VELDEMAN
STRUCTURE SOLUTIONS

Calculation note

Project : Alu 10m t97
BS6399

June 2006

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Project : Alu10m t97

BS 6399 : wind : 25m/s

mcd : Alu10t97_BS6399 v3.0
esa : Alu10t97_BS6399 v3.0
units : kN / m

version 3.0

date : June 2006

Reference:J:\Engineering\Berekeningen strukturen\Normen\BS\doc v3.0.mcd(R)

= Region for variable input

= Region for the input of forces from computer program Esa prima win

= Region for the output of results

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Structural calculation of the Alu 10m type 97 structure accord. to the British standard 6399.

1. Introduction.

This note describes the structural calculations for the relocatable Alu 10m structure manufactured by **Georges Veldeman N.V.** Belgium. The length of the structure can reach any value as long as it's a multiple of the span distance.

For a length of 35 m or less, two bays with bracing cables are needed. If the length is higher than 35 m, an additional bay with bracing cables is needed. The maximum distance between two bays with bracing cables is 25 m. There should always be a bay with bracing cables at both ends of the structure.

Building geometry

Distance between two arches	$Span\_distance := 5 \cdot m$	$Span\_distance = 196.85\,in$
Height of the peak	$H_{peak} := 4.27 \cdot m$	$H_{peak} = 168.11\,in$
Height of the eaves	$H_{eaves} := 2.8 \cdot m$	$H_{eaves} = 110.236\,in$
Width of structure	$Width := 10 \cdot m$	$Width = 32.808\,ft$
Length of structure	$Length := 35 \cdot m$	$Length = 114.829\,ft$
Slope of the roof :	$\alpha_{roof} := 18 \cdot deg$	

Design criteria

Mean recurrence interval :	$Recurrence_{Interval} := 1yr$
Site in country (0) or site in town (1):	$site := 1$
Distance of the site to the sea :	$dist\_to\_sea := 0km$

Basic wind speed : $V_b := 25 \frac{m}{sec}$ $V_b = 90 \frac{km}{hr}$

The external loadings on the fabric like wind, rain and snow, are transmitted directly to the main arch. The function of the purlins is to keep the distance between the arches and to ensure the longitudinal stability in combination with the cable bracing system.

The calculation is based on the finite element method and uses nodes which are connected by beams. Each beam has a material number. All materials are represented in a materials list.
The connections of the arches with the base plates are considered as hinges. The connections of the cable connections are considered as hinges too, as well as the connection of the purlins to the arches.

The profile is calculated as being continuous. The splices are checked with the results from the general arch calculation.

The hinged connection of the arch and base plate is situated at 160 mm above the ground level.

2. Determination of the loads.

2.1. Dead load.

2.1.1. Uniform loading.

The self weight of the aluminium structure is calculated by the computerprogram Esa prima win.

Weight of the fabric

$$Weight_{fabric} := 0.650 \cdot \frac{kg}{m^2} \cdot Span\_distance$$

$$Weight_{fabric} = 3.25 \frac{kg}{m}$$

2.1.2. Local loadings.

Local loadings are for example the weight of the peak splice and the connection splices.

$$Weight_{peak\_splice} := 10 \cdot kg$$

$$Weight_{eaves\_splice} := 10 \cdot kg$$

2.1.3. Lighting weight

We put on every arc 2 points with an extra weight of 50 kg, to take into account the weight of the lights inside the structure.

$ExtraWeight_{lighting} := 50 \cdot kg$ x 2 points for every arc

2.2. Wind load (acc. to BS6399 part 2) <formulas: see document section 1.2>

Basic wind speed

$V_b = 25 \frac{m}{sec}$ $V_b = 90 \frac{km}{hr}$ $V_b = 55.923\ mph$

Site wind speed

Altitude factor : $S_a = 1$

Direction factor : $S_d = 1$

Seasonal factor : $S_s = 1$

Probability factor (2.2.2.5) : $S_p = 0.749$ **<1.4>**

=> site wind speed :

$V_s = 18.737 \frac{m}{s}$ $V_s = 67.453 \frac{km}{hr}$ $V_s = 41.913\ mph$ **<1.5>**

Effective wind speed

$S_b = 1.433$ **<1.6>**

$V_e = 26.858 \frac{m}{s}$ $V_e = 96.688 \frac{km}{hr}$ $V_e = 60.079\ mph$ **<1.7>**

Dynamic pressure

$q_s = 0.442 \frac{kN}{m^2}$ **<1.8>**

Effective dynamic pressure

diagonal dimension of loaded areas : (fig. 5) **<1.9>**

$a_{side\_wall} = 35.112\,m$ for the wall

$a_{side\_roof} = 35.393\,m$ for the roof

$a_{gable} = 10.385\,m$ for the gable

$a_{in} = 107.354\,m$ for internal pressure

Size effect factor Ca : (fig. 4) **<1.10>**

So, for curve = "A" we become :

$C_{a\_wall} = 0.879$ for the wall

$C_{a\_roof} = 0.878$ for the roof

$C_{a\_gable} = 0.954$ for the gable

$C_{a\_in} = 0.809$ for internal pressure

=> Effective dynamic pressure : **<1.11>**

wind on side

$$q_{wall} = 0.389\frac{kN}{m^2}$$

$$q_{roof} = 0.388\frac{kN}{m^2}$$

wind on gable

$$q_{gable} = 0.422\frac{kN}{m^2}$$

internal wind pressure

$$q_{in} = 0.362\frac{kN}{m^2}$$

1. External wind pressure coefficients.

Wind normal on Side :

Wall pressure : **<1.12>**

sidewall	gable wall	zones
$C_{pe\_s\_windw} = 0.738$	$C_{pe\_s\_gA} = -1.3$	$L_{s\_gA} = 1.708\,m$
$C_{pe\_s\_leew} = -0.5$	$C_{pe\_s\_gB} = -0.8$	$L_{s\_gB} = 6.832\,m$
	$C_{pe\_s\_gC} = -0.5$	$L_{s\_gC} = 1.46\,m$

Roof pressure : **<1.14>**

windward roof	leeward roof	zones	
$C_{pe\_rs\_A.o} = -0.98$	$C_{pe\_rs\_E} = -1.22$	$Length_{rsA} = 4.27\,m$ $Width_{rsA} = 0.854\,m$	$Length_{rsE} = 4.27\,m$ $Width_{rsE} = 0.854\,m$
$C_{pe\_rs\_A.u} = 0.32$	$C_{pe\_rs\_F} = -0.82$	$Length_{rsB} = 26.46\,m$ $Width_{rsB} = 0.854\,m$	$Length_{rsF} = 26.46\,m$ $Width_{rsF} = 0.854\,m$
$C_{pe\_rs\_B.o} = -0.74$	$C_{pe\_rs\_G} = -0.5$		
$C_{pe\_rs\_B.u} = 0.26$			
$C_{pe\_rs\_C.o} = -0.36$			
$C_{pe\_rs\_C.u} = 0.24$			

Wind normal on Gable :

Wall pressure : **<1.13>**

gable wall	sidewall	zones
$C_{pe\_g\_windw} = 0.6$	$C_{pe\_g\_sA} = -1.3$	$L_{g\_sA} = 1.708\,m$
$C_{pe\_g\_leew} = -0.5$	$C_{pe\_g\_sB} = -0.8$	$L_{g\_sB} = 6.832\,m$
	$C_{pe\_g\_sC} = -0.5$	$L_{g\_sC} = 26.46\,m$

Roof pressure : <1.15>

zones

$C_{pe\_rg\_A} = -1.52$ $L_{g\_rA} = 0.854\,m$

$C_{pe\_rg\_B} = -1.42$ $L_{g\_rB} = 0.854\,m$

$C_{pe\_rg\_C} = -0.6$ $L_{g\_rC} = 3.416\,m$

$C_{pe\_rg\_D} = -0.42$ $L_{g\_rD} = 30.73\,m$

2. Internal wind pressure coefficients.

The wind also causes (table 16)

an overpressure: $C_{pi\_o} := 0.0$

an underpressure: $C_{pi\_u} := -0.3$

3. Global wind pressure.

Wind load normal to the side wall of the structure.

Overpressure <1.16>

side walls

$Q_{sw\_ww.o} = 0.287 \frac{kN}{m^2}$

$Q_{sw\_lw.o} = -0.194 \frac{kN}{m^2}$

gable walls

$Q_{gA\_o} = -0.549 \frac{kN}{m^2}$

$Q_{gB\_o} = -0.338 \frac{kN}{m^2}$

$Q_{gC\_o} = -0.211 \frac{kN}{m^2}$

roofs

$Q_{rA\_s.o} = -0.381 \frac{kN}{m^2}$

$Q_{rB\_s.o} = -0.287 \frac{kN}{m^2}$

$Q_{rC\_s.o} = -0.14 \frac{kN}{m^2}$

$Q_{rE\_s.o} = -0.474 \frac{kN}{m^2}$

$Q_{rF\_s.o} = -0.318 \frac{kN}{m^2}$

$Q_{rG\_s.o} = -0.194 \frac{kN}{m^2}$

Underpressure **<1.17>**

side walls

$Q_{sw\_ww.u} = 0.395 \frac{kN}{m^2}$

$Q_{sw\_lw.u} = -0.086 \frac{kN}{m^2}$

gable walls

$Q_{gA\_u} = -0.44 \frac{kN}{m^2}$

$Q_{gB\_u} = -0.229 \frac{kN}{m^2}$

$Q_{gC\_u} = -0.103 \frac{kN}{m^2}$

roofs

$Q_{rA\_s.u} = 0.233 \frac{kN}{m^2}$

$Q_{rB\_s.u} = 0.209 \frac{kN}{m^2}$

$Q_{rC\_s.u} = 0.202 \frac{kN}{m^2}$

$Q_{rE\_s.u} = -0.365 \frac{kN}{m^2}$

$Q_{rF\_s.u} = -0.21 \frac{kN}{m^2}$

$Q_{rG\_s.u} = -0.086 \frac{kN}{m^2}$

Wind load normal to the gable wall of the structure.

Overpressure **<1.18>**

side walls

$Q_{sA\_o} = -0.505 \frac{kN}{m^2}$

$Q_{sB\_o} = -0.311 \frac{kN}{m^2}$

$Q_{sC\_o} = -0.194 \frac{kN}{m^2}$

gable walls

$Q_{g\_ww.o} = 0.253 \frac{kN}{m^2}$

$Q_{g\_lw.o} = -0.211 \frac{kN}{m^2}$

roofs

$Q_{rA\_g.o} = -0.59 \frac{kN}{m^2}$

$Q_{rB\_g.o} = -0.551 \frac{kN}{m^2}$

$Q_{rC\_g.o} = -0.233 \frac{kN}{m^2}$

$Q_{rD\_g.o} = -0.163 \frac{kN}{m^2}$

Underpressure **<1.18>**

side walls	gable walls	roofs
$Q_{sA\_u} = -0.397 \frac{kN}{m^2}$	$Q_{g\_ww.u} = 0.362 \frac{kN}{m^2}$	$Q_{rA\_g.u} = -0.482 \frac{kN}{m^2}$
$Q_{sB\_u} = -0.202 \frac{kN}{m^2}$	$Q_{g\_lw.u} = -0.103 \frac{kN}{m^2}$	$Q_{rB\_g.u} = -0.443 \frac{kN}{m^2}$
$Q_{sC\_u} = -0.086 \frac{kN}{m^2}$		$Q_{rC\_g.u} = -0.124 \frac{kN}{m^2}$
		$Q_{rD\_g.u} = -0.055 \frac{kN}{m^2}$

The wind pressure on one bay must be supported by one arch. The total wind load per arch equals :

Span_distance = 5 m

A. Wind normal on Side :

Overpressure :

foot beams

$P_{windward\_o} = 1.434 \frac{kN}{m}$

$P_{leeward\_o} = -0.971 \frac{kN}{m}$

roof beams

- *Load on the first arch :* **<1.19>**

windward

$P1_{roof.low.windw\_o} = -0.951 \frac{kN}{m}$ relative_length$_{lowAB}$ = 16 %

$P1_{roof.up.windw\_o} = -0.349 \frac{kN}{m}$ relative_length$_{upC}$ = 84 %

leeward

$P1_{roof.up.leew\_o} = -1.184 \frac{kN}{m}$ relative_length$_{upEF}$ = 16 %

$P1_{roof.low.leew\_o} = -0.485 \frac{kN}{m}$ relative_length$_{lowG}$ = 84 %

- *Load on the second arch :* **<1.20>**

windward

$P2_{roof.low.windw\_o} = -1.602 \frac{kN}{m}$ relative_length$_{lowAB}$ = 16 %

$P2_{roof.up.windw\_o} = -0.699 \frac{kN}{m}$ relative_length$_{upC}$ = 84 %

leeward

$P2_{roof.up.leew\_o} = -1.867 \frac{kN}{m}$ relative_length$_{upEF}$ = 16 %

$P2_{roof.low.leew\_o} = -0.971 \frac{kN}{m}$ relative_length$_{lowG}$ = 84 %

- *Load on the third arch :* **<1.21>**

windward

$$P3_{roof.low.windw\_o} = -1.437 \frac{kN}{m}$$ $$relative\_length_{lowAB} = 16\,\%$$

$$P3_{roof.up.windw\_o} = -0.699 \frac{kN}{m}$$ $$relative\_length_{upC} = 84\,\%$$

leeward

$$P3_{roof.up.leew\_o} = -1.592 \frac{kN}{m}$$ $$relative\_length_{upEF} = 16\,\%$$

$$P3_{roof.low.leew\_o} = -0.971 \frac{kN}{m}$$ $$relative\_length_{lowG} = 84\,\%$$

- *Load on the fourth arch :* **<1.22>**

windward

$$P4_{roof.low.windw\_o} = -1.437 \frac{kN}{m}$$ $$relative\_length_{lowAB} = 16\,\%$$

$$P4_{roof.up.windw\_o} = -0.699 \frac{kN}{m}$$ $$relative\_length_{upC} = 84\,\%$$

leeward

$$P4_{roof.up.leew\_o} = -1.592 \frac{kN}{m}$$ $$relative\_length_{upEF} = 16\,\%$$

$$P4_{roof.low.leew\_o} = -0.971 \frac{kN}{m}$$ $$relative\_length_{lowG} = 84\,\%$$

- *Load on the fifth arch :*

....

Underpressure :

foot beams

$P_{windward\_u} = 1.976 \frac{kN}{m}$

$P_{leeward\_u} = -0.429 \frac{kN}{m}$

roof beams

- *Load on the first arch :* **<1.23>**

windward

$P1_{roof.low.windw\_u} = 0.582 \frac{kN}{m}$ relative_length$_{lowAB}$ = 16 %

$P1_{roof.up.windw\_u} = 0.504 \frac{kN}{m}$ relative_length$_{upC}$ = 84 %

leeward

$P1_{roof.up.leew\_u} = -0.913 \frac{kN}{m}$ relative_length$_{upEF}$ = 16 %

$P1_{roof.low.leew\_u} = -0.214 \frac{kN}{m}$ relative_length$_{lowG}$ = 84 %

- *Load on the second arch :* **<1.24>**

windward

$P2_{roof.low.windw\_u} = 1.088 \frac{kN}{m}$ relative_length$_{lowAB}$ = 16 %

$P2_{roof.up.windw\_u} = 1.008 \frac{kN}{m}$ relative_length$_{upC}$ = 84 %

leeward

$P2_{roof.up.leew\_u} = -1.324 \frac{kN}{m}$ relative_length$_{upEF}$ = 16 %

$P2_{roof.low.leew\_u} = -0.428 \frac{kN}{m}$ relative_length$_{lowG}$ = 84 %

- *Load on the third arch :* **<1.25>**

windward

$P3_{roof.low.windw\_u} = 1.047 \frac{kN}{m}$ $relative\_length_{lowAB} = 16\%$

$P3_{roof.up.windw\_u} = 1.008 \frac{kN}{m}$ $relative\_length_{upC} = 84\%$

leeward

$P3_{roof.up.leew\_u} = -1.049 \frac{kN}{m}$ $relative\_length_{upEF} = 16\%$

$P3_{roof.low.leew\_u} = -0.428 \frac{kN}{m}$ $relative\_length_{lowG} = 84\%$

- *Load on the fourth arch :* **<1.26>**

windward

$P4_{roof.low.windw\_u} = 1.047 \frac{kN}{m}$ $relative\_length_{lowAB} = 16\%$

$P4_{roof.up.windw\_u} = 1.008 \frac{kN}{m}$ $relative\_length_{upC} = 84\%$

leeward

$P4_{roof.up.leew\_u} = -1.049 \frac{kN}{m}$ $relative\_length_{upEF} = 16\%$

$P4_{roof.low.leew\_u} = -0.428 \frac{kN}{m}$ $relative\_length_{lowG} = 84\%$

- *Load on the fifth arch :*

....

B. Wind normal on Gable :

Overpressure :

- *Load on the first arch :* **<1.27>**

foot beams $P1_{sidewall\_g.o} = -1.109 \frac{kN}{m}$

roof beams $P1_{g\_roof.low\_o} = -0.887 \frac{kN}{m}$ $relative\_length_{lowA} := 50\%$

$P1_{g\_roof.up\_o} = -0.854 \frac{kN}{m}$ $relative\_length_{upB} := 50\%$

- *Load on the second arch :* **<1.28>**

foot beams $P2_{sidewall\_g.o} = -1.521 \frac{kN}{m}$

roof beams $P2_{g\_roof.low\_o} = -0.939 \frac{kN}{m}$

$P2_{g\_roof.up\_o} = -0.939 \frac{kN}{m}$

- *Load on the third arch :* **<1.29>**

foot beams $P3_{sidewall\_g.o} = -1.187 \frac{kN}{m}$

roof beams $P3_{g\_roof.low\_o} = -0.815 \frac{kN}{m}$

$P3_{g\_roof.up\_o} = -0.815 \frac{kN}{m}$

- *Load on the fourth arch :* **<1.30>**

foot beams $P4_{sidewall\_g.o} = -1.055 \frac{kN}{m}$

roof beams $P4_{g\_roof.low\_o} = -0.815 \frac{kN}{m}$

$P4_{g\_roof.up\_o} = -0.815 \frac{kN}{m}$

- *Load on the fifth arch :* **<1.31>**

foot beams $P5_{sidewall\_g.o} = -1.055 \frac{kN}{m}$

roof beams $P5_{g\_roof.low\_o} = -0.815 \frac{kN}{m}$

$P5_{g\_roof.up\_o} = -0.815 \frac{kN}{m}$

- *Load on the sixth arch :*

...

Underpressure :

- *Load on the first arch :* **<1.27>**

foot beams $P1_{sidewall\_g.u} = -0.838 \frac{kN}{m}$

roof beams $P1_{g\_roof.low\_u} = -0.616 \frac{kN}{m}$ $relative\_length_{lowA} := 50\%$

$P1_{g\_roof.up\_u} = -0.583 \frac{kN}{m}$ $relative\_length_{upB} := 50\%$

- *Load on the second arch :* **<1.28>**

foot beams $P2_{sidewall\_g.u} = -0.981 \frac{kN}{m}$

roof beams $P2_{g\_roof.low\_u} = -0.397 \frac{kN}{m}$

$P2_{g\_roof.up\_u} = -0.397 \frac{kN}{m}$

- *Load on the third arch :* **<1.29>**

foot beams $P3_{sidewall\_g.u} = -0.647 \frac{kN}{m}$

roof beams $P3_{g\_roof.low\_u} = -0.273 \frac{kN}{m}$

$P3_{g\_roof.up\_u} = -0.273 \frac{kN}{m}$

- *Load on the fourth arch :* **<1.30>**

foot beams $P4_{sidewall\_g.u} = -0.515 \frac{kN}{m}$

roof beams $P4_{g\_roof.low\_u} = -0.273 \frac{kN}{m}$

$P4_{g\_roof.up\_u} = -0.273 \frac{kN}{m}$

- *Load on the fifth arch :* **<1.31>**

foot beams $P5_{sidewall\_g.u} = -0.515 \frac{kN}{m}$

roof beams $P5_{g\_roof.low\_u} = -0.273 \frac{kN}{m}$

$P5_{g\_roof.up\_u} = -0.273 \frac{kN}{m}$

- *Load on the sixth arch :*

...

3. Materials.

3.1. Properties.

$\gamma_M = 1.1$ partial safety factor

$\gamma_{Mb} = 1.25$ partial safety factor for bolts and pins

$\gamma_{Mr} = 1.25$ partial safety factor for rivets

3.2. Aluminium.

Quality = 6061 T6.

Yield stress $R_{e\_alu} = 240 \frac{N}{mm^2}$

Tensile strength $R_{t\_alu} = 260 \frac{N}{mm^2}$

Modulus of elasticity $E_{alu} = 7 \times 10^4 \frac{N}{mm^2}$

Admissible stress $\sigma_{adm\_alu} = 218.182 \frac{N}{mm^2}$

3.3. Steel.

	Steel quality S235.	**Steel quality S355.**
Yield stress	$R_{e\_S235} = 235 \frac{N}{mm^2}$	$R_{e\_S355} = 355 \frac{N}{mm^2}$
Tensile strength	$R_{t\_S235} = 360 \frac{N}{mm^2}$	$R_{t\_S355} = 510 \frac{N}{mm^2}$
Modulus of elasticity	$\sigma_{adm\_S235} = 213.636 \frac{N}{mm^2}$	$\sigma_{adm\_S355} = 322.727 \frac{N}{mm^2}$
Admissible stress	$E_{steel} = 2.1 \times 10^5 \frac{N}{mm^2}$	

3.4. Bolts - class = 8.8.

Yield stress $R_{e\_bolt} = 640 \frac{N}{mm^2}$

Tensile strength $R_{t\_bolt} = 800 \frac{N}{mm^2}$

3.5. Used profiles

Aluminium
0 = pas utilisé
1 = alu60/60/3
2 = alu70/50/2.5/3
3 = alu88/66/2
4 = alu70/70/4.5
5 = alu97/77/3.1
6 = alu129/89/3.1
7 = alu130/70
8 = alu133/70
9 = alu133/70+80/5
10 = alu158/100
20 = alu240/100
200 = alu232/92
220 = alu240+232
30 = alu270/100
300 = alu260/91
330 = alu270+260
40 = alu310/130
400 = alu297_8/117
401 = alu297_11/117
402 = alu297_24.5/117
440 = alu310+297_8
441 = alu310+297_11
442 = alu310+297_24.5
50 = alu380/166

Steel
60 = K70/70/2
70 = K70/70/3
80 = K80/80/4
90 = K120/120/3
100 = plat en acier 80/12

The principal profile of the foot

$prof\_foot_{prin} := 10$

$foot_{prin} = $ "alu158/100"

$A_{foot\_prin} = 1.836 \times 10^{3}\ mm^{2}$

$I_{y\_foot\_prin} = 6.41 \times 10^{6}\ mm^{4}$

$I_{z\_foot\_prin} = 2.74 \times 10^{6}\ mm^{4}$

$W_{ely\_foot\_prin} = 8.12 \times 10^{4}\ mm^{3}$

$W_{elz\_foot\_prin} = 5.49 \times 10^{4}\ mm^{3}$

$h_{foot\_prin} = 158\ mm$

$b_{foot\_prin} = 100\ mm$

The reinforcement profile of the foot

$prof\_foot_{reinf} := 0$

$foot_{reinf} = $ "not used"

$A_{foot_reinf} = $ "not used"

$I_{y_foot_reinf} = $ "not used"

$I_{z_foot_reinf} = $ "not used"

$W_{ely_foot_reinf} = $ "not used"

$W_{elz_foot_reinf} = $ "not used"

$h_{foot_reinf} = $ "not used"

$b_{foot_reinf} = $ "not used"

The reinforced profile of the foot

$prof\_foot_{prin\_reinf} := prof\_foot_{prin} + prof\_foot_{reinf}$

$foot_{prin_reinf} = $ "alu158/100"

$A_{foot\_p\_r} = 1.836 \times 10^{3}\ mm^{2}$

$I_{y\_foot\_p\_r} = 6.41 \times 10^{6}\ mm^{4}$

$I_{z\_foot\_p\_r} = 2.74 \times 10^{6}\ mm^{4}$

$W_{ely\_foot\_p\_r} = 8.12 \times 10^{4}\ mm^{3}$

$W_{elz\_foot\_p\_r} = 5.49 \times 10^{4}\ mm^{3}$

$h_{foot\_p\_r} = 158\ mm$

$b_{foot\_p\_r} = 100\ mm$

The principal profile of the roof

$prof\_roof_{prin} := 10$

$roof_{prin} = \text{"alu158/100"}$

$A_{roof\_prin} = 1.836 \times 10^{3}\ mm^{2}$

$I_{y\_roof\_prin} = 6.41 \times 10^{6}\ mm^{4}$

$I_{z\_roof\_prin} = 2.74 \times 10^{6}\ mm^{4}$

$W_{ely\_roof\_prin} = 8.12 \times 10^{4}\ mm^{3}$

$W_{elz\_roof\_prin} = 5.49 \times 10^{4}\ mm^{3}$

$h_{roof\_prin} = 158\ mm$

$b_{roof\_prin} = 100\ mm$

The reinforcement profile of the roof

$prof\_roof_{reinf} := 0$

$roof_{reinf} = \text{"not used"}$

$A_{roof\_reinf} = \text{"not used"}$

$I_{y\_roof\_reinf} = \text{"not used"}$

$I_{z\_roof\_reinf} = \text{"not used"}$

$W_{ely\_roof\_reinf} = \text{"not used"}$

$W_{elz\_roof\_reinf} = \text{"not used"}$

$h_{roof\_reinf} = \text{"not used"}$

$b_{roof\_reinf} = \text{"not used"}$

The reinforced profile of the roof

$prof\_roof_{prin\_reinf} := prof\_roof_{prin} + prof\_roof_{reinf}$

$roof_{prin\_reinf} = \text{"alu158/100"}$

$A_{roof\_p\_r} = 1.836 \times 10^{3}\ mm^{2}$

$I_{y\_roof\_p\_r} = 6.41 \times 10^{6}\ mm^{4}$

$I_{z\_roof\_p\_r} = 2.74 \times 10^{6}\ mm^{4}$

$W_{ely\_roof\_p\_r} = 8.12 \times 10^{4}\ mm^{3}$

$W_{elz\_roof\_p\_r} = 5.49 \times 10^{4}\ mm^{3}$

$h_{roof\_p\_r} = 158\ mm$

$b_{roof\_p\_r} = 100\ mm$

Gable upright

$prof\_gable_{up} := 8$

$gable_{up} = \text{"alu133/70"}$

$A_{gable\_up} = 1.604 \times 10^{3}\ mm^{2}$

$I_{y\_gable\_up} = 3.82 \times 10^{6}\ mm^{4}$

$I_{z\_gable\_up} = 1.06 \times 10^{6}\ mm^{4}$

$W_{ely\_gable\_up} = 5.74 \times 10^{4}\ mm^{3}$

$W_{elz\_gable\_up} = 3.02 \times 10^{4}\ mm^{3}$

$h_{gable\_up} = 133\ mm$

$b_{gable\_up} = 70\ mm$

Gable upright 2

$prof\_gable_{up2} := 0$

$gable_{up2} = \text{"not used"}$

$A_{gable\_up2} = \text{"not used"}$

$I_{y\_gable\_up2} = \text{"not used"}$

$I_{z\_gable\_up2} = \text{"not used"}$

$W_{ely\_gable\_up2} = \text{"not used"}$

$W_{elz\_gable\_up2} = \text{"not used"}$

$h_{gable\_up2} = \text{"not used"}$

$b_{gable\_up2} = \text{"not used"}$

Horizontal beam gable

$prof\_gable_{hor} := 7$

$gable_{hor} = \text{"alu130/70"}$

$A_{gable\_hor} = 1.497 \times 10^{3}\ mm^{2}$

$I_{y\_gable\_hor} = 3.12 \times 10^{6}\ mm^{4}$

$I_{z\_gable\_hor} = 1.12 \times 10^{6}\ mm^{4}$

$W_{ely\_gable\_hor} = 4.81 \times 10^{4}\ mm^{3}$

$W_{elz\_gable\_hor} = 3.19 \times 10^{4}\ mm^{3}$

$h_{gable\_hor} = 130\ mm$

$b_{gable\_hor} = 70\ mm$

Purlin: strong section 1

$prof\_purlin_{strong1} := 8$

$purlin_{strong1} = "alu133/70"$

$A_{purlin\_strong1} = 1.604 \times 10^{3}\ mm^{2}$

$I_{y\_purlin\_strong1} = 3.82 \times 10^{6}\ mm^{4}$

$I_{z\_purlin\_strong1} = 1.06 \times 10^{6}\ mm^{4}$

$W_{ely\_purlin\_strong1} = 5.74 \times 10^{4}\ mm^{3}$

$W_{elz\_purlin\_strong1} = 3.02 \times 10^{4}\ mm^{3}$

$h_{purlin\_strong1} = 133\ mm$

$b_{purlin\_strong1} = 70\ mm$

Purlin: strong section 2

$prof\_purlin_{strong2} := 0$

$purlin_{strong2} = "not\ used"$

$A_{purlin\_strong2} = "not\ used"$

$I_{y\_purlin\_strong2} = "not\ used"$

$I_{z\_purlin\_strong2} = "not\ used"$

$W_{ely\_purlin\_strong2} = "not\ used"$

$W_{elz\_purlin\_strong2} = "not\ used"$

$h_{purlin\_strong2} = "not\ used"$

$b_{purlin\_strong2} = "not\ used"$

Purlin: strong section 3

$prof\_purlin_{strong3} := 0$

$purlin_{strong3} = "not\ used"$

$A_{purlin\_strong3} = "not\ used"$

$I_{y\_purlin\_strong3} = "not\ used"$

$I_{z\_purlin\_strong3} = "not\ used"$

$W_{ely\_purlin\_strong3} = "not\ used"$

$W_{elz\_purlin\_strong3} = "not\ used"$

$h_{purlin\_strong3} = "not\ used"$

$b_{purlin\_strong3} = "not\ used"$

Purlin: weak section

$prof\_purlin_{weak} := 1$

$purlin_{weak} = "alu60/60/3"$

$A_{purlin\_weak} = 660\ mm^{2}$

$I_{y\_purlin\_weak} = 3.51 \times 10^{5}\ mm^{4}$

$I_{z\_purlin\_weak} = 3.51 \times 10^{5}\ mm^{4}$

$W_{ely\_purlin\_weak} = 1.17 \times 10^{4}\ mm^{3}$

$W_{elz\_purlin\_weak} = 1.17 \times 10^{4}\ mm^{3}$

$h_{purlin\_weak} = 60\ mm$

$b_{purlin\_weak} = 60\ mm$

Corner bar (steel)

$prof\_bar_{corner} := 0$

bar_{corner} = "not used"

A_{corner_bar} = "not used"

$I_{y\_corner\_bar}$ = "not used"

$I_{z\_corner\_bar}$ = "not used"

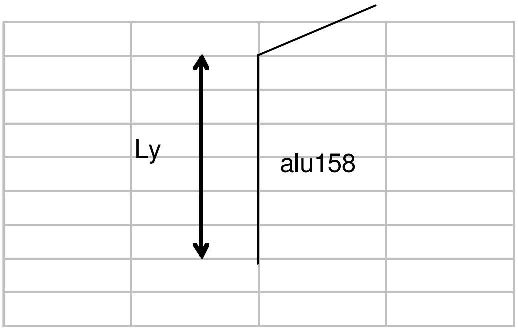
$W_{ely\_corner\_bar}$ = "not used"

$W_{elz\_corner\_bar}$ = "not used"

h_{corner_bar} = "not used"

b_{corner_bar} = "not used"

4. Control of the main profiles. **<formulas: see document 3>**



$k_y := 1.0$ $k_z := 1.0$ buckling factor

$L_{yf} := 2649 \cdot mm$ Buckling length of the foot profile in the strong direction

$L_{yr} := 5256 \cdot mm$ Buckling length of the roof profile in the strong direction

$L_{zf} := 2649mm$ buckling length of the foot profile in the weak direction

$L_{zr} := 2628mm$ buckling length of the roof profile in the weak direction (max. distance between two purlins)

4.1 Foot (alu158)

$L_y := L_{yf}$
$L_z := L_{zf}$

$profile := prof\_foot_{prin}$

$prof_{control}(profile) = \text{"alu158/100"}$

$classification(profile) = 2$ <3.1>

Shape factor :

$\alpha_{y\_prof} = 1.244$ $\alpha_{z\_prof} = 1.215$ <3.2>

Profile capacity :

$N_{rd\_prof} = 400.582\,kN$

$M_{yrd\_prof} = 22.036\,kN \cdot m$ <3.3>

$M_{zrd\_prof} = 14.553\,kN \cdot m$

Slenderness :

$\lambda_{y\_prof} = 44.832$ $\lambda_{z\_prof} = 68.571$ <3.4>

$\lambda_{by\_prof} = 0.836$ $\lambda_{bz\_prof} = 1.278$ <3.5>

Reduction coefficient for buckling :

$\phi_{y\_prof} = 0.923$ $\phi_{z\_prof} = 1.435$ <3.6>

$\chi_{y\_prof} = 0.761$ $\chi_{z\_prof} = 0.479$ <3.7>

4.1.1 Bending and axial compression (art. 5.9.4)

4.1.1.1 Maximum moment

$M_y := 12.2 \cdot kN \cdot m$ **{comb. 8, member 32, x=2.649m}**

$M_z := 0.0 \cdot kN \cdot m$

$N_v := 3.0 \cdot kN$ normal force / compression

Buckling control

$buckling_{control\_unity} = 0.583$ **<3.8>**

$$control := \begin{cases} \text{"OK"} & \text{if } buckling_{control\_unity} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

$control = \text{"OK"}$

Stress control

$\sigma_{control} = 151.993 \frac{N}{mm^2}$ **<3.10>**

$$\frac{\sigma_{control}}{\sigma_{adm\_alu}} = 0.697$$

$$stress := \begin{cases} \text{"OK"} & \text{if } \frac{\sigma_{control}}{\sigma_{adm\_alu}} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

$stress = \text{"OK"}$

4.1.1.2 Maximum normal force

$M_y := 12.2 \cdot kN \cdot m$

$M_z := 0.0 \cdot kN \cdot m$

$N_v := 3.0 \cdot kN$

{comb. 8, member 26, x = 2.649m}

Buckling control

$buckling_{control\_unity} = 0.583$

<3.8>

$$control := \begin{cases} \text{"OK"} & \text{if } buckling_{control\_unity} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

control = "OK"

Stress control

$\sigma_{control} = 151.993 \frac{N}{mm^2}$

<3.10>

$\frac{\sigma_{control}}{\sigma_{adm\_alu}} = 0.697$

$$stress := \begin{cases} \text{"OK"} & \text{if } \frac{\sigma_{control}}{\sigma_{adm\_alu}} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

stress = "OK"

4.1.2 Bending and axial traction (art. 5.9.3.3)

4.1.2.1 Maximum moment

$M_y := 10.4 \cdot kN \cdot m$ **{comb. 3, member 21, x = 2.649m}**

$M_z := 0.0 \cdot kN \cdot m$

$N_v := 5.5 \cdot kN$ normal force / traction

Unity control

$bending\_traction_{control\_unity} = 0.469$ **<3.9>**

$$control := \begin{cases} \text{"OK"} & \text{if } bending\_traction_{control\_unity} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

$control = \text{"OK"}$

Stress control

$\sigma_{control} = 131.17 \frac{N}{mm^2}$ **<3.10>**

$$\frac{\sigma_{control}}{\sigma_{adm\_alu}} = 0.601$$

$$stress := \begin{cases} \text{"OK"} & \text{if } \frac{\sigma_{control}}{\sigma_{adm\_alu}} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

$stress = \text{"OK"}$

4.1.2.2 Maximum normal force

$M_y := 10.4 \cdot kN \cdot m$

$M_z := 0.0 \cdot kN \cdot m$

$N_v := 5.5 \cdot kN$ **{comb. 3, member 21, x=2.649m}**

Unity control

$bending\_traction_{control\_unity} = 0.469$ **<3.9>**

$$control := \begin{cases} \text{"OK"} & \text{if } bending\_traction_{control\_unity} \leq 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

control = "OK"

Stress control

$\sigma_{control} = 131.17 \frac{N}{mm^2}$ **<3.10>**

$$\frac{\sigma_{control}}{\sigma_{adm\_alu}} = 0.601$$

$$stress := \begin{cases} \text{"OK"} & \text{if } \frac{\sigma_{control}}{\sigma_{adm\_alu}} \leq 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

stress = "OK"

4.2 Roof (alu158)

$L_y := L_{yr}$ $k_y := 0.7$

$L_z := L_{zr}$ $k_z := 0.7$

$profile := prof\_roof_{prin\_reinf}$

$prof_{control}(profile) =$ "alu158/100"

classification(profile) = 2 <3.1>

Shape factor :

$\alpha_{y\_prof} = 1.244$ $\alpha_{z\_prof} = 1.215$ <3.2>

Profile capacity :

$N_{rd\_prof} = 400.582\,kN$

$M_{yrd\_prof} = 22.036\,kN \cdot m$ <3.3>

$M_{zrd\_prof} = 14.553\,kN \cdot m$

Slenderness :

$\lambda_{y\_prof} = 62.267$ $\lambda_{z\_prof} = 47.619$ <3.4>

$\lambda_{by\_prof} = 1.161$ $\lambda_{bz\_prof} = 0.888$ <3.5>

Reduction coefficient for buckling :

$\phi_{y\_prof} = 1.28$ $\phi_{z\_prof} = 0.973$ <3.6>

$\chi_{y\_prof} = 0.55$ $\chi_{z\_prof} = 0.73$ <3.7>

4.2.1 Bending and axial compression (art. 5.9.4)

4.2.1.1 Maximum moment

$M_y := 12.2 \cdot kN \cdot m$ **{comb. 8, member 24, x=0.0m}**

$M_z := 0.0 \cdot kN \cdot m$

$N_v := 4.5 \cdot kN$ normal force / compression

Buckling control

$buckling_{control\_unity} = 0.592$ **<3.8>**

$$control := \begin{cases} \text{"OK"} & \text{if } buckling_{control\_unity} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

$control = \text{"OK"}$

Stress control

$\sigma_{control} = 152.81 \frac{N}{mm^2}$ **<3.10>**

$$\frac{\sigma_{control}}{\sigma_{adm\_alu}} = 0.7$$

$$stress := \begin{cases} \text{"OK"} & \text{if } \frac{\sigma_{control}}{\sigma_{adm\_alu}} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

$stress = \text{"OK"}$

4.2.1.2 Maximum normal force

$M_y := 7.3 \cdot kN \cdot m$

$M_z := 0.0 \cdot kN \cdot m$

$N_v := 5.0 \cdot kN$ **{comb. 8, member 12, x = 0.0 m}**

Buckling control

$buckling_{control\_unity} = 0.372$ **<3.8>**

$$control := \begin{cases} \text{"OK"} & \text{if } buckling_{control\_unity} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

control = "OK"

Stress control

$\sigma_{control} = 92.692 \frac{N}{mm^2}$ **<3.10>**

$\frac{\sigma_{control}}{\sigma_{adm\_alu}} = 0.425$

$$stress := \begin{cases} \text{"OK"} & \text{if } \frac{\sigma_{control}}{\sigma_{adm\_alu}} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

stress = "OK"

4.2.2 Bending and axial traction (art. 5.9.3.3)

4.2.2.1 Maximum moment

$M_y := 10.4 \cdot kN \cdot m$ **{comb. 3, member 22, x = 0.0m}**

$M_z := 0.0 \cdot kN \cdot m$

$N_v := 3.5 \cdot kN$ normal force / traction

Unity control

$bending\_traction_{control\_unity} = 0.467$ **<3.9>**

$$control := \begin{cases} \text{"OK"} & \text{if } bending\_traction_{control\_unity} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

$control = \text{"OK"}$

Stress control

$\sigma_{control} = 130.081 \frac{N}{mm^2}$ **<3.10>**

$$\frac{\sigma_{control}}{\sigma_{adm\_alu}} = 0.596$$

$$stress := \begin{cases} \text{"OK"} & \text{if } \frac{\sigma_{control}}{\sigma_{adm\_alu}} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

$stress = \text{"OK"}$

4.2.2.2 Maximum normal force

$M_y := 5.7 \cdot kN \cdot m$

$M_z := 0.0 \cdot kN \cdot m$

$N_v := 4.4 \cdot kN$ **{comb. 8, member 2, x=0.449m}**

Unity control

$bending\_traction_{control\_unity} = 0.255$ **<3.9>**

$$control := \begin{cases} \text{"OK"} & \text{if } bending\_traction_{control\_unity} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

control = "OK"

Stress control

$\sigma_{control} = 72.646 \frac{N}{mm^2}$ **<3.10>**

$$\frac{\sigma_{control}}{\sigma_{adm\_alu}} = 0.333$$

$$stress := \begin{cases} \text{"OK"} & \text{if } \frac{\sigma_{control}}{\sigma_{adm\_alu}} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

stress = "OK"

5. Peak splice.

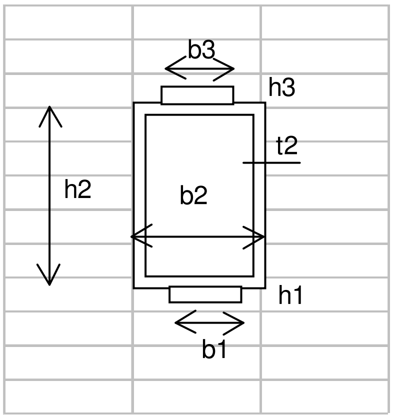
5.1. Steel profile <formulas: see document 6>

Section K150/50/3.
The splice is connected to the main profiles by 2 bolts M16-8.8.

$material := R_{e\_S235}$

Maximum moment at the section:

$M_y := 2.4\ kN \cdot m$ {Comb. 5, member 4, x = 2.628m}
$M_z := 0.0\ kN \cdot m$
$S_v := 2.7\ kN$
$N_v := 0.2\ kN$



example of section numbering

number of parts ([1]): $n := 1$

	Width	Height	Wall thickness ([2])	Gravity point of the part in y-direction	Gravity point of the part in z-direction
Part 1:	$b_1 := 50 \cdot mm$	$h_1 := 150 \cdot mm$	$t_1 := 3mm$	$y1 := \frac{h_1}{2}$	$z1 := \frac{b_1}{2}$

([1]) part = either a tube or a plate
([2]) if the part is a plate, the wall thickness = height / 2

Section

$A_{section} = 1.164 \times 10^{3}\ mm^{2}$ <6.1>

Gravity point

$y_{v} = 75\ mm$ <6.2>

$z_{v} = 25\ mm$

Moment of inertia

$I_{tot\_y} = 3.114 \times 10^{6}\ mm^{4}$ <6.4>

$I_{tot\_z} = 5.403 \times 10^{5}\ mm^{4}$

Von mise stress

$\sigma_{st} = 57.977 \frac{N}{mm^{2}}$ <6.6>

$\tau_{st} = 2.32 \frac{N}{mm^{2}}$ <6.7>

$\sigma_{vonmise} = 58.116 \frac{N}{mm^{2}}$ <6.8>

$\sigma_{adm}(material) = 213.636 \frac{N}{mm^{2}}$

$$stress := \begin{cases} \text{"OK"} & \text{if } \sigma_{vonmise} \le \sigma_{adm}(material) \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

stress = "OK"

5.2. Weld.

The connection is welded through the full cross section, so that the welded connection is as strong as the steel profile itself and hasn't to be checked.

5.3. Control of the bolts <formulas: see document 5>

Maximum moment at the gravity point of the bolted connection:

$M_v := 2.4$ kN·m **{Comb. 5, member 4, x = 2.628m}**

$N_v := 0.2$ kN

$S_v := 2.7$ kN

Number of bolts:

$n_{bolt} := 2$

The coordinates of the bolts are:

$x1 := 0mm$ $y1 := 0mm$ $x3 := 0mm$ $y3 := 0mm$ $x5 := 0mm$ $y5 := 0mm$

$x2 := 350mm$ $y2 := 0mm$ $x4 := 0mm$ $y4 := 0mm$ $x6 := 0mm$ $y6 := 0mm$

The properties of the bolt equal:

$D_b := 16 \cdot mm$ diameter of the bolt

$D_0 := 18 \cdot mm$ diameter of the bolthole

$F_{ub} := R_{t\_bolt}$ bolt material

The properties of the connection equal:

$e_{1\_out} := 80 \cdot mm$ enddistance of the outside profile

$e_{1\_in} := 50 \cdot mm$ enddistance of the inside profile

$p_1 := 290 \cdot mm$ distance between two bolts

$t_{out} := t_{alu}(prof\_roof_{prin})$ wall thickness of the outside profile

$t_{in} := t_1$ wall thickness of the inside profile

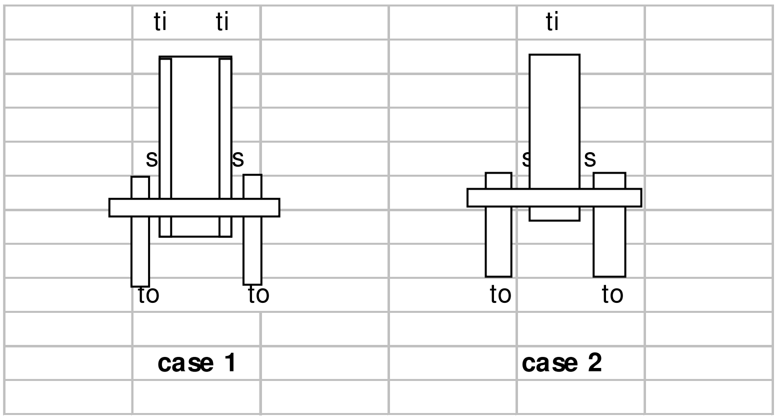
$s_{margin} := 22.5mm$ margin between the inside profile and the outside profile

$f_{y\_out} := R_{e\_alu}$ yield stress of the material on the outside

$f_{u\_out} := R_{t\_alu}$ tensile strength of the material on the outside

$f_{y\_in} := R_{e\_S235}$ yield stress of the material on the inside

$f_{u\_in} := R_{t\_S235}$ tensile strength of the material on the inside



case := 1

$$F_{res} := \begin{cases} F_R(M_v, N_v, S_v, n_{bolt}, x1, x2, x3, x4, x5, x6, y1, y2, y3, y4, y5, y6)\cdot kN & \text{if } n_{bolt} > 1 \\ \dfrac{\sqrt{N_v^2 + S_v^2}}{2}\cdot kN & \text{if } n_{bolt} = 1 \end{cases}$$ <5.1>

$F_{res} = 4.104\,kN$

$A_{bolt}(D_b) = 201.062\,mm^2$ <5.2>

Control of the shear force in the bolts

$c(F_{ub}) = 0.6$ <5.3>

bolt_force = 4.104 kN

shear_resist = 77.208 kN <5.4>

control_shear := | "OK" if bolt_force ≤ shear_resist
| "NOK" otherwise

control_shear = "OK"

Control of the bearing force in the aluminium profile

$\alpha_{out} = 1$ **<5.5>**

bolt_force = 4.104 kN

bearing_resist_out = 20.8 kN **<5.6>**

control_bearing := | "OK" if bolt_force ≤ bearing_resist_out
| "NOK" otherwise

control_bearing = "OK"

Control of the bearing force in the steel profile

$\alpha_{in} = 0.926$ **<5.5>**

bolt_force = 4.104 kN

bearing_resist_in = 32 kN **<5.6>**

control_bearing := | "OK" if bolt_force ≤ bearing_resist_in
| "NOK" otherwise

control_bearing = "OK"

Moment control in the bolts

$W(D_b) = 402.124\ mm^3$ **<5.7>**

d = 25.25 mm **<5.9>**

moment = 0.104 kN·m

moment_capacity = 0.206 kN·m **<5.8>**

control_moment := | "OK" if moment ≤ moment_capacity
| "NOK" otherwise

control_moment = "OK"

6. Eaves splice.

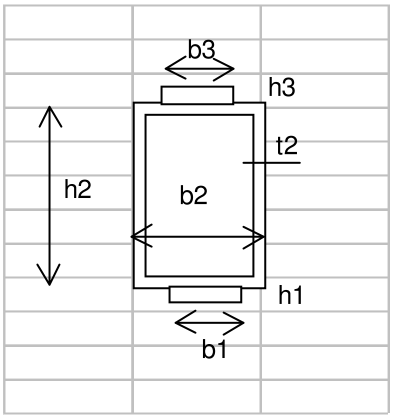
6.1. Steel profile <formulas: see document 6>

Section K150/50/4
The splice is connected to the main profiles by 3 bolts M16-8.8.

$material := R_{e\_S355}$

Maximum moment at the section:

$M_y := 12.2\ kN \cdot m$ **{Comb. 8, member 26, x = 2.649m}**
$M_z := 0.0\ kN \cdot m$
$S_v := 3.9\ kN$
$N_v := 3.0\ kN$



example of section numbering

number of parts ([1]): $n := 1$

	Width	Height	Wall thickness ([2])	Gravity point of the part in y-direction	Gravity point of the part in z-direction
Part 1:	$b_1 := 50 \cdot mm$	$h_1 := 150 \cdot mm$	$t_1 := 4mm$	$y1 := \frac{h_1}{2}$	$z1 := \frac{b_1}{2}$

([1]) part = either a tube or a plate
([2]) if the part is a plate, the wall thickness = height / 2

Section

$A_{section} = 1.536 \times 10^{3}\ mm^{2}$ <6.1>

Gravity point

$y_{v} = 75\ mm$

$z_{v} = 25\ mm$ <6.2>

Moment of inertia

$I_{tot\_y} = 4.041 \times 10^{6}\ mm^{4}$

$I_{tot\_z} = 6.858 \times 10^{5}\ mm^{4}$ <6.4>

Von mise stress

$\sigma_{st} = 228.383 \frac{N}{mm^{2}}$ <6.6>

$\tau_{st} = 2.539 \frac{N}{mm^{2}}$ <6.7>

$\sigma_{vonmise} = 228.425 \frac{N}{mm^{2}}$ <6.8>

$\sigma_{adm}(\text{material}) = 322.727 \frac{N}{mm^{2}}$

stress := "OK" if $\sigma_{vonmise} \le \sigma_{adm}(\text{material})$
"NOK" otherwise

stress = "OK"

6.2. Weld.

The connection is welded through the full cross section, so that the welded connection is as strong as the steel profile itself and hasn't to be checked.

