

Centrum Energetických a Environmentálních Technologií – Explorer (CEETe)

Projektová dokumentace pro vydání stavebního povolení

SO 01.1 Budova CEETe

Statický výpočet

01.1.21 Stavebně konstrukční řešení - OK

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10/2020

Vypracoval: Ing. Jeżowicz

ZATÍŽENÍ

1. STÁLÉ

1.1 Vlastní hmotnost konstrukce generována z průřezových ploch prvků

1.2 Fotovoltaická stěna (panely)

Fotopanely (25 kg/m ²)	0,25
Podkonstrukce (10kg/m ²)	0,10
	<u>g_{foto,k} = 0,35 kN/m²</u>

1.3 Zelená stěna

Zelená fasáda (62 kg/m ²)	0,65
Podkladní Cetris deska 12mm (17kg/m ²)	0,17
	<u>g_{foto,k} = 0,82 kN/m²</u>

1.4 Stěny fasádních arkýřů

Tenkovrstvá omítka 5mm (4 kg/m ²)	0,04
Kamenná vlna 200mm (100 kg/m ³)	0,20
SDK 2x 15mm (13.44 kg/m ²)	0,27
Minerální vlna 150mm (50 kg/m ³)	0,08
SDK 2x 12.5mm (11.2 kg/m ²)	0,22
	<u>g_{foto,k} = 0,81 kN/m²</u>

Součinitel zatížení $\gamma_f=1.35$

2. PROMĚNLIVÉ

2.1 Sníh

sněhová oblast II (Ostrava) $s_k=1.0 \text{ kN/m}^2$

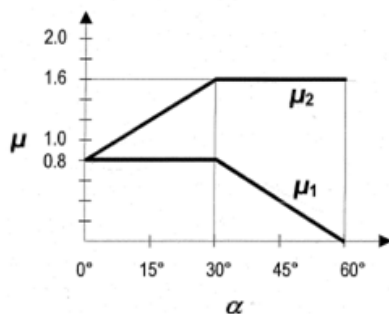
tepelný součinitel $C_t=1.0$

součinitel expozice $C_e=1.0$

a) střecha objektu

tvarový součinitel μ

ČSN EN 1991-1-3



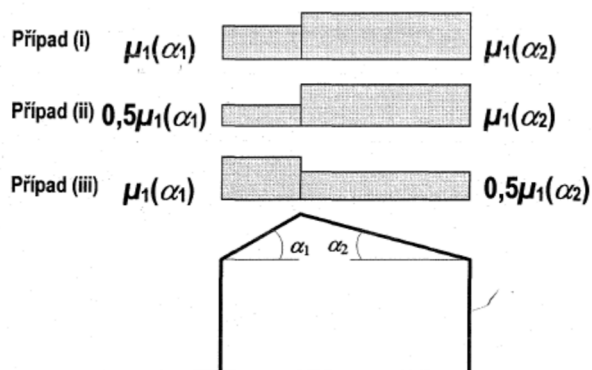
Obrázek 5.1 – Tvarové součinitele zatížení sněhem

(2) Hodnoty uvedené v tabulce 5.2 platí, pokud není zabráněno sklouzávání sněhu ze střechy. Pokud jsou na střeše sněžníky nebo jiné překážky nebo je dolní okraj střechy ukončen atikou (nadezdívkou), potom hodnota tvarového součinitele zatížení sněhem nemá klesnout pod 0,8.

Tabulka 5.2 – Tvarové součinitele zatížení sněhem

úhel sklonu střechy α	$0^\circ \leq \alpha \leq 30^\circ$	$30^\circ < \alpha < 60^\circ$	$\alpha \geq 60^\circ$
μ_1	0,8	$0,8(60 - \alpha)/30$	0,0
μ_2	$0,8 + 0,8\alpha/30$	1,6	—

(3) Uspořádání zatížení podle obrázku 5.2 se má použít pro zatížení nenavátým i navátým sněhem.



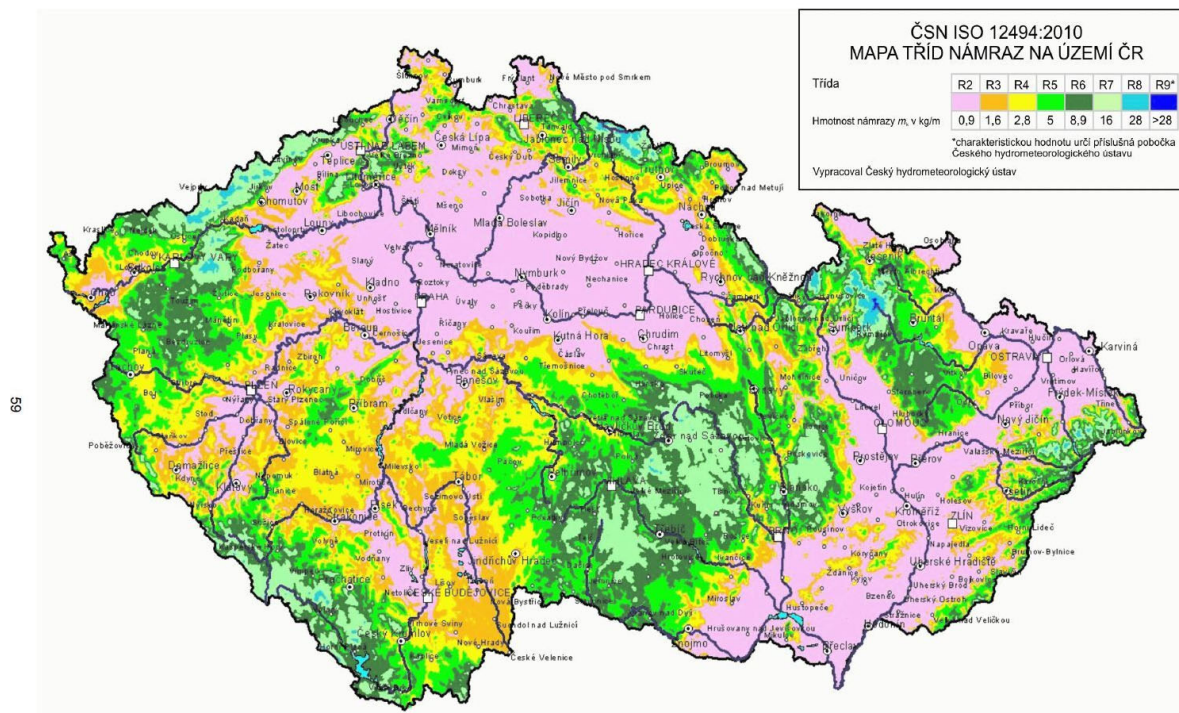
$$\alpha=0^\circ \rightarrow \mu_1=0.8, \mu_2=0.8+0.8*0/30=0.80 \text{ kN/m}^2$$

$$s_{1,k} = s_k \cdot C_t \cdot C_e \cdot \mu_1 = 1.0 \cdot 1 \cdot 1 \cdot 0.8 = 0.80 \text{ kN/m}^2 \text{ (zelená stěna)}$$

2.2 Námraza (dle ČSN ISO 12494)

Třída námrazyR2

Hmotnost námrazy $m_k=0.9 \text{ kg/m}$

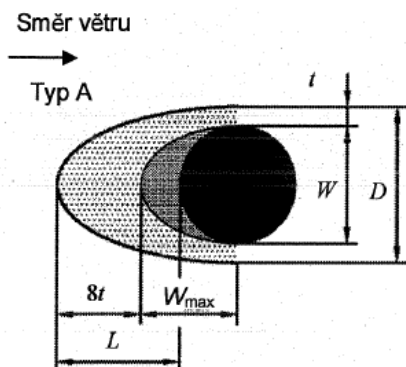


Obrázek NA.1 – Mapa tříd námraz pro území České republiky

ČSN ISO 12494

Tabulka 5 – Rozměry námrazy na profilech typů A a B
(platí pouze pro námrazu z oblačnosti, objemová hmotnost námrazy = 500 kg/m^3)

Tvary průřezů typů A a B									
Šířka profilu [mm]		10		30		100		300	
IC	Hmotnost námrazy <i>m</i> [kg/m]	Rozměry námrazy [mm]							
		<i>L</i>	<i>D</i>	<i>L</i>	<i>D</i>	<i>L</i>	<i>D</i>	<i>L</i>	<i>D</i>
R1	0,5	54	22	34	35	13	100	4	300
R2	0,9	78	28	54	40	23	100	8	300
R3	1,6	109	36	82	47	41	100	14	300
R4	2,8	150	46	120	56	67	104	24	300
R5	5,0	207	60	174	70	106	114	42	300
R6	8,9	282	79	247	88	165	129	76	300
R7	16,0	384	105	348	113	253	151	136	300
R8	28,0	514	137	478	146	372	181	217	317
R9	50,0	694	182	656	190	543	223	344	349
R10	Používá se pro extrémní námrazu								



Parametry tvorby námrazy:

$W = 2.5 \text{ mm}$, $L = 78 \text{ mm}$,

IC R2 - $\rightarrow D = D(10\text{mm}) - W(10\text{mm}) + D = 28 - 10 + 2.5 = 20.5 \text{ mm}$

$t = (D - W)/2 = (20.5 - 2.5)/2 = 9 \text{ mm}$, $L = 78\text{mm}$

Prodyšnost plochy pletivaítě 50x50/2.5 při námraze :

$(50-2.5-2 \times 9)^2/50^2 = 0.348 - \rightarrow \text{cca } 35\%$

Tabulka 27 – Součinitel pro snížení tlaku větru

ICG	k	ICR	k
G1	0,40	R1	0,40
G2	0,45	R2	0,45
G3	0,50	R3	0,50
G4	0,55	R4	0,55
G5	0,60	R5	0,60
		R6	0,70
		R7	0,80
		R8	0,90
		R9	1,00

ICR = R2 -> Součinitel snížení tlaku větru $k=0.45$

Hmotnost námrazy na 1 bm lana sítě -> 0.9 kg/bm

Hmotnost námrazy na 1 m^2 plochy sítě $> 40 \text{ ks} \times 0.9 \text{ kg/m}^2 = 36 \text{ kg/m}^2$.

Součinitel zatížení $\gamma_f=1.5$

VÝPOČET ZATÍŽENÍ VĚTREM PODLE ČTN EN 1991-1-4

Větrová oblast



místo: Ostrava

odečteno z mapy větrových oblastí ČR

$V_{b,0} = 25$ m/s

výchozí základní rychlost větru

Základní rychlost větru

$V_b = V_{b,0} \cdot C_{dir} \cdot C_{season} = 25$ m/s

základní rychlost větru 4.2 (4.1)

$C_{dir} = 1$

součinitel směru větru NA.2.6.

$C_{season} = 1$

součinitel ročního období NA.2.7.

Kategorie terénu



Příloha A.1

$z_0 = 0,3$ m

tab.4.1

$z_{min} = 5,00$ m

tab.4.1

$z_{max} = 200$ m

$z_{e1} = 10,00$ m

referenční výška 7.2.2 (1)

$z_{e2} = 0$ m

Součinitel terénu

$k_r = 0,19 \cdot (z_0/z_{0,II})^{0,07} = 0,215$

součinitel terénu 4.3.2 (4.5)

$z_{0,II} = 0,05$

kat. terénu II tab.4.1

Součinitel drsnosti terénu

$c_r(z_{e1}) = k_r \cdot \ln(z/z_0) = 0,755$

4.3.2 (4.4)

$c_r(z_{e2}) = k_r \cdot \ln(z/z_0) =$

Součinitel orografie

$c_0(z) = 1$

4.3.1.

Střední rychlost větru

$v_m(z_{e1}) = c_r(z) \cdot c_0(z) \cdot v_b = 18,88 \text{ ms}^{-1}$

4.3.1 (4.3)

$v_m(z_{e2}) = c_r(z) \cdot c_0(z) \cdot v_b = \text{ms}^{-1}$

Intenzita turbulence

$I_v(z_{e1}) = k_t/c_0(z) \cdot \ln(z/z_0) = 0,285$

$k_t = 1$

součinitel turbulence 4.4 (4.7)

$I_v(z_{e2}) = k_t/c_0(z) \cdot \ln(z/z_0) =$

Maximální dynamický tlak větru

$q_p(z_{e1}) = [1+7I_v(z)] \cdot 0,5\rho \cdot v_m(z)^2 =$

668 Nm⁻²

=

0,668 kNm⁻²

4.4 (4.8)

$q_p(z_{e2}) = [1+7I_v(z)] \cdot 0,5\rho \cdot v_m(z)^2 =$

Nm⁻²

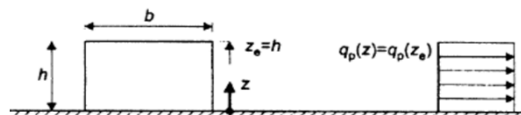
=

kNm⁻²

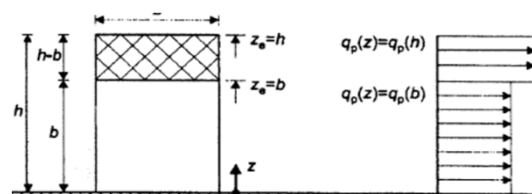
Rozměry objektu

$h =$	10,00 m	výška stavby
$b =$	17,60 m	rozměr kolmo na hřeben - délka štítu
$l =$	56,40 m	rozměr rovnoběžně s hřebenem
$l_1 =$	6,00 m	vzdálenost rámu
$l_2 =$	6,00 m	vzdálenost štítových sloupů
$l_3 =$	6,00 m	vzdálenost vaznic

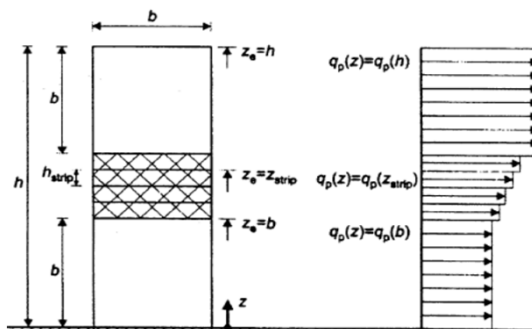
(1)		výška průběh	
$z_{e1} =$	10 m	0 až h konst.	$h < b$



(2)			
$z_{e1} = h$	10 m	b až h konst.	$b < h < 2b$
$z_{e2} = b$	17,6 m	0 až b konst.	



(3)			
$z_{e1} = h$	10 m	$(h - b)$ a konst.	$h > 2b$
$z_{es} = h$	m	b až $(h \cdot \text{lin.})$	
$z_{e2} = b$	17,6 m	0 až b konst.	



PLATÍ 1.PŘÍPAD

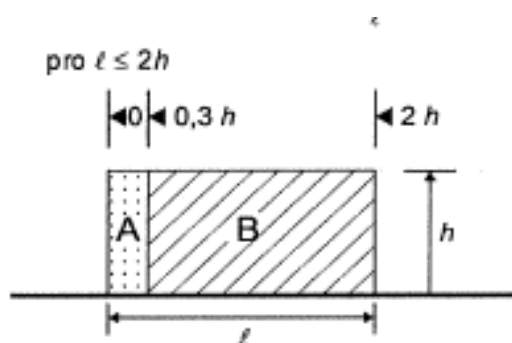
2.3.1 Volně stojící stěna (zelená stěna, fotovoltaika)

max. dynamický tlak $q_p = 0.668 \text{ kN/m}^2$

součinitel plnosti (prodyšnost 0%)..... $\varphi = 1.0$

délka - zelená stěna $\ell = 15.7 \text{ m}$, $h = 12.8 \text{ m}$

- fotovoltaika $\ell = 28 \text{ m}$, $h = 12.8 \text{ m}$



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Tabulka 7.9 – Doporučené hodnoty součinitelů tlaku $c_{p,net}$ pro volně stojící stěny a zděná zábradlí

Součinitel plnosti	Oblast		A	B	C	D
$\varphi = 1$	Bez vedlejšího průčelí	$\ell/h \leq 3$	2,3	1,4	1,2	1,2
		$\ell/h = 5$	2,9	1,8	1,4	1,2
		$\ell/h \geq 10$	3,4	2,1	1,7	1,2
	S vedlejšími průčelími s délkou $\geq h^a$		2,1	1,8	1,4	1,2
$\varphi = 0,8$			1,2	1,2	1,2	1,2

^a Pro vedlejší průčelí s délkami mezi 0,0 a h lze použít lineární interpolaci.

^a Pro vedlejší průčelí s délkami mezi 0,0 a h lze použít lineární interpolaci.

Součinitel tlaku pro oblast A s vedlejším průčelím

$$c_{p,net} = 2.1 \rightarrow \text{tlak větru } w = q_p \cdot c_{p,net} = 0.668 \times 2.1 = 1.40 \text{ kN/m}^2$$

Součinitel tlaku pro oblast B s vedlejším průčelím

$$c_{p,net} = 1.8 \rightarrow \text{tlak větru } w = q_p \cdot c_{p,net} = 0.668 \times 1.8 = 1.20 \text{ kN/m}^2$$

VÝPOČET ZATÍŽENÍ VĚTREM PODLE ČTN EN 1991-1-4

Větrová oblast

místo: Ostrava

odečteno z mapy větrových oblastí ČR

$V_{b,0} = 25$ m/s

výchozí základní rychlost větru

Základní rychlost větru

$V_b = V_{b,0} \cdot C_{dir} \cdot C_{season} = 25$ m/s

základní rychlost větru 4.2 (4.1)

$C_{dir} = 1$

součinitel směru větru NA.2.6.

$C_{season} = 1$

součinitel ročního období NA.2.7.

Kategorie terénu

Příloha A.1

$z_0 = 0,3$ m

tab.4.1

$z_{min} = 5,00$ m

tab.4.1

$z_{max} = 200$ m

$z_{e1} = 4,00$ m

zadej $z = z_{min}$

referenční výška

7.2.2 (1)

$z_{e2} = 0$ m

Součinitel terénu

$k_r = 0,19 \cdot (z_0/z_{0,II})^{0,07} = 0,215$

součinitel terénu 4.3.2 (4.5)

$z_{0,II} = 0,05$

kat. terénu II

tab.4.1

Součinitel drsnosti terénu

$c_r(z_{e1}) = k_r \cdot \ln(z/z_0) = 0,558$

4.3.2 (4.4)

$c_r(z_{e2}) = k_r \cdot \ln(z/z_0) =$

Součinitel orografie

$c_0(z) = 1$

4.3.1.

Střední rychlost větru

$v_m(z_{e1}) = c_r(z) \cdot c_0(z) \cdot v_b = 13,95$ ms⁻¹

4.3.1 (4.3)

$v_m(z_{e2}) = c_r(z) \cdot c_0(z) \cdot v_b =$ ms⁻¹

Intenzita turbulence

$I_v(z_{e1}) = k_t/c_0(z) \cdot \ln(z/z_0) = 0,386$

$k_t = 1$

součinitel turbulence

4.4 (4.7)

$I_v(z_{e2}) = k_t/c_0(z) \cdot \ln(z/z_0) =$

Maximální dynamický tlak větru

$q_p(z_{e1}) = [1+7I_v(z)] \cdot 0,5\rho \cdot v_m(z)^2 =$

450 Nm⁻²

=

0,45 kNm⁻²

4.4 (4.8)

$q_p(z_{e2}) = [1+7I_v(z)] \cdot 0,5\rho \cdot v_m(z)^2 =$

Nm⁻²

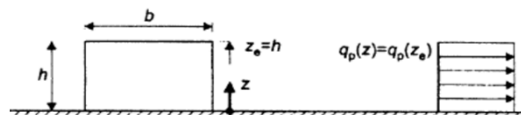
=

kNm⁻²

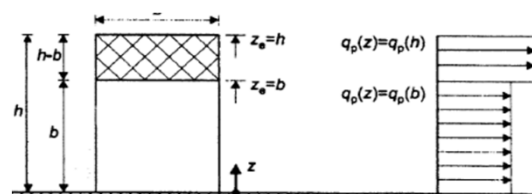
Rozměry objektu

$h =$	4,00 m	výška stavby
$b =$	17,60 m	rozměr kolmo na hřeben - délka štítu
$l =$	56,40 m	rozměr rovnoběžně s hřebenem
$l_1 =$	6,00 m	vzdálenost rámu
$l_2 =$	6,00 m	vzdálenost štítových sloupů
$l_3 =$	6,00 m	vzdálenost vaznic

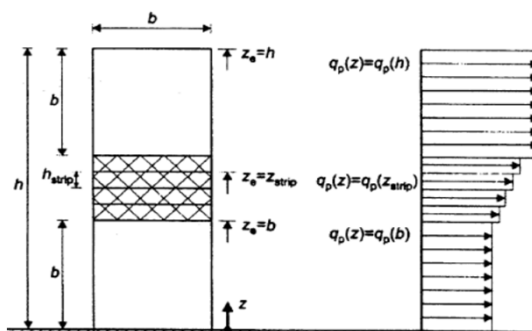
(1)		výška průběh	
$z_{e1} =$	4 m	0 až h konst.	$h < b$



(2)			
$z_{e1} = h$	4 m	b až h konst.	$b < h < 2b$
$z_{e2} = b$	17,6 m	0 až b konst.	



(3)			
$z_{e1} = h$	4 m	$(h - b)$ a konst.	$h > 2b$
$z_{es} = h$	m	b až $(h \cdot \text{lin.})$	
$z_{e2} = b$	17,6 m	0 až b konst.	



PLATÍ 1.PŘÍPAD

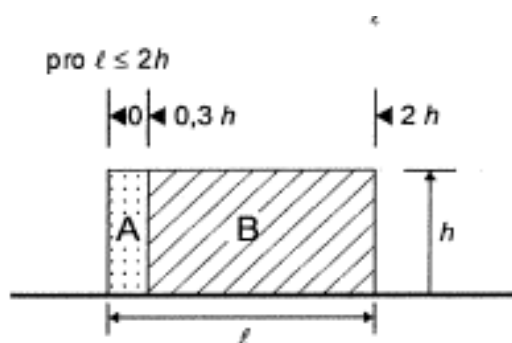
2.3.2 Volně stojící stěna (schodiště)

max. dynamický tlak $q_p = 0.45 \text{ kN/m}^2$

součinitel plnosti (prodyšnost 0%)..... $\varphi = 1.0$

délka - podélná stěna $\ell = 7.3 \text{ m}$, $h = 4.0 \text{ m}$

- příčná stěna $\ell = 2.45 \text{ m}$, $h = 4.8 \text{ m}$



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Tabulka 7.9 – Doporučené hodnoty součinitelů tlaku $c_{p,net}$ pro volně stojící stěny a zděná zábradlí

Součinitel plnosti	Oblast		A	B	C	D
$\varphi = 1$	Bez vedlejšího průčelí	$\ell/h \leq 3$	2,3	1,4	1,2	1,2
		$\ell/h = 5$	2,9	1,8	1,4	1,2
		$\ell/h \geq 10$	3,4	2,1	1,7	1,2
	S vedlejšími průčelími s délkou $\geq h^a$		2,1	1,8	1,4	1,2
$\varphi = 0,8$			1,2	1,2	1,2	1,2

^a Pro vedlejší průčelí s délkami mezi 0,0 a h lze použít lineární interpolaci.

Součinitel tlaku pro oblast A s vedlejším průčelím

$$c_{p,net} = 2.1 \rightarrow \text{tlak větru } w = q_p \cdot c_{p,net} = 0.45 \times 2.1 = 0.945 \text{ kN/m}^2$$

Součinitel tlaku pro oblast B s vedlejším průčelím

$$c_{p,net} = 1.8 \rightarrow \text{tlak větru } w = q_p \cdot c_{p,net} = 0.45 \times 1.8 = 0.81 \text{ kN/m}^2$$

2.4 Zatížení jeřábem (mezi řadami 8-9)

Mostový jeřáb 4t - technické údaje od jeřábů:

Nosnost	$m_{(v)}$	=	4000	kg
Hmotnost jeřábu s kočkou	m	=	1580	kg
Hmotnost kočky	m_k	=	363	kg
Hmotnost jeřábu bez kočky	m_j	=	1220	kg
Rychlost pojezdu jeřábu	v_x	=	40	m/min
Rychlost zdvihu břemene	v_y	=	4	m/min
Rychlost pojezdu kočky	v_k	=	30	m/min
Nosnost pomoc. zdvihu	v_y	=	-	t
Rychlost pom. zdvihu břemene	v_y	=	-	m/min

VÝPOČET ZATÍŽENÍ OD JEŘÁBU PODLE ČSN-EN-1991-1-3

NOSNOST:	4 t	Dojezd kočky	0,588 m	Tíha jeřábu	12,2 kN
Rozpětí L =	8,05 m	Rozvor kol a =	2 m	Tíha kočky	3,63 kN

SVISLÉ KOLOVÉ SÍLY

$Q_{rmax} =$	23,27 kN	... Max. svislá kolová síla
$Q_{(rmax)} =$	4,64 kN	... Odpovídající kolová síla na druhé větvi JD
$Q_{rmin} =$	3,18 kN	... Min. svislá kolová síla
$Q_{(rmin)} =$	4,73 kN	... Odpovídající kolová síla na druhé větvi JD

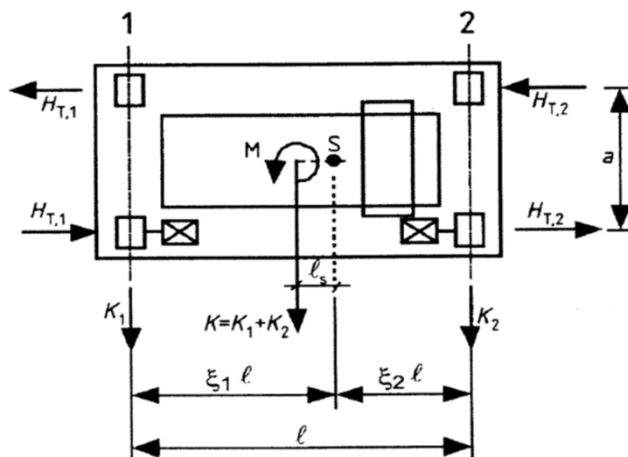
VODOROVNÉ SÍLY OD ZRYCHLENÍ A ZPOMALENÍ JEŘÁBU

Podélné síly

μ	0,2	... součinitel tření
$m_w =$	2,0	... počet pohonů jednotlivých kol
$K =$	1,3	... hnací síla
$\varphi_5 =$	1,5	... dyn. Součinitel
$H_{L,1} =$	0,6 kN	$H_{L,1} \cdot \varphi_5 =$ 1,0 kN
$H_{L,2} =$	0,6 kN	$H_{L,2} \cdot \varphi_5 =$ 1,0 kN

Příčné síly

$\xi_1 =$	0,834		
$\xi_2 =$	0,166		
$L_s =$	2,69 m		
$M =$	3,42 kNm		
$\varphi_5 =$	1,2		
$H_{T,1} =$	0,28 kN	$H_{T,1} \cdot \varphi_5 :$	0,43 kN
$H_{T,2} =$	1,43 kN	$H_{T,2} \cdot \varphi_5 :$	2,14 kN



VODOROVNÉ SÍLY OD PŘÍČENÍ JEŘÁBU

úhel přičení

$\alpha = \alpha_F + \alpha_v + \alpha_0 =$	0,015 rad	$b =$	0,12 m	... šířka hlavy kolejnice
$\alpha_F =$	0,150 rad	$x =$	0,002 m	... vůle mezi kolejnicí a vedením
$\alpha_v =$	1,200 rad	$y = 0,1b =$	0,012 m	... opotřebení kolejnice
$\alpha_0 =$	0,001 rad	$a_{ext} =$	0,01 m	... mezera mezi nákolky kol

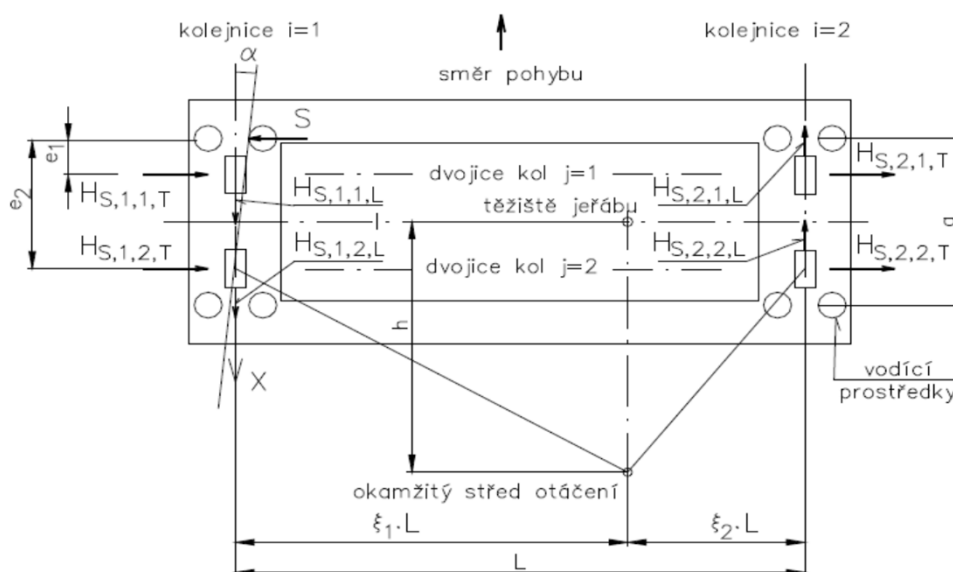
součinitel reakcí při přičení

$$f = 0,3(1 - e^{-250\alpha}) = 0,29 < 0,3 \Rightarrow 0,29$$

(ve směru JD)

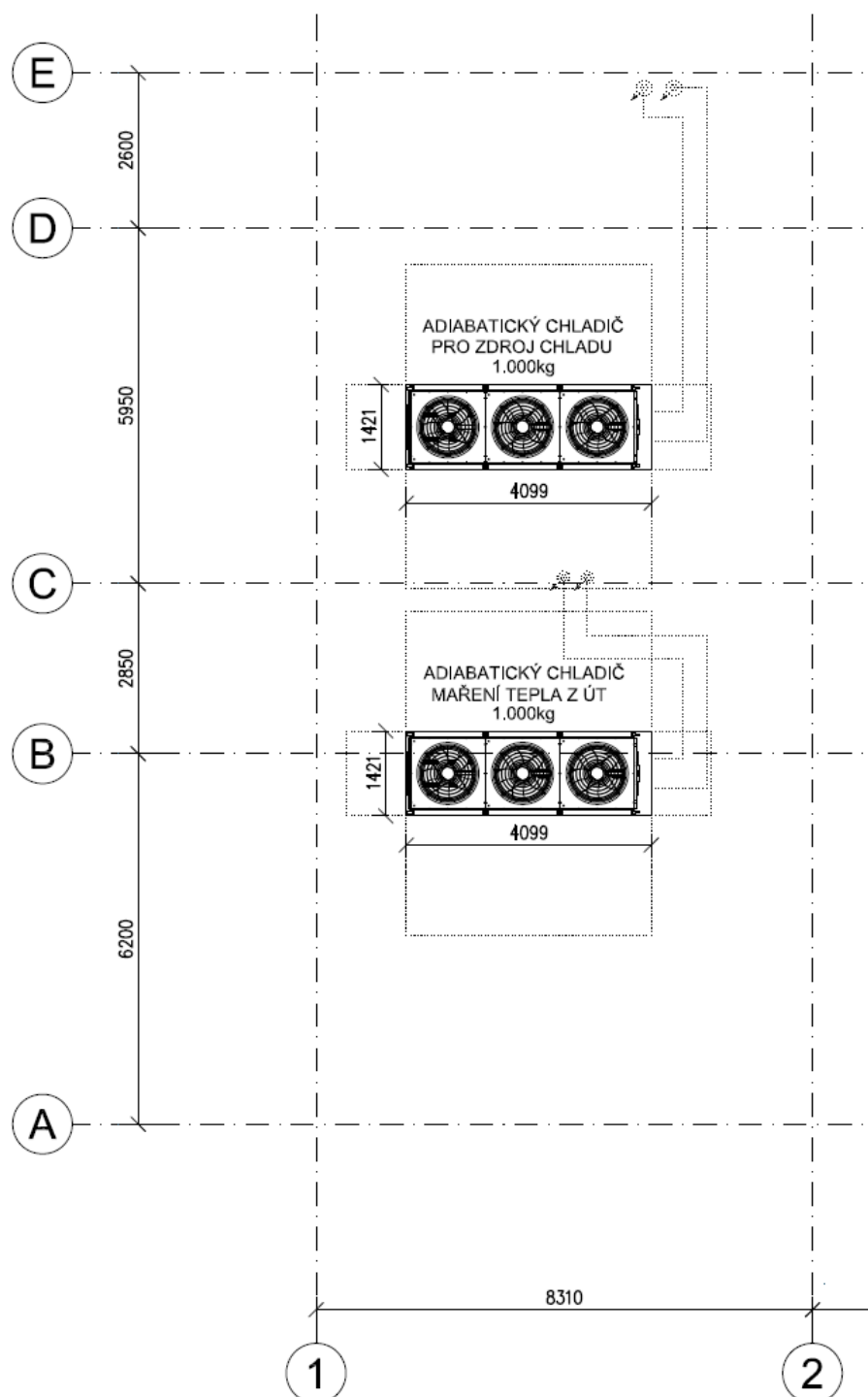
$e_1 =$	0,55 m
$e_2 =$	2,55 m
$h =$	2 m
$n =$	2 ... počet dvojic kol

$\lambda_{s,1,T} =$	0,062	$H_{s,1,1,T} =$	1,02 kN	... dvojkolí 1
$\lambda_{s,2,T} =$	0,312	$H_{s,2,1,T} =$	5,11 kN	model IFF - nezávislé uložení kol
$\lambda_{s,1,T} =$	-0,013	$H_{s,1,2,T} =$	-0,22 kN	... dvojkolí 2
$\lambda_{s,2,T} =$	-0,067	$H_{s,2,2,T} =$	-1,10 kN	
$\lambda_s =$	0,5	$S =$	8,18 kN	



