

ETC 3

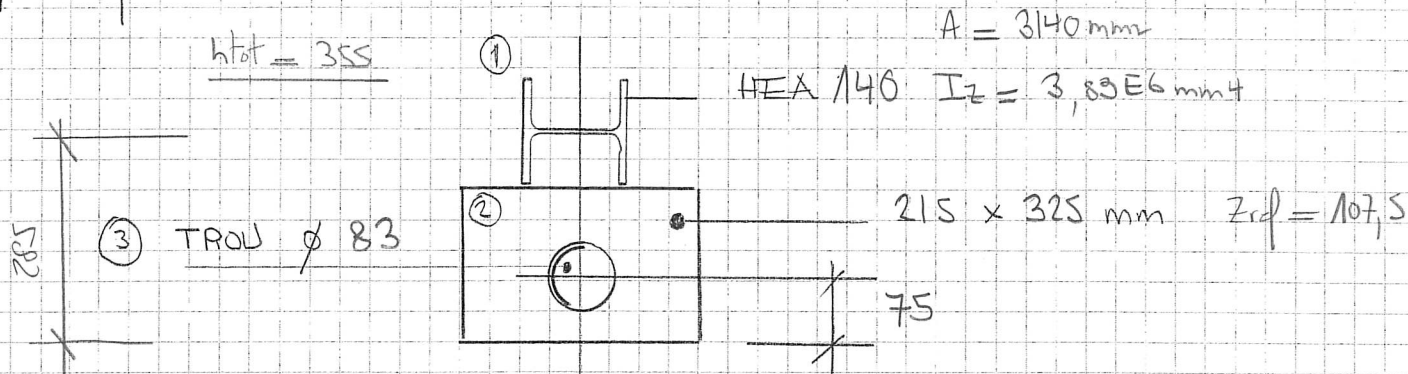
TE SERIE A

9.05.23

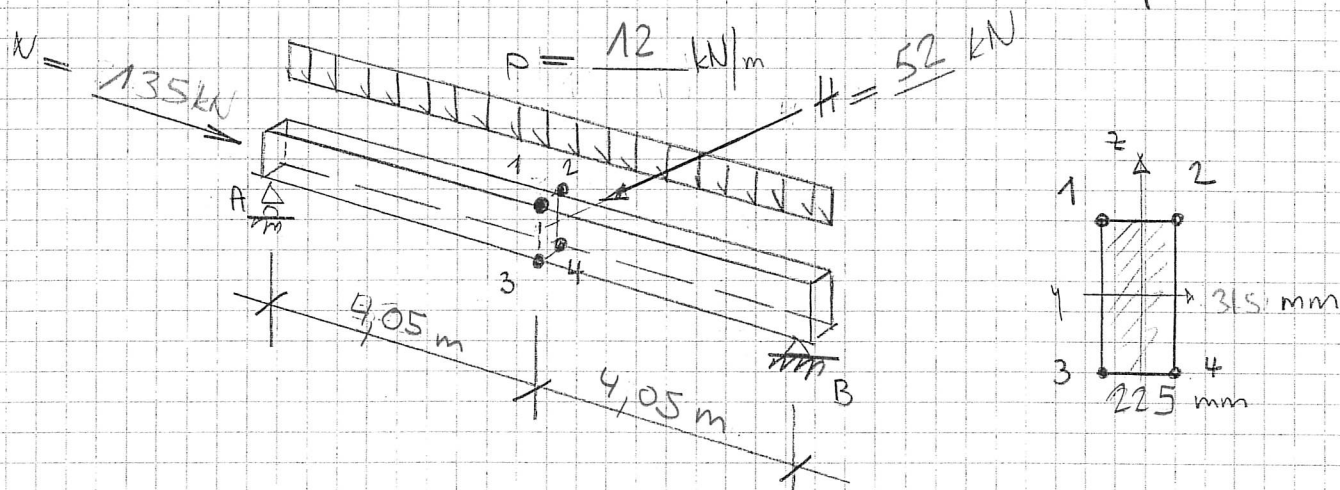
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NOM :

