Release Note

Release Date : Jan. 04, 2022

Product Ver. : Civil 2022 (v1.2)

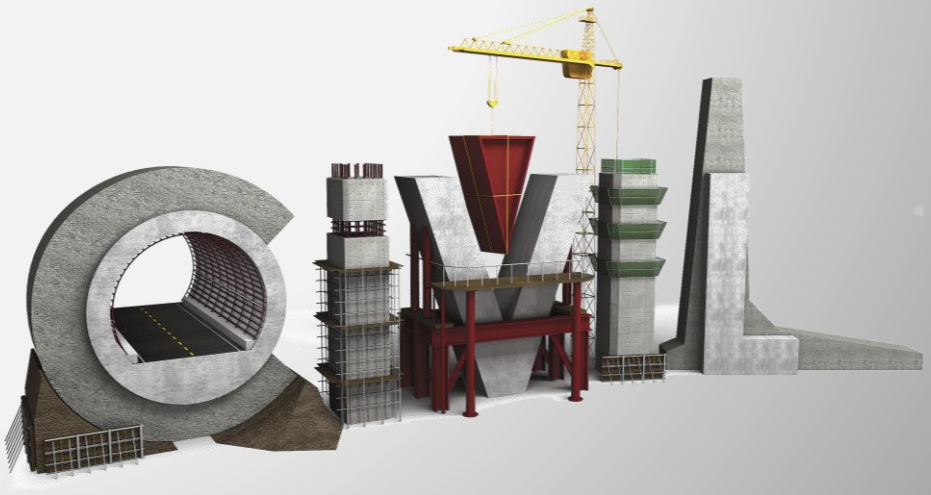
Enhancements

Enhancements in Civil 2022 (v1.2)

1. UK CS 454 Bridge Assessment for Steel Composite Girder with Longitudinal Stiffeners
2. Add New Type of Elastic Link: Rail Track Interaction Type

Enhancements in Civil 2022 (v1.1): Refer to Civil 2022 (v1.1) release note for details.

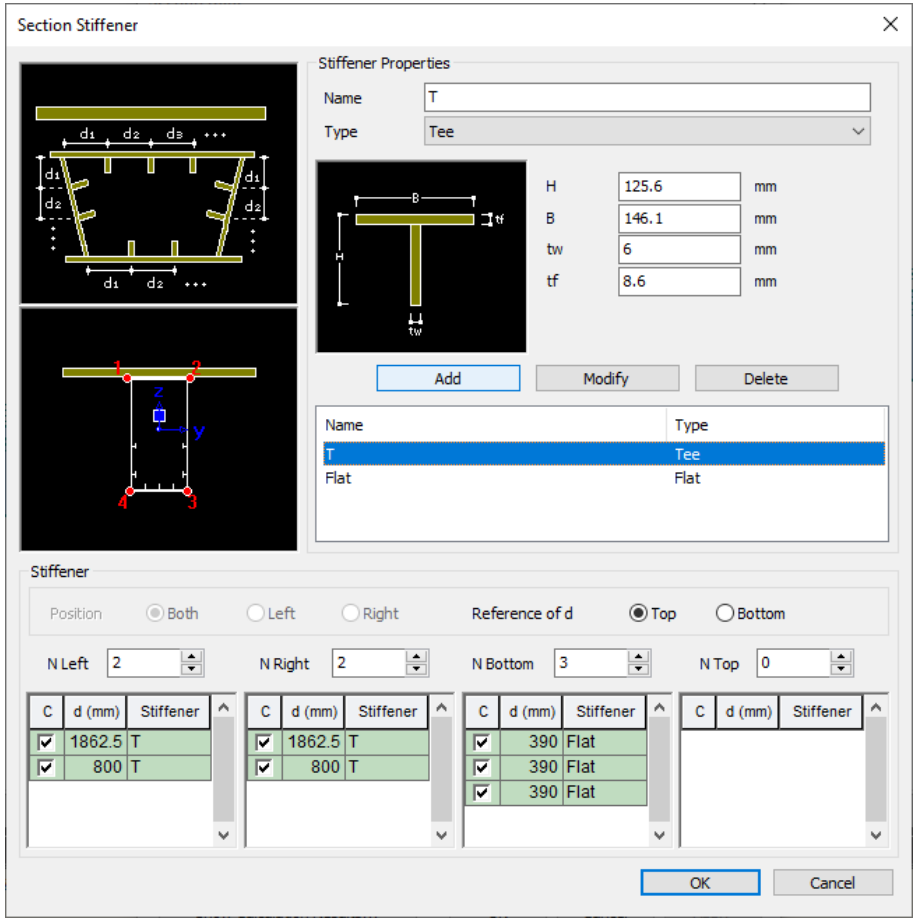
1. UK CS 454 Bridge Assessment for Steel Composite Girder
2. UK High-Speed Train Loads Database for Train Load Generator
3. Train Load Generator Time Forcing Function Improvement
4. AS 5100.5:17 Update for midas GSD
5. Italy NTC 2018 RS function
6. Auto-generation of Beam Section Temperature Loads (AASHTO, Eurocode, Australia)
7. Load Rating LRFR 2019 Update to AASHTO MBE 3rd edition
8. Traffic Load AK, N11 Update to Russia Standard
9. Longitudinal Stiffener Input Measured from Bottom of Steel Composite Girder

