AFFAIRE:

INRIA Talence

Lot n° 8 - METALLERIE

MAITRE D'OUVRAGE:

INRIA

351 cours de la Libération Bât A29 - 33405 TALENCE CEDEX

BMA

25 rue Jean Fleuret cs 80010 - 33001 BORDEAUX CEDEX

ARCHITECTE MANDATAIRE :

BMT Architectes - Mr Thouveny

6 rue Placieux BP 53891 - 54029 NANCY CEDEX

ARCHITECTE ASSOCIE :

L'Atelier d'Architecture - Mr Eyquem

13 rue d'Aubidey - 33800 BORDEAUX

TITRE: **NOTE DE CALCULS LOCAUX TECHNIQUES EN TOITURE**

Révision	Date	Modification
A	28-01-11	Emission

Métallerie

Constructions métalliques

Menuiseries aluminium et acier

SOBLACO

101, cours de Bacalan
BP 165
33390 BLAYE

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SOBLACO

COMMANDE N°: 10050

DATE: 28-01-11

ECHELLE:

REVISIONS: A

PLAN N°: 37

Charges permanentes

Ossature horizontale	15 daN/m²
Cailleboti	15 daN/m²

Ossature verticale + Bardages	150 daN/m.

Couche sur chaufferie

Ossature	15
couche	15
	30 daN/m²

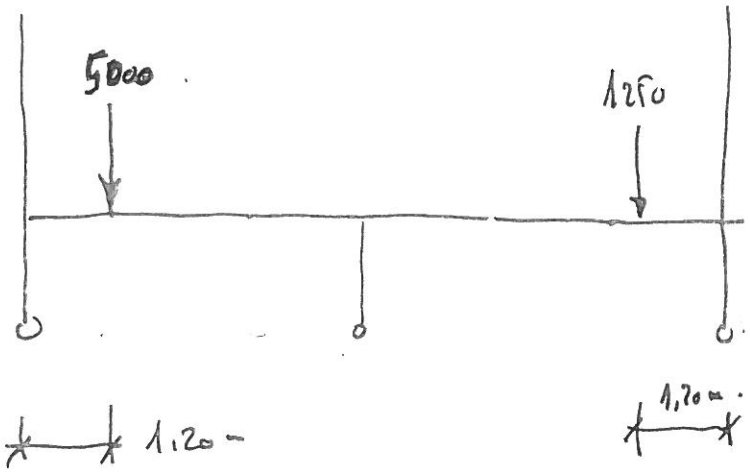
Neige

Sur chaussée 35 daN/m²

Nacc 80 daN/m²

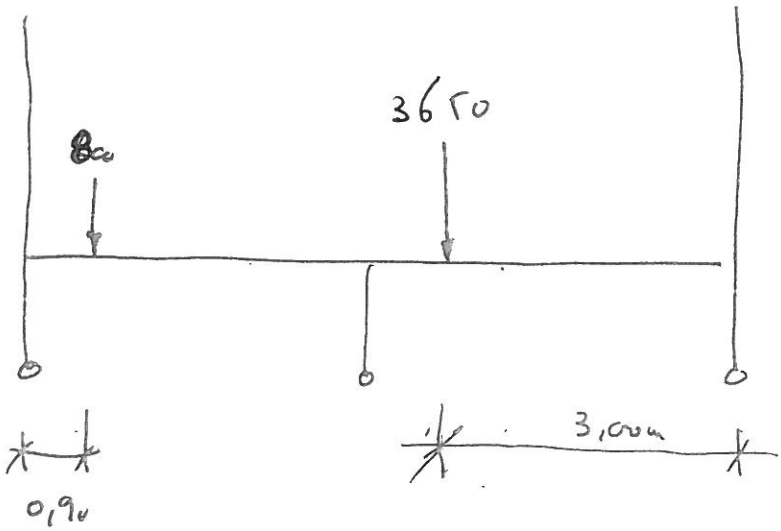
Surcharge 150 daN/m²

Appareil



chaufferie

OU



Groupe froid

VENT

$P_n = 60$ daN/m².

$H = 15m$ $\quad P_n = 56$

Dimension.

$H = 3m \Rightarrow \delta = 0,90$

$P = 59,4$ daN/m²

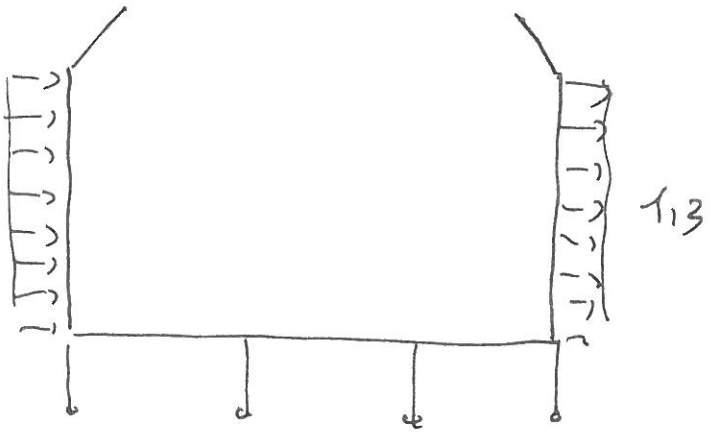
$L = 30m$

$l = 8m$

$H = 3m$

$d_a = 0,10$ $\quad d_b = 0,30$

$\gamma_0 = 0,94$



règle pour panneau plein

$h = 3m$

$L = 30m$ $\quad \frac{h}{e} = 0,10$

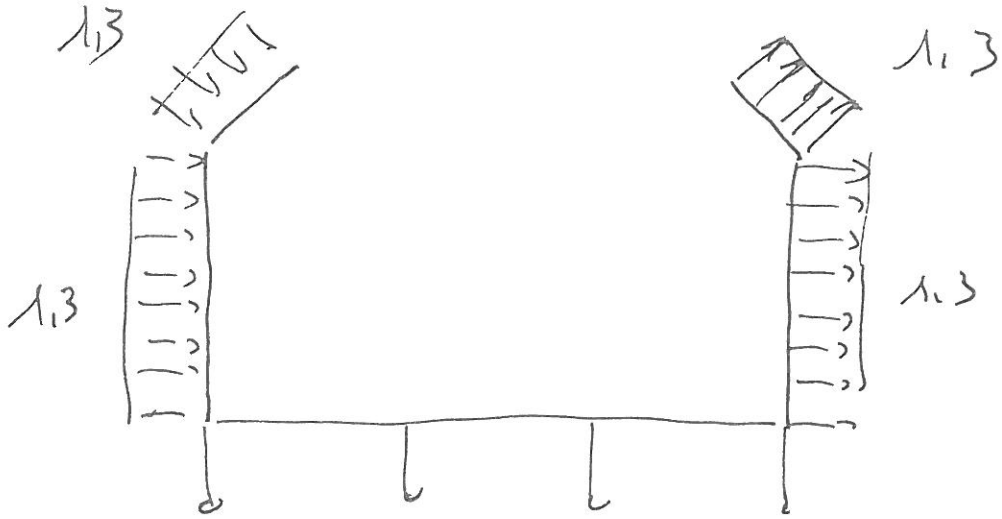
Coefficient $\quad C_f = 1,3$

Pour retour à 45° → faire isolée

$h_d = 1m$

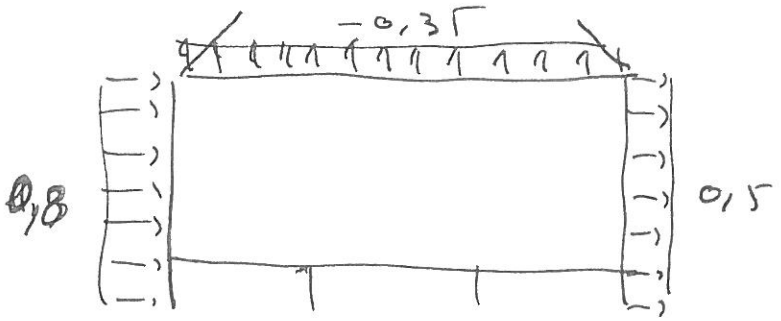
$L = 30m$ $\quad d = \frac{h_d}{L} = 0,03$

→ $\gamma = 1,3$



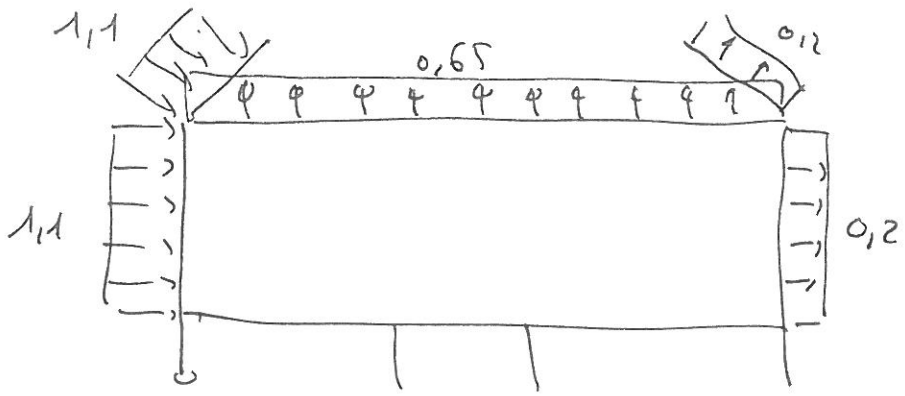
Action d'ensemble

Sur local chaufferie – bâtiment fermé.



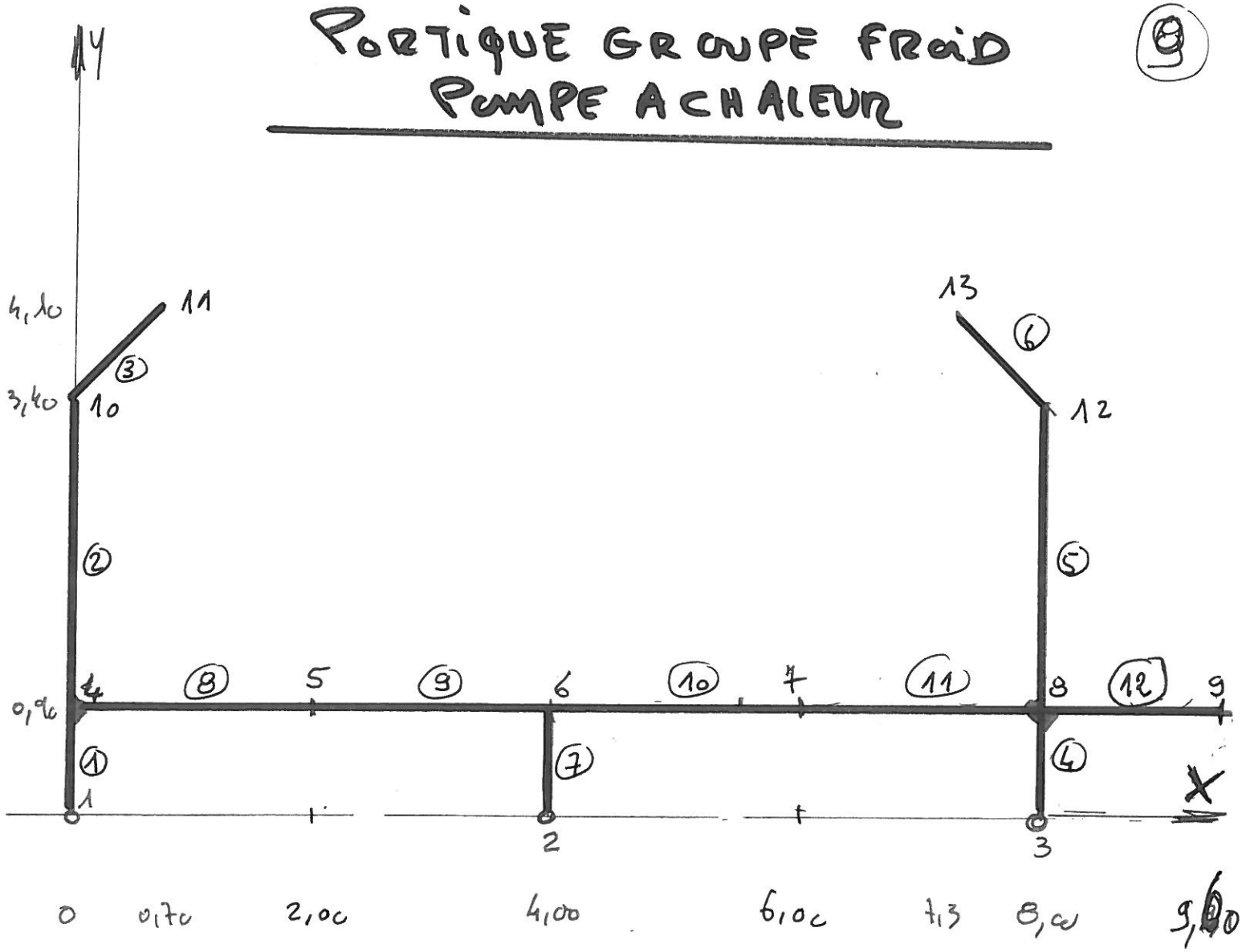
actions extr.