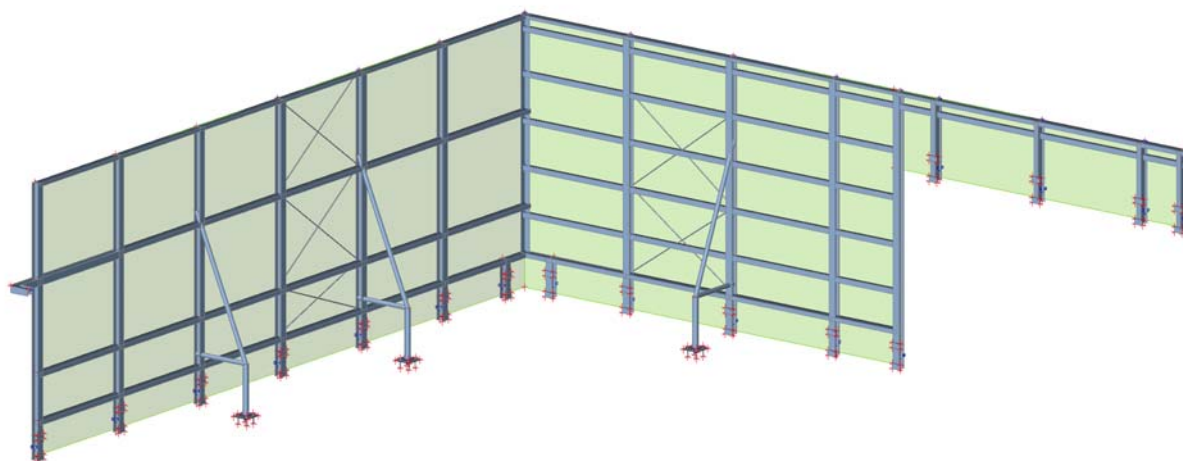
2.5 Jednotky VZT a jednotky chladu

Jednotka chladu (1000 kg)..... $P_{chill} = 10 \text{ kN}$

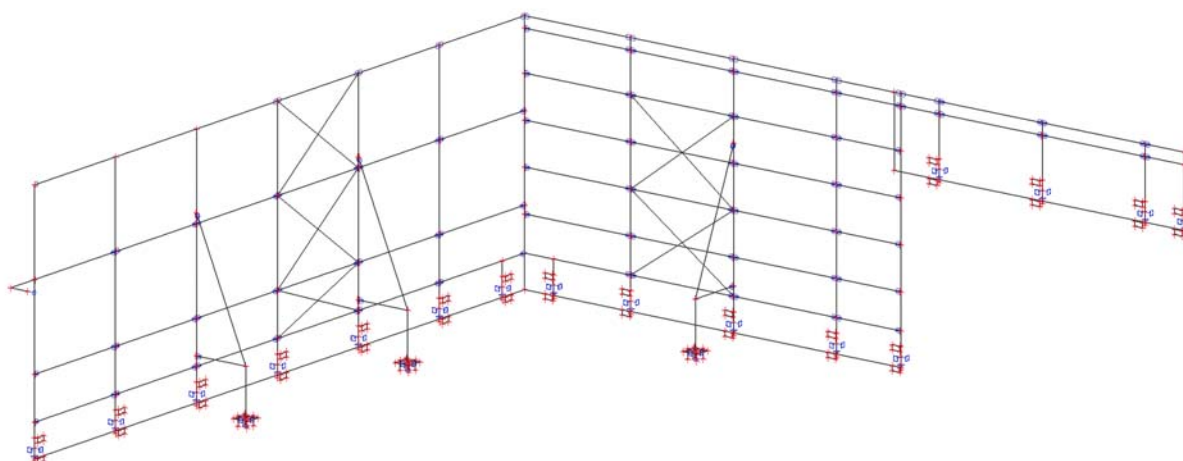


KONSTRUKCE STĚNY PRO FOTOVOLTAIKU A ZELENÉ STĚNY

3D MODEL OF STRUCTURE



Structural model



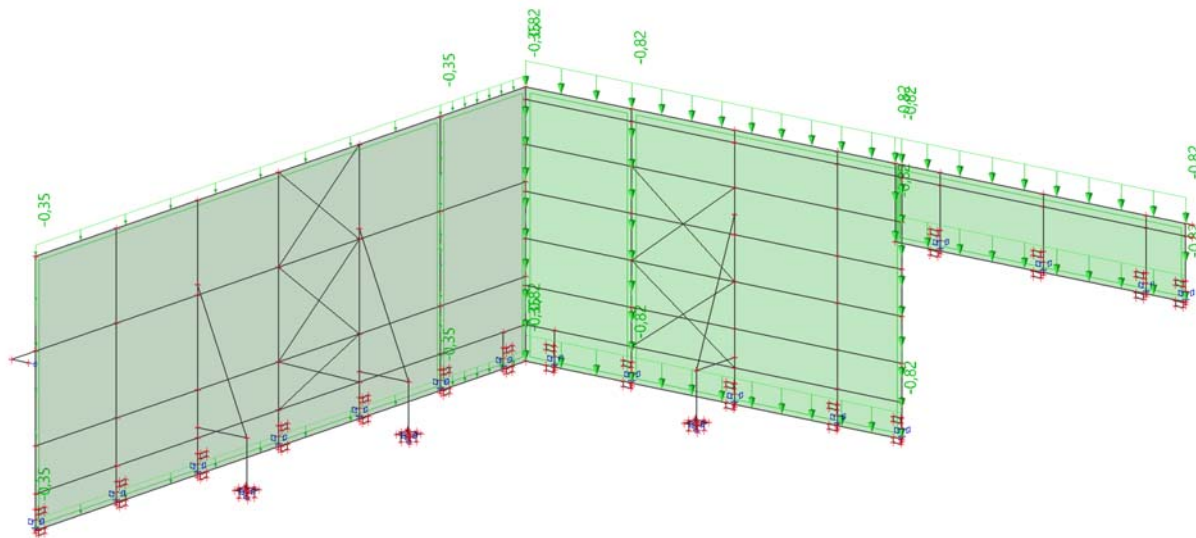
Project

Version	SCIA Engineer 17.1.2029
Licence number	555797
Project	Centrum Energetických a Enviromentálních Technologíí
Part	SO 01.1 Objekt CEETe
Description	Ocelová konstrukce
Author	Ing. Jeřowicz
Date	Date
Structure	General XYZ
No. of nodes :	1212
No. of beams :	367
No. of slabs :	150
No. of solids :	1390
No. of used profiles :	33
No. of load cases :	14
No. of used materials :	3
Acceleration of gravity [m/s ²]	9,807
National code	EC - EN

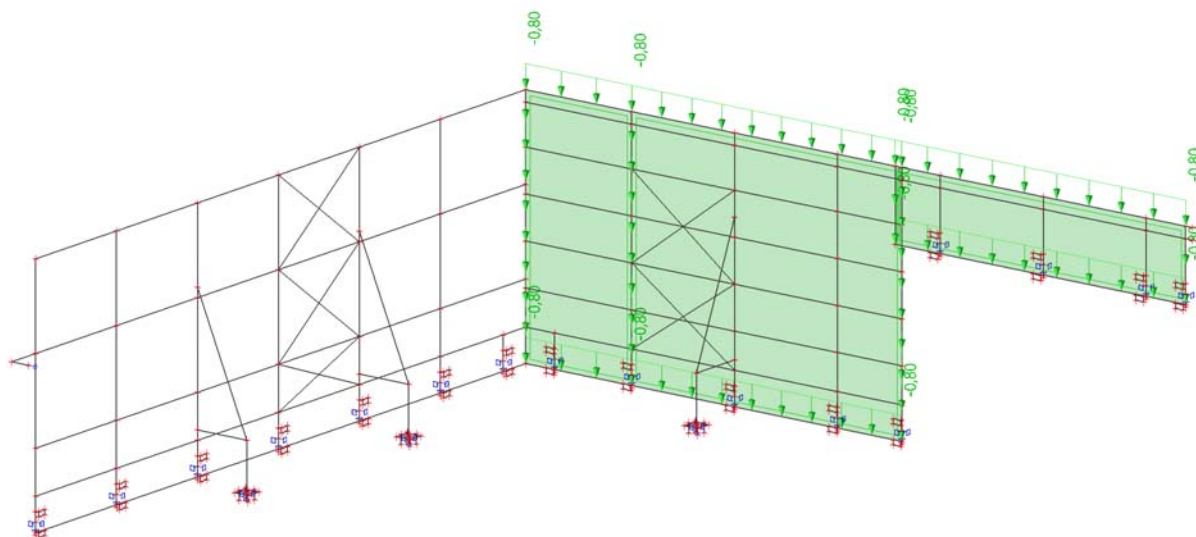
Load cases

Name	Description	Action type	Load group	Direction	Duration	Master load case
	Spec	Load type				
LC1	self weight	Permanent Self weight	LG1	-Z		
LC2	dead load	Permanent Standard	LG1			
LC3	snow/rime Standard	Variable Static	snow		Short	None
LC4	wind +x Standard	Variable Static	wind		Short	None
LC5	wind -x Standard	Variable Static	wind		Short	None
LC6	wind +y Standard	Variable Static	wind		Short	None
LC7	wind -y Standard	Variable Static	wind		Short	None
LC8	live load Standard	Variable Static	live		Short	None
LC9	Rmax (C) Standard	Variable Static	crane		Short	None
LC10	Ht+Hl_Rmax (C) Standard	Variable Static	Ht+Hl		Short	None
LC11	Hs_Rmax (C) Standard	Variable Static	Hs		Short	None
LC12	Mmax (C-D) Standard	Variable Static	crane		Short	None
LC13	Ht+Hl_Mmax (C-D) Standard	Variable Static	Ht+Hl		Short	None
LC14	Hs_Mmax (C-D) Standard	Variable Static	Hs		Short	None

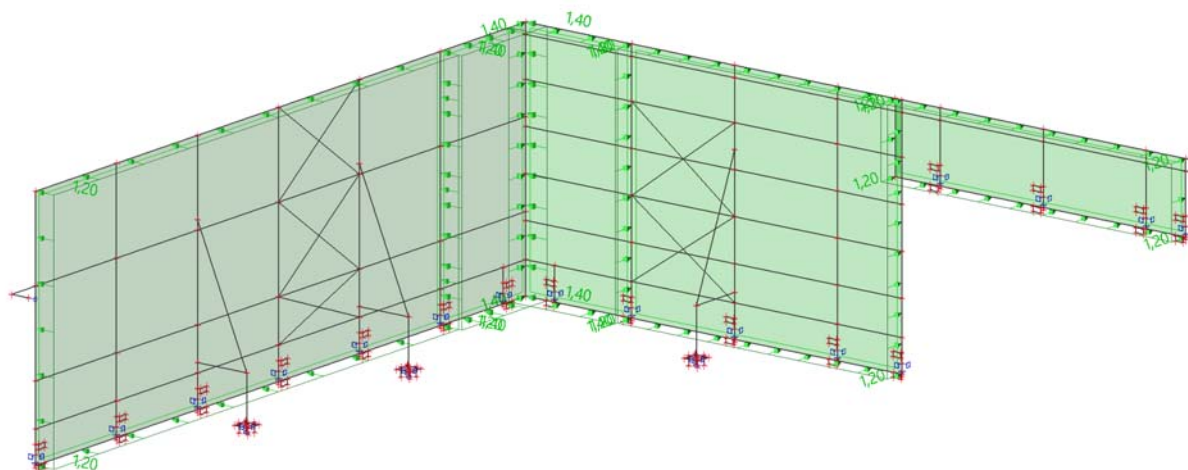
LC2 / Tot. value



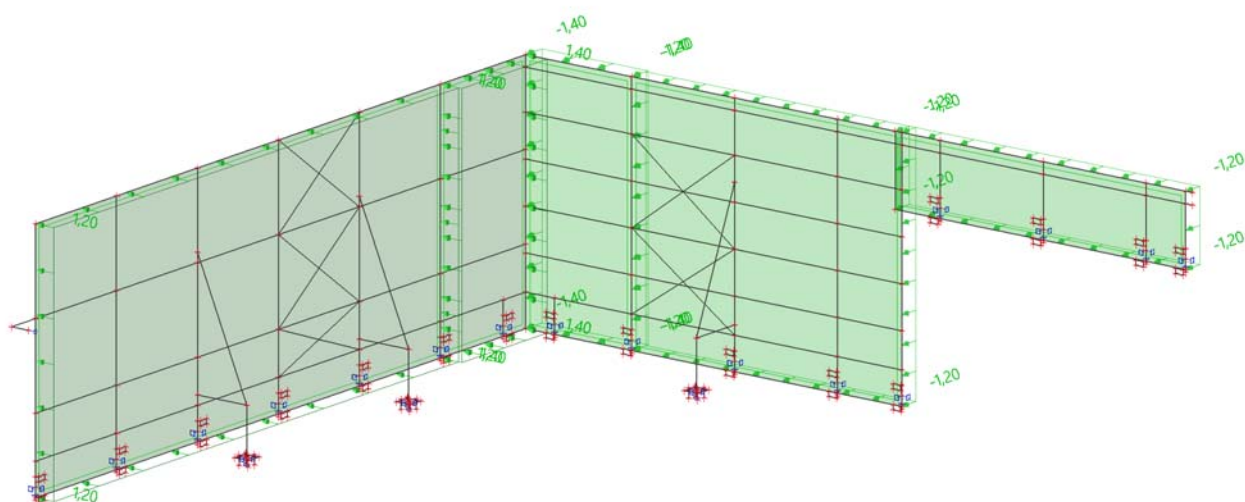
LC3 / Tot. value



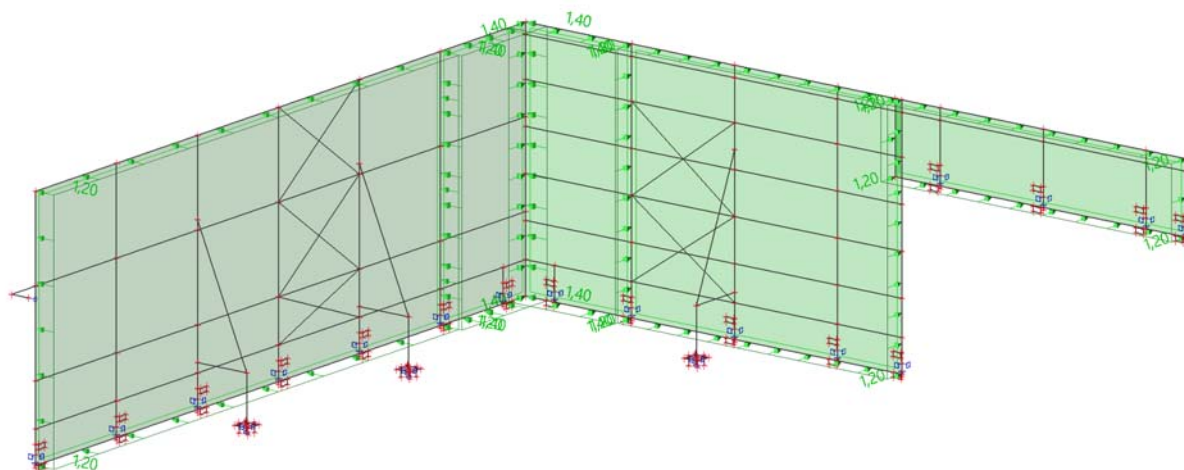
LC4 / Tot. value



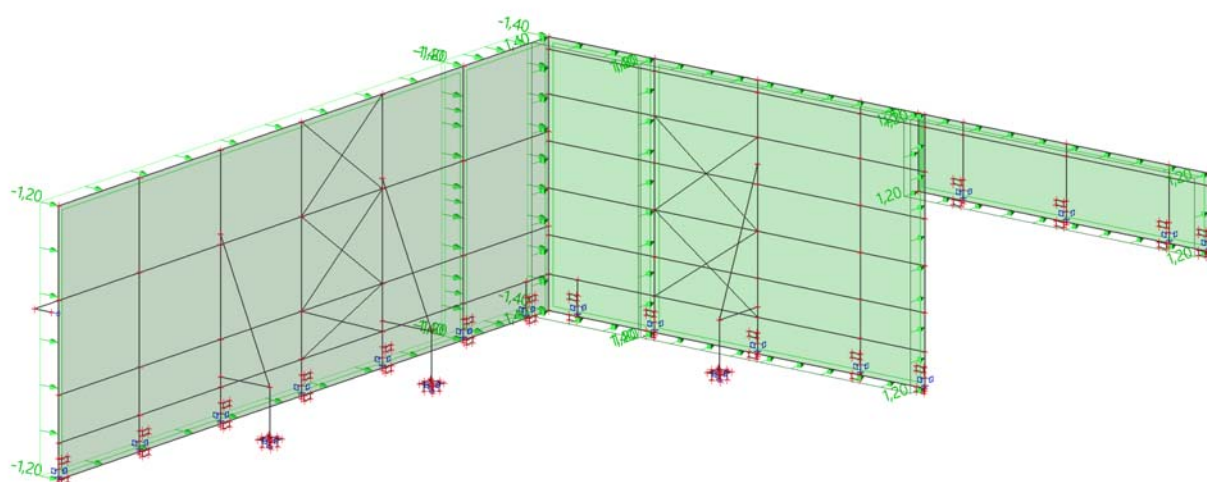
LC5 / Tot. value



LC6 / Tot. value



LC7 / Tot. value



Load groups

Name	Load	Relation	Type
LG1	Permanent		
snow	Variable	Exclusive	Snow
wind	Variable	Exclusive	Wind
live	Variable	Exclusive	Cat C : Congregation
crane	Variable	Exclusive	Cat F : Vehicle <30kN
Ht+Hl	Variable	Exclusive	Cat F : Vehicle <30kN
Hs	Variable	Exclusive	Cat F : Vehicle <30kN

Combinations

Name	Description	Type	Load cases	Coeff. [-]
CO1		EN-ULS (STR/GEO) Set B	LC1 - self weight	1,00
			LC2 - dead load	1,00
			LC3 - snow/rime	1,00
			LC4 - wind +x	1,00
			LC5 - wind -x	1,00
			LC6 - wind +y	1,00
			LC7 - wind -y	1,00
			LC8 - live load	1,00
CO2		EN-SLS Characteristic	LC1 - self weight	1,00
			LC2 - dead load	1,00
			LC3 - snow/rime	1,00
			LC4 - wind +x	1,00
			LC5 - wind -x	1,00
			LC6 - wind +y	1,00
			LC7 - wind -y	1,00
			LC8 - live load	1,00
Rmax +		Envelope - ultimate	LC1 - self weight	1,35
			LC9 - Rmax (C)	1,50
			LC10 - Ht+Hl_Rmax (C)	1,35
			LC11 - Hs_Rmax (C)	1,35
Rmax -		Envelope - ultimate	LC1 - self weight	1,35
			LC9 - Rmax (C)	1,50
			LC10 - Ht+Hl_Rmax (C)	-1,35
			LC11 - Hs_Rmax (C)	-1,35
Mmax +		Envelope - ultimate	LC1 - self weight	1,35
			LC12 - Mmax (C-D)	1,50
			LC13 - Ht+Hl_Mmax (C-D)	1,35
			LC14 - Hs_Mmax (C-D)	1,35
Mmax -		Envelope - ultimate	LC1 - self weight	1,35
			LC12 - Mmax (C-D)	1,50
			LC13 - Ht+Hl_Mmax (C-D)	-1,35
			LC14 - Hs_Mmax (C-D)	-1,35
Mmax +def		Envelope - serviceability	LC1 - self weight	1,00
			LC12 - Mmax (C-D)	1,00
			LC13 - Ht+Hl_Mmax (C-D)	1,00
			LC14 - Hs_Mmax (C-D)	1,00
Mmax -def		Envelope - serviceability	LC1 - self weight	1,00
			LC12 - Mmax (C-D)	1,00
			LC13 - Ht+Hl_Mmax (C-D)	-1,00
			LC14 - Hs_Mmax (C-D)	-1,00

Result classes

Name	List
All ULS	CO1 - EN-ULS (STR/GEO) Set B
	Rmax + - Envelope - ultimate
	Rmax - - Envelope - ultimate
	Mmax + - Envelope - ultimate
	Mmax - - Envelope - ultimate
All SLS	CO2 - EN-SLS Characteristic
	Mmax +def - Envelope - serviceability
	Mmax -def - Envelope - serviceability

Combination key

Combination key

REAKCE

REACTIONS

R1 - Reactions; R_x ; R_y ; R_z ; M_x ; M_y ; M_z

Values: M_z , M_x , M_y , R_z , R_y , R_x

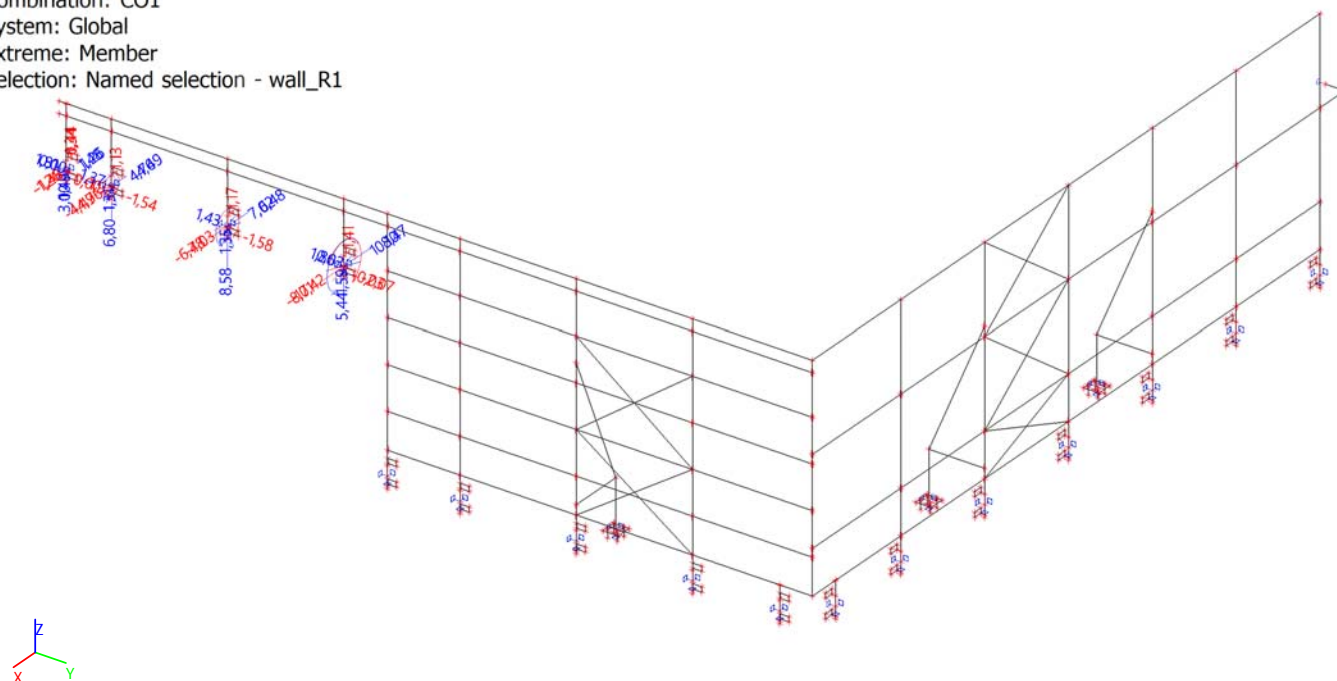
Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - wall_R1



Reactions

Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - wall_R1

Nodal reactions

Name	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]	e_x [mm]	e_y [mm]
Sn103/N2999	CO1/1	8,47	-2,07	4,13	1,56	10,10	-0,03	378,8	2448,4
Sn103/N2999	CO1/2	0,00	-0,17	5,44	0,12	0,00	0,00	22,3	-0,9
Sn103/N2999	CO1/3	-8,47	1,86	2,45	-1,41	-10,11	0,03	-575,7	-4126,1
Sn103/N2999	CO1/4	-8,71	-2,01	4,13	1,59	-10,42	0,03	384,3	-2525,4
Sn103/N2999	CO1/5	8,47	-2,02	2,45	1,53	10,10	-0,03	623,4	4124,3
Sn104/N3000	CO1/2	0,00	-0,10	8,58	0,08	0,00	0,00	9,9	0,0
Sn104/N3000	CO1/3	-6,48	1,43	3,72	-1,17	-7,02	0,00	-314,7	-1890,2
Sn104/N3000	CO1/4	-6,48	-1,58	6,42	1,35	-7,03	0,00	209,5	-1094,6
Sn104/N3000	CO1/5	6,48	-1,52	3,72	1,25	7,02	0,00	336,6	1890,2
Sn105/N3001	CO1/6	-2,69	-0,95	6,80	0,82	-2,86	0,00	120,4	-419,9
Sn105/N3001	CO1/3	-4,49	1,37	1,30	-1,13	-4,76	0,00	-873,1	-3673,8
Sn105/N3001	CO1/4	-4,49	-1,54	5,96	1,31	-4,76	0,00	220,4	-799,3
Sn105/N3001	CO1/5	4,49	-1,42	3,92	1,19	4,76	0,00	303,4	1214,5
Sn106/N3010	CO1/7	-1,26	-1,92	-0,29	1,49	-1,48	0,00	-5208,4	5187,0
Sn106/N3010	CO1/8	-1,26	-1,92	-0,44	1,49	-1,48	0,00	-3355,3	3343,8
Sn106/N3010	CO1/9	-1,26	1,81	3,00	-1,34	-1,48	0,00	-445,2	-494,1
Sn106/N3010	CO1/10	-1,26	1,81	2,85	-1,34	-1,48	0,00	-470,2	-521,5
Sn106/N3010	CO1/4	-1,26	-1,89	0,18	1,49	-1,48	0,00	8320,7	-8301,6
Sn106/N3010	CO1/5	1,26	-1,75	-0,24	1,35	1,48	0,00	-5562,0	-6116,5

R2 - Reactions; R_x; R_y; R_z; M_x; M_y; M_z

Values: M_z, M_x, M_y, R_z, R_y, R_x

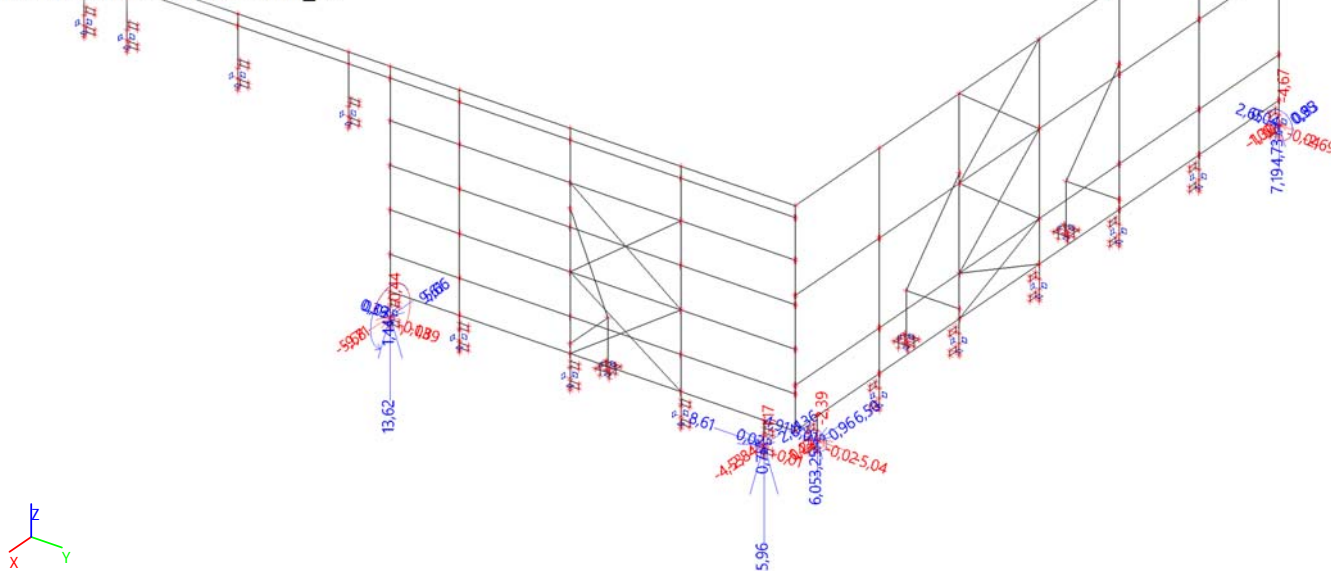
Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - wall_R2



Reactions

Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - wall_R2

Nodal reactions

Name	Case	R _x [kN]	R _y [kN]	R _z [kN]	M _x [kNm]	M _y [kNm]	M _z [kNm]	e _x [mm]	e _y [mm]
Sn94/N2998	CO1/1	0,00	-1,01	13,62	0,70	-0,02	0,00	51,2	-1,8
Sn94/N2998	CO1/2	-5,66	0,39	6,56	-0,44	-9,63	0,03	-66,4	-1468,8
Sn94/N2998	CO1/3	-5,68	-1,89	10,57	1,44	-9,71	0,03	136,4	-918,4
Sn94/N2998	CO1/4	5,66	-1,47	6,56	1,17	9,61	-0,03	178,9	1465,5
Sn95/N3002	CO1/5	-4,44	2,11	7,90	0,75	-2,66	-0,01	94,6	-337,1
Sn95/N3002	CO1/4	4,36	2,45	7,69	0,54	2,41	0,02	69,9	314,0
Sn95/N3002	CO1/6	-2,79	8,61	15,96	-0,95	-1,87	-0,01	-59,3	-117,1
Sn95/N3002	CO1/7	-4,53	7,84	12,67	-1,17	-2,84	-0,01	-92,1	-223,8
Sn95/N3002	CO1/2	-4,49	5,79	8,12	-1,03	-2,75	-0,01	-127,4	-338,1
Sn95/N3002	CO1/8	4,32	4,49	12,24	0,41	2,33	0,02	33,2	190,0
Sn97/N3004	CO1/5	-0,22	-4,99	3,57	3,02	-1,40	0,01	845,5	-390,6
Sn97/N3004	CO1/8	6,37	-5,04	5,20	3,25	0,93	0,01	626,0	178,9
Sn97/N3004	CO1/9	6,50	-3,07	6,05	2,29	0,50	0,01	378,8	82,9
Sn97/N3004	CO1/2	0,14	4,91	3,31	-2,39	-1,07	-0,02	-723,4	-324,3
Sn97/N3004	CO1/3	1,24	-5,02	5,03	3,20	-1,43	0,01	636,6	-283,7
Sn97/N3004	CO1/7	1,59	4,88	4,76	-2,21	-1,10	-0,02	-464,5	-231,6
Sn97/N3004	CO1/4	4,91	-5,01	3,74	3,07	0,96	0,01	821,3	256,7
Sn102/N3009	CO1/10	-1,08	-2,69	5,87	4,73	-1,30	-0,04	806,1	-220,6
Sn102/N3009	CO1/5	-1,07	-2,69	5,09	4,73	-1,29	-0,04	929,2	-253,6
Sn102/N3009	CO1/11	0,46	-1,62	7,19	2,84	0,54	-0,02	394,8	75,4
Sn102/N3009	CO1/12	-0,92	2,65	5,22	-4,67	-1,02	0,04	-896,3	-195,7
Sn102/N3009	CO1/4	0,83	-2,68	5,37	4,71	0,95	-0,04	877,4	177,9
Sn102/N3009	CO1/3	-1,09	-2,69	5,87	4,73	-1,30	-0,04	806,1	-222,1
Sn102/N3009	CO1/2	-0,91	2,65	5,22	-4,67	-1,01	0,04	-896,3	-193,9

R3 - Reactions; R_x; R_y; R_z; M_x; M_y; M_z

Values: M_z , M_x , M_y , R_z , R_y , R_x

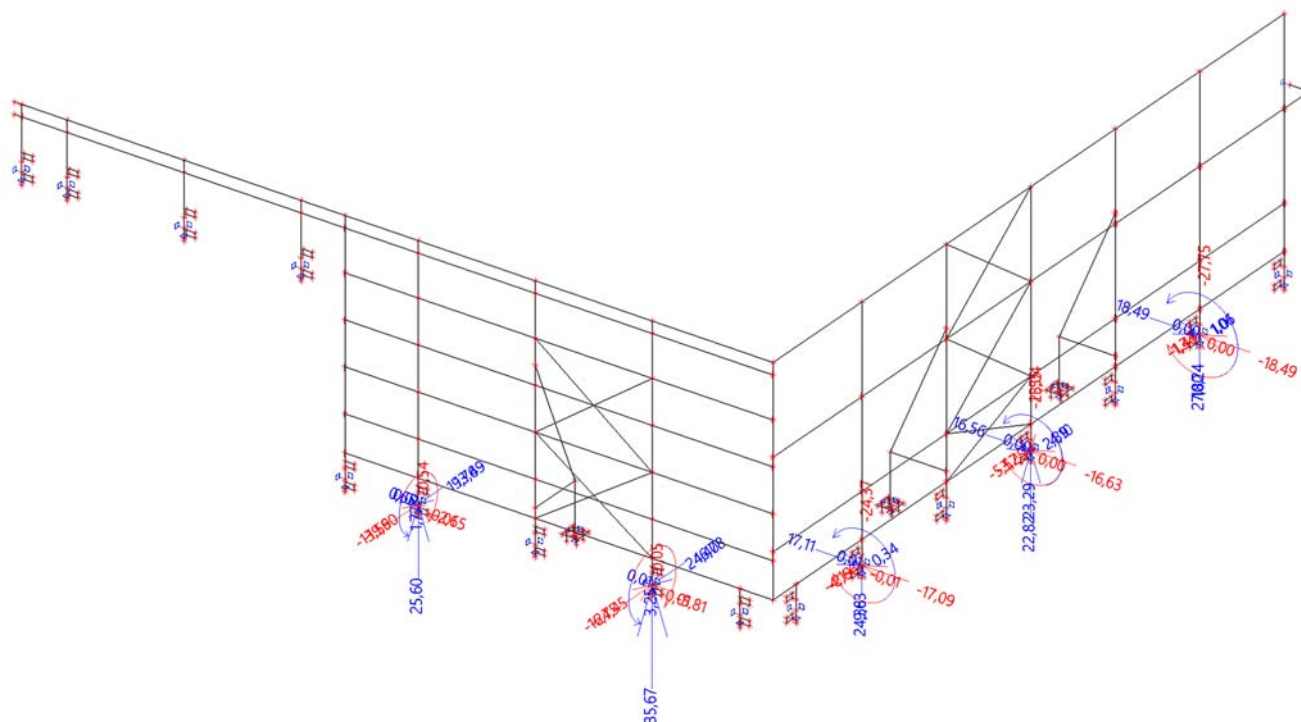
Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - wall_R3



Reactions

Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - wall_R3

Nodal reactions

Name	Case	R _x [kN]	R _y [kN]	R _z [kN]	M _x [kNm]	M _y [kNm]	M _z [kNm]	e _x [mm]	e _y [mm]
Sn93/N2997	CO1/1	-0,01	-1,34	25,60	0,85	-0,07	0,00	33,2	-2,6
Sn93/N2997	CO1/2	-13,51	0,65	11,56	-0,54	-19,82	0,01	-46,6	-1714,3
Sn93/N2997	CO1/3	-13,56	-2,65	19,43	1,77	-19,90	0,01	91,1	-1024,2
Sn93/N2997	CO1/4	13,49	-2,08	11,56	1,44	19,76	-0,01	124,6	1709,1
Sn93/N2997	CO1/5	-13,51	0,28	19,43	-0,31	-19,84	0,01	-15,8	-1021,0
Sn96/N3003	CO1/6	-4,19	-9,79	8,12	12,71	-2,38	0,01	1566,7	-293,3
Sn96/N3003	CO1/4	-1,03	-17,09	7,14	24,38	0,34	0,01	3413,7	47,7
Sn96/N3003	CO1/5	-3,51	17,11	8,14	-24,37	-2,25	-0,01	-2991,8	-276,2
Sn96/N3003	CO1/7	-3,93	-9,80	7,06	12,71	-2,27	0,01	1799,8	-321,5
Sn96/N3003	CO1/8	-1,94	-10,25	9,63	14,63	-0,35	0,00	1519,1	-36,4
Sn96/N3003	CO1/9	-1,29	-17,09	8,19	24,38	0,23	0,01	2975,7	28,3

