Project : Manege - V.D

General properties of project	
Project name	Manege
Project client	V. D.
Project adress	-
Author of the project	-
Project date	09/12/2024
Comments on projet	-

Table of Contents

1 General hypothesis

1.1 Construction site

Country : User loads
Altitude : 100m

1.2 Snow Loads

	General characteristics of snow loads	
s_k	0.5 kN/m2	Snow characteristic load for the considered altitude
s_{Ad}	0 kN/m2	Snow accidental load : sAd

1.3 Wind loads

	General characteristics of wind loads	
$q_p\ (z)$	0.7 kN/m2	Dynamic pressure given by the user

1.4 Seismic loads

	Seismic loads	
Sh	0.5 m/s2	User horizontal acceleration for calculation of forces
Sv	0.5 m/s2	User vertical acceleration for calculation of forces
q horizontal	1.5	Behavior coefficient q for horizontal direction
q vertical	1.5	Behavior coefficient q for vertical direction

2 Study : Alu-Sandwich

Id	Type	Name	Fragile load	Permanent load
-	-	-	-	[kN/m2]
1	Divers	Alu - Sandwich		0.14
			Total load no fragile (Phase 1)	0.14 (100%)
			Total load fragile (Phase 2)	0 (0%)
			Total load (Phases 1+2)	0.14

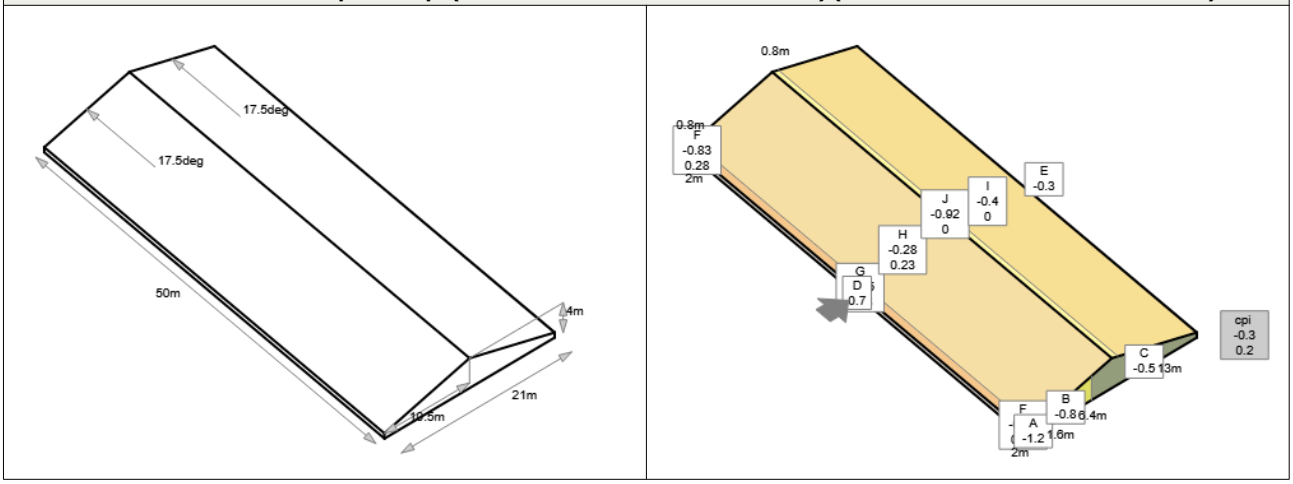
3 Study : Charges de vent_1

3.1 Wind general properties

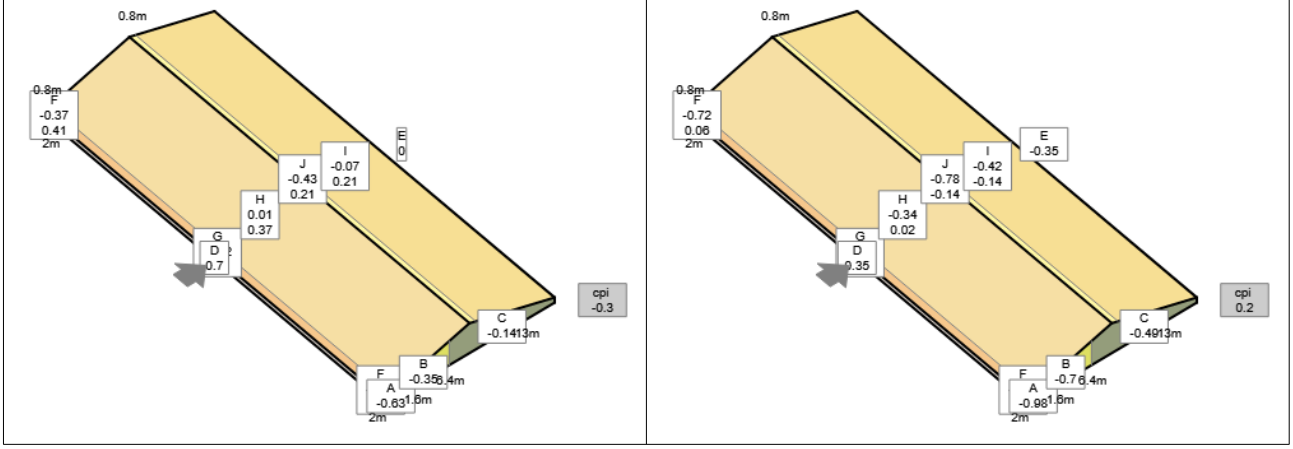
	General characteristics of wind loads	
$q_p\ (z)$	0.7 kN/m2	Dynamic pressure given by the user

3.2 Wind direction X+ (on long side)

Wind X+ : Pressure coefficients Cpe and Cpi (Reference surface for roof = 10m^2) (Reference surface for walls = 10m^2)



Wind X+ : Pressures on zones (Reference surface for roof = 10m^2) (Reference surface for walls = 10m^2) (kN/m2)

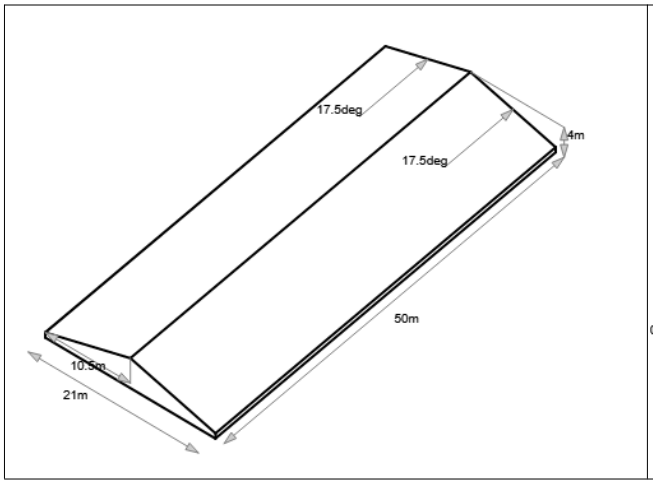


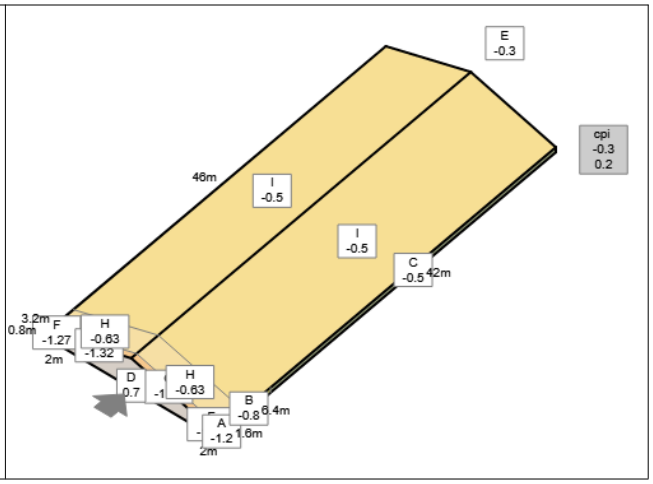
Wind X+ : Detail of resultant forces for every level (Normal and thrown of center) (with correlation coefficient)

Level	Fx	Fy	xp	yp	Fx eccentricity	Fy eccentricity	xp eccentricity	yp eccentricity
-	*[kN]*	*[kN]*	*[m]*	*[m]*	*[kN]*	*[kN]*	*[m]*	*[m]*
0	76.88	0	10.5	25	73.3	0	10.5	24.24

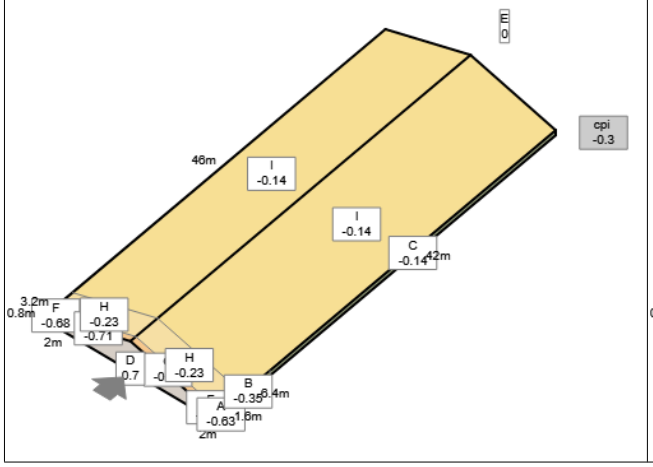
3.3 Wind direction Y+ (on pinion)

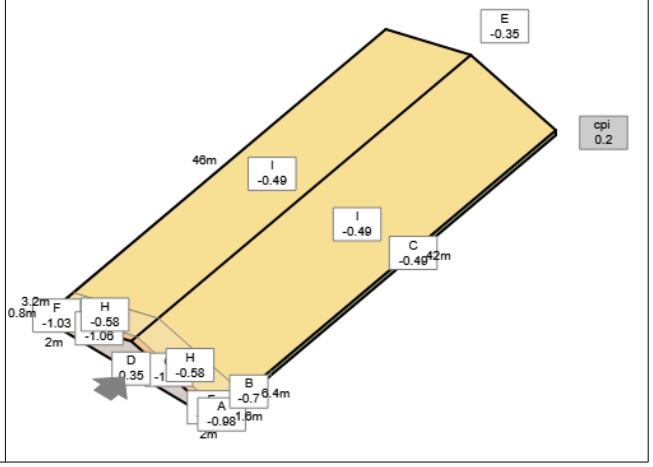
Wind Y+ : Pressure coefficients Cpe and Cpi (Reference surface for roof = 10m^2) (Reference surface for walls = 10m^2)





Wind Y+ : Pressures on zones (Reference surface for roof = 10m^2) (Reference surface for walls = 10m^2) (kN/m2)



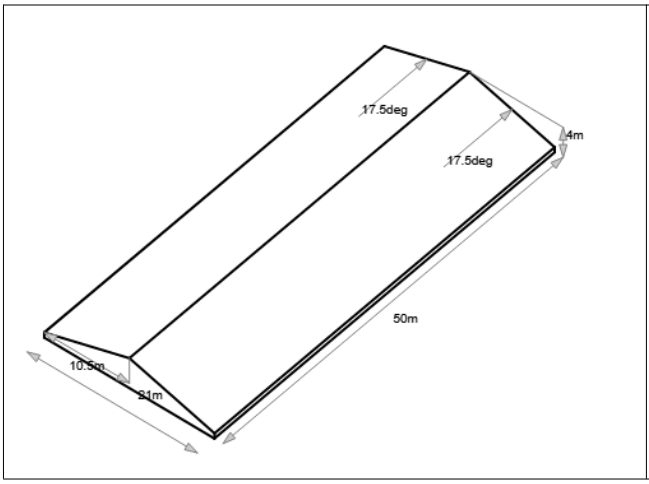


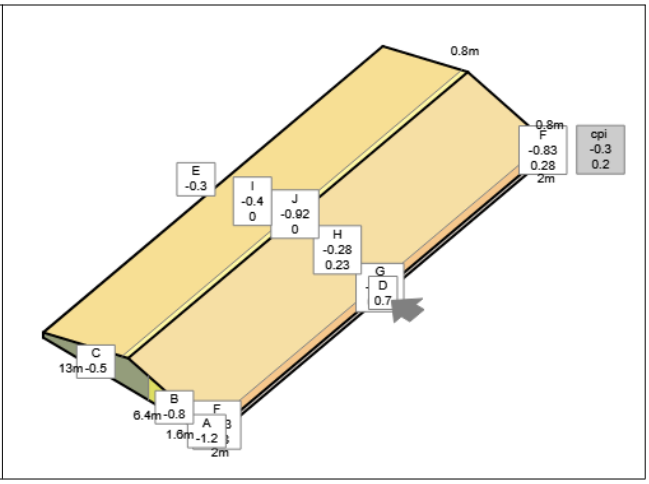
Wind Y+ : Detail of resultant forces for every level (Normal and thrown of center) (with correlation coefficient)

Level	Fx	Fy	xp	yp	Fx eccentricity	Fy eccentricity	xp eccentricity	yp eccentricity
-	*[kN]*	*[kN]*	*[m]*	*[m]*	*[kN]*	*[kN]*	*[m]*	*[m]*
0	0	24.99	10.5	25	0	16.24	14	25

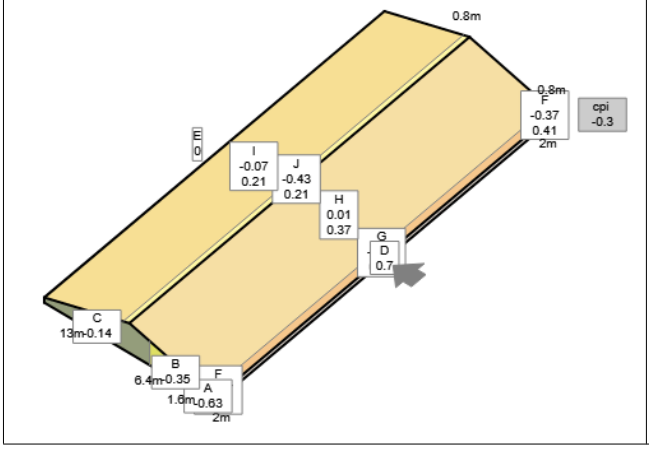
3.4 Wind direction X- (on long side)

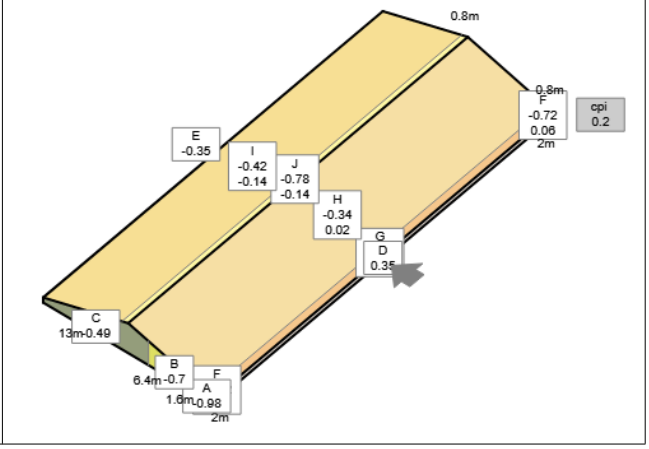
Wind X- : Pressure coefficients Cpe and Cpi (Reference surface for roof = 10m^2) (Reference surface for walls = 10m^2)





Wind X- : Pressures on zones (Reference surface for roof = 10m^2) (Reference surface for walls = 10m^2) (kN/m2)



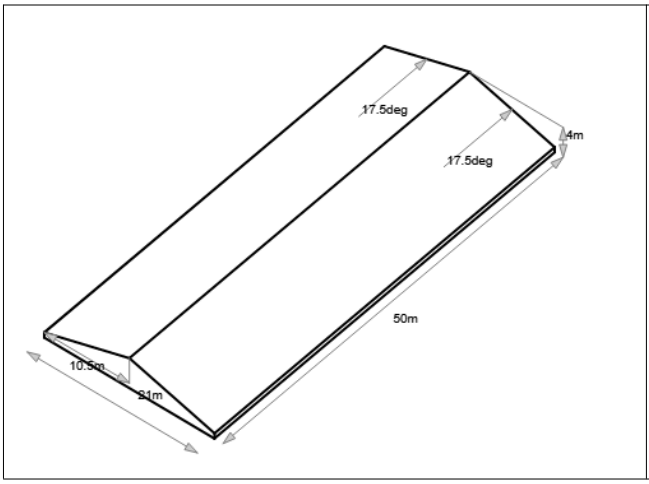


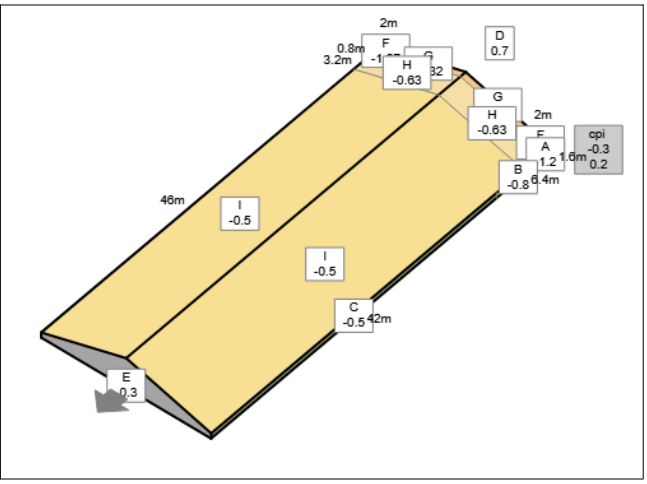
Wind X- : Detail of resultant forces for every level (Normal and thrown of center) (with correlation coefficient)