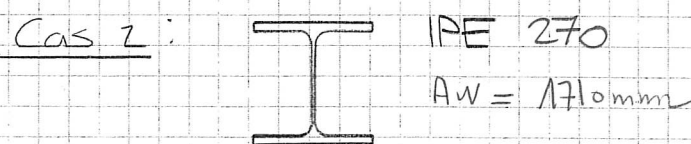
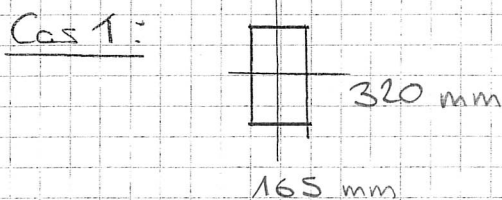
1 - Déterminez les valeurs caractéristiques I_y, i_y, A, W_y de la section ci-dessous. 15pts



2 - Déterminez les contraintes aux 4 angles dans la section ci-dessous au milieu de la poutre. 25pts



3 - Si l'effort tranchant dans une poutre vaut 82 kN, quelle sera la contrainte τ dans la matière. Faites un schéma de sa répartition. 10pts



$\tau = 2,33 \text{ N/mm}^2$

$\tau = 71,9 \text{ N/mm}^2$

CARACTERISTIQUES DES SECTIONS SELON Y

Série A

unités **mm**

H totale section = **355**

Demi cercle	
r	ly (0.11*r^4)
0.0	0.0
A	z cg (0.424*r)
0.00	0.00
	0.00

n°	base ou D	hauteur	A	Z ref	Sy réf	I propre	Zref - Zcg	(Zref - Zcg)^2	A*(Zref - Zcg)^2	Inertie totale
1	325.00	215.00	69'875.00	107.50	7'511'562.50	2.6916E+08	-10.85	117.62	8.2189E+06	2.7738E+08
2			0.00	0.00	0.00	0.0000E+00	-118.35	14'005.63	0.0000E+00	0.0000E+00
3 TROU			0.00	0.00	0.00	0.0000E+00	-118.35	14'005.63	0.0000E+00	0.0000E+00
4			0.00	0.00	0.00	0.0000E+00	-118.35	14'005.63	0.0000E+00	0.0000E+00
5 TRI	0.00	0.00	0.00	0.00	0.00	0.0000E+00	-118.35	14'005.63	0.0000E+00	0.0000E+00
6 ROND	-83.00	ROND	-5'410.62	75.00	-405'796.55	-2.3296E+06	-43.35	1'878.82	-1.0166E+07	-1.2495E+07
7 ACIER	HEA140z	PROFILE	3'140.00	285.00	894'900.00	3.8900E+06	166.65	27'773.76	8.7210E+07	9.1100E+07
Total		215.00	67'604.38		8'000'665.96	2.7072E+08			8.5263E+07	3.5599E+08

$$Z_{cg} = \frac{8'000'665.96}{67'604.38} = 118.345$$

$$i_y = \sqrt{\frac{355'987'589.51}{67'604.38}} = 72.57$$

$$W_{y\ sup} = \frac{355'987'589.5}{236.655} = 1.504E+06$$

$$W_{y\ inf} = \frac{355'987'589.51}{118.345} = 3.008E+06$$

CARACTERISTIQUES DES SECTIONS SELON Z

unités **mm**

H totale section =

n°	base ou D	hauteur	A	Y ref	Sz réf	I propre	Yref - Ycg	(Yref - Ycg)^2	A*(Yref - Ycg)^2	Inertie totale
1	0.00	0.00	0.00	0.00	0.00	0.0000E+00	-118.35	14'005.63	0.0000E+00	0.0000E+00
2	0.00	0.00	0.00	0.00	0.00	0.0000E+00	-118.35	14'005.63	0.0000E+00	0.0000E+00
3 TROU	0.00	0.00	0.00	0.00	0.00	0.0000E+00	-118.35	14'005.63	0.0000E+00	0.0000E+00
4	0.00	0.00	0.00	0.00	0.00	0.0000E+00	-118.35	14'005.63	0.0000E+00	0.0000E+00
5 TRI	0.00	0.00	0.00	0.00	0.00	0.0000E+00	-118.35	14'005.63	0.0000E+00	0.0000E+00
6 ROND	0.00	ROND	0.00	0.00	0.00	0.0000E+00	-118.35	14'005.63	0.0000E+00	0.0000E+00
7 ACIER		PROFILE	0.00	0.00	0.00	0.0000E+00	-118.35	14'005.63	0.0000E+00	0.0000E+00
Total		0.00	0.00		0.00	0.0000E+00			0.0000E+00	0.0000E+00

