Verification example – Coped beam

Type of connection: Beam to beam fin plate connection

Unit system: Metric

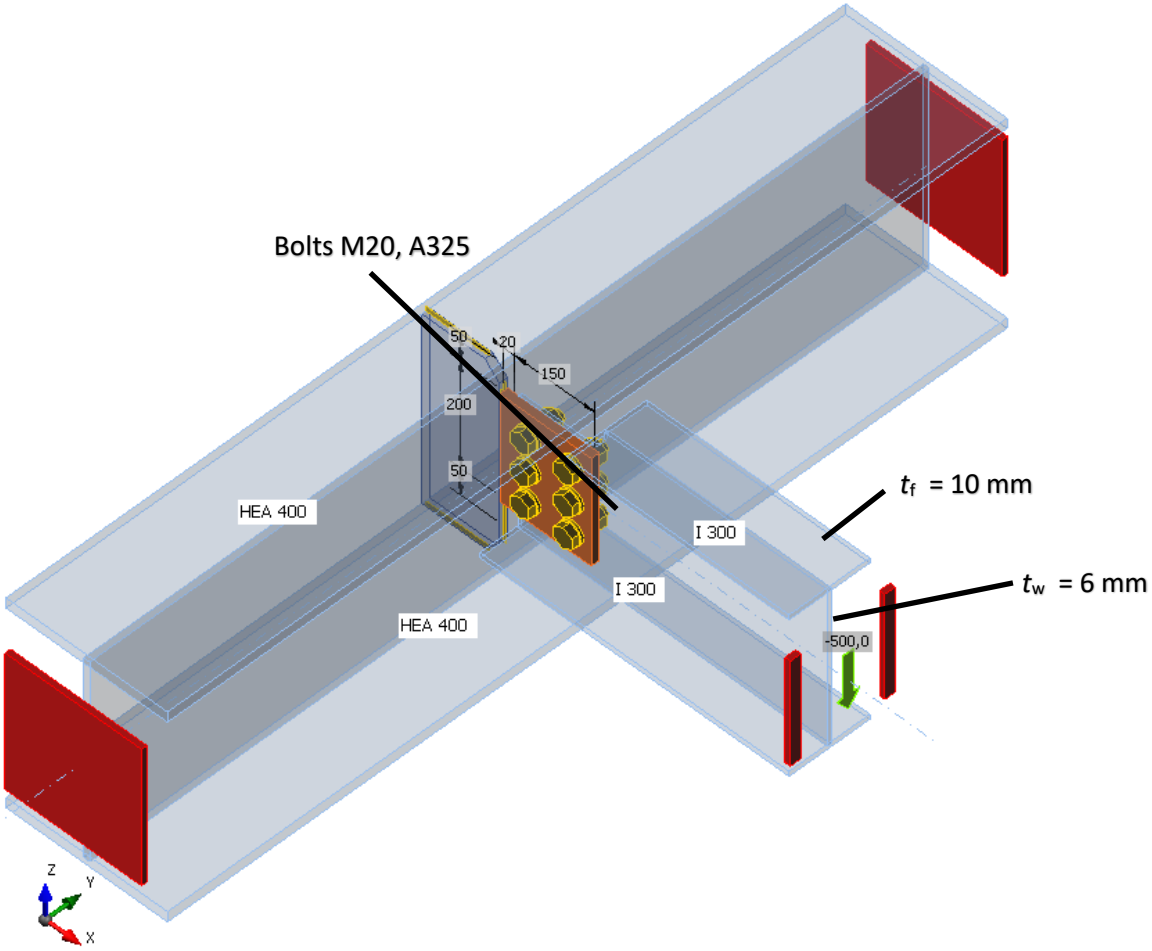
Designed acc. to: CSA S14-16

Investigated: Base material

Plate Materials: W series steel grade

Bolts: M20, grade A325, standard holes with diameter 22 mm

Geometry:



Applied forces:

N = 0 kN

V = -500 kN

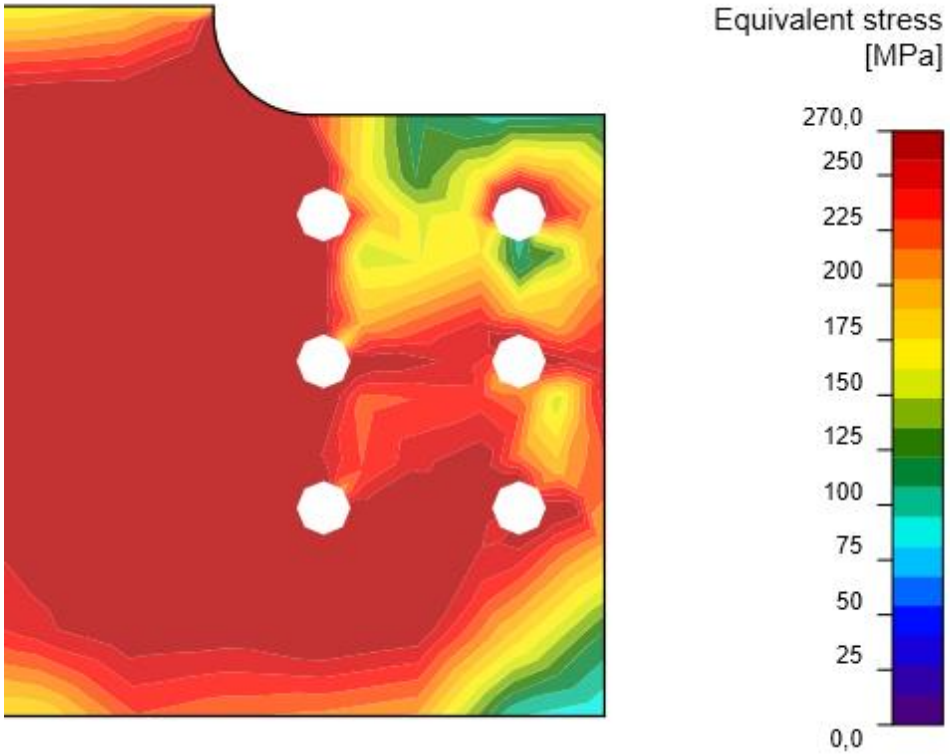
M = 0 kNm

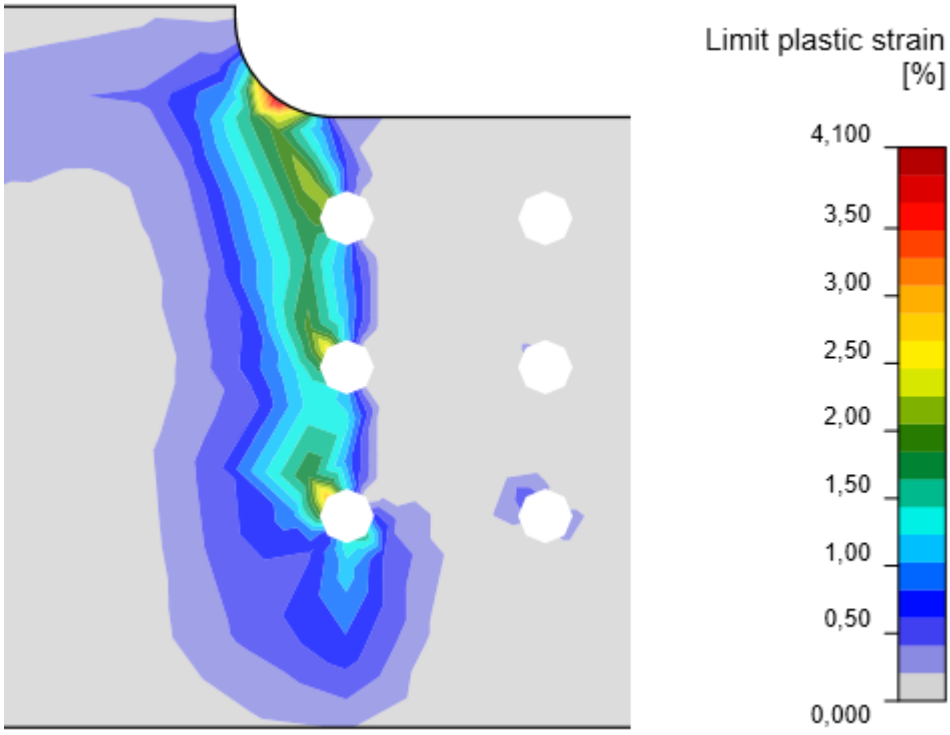
Procedure:

Block shear resistance is checked on a coped beam (thickness of the web 6 mm), which is designed to fail while other components are still undamaged.