Level	Fx	Fy	xp	yp	Fx eccentricity	Fy eccentricity	xp eccentricity	yp eccentricity
-	*[kN]*	*[kN]*	*[m]*	*[m]*	*[kN]*	*[kN]*	*[m]*	*[m]*
0	-76.88	0	10.5	25	-73.3	0	10.5	24.24

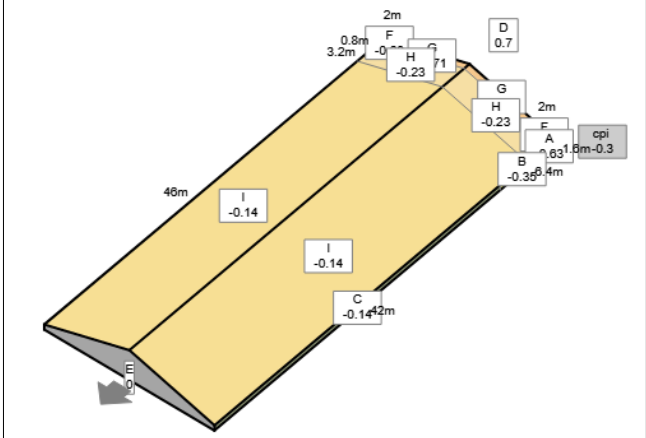
3.5 Wind direction Y- (on pinion)

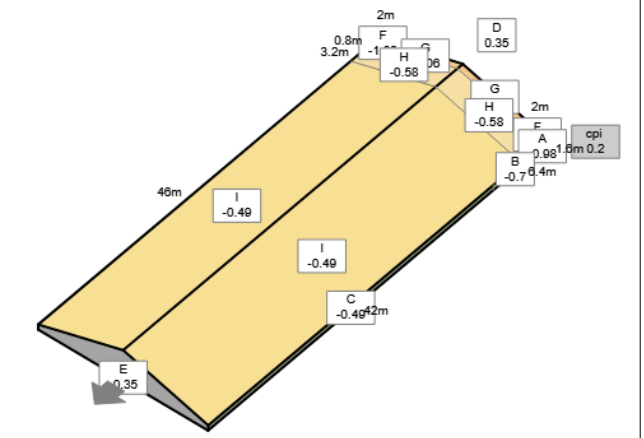
Wind Y- : Pressure coefficients Cpe and Cpi (Reference surface for roof = 10m^2) (Reference surface for walls = 10m^2)





Wind Y- : Pressures on zones (Reference surface for roof = 10m^2) (Reference surface for walls = 10m^2) (kN/m2)



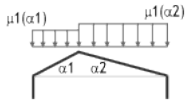
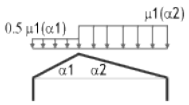
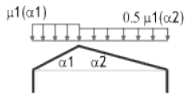


Wind Y- : Detail of resultant forces for every level (Normal and thrown of center) (with correlation coefficient)

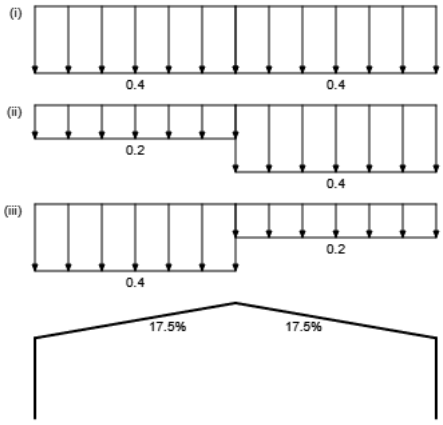
Level	Fx	Fy	xp	yp	Fx eccentricity	Fy eccentricity	xp eccentricity	yp eccentricity
-	*[kN]*	*[kN]*	*[m]*	*[m]*	*[kN]*	*[kN]*	*[m]*	*[m]*
0	0	-24.99	10.5	25	0	-16.24	14	25

4 Study snow loads : Charges de neige_1

Snow Loads S (Normal), Sa (Accidental)		
Characteristic value (sk) and exceptionnal value (Sad) of snow load on soil for the considered altitude Snow region : User ; Site altitude : 100m		
s_k	0.5kN/m2	User defined snow load
s_{Ad}	0kN/m2	User defined snow load
Coefficients		
Ce	1	Exposition coefficient (Normal site)
Ct	1	Thermal coefficient
With snow stops		
Snow case : S1		

	Left slope $S = \mu_1 \ C_t \ C_e \ s_k = 0.8 \times 1 \times 1 \times 0.5 = 0.4 \text{kN} / m2$ $\mu_1 = 0.8$ Right slope $S = \mu_1 \ C_t \ C_e \ s_k = 0.8 \times 1 \times 1 \times 0.5 = 0.4 \text{kN} / m2$ $\mu_1 = 0.8$
Snow case : S2	
	Left slope $S = 0.5 \left(\mu_1 \ C_t \ C_e \ s_k\right) = 0.5 \times \left(0.8 \times 1 \times 1 \times 0.5\right) = 0.2 \text{kN} / m2$ $\mu_1 = 0.8$ Right slope $S = \mu_1 \ C_t \ C_e \ s_k = 0.8 \times 1 \times 1 \times 0.5 = 0.4 \text{kN} / m2$ $\mu_1 = 0.8$
Snow case : S3	
	Left slope $S = \mu_1 \ C_t \ C_e \ s_k = 0.8 \times 1 \times 1 \times 0.5 = 0.4 \text{kN} / m2$ $\mu_1 = 0.8$ Right slope $S = 0.5 \left(\mu_1 \ C_t \ C_e \ s_k\right) = 0.5 \times \left(0.8 \times 1 \times 1 \times 0.5\right) = 0.2 \text{kN} / m2$ $\mu_1 = 0.8$

Normal snow : Sustainable / transitional project situation (kN/m2)



5 Study : Manege incl

5.1 Model definition

5.1.1 Model Points

Point coordinates

Point	Point name	X	Y	Point	Point name	X	Y	Point	Point name	X	Y
-	-	*m*	*m*	-	-	*m*	*m*	-	-	*m*	*m*
1	-	0	0	4	-	20	0	7	-	10	6.68
9	-	0.41	4.11	10	-	19.59	4.11	-	-	-	-

5.1.2 Model Members

Properties of structural members

Group : Members not in a group

Member	Name	Vertices	Length	Vy	Property set	Section	Material	Link origin	Link end

Id									
7	-	9-7	9.93	0 ; 0 ; -1	P - 1	(41)R20x120-60	(39) GL24H		
9	-	1-9	4.13	0 ; 0 ; -1	P - 1	(40)RR10x20x50-120	(39) GL24H		
10	-	10-7	9.93	0 ; 0 ; 1	P - 1	(41)R20x120-60	(39) GL24H		
11	-	4-10	4.13	0 ; 0 ; 1	P - 1	(40)RR10x20x50-120	(39) GL24H		

Section properties (standard members)

Part section name	Name section	S	Sry	Srz	It	Iy	Iz	Wely	Welz
-	-	*mm^2*	*mm^2*	*mm^2*	*mm^4*	*mm^4*	*mm^4*	*mm^3*	*mm^3*
(40) RR10x20x50-120	RR10x20x50	100000	83333.333	83333.333	291338933.33	2083333333.33	83333333.33	8333333.33	1666666.67
(40) RR10x20x50-120	RR10x20x120	240000	200000	200000	758000168.79	288000000 00	200000000	48000000	4000000
(41) R20x120-60	R20x120	240000	200000	200000	2864021604.94	288000000 00	800000000	48000000	8000000
(41) R20x120-60	R20x60	120000	100000	100000	1264345679.01	360000000 0	400000000	12000000	4000000

Properties of wood materials

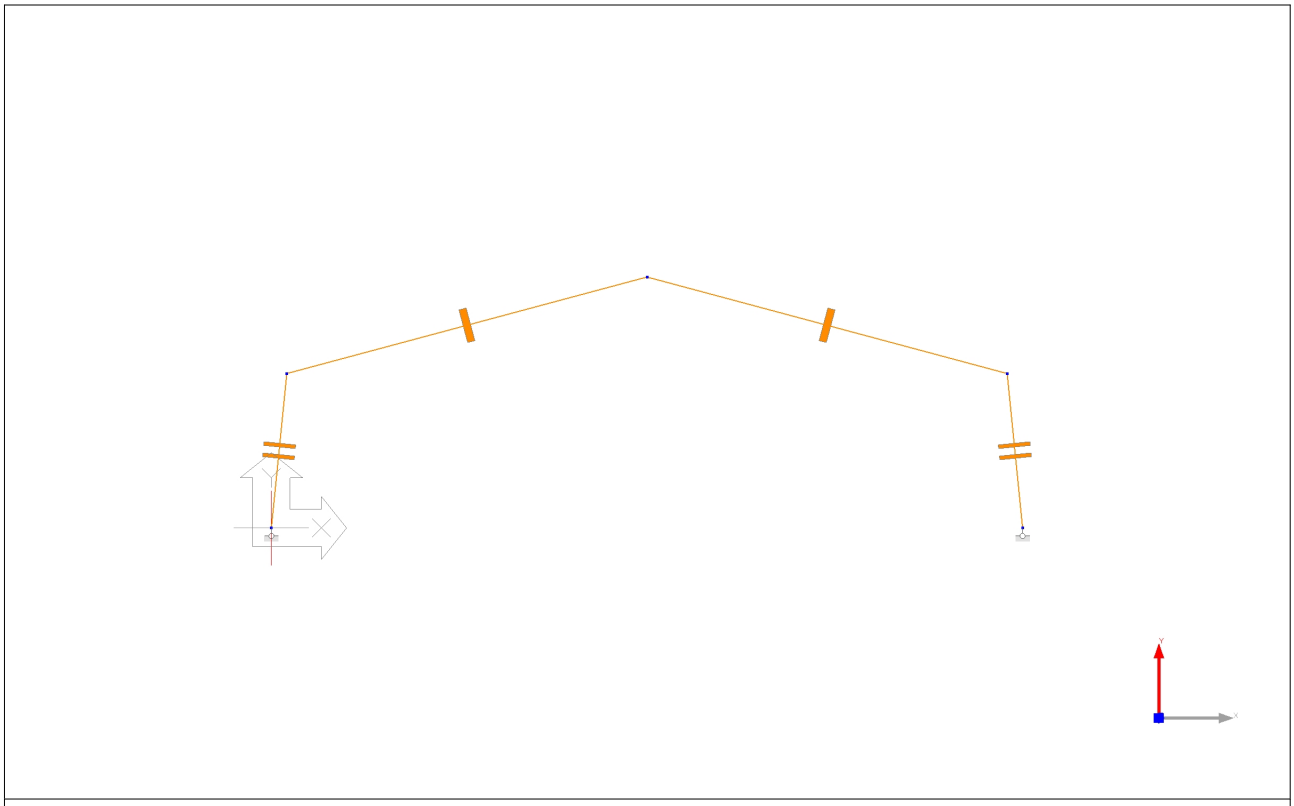
Name	E_0mean	E_005	E_90mean	G_mean	G_005	rho_mean	rho_k	f_t0k	f_c0k	f_mk	f_vk	f_t90k	f_c90k	Service class	Initial humidity
-	*MPa*	*MPa*	*MPa*	*MPa*	*MPa*	*kg/m^3*	*kg/m^3*	*MPa*	*MPa*	*MPa*	*MPa*	*MPa*	*MPa*	-	-
(39) GL24H	11500	9600	300	650	540	420	385	19.2	24	24	3.5	0.5	2.5	2	12

5.1.3 Boundary conditions

Boundary conditions : Points

Point	Point name	Boundary conditions set	U	V	W	Tx	Ty	Tz	Coordinate system
-	-	-	*mm ; kN/m*	*mm ; kN/m*	*mm ; kN/m*	*deg ; kN*m/rad*	*deg ; kN*m/rad*	*deg ; kN*m/rad*	-
1	-	BC - 1	U=0	V=0	W=0				-
4	-	BC - 1	U=0	V=0	W=0				-

Manege incl



Modèle

5.2 Reactions basic case sets

5.2.1 : Charges permanentes

General properties of basic case set										
Case Id	**Name**	**Property sets**	**Boundary conditions set**	**Nature**	**Category**	**Duration**	**Psi0**	**Psi1**	**Psi2**	**PsiE**
1 - G	Charges permanentes	P - 1	BC - 1	Permanent	-	Permanent	1	1	1	1

Table of member distributed loads												
Case Id	**Load user name**	**Member labels**	**Name**	**Vx**	**Vy**	**Vz**	**P1**	**P2**	**Start**	**End**	**Coordinate system**	**Projection**
-	-	-	-	-	-	-	*kN/m*	*kN/m*	-	-	-	-
1		7	-	0	-1	0	1.25	1.25	0%	100%	G	On beam
1		10	-	0	-1	0	1.25	1.25	0%	100%	G	On beam

Volumic forces (Proper weight,...)			
Case Id	**Gx**	**Gy**	**Gz**
-	*m/s2*	*m/s2*	*m/s2*
1	0	-9.81	0

5.2.2 : S1

General properties of basic case set

Case Id	Name	Property sets	Boundary conditions set	Nature	Category	Duration	Psi0	Psi1	Psi2	PsiE
12 - S	S1	P - 1	BC - 1	Snow	H inf 1000m	Short term	0.5	0.2	0	0

Table of punctual loads on members

Case Id	Load user name	Member labels	Name	Fx	Fy	Fz	Mx	My	Mz	Position	Coordinate system
-	-	-	-	*kN*	*kN*	*kN*	*kN*m*	*kN*m*	*kN*m*	-	-
12		7	-	0	0	0	0	0	0	0%	G

Table of member distributed loads

Case Id	Load user name	Member labels	Name	Vx	Vy	Vz	P1	P2	Start	End	Coordinate system	Projection
-	-	-	-	-	-	-	*kN/m*	*kN/m*	-	-	-	-
12		7	-	0	-1	0	2	2	0%	100%	G	Horizontal

5.2.3 : S2

General properties of basic case set

Case Id	Name	Property sets	Boundary conditions set	Nature	Category	Duration	Psi0	Psi1	Psi2	PsiE
13 - S2	S2	P - 1	BC - 1	Snow	H inf 1000m	Short term	0.5	0.2	0	0

Table of punctual loads on members

Case Id	Load user name	Member labels	Name	Fx	Fy	Fz	Mx	My	Mz	Position	Coordinate system
-	-	-	-	*kN*	*kN*	*kN*	*kN*m*	*kN*m*	*kN*m*	-	-
13		7	-	0	0	0	0	0	0	0%	G

Table of member distributed loads

Case Id	Load user name	Member labels	Name	Vx	Vy	Vz	P1	P2	Start	End	Coordinate system	Projection
-	-	-	-	-	-	-	*kN/m*	*kN/m*	-	-	-	-
13		7	-	0	-1	0	1	1	0%	100%	G	Horizontal

5.2.4 : Vent : X+ : PD -0.3

General properties of basic case set

Case Id	Name	Property sets	Boundary conditions set	Nature	Category	Duration	Psi0	Psi1	Psi2	PsiE
17 - W	Vent : X+ : PD -0.3	P - 1	BC - 1	Wind	-	Instantaneous	0.6	0.2	0	0

Table of member distributed loads

Case Id	Load user name	Member labels	Name	Vx	Vy	Vz	P1	P2	Start	End	Coordinate system	Projection
-	-	-	-	-	-	-	*kN/m*	*kN/m*	-	-	-	-
17		7	-	0	-1	0	1.25	1.25	0%	100%	G	On beam
17		9	-	0	-1	0	1.25	1.25	0%	100%	G	On beam