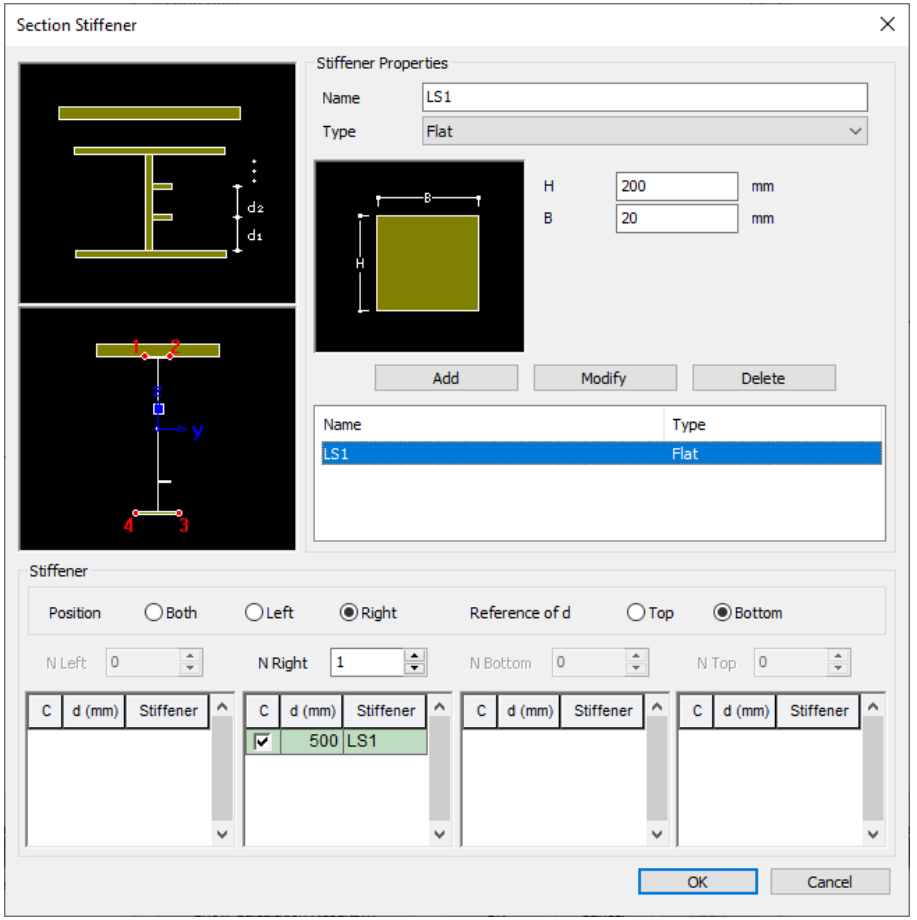


1. UK CS 454 Bridge Assessment for Steel Composite Girder with Longitudinal Stiffeners

- Steel composite girders with longitudinal stiffeners on the flange/web are now supported for the bridge assessment to UK CS 454.
- In Civil 2022 (v1.1), the assessment could only be performed for the beams without longitudinal stiffeners.