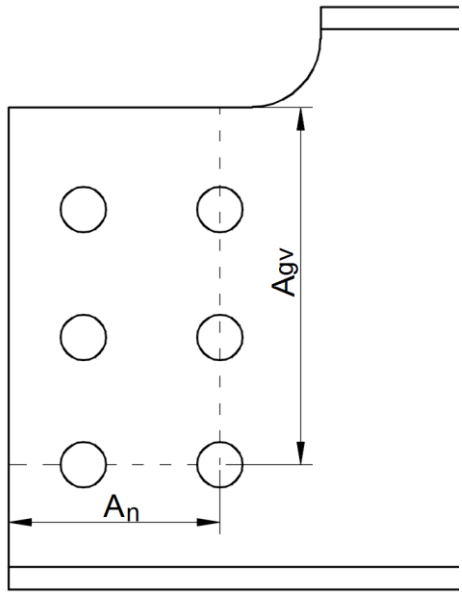
IDEA StatiCa Connection

The resistance of plate in IDEA is determined at 5% limit strain. Steel grade 300W is shown on following pictures.





CISC



t =	6	mm
w_n =	82	mm
w_{gv} =	160	mm
A_n =	492	mm^2
U_t =	0.3	
A_{gv} =	1920	mm^2

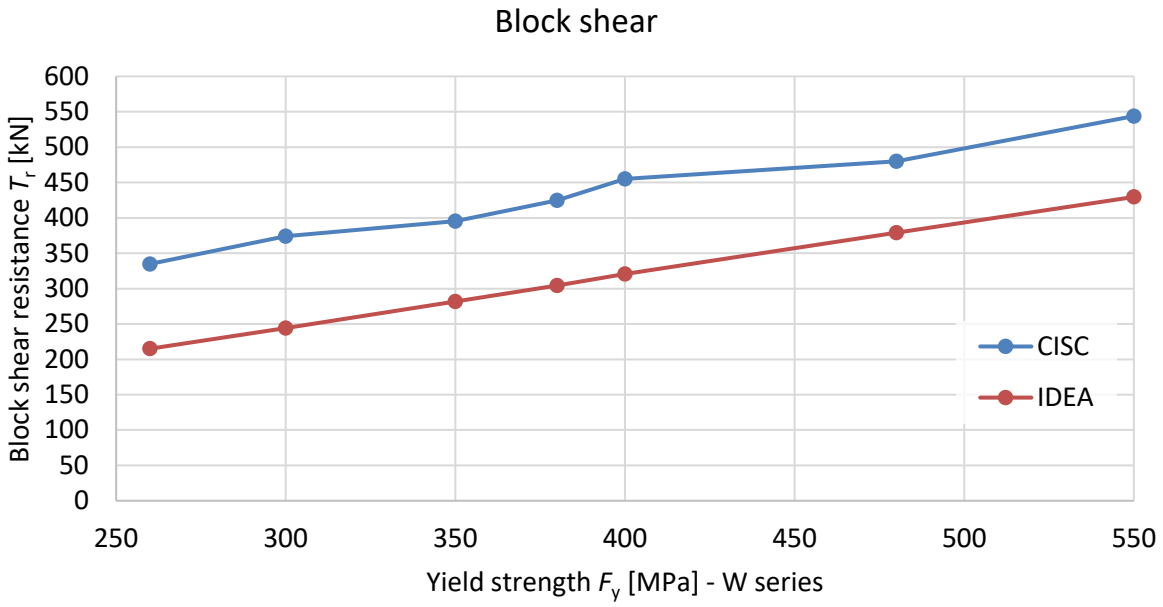
$$T_r = \Phi_u \cdot \left[U_t \cdot A_n \cdot F_u + 0.6 \cdot A_{gv} \cdot \frac{(F_y + F_u)}{2} \right]$$

For steel grades with F_y > 460 MPa, (F_y+ F_u)/2 is replaced with F_y.

Comparison:

Steel grade	F_y	F_u	Block shear resistance: CISC	IDEA	IDEA/CISC
260W	260	410	335	215	64%
300W	300	450	374	244	65%
350W	350	450	395	282	71%
380W	380	480	425	305	72%
400W	400	520	455	321	70%
480W	480	590	480	379	79%
550W	550	620	544	430	79%

The results of IDEA StatiCa Connection design gives conservative values of block shear resistance compared to manual computation according to CSA 16-14. This is caused mainly due to the use of the tensile force, F_u, in the analytical formula. IDEA works only with the yield strength, F_y, and therefore the results differ with increasing difference between the tensile strength and yield strength. Also, due to the one-sided fin plate connection, the fin plate slightly bends and thus decreases the resistance.


Block shear
Block shear resistance T_r [kN]
600
550
500
450
400
350
300
250
200
150
100
50
0
250
300
350
400
450
500
550
Yield strength F_y [MPa] - W series
CISC
IDEA