

Job number
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BS 5950-1:2000

EXISTING GIRDER CHECK

PHILOSOPHY

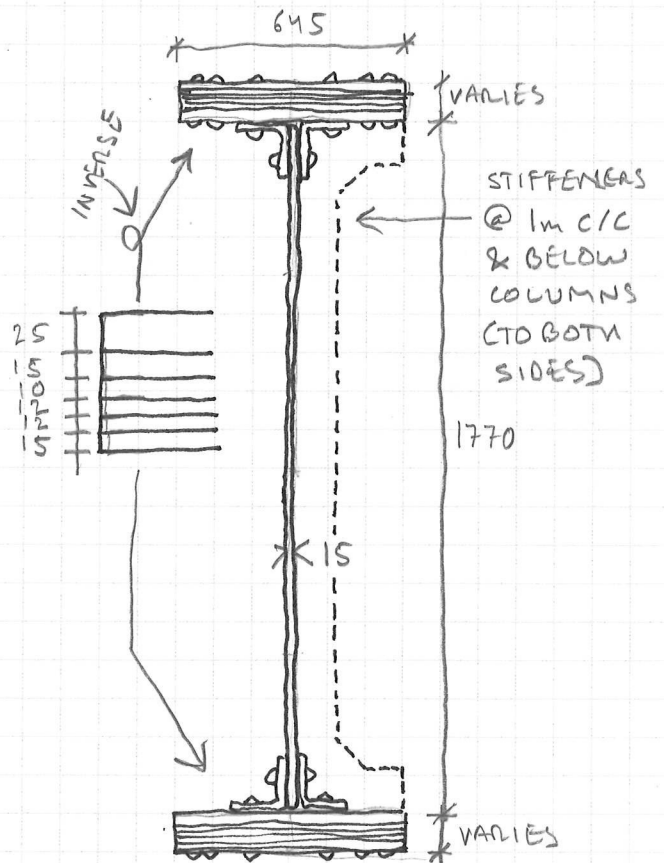
GIRDER E IS VALIDATED HERE, THE REMAINDER OF THE GIRDERS ARE CHECKED IN THE ATTACHED SPREADSHEET. INTERNAL FORCES ARE FROM ROBOT STRUCTURAL ANALYSIS (RESULTS ATTACHED).

AS OUTLINED IN THE REPORT TO WHICH THIS IS AN APPENDIX, THE GIRDERS WILL HERE BE VALIDATED AS GRADE 46 (S275). UTILISATIONS FOUND HERE ARE FURTHER ANALYSED IN THE REPORT.

GEOMETRY

CALCULATIONS ARE MADE FOR [1, 2, 3, 4, 5, 6] FLANGE PLATES.

$I_x = 0.16 \text{ m}^4$
 $I_y = 0.04 \text{ m}^4$
 $T = 4.2 \text{ m}^2$
 $W_x = 1.1 \text{ m}^3$
 $W_y = 0.3 \text{ m}^3$



EXISTING GIRDER CHECK

SECTION CLASSIFICATION

TABLE 11

OUTSTAND FLANGE: $b/t = [12.6, 7.9, 6.3, 5.1, 4.3, 3.5]$
 $CL = [3, 1, 1, 1, 1, 1]$

WEB: $d/t = 118$
 $CL = 3$

BENDING CHECK

§ 4.2.3

$$P_v = 0.6 p_y A_v$$

$$= 0.6 \times 275 \times 15 \times 1770$$

$$= 4381 \text{ kN}$$

$$F_v = 458 \text{ kN}$$

$u = 10\% \rightarrow$ LOW SHEAR

§ 4.2.5.2

$$M_c = p_y Z$$

$$Z = \frac{I}{y} \quad I = [33, 49, 60, 74, 88, 106] \times 10^9 \text{ mm}^4$$

$$Z = [36, 53, 64, 78, 92, 109] \times 10^6 \text{ mm}^3$$

$$p_y = [265, 265, 255, 255, 245, 235] \text{ MPa}$$

$$M_c = [9.58, 14.1, 16.5, 19.9, 22.5, 25.6] \times 10^3 \text{ kNm}$$

FOR LTB, THE FLANGE THICKNESS WILL BE TAKEN AS 50 mm THROUGHOUT (AS A CONSERVATIVE ESTIMATION)

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§ 4.3.6.2

$$M_x \leq M_b / m_{LT}$$

TABLE 18

$$m_{LT} = 0.925$$

§ 4.3.6.4

$$M_b = p_b Z_x$$

$$p_y = 255 \text{ MPa}$$

○ § 4.3.6.7

$$\lambda_{LT} = u v \lambda \sqrt{\beta_w}$$

$$\lambda = L_E / r_y$$

$$r_y = \sqrt{\frac{I_y}{A}} = \sqrt{\frac{4.93 \times 10^9}{91 \times 10^3}} = 233 \text{ mm}$$