actions intr $a = \pm 0,3$

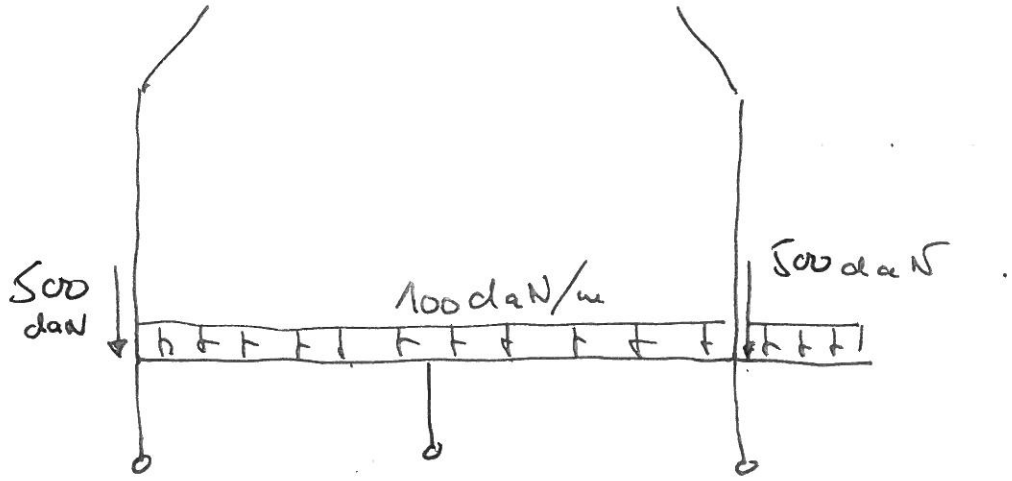


actions d'ensemble

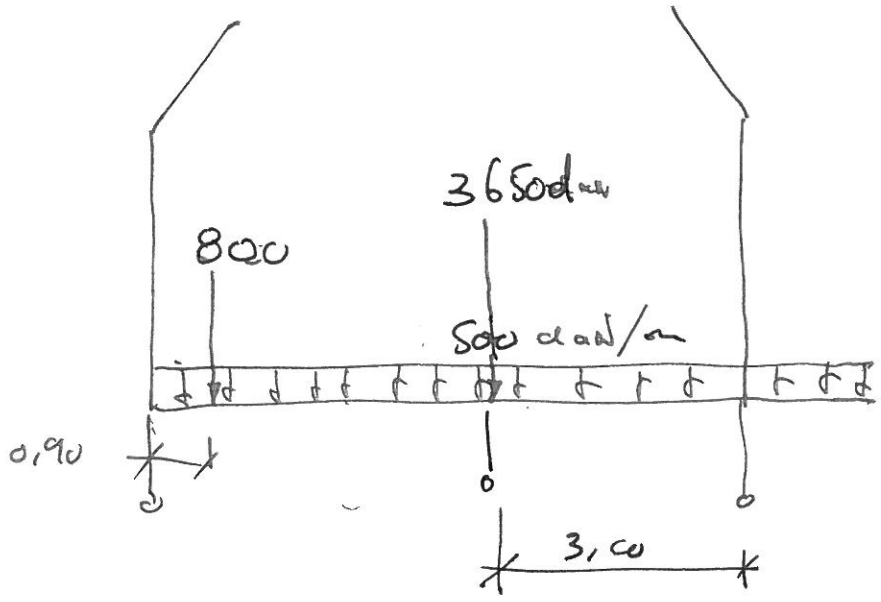
PORTIQUE GROUPE FROID POMPE A CHALEUR



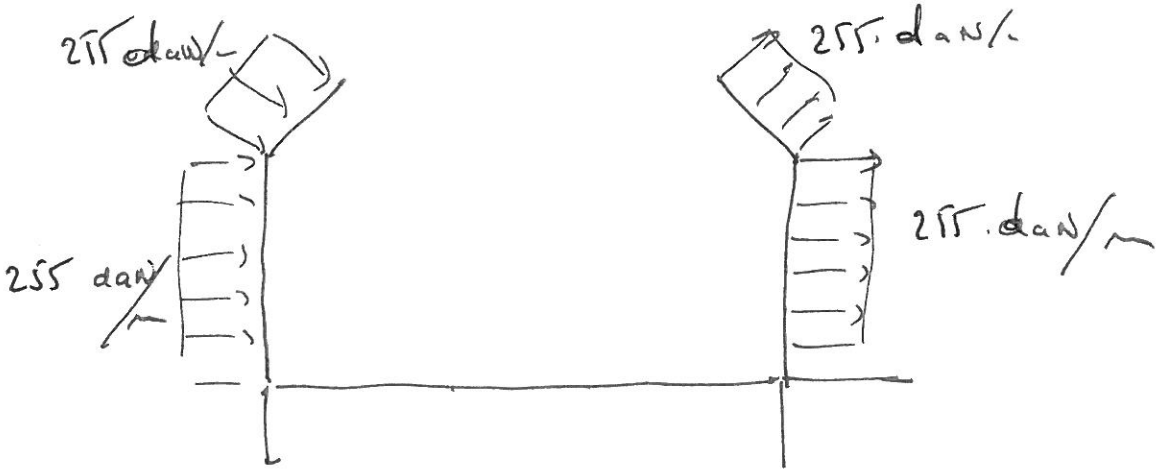
CAS N°1 CP



CAS N°2 S



Cas N°3 = Vent



Cas N°4 Vent

Sens inverse.

Pondération

$$\frac{4}{3} CP + \frac{3}{2} S$$

$$\frac{4}{3} CP + \frac{17}{12} (S + V_4)$$

$$CP + S + V_{ext}$$

S.A. SOBLAEC 101 COURS DE BACALAN
33390 BLAYE TEL: 57.42.19.95

GROUPE MACOID PAC

Coordonnees des noeuds libres (en metres)

N	X	Y
4	0.00	0.90
5	2.00	0.90
6	4.00	0.90
7	6.00	0.90
8	8.00	0.90
9	9.60	0.70
10	0.00	3.40
11	0.70	4.10
12	8.00	3.40
13	7.30	4.10

Coordonnees des appuis (metres)

N	X	Y
1	0.00	0.00
2	4.00	0.00
3	9.00	0.00

Relaxations

N	FX	FY	MZ

1	0	0	1
2	0	0	1
3	0	0	1

Incidences des barres

Barre	Origine	Extremite
1	1	4
2	4	10
3	10	11
4	3	8
5	8	12
6	12	13
7	2	6
8	4	5
9	5	6
10	6	7
11	7	8
12	8	9

Proprietes des barres (cm2,cm4)

Barre	AX	AY	IZ
1	23.9	0.0	1317.0
2	23.9	0.0	1317.0
3	23.9	0.0	1317.0
4	23.9	0.0	1317.0
5	23.9	0.0	1317.0
6	23.9	0.0	1317.0
7	23.9	0.0	1317.0
8	23.9	0.0	1317.0
9	23.9	0.0	1317.0
10	23.9	0.0	1317.0
11	23.9	0.0	1317.0
12	23.9	0.0	1317.0

Constantes du materiau (kg/mm2)

Barre	E	G
1	21000.00	7100.00
2	21000.00	7100.00
3	21000.00	7100.00
4	21000.00	7100.00
5	21000.00	7100.00

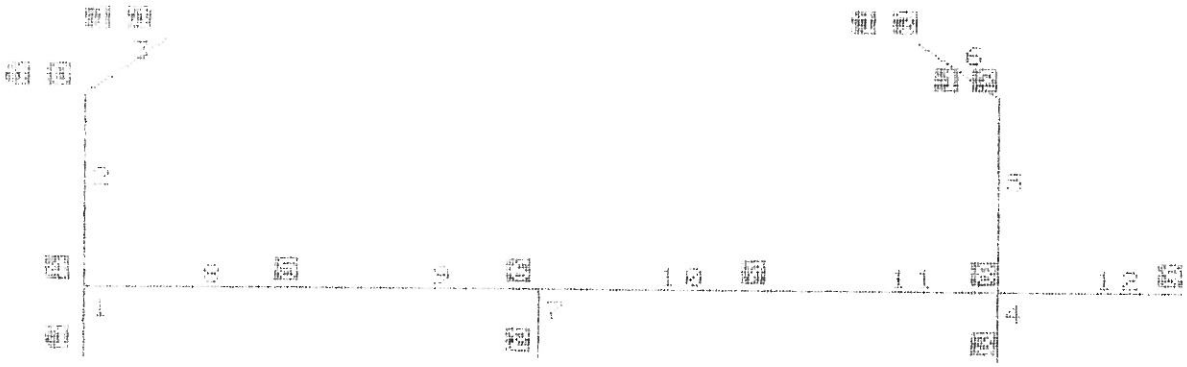
6	21000.00	7100.00
7	21000.00	7100.00
8	21000.00	7100.00
9	21000.00	7100.00
10	21000.00	7100.00
11	21000.00	7100.00
12	21000.00	7100.00

Relaxations des Barres

Barre	Debut			Fin		
	FX	FY	MZ	FX	FY	MZ

Desain de la struktura initiala

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****
Description des cas de Charges
****

Cas de charges 1

Charges aux noeuds (en kg,m)

N	FX	FY	MZ
4	0.	-500.	0.
8	0.	-500.	0.

Charges sur barres (en kg,m)

Barre	Type	Dir.	INT 1	INT 2	ABS 1	ABS 2
6	U	2	-100.		0.00	2.00
9	U	2	-100.		0.00	2.00
10	U	2	-100.		0.00	2.00
11	U	2	-100.		0.00	2.00
12	U	2	-100.		0.00	1.60

Cas de charges 2

Charges aux noeuds (en kg,m)

N	FX	FY	MZ

Charges sur barres (en kg,m)

Barre	Type	Dir.	INT 1	INT 2	ABS 1	ABS 2
3	C	2	-800.		0.90	
10	C	2	-3650.		1.00	
6	U	2	-500.		0.00	2.00
9	U	2	-500.		0.00	2.00
10	U	2	-500.		0.00	2.00
11	U	2	-500.		0.00	2.00

12	U	2	-500.	0.00	1.60

Cas de charges 3

Charges aux noeuds (en kg,m)

N	FX	FY	MZ

Charges sur barres (en kg,m)

Barre	Type	Dir.	INT 1	INT 2	ABS 1	ABS 2
2	U	2	-255.		0.00	2.50
3	U	2	-255.		0.00	0.99
5	U	2	-255.		0.00	2.50
6	U	2	-255.		0.00	0.99

Cas de charges 4

Charges aux noeuds (en kg,m)

N	FX	FY	MZ

Charges sur barres (en kg,m)

Barre	Type	Dir.	INT 1	INT 2	ABS 1	ABS 2
2	U	2	255.		0.00	2.50
3	U	2	255.		0.00	0.99
5	U	2	255.		0.00	2.50
6	U	2	255.		0.00	0.99

****
RESULTATS
****

CAS NUMERO 1

Charges appliquees (ou residus) aux noeuds libres (en kg,m)

Noeud	FX	FY	MZ
4	-0.	-500.	-0.
5	-0.	-0.	0.
6	-0.	0.	0.
7	-0.	0.	0.
8	-0.	-500.	-0.
9	0.	0.	0.
10	-0.	0.	0.
11	0.	-0.	0.
12	-0.	-0.	0.
13	0.	0.	0.

Reactions aux appuis (en kg,m)

Noeud	FX	FY	MZ
1	86.	677.	0.
2	-58.	413.	0.
3	-29.	969.	-0.

Deplacements des noeuds libres (en cm,rad)

Noeud	DEPX	DEPY	ROTZ
4	0.01	-0.00	-0.00
5	0.01	-0.03	0.00
6	0.01	-0.00	-0.00
7	0.01	-0.02	0.00
8	0.01	-0.00	-0.00
9	0.01	-0.04	-0.00
10	0.05	-0.00	-0.00
11	0.07	-0.01	-0.00
12	0.02	-0.00	-0.00
13	0.03	0.00	-0.00

Deplacements des noeuds supports (en cm,rad)

Noeud	DEPX	DEPY	ROTZ
1	0.00	0.00	-0.00
2	0.00	0.00	-0.00
3	0.00	0.00	-0.00

CAS NUMERO 2

Charges appliquees (ou residus) aux noeuds libres (en kg,m)

Noeud	FX	FY	MZ
4	-0.	0.	0.
5	0.	0.	-0.
6	-0.	0.	-0.
7	0.	0.	0.
8	-0.	-0.	-0.
9	0.	0.	-0.
10	-0.	0.	0.
11	0.	-0.	0.
12	-0.	-0.	0.
13	0.	0.	0.

Reactions aux appuis (en kg,m)

Noeud	FX	FY	MZ
1	416.	1326.	0.
2	694.	5345.	0.
3	-1110.	2379.	0.

Deplacements des noeuds libres (en cm,rad)

Noeud	DEPX	DEPY	ROTZ
4	0.12	-0.00	-0.00
5	0.11	-0.16	0.00
6	0.11	-0.01	-0.00
7	0.11	-0.44	0.00
8	0.10	-0.00	-0.00
9	0.10	-0.14	-0.00
10	0.54	-0.00	-0.00
11	0.66	-0.12	-0.00
12	0.12	-0.00	-0.00
13	0.12	-0.00	-0.00

Deplacements des noeuds supports (en cm,rad)

Noeud	DEPX	DEPY	ROTZ
1	0.00	0.00	-0.00

2	0.00	0.00	-0.00
3	0.00	0.00	-0.00

CAS NUMERO 8

Charges appliquees (ou residus) aux noeuds libres (en kg,m)

Noeud	FX	FY	MZ
4	-0.	-0.	-0.
5	0.	0.	0.
6	-0.	0.	0.
7	0.	0.	-0.
8	-0.	0.	0.
9	0.	-0.	0.
10	-0.	0.	0.
11	0.	-0.	0.
12	-0.	-0.	0.
13	0.	0.	0.

Reactions aux appuis (en kg,m)

Noeud	FX	FY	MZ
1	182.	-347.	-0.
2	-1996.	-0.	0.
3	182.	347.	0.