▪ ***Rating> Steel Bridge > CS 454/20***

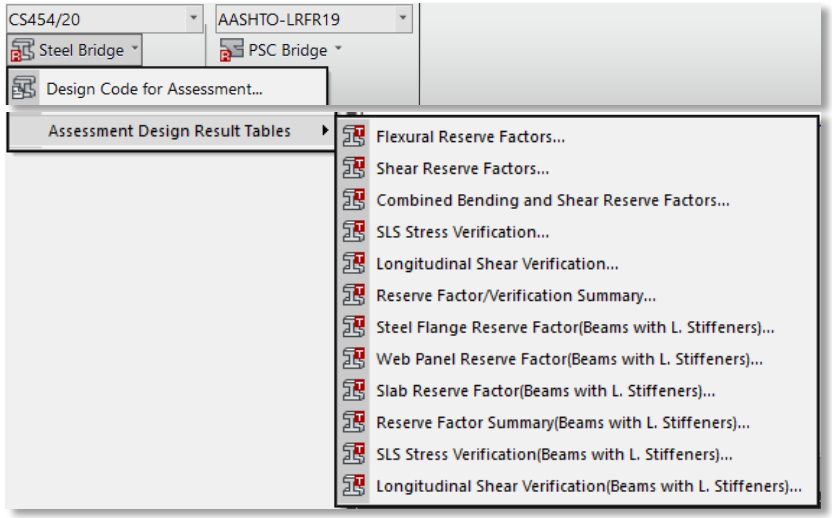




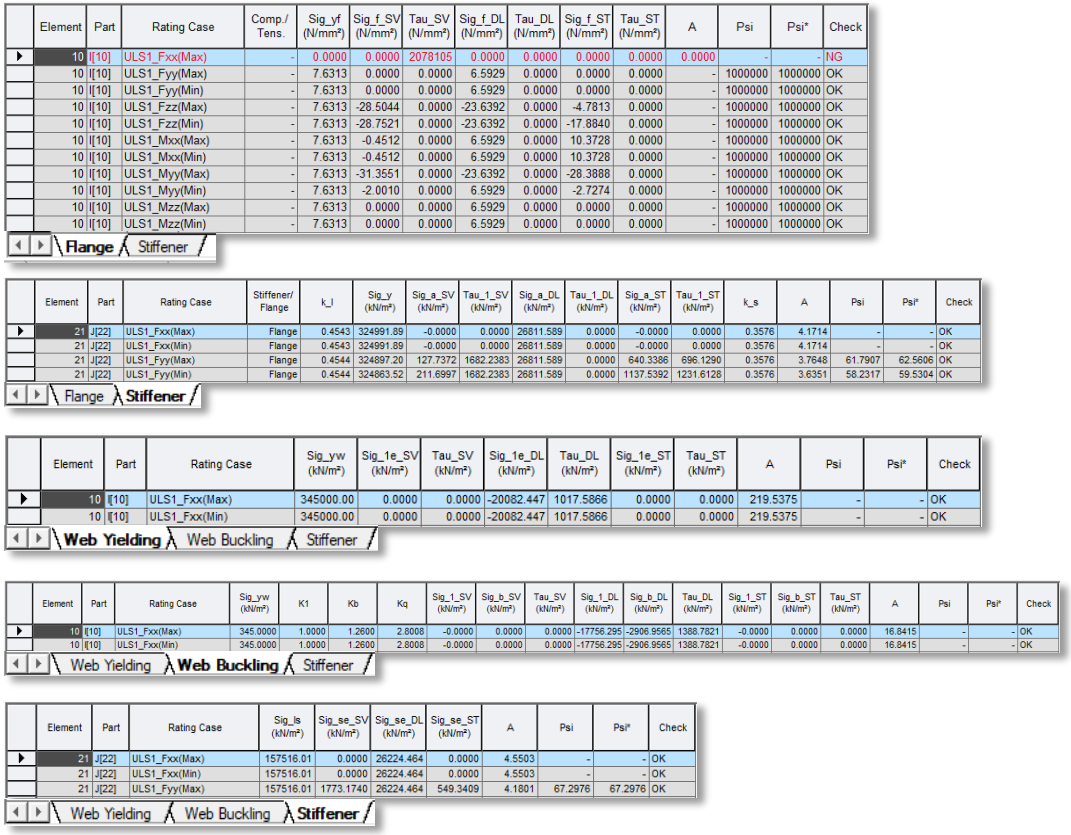
1. UK CS 454 Bridge Assessment for Steel Composite Girder with Longitudinal Stiffeners

- The table results are provided separately for the beams with longitudinal stiffeners.
- Reserve factors, SLS checks, and longitudinal shear checks are provided separately on the result tables for flanges/webs with longitudinal stiffeners.

