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Project RXB

Job number	
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RIVETS TO GIRDERS

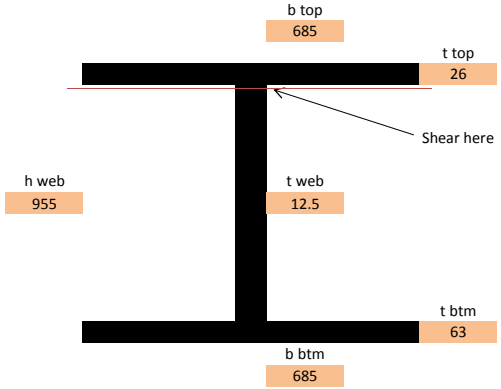
PHILOSOPHY

TO ACTIVATE GIRDER FLANGES FULLY FOR BENDING, RIVETS BETWEEN THE WEB & FLANGE WILL NEED TO CARRY SUFFICIENT LONGITUDINAL SHEAR AS PER THE "SAY IT" FORMULA:

$$\frac{SA\bar{y}}{I_{yy}\,t} = \tau$$

IT WAS FOUND THAT THIS WAS MORE CRITICAL WHEN THE NUMBER OF FLANGE PLATES WAS MAXIMISED (i.e. A IS MAXIMISED), & ALTHOUGH THIS IS NOT THE CASE IN THE WORST CASE AREAS, THIS WAS TAKEN CONSERVATIVELY. IT WAS ALSO FOUND THAT THE WORST CASE RELEVANT CUT WAS (BETWEEN WEB & FLANGE (& NOT BETWEEN FLANGE PLATES) FOR THE SAME REASON.

WORST CASE SHEAR VALUES ARE TAKEN FROM ROBOT STRUCTURAL ANALYSIS (ATTACHED).



GIRDER A

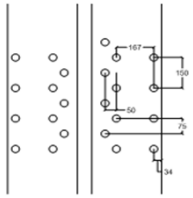
NTS

Vz	875	kN
A	17810	mm2
NA	359.0235074	mm
y0	658.9764926	mm
y-bar	671.9764926	mm
b	12.5	mm
Iyy top eff	8043151658	mm4
Iyy web eff	1300421121	mm4
Iyy btm eff	4643581482	mm4
Iyy	13987154261	mm4
tau	60	MPa
Fv	749	kN/m

SLS shear - eqv. to permissible

Iyy top	1003297	mm4	y top	671.9765	mm
Iyy web	907274869.8	mm4	y web	181.4765	mm
Iyy btm	14273516.25	mm4	y btm	-327.524	mm

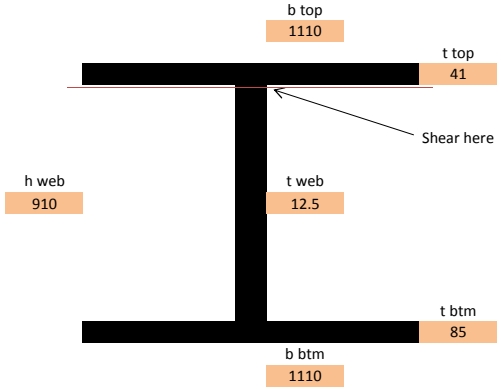
River head diameter	51	mm
Rivert shear strength	77	MPa
Pitch	150	mm
No. of rows	3	
Rivet shank diameter	32	mm
Rivet capacity	61	kN
Capacity per meter	1229	kN/m
Utilisation	**61%**	



Girder A
Underside with typical rivet arrangment
Scale 1:20 @ A3

$$\tau = \frac{V_z \times \bar{y} \times A}{b \times I_{yy}}$$

V	=total shear
y-bar	=NA to centroid of area above cut
A	=area of section above cut
b	=width of cut
Iyy	=total section second moment of area