6.3. Control of the bolts <formulas: see document 5>

Maximum moment at the gravity point of the bolted connection:

$M_v := 12.2$ kN·m {Comb. 8, member 26, x = 2.649m}

$N_v := 3.0$ kN

$S_v := 3.9$ kN

Number of bolts:

$n_{bolt} := 2$

The coordinates of the bolts are:

$x1 := 0mm$ $y1 := 0mm$ $x3 := 0mm$ $y3 := 0mm$ $x5 := 0mm$ $y5 := 0mm$

$x2 := 200mm$ $y2 := 0mm$ $x4 := 0mm$ $y4 := 0mm$ $x6 := 0mm$ $y6 := 0mm$

The properties of the bolt equal:

$D_b := 16\cdot mm$ diameter of the bolt

$D_0 := 18\cdot mm$ diameter of the bolthole

$F_{ub} := R_{t\_bolt}$ bolt material

The properties of the connection equal:

$e_{1\_out} := 54\cdot mm$ enddistance of the outside profile

$e_{1\_in} := 45\cdot mm$ enddistance of the inside profile

$p_1 := 100\cdot mm$ distance between two bolts

$t_{out} := t_{alu}(prof\_roof_{prin})$ wall thickness of the outside profile

$t_{in} := t_1$ wall thickness of the inside profile

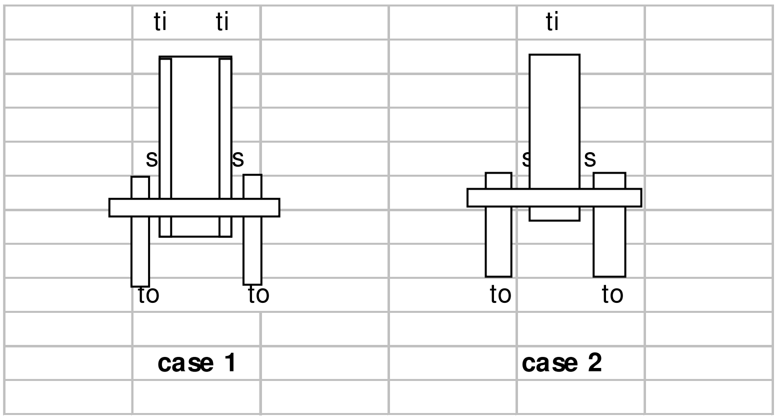
$s_{margin} := 1.5mm$ margin between the inside profile and the outside profile

$f_{y\_out} := R_{e\_alu}$ yield stress of the material on the outside

$f_{u\_out} := R_{t\_alu}$ tensile strength of the material on the outside

$f_{y\_in} := R_{e\_S355}$ yield stress of the material on the inside

$f_{u\_in} := R_{t\_S355}$ tensile strength of the material on the inside



case := 1

$$F_{res} := \begin{cases} F_R(M_v, N_v, S_v, n_{bolt}, x1, x2, x3, x4, x5, x6, y1, y2, y3, y4, y5, y6) \cdot kN & \text{if } n_{bolt} > 1 \\ \frac{\sqrt{N_v^2 + S_v^2}}{2} \cdot kN & \text{if } n_{bolt} = 1 \end{cases}$$ <5.1>

$F_{res} = 19.081\,kN$

$A_{bolt}(D_b) = 201.062\,mm^2$ <5.2>

Control of the shear force in the bolts

$c(F_{ub}) = 0.6$ <5.3>

bolt_force = 19.081 kN

shear_resist = 77.208 kN <5.4>

$$control\_shear := \begin{cases} \text{"OK"} & \text{if } bolt\_force \le shear\_resist \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

control_shear = "OK"

Control of the bearing force in the aluminium profile

$\alpha_{out} = 1$ **<5.5>**

bolt_force = 19.081 kN

bearing_resist_out = 20.8 kN **<5.6>**

control_bearing := | "OK" if bolt_force ≤ bearing_resist_out
| "NOK" otherwise

control_bearing = "OK"

Control of the bearing force in the steel profile

$\alpha_{in} = 0.833$ **<5.5>**

bolt_force = 19.081 kN

bearing_resist_in = 54.4 kN **<5.6>**

control_bearing := | "OK" if bolt_force ≤ bearing_resist_in
| "NOK" otherwise

control_bearing = "OK"

Moment control in the bolts

$W(D_b) = 402.124\ mm^3$ **<5.7>**

d = 4.75 mm **<5.9>**

moment = 0.091 kN·m

moment_capacity = 0.206 kN·m **<5.8>**

control_moment := | "OK" if moment ≤ moment_capacity
| "NOK" otherwise

control_moment = "OK"

7. Purlins. <formulas: see document 3>

$k_y := 1.0$ $k_z := 1.0$ $L_y := 4900mm$ $L_z := 4900mm$

7.1. Peak and eaves purlin : alu133/70.

$profile := prof\_purlin_{strong1}$

$prof_{control}(profile) = "alu133/70"$

classification(profile) = 2 <3.1>

Shape factor :

$\alpha_{y\_prof} = 1.256$ $\alpha_{z\_prof} = 1.248$ <3.2>

Profile capacity :

$N_{rd\_prof} = 349.964\,kN$

$M_{yrd\_prof} = 15.731\,kN \cdot m$ <3.3>

$M_{zrd\_prof} = 8.225\,kN \cdot m$

Slenderness :

$\lambda_{y\_prof} = 100.408$ $\lambda_{z\_prof} = 190.61$ <3.4>

$\lambda_{by\_prof} = 1.871$ $\lambda_{bz\_prof} = 3.553$ <3.5>

Reduction coefficient for buckling :

$\phi_{y\_prof} = 2.428$ $\phi_{z\_prof} = 7.156$ <3.6>

$\chi_{y\_prof} = 0.252$ $\chi_{z\_prof} = 0.075$ <3.7>

7.1.1 Compression

$M_y := 0.0 \cdot kN \cdot m$

$M_z := 0.0 \cdot kN \cdot m$

$N_{comp} := 3.8 \cdot kN$ **{comb. 5, member 53, x=3.33m}**

Buckling control

$buckling_{control\_unity} = 0.214$ **<3.8>**

$$control := \begin{cases} \text{"OK"} & \text{if } buckling_{control\_unity} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

control = "OK"

Stress control

$\sigma_{control} = 2.369 \frac{N}{mm^2}$ **<3.10>**

$\frac{\sigma_{control}}{\sigma_{adm\_alu}} = 0.011$

$$stress := \begin{cases} \text{"OK"} & \text{if } \frac{\sigma_{control}}{\sigma_{adm\_alu}} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

stress = "OK"

7.1.2 Traction

$N_{traction} := 8.5 \cdot kN$ **{comb. 3, member 68, x=0.0m}**

$bending\_traction_{control\_unity} = 7.962 \times 10^{-3}$ **<3.9>**

$$control := \begin{cases} \text{"OK"} & \text{if } bending\_traction_{control\_unity} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

$control = \text{"OK"}$

Stress control

$\sigma_{control} = 5.299 \frac{N}{mm^2}$ **<3.10>**

$$\frac{\sigma_{control}}{\sigma_{adm\_alu}} = 0.024$$

$$stress := \begin{cases} \text{"OK"} & \text{if } \frac{\sigma_{control}}{\sigma_{adm\_alu}} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

$stress = \text{"OK"}$

7.2. Normal purlin : alu60/60/3.

$profile := prof\_purlin_{weak}$

$prof_{control}(profile) = $ "alu60/60/3"

$classification(profile) = 1$ **<3.1>**

Shape factor :

$\alpha_{y\_prof} = 1.188$ $\alpha_{z\_prof} = 1.188$ **<3.2>**

Profile capacity :

$N_{rd\_prof} = 144\,kN$

$M_{yrd\_prof} = 3.033\,kN \cdot m$ **<3.3>**

$M_{zrd\_prof} = 3.033\,kN \cdot m$

Slenderness :

$\lambda_{y\_prof} = 212.478$ $\lambda_{z\_prof} = 212.478$ **<3.4>**

$\lambda_{by\_prof} = 3.96$ $\lambda_{bz\_prof} = 3.96$ **<3.5>**

Reduction coefficient for buckling :

$\phi_{y\_prof} = 8.728$ $\phi_{z\_prof} = 8.728$ **<3.6>**

$\chi_{y\_prof} = 0.061$ $\chi_{z\_prof} = 0.061$ **<3.7>**

7.2.1 Compression

$N_{comp} := 0.5 \cdot kN$ **{comb. 10, member 74, x=2.5m}**

Buckling control

$buckling_{control\_unity} = 0.102$ **<3.8>**

$$control := \begin{cases} \text{"OK"} & \text{if } buckling_{control\_unity} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

$control = \text{"OK"}$

Stress control

$\sigma_{control} = 0.758 \frac{N}{mm^2}$ **<3.10>**

$$\frac{\sigma_{control}}{\sigma_{adm\_alu}} = 3.472 \times 10^{-3}$$

$$stress := \begin{cases} \text{"OK"} & \text{if } \frac{\sigma_{control}}{\sigma_{adm\_alu}} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

$stress = \text{"OK"}$

7.2.2 Traction

$N_{traction} := 0.7 \cdot kN$ **{comb. 3, member 77, x=0.0m}**

$bending\_traction_{control\_unity} = 9.835 \times 10^{-4}$ **<3.9>**

$$control := \begin{cases} "OK" & \text{if } bending\_traction_{control\_unity} \leq 1.0 \\ "NOK" & \text{otherwise} \end{cases}$$

$control = "OK"$

Stress control

$\sigma_{control} = 1.061 \frac{N}{mm^2}$ **<3.10>**

$$\frac{\sigma_{control}}{\sigma_{adm\_alu}} = 4.861 \times 10^{-3}$$

$$stress := \begin{cases} "OK" & \text{if } \frac{\sigma_{control}}{\sigma_{adm\_alu}} \leq 1.0 \\ "NOK" & \text{otherwise} \end{cases}$$

$stress = "OK"$

8. Gable end. <formulas: see document 3>

8.1. Gable upright : alu133/70

$k_y := 1.0$ $k_z := 1.0$ $L_y := 4250mm$ $L_z := 2649mm$

$profile := prof\_gable_{up}$

$prof_{control}(profile) = "alu133/70"$

$classification(profile) = 2$ <3.1>

Shape factor :

$\alpha_{y\_prof} = 1.256$ $\alpha_{z\_prof} = 1.248$ <3.2>

Profile capacity :

$N_{rd\_prof} = 349.964\,kN$

$M_{yrd\_prof} = 15.731\,kN \cdot m$ <3.3>

$M_{zrd\_prof} = 8.225\,kN \cdot m$

Slenderness :

$\lambda_{y\_prof} = 87.088$ $\lambda_{z\_prof} = 103.046$ <3.4>

$\lambda_{by\_prof} = 1.623$ $\lambda_{bz\_prof} = 1.921$ <3.5>

Reduction coefficient for buckling :

$\phi_{y\_prof} = 1.97$ $\phi_{z\_prof} = 2.526$ <3.6>

$\chi_{y\_prof} = 0.324$ $\chi_{z\_prof} = 0.24$ <3.7>

8.1.1 Bending + compression

$M_y := 2.8 \cdot kN \cdot m$ **{comb. 8, member 105, x=0.0m}**

$M_z := 0.2 \cdot kN \cdot m$

$N_v := 3.7 \cdot kN$ normal force / compression

Buckling control

$buckling_{control\_unity} = 0.258$ **<3.8>**

$$control := \begin{cases} \text{"OK"} & \text{if } buckling_{control\_unity} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

$control = \text{"OK"}$

Stress control

$\sigma_{control} = 57.654 \frac{N}{mm^2}$ **<3.10>**

$$\frac{\sigma_{control}}{\sigma_{adm\_alu}} = 0.264$$

$$stress := \begin{cases} \text{"OK"} & \text{if } \frac{\sigma_{control}}{\sigma_{adm\_alu}} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

$stress = \text{"OK"}$

8.1.2. Bending + traction

$M_y := 3.7 \cdot kN \cdot m$

{comb. 7, member 104, x = 2.649m}

$M_z := 1.6 \cdot kN \cdot m$

$N_v := 3.1 \cdot kN$ normal force / traction

Unity control

$bending\_traction_{control\_unity} = 0.319$ **<3.9>**

$$control := \begin{cases} \text{"OK"} & \text{if } bending\_traction_{control\_unity} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

control = "OK"

Stress control

$\sigma_{control} = 119.174 \frac{N}{mm^2}$ **<3.10>**

$\frac{\sigma_{control}}{\sigma_{adm\_alu}} = 0.546$

$$stress := \begin{cases} \text{"OK"} & \text{if } \frac{\sigma_{control}}{\sigma_{adm\_alu}} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

stress = "OK"

8.2. Gable horizontal : alu130/70

$k_y := 1.0$ $k_z := 1.0$ $L_y := 4930mm$ $L_z := 4930mm$

$profile := prof\_gable_{hor}$

$prof_{control}(profile) = "alu130/70"$

classification(profile) = 2 <3.1>

Shape factor :

$\alpha_{y\_prof} = 1.312$ $\alpha_{z\_prof} = 1.191$ <3.2>

Profile capacity :

$N_{rd\_prof} = 326.618\,kN$

$M_{yrd\_prof} = 13.767\,kN \cdot m$ <3.3>

$M_{zrd\_prof} = 8.291\,kN \cdot m$

Slenderness :

$\lambda_{y\_prof} = 107.989$ $\lambda_{z\_prof} = 180.239$ <3.4>

$\lambda_{by\_prof} = 2.013$ $\lambda_{bz\_prof} = 3.359$ <3.5>

Reduction coefficient for buckling :

$\phi_{y\_prof} = 2.717$ $\phi_{z\_prof} = 6.469$ <3.6>

$\chi_{y\_prof} = 0.22$ $\chi_{z\_prof} = 0.083$ <3.7>

8.2.1 Bending + compression

$M_y := 2.3 \cdot kN \cdot m$ **{comb. 3, member 106, x=2.5m}**

$M_z := 0.2 \cdot kN \cdot m$

$N_v := 1.3 \cdot kN$ normal force / compression

Buckling control

$buckling_{control\_unity} = 0.252$ **<3.8>**

$$control := \begin{cases} \text{"OK"} & \text{if } buckling_{control\_unity} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

$control = \text{"OK"}$

Stress control

$\sigma_{control} = 55.035 \frac{N}{mm^2}$ **<3.10>**

$$\frac{\sigma_{control}}{\sigma_{adm\_alu}} = 0.252$$

$$stress := \begin{cases} \text{"OK"} & \text{if } \frac{\sigma_{control}}{\sigma_{adm\_alu}} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

$stress = \text{"OK"}$

8.2.2 Bending + traction

$M_y := 2.1 \cdot kN \cdot m$ **{comb. 6, member 106, x = 2.5m}**

$M_z := 0.0 \cdot kN \cdot m$

$N_v := 1.8 \cdot kN$ normal force / traction

Unity control

$bending\_traction_{control\_unity} = 0.148$ **<3.9>**

$$control := \begin{cases} \text{"OK"} & \text{if } bending\_traction_{control\_unity} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

control = "OK"

Stress control

$\sigma_{control} = 44.952 \frac{N}{mm^2}$ **<3.10>**

$\frac{\sigma_{control}}{\sigma_{adm\_alu}} = 0.206$

$$stress := \begin{cases} \text{"OK"} & \text{if } \frac{\sigma_{control}}{\sigma_{adm\_alu}} \le 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

stress = "OK"

9. Wind bracing cable.

Side

The maximum force in the bracing cable equals :

$N_{max} := 3.1 \cdot kN$ **{Comb. 9, member 92}**

$$Security(S) := \begin{cases} "OK" & \text{if } S \geq 1.0 \\ "NOK" & \text{otherwise} \end{cases}$$

1. Cable tightener : 3/4" x 12 Type 2 2360 kg

$MBL := 118 \cdot kN$ Minimum break load

The security factor equals :

$S := \frac{MBL}{N_{max}}$ $S = 38.065$ $Security(S) = "OK"$

2. Steel cable - diameter 10 mm - 6 x 19

$MBL := 58.9 \cdot kN$ Minimum break load

The security factor equals :

$S := \frac{MBL}{N_{max}}$ $S = 19$ $Security(S) = "OK"$

3. D-fastener - dia 9/16 - 0.6 ton

$MBL := 30 \cdot kN$ Minimum break load

The security factor equals :

$S := \frac{MBL}{N_{max}}$ $S = 9.677$ $Security(S) = "OK"$

4. Eyebolt M16

$MBL := 35 \cdot kN$ Minimum break load

The security factor equals :

$S := \frac{MBL}{N_{max}}$ $S = 11.29$ $Security(S) = "OK"$

Roof

The maximum force in the bracing cable equals :

$N_{max} := 5.5 \cdot kN$ **{Comb. 3, member 103}**

$$Security(S) := \begin{cases} \text{"OK"} & \text{if } S \geq 1.0 \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

1. Cable tightener : 1/2" x 9 Type 2 1000 kg

$MBL := 50 \cdot kN$ Minimum break load

The security factor equals :

$S := \dfrac{MBL}{N_{max}}$ $S = 9.091$ $Security(S) = \text{"OK"}$

2. Steel cable - diameter 6 mm - 6 x 19 VZ

$MBL := 19.6 \cdot kN$ Minimum break load

The security factor equals :

$S := \dfrac{MBL}{N_{max}}$ $S = 3.564$ $Security(S) = \text{"OK"}$

3. D-fastener - dia 7/16 - 0.4 ton

$MBL := 20 \cdot kN$ Minimum break load

The security factor equals :

$S := \dfrac{MBL}{N_{max}}$ $S = 3.636$ $Security(S) = \text{"OK"}$

4. Eyebolt M16

$MBL := 35 \cdot kN$ Minimum break load

The security factor equals :

$S := \dfrac{MBL}{N_{max}}$ $S = 6.364$ $Security(S) = \text{"OK"}$

10. Connection of arch to baseplate.

The reaction forces are (in kN):

$$R := \begin{pmatrix} 1.7 & 0.2 & 1.2 \\ 0.9 & 3.1 & 2.4 \\ 6.4 & 0.0 & 5.3 \\ 4.2 & 0.3 & 4.7 \end{pmatrix} \quad kN$$

row 1 = {comb. 10, node 8} with max Rx
row 2 = {comb. 10, node 5} with max Ry
row 3 = {comb. 3, node 22} with max Rz
row 4 = {comb. 8, node 43} with max Rz downforce

$R_x := R^{\langle 0 \rangle} \quad R_y := R^{\langle 1 \rangle} \quad R_z := R^{\langle 2 \rangle}$

$R_{x\_df} := \left(R^{\langle 0 \rangle T}\right)^{\langle 3 \rangle} \cdot kN \qquad R_{x\_df} = (4.2)\,kN$

$R_{y\_df} := \left(R^{\langle 1 \rangle T}\right)^{\langle 3 \rangle} \cdot kN \qquad R_{y\_df} = (0.3)\,kN$

$R_{z\_df} := \left(R^{\langle 2 \rangle T}\right)^{\langle 3 \rangle} \cdot kN \qquad R_{z\_df} = (4.7)\,kN$

10.1. Steel profile

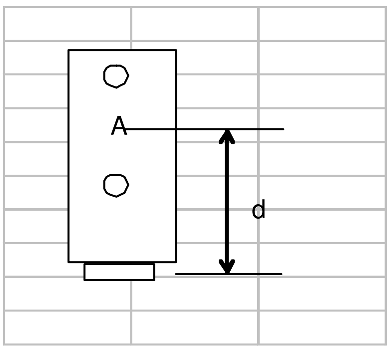
<formulas: see document 6>

Section K150/50/4
The splice is connected to the main profiles by 2 bolts M16-8.8.

$material := R_{e\_S235}$

Maximum forces at the gravity point of the bolted connection:

$d := 175mm$

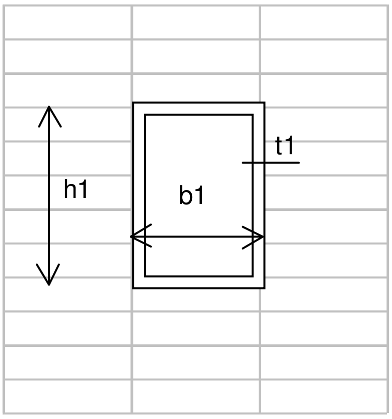


$M_y := R_x \cdot d$

$M_z := R_y \cdot d$

$N_v := R_z$

$S_v := \sqrt{R_x^{\,2} + R_y^{\,2}}$



$$M_y = \begin{pmatrix} 0.298 \\ 0.158 \\ 1.12 \\ 0.735 \end{pmatrix} m \quad N_v = \begin{pmatrix} 1.2 \\ 2.4 \\ 5.3 \\ 4.7 \end{pmatrix} \quad S_v = \begin{pmatrix} 1.712 \\ 3.228 \\ 6.4 \\ 4.211 \end{pmatrix}$$

$$M_z = \begin{pmatrix} 0.035 \\ 0.543 \\ 0 \\ 0.053 \end{pmatrix} m$$

number of parts (1): $n := 1$

	Width	Height	Wall thickness (2)	Gravity point of the part in y-direction	Gravity point of the part in z-direction
Part 1:	$b_1 := 50 \cdot mm$	$h_1 := 150 \cdot mm$	$t_1 := 4 \cdot mm$	$y1 := 75 \cdot mm$	$z1 := 25 \cdot mm$

(1) part = either a tube or a plate
(2) if the part is a plate, the wall thickness = height / 2

Section

$A_{section} = 1.536 \times 10^3\ mm^2$ <6.1>

Gravity point

$y_v = 75\ mm$ <6.2>

$z_v = 25\ mm$ <6.3>

Moment of inertia

$I_{tot\_y} = 4.041 \times 10^6\ mm^4$ <6.4>

$I_{tot\_z} = 6.858 \times 10^5\ mm^4$ <6.5>

Von mise stress

$$\sigma_{st} = 24.237 \frac{N}{mm^2}$$ **<6.6>**

$$\tau_{st} = 4.167 \frac{N}{mm^2}$$ **<6.7>**

$$\sigma_{vonmise} = 25.289 \frac{N}{mm^2}$$ **<6.8>**

$$\sigma_{adm}(\text{material}) = 213.636 \frac{N}{mm^2}$$

$$\text{stress} := \begin{cases} \text{"OK"} & \text{if } \sigma_{vonmise} \le \sigma_{adm}(\text{material}) \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

stress = "OK"

10.2. Control of the bolts (2xM16) **<formulas: see document 5>**

The forces in the bolts are:

$M_v := M_y$

$N_v := R_z$

$S_v := R_x$

$$M_v = \begin{pmatrix} 0.298 \\ 0.158 \\ 1.12 \\ 0.735 \end{pmatrix} m \quad N_v = \begin{pmatrix} 1.2 \\ 2.4 \\ 5.3 \\ 4.7 \end{pmatrix} \quad S_v = \begin{pmatrix} 1.7 \\ 0.9 \\ 6.4 \\ 4.2 \end{pmatrix}$$

Number of bolts:

$n_{bolt} := 2$

The coordinates of the bolts are:

$x1 := 0mm$	$y1 := 0mm$	$x3 := 0mm$	$y3 := 0mm$	$x5 := 0mm$	$y5 := 0mm$
$x2 := 200mm$	$y2 := 0mm$	$x4 := 0mm$	$y4 := 0mm$	$x6 := 0mm$	$y6 := 0mm$

The properties of the bolt equal:

$D_b := 16 \cdot mm$ diameter of the bolt

$D_0 := 18 \cdot mm$ diameter of the bolthole

$F_{ub} := R_{t\_bolt}$ bolt material

The properties of the connection equal:

$e_{1\_out} := 50 \cdot mm$ enddistance of the outside profile

$e_{1\_in} := 40 \cdot mm$ enddistance of the inside profile

$p_1 := 200 \cdot mm$ distance between two bolts

$t_{out} := t_{alu}(prof\_foot_{prin})$ wall thickness of the outside profile

$t_{in} := t_1$ wall thickness of the inside profile

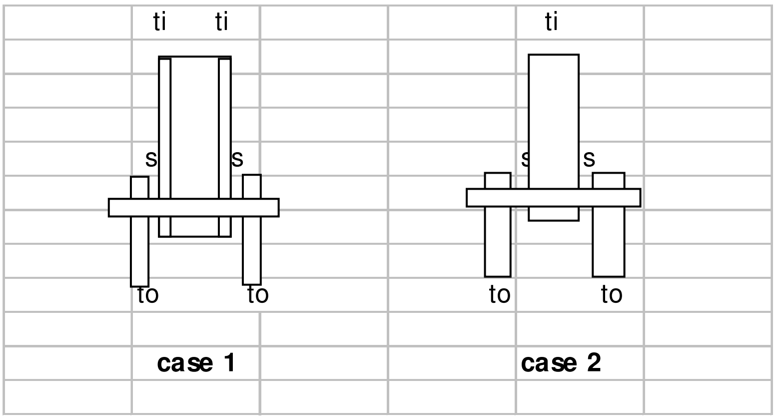
$s_{margin} := 1.5mm$ margin between the inside profile and the outside profile

$f_{y\_out} := R_{e\_alu}$ yield stress of the material on the outside

$f_{u\_out} := R_{t\_alu}$ tensile strength of the material on the outside

$f_{y\_in} := R_{e\_S235}$ yield stress of the material on the inside

$f_{u\_in} := R_{t\_S235}$ tensile strength of the material on the inside



case := 1

$F_{res} = 4.595\,kN$ **<5.1>**

$A_{bolt}(D_b) = 201.062\,mm^2$ **<5.2>**

Control of the shear force in the bolts

$c(F_{ub}) = 0.6$ **<5.3>**

bolt_force = 4.595 kN

shear_resist = 77.208 kN **<5.4>**

control_shear := | "OK" if bolt_force ≤ shear_resist
| "NOK" otherwise

control_shear = "OK"

Control of the bearing force in the aluminium profile

$\alpha_{out} = 0.926$ **<5.5>**

$bolt\_force = 4.595\,kN$

$bearing\_resist\_out = 19.259\,kN$ **<5.6>**

$$control\_bearing := \begin{cases} \text{"OK"} & \text{if } bolt\_force \le bearing\_resist\_out \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

$control\_bearing = \text{"OK"}$

Control of the bearing force in the steel profile

$\alpha_{in} = 0.741$ **<5.5>**

$bolt\_force = 4.595\,kN$

$bearing\_resist\_in = 34.133\,kN$ **<5.6>**

$$control\_bearing := \begin{cases} \text{"OK"} & \text{if } bolt\_force \le bearing\_resist\_in \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

$control\_bearing = \text{"OK"}$

Moment control in the bolts

$W(D_b) = 402.124\,mm^3$ **<5.7>**

$d = 4.75\,mm$ **<5.9>**

$moment = 0.022\,kN \cdot m$

$moment\_capacity = 0.206\,kN \cdot m$ **<5.8>**

$$control\_moment := \begin{cases} \text{"OK"} & \text{if } moment \le moment\_capacity \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

$control\_moment = \text{"OK"}$

10.3. Control of the pin in the footplate M16 <formulas: see document 5>

$n_{bolt} := 1$ number of bolts

The properties of the bolt equal:

$D_b := 16 \cdot mm$ diameter of the bolt

$D_0 := 18.9 \cdot mm$ diameter of the bolthole

$F_{ub} := R_{t\_S235}$ bolt material

$F_{res} = 4.595\,kN$ **<5.1>**

$A_{bolt}(D_b) = 201.062\,mm^2$ **<5.2>**

<u>Control of the shear force in the bolts</u>

$c(F_{ub}) = 0.6$ **<5.3>**

bolt_force = 4.595 kN

shear_resist = 34.744 kN **<5.4>**

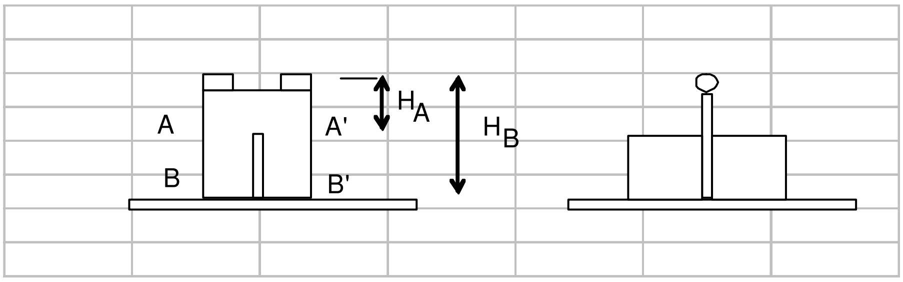
control_shear := | "OK" if bolt_force ≤ shear_resist
| "NOK" otherwise

control_shear = "OK"

11. Baseplate.

11.1. Bending of the vertical steel plates.

$material := R_{e\_S235}$



$H_A := 70mm$

$H_B := 163mm$

a) Section AA' (Fe 140/10)

The forces are:

$M_y := R_y \cdot H_A$

$M_z := R_x \cdot H_A$

$N_v := R_z$

$S_v := \sqrt{R_x^{\,2} + R_y^{\,2}}$

$M_y = \begin{pmatrix} 0.014 \\ 0.217 \\ 0 \\ 0.021 \end{pmatrix} m \qquad M_z = \begin{pmatrix} 0.119 \\ 0.063 \\ 0.448 \\ 0.294 \end{pmatrix} m \qquad N_v = \begin{pmatrix} 1.2 \\ 2.4 \\ 5.3 \\ 4.7 \end{pmatrix} \qquad S_v = \begin{pmatrix} 1.712 \\ 3.228 \\ 6.4 \\ 4.211 \end{pmatrix}$

number of parts (1): $n := 1$

	Width	Height	Wall thickness (2)	Gravity point of the part in y-direction	Gravity point of the part in z-direction
Part 1:	$b_1 := 140 \cdot mm$	$h_1 := 10 \cdot mm$	$t_1 := 5 \cdot mm$	$y1 := 5 \cdot mm$	$z1 := 70 \cdot mm$

(1) part = either a tube or a plate
(2) if the part is a plate, the wall thickness = height / 2

Section

$A_{section} = 1.4 \times 10^{3}\,mm^{2}$ <6.1>

Gravity point

$y_v = 5\,mm$ <6.2>

$z_v = 70\,mm$ <6.3>

Moment of inertia

$I_{tot\_y} = 1.167 \times 10^{4}\,mm^{4}$ <6.4>

$I_{tot\_z} = 2.287 \times 10^{6}\,mm^{4}$ <6.5>

Von mise stress

$\sigma_{st} = 96.643\,\frac{N}{mm^{2}}$ <6.6>

$\tau_{st} = 2.306\,\frac{N}{mm^{2}}$ <6.7>

$\sigma_{vonmise} = 96.725\,\frac{N}{mm^{2}}$ <6.8>

$\sigma_{adm}(material) = 213.636\,\frac{N}{mm^{2}}$

$$stress := \begin{cases} "OK" & \text{if } \sigma_{vonmise} \le \sigma_{adm}(material) \\ "NOK" & \text{otherwise} \end{cases}$$

stress = "OK"

b) Section BB' (Fe140/10 + 2x Fe70/10)

The forces are:

$M_y := R_y \cdot H_B$

$M_z := R_x \cdot H_B$

$N_v := R_z$

$S_v := \sqrt{R_x^2 + R_y^2}$

$$M_y = \begin{pmatrix} 0.033 \\ 0.505 \\ 0 \\ 0.049 \end{pmatrix} m \qquad M_z = \begin{pmatrix} 0.277 \\ 0.147 \\ 1.043 \\ 0.685 \end{pmatrix} m \qquad N_v = \begin{pmatrix} 1.2 \\ 2.4 \\ 5.3 \\ 4.7 \end{pmatrix} \qquad S_v = \begin{pmatrix} 1.712 \\ 3.228 \\ 6.4 \\ 4.211 \end{pmatrix}$$

number of parts (1): $n := 3$

	Width	Height	Wall thickness (2)	Gravity point of the part in y-direction	Gravity point of the part in z-direction
Part 1:	$b_1 := 10 \cdot mm$	$h_1 := 70 \cdot mm$	$t_1 := 35 \cdot mm$	$y1 := 35 \cdot mm$	$z1 := 70 \cdot mm$
Part 2:	$b_2 := 140 \cdot mm$	$h_2 := 10 \cdot mm$	$t_2 := 5 \cdot mm$	$y2 := 75 \cdot mm$	$z2 := 70 \cdot mm$
Part 3:	$b_3 := 10 \cdot mm$	$h_3 := 70 \cdot mm$	$t_3 := 35 \cdot mm$	$y3 := 115 \cdot mm$	$z3 := 70 \cdot mm$

(1) part = either a tube or a plate
(2) if the part is a plate, the wall thickness = height / 2

Section

$A_{section} = 2.8 \times 10^3 \, mm^2$ **<6.1>**

Gravity point

$y_v = 75 \, mm$ **<6.2>**

$z_v = 70 \, mm$ **<6.3>**

Moment of inertia

$I_{tot\_y} = 2.823 \times 10^6 \, mm^4$ **<6.4>**

$I_{tot\_z} = 2.298 \times 10^6 \, mm^4$ **<6.5>**

Von mise stress

$$\sigma_{st} = 33.665 \frac{N}{mm^2}$$ **<6.6>**

$$\tau_{st} = 2.286 \frac{N}{mm^2}$$ **<6.7>**

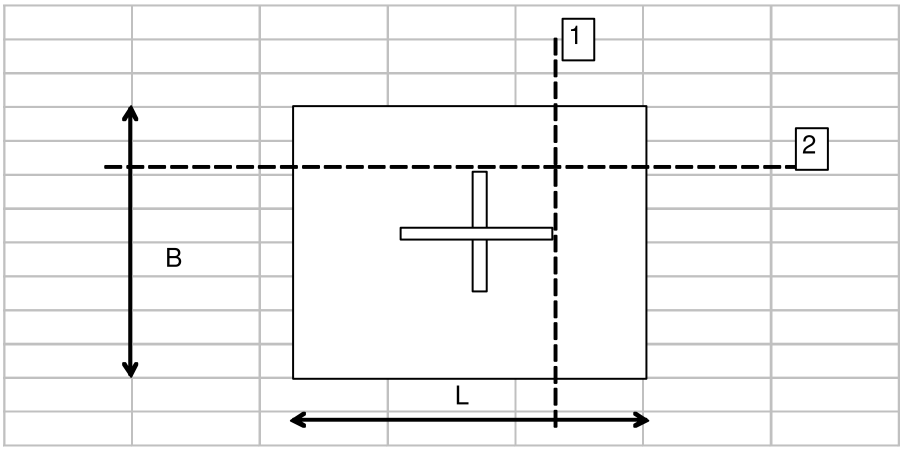
$$\sigma_{vonmise} = 33.897 \frac{N}{mm^2}$$ **<6.8>**

$$\sigma_{adm}(material) = 213.636 \frac{N}{mm^2}$$

$$stress := \begin{cases} \text{"OK"} & \text{if } \sigma_{vonmise} \le \sigma_{adm}(material) \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

stress = "OK"

11.2. Bending of the horizontal steel plate. <formulas: see document 7>



The checked sections

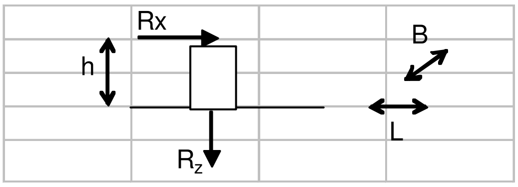
$B_p := 300 \cdot mm$ $H_p := 10 \cdot mm$ $L_p := 300 \cdot mm$

material := R_{e_S235}

baseplate := "side"

L = length of the horizontal plate in y direction
B = width of the horizontal plate in x direction
H = thickness of the horizontal plate

a) Section 1



$R_{x\_df} = (4.2)\,kN$

$R_{z\_df} = (4.7)\,kN$

{Comb 8, node 43}

$h_p := H_B + H_p$

Maximum groundpressure : $p_{max\_ground} := 100 \frac{kN}{m^2}$

$p_{ground}(\sigma) := \begin{cases} \text{"OK, no need for terrain verification"} & \text{if } \sigma \le p_{max\_ground} \\ \text{"terrain verrification needed"} & \text{otherwise} \end{cases}$

$\sigma_{Max} = 0.214 \frac{N}{mm^2}$ <7.1> $p_{ground}(\sigma_{Max}) = \text{"terrain verrification needed"}$

$\sigma_{Min} = -0.109 \frac{N}{mm^2}$

$p_{Max} = 64.107 \frac{kN}{m}$ <7.2>

$p_{Min} = -32.773 \frac{kN}{m}$

$a_1 := 80mm$ distance from the border of the plate till section 1

$p_{r1} = 25.835 \frac{kN}{m}$ <7.3>

$a_{\Delta 1} = 198.514\,mm$ <7.4>

$p_{ax1} = 38.272 \frac{kN}{m}$ <7.5>

Gravity distance:

$a_{g1} = 43.365\,mm$ <7.6>

Maximum moment:

$M_{max1} = 0.178\,kN \cdot m$ <7.7>

Section 1: at distance a1

$$M_y := \frac{M_{max1}}{kN}$$

number of parts (1): $n := 1$

	Width	Height	Wall thickness (2)	Gravity point of the part in y-direction
Part 1:	$b_1 := B_p$	$h_1 := H_p$	$t_1 := \frac{H_p}{2}$	$y1 := \frac{H_p}{2}$

Section

$A_{section} = 3 \times 10^{3}\ mm^{2}$ **<6.1>**

Gravity point

$y_{v} = 5\ mm$ **<6.2>**

Moment of inertia

$I_{tot\_y} = 2.5 \times 10^{4}\ mm^{4}$ **<6.4>**

Von mise stress

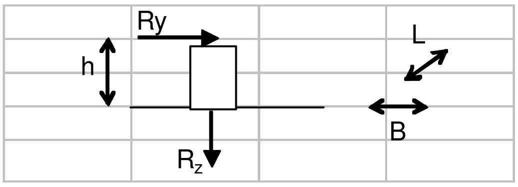
$\sigma_{vonmise} = 35.517\ \frac{N}{mm^{2}}$ **<6.8>**

$\sigma_{adm}(material) = 213.636\ \frac{N}{mm^{2}}$

$$stress := \begin{cases} \text{"OK"} & \text{if } \sigma_{vonmise} \le \sigma_{adm}(material) \\ \text{"NOK"} & \text{otherwise} \end{cases}$$

stress = "OK"

b) Section 2



$R_{y\_df} = (0.3)\,kN$

$R_{z\_df} = (4.7)\,kN$ **{Comb 8, node 43}**

$\sigma_{Max} = 0.064 \frac{N}{mm^2}$ **<7.1>** $p_{ground}(\sigma_{Max})$ = "OK, no need for terrain verification"

$\sigma_{Min} = 0.041 \frac{N}{mm^2}$

$p_{Max} = 19.127 \frac{kN}{m}$ **<7.2>**

$p_{Min} = 12.207 \frac{kN}{m}$

$a_2 := 75mm$ distance from the border of the plate till section 2

$p_{r2} = 1.73 \frac{kN}{m}$ **<7.3>**

$a_{\Delta 2} = 183.128\,mm$ **<7.4>**

$p_{ax2} = 17.397 \frac{kN}{m}$ **<7.5>**

Gravity distance:

$a_{g2} = 38.092\,mm$ **<7.6>**

Maximum moment:

$M_{max2} = 0.052\,kN \cdot m$ **<7.7>**

Section 2: at distance a2

$M_y := \frac{M_{max2}}{kN}$

number of parts (1): $n := 1$

	Width	Height	Wall thickness (2)	Gravity point of the part in y-direction
Part 1:	$b_1 := L_p$	$h_1 := H_p$	$t_1 := \frac{H_p}{2}$	$y1 := \frac{H_p}{2}$

(1) part = either a tube or a plate
(2) if the part is a plate, the wall thickness = height / 2

Section

$A_{section} = 3 \times 10^3\ mm^2$ **<6.1>**

Gravity point

$y_v = 5\ mm$ **<6.2>**

Moment of inertia

$I_{tot\_y} = 2.5 \times 10^4\ mm^4$ **<6.4>**

Von mise stress

$\sigma_{vonmise} = 10.434 \frac{N}{mm^2}$ **<6.8>**

$\sigma_{adm}(material) = 213.636 \frac{N}{mm^2}$

$stress := \begin{cases} \text{"OK"} & \text{if } \sigma_{vonmise} \le \sigma_{adm}(material) \\ \text{"NOK"} & \text{otherwise} \end{cases}$

$stress = \text{"OK"}$

12. Anchorage. acc to EN 13782, Art. 8

12.1. Anchorbars.

12.1.1. General remark:

The anchorage (number of anchor bars needed) of the structure is depending on the type of the ground on which the structure will be built and the dimensions of the anchor bars. For reason of safety, the client / builder needs to verify the effective resistance of a single anchor bar by means of at least 3 pull out tests at 3 different places.

A. at bracing cables

Every baseplate can be anchored by 4 steel anchorbars. The dimensions of the anchorbars are:

Length	$l := 150 \cdot cm$
Section	$d_{eq} := 2.8 \cdot cm$
Maximum number of bars	$n_{max} := 4$

The reaction forces equal:

$R_{x\_f} := 4.8kN$

$R_{y\_f} := 0.0kN$

$R_{z\_f} := 3.9kN$ **{Foundation table: permanent load + wind on side overpressure}**

$$R_{tot} := \sqrt{R_{x\_f}^2 + R_{y\_f}^2 + R_{z\_f}^2} \qquad R_{tot} = 6.185\,kN$$

The security factor must be less than or equal to 1.2, so the capacity (Z) of a single anchorbar for this security factor and this number of anchorbars has to be at least:

$S := 1.2$ Security factor

Tension force		Angle with the vertical force	
$Z_\beta := \frac{S \cdot R_{tot}}{n_{max}}$	$Z_\beta = 1.855\,kN$	$\beta := acos\left(\frac{R_{z\_f}}{R_{tot}}\right)$	$\beta = 50.906\,deg$
$Z_{0°} := \frac{S \cdot R_{z\_f}}{n_{max}}$	$Z_{0°} = 1.17\,kN$	$\beta_{0°} := 0deg$	

B. at side

Every baseplate can be anchored by 4 steel anchorbars. The dimensions of the anchorbars are:

Length	$l := 150 \cdot cm$
Section	$d_{eq} := 2.8 \cdot cm$
Maximum number of bars	$n_{max} := 4$

The reaction forces equal:

$R_{x\_f} := 5.1kN$

$R_{y\_f} := 0.0kN$

$R_{z\_f} := 4.0kN$ **{Foundation table: permanent load + wind on side overpressure}**

$$R_{tot} := \sqrt{R_{x\_f}^2 + R_{y\_f}^2 + R_{z\_f}^2} \qquad R_{tot} = 6.482\,kN$$

The security factor must be less than or equal to 1.2, so the capacity (Z) of a single anchorbar for this security factor and this number of anchorbars has to be at least:

$S := 1.2$ Security factor

Tension force		Angle with the vertical force	
$Z_\beta := \frac{S \cdot R_{tot}}{n_{max}}$	$Z_\beta = 1.944\,kN$	$\beta := acos\left(\frac{R_{z\_f}}{R_{tot}}\right)$	$\beta = 51.892\,deg$
$Z_{0°} := \frac{S \cdot R_{z\_f}}{n_{max}}$	$Z_{0°} = 1.2\,kN$	$\beta_{0°} := 0deg$	

13. Conclusion.

The relocatable Alu 10m t97 structure, manufactured by EFS N.V., Veldeman Structure Solutions in Bree Belgium complies with the stipulations of the British Standard 6399 under the following conditions:

basic windspeed = 25m/s
effective windspeed = 26.9m/s

The structure will be able to resist this load if the structure is good anchored to the ground and when it is completely closed.

Bree, June 2006

____
for EFS nv,
Veldeman Structure Solutions

VELDEMAN
STRUCTURE SOLUTIONS

ENCLOSURE 1 :

$N := newton$ $\quad ksi := 1000 \cdot \dfrac{lbf}{in^2}$ $\quad psf := 47.88026 \cdot Pa$

$kN := 1000 \cdot N$ $\quad kip := 1000 \cdot lbf$ $\quad 1 \cdot ksi = 6.89476 \dfrac{N}{mm^2}$

$psf := \dfrac{lbf}{ft^2}$

Document : formulas BS 6399, ENV1993-1-1 & 1999-1-1

Doc. 1. Wind + snow load.