5.2.5 : Vent : X+ : DP 0.2

General properties of basic case set										
Case Id	**Name**	**Property sets**	**Boundary conditions set**	**Nature**	**Category**	**Duration**	**Psi0**	**Psi1**	**Psi2**	**PsiE**
18 - W2	Vent : X+ : DP 0.2	P - 1	BC - 1	Wind	-	Instantaneous	0.6	0.2	0	0

Table of member distributed loads												
Case Id	**Load user name**	**Member labels**	**Name**	**Vx**	**Vy**	**Vz**	**P1**	**P2**	**Start**	**End**	**Coordinate system**	**Projection**
-	-	-	-	-	-	-	*kN/m*	*kN/m*	-	-	-	-
18		7	-	0	0	-1	1.05	1.05	0%	100%	L	On beam

5.2.6 Reactions basic case sets

Reactions table								
Group : Vertices not in a group ()								
Point	**Point name**	**Case Id**	**RFx**	**RFy**	**RFz**	**RMx**	**RMy**	**RMz**
-	-	-	*kN*	*kN*	*kN*	*kN*m*	*kN*m*	*kN*m*
1	-	1-G	13.59	22.66	0	0	0	0
1	-	12-S	6.74	14.19	0	0	0	0
1	-	13-S2	3.37	7.09	0	0	0	0
1	-	17-W	4.46	14.29	0	0	0	0
1	-	18-W2	2.05	6.72	0	0	0	0
4	-	1-G	-13.59	22.66	0	0	0	0
4	-	12-S	-6.74	4.99	0	0	0	0
4	-	13-S2	-3.37	2.5	0	0	0	0
4	-	17-W	-4.46	3.28	0	0	0	0
4	-	18-W2	-4.75	3.35	0	0	0	0
Total	Total	1-G	0	45.33	0	0	0	0
Total	Total	12-S	0	19.18	0	0	0	0
Total	Total	13-S2	0	9.59	0	0	0	0
Total	Total	17-W	0	17.57	0	0	0	0
Total	Total	18-W2	-2.7	10.07	0	0	0	0

5.3 Results for ULS combinations

5.3.1 Loop on cases "Linear combinations" : ELU-STR

List of linear combinations	
1	1.35G
2	1.35G+1.5S
3	1.35G+1.5S+0.9W
4	1.35G+1.5S+0.9W2

5	1.35G+1.5S2
6	1.35G+1.5S2+0.9W
7	1.35G+1.5S2+0.9W2
8	1.35G+1.5W
9	1.35G+1.5W+0.75S
10	1.35G+1.5W+0.75S2
11	1.35G+1.5W2
12	1.35G+1.5W2+0.75S
13	1.35G+1.5W2+0.75S2
14	G
15	G+1.5S
16	G+1.5S+0.9W
17	G+1.5S+0.9W2
18	G+1.5S2
19	G+1.5S2+0.9W
20	G+1.5S2+0.9W2
21	G+1.5W
22	G+1.5W+0.75S
23	G+1.5W+0.75S2
24	G+1.5W2
25	G+1.5W2+0.75S
26	G+1.5W2+0.75S2

Synthesis : Min and Max internal forces N,V,M in members

Group : Members not in a group

Type	Member labels	Name	Position	Case Id	Combination type	Duration	N	Vy	Vz	Mx	My	Mz
-	-	-	-	-	-	-	*kN*	*kN*	*kN*	*kN*m*	*kN*m*	*kN*m*
N max	7	-	1.00	14	ELU-STR	Permanent	-13.13	0	3.52	0	-8.91	0
Vy max	7	-	0.00	1	ELU-STR	Permanent	-24.63	0	-21.03	0	63.52	0
Vz max	11	-	1.00	4	ELU-STR	Instantaneous	-40.26	0	28.87	0	118.34	0
Mx max	7	-	0.00	1	ELU-STR	Permanent	-24.63	0	-21.03	0	63.52	0
My max	10	-	0.00	4	ELU-STR	Instantaneous	-41.24	0	-27.45	0	118.34	0
Mz max	7	-	0.00	1	ELU-STR	Permanent	-24.63	0	-21.03	0	63.52	0
N min	9	-	0.00	3	ELU-STR	Instantaneous	-67.65	0	25.87	0	0	0
Vy min	7	-	0.00	1	ELU-STR	Permanent	-24.63	0	-21.03	0	63.52	0
Vz min	7	-	0.00	3	ELU-STR	Instantaneous	-45.91	0	-45.87	0	108.51	0
Mx min	7	-	0.00	1	ELU-STR	Permanent	-24.63	0	-21.03	0	63.52	0
My min	7	-	0.70	3	ELU-STR	Instantaneous	-33.6	0	0.06	0	-49.51	0
Mz min	7	-	0.00	1	ELU-STR	Permanent	-24.63	0	-21.03	0	63.52	0

Synthesis : Max internal stresses in members									
Group : Members not in a group									
Type	**Member labels**	**Name**	**Case Id**	**St (Traction)**	**Sc (Compression)**	**Sm (Flexion)**	**Smax axial**	**Shear Y**	**Shear Z**
-	-	-	-	*MPa*	*MPa*	*MPa*	*MPa*	*MPa*	*MPa*
St (Traction) max	7	-	1	0	-0.15	1.32	-1.43	0	-0.13
Sc (Compression) max	9	-	3	0	-0.68	2.31	-2.63	0	0.39
Sm (Flexion) max	7	-	3	0	-0.24	2.7	-2.92	0	-0.29
Smax axial max	7	-	3	0	-0.24	2.7	-2.92	0	-0.29
Shear Y max	7	-	1	0	-0.15	1.32	-1.43	0	-0.13
Shear Z max	11	-	4	0	-0.44	2.53	-2.74	0	0.43

5.3.2 Loop on cases "Linear combinations" : ELS-UINST (Flèches instantanées)

List of linear combinations	
1	S
2	S+0.6W
3	S+0.6W2
4	S2
5	S2+0.6W
6	S2+0.6W2
7	W
8	W+0.5S
9	W+0.5S2
10	W2
11	W2+0.5S
12	W2+0.5S2

Synthesis : Min and Max internal forces N,V,M in members												
Group : Members not in a group												
Type	**Member labels**	**Name**	**Position**	**Case Id**	**Combination type**	**Duration**	**N**	**Vy**	**Vz**	**Mx**	**My**	**Mz**
-	-	-	-	-	-	-	*kN*	*kN*	*kN*	*kN*m*	*kN*m*	*kN*m*
N max	7	-	1.00	4	ELS-UINST	Permanent	-2.61	0	3.28	0	-2.44	0
Vy max	7	-	0.00	1	ELS-UINST	Permanent	-10.19	0	-11.96	0	21.89	0
Vz max	7	-	1.00	3	ELS-UINST	Permanent	-7.45	0	9.24	0	-5.93	0
Mx max	7	-	0.00	1	ELS-UINST	Permanent	-10.19	0	-11.96	0	21.89	0
My max	10	-	0.00	3	ELS-UINST	Permanent	-11.08	0	-4.28	0	36.55	0
Mz max	7	-	0.00	1	ELS-	Permane	-10.19	0	-11.96	0	21.89	0

					UINST	nt						
N min	9	-	0.00	2	ELS-UINST	Permanent	-23.58	0	7.11	0	0	0
Vy min	7	-	0.00	1	ELS-UINST	Permanent	-10.19	0	-11.96	0	21.89	0
Vz min	7	-	0.00	2	ELS-UINST	Permanent	-14.19	0	-16.55	0	30	0
Mx min	7	-	0.00	1	ELS-UINST	Permanent	-10.19	0	-11.96	0	21.89	0
My min	7	-	0.63	3	ELS-UINST	Permanent	-9.31	0	0	0	-23.05	0
Mz min	7	-	0.00	1	ELS-UINST	Permanent	-10.19	0	-11.96	0	21.89	0

Synthesis : Max internal stresses in members

Group : Members not in a group

Type	Member labels	Name	Case Id	St (Traction)	Sc (Compression)	Sm (Flexion)	Smax axial	Shear Y	Shear Z
-	-	-	-	*MPa*	*MPa*	*MPa*	*MPa*	*MPa*	*MPa*
St (Traction) max	7	-	1	0	-0.04	0.82	-0.87	0	0.08
Sc (Compression) max	9	-	2	0	-0.24	0.64	-0.75	0	0.11
Sm (Flexion) max	7	-	2	0	-0.06	1.14	-1.21	0	0.11
Smax axial max	7	-	2	0	-0.06	1.14	-1.21	0	0.11
Shear Y max	7	-	1	0	-0.04	0.82	-0.87	0	0.08
Shear Z max	11	-	3	0	-0.08	0.78	-0.82	0	0.13

5.3.3 Loop on cases "Linear combinations" : ELS-UFIN (Flèches finales)

List of linear combinations	
1	G
2	G+S
3	G+S+0.6W
4	G+S+0.6W2
5	G+S2
6	G+S2+0.6W
7	G+S2+0.6W2
8	G+W
9	G+W+0.5S
10	G+W+0.5S2
11	G+W2
12	G+W2+0.5S
13	G+W2+0.5S2

Synthesis : Min and Max internal forces N,V,M in members

Group : Members not in a group												
Type	**Member labels**	**Name**	**Position**	**Case Id**	**Combination type**	**Duration**	**N**	**Vy**	**Vz**	**Mx**	**My**	**Mz**
-	-	-	-	-	-	-	*kN*	*kN*	*kN*	*kN*m*	*kN*m*	*kN*m*
N max	7	-	1.00	1	ELS-UFIN	Permanent	-13.13	0	3.52	0	-8.91	0
Vy max	7	-	0.00	1	ELS-UFIN	Permanent	-18.24	0	-15.58	0	47.05	0
Vz max	11	-	1.00	4	ELS-UFIN	Permanent	-28.95	0	20.4	0	83.6	0
Mx max	7	-	0.00	1	ELS-UFIN	Permanent	-18.24	0	-15.58	0	47.05	0
My max	10	-	0.00	4	ELS-UFIN	Permanent	-29.32	0	-19.86	0	83.6	0
Mz max	7	-	0.00	1	ELS-UFIN	Permanent	-18.24	0	-15.58	0	47.05	0
N min	9	-	0.00	3	ELS-UFIN	Permanent	-47.49	0	18.37	0	0	0
Vy min	7	-	0.00	1	ELS-UFIN	Permanent	-18.24	0	-15.58	0	47.05	0
Vz min	7	-	0.00	3	ELS-UFIN	Permanent	-32.43	0	-32.14	0	77.05	0
Mx min	7	-	0.00	1	ELS-UFIN	Permanent	-18.24	0	-15.58	0	47.05	0
My min	7	-	0.71	3	ELS-UFIN	Permanent	-23.81	0	0.05	0	-34.18	0
Mz min	7	-	0.00	1	ELS-UFIN	Permanent	-18.24	0	-15.58	0	47.05	0

Synthesis : Max internal stresses in members									
Group : Members not in a group									
Type	**Member labels**	**Name**	**Case Id**	**St (Traction)**	**Sc (Compression)**	**Sm (Flexion)**	**Smax axial**	**Shear Y**	**Shear Z**
-	-	-	-	*MPa*	*MPa*	*MPa*	*MPa*	*MPa*	*MPa*
St (Traction) max	7	-	1	0	-0.11	0.98	-1.06	0	-0.1
Sc (Compression) max	9	-	3	0	-0.47	1.64	-1.87	0	0.28
Sm (Flexion) max	7	-	3	0	-0.17	1.88	-2.04	0	-0.2
Smax axial max	7	-	3	0	-0.17	1.88	-2.04	0	-0.2
Shear Y max	7	-	1	0	-0.11	0.98	-1.06	0	-0.1
Shear Z max	11	-	4	0	-0.32	1.79	-1.94	0	0.3

5.3.4 Loop on cases "Linear combinations" : ELS-CR

List of linear combinations	
1	G

2	G+S
3	G+S+0.6W
4	G+S+0.6W2
5	G+S2
6	G+S2+0.6W
7	G+S2+0.6W2
8	G+W
9	G+W+0.5S
10	G+W+0.5S2
11	G+W2
12	G+W2+0.5S
13	G+W2+0.5S2

Synthesis : Min and Max internal forces N,V,M in members

Group : Members not in a group

Type	Member labels	Name	Position	Case Id	Combination type	Duration	N	Vy	Vz	Mx	My	Mz
-	-	-	-	-	-	-	*kN*	*kN*	*kN*	*kN*m*	*kN*m*	*kN*m*
N max	7	-	1.00	1	ELS-CR	Permanent	-13.13	0	3.52	0	-8.91	0
Vy max	7	-	0.00	1	ELS-CR	Permanent	-18.24	0	-15.58	0	47.05	0
Vz max	11	-	1.00	4	ELS-CR	Permanent	-28.95	0	20.4	0	83.6	0
Mx max	7	-	0.00	1	ELS-CR	Permanent	-18.24	0	-15.58	0	47.05	0
My max	10	-	0.00	4	ELS-CR	Permanent	-29.32	0	-19.86	0	83.6	0
Mz max	7	-	0.00	1	ELS-CR	Permanent	-18.24	0	-15.58	0	47.05	0
N min	9	-	0.00	3	ELS-CR	Permanent	-47.49	0	18.37	0	0	0
Vy min	7	-	0.00	1	ELS-CR	Permanent	-18.24	0	-15.58	0	47.05	0
Vz min	7	-	0.00	3	ELS-CR	Permanent	-32.43	0	-32.14	0	77.05	0
Mx min	7	-	0.00	1	ELS-CR	Permanent	-18.24	0	-15.58	0	47.05	0
My min	7	-	0.71	3	ELS-CR	Permanent	-23.81	0	0.05	0	-34.18	0
Mz min	7	-	0.00	1	ELS-CR	Permanent	-18.24	0	-15.58	0	47.05	0

Synthesis : Max internal stresses in members

Group : Members not in a group

Type	Member labels	Name	Case Id	St (Traction)	Sc (Compression)	Sm (Flexion)	Smax axial	Shear Y	Shear Z
-	-	-	-	*MPa*	*MPa*	*MPa*	*MPa*	*MPa*	*MPa*
St (Traction) max	7	-	1	0	-0.11	0.98	-1.06	0	-0.1
Sc	9	-	3	0	-0.47	1.64	-1.87	0	0.28

(Compression) max									
Sm (Flexion) max	7	-	3	0	-0.17	1.88	-2.04	0	-0.2
Smax axial max	7	-	3	0	-0.17	1.88	-2.04	0	-0.2
Shear Y max	7	-	1	0	-0.11	0.98	-1.06	0	-0.1
Shear Z max	11	-	4	0	-0.32	1.79	-1.94	0	0.3

5.4 Results for SLS combinations

5.4.1 Loop on cases "Linear combinations" : ELU-STR

List of linear combinations	
1	1.35G
2	1.35G+1.5S
3	1.35G+1.5S+0.9W
4	1.35G+1.5S+0.9W2
5	1.35G+1.5S2
6	1.35G+1.5S2+0.9W
7	1.35G+1.5S2+0.9W2
8	1.35G+1.5W
9	1.35G+1.5W+0.75S
10	1.35G+1.5W+0.75S2
11	1.35G+1.5W2
12	1.35G+1.5W2+0.75S
13	1.35G+1.5W2+0.75S2
14	G
15	G+1.5S
16	G+1.5S+0.9W
17	G+1.5S+0.9W2
18	G+1.5S2
19	G+1.5S2+0.9W
20	G+1.5S2+0.9W2
21	G+1.5W
22	G+1.5W+0.75S
23	G+1.5W+0.75S2
24	G+1.5W2
25	G+1.5W2+0.75S
26	G+1.5W2+0.75S2

Envelope : Member displacements											
Group : Members not in a group											
Member labels	Name	Displacement v	Case Id	Displacement w	Case Id	u local	Case Id	v local	Case Id	w local	Case Id
-	-	*mm*	-	*mm*	-	*mm*	-	*mm*	-	*mm*	-
7	-	0	1	3.22	4	-1.25	1	0	1	-9.4	3
9	-	0	1	0.82	3	-0.11	17	0	1	1.26	1
10	-	0	1	1.01	17	-4.3	4	0	1	-7.89	3

11	-	0	1	0.9	4	-0.1	4	0	1	4.36	4

5.4.2 Loop on cases "Linear combinations" : ELS-UINST (Flèches instantanées)

List of linear combinations	
1	S
2	S+0.6W
3	S+0.6W2
4	S2
5	S2+0.6W
6	S2+0.6W2
7	W
8	W+0.5S
9	W+0.5S2
10	W2
11	W2+0.5S
12	W2+0.5S2

Envelope : Member displacements

Group : Members not in a group

Member labels	Name	Displacement v	Case Id	Displacement w	Case Id	u local	Case Id	v local	Case Id	w local	Case Id
-	-	*mm*	-	*mm*	-	*mm*	-	*mm*	-	*mm*	-
7	-	0	1	1.64	3	0.9	11	0	1	-3.46	2
9	-	0	1	0.23	2	-0.05	2	0	1	-1	11
10	-	0	1	0.92	3	-2.03	3	0	1	-2.14	2
11	-	0	1	0.28	3	-0.02	3	0	1	2.1	3