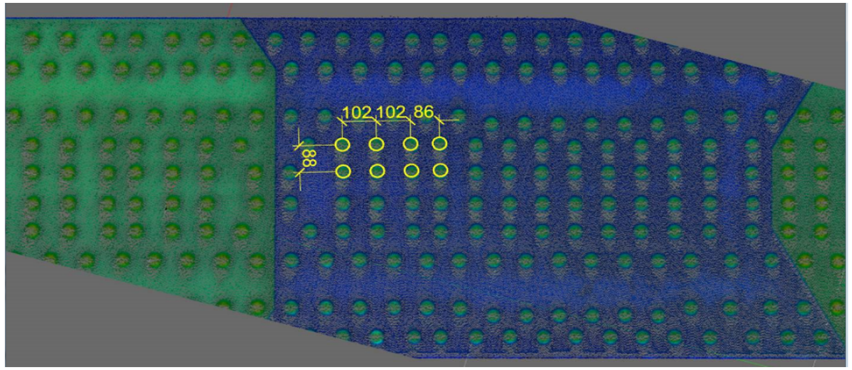


GIRDER B

NTS

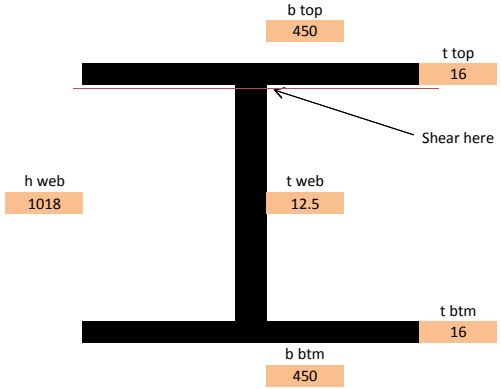
Vz	1644	kN	SLS shear - eqv. to permissible					
A	45510	mm2						
NA	372.7165008	mm						
y0	622.2834992	mm						
y-bar	642.7834992	mm						
b	12.5	mm						
Iyy top eff	18809770420	mm4	Iyy top	6375193	mm4	y top	642.7835	mm
Iyy web eff	1103285165	mm4	Iyy web	784969791.7	mm4	y web	167.2835	mm
Iyy btm eff	10345007707	mm4	Iyy btm	56806562.5	mm4	y btm	-330.217	mm
Iyy	30258063292	mm4						
tau	127	MPa						
Fv	1589	kN/m						

River head diameter	40	mm
Rivert shear strength	77	MPa
Pitch	102	mm
No. of rows	10	
Rivet shank diameter	25	mm
Rivet capacity	38	kN
Capacity per meter	3706	kN/m
Utilisation	**43%**	



$$\tau = \frac{V_z \times \bar{y} \times A}{b \times I_{yy}}$$

V	=total shear
y-bar	=NA to centroid of area above cut
A	=area of section above cut
b	=width of cut
Iyy	=total section second moment of area



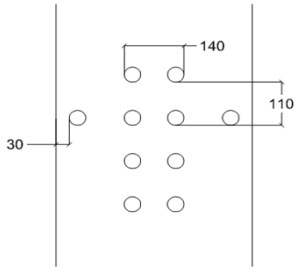
GIRDER C

NTS

Vz	346	kN	SLS shear - eqv. to permissible
A	7200	mm2	
NA	525	mm	
y0	509	mm	
y-bar	517	mm	
b	12.5	mm	
Iyy top eff	1924634400	mm4	
Iyy web eff	1098935242	mm4	
Iyy btm eff	1924634400	mm4	
Iyy	4948204042	mm4	
tau	21	MPa	
Fv	260	kN/m	

Iyy top	153600	mm4	y top	517	mm
Iyy web	1098935242	mm4	y web	0	mm
Iyy btm	153600	mm4	y btm	-517	mm

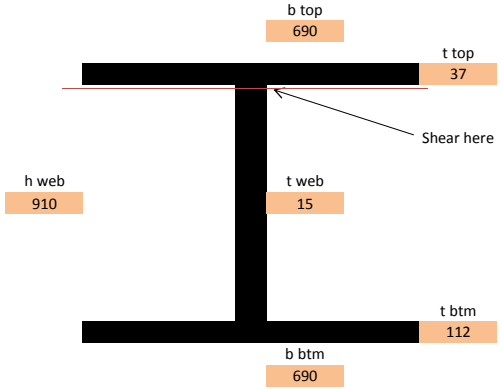
River head diameter	51	mm
Rivert shear strength	77	MPa
Pitch	110	mm
No. of rows	2	
Rivet shank diameter	32	mm
Rivet capacity	61	kN
Capacity per meter	1117	kN/m
Utilisation	**23%**	



Girder C
Underside with typical rivet arrangment
Scale 1:20 @ A4

$$\tau = \frac{V_z \times \bar{y} \times A}{b \times I_{yy}}$$

V	=total shear
y-bar	=NA to centroid of area above cut
A	=area of section above cut
b	=width of cut
Iyy	=total section second moment of area