1.1. Snow load.

The snow load on a roof shall determined from : (acc. eurocode ENV 1991 - 2 - 3 : 1995, § 5.1)

$s = \mu_i \cdot C_{es} \cdot C_{ts} \cdot s_k$

the snow load shape coefficient μ_i

the exposure coefficient, which usually has the value 1 $C_{es} := 1.0$

the exposure coefficient, which usually has the value 1 $C_{ts} := 1.0$

the characteristic value of the snow load on the ground (kN/m2) $s_k(p_f) := p_f$

duopitch roof : acc eurocode env 1991-2-3 §7.2 (5), table 7.2

angle of pitch of roof α

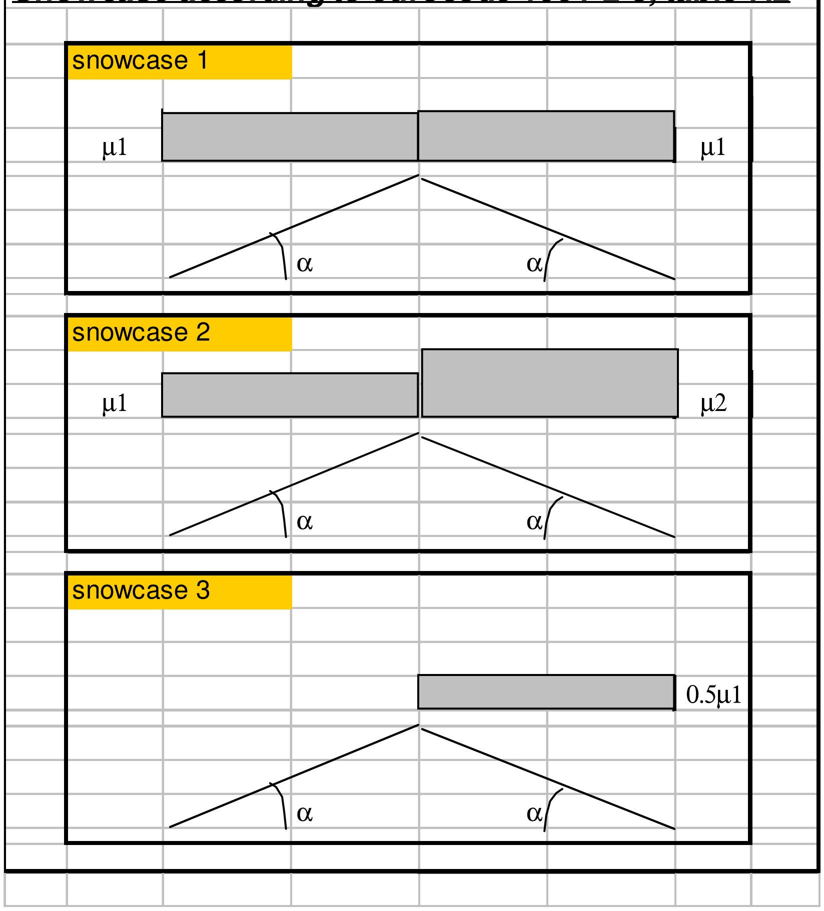
$$\mu_1(\alpha) := \begin{cases} 0.8 & \text{if } 0\cdot deg \le \alpha \le 15\cdot deg \\ 0.8 & \text{if } 15\cdot deg < \alpha \le 30\cdot deg \\ \dfrac{0.8\cdot\left(60 - \dfrac{\alpha}{deg}\right)}{30} & \text{if } 30\cdot deg < \alpha \le 60\cdot deg \\ 0 & \text{if } \alpha \ge 60\cdot deg \end{cases}$$

<1.1>

$$\mu_2(\alpha) := \begin{cases} 0.8 & \text{if } 0\cdot deg \le \alpha \le 15\cdot deg \\ 0.8 + \dfrac{0.6\cdot\left(\dfrac{\alpha}{deg} - 15\right)}{30} & \text{if } 15\cdot deg < \alpha \le 30\cdot deg \\ \dfrac{1.1\cdot\left(60 - \dfrac{\alpha}{deg}\right)}{30} & \text{if } 30\cdot deg < \alpha \le 60\cdot deg \\ 0 & \text{if } \alpha \ge 60\cdot deg \end{cases}$$

<1.2>

Snowcase according to eurocode 1991-2-3, table 7.2



snowcase 1 :

$$s_{1\_windward}(\alpha, p_f, Span\_distance) := \mu_1(\alpha)\cdot(C_{es}\cdot C_{ts}\cdot s_k(p_f))\cdot Span\_distance$$

$$s_{1\_leeward}(\alpha, p_f, Span\_distance) := \mu_1(\alpha)\cdot(C_{es}\cdot C_{ts}\cdot s_k(p_f))\cdot Span\_distance$$

snowcase 2 :

$$s_{2\_windward}(\alpha, p_f, Span\_distance) := \mu_1(\alpha)\cdot(C_{es}\cdot C_{ts}\cdot s_k(p_f))\cdot Span\_distance$$ **<1.3>**

$$s_{2\_leeward}(\alpha, p_f, Span\_distance) := \mu_2(\alpha)\cdot(C_{es}\cdot C_{ts}\cdot s_k(p_f))\cdot Span\_distance$$

snowcase 3 :

$$s_{3\_leeward}(\alpha, p_f, Span\_distance) := 0.5\mu_1(\alpha)\cdot(C_{es}\cdot C_{ts}\cdot s_k(p_f))\cdot Span\_distance$$

1.2. Wind load.

The wind load is calculated according to **"BS 6399 part 2 - 1997"**

Basic wind speed

Basic wind speed acc. to fig. 6 V_b

Site wind speed

Altitude factor : $S_a := 1$

Direction factor : $S_d := 1$

Seasonal factor : $S_s(RI) := \begin{cases} 0.98 & \text{if } RI \le \frac{1}{12}yr \\ 1 & \text{otherwise} \end{cases}$

Probability factor (2.2.2.5) : S_p

Annex D, 1 year storm: the most likely annual maximum value

$$Q(RI) := \begin{cases} 0.632 & \text{if } RI \le 1yr \\ \frac{yr}{RI} & \text{otherwise} \end{cases}$$

$$S_p(RI) := \sqrt{\frac{5 - \ln(-\ln(1 - Q(RI)))}{5 - \ln(-\ln(0.98))}} \qquad \text{<1.4>}$$

=> site wind speed :

$$V_s(V_b, RI) := V_b \cdot S_a \cdot S_d \cdot S_s(RI) \cdot S_p(RI) \qquad \text{<1.5>}$$

Effective wind speed

Terrain and building factor (2.2.3.3)

Interpolation of table 4 gives us:

Effective height — Closest distance to sea: — Site in country (0) or site in town (1):

site

$$H_e := \begin{pmatrix} 2m \\ 5m \\ 10m \\ 15m \\ 20m \\ 30m \\ 50m \\ 100m \end{pmatrix} \quad D_{s\_c} := \begin{pmatrix} 0km \\ 0.1km \\ 2km \\ 10km \\ 100km \end{pmatrix} \quad D_{s\_t} := \begin{pmatrix} 2km \\ 10km \\ 100km \end{pmatrix}$$

$$D_{s1} := \begin{pmatrix} 1.48 \\ 1.65 \\ 1.78 \\ 1.85 \\ 1.90 \\ 1.96 \\ 2.04 \\ 2.12 \end{pmatrix} \quad D_{s2} := \begin{pmatrix} 1.48 \\ 1.65 \\ 1.78 \\ 1.85 \\ 1.90 \\ 1.96 \\ 2.04 \\ 2.12 \end{pmatrix} \quad D_{s3} := \begin{pmatrix} 1.40 \\ 1.62 \\ 1.78 \\ 1.85 \\ 1.90 \\ 1.96 \\ 2.04 \\ 2.12 \end{pmatrix} \quad D_{s4} := \begin{pmatrix} 1.35 \\ 1.57 \\ 1.73 \\ 1.82 \\ 1.89 \\ 1.96 \\ 2.04 \\ 2.12 \end{pmatrix} \quad D_{s5} := \begin{pmatrix} 1.26 \\ 1.45 \\ 1.62 \\ 1.71 \\ 1.77 \\ 1.85 \\ 1.95 \\ 2.07 \end{pmatrix}$$

$$D_{s6} := \begin{pmatrix} 1.18 \\ 1.50 \\ 1.73 \\ 1.85 \\ 1.90 \\ 1.96 \\ 2.04 \\ 2.12 \end{pmatrix} \quad D_{s7} := \begin{pmatrix} 1.15 \\ 1.45 \\ 1.69 \\ 1.82 \\ 1.89 \\ 1.96 \\ 2.04 \\ 2.12 \end{pmatrix} \quad D_{s8} := \begin{pmatrix} 1.07 \\ 1.36 \\ 1.58 \\ 1.71 \\ 1.77 \\ 1.85 \\ 1.95 \\ 2.07 \end{pmatrix}$$

$S_{b1}(H_{peak}) := \text{linterp}(H_e, D_{s1}, H_{peak})$ $\quad S_{b4}(H_{peak}) := \text{linterp}(H_e, D_{s4}, H_{peak})$ $\quad S_{b7}(H_{peak}) := \text{linterp}(H_e, D_{s7}, H_{peak})$

$S_{b2}(H_{peak}) := \text{linterp}(H_e, D_{s2}, H_{peak})$ $\quad S_{b5}(H_{peak}) := \text{linterp}(H_e, D_{s5}, H_{peak})$ $\quad S_{b8}(H_{peak}) := \text{linterp}(H_e, D_{s8}, H_{peak})$

$S_{b3}(H_{peak}) := \text{linterp}(H_e, D_{s3}, H_{peak})$ $\quad S_{b6}(H_{peak}) := \text{linterp}(H_e, D_{s6}, H_{peak})$

$$S_{b\_c}(H_{peak}) := \begin{pmatrix} S_{b1}(H_{peak}) \\ S_{b2}(H_{peak}) \\ S_{b3}(H_{peak}) \\ S_{b4}(H_{peak}) \\ S_{b5}(H_{peak}) \end{pmatrix} \qquad S_{b\_t}(H_{peak}) := \begin{pmatrix} S_{b6}(H_{peak}) \\ S_{b7}(H_{peak}) \\ S_{b8}(H_{peak}) \end{pmatrix}$$

So we become:

$$S_b(H_{peak}, dist\_to\_sea, site) := \begin{cases} linterp(D_{s\_c}, S_{b\_c}(H_{peak}), dist\_to\_sea) & \text{if } site = 0 \\ linterp(D_{s\_t}, S_{b\_t}(H_{peak}), dist\_to\_sea) & \text{if } site = 1 \end{cases}$$ **<1.6>**

=> effective wind speed :

$$V_e(V_b, H_{peak}, sea, site, RI) := V_s(V_b, RI) \cdot S_b(H_{peak}, sea, site)$$ **<1.7>**

Dynamic pressure

$$q_s(V_b, H_{peak}, sea, site, RI) := 0.613 \cdot \left(\frac{sec^2 \cdot N}{m^4}\right) \cdot V_e(V_b, H_{peak}, sea, site, RI)^2$$ **<1.8>**

Effective dynamic pressure

$$a_{side\_w}(Length, H_{eave}) := \sqrt{Length^2 + H_{eave}{}^2}$$

$$a_{side\_r}(Length, Width, \alpha_{roof}) := \sqrt{Length^2 + \left(\frac{Width}{2\cos(\alpha_{roof})}\right)^2}$$

diagonal of loaded areas (fig. 5)

<1.9>

$$a_{gable}(Width, H_{eave}) := \sqrt{Width^2 + H_{eave}{}^2}$$

$$a_{in}(Width, H_{peak}, H_{eave}, Length) := 10 \cdot \left[(Width \cdot Length \cdot H_{eave}) + \frac{Width \cdot (H_{peak} - H_{eave})}{2} \cdot Length \right]^{\frac{1}{3}}$$

diagonal dimension for internal pressure 2.6.1.1

$$\text{curve}(H_{peak}, \text{dist\_to\_sea}, \text{site}) := \begin{cases} \begin{cases} \begin{pmatrix} \text{"A"} & \text{if dist\_to\_sea} < 2km \\ \text{"B"} & \text{if dist\_to\_sea} \ge 2km \end{pmatrix} & \text{if } 0m < H_{peak} \le 5m \\ \begin{pmatrix} \text{"A"} & \text{if dist\_to\_sea} < 10km \\ \text{"B"} & \text{if dist\_to\_sea} \ge 10km \end{pmatrix} & \text{if } 5m < H_{peak} \le 20m \\ \begin{pmatrix} \text{"A"} & \text{if dist\_to\_sea} < 100km \\ \text{"B"} & \text{if dist\_to\_sea} \ge 100km \end{pmatrix} & \text{if } H_{peak} > 20m \end{cases} & \text{if site} = 0 \\ \begin{cases} \begin{pmatrix} \text{"A"} & \text{if dist\_to\_sea} < 2km \\ \text{"C"} & \text{if dist\_to\_sea} \ge 2km \end{pmatrix} & \text{if } 0m < H_{peak} \le 5m \\ \begin{pmatrix} \text{"A"} & \text{if dist\_to\_sea} < 10km \\ \text{"C"} & \text{if dist\_to\_sea} \ge 10km \end{pmatrix} & \text{if } 5m < H_{peak} \le 10m \\ \begin{pmatrix} \text{"A"} & \text{if dist\_to\_sea} < 10km \\ \text{"B"} & \text{if dist\_to\_sea} \ge 10km \end{pmatrix} & \text{if } 10m < H_{peak} \le 20m \\ \begin{pmatrix} \text{"A"} & \text{if dist\_to\_sea} < 100km \\ \text{"B"} & \text{if dist\_to\_sea} \ge 100km \end{pmatrix} & \text{if } H_{peak} > 20m \end{cases} & \text{if site} = 1 \end{cases}$$

Size effect factor Ca : (fig. 4) **<1.10>**

$$C_{a\_w}(L, H_e, H_p, \text{sea}, \text{site}) := \begin{cases} \left[\dfrac{\left(\log\left(\dfrac{a_{side\_w}(L, H_e)}{m}\right) - \log(5)\right)\cdot(0.67 - 1)}{\log(1000) - \log(5)} + 1\right] & \text{if curve}(H_p, \text{sea}, \text{site}) = \text{"A"} \\ \left[\dfrac{\left(\log\left(\dfrac{a_{side\_w}(L, H_e)}{m}\right) - \log(5)\right)\cdot(0.61 - 1)}{\log(1000) - \log(5)} + 1\right] & \text{if curve}(H_p, \text{sea}, \text{site}) = \text{"B"} \\ \left[\dfrac{\left(\log\left(\dfrac{a_{side\_w}(L, H_e)}{m}\right) - \log(5)\right)\cdot(0.52 - 1)}{\log(1000) - \log(5)} + 1\right] & \text{if curve}(H_p, \text{sea}, \text{site}) = \text{"C"} \end{cases}$$

$$C_{a\_r}(L, W, \alpha_r, H_p, \text{sea}, \text{site}) := \begin{cases} \left[\dfrac{\left(\log\left(\dfrac{a_{side\_r}(L, W, \alpha_r)}{m}\right) - \log(5)\right)\cdot(0.67 - 1)}{\log(1000) - \log(5)} + 1\right] & \text{if curve}(H_p, \text{sea}, \text{site}) = \text{"A"} \\ \left[\dfrac{\left(\log\left(\dfrac{a_{side\_r}(L, W, \alpha_r)}{m}\right) - \log(5)\right)\cdot(0.61 - 1)}{\log(1000) - \log(5)} + 1\right] & \text{if curve}(H_p, \text{sea}, \text{site}) = \text{"B"} \\ \left[\dfrac{\left(\log\left(\dfrac{a_{side\_r}(L, W, \alpha_r)}{m}\right) - \log(5)\right)\cdot(0.52 - 1)}{\log(1000) - \log(5)} + 1\right] & \text{if curve}(H_p, \text{sea}, \text{site}) = \text{"C"} \end{cases}$$

$$C_{a\_g}(W,H_e,H_p,sea,site) := \left| \begin{array}{ll} \left[\dfrac{\left(\log\left(\dfrac{a_{gable}(W,H_e)}{m}\right) - \log(5)\right)\cdot(0.67-1)}{\log(1000)-\log(5)} + 1\right] & \text{if } curve(H_p,sea,site) = \text{"A"} \\ \left[\dfrac{\left(\log\left(\dfrac{a_{gable}(W,H_e)}{m}\right) - \log(5)\right)\cdot(0.61-1)}{\log(1000)-\log(5)} + 1\right] & \text{if } curve(H_p,sea,site) = \text{"B"} \\ \left[\dfrac{\left(\log\left(\dfrac{a_{gable}(W,H_e)}{m}\right) - \log(5)\right)\cdot(0.52-1)}{\log(1000)-\log(5)} + 1\right] & \text{if } curve(H_p,sea,site) = \text{"C"} \end{array}\right.$$

$$C_{a\_i}(W,L,H_e,H_p,sea,site) := \left| \begin{array}{ll} \left[\dfrac{\left(\log\left(\dfrac{a_{in}(W,H_p,H_e,L)}{m}\right) - \log(5)\right)\cdot(0.67-1)}{\log(1000)-\log(5)} + 1\right] & \text{if } curve(H_p,sea,site) = \text{"A"} \\ \left[\dfrac{\left(\log\left(\dfrac{a_{in}(W,H_p,H_e,L)}{m}\right) - \log(5)\right)\cdot(0.61-1)}{\log(1000)-\log(5)} + 1\right] & \text{if } curve(H_p,sea,site) = \text{"B"} \\ \left[\dfrac{\left(\log\left(\dfrac{a_{in}(W,H_p,H_e,L)}{m}\right) - \log(5)\right)\cdot(0.52-1)}{\log(1000)-\log(5)} + 1\right] & \text{if } curve(H_p,sea,site) = \text{"C"} \end{array}\right.$$

=> Effective dynamic pressure : **<1.11>**

wind on side

$$q_w(V_b,H_{peak},sea,site,RI,Length,H_{eave}) := q_s(V_b,H_{peak},sea,site,RI)\cdot C_{a\_w}(Length,H_{eave},H_{peak},sea,site)$$

$$q_r(V_b,H_{peak},sea,site,RI,L,W,\alpha_{roof}) := q_s(V_b,H_{peak},sea,site,RI)\cdot C_{a\_r}(L,W,\alpha_{roof},H_{peak},sea,site)$$

wind on gable

$$q_g(V_b,H_{peak},sea,site,RI,Width,H_{eave}) := q_s(V_b,H_{peak},sea,site,RI)\cdot C_{a\_g}(Width,H_{eave},H_{peak},sea,site)$$

internal wind pressure

$$q_i(V_b,H_{peak},sea,site,RI,Width,H_{eave},Length) := q_s(V_b,H_{peak},sea,site,RI)\cdot C_{a\_i}(Width,H_{peak},H_{eave},Length,sea,site)$$

1. External wind pressure coefficients.

a. Walls art. 2.4.1

Wind load normal to the sidewall of the structure. **<1.12>**

Side wall (D<B) :

B = Length
D = Width
H = Hight of peak

$$b_s(Length, H_{peak}) := \min(Length, 2 \cdot H_{peak})$$

Windward

$$C_{pe\_s\_ww}(Width, H_{peak}) := \begin{cases} \left[\dfrac{\left(\dfrac{Width}{H_{peak}} - 4\right)\cdot(0.85 - 0.6)}{1 - 4} + 0.6\right] & \text{if } 1 < \dfrac{Width}{H_{peak}} < 4 \\ 0.85 & \text{if } \dfrac{Width}{H_{peak}} \le 1 \\ 0.6 & \text{if } \dfrac{Width}{H_{peak}} \ge 4 \end{cases}$$

Table 5

Leeward

$$C_{pe\_s\_lw}(Width, H_{peak}) := \begin{cases} \left[\dfrac{\left(\dfrac{Width}{H_{peak}} - 4\right)\cdot[(-0.5) - (-0.5)]}{1 - 4} + (-0.5)\right] & \text{if } 1 < \dfrac{Width}{H_{peak}} < 4 \\ -0.5 & \text{if } \dfrac{Width}{H_{peak}} \le 1 \\ -0.5 & \text{if } \dfrac{Width}{H_{peak}} \ge 4 \end{cases}$$

Table 5

Gable wall :

$C_{pe\_s\_gA} := -1.3$ $C_{pe\_s\_gB} := -0.8$ $C_{pe\_s\_gC} := -0.5$ Table 5

Zones:

$$L_{sA}(Length, H_{peak}) := 0.2 \cdot b_s(Length, H_{peak})$$

$$L_{sB}(Length, H_{peak}, Width) := \min\left[b_s(Length, H_{peak}) - 0.2 \cdot b_s(Length, H_{peak}), \left(Width - L_{sA}(Length, H_{peak})\right)\right]$$

$$L_{sC}(Length, H_{peak}, Width) := Width - \left(L_{sA}(Length, H_{peak}) + L_{sB}(Length, H_{peak}, Width)\right)$$

Wind load normal to the gablewall of the structure. **<1.13>**

Gable wall (D>B) :

B = Width
D = Length
H = Hight of peak

$$b_g(Width, H_{peak}) := \min(Width, 2 \cdot H_{peak})$$

Windward

$$C_{pe\_g\_ww}(Length, H_{peak}) := \begin{cases} \left[\dfrac{\left(\dfrac{Length}{H_{peak}} - 4\right) \cdot (0.8 - 0.6)}{1 - 4} + 0.6\right] & \text{if } 1 < \dfrac{Length}{H_{peak}} < 4 \\ 0.8 & \text{if } \dfrac{Length}{H_{peak}} \le 1 \\ 0.6 & \text{if } \dfrac{Length}{H_{peak}} \ge 4 \end{cases}$$

Table 5

Leeward

$$C_{pe\_g\_lw}(Length, H_{peak}) := \begin{cases} \left[\dfrac{\left(\dfrac{Length}{H_{peak}} - 4\right) \cdot [(-0.5) - (-0.5)]}{1 - 4} + (-0.5)\right] & \text{if } 1 < \dfrac{Length}{H_{peak}} < 4 \\ -0.5 & \text{if } \dfrac{Length}{H_{peak}} \le 1 \\ -0.5 & \text{if } \dfrac{Length}{H_{peak}} \ge 4 \end{cases}$$

Table 5

Side wall :

$C_{pe\_g\_sA} := -1.3$ $C_{pe\_g\_sB} := -0.8$ $C_{pe\_g\_sC} := -0.5$ Table 5

Zones:

$$L_{gA}(Width, H_{peak}) := 0.2 \cdot b_g(Width, H_{peak})$$

$$L_{gB}(Width, H_{peak}, Length) := \min\left[b_g(Width, H_{peak}) - 0.2 \cdot b_g(Width, H_{peak}), \left(Length - L_{gA}(Width, H_{peak})\right)\right]$$

$$L_{gC}(Width, H_{peak}, Length) := Length - \left(L_{gA}(Width, H_{peak}) + L_{gB}(Width, H_{peak}, Length)\right)$$

b. Roofs art. 2.5.2

$$b_L(Length, H_{peak}) := \min(Length, 2H_{peak})$$

$$b_W(Width, H_{peak}) := \min(Width, 2H_{peak})$$

Wind load normal to the sidewall of the structure. **<1.14>**

Table 10:

$$A_o := \begin{pmatrix} -1.8 \\ -1.1 \\ -0.5 \\ 0.0 \\ 0.8 \\ 0.8 \end{pmatrix} \quad B_o := \begin{pmatrix} -1.2 \\ -0.8 \\ -0.5 \\ 0.0 \\ 0.8 \\ 0.8 \end{pmatrix} \quad C_o := \begin{pmatrix} -0.6 \\ -0.4 \\ -0.2 \\ 0.0 \\ 0.8 \\ 0.8 \end{pmatrix} \quad E := \begin{pmatrix} -0.9 \\ -1.3 \\ -0.9 \\ -0.4 \\ -0.8 \\ -0.9 \end{pmatrix} \quad F := \begin{pmatrix} -0.3 \\ -0.9 \\ -0.5 \\ -0.3 \\ -0.7 \\ -0.6 \end{pmatrix} \quad G := \begin{pmatrix} -0.4 \\ -0.5 \\ -0.5 \\ -0.3 \\ -0.6 \\ -0.8 \end{pmatrix}$$

$$A_u := \begin{pmatrix} 0.0 \\ 0.2 \\ 0.8 \\ 0.8 \\ 0.8 \\ 0.8 \end{pmatrix} \quad B_u := \begin{pmatrix} 0.0 \\ 0.2 \\ 0.5 \\ 0.6 \\ 0.8 \\ 0.8 \end{pmatrix} \quad C_u := \begin{pmatrix} 0.0 \\ 0.2 \\ 0.4 \\ 0.7 \\ 0.8 \\ 0.8 \end{pmatrix} \quad \alpha_p := \begin{pmatrix} 5deg \\ 15deg \\ 30deg \\ 45deg \\ 60deg \\ 75deg \end{pmatrix}$$

$C_{pe\_rs\_A\_o}(\alpha_{roof}) := \text{linterp}(\alpha_p, A_o, \alpha_{roof})$

$C_{pe\_rs\_A\_u}(\alpha_{roof}) := \text{linterp}(\alpha_p, A_u, \alpha_{roof})$

$C_{pe\_rs\_B\_o}(\alpha_{roof}) := \text{linterp}(\alpha_p, B_o, \alpha_{roof})$

$C_{pe\_rs\_B\_u}(\alpha_{roof}) := \text{linterp}(\alpha_p, B_u, \alpha_{roof})$

$C_{pe\_rs\_C\_o}(\alpha_{roof}) := \text{linterp}(\alpha_p, C_o, \alpha_{roof})$

$C_{pe\_rs\_C\_u}(\alpha_{roof}) := \text{linterp}(\alpha_p, C_u, \alpha_{roof})$

$C_{pe\_rs\_E}(\alpha_{roof}) := \text{linterp}(\alpha_p, E, \alpha_{roof})$

$C_{pe\_rs\_F}(\alpha_{roof}) := \text{linterp}(\alpha_p, F, \alpha_{roof})$

$C_{pe\_rs\_G}(\alpha_{roof}) := \text{linterp}(\alpha_p, G, \alpha_{roof})$

Zones:

$$L_{rsA}(Length, H_{peak}) := \frac{b_L(Length, H_{peak})}{2}$$

$$L_{rsB}(Length, H_{peak}) := Length - 2 \cdot L_{rsA}(Length, H_{peak})$$

$$W_{rsA}(Length, H_{peak}) := \frac{b_L(Length, H_{peak})}{10}$$

$$W_{rsB}(Length, H_{peak}) := \frac{b_L(Length, H_{peak})}{10}$$

$$L_{rsE}(Length, H_{peak}) := \frac{b_L(Length, H_{peak})}{2}$$

$$L_{rsF}(Length, H_{peak}) := Length - 2 \cdot L_{rsE}(Length, H_{peak})$$

$$W_{rsE}(Length, H_{peak}) := \frac{b_L(Length, H_{peak})}{10}$$

$$W_{rsF}(Length, H_{peak}) := \frac{b_L(Length, H_{peak})}{10}$$

Wind load normal to the gablewall of the structure. **<1.15>**

Table 10:

$$A := \begin{pmatrix} -2.0 \\ -1.6 \\ -1.2 \\ -1.2 \\ -1.2 \\ -1.2 \end{pmatrix} \quad B := \begin{pmatrix} -1.1 \\ -1.5 \\ -1.1 \\ -1.2 \\ -1.2 \\ -1.2 \end{pmatrix} \quad C := \begin{pmatrix} -0.6 \\ -0.6 \\ -0.6 \\ -0.6 \\ -0.7 \\ -1.15 \end{pmatrix} \quad D := \begin{pmatrix} -0.5 \\ -0.4 \\ -0.5 \\ -0.4 \\ -0.6 \\ -0.6 \end{pmatrix}$$

$$C_{pe\_rg\_A}(\alpha_{roof}) := \mathrm{linterp}(\alpha_p, A, \alpha_{roof})$$

$$C_{pe\_rg\_B}(\alpha_{roof}) := \mathrm{linterp}(\alpha_p, B, \alpha_{roof})$$

$$C_{pe\_rg\_C}(\alpha_{roof}) := \mathrm{linterp}(\alpha_p, C, \alpha_{roof})$$

$$C_{pe\_rg\_D}(\alpha_{roof}) := \mathrm{linterp}(\alpha_p, D, \alpha_{roof})$$

Zones:

$$L_{rgA}(Width, H_{peak}) := \frac{b_W(Width, H_{peak})}{10} \qquad L_{rgB}(Width, H_{peak}) := \frac{b_W(Width, H_{peak})}{10}$$

$$L_{rgC}(Width, H_{peak}) := \frac{b_W(Width, H_{peak})}{2} - \frac{b_W(Width, H_{peak})}{10}$$

$$L_{rgD}(Width, H_{peak}, Length) := Length - \frac{b_W(Width, H_{peak})}{2}$$

2. Internal wind pressure coefficients.

The wind also causes (table 16)

an underpressure: C_{pi_u}

an overpressure: C_{pi_o}

3. Global wind pressure.

Wind load normal to the sidewall of the structure.

Overpressure **<1.16>**

$$q_{sw\_ww.o}(V_b, H_{peak}, H_{eave}, sea, site, RI, W, L, C_{pi\_o}) := C_{pe\_s\_ww}(W, H_{peak}) \cdot q_w(V_b, H_{peak}, sea, site, RI, L, H_{eave}) \ldots + -(C_{pi\_o} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{sw\_lw.o}(V_b, H_{peak}, H_{eave}, sea, site, RI, W, L, C_{pi\_o}) := C_{pe\_s\_lw}(W, H_{peak}) \cdot q_w(V_b, H_{peak}, sea, site, RI, L, H_{eave}) \ldots + -(C_{pi\_o} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{rA\_s.o}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) := C_{pe\_rs\_A\_o}(\alpha_r) \cdot q_r(V_b, H_{peak}, sea, site, RI, L, W, \alpha_r) \ldots + -(C_{pi\_o} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{rB\_s.o}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) := C_{pe\_rs\_B\_o}(\alpha_r) \cdot q_r(V_b, H_{peak}, sea, site, RI, L, W, \alpha_r) \ldots + -(C_{pi\_o} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{rC\_s.o}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) := C_{pe\_rs\_C\_o}(\alpha_r) \cdot q_r(V_b, H_{peak}, sea, site, RI, L, W, \alpha_r) \ldots + -(C_{pi\_o} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{rE\_s.o}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) := C_{pe\_rs\_E}(\alpha_r) \cdot q_r(V_b, H_{peak}, sea, site, RI, L, W, \alpha_r) \ldots + -(C_{pi\_o} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{rF\_s.o}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) := C_{pe\_rs\_F}(\alpha_r) \cdot q_r(V_b, H_{peak}, sea, site, RI, L, W, \alpha_r) \ldots + -(C_{pi\_o} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{rG\_s.o}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) := C_{pe\_rs\_G}(\alpha_r) \cdot q_r(V_b, H_{peak}, sea, site, RI, L, W, \alpha_r) \ldots + -(C_{pi\_o} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{gA\_o}(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L, C_{pi\_o}) := C_{pe\_s\_gA} \cdot q_g(V_b, H_{peak}, sea, site, RI, W, H_{eave}) \ldots + -(C_{pi\_o} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{gB\_o}(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L, C_{pi\_o}) := C_{pe\_s\_gB} \cdot q_g(V_b, H_{peak}, sea, site, RI, W, H_{eave}) \ldots + -(C_{pi\_o} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{gC\_o}(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L, C_{pi\_o}) := C_{pe\_s\_gC} \cdot q_g(V_b, H_{peak}, sea, site, RI, W, H_{eave}) \ldots + -(C_{pi\_o} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

Underpressure **<1.17>**

$$q_{sw\_ww.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, W, L, C_{pi\_u}) := C_{pe\_s\_ww}(W, H_{peak}) \cdot q_w(V_b, H_{peak}, sea, site, RI, L, H_{eave}) \ldots + -(C_{pi\_u} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{sw\_lw.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, W, L, C_{pi\_u}) := C_{pe\_s\_lw}(W, H_{peak}) \cdot q_w(V_b, H_{peak}, sea, site, RI, L, H_{eave}) \ldots + -(C_{pi\_u} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{rA\_s.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) := C_{pe\_rs\_A\_u}(\alpha_r) \cdot q_r(V_b, H_{peak}, sea, site, RI, L, W, \alpha_r) \ldots + -(C_{pi\_u} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{rB\_s.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) := C_{pe\_rs\_B\_u}(\alpha_r) \cdot q_r(V_b, H_{peak}, sea, site, RI, L, W, \alpha_r) \ldots + -(C_{pi\_u} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{rC\_s.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) := C_{pe\_rs\_C\_u}(\alpha_r) \cdot q_r(V_b, H_{peak}, sea, site, RI, L, W, \alpha_r) \ldots + -(C_{pi\_u} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{rE\_s.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) := C_{pe\_rs\_E}(\alpha_r) \cdot q_r(V_b, H_{peak}, sea, site, RI, L, W, \alpha_r) \ldots + -(C_{pi\_u} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{rF\_s.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) := C_{pe\_rs\_F}(\alpha_r) \cdot q_r(V_b, H_{peak}, sea, site, RI, L, W, \alpha_r) \ldots + -(C_{pi\_u} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{rG\_s.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) := C_{pe\_rs\_G}(\alpha_r) \cdot q_r(V_b, H_{peak}, sea, site, RI, L, W, \alpha_r) \ldots + -(C_{pi\_u} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{gA\_u}(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L, C_{pi\_u}) := C_{pe\_s\_gA} \cdot q_g(V_b, H_{peak}, sea, site, RI, W, H_{eave}) \ldots + -(C_{pi\_u} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{gB\_u}(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L, C_{pi\_u}) := C_{pe\_s\_gB} \cdot q_g(V_b, H_{peak}, sea, site, RI, W, H_{eave}) \ldots + -(C_{pi\_u} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{gC\_u}(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L, C_{pi\_u}) := C_{pe\_s\_gC} \cdot q_g(V_b, H_{peak}, sea, site, RI, W, H_{eave}) \ldots + -(C_{pi\_u} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

Wind load normal to the gablewall of the structure.

Overpressure / Underpressure **<1.18>**

$$q_{sA\_o.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, W, L, C_{pi}) := C_{pe\_g\_sA} \cdot q_w(V_b, H_{peak}, sea, site, RI, L, H_{eave}) \dots + -(C_{pi} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{sB\_o.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, W, L, C_{pi}) := C_{pe\_g\_sB} \cdot q_w(V_b, H_{peak}, sea, site, RI, L, H_{eave}) \dots + -(C_{pi} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{sC\_o.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, W, L, C_{pi}) := C_{pe\_g\_sC} \cdot q_w(V_b, H_{peak}, sea, site, RI, L, H_{eave}) \dots + -(C_{pi} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{rA\_g.o.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi}) := C_{pe\_rg\_A}(\alpha_r) \cdot q_r(V_b, H_{peak}, sea, site, RI, L, W, \alpha_r) \dots + -(C_{pi} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{rB\_g.o.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi}) := C_{pe\_rg\_B}(\alpha_r) \cdot q_r(V_b, H_{peak}, sea, site, RI, L, W, \alpha_r) \dots + -(C_{pi} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{rC\_g.o.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi}) := C_{pe\_rg\_C}(\alpha_r) \cdot q_r(V_b, H_{peak}, sea, site, RI, L, W, \alpha_r) \dots + -(C_{pi} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{rD\_g.o.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi}) := C_{pe\_rg\_D}(\alpha_r) \cdot q_r(V_b, H_{peak}, sea, site, RI, L, W, \alpha_r) \dots + -(C_{pi} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{g\_ww.o.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, C_{pi}) := C_{pe\_g\_ww}(L, H_{peak}) \cdot q_g(V_b, H_{peak}, sea, site, RI, W, H_{eave}) \dots + -(C_{pi} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

$$q_{g\_lw.o.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, C_{pi}) := C_{pe\_g\_lw}(L, H_{peak}) \cdot q_g(V_b, H_{peak}, sea, site, RI, W, H_{eave}) \dots + -(C_{pi} \cdot q_i(V_b, H_{peak}, sea, site, RI, W, H_{eave}, L))$$

The wind pressure on one bay must be supported by one arch. The total wind load per arch equals :

Wind normal on Side :

Overpressure :

Load on the first arch: **<1.19>**

Walls:

$$P_{side1\_o}(V_b, H_{peak}, H_{eave}, sea, site, RI, W, L, C_{pi\_o}, S) := q_{sw\_ww.o}(V_b, H_{peak}, H_{eave}, sea, site, RI, W, L, C_{pi\_o}) \cdot S$$

$$P_{side4\_o}(V_b, H_{peak}, H_{eave}, sea, site, RI, W, L, C_{pi\_o}, S) := q_{sw\_lw.o}(V_b, H_{peak}, H_{eave}, sea, site, RI, W, L, C_{pi\_o}) \cdot S$$

Lower roof:

$$\text{load1}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}, S) := q_{rA\_s.o}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot \frac{S}{2}$$

$$\text{load2}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}, S) := q_{rA\_s.o}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot L_{rsA}(L, H_p) \ldots \\ + q_{rB\_s.o}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot \left(\frac{S}{2} - L_{rsA}(L, H_p)\right)$$

$$\text{case1}(L, H_p, S) := \frac{S}{2} \le L_{rsA}(L, H_p)$$

$$\text{case2}(L, H_p, S) := L_{rsA}(L, H_p) < \frac{S}{2} < \left(L_{rsA}(L, H_p) + L_{rsB}(L, H_p)\right)$$

$$P1_{side2.lower\_o}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_o}, S) := \left| \begin{array}{ll} \text{load1}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_o}, S) & \text{if } \text{case1}(L, H_p, S) \\ \text{load2}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_o}, S) & \text{if } \text{case2}(L, H_p, S) \end{array} \right.$$

$$P1_{side3.lower\_o}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_o}, S) := q_{rG\_s.o}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot \frac{S}{2}$$

Upper roof:

$$\mathrm{load3}\left(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}, S\right) := q_{rE\_s.o}\left(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}\right)\cdot\frac{S}{2}$$

$$\mathrm{load4}\left(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}, S\right) := q_{rE\_s.o}\left(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}\right)\cdot L_{rsE}\left(L, H_p\right) \ldots$$
$$+ q_{rF\_s.o}\left(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}\right)\cdot\left(\frac{S}{2} - L_{rsE}\left(L, H_p\right)\right)$$

$$\mathrm{case3}\left(L, H_p, S\right) := \frac{S}{2} \le L_{rsE}\left(L, H_p\right)$$

$$\mathrm{case4}\left(L, H_p, S\right) := L_{rsE}\left(L, H_p\right) < \frac{S}{2} < \left(L_{rsE}\left(L, H_p\right) + L_{rsF}\left(L, H_p\right)\right)$$

$$P1_{side3.upper\_o}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_o}, S\right) := \left| \begin{array}{l} \mathrm{load3}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_o}, S\right) \text{ if } \mathrm{case3}\left(L, H_p, S\right) \\ \mathrm{load4}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_o}, S\right) \text{ if } \mathrm{case4}\left(L, H_p, S\right) \end{array} \right.$$

$$P1_{side2.upper\_o}\left(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_o}, S\right) := q_{rC\_s.o}\left(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_o}\right)\cdot\frac{S}{2}$$

Load on the second arch: **<1.20>**

Lower roof:

$$\mathrm{load5}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o},S) := q_{rB\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot S$$

$$\mathrm{load6}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o},S) := q_{rA\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot\left(L_{rsA}(L,H_p)-\frac{S}{2}\right) + q_{rB\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot(S-L_{rsA}(L,H_p)) + q_{rB\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot\frac{S}{2}$$

$$\mathrm{load7}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o},S) := q_{rA\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot\frac{S}{2} + q_{rA\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot(L_{rsA}(L,H_p)-S) + q_{rB\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot\left(\frac{3S}{2}-L_{rsA}(L,H_p)\right)$$

$$\mathrm{load8}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o},S) := q_{rA\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot S$$

$$\mathrm{case5}(L,H_p,S) := \left(L_{rsA}(L,H_p)\le\frac{S}{2}\right)\wedge L_{rsB}(L,H_p)\ne 0$$

$$\mathrm{case6}(L,H_p,S) := \left(\frac{S}{2}<L_{rsA}(L,H_p)\le S\right)\wedge L_{rsB}(L,H_p)\ne 0$$

$$\mathrm{case7}(L,H_p,S) := \left(L_{rsA}(L,H_p)\le\frac{3S}{2}\right)\wedge L_{rsB}(L,H_p)\ne 0$$

$$\mathrm{case8}(L,H_p,S) := L_{rsA}(L,H_p)>\frac{3S}{2}\vee L_{rsB}(L,H_p)=0$$

$$P2_{side2.lower\_o}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_o},S) := \begin{cases}\mathrm{load5}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_o},S) & \text{if } \mathrm{case5}(L,H_p,S)\\ \mathrm{load6}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_o},S) & \text{if } \mathrm{case6}(L,H_p,S)\\ \mathrm{load7}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_o},S) & \text{if } \mathrm{case7}(L,H_p,S)\\ \mathrm{load8}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_o},S) & \text{if } \mathrm{case8}(L,H_p,S)\end{cases}$$

$$P2_{side3.lower\_o}(V_b,H_{peak},H_{eave},sea,site,RI,L,W,\alpha_r,C_{pi\_o},S) := q_{rG\_s.o}(V_b,H_{peak},H_{eave},sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot S$$

Upper roof:

$$load9(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}, S) := q_{rF\_s.o}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot S$$

$$load10(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}, S) := q_{rE\_s.o}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot \left(L_{rsE}(L, H_p) - \frac{S}{2}\right) ... + q_{rF\_s.o}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot (S - L_{rsE}(L, H_p)) ... + q_{rF\_s.o}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot \frac{S}{2}$$

$$load11(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}, S) := q_{rE\_s.o}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot \frac{S}{2} ... + q_{rE\_s.o}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot (L_{rsE}(L, H_p) - S) ... + q_{rF\_s.o}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot \left(\frac{3S}{2} - L_{rsE}(L, H_p)\right)$$

$$load12(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}, S) := q_{rE\_s.o}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot S$$

$$case9(L, H_p, S) := \left(L_{rsE}(L, H_p) \le \frac{S}{2}\right) \wedge L_{rsF}(L, H_p) \ne 0$$

$$case10(L, H_p, S) := \left(\frac{S}{2} < L_{rsE}(L, H_p) \le S\right) \wedge L_{rsF}(L, H_p) \ne 0$$

$$case11(L, H_p, S) := \left(L_{rsE}(L, H_p) \le \frac{3S}{2}\right) \wedge L_{rsF}(L, H_p) \ne 0$$

$$case12(L, H_p, S) := L_{rsE}(L, H_p) > \frac{3S}{2} \vee L_{rsF}(L, H_p) = 0$$

$$P2_{side3.upper\_o}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_o}, S) := \begin{cases} load9(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_o}, S) & \text{if } case9(L, H_p, S) \\ load10(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_o}, S) & \text{if } case10(L, H_p, S) \\ load11(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_o}, S) & \text{if } case11(L, H_p, S) \\ load12(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_o}, S) & \text{if } case12(L, H_p, S) \end{cases}$$

$$P2_{side2.upper\_o}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_o}, S) := q_{rC\_s.o}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot S$$

Load on the third arch: **<1.21>**

Lower roof:

$$\mathrm{load13}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o},S) := q_{rB\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot S$$

$$\mathrm{load14}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o},S) := q_{rA\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot\left(L_{rsA}(L,H_p)-\frac{3S}{2}\right)\ldots$$
$$+q_{rB\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot\left(2S-L_{rsA}(L,H_p)\right)\ldots$$
$$+q_{rB\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot\frac{S}{2}$$

$$\mathrm{load15}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o},S) := q_{rA\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot\frac{S}{2}\ldots$$
$$+q_{rA\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot\left(L_{rsA}(L,H_p)-2S\right)\ldots$$
$$+q_{rB\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot\left(\frac{5S}{2}-L_{rsA}(L,H_p)\right)$$

$$\mathrm{load16}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o},S) := q_{rA\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot S$$

$$\mathrm{case13}(L,H_p,S) := \left(L_{rsA}(L,H_p)\le\frac{3S}{2}\right)\wedge L_{rsB}(L,H_p)\ne 0$$

$$\mathrm{case14}(L,H_p,S) := \left(\frac{3S}{2}<L_{rsA}(L,H_p)\le 2S\right)\wedge L_{rsB}(L,H_p)\ne 0$$

$$\mathrm{case15}(L,H_p,S) := \left(2S<L_{rsA}(L,H_p)\le\frac{5S}{2}\right)\wedge L_{rsB}(L,H_p)\ne 0$$

$$\mathrm{case16}(L,H_p,S) := L_{rsA}(L,H_p)>\frac{5S}{2}\vee L_{rsB}(L,H_p)=0$$

$$P3_{side2.lower\_o}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_o},S) := \left|\begin{array}{ll}\mathrm{load13}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_o},S) & \text{if } \mathrm{case13}(L,H_p,S)\\ \mathrm{load14}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_o},S) & \text{if } \mathrm{case14}(L,H_p,S)\\ \mathrm{load15}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_o},S) & \text{if } \mathrm{case15}(L,H_p,S)\\ \mathrm{load16}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_o},S) & \text{if } \mathrm{case16}(L,H_p,S)\end{array}\right.$$

$$P3_{side3.lower\_o}(V_b,H_{peak},H_{eave},sea,site,RI,L,W,\alpha_r,C_{pi\_o},S) := q_{rG\_s.o}(V_b,H_{peak},H_{eave},sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot S$$

Upper roof:

$$load17(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o},S) := q_{rF\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot S$$

$$load18(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o},S) := q_{rE\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot\left(L_{rsE}(L,H_p)-\frac{3S}{2}\right) \dots$$
$$+ q_{rF\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot(2S-L_{rsE}(L,H_p)) \dots$$
$$+ q_{rF\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot\frac{S}{2}$$

$$load19(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o},S) := q_{rE\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot\frac{S}{2} \dots$$
$$+ q_{rE\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot(L_{rsE}(L,H_p)-2S) \dots$$
$$+ q_{rF\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot\left(\frac{5S}{2}-L_{rsE}(L,H_p)\right)$$

$$load20(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o},S) := q_{rE\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot S$$

$$case17(L,H_p,S) := \left(L_{rsE}(L,H_p) \le \frac{3S}{2}\right) \wedge L_{rsF}(L,H_p) \ne 0$$

$$case18(L,H_p,S) := \left(\frac{3S}{2} < L_{rsE}(L,H_p) \le 2S\right) \wedge L_{rsF}(L,H_p) \ne 0$$

$$case19(L,H_p,S) := \left(2S < L_{rsE}(L,H_p) \le \frac{5S}{2}\right) \wedge L_{rsF}(L,H_p) \ne 0$$

$$case20(L,H_p,S) := L_{rsE}(L,H_p) > \frac{5S}{2} \vee L_{rsF}(L,H_p) = 0$$

$$P3_{side3.upper\_o}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_o},S) := \begin{cases} load17(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_o},S) & \text{if } case17(L,H_p,S) \\ load18(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_o},S) & \text{if } case18(L,H_p,S) \\ load19(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_o},S) & \text{if } case19(L,H_p,S) \\ load20(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_o},S) & \text{if } case20(L,H_p,S) \end{cases}$$

$$P3_{side2.upper\_o}(V_b,H_{peak},H_{eave},sea,site,RI,L,W,\alpha_r,C_{pi\_o},S) := q_{rC\_s.o}(V_b,H_{peak},H_{eave},sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot S$$

Load on the fourth arch: **<1.22>**

Lower roof:

$$load21(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o},S) := q_{rB\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot S$$

$$load22(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o},S) := q_{rA\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot\left(L_{rsA}(L,H_p)-\frac{5S}{2}\right) \ldots$$
$$+ q_{rB\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot\left(3S-L_{rsA}(L,H_p)\right) \ldots$$
$$+ q_{rB\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot\frac{S}{2}$$

$$load23(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o},S) := q_{rA\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot\frac{S}{2} \ldots$$
$$+ q_{rA\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot\left(L_{rsA}(L,H_p)-3S\right) \ldots$$
$$+ q_{rB\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot\left(\frac{7S}{2}-L_{rsA}(L,H_p)\right)$$

$$load24(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o},S) := q_{rA\_s.o}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot S$$

$$case21(L,H_p,S) := \left(L_{rsA}(L,H_p) \le \frac{5S}{2}\right) \wedge L_{rsB}(L,H_p) \ne 0$$

$$case22(L,H_p,S) := \left(\frac{5S}{2} < L_{rsA}(L,H_p) \le 3S\right) \wedge L_{rsB}(L,H_p) \ne 0$$

$$case23(L,H_p,S) := \left(3S < L_{rsA}(L,H_p) \le \frac{7S}{2}\right) \wedge L_{rsB}(L,H_p) \ne 0$$

$$case24(L,H_p,S) := L_{rsA}(L,H_p) > \frac{7S}{2} \vee L_{rsB}(L,H_p) = 0$$

$$P4_{side2.lower\_o}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_o},S) := \begin{array}{|l} load21(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_o},S) \text{ if } case21(L,H_p,S) \\ load22(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_o},S) \text{ if } case22(L,H_p,S) \\ load23(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_o},S) \text{ if } case23(L,H_p,S) \\ load24(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_o},S) \text{ if } case24(L,H_p,S) \end{array}$$

$$P4_{side3.lower\_o}(V_b,H_{peak},H_{eave},sea,site,RI,L,W,\alpha_r,C_{pi\_o},S) := q_{rG\_s.o}(V_b,H_{peak},H_{eave},sea,site,RI,L,W,\alpha_r,C_{pi\_o})\cdot S$$

Upper roof:

$$load25(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}, S) := q_{rF\_s.o}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot S$$

$$load26(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}, S) := q_{rE\_s.o}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot \left(L_{rsE}(L, H_p) - \frac{5S}{2}\right) \ldots + q_{rF\_s.o}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot (3S - L_{rsE}(L, H_p)) \ldots + q_{rF\_s.o}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot \frac{S}{2}$$

$$load27(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}, S) := q_{rE\_s.o}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot \frac{S}{2} \ldots + q_{rE\_s.o}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot (L_{rsE}(L, H_p) - 3S) \ldots + q_{rF\_s.o}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot \left(\frac{7S}{2} - L_{rsE}(L, H_p)\right)$$

$$load28(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}, S) := q_{rE\_s.o}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot S$$

$$case25(L, H_p, S) := \left(L_{rsE}(L, H_p) \le \frac{5S}{2}\right) \wedge L_{rsF}(L, H_p) \ne 0$$

$$case26(L, H_p, S) := \left(\frac{5S}{2} < L_{rsE}(L, H_p) \le 3S\right) \wedge L_{rsF}(L, H_p) \ne 0$$

$$case27(L, H_p, S) := \left(3S < L_{rsE}(L, H_p) \le \frac{7S}{2}\right) \wedge L_{rsF}(L, H_p) \ne 0$$

$$case28(L, H_p, S) := L_{rsE}(L, H_p) > \frac{7S}{2} \vee L_{rsF}(L, H_p) = 0$$

$$P4_{side3.upper\_o}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_o}, S) := \begin{array}{|ll} load25(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_o}, S) & \text{if } case25(L, H_p, S) \\ load26(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_o}, S) & \text{if } case26(L, H_p, S) \\ load27(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_o}, S) & \text{if } case27(L, H_p, S) \\ load28(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_o}, S) & \text{if } case28(L, H_p, S) \end{array}$$

$$P4_{side2.upper\_o}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_o}, S) := q_{rC\_s.o}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_o}) \cdot S$$

Underpressure :

Load on the first arch: **<1.23>**

Walls:

$$P_{side1\_u}(V_b, H_{peak}, H_{eave}, sea, site, RI, W, L, C_{pi\_u}, S) := q_{sw\_ww.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, W, L, C_{pi\_u})\cdot S$$

$$P_{side4\_u}(V_b, H_{peak}, H_{eave}, sea, site, RI, W, L, C_{pi\_u}, S) := q_{sw\_lw.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, W, L, C_{pi\_u})\cdot S$$

Lower roof:

$$load1(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}, S) := q_{rA\_s.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u})\cdot\frac{S}{2}$$

$$load2(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}, S) := q_{rA\_s.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u})\cdot L_{rsA}(L, H_p)\ ...\ + q_{rB\_s.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u})\cdot\left(\frac{S}{2} - L_{rsA}(L, H_p)\right)$$

$$case1(L, H_p, S) := \frac{S}{2} \le L_{rsA}(L, H_p)$$

$$case2(L, H_p, S) := L_{rsA}(L, H_p) < \frac{S}{2} < (L_{rsA}(L, H_p) + L_{rsB}(L, H_p))$$

$$P1_{side2.lower\_u}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S) := \left| \begin{array}{l} load1(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S) \text{ if } case1(L, H_p, S) \\ load2(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S) \text{ if } case2(L, H_p, S) \end{array} \right.$$

$$P1_{side3.lower\_u}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_u}, S) := q_{rG\_s.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_u})\cdot\frac{S}{2}$$

Upper roof:

$$load3\left(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}, S\right) := q_{rE\_s.u}\left(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}\right)\cdot\frac{S}{2}$$

$$load4\left(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}, S\right) := q_{rE\_s.u}\left(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}\right)\cdot L_{rsE}\left(L, H_p\right) \dots$$
$$+ q_{rF\_s.u}\left(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}\right)\cdot\left(\frac{S}{2} - L_{rsE}\left(L, H_p\right)\right)$$

$$case3\left(L, H_p, S\right) := \frac{S}{2} \le L_{rsE}\left(L, H_p\right)$$

$$case4\left(L, H_p, S\right) := L_{rsE}\left(L, H_p\right) < \frac{S}{2} < \left(L_{rsE}\left(L, H_p\right) + L_{rsF}\left(L, H_p\right)\right)$$

$$P1_{side3.upper\_u}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S\right) := \begin{array}{|l} load3\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S\right) \text{ if } case3\left(L, H_p, S\right) \\ load4\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S\right) \text{ if } case4\left(L, H_p, S\right) \end{array}$$

$$P1_{side2.upper\_u}\left(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_u}, S\right) := q_{rC\_s.u}\left(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_u}\right)\cdot\frac{S}{2}$$

Load on the second arch: **<1.24>**

Lower roof:

$$\text{load5}(V_b, H_p, H_e, \text{sea}, \text{site}, RI, L, W, \alpha_r, C_{pi\_u}, S) := q_{rB\_s.u}(V_b, H_p, H_e, \text{sea}, \text{site}, RI, L, W, \alpha_r, C_{pi\_u}) \cdot S$$

$$\text{load6}(V_b, H_p, H_e, \text{sea}, \text{site}, RI, L, W, \alpha_r, C_{pi\_u}, S) := q_{rA\_s.u}(V_b, H_p, H_e, \text{sea}, \text{site}, RI, L, W, \alpha_r, C_{pi\_u}) \cdot \left(L_{rsA}(L, H_p) - \frac{S}{2}\right) \ldots + q_{rB\_s.u}(V_b, H_p, H_e, \text{sea}, \text{site}, RI, L, W, \alpha_r, C_{pi\_u}) \cdot (S - L_{rsA}(L, H_p)) \ldots + q_{rB\_s.u}(V_b, H_p, H_e, \text{sea}, \text{site}, RI, L, W, \alpha_r, C_{pi\_u}) \cdot \frac{S}{2}$$

$$\text{load7}(V_b, H_p, H_e, \text{sea}, \text{site}, RI, L, W, \alpha_r, C_{pi\_u}, S) := q_{rA\_s.u}(V_b, H_p, H_e, \text{sea}, \text{site}, RI, L, W, \alpha_r, C_{pi\_u}) \cdot \frac{S}{2} \ldots + q_{rA\_s.u}(V_b, H_p, H_e, \text{sea}, \text{site}, RI, L, W, \alpha_r, C_{pi\_u}) \cdot (L_{rsA}(L, H_p) - S) \ldots + q_{rB\_s.u}(V_b, H_p, H_e, \text{sea}, \text{site}, RI, L, W, \alpha_r, C_{pi\_u}) \cdot \left(\frac{3S}{2} - L_{rsA}(L, H_p)\right)$$

$$\text{load8}(V_b, H_p, H_e, \text{sea}, \text{site}, RI, L, W, \alpha_r, C_{pi\_u}, S) := q_{rA\_s.u}(V_b, H_p, H_e, \text{sea}, \text{site}, RI, L, W, \alpha_r, C_{pi\_u}) \cdot S$$

$$\text{case5}(L, H_p, S) := \left(L_{rsA}(L, H_p) \le \frac{S}{2}\right) \wedge L_{rsB}(L, H_p) \ne 0$$

$$\text{case6}(L, H_p, S) := \left(\frac{S}{2} < L_{rsA}(L, H_p) \le S\right) \wedge L_{rsB}(L, H_p) \ne 0$$

$$\text{case7}(L, H_p, S) := \left(L_{rsA}(L, H_p) \le \frac{3S}{2}\right) \wedge L_{rsB}(L, H_p) \ne 0$$

$$\text{case8}(L, H_p, S) := L_{rsA}(L, H_p) > \frac{3S}{2} \vee L_{rsB}(L, H_p) = 0$$

$$P2_{side2.lower\_u}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S) := \left| \begin{array}{ll} \text{load5}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S) & \text{if } \text{case5}(L, H_p, S) \\ \text{load6}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S) & \text{if } \text{case6}(L, H_p, S) \\ \text{load7}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S) & \text{if } \text{case7}(L, H_p, S) \\ \text{load8}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S) & \text{if } \text{case8}(L, H_p, S) \end{array} \right.$$

$$P2_{side3.lower\_u}(V_b, H_{peak}, H_{eave}, \text{sea}, \text{site}, RI, L, W, \alpha_r, C_{pi\_u}, S) := q_{rG\_s.u}(V_b, H_{peak}, H_{eave}, \text{sea}, \text{site}, RI, L, W, \alpha_r, C_{pi\_u}) \cdot S$$