$$Y_{cg} = \frac{0.00}{0.00} = \#DIV/0!$$

$$i_z = \sqrt{\frac{0.00}{0.00}} = \#DIV/0!$$

$$W_{z\ gauche} = \frac{0.0}{\#DIV/0!} = \#DIV/0!$$

$$W_{z\ droit} = \frac{0.00}{\#DIV/0!} = \#DIV/0!$$

Calcul **A**

p	12	kn/m
F	52	kN
Bpoutre	225	mm
Hpoutre	315	mm
Portée	8.1	m

A	70'875	mm ²
Wy	3'720'938	mm ³
Wz	2'657'813	mm ³

Efforts

My	98.4	kNm	$PL^2/8$
Mz	105.3	kNm	$PL/4$
N	-135.0	kN	N

Point	N/A	My/wy	Mz/Wz	Somme
1	- 1.9	- 26.4	39.6	11.3
2	- 1.9	- 26.4	- 39.6	- 68.0
3	- 1.9	26.4	39.6	64.2
4	- 1.9	26.4	- 39.6	- 15.1

ETC 3

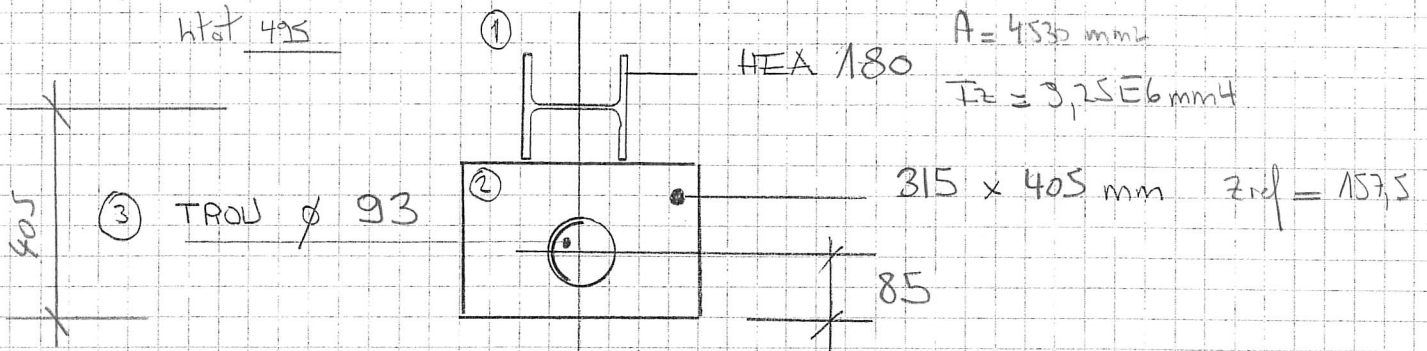
TE SERIE B

9.05.23

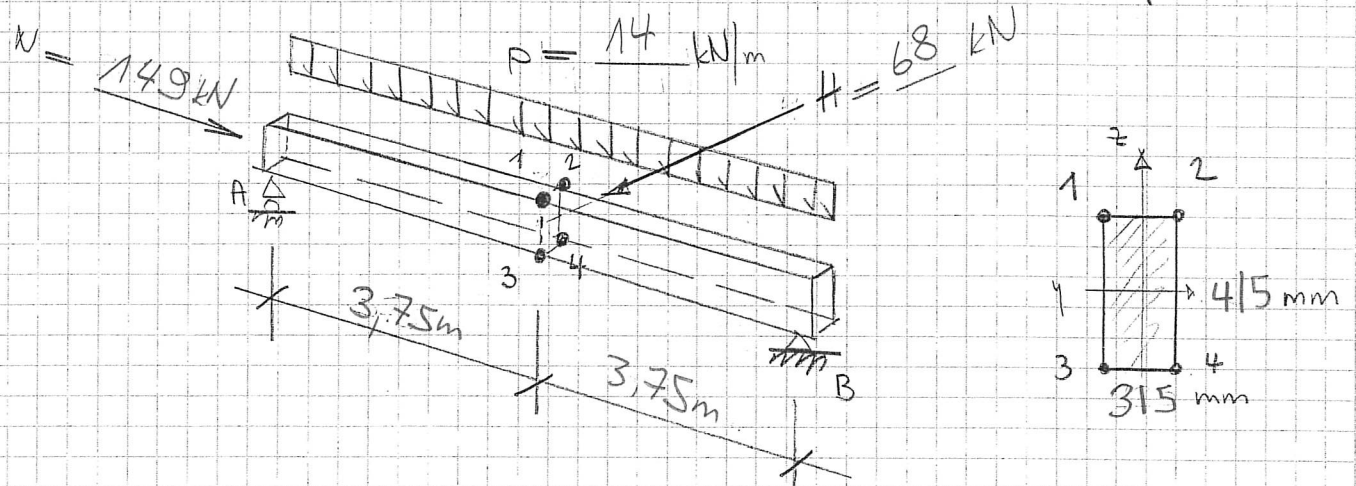
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NOM :

1. Déterminez les valeurs caractéristiques $I_y; i_y; A; W_y$ de la section ci-dessous. 15pts

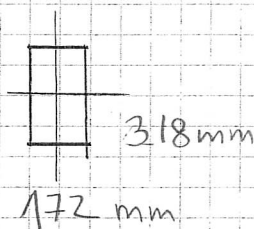


2. Déterminez les contraintes aux 4 angles dans la section ci-dessous au milieu de la poutre. 25pts

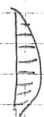


3. Si l'effort tranchant dans une poutre vaut 95 kN, quelle sera la contrainte τ dans la matière. Faites un schéma de sa répartition. 10pts