Name	Case	R _x [kN]	R _y [kN]	R _z [kN]	M _x [kNm]	M _y [kNm]	M _z [kNm]	e _x [mm]	e _y [mm]
Sn96/N3003	CO1/3	-3,87	-16,34	8,13	21,19	-2,66	0,01	2606,1	-326,9
Sn96/N3003	CO1/10	-3,25	17,11	7,09	-24,37	-2,14	-0,01	-3435,5	-301,8
Sn96/N3003	CO1/11	-3,11	-16,34	8,16	21,19	-2,34	0,01	2598,1	-286,9
Sn99/N3006	CO1/11	-5,47	-16,63	-10,48	23,29	-3,21	0,00	-2221,7	305,7
Sn99/N3006	CO1/12	-5,54	-16,63	-11,55	23,29	-3,24	0,00	-2016,4	280,5
Sn99/N3006	CO1/9	4,07	-16,58	22,82	23,10	2,37	0,00	1012,1	104,0
Sn99/N3006	CO1/10	-4,65	16,56	-7,51	-23,04	-2,64	0,00	3067,6	352,1
Sn99/N3006	CO1/3	-5,57	-16,63	-10,50	23,29	-3,25	0,00	-2219,0	310,0
Sn99/N3006	CO1/4	4,10	-16,58	21,77	23,09	2,39	0,00	1060,9	109,7
Sn99/N3006	CO1/13	-4,58	16,56	-6,44	-23,03	-2,61	0,00	3573,8	405,0
Sn101/N3008	CO1/14	1,00	-18,49	7,48	27,77	1,05	0,00	3711,4	140,2
Sn101/N3008	CO1/15	-0,83	-11,10	10,24	16,68	-0,87	0,00	1628,7	-84,6
Sn101/N3008	CO1/2	-1,12	18,49	7,56	-27,75	-1,11	0,00	-3671,2	-146,6
Sn101/N3008	CO1/3	-1,34	-18,49	8,78	27,80	-1,43	0,00	3165,0	-162,8
Sn101/N3008	CO1/13	-1,12	18,49	8,67	-27,75	-1,11	0,00	-3201,3	-128,3
Sn101/N3008	CO1/4	1,01	-18,49	7,48	27,77	1,06	0,00	3711,4	141,7
Sn91/N2995	CO1/16	16,78	-4,74	28,05	2,83	24,38	0,01	101,0	869,2
Sn91/N2995	CO1/6	-9,48	-5,52	35,67	3,01	-12,47	-0,01	84,4	-349,5
Sn91/N2995	CO1/2	-16,75	-0,63	8,77	-0,05	-24,44	-0,01	-5,2	-2786,6
Sn91/N2995	CO1/5	-16,75	-1,69	18,19	0,51	-24,45	-0,01	28,1	-1343,9
Sn91/N2995	CO1/3	-15,82	-5,81	31,69	3,25	-20,74	-0,01	102,5	-654,3
Sn91/N2995	CO1/4	16,78	-3,68	18,63	2,28	24,40	0,01	122,3	1309,7

R4 - Reactions; R_x; R_y; R_z; M_x; M_y; M_z

Values: M_z, M_x, M_y, R_z, R_y, R_x

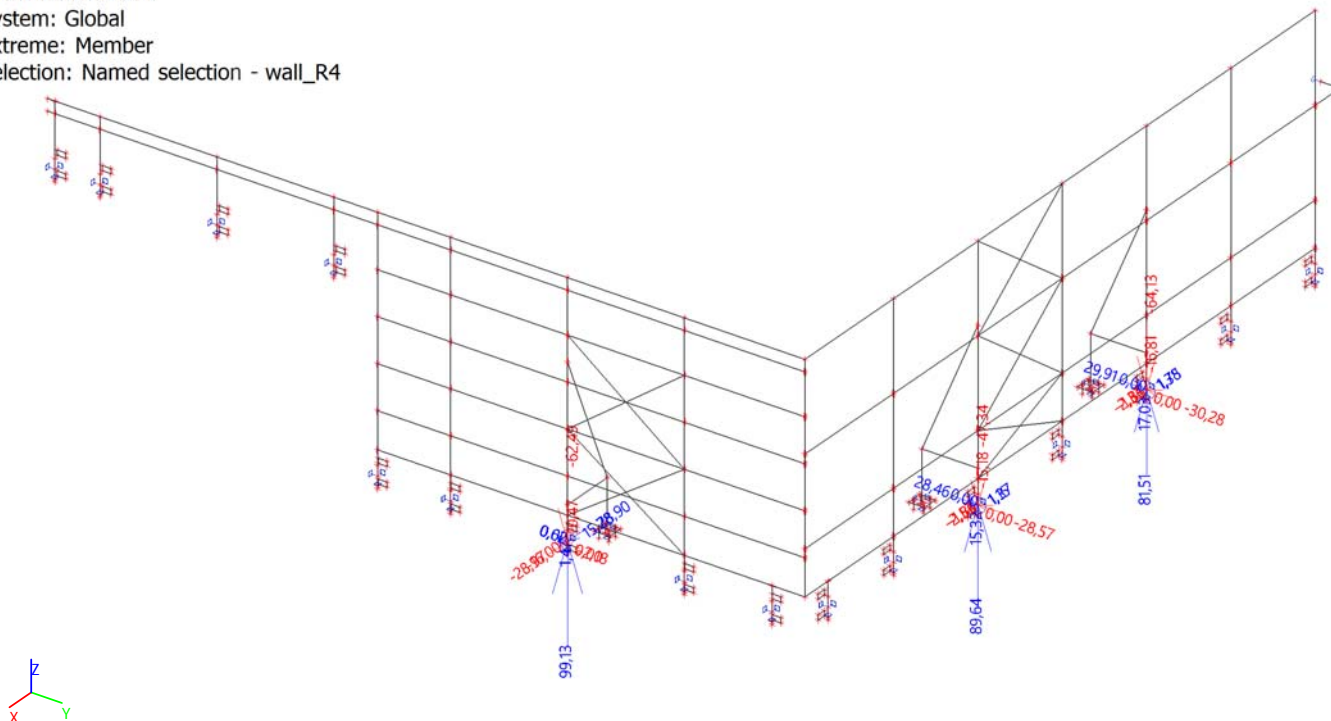
Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - wall_R4



Reactions

Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - wall_R4

Nodal reactions

Name	Case	R _x [kN]	R _y [kN]	R _z [kN]	M _x [kNm]	M _y [kNm]	M _z [kNm]	e _x [mm]	e _y [mm]
Sn98/N3005	CO1/1	1,32	-28,57	63,98	15,32	1,13	0,00	239,4	17,7
Sn98/N3005	CO1/2	-2,01	28,46	-47,34	-15,18	-1,42	0,00	320,7	29,9
Sn98/N3005	CO1/3	-2,15	28,46	-47,34	-15,18	-1,47	0,00	320,8	31,1
Sn98/N3005	CO1/4	-2,57	-26,85	89,64	15,00	-1,86	0,00	167,3	-20,8
Sn98/N3005	CO1/5	1,37	-28,56	62,83	15,31	1,15	0,00	243,6	18,3
Sn100/N3007	CO1/6	-2,29	-30,28	81,51	17,03	-1,84	0,00	208,9	-22,6
Sn100/N3007	CO1/3	-1,94	29,91	-64,13	-16,81	-1,48	0,00	262,1	23,0
Sn100/N3007	CO1/4	-2,33	-30,28	81,51	17,03	-1,86	0,00	208,9	-22,8
Sn100/N3007	CO1/5	1,75	-30,02	79,28	16,94	1,38	0,00	213,7	17,5
Sn100/N3007	CO1/7	-1,92	29,90	-63,01	-16,80	-1,46	0,00	266,6	23,2
Sn100/N3007	CO1/8	-2,31	-30,27	80,39	17,02	-1,86	0,00	211,7	-23,1
Sn92/N2996	CO1/7	-28,97	0,54	91,76	-0,42	-15,97	0,00	-4,5	-174,0
Sn92/N2996	CO1/9	28,90	-1,86	-55,12	1,33	15,76	0,00	-24,0	-285,9
Sn92/N2996	CO1/5	28,89	-1,68	-62,49	1,19	15,78	0,00	-19,1	-252,6
Sn92/N2996	CO1/2	-28,97	0,62	89,75	-0,47	-15,95	0,00	-5,2	-177,8
Sn92/N2996	CO1/10	-28,96	0,36	99,13	-0,29	-16,00	0,00	-2,9	-161,4
Sn92/N2996	CO1/4	-26,98	-2,18	77,05	1,47	-15,41	0,00	19,1	-200,0

R5 - Reactions; R_x ; R_y ; R_z ; M_x ; M_y ; M_z

Values: M_z , M_x , M_y , R_z , R_y , R_x

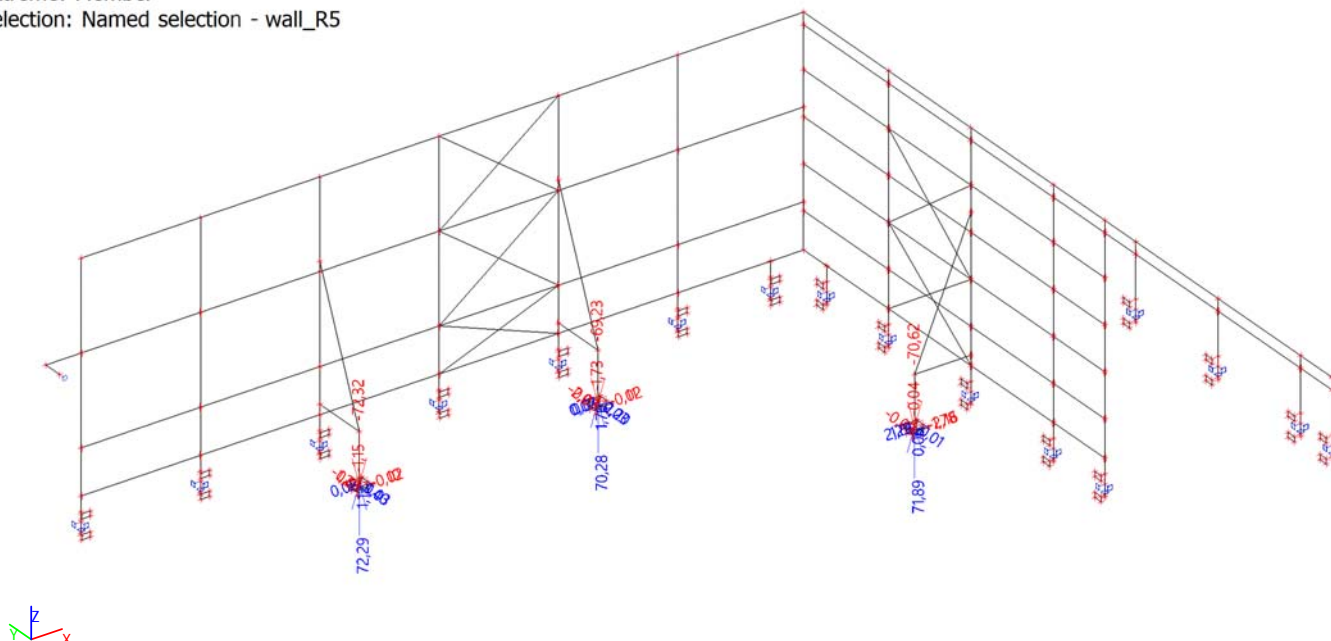
Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - wall_R5



R6 - Reactions; R_x; R_y; R_z; M_x; M_y; M_z

Values: M_z , M_x , M_y , R_z , R_y , R_x

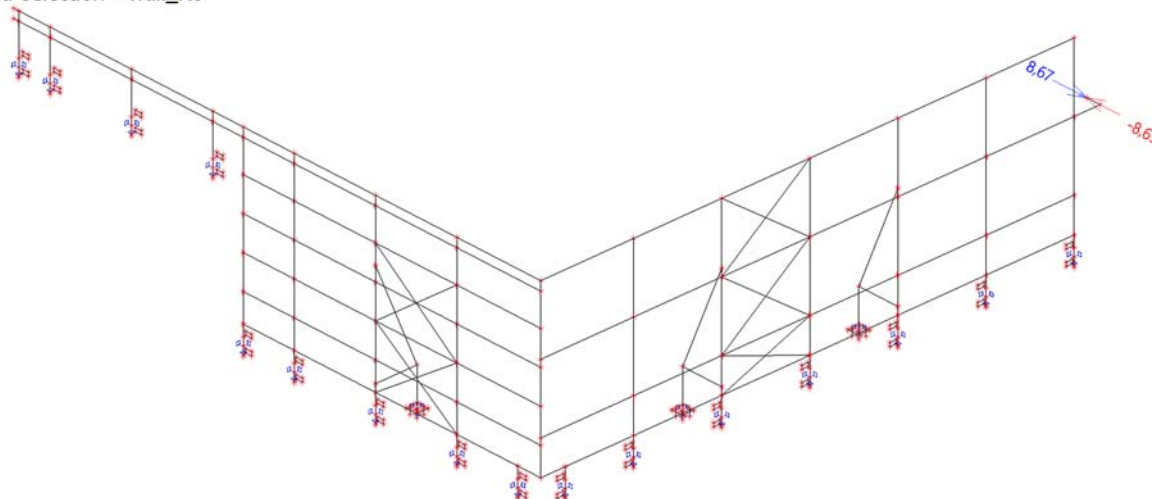
Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - wall_R6



Reactions

Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - wall_R6

Nodal reactions

Name	Case	R _x [kN]	R _y [kN]	R _z [kN]	M _x [kNm]	M _y [kNm]	M _z [kNm]	e _x [mm]	e _y [mm]
Sn35/N521	CO1/1	0,00	-8,65	0,00	0,00	0,00	0,00	-	-
Sn35/N521	CO1/2	0,00	8,67	0,00	0,00	0,00	0,00	-	-

DEFORMACE

DEFORMATIONS

1D deformations; u_x

Values: u_x

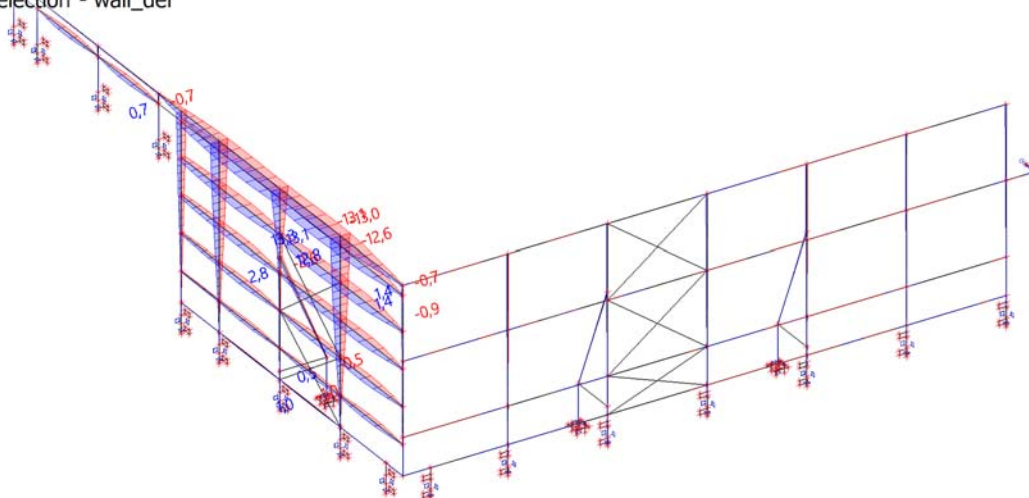
Linear calculation

Combination: CO2

Coordinate system: Global

Extreme 1D: Cross-section

Selection: Named selection - wall_def



1D deformations; u_y

Values: u_y

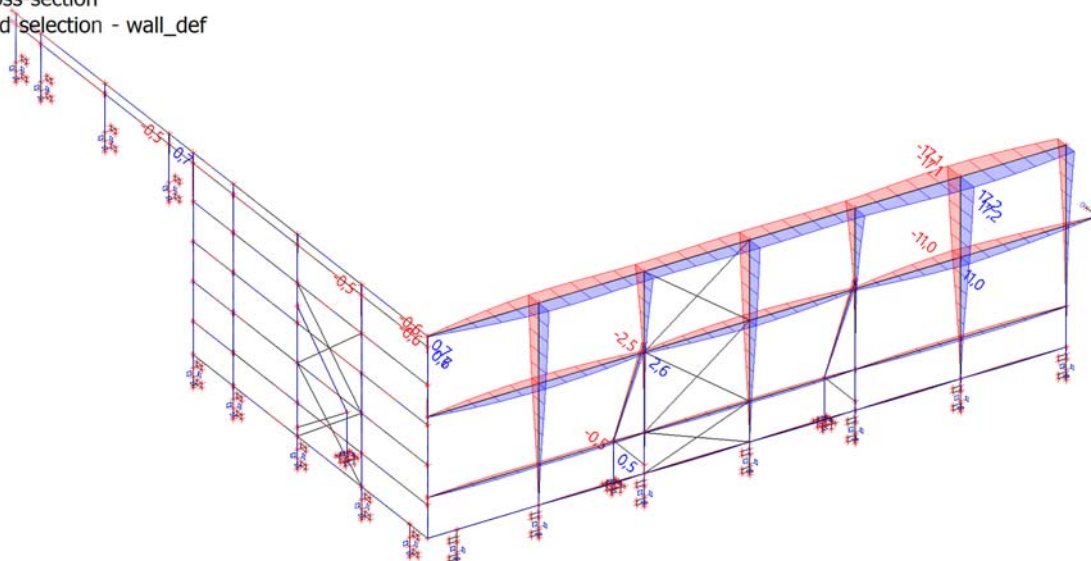
Linear calculation

Combination: CO2

Coordinate system: Global

Extreme 1D: Cross-section

Selection: Named selection - wall_def



Deformations on member

Linear calculation, Extreme : Global

Selection : Named selection - wall_def

Combinations : CO2

Member	dx [mm]	Case	ux [mm]	uy [mm]	uz [mm]	fix [mrad]	fiy [mrad]	fiz [mrad]	Resultant [mm]
B16	4550,000	CO2/7	-1,7	-0,9	0,3	-0,3	0,2	-0,2	1,9
B43	2570,000	CO2/8	1,4	1,4	0,7	-0,4	0,5	-2,0	2,1
B64	1440,000	CO2/9	-0,5	-13,3	-1,1	3,5	-0,5	-0,2	13,4
B64	1440,000	CO2/6	0,6	13,1	-0,7	-3,4	-0,2	0,3	13,1
B40	2440,000	CO2/3	0,7	0,0	-17,1	3,0	-0,3	0,0	17,1
B40	2440,000	CO2/8	1,3	0,0	17,2	-3,1	0,2	0,1	17,2
B40	4880,000	CO2/5	1,3	0,2	12,5	-7,2	1,1	0,2	12,6
B40	4880,000	CO2/9	0,7	-0,2	-12,1	7,0	-1,2	0,1	12,1
B93	5300,000	CO2/5	-0,2	1,3	12,5	-1,1	-7,2	0,2	12,6
B93	5300,000	CO2/9	0,2	0,7	-12,1	1,2	7,0	0,1	12,1
B50	2474,960	CO2/6	0,5	0,9	-1,1	-0,3	-1,2	-9,3	1,5
B50	2474,960	CO2/9	-0,4	-0,9	-1,3	0,3	-1,8	9,3	1,6

VNITŘNÍ SÍLY A POSOUZENÍ PŘŮŘEZŮ

1. STRESS ANALYSIS OF CROSS SECTIONS

2. CS11 - 1D internal forces; N

Values: **N**

Linear calculation

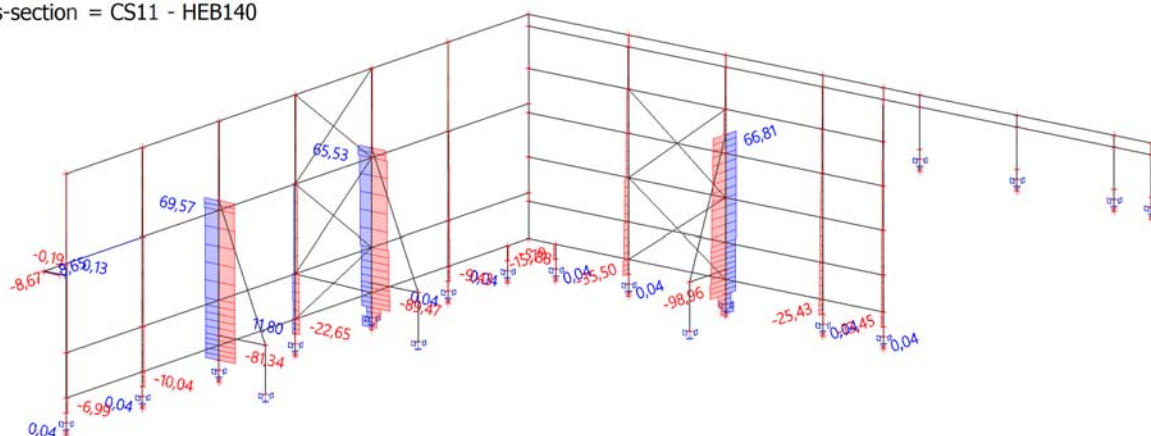
Combination: CO1

Coordinate system: Principal

Extreme 1D: Member

Selection: All

Filter: Cross-section = CS11 - HEB140



3. CS11 - 1D internal forces; M_y

Values: **M_y**

Linear calculation

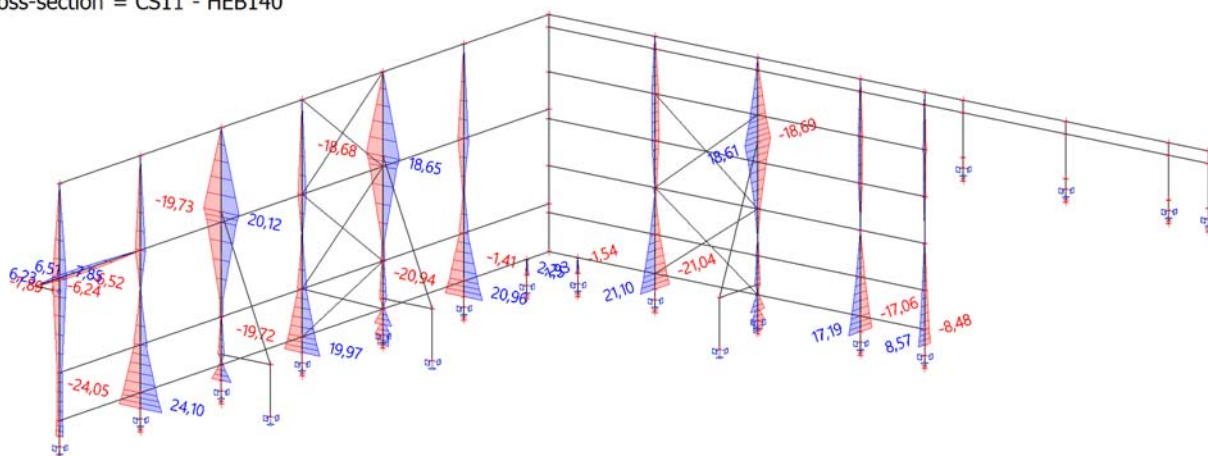
Combination: CO1

Coordinate system: Principal

Extreme 1D: Member

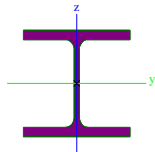
Selection: All

Filter: Cross-section = CS11 - HEB140



4. Cross-sections

4.1. Cross-sections - CS11

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
	Detailed						
CS11	HEB140	S 235	rolled	b	c		European wide flange beam

4.1.1. EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS11 - HEB140

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B91	950,000+	CO1/1	CS11 - HEB140	S 235	0,81	0,08	0,81

Name	Combination key
CO1/1	1.15*LC1 + 1.15*LC2 + 1.50*LC4

5. CS12 - 1D internal forces; N

Values: **N**

Linear calculation

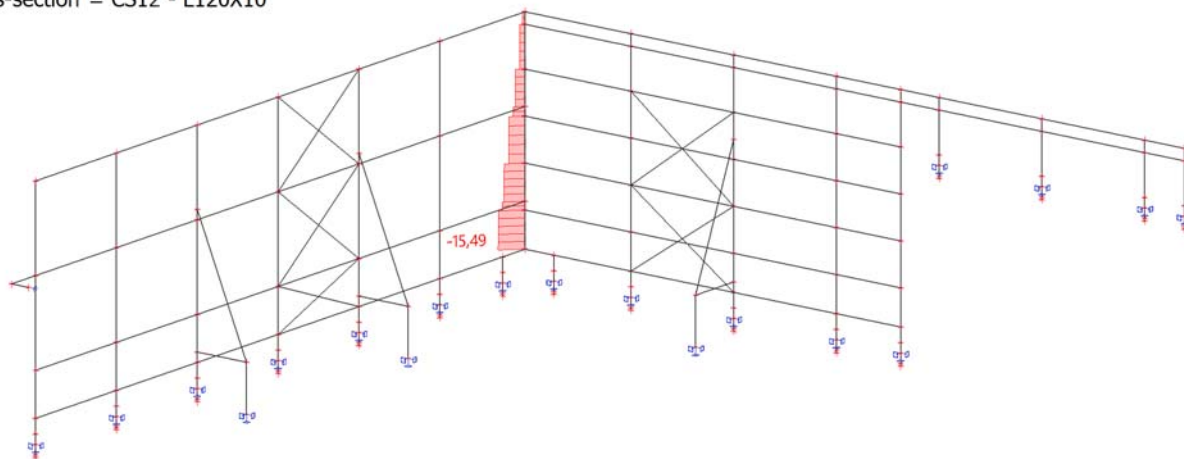
Combination: CO1

Coordinate system: Principal

Extreme 1D: Member

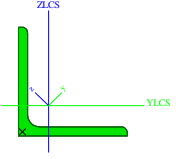
Selection: All

Filter: Cross-section = CS12 - L120X10



6. Cross-sections

6.1. Cross-sections - CS12

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
	Detailed						
CS12	L120X10	S 235	rolled	b	b		Leg angle

6.1.1. EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS12 - L120X10

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B16	0,000	CO1/1	CS12 - L120X10	S 235	0,30	0,30	0,22

Name	Combination key
CO1/1	1.15*LC1 + 1.15*LC2 + 1.50*LC3 + 0.90*LC7

7. CS13 - 1D internal forces; N

Values: **N**

Linear calculation

Combination: CO1

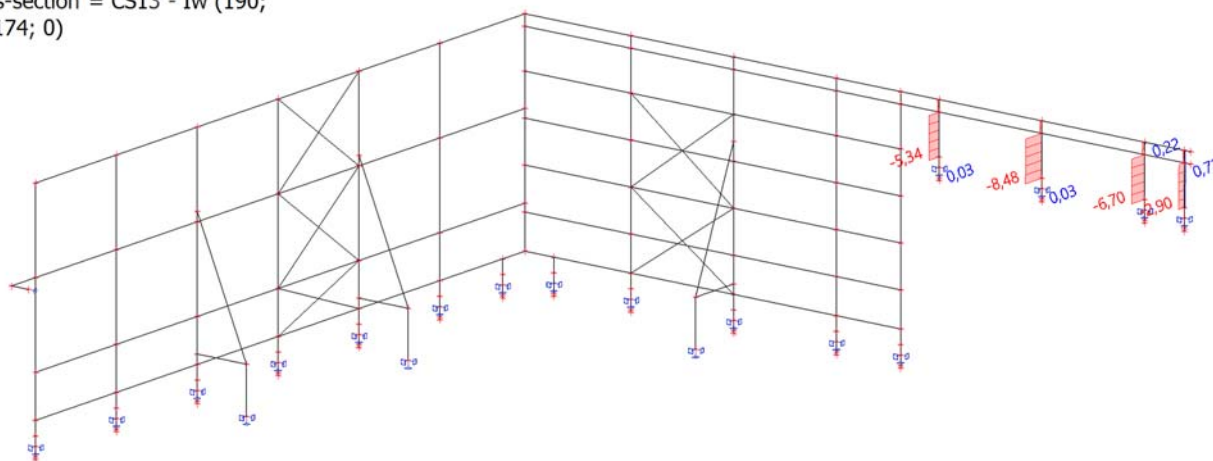
Coordinate system: Principal

Extreme 1D: Member

Selection: All

Filter: Cross-section = CS13 - Iw (190;

6; 100; 8; 174; 0)



8. CS13 - 1D internal forces; M_y

Values: **M_y**

Linear calculation

Combination: CO1

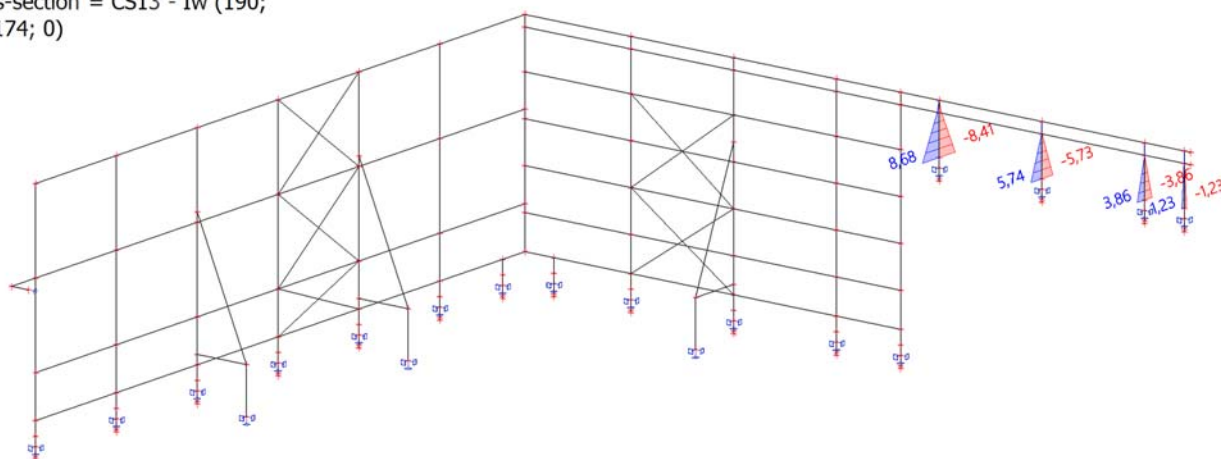
Coordinate system: Principal

Extreme 1D: Member

Selection: All

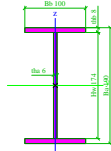
Filter: Cross-section = CS13 - Iw (190;

6; 100; 8; 174; 0)



9. Cross-sections

9.1. Cross-sections - CS13

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture
	Detailed					
CS13	Iw	S 235	welded	b	c	
	190; 6; 100; 8; 174; 0					

9.1.1. EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS13 - Iw (190; 6; 100; 8; 174; 0)

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B84	450,000+	CO1/1	CS13 - Iw	S 235	0,19	0,19	0,19

Name	Combination key
CO1/1	1.15*LC1 + 1.15*LC2 + 0.75*LC3 + 1.50*LC4

10. CS15 - 1D internal forces; M_y

Values: M_y

Linear calculation

Combination: CO1

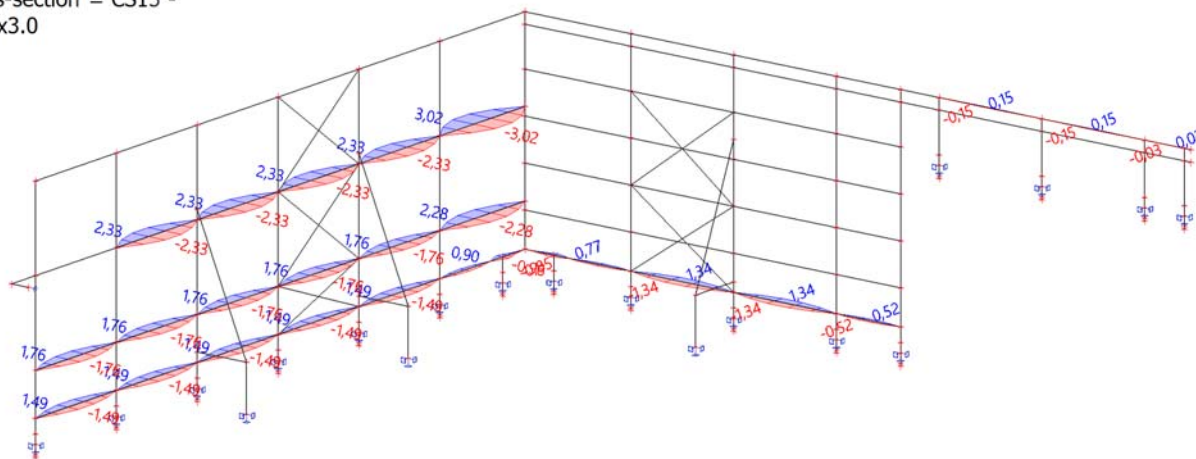
Coordinate system: Principal

Extreme 1D: Member

Selection: All

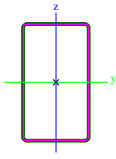
Filter: Cross-section = CS15 -

VHP140/80x3.0



11. Cross-sections

11.1. Cross-sections - CS15

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
CS15	Detailed VHP140/80x3.0	S 235	cold formed	c	c		Rectangular hollow section

11.1.1. EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS15 - VHP140/80x3.0

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B47	674,956-	CO1/1	CS15 - VHP140/80x3.0	S 235	0,74	0,63	0,74

Name	Combination key
CO1/1	1.15*LC1 + 1.15*LC2 + 1.50*LC3 + 0.90*LC5

12. CS16 - 1D internal forces; M_z

Values: M_z

Linear calculation

Combination: CO1

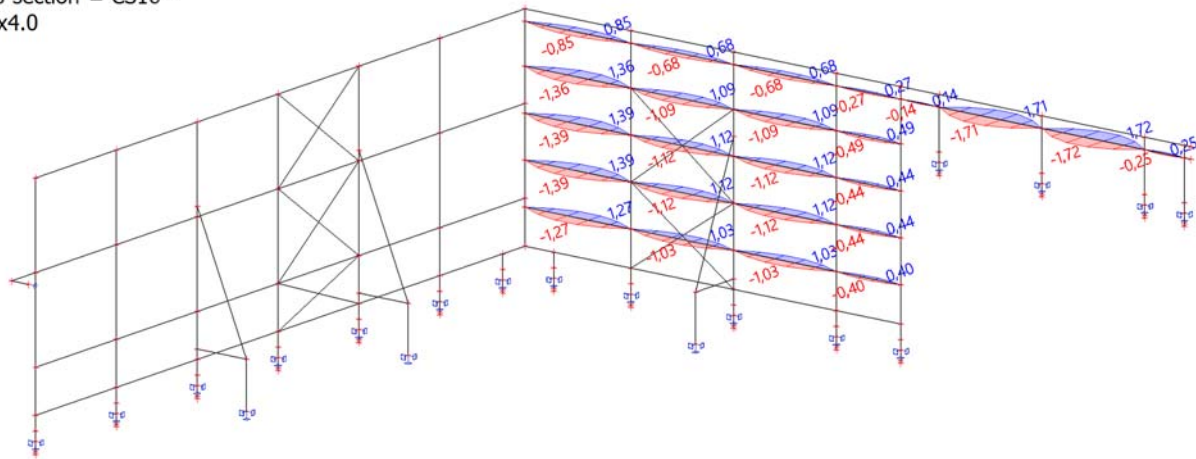
Coordinate system: Principal

Extreme 1D: Member

Selection: All

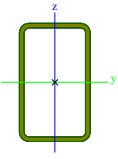
Filter: Cross-section = CS16 -

VHP100/60x4.0



13. Cross-sections

13.1. Cross-sections - CS16

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
CS16	Detailed VHP100/60x4.0	S 235	cold formed	c	c		Rectangular hollow section

13.1.1. EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS16 - VHP100/60x4.0

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B71	960,000-	CO1/1	CS16 - VHP100/60x4.0	S 235	0,37	0,27	0,37

