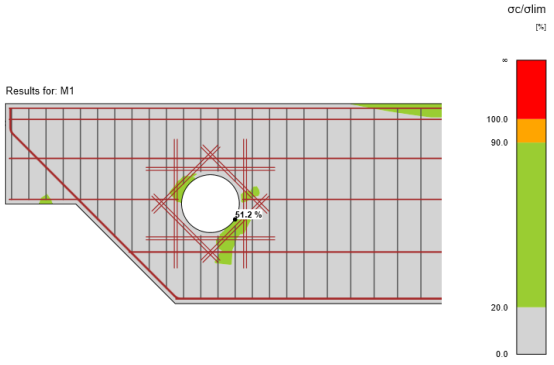
Strength



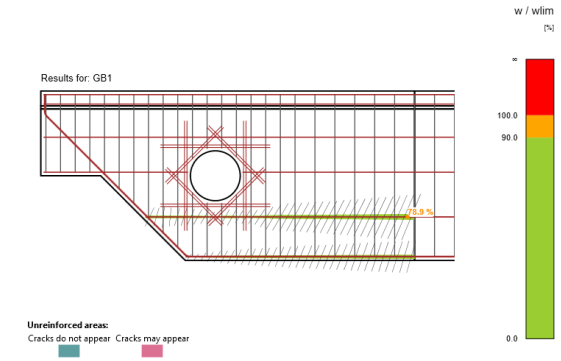
Anchorage



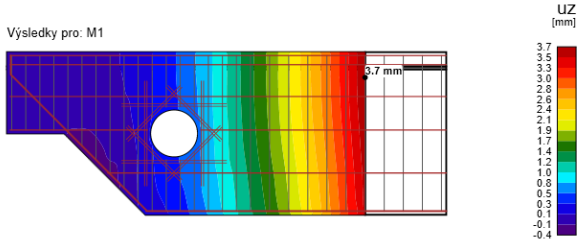
Stress