Deplacements des noeuds libres (en cm,rad)

Noeud	DEPX	DEPY	ROTZ
4	0.31	0.00	-0.00
5	0.31	-0.11	0.00
6	0.30	0.00	-0.00
7	0.31	0.11	0.00
8	0.31	-0.00	-0.00
9	0.31	-0.58	-0.00
10	2.15	-0.00	-0.01
11	2.80	-0.65	-0.01
12	2.15	0.00	-0.01
13	2.80	0.65	-0.01

Deplacements des noeuds supports (en cm,rad)

Noeud	DEPX	DEPY	ROTZ
1	0.00	0.00	-0.00

2	0.00	0.00	-0.00
3	0.00	0.00	-0.00

CAS NUMERO 4

Charges appliquees (ou residus) aux noeuds libres (en kg,m)

Noeud	FX	FY	MZ
4	0.	0.	0.
5	0.	-0.	-0.
6	0.	-0.	-0.
7	0.	0.	0.
8	0.	-0.	-0.
9	-0.	0.	-0.
10	0.	-0.	-0.
11	-0.	0.	-0.
12	0.	0.	-0.
13	-0.	-0.	-0.

Reactions aux appuis (en kg,m)

Noeud	FX	FY	MZ
1	-182.	347.	0.
2	1994.	0.	-0.
3	-182.	-347.	-0.

Deplacements des noeuds libres (en cm,rad)

Noeud	DEPX	DEPY	ROTZ
4	-0.31	-0.00	0.00
5	-0.31	0.11	-0.00
6	-0.30	-0.00	0.00
7	-0.31	-0.11	-0.00
8	-0.31	0.00	0.00
9	-0.31	0.58	0.00
10	-2.15	0.00	0.01
11	-2.80	0.65	0.01
12	-2.15	-0.00	0.01
13	-2.80	-0.65	0.01

Deplacements des noeuds supports (en cm,rad)

Noeud	DEPX	DEPY	ROTZ
1	0.00	0.00	0.00

2	0.00	0.00	0.00
3	0.00	0.00	0.00

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Efforts Barre par Barre (en kg.m)

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Barre 1

Noeud	Cas	FX	FY	MZ
1	1	677.	-86.	0.
4	1	-677.	86.	-78.
1	2	1326.	-416.	0.
4	2	-1326.	416.	-374.
1	3	-347.	-182.	-0.
4	3	347.	182.	-164.
1	4	347.	182.	0.
4	4	-347.	-182.	164.

Barre 2

Noeud	Cas	FX	FY	MZ
4	1	-0.	-0.	-0.
10	1	0.	0.	-0.
4	2	-0.	-0.	-0.
10	2	0.	0.	-0.
4	3	179.	816.	1368.
10	3	-179.	-179.	-125.
4	4	-179.	-816.	-1368.
10	4	179.	179.	125.

Barre 3

Noeud	Cas	FX	FY	MZ
10	1	0.	0.	0.
11	1	0.	-0.	0.
10	2	-0.	0.	0.
11	2	0.	-0.	0.
10	3	0.	253.	125.
11	3	-0.	-0.	0.
10	4	-0.	-253.	-125.
11	4	0.	0.	-0.

Barre 4

Noeud	Cas	FX	FY	MZ
3	1	869.	29.	-0.
9	1	-869.	-29.	26.
3	2	2579.	1110.	-0.
9	2	-2579.	-1110.	999.
3	3	347.	-182.	0.

8	3	-347.	182.	-164.
5	4	-347.	182.	-0.
8	4	347.	-182.	164.

Barre 5

Noeud	Cas	FX	FY	MZ
9	1	0.	0.	0.
12	1	-0.	-0.	-0.
8	2	0.	0.	0.
12	2	-0.	-0.	-0.
8	3	-179.	816.	1368.
12	3	179.	-179.	-125.
8	4	179.	-816.	-1368.
12	4	-179.	179.	125.

Barre 6

Noeud	Cas	FX	FY	MZ
12	1	0.	0.	0.
13	1	0.	-0.	0.
12	2	-0.	0.	0.
13	2	0.	-0.	0.
12	3	0.	253.	125.
13	3	0.	-0.	0.
12	4	0.	-253.	-125.
13	4	0.	0.	-0.

Barre 7

Noeud	Cas	FX	FY	MZ
2	1	413.	58.	0.
6	1	-413.	-58.	52.
2	2	5345.	-694.	0.
6	2	-5345.	694.	-625.
2	3	-0.	1996.	0.
6	3	0.	-1996.	1796.
2	4	0.	-1996.	-0.
6	4	-0.	1996.	-1796.

Barre 8

Noeud	Cas	FX	FY	MZ
4	1	86.	177.	79.
5	1	-86.	23.	77.
4	2	416.	1326.	374.
5	2	-416.	474.	398.
4	3	998.	-526.	-1204.
5	3	-998.	526.	153.
4	4	-998.	526.	1204.
5	4	998.	-526.	-153.

Barre 9

Noeud	Cas	FX	FY	MZ
5	1	96.	-23.	-77.
6	1	-86.	223.	-168.
5	2	416.	-474.	-378.
6	2	-416.	1474.	-1550.
5	3	998.	-526.	-153.
6	3	-998.	526.	-898.
5	4	-998.	526.	153.
6	4	998.	-526.	898.

Barre 10

Noeud	Cas	FX	FY	MZ
6	1	29.	191.	116.
7	1	-29.	9.	65.
6	2	1110.	3871.	2174.
7	2	-1110.	779.	918.
6	3	-998.	-526.	-898.
7	3	998.	526.	-153.
6	4	998.	526.	898.
7	4	-998.	-526.	153.

Barre 11

Noeud	Cas	FX	FY	MZ
7	1	29.	-9.	-65.
8	1	-29.	209.	-154.
7	2	1110.	-779.	-918.
8	2	-1110.	1779.	-1639.
7	3	-998.	-526.	153.
8	3	998.	526.	-1204.
7	4	998.	526.	-153.
8	4	-998.	-526.	1204.

Barre 12

Noeud	Cas	FX	FY	MZ
8	1	-0.	160.	128.
9	1	0.	0.	0.
8	2	-0.	800.	640.
9	2	0.	0.	-0.
8	3	-0.	0.	0.
9	3	0.	-0.	0.
8	4	0.	-0.	-0.
9	4	-0.	0.	-0.

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Ponderation des Efforts
****

Cas Envisages

Numero Ponderation	Chargement 1	2	3	4	5	6	7	8	9	10
1	1.33	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.
2	1.33	1.42	1.42	0.00	0.00	0.00	0.00	0.00	0.00	0.
3	1.33	1.42	0.00	1.42	0.00	0.00	0.00	0.00	0.00	0.
4	1.00	1.00	1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.
5	1.00	1.00	0.00	1.75	0.00	0.00	0.00	0.00	0.00	0.

Barre 1

Noeud	Cas	FX	FY	MZ
1	1	2892.	-739.	0.
4	1	-2892.	739.	-665.
1	2	2290.	-962.	-0.
4	2	-2290.	962.	-866.
1	3	3274.	-447.	0.
4	3	-3274.	447.	-402.
1	4	1396.	-821.	-0.
4	4	-1396.	821.	-738.
1	5	2611.	-184.	0.
4	5	-2611.	184.	-165.

Barre 2

Noeud	Cas	FX	FY	MZ
4	1	-0.	-0.	-0.
10	1	0.	0.	-0.
4	2	253.	1156.	1939.
10	2	-253.	-253.	-177.
4	3	-253.	-1156.	-1939.
10	3	253.	253.	177.
4	4	312.	1428.	2394.
10	4	-312.	-312.	-219.

1	5	-312.	-1428.	-2394.
10	5	312.	312.	219.

Barre 3

Noeud	Cas	FX	FY	MZ
10	1	-0.	0.	0.
11	1	0.	-0.	0.
10	2	0.	358.	177.
11	2	-0.	-0.	0.
10	3	-0.	-358.	-177.
11	3	0.	0.	-0.
10	4	0.	142.	212.
11	4	-0.	-0.	0.
10	5	-0.	-442.	-219.
11	5	0.	0.	-0.

Barre 4

Noeud	Cas	FX	FY	MZ
7	1	5027.	1703.	-0.
8	1	-5027.	-1703.	1533.
7	2	5305.	1353.	-0.
8	2	-5305.	-1353.	1218.
7	3	4321.	1869.	-0.
8	3	-4321.	-1869.	1682.
7	4	4055.	820.	0.
8	4	-4055.	-820.	738.
7	5	2841.	1457.	-0.
8	5	-2841.	-1457.	1311.

Barre 5

Noeud	Cas	FX	FY	MZ
8	1	0.	0.	0.
12	1	-0.	-0.	-0.
8	2	-253.	1156.	1937.
12	2	253.	-253.	-177.
8	3	253.	-1156.	-1937.
12	3	-253.	253.	177.
8	4	-312.	1428.	2394.
12	4	312.	-312.	-219.
8	5	312.	-1428.	-2394.
12	5	-312.	312.	219.

Barre 6

Noeud	Cas	FX	FY	MZ
12	1	-0.	0.	0.
13	1	0.	-0.	0.
12	2	-0.	358.	177.
13	2	0.	-0.	0.
12	3	-0.	-358.	-177.
13	3	0.	0.	-0.
12	4	-0.	442.	219.
13	4	0.	-0.	0.
12	5	-0.	-442.	-219.
13	5	0.	0.	-0.

Barre 7

Noeud	Cas	FX	FY	MZ
2	1	8569.	-955.	0.
6	1	-8569.	955.	-668.
2	2	8125.	1921.	0.
6	2	-8125.	-1921.	1729.
2	3	8125.	-3735.	-0.
6	3	-8125.	3735.	-3362.
2	4	5759.	2856.	0.
6	4	-5759.	-2856.	2571.
2	5	5759.	-4129.	-0.
6	5	-5759.	4129.	-3716.

Barre 8

Noeud	Cas	FX	FY	MZ
4	1	739.	2226.	665.
5	1	-739.	741.	700.
4	2	2118.	1371.	-1073.
5	2	-2118.	1446.	884.
4	3	-710.	2860.	2340.
5	3	710.	-43.	450.
4	4	2249.	584.	-1656.
5	4	-2249.	1416.	743.
4	5	-1244.	2423.	2560.
5	5	1244.	-423.	207.

Barre 9

Noeud	Cas	FX	FY	MZ
5	1	739.	-741.	-700.
6	1	-739.	2508.	-2549.
5	2	2119.	-1446.	-884.
6	2	-2118.	3130.	-3693.
5	3	-710.	43.	-450.
6	3	710.	1640.	-1148.
5	4	2249.	-1416.	-743.
6	4	-2249.	2616.	-3290.
5	5	-1244.	423.	-207.
6	5	1244.	777.	-146.

Barre 10

Noeud	Cas	FX	FY	MZ
6	1	1703.	6061.	3417.
7	1	-1703.	1180.	1464.
6	2	197.	4995.	1964.
7	2	-197.	1861.	1171.
6	3	3025.	6485.	4509.
7	3	-3025.	371.	1605.
6	4	-608.	3142.	719.
7	4	608.	1708.	715.
6	5	2885.	4982.	3863.
7	5	-2885.	-132.	1251.

Barre 11

Noeud	Cas	FX	FY	MZ
7	1	1703.	-1180.	-1464.
8	1	-1703.	2947.	-2664.
7	2	197.	-1861.	-1171.
8	2	-197.	3544.	-4234.
7	3	3025.	-371.	-1605.
8	3	-3025.	2055.	-821.
7	4	-608.	-1708.	-715.
8	4	608.	2908.	-3901.
7	5	2885.	132.	-1251.
8	5	-2885.	1068.	315.

Barre 12

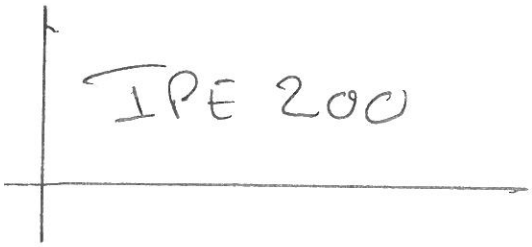
Noeud	Cas	FX	FY	MZ
8	1	-0.	1413.	1131.
9	1	0.	0.	-0.
8	2	-0.	1347.	1078.
9	2	0.	-0.	0.
8	3	-0.	1347.	1078.
9	3	0.	0.	-0.
8	4	-0.	960.	768.
9	4	0.	-0.	0.
8	5	0.	960.	768.
9	5	-0.	0.	-0.

Muari = 3901 mdaN barre 11

IPE 200 σ_f = 20,11 daN/mm²
< 24

flèche CP = 0,01 cm
S = 0,16 cm
0,17 cm

$f/L = \frac{0,17}{400} = \frac{1}{2350}$



POTEAUX

$M_{maxi} = 2394$ mdaN.

IPE 180 $\sigma_f = 16{,}40$ daN/mm²

< 24.

flèche $f = 2{,}80$ cm

$f/H = \frac{2{,}80}{410} = \frac{1}{146}$

admissible

IPE 180

Barre (7) poteau central

$N = 5759$ daN

$\gamma = 3716$ m daN.