Name	Combination key
CO1/1	1.15*LC1 + 1.15*LC2 + 0.75*LC3 + 1.50*LC7

14. CS17 - 1D internal forces; M_y

Values: M_y

Linear calculation

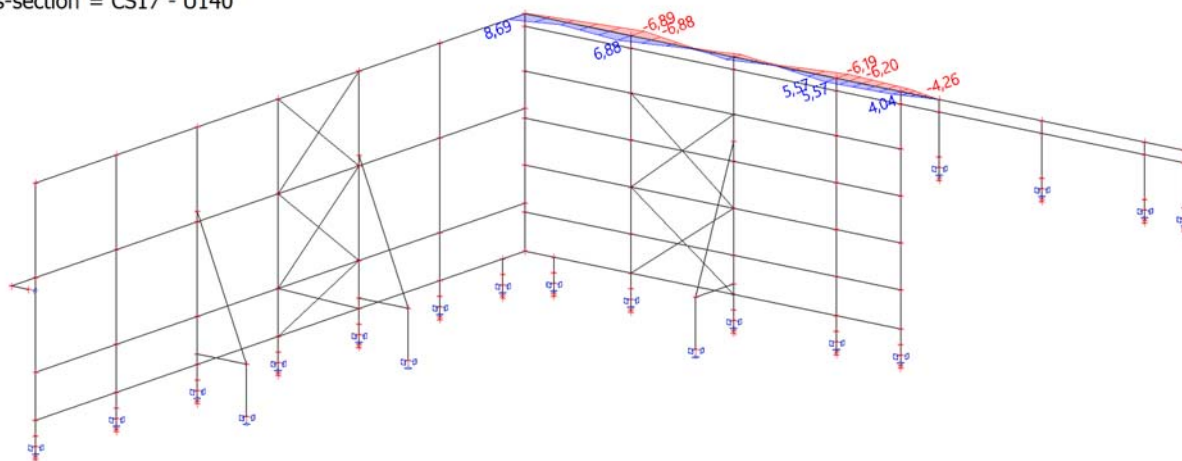
Combination: CO1

Coordinate system: Principal

Extreme 1D: Member

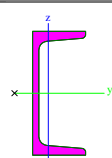
Selection: All

Filter: Cross-section = CS17 - U140



15. Cross-sections

15.1. Cross-sections - CS17

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
	Detailed						
CS17	U140	S 235	rolled	c	c		European standard channel

15.1.1. EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS17 - U140

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B44	0,000	CO1/1	CS17 - U140	S 235	0,53	0,37	0,53

Name	Combination key
CO1/1	1.15*LC1 + 1.15*LC2 + 0.75*LC3 + 1.50*LC4

16. CS18 - 1D internal forces; M_y

Values: M_y

Linear calculation

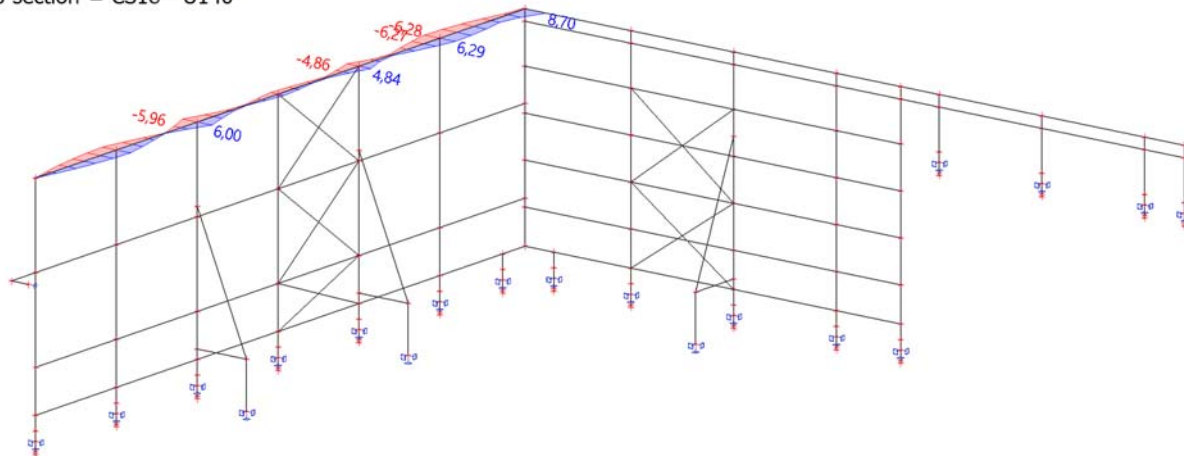
Combination: CO1

Coordinate system: Principal

Extreme 1D: Member

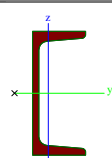
Selection: All

Filter: Cross-section = CS18 - U140



17. Cross-sections

17.1. Cross-sections - CS18

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
	Detailed						
CS18	U140	S 235	rolled	c	c		European standard channel

17.1.1. EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS18 - U140

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B43	2570,002	CO1/1	CS18 - U140	S 235	0,53	0,37	0,53

Name	Combination key
CO1/1	1.15*LC1 + 1.15*LC2 + 0.75*LC3 + 1.50*LC4

18. CS21 - 1D internal forces; N

Values: **N**

Linear calculation

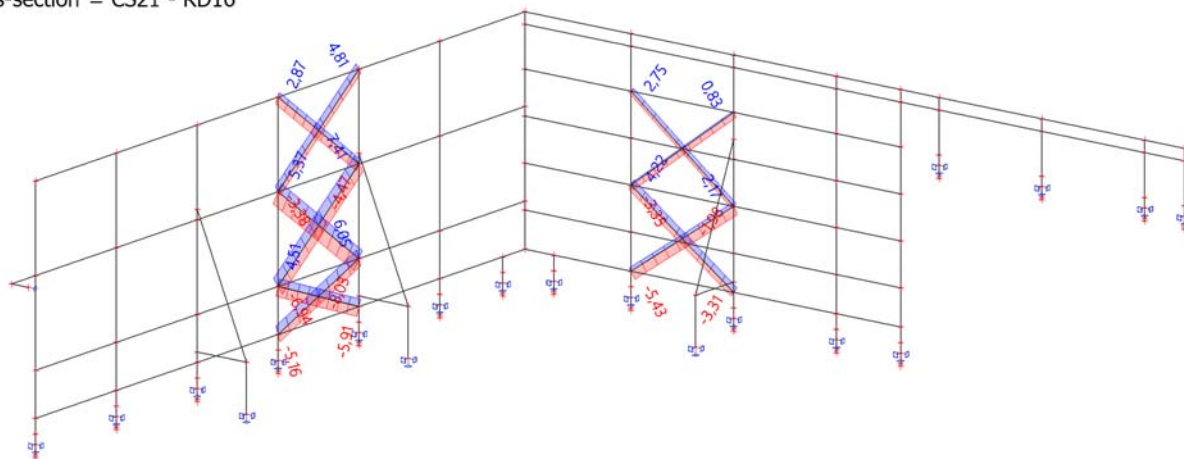
Combination: CO1

Coordinate system: Principal

Extreme 1D: Member

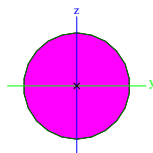
Selection: All

Filter: Cross-section = CS21 - RD16



19. Cross-sections

19.1. Cross-sections - CS21

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
	Detailed						
CS21	RD16	S 235	rolled	c	c		Round bar

19.1.1. EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS21 - RD16

There are 2 warnings on selected members. 2 of them are shown.

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]	Errors, warnings, notes
B98	3041,024	CO1/1	CS21 - RD16	S 235	0,17	0,17	0,00	W2, W9

20. CS22 - 1D internal forces; N

Values: **N**

Linear calculation

Combination: CO1

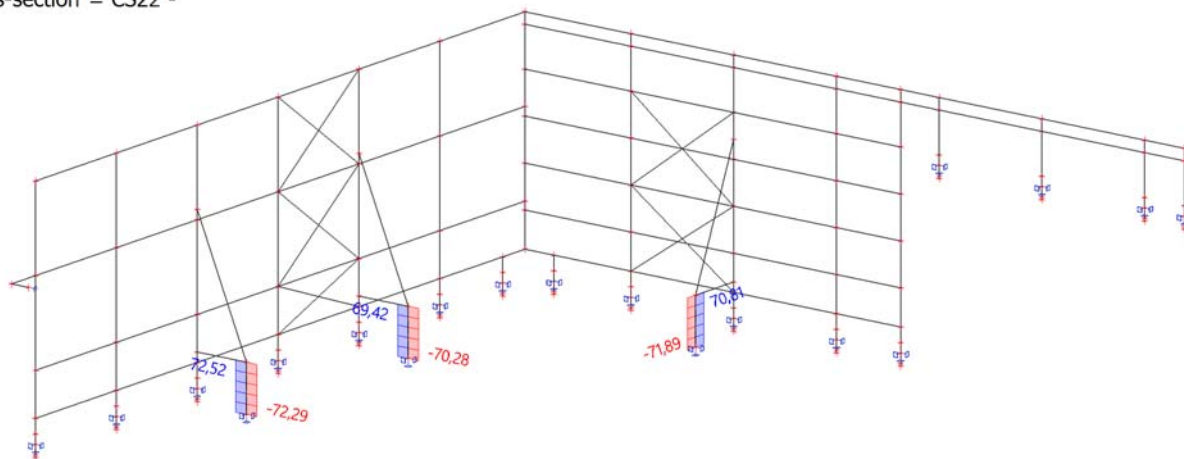
Coordinate system: Principal

Extreme 1D: Member

Selection: All

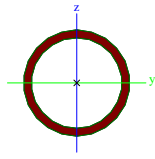
Filter: Cross-section = CS22 -

RO108X8



21. Cross-sections

21.1. Cross-sections - CS22

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
CS22	RO108X8	S 235	rolled	a	a		Circular hollow section

21.1.1. EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS22 - RO108X8

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B117	0,000	CO1/1	CS22 - RO108X8	S 235	0,21	0,12	0,21

Name	Combination key
CO1/1	1.15*LC1 + 1.15*LC2 + 0.75*LC3 + 1.50*LC5

22. CS23 - 1D internal forces; N

Values: **N**

Linear calculation

Combination: CO1

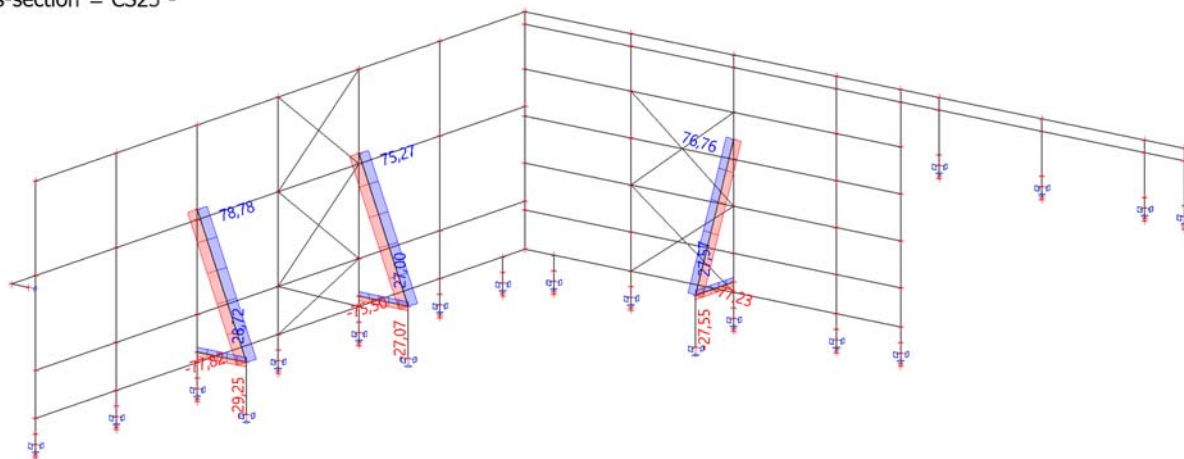
Coordinate system: Principal

Extreme 1D: Member

Selection: All

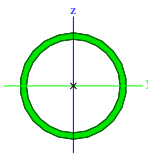
Filter: Cross-section = CS23 -

RO82.5X5



23. Cross-sections

23.1. Cross-sections - CS23

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
CS23	RO82.5X5	S 235	rolled	a	a		Circular hollow section

23.1.1. EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS23 - RO82.5X5

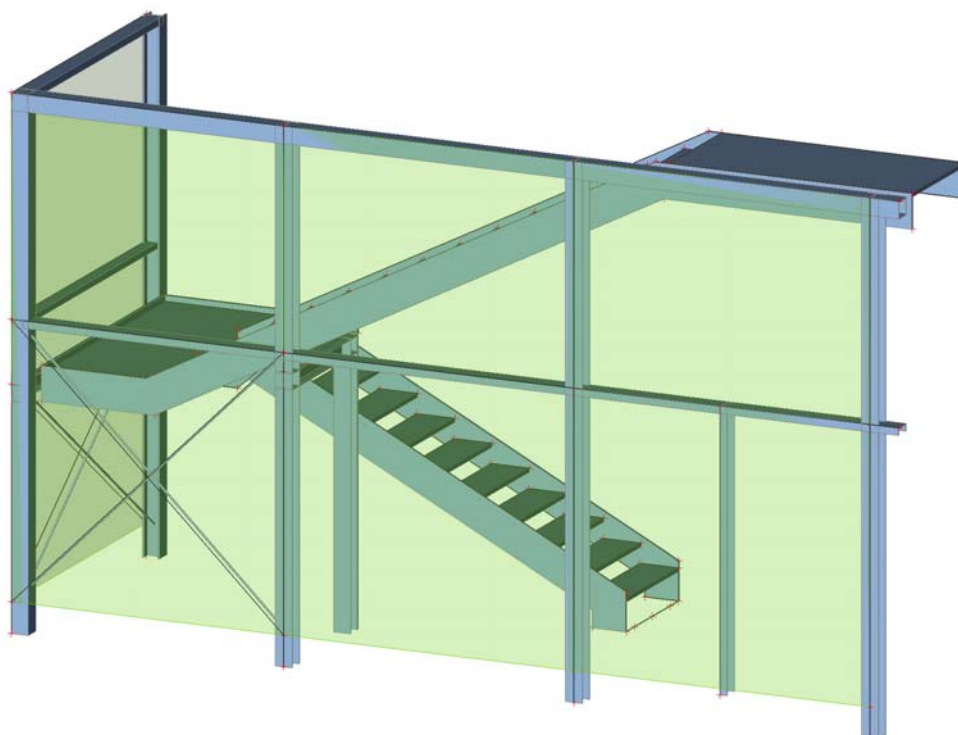
Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B112	0,000	CO1/1	CS23 - RO82.5X5	S 235	0,50	0,27	0,50

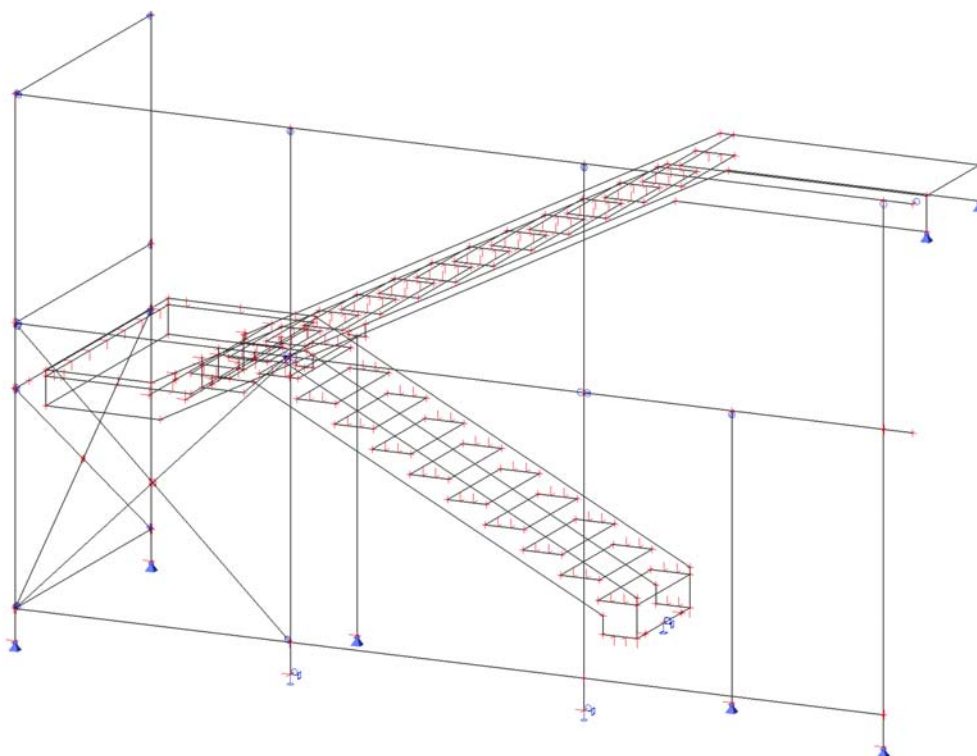
Name	Combination key
CO1/1	1.15*LC1 + 1.15*LC2 + 0.75*LC3 + 1.50*LC7

VENKOVNÍ SCHODY 4-5/D-E

3D MODEL OF STRUCTURE



Structural model



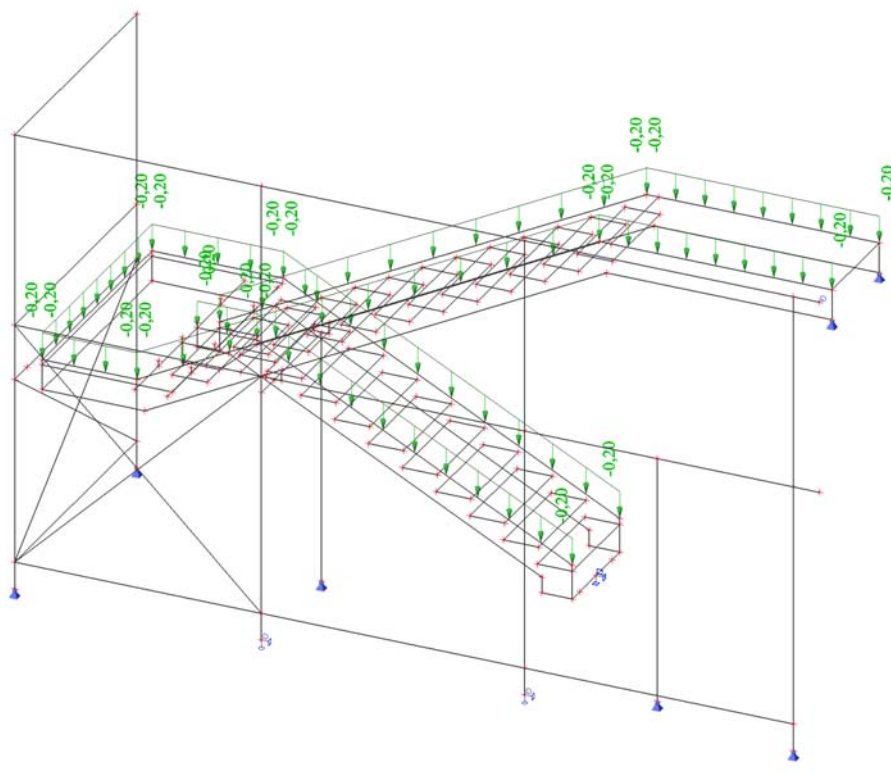
Project

Version	SCIA Engineer 17.1.2029
Licence number	555797
Project	Centrum Energetických a Enviromentálních Technologí
Part	SO 01.1 Objekt CEETe
Description	Ocelová konstrukce
Author	Ing. Jeřowicz
Date	Date
Structure	General XYZ
No. of nodes :	1268
No. of beams :	353
No. of slabs :	150
No. of solids :	1390
No. of used profiles :	33
No. of load cases :	14
No. of used materials :	3
Acceleration of gravity [m/s ²]	9,807
National code	EC - EN

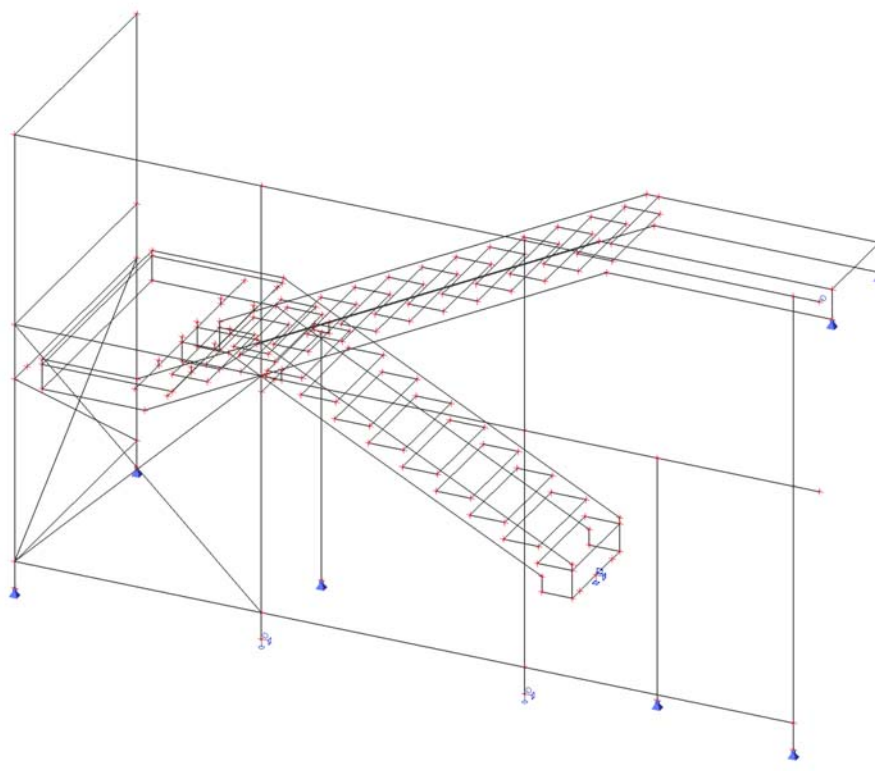
Load cases

Name	Description	Action type	Load group	Direction	Duration	Master load case
	Spec	Load type				
LC1	self weight	Permanent Self weight	LG1	-Z		
LC2	dead load	Permanent Standard	LG1			
LC3	snow/rime Standard	Variable Static	snow		Short	None
LC4	wind +x Standard	Variable Static	wind		Short	None
LC5	wind -x Standard	Variable Static	wind		Short	None
LC6	wind +y Standard	Variable Static	wind		Short	None
LC7	wind -y Standard	Variable Static	wind		Short	None
LC8	live load Standard	Variable Static	live		Short	None
LC9	Rmax (C) Standard	Variable Static	crane		Short	None
LC10	Ht+Hl_Rmax (C) Standard	Variable Static	Ht+Hl		Short	None
LC11	Hs_Rmax (C) Standard	Variable Static	Hs		Short	None
LC12	Mmax (C-D) Standard	Variable Static	crane		Short	None
LC13	Ht+Hl_Mmax (C-D) Standard	Variable Static	Ht+Hl		Short	None
LC14	Hs_Mmax (C-D) Standard	Variable Static	Hs		Short	None

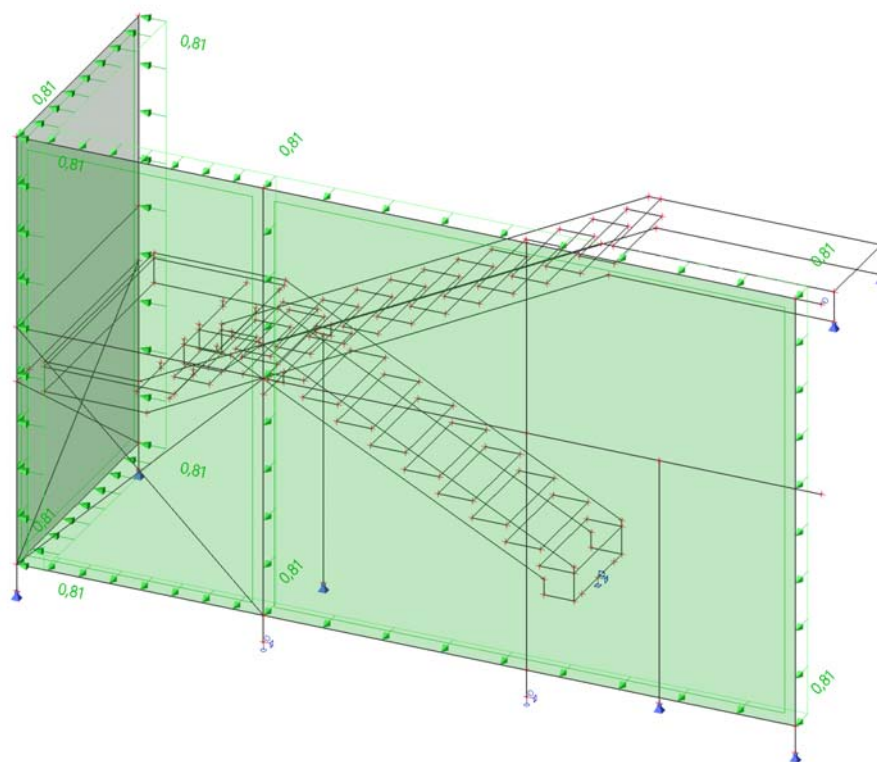
LC2 / Tot. value



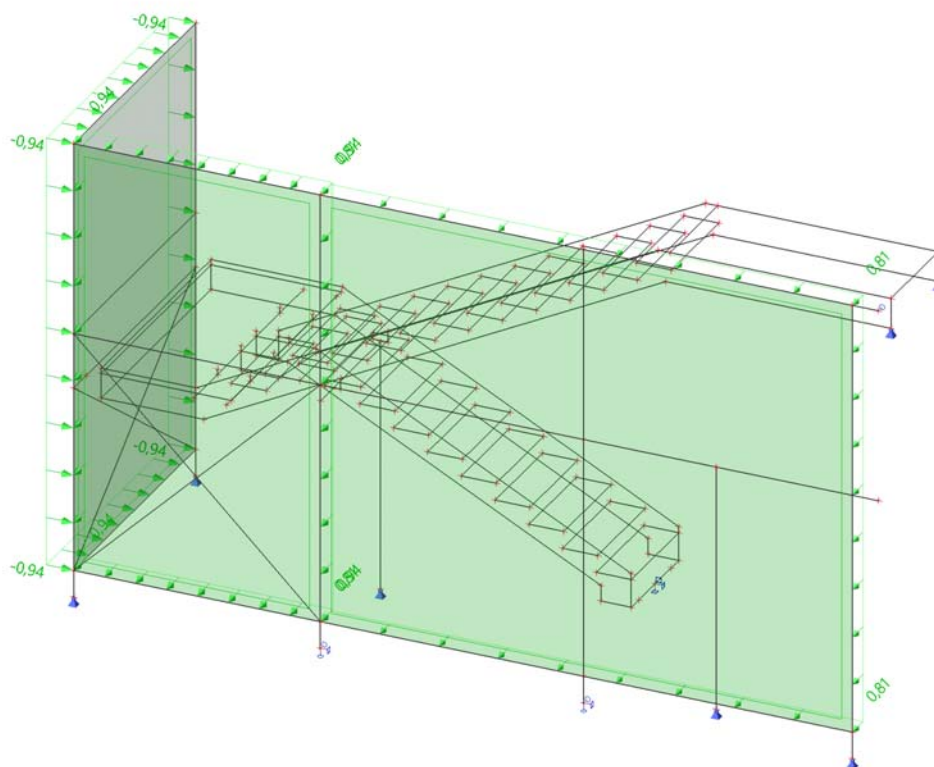
LC3 / Tot. value



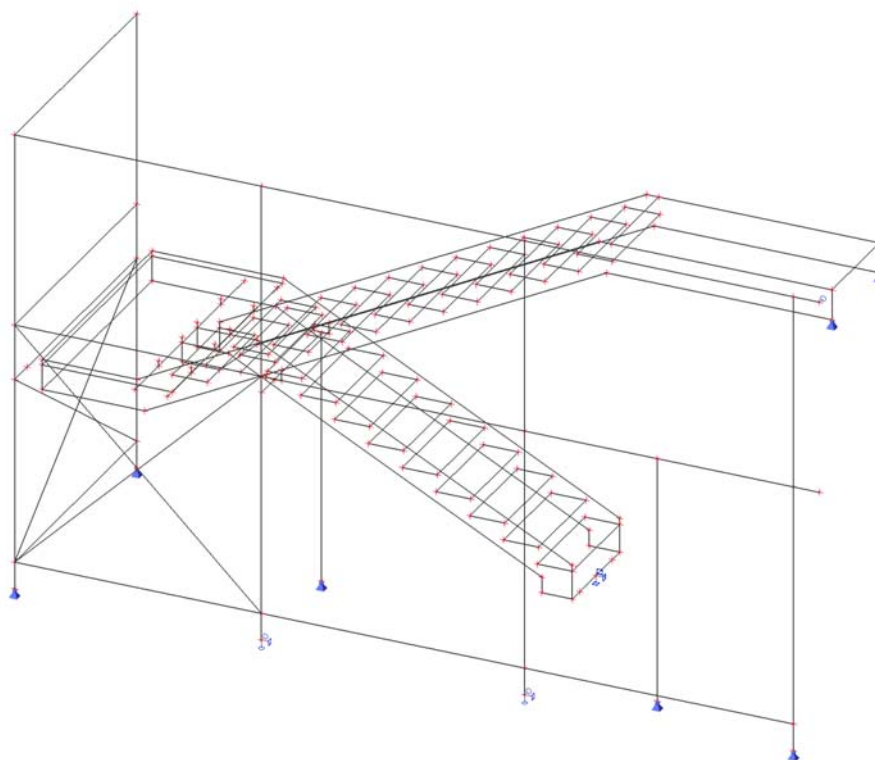
LC4 / Tot. value



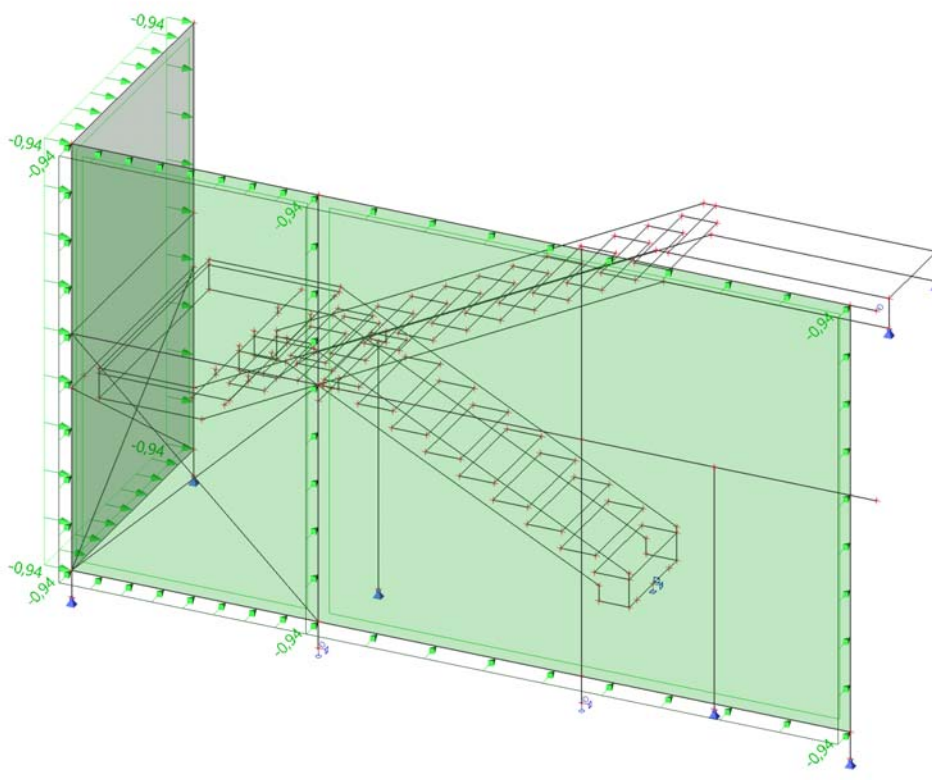
LC5 / Tot. value



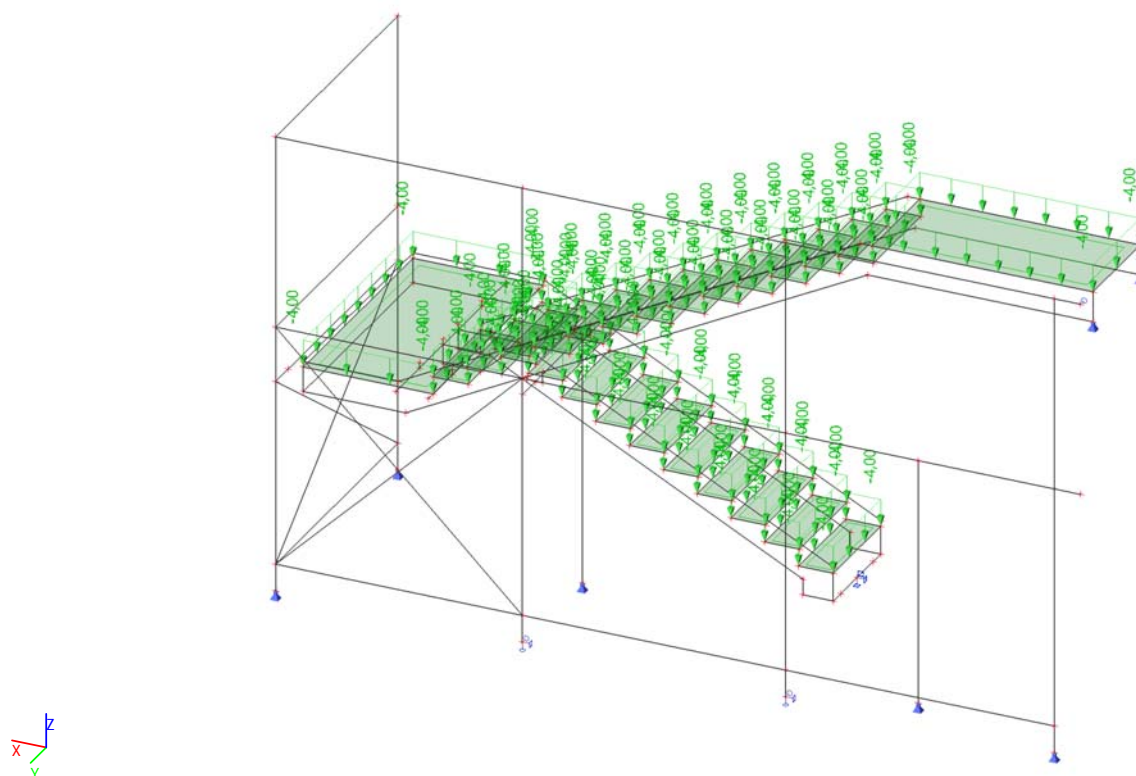
LC6 / Tot. value



LC7 / Tot. value



LC8 / Tot. value



Load groups

Name	Load	Relation	Type
LG1	Permanent		
snow	Variable	Exclusive	Snow
wind	Variable	Exclusive	Wind
live	Variable	Exclusive	Cat C : Congregation
crane	Variable	Exclusive	Cat F : Vehicle <30kN
Ht+Hl	Variable	Exclusive	Cat F : Vehicle <30kN
Hs	Variable	Exclusive	Cat F : Vehicle <30kN

Combinations

Name	Description	Type	Load cases	Coeff. [-]
CO1		EN-ULS (STR/GEO) Set B	LC1 - self weight	1,00
			LC2 - dead load	1,00
			LC3 - snow/rime	1,00
			LC4 - wind +x	1,00
			LC5 - wind -x	1,00
			LC6 - wind +y	1,00
			LC7 - wind -y	1,00
			LC8 - live load	1,00
CO2		EN-SLS Characteristic	LC1 - self weight	1,00
			LC2 - dead load	1,00
			LC3 - snow/rime	1,00
			LC4 - wind +x	1,00
			LC5 - wind -x	1,00
			LC6 - wind +y	1,00
			LC7 - wind -y	1,00
			LC8 - live load	1,00
Rmax +		Envelope - ultimate	LC1 - self weight	1,35
			LC9 - Rmax (C)	1,50