5.4.3 Loop on cases "Linear combinations" : ELS-UFIN (Flèches finales)

List of linear combinations	
1	G
2	G+S
3	G+S+0.6W
4	G+S+0.6W2
5	G+S2
6	G+S2+0.6W
7	G+S2+0.6W2
8	G+W
9	G+W+0.5S
10	G+W+0.5S2
11	G+W2
12	G+W2+0.5S
13	G+W2+0.5S2

Envelope : Member displacements

Group : Members not in a group

Member labels	Name	Displacement v	Case Id	Displacement w	Case Id	u local	Case Id	v local	Case Id	w local	Case Id
-	-	*mm*	-	*mm*	-	*mm*	-	*mm*	-	*mm*	-
7	-	0	1	2.67	4	-1.67	1	0	1	-9.26	3

9	-	0	1	0.86	3	-0.11	9	0	1	1.68	1
10	-	0	1	1.06	1	-3.7	4	0	1	-8.38	3
11	-	0	1	0.92	4	-0.11	4	0	1	3.72	4

5.4.4 Loop on cases "Linear combinations" : ELS-CR

List of linear combinations	
1	G
2	G+S
3	G+S+0.6W
4	G+S+0.6W2
5	G+S2
6	G+S2+0.6W
7	G+S2+0.6W2
8	G+W
9	G+W+0.5S
10	G+W+0.5S2
11	G+W2
12	G+W2+0.5S
13	G+W2+0.5S2

Envelope : Member displacements

Group : Members not in a group

Member labels	Name	Displacement v	Case Id	Displacement w	Case Id	u local	Case Id	v local	Case Id	w local	Case Id
-	-	*mm*	-	*mm*	-	*mm*	-	*mm*	-	*mm*	-
7	-	0	1	2.2	4	-0.93	1	0	1	-6.59	3
9	-	0	1	0.58	3	-0.06	8	0	1	0.93	1
10	-	0	1	0.64	4	-2.96	4	0	1	-5.61	3
11	-	0	1	0.63	4	-0.07	4	0	1	3	4

5.5 WOOD : Rules Verifications

Members : Properties for rule verifications

Group : Members not in a group

Member Id	Name	Property	SLS Ratios	Spans w	Spans v	Buckling plane xz	Buckling plane xy	Lateral buckling (z+)	Lateral buckling (z-)
7	-	Wood	L/Winst=300 L/Wfin=125 L/Wnetfin=200	Ls=1	Ls=1	Ls=1 (Klf=1)	Ls=1 (Klf=1)	Ls=0.17 (Klf=1) Ls=0.17 (Klf=1) Ls=0.17 (Klf=1) Ls=0.17 (Klf=1) Ls=0.17 (Klf=1) Ls=0.17 (Klf=1) Ls=0.17 (Klf=1)	Ls=1 (Klf=1)
9	-	Wood	L/Winst=300 L/Wfin=125 L/Wnetfin=2	Ls=1	Ls=1	Ls=0.33 (Klf=1) Ls=0.33	Ls=1 (Klf=1)	Ls=1 (Klf=1)	Ls=1 (Klf=1)

			00			(Klf=1) Ls=0.33 (Klf=1)			
10	-	Wood	L/Winst=300 L/Wfin=125 L/Wnetfin=200	Ls=1	Ls=1	Ls=1 (Klf=1)	Ls=1 (Klf=1)	Ls=0.17 (Klf=1) Ls=0.17 (Klf=1) Ls=0.17 (Klf=1) Ls=0.17 (Klf=1) Ls=0.17 (Klf=1) Ls=0.17 (Klf=1)	Ls=1 (Klf=1)
11	-	Wood	L/Winst=300 L/Wfin=125 L/Wnetfin=200	Ls=1	Ls=1	Ls=0.33 (Klf=1) Ls=0.33 (Klf=1) Ls=0.33 (Klf=1)	Ls=1 (Klf=1)	Ls=1 (Klf=1)	Ls=1 (Klf=1)

EC5 : Standard wood members / Group : Members not in a group

Member properties				ELU Results						SLS results		
Piece	Name	Section	Material	Axial-Flexion	Shear	Tensile stresses perpendicular to the grain	Shear stresses and tensile stresses perpendicular to the grain	Buckling	Lateral buckling	Instantaneous deflections (Rare combinations)	Final deflections (Rare combinations)	Deflections w2 (Rare combinations)
7	_	R20x69	GL24H	12.95%	14.43%	-	-	18.04%	16.57%	4.95% (1.64mm)	5.38% (2.67mm)	-
9	_	RR10x20x120	GL24H	11,94%	20,57%	-	-	18,92%	31,38%	1,63% (0,23mm)	4,19% (0,86mm)	-
10	_	R20x60	GL24H	12,31%	11,68%	-	-	17,55%	17,54%	2,78% (0,92mm)	2,14% (1,06mm)	-
11	_	RR10x20x120	GL24H	12,63%	21,79%	-	-	17,33%	33,23%	2,02% (0,28mm)	4,45% (0,92mm)	-

5.5.1 : Piece : 7

ELU results		
Axial stress resistance		
ELU-STR / 2: 1.35G+1.5S (LC1) / Short term / kmod = 0,9 / gamma_m = 1,25 xrel = 0,85 / N = -27,6 kN / Vz = 6,97 kN / My = -35,47 kN*m		
Criterium EC5_FC1	12,95%	$\left\lvert -\left(\frac{\sigma_{c,0,d}}{f_{c,0,d}}\right)^2 + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} \right\rvert = \left\lvert -\left(\frac{-0,2}{17,28}\right)^2 + \frac{-2,24}{17,28} + 0,7\frac{0}{19,01} \right\rvert = 0,13$
Shear resistance		
ELU-STR / 2: 1.35G+1.5S (LC1) / Short term / kmod = 0,9 / gamma_m = 1,25 xrel = 0 / N = -39,91 kN / Vz = -38,97 kN / My = 96,35 kN*m		
Criterium EC5_Sz	14,43%	$\frac{\lvert \tau_{z,d} \rvert}{f_{v,d}} = \frac{\lvert -0,36 \rvert}{2,52} = 0,14$
Buckling resistance		
ELU-STR / 2: 1.35G+1.5S (LC1) / Short term / kmod = 0,9 / gamma_m = 1,25 xrel = 0,85 / N = -27,6 kN / Vz = 6,97 kN / My = -35,47 kN*m		

Criterium EC5_B2	18,04%	$\left\lvert \frac{\sigma_{\cdot\cdot}}{k_{\cdot\cdot} \; f_{\cdot\cdot}} + k_{\cdot\cdot} \frac{\sigma_{\cdot\cdot}}{f_{\cdot\cdot}} + \frac{\sigma_{\cdot\cdot}}{f_{\cdot\cdot}} \right\rvert = \left\lvert \frac{-0,2}{0,13 \times 17,28} + 0,7 \frac{-2,24}{17,28} + \frac{0}{19,01} \right\rvert = 0,18$
Lateral buckling resistance		
ELU-STR / 2: 1.35G+1.5S (LC1) / Short term / kmod = 0,9 / gamma_m = 1,25 xrel = 0 / N = -39,91 kN / Vz = -38,97 kN / My = 96,35 kN*m		
Criterium EC5_LB1	16,57%	$\frac{\lvert \sigma_{m,y,d} \rvert}{k_{crit} \; f_{m,y,d}} = \frac{\lvert 2,01 \rvert}{0,7 \times 17,28} = 0,17$

ELS results			
Component w of the deflections (mm)			
Segment	Type	$\frac{w_{inst}}{w_{inst \; , \; adm}}$	$\frac{w_{fin} - w_c}{w_{net \; , \; fin \; , \; adm}}$
1 (9,93m)	Span	$\frac{1,64}{33,09} = 4,95\%$ 3: S+0.6W2 (LC2) (L/300)	$\frac{2,67-0}{49,64} = 5,38\%$ 4: G+S+0.6W2 (LC3) (L/200) (kdef=0,8, wcreep=0,47mm)

5.5.2 : Piece : 9

ELU results		
Axial stress resistance		
ELU-STR / 2: 1.35G+1.5S (LC1) / Short term / kmod = 0,9 / gamma_m = 1,25 xrel = 0,7 / N = -52,07 kN / Vz = 23,4 kN / My = 67,27 kN*m		
Criterium EC5_FC1	11,94%	$\left\lvert -\left(\frac{\sigma_{c,0,d}}{f_{c,0,d}}\right)^2 + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} \right\rvert = \left\lvert -\left(\frac{-0,26}{17,28}\right)^2 + \frac{-2,06}{17,28} + 0,7 \frac{0}{17,28} \right\rvert = 0,12$
Shear resistance		
ELU-STR / 2: 1.35G+1.5S (LC1) / Short term / kmod = 0,9 / gamma_m = 1,25 xrel = 0 / N = -54,45 kN / Vz = 23,16 kN		
Criterium EC5_Sz	20,57%	$\frac{\lvert \tau_{z,d} \rvert}{f_{v,d}} = \frac{\lvert 0,52 \rvert}{2,52} = 0,21$
Buckling resistance		
ELU-STR / 2: 1.35G+1.5S (LC1) / Short term / kmod = 0,9 / gamma_m = 1,25 xrel = 0,2 / N = -53,93 kN / Vz = 23,21 kN / My = 19,15 kN*m		
Criterium EC5_B2	18,92%	$\left\lvert \frac{\sigma_{c,0,d}}{k_{c,z} \; f_{c,0,d}} + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} \right\rvert = \left\lvert \frac{-0,42}{0,18 \times 17,28} + 0,7 \frac{-1,4}{17,28} + \frac{0}{17,28} \right\rvert = 0,19$
Lateral buckling resistance		
ELU-STR / 2: 1.35G+1.5S (LC1) / Short term / kmod = 0,9 / gamma_m = 1,25 xrel = 1 / N = -50,56 kN / Vz = 23,55 kN / My = 96,35 kN*m		
Criterium EC5_LB1	31,38%	$\frac{\lvert \sigma_{m,y,d} \rvert}{k_{crit} \; f_{m,y,d}} = \frac{\lvert 2,01 \rvert}{0,37 \times 17,28} = 0,31$

ELS results			
Component w of the deflections (mm)			
Segment	Type	$\frac{w_{inst}}{w_{inst \; , \; adm}}$	$\frac{w_{fin} - w_c}{w_{net \; , \; fin \; , \; adm}}$
1 (4,13m)	Span	$\frac{0,23}{13,77} = 1,63\%$ 2: S+0.6W (LC2) (L/300)	$\frac{0,86-0}{20,65} = 4,19\%$ 3: G+S+0.6W (LC3) (L/200) (kdef=0,8, wcreep=0,28mm)

5.5.3 : Piece : 10

ELU results
Axial stress resistance

ELU-STR / 2: 1.35G+1.5S (LC1) / Short term / kmod = 0,9 / gamma_m = 1,25 xrel = 0 / N = -36,34 kN / Vz = -25,65 kN / My = 102,02 kN*m		
Criterium EC5_FC1	12,31%	$\left\lvert -\left(\frac{\sigma_{c,0,d}}{f_{c,0,d}}\right)^2 + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} \right\rvert = \left\lvert -\left(\frac{-0,15}{17,28}\right)^2 + \frac{-2,13}{17,28} + 0,7\frac{0}{19,01} \right\rvert = 0,12$
Shear resistance		
ELU-STR / 1: 1.35G (LC1) / Permanent / kmod = 0,6 / gamma_m = 1,25 xrel = 0 / N = -24,63 kN / Vz = -21,03 kN / My = 63,52 kN*m		
Criterium EC5_Sz	11,68%	$\frac{\lvert \tau_{z,d} \rvert}{f_{v,d}} = \frac{\lvert -0,2 \rvert}{1,68} = 0,12$
Buckling resistance		
ELU-STR / 2: 1.35G+1.5S (LC1) / Short term / kmod = 0,9 / gamma_m = 1,25 xrel = 1 / N = -29,43 kN / Vz = 0,13 kN / My = -19,34 kN*m		
Criterium EC5_B2	17,55%	$\left\lvert \frac{\sigma_{c,0,d}}{k_{c,z} f_{c,0,d}} + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} \right\rvert = \left\lvert \frac{-0,25}{0,13 \times 17,28} + 0,7\frac{-1,61}{17,28} + \frac{0}{19,01} \right\rvert = 0,18$
Lateral buckling resistance		
ELU-STR / 2: 1.35G+1.5S (LC1) / Short term / kmod = 0,9 / gamma_m = 1,25 xrel = 0 / N = -36,34 kN / Vz = -25,65 kN / My = 102,02 kN*m		
Criterium EC5_LB1	17,54%	$\frac{\lvert \sigma_{m,y,d} \rvert}{k_{crit} f_{m,y,d}} = \frac{\lvert 2,13 \rvert}{0,7 \times 17,28} = 0,18$

ELS results			
Component w of the deflections (mm)			
Segment	Type	$\frac{w_{inst}}{w_{inst,adm}}$	$\frac{w_{fin} - w_c}{w_{net,fin,adm}}$
1 (9,93m)	Span	$\frac{0,92}{33,09} = 2,78\%$ 3: S+0.6W2 (LC2) (L/300)	$\frac{1,06-0}{49,64} = 2,14\%$ 1: G (LC3) (L/200) (kdef=0,8, wcreep=0,47mm)

5.5.4 : Piece : 11

ELU results		
Axial stress resistance		
ELU-STR / 2: 1.35G+1.5S (LC1) / Short term / kmod = 0.9 / gamma_m = 1.25 xrel = 0.7 / N = -38.34 kN / Vz = 24.77 kN / My = 71.23 kN*m		
Criterium EC5_FC1	12.63%	$\left\lvert -\left(\frac{\sigma_{c,0,d}}{f_{c,0,d}}\right)^2 + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} \right\rvert = \left\lvert -\left(\frac{-0.19}{17.28}\right)^2 + \frac{-2.18}{17.28} + 0.7\frac{0}{17.28} \right\rvert = 0.13$
Shear resistance		
ELU-STR / 2: 1.35G+1.5S (LC1) / Short term / kmod = 0.9 / gamma_m = 1.25 xrel = 0 / N = -40.73 kN / Vz = 24.53 kN		
Criterium EC5_Sz	21.79%	$\frac{\lvert \tau_{z,d} \rvert}{f_{v,d}} = \frac{\lvert 0.55 \rvert}{2.52} = 0.22$
Buckling resistance		
ELU-STR / 1: 1.35G (LC1) / Permanent / kmod = 0.6 / gamma_m = 1.25 xrel = 0.25 / N = -31.6 kN / Vz = 15.28 kN / My = 15.74 kN*m		
Criterium EC5_B2	17.33%	$\left\lvert \frac{\sigma_{c,0,d}}{k_{c,z} f_{c,0,d}} + k_m \frac{\sigma_{m,y,d}}{f_{m,y,d}} + \frac{\sigma_{m,z,d}}{f_{m,z,d}} \right\rvert = \left\lvert \frac{-0.23}{0.18 \times 11.52} + 0.7\frac{-1.04}{11.52} + \frac{0}{11.52} \right\rvert = 0.17$
Lateral buckling resistance		
ELU-STR / 2: 1.35G+1.5S (LC1) / Short term / kmod = 0.9 / gamma_m = 1.25 xrel = 1 / N = -36.84 kN / Vz = 24.92 kN / My = 102.02 kN*m		
Criterium EC5_LB1	33.23%	$\frac{\lvert \sigma_{m,y,d} \rvert}{k_{crit} f_{m,y,d}} = \frac{\lvert 2.13 \rvert}{0.37 \times 17.28} = 0.33$