Cas 1:



$\tau = 2,6 \text{ N/mm}^2$



Cas 2:



IPE 330

$A_w = 2330 \text{ mm}^2$

$\tau = 59,6 \text{ N/mm}^2$

2B

CARACTERISTIQUES DES SECTIONS SELON Y

Série B

unités **mm** H totale section = **495**

Demi cercle	
r	ly (0.11*r^4)
0.0	0.0
A	z cg (0.424*r)
0.00	0.00
	0.00

n°	base ou D	hauteur	A	Z ref	Sy réf	I propre	Zref - Zcg	(Zref - Zcg)^2	A*(Zref - Zcg)^2	Inertie totale
1	405.00	315.00	127'575.00	157.50	20'093'062.50	1.0549E+09	-12.88	165.82	2.1155E+07	1.0760E+09
2			0.00	0.00	0.00	0.0000E+00	-170.38	29'028.37	0.0000E+00	0.0000E+00
3 TROU			0.00	0.00	0.00	0.0000E+00	-170.38	29'028.37	0.0000E+00	0.0000E+00
4			0.00	0.00	0.00	0.0000E+00	-170.38	29'028.37	0.0000E+00	0.0000E+00
5 TRI	0.00	0.00	0.00	0.00	0.00	0.0000E+00	-170.38	29'028.37	0.0000E+00	0.0000E+00
6 ROND	-93.00	ROND	-6'792.92	85.00	-577'398.59	-3.6720E+06	-85.38	7'289.26	-4.9515E+07	-5.3187E+07
7 ACIER	HEA180z	PROFILE	4'530.00	405.00	1'834'650.00	9.2500E+06	234.62	55'047.88	2.4937E+08	2.5862E+08
Total		315.00	125'312.08		21'350'313.91	1.0605E+09			2.2101E+08	1.2815E+09