Name	Description	Type	Load cases	Coeff. [-]
			LC10 - Ht+Hl_Rmax (C)	1,35
			LC11 - Hs_Rmax (C)	1,35
Rmax -		Envelope - ultimate	LC1 - self weight	1,35
			LC9 - Rmax (C)	1,50
			LC10 - Ht+Hl_Rmax (C)	-1,35
			LC11 - Hs_Rmax (C)	-1,35
Mmax +		Envelope - ultimate	LC1 - self weight	1,35
			LC12 - Mmax (C-D)	1,50
			LC13 - Ht+Hl_Mmax (C-D)	1,35
			LC14 - Hs_Mmax (C-D)	1,35
Mmax -		Envelope - ultimate	LC1 - self weight	1,35
			LC12 - Mmax (C-D)	1,50
			LC13 - Ht+Hl_Mmax (C-D)	-1,35
			LC14 - Hs_Mmax (C-D)	-1,35
Mmax +def		Envelope - serviceability	LC1 - self weight	1,00
			LC12 - Mmax (C-D)	1,00
			LC13 - Ht+Hl_Mmax (C-D)	1,00
			LC14 - Hs_Mmax (C-D)	1,00
Mmax -def		Envelope - serviceability	LC1 - self weight	1,00
			LC12 - Mmax (C-D)	1,00
			LC13 - Ht+Hl_Mmax (C-D)	-1,00
			LC14 - Hs_Mmax (C-D)	-1,00

Result classes

Name	List
All ULS	CO1 - EN-ULS (STR/GEO) Set B
	Rmax + - Envelope - ultimate
	Rmax - - Envelope - ultimate
	Mmax + - Envelope - ultimate
	Mmax - - Envelope - ultimate
All SLS	CO2 - EN-SLS Characteristic
	Mmax +def - Envelope - serviceability
	Mmax -def - Envelope - serviceability

Combination key

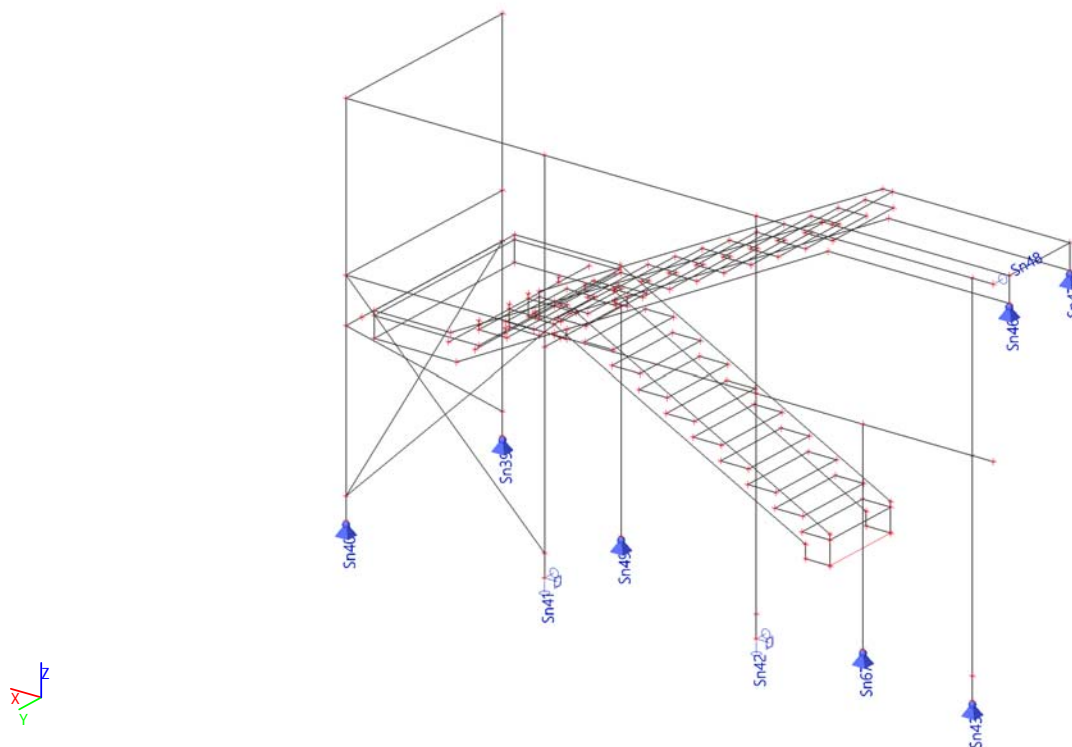
Combination key

Name	Description of combinations
1	LC1*1,00 +LC2*1,00 +LC6*1,00
2	LC1*1,00 +LC2*1,00 +LC3*0,50 +LC4*1,00
3	LC1*1,00 +LC2*1,00 +LC5*1,00
4	LC1*1,00 +LC2*1,00 +LC3*0,50 +LC6*1,00
5	LC1*1,00 +LC2*1,00 +LC4*1,00
6	LC1*1,00 +LC2*1,00 +LC3*0,50 +LC5*1,00
7	LC1*1,00 +LC2*1,00 +LC7*1,00

REAKCE

REACTIONS

Structural model - number of supports



R1 - Reactions; R_x ; R_y ; R_z ; M_x ; M_y ; M_z

Values: M_z , M_x , M_y , R_z , R_y , R_x

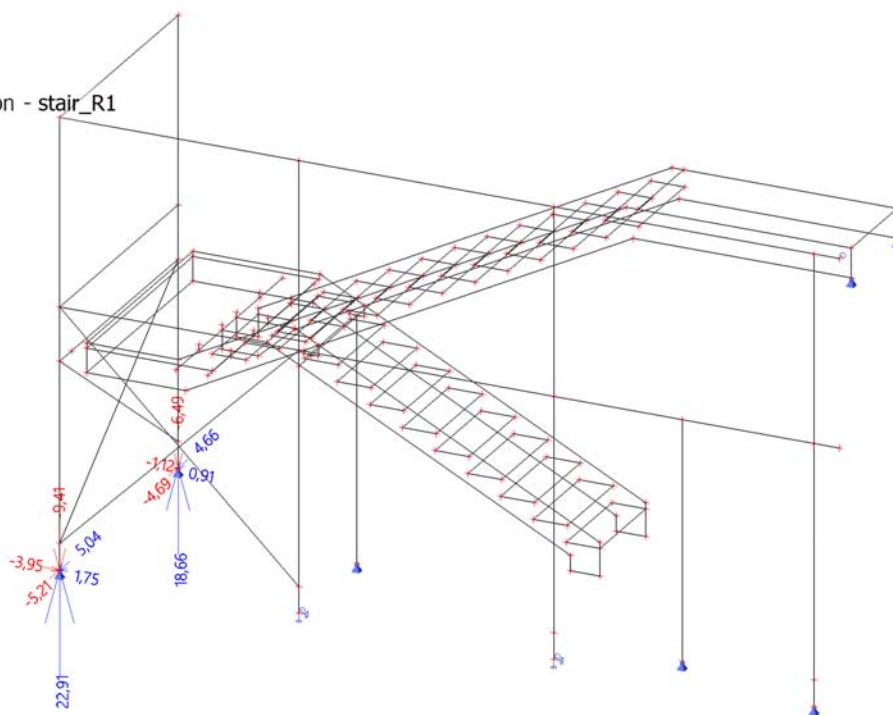
Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - stair_R1



Reactions

Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - stair_R1

Nodal reactions

Name	Case	R _x [kN]	R _y [kN]	R _z [kN]	M _x [kNm]	M _y [kNm]	M _z [kNm]	e _x [mm]	e _y [mm]
Sn39/N539	CO1/1	0,91	-4,10	-1,73	0,00	0,00	0,00	0,0	0,0
Sn39/N539	CO1/2	-1,10	-4,69	0,19	0,00	0,00	0,00	0,0	0,0
Sn39/N539	CO1/3	-1,08	4,66	11,97	0,00	0,00	0,00	0,0	0,0
Sn39/N539	CO1/4	-1,06	-4,49	-6,49	0,00	0,00	0,00	0,0	0,0
Sn39/N539	CO1/5	-1,12	4,45	18,66	0,00	0,00	0,00	0,0	0,0
Sn40/N523	CO1/2	-1,15	-5,21	17,29	0,00	0,00	0,00	0,0	0,0
Sn40/N523	CO1/3	1,75	5,04	-9,41	0,00	0,00	0,00	0,0	0,0
Sn40/N523	CO1/6	-3,95	-4,71	22,91	0,00	0,00	0,00	0,0	0,0

R2 - Reactions; R_x; R_y; R_z; M_x; M_y; M_z

Values: M_z, M_x, M_y, R_z, R_y, R_x

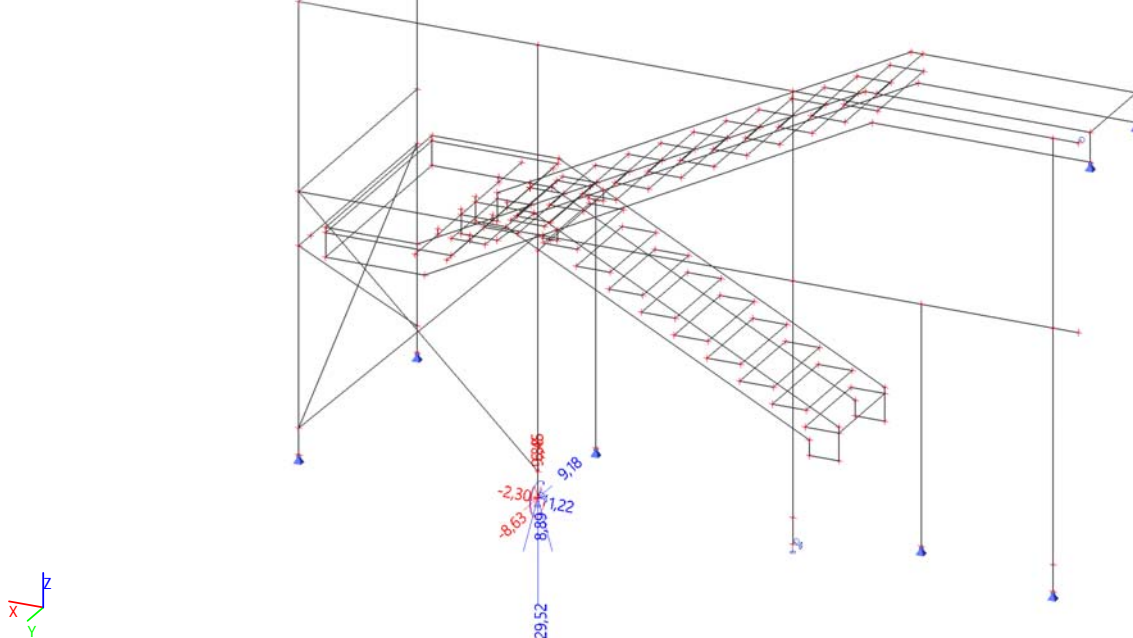
Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - stair_R2



Reactions

Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - stair_R2

Nodal reactions

Name	Case	R _x [kN]	R _y [kN]	R _z [kN]	M _x [kNm]	M _y [kNm]	M _z [kNm]	e _x [mm]	e _y [mm]
Sn41/N738	CO1/1	-0,03	-8,63	29,52	8,67	0,00	0,00	293,5	0,0
Sn41/N738	CO1/2	1,22	9,18	-6,45	-9,66	0,00	0,00	1498,1	0,0
Sn41/N738	CO1/3	0,52	9,16	-0,78	-9,88	0,00	0,00	12743,9	0,0
Sn41/N738	CO1/4	0,67	-8,61	23,85	8,89	0,00	0,00	372,6	0,0
Sn41/N738	CO1/5	-2,30	-7,93	20,58	7,95	0,00	0,00	386,1	0,0

R3 - Reactions; R_x; R_y; R_z; M_x; M_y; M_z

Values: M_z , M_x , M_y , R_z , R_y , R_x

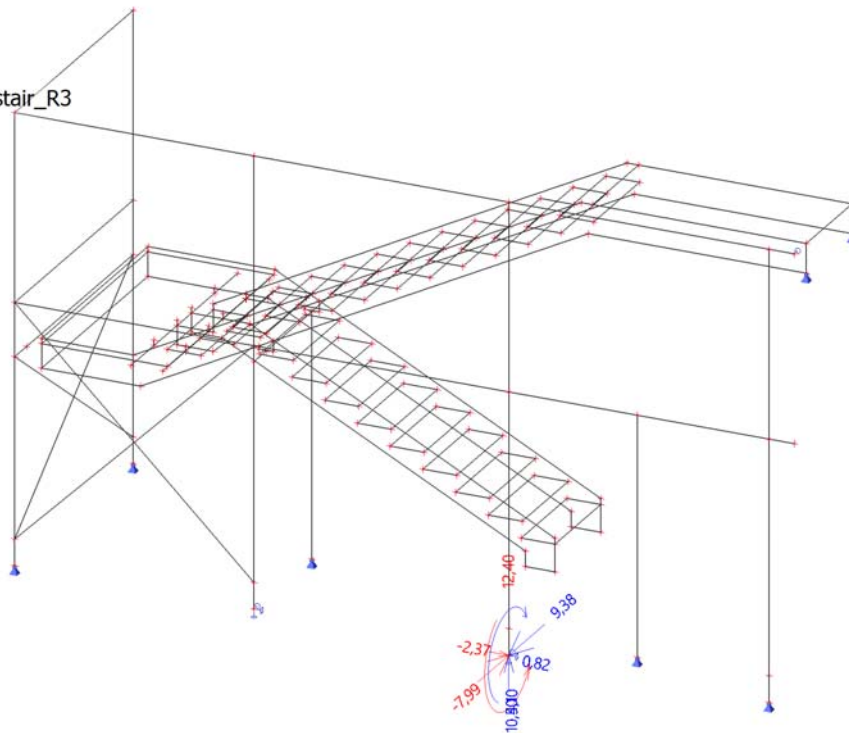
Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - stair_R3



Reactions

Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - stair_R3

Nodal reactions

Name	Case	R _x [kN]	R _y [kN]	R _z [kN]	M _x [kNm]	M _y [kNm]	M _z [kNm]	e _x [mm]	e _y [mm]
Sn42/N737	CO1/1	-0,01	-7,99	3,07	10,50	0,00	0,00	3423,8	0,0
Sn42/N737	CO1/2	0,82	9,33	2,94	-12,21	0,00	0,00	-4148,3	0,0
Sn42/N737	CO1/3	-1,18	-4,73	4,10	6,07	0,00	0,00	1482,4	0,0
Sn42/N737	CO1/4	-0,13	9,38	3,42	-12,40	0,00	0,00	-3631,7	0,0
Sn42/N737	CO1/5	-2,37	-7,90	3,45	10,16	0,00	0,00	2944,0	0,0

R4 - Reactions; R_x; R_y; R_z; M_x; M_y; M_z

Values: M_z , M_x , M_y , R_z , R_y , R_x

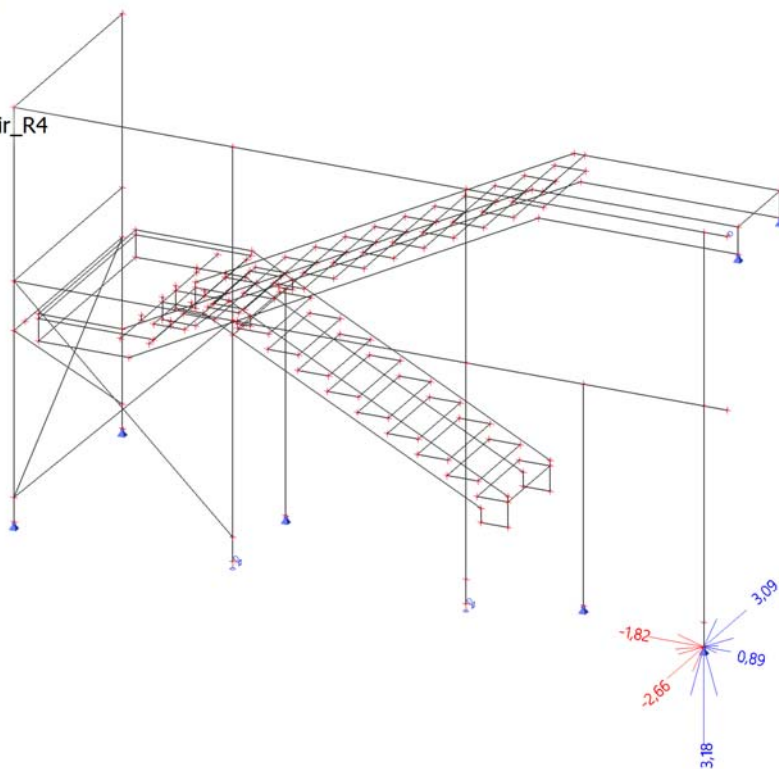
Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - stair_R4



Reactions

Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - stair_R4

Nodal reactions

Name	Case	R _x [kN]	R _y [kN]	R _z [kN]	M _x [kNm]	M _y [kNm]	M _z [kNm]	e _x [mm]	e _y [mm]
Sn43/N736	CO1/1	-1,76	-2,66	2,39	0,00	0,00	0,00	0,0	0,0
Sn43/N736	CO1/2	0,89	3,09	2,47	0,00	0,00	0,00	0,0	0,0
Sn43/N736	CO1/3	-1,75	-2,66	2,06	0,00	0,00	0,00	0,0	0,0
Sn43/N736	CO1/4	0,49	1,85	3,18	0,00	0,00	0,00	0,0	0,0
Sn43/N736	CO1/5	-1,82	-1,60	2,45	0,00	0,00	0,00	0,0	0,0

R5 - Reactions; R_x; R_y; R_z; M_x; M_y; M_z

Values: M_z , M_x , M_y , R_z , R_y , R_x

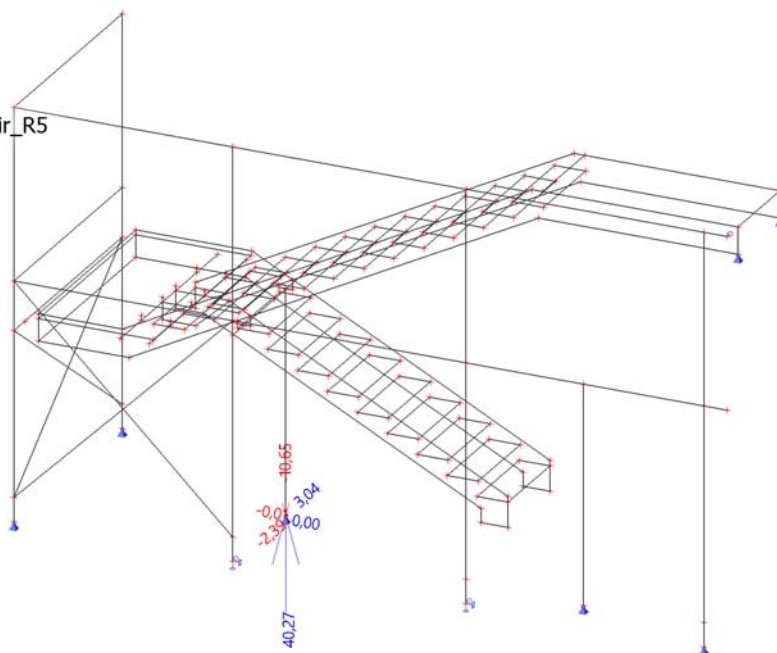
Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - stair_R5



Reactions

Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - stair_R5

Nodal reactions

Name	Case	R _x [kN]	R _y [kN]	R _z [kN]	M _x [kNm]	M _y [kNm]	M _z [kNm]	e _x [mm]	e _y [mm]
Sn49/N750	CO1/1	0,00	-2,23	-7,17	0,00	0,00	0,00	0,0	0,0
Sn49/N750	CO1/2	-0,01	3,04	39,90	0,00	0,00	0,00	0,0	0,0
Sn49/N750	CO1/3	0,00	-2,39	-10,65	0,00	0,00	0,00	0,0	0,0
Sn49/N750	CO1/4	-0,01	2,05	40,27	0,00	0,00	0,00	0,0	0,0
Sn49/N750	CO1/5	-0,01	-1,07	20,13	0,00	0,00	0,00	0,0	0,0

R6 - Reactions; R_x; R_y; R_z; M_x; M_y; M_z

Values: M_z , M_x , M_y , R_z , R_y , R_x

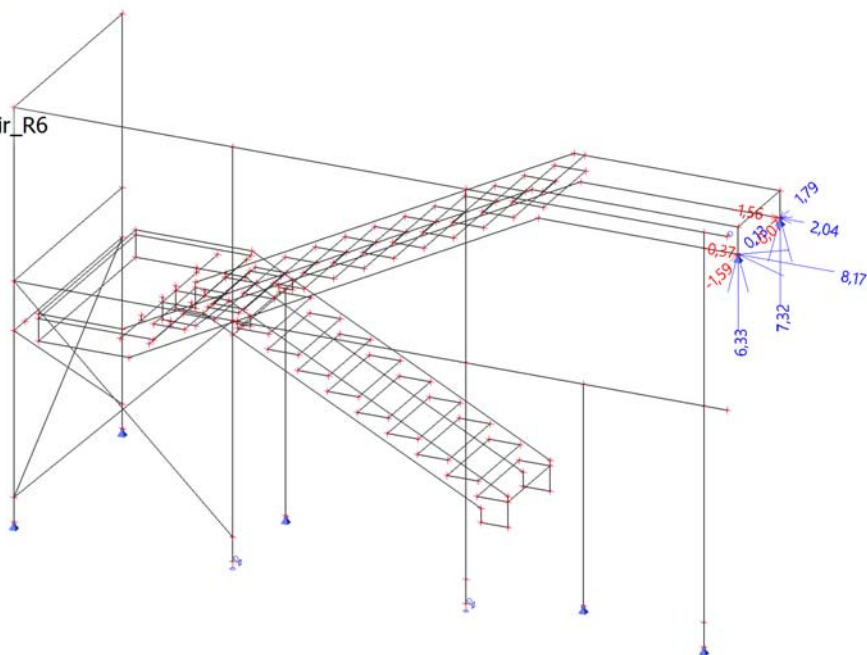
Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - stair_R6



Reactions

Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - stair_R6

Nodal reactions

Name	Case	R _x [kN]	R _y [kN]	R _z [kN]	M _x [kNm]	M _y [kNm]	M _z [kNm]	e _x [mm]	e _y [mm]
Sn46/N716	CO1/1	8,17	-1,36	5,58	0,00	0,00	0,00	0,0	0,0
Sn46/N716	CO1/2	7,77	-1,59	5,92	0,00	0,00	0,00	0,0	0,0
Sn46/N716	CO1/3	3,32	0,13	0,46	0,00	0,00	0,00	0,0	0,0
Sn46/N716	CO1/4	5,96	-1,58	6,33	0,00	0,00	0,00	0,0	0,0
Sn46/N716	CO1/5	-0,37	-0,24	1,72	0,00	0,00	0,00	0,0	0,0
Sn47/N706	CO1/6	2,04	-0,07	0,80	0,00	0,00	0,00	0,0	0,0
Sn47/N706	CO1/1	0,44	1,79	7,32	0,00	0,00	0,00	0,0	0,0
Sn47/N706	CO1/7	-1,56	1,03	5,59	0,00	0,00	0,00	0,0	0,0

R7 - Reactions; R_x; R_y; R_z; M_x; M_y; M_z

Values: M_z , M_x , M_y , R_z , R_y , R_x

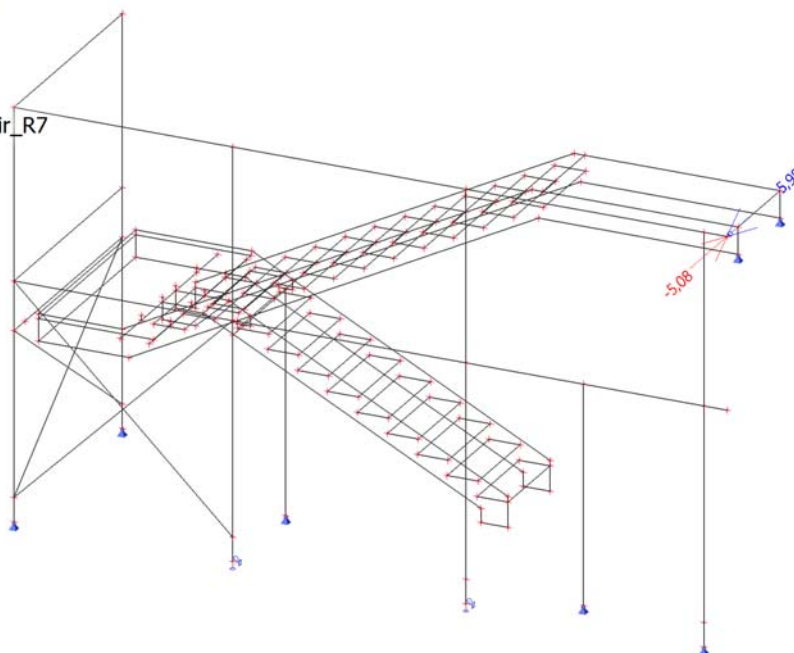
Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - stair_R7



Reactions

Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - stair_R7

Nodal reactions

Name	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]	e_x [mm]	e_y [mm]
Sn48/N543	CO1/1	0,00	-5,08	0,00	0,00	0,00	0,00	-	-
Sn48/N543	CO1/2	0,00	5,98	0,00	0,00	0,00	0,00	-	-

R8 - Reactions; R_x; R_y; R_z; M_x; M_y; M_z

Values: M_z , M_x , M_y , R_z , R_y , R_x

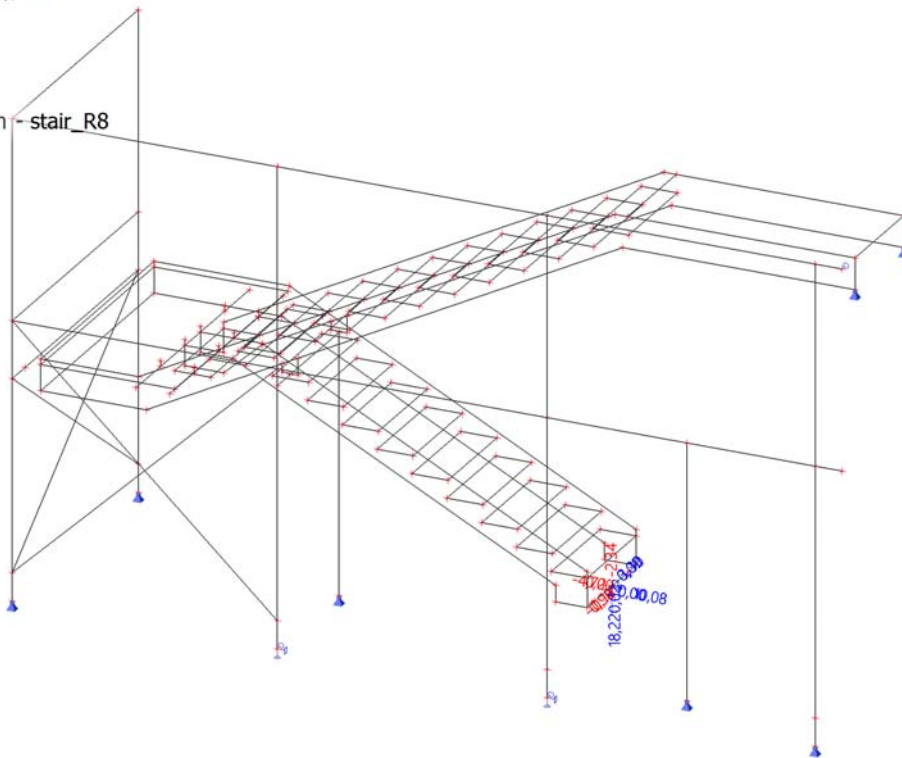
Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - stair_R8



Reactions

Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - stair_R8

Nodal reactions

Name	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]	e_x [mm]	e_y [mm]
Sn108/N3176	CO1/1	-4,79	-0,03	1,36	-0,16	0,00	-0,69	-116,4	-0,1
Sn108/N3176	CO1/2	9,56	-0,08	15,38	-2,51	0,00	3,76	-163,4	0,0
Sn108/N3176	CO1/3	9,26	-0,10	7,07	-1,42	0,00	3,07	-200,3	0,0
Sn108/N3176	CO1/4	5,84	0,09	14,23	-2,05	0,00	2,44	-144,0	0,0
Sn108/N3176	CO1/5	5,98	-0,02	17,77	-2,67	0,00	3,03	-150,1	0,0
Sn108/N3176	CO1/6	-2,44	0,02	14,07	-1,87	0,00	0,74	-133,0	0,0
Sn108/N3176	CO1/7	-4,79	-0,04	0,91	-0,09	0,00	-0,75	-99,3	-0,2
Sn108/N3176	CO1/8	9,56	-0,07	15,82	-2,58	0,00	3,82	-163,1	0,0

DEFORMACE

DEFORMATIONS

1D deformations; u_z

Values: u_z

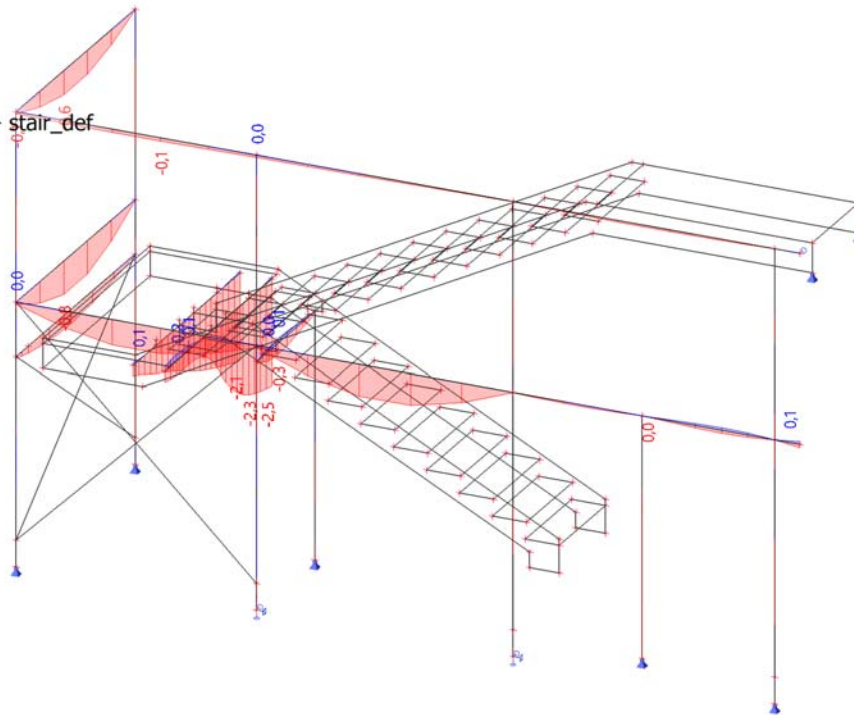
Linear calculation

Combination: CO2

Coordinate system: Global

Extreme 1D: Cross-section

Selection: Named selection - stair_def



1D deformations; u_x

Values: u_x

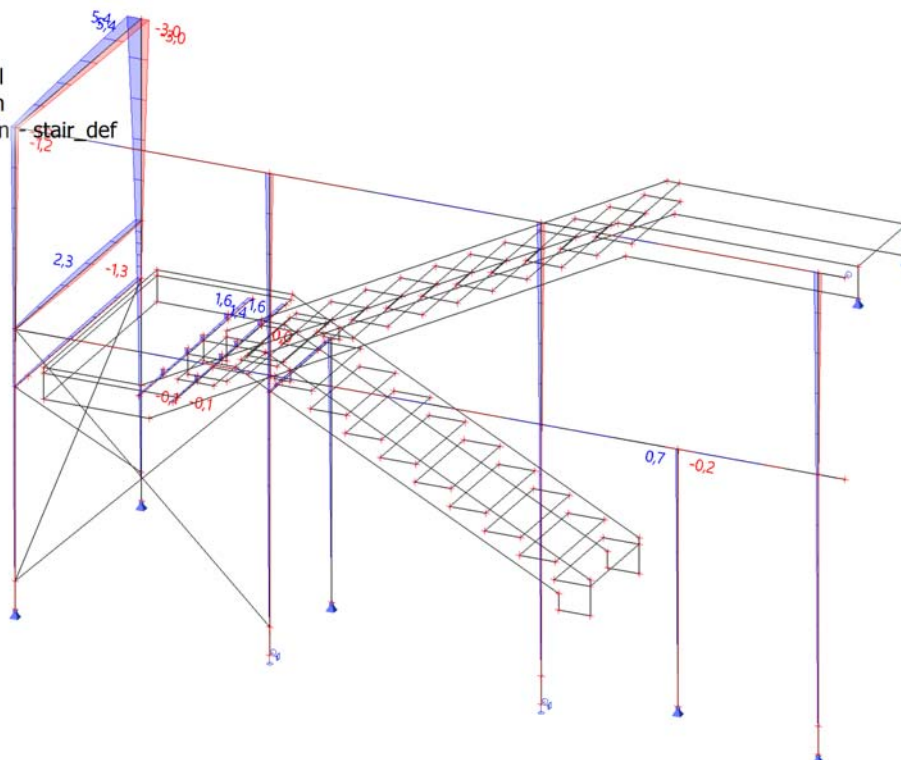
Linear calculation

Combination: CO2

Coordinate system: Global

Extreme 1D: Cross-section

Selection: Named selection - stair_def



1D deformations; u_y

Values: u_y

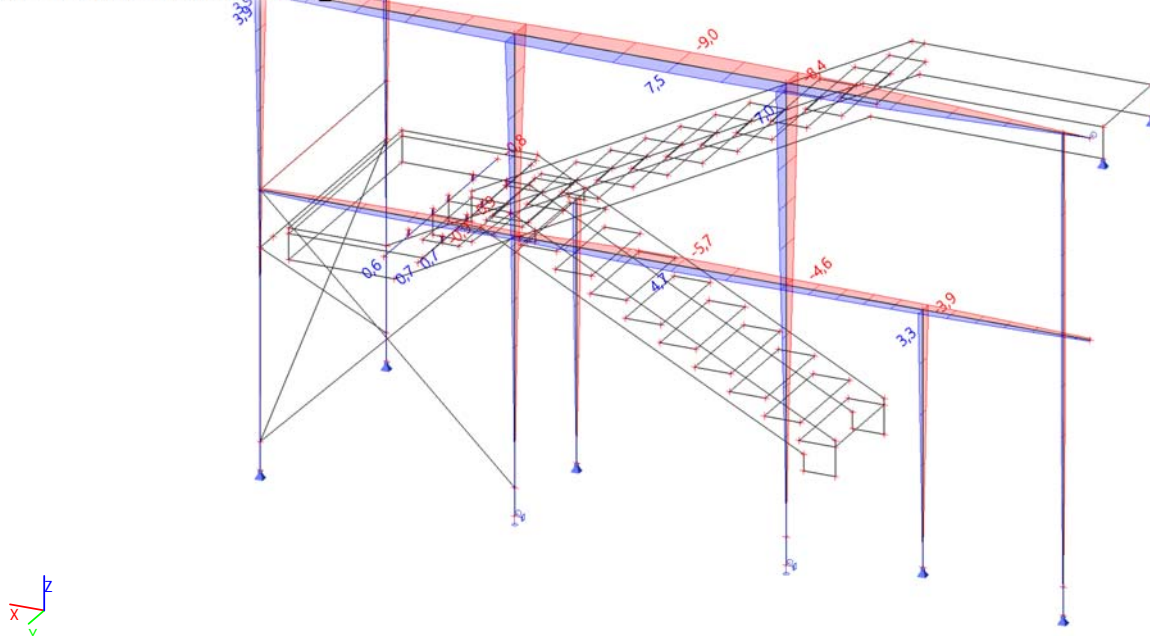
Linear calculation

Combination: CO2

Coordinate system: Global

Extreme 1D: Cross-section

Selection: Named selection - stair_def



Deformations on member

Linear calculation, Extreme : Global

Selection : Named selection - H2_def

Combinations : CO2

Member	dx [mm]	Case	ux [mm]	uy [mm]	uz [mm]	fix [mrad]	fiy [mrad]	fiz [mrad]	Resultant [mm]
B439	549,500	CO2/1	-9,0	1,9	-1,7	-0,4	0,3	-0,2	9,4
B439	649,410	CO2/2	11,2	0,1	2,0	0,0	-0,2	0,2	11,4
B252	4020,000	CO2/3	-2,2	-12,9	-0,2	0,0	-0,1	0,0	13,1
B252	4200,000	CO2/4	0,1	14,5	0,0	-0,5	0,0	0,1	14,5
B455	1830,000	CO2/4	-0,1	3,4	-18,3	1,4	-0,6	0,0	18,6
B455	1830,000	CO2/5	0,2	3,4	15,5	-0,6	0,9	0,0	15,8
B330	0,000	CO2/3	0,1	0,0	2,5	-5,4	0,4	0,2	2,5
B331	0,000	CO2/4	0,0	0,0	-2,6	5,7	0,5	0,0	2,6
B455	3660,000	CO2/4	-0,1	0,0	-6,7	1,5	-9,7	-3,0	6,7
B455	3660,000	CO2/5	0,2	0,0	3,4	-0,6	10,0	-3,0	3,4
B455	3660,000	CO2/6	-1,2	0,0	0,2	-0,1	0,0	-3,0	1,2
B455	0,000	CO2/5	0,2	0,0	6,6	-0,5	-8,3	3,0	6,6

DEFORMATIONS OF PLATE ELEMENTS

2D displacement; u_z

Values: u_z

Linear calculation

Combination: CO2

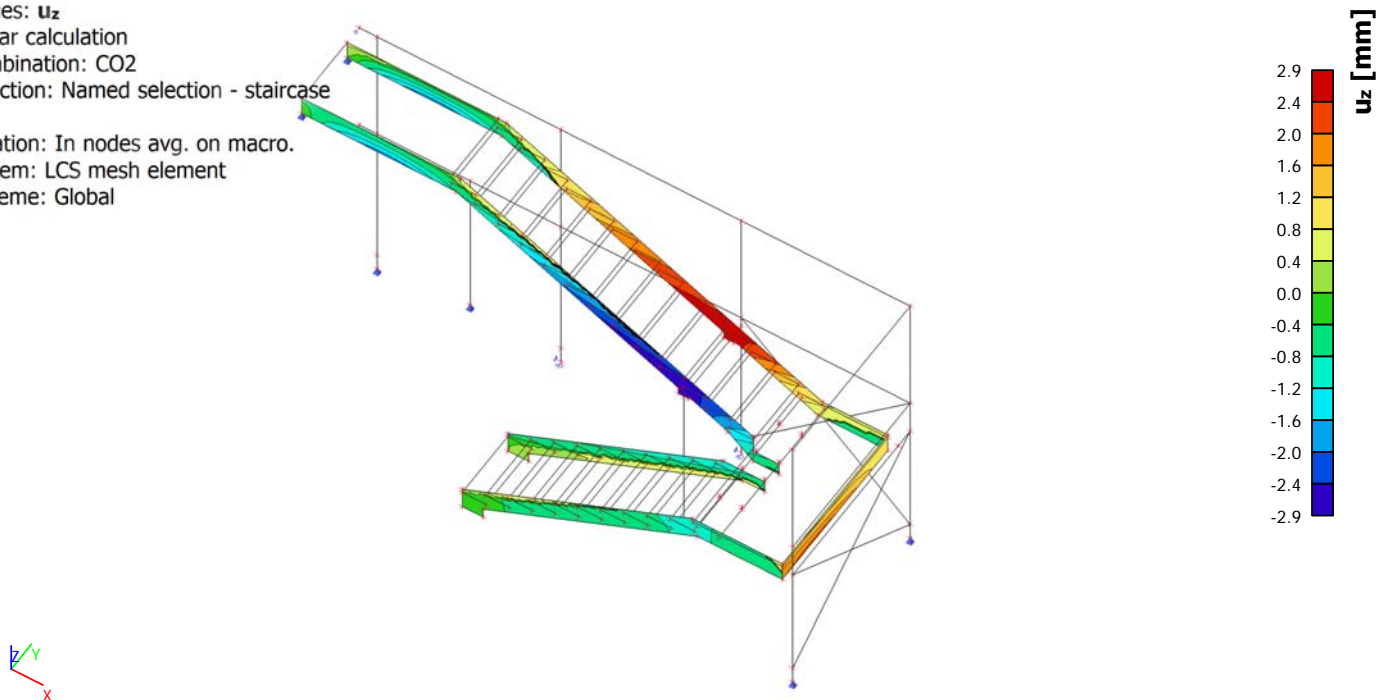
Selection: Named selection - staircase

2D

Location: In nodes avg. on macro.