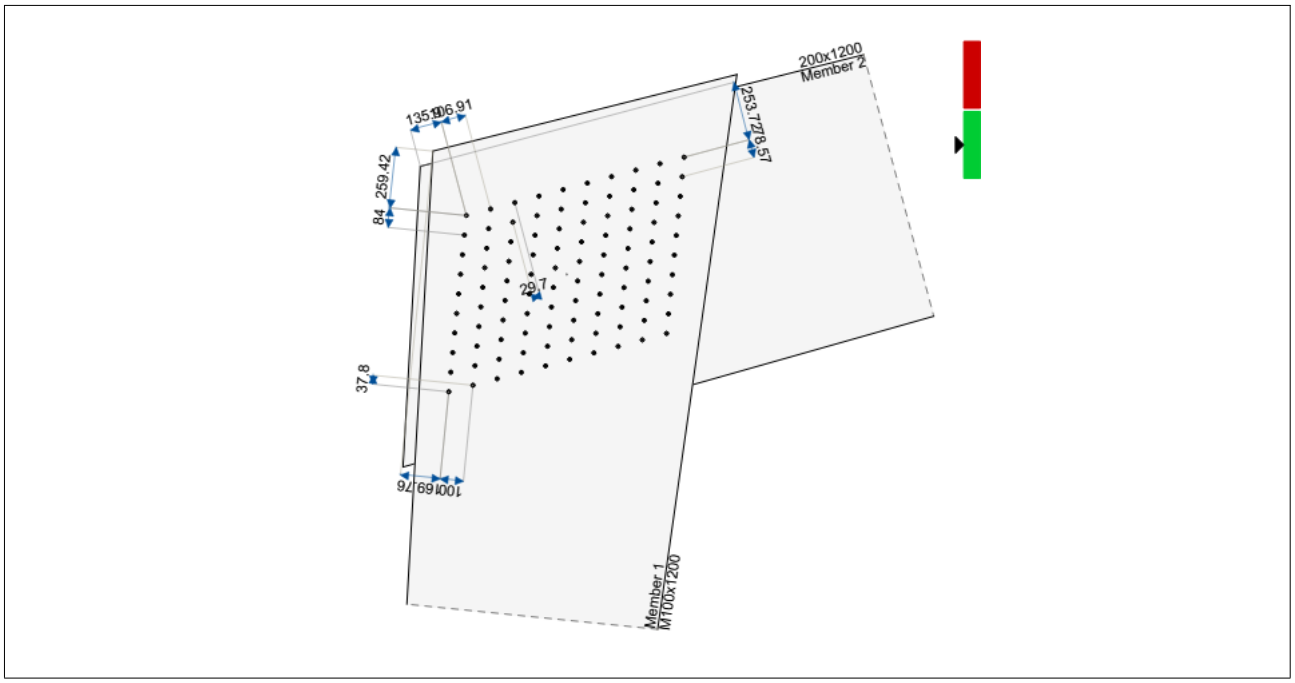
ELS results
Component w of the deflections (mm)

Segment	Type	$\frac{w_{inst}}{w_{inst\ ,\ adm}}$	$\frac{w_{fin} - w_c}{w_{net\ ,\ fin\ ,\ adm}}$
1 (4.13m)	Span	$\frac{0.28}{13.77} = 2.02\%$ 3: S+0.6W2 (LC2) (L/300)	$\frac{0.92 - 0}{20.65} = 4.45\%$ 4: G+S+0.6W2 (LC3) (L/200) (kdef=0.8, wcreep=0.28mm)

5.6 STEEL : Rules Verifications

6 Study : Assemblage direct par organes_0 (Direct wood-wood assembly)

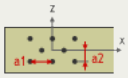
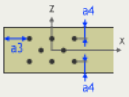
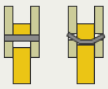
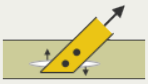
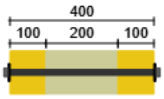
6.1 Connection configuration

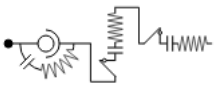
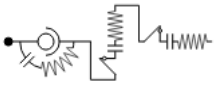


Properties of members and fasteners				
Wood member 1		**Wood member 2**		**Fasteners**
Unique Id	**Section**	**Unique Id**	**Section**	**-**
-	*mm*	-	*mm*	-
GL24H	100 x 1200	GL24H	200 x 1200	Bolts : Diameter : M16 Class : 6.8

6.2 Synthetic analysis of results

Member Id	Configurations	Admissibles spacings a1,a2	Admissibles distance a3,a4	Rupture mode	Fasteners working rate	Result fendage
-	*[mm]*	*[mm]*	*[mm]*	-	*[%]*	*[%]*

-	-				-	
1		a1 > 78.8mm a2 > 64mm	a3 > 64mm a4sup > 48mm a4inf > 48mm		2.99 % FvEd=0.56 kN ((6) 2: 1.35G+1.5S) Npo=-50.56 kN Vzpo=23.55 kN	13.25 % Vzmax=23.55 kN ((6) 2: 1.35G+1.5S)
2		a1 > 76.2mm a2 > 64mm	a3 > 86mm a4sup > 55.3mm a4inf > 48mm		2.64 % FvEd=0.56 kN ((6) 2: 1.35G+1.5S) Npo=-39.91 kN Vzpo=-38.97 kN	29.5 % Vzmax=38.97 kN ((6) 2: 1.35G+1.5S)
EC5 requirement : (EC5 10.4.3(1)) Bolt holes in timber should have a diameter not more than d+1mm						

Analysis of connection stiffness							
Member Id	**Kser Model**	**Stiffness center**	**Stiffness Kser**	**Stiffnesses Ku**	**Secant stiffness Kser**	**Secant stiffnesses Ku**	**Connection gaps**
-	-	*mm*	*kN/m ; kN*m/rad*	*kN/m ; kN*m/rad*	*kN/m ; kN*m/rad*	*kN/m ; kN*m/rad*	*mm ; deg*
1		Xc=0mm Zc=0mm	Kx=1197556.7 Kz=1197556.7 Kt=182629.34 Beta=3.31	Kx=798371.1 Kz=798371.1 Kt=121752.89 Beta=2.64	Kx=107642.6 (Nref=59.14kN) Kz=51162.8 (Vzref=26.72kN) Kt=1407.42 (Myref=1kN*m)	Kx=103013 (Nref=59.14kN) Kz=50092.7 (Vzref=26.72kN) Kt=1402.01 (Myref=1kN*m)	Gap Δu =0.5mm Gap Δθ =0.04deg
2		Xc=0mm Zc=0mm	Kx=1197556.7 Kz=1197556.7 Kt=182629.34 Beta=1.65	Kx=798371.1 Kz=798371.1 Kt=121752.89 Beta=1.32	Kx=85277.3 (Nref=45.91kN) Kz=85206.9 (Vzref=45.87kN) Kt=1407.42 (Myref=1kN*m)	Kx=82345.4 (Nref=45.91kN) Kz=82279.7 (Vzref=45.87kN) Kt=1402.01 (Myref=1kN*m)	Gap Δu =0.5mm Gap Δθ =0.04deg

6.3 Global analysis for all combinations

6.3.1 Connection forces

Connection forces member : 1								
Combination	**Type**	**Duration**	**N left**	**Vz left**	**My left**	**N right**	**Vz right**	**My right**
-	-	-	*[kN]*	*[kN]*	*[kN*m]*	*[kN]*	*[kN]*	*[kN*m]*
1 : (6) 1: 1.35G	ELU-STR	Permanent	0	0	0	-28.38	15.6	0
2 : (6) 2: 1.35G+1.5S	ELU-STR	Short term	0	0	0	-50.56	23.55	0
3 : (6) 3: 1.35G+1.5S+0.9W	ELU-STR	Instantaneous	0	0	0	-59.14	26.72	0
4 : (6) 4: 1.35G+1.5S+0.9W2	ELU-STR	Instantaneous	0	0	0	-56.77	24.78	0
5 : (6) 5: 1.35G+1.5S2	ELU-STR	Short term	0	0	0	-39.47	19.57	0
6 : (6) 6: 1.35G+1.5S2+0.9W	ELU-STR	Instantaneous	0	0	0	-48.05	22.75	0
7 : (6) 7: 1.35G+1.5S2+0.9W2	ELU-STR	Instantaneous	0	0	0	-45.68	20.81	0
8 : (6) 8: 1.35G+1.5W	ELU-STR	Instantaneous	0	0	0	-42.67	20.89	0
9 : (6) 9:	ELU-STR	Instantaneou	0	0	0	-53.76	24.87	0

1.35G+1.5W+0.75S		s						
10 : (6) 10: 1.35G+1.5W+0.75S2	ELU-STR	Instantaneous	0	0	0	-48.22	22.88	0
11 : (6) 11: 1.35G+1.5W2	ELU-STR	Instantaneous	0	0	0	-38.72	17.66	0
12 : (6) 12: 1.35G+1.5W2+0.75S	ELU-STR	Instantaneous	0	0	0	-49.81	21.63	0
13 : (6) 13: 1.35G+1.5W2+0.75S2	ELU-STR	Instantaneous	0	0	0	-44.27	19.64	0
14 : (6) 14: G	ELU-STR	Permanent	0	0	0	-21.03	11.55	0
15 : (6) 15: G+1.5S	ELU-STR	Short term	0	0	0	-43.21	19.5	0
16 : (6) 16: G+1.5S+0.9W	ELU-STR	Instantaneous	0	0	0	-51.78	22.68	0
17 : (6) 17: G+1.5S+0.9W2	ELU-STR	Instantaneous	0	0	0	-49.41	20.74	0
18 : (6) 18: G+1.5S2	ELU-STR	Short term	0	0	0	-32.12	15.53	0
19 : (6) 19: G+1.5S2+0.9W	ELU-STR	Instantaneous	0	0	0	-40.69	18.7	0
20 : (6) 20: G+1.5S2+0.9W2	ELU-STR	Instantaneous	0	0	0	-38.32	16.76	0
21 : (6) 21: G+1.5W	ELU-STR	Instantaneous	0	0	0	-35.31	16.85	0
22 : (6) 22: G+1.5W+0.75S	ELU-STR	Instantaneous	0	0	0	-46.4	20.82	0
23 : (6) 23: G+1.5W+0.75S2	ELU-STR	Instantaneous	0	0	0	-40.86	18.84	0
24 : (6) 24: G+1.5W2	ELU-STR	Instantaneous	0	0	0	-31.36	13.61	0
25 : (6) 25: G+1.5W2+0.75S	ELU-STR	Instantaneous	0	0	0	-42.45	17.59	0
26 : (6) 26: G+1.5W2+0.75S2	ELU-STR	Instantaneous	0	0	0	-36.91	15.6	0

Connection forces member : 2

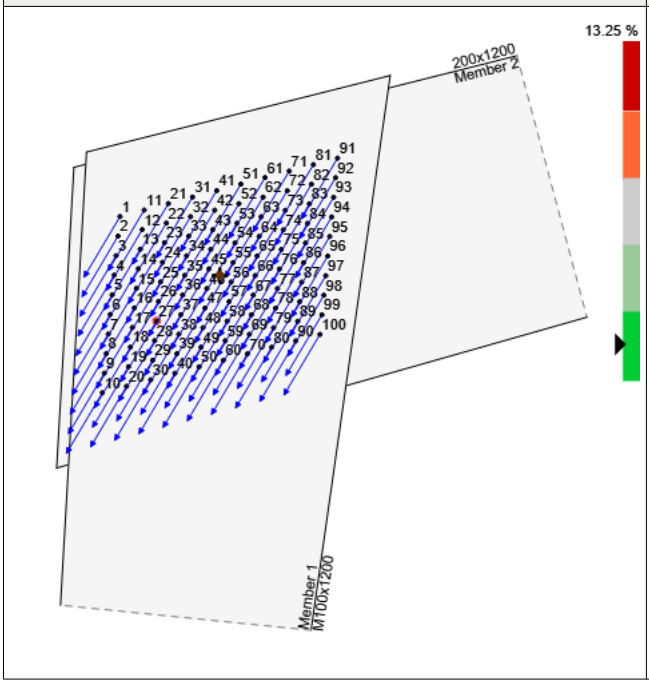
Combination	Type	Duration	N left	Vz left	My left	N right	Vz right	My right
-	-	-	*[kN]*	*[kN]*	*[kN*m]*	*[kN]*	*[kN]*	*[kN*m]*
1 : (6) 1: 1.35G	ELU-STR	Permanent	0	0	0	-24.63	-21.03	0
2 : (6) 2: 1.35G+1.5S	ELU-STR	Short term	0	0	0	-39.91	-38.97	0
3 : (6) 3: 1.35G+1.5S+0.9W	ELU-STR	Instantaneous	0	0	0	-45.91	-45.87	0
4 : (6) 4: 1.35G+1.5S+0.9W2	ELU-STR	Instantaneous	0	0	0	-43.25	-44.34	0
5 : (6) 5: 1.35G+1.5S2	ELU-STR	Short term	0	0	0	-32.27	-30	0
6 : (6) 6: 1.35G+1.5S2+0.9W	ELU-STR	Instantaneous	0	0	0	-38.27	-36.9	0
7 : (6) 7: 1.35G+1.5S2+0.9W2	ELU-STR	Instantaneous	0	0	0	-35.61	-35.37	0
8 : (6) 8: 1.35G+1.5W	ELU-STR	Instantaneous	0	0	0	-34.63	-32.53	0
9 : (6) 9: 1.35G+1.5W+0.75S	ELU-STR	Instantaneous	0	0	0	-42.27	-41.5	0
10 : (6) 10: 1.35G+1.5W+0.75S2	ELU-STR	Instantaneous	0	0	0	-38.45	-37.01	0
11 : (6) 11: 1.35G+1.5W2	ELU-STR	Instantaneous	0	0	0	-30.21	-29.98	0
12 : (6) 12:	ELU-STR	Instantaneou	0	0	0	-37.85	-38.94	0

1.35G+1.5W2+0.75S		s						
13 : (6) 13: 1.35G+1.5W2+0.75S2	ELU-STR	Instantaneous	0	0	0	-34.03	-34.46	0
14 : (6) 14: G	ELU-STR	Permanent	0	0	0	-18.24	-15.58	0
15 : (6) 15: G+1.5S	ELU-STR	Short term	0	0	0	-33.52	-33.52	0
16 : (6) 16: G+1.5S+0.9W	ELU-STR	Instantaneous	0	0	0	-39.52	-40.41	0
17 : (6) 17: G+1.5S+0.9W2	ELU-STR	Instantaneous	0	0	0	-36.87	-38.88	0
18 : (6) 18: G+1.5S2	ELU-STR	Short term	0	0	0	-25.88	-24.55	0
19 : (6) 19: G+1.5S2+0.9W	ELU-STR	Instantaneous	0	0	0	-31.88	-31.44	0
20 : (6) 20: G+1.5S2+0.9W2	ELU-STR	Instantaneous	0	0	0	-29.23	-29.91	0
21 : (6) 21: G+1.5W	ELU-STR	Instantaneous	0	0	0	-28.25	-27.07	0
22 : (6) 22: G+1.5W+0.75S	ELU-STR	Instantaneous	0	0	0	-35.89	-36.04	0
23 : (6) 23: G+1.5W+0.75S2	ELU-STR	Instantaneous	0	0	0	-32.07	-31.56	0
24 : (6) 24: G+1.5W2	ELU-STR	Instantaneous	0	0	0	-23.82	-24.52	0
25 : (6) 25: G+1.5W2+0.75S	ELU-STR	Instantaneous	0	0	0	-31.46	-33.49	0
26 : (6) 26: G+1.5W2+0.75S2	ELU-STR	Instantaneous	0	0	0	-27.64	-29.01	0

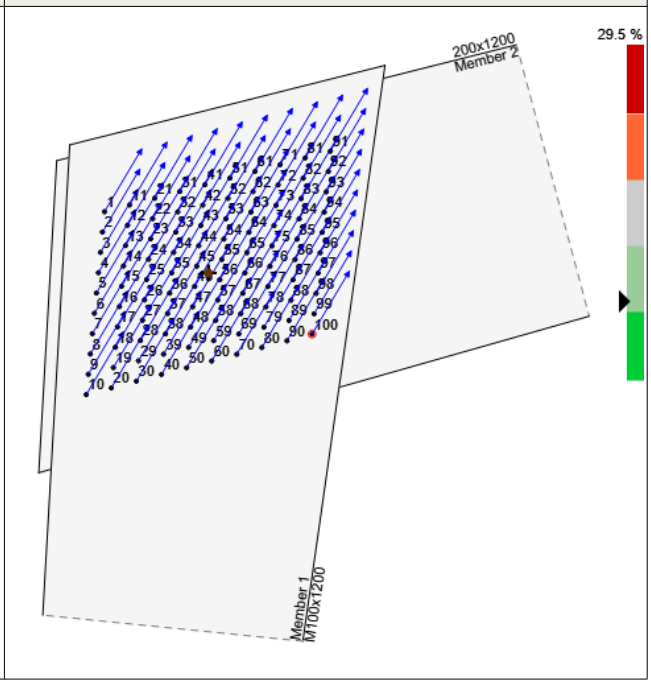
6.3.2 Forces and working rates of fasteners

Forces of fasteners on members (Worse linear combination for every member)

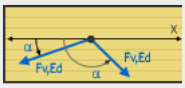
Member : 1



Member : 2



Notations for fastener verifications



FvEd	Force applied by the fastener on the member
AlphaFvEd	Angle between force FvEd and wood fibers
FvRd	Design capacity of the fastener