▪ ***Rating> Steel Bridge > CS 454/20***



Assessment Result Tables



Element	Part	Rating Case	Comp./ Tens.	Sig_yf (N/mm²)	Sig_f_SV (N/mm²)	Tau_SV (N/mm²)	Sig_f_DL (N/mm²)	Tau_DL (N/mm²)	Sig_f_ST (N/mm²)	Tau_ST (N/mm²)	A	Psi	Psi*	Check
10	I[10]	ULS1_Fxx(Max)	-	0.0000	0.0000	2078105	0.0000	0.0000	0.0000	0.0000	0.0000	-	-	NG
10	I[10]	ULS1_Fyy(Max)	-	7.6313	0.0000	0.0000	6.5929	0.0000	0.0000	0.0000	-	1000000	1000000	OK
10	I[10]	ULS1_Fyy(Min)	-	7.6313	0.0000	0.0000	6.5929	0.0000	0.0000	0.0000	-	1000000	1000000	OK
10	I[10]	ULS1_Fzz(Max)	-	7.6313	-28.5044	0.0000	-23.6392	0.0000	-4.7813	0.0000	-	1000000	1000000	OK
10	I[10]	ULS1_Fzz(Min)	-	7.6313	-28.7521	0.0000	-23.6392	0.0000	-17.8840	0.0000	-	1000000	1000000	OK
10	I[10]	ULS1_Mxx(Max)	-	7.6313	-0.4512	0.0000	6.5929	0.0000	10.3728	0.0000	-	1000000	1000000	OK
10	I[10]	ULS1_Mxx(Min)	-	7.6313	-0.4512	0.0000	6.5929	0.0000	10.3728	0.0000	-	1000000	1000000	OK
10	I[10]	ULS1_Myy(Max)	-	7.6313	-31.3551	0.0000	-23.6392	0.0000	-28.3888	0.0000	-	1000000	1000000	OK
10	I[10]	ULS1_Myy(Min)	-	7.6313	-2.0010	0.0000	6.5929	0.0000	-2.7274	0.0000	-	1000000	1000000	OK
10	I[10]	ULS1_Mzz(Max)	-	7.6313	0.0000	0.0000	6.5929	0.0000	0.0000	0.0000	-	1000000	1000000	OK
10	I[10]	ULS1_Mzz(Min)	-	7.6313	0.0000	0.0000	6.5929	0.0000	0.0000	0.0000	-	1000000	1000000	OK

Flange | Stiffener

Element	Part	Rating Case	Stiffener/ Flange	k_l	Sig_y (kN/m²)	Sig_a_SV (kN/m²)	Tau_1_SV (kN/m²)	Sig_a_DL (kN/m²)	Tau_1_DL (kN/m²)	Sig_a_ST (kN/m²)	Tau_1_ST (kN/m²)	k_s	A	Psi	Psi*	Check
21	J[22]	ULS1_Fxx(Max)	Flange	0.4543	324991.89	-0.0000	0.0000	26811.589	0.0000	-0.0000	0.0000	0.3576	4.1714	-	-	OK
21	J[22]	ULS1_Fxx(Min)	Flange	0.4543	324991.89	-0.0000	0.0000	26811.589	0.0000	-0.0000	0.0000	0.3576	4.1714	-	-	OK
21	J[22]	ULS1_Fyy(Max)	Flange	0.4544	324897.20	127.7372	1682.2383	26811.589	0.0000	640.3386	696.1290	0.3576	3.7648	61.7907	62.5606	OK
21	J[22]	ULS1_Fyy(Min)	Flange	0.4544	324863.52	211.6997	1682.2383	26811.589	0.0000	1137.5392	1231.6128	0.3576	3.6351	58.2317	59.5304	OK

Flange | Stiffener

Element	Part	Rating Case	Sig_yw (kN/m²)	Sig_1e_SV (kN/m²)	Tau_SV (kN/m²)	Sig_1e_DL (kN/m²)	Tau_DL (kN/m²)	Sig_1e_ST (kN/m²)	Tau_ST (kN/m²)	A	Psi	Psi*	Check
10	I[10]	ULS1_Fxx(Max)	345000.00	0.0000	0.0000	-20082.447	1017.5866	0.0000	0.0000	219.5375	-	-	OK
10	I[10]	ULS1_Fxx(Min)	345000.00	0.0000	0.0000	-20082.447	1017.5866	0.0000	0.0000	219.5375	-	-	OK

Web Yielding | Web Buckling | Stiffener

Element	Part	Rating Case	Sig_yw (kN/m²)	K1	Kb	Kq	Sig_1_SV (kN/m²)	Sig_b_SV (kN/m²)	Tau_SV (kN/m²)	Sig_1_DL (kN/m²)	Sig_b_DL (kN/m²)	Tau_DL (kN/m²)	Sig_1_ST (kN/m²)	Sig_b_ST (kN/m²)	Tau_ST (kN/m²)	A	Psi	Psi*	Check
10	I[10]	ULS1_Fxx(Max)	345.0000	1.0000	1.2600	2.8008	-0.0000	0.0000	0.0000	-17756.295	-2906.9565	1388.7821	-0.0000	0.0000	0.0000	16.8415	-	-	OK
10	I[10]	ULS1_Fxx(Min)	345.0000	1.0000	1.2600	2.8008	-0.0000	0.0000	0.0000	-17756.295	-2906.9565	1388.7821	-0.0000	0.0000	0.0000	16.8415	-	-	OK

Web Yielding | Web Buckling | Stiffener

Element	Part	Rating Case	Sig_ls (kN/m²)	Sig_se_SV (kN/m²)	Sig_se_DL (kN/m²)	Sig_se_ST (kN/m²)	A	Psi	Psi*	Check
21	J[22]	ULS1_Fxx(Max)	157516.01	0.0000	26224.464	0.0000	4.5503	-	-	OK
21	J[22]	ULS1_Fxx(Min)	157516.01	0.0000	26224.464	0.0000	4.5503	-	-	OK
21	J[22]	ULS1_Fyy(Max)	157516.01	1773.1740	26224.464	549.3409	4.1801	67.2976	67.2976	OK

Web Yielding | Web Buckling | Stiffener

Additional result tabs on the assessment result tables

1. UK CS 454 Bridge Assessment for Steel Composite Girder with Longitudinal Stiffeners

- The calculation procedure is provided in excel format.
- The excel report shows different contents depending on longitudinal stiffeners on a flange/web.