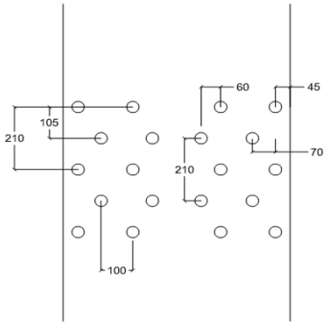
GIRDER D

NTS

Vz	1023	kN	SLS shear - eqv. to permissible
A	25530	mm2	
NA	331.7121329	mm	
y0	690.2878671	mm	
y-bar	708.7878671	mm	
b	15	mm	
Iyy top eff	12828680088	mm4	
Iyy web eff	1697632942	mm4	
Iyy btm eff	5955391049	mm4	
Iyy	20481704079	mm4	
tau	60	MPa	
Fv	904	kN/m	

Iyy top	2912548	mm4		y top	708.7879	mm	
Iyy web	941963750	mm4		y web	235.2879	mm	
Iyy btm	80783360	mm4		y btm	-275.712	mm	

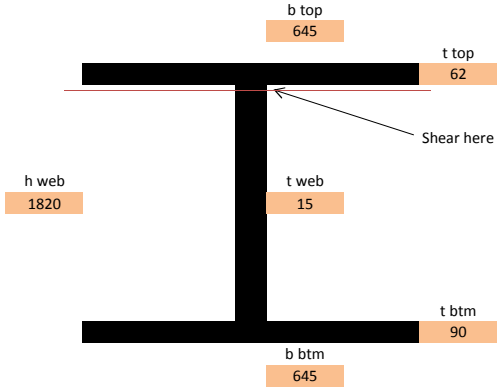
River head diameter	51	mm
Rivert shear strength	77	MPa
Pitch	105	mm
No. of rows	4	
Rivet shank diameter	32	mm
Rivet capacity	61	kN
Capacity per meter	2341	kN/m
Utilisation	**39%**	



Girder D
Underside with typical
rivet arrangment
Scale 1:20 @ A4

$$\tau = \frac{V_z \times \bar{y} \times A}{b \times I_{yy}}$$

V	=total shear
y-bar	=NA to centroid of area above cut
A	=area of section above cut
b	=width of cut
Iyy	=total section second moment of area



GIRDER E

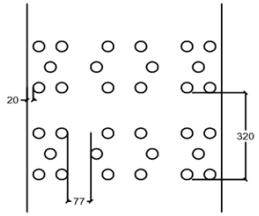
NTS

Vz	690	kN
A	39990	mm2
NA	857.9291527	mm
y0	1052.070847	mm
y-bar	1083.070847	mm
b	15	mm
Iyy top eff	46922778116	mm4
Iyy web eff	8086736630	mm4
Iyy btm eff	38401747265	mm4
Iyy	93411262011	mm4
tau	21	MPa
Fv	320	kN/m

SLS shear - eqv. to permissible

Iyy top	12810130	mm4	y top	1083.071	mm
Iyy web	7535710000	mm4	y web	142.0708	mm
Iyy btm	39183750	mm4	y btm	-812.929	mm