IPE 200

$\sigma = 2,02$

$\sigma_f = 19,15$

$l_0 = 0,90$ m $\quad l_{fz} = 1,80$ m

$\lambda = \frac{180}{6,58} = 27 \quad k = 1,035$

$$\frac{q}{\delta}(k\sigma + \sigma_f) = \frac{g}{\delta}(1,035 \times 2,02 + 19,15)$$

$$= 23,90 \text{ daN/mm}^2$$

$$< 24$$

IPE 200

Barres (1) et (4) poteaux latéraux

$N = 2841$ daN

$\gamma = 1311$ m daN

IPE 180

$\sigma = 1,19$

$\sigma_p = 8,98$

$$\frac{9}{8}(k\sigma + \sigma_p) = \frac{9}{8}(1,035 \times 1,19 + 8,98)$$

$$= 11,49 \text{ daN/mm}^2$$

< 24

IPE 180

Console

Balle (12)

$\eta_{maxi} = 1131$ mdaN

IPE 160

$\sigma_f = 10{,}38$ daN/mm²

< 24

flèche $cP = 0{,}04$

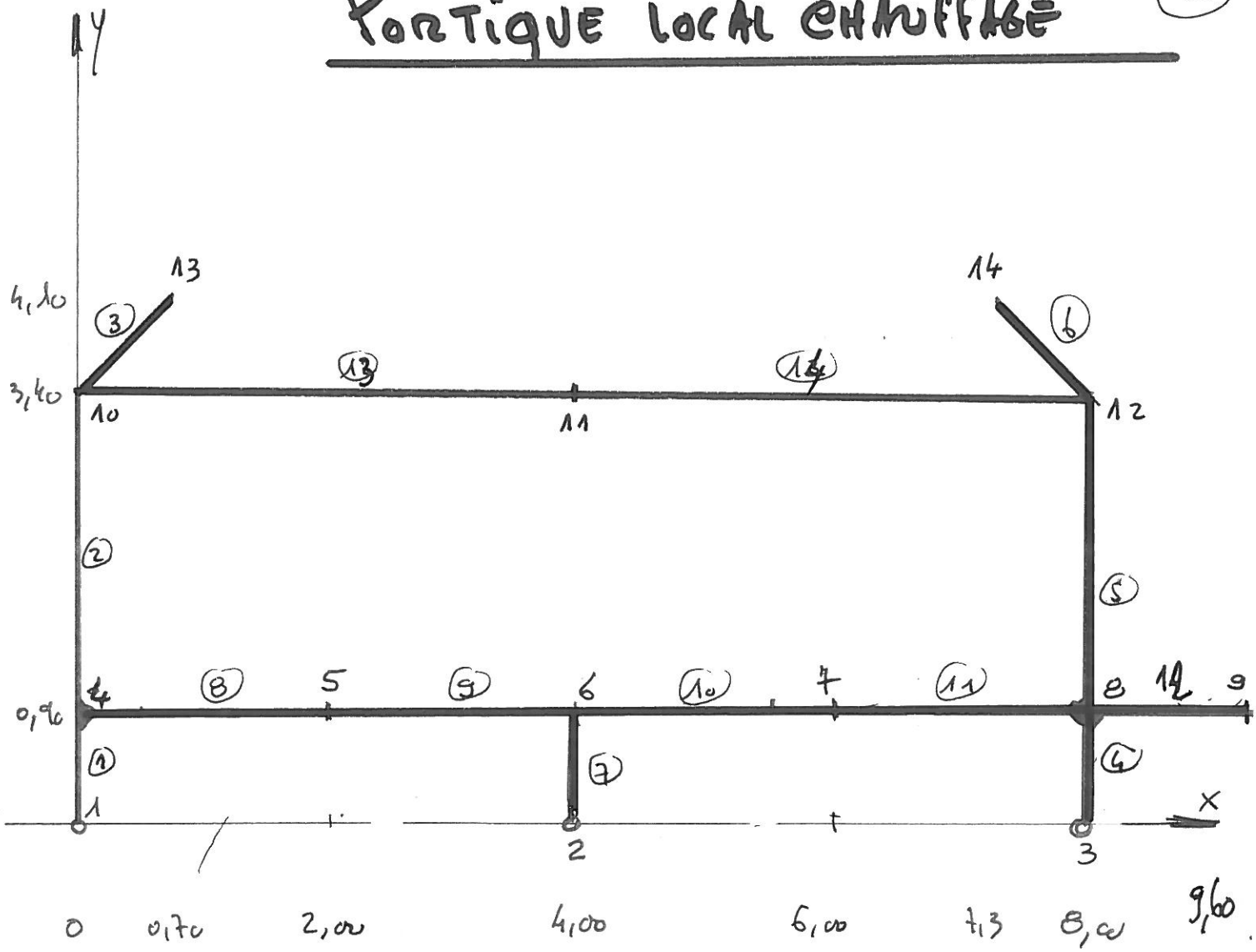
$S = \underline{0{,}16}$

$0{,}20$ cm

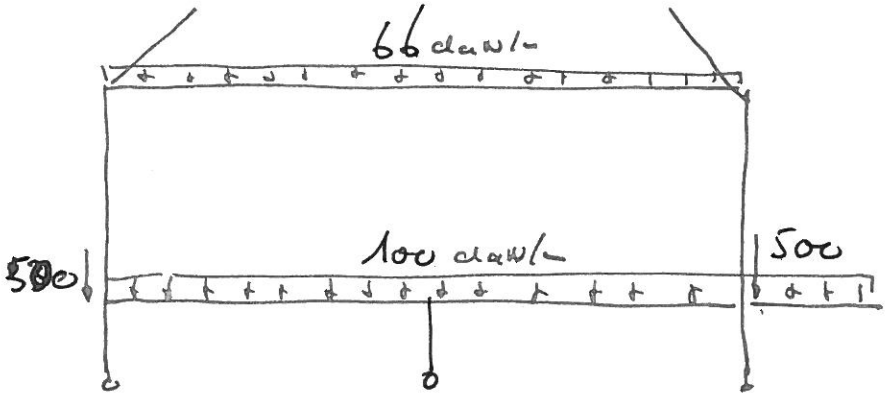
$f/L = \frac{0{,}20}{160} = \frac{1}{80}$

IPE 160

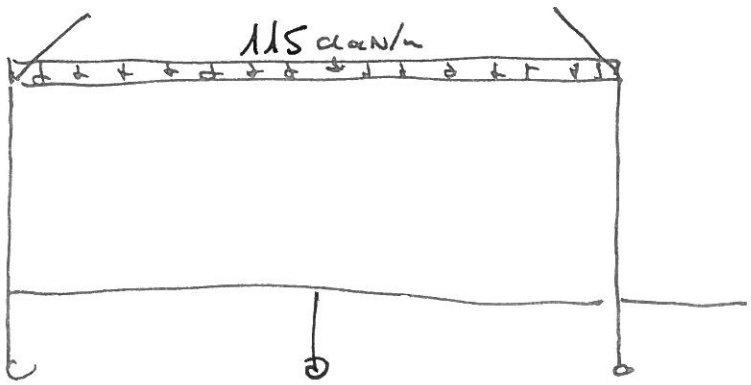
PORTIQUE LOCAL CHAUFFAGE



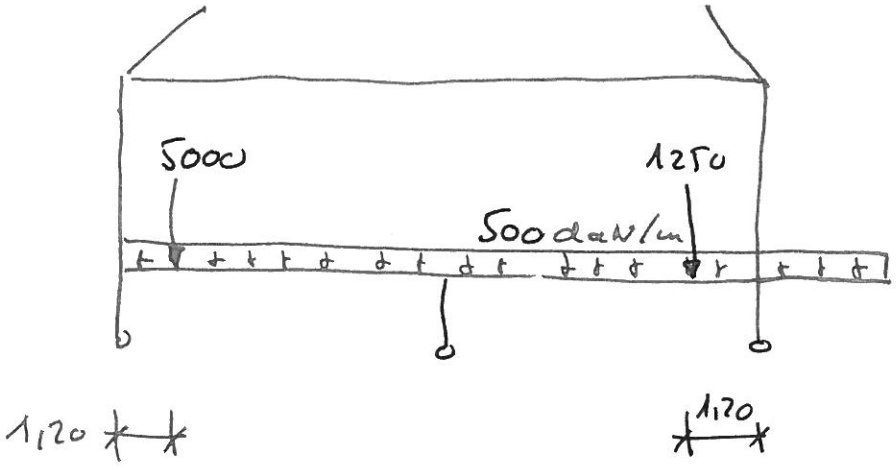
Cas N°1 CP



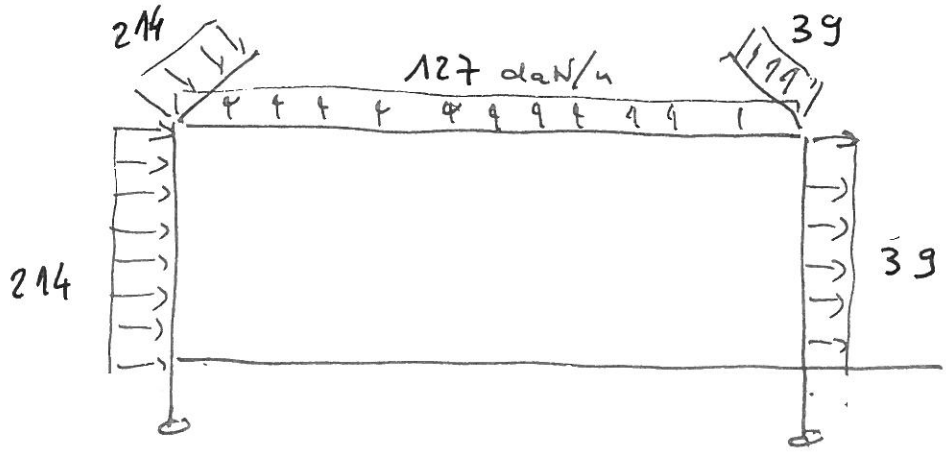
Cas N° 2 = Neige



Cas N°3 = S



Cas N°4 = Vent



Cas N°5 = Vent

Sens inverse

Pondérations

$\frac{4}{3}$ CP + $\frac{3}{2}$ S

$\frac{4}{3}$ CP + $\frac{17}{12}$ (N_4 + S)

$\frac{4}{3}$ CP + $\frac{17}{12}$ (N + S)

CP + S + Vext.

CP + S + $\frac{Nacc}{2}$ + Vext.

CP + S + Nacc

S.A. BOBLAGO 101 COURS DE BACALAN
33390 BLAYE TEL: 57.42.19.95

LOCAL CHAUFFAGE

Coordonnees des noeuds libres (en metres)

N	X	Y
4	0.00	0.90
5	2.00	0.90
6	4.00	0.90
7	6.00	0.90
8	8.00	0.90
9	9.60	0.90
10	0.00	3.40
11	4.00	3.40
12	8.00	3.40
13	0.70	4.10
14	7.30	4.10

Coordonnees des appuis (metres)

N	X	Y
1	0.00	0.00
2	4.00	0.00
3	8.00	0.00

Relaxations

N	FX	FY	MZ
1	0	0	1
2	0	0	1
3	0	0	1

Incidences des barres

Barre	Origine	Extremite
1	1	4
2	4	10
3	10	13
4	3	8
5	8	12
6	12	14
7	2	6
8	4	5
9	5	6
10	6	7
11	7	8
12	8	9
13	10	11
14	11	12

Proprietes des barres (cm2,cm4)

Barre	AX	AY	IZ
1	23.7	0.0	1317.0
2	23.9	0.0	1317.0
3	23.9	0.0	1317.0
4	23.9	0.0	1317.0
5	23.9	0.0	1317.0
6	23.9	0.0	1317.0
7	23.9	0.0	1317.0
8	23.9	0.0	1317.0
9	23.9	0.0	1317.0
10	23.9	0.0	1317.0
11	23.9	0.0	1317.0
12	23.9	0.0	1317.0
13	23.9	0.0	1317.0
14	23.9	0.0	1317.0

Constantes du materiau (kg/mm2)

Barre	E	G
1	21000.00	7100.00

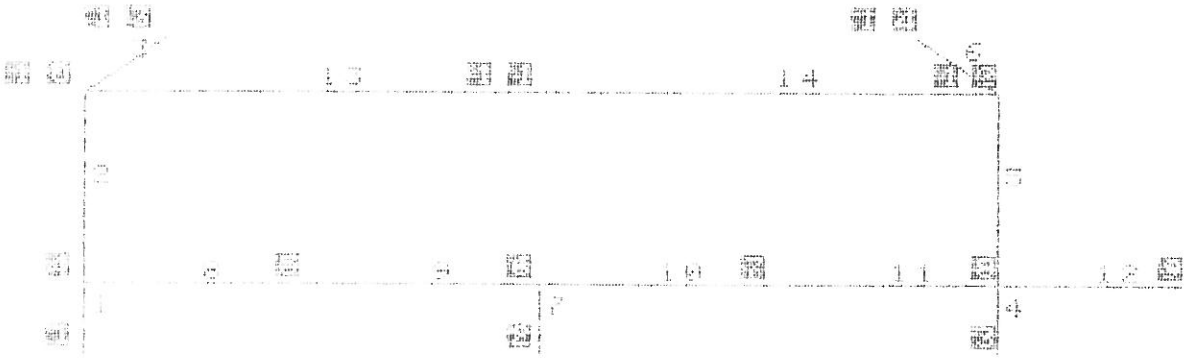
2	21000.00	7100.00
3	21000.00	7100.00
4	21000.00	7100.00
5	21000.00	7100.00
6	21000.00	7100.00
7	21000.00	7100.00
8	21000.00	7100.00
9	21000.00	7100.00
10	21000.00	7100.00
11	21000.00	7100.00
12	21000.00	7100.00
13	21000.00	7100.00
14	21000.00	7100.00

Relaxations des Barres

Barre	Debut			Fin		
	FX	FY	MZ	FX	FY	MZ

Dessin de la structure initiale

****



****
Description des cas de Charges
****

Cas de charges 1

Charges aux noeuds (en kg,m)

N	FX	FY	MZ
4	0.	-500.	0.
8	0.	-500.	0.