▪ ***Rating> Steel Bridge > CS 454/20***

1. Design Condition

Design code	Element	Part(Node)
CS454/20	8	I(8)

2. Assessment factors

The following factors, as in CS 454, have been used to compare results of different configurations and combinations.

▪ Adequacy factor:

$$A = \frac{R_a^*}{S_a^*}$$

▪ Special Vehicle reserve factor

$$\Psi = \frac{R_a^* - (S_D^* + S_{ST}^*)}{S^*}$$

▪ Sepcial Vehicle reserve factor

Where:

R^*_a : the as

S^* :

S :

3. Flexural Reserve Factors

Assessment Case	Load Effect	R_a^* (kN.m)	S^* (kN.m)	S_D^* (kN.m)	S_{ST}^* (kN.m)	S_a^* (kN.m)	A	Ψ	Ψ*	Check
ULS1_Fxx(Max)	Negative	7818.638	0.000	-393.340	0.000	-393.340	19.878	-	-	OK
ULS1_Fxx(Min)	Negative	7818.638	0.000	-393.340	0.000	-393.340	19.878	-	-	OK

4. Shear Reserve Factors

Assessment Case	R_a^* (kN)	S^* (kN)	S_D^* (kN)	S_{ST}^* (kN)	S_a^* (kN)	A	Ψ	Ψ*	Check
ULS1_Fxx(Max)	-	-	-	-	-	-	-	-	-
ULS1_Fxx(Min)	7720.152	0.000	201.277	0.000	201.277	38.356	-	-	OK

5. Combined Bending and Shear Reserve Factors

Assessment Case	M_D (kN.m)	M_f (kN.m)	V_D (kN)	V_R (kN)	M_{SV} (kN.m)	V_{SV} (kN)	M_{DL} (kN.m)	V_{DL} (kN)	M_{ST} (kN.m)	V_{ST} (kN)	A	Ψ	Ψ*	Check
ULS1_Fxx(Max)	6769.383	6769.383	7720.152	7720.152	0.000	0.000	-322.941	NG	0.000	0.000	0.058	-		OK
ULS1_Fxx(Min)	6769.383	6769.383	7720.152	7720.152	0.000	0.000	-322.941	NG	0.000	0.000	0.058	-		OK

6. Longitudinal Shear Verification

Assessment Case	q (kN/m)	P_m (kN)	P_a (kN)	q_r (kN/m)	q/q_r	$(q/q_r)_{limit}$	Check
ULS1_Fxx(Max)	0.032	125.000	82.642	0.248	0.065	1.000	NG
ULS1_Fxx(Min)	-	-	-	-	-	-	-
ULS1_Fyy(Max)	0.032	125.000	82.642	0.248	0.065	1.000	NG
ULS1_Fyy(Min)	0.032	125.000	82.642	0.248	0.065	1.000	NG
ULS1_Fzz(Max)	0.578	125.000	82.642	0.248	1.166	1.000	NG
ULS1_Fzz(Min)	0.255	125.000	82.642	0.248	0.513	1.000	NG
ULS1_Mxx(Max)	0.351	125.000	82.642	0.248	0.708	1.000	NG
ULS1_Mxx(Min)	0.077	125.000	82.642	0.248	0.156	1.000	NG
ULS1_Myy(Max)	0.077	125.000	82.642	0.248	0.155	1.000	NG
ULS1_Myy(Min)	0.162	125.000	82.642	0.248	0.327	1.000	NG
ULS1_Mzz(Max)	0.032	125.000	82.642	0.248	0.065	1.000	NG
ULS1_Mzz(Min)	0.032	125.000	82.642	0.248	0.065	1.000	NG

Assessment report for beams without longitudinal stiffeners

1. Design Condition

Design code	Element	Part(Node)
CS454/20	10	I(10)

2. Assessment factors

The following factors, as in CS 454, have been used to compare results of different configurations and comb

▪ Adequacy factor:

$$A = \frac{R_a^*}{S_a^*}$$

▪ Special Vehicle rese

$$\Psi = \frac{R_a^* - (S_D^*}{S^*}$$

▪ Sepcial Vehicle rese

Where:

R^*_a : the as

S^*_D : the as

S^*_{ST} : the as

S^* : the as

S^*_a : the to

7. Steel Flange Reserve Factor(Beams with L.Stiffeners)

Flange

Assessment Case	Load Effect	σ_{yf} (MPa)	$\sigma_{f,SV}$ (MPa)	τ_{SV} (MPa)	$\sigma_{f,DL}$ (MPa)	τ_{DL} (MPa)	$\sigma_{f,ST}$ (MPa)	τ_{ST} (MPa)	A	Ψ	Ψ*	Check
ULS1_Fxx(Max)	Comp.	290.043	0.000	0.000	23.309	0.000	0.000	0.000	12.443	-	-	OK
ULS1_Fxx(Max)	Tens.	281.385	0.000	0.000	-21.650	0.000	0.000	0.000	12.997	-	-	OK

Stiffener

Assessment Case	Stiffener/ Flange	k_l	σ_y (MPa)	$\sigma_{a,SV}$ (MPa)	$\tau_{1,SV}$ (MPa)	$\sigma_{a,DL}$ (MPa)	$\tau_{1,DL}$ (MPa)	$\sigma_{a,ST}$ (MPa)	$\tau_{1,ST}$ (MPa)	k_s	A	Ψ	Ψ*	Check
ULS1_Fxx(Max)	Stiffener	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	OK
ULS1_Fxx(Min)	Stiffener	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	OK

8. Web Panel Reserve Factor(Beams with L.Stiffeners)

Web Yielding

Assessment Case	σ_{yw} (MPa)	$\sigma_{f,SV}$ (MPa)	τ_{SV} (MPa)	$\sigma_{f,DL}$ (MPa)	τ_{DL} (MPa)	$\sigma_{f,ST}$ (MPa)	τ_{ST} (MPa)	A	Ψ	Ψ*	Check
ULS1_Fxx(Max)	345.000	0.000	0.000	-20.082	1.018	0.000	0.000	219.557	-	-	OK
ULS1_Fxx(Min)	345.000	0.000	0.000	-20.082	1.018	0.000	0.000	219.557	-	-	OK
ULS1_Fyy(Max)	345.000	0.067	10.254	-20.082	1.018	-0.997	2.683	86.988	47.933	48.124	OK

Web Buckling

Assessment Case	σ_{yw} (MPa)	K_l	K_b	K_s	$\sigma_{f,SV}$ (MPa)	$\sigma_{b,SV}$ (MPa)	τ_{SV} (MPa)	$\sigma_{f,DL}$ (MPa)	$\sigma_{b,DL}$ (MPa)	τ_{DL} (MPa)	$\sigma_{f,ST}$ (MPa)	$\sigma_{b,ST}$ (MPa)	τ_{ST} (MPa)	A	Ψ	Ψ*	Check
ULS1_Fxx(Max)	345.000	1.000	1.260	2.801	0.000	0.000	0.000	-17.756	-2.907	1.389	0.000	0.000	0.000	16.842	-	-	OK
ULS1_Fxx(Min)	345.000	1.000	1.260	2.801	0.000	0.000	0.000	-17.756	-2.907	1.389	0.000	0.000	0.000	16.842	-	-	OK
ULS1_Fyy(Max)	345.000	1.000	1.260	2.801	0.062	0.007	10.254	-17.756	-2.907	1.389	-0.916	-0.095	2.683	16.297	-	-	OK

Stiffener

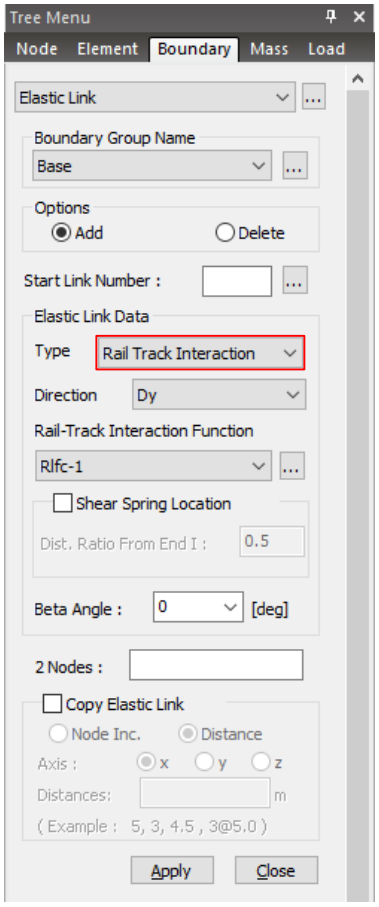
Assessment Case	σ_b (MPa)	$\sigma_{w,SV}$ (MPa)	$\sigma_{w,DL}$ (MPa)	$\sigma_{w,ST}$ (MPa)	A	Ψ	Ψ*	Check
ULS1_Fxx(Max)	14.635	0.000	-14.735	0.000	0.860	-	-	NG
ULS1_Fxx(Min)	14.635	0.000	-14.735	0.000	0.860	-	-	NG
ULS1_Fyy(Max)	14.635	0.055	-14.735	-0.810	0.818	-	-	NG