Upper roof:

$$load9(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u},S) := q_{rF\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot S$$

$$\begin{aligned} load10(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u},S) := {} & q_{rE\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot\left(L_{rsE}(L,H_p)-\frac{S}{2}\right) \ldots \\ & + q_{rF\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot(S-L_{rsE}(L,H_p)) \ldots \\ & + q_{rF\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot\frac{S}{2} \end{aligned}$$

$$\begin{aligned} load11(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u},S) := {} & q_{rE\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot\frac{S}{2} \ldots \\ & + q_{rE\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot(L_{rsE}(L,H_p)-S) \ldots \\ & + q_{rF\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot\left(\frac{3S}{2}-L_{rsE}(L,H_p)\right) \end{aligned}$$

$$load12(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u},S) := q_{rE\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot S$$

$$case9(L,H_p,S) := \left(L_{rsE}(L,H_p) \le \frac{S}{2}\right) \wedge L_{rsF}(L,H_p) \ne 0$$

$$case10(L,H_p,S) := \left(\frac{S}{2} < L_{rsE}(L,H_p) \le S\right) \wedge L_{rsF}(L,H_p) \ne 0$$

$$case11(L,H_p,S) := \left(L_{rsE}(L,H_p) \le \frac{3S}{2}\right) \wedge L_{rsF}(L,H_p) \ne 0$$

$$case12(L,H_p,S) := L_{rsE}(L,H_p) > \frac{3S}{2} \vee L_{rsF}(L,H_p) = 0$$

$$P2_{side3.upper\_u}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_u},S) := \left| \begin{array}{ll} load9(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_u},S) & \text{if } case9(L,H_p,S) \\ load10(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_u},S) & \text{if } case10(L,H_p,S) \\ load11(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_u},S) & \text{if } case11(L,H_p,S) \\ load12(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_u},S) & \text{if } case12(L,H_p,S) \end{array} \right.$$

$$P2_{side2.upper\_u}(V_b,H_{peak},H_{eave},sea,site,RI,L,W,\alpha_r,C_{pi\_u},S) := q_{rC\_s.u}(V_b,H_{peak},H_{eave},sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot S$$

Load on the third arch: **<1.25>**

Lower roof:

$$load13(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}, S) := q_{rB\_s.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) \cdot S$$

$$load14(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}, S) := q_{rA\_s.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) \cdot \left(L_{rsA}(L, H_p) - \frac{3S}{2}\right) \dots + q_{rB\_s.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) \cdot (2S - L_{rsA}(L, H_p)) \dots + q_{rB\_s.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) \cdot \frac{S}{2}$$

$$load15(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}, S) := q_{rA\_s.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) \cdot \frac{S}{2} \dots + q_{rA\_s.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) \cdot (L_{rsA}(L, H_p) - 2S) \dots + q_{rB\_s.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) \cdot \left(\frac{5S}{2} - L_{rsA}(L, H_p)\right)$$

$$load16(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}, S) := q_{rA\_s.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) \cdot S$$

$$case13(L, H_p, S) := \left(L_{rsA}(L, H_p) \le \frac{3S}{2}\right) \wedge L_{rsB}(L, H_p) \ne 0$$

$$case14(L, H_p, S) := \left(\frac{3S}{2} < L_{rsA}(L, H_p) \le 2S\right) \wedge L_{rsB}(L, H_p) \ne 0$$

$$case15(L, H_p, S) := \left(2S < L_{rsA}(L, H_p) \le \frac{5S}{2}\right) \wedge L_{rsB}(L, H_p) \ne 0$$

$$case16(L, H_p, S) := L_{rsA}(L, H_p) > \frac{5S}{2} \vee L_{rsB}(L, H_p) = 0$$

$$P3_{side2.lower\_u}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S) := \begin{cases} load13(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S) & \text{if } case13(L, H_p, S) \\ load14(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S) & \text{if } case14(L, H_p, S) \\ load15(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S) & \text{if } case15(L, H_p, S) \\ load16(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S) & \text{if } case16(L, H_p, S) \end{cases}$$

$$P3_{side3.lower\_u}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_u}, S) := q_{rG\_s.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) \cdot S$$

Upper roof:

$$\mathrm{load17}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u},S) := q_{rF\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot S$$

$$\mathrm{load18}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u},S) := q_{rE\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot\left(L_{rsE}(L,H_p)-\frac{3S}{2}\right) \ldots$$
$$+q_{rF\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot(2S-L_{rsE}(L,H_p)) \ldots$$
$$+q_{rF\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot\frac{S}{2}$$

$$\mathrm{load19}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u},S) := q_{rE\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot\frac{S}{2} \ldots$$
$$+q_{rE\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot(L_{rsE}(L,H_p)-2S) \ldots$$
$$+q_{rF\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot\left(\frac{5S}{2}-L_{rsE}(L,H_p)\right)$$

$$\mathrm{load20}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u},S) := q_{rE\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot S$$

$$\mathrm{case17}(L,H_p,S) := \left(L_{rsE}(L,H_p)\le\frac{3S}{2}\right)\wedge L_{rsF}(L,H_p)\ne 0$$

$$\mathrm{case18}(L,H_p,S) := \left(\frac{3S}{2}<L_{rsE}(L,H_p)\le 2S\right)\wedge L_{rsF}(L,H_p)\ne 0$$

$$\mathrm{case19}(L,H_p,S) := \left(2S<L_{rsE}(L,H_p)\le\frac{5S}{2}\right)\wedge L_{rsF}(L,H_p)\ne 0$$

$$\mathrm{case20}(L,H_p,S) := L_{rsE}(L,H_p)>\frac{5S}{2}\vee L_{rsF}(L,H_p)=0$$

$$P3_{side3.upper\_u}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_u},S) := \left|\begin{array}{l}\mathrm{load17}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_u},S)\ \text{ if }\ \mathrm{case17}(L,H_p,S)\\ \mathrm{load18}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_u},S)\ \text{ if }\ \mathrm{case18}(L,H_p,S)\\ \mathrm{load19}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_u},S)\ \text{ if }\ \mathrm{case19}(L,H_p,S)\\ \mathrm{load20}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_u},S)\ \text{ if }\ \mathrm{case20}(L,H_p,S)\end{array}\right.$$

$$P3_{side2.upper\_u}(V_b,H_{peak},H_{eave},sea,site,RI,L,W,\alpha_r,C_{pi\_u},S) := q_{rC\_s.u}(V_b,H_{peak},H_{eave},sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot S$$

Load on the fourth arch: **<1.26>**

Lower roof:

$$load21(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u},S) := q_{rB\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot S$$

$$load22(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u},S) := q_{rA\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot\left(L_{rsA}(L,H_p)-\frac{5S}{2}\right) \ldots$$
$$+ q_{rB\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot(3S-L_{rsA}(L,H_p)) \ldots$$
$$+ q_{rB\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot\frac{S}{2}$$

$$load23(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u},S) := q_{rA\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot\frac{S}{2} \ldots$$
$$+ q_{rA\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot(L_{rsA}(L,H_p)-3S) \ldots$$
$$+ q_{rB\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot\left(\frac{7S}{2}-L_{rsA}(L,H_p)\right)$$

$$load24(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u},S) := q_{rA\_s.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot S$$

$$case21(L,H_p,S) := \left(L_{rsA}(L,H_p) \le \frac{5S}{2}\right) \wedge L_{rsB}(L,H_p) \ne 0$$

$$case22(L,H_p,S) := \left(\frac{5S}{2} < L_{rsA}(L,H_p) \le 3S\right) \wedge L_{rsB}(L,H_p) \ne 0$$

$$case23(L,H_p,S) := \left(3S < L_{rsA}(L,H_p) \le \frac{7S}{2}\right) \wedge L_{rsB}(L,H_p) \ne 0$$

$$case24(L,H_p,S) := L_{rsA}(L,H_p) > \frac{7S}{2} \vee L_{rsB}(L,H_p) = 0$$

$$P4_{side2.lower\_u}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_u},S) := \begin{vmatrix} load21(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_u},S) & \text{if } case21(L,H_p,S) \\ load22(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_u},S) & \text{if } case22(L,H_p,S) \\ load23(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_u},S) & \text{if } case23(L,H_p,S) \\ load24(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi\_u},S) & \text{if } case24(L,H_p,S) \end{vmatrix}$$

$$P4_{side3.lower\_u}(V_b,H_{peak},H_{eave},sea,site,RI,L,W,\alpha_r,C_{pi\_u},S) := q_{rG\_s.u}(V_b,H_{peak},H_{eave},sea,site,RI,L,W,\alpha_r,C_{pi\_u})\cdot S$$

Upper roof:

$$\text{load25}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}, S) := q_{rF\_s.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) \cdot S$$

$$\text{load26}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}, S) := q_{rE\_s.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) \cdot \left(L_{rsE}(L, H_p) - \frac{5S}{2}\right) \ldots$$
$$+ q_{rF\_s.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) \cdot (3S - L_{rsE}(L, H_p)) \ldots$$
$$+ q_{rF\_s.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) \cdot \frac{S}{2}$$

$$\text{load27}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}, S) := q_{rE\_s.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) \cdot \frac{S}{2} \ldots$$
$$+ q_{rE\_s.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) \cdot (L_{rsE}(L, H_p) - 3S) \ldots$$
$$+ q_{rF\_s.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) \cdot \left(\frac{7S}{2} - L_{rsE}(L, H_p)\right)$$

$$\text{load28}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}, S) := q_{rE\_s.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) \cdot S$$

$$\text{case25}(L, H_p, S) := \left(L_{rsE}(L, H_p) \le \frac{5S}{2}\right) \wedge L_{rsF}(L, H_p) \ne 0$$

$$\text{case26}(L, H_p, S) := \left(\frac{5S}{2} < L_{rsE}(L, H_p) \le 3S\right) \wedge L_{rsF}(L, H_p) \ne 0$$

$$\text{case27}(L, H_p, S) := \left(3S < L_{rsE}(L, H_p) \le \frac{7S}{2}\right) \wedge L_{rsF}(L, H_p) \ne 0$$

$$\text{case28}(L, H_p, S) := L_{rsE}(L, H_p) > \frac{7S}{2} \vee L_{rsF}(L, H_p) = 0$$

$$P4_{side3.upper\_u}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S) := \begin{array}{|l} \text{load25}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S) \text{ if case25}(L, H_p, S) \\ \text{load26}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S) \text{ if case26}(L, H_p, S) \\ \text{load27}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S) \text{ if case27}(L, H_p, S) \\ \text{load28}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi\_u}, S) \text{ if case28}(L, H_p, S) \end{array}$$

$$P4_{side2.upper\_u}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_u}, S) := q_{rC\_s.u}(V_b, H_{peak}, H_{eave}, sea, site, RI, L, W, \alpha_r, C_{pi\_u}) \cdot S$$

Wind normal on gable :

Overpressure / Underpressure :

Load on the first arch: **<1.27>**

Walls:

$$load1\left(V_b, H_p, H_e, sea, site, RI, L, C_{pi}, S\right) := q_{sA\_o.u}\left(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}\right)\cdot\frac{S}{2}$$

$$load2\left(V_b, H_p, H_e, sea, site, RI, L, W, C_{pi}, S\right) := q_{sA\_o.u}\left(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}\right)\cdot L_{gA}\left(W, H_p\right) \ldots + q_{sB\_o.u}\left(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}\right)\cdot\left(\frac{S}{2} - L_{gA}\left(W, H_p\right)\right)$$

$$case1\left(W, H_p, S\right) := \frac{S}{2} \le L_{gA}\left(W, H_p\right)$$

$$case2\left(W, L, H_p, S\right) := L_{gA}\left(W, H_p\right) < \frac{S}{2} < \left(L_{gA}\left(W, H_p\right) + L_{gB}\left(W, H_p, L\right)\right)$$

$$P1_{gab1.4\_o.u}\left(V_b, H_p, H_e, se, si, RI, L, W, C_{pi}, S\right) := \begin{array}{|l} load1\left(V_b, H_p, H_e, se, si, RI, L, C_{pi}, S\right) \text{ if } case1\left(W, H_p, S\right) \\ load2\left(V_b, H_p, H_e, se, si, RI, L, W, C_{pi}, S\right) \text{ if } case2\left(W, L, H_p, S\right) \end{array}$$

Roof:

$$load3a(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}, S) := q_{rA\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot \frac{S}{2}$$

$$load3b(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}, S) := q_{rB\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot \frac{S}{2}$$

$$load4a(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}, S) := q_{rA\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot L_{rgA}(W, H_p) \ldots + q_{rC\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot \left(\frac{S}{2} - L_{rgA}(W, H_p)\right)$$

$$load4b(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}, S) := q_{rB\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot L_{rgB}(W, H_p) \ldots + q_{rC\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot \left(\frac{S}{2} - L_{rgB}(W, H_p)\right)$$

$$case3(W, H_p, S) := \frac{S}{2} \le L_{rgA}(W, H_p)$$

$$case4(W, H_p, S) := L_{rgA}(W, H_p) < \frac{S}{2} < \left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right)$$

$$P1_{g2.3a\_o.u}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S) := \begin{vmatrix} load3a(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S) \text{ if } case3(W, H_p, S) \\ load4a(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S) \text{ if } case4(W, H_p, S) \end{vmatrix}$$

$$P1_{g2.3b\_o.u}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S) := \begin{vmatrix} load3b(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S) \text{ if } case3(W, H_p, S) \\ load4b(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S) \text{ if } case4(W, H_p, S) \end{vmatrix}$$

Load on the second arch: <1.28>

Walls:

$$load5(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}, S) := q_{sB\_o.u}(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}) \cdot S$$

$$load6(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}, S) := q_{sA\_o.u}(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}) \cdot \left(L_{gA}(W, H_p) - \frac{S}{2}\right) ... + q_{sB\_o.u}(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}) \cdot (S - L_{gA}(W, H_p)) ... + q_{sB\_o.u}(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}) \cdot \frac{S}{2}$$

$$load7(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}, S) := q_{sA\_o.u}(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}) \cdot \frac{S}{2} ... + q_{sA\_o.u}(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}) \cdot (L_{gA}(W, H_p) - S) ... + q_{sB\_o.u}(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}) \cdot \left(\frac{3S}{2} - L_{gA}(W, H_p)\right)$$

$$load8(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}, S) := q_{sA\_o.u}(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}) \cdot S$$

$$case5(W, H_p, S) := L_{gA}(W, H_p) \le \frac{S}{2}$$

$$case6(W, H_p, S) := \frac{S}{2} < L_{gA}(W, H_p) \le S$$

$$case7(W, H_p, S) := L_{gA}(W, H_p) \le \frac{3S}{2}$$

$$case8(W, H_p, S) := L_{gA}(W, H_p) > \frac{3S}{2}$$

$$P2_{gab1.4\_o.u}(V_b, H_p, H_e, se, si, RI, W, L, C_{pi}, S) := \begin{array}{|l} load5(V_b, H_p, H_e, se, si, RI, W, L, C_{pi}, S) \text{ if } case5(W, H_p, S) \\ load6(V_b, H_p, H_e, se, si, RI, W, L, C_{pi}, S) \text{ if } case6(W, H_p, S) \\ load7(V_b, H_p, H_e, se, si, RI, W, L, C_{pi}, S) \text{ if } case7(W, H_p, S) \\ load8(V_b, H_p, H_e, se, si, RI, W, L, C_{pi}, S) \text{ if } case8(W, H_p, S) \end{array}$$

Roof:

$$\mathrm{load9}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}, S) := q_{rD\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot S$$

$$\begin{aligned}\mathrm{load10}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}, S) := {} & q_{rC\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot \left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p) - \frac{S}{2}\right) \\ & + q_{rD\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot \left[S - \left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right)\right] \\ & + q_{rD\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot \frac{S}{2}\end{aligned}$$

$$\begin{aligned}\mathrm{load11}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S) := {} & q_{rC\_g.o.u}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}) \cdot \frac{S}{2} \\ & + q_{rC\_g.o.u}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}) \cdot \left[\left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right) - S\right] \\ & + q_{rD\_g.o.u}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}) \cdot \left[\frac{3S}{2} + -\left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right)\right]\end{aligned}$$

$$\mathrm{load12}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}, S) := q_{rC\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot S$$

$$\begin{aligned}\mathrm{load13a}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}, S) := {} & q_{rA\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot \left(L_{rgA}(W, H_p) - \frac{S}{2}\right) \\ & + q_{rC\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot \left(S - L_{rgA}(W, H_p)\right) \\ & + q_{rC\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot \frac{S}{2}\end{aligned}$$

$$\begin{aligned}\mathrm{load13b}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}, S) := {} & q_{rB\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot \left(L_{rgB}(W, H_p) - \frac{S}{2}\right) \\ & + q_{rC\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot \left(S - L_{rgB}(W, H_p)\right) \\ & + q_{rC\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot \frac{S}{2}\end{aligned}$$

$$\begin{aligned}\mathrm{load14a}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}, S) := {} & q_{rA\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot \frac{S}{2} \\ & + q_{rA\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot \left(L_{rgA}(W, H_p) - S\right) \\ & + q_{rC\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot \left(\frac{3S}{2} - L_{rgA}(W, H_p)\right)\end{aligned}$$

$$\text{load14b}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi},S) := q_{rB\_g.o.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi})\cdot\frac{S}{2}\ ...$$
$$+\,q_{rB\_g.o.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi})\cdot(L_{rgB}(W,H_p)-S)\ ...$$
$$+\,q_{rC\_g.o.u}(V_b,H_p,H_e,sea,site,RI,L,W,\alpha_r,C_{pi})\cdot\left(\frac{3S}{2}-L_{rgB}(W,H_p)\right)$$

$$\text{case9}(W,H_p,S) := (L_{rgA}(W,H_p)+L_{rgC}(W,H_p)) \le \frac{S}{2}$$

$$\text{case10}(W,H_p,S) := \frac{S}{2} < (L_{rgA}(W,H_p)+L_{rgC}(W,H_p)) \le S$$

$$\text{case11}(W,H_p,S) := S < (L_{rgA}(W,H_p)+L_{rgC}(W,H_p)) \le \frac{3S}{2}$$

$$\text{case12}(W,H_p,S) := (L_{rgA}(W,H_p)+L_{rgC}(W,H_p)) > \frac{3S}{2}$$

$$\text{case13}(W,H_p,S) := \frac{S}{2} < L_{rgA}(W,H_p) \le S$$

$$\text{case14}(W,H_p,S) := S < L_{rgA}(W,H_p) \le \frac{3S}{2}$$

$$P2_{g2.3a\_o.u}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi},S) := \left|\begin{array}{l} \text{load9}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi},S)\ \text{if}\ \text{case9}(W,H_p,S)\\ \text{load10}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi},S)\ \text{if}\ \text{case10}(W,H_p,S)\\ \text{load11}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi},S)\ \text{if}\ \text{case11}(W,H_p,S)\\ \text{load12}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi},S)\ \text{if}\ \text{case12}(W,H_p,S)\\ \text{load13a}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi},S)\ \text{if}\ \text{case13}(W,H_p,S)\\ \text{load14a}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi},S)\ \text{if}\ \text{case14}(W,H_p,S)\end{array}\right.$$

$$P2_{g2.3b\_o.u}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi},S) := \left|\begin{array}{l} \text{load9}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi},S)\ \text{if}\ \text{case9}(W,H_p,S)\\ \text{load10}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi},S)\ \text{if}\ \text{case10}(W,H_p,S)\\ \text{load11}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi},S)\ \text{if}\ \text{case11}(W,H_p,S)\\ \text{load12}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi},S)\ \text{if}\ \text{case12}(W,H_p,S)\\ \text{load13b}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi},S)\ \text{if}\ \text{case13}(W,H_p,S)\\ \text{load14b}(V_b,H_p,H_e,se,si,RI,L,W,\alpha_r,C_{pi},S)\ \text{if}\ \text{case14}(W,H_p,S)\end{array}\right.$$

Load on the third arch: **<1.29>**

Walls:

$$load15(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}, S) := q_{sC\_o.u}(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}) \cdot S$$

$$load16(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}, S) := q_{sB\_o.u}(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}) \cdot \left(L_{gA}(W, H_p) + L_{gB}(W, H_p, L) - \frac{3S}{2}\right) + q_{sC\_o.u}(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}) \cdot \left[2S - \left(L_{gA}(W, H_p) + L_{gB}(W, H_p, L)\right)\right] + q_{sC\_o.u}(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}) \cdot \frac{S}{2}$$

$$load17(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}, S) := q_{sB\_o.u}(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}) \cdot \frac{S}{2} + q_{sB\_o.u}(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}) \cdot \left[\left(L_{gA}(W, H_p) + L_{gB}(W, H_p, L)\right) - 2S\right] + q_{sC\_o.u}(V_b, H_p, H_e, sea, site, RI, W, L, C_{pi}) \cdot \left[\frac{5S}{2} - \left(L_{gA}(W, H_p) + L_{gB}(W, H_p, L)\right)\right]$$

$$case15(W, H_p, L, S) := \left(L_{gA}(W, H_p) + L_{gB}(W, H_p, L)\right) \le \frac{3S}{2}$$

$$case16(W, H_p, L, S) := \frac{3 \cdot S}{2} < \left(L_{gA}(W, H_p) + L_{gB}(W, H_p, L)\right) \le 2S$$

$$case17(W, H_p, L, S) := 2 \cdot S < \left(L_{gA}(W, H_p) + L_{gB}(W, H_p, L)\right) \le \frac{5S}{2}$$

$$P3_{gab1.4\_o.u}(V_b, H_p, H_e, se, si, RI, W, L, C_{pi}, S) := \begin{vmatrix} load15(V_b, H_p, H_e, se, si, RI, W, L, C_{pi}, S) \text{ if } case15(W, H_p, L, S) \\ load16(V_b, H_p, H_e, se, si, RI, W, L, C_{pi}, S) \text{ if } case16(W, H_p, L, S) \\ load17(V_b, H_p, H_e, se, si, RI, W, L, C_{pi}, S) \text{ if } case17(W, H_p, L, S) \end{vmatrix}$$

Roof:

$$\text{load18}\left(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}, S\right) := q_{rD\_g.o.u}\left(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}\right)\cdot S$$

$$\text{load19}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S\right) := q_{rC\_g.o.u}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}\right)\cdot\left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p) - \frac{3S}{2}\right) + q_{rD\_g.o.u}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}\right)\cdot\left[2S - \left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right)\right] + q_{rD\_g.o.u}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}\right)\cdot\frac{S}{2}$$

$$\text{load20}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S\right) := q_{rC\_g.o.u}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}\right)\cdot\frac{S}{2} + q_{rC\_g.o.u}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}\right)\cdot\left[\left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right) - 2S\right] + q_{rD\_g.o.u}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}\right)\cdot\left[\frac{5S}{2} + -\left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right)\right]$$

$$\text{case18}(W, H_p, S) := \left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right) \le \frac{3S}{2}$$

$$\text{case19}(W, H_p, S) := \frac{3S}{2} < \left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right) \le 2S$$

$$\text{case20}(W, H_p, S) := 2S < \left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right) \le \frac{5S}{2}$$

$$P3_{g2.3\_o.u}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S\right) := \begin{cases} \text{load18}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S\right) & \text{if } \text{case18}(W, H_p, S) \\ \text{load19}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S\right) & \text{if } \text{case19}(W, H_p, S) \\ \text{load20}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S\right) & \text{if } \text{case20}(W, H_p, S) \end{cases}$$

Load on the fourth arch: **<1.30>**

Walls:

$$load21\left(V_b,H_p,H_e,sea,site,RI,W,L,C_{pi},S\right) := q_{sC\_o.u}\left(V_b,H_p,H_e,sea,site,RI,W,L,C_{pi}\right)\cdot S$$

$$load22\left(V_b,H_p,H_e,sea,site,RI,W,L,c,C_{pi},S\right) := q_{sB\_o.u}\left(V_b,H_p,H_e,sea,site,RI,W,L,c,C_{pi}\right)\cdot\left(L_{gA}\left(W,H_p\right) + L_{gB}\left(W,H_p,L\right) - \frac{5S}{2}\right) + q_{sC\_o.u}\left(V_b,H_p,H_e,sea,site,RI,W,L,c,C_{pi}\right)\cdot\left[3S - \left(L_{gA}\left(W,H_p\right) + L_{gB}\left(W,H_p,L\right)\right)\right] + q_{sC\_o.u}\left(V_b,H_p,H_e,sea,site,RI,W,L,c,C_{pi}\right)\cdot\frac{S}{2}$$

$$load23\left(V_b,H_p,H_e,sea,site,RI,W,L,C_{pi},S\right) := q_{sB\_o.u}\left(V_b,H_p,H_e,sea,site,RI,W,L,C_{pi}\right)\cdot\frac{S}{2} + q_{sB\_o.u}\left(V_b,H_p,H_e,sea,site,RI,W,L,C_{pi}\right)\cdot\left[\left(L_{gA}\left(W,H_p\right) + L_{gB}\left(W,H_p,L\right)\right) - 3S\right] + q_{sC\_o.u}\left(V_b,H_p,H_e,sea,site,RI,W,L,C_{pi}\right)\cdot\left[\frac{7S}{2} - \left(L_{gA}\left(W,H_p\right) + L_{gB}\left(W,H_p,L\right)\right)\right]$$

$$case21\left(W,H_p,L,S\right) := \left(L_{gA}\left(W,H_p\right) + L_{gB}\left(W,H_p,L\right)\right) \le \frac{5S}{2}$$

$$case22\left(W,H_p,L,S\right) := \frac{5\cdot S}{2} < \left(L_{gA}\left(W,H_p\right) + L_{gB}\left(W,H_p,L\right)\right) \le 3S$$

$$case23\left(W,H_p,L,S\right) := 3\cdot S < \left(L_{gA}\left(W,H_p\right) + L_{gB}\left(W,H_p,L\right)\right) \le \frac{7S}{2}$$

$$P4_{gab1.4\_o.u}\left(V_b,H_p,H_e,se,si,RI,W,L,C_{pi},S\right) := \begin{cases} load21\left(V_b,H_p,H_e,se,si,RI,W,L,C_{pi},S\right) & \text{if } case21\left(W,H_p,L,S\right) \\ load22\left(V_b,H_p,H_e,se,si,RI,W,L,C_{pi},S\right) & \text{if } case22\left(W,H_p,L,S\right) \\ load23\left(V_b,H_p,H_e,se,si,RI,W,L,C_{pi},S\right) & \text{if } case23\left(W,H_p,L,S\right) \end{cases}$$

Roof:

$$load24(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}, S) := q_{rD\_g.o.u}(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}) \cdot S$$

$$load25(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S) := q_{rC\_g.o.u}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}) \cdot \left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p) - \frac{5S}{2}\right) + q_{rD\_g.o.u}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}) \cdot \left[3S - \left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right)\right] + q_{rD\_g.o.u}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}) \cdot \frac{S}{2}$$

$$load26(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S) := q_{rC\_g.o.u}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}) \cdot \frac{S}{2} + q_{rC\_g.o.u}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}) \cdot \left[\left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right) - 3S\right] + q_{rD\_g.o.u}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}) \cdot \left[\frac{7S}{2} + -\left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right)\right]$$

$$case24(W, H_p, S) := \left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right) \le \frac{5S}{2}$$

$$case25(W, H_p, S) := \frac{5S}{2} < \left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right) \le 3S$$

$$case26(W, H_p, S) := 3S < \left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right) \le \frac{7S}{2}$$

$$P4_{g2.3\_o.u}(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S) := \begin{cases} load24(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S) & \text{if } case24(W, H_p, S) \\ load25(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S) & \text{if } case25(W, H_p, S) \\ load26(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S) & \text{if } case26(W, H_p, S) \end{cases}$$

Load on the fifth arch: **<1.31>**

Walls:

$$load27(V_b,H_p,H_e,sea,site,RI,W,L,C_{pi},S) := q_{sC\_o.u}(V_b,H_p,H_e,sea,site,RI,W,L,C_{pi})\cdot S$$

$$\begin{aligned}load28(V_b,H_p,H_e,sea,site,RI,W,L,C_{pi},S) := {} & q_{sB\_o.u}(V_b,H_p,H_e,sea,site,RI,W,L,C_{pi})\cdot\left(L_{gA}(W,H_p) + L_{gB}(W,H_p,L) - \frac{7S}{2}\right) \\ & + q_{sC\_o.u}(V_b,H_p,H_e,sea,site,RI,W,L,C_{pi})\cdot\left[4S - \left(L_{gA}(W,H_p) + L_{gB}(W,H_p,L)\right)\right] \\ & + q_{sC\_o.u}(V_b,H_p,H_e,sea,site,RI,W,L,C_{pi})\cdot\frac{S}{2}\end{aligned}$$

$$\begin{aligned}load29(V_b,H_p,H_e,sea,site,RI,W,L,C_{pi},S) := {} & q_{sB\_o.u}(V_b,H_p,H_e,sea,site,RI,W,L,C_{pi})\cdot\frac{S}{2} \\ & + q_{sB\_o.u}(V_b,H_p,H_e,sea,site,RI,W,L,C_{pi})\cdot\left[\left(L_{gA}(W,H_p) + L_{gB}(W,H_p,L)\right) - 4S\right] \\ & + q_{sC\_o.u}(V_b,H_p,H_e,sea,site,RI,W,L,C_{pi})\cdot\left[\frac{9S}{2} - \left(L_{gA}(W,H_p) + L_{gB}(W,H_p,L)\right)\right]\end{aligned}$$

$$case27(W,H_p,L,S) := \left(L_{gA}(W,H_p) + L_{gB}(W,H_p,L)\right) \le \frac{7S}{2}$$

$$case28(W,H_p,L,S) := \frac{7\cdot S}{2} < \left(L_{gA}(W,H_p) + L_{gB}(W,H_p,L)\right) \le 4S$$

$$case29(W,H_p,L,S) := 4\cdot S < \left(L_{gA}(W,H_p) + L_{gB}(W,H_p,L)\right) \le \frac{9S}{2}$$

$$P5_{gab1.4\_o.u}(V_b,H_p,H_e,se,si,RI,W,L,C_{pi},S) := \begin{cases} load27(V_b,H_p,H_e,se,si,RI,W,L,C_{pi},S) & \text{if } case27(W,H_p,L,S) \\ load28(V_b,H_p,H_e,se,si,RI,W,L,C_{pi},S) & \text{if } case28(W,H_p,L,S) \\ load29(V_b,H_p,H_e,se,si,RI,W,L,C_{pi},S) & \text{if } case29(W,H_p,L,S) \end{cases}$$

Roof:

$$load30\left(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}, S\right) := q_{rD\_g.o.u}\left(V_b, H_p, H_e, sea, site, RI, L, W, \alpha_r, C_{pi}\right)\cdot S$$

$$load31\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S\right) := q_{rC\_g.o.u}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}\right)\cdot\left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p) - \frac{7S}{2}\right) + q_{rD\_g.o.u}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}\right)\cdot\left[4S - \left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right)\right] + q_{rD\_g.o.u}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}\right)\cdot\frac{S}{2}$$

$$load32\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S\right) := q_{rC\_g.o.u}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}\right)\cdot\frac{S}{2} + q_{rC\_g.o.u}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}\right)\cdot\left[\left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right) - 4S\right] + q_{rD\_g.o.u}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}\right)\cdot\left[\frac{9S}{2} + -\left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right)\right]$$

$$case30(W, H_p, S) := \left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right) \le \frac{7S}{2}$$

$$case31(W, H_p, S) := \frac{7S}{2} < \left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right) \le 4S$$

$$case32(W, H_p, S) := 4S < \left(L_{rgA}(W, H_p) + L_{rgC}(W, H_p)\right) \le \frac{9S}{2}$$

$$P5_{g2.3\_o.u}\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S\right) := \begin{cases} load30\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S\right) & \text{if } case30(W, H_p, S) \\ load31\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S\right) & \text{if } case31(W, H_p, S) \\ load32\left(V_b, H_p, H_e, se, si, RI, L, W, \alpha_r, C_{pi}, S\right) & \text{if } case32(W, H_p, S) \end{cases}$$

1.3. Load combinations.

The different load combinations that will be checked, (+ the combination factors), are automatically generated by the computer program according to the desired norm.

Doc. 2. Materials.

2.1. Properties.

$\gamma_M := 1.1$	partial safety factor
$\gamma_{Mb} := 1.25$	partial safety factor for bolts and pins
$\gamma_{Mr} := 1.25$	partial safety factor for rivets

2.2. Aluminium.

Quality = 6061 T6.

Yield stress	$R_{e\_alu} := 240 \cdot \frac{N}{mm^2}$	Modulus of elasticity	$E_{alu} := 70000 \cdot \frac{N}{mm^2}$
Tensile strength	$R_{t\_alu} := 260 \cdot \frac{N}{mm^2}$	Admissible stress	$\sigma_{adm\_alu} := \frac{R_{e\_alu}}{\gamma_M}$

	2.2.1. ALU 380/166	2.2.2. ALU 310/130
Wall thickness	$t_{alu380} := 6mm$	$t_{alu310} := 4.5mm$
Section	$A_{alu380} := 7216 \cdot mm^2$	$A_{alu310} := 4375 \cdot mm^2$
Moment of inertia in the y-direction	$I_{y\_alu380} := 1.27 \cdot 10^8 \cdot mm^4$	$I_{y\_alu310} := 5.05 \cdot 10^7 \cdot mm^4$
Moment of inertia in the z-direction	$I_{z\_alu380} := 3.33 \cdot 10^7 \cdot mm^4$	$I_{z\_alu310} := 1.25 \cdot 10^7 \cdot mm^4$
Height of the profile in y-direction	$y_{y\_alu380} := 190 \cdot mm$	$y_{y\_alu310} := 155 \cdot mm$
Height of the profile in z-direction	$y_{z\_alu380} := 83 \cdot mm$	$y_{z\_alu310} := 65 \cdot mm$
Elastic resistance in the y-direction	$W_{ely\_alu380} := 6.66 \cdot 10^5 \cdot mm^3$	$W_{ely\_alu310} := 3.26 \cdot 10^5 \cdot mm^3$
Elastic resistance in the z-direction	$W_{elz\_alu380} := 4.01 \cdot 10^5 \cdot mm^3$	$W_{elz\_alu310} := 1.92 \cdot 10^5 \cdot mm^3$
Plastic resistance in the y-direction	$W_{ply\_alu380} := 8.66 \cdot 10^5 \cdot mm^3$	$W_{ply\_alu310} := 4.26 \cdot 10^5 \cdot mm^3$
Plastic resistance in the z-direction	$W_{plz\_alu380} := 4.66 \cdot 10^5 \cdot mm^3$	$W_{plz\_alu310} := 2.22 \cdot 10^5 \cdot mm^3$

	2.2.3. ALU 297_8/117	**2.2.4. ALU 297_11/117**
Wall thickness	$t_{alu297\_8} := 4mm$	$t_{alu297\_11} := 4.5mm$
Section	$A_{alu297\_8} := 3509 \cdot mm^2$	$A_{alu297\_11} := 4237 \cdot mm^2$
Moment of inertia in the y-direction	$I_{y\_alu297\_8} := 3.86 \cdot 10^7 \cdot mm^4$	$I_{y\_alu297\_11} := 4.89 \cdot 10^7 \cdot mm^4$
Moment of inertia in the z-direction	$I_{z\_alu297\_8} := 6.88 \cdot 10^6 \cdot mm^4$	$I_{z\_alu297\_11} := 7.78 \cdot 10^6 \cdot mm^4$
Height of the profile in y-direction	$y_{y\_alu297\_8} := 148.5 \cdot mm$	$y_{y\_alu297\_11} := 148.5 \cdot mm$
Height of the profile in z-direction	$y_{z\_alu297\_8} := 58.5 \cdot mm$	$y_{z\_alu297\_11} := 58.5 \cdot mm$
Elastic resistance in the y-direction	$W_{ely\_alu297\_8} := 2.56 \cdot 10^5 \cdot mm^3$	$W_{ely\_alu297\_11} := 3.25 \cdot 10^5 \cdot mm^3$
Elastic resistance in the z-direction	$W_{elz\_alu297\_8} := 1.18 \cdot 10^5 \cdot mm^3$	$W_{elz\_alu297\_11} := 1.33 \cdot 10^5 \cdot mm^3$
Plastic resistance in the y-direction	$W_{ply\_alu297\_8} := 3.30 \cdot 10^5 \cdot mm^3$	$W_{ply\_alu297\_11} := 4.11 \cdot 10^5 \cdot mm^3$
Plastic resistance in the z-direction	$W_{plz\_alu297\_8} := 1.41 \cdot 10^5 \cdot mm^3$	$W_{plz\_alu297\_11} := 1.63 \cdot 10^5 \cdot mm^3$

	2.2.5. ALU 297_24.5/117	**2.2.6. ALU 310+297_8**
Wall thickness	$t_{alu297\_24.5} := 4mm$	$t_{alu310297\_8} := t_{alu310} + t_{alu297\_8}$
Section	$A_{alu297\_24.5} := 5574 \cdot mm^2$	$A_{alu310297\_8} := 7884 \cdot mm^2$
Moment of inertia in the y-direction	$I_{y\_alu297\_24.5} := 7.46 \cdot 10^7 \cdot mm^4$	$I_{y\_alu310297\_8} := 8.91 \cdot 10^7 \cdot mm^4$
Moment of inertia in the z-direction	$I_{z\_alu297\_24.5} := 7.60 \cdot 10^6 \cdot mm^4$	$I_{z\_alu310297\_8} := 1.94 \cdot 10^7 \cdot mm^4$
Height of the profile in y-direction	$y_{y\_alu297\_24.5} := 148.5 \cdot mm$	$y_{y\_alu310297\_8} := 155 \cdot mm$
Height of the profile in z-direction	$y_{z\_alu297\_24.5} := 58.5 \cdot mm$	$y_{z\_alu310297\_8} := 65 \cdot mm$
Elastic resistance in the y-direction	$W_{ely\_alu297\_24.5} := 5.02 \cdot 10^5 \cdot mm^3$	$W_{ely\_alu310297\_8} := 5.75 \cdot 10^5 \cdot mm^3$
Elastic resistance in the z-direction	$W_{elz\_alu297\_24.5} := 1.30 \cdot 10^5 \cdot mm^3$	$W_{elz\_alu310297\_8} := 2.98 \cdot 10^5 \cdot mm^3$
Plastic resistance in the y-direction	$W_{ply\_alu297\_24.5} := 6.02 \cdot 10^5 \cdot mm^3$	$W_{ply\_alu310297\_8} := 7.56 \cdot 10^5 \cdot mm^3$
Plastic resistance in the z-direction	$W_{plz\_alu297\_24.5} := 1.75 \cdot 10^5 \cdot mm^3$	$W_{plz\_alu310297\_8} := 3.64 \cdot 10^5 \cdot mm^3$

	2.2.7. ALU 310+297_11	2.2.8. ALU 310+297_24.5
Wall thickness	$t_{alu310297\_11} := t_{alu310} + t_{alu297\_11}$	$t_{alu310297\_24.5} := t_{alu310} + t_{alu297\_24.5}$
Section	$A_{alu310297\_11} := 8612 \cdot mm^2$	$A_{alu310297\_24.5} := 9949 \cdot mm^2$
Moment of inertia in the y-direction	$I_{y\_alu310297\_11} := 9.94 \cdot 10^7 \cdot mm^4$	$I_{y\_alu310297\_24.5} := 1.25 \cdot 10^8 \cdot mm^4$
Moment of inertia in the z-direction	$I_{z\_alu310297\_11} := 2.03 \cdot 10^7 \cdot mm^4$	$I_{z\_alu310297\_24.5} := 2.01 \cdot 10^7 \cdot mm^4$
Height of the profile in y-direction	$y_{y\_alu310297\_11} := 155 \cdot mm$	$y_{y\_alu310297\_24.5} := 155 \cdot mm$
Height of the profile in z-direction	$y_{z\_alu310297\_11} := 65 \cdot mm$	$y_{z\_alu310297\_24.5} := 65 \cdot mm$
Elastic resistance in the y-direction	$W_{ely\_alu310297\_11} := 6.41 \cdot 10^5 \cdot mm^3$	$W_{ely\_alu310297\_24.5} := 8.07 \cdot 10^5 \cdot mm^3$
Elastic resistance in the z-direction	$W_{elz\_alu310297\_11} := 3.12 \cdot 10^5 \cdot mm^3$	$W_{elz\_alu310297\_24.5} := 3.09 \cdot 10^5 \cdot mm^3$
Plastic resistance in the y-direction	$W_{ply\_alu310297\_11} := 8.37 \cdot 10^5 \cdot mm^3$	$W_{ply\_alu310297\_24.5} := 1.03 \cdot 10^6 \cdot mm^3$
Plastic resistance in the z-direction	$W_{plz\_alu310297\_11} := 3.86 \cdot 10^5 \cdot mm^3$	$W_{plz\_alu310297\_24.5} := 3.97 \cdot 10^5 \cdot mm^3$

	2.2.9. ALU 270/100	2.2.10. ALU 260/91
Wall thickness	$t_{alu270} := 3.5 \cdot mm$	$t_{alu260} := 4mm$
Section	$A_{alu270} := 3110 \cdot mm^2$	$A_{alu260} := 3257 \cdot mm^2$
Moment of inertia in the y-direction	$I_{y\_alu270} := 2.71 \cdot 10^7 \cdot mm^4$	$I_{y\_alu260} := 2.55 \cdot 10^7 \cdot mm^4$
Moment of inertia in the z-direction	$I_{z\_alu270} := 5.11 \cdot 10^6 \cdot mm^4$	$I_{z\_alu260} := 3.58 \cdot 10^6 \cdot mm^4$
Height of the profile in y-direction	$y_{y\_alu270} := 135 \cdot mm$	$y_{y\_alu260} := 130 \cdot mm$
Height of the profile in z-direction	$y_{z\_alu270} := 50 \cdot mm$	$y_{z\_alu260} := 45.5 \cdot mm$
Elastic resistance in the y-direction	$W_{ely\_alu270} := 2.01 \cdot 10^5 \cdot mm^3$	$W_{ely\_alu260} := 1.96 \cdot 10^5 \cdot mm^3$
Elastic resistance in the z-direction	$W_{elz\_alu270} := 1.02 \cdot 10^5 \cdot mm^3$	$W_{elz\_alu260} := 7.86 \cdot 10^4 \cdot mm^3$
Plastic resistance in the y-direction	$W_{ply\_alu270} := 2.64 \cdot 10^5 \cdot mm^3$	$W_{ply\_alu260} := 2.60 \cdot 10^5 \cdot mm^3$
Plastic resistance in the z-direction	$W_{plz\_alu270} := 1.20 \cdot 10^5 \cdot mm^3$	$W_{plz\_alu260} := 9.95 \cdot 10^4 \cdot mm^3$

	2.2.11. ALU 270+260	2.2.12. ALU 240/100
Wall thickness	$t_{alu270260} := t_{alu270} + t_{alu260}$	$t_{alu240} := 3 \cdot mm$
Section	$A_{alu270260} := 6367 \cdot mm^2$	$A_{alu240} := 2320 \cdot mm^2$
Moment of inertia in the y-direction	$I_{y\_alu270260} := 5.26 \cdot 10^7 \cdot mm^4$	$I_{y\_alu240} := 1.68 \cdot 10^7 \cdot mm^4$
Moment of inertia in the z-direction	$I_{z\_alu270260} := 8.69 \cdot 10^6 \cdot mm^4$	$I_{z\_alu240} := 3.90 \cdot 10^6 \cdot mm^4$
Height of the profile in y-direction	$y_{y\_alu270260} := 135 \cdot mm$	$y_{y\_alu240} := 120 \cdot mm$
Height of the profile in z-direction	$y_{z\_alu270260} := 50 \cdot mm$	$y_{z\_alu240} := 50 \cdot mm$
Elastic resistance in the y-direction	$W_{ely\_alu270260} := 3.90 \cdot 10^5 \cdot mm^3$	$W_{ely\_alu240} := 1.40 \cdot 10^5 \cdot mm^3$
Elastic resistance in the z-direction	$W_{elz\_alu270260} := 1.74 \cdot 10^5 \cdot mm^3$	$W_{elz\_alu240} := 7.79 \cdot 10^4 \cdot mm^3$
Plastic resistance in the y-direction	$W_{ply\_alu270260} := 5.25 \cdot 10^5 \cdot mm^3$	$W_{ply\_alu240} := 1.79 \cdot 10^5 \cdot mm^3$
Plastic resistance in the z-direction	$W_{plz\_alu270260} := 2.19 \cdot 10^5 \cdot mm^3$	$W_{plz\_alu240} := 9.04 \cdot 10^4 \cdot mm^3$

	2.2.13. ALU 232/92	2.2.14. ALU 240+232
Wall thickness	$t_{alu232} := 3mm$	$t_{alu240232} := t_{alu240} + t_{alu232}$
Section	$A_{alu232} := 2371 \cdot mm^2$	$A_{alu240232} := 4691 \cdot mm^2$
Moment of inertia in the y-direction	$I_{y\_alu232} := 1.62 \cdot 10^7 \cdot mm^4$	$I_{y\_alu240232} := 3.29 \cdot 10^7 \cdot mm^4$
Moment of inertia in the z-direction	$I_{z\_alu232} := 2.69 \cdot 10^6 \cdot mm^4$	$I_{z\_alu240232} := 6.58 \cdot 10^6 \cdot mm^4$
Height of the profile in y-direction	$y_{y\_alu232} := 116 \cdot mm$	$y_{y\_alu240232} := 120 \cdot mm$
Height of the profile in z-direction	$y_{z\_alu232} := 46 \cdot mm$	$y_{z\_alu240232} := 50 \cdot mm$
Elastic resistance in the y-direction	$W_{ely\_alu232} := 1.39 \cdot 10^5 \cdot mm^3$	$W_{ely\_alu240232} := 2.74 \cdot 10^5 \cdot mm^3$
Elastic resistance in the z-direction	$W_{elz\_alu232} := 5.85 \cdot 10^4 \cdot mm^3$	$W_{elz\_alu240232} := 1.32 \cdot 10^5 \cdot mm^3$
Plastic resistance in the y-direction	$W_{ply\_alu232} := 1.78 \cdot 10^5 \cdot mm^3$	$W_{ply\_alu240232} := 3.57 \cdot 10^5 \cdot mm^3$
Plastic resistance in the z-direction	$W_{plz\_alu232} := 7.25 \cdot 10^4 \cdot mm^3$	$W_{plz\_alu240232} := 1.63 \cdot 10^5 \cdot mm^3$

	2.2.15. ALU 158/100	**2.2.16. ALU 133/70**
Wall thickness	$t_{alu158} := 2.5mm$	$t_{alu133} := 3mm$
Section	$A_{alu158} := 1836 \cdot mm^2$	$A_{alu133} := 1604 \cdot mm^2$
Moment of inertia in the y-direction	$I_{y\_alu158} := 6.41 \cdot 10^6 \cdot mm^4$	$I_{y\_alu133} := 3.82 \cdot 10^6 \cdot mm^4$
Moment of inertia in the z-direction	$I_{z\_alu158} := 2.74 \cdot 10^6 \cdot mm^4$	$I_{z\_alu133} := 1.06 \cdot 10^6 \cdot mm^4$
Height of the profile in y-direction	$y_{y\_alu158} := 79 \cdot mm$	$y_{y\_alu133} := 66.5 \cdot mm$
Height of the profile in z-direction	$y_{z\_alu158} := 50 \cdot mm$	$y_{z\_alu133} := 35 \cdot mm$
Elastic resistance in the y-direction	$W_{ely\_alu158} := 8.12 \cdot 10^4 \cdot mm^3$	$W_{ely\_alu133} := 5.74 \cdot 10^4 \cdot mm^3$
Elastic resistance in the z-direction	$W_{elz\_alu158} := 5.49 \cdot 10^4 \cdot mm^3$	$W_{elz\_alu133} := 3.02 \cdot 10^4 \cdot mm^3$
Plastic resistance in the y-direction	$W_{ply\_alu158} := 1.01 \cdot 10^5 \cdot mm^3$	$W_{ply\_alu133} := 7.21 \cdot 10^4 \cdot mm^3$
Plastic resistance in the z-direction	$W_{plz\_alu158} := 6.67 \cdot 10^4 \cdot mm^3$	$W_{plz\_alu133} := 3.77 \cdot 10^4 \cdot mm^3$

	2.2.17. ALU 133/70 + ALU 80/5	**2.2.18. ALU 130/70**
Wall thickness	$t_{alu133r} := 8mm$	$t_{alu130} := 3mm$
Section	$A_{alu133r} := 2404 \cdot mm^2$	$A_{alu130} := 1497 \cdot mm^2$
Moment of inertia in the y-direction	$I_{y\_alu133r} := 4.25 \cdot 10^6 \cdot mm^4$	$I_{y\_alu130} := 3.12 \cdot 10^6 \cdot mm^4$
Moment of inertia in the z-direction	$I_{z\_alu133r} := 2.18 \cdot 10^6 \cdot mm^4$	$I_{z\_alu130} := 1.12 \cdot 10^6 \cdot mm^4$
Height of the profile in y-direction	$y_{y\_alu133r} := 66.5 \cdot mm$	$y_{y\_alu130} := 65 \cdot mm$
Height of the profile in z-direction	$y_{z\_alu133r} := 40 \cdot mm$	$y_{z\_alu130} := 35 \cdot mm$
Elastic resistance in the y-direction	$W_{ely\_alu133r} := 6.37 \cdot 10^4 \cdot mm^3$	$W_{ely\_alu130} := 4.81 \cdot 10^4 \cdot mm^3$
Elastic resistance in the z-direction	$W_{elz\_alu133r} := 5.46 \cdot 10^4 \cdot mm^3$	$W_{elz\_alu130} := 3.19 \cdot 10^4 \cdot mm^3$
Plastic resistance in the y-direction	$W_{ply\_alu133r} := 8.81 \cdot 10^4 \cdot mm^3$	$W_{ply\_alu130} := 6.31 \cdot 10^4 \cdot mm^3$
Plastic resistance in the z-direction	$W_{plz\_alu133r} := 6.77 \cdot 10^4 \cdot mm^3$	$W_{plz\_alu130} := 3.80 \cdot 10^4 \cdot mm^3$

	2.2.19. ALU 129/89/3.1	2.2.20. ALU 97/77/2.25
Wall thickness	$t_{alu129} := 3.1mm$	$t_{alu97} := 3.1mm$
Section	$A_{alu129} := 1290 \cdot mm^2$	$A_{alu97} := 747 \cdot mm^2$
Moment of inertia in the y-direction	$I_{y\_alu129} := 3.05 \cdot 10^6 \cdot mm^4$	$I_{y\_alu97} := 1.04 \cdot 10^6 \cdot mm^4$
Moment of inertia in the z-direction	$I_{z\_alu129} := 1.72 \cdot 10^6 \cdot mm^4$	$I_{z\_alu97} := 7.29 \cdot 10^5 \cdot mm^4$
Height of the profile in y-direction	$y_{y\_alu129} := 64.5 \cdot mm$	$y_{y\_alu97} := 48.5 \cdot mm$
Height of the profile in z-direction	$y_{z\_alu129} := 44.5 \cdot mm$	$y_{z\_alu97} := 38.5 \cdot mm$
Elastic resistance in the y-direction	$W_{ely\_alu129} := 4.72 \cdot 10^4 \cdot mm^3$	$W_{ely\_alu97} := 2.14 \cdot 10^4 \cdot mm^3$
Elastic resistance in the z-direction	$W_{elz\_alu129} := 3.87 \cdot 10^4 \cdot mm^3$	$W_{elz\_alu97} := 1.89 \cdot 10^4 \cdot mm^3$
Plastic resistance in the y-direction	$W_{ply\_alu129} := 5.66 \cdot 10^4 \cdot mm^3$	$W_{ply\_alu97} := 2.53 \cdot 10^4 \cdot mm^3$
Plastic resistance in the z-direction	$W_{plz\_alu129} := 4.39 \cdot 10^4 \cdot mm^3$	$W_{plz\_alu97} := 2.16 \cdot 10^4 \cdot mm^3$