Working rate of fasteners for member : 1

Combination	Fastener	kmod	FvEd	Alpha FvEd	Mode	FvRd	Rate
-	-	-	[kN]	[deg]	-	[kN]	[%]
1 : (6) 1: 1.35G	10	0.6	0.32	151.21	k	12.7	2.55 %
2 : (6) 2: 1.35G+1.5S	27	0.9	0.56	155.03	k	18.63	2.99 %
3 : (6) 3: 1.35G+1.5S+0.9W	30	1.1	0.65	155.68	k	22.68	2.86 %
4 : (6) 4: 1.35G+1.5S+0.9W2	30	1.1	0.62	156.42	k	22.58	2.74 %
5 : (6) 5: 1.35G+1.5S2	30	0.9	0.44	153.63	k	18.79	2.35 %
6 : (6) 6: 1.35G+1.5S2+0.9W	10	1.1	0.53	154.66	k	22.82	2.33 %
7 : (6) 7: 1.35G+1.5S2+0.9W2	29	1.1	0.5	155.51	k	22.71	2.21 %
8 : (6) 8: 1.35G+1.5W	30	1.1	0.48	153.91	k	22.92	2.07 %
9 : (6) 9: 1.35G+1.5W+0.75S	25	1.1	0.59	155.18	k	22.75	2.6 %
10 : (6) 10: 1.35G+1.5W+0.75S2	70	1.1	0.53	154.62	k	22.83	2.34 %
11 : (6) 11: 1.35G+1.5W2	10	1.1	0.43	155.49	k	22.71	1.87 %
12 : (6) 12: 1.35G+1.5W2+0.75S	23	1.1	0.54	156.53	k	22.57	2.41 %
13 : (6) 13: 1.35G+1.5W2+0.75S2	70	1.1	0.48	156.07	k	22.63	2.14 %
14 : (6) 14: G	23	0.6	0.24	151.21	k	12.7	1.89 %
15 : (6) 15: G+1.5S	22	0.9	0.47	155.71	k	18.56	2.55 %
16 : (6) 16: G+1.5S+0.9W	30	1.1	0.57	156.35	k	22.59	2.5 %
17 : (6) 17: G+1.5S+0.9W2	67	1.1	0.54	157.23	k	22.47	2.38 %
18 : (6) 18: G+1.5S2	4	0.9	0.36	154.2	k	18.72	1.91 %
19 : (6) 19: G+1.5S2+0.9W	30	1.1	0.45	155.31	k	22.73	1.97 %
20 : (6) 20: G+1.5S2+0.9W2	93	1.1	0.42	156.37	k	22.59	1.85 %
21 : (6) 21: G+1.5W	10	1.1	0.39	154.49	k	22.84	1.71 %
22 : (6) 22: G+1.5W+0.75S	30	1.1	0.51	155.83	k	22.66	2.24 %
23 : (6) 23: G+1.5W+0.75S2	70	1.1	0.45	155.25	k	22.74	1.98 %
24 : (6) 24: G+1.5W2	21	1.1	0.34	156.54	k	22.57	1.52 %
25 : (6) 25: G+1.5W2+0.75S	14	1.1	0.46	157.5	k	22.43	2.05 %
26 : (6) 26: G+1.5W2+0.75S2	20	1.1	0.4	157.09	k	22.49	1.78 %

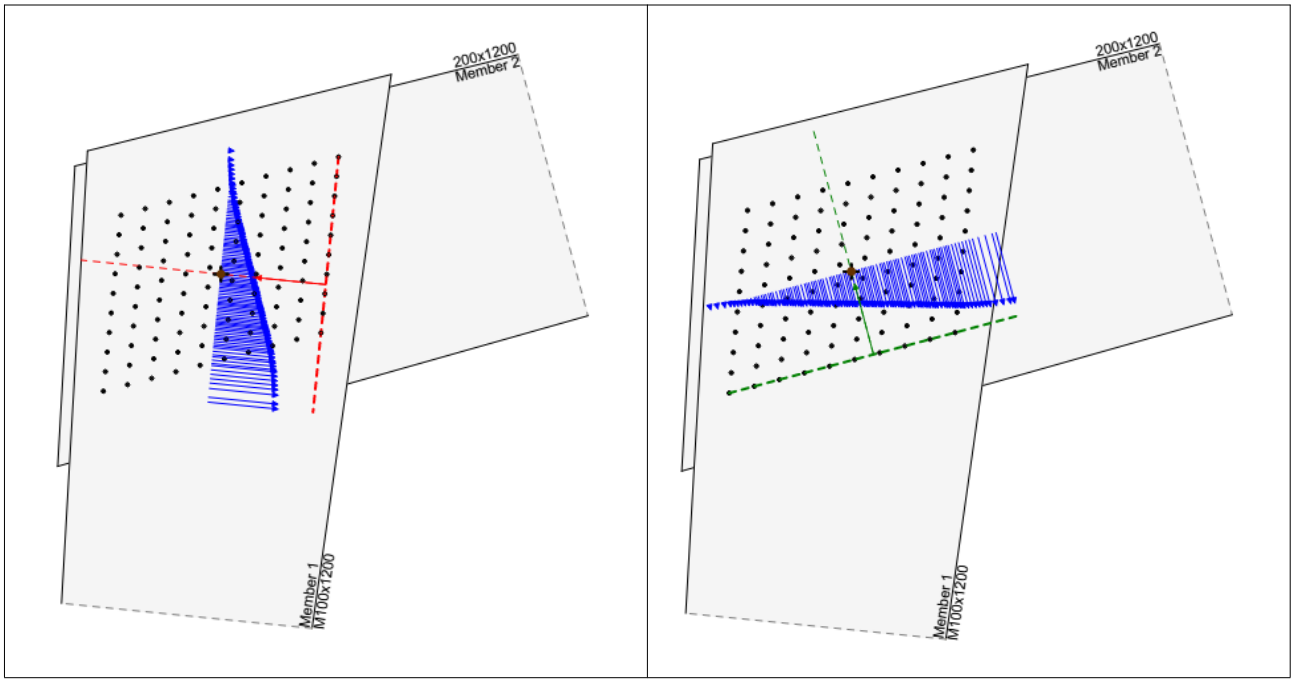
Working rate of fasteners for member : 2

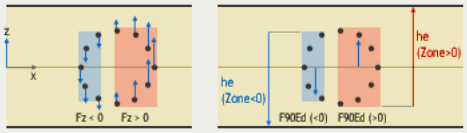
Combination	Fastener	kmod	FvEd	Alpha FvEd	Mode	FvRd	Rate
-	-	-	[kN]	[deg]	-	[kN]	[%]
1 : (6) 1: 1.35G	90	0.6	0.32	151.21	k	13.87	2.33 %
2 : (6) 2: 1.35G+1.5S	100	0.9	0.56	155.03	k	21.14	2.64 %

3 : (6) 3: 1.35G+1.5S+0.9W	100	1.1	0.65	155.68	k	25.9	2.51 %
4 : (6) 4: 1.35G+1.5S+0.9W2	98	1.1	0.62	156.42	k	25.97	2.38 %
5 : (6) 5: 1.35G+1.5S2	98	0.9	0.44	153.63	k	21.02	2.1 %
6 : (6) 6: 1.35G+1.5S2+0.9W	100	1.1	0.53	154.66	k	25.8	2.06 %
7 : (6) 7: 1.35G+1.5S2+0.9W2	100	1.1	0.5	155.51	k	25.88	1.94 %
8 : (6) 8: 1.35G+1.5W	98	1.1	0.48	153.91	k	25.72	1.85 %
9 : (6) 9: 1.35G+1.5W+0.75S	100	1.1	0.59	155.18	k	25.85	2.29 %
10 : (6) 10: 1.35G+1.5W+0.75S2	100	1.1	0.53	154.62	k	25.79	2.07 %
11 : (6) 11: 1.35G+1.5W2	100	1.1	0.43	155.49	k	25.88	1.64 %
12 : (6) 12: 1.35G+1.5W2+0.75S	98	1.1	0.54	156.53	k	25.98	2.09 %
13 : (6) 13: 1.35G+1.5W2+0.75S2	100	1.1	0.48	156.07	k	25.94	1.87 %
14 : (6) 14: G	98	0.6	0.24	151.21	k	13.87	1.73 %
15 : (6) 15: G+1.5S	100	0.9	0.47	155.71	k	21.19	2.24 %
16 : (6) 16: G+1.5S+0.9W	95	1.1	0.57	156.35	k	25.97	2.18 %
17 : (6) 17: G+1.5S+0.9W2	100	1.1	0.54	157.23	k	26.06	2.06 %
18 : (6) 18: G+1.5S2	100	0.9	0.36	154.2	k	21.07	1.69 %
19 : (6) 19: G+1.5S2+0.9W	98	1.1	0.45	155.31	k	25.86	1.73 %
20 : (6) 20: G+1.5S2+0.9W2	93	1.1	0.42	156.37	k	25.97	1.61 %
21 : (6) 21: G+1.5W	100	1.1	0.39	154.49	k	25.78	1.52 %
22 : (6) 22: G+1.5W+0.75S	98	1.1	0.51	155.83	k	25.92	1.96 %
23 : (6) 23: G+1.5W+0.75S2	100	1.1	0.45	155.25	k	25.86	1.74 %
24 : (6) 24: G+1.5W2	98	1.1	0.34	156.54	k	25.99	1.32 %
25 : (6) 25: G+1.5W2+0.75S	98	1.1	0.46	157.5	k	26.08	1.76 %
26 : (6) 26: G+1.5W2+0.75S2	100	1.1	0.4	157.09	k	26.04	1.54 %

6.3.3 Splitting results

Verification splitting and shear forces (Worse linear combination for every member)	
Member : 1	**Member : 2**



Notations for verification splitting and shear force	
	
Zone (Positive)	Zone where the vertical component of fastener force on member is positive
Zone (Negative)	Zone where the vertical component of fastener force on member is negative
he	Loaded edge distance for the considered zone
F90Ed	Resultant of vertical forces Fz for the considered zone (given only for information)
FvEd	Maximum shear force in the connection
F90Rd	Design value of the splitting capacity
FvRd	Design value of shear resistance for the considered zone
Rate	Ration between FvEd and the minimal value of F90Rd and FvRd

Verification splitting and shear for member : 1

Combination	Zone	kmod	he	F90Ed	FvEd	F90Rd	FvRd	Rate
-	-	-	[mm]	[kN]	[kN]	[kN]	[kN]	[%]
1 : (6) 1: 1.35G	Negative	0.6	1050	-15.6	15.6	118.44	151.52	13.17 %
2 : (6) 2: 1.35G+1.5S	Negative	0.9	1050	-23.55	23.55	177.66	227.28	13.25 %
3 : (6) 3: 1.35G+1.5S+0.9W	Negative	1.1	1050	-26.72	26.72	217.14	277.79	12.31 %
4 : (6) 4: 1.35G+1.5S+0.9W2	Negative	1.1	1050	-24.78	24.78	217.14	277.79	11.41 %
5 : (6) 5: 1.35G+1.5S2	Negative	0.9	1050	-19.57	19.57	177.66	227.28	11.02 %
6 : (6) 6: 1.35G+1.5S2+0.9W	Negative	1.1	1050	-22.75	22.75	217.14	277.79	10.48 %
7 : (6) 7: 1.35G+1.5S2+0.9W2	Negative	1.1	1050	-20.81	20.81	217.14	277.79	9.58 %
8 : (6) 8: 1.35G+1.5W	Negative	1.1	1050	-20.89	20.89	217.14	277.79	9.62 %
9 : (6) 9: 1.35G+1.5W+0.75S	Negative	1.1	1050	-24.87	24.87	217.14	277.79	11.45 %
10 : (6) 10:	Negative	1.1	1050	-22.88	22.88	217.14	277.79	10.54 %

1.35G+1.5W+0.75S2								
11 : (6) 11: 1.35G+1.5W2	Negative	1.1	1050	-17.66	17.66	217.14	277.79	8.13 %
12 : (6) 12: 1.35G+1.5W2+0.75S	Negative	1.1	1050	-21.63	21.63	217.14	277.79	9.96 %
13 : (6) 13: 1.35G+1.5W2+0.75S2	Negative	1.1	1050	-19.64	19.64	217.14	277.79	9.05 %
14 : (6) 14: G	Negative	0.6	1050	-11.55	11.55	118.44	151.52	9.76 %
15 : (6) 15: G+1.5S	Negative	0.9	1050	-19.5	19.5	177.66	227.28	10.98 %
16 : (6) 16: G+1.5S+0.9W	Negative	1.1	1050	-22.68	22.68	217.14	277.79	10.44 %
17 : (6) 17: G+1.5S+0.9W2	Negative	1.1	1050	-20.74	20.74	217.14	277.79	9.55 %
18 : (6) 18: G+1.5S2	Negative	0.9	1050	-15.53	15.53	177.66	227.28	8.74 %
19 : (6) 19: G+1.5S2+0.9W	Negative	1.1	1050	-18.7	18.7	217.14	277.79	8.61 %
20 : (6) 20: G+1.5S2+0.9W2	Negative	1.1	1050	-16.76	16.76	217.14	277.79	7.72 %
21 : (6) 21: G+1.5W	Negative	1.1	1050	-16.85	16.85	217.14	277.79	7.76 %
22 : (6) 22: G+1.5W+0.75S	Negative	1.1	1050	-20.82	20.82	217.14	277.79	9.59 %
23 : (6) 23: G+1.5W+0.75S2	Negative	1.1	1050	-18.84	18.84	217.14	277.79	8.67 %
24 : (6) 24: G+1.5W2	Negative	1.1	1050	-13.61	13.61	217.14	277.79	6.27 %
25 : (6) 25: G+1.5W2+0.75S	Negative	1.1	1050	-17.59	17.59	217.14	277.79	8.1 %
26 : (6) 26: G+1.5W2+0.75S2	Negative	1.1	1050	-15.6	15.6	217.14	277.79	7.18 %

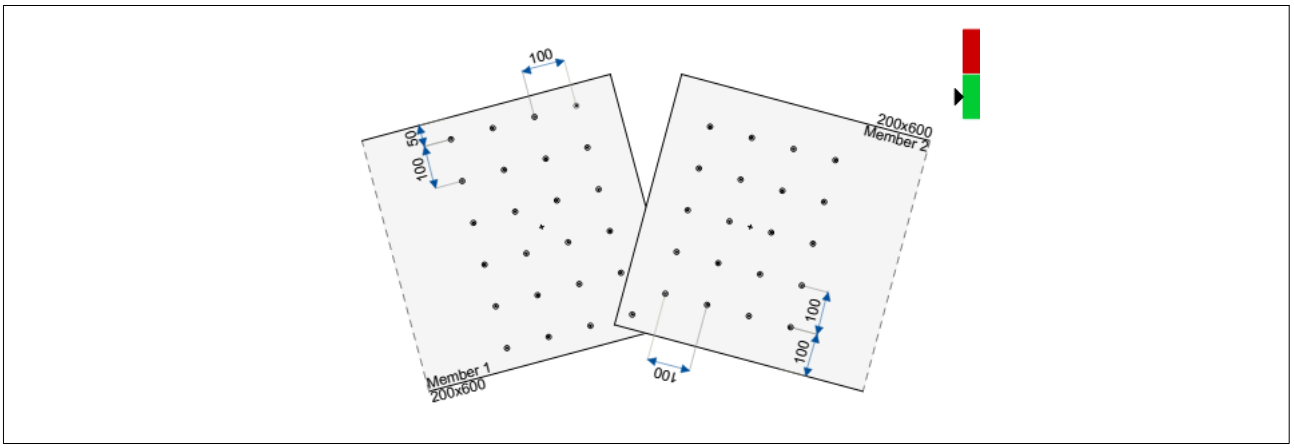
Verification splitting and shear for member : 2