Charges sur barres (en kg,m)

Barre	Type	Dir.	INT 1	INT 2	ABS 1	ABS 2
8	U	Z	-100.	0.00	2.00	
9	U	Z	-100.	0.00	2.00	
10	U	Z	-100.	0.00	2.00	
11	U	Z	-100.	0.00	2.00	
12	U	Z	-100.	0.00	1.60	

Cas de charges 2

Charges aux noeuds (en kg,m)

N	FX	FY	MZ

Charges sur barres (en kg,m)

Barre	Type	Dir.	INT 1	INT 2	ABS 1	ABS 2
13	U	Z	-165.	0.00	4.00	
14	U	Z	-165.	0.00	4.00	

Cas de charges 3

Charges aux noeuds (en kg,m)

N°	FX	FY	MZ

Charges sur barres (en kg,m)

Barre	Type	Dir.	INT 1	INT 2	ABS 1	ABS 2
8	C	2	-5000.		1.20	
11	C	2	-1250.		0.80	
8	U	2	-500.		0.00	2.00
9	U	2	-500.		0.00	2.00
10	U	2	-500.		0.00	2.00
11	U	2	-500.		0.00	2.00
12	U	2	-500.		0.00	1.60

Cas de charges 4

Charges aux noeuds (en kg,m)

N	FX	FY	MZ

Charges sur barres (en kg,m)

Barre	Type	Dir.	INT 1	INT 2	ABS 1	ABS 2
2	U	2	-214.		0.00	2.50
7	U	2	-214.		0.00	0.99
5	U	2	-39.		0.00	2.50
6	U	2	-39.		0.00	0.99
13	U	2	127.		0.00	4.00
14	U	2	127.		0.00	4.00

Cas de charges 5

Charges aux noeuds (en kg,m)

N	FX	FY	MZ

Charges sur barres (en kg/m)

Barre	Type	Dir.	INT 1	INT 2	ABS 1	ABS 2
2	U	2	214.		0.00	2.50
3	U	2	214.		0.00	0.99
5	U	2	39.		0.00	2.50
6	U	2	39.		0.00	0.99
13	U	2	127.		0.00	4.00
14	U	2	127.		0.00	4.00

****
RESULTATS
****

CAS NUMERO 1

Charges appliquees (ou residue) aux noeuds libres (en kg,m)

Noeud	FX	FY	MZ
4	-0.	-500.	-0.
5	-0.	0.	0.
6	-0.	0.	0.
7	0.	0.	-0.
8	-0.	-500.	-0.
9	0.	0.	0.
10	-0.	0.	0.
11	0.	0.	-0.
12	-0.	-0.	0.
13	0.	-0.	0.
14	0.	0.	0.

Reactions aux appuis (en kg,m)

Noeud	FX	FY	MZ
1	69.	679.	-0.
2	-51.	410.	0.
3	-19.	971.	0.

Deplacements des noeuds libres (en cm,rad)

Noeud	DEPX	DEPY	ROTZ
4	0.01	-0.00	-0.00
5	0.01	-0.03	0.00
6	0.01	-0.00	-0.00
7	0.01	-0.02	0.00
8	0.01	-0.00	-0.00
9	0.01	-0.04	-0.00
10	0.03	-0.00	-0.00
11	0.03	0.00	0.00
12	0.03	-0.00	-0.00
13	0.03	-0.00	-0.00
14	0.03	0.00	-0.00

Déplacements des noeuds supports (en cm,rad)

Noeud	DEPX	DEPY	ROTZ
1	0.00	0.00	-0.00
2	0.00	0.00	-0.00
3	0.00	0.00	-0.00

Cas NUMERO 2

Charges appliquees (ou residus) aux noeuds libres (en kg,m)

Noeud	FX	FY	MZ
4	-0.	0.	0.
5	0.	0.	0.
6	-0.	-0.	0.
7	-0.	0.	-0.
8	-0.	0.	0.
9	0.	0.	-0.
10	-0.	0.	0.
11	-0.	0.	0.
12	0.	0.	-0.
13	0.	-0.	0.
14	-0.	-0.	-0.

Reactions aux appuis (en kg,m)

Noeud	FX	FY	MZ
1	-322.	680.	0.
2	0.	-55.	0.
3	322.	680.	-0.

Deplacements des noeuds libres (en cm,rad)

Noeud	DEPX	DEPY	ROTZ
4	-0.01	-0.00	0.00
5	-0.00	0.01	-0.00
6	-0.00	0.00	0.00
7	0.00	0.01	0.00
8	0.01	-0.00	-0.00
9	0.01	-0.04	-0.00
10	0.00	-0.00	-0.00
11	-0.00	-1.02	-0.00
12	-0.00	-0.00	0.00
13	0.13	-0.14	-0.00
14	-0.13	-0.14	0.00

Deplacements des noeuds supports (en cm,rad)

Noeud	DEPX	DEPY	ROTZ

1	0.00	0.00	-0.00
2	0.00	0.00	0.00
3	0.00	0.00	0.00

Cas numéro 3

Charges appliquées (ou résidus) aux noeuds libres (en kg,m)

Noeud	FX	FY	MZ
4	0.	-0.	-0.
5	-0.	-0.	-0.
6	-0.	0.	0.
7	0.	0.	0.
8	0.	-0.	0.
9	-0.	-0.	0.
10	-0.	0.	0.
11	0.	0.	0.
12	-0.	-0.	0.
13	0.	-0.	0.
14	0.	0.	0.

Reactions aux appuis (en kg,m)

Noeud	FX	FY	MZ
1	2182.	4930.	0.
2	-1570.	3655.	0.
3	-612.	2965.	0.

Deplacements des noeuds libres (en cm,rad)

Noeud	DEPX	DEPY	ROTZ
4	0.13	-0.01	-0.00
5	0.13	-0.71	0.00
6	0.12	-0.01	0.00
7	0.12	-0.18	-0.00
8	0.11	-0.01	-0.00
9	0.11	-0.26	-0.00
10	0.49	-0.01	-0.00
11	0.48	0.17	0.00
12	0.48	-0.01	-0.00
13	0.49	-0.01	-0.00
14	0.58	0.09	-0.00

Deplacements des noeuds supports (en cm,rad)

Noeud	DEPX	DEPY	ROTZ

1	0.00	0.00	-0.00
2	0.00	0.00	-0.00
3	0.00	0.00	-0.00

CAS NUMERO 4

Charges ponctuelles (ou residus) aux noeuds libres (en kg,m)

Noeud	FX	FY	MZ
4	-0.	0.	-0.
5	0.	-0.	0.
6	-0.	-0.	-0.
7	0.	0.	-0.
8	-0.	0.	-0.
9	0.	-0.	0.
10	0.	-0.	-0.
11	0.	0.	0.
12	-0.	-0.	0.
13	-0.	0.	-0.
14	0.	0.	0.

Reactions aux appuis (en kg,m)

Noeud	FX	FY	MZ
1	157.	-644.	-0.
2	-729.	50.	-0.
3	-237.	-300.	-0.

Deplacements des noeuds libres (en cm,rad)

Noeud	DEPX	DEPY	ROTZ
4	0.12	0.00	-0.00
5	0.12	-0.05	0.00
6	0.11	-0.00	-0.00
7	0.11	0.02	0.00
8	0.11	0.00	-0.00
9	0.11	-0.16	-0.00
10	0.56	0.00	0.00
11	0.57	0.79	0.00
12	0.57	0.00	-0.00
13	0.57	0.00	-0.00
14	0.77	0.20	-0.00

Deplacements des noeuds supports (en cm,rad)

Noeud	DEPX	DEPY	ROTZ

	0.00	0.00	-0.00
	0.00	0.00	-0.00
	0.00	0.00	-0.00

CAS NUMERO 5

Charges appliquees (ou residus) aux noeuds libres (en kg,m)

Noeud	FX	FY	MZ
4	-0.	0.	-0.
5	0.	-0.	0.
6	0.	0.	-0.
7	0.	-0.	0.
8	-0.	-0.	-0.
9	0.	0.	-0.
10	0.	-0.	-0.
11	0.	-0.	-0.
12	-0.	-0.	0.
13	-0.	0.	-0.
14	0.	0.	0.

Reactions aux appuis (en kg.m)

Noeud	FX	FY	MZ
1	185.	-414.	-0.
2	727.	35.	-0.
3	-104.	-759.	0.

Deplacements des noeuds libres (en cm,rad)

Noeud	DEPX	DEPY	ROTZ
4	-0.11	0.00	0.00
5	-0.11	0.03	-0.00
6	-0.11	-0.00	0.00
7	-0.12	-0.04	-0.00
8	-0.12	0.00	0.00
9	-0.12	0.23	0.00
10	-0.57	0.00	0.00
11	-0.57	0.78	-0.00
12	-0.56	0.00	-0.00
13	-0.77	0.21	0.00
14	-0.56	0.01	-0.00

Deplacements des noeuds supports (en cm,rad)

Noeud	DEPX	DEPY	ROTZ

1	0.00	0.00	0.00
2	0.00	0.00	0.00
3	0.00	0.00	0.00

****

Efforts Barre par Barre (en kg.m)

****

Barre 1

Noeud	Cas	FX	FY	MZ
1	1	679.	-69.	-0.
4	1	-679.	69.	-62.
1	2	688.	222.	0.
4	2	-688.	-222.	200.
1	3	4530.	-2182.	0.
4	3	-4530.	2182.	-1964.
1	4	-644.	-157.	-0.
4	4	644.	157.	-141.
1	5	-414.	-185.	-0.
4	5	414.	185.	-166.

Barre 2

Noeud	Cas	FX	FY	MZ
4	1	-2.	-7.	-24.
10	1	2.	7.	6.
4	2	660.	-409.	-274.
10	2	-660.	409.	-750.
4	3	-39.	-227.	-675.
10	3	39.	227.	108.
4	4	-431.	825.	634.
10	4	431.	-290.	761.
4	5	-505.	-195.	-213.
10	5	585.	-340.	394.

Barre 3

Noeud	Cas	FX	FY	MZ
10	1	0.	0.	0.
13	1	0.	-0.	0.
10	2	0.	0.	0.
13	2	-0.	-0.	0.
10	3	-0.	0.	0.
13	3	0.	-0.	0.
10	4	0.	212.	105.
13	4	0.	0.	-0.
10	5	-0.	-212.	-105.
13	5	0.	0.	-0.

Barre 4

Noeud	Cas	FX	FY	MZ
7	1	871.	19.	0.
9	1	-871.	-19.	17.
7	2	688.	-232.	-0.
9	2	-688.	232.	-200.
7	3	2865.	612.	0.
9	3	-2865.	-612.	551.
7	4	-300.	237.	-0.
9	4	300.	-237.	214.
7	5	-759.	104.	0.
9	5	759.	-104.	74.

Barre 5

Noeud	Cas	FX	FY	MZ
8	1	2.	7.	9.
12	1	-2.	-7.	9.
8	2	660.	409.	274.
12	2	-660.	-409.	750.
8	3	39.	227.	364.
12	3	-39.	-227.	201.
8	4	-463.	-16.	144.
12	4	463.	113.	-305.
8	5	-553.	-615.	-565.
12	5	553.	517.	-849.

Barre 6

Noeud	Cas	FX	FY	MZ
12	1	0.	0.	0.
14	1	0.	-0.	0.
12	2	-0.	-0.	-0.
14	2	0.	0.	-0.
12	3	-0.	0.	0.
14	3	0.	-0.	0.
12	4	-0.	39.	19.
14	4	0.	-0.	0.
12	5	0.	-39.	-19.
14	5	-0.	-0.	0.

Barre 7

Noeud	Cas	FX	FY	MZ
2	1	410.	51.	0.
6	1	-410.	-51.	46.
2	2	-55.	-0.	0.
6	2	55.	0.	-0.
2	3	3455.	1570.	0.
6	3	-3455.	-1570.	1413.
2	4	50.	729.	-0.
6	4	-50.	-729.	656.
2	5	35.	-729.	-0.
6	5	-35.	729.	-656.

Barre 8

Noeud	Cas	FX	FY	MZ
4	1	62.	181.	96.
5	1	-62.	19.	75.
4	2	-631.	28.	74.
5	2	631.	-28.	-19.
4	3	1956.	4559.	2639.
5	3	-1956.	1431.	1499.
4	4	982.	-214.	-493.
5	4	-982.	214.	66.
4	5	-10.	171.	379.
5	5	10.	-171.	-37.

Barre 9

Noeud	Cas	FX	FY	MZ
5	1	62.	-19.	-75.
6	1	-62.	219.	-163.
5	2	-631.	28.	19.
6	2	631.	-28.	36.
5	3	1956.	-1431.	-1499.
6	3	-1956.	2431.	-2364.
5	4	982.	-214.	-66.
6	4	-982.	214.	-361.
5	5	-10.	171.	37.
6	5	10.	-171.	305.

Barre 10

Noeud	Cas	FX	FY	MZ
6	1	11.	191.	118.
7	1	-11.	9.	65.
6	2	-631.	-28.	-36.
7	2	631.	28.	-19.
6	3	386.	1223.	951.
7	3	-386.	-223.	496.
6	4	253.	-163.	-295.
7	4	-253.	163.	-32.
6	5	718.	206.	351.
7	5	-718.	-206.	61.

Barre 11

Noeud	Cas	FX	FY	MZ
7	1	11.	-9.	-65.
8	1	-11.	209.	-153.
7	2	-631.	-28.	19.
8	2	631.	28.	-74.
7	3	386.	223.	-496.
8	3	-386.	2027.	-1557.

7	4	252.	-163.	32.
8	4	-252.	163.	-358.
7	5	718.	206.	-61.
8	5	-718.	-206.	472.