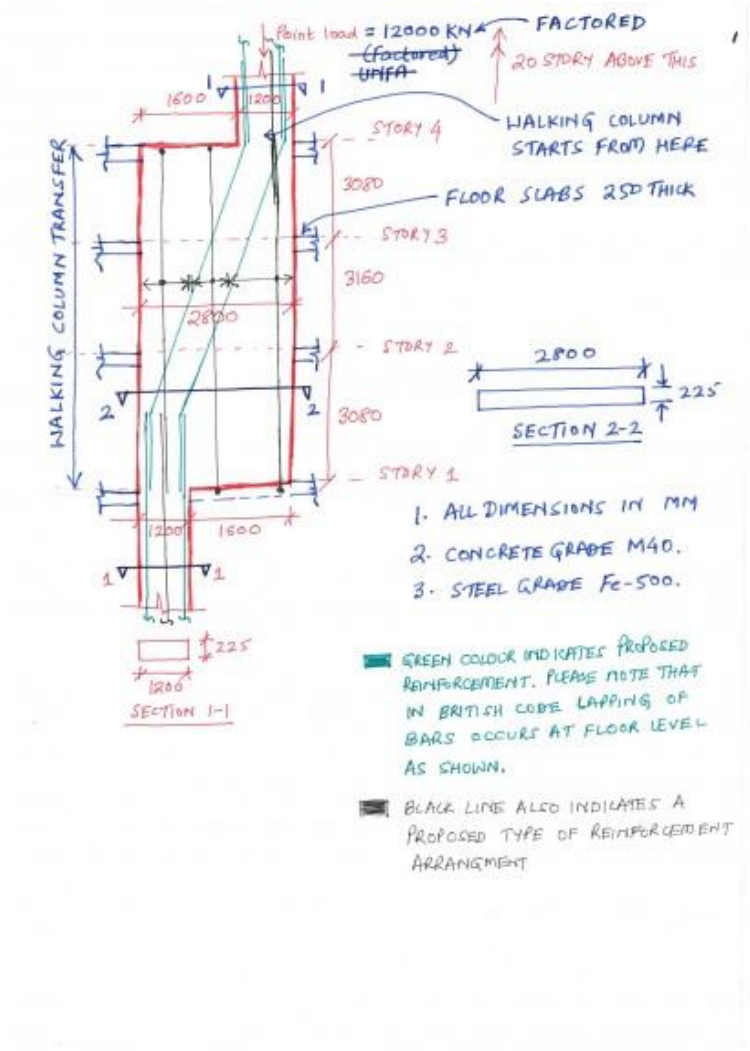
Cracks

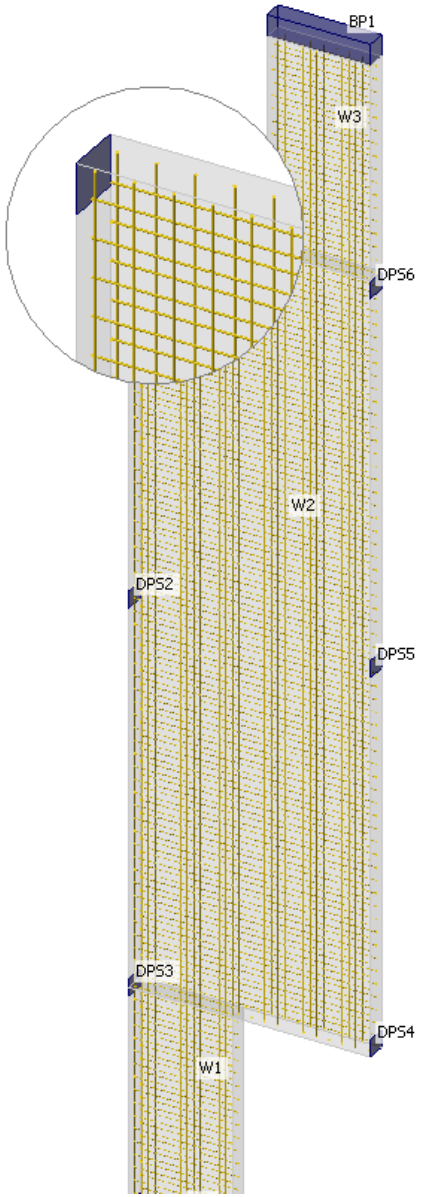


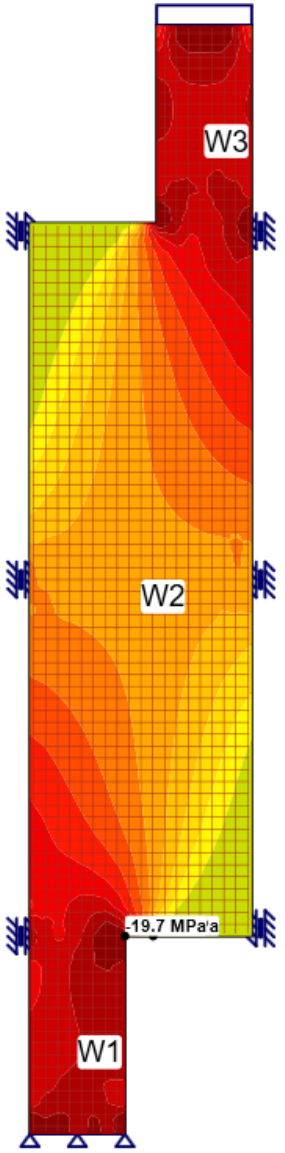
Deflection