Assessment report for beams with longitudinal stiffeners

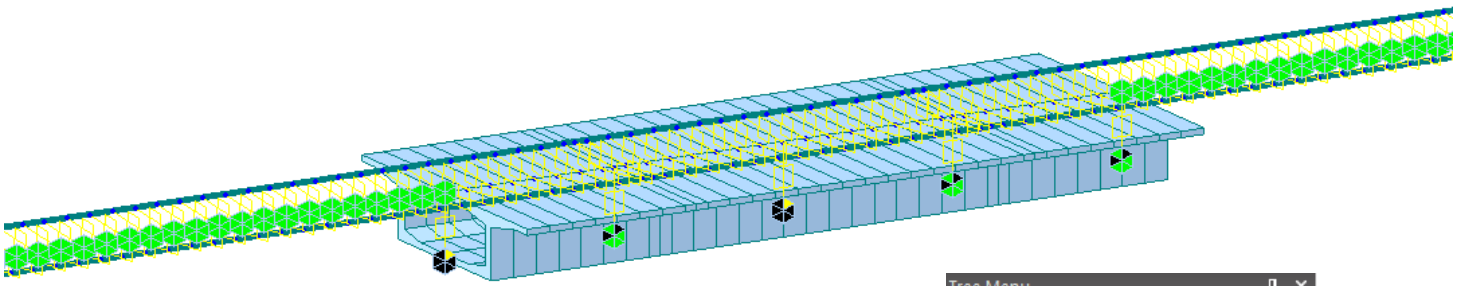
2. Add New Type of Elastic Link: Rail Track Interaction Type

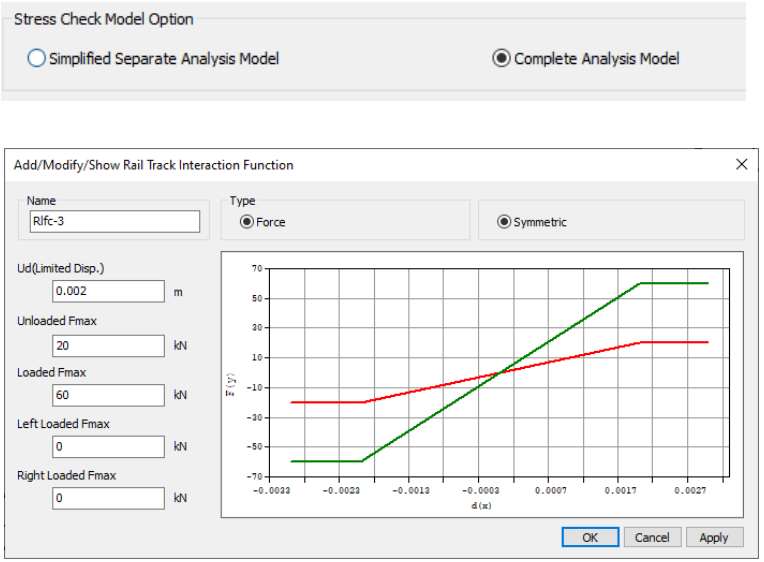
- This new function enables the user to modify the hysteretic behavior of the multi-linear links generated by the Rail Track Analysis Model wizard.
- The Rail Track Interaction Type Link will be generated by the wizard for the 'Complete Analysis Model' type.