	2.2.21. ALU 70/70/4.5	2.2.22. ALU 88/66/2/3
Wall thickness	$t_{alu70} := 4.5mm$	$t_{alu88} := 2mm$
Section	$A_{alu70} := 1165 \cdot mm^2$	$A_{alu88} := 720 \cdot mm^2$
Moment of inertia in the y-direction	$I_{y\_alu70} := 8.29 \cdot 10^5 \cdot mm^4$	$I_{y\_alu88} := 8.90 \cdot 10^5 \cdot mm^4$
Moment of inertia in the z-direction	$I_{z\_alu70} := 8.29 \cdot 10^5 \cdot mm^4$	$I_{z\_alu88} := 4.75 \cdot 10^5 \cdot mm^4$
Height of the profile in y-direction	$y_{y\_alu70} := 35 \cdot mm$	$y_{y\_alu88} := 44 \cdot mm$
Height of the profile in z-direction	$y_{z\_alu70} := 35 \cdot mm$	$y_{z\_alu88} := 33 \cdot mm$
Elastic resistance in the y-direction	$W_{ely\_alu70} := 2.37 \cdot 10^4 \cdot mm^3$	$W_{ely\_alu88} := 2.02 \cdot 10^4 \cdot mm^3$
Elastic resistance in the z-direction	$W_{elz\_alu70} := 2.37 \cdot 10^4 \cdot mm^3$	$W_{elz\_alu88} := 1.44 \cdot 10^4 \cdot mm^3$
Plastic resistance in the y-direction	$W_{ply\_alu70} := 2.85 \cdot 10^4 \cdot mm^3$	$W_{ply\_alu88} := 2.34 \cdot 10^4 \cdot mm^3$
Plastic resistance in the z-direction	$W_{plz\_alu70} := 2.85 \cdot 10^4 \cdot mm^3$	$W_{plz\_alu88} := 1.69 \cdot 10^4 \cdot mm^3$

	2.2.23. ALU 70/50/2.5/3	**2.2.24. ALU 60/60/3**
Wall thickness	$t_{alu7050} := 2.5mm$	$t_{alu60} := 3mm$
Section	$A_{alu7050} := 596 \cdot mm^2$	$A_{alu60} := 660 \cdot mm^2$
Moment of inertia in the y-direction	$I_{y\_alu7050} := 4.18 \cdot 10^5 \cdot mm^4$	$I_{y\_alu60} := 3.51 \cdot 10^5 \cdot mm^4$
Moment of inertia in the z-direction	$I_{z\_alu7050} := 2.29 \cdot 10^5 \cdot mm^4$	$I_{z\_alu60} := 3.51 \cdot 10^5 \cdot mm^4$
Height of the profile in y-direction	$y_{y\_alu7050} := 35 \cdot mm$	$y_{y\_alu60} := 30 \cdot mm$
Height of the profile in z-direction	$y_{z\_alu7050} := 25 \cdot mm$	$y_{z\_alu60} := 30 \cdot mm$
Elastic resistance in the y-direction	$W_{ely\_alu7050} := 1.19 \cdot 10^4 \cdot mm^3$	$W_{ely\_alu60} := 1.17 \cdot 10^4 \cdot mm^3$
Elastic resistance in the z-direction	$W_{elz\_alu7050} := 9.17 \cdot 10^3 \cdot mm^3$	$W_{elz\_alu60} := 1.17 \cdot 10^4 \cdot mm^3$
Plastic resistance in the y-direction	$W_{ply\_alu7050} := 1.44 \cdot 10^4 \cdot mm^3$	$W_{ply\_alu60} := 1.39 \cdot 10^4 \cdot mm^3$
Plastic resistance in the z-direction	$W_{plz\_alu7050} := 1.08 \cdot 10^4 \cdot mm^3$	$W_{plz\_alu60} := 1.39 \cdot 10^4 \cdot mm^3$

2.3. Steel.

	Steel quality S235.	**Steel quality S355.**
Yield stress	$R_{e\_S235} := 235 \cdot \frac{N}{mm^2}$	$R_{e\_S355} := 355 \cdot \frac{N}{mm^2}$
Tensile strength	$R_{t\_S235} := 360 \cdot \frac{N}{mm^2}$	$R_{t\_S355} := 510 \cdot \frac{N}{mm^2}$
Admissible stress	$\sigma_{adm\_S235} := \frac{R_{e\_S235}}{\gamma_M}$	$\sigma_{adm\_S355} := \frac{R_{e\_S355}}{\gamma_M}$
Modulus of elasticity	$E_{steel} := 210000 \cdot \frac{N}{mm^2}$	

	2.3.1. K70/70/2.	**2.3.2. K70/70/3.**
Section	$A_{K70\_2} := 544 \cdot mm^2$	$A_{K70\_3} := 800 \cdot mm^2$
Moment of inertia in the y-direction	$I_{y\_K70\_2} := 4.20 \cdot 10^5 \cdot mm^4$	$I_{y\_K70\_3} := 6.01 \cdot 10^5 \cdot mm^4$
Moment of inertia in the z-direction	$I_{z\_K70\_2} := 4.20 \cdot 10^5 \cdot mm^4$	$I_{z\_K70\_3} := 6.01 \cdot 10^5 \cdot mm^4$
Height of the profile in y-direction	$y_{y\_K70\_2} := 35 \cdot mm$	$y_{y\_K70\_3} := 35 \cdot mm$
Height of the profile in z-direction	$y_{z\_K70\_2} := 35 \cdot mm$	$y_{z\_K70\_3} := 35 \cdot mm$
Elastic resistance in the y-direction	$W_{ely\_K70\_2} := 1.20 \cdot 10^4 \cdot mm^3$	$W_{ely\_K70\_3} := 1.72 \cdot 10^4 \cdot mm^3$
Elastic resistance in the z-direction	$W_{elz\_K70\_2} := 1.20 \cdot 10^4 \cdot mm^3$	$W_{elz\_K70\_3} := 1.72 \cdot 10^4 \cdot mm^3$
Plastic resistance in the y-direction	$W_{ply\_K70\_2} := 1.39 \cdot 10^4 \cdot mm^3$	$W_{ply\_K70\_3} := 2.02 \cdot 10^4 \cdot mm^3$
Plastic resistance in the z-direction	$W_{plz\_K70\_2} := 1.39 \cdot 10^4 \cdot mm^3$	$W_{plz\_K70\_3} := 2.02 \cdot 10^4 \cdot mm^3$

	2.3.3. K80/80/4.	**2.3.4. K120/120/3.**
Section	$A_{K80} := 1200\cdot mm^2$	$A_{K120} := 1380\cdot mm^2$
Moment of inertia in the y-direction	$I_{y\_K80} := 1.17\cdot 10^7\cdot mm^4$	$I_{y\_K120} := 3.12\cdot 10^6\cdot mm^4$
Moment of inertia in the z-direction	$I_{z\_K80} := 1.17\cdot 10^7\cdot mm^4$	$I_{z\_K120} := 3.12\cdot 10^6\cdot mm^4$
Height of the profile in y-direction	$y_{y\_K80} := 40\cdot mm$	$y_{y\_K120} := 60\cdot mm$
Height of the profile in z-direction	$y_{z\_K80} := 40\cdot mm$	$y_{z\_K120} := 60\cdot mm$
Elastic resistance in the y-direction	$W_{ely\_K80} := 2.93\cdot 10^4\cdot mm^3$	$W_{ely\_K120} := 5.21\cdot 10^4\cdot mm^3$
Elastic resistance in the z-direction	$W_{elz\_K80} := 2.93\cdot 10^4\cdot mm^3$	$W_{elz\_K120} := 5.34\cdot 10^4\cdot mm^3$
Plastic resistance in the y-direction	$W_{ply\_K80} := 3.47\cdot 10^4\cdot mm^3$	$W_{ply\_K120} := 6.16\cdot 10^4\cdot mm^3$
Plastic resistance in the z-direction	$W_{plz\_K80} := 3.47\cdot 10^4\cdot mm^3$	$W_{plz\_K120} := 6.16\cdot 10^4\cdot mm^3$

2.4. Bolts - class = 8.8.

Yield stress $R_{e\_bolt} := 640\cdot\frac{N}{mm^2}$

Tensile strength $R_{t\_bolt} := 800\cdot\frac{N}{mm^2}$

$$\sigma_{adm}(material) := \begin{cases} \sigma_{adm\_alu} & \text{if } material = R_{e\_alu} \\ \sigma_{adm\_S235} & \text{if } material = R_{e\_S235} \\ \sigma_{adm\_S355} & \text{if } material = R_{e\_S355} \end{cases}$$

Doc. 3. Aluminium profile. acc. to ENV 1999-1-1: Mai 1998

$t_{alu}(profile) :=$
- "not used" if profile = 0
- t_{alu60} if profile = 1
- $t_{alu7050}$ if profile = 2
- t_{alu88} if profile = 3
- t_{alu70} if profile = 4
- t_{alu97} if profile = 5
- t_{alu129} if profile = 6
- t_{alu130} if profile = 7
- t_{alu133} if profile = 8
- $t_{alu133r}$ if profile = 9
- t_{alu158} if profile = 10
- t_{alu240} if profile = 20
- t_{alu232} if profile = 200
- $t_{alu240232}$ if profile = 220
- t_{alu270} if profile = 30
- t_{alu260} if profile = 300
- $t_{alu270260}$ if profile = 330
- t_{alu310} if profile = 40
- t_{alu297_8} if profile = 400
- t_{alu297_11} if profile = 401
- $t_{alu297\_24.5}$ if profile = 402
- $t_{alu310297\_8}$ if profile = 440
- $t_{alu310297\_11}$ if profile = 441
- $t_{alu310297\_24.5}$ if profile = 442
- t_{alu380} if profile = 50

$d_{alu}(profile) :=$
- "not used" if profile = 0
- (54mm) if profile = 1
- (64mm) if profile = 2
- (82mm) if profile = 3
- (61mm) if profile = 4
- (92.5mm) if profile = 5
- (122.8mm) if profile = 6
- (96mm) if profile = 7
- (122mm) if profile = 8
- (80mm) if profile = 9
- (100mm) if profile = 10
- (168mm) if profile = 20
- (162mm) if profile = 200
- (162mm) if profile = 220
- (170mm) if profile = 30
- (164mm) if profile = 300
- (164mm) if profile = 330
- (205mm) if profile = 40
- (200mm) if profile = 400
- (200mm) if profile = 401
- (200mm) if profile = 402
- (200mm) if profile = 440
- (200mm) if profile = 441
- (200mm) if profile = 442
- (245mm) if profile = 50

$$A_{alu}(profile) := \begin{cases} \text{"not used"} & \text{if } profile = 0 \\ A_{alu60} & \text{if } profile = 1 \\ A_{alu7050} & \text{if } profile = 2 \\ A_{alu88} & \text{if } profile = 3 \\ A_{alu70} & \text{if } profile = 4 \\ A_{alu97} & \text{if } profile = 5 \\ A_{alu129} & \text{if } profile = 6 \\ A_{alu130} & \text{if } profile = 7 \\ A_{alu133} & \text{if } profile = 8 \\ A_{alu133r} & \text{if } profile = 9 \\ A_{alu158} & \text{if } profile = 10 \\ A_{alu240} & \text{if } profile = 20 \\ A_{alu232} & \text{if } profile = 200 \\ A_{alu240232} & \text{if } profile = 220 \\ A_{alu270} & \text{if } profile = 30 \\ A_{alu260} & \text{if } profile = 300 \\ A_{alu270260} & \text{if } profile = 330 \\ A_{alu310} & \text{if } profile = 40 \\ A_{alu297\_8} & \text{if } profile = 400 \\ A_{alu297\_11} & \text{if } profile = 401 \\ A_{alu297\_24.5} & \text{if } profile = 402 \\ A_{alu310297\_8} & \text{if } profile = 440 \\ A_{alu310297\_11} & \text{if } profile = 441 \\ A_{alu310297\_24.5} & \text{if } profile = 442 \\ A_{alu380} & \text{if } profile = 50 \end{cases}$$

$y_{y\_alu}(profile) :=$
- "not used" if profile = 0
- y_{y_alu60} if profile = 1
- $y_{y\_alu7050}$ if profile = 2
- y_{y_alu88} if profile = 3
- y_{y_alu70} if profile = 4
- y_{y_alu97} if profile = 5
- y_{y_alu129} if profile = 6
- y_{y_alu130} if profile = 7
- y_{y_alu133} if profile = 8
- $y_{y\_alu133r}$ if profile = 9
- y_{y_alu158} if profile = 10
- y_{y_alu240} if profile = 20
- y_{y_alu232} if profile = 200
- $y_{y\_alu240232}$ if profile = 220
- y_{y_alu270} if profile = 30
- y_{y_alu260} if profile = 300
- $y_{y\_alu270260}$ if profile = 330
- y_{y_alu310} if profile = 40
- $y_{y\_alu297\_8}$ if profile = 400
- $y_{y\_alu297\_11}$ if profile = 401
- $y_{y\_alu297\_24.5}$ if profile = 402
- $y_{y\_alu310297\_8}$ if profile = 440
- $y_{y\_alu310297\_11}$ if profile = 441
- $y_{y\_alu310297\_24.5}$ if profile = 442
- y_{y_alu380} if profile = 50

$y_{z\_alu}(profile) :=$
- "not used" if profile = 0
- y_{z_alu60} if profile = 1
- $y_{z\_alu7050}$ if profile = 2
- y_{z_alu88} if profile = 3
- y_{z_alu70} if profile = 4
- y_{z_alu97} if profile = 5
- y_{z_alu129} if profile = 6
- y_{z_alu130} if profile = 7
- y_{z_alu133} if profile = 8
- $y_{z\_alu133r}$ if profile = 9
- y_{z_alu158} if profile = 10
- y_{z_alu240} if profile = 20
- y_{z_alu232} if profile = 200
- $y_{z\_alu240232}$ if profile = 220
- y_{z_alu270} if profile = 30
- y_{z_alu260} if profile = 300
- $y_{z\_alu270260}$ if profile = 330
- y_{z_alu310} if profile = 40
- $y_{z\_alu297\_8}$ if profile = 400
- $y_{z\_alu297\_11}$ if profile = 401
- $y_{z\_alu297\_24.5}$ if profile = 402
- $y_{z\_alu310297\_8}$ if profile = 440
- $y_{z\_alu310297\_11}$ if profile = 441
- $y_{z\_alu310297\_24.5}$ if profile = 442
- y_{z_alu380} if profile = 50

$$I_{y\_alu}(profile) := \begin{cases} \text{"not used"} & \text{if } profile = 0 \\ I_{y\_alu60} & \text{if } profile = 1 \\ I_{y\_alu7050} & \text{if } profile = 2 \\ I_{y\_alu88} & \text{if } profile = 3 \\ I_{y\_alu70} & \text{if } profile = 4 \\ I_{y\_alu97} & \text{if } profile = 5 \\ I_{y\_alu129} & \text{if } profile = 6 \\ I_{y\_alu130} & \text{if } profile = 7 \\ I_{y\_alu133} & \text{if } profile = 8 \\ I_{y\_alu133r} & \text{if } profile = 9 \\ I_{y\_alu158} & \text{if } profile = 10 \\ I_{y\_alu240} & \text{if } profile = 20 \\ I_{y\_alu232} & \text{if } profile = 200 \\ I_{y\_alu240232} & \text{if } profile = 220 \\ I_{y\_alu270} & \text{if } profile = 30 \\ I_{y\_alu260} & \text{if } profile = 300 \\ I_{y\_alu270260} & \text{if } profile = 330 \\ I_{y\_alu310} & \text{if } profile = 40 \\ I_{y\_alu297\_8} & \text{if } profile = 400 \\ I_{y\_alu297\_11} & \text{if } profile = 401 \\ I_{y\_alu297\_24.5} & \text{if } profile = 402 \\ I_{y\_alu310297\_8} & \text{if } profile = 440 \\ I_{y\_alu310297\_11} & \text{if } profile = 441 \\ I_{y\_alu310297\_24.5} & \text{if } profile = 442 \\ I_{y\_alu380} & \text{if } profile = 50 \end{cases}$$

$$I_{z\_alu}(profile) := \begin{cases} \text{"not used"} & \text{if } profile = 0 \\ I_{z\_alu60} & \text{if } profile = 1 \\ I_{z\_alu7050} & \text{if } profile = 2 \\ I_{z\_alu88} & \text{if } profile = 3 \\ I_{z\_alu70} & \text{if } profile = 4 \\ I_{z\_alu97} & \text{if } profile = 5 \\ I_{z\_alu129} & \text{if } profile = 6 \\ I_{z\_alu130} & \text{if } profile = 7 \\ I_{z\_alu133} & \text{if } profile = 8 \\ I_{z\_alu133r} & \text{if } profile = 9 \\ I_{z\_alu158} & \text{if } profile = 10 \\ I_{z\_alu240} & \text{if } profile = 20 \\ I_{z\_alu232} & \text{if } profile = 200 \\ I_{z\_alu240232} & \text{if } profile = 220 \\ I_{z\_alu270} & \text{if } profile = 30 \\ I_{z\_alu260} & \text{if } profile = 300 \\ I_{z\_alu270260} & \text{if } profile = 330 \\ I_{z\_alu310} & \text{if } profile = 40 \\ I_{z\_alu297\_8} & \text{if } profile = 400 \\ I_{z\_alu297\_11} & \text{if } profile = 401 \\ I_{z\_alu297\_24.5} & \text{if } profile = 402 \\ I_{z\_alu310297\_8} & \text{if } profile = 440 \\ I_{z\_alu310297\_11} & \text{if } profile = 441 \\ I_{z\_alu310297\_24.5} & \text{if } profile = 442 \\ I_{z\_alu380} & \text{if } profile = 50 \end{cases}$$

$$W_{ply}(profile) := \begin{cases} \text{"not used"} & \text{if } profile = 0 \\ W_{ply\_alu60} & \text{if } profile = 1 \\ W_{ply\_alu7050} & \text{if } profile = 2 \\ W_{ply\_alu88} & \text{if } profile = 3 \\ W_{ply\_alu70} & \text{if } profile = 4 \\ W_{ply\_alu97} & \text{if } profile = 5 \\ W_{ply\_alu129} & \text{if } profile = 6 \\ W_{ply\_alu130} & \text{if } profile = 7 \\ W_{ply\_alu133} & \text{if } profile = 8 \\ W_{ply\_alu133r} & \text{if } profile = 9 \\ W_{ply\_alu158} & \text{if } profile = 10 \\ W_{ply\_alu240} & \text{if } profile = 20 \\ W_{ply\_alu232} & \text{if } profile = 200 \\ W_{ply\_alu240232} & \text{if } profile = 220 \\ W_{ply\_alu270} & \text{if } profile = 30 \\ W_{ply\_alu260} & \text{if } profile = 300 \\ W_{ply\_alu270260} & \text{if } profile = 330 \\ W_{ply\_alu310} & \text{if } profile = 40 \\ W_{ply\_alu297\_8} & \text{if } profile = 400 \\ W_{ply\_alu297\_11} & \text{if } profile = 401 \\ W_{ply\_alu297\_24.5} & \text{if } profile = 402 \\ W_{ply\_alu310297\_8} & \text{if } profile = 440 \\ W_{ply\_alu310297\_11} & \text{if } profile = 441 \\ W_{ply\_alu310297\_24.5} & \text{if } profile = 442 \\ W_{ply\_alu380} & \text{if } profile = 50 \end{cases}$$

$$W_{plz}(profile) := \begin{cases} \text{"not used"} & \text{if } profile = 0 \\ W_{plz\_alu60} & \text{if } profile = 1 \\ W_{plz\_alu7050} & \text{if } profile = 2 \\ W_{plz\_alu88} & \text{if } profile = 3 \\ W_{plz\_alu70} & \text{if } profile = 4 \\ W_{plz\_alu97} & \text{if } profile = 5 \\ W_{plz\_alu129} & \text{if } profile = 6 \\ W_{plz\_alu130} & \text{if } profile = 7 \\ W_{plz\_alu133} & \text{if } profile = 8 \\ W_{plz\_alu133r} & \text{if } profile = 9 \\ W_{plz\_alu158} & \text{if } profile = 10 \\ W_{plz\_alu240} & \text{if } profile = 20 \\ W_{plz\_alu232} & \text{if } profile = 200 \\ W_{plz\_alu240232} & \text{if } profile = 220 \\ W_{plz\_alu270} & \text{if } profile = 30 \\ W_{plz\_alu260} & \text{if } profile = 300 \\ W_{plz\_alu270260} & \text{if } profile = 330 \\ W_{plz\_alu310} & \text{if } profile = 40 \\ W_{plz\_alu297\_8} & \text{if } profile = 400 \\ W_{plz\_alu297\_11} & \text{if } profile = 401 \\ W_{plz\_alu297\_24.5} & \text{if } profile = 402 \\ W_{plz\_alu310297\_8} & \text{if } profile = 440 \\ W_{plz\_alu310297\_11} & \text{if } profile = 441 \\ W_{plz\_alu310297\_24.5} & \text{if } profile = 442 \\ W_{plz\_alu380} & \text{if } profile = 50 \end{cases}$$

$$W_{ely}(\text{profile}) := \begin{cases} \text{"not used"} & \text{if profile} = 0 \\ W_{ely\_alu60} & \text{if profile} = 1 \\ W_{ely\_alu7050} & \text{if profile} = 2 \\ W_{ely\_alu88} & \text{if profile} = 3 \\ W_{ely\_alu70} & \text{if profile} = 4 \\ W_{ely\_alu97} & \text{if profile} = 5 \\ W_{ely\_alu129} & \text{if profile} = 6 \\ W_{ely\_alu130} & \text{if profile} = 7 \\ W_{ely\_alu133} & \text{if profile} = 8 \\ W_{ely\_alu133r} & \text{if profile} = 9 \\ W_{ely\_alu158} & \text{if profile} = 10 \\ W_{ely\_alu240} & \text{if profile} = 20 \\ W_{ely\_alu232} & \text{if profile} = 200 \\ W_{ely\_alu240232} & \text{if profile} = 220 \\ W_{ely\_alu270} & \text{if profile} = 30 \\ W_{ely\_alu260} & \text{if profile} = 300 \\ W_{ely\_alu270260} & \text{if profile} = 330 \\ W_{ely\_alu310} & \text{if profile} = 40 \\ W_{ely\_alu297\_8} & \text{if profile} = 400 \\ W_{ely\_alu297\_11} & \text{if profile} = 401 \\ W_{ely\_alu297\_24.5} & \text{if profile} = 402 \\ W_{ely\_alu310297\_8} & \text{if profile} = 440 \\ W_{ely\_alu310297\_11} & \text{if profile} = 441 \\ W_{ely\_alu310297\_24.5} & \text{if profile} = 442 \\ W_{ely\_alu380} & \text{if profile} = 50 \end{cases}$$

$$W_{elz}(\text{profile}) := \begin{cases} \text{"not used"} & \text{if profile} = 0 \\ W_{elz\_alu60} & \text{if profile} = 1 \\ W_{elz\_alu7050} & \text{if profile} = 2 \\ W_{elz\_alu88} & \text{if profile} = 3 \\ W_{elz\_alu70} & \text{if profile} = 4 \\ W_{elz\_alu97} & \text{if profile} = 5 \\ W_{elz\_alu129} & \text{if profile} = 6 \\ W_{elz\_alu130} & \text{if profile} = 7 \\ W_{elz\_alu133} & \text{if profile} = 8 \\ W_{elz\_alu133r} & \text{if profile} = 9 \\ W_{elz\_alu158} & \text{if profile} = 10 \\ W_{elz\_alu240} & \text{if profile} = 20 \\ W_{elz\_alu232} & \text{if profile} = 200 \\ W_{elz\_alu240232} & \text{if profile} = 220 \\ W_{elz\_alu270} & \text{if profile} = 30 \\ W_{elz\_alu260} & \text{if profile} = 300 \\ W_{elz\_alu270260} & \text{if profile} = 330 \\ W_{elz\_alu310} & \text{if profile} = 40 \\ W_{elz\_alu297\_8} & \text{if profile} = 400 \\ W_{elz\_alu297\_11} & \text{if profile} = 401 \\ W_{elz\_alu297\_24.5} & \text{if profile} = 402 \\ W_{elz\_alu310297\_8} & \text{if profile} = 440 \\ W_{elz\_alu310297\_11} & \text{if profile} = 441 \\ W_{elz\_alu310297\_24.5} & \text{if profile} = 442 \\ W_{elz\_alu380} & \text{if profile} = 50 \end{cases}$$

$prof_{control}(profile) :=$

```
"not used"  if profile = 0
"alu60/60/3"  if profile = 1
"alu70/50/2.5/3"  if profile = 2
"alu88/66/2"  if profile = 3
"alu70/70/4.5"  if profile = 4
"alu97/77/3.1"  if profile = 5
"alu129/89/3.1"  if profile = 6
"alu130/70"  if profile = 7
"alu133/70"  if profile = 8
"alu133/70+80/5"  if profile = 9
"alu158/100"  if profile = 10
"alu240/100"  if profile = 20
"alu232/92"  if profile = 200
"alu240+232"  if profile = 220
"alu270/100"  if profile = 30
"alu260/91"  if profile = 300
"alu270+260"  if profile = 330
"alu310/130"  if profile = 40
"alu297_8/117"  if profile = 400
"alu297_11/117"  if profile = 401
"alu297_24.5/117"  if profile = 402
"alu310+297_8"  if profile = 440
"alu310+297_11"  if profile = 441
"alu310+297_24.5"  if profile = 442
"alu380/166"  if profile = 50
```

$b_{alu}(profile) :=$

"not used"	if profile = 0
60mm	if profile = 1
50mm	if profile = 2
66mm	if profile = 3
70mm	if profile = 4
77mm	if profile = 5
89mm	if profile = 6
70mm	if profile = 7
70mm	if profile = 8
80mm	if profile = 9
100mm	if profile = 10
100mm	if profile = 20
92mm	if profile = 200
100mm	if profile = 220
100mm	if profile = 30
91mm	if profile = 300
100mm	if profile = 330
130mm	if profile = 40
117mm	if profile = 400
117mm	if profile = 401
117mm	if profile = 402
130mm	if profile = 440
130mm	if profile = 441
130mm	if profile = 442
166mm	if profile = 50

$h_{alu}(profile) :=$

"not used"	if profile = 0
60mm	if profile = 1
70mm	if profile = 2
88mm	if profile = 3
70mm	if profile = 4
97mm	if profile = 5
129mm	if profile = 6
130mm	if profile = 7
133mm	if profile = 8
133mm	if profile = 9
158mm	if profile = 10
240mm	if profile = 20
232mm	if profile = 200
240mm	if profile = 220
270mm	if profile = 30
260mm	if profile = 300
270mm	if profile = 330
310mm	if profile = 40
297mm	if profile = 400
297mm	if profile = 401
297mm	if profile = 402
310mm	if profile = 440
310mm	if profile = 441
310mm	if profile = 442
380mm	if profile = 50

Bending and axiale compression

Profil classification

$$\beta(\text{profile}) := 0.40\cdot\left(\frac{d_{alu}(\text{profile})}{t_{alu}(\text{profile})}\right)$$ Slenderness parameter (art.5.4.3)

$$\varepsilon := \sqrt{\frac{250\cdot\frac{N}{mm^2}}{R_{e\_alu}}} \qquad \varepsilon = 1.021$$

$\beta1 := 11\cdot\varepsilon$ $\quad \beta1 = 11.227$ Table 5.1 (heat treated, unwelded)

$\beta2 := 16\cdot\varepsilon$ $\quad \beta2 = 16.33$

$\beta3 := 22\cdot\varepsilon$ $\quad \beta3 = 22.454$

$$\text{classification}(\text{profile}) := \begin{cases} 1 & \text{if } \beta(\text{profile}) \le \beta1 \\ 2 & \text{if } \beta1 < \beta(\text{profile}) \le \beta2 \\ 3 & \text{if } \beta2 < \beta(\text{profile}) \le \beta3 \\ 4 & \text{if } \beta3 < \beta(\text{profile}) \end{cases}$$ **<3.1>**

Profile properties

Shape factor (table 5.3, no welding)

$$\alpha_y(\text{profile}) := \begin{cases} \frac{W_{ply}(\text{profile})}{W_{ely}(\text{profile})} & \text{if classification(profile)} = 1 \vee 2 \\ \left[1 + \frac{\beta3 - \beta(\text{profile})}{\beta3 - \beta2}\cdot\left(\frac{W_{ply}(\text{profile})}{W_{ely}(\text{profile})} - 1\right)\right] & \text{if classification(profile)} = 3 \end{cases}$$ **<3.2>** form 5.15

$$\alpha_z(\text{profile}) := \begin{cases} \min\left(1.25, \frac{W_{plz}(\text{profile})}{W_{elz}(\text{profile})}\right) & \text{if classification(profile)} = 1 \vee 2 \\ \min\left[1.25, 1 + \frac{\beta3 - \beta(\text{profile})}{\beta3 - \beta2}\cdot\left(\frac{W_{plz}(\text{profile})}{W_{elz}(\text{profile})} - 1\right)\right] & \text{if classification(profile)} = 3 \end{cases}$$

ENV 1999-1-1, art. 5.9.4(6): Profile capacity

$$N_{rd}(profile) := A_{alu}(profile)\cdot\frac{R_{e\_alu}}{\gamma_M}$$ **<3.3>**

$$M_{yrd}(profile) := \frac{\alpha_y(profile)\cdot W_{ely}(profile)\cdot R_{e\_alu}}{\gamma_M}$$

$$M_{zrd}(profile) := \frac{\alpha_z(profile)\cdot W_{elz}(profile)\cdot R_{e\_alu}}{\gamma_M}$$

Buckling control

Hollow cross sections (art. 5.9.4.2(4))

$\psi_c := 0.8$

$\omega o := 1.0$ $\omega x := 1.0$ for beams without localized welds

Buckling stress (art. 5.8.4.1)

$\alpha := 0.20$ Values of imperfection factor (table 5.6, heat treated)

$\lambda o := 0.1$ Values of imperfection factor (table 5.6, heat treated)

$\eta := 1.0$

<u>*Slenderness :*</u>

$$\lambda_1 := \pi\cdot\sqrt{\frac{E_{alu}}{\eta\cdot R_{e\_alu}}}$$ $\lambda_1 = 53.653$

$$\lambda_y(profile, k_y, L_y) := \frac{k_y\cdot L_y}{\sqrt{\frac{I_{y\_alu}(profile)}{A_{alu}(profile)}}} \qquad \lambda_z(profile, k_z, L_z) := \frac{k_z\cdot L_z}{\sqrt{\frac{I_{z\_alu}(profile)}{A_{alu}(profile)}}}$$ **<3.4>**

$$\lambda_{by}(profile, k_y, L_y) := \frac{\lambda_y(profile, k_y, L_y)}{\lambda_1} \qquad \lambda_{bz}(profile, k_z, L_z) := \frac{\lambda_z(profile, k_z, L_z)}{\lambda_1}$$ **<3.5>**

Reduction coefficients :

$$\phi_y(\text{profile}, k_y, L_y) := 0.5 \cdot \left[1 + \alpha \cdot \left(\lambda_{by}(\text{profile}, k_y, L_y) - \lambda o\right) + \lambda_{by}(\text{profile}, k_y, L_y)^2\right]$$ <3.6>

$$\phi_z(\text{profile}, k_z, L_z) := 0.5 \cdot \left[1 + \alpha \cdot \left(\lambda_{bz}(\text{profile}, k_z, L_z) - \lambda o\right) + \lambda_{bz}(\text{profile}, k_z, L_z)^2\right]$$

$$\chi_y(\text{profile}, k_y, L_y) := \frac{1}{\phi_y(\text{profile}, k_y, L_y) + \sqrt{\phi_y(\text{profile}, k_y, L_y)^2 - \lambda_{by}(\text{profile}, k_y, L_y)^2}}$$ form 5.33 <3.7>

$$\chi_z(\text{profile}, k_z, L_z) := \frac{1}{\phi_z(\text{profile}, k_z, L_z) + \sqrt{\phi_z(\text{profile}, k_z, L_z)^2 - \lambda_{bz}(\text{profile}, k_z, L_z)^2}}$$ form 5.33

$$\chi_{min}(\text{profile}, k_y, k_z, L_y, L_z) := \min\left(\chi_y(\text{profile}, k_y, L_y), \chi_z(\text{profile}, k_z, L_z)\right)$$

$$\text{buckling}(\text{profile}, k_y, k_z, L_y, L_z, N_{Ed}, M_{yEd}, M_{zEd}) := \left(\frac{N_{Ed}}{\chi_{min}(\text{profile}, k_y, k_z, L_y, L_z) \cdot \omega x \cdot N_{rd}(\text{profile})}\right)^{\psi_c} \cdots + \left(\frac{1}{\omega o}\right) \cdot \left[\left(\frac{M_{yEd}}{M_{yrd}(\text{profile})}\right)^{1.7} \cdots + \left(\frac{M_{zEd}}{M_{zrd}(\text{profile})}\right)^{1.7}\right]^{0.6}$$ form 5.46 <3.8>

Bending and axial tension

Hollow cross sections (art. 5.9.3.3(1))

$\psi := 1.3$

$\omega o = 1$

$$equation(profile, N_{Ed}, M_{yEd}, M_{zEd}) := \left[\left(\frac{N_{Ed}}{\omega o \cdot N_{rd}(profile)}\right)^{\psi} \dots + \left[\left(\frac{M_{yEd}}{\omega o \cdot M_{yrd}(profile)}\right)^{1.7} + \left(\frac{M_{zEd}}{\omega o \cdot M_{zrd}(profile)}\right)^{1.7}\right]^{0.6}\right]$$

form 5.43

<3.9>

Stress

$$\sigma_s(profile, N_{Ed}, M_{yEd}, M_{zEd}) := \frac{N_{Ed}}{A_{alu}(profile)} + \frac{M_{yEd} \cdot y_{y\_alu}(profile)}{I_{y\_alu}(profile)} + \frac{M_{zEd} \cdot y_{z\_alu}(profile)}{I_{z\_alu}(profile)}$$

<3.10>

Doc. 4. Steel profile. acc. to ENV 1993-1-1: April 1992

$$t_w(profile) := \begin{cases} (2mm) & \text{if } profile = 60 \\ (3mm) & \text{if } profile = 70 \\ (4mm) & \text{if } profile = 80 \\ (3mm) & \text{if } profile = 90 \\ (10mm) & \text{if } profile = 100 \end{cases}$$

$$t_f(profile) := \begin{cases} (2mm) & \text{if } profile = 60 \\ (3mm) & \text{if } profile = 70 \\ (4mm) & \text{if } profile = 80 \\ (3mm) & \text{if } profile = 90 \\ (0mm) & \text{if } profile = 100 \end{cases}$$

$$d_{st}(profile) := \begin{cases} (66mm) & \text{if } profile = 60 \\ (64mm) & \text{if } profile = 70 \\ (72mm) & \text{if } profile = 80 \\ (114mm) & \text{if } profile = 90 \\ (80mm) & \text{if } profile = 100 \end{cases}$$

$$b_{st}(profile) := \begin{cases} (70mm) & \text{if } profile = 60 \\ (70mm) & \text{if } profile = 70 \\ (80mm) & \text{if } profile = 80 \\ (120mm) & \text{if } profile = 90 \\ (130mm) & \text{if } profile = 100 \end{cases}$$

$$A_{steel}(profile) := \begin{cases} \text{"not used"} & \text{if } profile = 0 \\ A_{K70\_2} & \text{if } profile = 60 \\ A_{K70\_3} & \text{if } profile = 70 \\ A_{K80} & \text{if } profile = 80 \\ A_{K120} & \text{if } profile = 90 \\ 2\left(t_w(profile) \cdot d_{st}(profile)\right) & \text{if } profile = 100 \end{cases}$$

$$y_{y\_steel}(profile) := \begin{cases} y_{y\_K70\_2} & \text{if } profile = 60 \\ y_{y\_K70\_3} & \text{if } profile = 70 \\ y_{y\_K80} & \text{if } profile = 80 \\ y_{y\_K120} & \text{if } profile = 90 \\ \frac{d_{st}(profile)}{2} & \text{if } profile = 100 \end{cases}$$

$$y_{z\_steel}(profile) := \begin{cases} y_{z\_K70\_2} & \text{if } profile = 60 \\ y_{z\_K70\_3} & \text{if } profile = 70 \\ y_{z\_K80} & \text{if } profile = 80 \\ y_{z\_K120} & \text{if } profile = 90 \\ \frac{t_w(profile)}{2} & \text{if } profile = 100 \end{cases}$$

$$I_{y\_steel}(profile) := \begin{cases} \text{"not used"} & \text{if } profile = 0 \\ I_{y\_K70\_2} & \text{if } profile = 60 \\ I_{y\_K70\_3} & \text{if } profile = 70 \\ I_{y\_K80} & \text{if } profile = 80 \\ I_{y\_K120} & \text{if } profile = 90 \\ \left(2 \cdot \frac{t_w(profile) \cdot d_{st}(profile)^3}{12}\right) & \text{if } profile = 100 \end{cases}$$

$$I_{z\_steel}(profile) := \begin{cases} \text{"not used"} & \text{if } profile = 0 \\ I_{z\_K70\_2} & \text{if } profile = 60 \\ I_{z\_K70\_3} & \text{if } profile = 70 \\ I_{z\_K80} & \text{if } profile = 80 \\ I_{z\_K120} & \text{if } profile = 90 \\ \left(\frac{d_{st}(profile)\cdot t_w(profile)^3}{12}\right) & \text{if } profile = 100 \end{cases}$$

$$W_{ely\_steel}(profile) := \begin{cases} \text{"not used"} & \text{if } profile = 0 \\ W_{ely\_K70\_2} & \text{if } profile = 60 \\ W_{ely\_K70\_3} & \text{if } profile = 70 \\ W_{ely\_K80} & \text{if } profile = 80 \\ W_{ely\_K120} & \text{if } profile = 90 \end{cases}$$

$$W_{elz\_steel}(profile) := \begin{cases} \text{"not used"} & \text{if } profile = 0 \\ W_{elz\_K70\_2} & \text{if } profile = 60 \\ W_{elz\_K70\_3} & \text{if } profile = 70 \\ W_{elz\_K80} & \text{if } profile = 80 \\ W_{elz\_K120} & \text{if } profile = 90 \end{cases}$$

$$W_{ply\_steel}(profile) := \begin{cases} W_{ply\_K70\_2} & \text{if } profile = 60 \\ W_{ply\_K70\_3} & \text{if } profile = 70 \\ W_{ply\_K80} & \text{if } profile = 80 \\ W_{ply\_K120} & \text{if } profile = 90 \end{cases}$$

$$W_{plz\_steel}(profile) := \begin{cases} W_{plz\_K70\_2} & \text{if } profile = 60 \\ W_{plz\_K70\_3} & \text{if } profile = 70 \\ W_{plz\_K80} & \text{if } profile = 80 \\ W_{plz\_K120} & \text{if } profile = 90 \end{cases}$$

$$prof_{contr\_steel}(profile) := \begin{cases} \text{"not used"} & \text{if } profile = 0 \\ \text{"K70/70/2"} & \text{if } profile = 60 \\ \text{"K70/70/3"} & \text{if } profile = 70 \\ \text{"K80/80/4"} & \text{if } profile = 80 \\ \text{"K120/120/3"} & \text{if } profile = 90 \\ \text{"plat 80/10"} & \text{if } profile = 100 \end{cases}$$

$$b_{steel}(profile) := \begin{cases} \text{"not used"} & \text{if } profile = 0 \\ (70mm) & \text{if } profile = 60 \\ (70mm) & \text{if } profile = 70 \\ (80mm) & \text{if } profile = 80 \\ (120mm) & \text{if } profile = 90 \end{cases}$$

$$h_{steel}(profile) := \begin{cases} \text{"not used"} & \text{if } profile = 0 \\ (70mm) & \text{if } profile = 60 \\ (70mm) & \text{if } profile = 70 \\ (80mm) & \text{if } profile = 80 \\ (120mm) & \text{if } profile = 90 \end{cases}$$

Buckling control

Profile classification

$$\varepsilon(R_e) := \sqrt{\frac{235 \cdot \left(\frac{N}{mm^2}\right)}{R_e}}$$

Table 5.3.1

$$\text{classification}_{web}(\text{profile}, R_e) := \begin{cases} 1 & \text{if } \dfrac{d_{st}(\text{profile})}{t_w(\text{profile})} \le 72 \cdot \varepsilon(R_e) \\ 2 & \text{if } 72 \cdot \varepsilon(R_e) < \dfrac{d_{st}(\text{profile})}{t_w(\text{profile})} \le 83 \cdot \varepsilon(R_e) \\ 3 & \text{if } 83 \cdot \varepsilon(R_e) < \dfrac{d_{st}(\text{profile})}{t_w(\text{profile})} \le 124 \cdot \varepsilon(R_e) \end{cases}$$

$$\text{classification}_{flange}(\text{profile}, R_e) := \begin{cases} 1 & \text{if } \dfrac{b_{st}(\text{profile}) - 3 \cdot t_f(\text{profile})}{t_f(\text{profile})} \le 33 \cdot \varepsilon(R_e) \\ 2 & \text{if } 10 \cdot \varepsilon(R_e) < \dfrac{b_{st}(\text{profile}) - 3 \cdot t_f(\text{profile})}{t_f(\text{profile})} \le 38 \cdot \varepsilon(R_e) \\ 3 & \text{if } 11 \cdot \varepsilon(R_e) < \dfrac{b_{st}(\text{profile}) - 3 \cdot t_f(\text{profile})}{t_f(\text{profile})} \le 42 \cdot \varepsilon(R_e) \end{cases}$$

$$\text{classification}_{tot}(\text{profile}, R_e) := \begin{cases} \text{classification}_{web}(\text{profile}, R_e) & \text{if } t_f(\text{profile}) = 0 \\ \max\left(\text{classification}_{web}(\text{profile}, R_e), \text{classification}_{flange}(\text{profile}, R_e)\right) & \text{otherwise} \end{cases}$$

<4.1>

Profile art. 5.5.1

$$\beta_A(profile, R_e) := \begin{cases} 1 & \text{if } classification_{tot}(profile, R_e) = 1 \vee 2 \vee 3 \\ \text{"A.eff/A"} & \text{otherwise} \end{cases}$$ **<4.2>**

Slenderness :

$$\lambda_{steel\_y}(profile, k_y, L_y) := \frac{k_y \cdot L_y}{\sqrt{\frac{I_{y\_steel}(profile)}{A_{steel}(profile)}}} \qquad \lambda_{steel\_z}(profile, k_z, L_z) := \frac{k_z \cdot L_z}{\sqrt{\frac{I_{z\_steel}(profile)}{A_{steel}(profile)}}}$$ **<4.3>**

$$\lambda_{steel\_1}(R_e) := \pi \cdot \sqrt{\frac{E_{steel}}{R_e}}$$ **<4.4>**

$$\lambda_{steel\_by}(profile, k_y, L_y, R_e) := \frac{\lambda_{steel\_y}(profile, k_y, L_y)}{\lambda_{steel\_1}(R_e)} \cdot \sqrt{\beta_A(profile, R_e)}$$

<4.5>

$$\lambda_{steel\_bz}(profile, k_z, L_z, R_e) := \frac{\lambda_{steel\_z}(profile, k_z, L_z)}{\lambda_{steel\_1}(R_e)} \cdot \sqrt{\beta_A(profile, R_e)}$$

Shape factor :

$$\alpha_{st\_y}(profile) := \begin{cases} 0.49 & \text{if } t_f(profile) = 0 \\ 0.21 & \text{otherwise} \end{cases} \qquad \alpha_{st\_z}(profile) := \begin{cases} 0.49 & \text{if } t_f(profile) = 0 \\ 0.21 & \text{otherwise} \end{cases}$$

Table 5.5.1
Table 5.5.3 **<4.6>**

Reduction coefficients :

$$\phi_{steel\_y}(profile, k_y, L_y, R_e) := 0.5 \cdot \left[1 + \alpha_{st\_y}(profile) \cdot \left(\lambda_{steel\_by}(profile, k_y, L_y, R_e) - 0.2\right) + \lambda_{steel\_by}(profile, k_y, L_y, R_e)^2\right]$$

<4.7>

$$\phi_{steel\_z}(profile, k_z, L_z, R_e) := 0.5 \cdot \left[1 + \alpha_{st\_z}(profile) \cdot \left(\lambda_{steel\_bz}(profile, k_z, L_z, R_e) - 0.2\right) + \lambda_{steel\_bz}(profile, k_z, L_z, R_e)^2\right]$$

$$\chi_{steel\_y}(profile, k_y, L_y, R_e) := \frac{1}{\phi_{steel\_y}(profile, k_y, L_y, R_e) + \sqrt{\phi_{steel\_y}(profile, k_y, L_y, R_e)^2 - \lambda_{steel\_by}(profile, k_y, L_y, R_e)^2}}$$

form 5.46 **<4.8>**

$$\chi_{steel\_z}(profile,k_z,L_z,R_e) := \frac{1}{\phi_{steel\_z}(profile,k_z,L_z,R_e) + \sqrt{\phi_{steel\_z}(profile,k_z,L_z,R_e)^2 - \lambda_{steel\_bz}(profile,k_z,L_z,R_e)^2}}$$

$$\chi_{steel\_min}(profile,k_z,k_y,L_z,L_y,R_e) := \min(\chi_{steel\_z}(profile,k_z,L_z,R_e),\chi_{steel\_y}(profile,k_y,L_y,R_e))$$ reduction factor

<u>Bending + axial compression (art. 5.5.4)</u>

<u>Factor relating to the equivalent uniform moment (fig 5.5.3):</u>

$$\psi_y(M_{1\_y},M_{2\_y}) := \begin{cases} \frac{M_{2\_y}}{M_{1\_y}} & \text{if } -1 \le \frac{M_{2\_y}}{M_{1\_y}} \le 1 \\ (-1) & \text{if } \frac{M_{2\_y}}{M_{1\_y}} < -1 \\ 1 & \text{if } \frac{M_{2\_y}}{M_{1\_y}} > 1 \end{cases} \qquad \psi_z(M_{1\_z},M_{2\_z}) := \begin{cases} \frac{M_{2\_z}}{M_{1\_z}} & \text{if } -1 \le \frac{M_{2\_z}}{M_{1\_z}} \le 1 \\ (-1) & \text{if } \frac{M_{2\_z}}{M_{1\_z}} < -1 \\ 1 & \text{if } \frac{M_{2\_z}}{M_{1\_z}} > 1 \end{cases}$$ **<4.9>**

$$\beta_{M\psi y}(M_{1\_y},M_{2\_y}) := 1.8 - 0.7\cdot\psi_y(M_{1\_y},M_{2\_y}) \qquad \beta_{M\psi z}(M_{1\_z},M_{2\_z}) := 1.8 - 0.7\cdot\psi_z(M_{1\_z},M_{2\_z})$$ **<4.10>**

$\beta_{MQ} := 1.3$ **<4.11>** distributed load

<u>Moments du to the shear load (fig. 5.5.3):</u>

$$M_{Qy}(M_{1\_y},M_{2\_y},M_{m\_y}) := \left|\frac{M_{1\_y} - M_{2\_y}}{2} + M_{2\_y} - M_{m\_y}\right|$$

$$M_{Qz}(M_{1\_z},M_{2\_z},M_{m\_z}) := \left|\frac{M_{1\_z} - M_{2\_z}}{2} + M_{2\_z} - M_{m\_z}\right|$$ **<4.12>**

$$\Delta M_y(M_{1\_y},M_{2\_y},M_{m\_y}) := \begin{cases} \max(|M_{1\_y}|,|M_{2\_y}|,|M_{m\_y}|) & \text{if } (\mathrm{sign}(M_{1\_y}) = \mathrm{sign}(M_{m\_y})) \wedge (\mathrm{sign}(M_{2\_y}) = \mathrm{sign}(M_{m\_y})) \\ |\max(M_{1\_y},M_{2\_y},M_{m\_y})| + |\min(M_{1\_y},M_{2\_y},M_{m\_y})| & \text{otherwise} \end{cases}$$ **<4.13>**

$$\Delta M_z(M_{1\_z},M_{2\_z},M_{m\_z}) := \begin{cases} \max(|M_{1\_z}|,|M_{2\_z}|,|M_{m\_z}|) & \text{if } (\mathrm{sign}(M_{1\_z}) = \mathrm{sign}(M_{m\_z})) \wedge (\mathrm{sign}(M_{2\_z}) = \mathrm{sign}(M_{m\_z})) \\ |\max(M_{1\_z},M_{2\_z},M_{m\_z})| + |\min(M_{1\_z},M_{2\_z},M_{m\_z})| & \text{otherwise} \end{cases}$$

$$\beta_{My}(M_{1\_y},M_{2\_y},M_{m\_y}) := \beta_{M\psi y}(M_{1\_y},M_{2\_y}) + \frac{M_{Qy}(M_{1\_y},M_{2\_y},M_{m\_y})}{\Delta M_y(M_{1\_y},M_{2\_y},M_{m\_y})}\cdot(\beta_{MQ} - \beta_{M\psi y}(M_{1\_y},M_{2\_y}))$$

<4.14>

$$\beta_{Mz}(M_{1\_z},M_{2\_z},M_{m\_z}) := \beta_{M\psi z}(M_{1\_z},M_{2\_z}) + \frac{M_{Qz}(M_{1\_z},M_{2\_z},M_{m\_z})}{\Delta M_z(M_{1\_z},M_{2\_z},M_{m\_z})}\cdot(\beta_{MQ} - \beta_{M\psi z}(M_{1\_z},M_{2\_z}))$$