Barre 12

Noeud	Cas	FX	FY	MZ
8	1	-0.	160.	128.
7	1	0.	0.	0.
8	2	-0.	-0.	-0.
9	2	0.	0.	-0.
8	3	0.	800.	640.
9	3	-0.	-0.	0.
8	4	0.	0.	0.
9	4	0.	-0.	0.
8	5	0.	-0.	-0.
9	5	0.	0.	-0.

Barre 13

Noeud	Cas	FX	FY	MZ
10	1	7.	-2.	-6.
11	1	-7.	2.	-1.
10	2	409.	660.	750.
11	2	-409.	-0.	570.
10	3	227.	-39.	-108.
11	3	-227.	39.	-47.
10	4	-141.	-580.	-865.
11	4	141.	72.	-440.
10	5	-490.	-436.	-287.
11	5	490.	-72.	-437.

Barre 14

Noeud	Cas	FX	FY	MZ
11	1	7.	-2.	1.
12	1	-7.	2.	-9.
11	2	409.	0.	-570.
12	2	-409.	660.	-750.
11	3	227.	-39.	47.
12	3	-227.	39.	-201.
11	4	-141.	-72.	440.
12	4	141.	-436.	286.
11	5	-490.	72.	437.
12	5	490.	-580.	868.

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Pondération des Efforts

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Cas Envisagés

Numéro Fondération	Chargement 1	2	3	4	5	6	7	8	9	10
1	1.33	0.00	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.
2	1.33	0.00	1.42	1.42	0.00	0.00	0.00	0.00	0.00	0.
3	1.33	0.00	1.42	0.00	1.42	0.00	0.00	0.00	0.00	0.
4	1.33	1.42	1.42	0.00	0.00	0.00	0.00	0.00	0.00	0.
5	1.00	0.00	1.00	1.75	0.00	0.00	0.00	0.00	0.00	0.
6	1.00	0.00	1.00	0.00	1.75	0.00	0.00	0.00	0.00	0.
7	1.00	1.14	1.00	1.75	0.00	0.00	0.00	0.00	0.00	0.
8	1.00	1.14	1.00	0.00	1.75	0.00	0.00	0.00	0.00	0.
9	1.00	2.27	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.

Barre 1

Noeud	Cas	FX	FY	MZ
1	1	7698.	-3366.	-0.
4	1	-7698.	3366.	-3029.
1	2	6423.	-3414.	-0.
4	2	-6423.	3414.	-3073.
1	3	6747.	-3453.	-0.
4	3	-6747.	3453.	-3108.
1	4	8312.	-2076.	0.
4	4	-8312.	2876.	-2589.
1	5	4082.	-2526.	-0.
4	5	-4082.	2526.	-2274.
1	6	4484.	-2575.	-0.
4	6	-4484.	2575.	-2317.
1	7	4866.	-2273.	-0.
4	7	-4866.	2273.	-2046.
1	8	5268.	-2322.	-0.
4	8	-5268.	2322.	-2090.
1	9	6784.	-1744.	0.
4	9	-6784.	1744.	-1569.
1	10	0.	0.	0.
4	10	0.	0.	0.

Barre 2

Noeud	Cas	FX	FY	MZ
4	1	-61.	-350.	-1044.
10	1	61.	350.	170.
4	2	-669.	840.	-90.
10	2	669.	-81.	1242.
4	3	-389.	-609.	-1293.
10	3	389.	-151.	721.
4	4	880.	-913.	-1379.
10	4	-880.	913.	-903.
4	5	-794.	1210.	410.
10	5	794.	-274.	1445.
4	6	-1065.	-575.	-1072.
10	6	1065.	-361.	804.
4	7	-42.	744.	99.
10	7	42.	193.	590.
4	8	-313.	-1042.	-1383.
10	8	313.	106.	-51.
4	9	1471.	-1171.	-1325.
10	9	-1471.	1171.	-1603.
4	10	0.	0.	0.
10	10	0.	0.	0.

Barre 3

Noeud	Cas	FX	FY	MZ
10	1	-0.	0.	0.
13	1	0.	-0.	0.
10	2	-0.	301.	149.
13	2	0.	-0.	0.
10	3	-0.	-301.	-149.
13	3	0.	0.	-0.
10	4	-0.	0.	0.
13	4	0.	-0.	0.
10	5	-0.	371.	184.
13	5	0.	0.	-0.
10	6	-0.	-371.	-184.
13	6	0.	0.	-0.
10	7	-0.	371.	184.
13	7	0.	-0.	0.
10	8	-0.	-371.	-184.
13	8	0.	0.	-0.
10	9	-0.	0.	0.
13	9	0.	-0.	0.
10	10	0.	0.	0.
13	10	0.	0.	0.

Barre 4

Noeud	Cas	FX	FY	MZ
7	1	5456.	943.	0.
8	1	-5456.	-942.	849.
7	2	4804.	1232.	0.
8	2	-4804.	-1232.	1108.
7	3	4149.	1042.	0.
8	3	-4149.	-1042.	938.
7	4	6203.	579.	0.
8	4	-6203.	-579.	521.
7	5	3212.	1047.	0.
8	5	-3212.	-1047.	942.
7	6	2408.	813.	0.
8	6	-2408.	-813.	732.
7	7	3995.	794.	0.
8	7	-3995.	-794.	714.
7	8	3192.	560.	0.
8	8	-3192.	-560.	504.
7	9	5311.	123.	0.
8	9	-5311.	-123.	111.
7	10	0.	0.	0.
8	10	0.	0.	0.

Barre 5

Noeud	Cas	FX	FY	MZ
8	1	61.	350.	560.
12	1	-61.	-350.	314.
8	2	-400.	309.	736.
12	2	600.	-171.	-136.
8	3	-728.	-541.	-272.
12	3	728.	403.	-908.
8	4	995.	913.	920.
12	4	-995.	-913.	1363.
8	5	-770.	206.	627.
12	5	770.	-36.	-324.
8	6	-927.	-842.	-615.
12	6	927.	671.	-1275.
8	7	-17.	673.	739.
12	7	17.	-503.	531.
8	8	-175.	-375.	-303.
12	8	175.	204.	-421.
8	9	1532.	1171.	1001.
12	9	-1532.	-1171.	1928.
8	10	0.	0.	0.
12	10	0.	0.	0.

Barra 6

Nonud	Cas	FX	FY	MZ
12	1	-0.	0.	0.
14	1	0.	-0.	0.
12	2	-0.	55.	27.
14	2	0.	-0.	0.
12	3	0.	-55.	-27.
14	3	0.	-0.	0.
12	4	-0.	-0.	-0.
14	4	0.	0.	-0.
12	5	-0.	68.	33.
14	5	0.	-0.	0.
12	6	0.	-68.	-33.
14	6	-0.	-0.	0.
12	7	-0.	68.	33.
14	7	0.	-0.	0.
12	8	0.	-68.	-33.
14	8	-0.	0.	-0.
12	9	-0.	-0.	-0.
14	9	0.	0.	-0.
12	10	0.	0.	0.
14	10	0.	0.	0.

Barra 7

Nonud	Cas	FX	FY	MZ
2	1	6027.	2422.	0.
6	1	-6027.	-2422.	2180.
2	2	5808.	3332.	0.
6	2	-5808.	-3332.	2999.
2	3	5784.	1262.	0.
6	3	-5784.	-1262.	1136.
2	4	5557.	2297.	0.
6	4	-5557.	-2297.	2067.
2	5	4153.	2896.	0.
6	5	-4153.	-2896.	2607.
2	6	4125.	345.	0.
6	6	-4125.	-345.	311.
2	7	4090.	2896.	0.
6	7	-4090.	-2896.	2607.
2	8	4062.	345.	0.
6	8	-4062.	-345.	311.
2	9	3939.	1621.	0.
6	9	-3939.	-1621.	1459.
2	10	0.	0.	0.
6	10	0.	0.	0.

Barre 2

Noeud	Cas	FX	FY	MZ
4	1	3016.	7094.	4074.
5	1	-3016.	2172.	2348.
4	2	4254.	6426.	3163.
5	2	-4254.	2361.	2322.
4	3	2845.	6771.	4401.
5	3	-2845.	1815.	2176.
4	4	1963.	6767.	3968.
5	4	-1963.	2019.	2201.
4	5	3736.	4376.	1863.
5	5	-3736.	1824.	1689.
4	6	1999.	5049.	3389.
5	6	-1999.	1151.	1509.
4	7	3017.	4407.	1947.
5	7	-3017.	1793.	1667.
4	8	1280.	5080.	3473.
5	8	-1280.	1120.	1488.
4	9	572.	4813.	2095.
5	9	-572.	1387.	1531.
4	10	0.	0.	0.
5	10	0.	0.	0.

Barre 9

Noeud	Cas	FX	FY	MZ
5	1	3016.	-2172.	-2348.
6	1	-3016.	3938.	-3763.
5	2	4254.	-2361.	-2322.
6	2	-4254.	4048.	-4087.
5	3	2845.	-1815.	-2176.
6	3	-2845.	3501.	-3140.
5	4	1963.	-2019.	-2201.
6	4	-1963.	3705.	-3522.
5	5	3736.	-1824.	-1689.
6	5	-3736.	3024.	-3159.
5	6	1999.	-1151.	-1509.
6	6	-1999.	2351.	-1993.
5	7	3017.	-1793.	-1667.
6	7	-3017.	2993.	-3118.
5	8	1280.	-1120.	-1488.
6	8	-1280.	2320.	-1951.
5	9	572.	-1387.	-1531.
6	9	-572.	2587.	-2444.
5	10	0.	0.	0.
6	10	0.	0.	0.

Barre 10

Noeud	Cas	FX	FY	MZ
6	1	594.	2009.	1582.
7	1	-594.	-323.	830.
6	2	922.	1760.	1088.
7	2	-922.	-74.	746.
6	3	1583.	2283.	2004.
7	3	-1583.	-597.	876.
6	4	-334.	1952.	1455.
7	4	334.	-266.	764.
6	5	840.	1129.	552.
7	5	-840.	71.	505.
6	6	1654.	1774.	1682.
7	6	-1654.	-574.	667.
6	7	121.	1097.	511.
7	7	-121.	103.	484.
6	8	935.	1743.	1641.
7	8	-935.	-543.	645.
6	9	1048.	1351.	985.
7	9	-1048.	-151.	517.
6	10	0.	0.	0.
7	10	0.	0.	0.

Barre 11

Noeud	Cas	FX	FY	MZ
7	1	594.	323.	-830.
8	1	-594.	3318.	-2540.
7	2	922.	74.	-746.
8	2	-922.	3388.	-2734.
7	3	1583.	597.	-876.
8	3	-1583.	2864.	-1745.
7	4	-334.	266.	-764.
8	4	334.	3195.	-2520.
7	5	840.	-71.	-505.
8	5	-840.	2521.	-2337.
7	6	1654.	574.	-667.
8	6	-1654.	1876.	-886.
7	7	121.	-103.	-484.
8	7	-121.	2553.	-2421.
7	8	935.	543.	-645.
8	8	-935.	1707.	-969.
7	9	1048.	151.	-517.
8	9	-1048.	2299.	-1080.
7	10	0.	0.	0.
8	10	0.	0.	0.

Barre 12

Noeud	Cas	FX	FY	MZ
8	1	0.	1113.	1130.
9	1	-0.	-0.	0.
8	2	0.	1349.	1079.
9	2	-0.	-0.	0.
8	3	0.	1349.	1079.
9	3	-0.	0.	0.
8	4	0.	1349.	1079.
9	4	-0.	-0.	0.
8	5	0.	960.	768.
9	5	-0.	-0.	0.
8	6	0.	960.	768.
9	6	-0.	0.	-0.
8	7	0.	960.	768.
9	7	-0.	-0.	0.
8	8	0.	960.	768.
9	8	-0.	0.	-0.
8	9	0.	960.	768.
9	9	-0.	-0.	0.
8	10	0.	0.	0.
9	10	0.	0.	0.

Barre 13

Noeud	Cas	FX	FY	MZ
10	1	330.	-61.	-170.
11	1	-330.	61.	-72.
10	2	132.	-882.	-1390.
11	2	-132.	160.	-693.
10	3	-364.	-676.	-572.
11	3	364.	-45.	-689.
10	4	913.	880.	903.
11	4	-913.	57.	741.
10	5	-12.	-1056.	-1627.
11	5	12.	167.	-818.
10	6	-623.	-803.	-620.
11	6	623.	-86.	-813.
10	7	458.	-304.	-774.
11	7	-455.	167.	-168.
10	8	-156.	-51.	235.
11	8	156.	-86.	-164.
10	9	1171.	1471.	1603.
11	9	-1171.	41.	1257.
10	10	0.	0.	0.
11	10	0.	0.	0.

Barre 14

Noeud	Cas	FX	FY	MZ
11	1	350.	-61.	72.
12	1	-350.	61.	-314.
11	2	132.	-140.	693.
12	2	-132.	-561.	109.
11	3	-364.	45.	699.
12	3	364.	-767.	935.
11	4	913.	-57.	-741.
12	4	-913.	995.	-1363.
11	5	-12.	-167.	918.
12	5	12.	-722.	391.
11	6	-623.	86.	813.
12	6	623.	-975.	1309.
11	7	455.	-167.	168.
12	7	-455.	31.	-564.
11	8	-156.	86.	164.
12	8	156.	-223.	454.
11	9	1171.	-41.	-1257.
12	9	-1171.	1532.	-1928.
11	10	0.	0.	0.
12	10	0.	0.	0.

Verification structure chauffage

Traverse inférieure

$N_{max} = 4{,}61$ daN

IPE 200 $\quad \sigma_f = 22{,}69$ daN/mm²

< 24

flèche $\quad CP = 0{,}01$

$S = 0{,}13$

$0{,}14$ cm

$f/l = \frac{0{,}14}{400} = \frac{1}{3076}$.