$$Z_{cg} = \frac{21'350'313.91}{125'312.08} = 170.377$$

$$i_y = \sqrt{\frac{1'281'469'920.08}{125'312.08}} = 101.12$$

$$W_{y\ sup} = \frac{1'281'469'920.1}{324.623} = 3.948E+06$$

$$W_{y\ inf} = \frac{1'281'469'920.08}{170.377} = 7.521E+06$$

CARACTERISTIQUES DES SECTIONS SELON Z

unités **mm** H totale section = **495**

n°	base ou D	hauteur	A	Y ref	Sz réf	I propre	Yref - Ycg	(Yref - Ycg)^2	A*(Yref - Ycg)^2	Inertie totale
1	0.00	0.00	0.00	0.00	0.00	0.0000E+00	-170.38	29'028.37	0.0000E+00	0.0000E+00
2	0.00	0.00	0.00	0.00	0.00	0.0000E+00	-170.38	29'028.37	0.0000E+00	0.0000E+00
3 TROU	0.00	0.00	0.00	0.00	0.00	0.0000E+00	-170.38	29'028.37	0.0000E+00	0.0000E+00
4	0.00	0.00	0.00	0.00	0.00	0.0000E+00	-170.38	29'028.37	0.0000E+00	0.0000E+00
5 TRI	0.00	0.00	0.00	0.00	0.00	0.0000E+00	-170.38	29'028.37	0.0000E+00	0.0000E+00
6 ROND	0.00	ROND	0.00	0.00	0.00	0.0000E+00	-170.38	29'028.37	0.0000E+00	0.0000E+00
7 ACIER		PROFILE	0.00	0.00	0.00	0.0000E+00	-170.38	29'028.37	0.0000E+00	0.0000E+00
Total		0.00	0.00		0.00	0.0000E+00			0.0000E+00	0.0000E+00

$$Y_{cg} = \frac{0.00}{0.00} = \#DIV/0!$$

$$i_z = \sqrt{\frac{0.00}{0.00}} = \#DIV/0!$$

$$W_{z\ gauche} = \frac{0.0}{\#DIV/0!} = \#DIV/0!$$

$$W_{z\ droit} = \frac{0.00}{\#DIV/0!} = \#DIV/0!$$

Calcul **B**

p	14	kn/m
F	68	kN
Bpoutre	315	mm
Hpoutre	415	mm
Portée	7.5	m

A	130'725	mm ²
Wy	9'041'813	mm ³
Wz	6'863'063	mm ³

Efforts

My	98.4	kNm	$PL^2/8$
Mz	127.5	kNm	$PL/4$
N	-149.0	kN	N

Point	N/A	My/wy	Mz/Wz	Somme
1	- 1.1	- 10.9	18.6	6.6
2	- 1.1	- 10.9	- 18.6	- 30.6
3	- 1.1	10.9	18.6	28.3
4	- 1.1	10.9	- 18.6	- 8.8