Coefficients μ (art 5.5.4)

classification = 1 or 2 :

$$\mu_{yc1\_2}(profile,k_y,L_y,R_e,M_{1\_y},M_{2\_y},M_{m\_y}) := \min\left[0.9,\left[\lambda_{steel\_by}(profile,k_y,L_y,R_e)\cdot(2\cdot\beta_{My}(M_{1\_y},M_{2\_y},M_{m\_y})-4) \ldots + \frac{W_{ply\_steel}(profile) - W_{ely\_steel}(profile)}{W_{ely\_steel}(profile)}\right]\right]$$

$$\mu_{zc1\_2}(profile,k_z,L_z,R_e,M_{1\_z},M_{2\_z},M_{m\_z}) := \min\left[0.9,\left[\lambda_{steel\_bz}(profile,k_z,L_z,R_e)\cdot(2\cdot\beta_{My}(M_{1\_z},M_{2\_z},M_{m\_z})-4) \ldots + \frac{W_{plz\_steel}(profile) - W_{elz\_steel}(profile)}{W_{elz\_steel}(profile)}\right]\right]$$

classification = 3 :

$$\mu_{yc3}(profile,k_y,L_y,R_e,M_{1\_y},M_{2\_y},M_{m\_y}) := \min\left[0.9,\lambda_{steel\_by}(profile,k_y,L_y,R_e)\cdot(2\cdot\beta_{My}(M_{1\_y},M_{2\_y},M_{m\_y})-4)\right]$$

$$\mu_{zc3}(profile,k_z,L_z,R_e,M_{1\_z},M_{2\_z},M_{m\_z}) := \min\left[0.9,\lambda_{steel\_bz}(profile,k_z,L_z,R_e)\cdot(2\cdot\beta_{Mz}(M_{1\_z},M_{2\_z},M_{m\_z})-4)\right]$$

$$\mu_y(profile,k_y,L_y,R_e,M_{1\_y},M_{2\_y},M_{m\_y}) := \left| \begin{array}{l} \mu_{yc1\_2}(profile,k_y,L_y,R_e,M_{1\_y},M_{2\_y},M_{m\_y}) \text{ if } classification_{tot}(profile,R_e) = 1 \vee 2 \\ \mu_{yc3}(profile,k_y,L_y,R_e,M_{1\_y},M_{2\_y},M_{m\_y}) \text{ if } classification_{tot}(profile,R_e) = 3 \end{array}\right.$$

<4.15>

$$\mu_z(profile,k_z,L_z,R_e,M_{1\_z},M_{2\_z},M_{m\_z}) := \left| \begin{array}{l} \mu_{zc1\_2}(profile,k_z,L_z,R_e,M_{1\_z},M_{2\_z},M_{m\_z}) \text{ if } classification_{tot}(profile,R_e) = 1 \vee 2 \\ \mu_{zc3}(profile,k_z,L_z,R_e,M_{1\_z},M_{2\_z},M_{m\_z}) \text{ if } classification_{tot}(profile,R_e) = 3 \end{array}\right.$$

Coefficients k (art 5.5.4)

$$K_y(profile,k_y,L_y,R_e,M_{1\_y},M_{2\_y},M_{m\_y},N_{Ed}) := \min\left(1 - \frac{\mu_y(profile,k_y,L_y,R_e,M_{1\_y},M_{2\_y},M_{m\_y})\cdot N_{Ed}}{\chi_{steel\_y}(profile,k_y,L_y,R_e)\cdot A_{steel}(profile)\cdot R_e}, 1.5\right)$$

<4.16>

$$K_z(profile,k_z,L_z,R_e,M_{1\_z},M_{2\_z},M_{m\_z},N_{Ed}) := \min\left(1 - \frac{\mu_z(profile,k_z,L_z,R_e,M_{1\_z},M_{2\_z},M_{m\_z})\cdot N_{Ed}}{\chi_{steel\_z}(profile,k_z,L_z,R_e)\cdot A_{steel}(profile)\cdot R_e}, 1.5\right)$$

Stress: bending + axial compression

$$\sigma_{bending\_comp}(profile, N_{Ed}, M_{1\_y}, M_{1\_z}, M_{m\_y}, M_{m\_z}) := \frac{N_{Ed}}{A_{steel}(profile)} + \frac{\max(|M_{1\_y}|, |M_{m\_y}|) \cdot y_{y\_steel}(profile)}{I_{y\_steel}(profile)} \dots + \frac{\max(|M_{1\_z}|, |M_{m\_z}|) \cdot y_{z\_steel}(profile)}{I_{z\_steel}(profile)}$$

<4.17>

Stress: bending + axial traction

$$\sigma_{flexion\_traction}(profile, N_{Ed}, M_{yEd}, M_{zEd}) := \frac{N_{Ed}}{A_{steel}(profile)} + \frac{M_{yEd} \cdot y_{y\_steel}(profile)}{I_{y\_steel}(profile)} \dots + \frac{M_{zEd} \cdot y_{z\_steel}(profile)}{I_{z\_steel}(profile)}$$

<4.18>

Axial compression (art. 5.5.1)

Profile capacity :

$$N_{bRd}(profile, R_e, k_y, k_z, L_y, L_z) := \chi_{steel\_min}(profile, k_z, k_y, L_z, L_y, R_e) \cdot \beta_A(profile, R_e) \cdot A_{steel}(profile) \cdot \frac{R_e}{\gamma_M}$$

<4.19>

form 5.45

$$buckling_{steel}(profile, R_e, k_y, k_z, L_y, L_z, N_{Ed}) := \begin{cases} \dfrac{\frac{N_{Ed}}{2}}{N_{bRd}(profile, R_e, k_y, k_z, L_y, L_z)} & \text{if } t_f(profile) = 0 \\ \dfrac{N_{Ed}}{N_{bRd}(profile, R_e, k_y, k_z, L_y, L_z)} & \text{otherwise} \end{cases}$$

<4.20>

Stress: axial compression or traction

$$\sigma_{comp\_trac}(profile, N_{Ed}) := \frac{N_{Ed}}{A_{steel}(profile)}$$

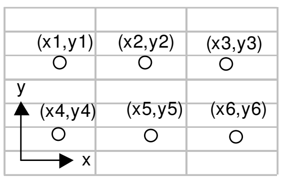
<4.21>

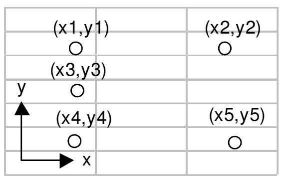
Doc. 5. Bolts, pins and rivets acc. to ENV1999-1-1:1998 + ENV1993-1-1:1992

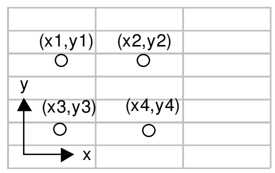
The coordinates for max 6 bolts:

$$x(x_1, x_2, x_3, x_4, x_5, x_6) := \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \end{pmatrix} \qquad y(y_1, y_2, y_3, y_4, y_5, y_6) := \begin{pmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \\ y_6 \end{pmatrix}$$

A few examples :







Resulting force on one bolt:

$$F_R(m_v, n_v, v_v, n, x_1, x_2, x_3, x_4, x_5, x_6, y_1, y_2, y_3, y_4, y_5, y_6) :=$$

{kN,kNm}		{m}		{m}		{m}	
M	-1.8	y1	0	x1	0	Xz	0.0725
N	-17	y2	0	x2	0.15	Yz	0
V	-14	y3	0	x3	0	B	0.0105
n	2	y4	0	x4	0		
	-7.5	y5	0	x5	0		
	9.6	y6	0	x6	0		
Forces on the bolts:							
			{kN}		{kN}		{kN}
Fx1	0	Fy1	-6.4	Fm1	6.38	Fm	6.3753
Fx2	0	Fy2	-6.4	Fm2	6.38	Fmx	0
Fx3	0	Fy3	-6.4	Fm3	6.38	Fmy	-6.375
Fx4	0	Fy4	-6.4	Fm4	6.38	Fn	-4.175
Fx5	0	Fy5	-6.4	Fm5	6.38	Fv	-3.375
Fx6	0	Fy6	-6.4	Fm6	6.38	Fr	10.607

<5.1>

$$\left(m_v \;\; n_v \;\; v_v \;\; n \;\; y(y_1, y_2, y_3, y_4, y_5, y_6) \;\; x(x_1, x_2, x_3, x_4, x_5, x_6)\right)$$

with:
* M, N and V : the outside forces on the bolts
* n : number of the bolts
* Xz : centre of gravity of the bolts in x direction
* Yz : centre of gravity of the bolts in y direction
* Fx, Fy : The force on 1 bolt in x or y direction, due to the moment force
* Fmx, Fmy : The biggest force on 1 bolt with Fx and Fy the moment force in the same bolt
* Fn : The force on 1 bolt due to the normal force
* Fv : The force on 1 bolt due to the shear force
* Fr : The resulting force on 1 bolt

Shear resistance for bolts, pins and rivets :
(ENV1999 table 6.4, 6.7 and 6.5, ENV1993 table 6.5.3, 6.5.7 and 6.5.5)

$$A_{bolt}(D_{bolt}) := \frac{\pi \cdot D_{bolt}^2}{4}$$

area of the bolt and the pin **<5.2>**

$$A_{rivet}(d_0) := \frac{\pi \cdot d_0^2}{4}$$

area of the rivet **<5.2>**

$$c(f_{ub}) := \begin{cases} 0.6 & \text{if } f_{ub} < 1000 \dfrac{N}{mm^2} \\ 0.5 & \text{if } f_{ub} \geq 1000 \dfrac{N}{mm^2} \end{cases}$$

<5.3>

$$F_{vRd}(f_{ub}, D_{bolt}) := \frac{c(f_{ub}) \cdot f_{ub} \cdot A_{bolt}(D_{bolt})}{\gamma_{Mb}}$$

Shear resistance for bolts and pins
(ENV9: table 6.4 form. 6.13) **<5.4>**

$$F_{vRd\_r}(f_{ub}, d_0) := \frac{0.6 \cdot f_{ub} \cdot A_{rivet}(d_0)}{\gamma_{Mr}}$$

Shear resistance for rivets
(ENV9: table 6.5 form. 6.22) **<5.4>**

Bearing resistance for bolts, pins and rivets :
(ENV1999 table 6.4 and 6.7, ENV1993 table 6.5.3 and 6.5.7)

$$\alpha(e_1, p_1, d_0, f_{ub}, f_u) := \min\left(\frac{e_1}{3 \cdot d_0}, \frac{p_1}{3 \cdot d_0} - \frac{1}{4}, \frac{f_{ub}}{f_u}, 1.0\right)$$

ENV9: table 6.4 form. 6.16 **<5.5>**
table 6.5 form. 6.24

$$F_{bRd}(e_1, p_1, d_0, f_{ub}, f_u, f_y, D_{bolt}, t, n) := \begin{cases} \dfrac{2.5 \cdot \alpha(e_1, p_1, d_0, f_{ub}, f_u) \cdot f_u \cdot D_{bolt} \cdot t}{\gamma_{Mb}} & \text{if } n > 1 \\ \dfrac{1.5 \cdot t \cdot D_{bolt} \cdot f_y}{\gamma_{Mb}} & \text{if } n = 1 \end{cases}$$

ENV9: table 6.4 form. 6.15 (free rotation not required)

ENV9: table 6.7 (free rotation required)

<5.6>

$$F_{bRd\_r}(e_1, p_1, d_0, f_{ub}, f_u, t) := \frac{2.5 \cdot \alpha(e_1, p_1, d_0, f_{ub}, f_u) \cdot f_u \cdot d_0 \cdot t}{\gamma_{Mr}}$$

ENV9: table 6.5 form. 6.23

Moment resistance for bolts and pins : (ENV1999 table 6.7, ENV1993 table 6.5.7)

$$W(D_{bolt}) := \pi \cdot \left(\frac{D_{bolt}^{3}}{32}\right)$$

moment resistance **<5.7>**

$$M_{Rd}(f_{ub}, D_{bolt}) := \frac{0.8 \cdot f_{ub} \cdot W(D_{bolt})}{\gamma_{Mb}}$$

moment capacity **<5.8>**

$$sp(t_i, t_o, s, C) := \begin{cases} \left(\frac{t_i}{2} + s + \frac{t_o}{2}\right) & \text{if } C = 1 \\ \frac{(2 \cdot t_o + 4 \cdot s + t_i)}{8} & \text{if } C = 2 \end{cases}$$

margin between connected parts **<5.9>**

C = 1 : exterior tube is connected with interior tube
C = 2 : 3 plates are connected together

Traction resistance for bolts : (ENV1999 tableau 6.4, ENV1993 tableau 6.5.3)

$$F_{tRd}(f_{ub}, D_{bolt}) := \frac{0.9 \cdot f_{ub} \cdot A_{bolt}(D_{bolt})}{\gamma_{Mb}}$$

ENV9: table 6.4 form. 6.17 **<5.10>**

Resistance against perforation of the bolts and the nuts (ENV3 form. 6.5)

$$d_{nut}(D_{bolt}) := \begin{cases} 10mm & \text{if } D_{bolt} = 6mm \\ 13mm & \text{if } D_{bolt} = 8mm \\ 17mm & \text{if } D_{bolt} = 10mm \\ 19mm & \text{if } D_{bolt} = 12mm \\ 22mm & \text{if } D_{bolt} = 14mm \\ 24mm & \text{if } D_{bolt} = 16mm \\ 27mm & \text{if } D_{bolt} = 18mm \\ 30mm & \text{if } D_{bolt} = 20mm \\ 34mm & \text{if } D_{bolt} = 22mm \\ 36mm & \text{if } D_{bolt} = 24mm \\ 41mm & \text{if } D_{bolt} = 27mm \\ 46mm & \text{if } D_{bolt} = 30mm \\ 50mm & \text{if } D_{bolt} = 33mm \\ 55mm & \text{if } D_{bolt} = 36mm \end{cases}$$

<5.11>

$$B_{pRd}(D_{bolt}, t, f_u) := \frac{0.6 \cdot \pi \cdot d_{nut}(D_{bolt}) \cdot t \cdot f_u}{\gamma_{Mb}}$$

maximum perforation force **<5.12>**

Connection by rivets :

Connection between the principal profile and the reinforcement profile

The static moment of the reinforcement profile equals:

$$s(reinf) := \begin{cases} (91.27mm) & \text{if } A_{alu}(reinf) = A_{alu297\_8} \\ (79.97mm) & \text{if } A_{alu}(reinf) = A_{alu260} \\ (74.93mm) & \text{if } A_{alu}(reinf) = A_{alu232} \end{cases}$$

$$S_{reinforcement}(reinf) := 0.5 \cdot A_{alu}(reinf) \cdot s(reinf)$$ **<5.13>**

The maximum distance between two rivets equals:

$$L_{max}(F_{max}, e_1, p_1, D_0, R_{t\_rivet}, R_{t\_alu}, prin, reinf) := \frac{\min\begin{pmatrix} F_{vRd\_r}(R_{t\_rivet}, D_0) \\ F_{bRd\_r}(e_1, p_1, D_0, R_{t\_rivet}, R_{t\_alu}, t_{alu}(prin)) \\ F_{bRd\_r}(e_1, p_1, D_0, R_{t\_rivet}, R_{t\_alu}, t_{alu}(reinf)) \end{pmatrix} \cdot I_{y\_alu}(prin + reinf)}{F_{max} \cdot S_{reinforcement}(reinf)}$$

<5.14>

We have 4 rivets per section.
The maximum distance between two rows of rivets equals:

$$L_{max\_row}(F_{max}, e_1, p_1, D_0, R_{t\_rivet}, R_{t\_alu}, prin, reinf) := L_{max}(F_{max}, e_1, p_1, D_0, R_{t\_rivet}, R_{t\_alu}, prin, reinf) \cdot 4$$ **<5.15>**

The real force on the rivets becomes:

$$F_{max\_real}(p_1, F_{max}, prin, reinf) := \frac{p_1 \cdot F_{max} \cdot S_{reinforcement}(reinf)}{I_{y\_alu}(prin + reinf) \cdot 4}$$ **<5.16>**

The stress in the rivet:

$$R_{t\_rivet\_real}(p_1, D_0, F_{max}, prin, reinf) := \frac{F_{max\_real}(p_1, F_{max}, prin, reinf) \cdot \gamma_{Mr}}{0.6 \cdot A_{rivet}(D_0)}$$ **<5.17>**

The stress in the principal profile:

$$R_{t\_prin\_real}(e_1, p_1, D_0, R_{t\_rivet}, R_{t\_alu}, F_{max}, prin, reinf) := \frac{F_{max\_real}(p_1, F_{max}, prin, reinf) \cdot \gamma_{Mr}}{2.5 \cdot \alpha(e_1, p_1, D_0, R_{t\_rivet}, R_{t\_alu}) \cdot D_0 \cdot t_{alu}(prin)}$$ **<5.18>**

The stress in the reinforcement profile:

$$R_{t\_reinf\_real}(e_1, p_1, D_0, R_{t\_rivet}, R_{t\_alu}, F_{max}, prin, reinf) := \frac{F_{max\_real}(p_1, F_{max}, prin, reinf) \cdot \gamma_{Mr}}{2.5 \cdot \alpha(e_1, p_1, D_0, R_{t\_rivet}, R_{t\_alu}) \cdot D_0 \cdot t_{alu}(reinf)}$$ **<5.19>**

Doc. 6. Steel connection

$$B(b_1, b_2, b_3, b_4, b_5, b_6, b_7) := \begin{pmatrix} b_1 \\ b_2 \\ b_3 \\ b_4 \\ b_5 \\ b_6 \\ b_7 \end{pmatrix} \qquad H(h_1, h_2, h_3, h_4, h_5, h_6, h_7) := \begin{pmatrix} h_1 \\ h_2 \\ h_3 \\ h_4 \\ h_5 \\ h_6 \\ h_7 \end{pmatrix}$$

$$T(t_1, t_2, t_3, t_4, t_5, t_6, t_7) := \begin{pmatrix} t_1 \\ t_2 \\ t_3 \\ t_4 \\ t_5 \\ t_6 \\ t_7 \end{pmatrix}$$

$$Y(y1, y2, y3, y4, y5, y6, y7) := \begin{pmatrix} y1 \\ y2 \\ y3 \\ y4 \\ y5 \\ y6 \\ y7 \end{pmatrix} \qquad Z(z1, z2, z3, z4, z5, z6, z7) := \begin{pmatrix} z1 \\ z2 \\ z3 \\ z4 \\ z5 \\ z6 \\ z7 \end{pmatrix}$$

Length [m]		Height [m]		Thickness [m]		Gravity point [m]			
b1	0.03	h1	0.04	t1	0.00	y1	0.02	z1	0.05
b2	0.07	h2	0.01	t2	0.01	y2	0.05	z2	0.05
b3	0.00	h3	0.14	t3	0.07	y3	0.12	z3	0.05
b4	0.00	h4	0.14	t4	0.07	y4	0.12	z4	0.08
b5	0.07	h5	0.07	t5	0.01	y5	0.20	z5	0.08
b6	0.05	h6	0.15	t6	0.00	y6	0.31	z6	0.08
b7	0.15	h7	0.25	t7	0.01	y7	0.01	z7	0.08
						H	0.3844		
n	6								

Section

A=b x h - (b-2t)(h-2t)

A1	0.00	m²	A5	0.00	m²
A2	0.00	m²	A6	0.00	m²
A3	0.00	m²	A7	0.00	m²
A4	0.00	m²			

Atot	4.67E-03	m²	**<6.1>**

Gravity point

Yg = [(A1 x y1) + (A2 x y2) + …] / Atot

Yg	0.17	m	
Yv	0.22	m	**<6.2>**

Zg = [(A1 x z1) + (A2 x z2) + …] / Atot

Zg	0.06	m	
Zv	0.06	m	**<6.3>**

Moment of inertia

Iy = [b x h^3 - (b-2t)(h-2t)^3] / 12

I1	8.14E-08	m^4	I5	9.21E-07	m^4
I2	5.83E-09	m^4	I6	3.11E-06	m^4
I3	9.15E-07	m^4	I7	4.03E-05	m^4
I4	9.15E-07	m^4			

	Iz = [h x b^3 - (b-2t)(b-2t)^3] / 12					
I1	5.08E-08	m^4		I5	9.21E-07	m^4
I2	2.86E-07	m^4		I6	5.40E-07	m^4
I3	7.47E-10	m^4		I7	1.82E-05	m^4
I4	7.47E-10	m^4				
	a_y = y - Yg					
a1	-0.15	m		a5	0.03	m
a2	-0.12	m		a6	0.14	m
a3	-0.05	m		a7	-0.16	m
a4	-0.05	m				
	a_z = z - Zg					
a1	-0.02	m		a5	0.01	m
a2	-0.02	m		a6	0.01	m
a3	-0.02	m		a7	0.01	m
a4	0.01	m				
	Itot = (I1 + a1^2 . A1) + (I2 + a2^2 . A2) + …					
Iy_tot	5.24E-05	m^4	**<6.4>**			

Iz_tot	2.76E-06	m^4	**<6.5>**	

	Von mises stress control			
	σ = (Nv / Atot) + [(My x Yv)/Iy_tot] + [(Mz x Zv)/Iz_tot]			
σ	8.08E+04	kN/m²		**<6.6>**

	τ = Sv / Atot			
τ	1.15E+04	kN/m²		**<6.7>**

	σ_{vm} = sqrt(σ^2 + 3.τ^2)			
σ_{vm}	8.32E+04	kN/m²		**<6.8>**

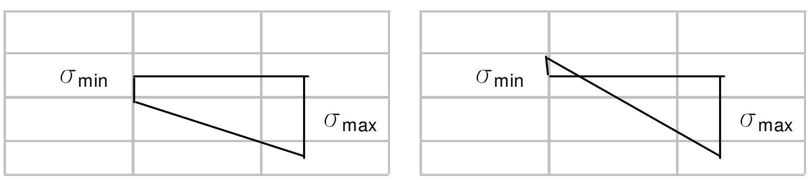
Doc. 7. Baseplate

7.1. Bending of the horizontal steel plate.

$$\sigma_{max}(R_x,R_z,B_p,L,h_p,v,P) := \begin{cases} \left(\dfrac{|R_z|}{B_p \cdot L} + \dfrac{|R_x| \cdot (h_p)}{\dfrac{B_p \cdot L^2}{6}}\right) & \text{if } P = \text{"side"} \\ \left[\dfrac{|R_z|}{B_p \cdot L} + \dfrac{|R_x| \cdot (h_p) \cdot v}{\dfrac{B_p \cdot L^3}{12} + \left(v - \dfrac{L}{2}\right)^2 \cdot B_p \cdot L}\right] & \text{if } P = \text{"corner"} \end{cases}$$

<7.1>

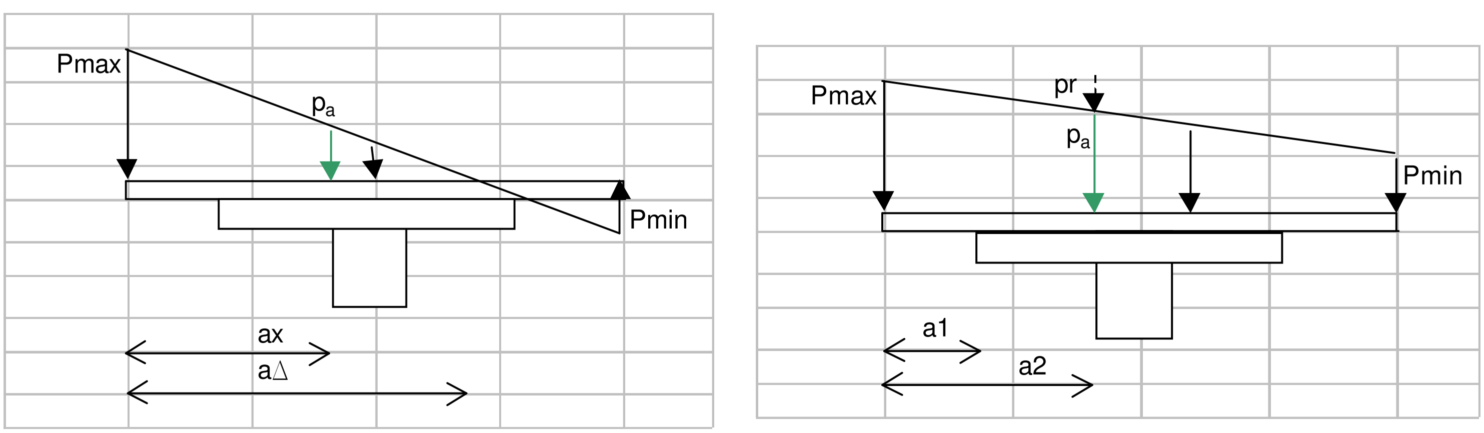
$$\sigma_{min}(R_x,R_z,B_p,L,h_p,v,P) := \begin{cases} \left(\dfrac{|R_z|}{B_p \cdot L} - \dfrac{|R_x| \cdot (h_p)}{\dfrac{B_p \cdot L^2}{6}}\right) & \text{if } P = \text{"side"} \\ \left[\dfrac{|R_z|}{B_p \cdot L} - \dfrac{|R_x| \cdot (h_p) \cdot v}{\dfrac{B_p \cdot L^3}{12} + \left(v - \dfrac{L}{2}\right)^2 \cdot B_p \cdot L}\right] & \text{if } P = \text{"corner"} \end{cases}$$



$$p_{max}(R_x,R_z,B_p,L,h_p,v,P) := \sigma_{max}(R_x,R_z,B_p,L,h_p,v,P) \cdot B_p$$

<7.2>

$$p_{min}(R_x,R_z,B_p,L,h_p,v,P) := \sigma_{min}(R_x,R_z,B_p,L,h_p,v,P) \cdot B_p$$



a_1 distance from the side of the plate to the reinforcement

a_2 distance from the side of the plate to the support

$$p_r(a_x,R_x,R_z,B_p,L,h_p,v,P) := \frac{a_x\cdot\left(p_{max}(R_x,R_z,B_p,L,h_p,v,P) - p_{min}(R_x,R_z,B_p,L,h_p,v,P)\right)}{L}$$ **<7.3>**

$$a_\Delta(R_x,R_z,B_p,L,h_p,v,P) := \frac{L}{\left|\frac{p_{min}(R_x,R_z,B_p,L,h_p,v,P)}{p_{max}(R_x,R_z,B_p,L,h_p,v,P)}\right| + 1}$$ **<7.4>**

$$p_{ax}(a_x,R_x,R_z,B_p,L,h_p,v,P) := \begin{cases} \left(p_{max}(R_x,R_z,B_p,L,h_p,v,P) \ldots + -p_r(a_x,R_x,R_z,B_p,L,h_p,v,P)\right) & \text{if } p_{min}(R_x,R_z,B_p,L,h_p,v,P) \ge 0 \\ \frac{p_{max}(R_x,R_z,B_p,L,h_p,v,P)\cdot\left(a_\Delta(R_x,R_z,B_p,L,h_p,v,P) - a_x\right)}{a_\Delta(R_x,R_z,B_p,L,h_p,v,P)} & \text{otherwise} \end{cases}$$ **<7.5>**

Distance of the gravity point:

$$a_g(a_x,R_x,R_z,B_p,L,h_p,v,P) := \begin{cases} \frac{\left(p_{ax}(a_x,R_x,R_z,B_p,L,h_p,v,P)\cdot a_x\cdot\frac{a_x}{2}\right) \ldots + \frac{\left(p_{max}(R_x,R_z,B_p,L,h_p,v,P) \ldots + -p_{ax}(a_x,R_x,R_z,B_p,L,h_p,v,P)\right)\cdot a_x}{2}\cdot\frac{2\cdot a_x}{3}}{\left(\frac{p_{max}(R_x,R_z,B_p,L,h_p,v,P) \ldots + p_{ax}(a_x,R_x,R_z,B_p,L,h_p,v,P)}{2}\right)\cdot a_x} & \text{if } p_{ax}(a_x,R_x,R_z,B_p,L,h_p,v,P) > 0 \\ \left(\frac{2}{3}\cdot a_\Delta(R_x,R_z,B_p,L,h_p,v,P)\right) & \text{if } p_{ax}(a_x,R_x,R_z,B_p,L,h_p,v,P) \le 0 \end{cases}$$

<7.6>

Maximum moment:

$$M_{max}(a_x,R_x,R_z,B_p,L,h_p,v,P) := \left(\frac{p_{max}(R_x,R_z,B_p,L,h_p,v,P) \ldots + p_{ax}(a_x,R_x,R_z,B_p,L,h_p,v,P)}{2}\right)\cdot a_x\cdot a_g(a_x,R_x,R_z,B_p,L,h_p,v,P)$$ **<7.7>**

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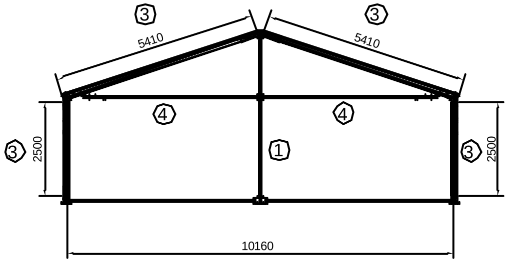
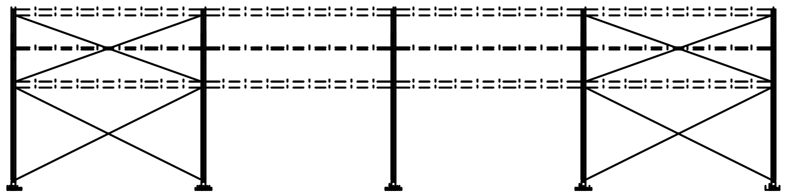
ENCLOSURE 2 :

Drawings of the Alu 10m t97 structure

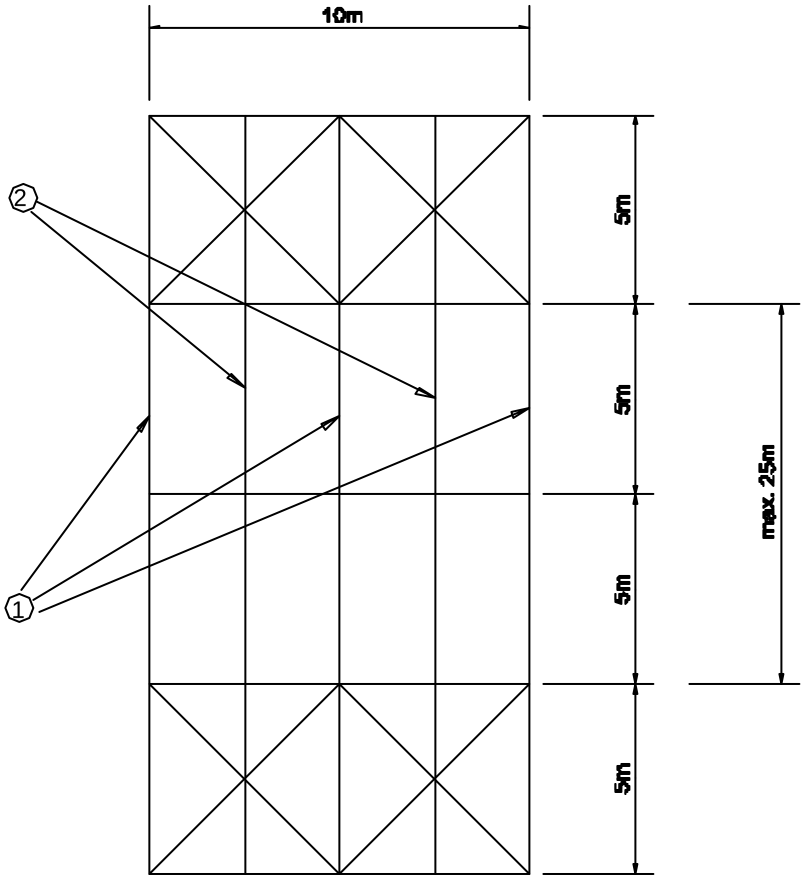
Front view

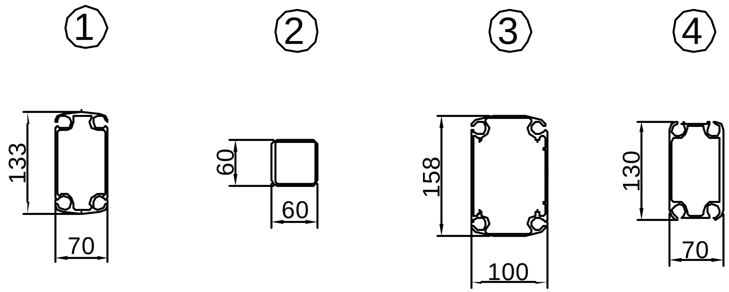


Side view



Top view





Alu133 Alu60 Alu158 Alu130

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Figure 1:
Global structure alu10m t97

PROJECTIE			NR. ONGEGALV.	
SCHAAL		A4		
DATUM	29/09/05	EB	CODENR.	BAL10T97_2.8E01

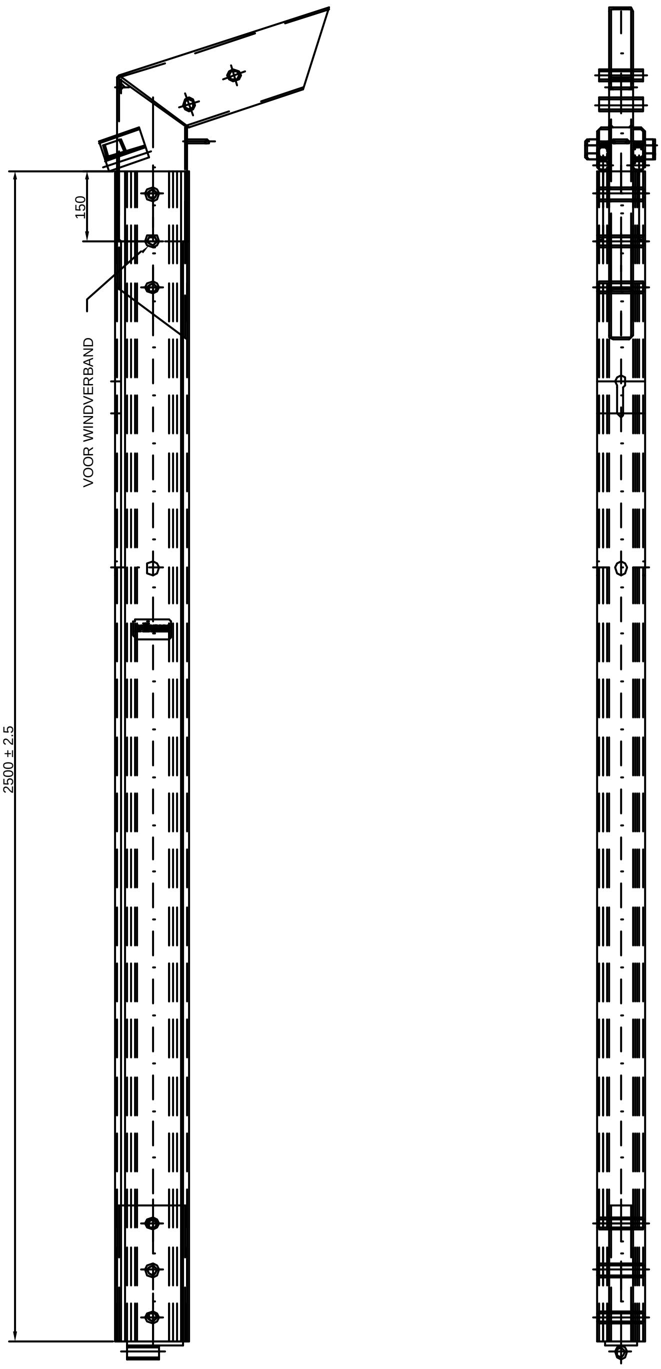

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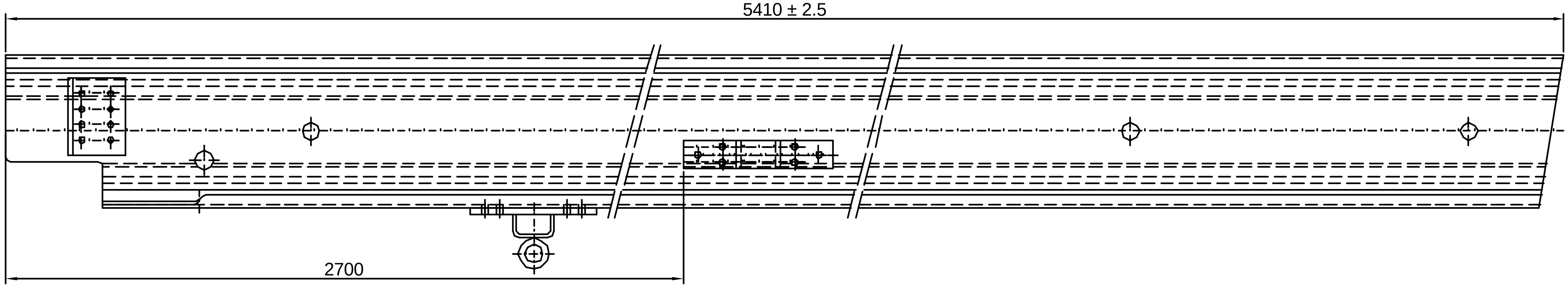
FIGURE 2

Foot truss

PROJECTIE		NR. ONGEGALV.	
SCHAAL	A4		
DATUM	30/10/02 eb	CODENR.	BAL10T97_2.8E02

Datum afdruk : maandag 12 juni 2006 14:03:48 Door : ####



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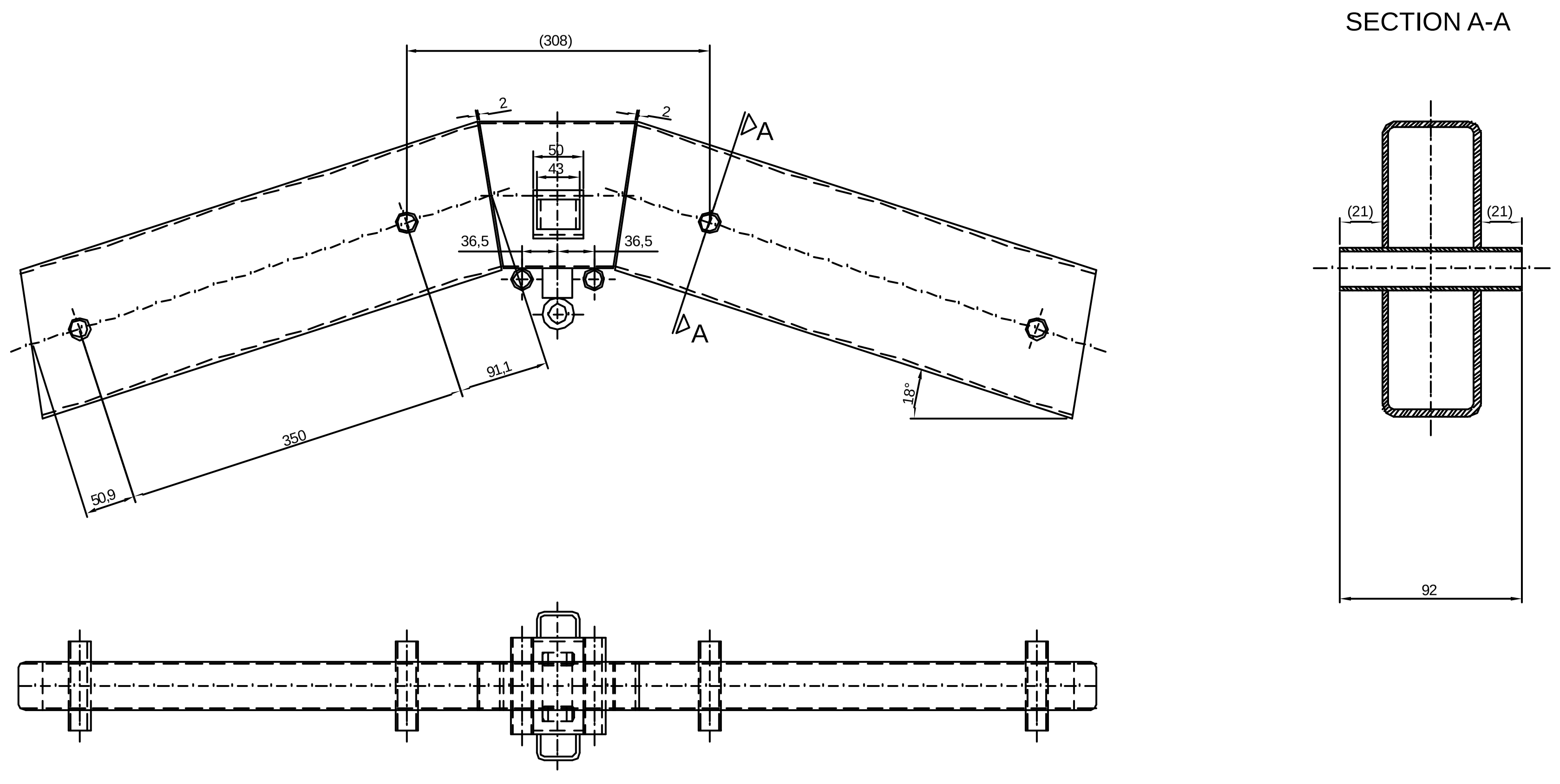
[redacted]

Figure 3: Roof truss

PROJECTIE		
SCHAAL		A4
DATUM	18/07/03	EB

NR. ONGEGALV.	
CODENR.	BAL10T97_2.8E03



Steel tube 150/50/3
grade S235

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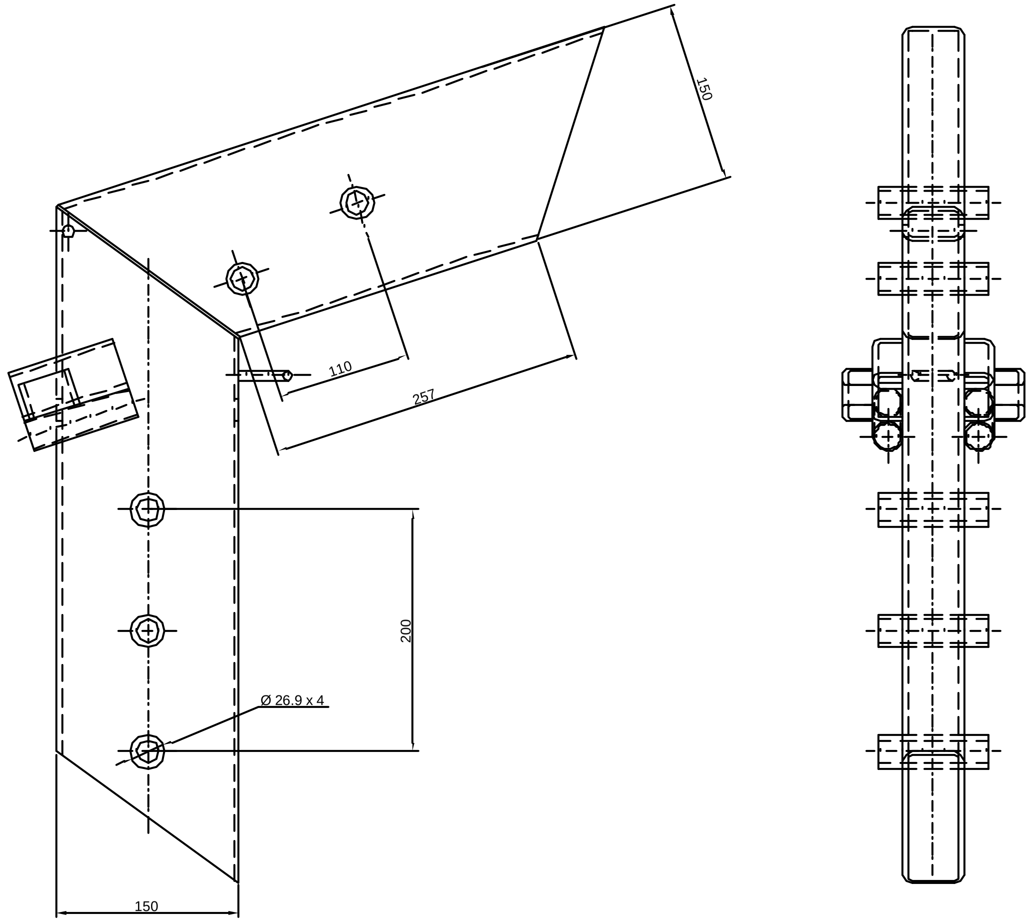
Figure 4: Peak splice

PROJECTIE		NR. ONGEGALV.	
SCHAAL	A4	CODENR.	BAL10t97_2.8E04
DATUM			

Datum afdruk : maandag 12 juni 2006 14:03:03 Door : ####



Steel tube 150/50/4
grade S355

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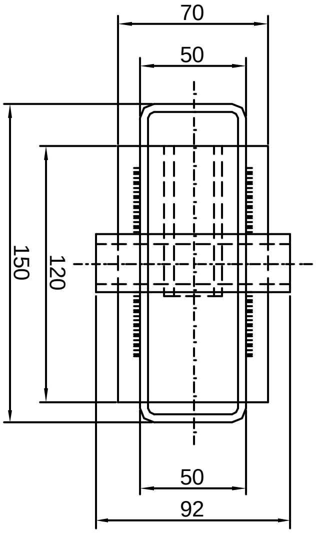
Figure 5: Eaves splice

PROJECTIE			NR. ONGEGALV.	
SCHAAL		A4	CODENR.	BAL10t97_2.8E05
DATUM				



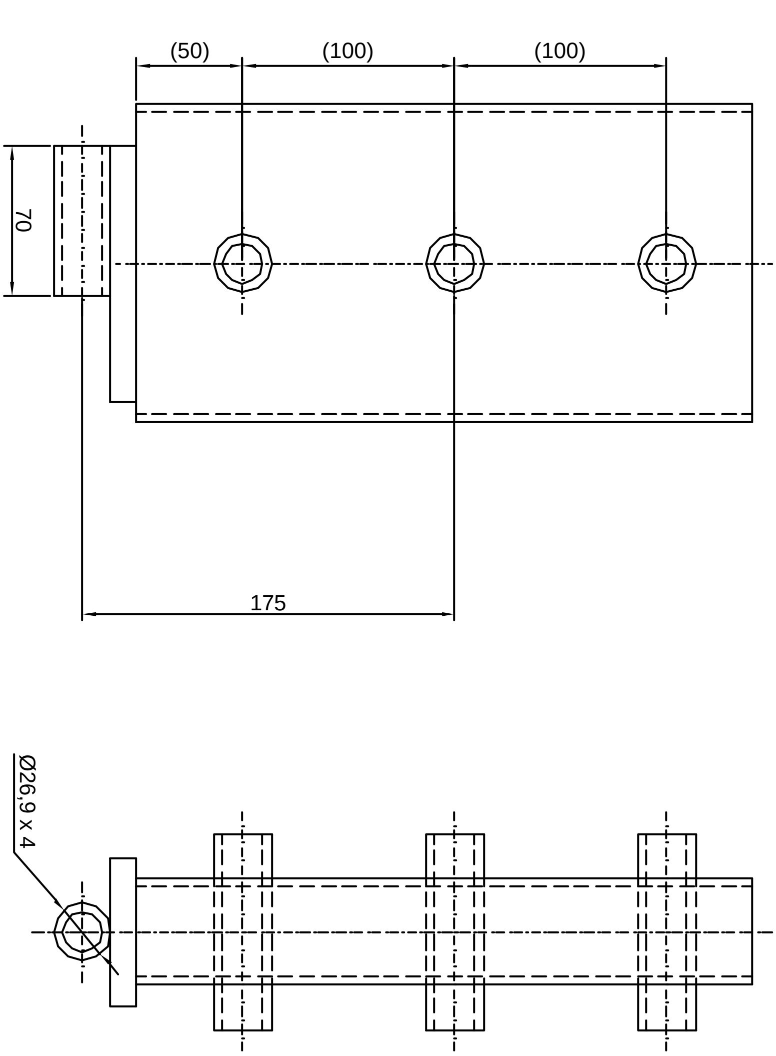


Figure 6: Connection of arch to baseplate

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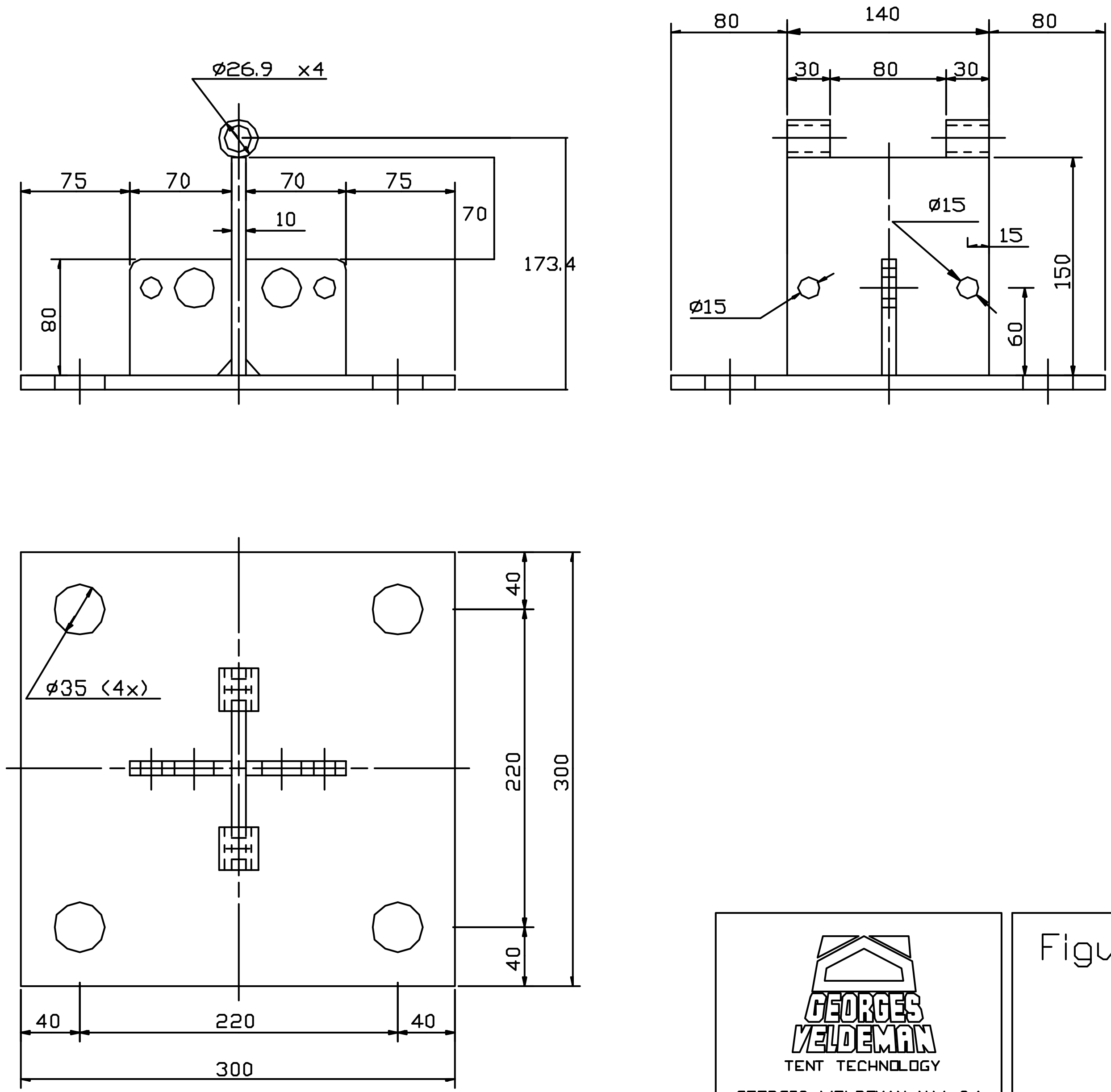
PROJECTIE	
SCHAAL	A4
DATUM	
NR. ONGEGALV.	
CODENR.	BAL10t97_2.8E06



TENT TECHNOLOGY

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Figure 7: Baseplate

PROJECTIE	
SCHAAL	
DATUM	
NR. ONGEGALV.	
CODENR.	BAL10t97_2.8E07

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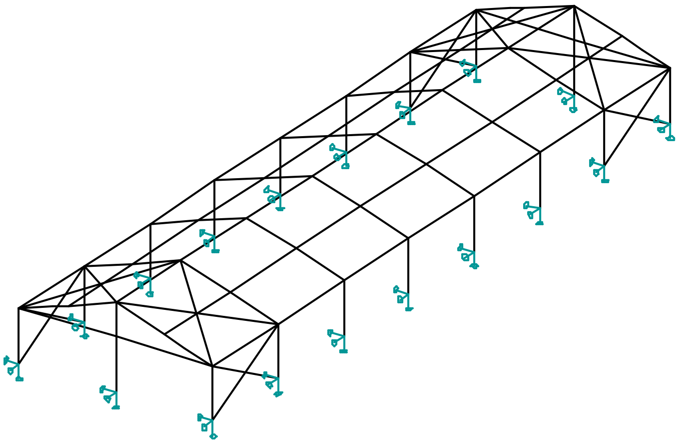
ENCLOSURE 3 :

Print out of calculation results of the Alu 10m x 35m t97 structure by program ESA PRIMA WIN (release 3.50.63).