System: LCS mesh element

Extreme: Global



2D displacement

Linear calculation

Combination: CO2

Selection: Named selection - staircase 2D

Location: In nodes avg. on macro. System: LCS mesh element

Extreme: Global

Name	Case	u_x [mm]	u_y [mm]	u_z [mm]	ϕ_x [mrad]	ϕ_y [mrad]	ϕ_z [mrad]	U_{total} [mm]
S118	CO2/1	-0,6	0,0	0,1	-0,2	0,5	0,0	1,2
S116	CO2/2	2,0	3,1	0,1	0,4	-0,4	-0,3	3,8
S117	CO2/2	0,1	-1,5	-0,4	1,8	-0,6	0,0	1,8
S116	CO2/2	2,0	3,1	0,0	0,4	-0,3	0,1	3,8
S119	CO2/3	0,8	0,1	-2,9	-1,4	-1,6	0,0	3,6
S120	CO2/3	0,3	-0,2	2,9	-2,0	1,3	0,1	3,4
S115	CO2/2	0,3	1,3	0,1	-5,8	-0,1	1,0	1,5
S117	CO2/4	0,2	-0,7	0,3	6,6	0,1	-0,6	1,1
S117	CO2/4	0,0	-1,1	-0,5	2,4	-2,3	-0,3	1,9
S115	CO2/4	0,0	0,0	0,0	1,7	3,2	1,9	0,0
S116	CO2/2	2,0	0,4	0,3	0,0	-0,1	-2,3	2,2
S116	CO2/2	0,0	0,0	0,0	1,0	0,6	2,9	0,0
S116	CO2/5	1,5	2,4	0,2	-0,3	0,0	-0,1	4,2

Name	Combination key
CO2/1	LC1 + LC2 + LC7
CO2/2	LC1 + LC2 + 0.60*LC4 + LC8
CO2/3	LC1 + LC2 + LC7 + 0.70*LC8
CO2/4	LC1 + LC2 + 0.60*LC7 + LC8
CO2/5	LC1 + LC2 + 0.60*LC5 + LC8

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STRESS ANALYSIS OF CROSS SECTIONS

CS31 - 1D internal forces; N

Values: **N**

Linear calculation

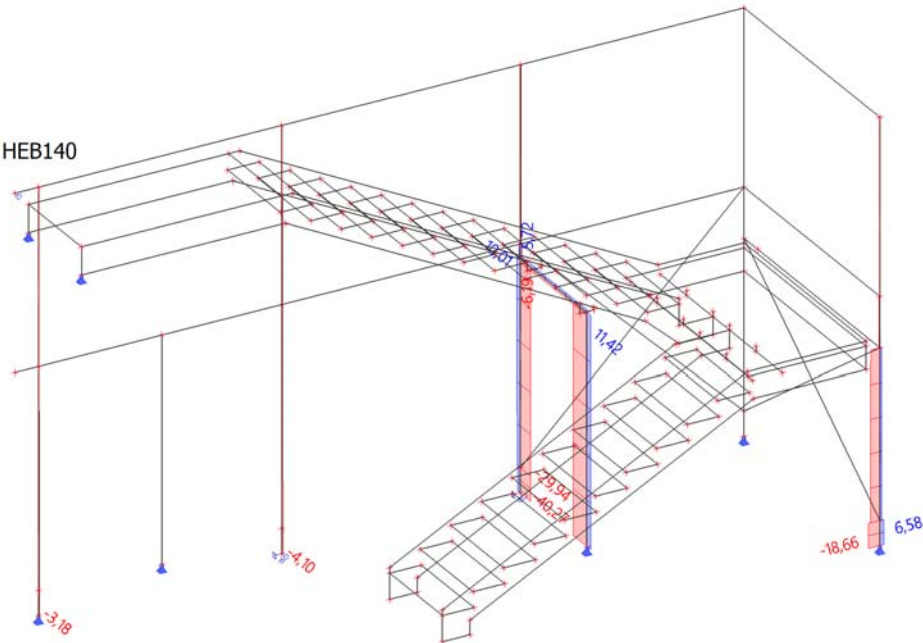
Combination: CO1

Coordinate system: Principal

Extreme 1D: Member

Selection: All

Filter: Cross-section = CS31 - HEB140



CS31 - 1D internal forces; M_y

Values: **M_y**

Linear calculation

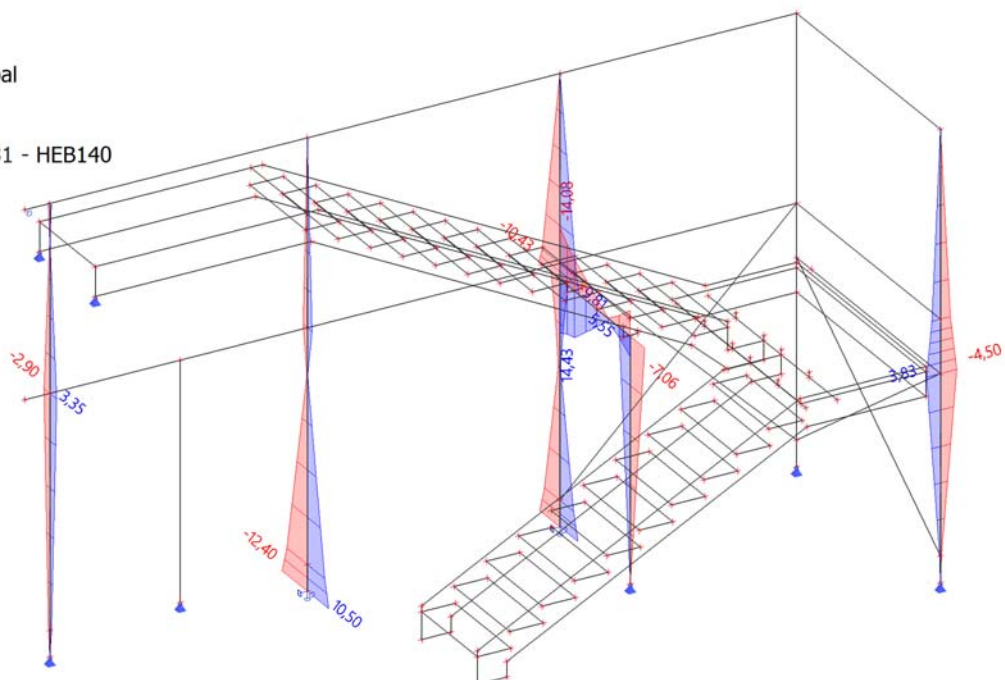
Combination: CO1

Coordinate system: Principal

Extreme 1D: Member

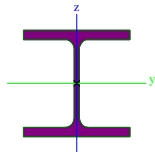
Selection: All

Filter: Cross-section = CS31 - HEB140



Cross-sections

Cross-sections - CS31

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
	Detailed						
CS31	HEB140	S 235	rolled	b	c		European wide flange beam

EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS31 - HEB140

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B173	0,000	CO1/1	CS31 - HEB140	S 235	0,25	0,25	0,24

Name	Combination key
CO1/1	LC1 + LC2 + 1.50*LC7

CS32 - 1D internal forces; N

Values: **N**

Linear calculation

Combination: CO1

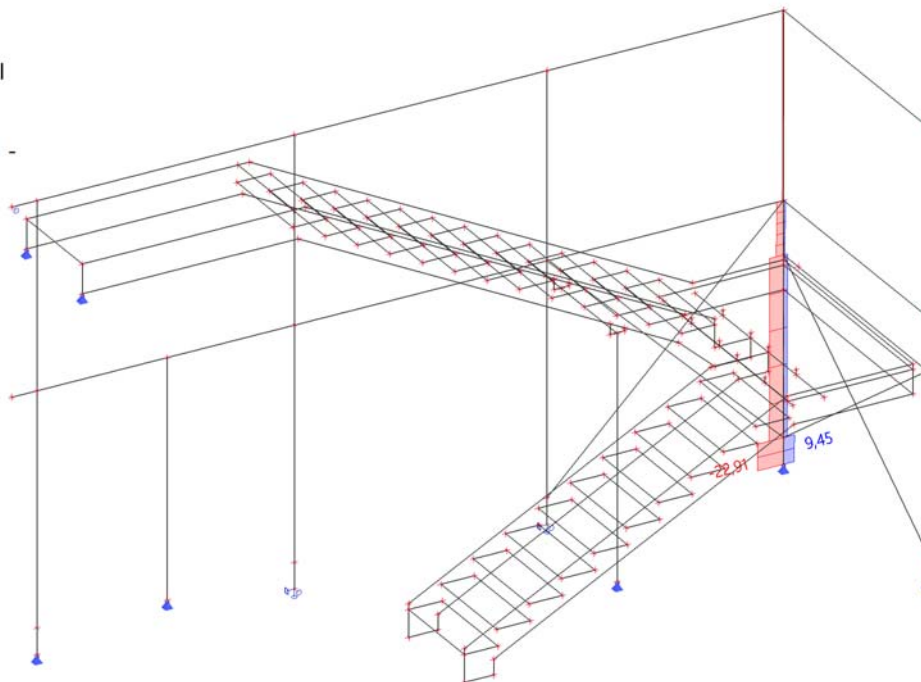
Coordinate system: Principal

Extreme 1D: Member

Selection: All

Filter: Cross-section = CS32 -

VHP140/140x4.0



Cross-sections

Cross-sections - CS32

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
CS32	Detailed VHP140/140x4.0	S 235	cold formed	c	c		Rectangular hollow section

EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS32 - VHP140/140x4.0

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B132	1960,000-	CO1/1	CS32 - VHP140/140x4.0	S 235	0,11	0,11	0,07

Name	Combination key
CO1/1	1.15*LC1 + 1.15*LC2 + 1.50*LC7 + 1.05*LC8

CS35 - 1D internal forces; M_y

Values: **M_y**

Linear calculation

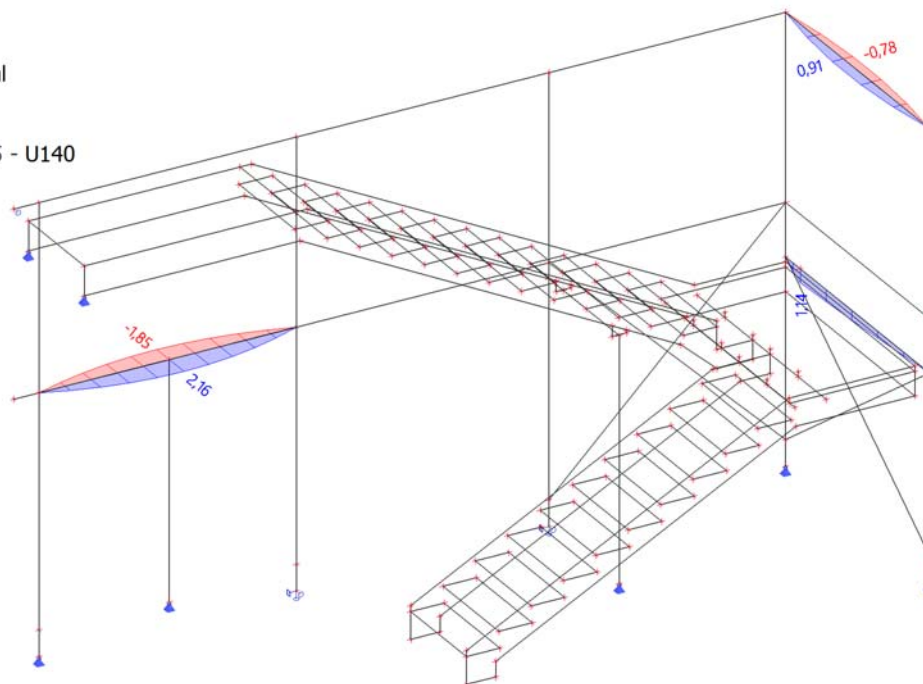
Combination: CO1

Coordinate system: Principal

Extreme 1D: Member

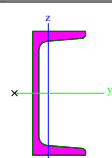
Selection: All

Filter: Cross-section = CS35 - U140



Cross-sections

Cross-sections - CS35

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
	Detailed						
CS35	U140	S 235	rolled	c	c		European standard channel

EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS35 - U140

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B140	1489,091-	CO1/1	CS35 - U140	S 235	0,09	0,09	0,00

Name	Combination key
CO1/1	LC1 + LC2 + 1.50*LC7

CS36 - 1D internal forces; M_y

Values: M_y

Linear calculation

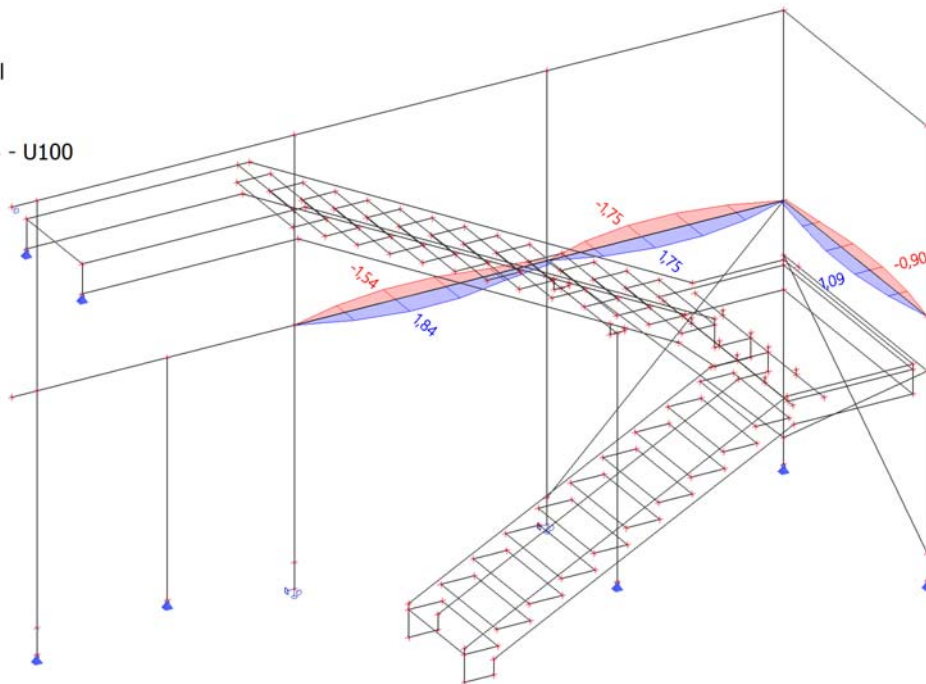
Combination: CO1

Coordinate system: Principal

Extreme 1D: Member

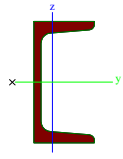
Selection: All

Filter: Cross-section = CS36 - U100



Cross-sections

Cross-sections - CS36

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
	Detailed						
CS36	U100	S 235	rolled	c	c		European standard channel

EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS36 - U100

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B141	967,045-	CO1/1	CS36 - U100	S 235	0,25	0,18	0,25

Name	Combination key
CO1/1	1.15*LC1 + 1.15*LC2 + 1.50*LC7 + 1.05*LC8

CS37 - 1D internal forces; M_y

Values: M_y

Linear calculation

Combination: CO1

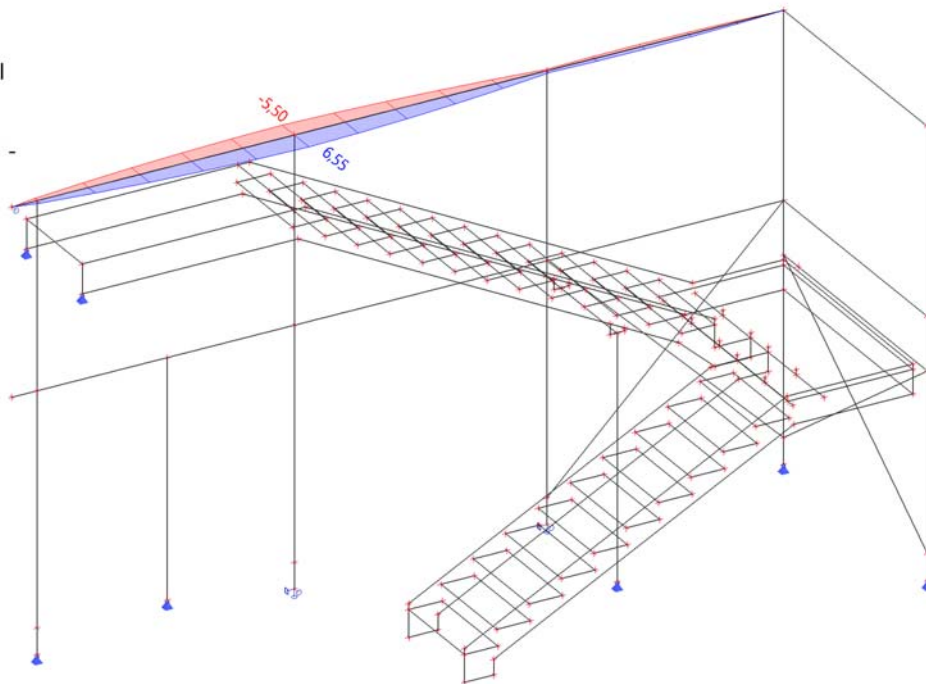
Coordinate system: Principal

Extreme 1D: Member

Selection: All

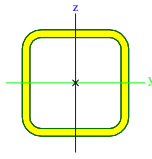
Filter: Cross-section = CS37 -

VHP140/140x10.0



Cross-sections

Cross-sections - CS37

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
	Detailed						
CS37	VHP140/140x10.0	S 235	cold formed	c	c		Rectangular hollow section

EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS37 - VHP140/140x10.0

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B119	2704,935+	CO1/1	CS37 - VHP140/140x10.0	S 235	0,12	0,12	0,11

Name	Combination key
CO1/1	1.15*LC1 + 1.15*LC2 + 1.50*LC7 + 1.05*LC8

CS38 - 1D internal forces; N

Values: **N**

Linear calculation

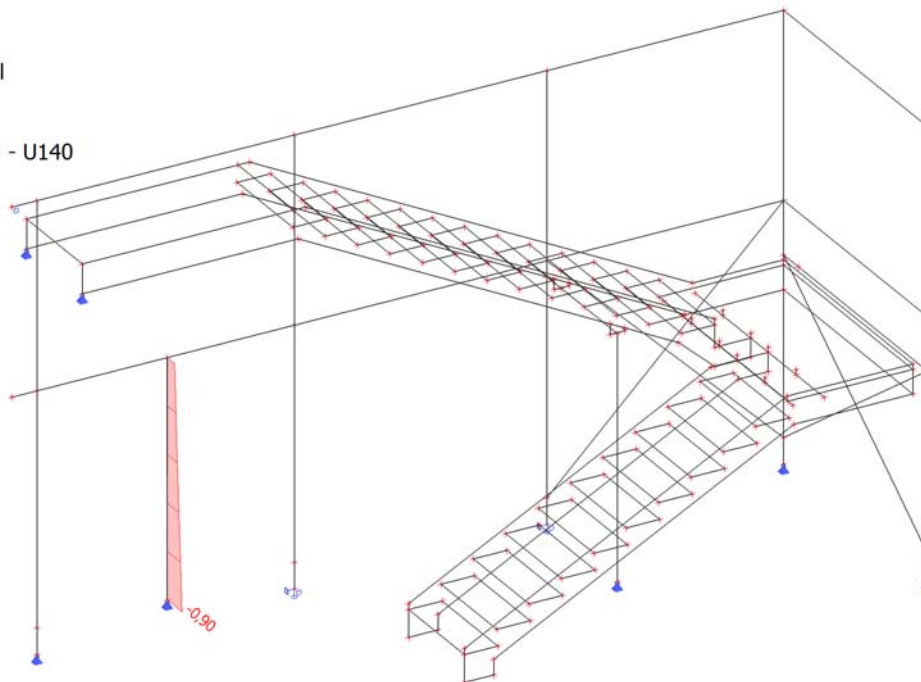
Combination: CO1

Coordinate system: Principal

Extreme 1D: Member

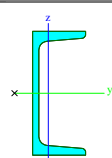
Selection: All

Filter: Cross-section = CS38 - U140



Cross-sections

Cross-sections - CS38

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
	Detailed						
CS38	U140	S 235	rolled	c	c		European standard channel

EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS38 - U140

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B235	2269,565	CO1/1	CS38 - U140	S 235	0,00	0,00	0,00

Name	Combination key
CO1/1	1.35*LC1 + 1.35*LC2 + 0.90*LC4 + 1.05*LC8

CS41 - 1D internal forces; N

Values: **N**

Linear calculation

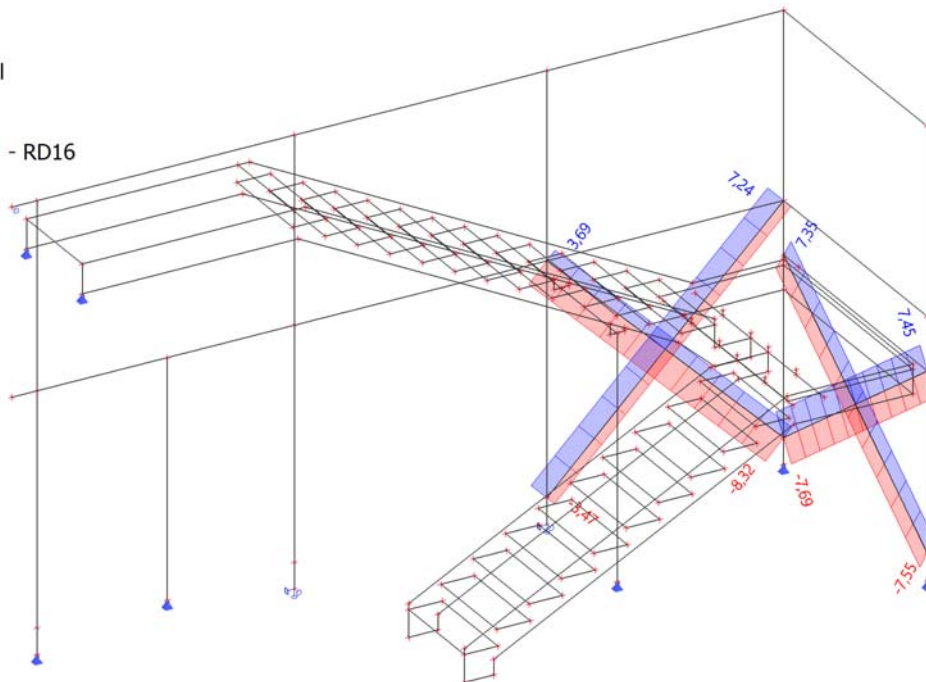
Combination: CO1

Coordinate system: Principal

Extreme 1D: Member

Selection: All

Filter: Cross-section = CS41 - RD16



Cross-sections

Cross-sections - CS41

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
	Detailed						
CS41	RD16	S 235	rolled	c	c		Round bar

EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS41 - RD16

There are 2 warnings on selected members. 2 of them are shown.

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]	Errors, warnings, notes
B145	0,000	CO1/1	CS41 - RD16	S 235	0,33	0,18	0,33	W2, W9

Name	Combination key
CO1/1	1.15*LC1 + 1.15*LC2 + 1.50*LC4 + 1.05*LC8

CS47 - 1D internal forces; M_y

Values: M_y

Linear calculation

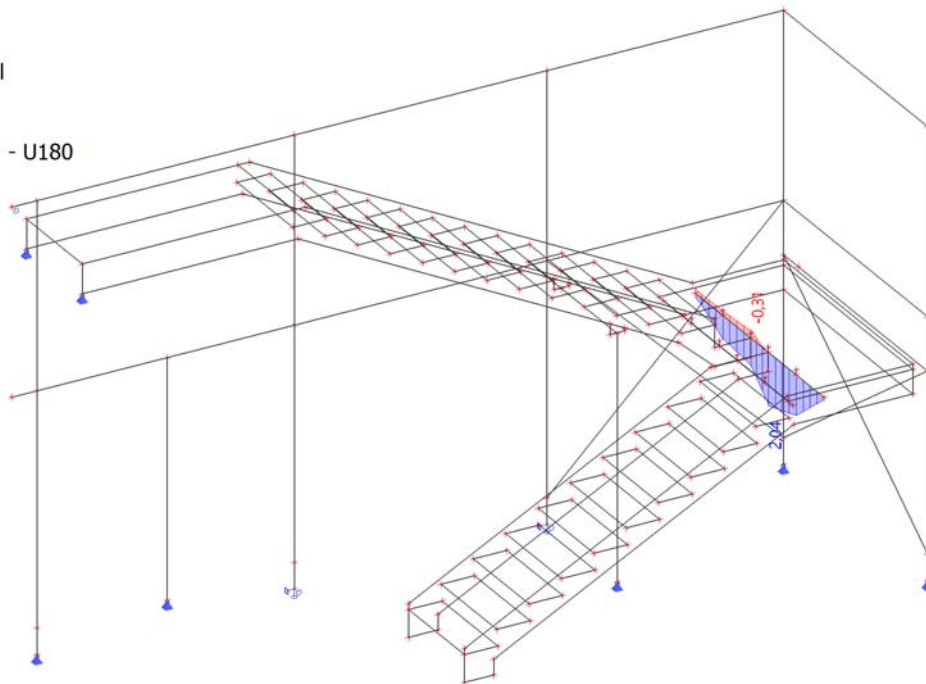
Combination: CO1

Coordinate system: Principal

Extreme 1D: Member

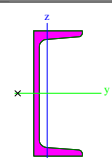
Selection: All

Filter: Cross-section = CS47 - U180



Cross-sections

Cross-sections - CS47

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
	Detailed						
CS47	U180	S 235	rolled	c	c		European standard channel

EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS47 - U180

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B159	1250,000+	CO1/1	CS47 - U180	S 235	0,07	0,07	0,00

CS48 - 1D internal forces; M_y

Values: M_y

Linear calculation

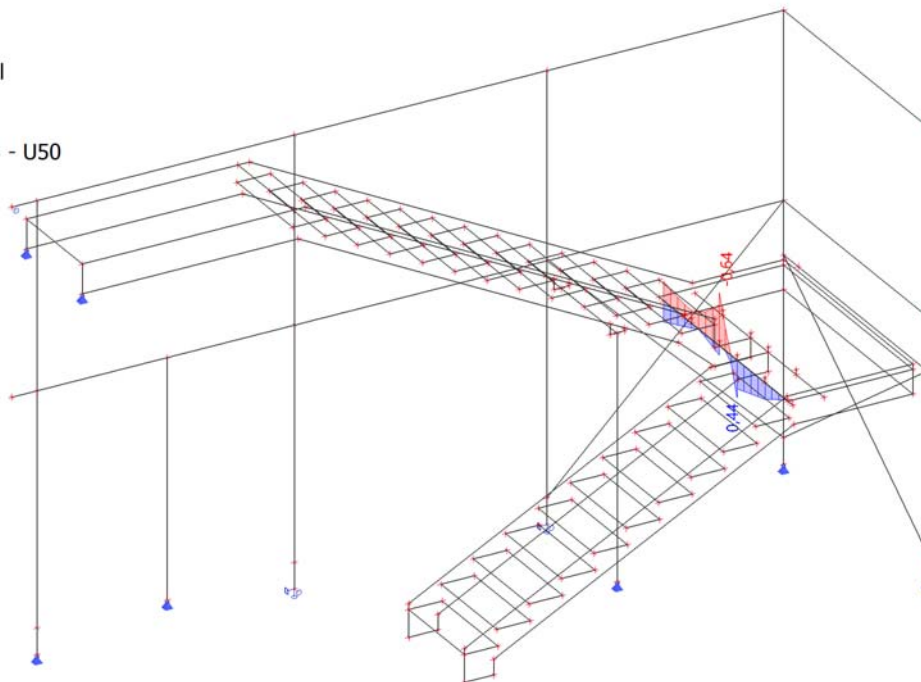
Combination: CO1

Coordinate system: Principal

Extreme 1D: Member

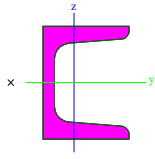
Selection: All

Filter: Cross-section = CS48 - U50



Cross-sections

Cross-sections - CS48

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
	Detailed						
CS48	U50	S 235	rolled	c	c		European standard channel

EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS48 - U50

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B160	950,000+	CO1/1	CS48 - U50	S 235	0,25	0,25	0,00

Name	Combination key
CO1/1	1.15*LC1 + 1.15*LC2 + 0.90*LC4 + 1.50*LC8

STRESS ANALYSIS OF PLATE ELEMENTS

2D stress/strain

Values: σ_{E+}

Linear calculation

Combination: CO1

Selection: Named selection - staircase

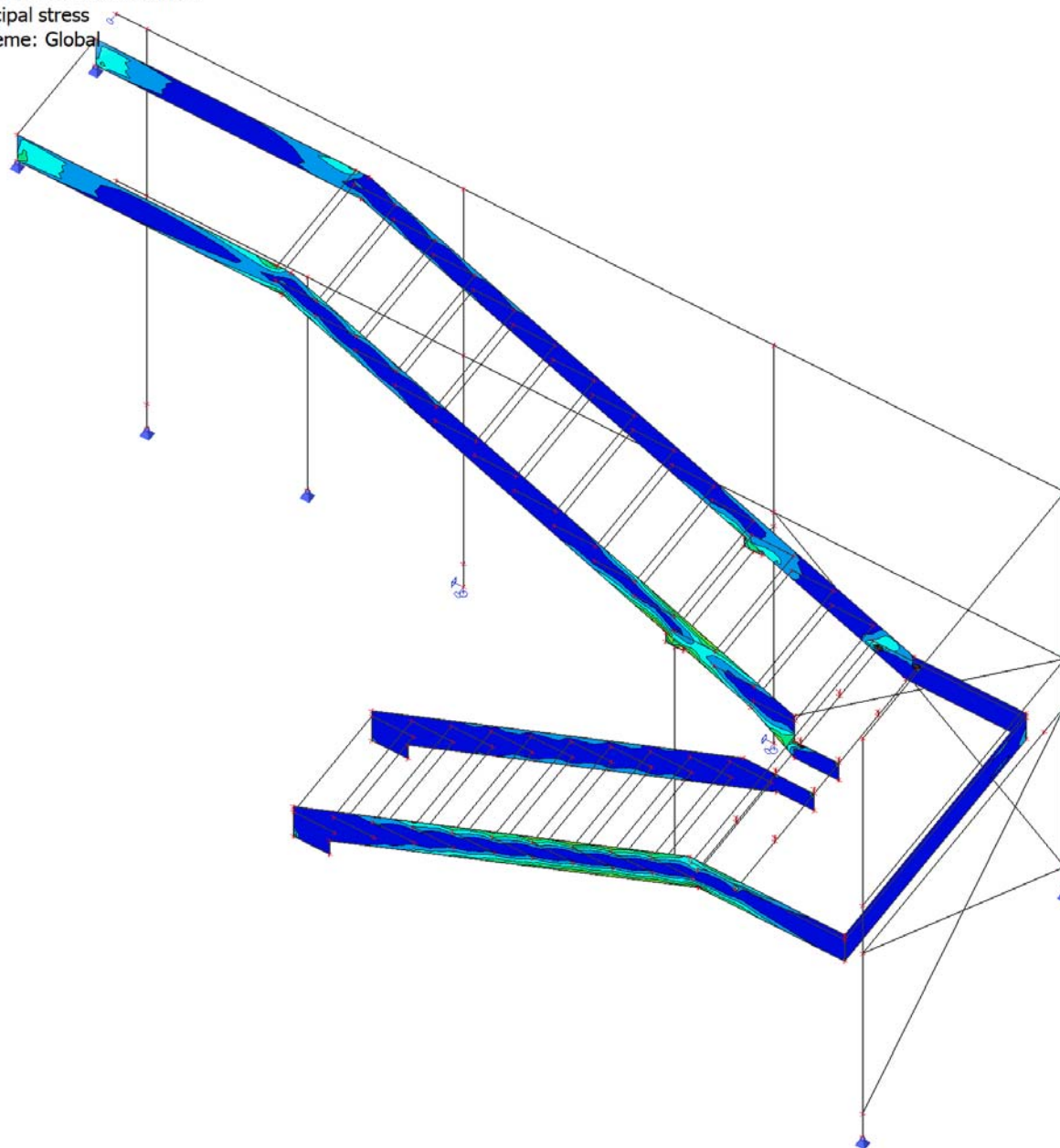
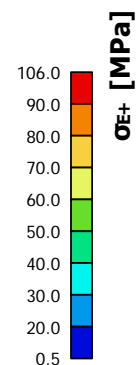
2D

Location: In nodes avg. on macro.