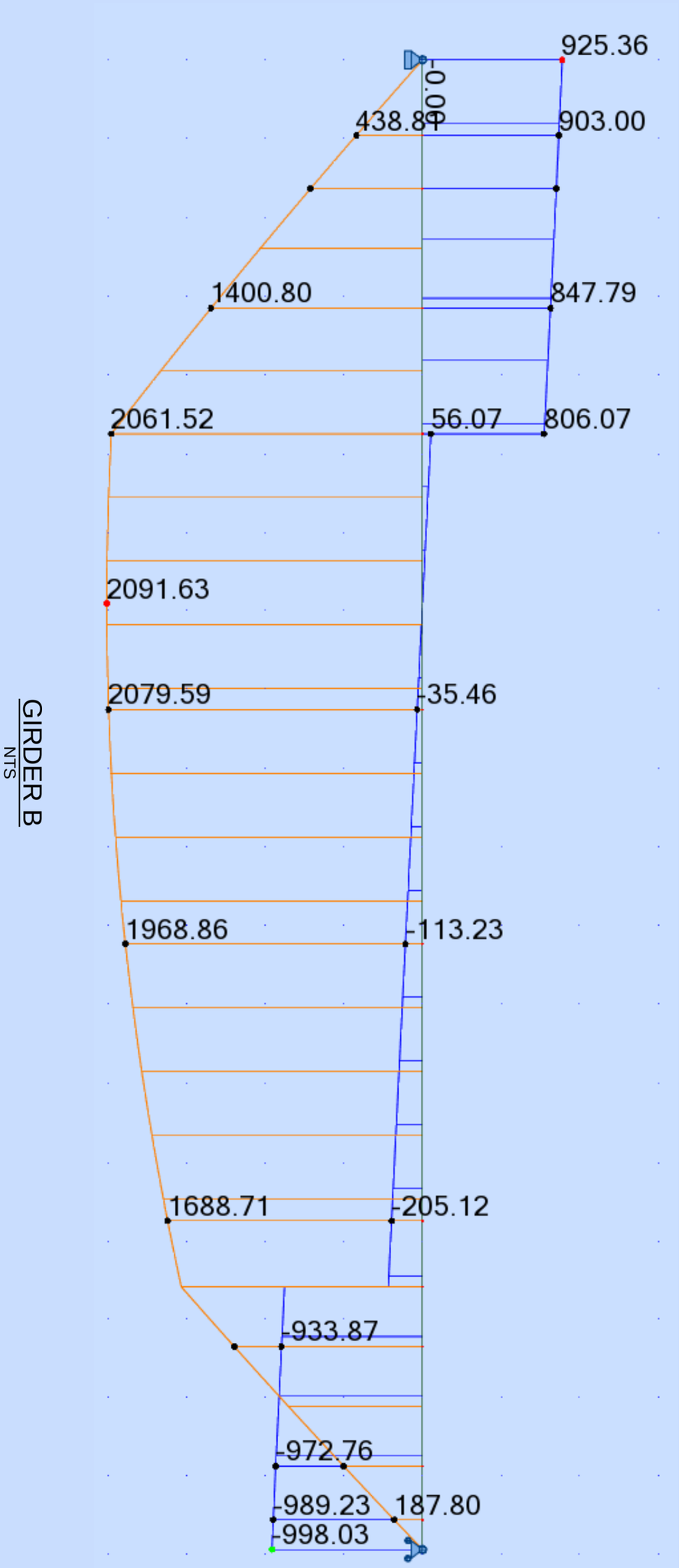
River head diameter	51	mm
Rivert shear strength	77	MPa
Pitch	107	mm
No. of rows	5	
Rivet shank diameter	32	mm
Rivet capacity	61	kN
Capacity per meter	2880	kN/m
Utilisation	**11%**	



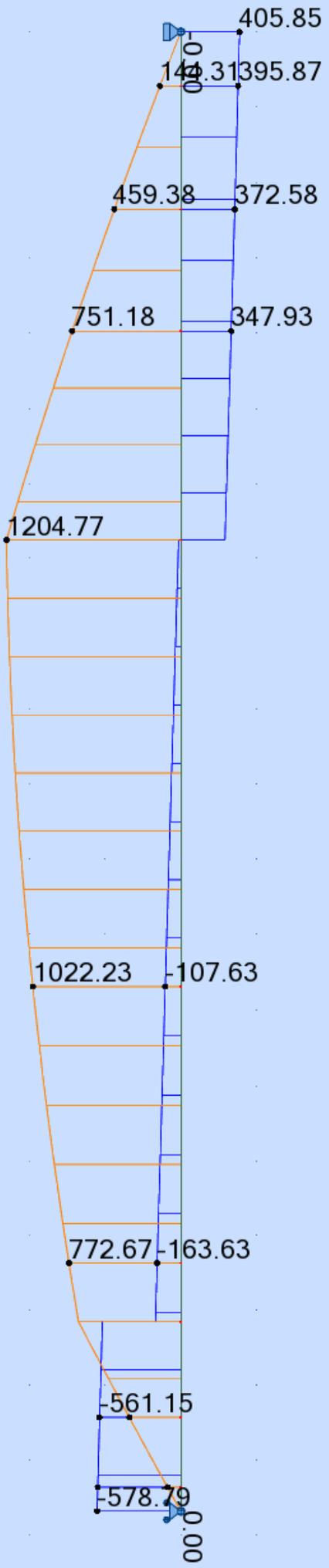
Girder E
Underside with typical rivet arrangment
Scale 1:20 @ A3

$$\tau = \frac{V_z \times \bar{y} \times A}{b \times I_{yy}}$$

V	=total shear
y-bar	=NA to centroid of area above cut
A	=area of section above cut
b	=width of cut
Iyy	=total section second moment of area



GIRDER B
NTS



GIRDER A
NTS

GIRDER E
NTS

-0.00
194.37
393.35
482.90
375.05
706.56
359.45
1116.73
328.18
1375.46
1356.14
-32.54
1241.72
-87.32
1053.68
-133.91
-412.13
-427.72
-446.30
-0.00

GIRDER D
NTS

-0.00
237.19
446.81
872.70
378.62
1047.87
63.54
1090.73
9.60
1033.29
-69.72
926.06
-111.71
849.60
-133.38
-565.40
-590.51
-0.00

GIRDER C
NTS

208.71
481.87
-192.71
-0.00