IPE 200

Poteaux

$M_{maxi} = 1928 \text{ mdaN}$

IPE 180 $\quad \sigma_f = 13{,}21 \text{ daN/mm}^2$

$< 24.$

flèche horizontale $\quad 0{,}77 \text{ cm}$

$$f/l = \frac{0{,}77}{410} = \frac{1}{532}$$

IPE 180

Traverse supérieure

$q_{max} = 1928$ daN

IPE 160 $\quad g_p = 17,69$ daN/mm

< 24

flèche $\quad CP = 0,41$

$N = \frac{1,02}{1,43}$

$f/l = \frac{1,43}{800} = \frac{1}{560}$

IPE 160

Potelets

Barre (7)

N = 5808 daN
M = 2999 mdaN

Voir calcul · Groupe Froid

IPE 200

Barres (1) et (4)

N = 4804 daN
M = 1108 mdaN

Voir calcul Groupe Froid

IPE 180

Console

Barre 12

$\eta_{maxi} = 1131$ mdaN

IPE 160

$\sigma_f = 10{,}38$ daN/mm²

< 24

flèche $CP = 0{,}04$

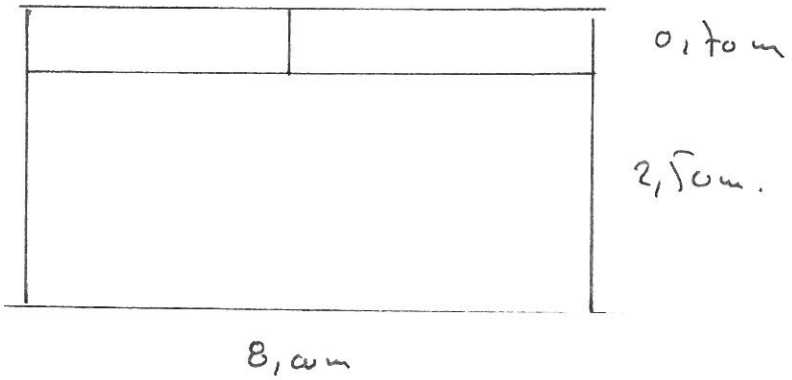
$S = 0{,}16$

$0{,}20$ cm

$f/L = \frac{0{,}20}{160} = \frac{1}{80}$

| IPE 160

LISSE SUPERIEURE RIGNON - GROUPE FROID



$l = 8{,}00\ m$

$e = 1{,}60\ m$

$P_u = 59{,}4\ daN/m^2$

$P = 8 \times 1{,}60 \times 59{,}4 \times 1{,}3 = 990\ daN$ $\sqrt{}$ normal

$\eta = 990 \times 1{,}75 \times \frac{8}{8} = 1730\ mdaN$. $\sqrt{}$ extrême

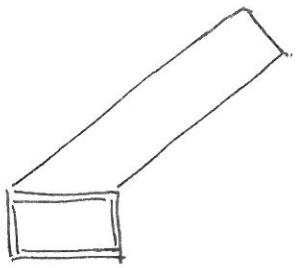
Tube $180 \times 100 \times 3{,}6$

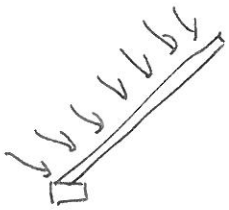
$\sigma_f = 9{,}06\ daN/mm^2$

Flèche $f = \frac{5 \cdot 990 \cdot 800^3}{384 \cdot 21 \cdot 10^5 \cdot 1716{,}4} = 4{,}03\ cm$

$f/l = \frac{4{,}03}{800} = \frac{1}{199} \# \frac{1}{200}$

Coupe au niveau potelet





$P = 4m \times 0,50m \times 59,4 \times 1,75$

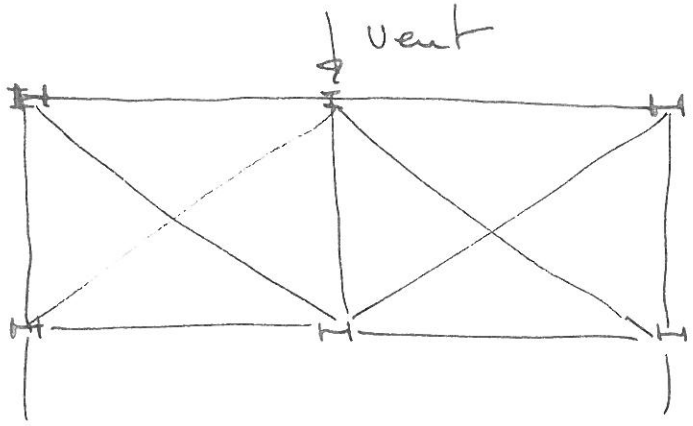
$P = 208\ daN$ Vent extrême

$M_t = 208 \times 1 = 208\ m\,daN$

$$\tau = \frac{M_t \cdot \rho}{J} = \frac{208 \times 0,36}{783} = 0,10\ daN/mm^2$$

Tube 180 x 100 x 3,6.

PIGNON LOCAL CHAUFFAGE



effort de vent repris par
poutre au vent horizontale L 50×50×5.

SOLIVES AU DROIT POMPE A CHALEUR

L = 3,30 m.

Appareil P = 1750 daN.

$$M = 1750 \times 1,5 \times \frac{3,30}{8} = 1083 \text{ m daN}$$

IPE 120 $\quad \sigma_f = 20,43$ daN/mm²

$$f = \frac{5 \cdot 1750 \cdot 330^3}{384 \cdot 21 \cdot 10^5 \cdot 318} = 1,23$$

$$f/L = \frac{1,23}{330} = \frac{1}{270}$$ acceptable

IPE 120

Solives par chillebotis

$L = 3{,}30$ m

$a = 2{,}00$ m

$CP = 30$

$S = 150$

$4/3\,CP + 3/2\,S = 265$

$P = 265 \times 3{,}30 \times 2{,}00 = 1750$ daN

$1 = \dfrac{1750 \times 3{,}30}{8} = 722$ mdaN

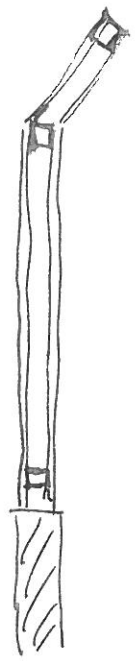
IPE 100 $\quad \sigma_f = 21{,}11$ daN/mm^2

$$\text{flèche} = \frac{5 \times 1170 \times 330^3}{384 \times 21 \times 10^5 \times 171} = 1{,}52 \text{ cm}$$

$$\frac{f}{L} = \frac{1{,}52}{330} = \frac{1}{217} < \frac{1}{200}$$

IPE 100

LISSES DE BARDAGE



0,70m

2,50m.

Lisse centrale

$P = 1,60m \times 3,30m \times 59,4 \times 1,3 = 408 daN$ Vnor

$M = 408 \times 1,75 \times \frac{3,30}{8} = 294 m.daN$

Tube 70 x 70 x 3 $\quad \sigma_f = 17,40 daN/mm^2$

$fleche = \frac{5 \cdot 408 \cdot 330^3}{384 \times 21 \times 10^5 \cdot 63,5} = 1,43 cm$

$f/L = \frac{1,43}{330} = \frac{1}{230} < \frac{1}{200}$

Tube 70 x 70 x 3

Lisse haute

$\ell = 0,50 m$

$L = 3,30 m$

$P = 3,30 \times 0,50 \times 59,4 \times 1,3 = 127 daN$

$M = 127 \times 1,75 \times \frac{3,30}{8} = 92 m daN$

Tube 50 x 50 x 2

$\sigma_f = 13,16 daN/mm^2$

< 24

$f = \frac{5 . 127 . 330^3}{384 . 21 . 10^5 . 17,5} \quad 1,62 cm$

$f/L = \frac{1,62}{330} = \frac{1}{204}$

$< \frac{1}{200}$

Tube 50 x 50 x 2

lisse basse

Vent normal

$P = 1,25 \times 3,30 \times 59,4 \times 1,3 = 319 \text{ daN}$

Cette lisse reprend également le cailleboti.

$cP = 30$
$S = 150$

$L = 3,30$
$a = 1,10.$

$P = \left(\frac{4}{3}30 + \frac{3}{2}150\right) 3,30 \times 1,10 = 875 \text{ daN}.$

$M_{xe} = 319 \times \frac{3}{2} \times \frac{3,30}{8} = 197 \text{ m daN}$

$3/2\, V_m$

$M_y = 875 \times \frac{3,30}{8} = 361 \text{ m daN}$

$4/3\, cP + 3/2\, S$

Tube 120 x 60 x 3,2

$\sigma_{fx} = 8,43$

$\sigma_{fy} = 10,37$

$18,80 \text{ daN/mm}^2$

< 24 .

Fleche

$$f_y = \frac{5 \cdot 594 \cdot 330^3}{384 \cdot 21 \cdot 10^5 \cdot 208,9} = 0,63 \text{ cm}$$

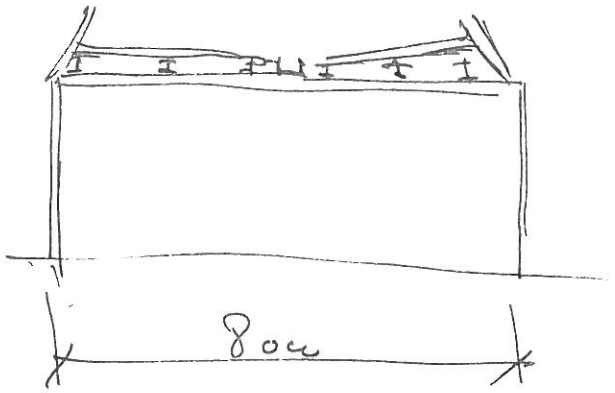
$$f_{y/L} = \frac{0,63}{330} = \frac{1}{524}$$

$$f_x = \frac{5 \cdot 319 \cdot 330^3}{384 \cdot 21 \cdot 10^5 \cdot 70,04} = 1,01 \text{ cm}$$

$$f_{x/L} = \frac{1}{330}$$

Tube 120 x 60 x 3,2

ANNEX LOCAL CHAUFFAGE



$l = 3,30\ m$

$a = 2,00\ m$

$CP = 30$

$N_{acc} = 80$

$P = 3,30 \times 2,00 \times 110 = 726\ daN$

$q = 726 \times \frac{3,30}{8} = 300\ m\ daN$

IPE 80 $\qquad \sigma_f = 15,00\ daN/mm^2$.

$$f = \frac{5 \cdot 430 \cdot 330^3}{384 \cdot 21 \cdot 10^5 \cdot 80,1} = 1,20\ cm$$

$$f/l = \frac{1,20}{330} = \frac{1}{275} < \frac{1}{200}$$

IPE 80

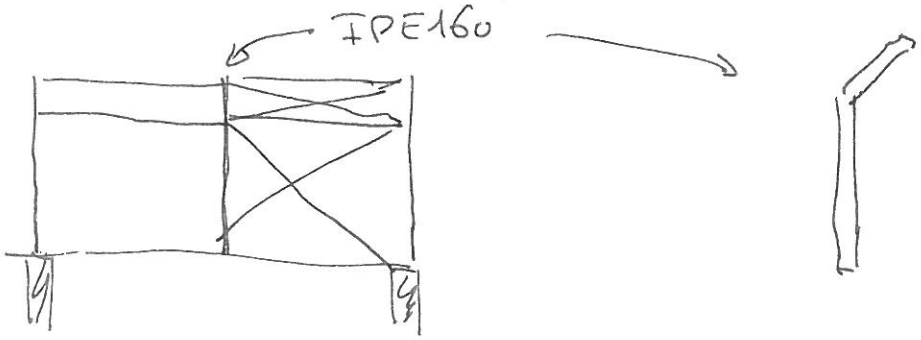
STABILITÉS



1 palée en croix de St André à chaque extrémité dans chaque file

L40 x 40 x 4

Signa local chauffage



L40 x 40 x 4

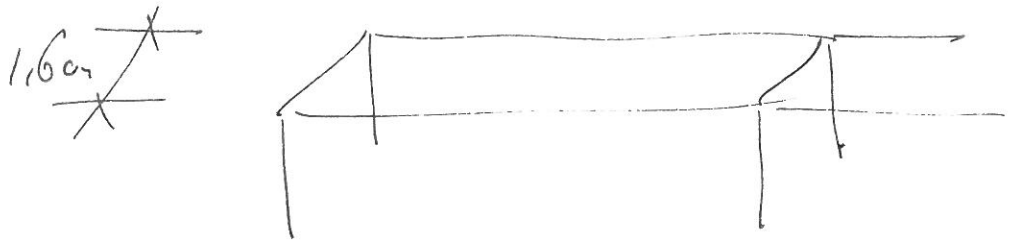
PASSERELLE EXTERIEURE

Suivant croquis ci-joints.