System: LCS mesh element

Principal stress

Extreme: Global



2D member - Stresses

Linear calculation, Extreme : Global

Selection : All

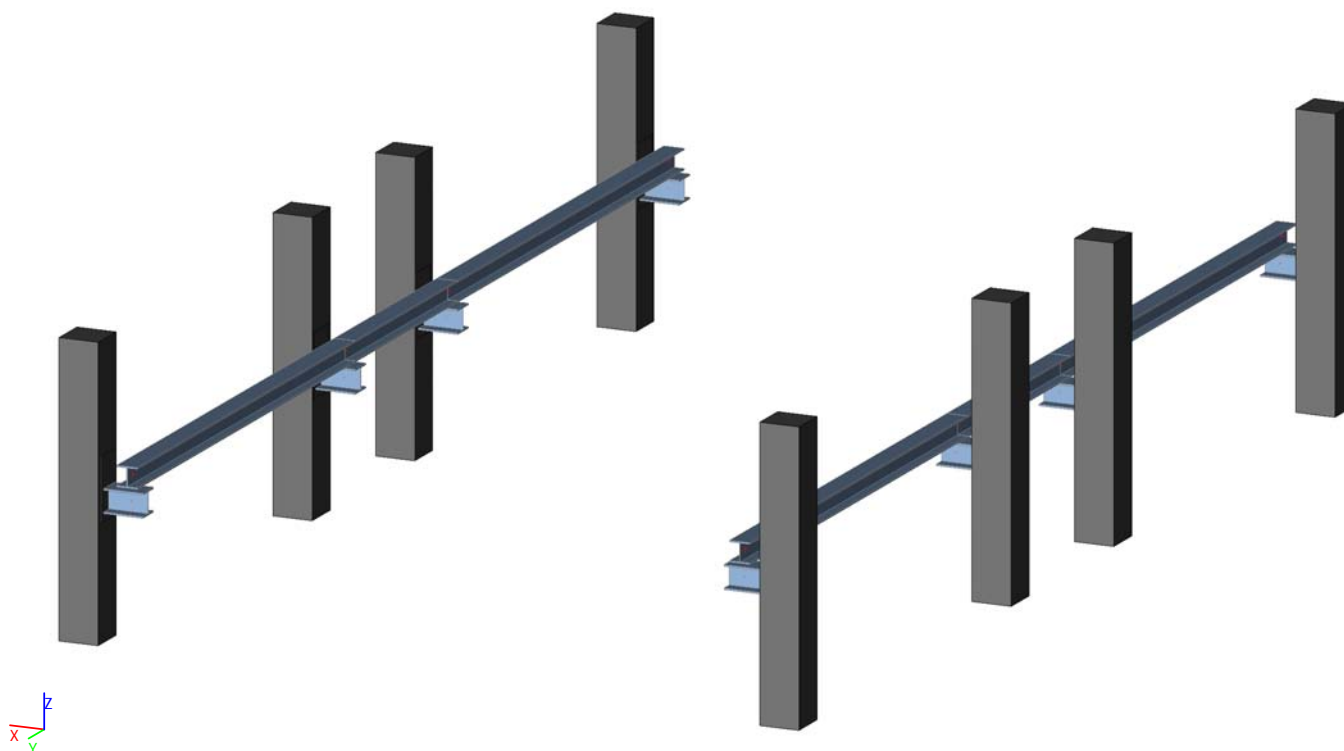
Combinations : CO2

Principal magnitudes. In nodes, avg. on macro.

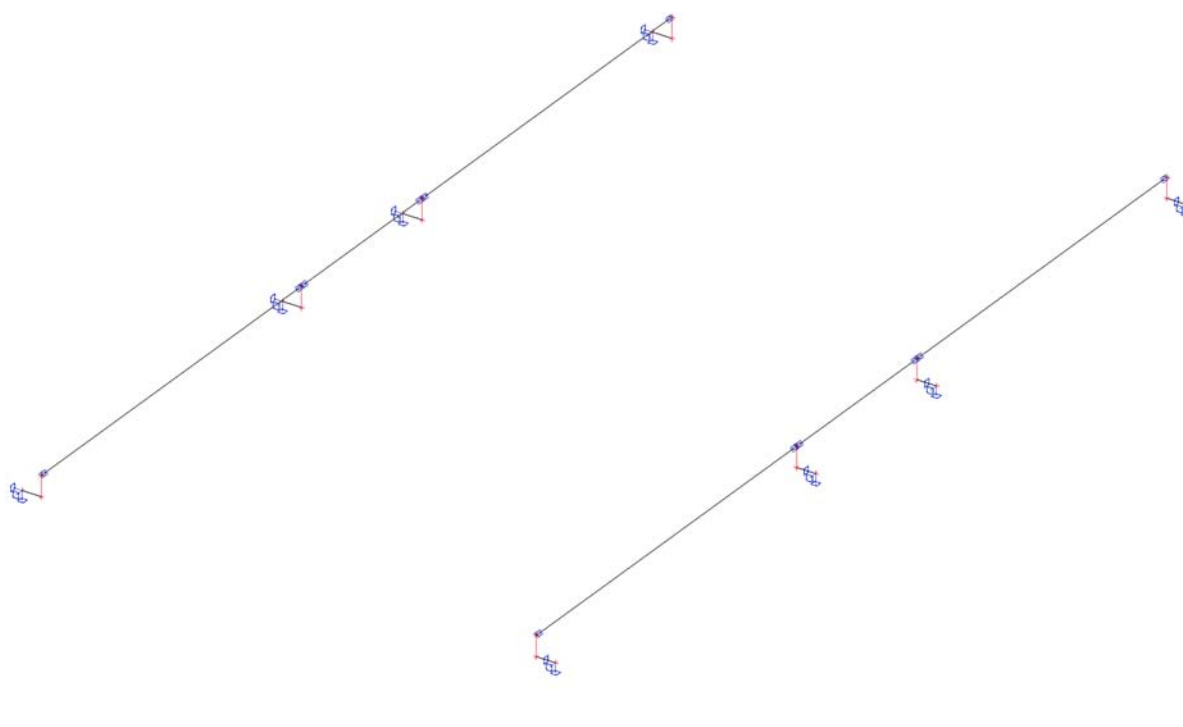
Member	Case	elem	sig1+ [MPa]	sig2+ [MPa]	alfa+ [deg]	sigE+ [MPa]	taumaxb [MPa]
			sig1- [MPa]	sig2- [MPa]	alfa- [deg]	sigE- [MPa]	
S629	CO2	28276	-26,8	-81,0	-81,52	6,6	0,6
			-10,6	-42,6	-60,63	8,8	
S537	CO2	10572	111,3	27,1	64,37	100,5	9,2
			65,6	16,4	67,00	68,6	
S117	CO2	6691	53,5	35,9	54,47	47,2	9,5
			26,6	18,3	51,94	45,7	
S560	CO2	19485	-3,3	-11,5	-90,00	10,2	0,1
			-7,0	-24,7	-89,38	9,7	
S563	CO2	22312	8,7	2,6	90,00	17,3	0,0
			16,0	5,7	88,03	14,0	
S469	CO2	10414	0,0	0,0	-0,63	0,0	0,0
			0,0	0,0	-0,46	0,0	
S117	CO2	6691	-19,8	-27,0	-43,93	24,2	4,8
			-35,3	-51,6	-36,61	23,6	
S115	CO2	4949	57,0	2,8	11,33	63,6	15,2
			108,3	-20,9	43,44	142,1	
S533	CO2	10415	-15,1	-50,5	-33,95	36,9	6,1
			-23,7	-100,6	-9,67	65,7	
S629	CO2	28276	51,1	13,7	41,46	71,5	3,4
			80,7	31,0	82,26	70,6	
S556	CO2	14556	-3,8	-20,2	-0,07	7,9	0,0
			-1,9	-8,0	-90,00	7,0	
S560	CO2	19412	15,1	3,7	88,88	13,6	0,2
			6,9	1,8	90,00	14,1	
S468	CO2	9005	0,0	0,0	0,46	0,0	0,0
			0,0	0,0	0,63	0,0	
S468	CO2	8390	0,0	-0,2	0,01	0,2	0,0
			0,0	-0,2	0,00	0,2	

JEŘÁBOVÁ DRÁHA 4t, +5.600

3D MODEL OF STRUCTURE



Structural model



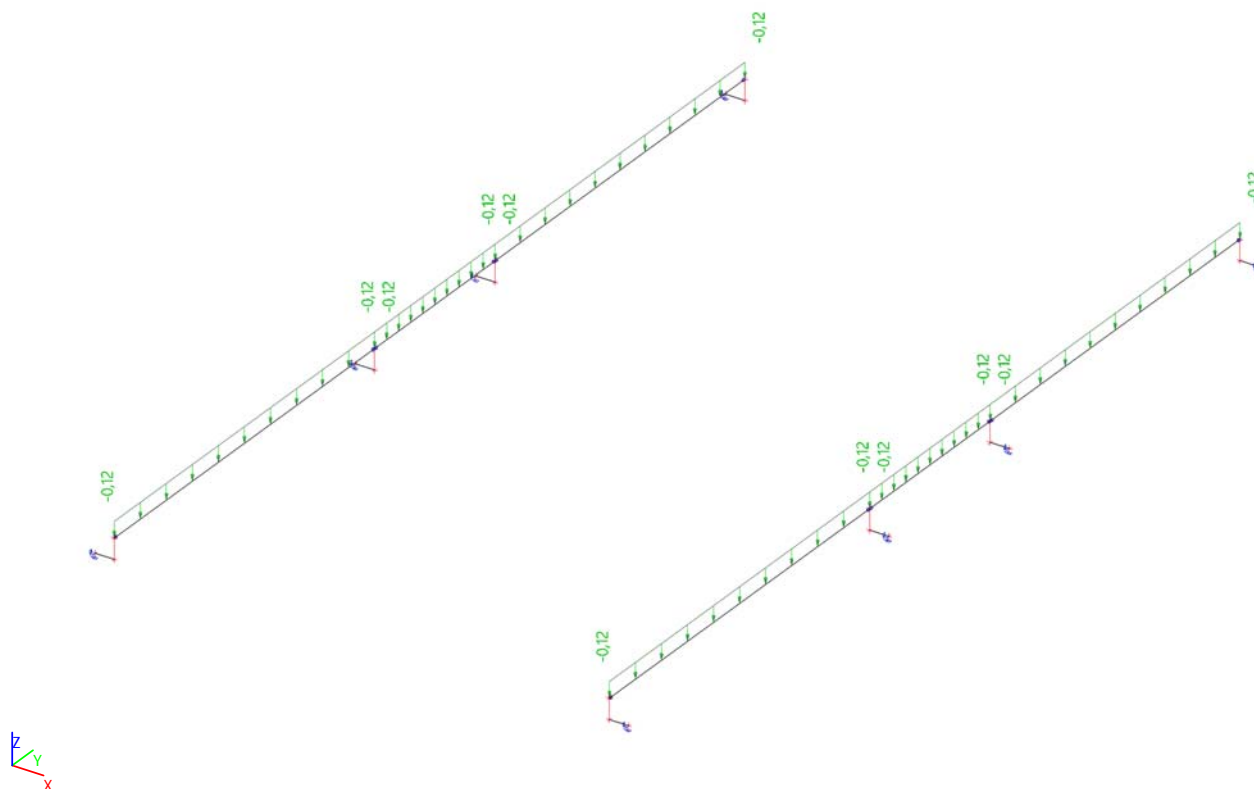
Project

Version	SCIA Engineer 17.1.2029
Licence number	555797
Project	Centrum Energetických a Enviromentálních Technologí
Part	SO 01.1 Objekt CEETe
Description	Ocelová konstrukce
Author	Ing. Jeřowicz
Date	Date
Structure	General XYZ
No. of nodes :	1258
No. of beams :	367
No. of slabs :	180
No. of solids :	1390
No. of used profiles :	33
No. of load cases :	14
No. of used materials :	3
Acceleration of gravity [m/s ²]	9,807
National code	EC - EN

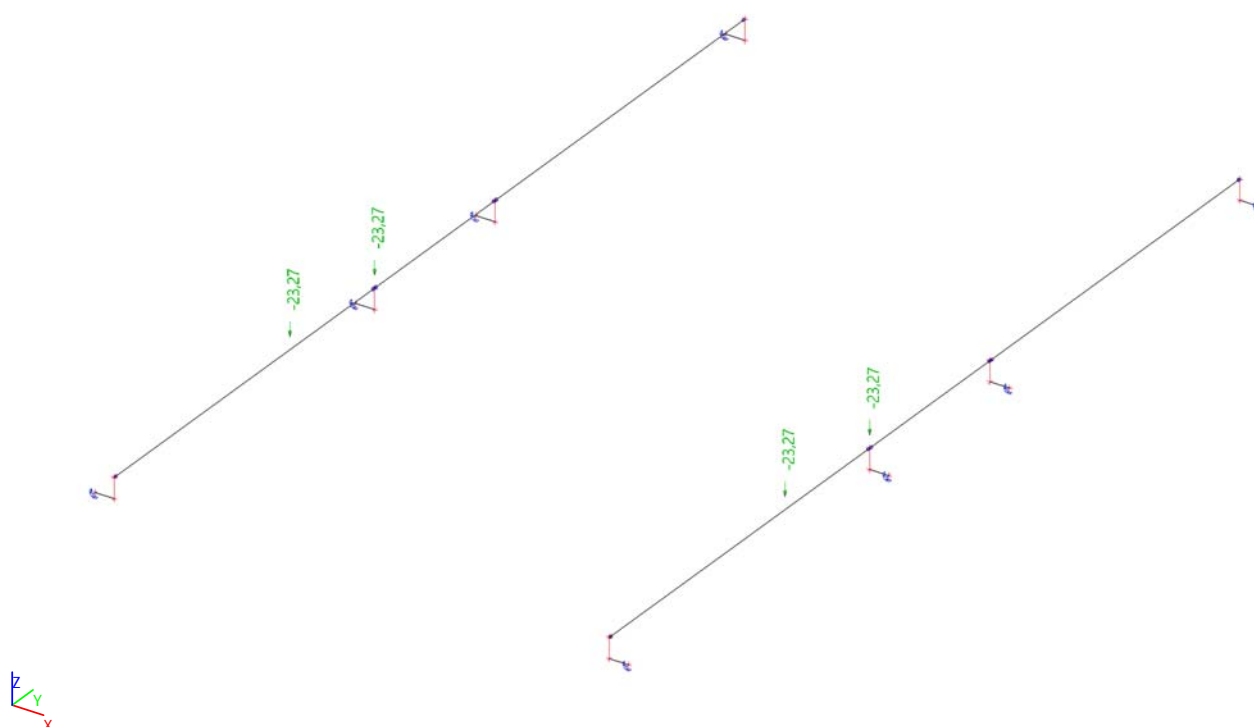
Load cases

Name	Description	Action type	Load group	Direction	Duration	Master load case
	Spec	Load type				
LC1	self weight	Permanent Self weight	LG1	-Z		
LC2	dead load	Permanent Standard	LG1			
LC3	snow/rime Standard	Variable Static	snow		Short	None
LC4	wind +x Standard	Variable Static	wind		Short	None
LC5	wind -x Standard	Variable Static	wind		Short	None
LC6	wind +y Standard	Variable Static	wind		Short	None
LC7	wind -y Standard	Variable Static	wind		Short	None
LC8	live load Standard	Variable Static	live		Short	None
LC9	Rmax (C) Standard	Variable Static	crane		Short	None
LC10	Ht+Hl_Rmax (C) Standard	Variable Static	Ht+Hl		Short	None
LC11	Hs_Rmax (C) Standard	Variable Static	Hs		Short	None
LC12	Mmax (C-D) Standard	Variable Static	crane		Short	None
LC13	Ht+Hl_Mmax (C-D) Standard	Variable Static	Ht+Hl		Short	None
LC14	Hs_Mmax (C-D) Standard	Variable Static	Hs		Short	None

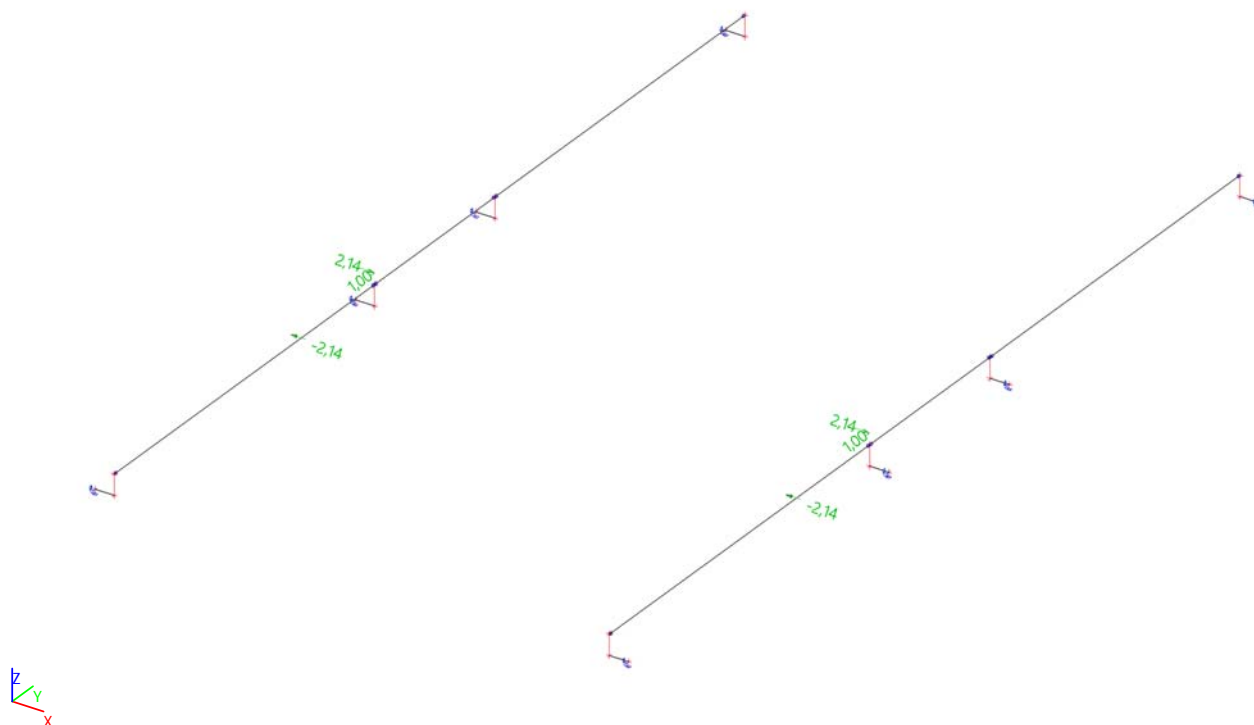
LC2 / Tot. value



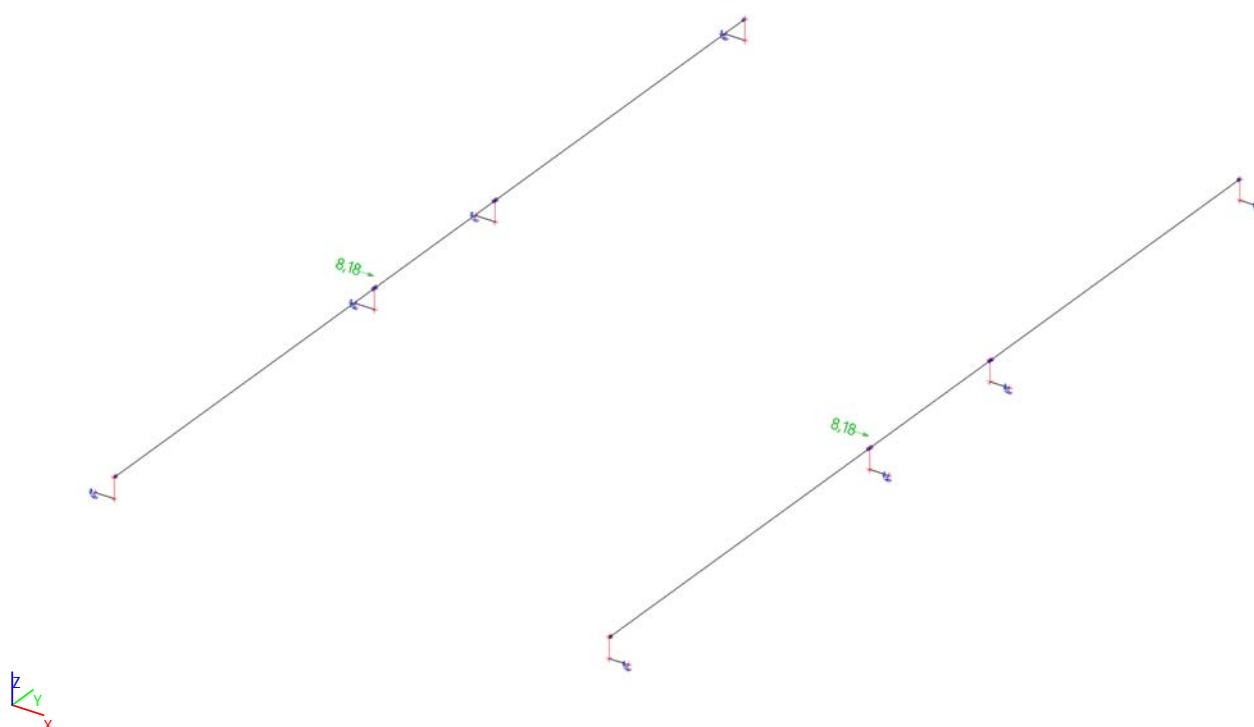
LC9 / Tot. value



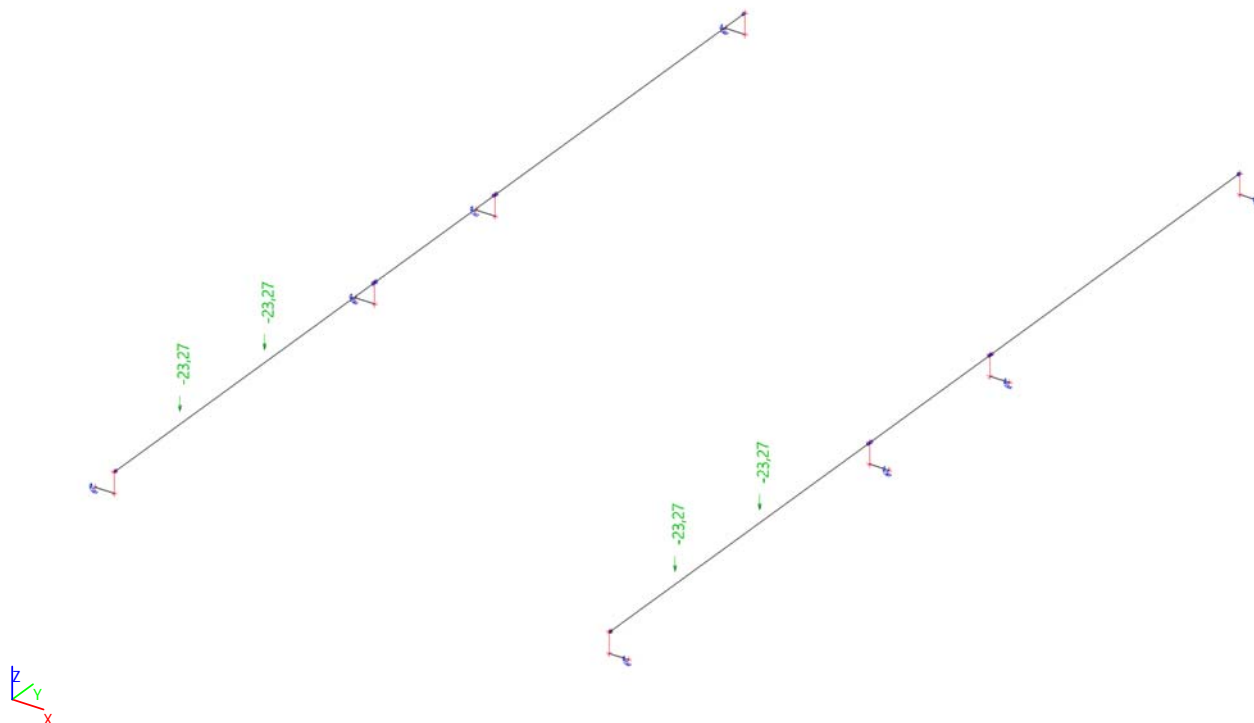
LC10 / Tot. value



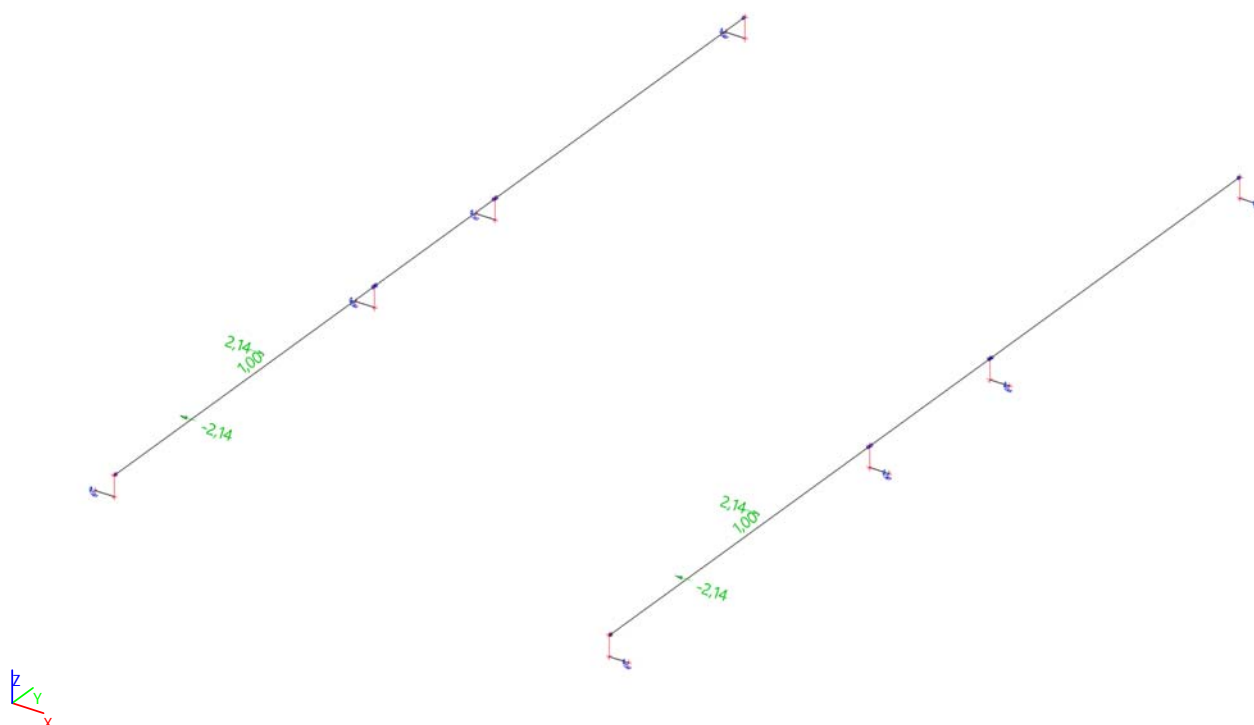
LC11 / Tot. value



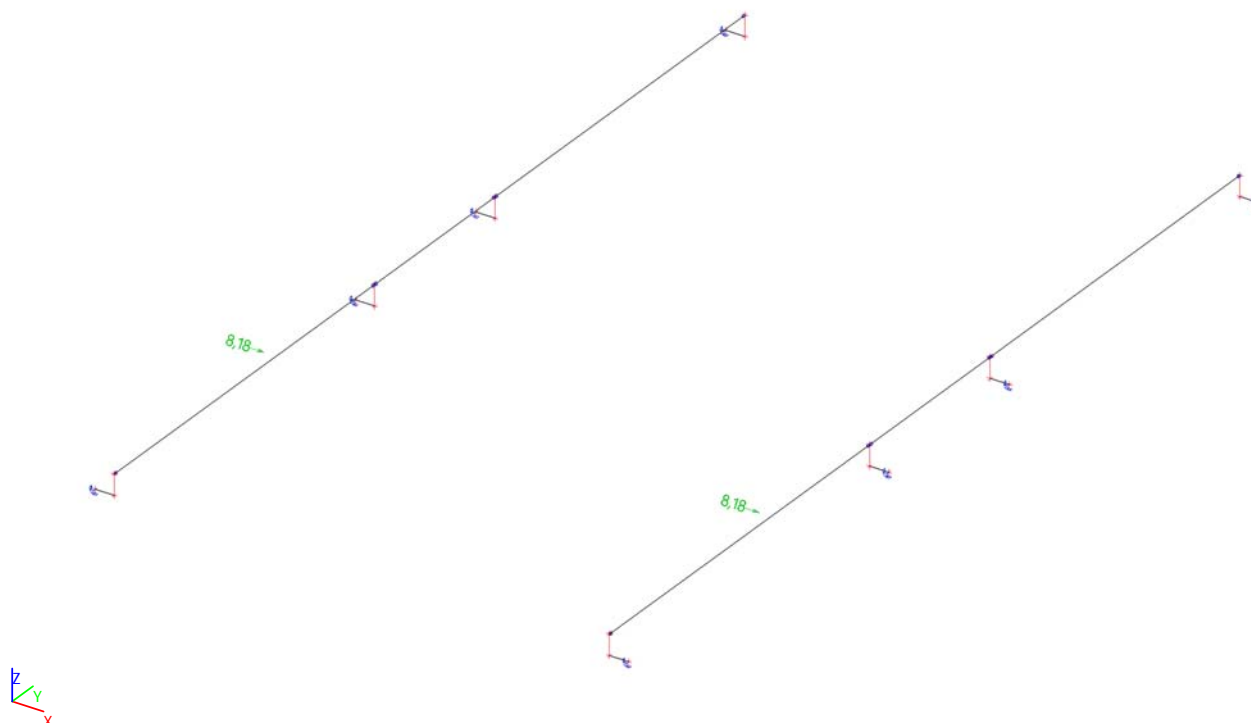
LC12 / Tot. value



LC13 / Tot. value



LC14 / Tot. value



Load groups

Name	Load	Relation	Type
LG1	Permanent		
snow	Variable	Exclusive	Snow
wind	Variable	Exclusive	Wind
live	Variable	Exclusive	Cat C : Congregation
crane	Variable	Exclusive	Cat F : Vehicle <30kN
Ht+Hl	Variable	Exclusive	Cat F : Vehicle <30kN
Hs	Variable	Exclusive	Cat F : Vehicle <30kN

Combinations

Name	Description	Type	Load cases	Coeff. [-]
CO1		EN-ULS (STR/GEO) Set B	LC1 - self weight	1,00
			LC2 - dead load	1,00
			LC3 - snow/rime	1,00
			LC4 - wind +x	1,00
			LC5 - wind -x	1,00
			LC6 - wind +y	1,00
			LC7 - wind -y	1,00
			LC8 - live load	1,00
CO2		EN-SLS Characteristic	LC1 - self weight	1,00
			LC2 - dead load	1,00
			LC3 - snow/rime	1,00
			LC4 - wind +x	1,00
			LC5 - wind -x	1,00
			LC6 - wind +y	1,00
			LC7 - wind -y	1,00
			LC8 - live load	1,00
Rmax +		Envelope - ultimate	LC1 - self weight	1,35
			LC9 - Rmax (C)	1,50

Name	Description	Type	Load cases	Coeff. [-]
			LC10 - Ht+Hl_Rmax (C)	1,35
			LC11 - Hs_Rmax (C)	1,35
Rmax -		Envelope - ultimate	LC1 - self weight	1,35
			LC9 - Rmax (C)	1,50
			LC10 - Ht+Hl_Rmax (C)	-1,35
			LC11 - Hs_Rmax (C)	-1,35
Mmax +		Envelope - ultimate	LC1 - self weight	1,35
			LC12 - Mmax (C-D)	1,50
			LC13 - Ht+Hl_Mmax (C-D)	1,35
			LC14 - Hs_Mmax (C-D)	1,35
Mmax -		Envelope - ultimate	LC1 - self weight	1,35
			LC12 - Mmax (C-D)	1,50
			LC13 - Ht+Hl_Mmax (C-D)	-1,35
			LC14 - Hs_Mmax (C-D)	-1,35
Mmax +def		Envelope - serviceability	LC1 - self weight	1,00
			LC12 - Mmax (C-D)	1,00
			LC13 - Ht+Hl_Mmax (C-D)	1,00
			LC14 - Hs_Mmax (C-D)	1,00
Mmax -def		Envelope - serviceability	LC1 - self weight	1,00
			LC12 - Mmax (C-D)	1,00
			LC13 - Ht+Hl_Mmax (C-D)	-1,00
			LC14 - Hs_Mmax (C-D)	-1,00

Result classes

Name	List
All ULS	CO1 - EN-ULS (STR/GEO) Set B
	Rmax + - Envelope - ultimate
	Rmax - - Envelope - ultimate
	Mmax + - Envelope - ultimate
	Mmax - - Envelope - ultimate
All SLS	CO2 - EN-SLS Characteristic
	Mmax +def - Envelope - serviceability
	Mmax -def - Envelope - serviceability