ETC 3

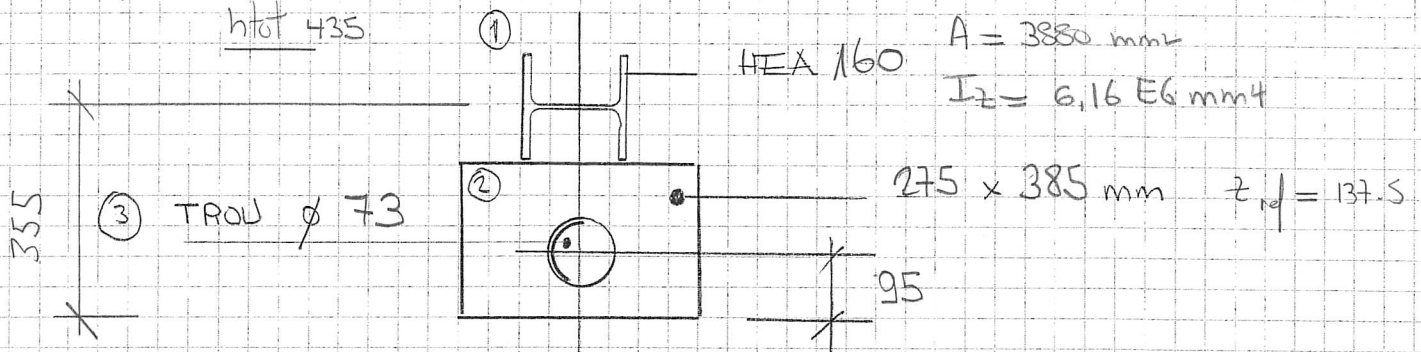
TE SERIE C

9.05.23

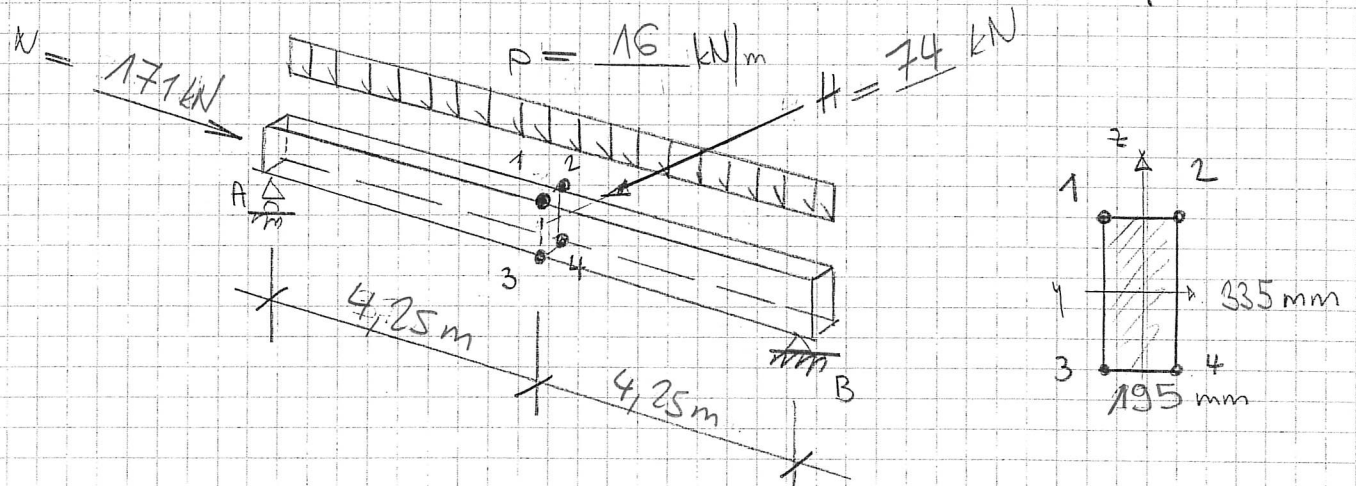
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NOM :

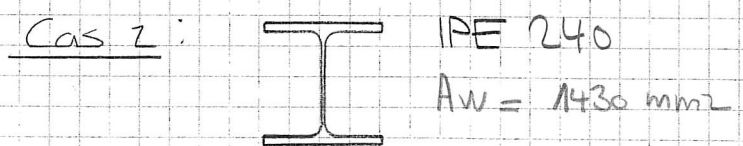
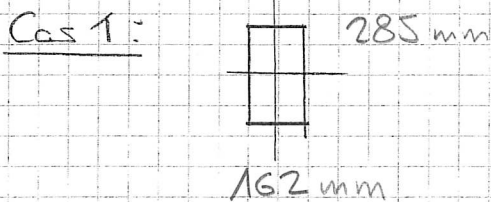
1. Déterminez les valeurs caractéristiques $I_y; i_y; A;$
 15pts W_y de la section ci-dessous.



2. Déterminez les contraintes aux 4 angles dans
 la section ci-dessous au milieu de la poutre
 25pts



3. Si l'effort tranchant dans une poutre vaut 71 kN,
 10pts quelle sera la contrainte τ dans la matière.
 Faites un schéma de sa répartition.