$cp = 20\ daN/m^2$

$g = 150\ daN/m^2$

$\frac{4}{3} cp + \frac{3}{2} g = 252\ daN/m^2$



L mati : 5,07 m

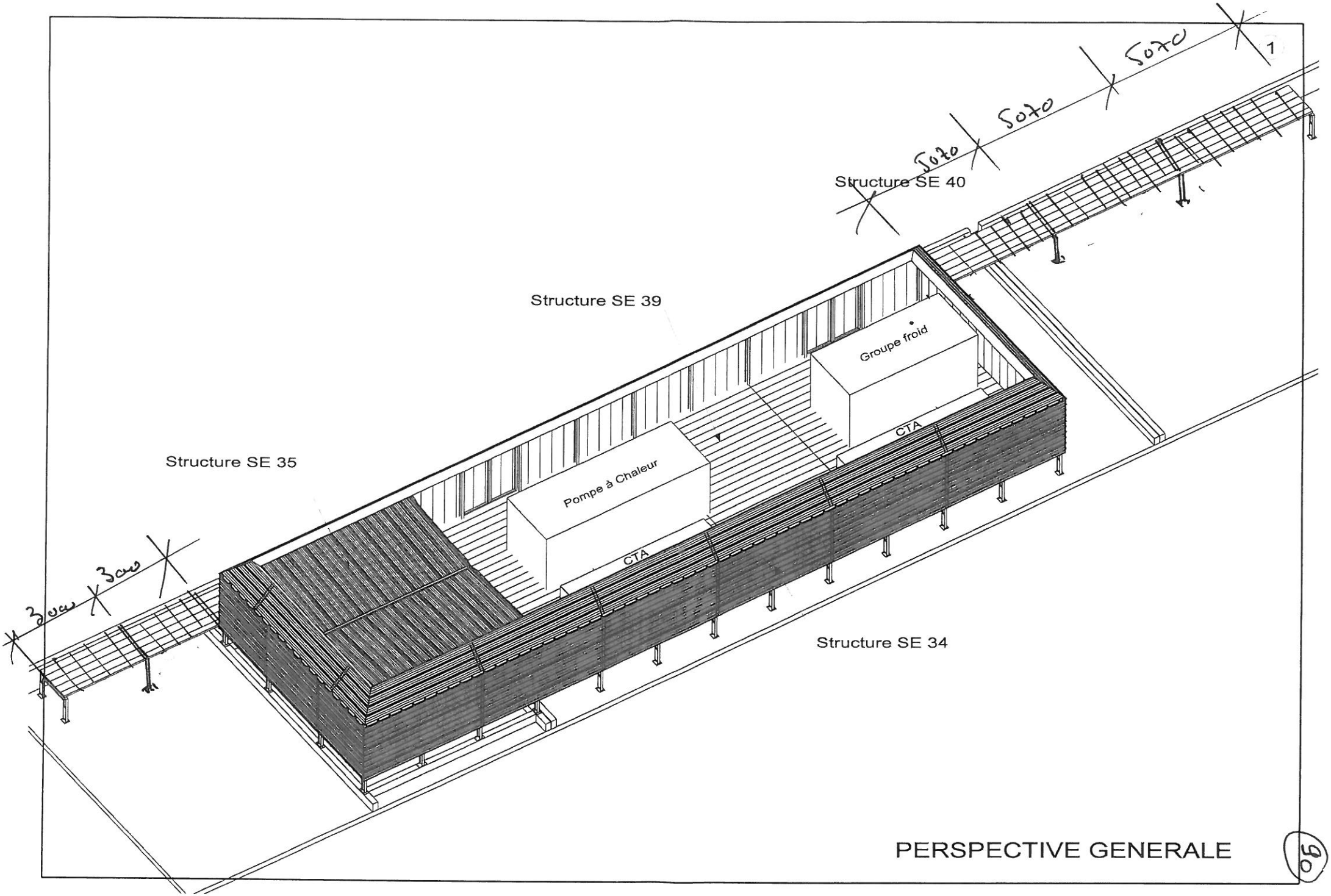
$a = 0,80\ m$

$P = 5,07 \times 0,80 \times 252 = 1022\ daN.$

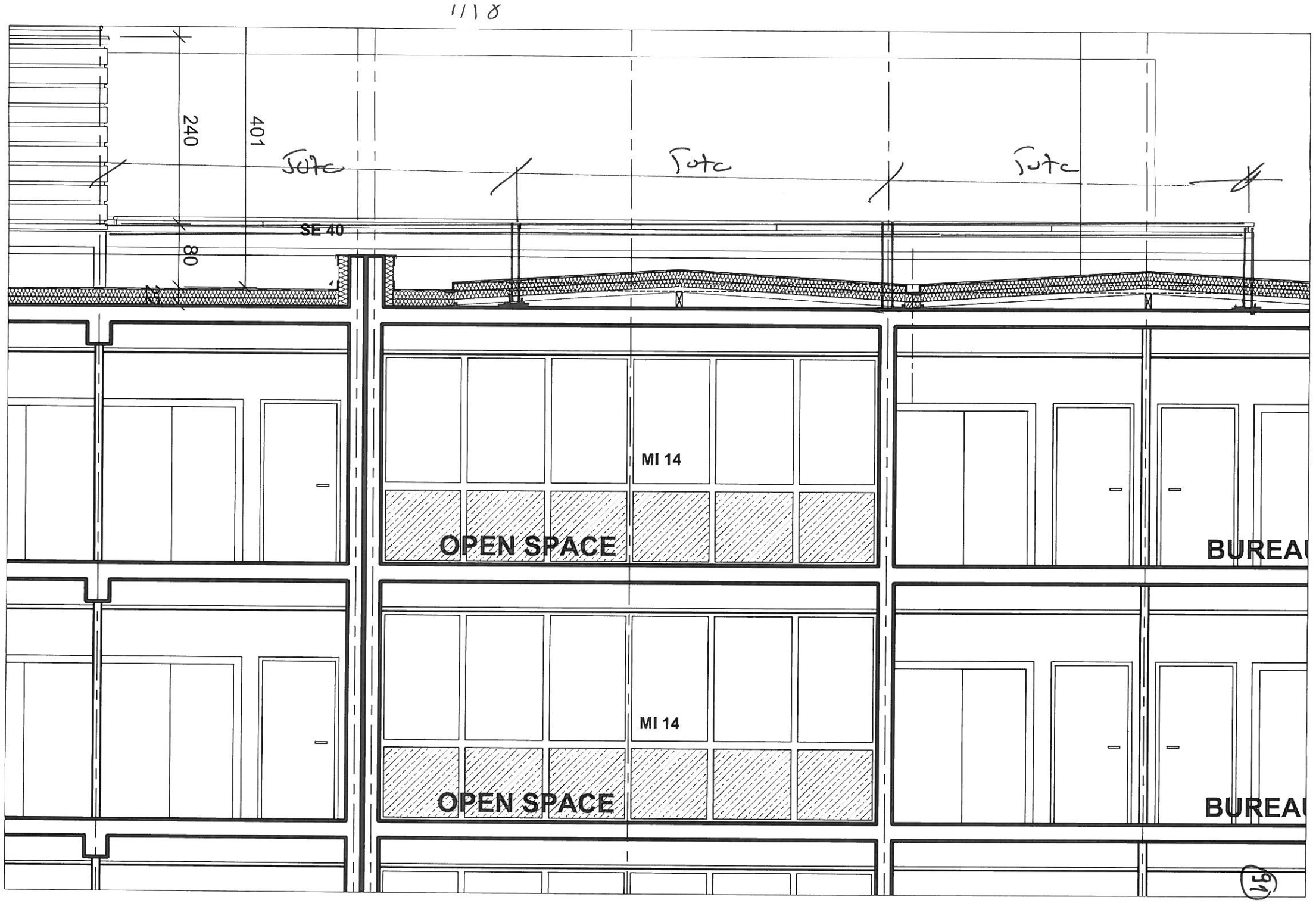
$M = 1022 \times \frac{5,07}{8} = 648\ mdaN$

IPE 120 $\quad \sigma_f = 12,22\ daN/mm^2$

< 24



PERSPECTIVE GENERALE


240
401
80
SE 40
MI 14
OPEN SPACE
MI 14
OPEN SPACE

flèche.

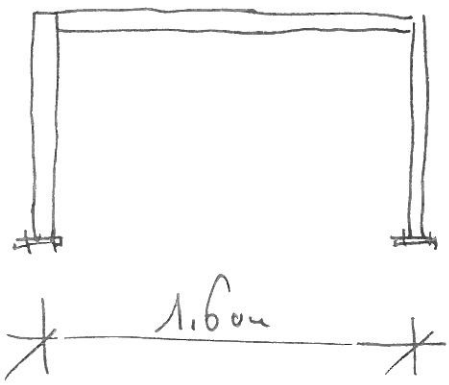
$P = 690$ daN uniformément répartie

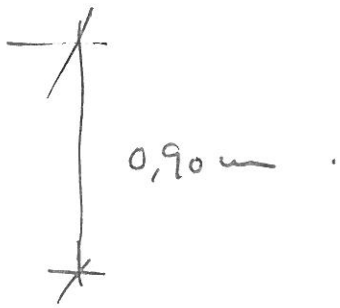
$$f = \frac{5PL^3}{384EI} = \frac{5 \cdot 690 \cdot 507^3}{384 \cdot 21 \cdot 10^5 \cdot 318} = 1{,}75 \text{ cm}$$

$$f/L = \frac{1}{290} < \frac{1}{200}.$$

IPE 120.

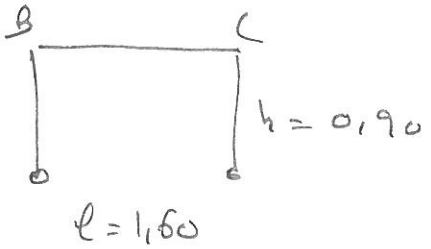
Portiques des supports





Charge ponctuelle

$P = 5,07 \times 1,60 \times 272 = 2044$ daN



$K = \frac{J_2}{J_1} \times \frac{h}{\ell} = 1 \times \frac{0,90}{1,60} = 0,56$

$N = 2K + 3 = 4,13$

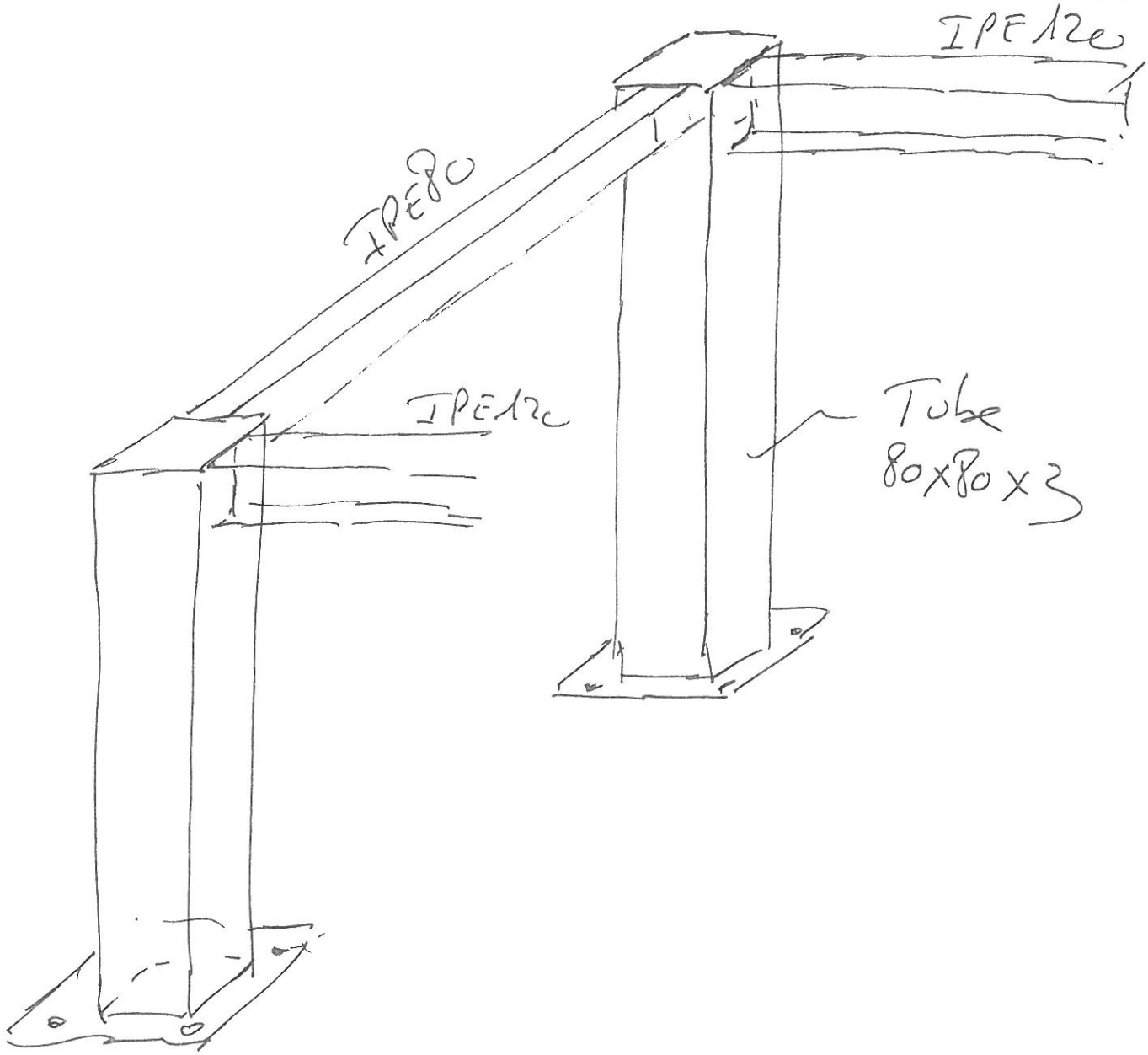
$\eta_B = \eta_C = \frac{P\ell}{4N} = 197$ mdaN

Mmi $\frac{P\ell}{8} - 197 = 212$ mdaN

Poteau = tube 80 x 80 x 3
Traverse IPE 80

$\sigma_f = \frac{212}{20} = 10,60$ daN/mm²

< 24


IPE 120
IPE80
IPE120
Tube
80x80x3