▪ ***Boundary > Link > Elastic Link***

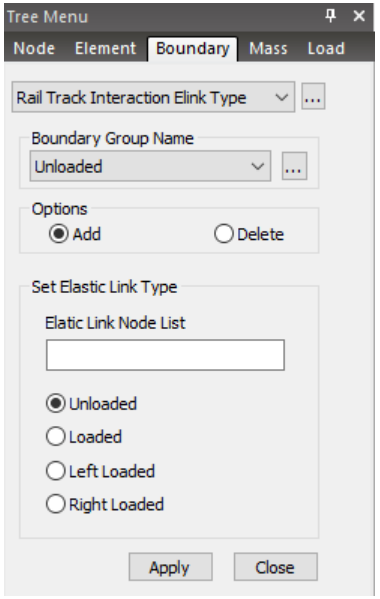


Elastic Link Function



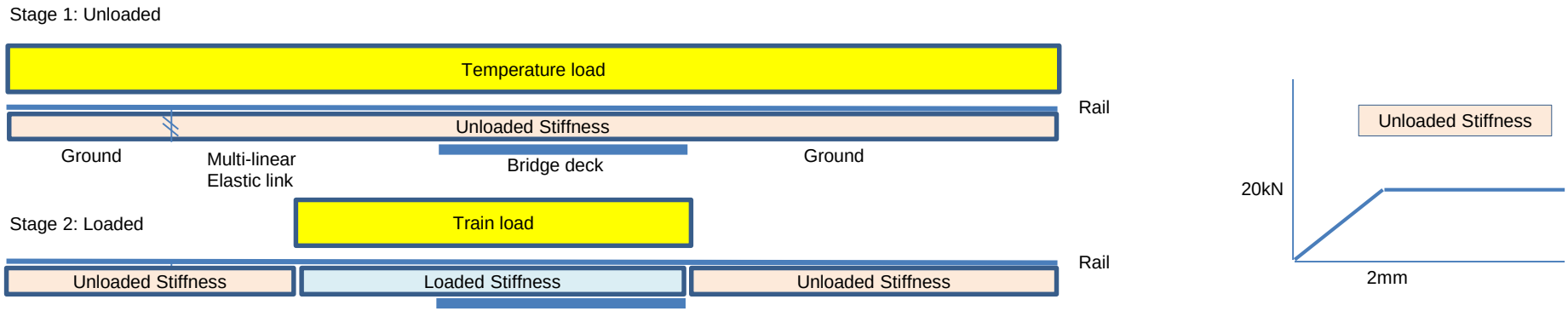


Rail Track Interaction Function



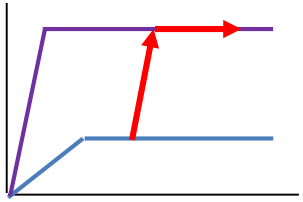
Rail Track Interaction E-Link Type

2. Add New Type of Elastic Link: Rail Track Interaction Type

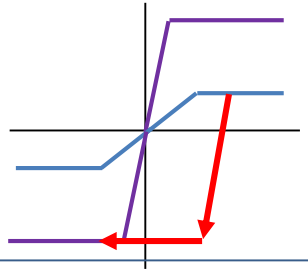


In case when Multi-linear link changes from 'unloaded' to 'loaded'.

Stage 1: The force of ML link reaches yielding.
Stage 2: ML link is subjected to additional loads in the same direction.



Stage 1: The force of ML link reaches yielding.
Stage 2: ML link is subjected to additional loads in the opposite direction.



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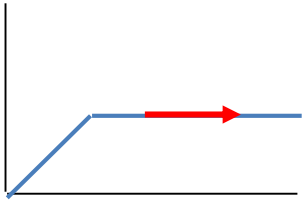

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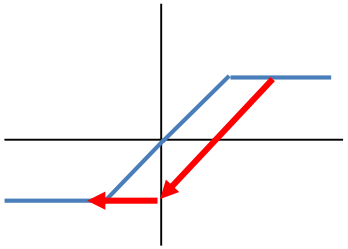

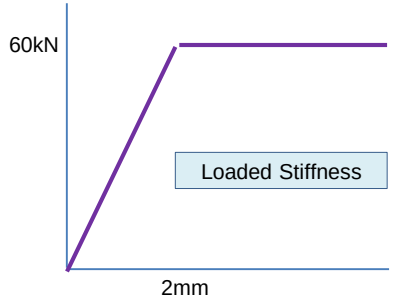

Loading/Unloading Behavior of ML Link

3. Bug fix list found in Civil 2022 (v1.1)

- Tendon Primary and Secondary, Creep/Shrinkage secondary load cases were not visible in the Load Combination dialog box when the Construction Stage Analysis Control Data was not defined.
- [RC Design to AASHTO LRFD 17] 1D Plate Column Check was not performed. This was happening only with AASHTO LRFD 17.
- [Steel Composite Girder Rating to AASHTO-LRFR 19] In the **Steel Bridge Load Rating Parameters** dialog box, clicking OK gave inconsistent error messages.
- [Steel Composite Girder Design to AASHTO-LRFD 17] The values of the plate buckling coefficient, k, for the uniform normal stress were different between the detailed calculation sheet for an element and the longitudinal stiffeners sheet.
- [PSC rating to AASHTO LRFD] The rating factor was incorrect for the negative moment when the signs of the moments for dead load and live load were different.
- [PSC design to AASHTO LRFD]
  - The shear strength resisted by the concrete, Vc, was incorrect. The design report showed zero for Vc, although all values for calculating Vc were not zero.
  - The principal stresses were verified using all the load combinations for serviceability, although only the Service III load combination should be used.
- [Moving Load Analysis to AS] The results from the beam forces/moments and the moving load tracer were different for the user-defined vehicle.
- [PSC Girder Design to AS 5100] PSC design result tables showed different outputs compared to the selected item. When the user selected the flexural strength result in tables, the table for compressive stress got opened up.
- [Moving Load Analysis to BS] Pedestrian loads were scaled down by 1000 when converted to a static load case from the moving load tracer.