Contents



Basic data
Type of structure : Frame XYZ

Number of nodes:	64
Number of members:	111
Number of 1D macros:	57
Number of bound. lines:	0
Number of 2D macros:	0
Number of profiles :	6
Number of cases:	9
Number of materials:	2

Material

Name:		
6061 T6		
	E modulus	71000.00 MPa
	Poisson coeff.	0.30
	Density	0.000 kg/mm^3
	Extensibility	2.4e-005 mm/mm.K
6x37 +1TWK		
	Ultimate strength	1770.000 MPa
	Yield design	664.000 MPa
	E modulus	80000.00 MPa
	Poisson coeff.	0.30
	Density	0.000 kg/mm^3
	Extensibility	1.2e-005 mm/mm.K

List of material
Group of members : 1/111

no.	Name:	quality	unit weight kg/mm	length mm	weight kg
1	ALU158 (General)	6061 T6	0.00	126483.20	626.85
2	Alu133/70 (General)	6061 T6	0.00	105000.00	454.76
3	Alu60/60/3 (General)	6061 T6	0.00	70000.00	124.84
4	Alu130/70 (General)	6061 T6	0.00	20000.00	80.84
5	Alu133/70 (General)	6061 T6	0.00	8540.00	36.99
6	Dia 10 6x37 + 1TWK (R10)	6x37 +1TWK	0.00	103302.92	35.79

The total weight of the structure: 1360.07 kg

Surface for painting:
mm^2

Nodes

node	X mm	Y mm	Z mm
1	0	0	0
2	0	0	2649
3	5000	0	4270
4	10000	0	2649
5	10000	0	0
6	7500	0	3459
7	2500	0	3459
8	0	5000	0
9	0	5000	2649
10	2500	5000	3459
11	5000	5000	4270
12	7500	5000	3459
13	10000	5000	2649
14	10000	5000	0
15	0	10000	0
16	0	10000	2649
17	2500	10000	3459
18	5000	10000	4270
19	7500	10000	3459
20	10000	10000	2649
21	10000	10000	0
22	0	15000	0
23	0	15000	2649
24	2500	15000	3459
25	5000	15000	4270
26	7500	15000	3459
27	10000	15000	2649
28	10000	15000	0
29	0	20000	0
30	0	20000	2649
31	2500	20000	3459
32	5000	20000	4270
33	7500	20000	3459
34	10000	20000	2649
35	10000	20000	0
36	0	25000	0
37	0	25000	2649

node	X mm	Y mm	Z mm
38	2500	25000	3459
39	5000	25000	4270
40	7500	25000	3459
41	10000	25000	2649
42	10000	25000	0
43	0	30000	0
44	0	30000	2649
45	2500	30000	3459
46	5000	30000	4270
47	7500	30000	3459
48	10000	30000	2649
49	10000	30000	0
50	0	35000	0
51	0	35000	2649
52	2500	35000	3459
53	5000	35000	4270
54	7500	35000	3459
55	10000	35000	2649
56	10000	35000	0
57	5000	0	0
58	5000	0	2649
59	5000	35000	0
60	5000	35000	2649
61	1708	0	3203
62	8540	0	3122
63	1708	35000	3203
64	8540	35000	3122

Members

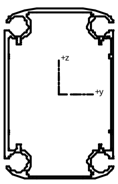
macro	memb	node 1	node 2	length mm	Rx deg	profile	quality
1	1	1	2	2649	0.00	1 - ALU158 (General)	6061 T6
2	2	2	61	1796	0.00	1 - ALU158 (General)	6061 T6
	3	61	7	833	0.00	1 - ALU158 (General)	6061 T6
	4	7	3	2628	0.00	1 - ALU158 (General)	6061 T6
3	5	4	62	1535	0.00	1 - ALU158 (General)	6061 T6
	6	62	6	1093	0.00	1 - ALU158 (General)	6061 T6
	7	6	3	2628	0.00	1 - ALU158 (General)	6061 T6
4	8	5	4	2649	0.00	1 - ALU158 (General)	6061 T6
5	9	8	9	2649	0.00	1 - ALU158 (General)	6061 T6

macro	memb	node 1	node 2	length mm	Rx deg	profile	quality
6	10	9	10	2628	0.00	1 - ALU158 (General)	6061 T6
	11	10	11	2628	0.00	1 - ALU158 (General)	6061 T6
7	12	13	12	2628	0.00	1 - ALU158 (General)	6061 T6
	13	12	11	2628	0.00	1 - ALU158 (General)	6061 T6
8	14	14	13	2649	0.00	1 - ALU158 (General)	6061 T6
9	15	15	16	2649	0.00	1 - ALU158 (General)	6061 T6
10	16	16	17	2628	0.00	1 - ALU158 (General)	6061 T6
	17	17	18	2628	0.00	1 - ALU158 (General)	6061 T6
11	18	20	19	2628	0.00	1 - ALU158 (General)	6061 T6
	19	19	18	2628	0.00	1 - ALU158 (General)	6061 T6
12	20	21	20	2649	0.00	1 - ALU158 (General)	6061 T6
13	21	22	23	2649	0.00	1 - ALU158 (General)	6061 T6
14	22	23	24	2628	0.00	1 - ALU158 (General)	6061 T6
	23	24	25	2628	0.00	1 - ALU158 (General)	6061 T6
15	24	27	26	2628	0.00	1 - ALU158 (General)	6061 T6
	25	26	25	2628	0.00	1 - ALU158 (General)	6061 T6
16	26	28	27	2649	0.00	1 - ALU158 (General)	6061 T6
17	27	29	30	2649	0.00	1 - ALU158 (General)	6061 T6
18	28	30	31	2628	0.00	1 - ALU158 (General)	6061 T6
	29	31	32	2628	0.00	1 - ALU158 (General)	6061 T6
19	30	34	33	2628	0.00	1 - ALU158 (General)	6061 T6
	31	33	32	2628	0.00	1 - ALU158 (General)	6061 T6
20	32	35	34	2649	0.00	1 - ALU158 (General)	6061 T6
21	33	36	37	2649	0.00	1 - ALU158 (General)	6061 T6
22	34	37	38	2628	0.00	1 - ALU158 (General)	6061 T6
	35	38	39	2628	0.00	1 - ALU158 (General)	6061 T6
23	36	41	40	2628	0.00	1 - ALU158 (General)	6061 T6
	37	40	39	2628	0.00	1 - ALU158 (General)	6061 T6
24	38	42	41	2649	0.00	1 - ALU158 (General)	6061 T6
25	39	43	44	2649	0.00	1 - ALU158 (General)	6061 T6
26	40	44	45	2628	0.00	1 - ALU158 (General)	6061 T6
	41	45	46	2628	0.00	1 - ALU158 (General)	6061 T6
27	42	48	47	2628	0.00	1 - ALU158 (General)	6061 T6
	43	47	46	2628	0.00	1 - ALU158 (General)	6061 T6
28	44	49	48	2649	0.00	1 - ALU158 (General)	6061 T6
29	45	50	51	2649	0.00	1 - ALU158 (General)	6061 T6
30	46	51	63	1796	0.00	1 - ALU158 (General)	6061 T6
	47	63	52	833	0.00	1 - ALU158 (General)	6061 T6
	48	52	53	2628	0.00	1 - ALU158 (General)	6061 T6
31	49	55	64	1535	0.00	1 - ALU158 (General)	6061 T6
	50	64	54	1093	0.00	1 - ALU158 (General)	6061 T6
	51	54	53	2628	0.00	1 - ALU158 (General)	6061 T6
32	52	56	55	2649	0.00	1 - ALU158 (General)	6061 T6

macro	memb	node 1	node 2	length mm	Rx deg	profile	quality
33	53	2	9	5000	0.00	2 - Alu133/70 (General)	6061 T6
	54	9	16	5000	0.00	2 - Alu133/70 (General)	6061 T6
	55	16	23	5000	0.00	2 - Alu133/70 (General)	6061 T6
	56	23	30	5000	0.00	2 - Alu133/70 (General)	6061 T6
	57	30	37	5000	0.00	2 - Alu133/70 (General)	6061 T6
	58	37	44	5000	0.00	2 - Alu133/70 (General)	6061 T6
	59	44	51	5000	0.00	2 - Alu133/70 (General)	6061 T6
34	60	7	10	5000	0.00	3 - Alu60/60/3 (General)	6061 T6
	61	10	17	5000	0.00	3 - Alu60/60/3 (General)	6061 T6
	62	17	24	5000	0.00	3 - Alu60/60/3 (General)	6061 T6
	63	24	31	5000	0.00	3 - Alu60/60/3 (General)	6061 T6
	64	31	38	5000	0.00	3 - Alu60/60/3 (General)	6061 T6
	65	38	45	5000	0.00	3 - Alu60/60/3 (General)	6061 T6
	66	45	52	5000	0.00	3 - Alu60/60/3 (General)	6061 T6
35	67	3	11	5000	0.00	2 - Alu133/70 (General)	6061 T6
	68	11	18	5000	0.00	2 - Alu133/70 (General)	6061 T6
	69	18	25	5000	0.00	2 - Alu133/70 (General)	6061 T6
	70	25	32	5000	0.00	2 - Alu133/70 (General)	6061 T6
	71	32	39	5000	0.00	2 - Alu133/70 (General)	6061 T6
	72	39	46	5000	0.00	2 - Alu133/70 (General)	6061 T6
	73	46	53	5000	0.00	2 - Alu133/70 (General)	6061 T6
36	74	6	12	5000	0.00	3 - Alu60/60/3 (General)	6061 T6
	75	12	19	5000	0.00	3 - Alu60/60/3 (General)	6061 T6
	76	19	26	5000	0.00	3 - Alu60/60/3 (General)	6061 T6
	77	26	33	5000	0.00	3 - Alu60/60/3 (General)	6061 T6
	78	33	40	5000	0.00	3 - Alu60/60/3 (General)	6061 T6
	79	40	47	5000	0.00	3 - Alu60/60/3 (General)	6061 T6
	80	47	54	5000	0.00	3 - Alu60/60/3 (General)	6061 T6
37	81	4	13	5000	0.00	2 - Alu133/70 (General)	6061 T6
	82	13	20	5000	0.00	2 - Alu133/70 (General)	6061 T6
	83	20	27	5000	0.00	2 - Alu133/70 (General)	6061 T6
	84	27	34	5000	0.00	2 - Alu133/70 (General)	6061 T6
	85	34	41	5000	0.00	2 - Alu133/70 (General)	6061 T6
	86	41	48	5000	0.00	2 - Alu133/70 (General)	6061 T6
	87	48	55	5000	0.00	2 - Alu133/70 (General)	6061 T6
38	88	5	13	5658	0.00	6 - Dia 10 6x37 + 1TWK (R10...	6x37 +1TWK
39	89	14	4	5658	0.00	6 - Dia 10 6x37 + 1TWK (R10...	6x37 +1TWK
40	90	4	11	7254	0.00	6 - Dia 10 6x37 + 1TWK (R10...	6x37 +1TWK
41	91	13	3	7254	0.00	6 - Dia 10 6x37 + 1TWK (R10...	6x37 +1TWK
42	92	1	9	5658	0.00	6 - Dia 10 6x37 + 1TWK (R10...	6x37 +1TWK
43	93	8	2	5658	0.00	6 - Dia 10 6x37 + 1TWK (R10...	6x37 +1TWK
44	94	2	11	7254	0.00	6 - Dia 10 6x37 + 1TWK (R10...	6x37 +1TWK
45	95	9	3	7254	0.00	6 - Dia 10 6x37 + 1TWK (R10...	6x37 +1TWK

macro	memb	node 1	node 2	length mm	Rx deg	profile	quality
46	96	49	55	5658	0.00	6 - Dia 10 6x37 + 1TWK (R10...	6x37 +1TWK
47	97	56	48	5658	0.00	6 - Dia 10 6x37 + 1TWK (R10...	6x37 +1TWK
48	98	48	53	7254	0.00	6 - Dia 10 6x37 + 1TWK (R10...	6x37 +1TWK
49	99	55	46	7254	0.00	6 - Dia 10 6x37 + 1TWK (R10...	6x37 +1TWK
50	100	43	51	5658	0.00	6 - Dia 10 6x37 + 1TWK (R10...	6x37 +1TWK
51	101	50	44	5658	0.00	6 - Dia 10 6x37 + 1TWK (R10...	6x37 +1TWK
52	102	44	53	7254	0.00	6 - Dia 10 6x37 + 1TWK (R10...	6x37 +1TWK
53	103	51	46	7254	0.00	6 - Dia 10 6x37 + 1TWK (R10...	6x37 +1TWK
54	104	57	58	2649	90.00	5 - Alu133/70 (General)	6061 T6
	105	58	3	1621	90.00	5 - Alu133/70 (General)	6061 T6
55	106	2	58	5000	90.00	4 - Alu130/70 (General)	6061 T6
	107	58	4	5000	90.00	4 - Alu130/70 (General)	6061 T6
56	108	59	60	2649	90.00	5 - Alu133/70 (General)	6061 T6
	109	60	53	1621	90.00	5 - Alu133/70 (General)	6061 T6
57	110	51	60	5000	90.00	4 - Alu130/70 (General)	6061 T6
	111	60	55	5000	90.00	4 - Alu130/70 (General)	6061 T6

Profiles

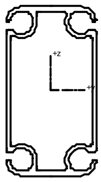


ALU158 (General)

Profile no. 1 - ALU158 (General)
Material : 19 - 6061 T6

A:	1.835548e+003 mm^2		
Ay/A:	1.000	Az/A:	1.000
Iy:	6.412627e+006 mm^4	Iz:	2.744490e+006 mm^4
Iyz:	-4.390313e-004 mm^4	It:	9.157116e+006 mm^4
Iw:	0.000000e+000 mm^6		
Wely:	8.117247e+004 mm^3	Welz:	5.488978e+004 mm^3
Wply:	1.008405e+005 mm^3	Wplz:	6.671818e+004 mm^3
cy:	0.00 mm	cz:	0.00 mm
iy:	59.11 mm	iz:	38.67 mm
dy:	0.00 mm	dz:	0.00 mm
Outline :		0.00 mm	

Type for check: Untypical section

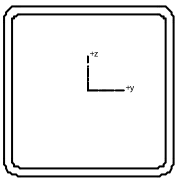


Alu133/70 (General)

Profile no. 2 - Alu133/70 (General)
Material : 19 - 6061 T6

A:	1.604102e+003 mm^2		
Ay/A:	1.000	Az/A:	1.000
Iy:	3.818656e+006 mm^4	Iz:	1.057790e+006 mm^4
Iyz:	2.525217e-008 mm^4	It:	4.876446e+006 mm^4
Iw:	0.000000e+000 mm^6		
Wely:	5.742340e+004 mm^3	Welz:	3.022257e+004 mm^3
Wply:	7.213053e+004 mm^3	Wplz:	3.774137e+004 mm^3
cy:	0.00 mm	cz:	0.00 mm
iy:	48.79 mm	iz:	25.68 mm
dy:	0.00 mm	dz:	0.00 mm
Outline :		0.00 mm	

Type for check: Untypical section

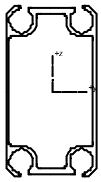


Alu60/60/3 (General)

Profile no. 3 - Alu60/60/3 (General)
Material : 19 - 6061 T6

A:	6.605234e+002 mm^2		
Ay/A:	1.000	Az/A:	1.000
Iy:	3.510982e+005 mm^4	Iz:	3.510982e+005 mm^4
Iyz:	-1.092637e+001 mm^4	It:	7.021964e+005 mm^4
Iw:	0.000000e+000 mm^6		
Wely:	1.170302e+004 mm^3	Welz:	1.170302e+004 mm^3
Wply:	1.394310e+004 mm^3	Wplz:	1.394310e+004 mm^3
cy:	0.00 mm	cz:	0.00 mm
iy:	23.06 mm	iz:	23.06 mm
dy:	0.00 mm	dz:	0.00 mm
Outline :		0.00 mm	

Type for check: Untypical section

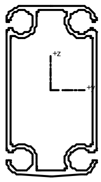


Alu130/70 (General)

Profile no. 4 - Alu130/70 (General)
Material : 19 - 6061 T6

A:	1.497113e+003 mm^2		
Ay/A:	1.000	Az/A:	1.000
Iy:	3.124341e+006 mm^4	Iz:	1.116041e+006 mm^4
Iyz:	6.637474e+002 mm^4	It:	4.240382e+006 mm^4
Iw:	0.000000e+000 mm^6		
Wely:	4.805314e+004 mm^3	Welz:	3.187422e+004 mm^3
Wply:	6.307383e+004 mm^3	Wplz:	3.804318e+004 mm^3
cy:	0.00 mm	cz:	0.00 mm
iy:	45.68 mm	iz:	27.30 mm
dy:	0.00 mm	dz:	0.00 mm
Outline :		0.00 mm	

Type for check: Untypical section

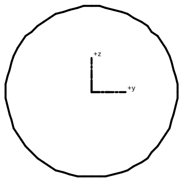


Alu133/70 (General)

Profile no. 5 - Alu133/70 (General)
Material : 19 - 6061 T6

A:	1.604102e+003 mm^2		
Ay/A:	1.000	Az/A:	1.000
Iy:	3.818656e+006 mm^4	Iz:	1.057790e+006 mm^4
Iyz:	2.525217e-008 mm^4	It:	4.876446e+006 mm^4
Iw:	0.000000e+000 mm^6		
Wely:	5.742340e+004 mm^3	Welz:	3.022257e+004 mm^3
Wply:	7.213053e+004 mm^3	Wplz:	3.774137e+004 mm^3
cy:	0.00 mm	cz:	0.00 mm
iy:	48.79 mm	iz:	25.68 mm
dy:	0.00 mm	dz:	0.00 mm
Outline :		0.00 mm	

Type for check: Untypical section

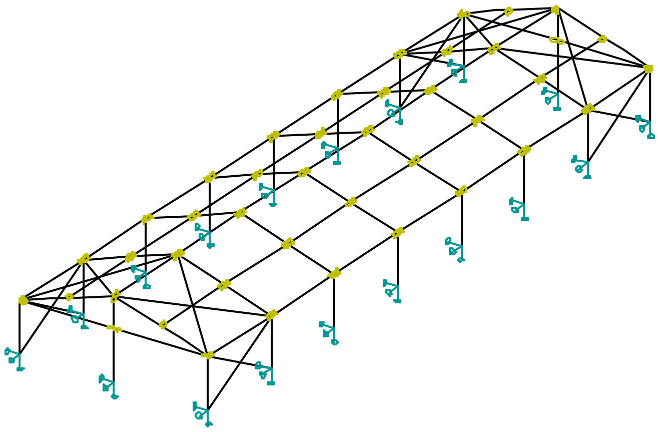


Dia 10 6x37 + 1TWK (R10)

Profile no. 6 - Dia 10 6x37 + 1TWK (R10)
Material : 20 - 6x37 +1TWK

A:	7.850000e+001 mm^2		
Ay/A:	0.850	Az/A:	0.850
Iy:	4.814015e+002 mm^4	Iz:	4.814015e+002 mm^4
Iyz:	0.000000e+000 mm^4	It:	9.628029e+002 mm^4
Iw:	0.000000e+000 mm^6		
Wely:	9.698743e+001 mm^3	Welz:	9.698743e+001 mm^3
Wply:	1.664764e+002 mm^3	Wplz:	1.664764e+002 mm^3
cy:	0.00 mm	cz:	0.00 mm
iy:	2.48 mm	iz:	2.48 mm
dy:	0.00 mm	dz:	0.00 mm
Outline :		31.38 mm	

Type for check: Untypical section



Hinges

Hinges

memb	type	pos
53	fiyfiz	beg
	fiyfiz	end
54	fiyfiz	beg
	fiyfiz	end
55	fiyfiz	beg
	fiyfiz	end
56	fiyfiz	beg
	fiyfiz	end
57	fiyfiz	beg
	fiyfiz	end
58	fiyfiz	beg
	fiyfiz	end
59	fiyfiz	beg
	fiyfiz	end
60	fiyfiz	beg
	fiyfiz	end
61	fiyfiz	beg
	fiyfiz	end

memb	type	pos
62	fiyfiz	beg
	fiyfiz	end
63	fiyfiz	beg
	fiyfiz	end
64	fiyfiz	beg
	fiyfiz	end
65	fiyfiz	beg
	fiyfiz	end
66	fiyfiz	beg
	fiyfiz	end
67	fiyfiz	beg
	fiyfiz	end
68	fiyfiz	beg
	fiyfiz	end
69	fiyfiz	beg
	fiyfiz	end
70	fiyfiz	beg
	fiyfiz	end
71	fiyfiz	beg
	fiyfiz	end
72	fiyfiz	beg
	fiyfiz	end
73	fiyfiz	beg
	fiyfiz	end
74	fiyfiz	beg
	fiyfiz	end
75	fiyfiz	beg
	fiyfiz	end
76	fiyfiz	beg
	fiyfiz	end
77	fiyfiz	beg
	fiyfiz	end
78	fiyfiz	beg
	fiyfiz	end
79	fiyfiz	beg
	fiyfiz	end
80	fiyfiz	beg
	fiyfiz	end
81	fiyfiz	beg
	fiyfiz	end
82	fiyfiz	beg
	fiyfiz	end
83	fiyfiz	beg

memb	type	pos
	fiyfiz	end
84	fiyfiz	beg
	fiyfiz	end
85	fiyfiz	beg
	fiyfiz	end
86	fiyfiz	beg
	fiyfiz	end
87	fiyfiz	beg
	fiyfiz	end
105	fiy	end
107	fiy	beg
	fiy	end
106	fiy	beg
	fiy	end
109	fiy	end
110	fiy	beg
	fiy	end
111	fiy	beg
	fiy	end

Supports

support	node	type	Size mm
1	1	XYZ	0.00
2	5	XYZ	0.00
3	8	XYZ	0.00
4	14	XYZ	0.00
5	15	XYZ	0.00
6	21	XYZ	0.00
7	22	XYZ	0.00
8	28	XYZ	0.00
9	29	XYZ	0.00
10	35	XYZ	0.00
11	36	XYZ	0.00
12	42	XYZ	0.00
13	43	XYZ	0.00
14	49	XYZ	0.00
15	50	XYZ	0.00
16	56	XYZ	0.00

support	node	type	Size mm
17	57	XYZ	0.00
18	59	XYZ	0.00

Loadcases

Case	Name:	Description
1	self weight	Self weight. Direction -Z
2	dead load - connections	Permanent - Loads
3	dead load - fabric	Permanent - Loads
4	dead load - sum	Permanent Summational load case 2. dead load - connections, 1.00 3. dead load - fabric, 1.00
5	wind side overpr	Variable - wind Excl.
6	wind side underpr	Variable - wind Excl.
7	wind gable overpr	Variable - wind Excl.
8	wind gable underpr	Variable - wind Excl.
9	dead load - extra	Permanent - Loads

Variable loads group

Name:		Description
snow	Excl.	BS - load type VL - vertical crane load
wind	Excl.	BS - load type VL - vertical crane load

Loadcase no. 2 - nodal loads

node	Fx kN	Fy kN	Fz kN	Mx kNm	My kNm	Mz kNm
2	0.00	0.00	-0.10	0.00	0.00	0.00
3	0.00	0.00	-0.10	0.00	0.00	0.00
4	0.00	0.00	-0.10	0.00	0.00	0.00
9	0.00	0.00	-0.10	0.00	0.00	0.00
11	0.00	0.00	-0.10	0.00	0.00	0.00
13	0.00	0.00	-0.10	0.00	0.00	0.00
16	0.00	0.00	-0.10	0.00	0.00	0.00
18	0.00	0.00	-0.10	0.00	0.00	0.00
20	0.00	0.00	-0.10	0.00	0.00	0.00
23	0.00	0.00	-0.10	0.00	0.00	0.00
25	0.00	0.00	-0.10	0.00	0.00	0.00
27	0.00	0.00	-0.10	0.00	0.00	0.00

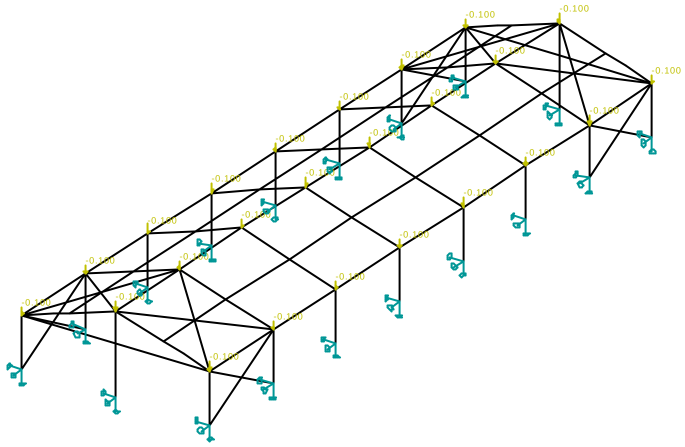
node	Fx kN	Fy kN	Fz kN	Mx kNm	My kNm	Mz kNm
30	0.00	0.00	-0.10	0.00	0.00	0.00
32	0.00	0.00	-0.10	0.00	0.00	0.00
34	0.00	0.00	-0.10	0.00	0.00	0.00
37	0.00	0.00	-0.10	0.00	0.00	0.00
39	0.00	0.00	-0.10	0.00	0.00	0.00
41	0.00	0.00	-0.10	0.00	0.00	0.00
44	0.00	0.00	-0.10	0.00	0.00	0.00
46	0.00	0.00	-0.10	0.00	0.00	0.00
48	0.00	0.00	-0.10	0.00	0.00	0.00
51	0.00	0.00	-0.10	0.00	0.00	0.00
53	0.00	0.00	-0.10	0.00	0.00	0.00
55	0.00	0.00	-0.10	0.00	0.00	0.00

Loadcase no. 4 - nodal loads

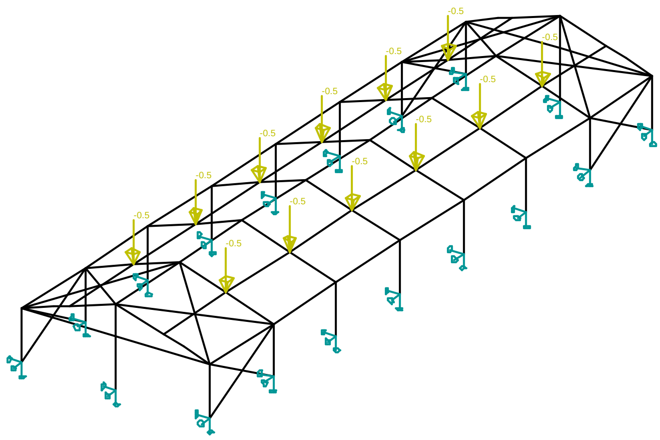
node	Fx kN	Fy kN	Fz kN	Mx kNm	My kNm	Mz kNm
2	0.00	0.00	-0.10	0.00	0.00	0.00
3	0.00	0.00	-0.10	0.00	0.00	0.00
4	0.00	0.00	-0.10	0.00	0.00	0.00
9	0.00	0.00	-0.10	0.00	0.00	0.00
11	0.00	0.00	-0.10	0.00	0.00	0.00
13	0.00	0.00	-0.10	0.00	0.00	0.00
16	0.00	0.00	-0.10	0.00	0.00	0.00
18	0.00	0.00	-0.10	0.00	0.00	0.00
20	0.00	0.00	-0.10	0.00	0.00	0.00
23	0.00	0.00	-0.10	0.00	0.00	0.00
25	0.00	0.00	-0.10	0.00	0.00	0.00
27	0.00	0.00	-0.10	0.00	0.00	0.00
30	0.00	0.00	-0.10	0.00	0.00	0.00
32	0.00	0.00	-0.10	0.00	0.00	0.00
34	0.00	0.00	-0.10	0.00	0.00	0.00
37	0.00	0.00	-0.10	0.00	0.00	0.00
39	0.00	0.00	-0.10	0.00	0.00	0.00
41	0.00	0.00	-0.10	0.00	0.00	0.00
44	0.00	0.00	-0.10	0.00	0.00	0.00
46	0.00	0.00	-0.10	0.00	0.00	0.00
48	0.00	0.00	-0.10	0.00	0.00	0.00
51	0.00	0.00	-0.10	0.00	0.00	0.00
53	0.00	0.00	-0.10	0.00	0.00	0.00
55	0.00	0.00	-0.10	0.00	0.00	0.00

Loadcase no. 9 - nodal loads

node	Fx kN	Fy kN	Fz kN	Mx kNm	My kNm	Mz kNm
10	0.00	0.00	-0.50	0.00	0.00	0.00
12	0.00	0.00	-0.50	0.00	0.00	0.00
17	0.00	0.00	-0.50	0.00	0.00	0.00
19	0.00	0.00	-0.50	0.00	0.00	0.00
24	0.00	0.00	-0.50	0.00	0.00	0.00
26	0.00	0.00	-0.50	0.00	0.00	0.00
31	0.00	0.00	-0.50	0.00	0.00	0.00
33	0.00	0.00	-0.50	0.00	0.00	0.00
38	0.00	0.00	-0.50	0.00	0.00	0.00
40	0.00	0.00	-0.50	0.00	0.00	0.00
45	0.00	0.00	-0.50	0.00	0.00	0.00
47	0.00	0.00	-0.50	0.00	0.00	0.00



Nodal loads.Loadcases - 2



Nodal loads.Loadcases - 9

Loadcase no. 3 - distributed loads

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
2	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.02 -0.02
3	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.02 -0.02
6	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
7	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
10	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
11	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
14	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
15	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
18	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
19	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
22	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
23	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
26	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
27	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
30	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.02 -0.02
31	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.02 -0.02

Loadcase no. 4 - distributed loads

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
2	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.02 -0.02
3	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.02 -0.02
6	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
7	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
10	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
11	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
14	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
15	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
18	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
19	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
22	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
23	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
26	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
27	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.03 -0.03
30	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.02 -0.02

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
31	force kN/m	0.00 rel 1.00	0.00	0.00	glo len	0.00 0.00	0.00 0.00	-0.02 -0.02

Loadcase no. 5 - distributed loads

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
1	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.72 -0.72
	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	-0.73 0.00	0.00 0.00
	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 -0.73	0.00 0.00
2	force kN/m	0.16 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.35 0.35
	force kN/m	0.00 rel 0.16	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.95 0.95
	force kN/m	0.00 abs 1708.00	0.00	0.00	glo len	0.00 0.00	0.00 -0.15	0.00 0.00
	force kN/m	1708.00 abs 1795.52	0.00	0.00	glo len	0.00 0.00	-0.15 0.00	0.00 0.00
	force kN/m	4317.60 abs 5256.20	0.00	0.00	glo len	0.00 0.00	-0.23 0.00	0.00 0.00
	force kN/m	1708.00 abs 1795.52	0.00	0.00	glo len	0.00 0.00	0.00 -0.10	0.00 0.00
	force kN/m	1795.52 abs 2628.10	0.00	0.00	glo len	0.00 0.00	-0.10 -0.14	0.00 0.00
	force kN/m	2628.10 abs 4317.60	0.00	0.00	glo len	0.00 0.00	-0.14 -0.23	0.00 0.00
3	force kN/m	0.00 rel 0.84	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.48 0.48
	force kN/m	1460.00 abs 1534.81	0.00	0.00	glo len	0.00 0.00	0.00 -0.08	0.00 0.00
	force kN/m	1534.81 abs 2628.10	0.00	0.00	glo len	0.00 0.00	-0.08 -0.14	0.00 0.00
	force kN/m	2628.10 abs 4317.60	0.00	0.00	glo len	0.00 0.00	-0.14 -0.23	0.00 0.00
	force kN/m	4317.60 abs 5256.20	0.00	0.00	glo len	0.00 0.00	-0.23 0.00	0.00 0.00
	force kN/m	0.84 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.18 1.18
	force kN/m	1460.00 abs 1534.81	0.00	0.00	glo len	0.00 0.00	-0.05 0.00	0.00 0.00
	force kN/m	0.00 abs 1460.00	0.00	0.00	glo len	0.00 0.00	0.00 -0.05	0.00 0.00
4	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.49 -0.49

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	-0.28 0.00	0.00 0.00
	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 -0.28	0.00 0.00
5	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.43 -1.43
6	force kN/m	0.00 rel 0.16	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.60 1.60
	force kN/m	0.16 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.70 0.70
7	force kN/m	0.00 rel 0.84	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.97 0.97
	force kN/m	0.84 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.87 1.87
8	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.97 -0.97
9	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.43 -1.43
10	force kN/m	0.16 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.70 0.70
	force kN/m	0.00 rel 0.16	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.44 1.44
11	force kN/m	0.84 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.59 1.59
	force kN/m	0.00 rel 0.84	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.97 0.97
12	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.97 -0.97
13	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.43 -1.43
14	force kN/m	0.00 rel 0.16	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.44 1.44
	force kN/m	0.16 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.70 0.70
15	force kN/m	0.00 rel 0.84	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.97 0.97
	force kN/m	0.84 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.59 1.59
16	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.97 -0.97
17	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.43 -1.43
18	force kN/m	0.00 rel 0.16	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.44 1.44
	force kN/m	0.16 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.70 0.70
19	force kN/m	0.84 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.59 1.59

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
	force kN/m	0.00 rel 0.84	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.97 0.97
20	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.97 -0.97
21	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.43 -1.43
22	force kN/m	0.16 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.70 0.70
	force kN/m	0.00 rel 0.16	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.44 1.44
23	force kN/m	0.00 rel 0.84	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.97 0.97
	force kN/m	0.84 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.59 1.59
24	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.97 -0.97
25	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.43 -1.43
26	force kN/m	0.00 rel 0.16	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.60 1.60
	force kN/m	0.16 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.70 0.70
27	force kN/m	0.00 rel 0.84	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.97 0.97
	force kN/m	0.84 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.87 1.87
28	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.97 -0.97
29	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.72 -0.72
	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	0.73 0.00	0.00 0.00
	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.73	0.00 0.00
30	force kN/m	0.16 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.35 0.35
	force kN/m	0.00 rel 0.16	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.95 0.95
	force kN/m	1708.00 abs 1795.52	0.00	0.00	glo len	0.00 0.00	0.15 0.00	0.00 0.00
	force kN/m	0.00 abs 1708.00	0.00	0.00	glo len	0.00 0.00	0.00 0.15	0.00 0.00
	force kN/m	1795.52 abs 2628.10	0.00	0.00	glo len	0.00 0.00	0.10 0.14	0.00 0.00
	force kN/m	2628.10 abs 4317.60	0.00	0.00	glo len	0.00 0.00	0.14 0.23	0.00 0.00
	force kN/m	4317.60 abs 5256.20	0.00	0.00	glo len	0.00 0.00	0.23 0.00	0.00 0.00

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
	force kN/m	1708.00 abs 1795.52	0.00	0.00	glo len	0.00 0.00	0.00 0.10	0.00 0.00
31	force kN/m	1534.81 abs 2628.10	0.00	0.00	glo len	0.00 0.00	0.08 0.14	0.00 0.00
	force kN/m	2628.10 abs 4317.60	0.00	0.00	glo len	0.00 0.00	0.14 0.23	0.00 0.00
	force kN/m	0.00 abs 1460.00	0.00	0.00	glo len	0.00 0.00	0.00 0.05	0.00 0.00
	force kN/m	0.00 rel 0.84	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.48 0.48
	force kN/m	0.84 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.18 1.18
	force kN/m	1460.00 abs 1534.81	0.00	0.00	glo len	0.00 0.00	0.05 0.00	0.00 0.00
	force kN/m	1460.00 abs 1534.81	0.00	0.00	glo len	0.00 0.00	0.00 0.08	0.00 0.00
	force kN/m	4317.60 abs 5256.20	0.00	0.00	glo len	0.00 0.00	0.23 0.00	0.00 0.00
32	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.28	0.00 0.00
	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.49 -0.49
	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	0.28 0.00	0.00 0.00
54	force kN/m	2649.00 abs 3331.40	0.00	0.00	glo len	0.00 0.00	0.00 -0.46	0.00 0.00
	force kN/m	3331.40 abs 4270.00	0.00	0.00	glo len	0.00 0.00	-0.46 0.00	0.00 0.00
	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 -0.90	0.00 0.00
	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	-0.90 0.00	0.00 0.00
55	force kN/m	4317.60 abs 5000.00	0.00	0.00	glo len	0.00 0.00	-0.46 0.00	0.00 0.00
	force kN/m	1708.00 abs 3675.50	0.00	0.00	glo len	0.00 0.00	-0.54 -0.64	0.00 0.00
	force kN/m	3675.50 abs 4317.60	0.00	0.00	glo len	0.00 0.00	-0.64 -0.46	0.00 0.00
	force kN/m	5000.00 abs 5682.40	0.00	0.00	glo len	0.00 0.00	0.00 -0.46	0.00 0.00
	force kN/m	5682.40 abs 6324.50	0.00	0.00	glo len	0.00 0.00	-0.46 -0.64	0.00 0.00
	force kN/m	1324.50 abs 1708.00	0.00	0.00	glo len	0.00 0.00	-0.84 -0.88	0.00 0.00
	force kN/m	8540.00 abs 8675.50	0.00	0.00	glo len	0.00 0.00	-0.33 -0.32	0.00 0.00
	force kN/m	8675.50 abs 10000.00	0.00	0.00	glo len	0.00 0.00	-0.32 0.00	0.00 0.00

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
	force kN/m	6324.50 abs 8540.00	0.00	0.00	glo len	0.00 0.00	-0.64 -0.53	0.00 0.00
	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 -0.84	0.00 0.00
56	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	0.90 0.00	0.00 0.00
	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.90	0.00 0.00
	force kN/m	2649.00 abs 3331.40	0.00	0.00	glo len	0.00 0.00	0.00 0.46	0.00 0.00
	force kN/m	3331.40 abs 4270.00	0.00	0.00	glo len	0.00 0.00	0.46 0.00	0.00 0.00
57	force kN/m	8540.00 abs 8675.50	0.00	0.00	glo len	0.00 0.00	0.33 0.32	0.00 0.00
	force kN/m	1708.00 abs 3675.50	0.00	0.00	glo len	0.00 0.00	0.54 0.64	0.00 0.00
	force kN/m	3675.50 abs 4317.60	0.00	0.00	glo len	0.00 0.00	0.64 0.46	0.00 0.00
	force kN/m	4317.60 abs 5000.00	0.00	0.00	glo len	0.00 0.00	0.46 0.00	0.00 0.00
	force kN/m	8675.50 abs 10000.00	0.00	0.00	glo len	0.00 0.00	0.32 0.00	0.00 0.00
	force kN/m	1324.50 abs 1708.00	0.00	0.00	glo len	0.00 0.00	0.84 0.88	0.00 0.00
	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.84	0.00 0.00
	force kN/m	6324.50 abs 8540.00	0.00	0.00	glo len	0.00 0.00	0.64 0.53	0.00 0.00
	force kN/m	5000.00 abs 5682.40	0.00	0.00	glo len	0.00 0.00	0.00 0.46	0.00 0.00
	force kN/m	5682.40 abs 6324.50	0.00	0.00	glo len	0.00 0.00	0.46 0.64	0.00 0.00

Loadcase no. 6 - distributed loads

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
1	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.99 -0.99
	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	-0.58 0.00	0.00 0.00
	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 -0.58	0.00 0.00
2	force kN/m	0.16 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.50 -0.50
	force kN/m	0.00 rel 0.16	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.58 -0.58

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
	force kN/m	0.00 abs 1708.00	0.00	0.00	glo len	0.00 0.00	0.00 -0.12	0.00 0.00
	force kN/m	1708.00 abs 1795.52	0.00	0.00	glo len	0.00 0.00	-0.12 0.00	0.00 0.00
	force kN/m	4317.60 abs 5256.20	0.00	0.00	glo len	0.00 0.00	-0.16 0.00	0.00 0.00
	force kN/m	1708.00 abs 1795.52	0.00	0.00	glo len	0.00 0.00	0.00 -0.06	0.00 0.00
	force kN/m	1795.52 abs 2628.10	0.00	0.00	glo len	0.00 0.00	-0.06 -0.10	0.00 0.00
	force kN/m	2628.10 abs 4317.60	0.00	0.00	glo len	0.00 0.00	-0.10 -0.16	0.00 0.00
3	force kN/m	0.00 rel 0.84	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.21 0.21
	force kN/m	1460.00 abs 1534.81	0.00	0.00	glo len	0.00 0.00	0.00 -0.06	0.00 0.00
	force kN/m	1534.81 abs 2628.10	0.00	0.00	glo len	0.00 0.00	-0.06 -0.10	0.00 0.00
	force kN/m	2628.10 abs 4317.60	0.00	0.00	glo len	0.00 0.00	-0.10 -0.16	0.00 0.00
	force kN/m	4317.60 abs 5256.20	0.00	0.00	glo len	0.00 0.00	-0.16 0.00	0.00 0.00
	force kN/m	0.84 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.91 0.91
	force kN/m	1460.00 abs 1534.81	0.00	0.00	glo len	0.00 0.00	-0.02 0.00	0.00 0.00
	force kN/m	0.00 abs 1460.00	0.00	0.00	glo len	0.00 0.00	0.00 -0.02	0.00 0.00
4	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.21 -0.21
	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	-0.14 0.00	0.00 0.00
	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 -0.14	0.00 0.00
5	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.98 -1.98
6	force kN/m	0.00 rel 0.16	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.09 -1.09
	force kN/m	0.16 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.01 -1.01
7	force kN/m	0.00 rel 0.84	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.43 0.43
	force kN/m	0.84 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.32 1.32
8	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.43 -0.43
9	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.98 -1.98

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
10	force kN/m	0.16 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.01 -1.01
	force kN/m	0.00 rel 0.16	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.05 -1.05
11	force kN/m	0.00 rel 0.84	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.43 0.43
	force kN/m	0.84 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.05 1.05
12	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.43 -0.43
13	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.98 -1.98
14	force kN/m	0.00 rel 0.16	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.05 -1.05
	force kN/m	0.16 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.01 -1.01
15	force kN/m	0.84 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.05 1.05
	force kN/m	0.00 rel 0.84	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.43 0.43
16	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.43 -0.43
17	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.98 -1.98
18	force kN/m	0.00 rel 0.16	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.05 -1.05
	force kN/m	0.16 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.01 -1.01
19	force kN/m	0.00 rel 0.84	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.43 0.43
	force kN/m	0.84 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.05 1.05
20	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.43 -0.43
21	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.98 -1.98
22	force kN/m	0.16 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.01 -1.01
	force kN/m	0.00 rel 0.16	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.05 -1.05
23	force kN/m	0.84 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.05 1.05
	force kN/m	0.00 rel 0.84	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.43 0.43
24	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.43 -0.43
25	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.98 -1.98

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
26	force kN/m	0.00 rel 0.16	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.09 -1.09
	force kN/m	0.16 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.01 -1.01
27	force kN/m	0.00 rel 0.84	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.43 0.43
	force kN/m	0.84 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.32 1.32
28	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.43 -0.43
29	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.99 -0.99
	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	0.58 0.00	0.00 0.00
	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.58	0.00 0.00
30	force kN/m	0.16 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.50 -0.50
	force kN/m	0.00 rel 0.16	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.58 -0.58
	force kN/m	1708.00 abs 1795.52	0.00	0.00	glo len	0.00 0.00	0.12 0.00	0.00 0.00
	force kN/m	0.00 abs 1708.00	0.00	0.00	glo len	0.00 0.00	0.00 0.12	0.00 0.00
	force kN/m	1795.52 abs 2628.10	0.00	0.00	glo len	0.00 0.00	0.06 0.10	0.00 0.00
	force kN/m	2628.10 abs 4317.60	0.00	0.00	glo len	0.00 0.00	0.10 0.16	0.00 0.00
	force kN/m	4317.60 abs 5256.20	0.00	0.00	glo len	0.00 0.00	0.16 0.00	0.00 0.00
	force kN/m	1708.00 abs 1795.52	0.00	0.00	glo len	0.00 0.00	0.00 0.06	0.00 0.00
31	force kN/m	1534.81 abs 2628.10	0.00	0.00	glo len	0.00 0.00	0.06 0.10	0.00 0.00
	force kN/m	2628.10 abs 4317.60	0.00	0.00	glo len	0.00 0.00	0.10 0.16	0.00 0.00
	force kN/m	0.00 abs 1460.00	0.00	0.00	glo len	0.00 0.00	0.00 0.02	0.00 0.00
	force kN/m	0.00 rel 0.84	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.21 0.21
	force kN/m	0.84 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.91 0.91
	force kN/m	1460.00 abs 1534.81	0.00	0.00	glo len	0.00 0.00	0.02 0.00	0.00 0.00
	force kN/m	1460.00 abs 1534.81	0.00	0.00	glo len	0.00 0.00	0.00 0.06	0.00 0.00
	force kN/m	4317.60 abs 5256.20	0.00	0.00	glo len	0.00 0.00	0.16 0.00	0.00 0.00

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
32	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.14	0.00 0.00
	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.21 -0.21
	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	0.14 0.00	0.00 0.00
54	force kN/m	2649.00 abs 3331.40	0.00	0.00	glo len	0.00 0.00	0.00 -0.31	0.00 0.00
	force kN/m	3331.40 abs 4270.00	0.00	0.00	glo len	0.00 0.00	-0.31 0.00	0.00 0.00
	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 -0.61	0.00 0.00
	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	-0.61 0.00	0.00 0.00
55	force kN/m	4317.60 abs 5000.00	0.00	0.00	glo len	0.00 0.00	-0.31 0.00	0.00 0.00
	force kN/m	1708.00 abs 3675.50	0.00	0.00	glo len	0.00 0.00	-0.37 -0.44	0.00 0.00
	force kN/m	3675.50 abs 4317.60	0.00	0.00	glo len	0.00 0.00	-0.44 -0.31	0.00 0.00
	force kN/m	5000.00 abs 5682.40	0.00	0.00	glo len	0.00 0.00	0.00 -0.31	0.00 0.00
	force kN/m	5682.40 abs 6324.50	0.00	0.00	glo len	0.00 0.00	-0.31 -0.44	0.00 0.00
	force kN/m	1324.50 abs 1708.00	0.00	0.00	glo len	0.00 0.00	-0.67 -0.70	0.00 0.00
	force kN/m	8540.00 abs 8675.50	0.00	0.00	glo len	0.00 0.00	-0.16 -0.16	0.00 0.00
	force kN/m	8675.50 abs 10000.00	0.00	0.00	glo len	0.00 0.00	-0.16 0.00	0.00 0.00
	force kN/m	6324.50 abs 8540.00	0.00	0.00	glo len	0.00 0.00	-0.44 -0.36	0.00 0.00
	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 -0.67	0.00 0.00
56	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	0.61 0.00	0.00 0.00
	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.61	0.00 0.00
	force kN/m	2649.00 abs 3331.40	0.00	0.00	glo len	0.00 0.00	0.00 0.31	0.00 0.00
	force kN/m	3331.40 abs 4270.00	0.00	0.00	glo len	0.00 0.00	0.31 0.00	0.00 0.00
57	force kN/m	8540.00 abs 8675.50	0.00	0.00	glo len	0.00 0.00	0.16 0.16	0.00 0.00
	force kN/m	1708.00 abs 3675.50	0.00	0.00	glo len	0.00 0.00	0.37 0.44	0.00 0.00
	force kN/m	3675.50 abs 4317.60	0.00	0.00	glo len	0.00 0.00	0.44 0.31	0.00 0.00

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
	force kN/m	4317.60 abs 5000.00	0.00	0.00	glo len	0.00 0.00	0.31 0.00	0.00 0.00
	force kN/m	8675.50 abs 10000.00	0.00	0.00	glo len	0.00 0.00	0.16 0.00	0.00 0.00
	force kN/m	1324.50 abs 1708.00	0.00	0.00	glo len	0.00 0.00	0.67 0.70	0.00 0.00
	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.67	0.00 0.00
	force kN/m	6324.50 abs 8540.00	0.00	0.00	glo len	0.00 0.00	0.44 0.36	0.00 0.00
	force kN/m	5000.00 abs 5682.40	0.00	0.00	glo len	0.00 0.00	0.00 0.31	0.00 0.00
	force kN/m	5682.40 abs 6324.50	0.00	0.00	glo len	0.00 0.00	0.31 0.44	0.00 0.00

Loadcase no. 7 - distributed loads

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
1	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.11 1.11
	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.34	0.00 0.00
	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	0.34 0.00	0.00 0.00
2	force kN/m	0.00 abs 1795.52	0.00	0.00	glo len	0.00 0.00	0.00 0.07	0.00 0.00
	force kN/m	1795.52 abs 2628.10	0.00	0.00	glo len	0.00 0.00	0.07 0.11	0.00 0.00
	force kN/m	2628.10 abs 4317.60	0.00	0.00	glo len	0.00 0.00	0.11 0.17	0.00 0.00
	force kN/m	4317.60 abs 5256.20	0.00	0.00	glo len	0.00 0.00	0.17 0.00	0.00 0.00
	force kN/m	0.50 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.85 0.85
	force kN/m	0.00 rel 0.50	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.89 0.89
3	force kN/m	2628.10 abs 4317.60	0.00	0.00	glo len	0.00 0.00	0.11 0.17	0.00 0.00
	force kN/m	1534.81 abs 2628.10	0.00	0.00	glo len	0.00 0.00	0.06 0.11	0.00 0.00
	force kN/m	0.00 abs 1534.81	0.00	0.00	glo len	0.00 0.00	0.00 0.06	0.00 0.00
	force kN/m	0.00 rel 0.50	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.89 0.89
	force kN/m	0.50 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.85 0.85