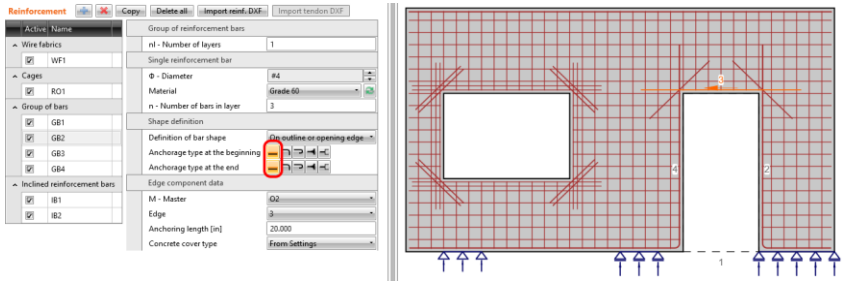
PRACTICAL PROBLEM

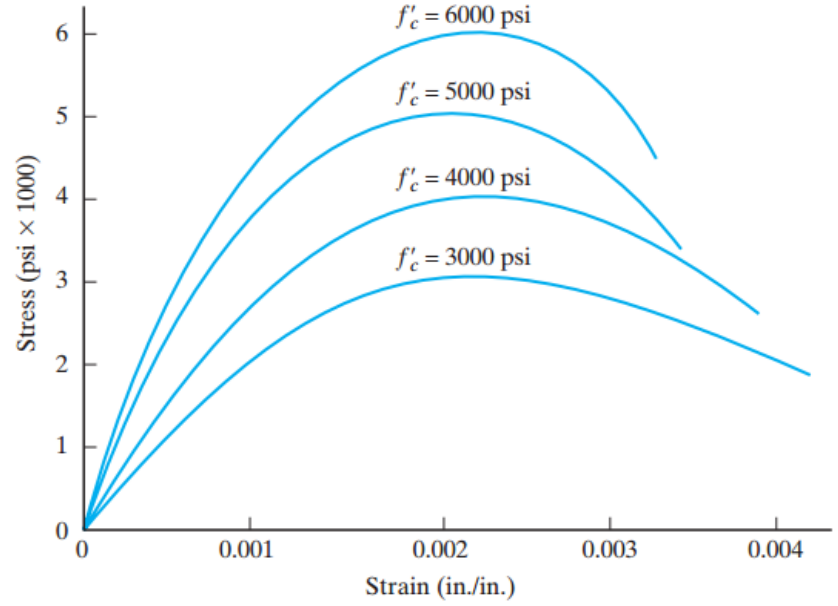


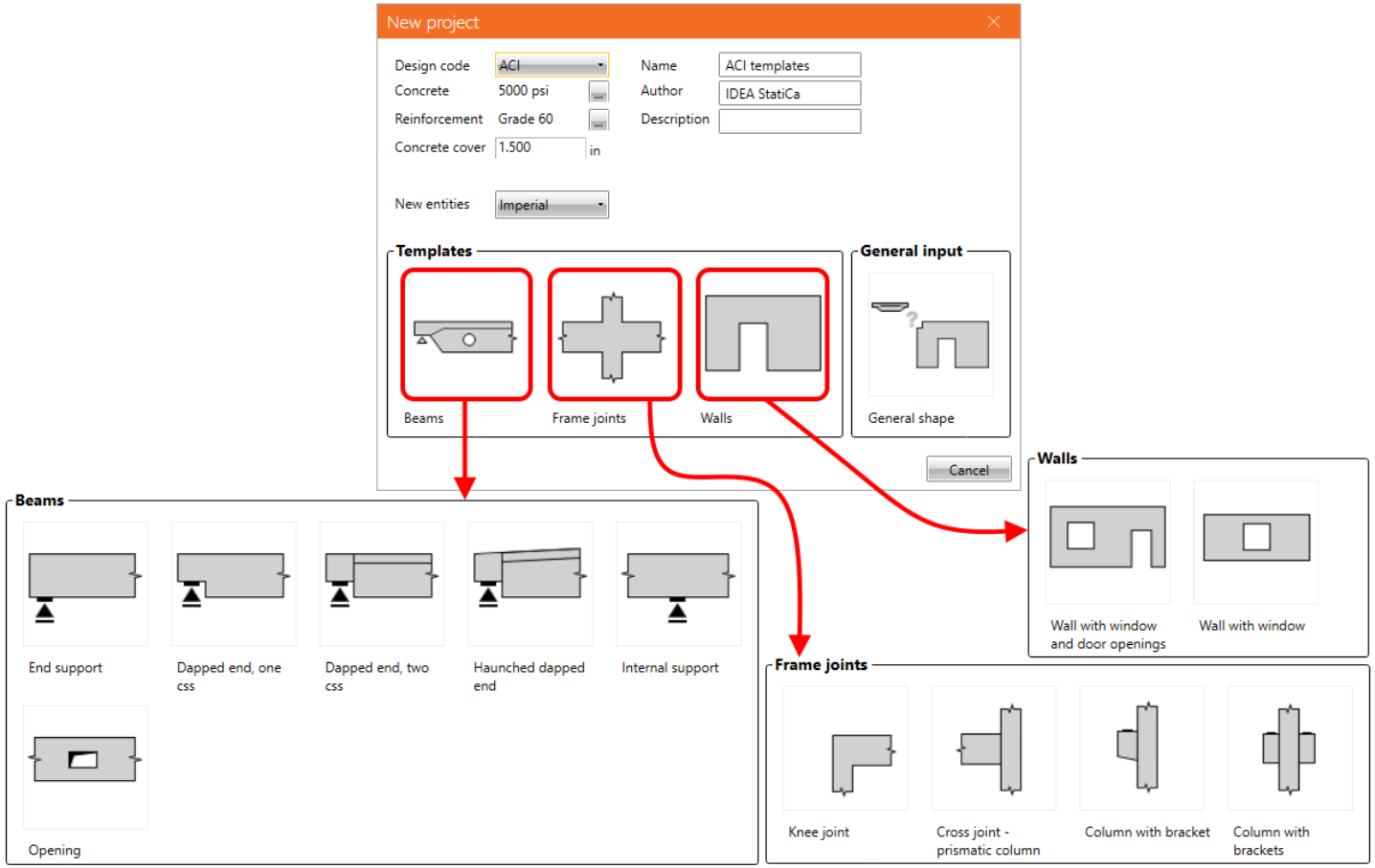




Improvements V23







Q&A