Combination	Zone	kmod	he	F90Ed	FvEd	F90Rd	FvRd	Rate
-	-	-	[mm]	[kN]	[kN]	[kN]	[kN]	[%]
1 : (6) 1: 1.35G	Positive	0.6	953.6	21.03	21.03	88.06	137.61	23.89 %
2 : (6) 2: 1.35G+1.5S	Positive	0.9	953.6	38.97	38.97	132.1	206.41	29.5 %
3 : (6) 3: 1.35G+1.5S+0.9W	Positive	1.1	953.6	45.87	45.87	161.45	252.28	28.41 %
4 : (6) 4: 1.35G+1.5S+0.9W2	Positive	1.1	953.6	44.34	44.34	161.45	252.28	27.46 %
5 : (6) 5: 1.35G+1.5S2	Positive	0.9	953.6	30	30	132.1	206.41	22.71 %
6 : (6) 6: 1.35G+1.5S2+0.9W	Positive	1.1	953.6	36.9	36.9	161.45	252.28	22.85 %
7 : (6) 7: 1.35G+1.5S2+0.9W2	Positive	1.1	953.6	35.37	35.37	161.45	252.28	21.91 %
8 : (6) 8: 1.35G+1.5W	Positive	1.1	953.6	32.53	32.53	161.45	252.28	20.15 %
9 : (6) 9: 1.35G+1.5W+0.75S	Positive	1.1	953.6	41.5	41.5	161.45	252.28	25.7 %
10 : (6) 10: 1.35G+1.5W+0.75S2	Positive	1.1	953.6	37.01	37.01	161.45	252.28	22.92 %
11 : (6) 11: 1.35G+1.5W2	Positive	1.1	953.6	29.98	29.98	161.45	252.28	18.57 %
12 : (6) 12: 1.35G+1.5W2+0.75S	Positive	1.1	953.6	38.94	38.94	161.45	252.28	24.12 %
13 : (6) 13: 1.35G+1.5W2+0.75S2	Positive	1.1	953.6	34.46	34.46	161.45	252.28	21.34 %
14 : (6) 14: G	Positive	0.6	953.6	15.58	15.58	88.06	137.61	17.69 %
15 : (6) 15: G+1.5S	Positive	0.9	953.6	33.52	33.52	132.1	206.41	25.37 %
16 : (6) 16: G+1.5S+0.9W	Positive	1.1	953.6	40.41	40.41	161.45	252.28	25.03 %
17 : (6) 17: G+1.5S+0.9W2	Positive	1.1	953.6	38.88	38.88	161.45	252.28	24.08 %
18 : (6) 18: G+1.5S2	Positive	0.9	953.6	24.55	24.55	132.1	206.41	18.58 %
19 : (6) 19: G+1.5S2+0.9W	Positive	1.1	953.6	31.44	31.44	161.45	252.28	19.48 %
20 : (6) 20:	Positive	1.1	953.6	29.91	29.91	161.45	252.28	18.53 %

G+1.5S2+0.9W2								
21 : (6) 21: G+1.5W	Positive	1.1	953.6	27.07	27.07	161.45	252.28	16.77 %
22 : (6) 22: G+1.5W+0.75S	Positive	1.1	953.6	36.04	36.04	161.45	252.28	22.32 %
23 : (6) 23: G+1.5W+0.75S2	Positive	1.1	953.6	31.56	31.56	161.45	252.28	19.55 %
24 : (6) 24: G+1.5W2	Positive	1.1	953.6	24.52	24.52	161.45	252.28	15.19 %
25 : (6) 25: G+1.5W2+0.75S	Positive	1.1	953.6	33.49	33.49	161.45	252.28	20.74 %
26 : (6) 26: G+1.5W2+0.75S2	Positive	1.1	953.6	29.01	29.01	161.45	252.28	17.97 %

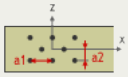
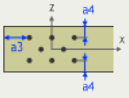
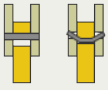
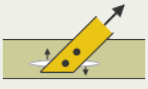
7 Study : Assemblage indirect 2 pièces_0 (Wood assembly with metal auxiliary part)

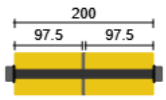
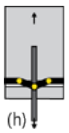
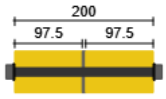
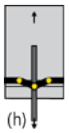
7.1 Connection configuration



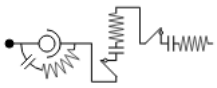
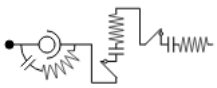
General properties by member						
	Wood member		Auxiliary pieces			Fasteners
Member Id	Unique Id	Section	Nature	Configuration	Thickness	-
-	-	*mm*	-	-	*mm*	-
1	GL24H	200 x 600	S 235	One internal plate	5	Bolts : Diameter : M12 Class : 6.8
2	GL24H	200 x 600	S 235	One internal plate	5	Bolts : Diameter : M12 Class : 6.8

7.2 Synthetic analysis of results

Member Id	Configurations	Admissibles spacings a1,a2	Admissibles distance a3,a4	Rupture mode	Fasteners working rate	Result fendage
-	*[mm]*	*[mm]*	*[mm]*	-	*[%]*	*[%]*
-	-				-	

1		a1 > 60mm a2 > 48mm	a3 > 84mm a4 > 48mm		12.55 % FvEd=2.29 kN ((7) 2: 1.35G+1.5S) Npo=-25.55 kN Vzpo=14.6 kN Mc=3.65 kN*m	13.12 % Vzmax=18.61 kN ((7) 4: 1.35G+1.5S+0.9W2)
2		a1 > 60mm a2 > 48mm	a3 > 84mm a4 > 48mm		11.11 % FvEd=1.35 kN ((7) 1: 1.35G) Npo=-17.72 kN Vzpo=-4.75 kN Mc=-1.19 kN*m	7.14 % Vzmax=4.93 kN ((7) 1: 1.35G)
EC5 requirement : (EC5 10.4.3(1)) Bolt holes in timber should have a diameter not more than d+1mm EC5 requirement : (EC5 10.4.3(1)) Bolt holes in steel plates should have a diameter not more than Max(d+2mm, 1.1d)						

Analysis of connection stiffness

Member Id	Kser Model	Stiffness center	Stiffness Kser	Stiffnesses Ku	Secant stiffness Kser	Secant stiffnesses Ku	Connection gaps
-	-	*mm*	*kN/m ; kN*m/rad*	*kN/m ; kN*m/rad*	*kN/m ; kN*m/rad*	*kN/m ; kN*m/rad*	*mm ; deg*
1		Xc=250mm Zc=0mm	Kx=431120.4 Kz=431120.4 Kt=17963.35 Beta=1.3	Kx=287413.6 Kz=287413.6 Kt=11975.57 Beta=1.04	Kx=18443.8 (Nref=28.9kN) Kz=12062 (Vzref=18.61kN) Kt=192.29 (Myref=1kN*m)	Kx=18057.5 (Nref=28.9kN) Kz=11895.6 (Vzref=18.61kN) Kt=191.26 (Myref=1kN*m)	Gap Δu =1.5mm Gap Δθ =0.29deg
2		Xc=250mm Zc=0mm	Kx=359267 Kz=359267 Kt=11676.18 Beta=0.85	Kx=239511.3 Kz=239511.3 Kt=7784.12 Beta=0.68	Kx=21520 (Nref=34.34kN) Kz=3137.2 (Vzref=4.75kN) Kt=164.32 (Myref=1kN*m)	Kx=20894.2 (Nref=34.34kN) Kz=3123.6 (Vzref=4.75kN) Kt=163.17 (Myref=1kN*m)	Gap Δu =1.5mm Gap Δθ =0.34deg
Stiffness center for all fasteners of plate : Xp=-22mm ; Zp=-64.7mm							

7.3 Global analysis for all combinations

7.3.1 Connection forces

Connection forces member : 1

Combination	Type	Duration	N left	Vz left	My left	N right	Vz right	My right
-	-	-	*[kN]*	*[kN]*	*[kN*m]*	*[kN]*	*[kN]*	*[kN*m]*
1 : (7) 1: 1.35G	ELU-STR	Permanent	0	0	0	-17.72	4.75	0
2 : (7) 2: 1.35G+1.5S	ELU-STR	Short term	0	0	0	-25.55	14.6	0
3 : (7) 3: 1.35G+1.5S+0.9W	ELU-STR	Instantaneous	0	0	0	-28.67	18.49	0
4 : (7) 4: 1.35G+1.5S+0.9W2	ELU-STR	Instantaneous	0	0	0	-28.9	18.61	0
5 : (7) 5: 1.35G+1.5S2	ELU-STR	Short term	0	0	0	-21.64	9.67	0
6 : (7) 6: 1.35G+1.5S2+0.9W	ELU-STR	Instantaneous	0	0	0	-24.75	13.56	0
7 : (7) 7: 1.35G+1.5S2+0.9W2	ELU-STR	Instantaneous	0	0	0	-24.99	13.69	0
8 : (7) 8: 1.35G+1.5W	ELU-STR	Instantaneous	0	0	0	-22.91	11.23	0
9 : (7) 9:	ELU-STR	Instantaneou	0	0	0	-26.82	16.16	0

1.35G+1.5W+0.75S		s						
10 : (7) 10: 1.35G+1.5W+0.75S2	ELU-STR	Instantaneous	0	0	0	-24.87	13.7	0
11 : (7) 11: 1.35G+1.5W2	ELU-STR	Instantaneous	0	0	0	-23.3	11.44	0
12 : (7) 12: 1.35G+1.5W2+0.75S	ELU-STR	Instantaneous	0	0	0	-27.22	16.37	0
13 : (7) 13: 1.35G+1.5W2+0.75S2	ELU-STR	Instantaneous	0	0	0	-25.26	13.9	0
14 : (7) 14: G	ELU-STR	Permanent	0	0	0	-13.13	3.52	0
15 : (7) 15: G+1.5S	ELU-STR	Short term	0	0	0	-20.96	13.37	0
16 : (7) 16: G+1.5S+0.9W	ELU-STR	Instantaneous	0	0	0	-24.07	17.26	0
17 : (7) 17: G+1.5S+0.9W2	ELU-STR	Instantaneous	0	0	0	-24.31	17.38	0
18 : (7) 18: G+1.5S2	ELU-STR	Short term	0	0	0	-17.04	8.44	0
19 : (7) 19: G+1.5S2+0.9W	ELU-STR	Instantaneous	0	0	0	-20.16	12.33	0
20 : (7) 20: G+1.5S2+0.9W2	ELU-STR	Instantaneous	0	0	0	-20.39	12.46	0
21 : (7) 21: G+1.5W	ELU-STR	Instantaneous	0	0	0	-18.31	10	0
22 : (7) 22: G+1.5W+0.75S	ELU-STR	Instantaneous	0	0	0	-22.23	14.93	0
23 : (7) 23: G+1.5W+0.75S2	ELU-STR	Instantaneous	0	0	0	-20.27	12.47	0
24 : (7) 24: G+1.5W2	ELU-STR	Instantaneous	0	0	0	-18.71	10.21	0
25 : (7) 25: G+1.5W2+0.75S	ELU-STR	Instantaneous	0	0	0	-22.62	15.14	0
26 : (7) 26: G+1.5W2+0.75S2	ELU-STR	Instantaneous	0	0	0	-20.66	12.67	0

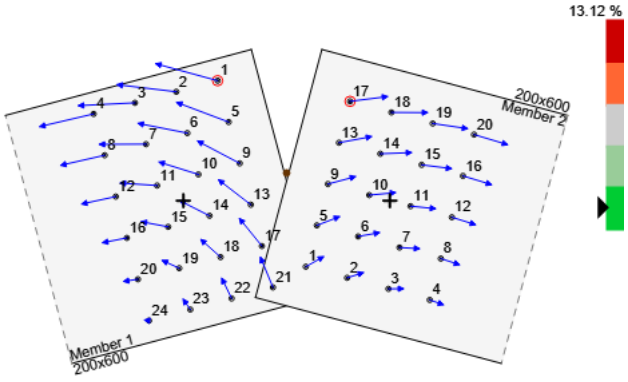
Connection forces member : 2

Combination	Type	Duration	N left	Vz left	My left	N right	Vz right	My right
-	-	-	*[kN]*	*[kN]*	*[kN*m]*	*[kN]*	*[kN]*	*[kN*m]*
1 : (7) 1: 1.35G	ELU-STR	Permanent	0	0	0	-17.72	-4.75	0
2 : (7) 2: 1.35G+1.5S	ELU-STR	Short term	0	0	0	-29.43	-0.13	0
3 : (7) 3: 1.35G+1.5S+0.9W	ELU-STR	Instantaneous	0	0	0	-34.07	1.68	0
4 : (7) 4: 1.35G+1.5S+0.9W2	ELU-STR	Instantaneous	0	0	0	-34.34	1.67	0
5 : (7) 5: 1.35G+1.5S2	ELU-STR	Short term	0	0	0	-23.57	-2.44	0
6 : (7) 6: 1.35G+1.5S2+0.9W	ELU-STR	Instantaneous	0	0	0	-28.22	-0.62	0
7 : (7) 7: 1.35G+1.5S2+0.9W2	ELU-STR	Instantaneous	0	0	0	-28.48	-0.64	0
8 : (7) 8: 1.35G+1.5W	ELU-STR	Instantaneous	0	0	0	-25.46	-1.72	0
9 : (7) 9: 1.35G+1.5W+0.75S	ELU-STR	Instantaneous	0	0	0	-31.31	0.59	0
10 : (7) 10: 1.35G+1.5W+0.75S2	ELU-STR	Instantaneous	0	0	0	-28.38	-0.57	0
11 : (7) 11: 1.35G+1.5W2	ELU-STR	Instantaneous	0	0	0	-25.9	-1.74	0
12 : (7) 12:	ELU-STR	Instantaneou	0	0	0	-31.75	0.57	0

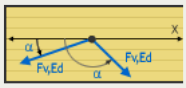
1.35G+1.5W2+0.75S		s						
13 : (7) 13: 1.35G+1.5W2+0.75S2	ELU-STR	Instantaneous	0	0	0	-28.83	-0.59	0
14 : (7) 14: G	ELU-STR	Permanent	0	0	0	-13.13	-3.52	0
15 : (7) 15: G+1.5S	ELU-STR	Short term	0	0	0	-24.84	1.1	0
16 : (7) 16: G+1.5S+0.9W	ELU-STR	Instantaneous	0	0	0	-29.48	2.91	0
17 : (7) 17: G+1.5S+0.9W2	ELU-STR	Instantaneous	0	0	0	-29.74	2.9	0
18 : (7) 18: G+1.5S2	ELU-STR	Short term	0	0	0	-18.98	-1.21	0
19 : (7) 19: G+1.5S2+0.9W	ELU-STR	Instantaneous	0	0	0	-23.62	0.61	0
20 : (7) 20: G+1.5S2+0.9W2	ELU-STR	Instantaneous	0	0	0	-23.89	0.6	0
21 : (7) 21: G+1.5W	ELU-STR	Instantaneous	0	0	0	-20.86	-0.49	0
22 : (7) 22: G+1.5W+0.75S	ELU-STR	Instantaneous	0	0	0	-26.72	1.82	0
23 : (7) 23: G+1.5W+0.75S2	ELU-STR	Instantaneous	0	0	0	-23.79	0.66	0
24 : (7) 24: G+1.5W2	ELU-STR	Instantaneous	0	0	0	-21.31	-0.51	0
25 : (7) 25: G+1.5W2+0.75S	ELU-STR	Instantaneous	0	0	0	-27.16	1.8	0
26 : (7) 26: G+1.5W2+0.75S2	ELU-STR	Instantaneous	0	0	0	-24.23	0.65	0

7.3.2 Forces and working rates of fasteners

Forces of fasteners on members (Worse linear combination for every member)



Notations for fastener verifications



FvEd	Force applied by the fastener on the member
AlphaFvEd	Angle between force FvEd and wood fibers
FvRd	Design capacity of the fastener

Working rate of fasteners for member : 1

Combination	Fastener	kmod	FvEd	Alpha FvEd	Mode	FvRd	Rate
-	-	-	[kN]	[deg]	-	[kN]	[%]
1 : (7) 1: 1.35G	1	0.6	1.1	160.04	h	12.15	9.06 %
2 : (7) 2: 1.35G+1.5S	1	0.9	2.29	149.69	h	18.25	12.55 %
3 : (7) 3: 1.35G+1.5S+0.9W	1	1.1	2.77	148.08	h	22.29	12.42 %
4 : (7) 4: 1.35G+1.5S+0.9W2	1	1.1	2.79	148.1	h	22.29	12.51 %
5 : (7) 5: 1.35G+1.5S2	1	0.9	1.69	153.05	h	18.25	9.26 %
6 : (7) 6: 1.35G+1.5S2+0.9W	1	1.1	2.16	150.25	h	22.3	9.7 %
7 : (7) 7: 1.35G+1.5S2+0.9W2	1	1.1	2.18	150.26	h	22.3	9.79 %
8 : (7) 8: 1.35G+1.5W	1	1.1	1.88	151.77	h	22.31	8.43 %
9 : (7) 9: 1.35G+1.5W+0.75S	1	1.1	2.48	148.98	h	22.3	11.13 %
10 : (7) 10: 1.35G+1.5W+0.75S2	1	1.1	2.18	150.18	h	22.3	9.78 %
11 : (7) 11: 1.35G+1.5W2	1	1.1	1.91	151.75	h	22.31	8.58 %
12 : (7) 12: 1.35G+1.5W2+0.75S	1	1.1	2.52	149.01	h	22.3	11.28 %
13 : (7) 13: 1.35G+1.5W2+0.75S2	1	1.1	2.21	150.19	h	22.3	9.93 %
14 : (7) 14: G	1	0.6	0.82	160.04	h	12.15	6.71 %
15 : (7) 15: G+1.5S	1	0.9	2.01	148.23	h	18.24	11.02 %
16 : (7) 16: G+1.5S+0.9W	1	1.1	2.49	146.72	h	22.28	11.17 %
17 : (7) 17: G+1.5S+0.9W2	1	1.1	2.51	146.75	h	22.28	11.26 %
18 : (7) 18: G+1.5S2	1	0.9	1.41	151.63	h	18.25	7.71 %
19 : (7) 19: G+1.5S2+0.9W	1	1.1	1.88	148.77	h	22.3	8.45 %
20 : (7) 20: G+1.5S2+0.9W2	1	1.1	1.9	148.8	h	22.3	8.54 %
21 : (7) 21: G+1.5W	1	1.1	1.6	150.3	h	22.3	7.17 %
22 : (7) 22: G+1.5W+0.75S	1	1.1	2.2	147.56	h	22.29	9.88 %
23 : (7) 23: G+1.5W+0.75S2	1	1.1	1.9	148.71	h	22.3	8.52 %
24 : (7) 24: G+1.5W2	1	1.1	1.63	150.31	h	22.3	7.32 %
25 : (7) 25: G+1.5W2+0.75S	1	1.1	2.24	147.61	h	22.29	10.03 %
26 : (7) 26: G+1.5W2+0.75S2	1	1.1	1.93	148.75	h	22.3	8.67 %