CARACTERISTIQUES DES SECTIONS SELON Y

Série C

unités **mm**

H totale section = **435**

Demi cercle	
r	ly (0.11*r^4)
0.0	0.0
A	z cg (0.424*r)
0.00	0.00
	0.00

n°	base ou D	hauteur	A	Z ref	Sy réf	I propre	Zref - Zcg	(Zref- Zcg)^2	A*(Zref- Zcg)^2	Inertie totale
1	385.00	275.00	105'875.00	137.50	14'557'812.50	6.6723E+08	-9.68	93.68	9.9181E+06	6.7715E+08
2			0.00	350.00	0.00	0.0000E+00	202.82	41'136.47	0.0000E+00	0.0000E+00
3 TROU			0.00	75.00	0.00	0.0000E+00	-72.18	5'209.77	0.0000E+00	0.0000E+00
4			0.00	25.00	0.00	0.0000E+00	-122.18	14'927.64	0.0000E+00	0.0000E+00
5 TRI	0.00	0.00	0.00	0.00	0.00	0.0000E+00	-147.18	21'661.58	0.0000E+00	0.0000E+00
6 ROND	-73.00	ROND	-4'185.40	95.00	-397'612.68	-1.3940E+06	-52.18	2'722.62	-1.1395E+07	-1.2789E+07
7 ACIER	HEA160z	PROFILE	3'880.00	355.00	1'377'400.00	6.1600E+06	207.82	43'189.68	1.6758E+08	1.7374E+08
Total		275.00	105'569.60		15'537'599.82	6.7200E+08			1.6610E+08	8.3810E+08

$$Z_{cg} = \frac{15'537'599.82}{105'569.60} = 147.179$$

$$i_y = \sqrt{\frac{838'097'928.36}{105'569.60}} = 89.10$$

$$W_{y\ sup} = \frac{838'097'928.4}{287.821} = 2.912E+06$$

$$W_{y\ inf} = \frac{838'097'928.36}{147.179} = 5.694E+06$$

CARACTERISTIQUES DES SECTIONS SELON Z

unités **mm**

H totale section = **mm**

n°	base ou D	hauteur	A	Y ref	Sz réf	I propre	Yref - Ycg	(Yref- Ycg)^2	A*(Yref- Ycg)^2	Inertie totale
1	0.00	0.00	0.00	0.00	0.00	0.0000E+00	-147.18	21'661.58	0.0000E+00	0.0000E+00
2	0.00	0.00	0.00	0.00	0.00	0.0000E+00	-147.18	21'661.58	0.0000E+00	0.0000E+00
3 TROU	0.00	0.00	0.00	0.00	0.00	0.0000E+00	-147.18	21'661.58	0.0000E+00	0.0000E+00
4	0.00	0.00	0.00	0.00	0.00	0.0000E+00	-147.18	21'661.58	0.0000E+00	0.0000E+00
5 TRI	0.00	0.00	0.00	0.00	0.00	0.0000E+00	-147.18	21'661.58	0.0000E+00	0.0000E+00
6 ROND	0.00	ROND	0.00	0.00	0.00	0.0000E+00	-147.18	21'661.58	0.0000E+00	0.0000E+00
7 ACIER		PROFILE	0.00	0.00	0.00	0.0000E+00	-147.18	21'661.58	0.0000E+00	0.0000E+00
Total		0.00	0.00		0.00	0.0000E+00			0.0000E+00	0.0000E+00

$$Y_{cg} = \frac{0.00}{0.00} = \#DIV/0!$$

$$i_z = \sqrt{\frac{0.00}{0.00}} = \#DIV/0!$$

$$W_{z\ gauche} = \frac{0.0}{\#DIV/0!} = \#DIV/0!$$

$$W_{z\ droit} = \frac{0.00}{\#DIV/0!} = \#DIV/0!$$

Calcul **C**

p	16	kn/m
F	74	kN
Bpoutre	195	mm
Hpoutre	335	mm
Portée	8.5	m

A	65'325	mm ²
Wy	3'647'313	mm ³
Wz	2'123'063	mm ³

Efforts

My	144.5	kNm	$PL^2/8$
Mz	157.3	kNm	$PL/4$
N	-171.0	kN	N

Point	N/A	My/wy	Mz/Wz	Somme
1	- 2.6	- 39.6	74.1	31.8
2	- 2.6	- 39.6	- 74.1	-116.3
3	- 2.6	39.6	74.1	111.1
4	- 2.6	39.6	- 74.1	- 37.1