REAKCE

REACTIONS

Reactions; R_x ; R_y ; R_z ; M_x ; M_y ; M_z

Values: M_z , M_x , M_y , R_z , R_y , R_x

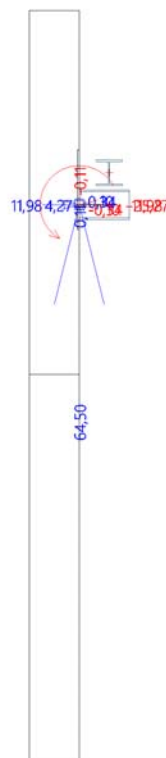
Linear calculation

Class: All ULS

System: Global

Extreme: Member

Selection: Named selection - R crane



Reactions

Linear calculation

Class: All ULS

System: Global

Extreme: Member

Selection: Named selection - R crane

Nodal reactions

Name	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]	e_x [mm]	e_y [mm]
Sn85/N2721	CO1/1	0,00	0,00	4,97	0,00	-1,44	0,00	0,0	-289,6
Sn85/N2721	Rmax -/2	11,98	0,34	5,96	-0,11	4,27	0,10	-18,3	716,2
Sn85/N2721	Rmax +/3	-11,98	-0,34	64,50	0,11	-25,27	-0,10	1,7	-391,7

DEFORMACE

DEFORMATIONS

1D deformations; u_x

Values: u_x

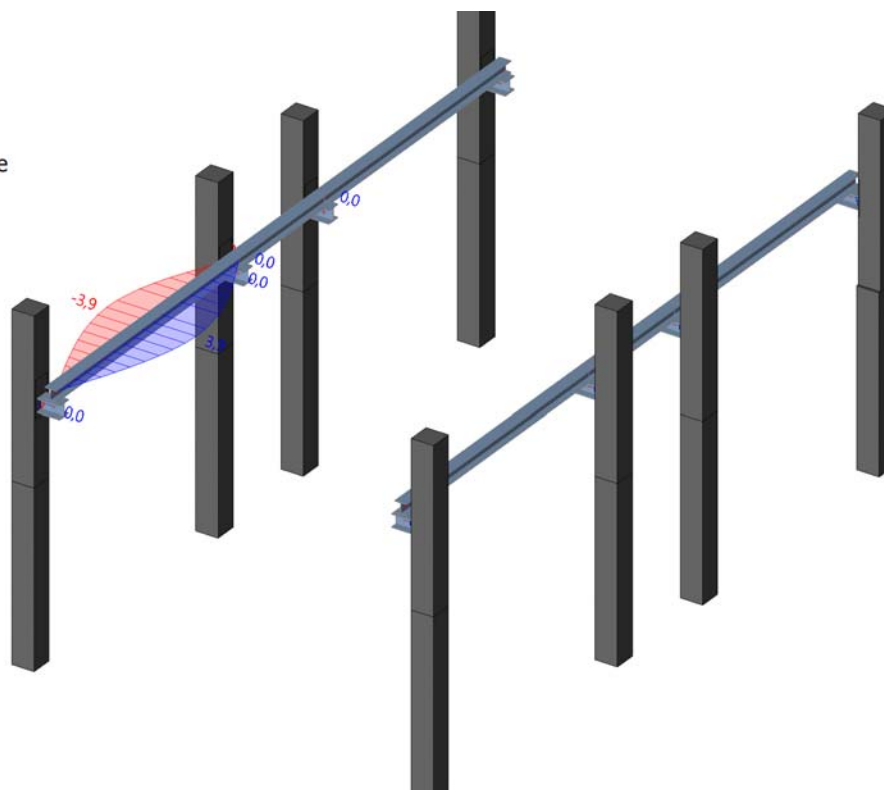
Linear calculation

Class: All SLS

Coordinate system: Global

Extreme 1D: Member

Selection: Named selection - def crane



1D deformations; u_z

Values: u_z

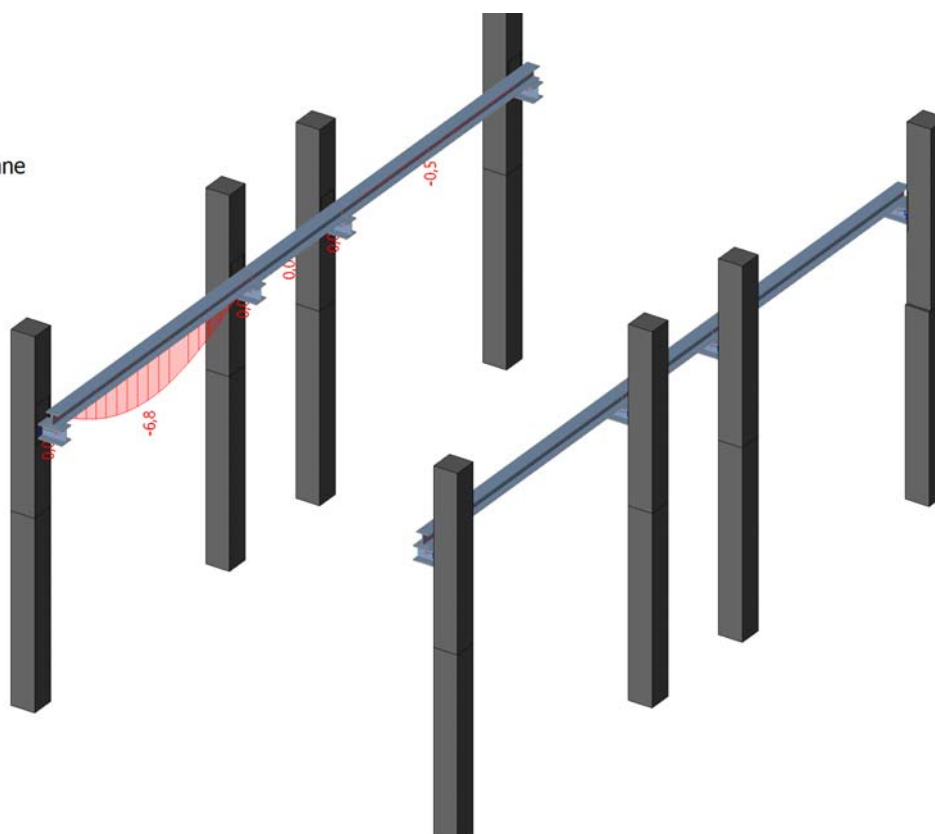
Linear calculation

Class: All SLS

Coordinate system: Global

Extreme 1D: Member

Selection: Named selection - def crane



Deformations on member

Linear calculation, Extreme : Global

Selection : Named selection - def crane

Class : All SLS

Member	dx [mm]	Case	ux [mm]	uy [mm]	uz [mm]	fix [mrad]	fiy [mrad]	fiz [mrad]	Resultant [mm]
B410	2600,000	Mmax +def/1	-0,1	0,3	-0,5	-3,3	0,1	0,0	0,6
B410	2600,000	Mmax -def/2	0,1	-0,3	-6,6	3,2	0,9	0,0	6,6
B410	2933,330	Mmax -def/3	0,1	-3,9	-0,6	22,4	0,0	0,1	3,9
B410	2933,330	Mmax +def/4	-0,1	3,9	-6,7	-22,4	0,3	-0,1	7,8
B410	3266,670	Mmax -def/2	0,1	-0,2	-6,8	1,5	-0,2	0,1	6,8
B413	300,000	Mmax -def/2	0,0	0,0	0,0	0,0	0,0	0,0	0,0
B410	2600,000	Mmax +def/4	-0,1	3,8	-6,6	-25,4	0,9	0,3	7,6
B410	2600,000	Mmax -def/3	0,1	-3,8	-0,6	25,4	0,1	-0,3	3,9
B410	6149,880	Mmax -def/2	0,1	0,0	0,0	0,0	-3,5	0,0	0,1
B410	0,000	Mmax -def/5	0,1	0,0	0,0	0,0	3,2	-2,0	0,1
B410	0,000	Mmax -def/3	0,1	0,0	0,0	0,0	0,3	-2,0	0,1
B410	0,000	Mmax +def/4	-0,1	0,0	0,0	0,0	3,2	2,0	0,1

VNITŘNÍ SÍLY A POSOUZENÍ PŘŮŘEZŮ

STRESS ANALYSIS OF CROSS SECTIONS

CS76 - 1D internal forces; M_y

Values: M_y

Linear calculation

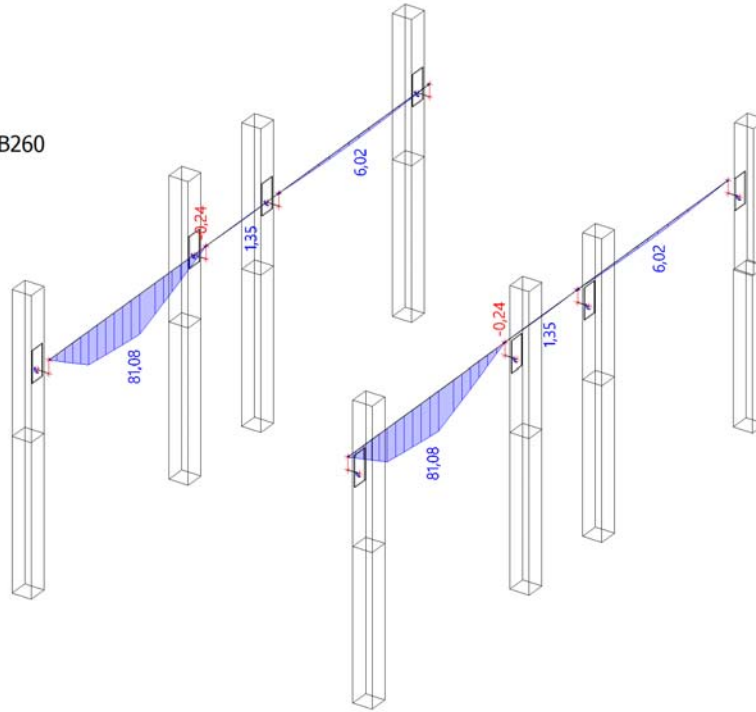
Class: All ULS

Coordinate system: Principal

Extreme 1D: Member

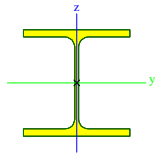
Selection: All

Filter: Cross-section = CS76 - HEB260



Cross-sections

Cross-sections - CS76

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
	Detailed						
CS76	HEB260	S 235	rolled	b	c		European wide flange beam

EC-EN 1993 Steel check ULS

Linear calculation

Class: All ULS

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS76 - HEB260

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B410	2600,000-	Mmax +/1	CS76 - HEB260	S 235	0,31	0,27	0,31

Name	Combination key
Mmax +/1	1.35*LC1 + 1.50*LC12 + 1.35*LC13 + 1.35*LC14

CS77 - 1D internal forces; M_y

Values: **M_y**

Linear calculation

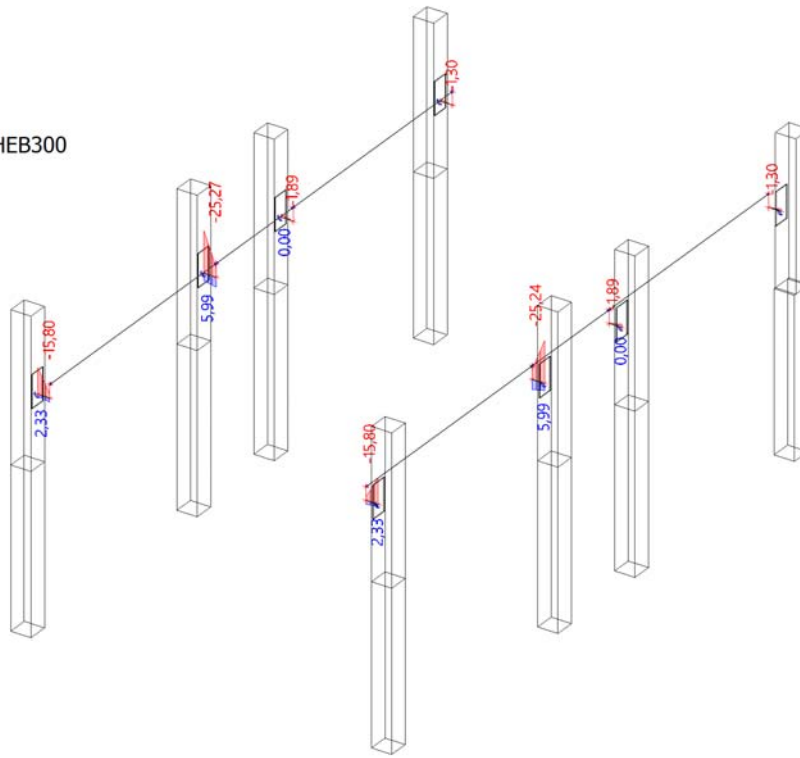
Class: All ULS

Coordinate system: Principal

Extreme 1D: Member

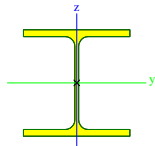
Selection: All

Filter: Cross-section = CS77 - HEB300



Cross-sections

Cross-sections - CS77

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
	Detailed						
CS77	HEB300	S 235	rolled	b	c		European wide flange beam

EC-EN 1993 Steel check ULS

Linear calculation

Class: All ULS

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS77 - HEB300

There are 2 warnings on selected members. 2 of them are shown.

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]	Errors, warnings, notes
B414	300,002	Rmax +/1	CS77 - HEB300	S 235	0,10	0,10	0,00	W19, W22

Name	Combination key
Rmax +/1	1.35*LC1 + 1.50*LC9 + 1.35*LC10

FATIGUE

1D stresses; σ_x - fatigue

Values: σ_x

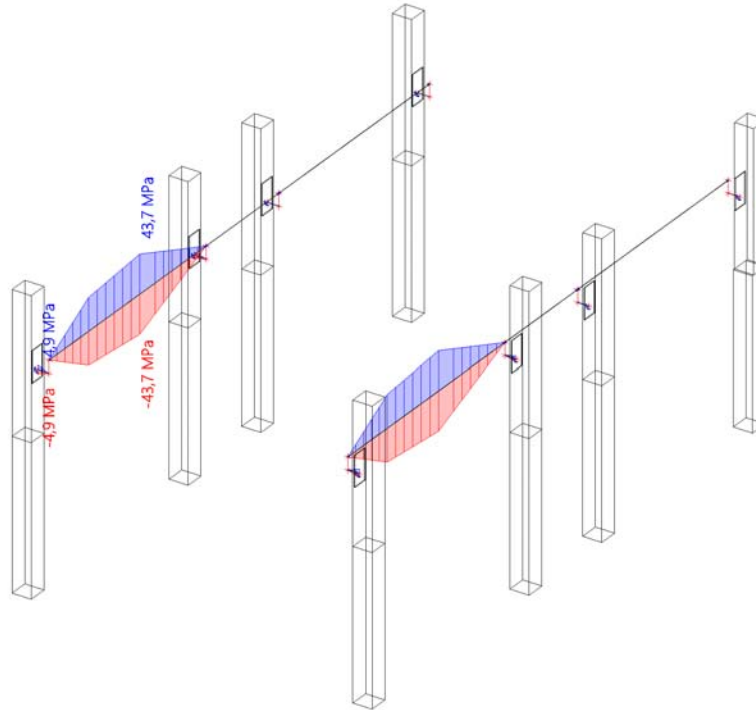
Linear calculation

Load case: LC12

Coordinate system: Principal

Extreme 1D: Cross-section

Selection: All



1D stresses; τ_{xz} / τ_{xs} - fatigue

Values: τ_{xz} / τ_{xs}

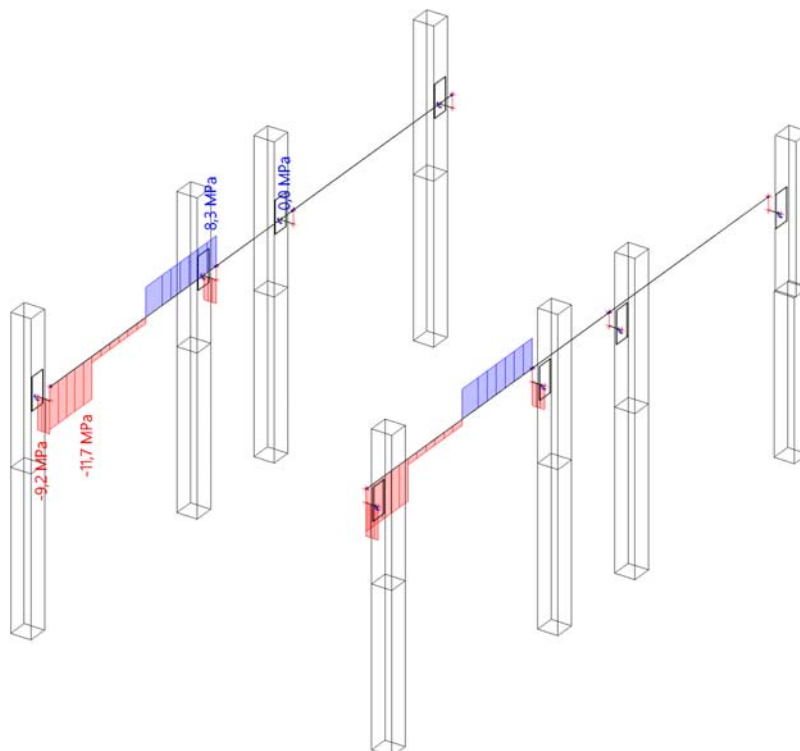
Linear calculation

Load case: LC12

Coordinate system: Principal

Extreme 1D: Cross-section

Selection: All



1D stresses

Linear calculation

Load case: LC12

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Name	dx [mm]	Fibre	Case	σ_x [MPa]	τ_{xy} / τ_{xs} [MPa]	τ_{xz} / τ_{xs} [MPa]
B410	2600,000-	13	LC12	-43,7	0,0	0,0
B410	2600,000-	1	LC12	43,7	0,0	0,0

1D stresses

Linear calculation

Load case: LC9

Coordinate system: Principal

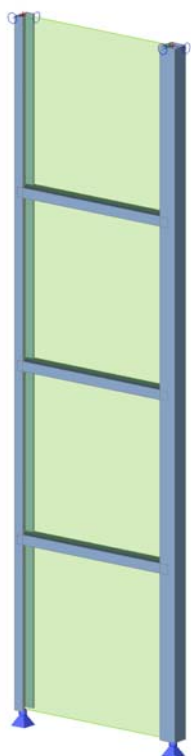
Extreme 1D: Global

Selection: All

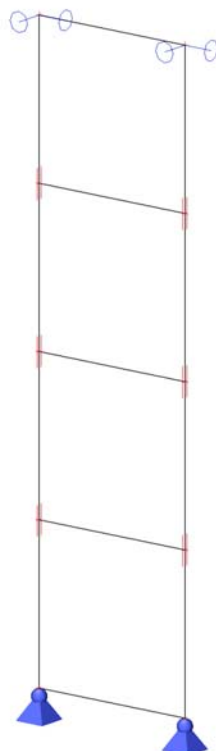
Name	dx [mm]	Fibre	Case	σ_x [MPa]	τ_{xy} / τ_{xs} [MPa]	τ_{xz} / τ_{xs} [MPa]
B414	0,000	8	LC9	0,0	0,0	-13,1
B410	0,000	8	LC9	0,0	0,0	6,7

KONSTRUKCE STĚN FASÁDNÍCH ARKÝŘŮ

3D MODEL OF STRUCTURE



Structural model



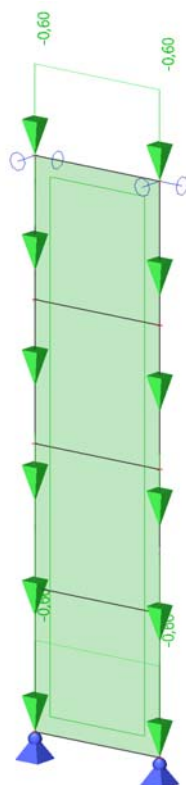
Project

Version	SCIA Engineer 17.1.2029
Licence number	555797
Project	Centrum Energetických a Enviromentálních Technologí
Part	SO 01.1 Objekt CEETe
Description	Ocelová konstrukce
Author	Ing. Jeřowicz
Date	Date
Structure	General XYZ
No. of nodes :	1222
No. of beams :	372
No. of slabs :	150
No. of solids :	1390
No. of used profiles :	36
No. of load cases :	14
No. of used materials :	3
Acceleration of gravity [m/s ²]	9,807
National code	EC - EN

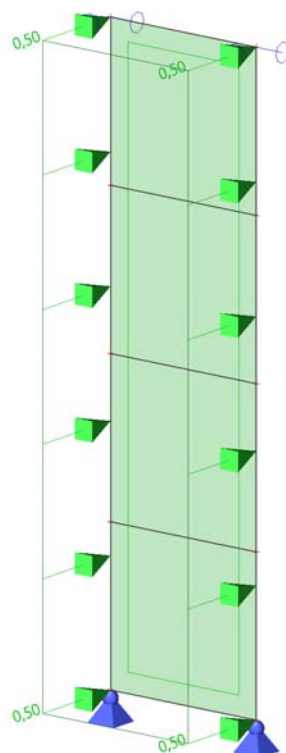
Load cases

Name	Description	Action type	Load group	Direction	Duration	Master load case
	Spec	Load type				
LC1	self weight	Permanent Self weight	LG1	-Z		
LC2	dead load	Permanent Standard	LG1			
LC3	snow/rime Standard	Variable Static	snow		Short	None
LC4	wind +x Standard	Variable Static	wind		Short	None
LC5	wind -x Standard	Variable Static	wind		Short	None
LC6	wind +y Standard	Variable Static	wind		Short	None
LC7	wind -y Standard	Variable Static	wind		Short	None
LC8	live load Standard	Variable Static	live		Short	None
LC9	Rmax (C) Standard	Variable Static	crane		Short	None
LC10	Ht+Hl_Rmax (C) Standard	Variable Static	Ht+Hl		Short	None
LC11	Hs_Rmax (C) Standard	Variable Static	Hs		Short	None
LC12	Mmax (C-D) Standard	Variable Static	crane		Short	None
LC13	Ht+Hl_Mmax (C-D) Standard	Variable Static	Ht+Hl		Short	None
LC14	Hs_Mmax (C-D) Standard	Variable Static	Hs		Short	None

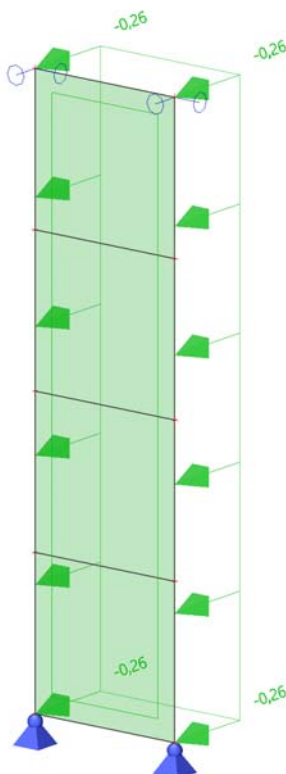
LC2 / Tot. value



LC4 / Tot. value



LC5 / Tot. value



Load groups

Name	Load	Relation	Type
LG1	Permanent		
snow	Variable	Exclusive	Snow
wind	Variable	Exclusive	Wind
live	Variable	Exclusive	Cat C : Congregation
crane	Variable	Exclusive	Cat F : Vehicle <30kN
Ht+Hl	Variable	Exclusive	Cat F : Vehicle <30kN
Hs	Variable	Exclusive	Cat F : Vehicle <30kN

Combinations

Name	Description	Type	Load cases	Coeff. [-]
CO1		EN-ULS (STR/GEO) Set B	LC1 - self weight	1,00
			LC2 - dead load	1,00
			LC3 - snow/rime	1,00
			LC4 - wind +x	1,00
			LC5 - wind -x	1,00
			LC6 - wind +y	1,00
			LC7 - wind -y	1,00
			LC8 - live load	1,00
CO2		EN-SLS Characteristic	LC1 - self weight	1,00
			LC2 - dead load	1,00
			LC3 - snow/rime	1,00
			LC4 - wind +x	1,00
			LC5 - wind -x	1,00
			LC6 - wind +y	1,00
			LC7 - wind -y	1,00
			LC8 - live load	1,00
Rmax +		Envelope - ultimate	LC1 - self weight	1,35
			LC9 - Rmax (C)	1,50
			LC10 - Ht+Hl_Rmax (C)	1,35
			LC11 - Hs_Rmax (C)	1,35
Rmax -		Envelope - ultimate	LC1 - self weight	1,35
			LC9 - Rmax (C)	1,50
			LC10 - Ht+Hl_Rmax (C)	-1,35
			LC11 - Hs_Rmax (C)	-1,35
Mmax +		Envelope - ultimate	LC1 - self weight	1,35
			LC12 - Mmax (C-D)	1,50
			LC13 - Ht+Hl_Mmax (C-D)	1,35
			LC14 - Hs_Mmax (C-D)	1,35
Mmax -		Envelope - ultimate	LC1 - self weight	1,35
			LC12 - Mmax (C-D)	1,50
			LC13 - Ht+Hl_Mmax (C-D)	-1,35
			LC14 - Hs_Mmax (C-D)	-1,35
Mmax +def		Envelope - serviceability	LC1 - self weight	1,00
			LC12 - Mmax (C-D)	1,00
			LC13 - Ht+Hl_Mmax (C-D)	1,00
			LC14 - Hs_Mmax (C-D)	1,00
Mmax -def		Envelope - serviceability	LC1 - self weight	1,00
			LC12 - Mmax (C-D)	1,00
			LC13 - Ht+Hl_Mmax (C-D)	-1,00
			LC14 - Hs_Mmax (C-D)	-1,00
CO3		EN-Accidental 1	LC1 - self weight	1,00
			LC2 - dead load	1,00
			LC3 - snow/rime	1,00
			LC4 - wind +x	1,00
			LC5 - wind -x	1,00
			LC6 - wind +y	1,00
			LC7 - wind -y	1,00
			LC8 - live load	1,00

Result classes

Name	List
All ULS	CO1 - EN-ULS (STR/GEO) Set B
	Rmax + - Envelope - ultimate
	Rmax - - Envelope - ultimate
	Mmax + - Envelope - ultimate
	Mmax - - Envelope - ultimate
	CO3 - EN-Accidental 1
All SLS	CO2 - EN-SLS Characteristic
	Mmax +def - Envelope - serviceability
	Mmax -def - Envelope - serviceability

Project Centrum Energetických a Enviromentálních Technologí

Part SO 01.1 Objekt CEETe

Description Ocelová konstrukce

Author Ing. Jeřowicz



Combination key

Combination key

REAKCE

REACTIONS

R1 - Reactions; R_x ; R_y ; R_z ; M_x ; M_y ; M_z

Values: M_z , M_x , M_y , R_z , R_y , R_x

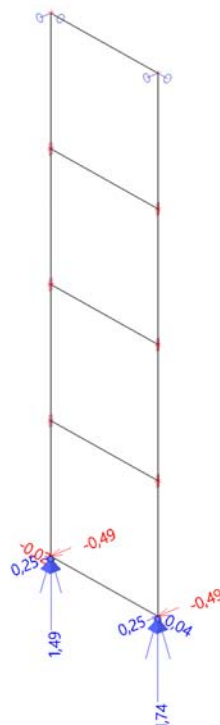
Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - add_R1



Reactions

Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - add_R1

Nodal reactions

Name	Case	R_x [kN]	R_y [kN]	R_z [kN]	M_x [kNm]	M_y [kNm]	M_z [kNm]	e_x [mm]	e_y [mm]
Sn109/N3298	CO1/1	0,25	0,03	1,48	0,00	0,00	0,00	0,0	0,0
Sn109/N3298	CO1/2	0,00	0,03	1,29	0,00	0,00	0,00	0,0	0,0
Sn109/N3298	CO1/3	0,00	0,04	1,74	0,00	0,00	0,00	0,0	0,0
Sn109/N3298	CO1/4	-0,49	0,03	1,48	0,00	0,00	0,00	0,0	0,0
Sn110/N3300	CO1/1	0,25	-0,02	1,27	0,00	0,00	0,00	0,0	0,0
Sn110/N3300	CO1/3	0,00	-0,02	1,49	0,00	0,00	0,00	0,0	0,0
Sn110/N3300	CO1/2	0,00	-0,02	1,11	0,00	0,00	0,00	0,0	0,0
Sn110/N3300	CO1/4	-0,49	-0,02	1,27	0,00	0,00	0,00	0,0	0,0

R2 - Reactions; R_x; R_y; R_z; M_x; M_y; M_z

Values: M_z, M_x, M_y, R_z, R_y, R_x

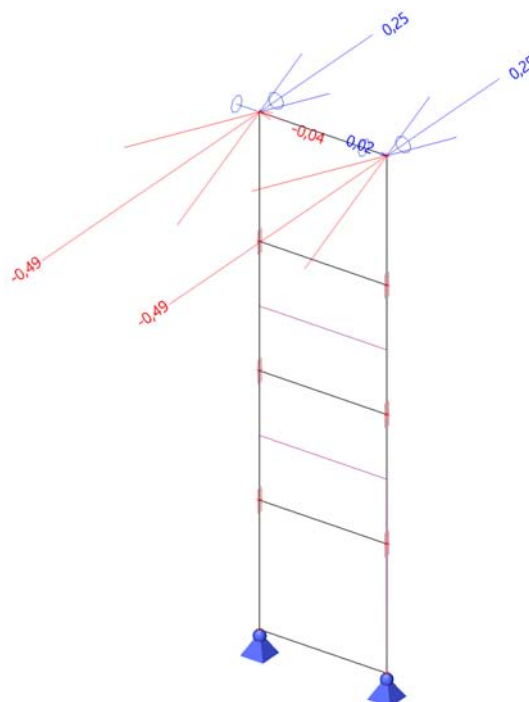
Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - add_R2



Reactions

Linear calculation

Combination: CO1

System: Global

Extreme: Member

Selection: Named selection - add_R2

Nodal reactions

Name	Case	R _x [kN]	R _y [kN]	R _z [kN]	M _x [kNm]	M _y [kNm]	M _z [kNm]	e _x [mm]	e _y [mm]
Sn111/N3299	CO1/1	0,25	-0,03	0,00	0,00	0,00	0,00	-	-
Sn111/N3299	CO1/2	0,00	-0,04	0,00	0,00	0,00	0,00	-	-
Sn111/N3299	CO1/3	0,00	-0,03	0,00	0,00	0,00	0,00	-	-
Sn111/N3299	CO1/4	-0,49	-0,03	0,00	0,00	0,00	0,00	-	-
Sn112/N3301	CO1/1	0,25	0,02	0,00	0,00	0,00	0,00	-	-
Sn112/N3301	CO1/3	0,00	0,02	0,00	0,00	0,00	0,00	-	-
Sn112/N3301	CO1/2	0,00	0,02	0,00	0,00	0,00	0,00	-	-
Sn112/N3301	CO1/4	-0,49	0,02	0,00	0,00	0,00	0,00	-	-

DEFORMACE

DEFORMATIONS

1D deformations; u_x

Values: u_x

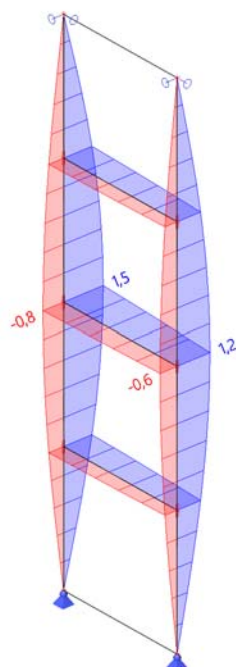
Linear calculation

Combination: CO2

Coordinate system: Global

Extreme 1D: Cross-section

Selection: Named selection - add



Deformations on member

Linear calculation, Extreme : Global

Selection : Named selection - add

Combinations : CO2

Member	dx [mm]	Case	ux [mm]	uy [mm]	uz [mm]	fix [mrad]	fiy [mrad]	fiz [mrad]	Resultant [mm]
B515	3150,000	CO2/7	0,0	0,0	0,0	0,0	0,0	0,0	0,0
B516	830,000	CO2/7	0,0	0,0	0,0	0,0	0,0	0,0	0,0
B515	472,500	CO2/7	0,0	0,0	0,0	0,0	0,0	0,0	0,0
B518	332,000	CO2/7	0,0	0,0	0,0	0,0	0,0	0,0	0,0
B514	1575,000	CO2/6	0,0	0,0	-1,2	-0,3	0,0	0,0	1,2
B515	1575,000	CO2/6	0,0	0,0	1,5	-0,3	0,0	0,0	1,5
B516	0,000	CO2/6	0,0	0,0	1,0	-1,0	0,2	0,1	1,0
B518	0,000	CO2/6	0,0	0,0	1,0	1,0	0,2	0,1	1,0
B515	0,000	CO2/6	0,0	0,0	0,0	-0,2	-1,5	0,0	0,0
B515	3150,000	CO2/6	0,0	0,0	0,0	-0,2	1,5	0,0	0,0
B518	664,000	CO2/7	0,0	0,0	0,0	0,0	0,0	-0,1	0,0
B516	166,000	CO2/7	0,0	0,0	0,0	0,0	0,0	0,1	0,0

VNITŘNÍ SÍLY A POSOUZENÍ PŘŮŘEZŮ

STRESS ANALYSIS OF CROSS SECTIONS

CS86 - 1D internal forces; M_y

Values: M_y

Linear calculation

Class: All ULS

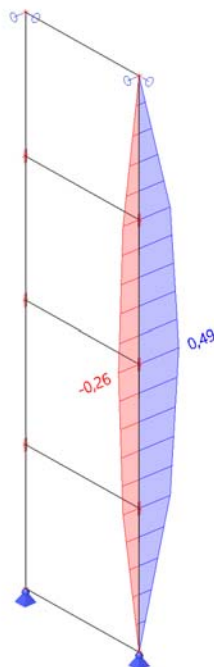
Coordinate system: Principal

Extreme 1D: Member

Selection: All

Filter: Cross-section = CS86 -

VHP80/80x5.0



Cross-sections

Cross-sections - CS86

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
CS86	Detailed VHP80/80x5.0	S 235	cold formed	c	c		Rectangular hollow section

EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS86 - VHP80/80x5.0

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B514	0,000	CO1/1	CS86 - VHP80/80x5.0	S 235	0,05	0,01	0,05

Name	Combination key
CO1/1	1.15*LC1 + 1.15*LC2 + 1.50*LC4

CS87 - 1D internal forces; M_y

Values: M_y

Linear calculation

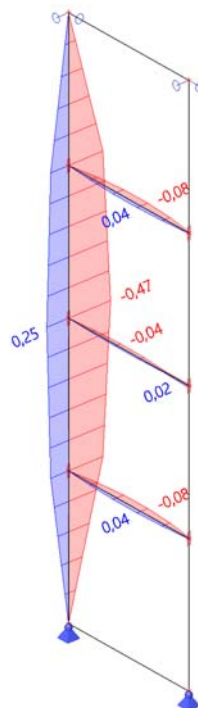
Class: All ULS

Coordinate system: Principal

Extreme 1D: Member

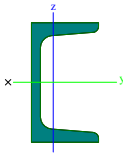
Selection: All

Filter: Cross-section = CS87 - U80



Cross-sections

Cross-sections - CS87

Name	Type	Item material	Fabrication	buckling y-y	buckling z-z	Picture	Type description
	Detailed						
CS87	U80	S 235	rolled	c	c		European standard channel

EC-EN 1993 Steel check ULS

Linear calculation

Combination: CO1

Coordinate system: Principal

Extreme 1D: Global

Selection: All

Filter: Cross-section = CS87 - U80

Overall Unity Check

Name	dx [mm]	Case	Cross-section	Material	UC _{Overall} [-]	UC _{Sec} [-]	UC _{Stab} [-]
B515	1575,000-	CO1/1	CS87 - U80	S 235	0,07	0,07	0,07

Name	Combination key
CO1/1	1.15*LC1 + 1.15*LC2 + 1.50*LC4

ZÁVĚR

Ocelové konstrukce vyhovují na mezní stav pevnosti a mezní stav použitelnosti dle ČSN EN 1993-1-1.