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
	force kN/m	4317.60 abs 5256.20	0.00	0.00	glo len	0.00 0.00	0.17 0.00	0.00 0.00
4	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.34	0.00 0.00
	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	0.34 0.00	0.00 0.00
	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.11 -1.11
5	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.52 1.52
6	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.94 0.94
7	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.94 0.94
8	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.52 -1.52
9	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.19 1.19
10	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.82 0.82
11	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.82 0.82
12	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.19 -1.19
13	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.05 1.05
14	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.82 0.82
15	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.82 0.82
16	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.05 -1.05
17	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.05 1.05
18	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.82 0.82
19	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.82 0.82
20	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.05 -1.05
21	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.05 1.05
22	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.82 0.82
23	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.82 0.82
24	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.05 -1.05

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
25	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	1.05 1.05
26	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.82 0.82
27	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.82 0.82
28	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-1.05 -1.05
29	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.53 0.53
	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	0.28 0.00	0.00 0.00
	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.28	0.00 0.00
30	force kN/m	0.00 abs 1795.52	0.00	0.00	glo len	0.00 0.00	0.00 0.06	0.00 0.00
	force kN/m	2628.10 abs 4317.60	0.00	0.00	glo len	0.00 0.00	0.09 0.14	0.00 0.00
	force kN/m	4317.60 abs 5256.20	0.00	0.00	glo len	0.00 0.00	0.14 0.00	0.00 0.00
	force kN/m	1795.52 abs 2628.10	0.00	0.00	glo len	0.00 0.00	0.06 0.09	0.00 0.00
	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.41 0.41
31	force kN/m	2628.10 abs 4317.60	0.00	0.00	glo len	0.00 0.00	0.09 0.14	0.00 0.00
	force kN/m	4317.60 abs 5256.20	0.00	0.00	glo len	0.00 0.00	0.14 0.00	0.00 0.00
	force kN/m	1534.81 abs 2628.10	0.00	0.00	glo len	0.00 0.00	0.05 0.09	0.00 0.00
	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.41 0.41
	force kN/m	0.00 abs 1534.81	0.00	0.00	glo len	0.00 0.00	0.00 0.05	0.00 0.00
32	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.28	0.00 0.00
	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	0.28 0.00	0.00 0.00
	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.53 -0.53
54	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.67	0.00 0.00
	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	0.67 0.00	0.00 0.00
	force kN/m	2649.00 abs 3331.40	0.00	0.00	glo len	0.00 0.00	0.00 0.35	0.00 0.00
	force kN/m	3331.40 abs 4270.00	0.00	0.00	glo len	0.00 0.00	0.35 0.00	0.00 0.00

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
55	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.39	0.00 0.00
	force kN/m	1324.50 abs 3675.50	0.00	0.00	glo len	0.00 0.00	0.39 0.48	0.00 0.00
	force kN/m	3675.50 abs 4317.60	0.00	0.00	glo len	0.00 0.00	0.48 0.35	0.00 0.00
	force kN/m	4317.60 abs 5000.00	0.00	0.00	glo len	0.00 0.00	0.35 0.00	0.00 0.00
	force kN/m	5000.00 abs 5682.40	0.00	0.00	glo len	0.00 0.00	0.00 0.35	0.00 0.00
	force kN/m	5682.40 abs 6324.50	0.00	0.00	glo len	0.00 0.00	0.35 0.48	0.00 0.00
	force kN/m	6324.50 abs 8675.50	0.00	0.00	glo len	0.00 0.00	0.48 0.39	0.00 0.00
	force kN/m	8675.50 abs 10000.00	0.00	0.00	glo len	0.00 0.00	0.39 0.00	0.00 0.00
56	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	0.56 0.00	0.00 0.00
	force kN/m	2649.00 abs 3331.40	0.00	0.00	glo len	0.00 0.00	0.00 0.29	0.00 0.00
	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.56	0.00 0.00
	force kN/m	3331.40 abs 4270.00	0.00	0.00	glo len	0.00 0.00	0.29 0.00	0.00 0.00
57	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.32	0.00 0.00
	force kN/m	1324.50 abs 3675.50	0.00	0.00	glo len	0.00 0.00	0.32 0.40	0.00 0.00
	force kN/m	6324.50 abs 8675.50	0.00	0.00	glo len	0.00 0.00	0.40 0.32	0.00 0.00
	force kN/m	8675.50 abs 10000.00	0.00	0.00	glo len	0.00 0.00	0.32 0.00	0.00 0.00
	force kN/m	3675.50 abs 4317.60	0.00	0.00	glo len	0.00 0.00	0.40 0.29	0.00 0.00
	force kN/m	4317.60 abs 5000.00	0.00	0.00	glo len	0.00 0.00	0.29 0.00	0.00 0.00
	force kN/m	5000.00 abs 5682.40	0.00	0.00	glo len	0.00 0.00	0.00 0.29	0.00 0.00
	force kN/m	5682.40 abs 6324.50	0.00	0.00	glo len	0.00 0.00	0.29 0.40	0.00 0.00

Loadcase no. 8 - distributed loads

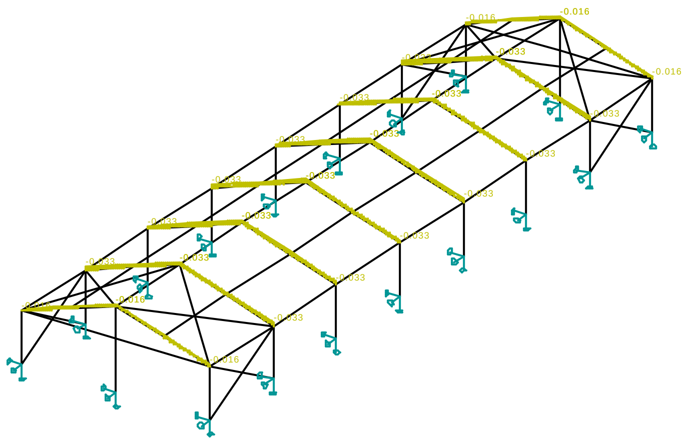
macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
1	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.84 0.84

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.48	0.00 0.00
	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	0.48 0.00	0.00 0.00
2	force kN/m	0.00 abs 1795.52	0.00	0.00	glo len	0.00 0.00	0.00 0.10	0.00 0.00
	force kN/m	1795.52 abs 2628.10	0.00	0.00	glo len	0.00 0.00	0.10 0.15	0.00 0.00
	force kN/m	2628.10 abs 4317.60	0.00	0.00	glo len	0.00 0.00	0.15 0.25	0.00 0.00
	force kN/m	4317.60 abs 5256.20	0.00	0.00	glo len	0.00 0.00	0.25 0.00	0.00 0.00
	force kN/m	0.50 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.58 0.58
	force kN/m	0.00 rel 0.50	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.62 0.62
3	force kN/m	2628.10 abs 4317.60	0.00	0.00	glo len	0.00 0.00	0.15 0.25	0.00 0.00
	force kN/m	1534.81 abs 2628.10	0.00	0.00	glo len	0.00 0.00	0.09 0.15	0.00 0.00
	force kN/m	0.00 abs 1534.81	0.00	0.00	glo len	0.00 0.00	0.00 0.09	0.00 0.00
	force kN/m	0.00 rel 0.50	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.62 0.62
	force kN/m	0.50 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.58 0.58
	force kN/m	4317.60 abs 5256.20	0.00	0.00	glo len	0.00 0.00	0.25 0.00	0.00 0.00
4	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.48	0.00 0.00
	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	0.48 0.00	0.00 0.00
	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.84 -0.84
5	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.98 0.98
6	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.40 0.40
7	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.40 0.40
8	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.98 -0.98
9	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.65 0.65
10	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.27 0.27
11	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.27 0.27

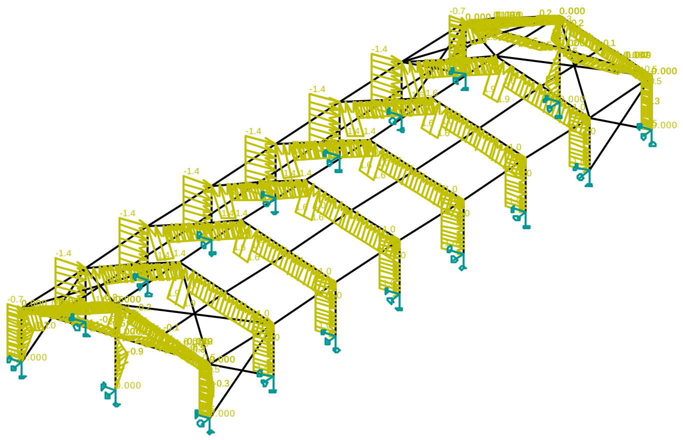
macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
12	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.65 -0.65
13	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.52 0.52
14	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.27 0.27
15	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.27 0.27
16	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.52 -0.52
17	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.52 0.52
18	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.27 0.27
19	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.27 0.27
20	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.52 -0.52
21	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.52 0.52
22	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.27 0.27
23	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.27 0.27
24	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.52 -0.52
25	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.52 0.52
26	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.27 0.27
27	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.27 0.27
28	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.52 -0.52
29	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.26 0.26
	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	0.14 0.00	0.00 0.00
	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.14	0.00 0.00
30	force kN/m	0.00 abs 1795.52	0.00	0.00	glo len	0.00 0.00	0.00 0.03	0.00 0.00
	force kN/m	2628.10 abs 4317.60	0.00	0.00	glo len	0.00 0.00	0.04 0.07	0.00 0.00
	force kN/m	4317.60 abs 5256.20	0.00	0.00	glo len	0.00 0.00	0.07 0.00	0.00 0.00
	force kN/m	1795.52 abs 2628.10	0.00	0.00	glo len	0.00 0.00	0.03 0.04	0.00 0.00

macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.14 0.14
31	force kN/m	2628.10 abs 4317.60	0.00	0.00	glo len	0.00 0.00	0.04 0.07	0.00 0.00
	force kN/m	4317.60 abs 5256.20	0.00	0.00	glo len	0.00 0.00	0.07 0.00	0.00 0.00
	force kN/m	1534.81 abs 2628.10	0.00	0.00	glo len	0.00 0.00	0.02 0.04	0.00 0.00
	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	0.14 0.14
	force kN/m	0.00 abs 1534.81	0.00	0.00	glo len	0.00 0.00	0.00 0.02	0.00 0.00
32	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.14	0.00 0.00
	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	0.14 0.00	0.00 0.00
	force kN/m	0.00 rel 1.00	0.00	0.00	loc len	0.00 0.00	0.00 0.00	-0.26 -0.26
54	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.96	0.00 0.00
	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	0.96 0.00	0.00 0.00
	force kN/m	2649.00 abs 3331.40	0.00	0.00	glo len	0.00 0.00	0.00 0.49	0.00 0.00
	force kN/m	3331.40 abs 4270.00	0.00	0.00	glo len	0.00 0.00	0.49 0.00	0.00 0.00
55	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.56	0.00 0.00
	force kN/m	1324.50 abs 3675.50	0.00	0.00	glo len	0.00 0.00	0.56 0.69	0.00 0.00
	force kN/m	3675.50 abs 4317.60	0.00	0.00	glo len	0.00 0.00	0.69 0.49	0.00 0.00
	force kN/m	4317.60 abs 5000.00	0.00	0.00	glo len	0.00 0.00	0.49 0.00	0.00 0.00
	force kN/m	5000.00 abs 5682.40	0.00	0.00	glo len	0.00 0.00	0.00 0.49	0.00 0.00
	force kN/m	5682.40 abs 6324.50	0.00	0.00	glo len	0.00 0.00	0.49 0.69	0.00 0.00
	force kN/m	6324.50 abs 8675.50	0.00	0.00	glo len	0.00 0.00	0.69 0.56	0.00 0.00
	force kN/m	8675.50 abs 10000.00	0.00	0.00	glo len	0.00 0.00	0.56 0.00	0.00 0.00
56	force kN/m	1324.50 abs 2649.00	0.00	0.00	glo len	0.00 0.00	0.27 0.00	0.00 0.00
	force kN/m	2649.00 abs 3331.40	0.00	0.00	glo len	0.00 0.00	0.00 0.14	0.00 0.00
	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.27	0.00 0.00

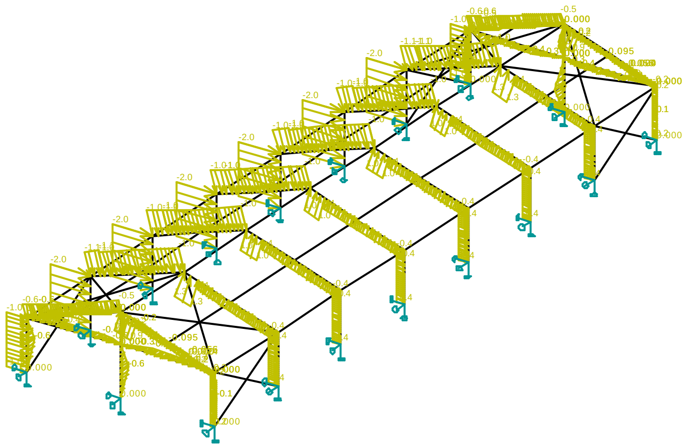
macro	type	dx mm	exY mm	exZ mm		X beg end	Y beg end	Z beg end
	force kN/m	3331.40 abs 4270.00	0.00	0.00	glo len	0.00 0.00	0.14 0.00	0.00 0.00
57	force kN/m	0.00 abs 1324.50	0.00	0.00	glo len	0.00 0.00	0.00 0.16	0.00 0.00
	force kN/m	1324.50 abs 3675.50	0.00	0.00	glo len	0.00 0.00	0.16 0.20	0.00 0.00
	force kN/m	6324.50 abs 8675.50	0.00	0.00	glo len	0.00 0.00	0.20 0.16	0.00 0.00
	force kN/m	8675.50 abs 10000.00	0.00	0.00	glo len	0.00 0.00	0.16 0.00	0.00 0.00
	force kN/m	3675.50 abs 4317.60	0.00	0.00	glo len	0.00 0.00	0.20 0.14	0.00 0.00
	force kN/m	4317.60 abs 5000.00	0.00	0.00	glo len	0.00 0.00	0.14 0.00	0.00 0.00
	force kN/m	5000.00 abs 5682.40	0.00	0.00	glo len	0.00 0.00	0.00 0.14	0.00 0.00
	force kN/m	5682.40 abs 6324.50	0.00	0.00	glo len	0.00 0.00	0.14 0.20	0.00 0.00



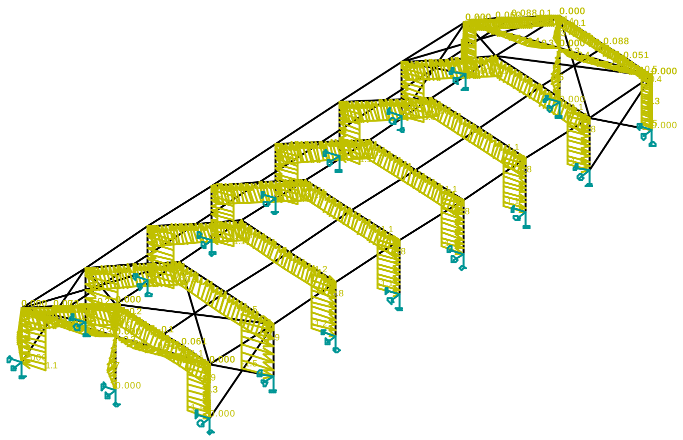
Distributed loads.Loadcases - 3



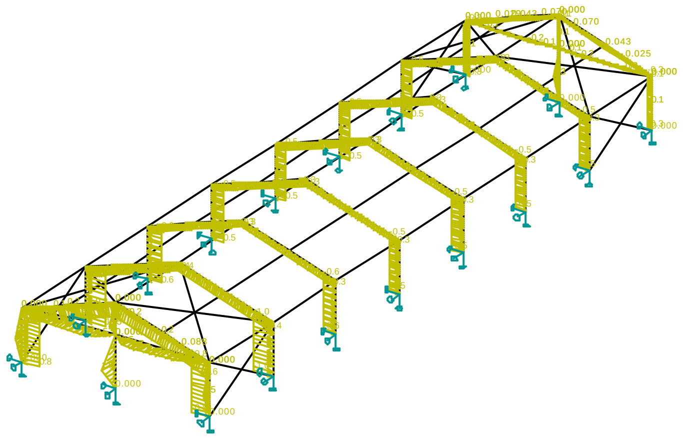
Distributed loads.Loadcases - 5



Distributed loads.Loadcases - 6



Distributed loads.Loadcases - 7



Distributed loads.Loadcases - 8

Combinations

Combi	Norm	Case	coeff
1.	User-ultimate	1 self weight	1.20
		4 dead load - sum	1.20
		9 dead load - extra	1.20
		5 wind side overpr	1.20
		6 wind side underpr	1.20
		7 wind gable overpr	1.20
		8 wind gable underpr	1.20
2.		1 self weight	0.80
		4 dead load - sum	0.80
		9 dead load - extra	0.80
		5 wind side overpr	1.20
		6 wind side underpr	1.20
		7 wind gable overpr	1.20
		8 wind gable underpr	1.20

Basic rules for generation of ultimate load combinations:
1 : 1.20*LC1 / 1.20*LC4 / 1.20*LC9 / 1.20*LC5 / 1.20*LC6 / 1.20*LC7 / 1.20*LC8
2 : 0.80*LC1 / 0.80*LC4 / 0.80*LC9 / 1.20*LC5 / 1.20*LC6 / 1.20*LC7 / 1.20*LC8

List of extreme ultimate load combinations
1/ 2 : +0.80*LC1+0.80*LC4+0.80*LC9
2/ 1 : +1.20*LC1+1.20*LC4+1.20*LC9
3/ 2 : +0.80*LC1+0.80*LC4+1.20*LC5+0.80*LC9
4/ 2 : +0.80*LC1+0.80*LC4+1.20*LC6+0.80*LC9
5/ 2 : +0.80*LC1+0.80*LC4+1.20*LC7+0.80*LC9
6/ 2 : +0.80*LC1+0.80*LC4+1.20*LC8+0.80*LC9
7/ 1 : +1.20*LC1+1.20*LC4+1.20*LC5+1.20*LC9
8/ 1 : +1.20*LC1+1.20*LC4+1.20*LC6+1.20*LC9
9/ 1 : +1.20*LC1+1.20*LC4+1.20*LC7+1.20*LC9
10/ 1 : +1.20*LC1+1.20*LC4+1.20*LC8+1.20*LC9

Nonlinear combination

Combi	Group of init. deformations	dx mm/m	dy mm/m	Group of init. curvatures	Case	coeff
C 1	0	0.00	0.00	0	1 self weight	0.80
	0	0.00	0.00	0	4 dead load - sum	0.80
	0	0.00	0.00	0	9 dead load - extra	0.80
C 2	0	0.00	0.00	0	1 self weight	1.20
	0	0.00	0.00	0	4 dead load - sum	1.20
	0	0.00	0.00	0	9 dead load - extra	1.20
C 3	0	0.00	0.00	0	1 self weight	0.80
	0	0.00	0.00	0	4 dead load - sum	0.80
	0	0.00	0.00	0	5 wind side overpr	1.20

Combi	Group of init. deformations	dx mm/m	dy mm/m	Group of init. curvatures	Case	coeff
	0	0.00	0.00	0	9 dead load - extra	0.80
C 4	0	0.00	0.00	0	1 self weight	0.80
	0	0.00	0.00	0	4 dead load - sum	0.80
	0	0.00	0.00	0	6 wind side underpr	1.20
	0	0.00	0.00	0	9 dead load - extra	0.80
C 5	0	0.00	0.00	0	1 self weight	0.80
	0	0.00	0.00	0	4 dead load - sum	0.80
	0	0.00	0.00	0	7 wind gable overpr	1.20
	0	0.00	0.00	0	9 dead load - extra	0.80
C 6	0	0.00	0.00	0	1 self weight	0.80
	0	0.00	0.00	0	4 dead load - sum	0.80
	0	0.00	0.00	0	8 wind gable underpr	1.20
	0	0.00	0.00	0	9 dead load - extra	0.80
C 7	0	0.00	0.00	0	1 self weight	1.20
	0	0.00	0.00	0	4 dead load - sum	1.20
	0	0.00	0.00	0	5 wind side overpr	1.20
	0	0.00	0.00	0	9 dead load - extra	1.20
C 8	0	0.00	0.00	0	1 self weight	1.20
	0	0.00	0.00	0	4 dead load - sum	1.20
	0	0.00	0.00	0	6 wind side underpr	1.20
	0	0.00	0.00	0	9 dead load - extra	1.20
C 9	0	0.00	0.00	0	1 self weight	1.20
	0	0.00	0.00	0	4 dead load - sum	1.20
	0	0.00	0.00	0	7 wind gable overpr	1.20
	0	0.00	0.00	0	9 dead load - extra	1.20
C 10	0	0.00	0.00	0	1 self weight	1.20
	0	0.00	0.00	0	4 dead load - sum	1.20
	0	0.00	0.00	0	8 wind gable underpr	1.20
	0	0.00	0.00	0	9 dead load - extra	1.20

Internal forces on foot (alu158)

Group of member(s) :1,8/9,14/15,20/21,26/27,32/33,38/39,44/45,52
Group of nonlinear combination(s) :1/10

memb	cr.nr	non. c.	dx [mm]	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
1	1	5	2649.0	**2.9**	0.2	2.4	-0.0	1.7	-0.0
		2	0.0	**-1.0**	0.0	-0.1	0.0	-0.0	-0.0
		8	2649.0	1.2	-0.5	1.2	0.0	**7.2**	0.0
		9	883.0	2.5	-0.2	0.0	-0.0	**-0.5**	-0.2
8		5	2649.0	**2.9**	0.2	-2.4	0.0	**-1.7**	-0.0
		8	0.0	**-1.6**	0.1	3.5	0.0	-0.0	-0.0

memb	cr.nr	non. c.	dx [mm]	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
			2649.0	-1.5	-0.1	2.8	0.0	**8.4**	0.1
9		3		**4.0**	-0.0	0.4	-0.0	**6.9**	-0.0
		8	0.0	**-4.6**	-0.0	4.4	-0.0	-0.0	0.0
		2	2649.0	-1.7	0.0	-0.5	0.0	**-1.4**	0.0
14		3		**3.1**	-0.0	-1.7	0.0	-0.4	-0.0
		2	0.0	**-1.9**	0.0	0.5	-0.0	-0.0	0.0
		8	2649.0	-1.6	-0.0	2.0	-0.0	**7.1**	-0.0
		5		2.2	0.0	-3.3	0.0	**-2.4**	-0.0
15		3	0.0	**5.5**	-0.0	6.1	0.0	-0.0	-0.0
		8		**-3.4**	0.0	5.7	-0.0	-0.0	0.0
		3	2649.0	5.5	-0.0	1.7	-0.0	**10.3**	-0.0
		2		-1.8	0.0	-0.7	-0.0	**-1.9**	0.0
20		5		**3.7**	0.0	-3.1	0.0	**-3.2**	0.0
		8	2207.5	**-3.0**	0.0	4.1	0.0	10.4	0.0
			2649.0	-3.0	0.0	3.8	0.0	**12.1**	0.0
21		3	0.0	**5.6**	-0.0	6.1	0.0	0.0	-0.0
		8		**-3.4**	0.0	5.8	-0.0	-0.0	0.0
		3	2649.0	5.5	-0.0	1.8	-0.0	**10.4**	-0.0
		2		-1.8	0.0	-0.7	-0.0	**-1.9**	0.0
26		5		**3.7**	0.0	-2.9	0.0	**-3.3**	0.0
		8		**-3.0**	0.0	3.9	0.0	**12.2**	0.0
27		3	0.0	**5.6**	0.0	6.1	-0.0	0.0	0.0
		8		**-3.4**	-0.0	5.8	0.0	-0.0	-0.0
		3	2649.0	5.5	0.0	1.8	0.0	**10.4**	0.0
		2		-1.8	-0.0	-0.7	0.0	**-1.9**	-0.0
32		5		**3.7**	0.0	-3.0	0.0	**-3.3**	0.0
		8		**-3.0**	-0.0	3.9	-0.0	**12.2**	-0.0
33		3	0.0	**5.5**	0.0	6.1	-0.0	-0.0	0.0
		8		**-3.4**	-0.0	5.7	0.0	-0.0	-0.0
		3	2649.0	5.5	0.0	1.7	0.0	**10.3**	0.0
		2		-1.8	-0.0	-0.7	0.0	**-1.9**	-0.0
38		5		**3.7**	0.0	-3.0	0.0	**-3.3**	0.0
		8	2207.5	**-3.0**	-0.0	4.1	-0.0	10.4	-0.0
			2649.0	-3.0	-0.0	3.8	-0.0	**12.1**	-0.0
39		3		**4.0**	0.0	0.4	0.0	**6.9**	0.0
		8	0.0	**-4.6**	0.0	4.4	0.0	-0.0	-0.0
		2	2649.0	-1.7	-0.0	-0.5	-0.0	**-1.4**	-0.0
44		5		**3.6**	0.0	-2.9	0.0	**-3.3**	0.0
		2	0.0	**-1.9**	-0.0	0.5	0.0	-0.0	-0.0
		8	2649.0	-1.6	0.0	2.0	0.0	**7.1**	0.0
45		3		**2.8**	0.6	0.7	-0.0	4.8	-0.0

memb	cr.nr	non. c.	dx [mm]	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
		10	0.0	**-1.7**	-0.1	-0.4	-0.0	-0.0	0.0
		8	2649.0	1.2	0.5	1.2	-0.0	**7.2**	-0.0
		9	883.0	-0.7	-0.1	-0.0	-0.0	**-0.3**	-0.2
52		3	2649.0	**0.0**	0.2	0.6	-0.0	3.7	-0.1
		10	0.0	**-1.7**	-0.1	0.4	0.0	0.0	0.0
		8	2649.0	-1.5	0.1	2.8	-0.0	**8.4**	-0.1
		5		-0.3	0.2	-1.1	0.0	**-0.8**	-0.0

Internal forces on roof (alu158)

Group of member(s) :2/7,10/13,16/19,22/25,28/31,34/37,40/43,46/51
Group of nonlinear combination(s) :1/10

memb	cr.nr	non. c.	dx [mm]	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
2	1	8	1795.5	**4.4**	-0.1	-0.7	-0.0	5.2	-0.0
		3	0.0	**-1.2**	0.1	-2.1	-0.0	4.0	-0.0
		8	448.9	4.4	0.0	0.1	-0.0	**5.7**	0.0
		5	1795.5	0.1	0.0	-0.7	-0.0	**-1.0**	-0.1
3		8	832.6	**4.4**	-0.2	-1.3	-0.0	4.4	-0.1
		3	0.0	**-1.1**	-0.1	-0.8	-0.0	1.7	-0.0
		8		4.4	-0.1	-0.8	-0.0	**5.2**	-0.0
		5	832.6	0.1	0.1	0.2	-0.0	**-1.2**	-0.0
4		8	2628.1	**4.5**	-0.1	-3.1	-0.0	**-1.3**	-0.1
		3	0.0	**-1.1**	0.3	-0.5	-0.0	1.2	-0.2
		8		4.5	0.2	-1.3	-0.0	**4.4**	-0.1
5		4	1534.8	**1.1**	0.0	1.0	-0.0	-5.0	0.0
		3	0.0	**-1.6**	0.0	-0.6	-0.0	-2.7	-0.0
		5		0.1	0.1	-2.5	0.0	**1.9**	-0.0
		8		0.9	0.0	0.8	-0.0	**-6.4**	-0.0
6		4	1093.3	**1.1**	0.1	1.2	-0.0	-3.8	0.1
		3	0.0	**-1.6**	0.1	0.2	-0.0	-3.0	0.0
		2	1093.3	-0.3	-0.0	-0.0	-0.0	**0.1**	-0.0
		8	0.0	1.0	0.0	1.1	-0.0	**-5.0**	0.0
7		4	2628.1	**1.2**	0.1	2.4	-0.0	0.4	-0.1
		3	0.0	**-1.5**	-0.4	0.8	-0.0	-2.4	0.2
		5	2628.1	0.2	-0.2	2.7	0.0	**2.4**	-0.0
		4	0.0	1.1	-0.3	1.2	-0.0	**-3.8**	0.1
10		5	2628.1	**4.3**	-0.1	0.1	-0.0	-1.0	-0.1
		8	876.0	**-3.3**	-0.0	1.9	-0.0	5.8	-0.0
			2190.1	-3.3	-0.0	0.1	-0.0	**7.1**	-0.0
		2	0.0	-2.0	0.0	0.9	0.0	**-1.5**	0.0

memb	cr.nr	non. c.	dx [mm]	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
11		5	2628.1	**4.5**	0.0	2.4	-0.0	1.7	0.0
		8	0.0	**-3.0**	0.0	-1.1	-0.0	**7.0**	-0.0
		5	438.0	4.5	0.1	0.1	-0.0	**-1.1**	-0.1
12			2628.1	**4.3**	0.1	0.1	0.0	-1.0	0.1
		8	0.0	**-5.0**	0.0	0.3	-0.0	**-7.3**	0.0
		5		4.3	0.0	-2.7	0.0	**2.4**	0.0
13			2628.1	**4.5**	-0.0	2.4	0.0	1.7	-0.0
		8	0.0	**-4.7**	-0.0	0.9	-0.0	-4.9	0.0
		9	2628.1	4.3	-0.0	2.4	-0.0	**1.8**	0.0
		4	0.0	-4.1	-0.0	0.9	-0.0	**-5.1**	0.0
16		5	2628.1	**4.2**	-0.0	-0.4	-0.0	-0.9	-0.1
		8	876.0	**-1.6**	0.0	1.5	-0.0	8.3	0.0
		3	0.0	3.4	-0.0	-4.9	-0.0	**10.2**	-0.0
		2		-1.1	0.0	1.1	0.0	**-1.9**	0.0
17		5	2628.1	**4.4**	0.0	1.6	-0.0	0.1	-0.0
		8	0.0	**-1.3**	-0.0	-1.5	-0.0	**8.8**	0.0
		3	2628.1	3.8	0.0	-0.4	-0.0	**-1.9**	0.0
18		5		**4.2**	0.0	-0.4	0.0	-0.9	0.1
		8	0.0	**-4.5**	0.0	1.3	-0.0	**-11.8**	-0.0
		5		4.2	0.0	-2.8	-0.0	**3.2**	-0.0
19			2628.1	**4.4**	-0.0	1.6	0.0	0.1	0.0
		8	0.0	**-4.1**	0.0	1.9	-0.0	-6.6	0.0
		10	2628.1	1.2	-0.0	0.6	-0.0	**1.0**	0.0
		4	0.0	-3.8	-0.0	1.8	-0.0	**-6.8**	0.0
22		5	2628.1	**4.1**	-0.0	-0.4	0.0	-0.9	-0.1
		8	876.0	**-1.5**	0.0	1.4	0.0	8.6	0.0
		3	0.0	3.5	-0.0	-4.9	-0.0	**10.4**	-0.0
		2		-1.1	0.0	1.1	0.0	**-1.9**	0.0
23		5	2628.1	**4.3**	0.0	1.5	0.0	-0.0	-0.0
		8	0.0	**-1.3**	-0.0	-1.6	0.0	**9.0**	0.0
		3	2628.1	3.8	0.0	-0.5	-0.0	**-1.9**	0.0
24		5		**4.1**	0.0	-0.4	-0.0	-0.9	0.1
		8	0.0	**-4.5**	0.0	1.3	-0.0	**-12.2**	-0.0
		5		4.0	0.0	-2.8	-0.0	**3.3**	-0.0
25			2628.1	**4.3**	-0.0	1.5	-0.0	-0.0	0.0
		8	0.0	**-4.1**	0.0	2.0	-0.0	-6.9	0.0
		2	2190.1	-0.8	0.0	-0.0	-0.0	**0.9**	0.0
		4	0.0	-3.8	-0.0	1.9	-0.0	**-7.0**	0.0
28		5	2628.1	**4.1**	-0.0	-0.4	0.0	-0.9	-0.1
		8	876.0	**-1.5**	-0.0	1.4	-0.0	8.6	-0.0
		3	0.0	3.5	0.0	-4.9	0.0	**10.4**	0.0

memb	cr.nr	non. c.	dx [mm]	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
		2		-1.1	-0.0	1.1	-0.0	**-1.9**	-0.0
29		5	2628.1	**4.3**	0.0	1.5	0.0	-0.0	-0.0
		8	0.0	**-1.3**	0.0	-1.6	-0.0	**9.0**	-0.0
		3	2628.1	3.8	-0.0	-0.5	0.0	**-1.9**	-0.0
30		5		**4.1**	0.0	-0.4	-0.0	-0.9	0.1
		8	0.0	**-4.5**	-0.0	1.3	0.0	**-12.2**	0.0
		5		4.0	0.0	-2.8	-0.0	**3.3**	-0.0
31			2628.1	**4.3**	-0.0	1.5	-0.0	-0.0	0.0
		8	0.0	**-4.1**	-0.0	2.0	0.0	-6.9	-0.0
		2	2190.1	-0.8	-0.0	-0.0	0.0	**0.9**	-0.0
		4	0.0	-3.8	0.0	1.9	0.0	**-7.0**	-0.0
34		5	2628.1	**4.1**	-0.0	-0.4	0.0	-0.9	-0.1
		8	876.0	**-1.6**	-0.0	1.5	0.0	8.3	-0.0
		3	0.0	3.4	0.0	-4.9	0.0	**10.2**	0.0
		2		-1.1	-0.0	1.1	-0.0	**-1.9**	-0.0
35		5	2628.1	**4.3**	0.0	1.5	0.0	-0.0	-0.0
		8	0.0	**-1.3**	0.0	-1.5	0.0	**8.8**	-0.0
		3	2628.1	3.8	-0.0	-0.4	0.0	**-1.9**	-0.0
36		5		**4.1**	0.0	-0.4	-0.0	-0.9	0.1
		8	0.0	**-4.5**	-0.0	1.3	0.0	**-11.8**	0.0
		5		4.0	0.0	-2.8	-0.0	**3.3**	-0.0
37			2628.1	**4.3**	-0.0	1.5	-0.0	-0.0	0.0
		8	0.0	**-4.1**	-0.0	1.9	0.0	-6.6	-0.0
		2	2190.1	-0.8	-0.0	-0.0	0.0	**0.9**	-0.0
		4	0.0	-3.8	0.0	1.8	0.0	**-6.8**	-0.0
40		5	2628.1	**3.8**	-0.0	-0.4	0.0	-0.9	-0.1
		8	876.0	**-3.3**	0.0	1.9	0.0	5.8	0.0
			2190.1	-3.3	0.0	0.1	0.0	**7.1**	0.0
		2	0.0	-2.0	-0.0	0.9	-0.0	**-1.5**	-0.0
41		5	2628.1	**4.0**	0.0	1.5	0.0	0.0	-0.0
		8	0.0	**-3.0**	-0.0	-1.1	0.0	**7.0**	0.0
		5	876.0	4.0	0.0	-0.1	0.0	**-1.3**	-0.1
42			2628.1	**3.8**	0.0	-0.4	-0.0	-0.9	0.1
		8	0.0	**-5.0**	-0.0	0.3	0.0	**-7.3**	-0.0
		5		3.8	0.0	-2.8	-0.0	**3.3**	-0.0
43			2628.1	**4.0**	-0.0	1.5	-0.0	0.0	0.0
		8	0.0	**-4.7**	0.0	0.9	0.0	-4.9	-0.0
		2		-1.7	-0.0	0.0	0.0	**0.7**	0.0
		4		-4.1	0.0	0.9	0.0	**-5.1**	-0.0
46		8	1795.5	**4.4**	0.1	-0.7	0.0	5.2	0.0
		3	0.0	**-1.2**	-0.1	-2.1	0.0	4.0	0.0

memb	cr.nr	non. c.	dx [mm]	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
		8	448.9	4.4	-0.0	0.1	0.0	**5.7**	-0.0
		5	1795.5	0.3	0.0	-0.3	0.0	**-0.4**	-0.1
47		8	832.6	**4.4**	0.2	-1.3	0.0	4.4	0.1
		3	0.0	**-1.1**	0.1	-0.8	0.0	1.7	0.0
		8		4.4	0.1	-0.8	0.0	**5.2**	0.0
		5	832.6	0.3	0.1	0.1	0.0	**-0.5**	-0.0
48		8	2628.1	**4.5**	0.1	-3.1	0.0	**-1.3**	0.1
		3	0.0	**-1.1**	-0.3	-0.5	0.0	1.2	0.2
		8		4.5	-0.2	-1.3	0.0	**4.4**	0.1
49		4	1534.8	**1.1**	-0.0	1.0	0.0	-5.0	-0.0
		3	0.0	**-1.6**	-0.0	-0.6	0.0	-2.7	0.0
		5		0.3	0.1	-1.1	-0.0	**0.8**	-0.0
		8		0.9	-0.0	0.8	0.0	**-6.4**	0.0
50		4	1093.3	**1.1**	-0.1	1.2	0.0	-3.8	-0.1
		3	0.0	**-1.6**	-0.1	0.2	0.0	-3.0	-0.0
		2	1093.3	-0.3	0.0	-0.0	0.0	**0.1**	0.0
		8	0.0	1.0	-0.0	1.1	0.0	**-5.0**	-0.0
51		4	2628.1	**1.2**	-0.1	2.4	0.0	0.4	0.1
		3	0.0	**-1.5**	0.4	0.8	0.0	-2.4	-0.2
			2628.1	-1.5	-0.1	2.9	0.0	**1.8**	0.1
		4	0.0	1.1	0.3	1.2	0.0	**-3.8**	-0.1

Peak splice : N,V,M

Group of member(s) :4,7,11,13,17,19,23,25,29,31,35,37,41,43,48,51
Group of nonlinear combination(s) :1/10

memb	cr.nr	non. c.	dx [mm]	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
4	1	8	2628.1	**4.5**	-0.1	-3.1	-0.0	-1.3	-0.1
11				**-2.9**	0.0	-4.6	-0.0	-0.7	-0.0
4		5		0.2	0.2	**2.7**	-0.0	**2.4**	0.0
23		8		-1.1	-0.0	**-5.1**	0.0	0.3	-0.0
29		3		3.8	-0.0	-0.5	0.0	**-1.9**	-0.0

Eaves splice : N,V,M

Group of member(s) :1,8/9,14/15,20/21,26/27,32/33,38/39,44/45,52
Group of nonlinear combination(s) :1/10

memb	cr.nr	non. c.	dx [mm]	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
21	1	3	2649.0	**5.5**	-0.0	1.8	-0.0	10.4	-0.0

memb	cr.nr	non. c.	dx [mm]	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
9		8		**-4.5**	-0.0	-1.9	-0.0	3.3	-0.0
26				-3.0	0.0	**3.9**	0.0	**12.2**	0.0
14		5		2.2	0.0	**-3.3**	0.0	-2.4	-0.0
32				3.7	0.0	-3.0	0.0	**-3.3**	0.0

Peak and eaves purlin : N

Group of member(s) :1/111
Group of nonlinear combination(s) :1/10
Cross-section : 2 - Alu133/70

memb	non. c.	dx [mm]	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
68	3	0.0	**8.5**	0.1	0.1	0.1	-0.0	-0.0
53	5	3333.3	**-3.8**	-0.0	-0.0	-0.0	0.1	0.0

Normal purlin : N

Group of member(s) :1/111
Group of nonlinear combination(s) :1/10
Cross-section : 3 - Alu60/60/3

memb	non. c.	dx [mm]	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
77	3	0.0	**0.7**	0.0	0.0	-0.0	-0.0	-0.0
74	10	2500.0	**-0.5**	0.0	-0.0	0.0	0.1	0.0

Gable upright : N,M

Group of member(s) :1/111
Group of nonlinear combination(s) :1/10
Cross-section : 5 - Alu133/70

memb	non. c.	dx [mm]	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
104	5	2649.0	**4.6**	0.0	0.5	0.0	2.7	0.0
	8	0.0	**-4.0**	1.2	-1.5	0.0	0.0	0.0
	10	2649.0	2.8	0.0	0.7	0.0	**3.9**	0.0
	7		3.1	0.7	-0.7	-0.0	**-3.7**	1.6
105	5	1621.0	**4.7**	-0.0	-1.9	0.0	-0.0	-0.0
	8	0.0	**-3.7**	1.0	1.5	-0.1	-2.8	0.2
	10		3.0	-0.0	-2.3	0.0	**4.0**	0.0
	7		3.3	0.4	2.2	-0.1	**-3.8**	0.2
108	3	2649.0	**3.6**	0.7	0.7	0.0	3.7	1.6
	8	0.0	**-4.0**	1.2	1.5	-0.0	-0.0	0.0

memb	non. c.	dx [mm]	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
	7	2649.0	3.1	0.7	0.7	0.0	**3.7**	1.6
	2		-1.7	-0.0	-0.0	0.0	**-0.0**	-0.0
109	3	1621.0	**3.7**	0.4	-2.6	0.1	-0.0	0.8
	8	0.0	**-3.7**	1.0	-1.5	0.1	2.8	0.2
	7		3.3	0.4	-2.2	0.1	**3.8**	0.2
	8	1621.0	-3.7	1.0	-1.8	0.1	**-0.0**	1.9

Gable horizontal : N,M

Group of member(s) :1/111
Group of nonlinear combination(s) :1/10
Cross-section : 4 - Alu130/70

memb	non. c.	dx [mm]	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
106	10	5000.0	**2.1**	-0.1	-1.5	-0.1	0.0	-0.1
	4	0.0	**-4.0**	-0.5	-1.2	0.1	0.0	1.9
	6	2500.0	1.8	0.0	0.1	-0.1	**2.1**	0.0
	3		-1.3	-0.3	0.0	0.1	**-2.3**	0.2
107	10	0.0	**2.1**	0.1	1.5	0.1	0.0	-0.1
	4	5000.0	**-4.1**	-0.6	0.7	-0.1	-0.0	-2.0
	6	2500.0	1.8	-0.0	-0.1	0.1	**2.1**	0.0
	3		-1.0	-0.4	0.1	-0.1	**-1.9**	-0.1
110	9	5000.0	**1.0**	-0.1	-0.9	-0.0	0.0	-0.1
	4	0.0	**-4.0**	-0.5	1.2	-0.1	-0.0	1.9
	3	2500.0	-1.3	-0.3	-0.0	-0.1	**2.3**	0.2
	8	0.0	-4.0	-0.4	1.2	-0.1	**-0.0**	1.9
111	9		**1.0**	0.1	0.9	0.0	0.0	-0.1
	4	5000.0	**-4.1**	-0.6	-0.7	0.1	0.0	-2.0
	3	2500.0	-1.0	-0.4	-0.1	0.1	**1.9**	-0.1
	4	0.0	-4.0	-0.5	1.0	0.1	**-0.0**	1.3

Wind bracing cable : side

Group of member(s) :88/89,92/93,96/97,100/101
Group of nonlinear combination(s) :1/10

memb	cr.nr	non. c.	dx [mm]	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
92	6	9	5658.7	**3.1**	0.0	0.0	0.0	0.0	0.0

Wind bracing cable : roof

Group of member(s) :90/91,94/95,98/99,102/103
Group of nonlinear combination(s) :1/10

memb	cr.nr	non. c.	dx [mm]	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
103	6	3	6348.3	**5.5**	0.0	0.0	0.0	0.0	0.0

Reactions in support(s) - nodal values. Global extreme

Nonlinear calculation, local nonlinearities, II. order
Group of node(s) :1/64
Group of nonlinear combination(s) :1/10

support	node	non. c.	Rx [kN]	Ry [kN]	Rz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
3	8	10	**1.7**	0.2	1.2	0.0	0.0	0.0
7	22	3	**-6.4**	-0.0	**-5.3**	0.0	0.0	0.0
17	57		-0.7	**2.1**	-3.5	0.0	0.0	0.0
2	5	10	-0.9	**-3.1**	-2.4	0.0	0.0	0.0
13	43	8	-4.2	-0.3	**4.7**	0.0	0.0	0.0

Foundation table : side

Group of node(s) :15,21/22,28/29,35/36,42
Group of load case(s) :1,4/9
Foundation table:

Loadcase/Node		15	21	22	28	29	35
Permanent loads							
LC: 1,4,9	Rx [kN]	0.6	-0.6	0.6	-0.6	0.6	-0.6
	Ry [kN]	0.0	0.0	0.0	0.0	-0.0	-0.0
	Rz [kN]	1.6	1.6	1.6	1.6	1.6	1.6
Variable loads - exclusive - 5: wind side overpr							
	Rx [kN]	-5.7	-1.0	-5.7	-1.0	-5.7	-1.0
	Ry [kN]	-0.0	-0.0	-0.0	-0.0	0.0	0.0
	Rz [kN]	-5.6	-3.8	-5.6	-3.8	-5.6	-3.8
Variable loads - exclusive - 6: wind side underpr							
	Rx [kN]	-5.2	-3.7	-5.2	-3.7	-5.2	-3.7
	Ry [kN]	-0.0	-0.0	-0.0	-0.0	0.0	0.0
	Rz [kN]	1.3	1.1	1.3	1.1	1.3	1.1
Variable loads - exclusive - 7: wind gable overpr							
	Rx [kN]	0.1	-0.1	-0.1	0.1	-0.1	0.1
	Ry [kN]	0.1	0.1	0.1	0.1	0.1	0.1
	Rz [kN]	-4.1	-4.1	-4.1	-4.1	-4.1	-4.1
Variable loads - exclusive - 8: wind gable underpr							
	Rx [kN]	0.4	-0.4	0.2	-0.2	0.2	-0.2
	Ry [kN]	0.1	0.1	0.1	0.1	0.1	0.1
	Rz [kN]	-1.4	-1.4	-1.4	-1.4	-1.4	-1.4

Loadcase/Node		15	21	22	28	29	35
Extremes							
	Max Rz [kN]	3.0	2.7	3.0	2.7	3.0	2.7
	Min Rz [kN]	-4.0	-2.4	-4.0	-2.4	-4.0	-2.4
	Max Rx [kN]	1.1	-0.6	0.8	-0.5	0.8	-0.5
	Min Rx [kN]	-5.1	-4.3	-5.1	-4.3	-5.1	-4.3
	Max Ry [kN]	0.1	0.1	0.1	0.1	0.1	0.1
	Min Ry [kN]	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0

Loadcase/Node		36	42
Permanent loads			
LC: 1,4,9	Rx [kN]	0.6	-0.6
	Ry [kN]	-0.0	-0.0
	Rz [kN]	1.6	1.6
Variable loads - exclusive - 5: wind side overpr			
	Rx [kN]	-5.7	-1.0
	Ry [kN]	0.0	0.0
	Rz [kN]	-5.6	-3.8
Variable loads - exclusive - 6: wind side underpr			
	Rx [kN]	-5.2	-3.7
	Ry [kN]	0.0	0.0
	Rz [kN]	1.3	1.1
Variable loads - exclusive - 7: wind gable overpr			
	Rx [kN]	-0.1	0.1
	Ry [kN]	0.1	0.1
	Rz [kN]	-4.1	-4.1
Variable loads - exclusive - 8: wind gable underpr			
	Rx [kN]	0.2	-0.2
	Ry [kN]	0.1	0.1
	Rz [kN]	-1.4	-1.4
Extremes			
	Max Rz [kN]	3.0	2.7
	Min Rz [kN]	-4.0	-2.4
	Max Rx [kN]	0.8	-0.5
	Min Rx [kN]	-5.1	-4.3
	Max Ry [kN]	0.1	0.1
	Min Ry [kN]	-0.0	-0.0

Foundation table : at wind bracing

Group of node(s) :1,5,8,14,43,49/50,56
Group of load case(s) :1,4/9
Foundation table:

Loadcase/Node		1	5	8	14	43	49
Permanent loads							
LC: 1,4,9	Rx [kN]	0.1	-0.1	0.6	-0.6	0.6	-0.6
	Ry [kN]	-0.4	-0.4	0.4	0.4	-0.4	-0.4
	Rz [kN]	0.6	0.6	1.7	1.7	1.7	1.7
Variable loads - exclusive - 5: wind side overpr							
	Rx [kN]	-2.2	-1.5	-5.4	-0.7	-5.4	-0.7
	Ry [kN]	0.5	0.2	0.0	0.0	-0.0	-0.0
	Rz [kN]	-2.2	-0.4	-5.5	-4.1	-5.5	-4.1
Variable loads - exclusive - 6: wind side underpr							
	Rx [kN]	-2.9	-2.2	-4.7	-3.0	-4.7	-3.0
	Ry [kN]	0.4	0.1	0.0	0.0	-0.0	-0.0
	Rz [kN]	-0.0	1.0	1.8	0.5	1.8	0.5
Variable loads - exclusive - 7: wind gable overpr							
	Rx [kN]	0.9	-0.9	0.6	-0.6	-0.2	0.2
	Ry [kN]	-1.3	-1.3	-1.1	-1.1	-1.1	-1.1
	Rz [kN]	-3.9	-3.9	-3.2	-3.2	-5.4	-5.4
Variable loads - exclusive - 8: wind gable underpr							
	Rx [kN]	0.7	-0.7	0.8	-0.8	0.1	-0.1
	Ry [kN]	-1.4	-1.4	-1.1	-1.1	-1.1	-1.1
	Rz [kN]	-3.1	-3.1	-0.6	-0.6	-2.8	-2.8
Extremes							
	Max Rz [kN]	0.6	1.7	3.4	2.1	3.4	2.1
	Min Rz [kN]	-3.3	-3.3	-3.9	-2.5	-3.9	-3.8
	Max Rx [kN]	0.9	-0.1	1.4	-0.6	0.7	-0.4
	Min Rx [kN]	-2.9	-2.2	-4.8	-3.6	-4.8	-3.6
	Max Ry [kN]	0.1	-0.1	0.4	0.4	-0.4	-0.4
	Min Ry [kN]	-1.8	-1.8	-0.7	-0.7	-1.5	-1.5

Loadcase/Node		50	56
Permanent loads			
LC: 1,4,9	Rx [kN]	0.1	-0.1
	Ry [kN]	0.4	0.4
	Rz [kN]	0.6	0.6
Variable loads - exclusive - 5: wind side overpr			
	Rx [kN]	-2.2	-1.5
	Ry [kN]	-0.5	-0.2
	Rz [kN]	-2.2	-0.4
Variable loads - exclusive - 6: wind side underpr			
	Rx [kN]	-2.9	-2.2
	Ry [kN]	-0.4	-0.1
	Rz [kN]	-0.0	1.0
Variable loads - exclusive - 7: wind gable overpr			
	Rx [kN]	0.4	-0.4

Loadcase/Node		50	56
	Ry [kN]	-1.3	-1.3
	Rz [kN]	0.0	0.0
Variable loads - exclusive - 8: wind gable underpr			
	Rx [kN]	0.2	-0.2
	Ry [kN]	-1.2	-1.2
	Rz [kN]	0.8	0.8
Extremes			
	Max Rz [kN]	1.4	1.7
	Min Rz [kN]	-1.6	0.2
	Max Rx [kN]	0.5	-0.1
	Min Rx [kN]	-2.9	-2.2
	Max Ry [kN]	0.4	0.4
	Min Ry [kN]	-0.9	-0.9