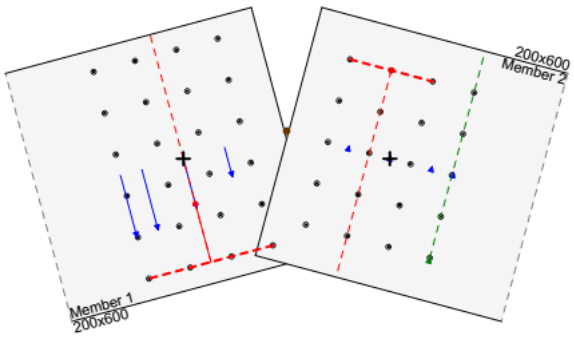
Working rate of fasteners for member : 2

Combination	Fastener	kmod	FvEd	Alpha FvEd	Mode	FvRd	Rate
-	-	-	[kN]	[deg]	-	[kN]	[%]
1 : (7) 1: 1.35G	17	0.6	1.35	202.23	h	12.16	11.11 %
2 : (7) 2: 1.35G+1.5S	20	0.9	1.48	179.96	h	17.6	8.42 %
3 : (7) 3: 1.35G+1.5S+0.9W	4	1.1	1.83	180.4	h	21.54	8.51 %
4 : (7) 4: 1.35G+1.5S+0.9W2	4	1.1	1.85	180.4	h	21.54	8.57 %
5 : (7) 5: 1.35G+1.5S2	20	0.9	1.37	179.21	h	17.64	7.75 %
6 : (7) 6: 1.35G+1.5S2+0.9W	20	1.1	1.46	179.81	h	21.52	6.78 %
7 : (7) 7: 1.35G+1.5S2+0.9W2	20	1.1	1.47	179.81	h	21.52	6.84 %
8 : (7) 8: 1.35G+1.5W	20	1.1	1.41	179.46	h	21.54	6.52 %

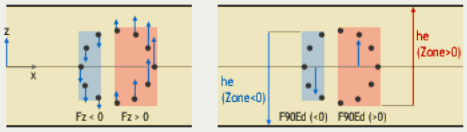
9 : (7) 9: 1.35G+1.5W+0.75S	4	1.1	1.61	180.16	h	21.52	7.48 %
10 : (7) 10: 1.35G+1.5W+0.75S2	20	1.1	1.46	179.83	h	21.52	6.8 %
11 : (7) 11: 1.35G+1.5W2	20	1.1	1.43	179.46	h	21.54	6.63 %
12 : (7) 12: 1.35G+1.5W2+0.75S	4	1.1	1.63	180.15	h	21.52	7.58 %
13 : (7) 13: 1.35G+1.5W2+0.75S2	20	1.1	1.49	179.83	h	21.52	6.91 %
14 : (7) 14: G	17	0.6	1	202.23	h	12.16	8.23 %
15 : (7) 15: G+1.5S	4	0.9	1.33	180.36	h	17.62	7.53 %
16 : (7) 16: G+1.5S+0.9W	4	1.1	1.7	180.76	h	21.56	7.88 %
17 : (7) 17: G+1.5S+0.9W2	4	1.1	1.71	180.75	h	21.56	7.93 %
18 : (7) 18: G+1.5S2	20	0.9	1.04	179.49	h	17.63	5.91 %
19 : (7) 19: G+1.5S2+0.9W	4	1.1	1.23	180.22	h	21.52	5.7 %
20 : (7) 20: G+1.5S2+0.9W2	4	1.1	1.24	180.21	h	21.52	5.76 %
21 : (7) 21: G+1.5W	20	1.1	1.08	179.8	h	21.52	5.02 %
22 : (7) 22: G+1.5W+0.75S	4	1.1	1.48	180.54	h	21.54	6.85 %
23 : (7) 23: G+1.5W+0.75S2	4	1.1	1.24	180.24	h	21.52	5.76 %
24 : (7) 24: G+1.5W2	20	1.1	1.1	179.8	h	21.52	5.13 %
25 : (7) 25: G+1.5W2+0.75S	4	1.1	1.5	180.53	h	21.54	6.95 %
26 : (7) 26: G+1.5W2+0.75S2	4	1.1	1.26	180.23	h	21.52	5.86 %

7.3.3 Splitting results

Verification splitting and shear forces (Worse linear combination for every member)



Notations for verification splitting and shear force



Zone (Positive)	Zone where the vertical component of fastener force on member is positive
Zone (Negative)	Zone where the vertical component of fastener force on member is negative
he	Loaded edge distance for the considered zone
F90Ed	Resultant of vertical forces Fz for the considered zone (given only for information)
FvEd	Maximum shear force in the connection

F90Rd	Design value of the splitting capacity
FvRd	Design value of shear resistance for the considered zone
Rate	Ration between FvEd and the minimal value of F90Rd and FvRd

Verification splitting and shear for member : 1

Combination	Zone	kmod	he	F90Ed	FvEd	F90Rd	FvRd	Rate
-	-	-	[mm]	[kN]	[kN]	[kN]	[kN]	[%]
1 : (7) 1: 1.35G	Negative	0.6	550	-4.75	4.75	102.36	77.39	6.13 %
2 : (7) 2: 1.35G+1.5S	Negative	0.9	550	-14.6	14.6	153.54	116.08	12.58 %
3 : (7) 3: 1.35G+1.5S+0.9W	Negative	1.1	550	-18.49	18.49	187.67	141.87	13.03 %
4 : (7) 4: 1.35G+1.5S+0.9W2	Negative	1.1	550	-18.61	18.61	187.67	141.87	13.12 %
5 : (7) 5: 1.35G+1.5S2	Negative	0.9	550	-9.67	9.67	153.54	116.08	8.33 %
6 : (7) 6: 1.35G+1.5S2+0.9W	Negative	1.1	550	-13.56	13.56	187.67	141.87	9.56 %
7 : (7) 7: 1.35G+1.5S2+0.9W2	Negative	1.1	550	-13.69	13.69	187.67	141.87	9.65 %
8 : (7) 8: 1.35G+1.5W	Negative	1.1	550	-11.23	11.23	187.67	141.87	7.92 %
9 : (7) 9: 1.35G+1.5W+0.75S	Negative	1.1	550	-16.16	16.16	187.67	141.87	11.39 %
10 : (7) 10: 1.35G+1.5W+0.75S2	Negative	1.1	550	-13.7	13.7	187.67	141.87	9.65 %
11 : (7) 11: 1.35G+1.5W2	Negative	1.1	550	-11.44	11.44	187.67	141.87	8.06 %
12 : (7) 12: 1.35G+1.5W2+0.75S	Negative	1.1	550	-16.37	16.37	187.67	141.87	11.54 %
13 : (7) 13: 1.35G+1.5W2+0.75S2	Negative	1.1	550	-13.9	13.9	187.67	141.87	9.8 %
14 : (7) 14: G	Negative	0.6	550	-3.52	3.52	102.36	77.39	4.54 %
15 : (7) 15: G+1.5S	Negative	0.9	550	-13.37	13.37	153.54	116.08	11.52 %
16 : (7) 16: G+1.5S+0.9W	Negative	1.1	550	-17.26	17.26	187.67	141.87	12.17 %
17 : (7) 17: G+1.5S+0.9W2	Negative	1.1	550	-17.38	17.38	187.67	141.87	12.25 %
18 : (7) 18: G+1.5S2	Negative	0.9	550	-8.44	8.44	153.54	116.08	7.27 %
19 : (7) 19: G+1.5S2+0.9W	Negative	1.1	550	-12.33	12.33	187.67	141.87	8.69 %
20 : (7) 20: G+1.5S2+0.9W2	Negative	1.1	550	-12.46	12.46	187.67	141.87	8.78 %
21 : (7) 21: G+1.5W	Negative	1.1	550	-10	10	187.67	141.87	7.05 %
22 : (7) 22: G+1.5W+0.75S	Negative	1.1	550	-14.93	14.93	187.67	141.87	10.52 %
23 : (7) 23: G+1.5W+0.75S2	Negative	1.1	550	-12.47	12.47	187.67	141.87	8.79 %
24 : (7) 24: G+1.5W2	Negative	1.1	550	-10.21	10.21	187.67	141.87	7.2 %
25 : (7) 25: G+1.5W2+0.75S	Negative	1.1	550	-15.14	15.14	187.67	141.87	10.67 %
26 : (7) 26: G+1.5W2+0.75S2	Negative	1.1	550	-12.67	12.67	187.67	141.87	8.93 %

Verification splitting and shear for member : 2

Combination	Zone	kmod	he	F90Ed	FvEd	F90Rd	FvRd	Rate
-	-	-	[mm]	[kN]	[kN]	[kN]	[kN]	[%]
1 : (7) 1: 1.35G	Negative	0.6	500	-0.18	4.93	69.01	70.35	7.14 %
1 : (7) 1: 1.35G	Positive	0.6	500	4.93	4.93	69.01	70.35	7.14 %
2 : (7) 2: 1.35G+1.5S	Negative	0.9	500	-0.01	0.14	103.52	105.53	0.13 %
2 : (7) 2: 1.35G+1.5S	Positive	0.9	500	0.14	0.14	103.52	105.53	0.13 %
3 : (7) 3: 1.35G+1.5S+0.9W	Negative	1.1	500	-1.75	1.75	126.52	128.98	1.38 %

3 : (7) 3: 1.35G+1.5S+0.9W	Positive	1.1	500	0.06	1.75	126.52	128.98	1.38 %
4 : (7) 4: 1.35G+1.5S+0.9W2	Negative	1.1	500	-1.74	1.74	126.52	128.98	1.37 %
4 : (7) 4: 1.35G+1.5S+0.9W2	Positive	1.1	500	0.06	1.74	126.52	128.98	1.37 %
5 : (7) 5: 1.35G+1.5S2	Negative	0.9	500	-0.09	2.53	103.52	105.53	2.45 %
5 : (7) 5: 1.35G+1.5S2	Positive	0.9	500	2.53	2.53	103.52	105.53	2.45 %
6 : (7) 6: 1.35G+1.5S2+0.9W	Negative	1.1	500	-0.02	0.65	126.52	128.98	0.51 %
6 : (7) 6: 1.35G+1.5S2+0.9W	Positive	1.1	500	0.65	0.65	126.52	128.98	0.51 %
7 : (7) 7: 1.35G+1.5S2+0.9W2	Negative	1.1	500	-0.02	0.66	126.52	128.98	0.52 %
7 : (7) 7: 1.35G+1.5S2+0.9W2	Positive	1.1	500	0.66	0.66	126.52	128.98	0.52 %
8 : (7) 8: 1.35G+1.5W	Negative	1.1	500	-0.07	1.79	126.52	128.98	1.41 %
8 : (7) 8: 1.35G+1.5W	Positive	1.1	500	1.79	1.79	126.52	128.98	1.41 %
9 : (7) 9: 1.35G+1.5W+0.75S	Negative	1.1	500	-0.61	0.61	126.52	128.98	0.48 %
9 : (7) 9: 1.35G+1.5W+0.75S	Positive	1.1	500	0.02	0.61	126.52	128.98	0.48 %
10 : (7) 10: 1.35G+1.5W+0.75S2	Negative	1.1	500	-0.02	0.59	126.52	128.98	0.47 %
10 : (7) 10: 1.35G+1.5W+0.75S2	Positive	1.1	500	0.59	0.59	126.52	128.98	0.47 %
11 : (7) 11: 1.35G+1.5W2	Negative	1.1	500	-0.07	1.81	126.52	128.98	1.43 %
11 : (7) 11: 1.35G+1.5W2	Positive	1.1	500	1.81	1.81	126.52	128.98	1.43 %
12 : (7) 12: 1.35G+1.5W2+0.75S	Negative	1.1	500	-0.59	0.59	126.52	128.98	0.47 %
12 : (7) 12: 1.35G+1.5W2+0.75S	Positive	1.1	500	0.02	0.59	126.52	128.98	0.47 %
13 : (7) 13: 1.35G+1.5W2+0.75S2	Negative	1.1	500	-0.02	0.61	126.52	128.98	0.48 %
13 : (7) 13: 1.35G+1.5W2+0.75S2	Positive	1.1	500	0.61	0.61	126.52	128.98	0.48 %
14 : (7) 14: G	Negative	0.6	500	-0.14	3.65	69.01	70.35	5.29 %
14 : (7) 14: G	Positive	0.6	500	3.65	3.65	69.01	70.35	5.29 %
15 : (7) 15: G+1.5S	Negative	0.9	500	-1.14	1.14	103.52	105.53	1.1 %
15 : (7) 15: G+1.5S	Positive	0.9	500	0.04	1.14	103.52	105.53	1.1 %
16 : (7) 16: G+1.5S+0.9W	Negative	1.1	500	-3.03	3.03	126.52	128.98	2.39 %
16 : (7) 16: G+1.5S+0.9W	Positive	1.1	500	0.11	3.03	126.52	128.98	2.39 %
17 : (7) 17: G+1.5S+0.9W2	Negative	1.1	500	-3.01	3.01	126.52	128.98	2.38 %
17 : (7) 17: G+1.5S+0.9W2	Positive	1.1	500	0.11	3.01	126.52	128.98	2.38 %
18 : (7) 18: G+1.5S2	Negative	0.9	500	-0.05	1.26	103.52	105.53	1.21 %
18 : (7) 18: G+1.5S2	Positive	0.9	500	1.26	1.26	103.52	105.53	1.21 %
19 : (7) 19: G+1.5S2+0.9W	Negative	1.1	500	-0.63	0.63	126.52	128.98	0.5 %
19 : (7) 19: G+1.5S2+0.9W	Positive	1.1	500	0.02	0.63	126.52	128.98	0.5 %
20 : (7) 20: G+1.5S2+0.9W2	Negative	1.1	500	-0.62	0.62	126.52	128.98	0.49 %
20 : (7) 20: G+1.5S2+0.9W2	Positive	1.1	500	0.02	0.62	126.52	128.98	0.49 %
21 : (7) 21: G+1.5W	Negative	1.1	500	-0.02	0.51	126.52	128.98	0.4 %
21 : (7) 21: G+1.5W	Positive	1.1	500	0.51	0.51	126.52	128.98	0.4 %
22 : (7) 22: G+1.5W+0.75S	Negative	1.1	500	-1.89	1.89	126.52	128.98	1.49 %
22 : (7) 22: G+1.5W+0.75S	Positive	1.1	500	0.07	1.89	126.52	128.98	1.49 %

23 : (7) 23: G+1.5W+0.75S2	Negative	1.1	500	-0.69	0.69	126.52	128.98	0.54 %
23 : (7) 23: G+1.5W+0.75S2	Positive	1.1	500	0.03	0.69	126.52	128.98	0.54 %
24 : (7) 24: G+1.5W2	Negative	1.1	500	-0.02	0.53	126.52	128.98	0.42 %
24 : (7) 24: G+1.5W2	Positive	1.1	500	0.53	0.53	126.52	128.98	0.42 %
25 : (7) 25: G+1.5W2+0.75S	Negative	1.1	500	-1.87	1.87	126.52	128.98	1.48 %
25 : (7) 25: G+1.5W2+0.75S	Positive	1.1	500	0.07	1.87	126.52	128.98	1.48 %
26 : (7) 26: G+1.5W2+0.75S2	Negative	1.1	500	-0.67	0.67	126.52	128.98	0.53 %
26 : (7) 26: G+1.5W2+0.75S2	Positive	1.1	500	0.02	0.67	126.52	128.98	0.53 %