$$L_E = 11,360 \text{ mm}$$

$$\lambda = 48.8$$

§ 4.3.6.8

$$\chi = D/T = 37.4$$

$$\lambda/\chi = 1.3$$

§ 4.3.6.9

$$\beta_w = Z_x / S_x = 0.788$$

TABLE 19

$$v = 0.99$$

$$\lambda_{LT} = 0.99 \cdot 48.8 \cdot \sqrt{0.788} = 42.9$$

TABLE 17

$$p_b = 218 \text{ MPa}$$

$$Z_x = 64.6 \times 10^6 \text{ mm}^3$$

$$M_b = 14,083 \text{ kNm}$$

$$u = 3007 / 14083 = 21\% \quad \underline{\underline{OK}}$$

EXISTING GIRDER CHECKPLATE GIRDER SPECIFIC

§ 4.4.3.3

$$a = 1000 \quad 1.5d = 2655 \quad a/d = 0.565$$

$$t \geq \frac{d}{250} \left(\frac{P_{yf}}{455} \right)^{0.5} = 5.4 \text{ mm (WORST) } \underline{\underline{OK}}$$

§ 4.4.5.2

$$V_b = V_w = dtq_w = 26,550 q_w$$

$$d/t = 118$$

TABLE 21

$$q_w = 163 \text{ MPa}$$

$$V_b = 4328 \text{ kN}$$

$$u = 458/4328 = 10.6\%$$

NOTE: SINCE THIS IS A WORST CASE BEAM FOR WEB BUCKLING WE CONCLUDE THAT WEB BUCKLING IS OK FOR ALL GIRDERS,

§ 4.6.4.4

$$I_s \geq 1.5 (d/a)^2 dt_{min}^3$$

$$t_{min}: V_b = 458 \therefore q_w = 17.3 \therefore t_{min} = 0$$

$$I_s \geq 0 \quad \underline{\underline{OK}}$$

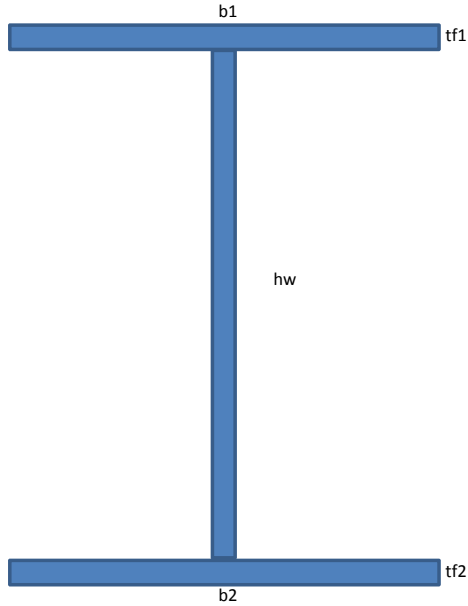
GIRDER	b1	hw	b2	tw	tf1	tf2
A	685	955	685	13	26	38
B	1110	910	1110	25	41	53
C	450	1018	450	9	16	16
D	690	910	690	20	37	67
E	645	1770	645	15	50	50

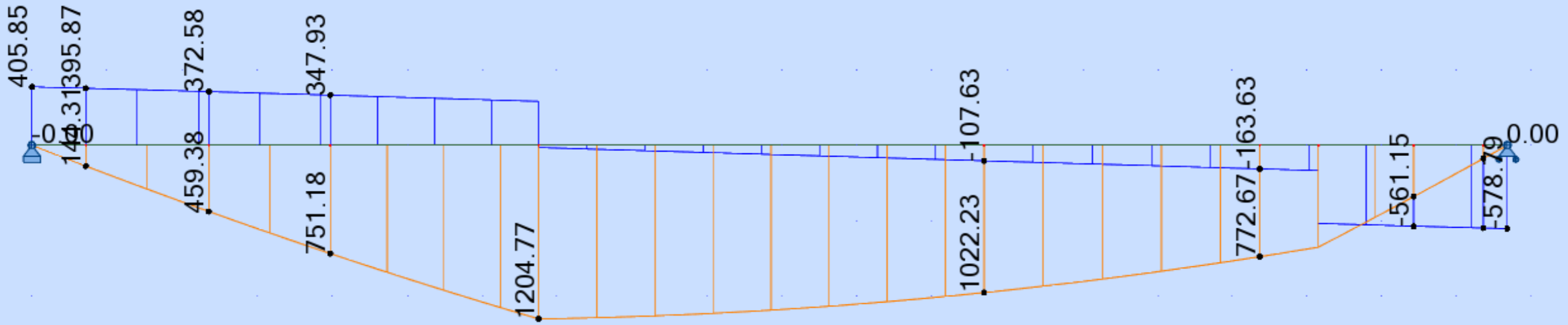
b/T	CL	d/t	CL
13	3	73	1
13	3	36	1
14	3	113	3
9	2	46	1
6	1	118	3

py,v	Av	A	Pv	Fv	uv	I	y	yc	Z
265	12415	56255	1974	1222	62%	11624199118	441	199	26355639.3
265	22750	127090	3617	2311	64%	25479068003	455	242	55950415.1
265	9162	23562	1457	488	33%	4640502174	525	525	8839051.76
255	18200	89960	2785	1444	52%	17874586947	405	65	44097963.5
255	26550	91050	4062	991	24%	60357428750	935	935	64553399.7

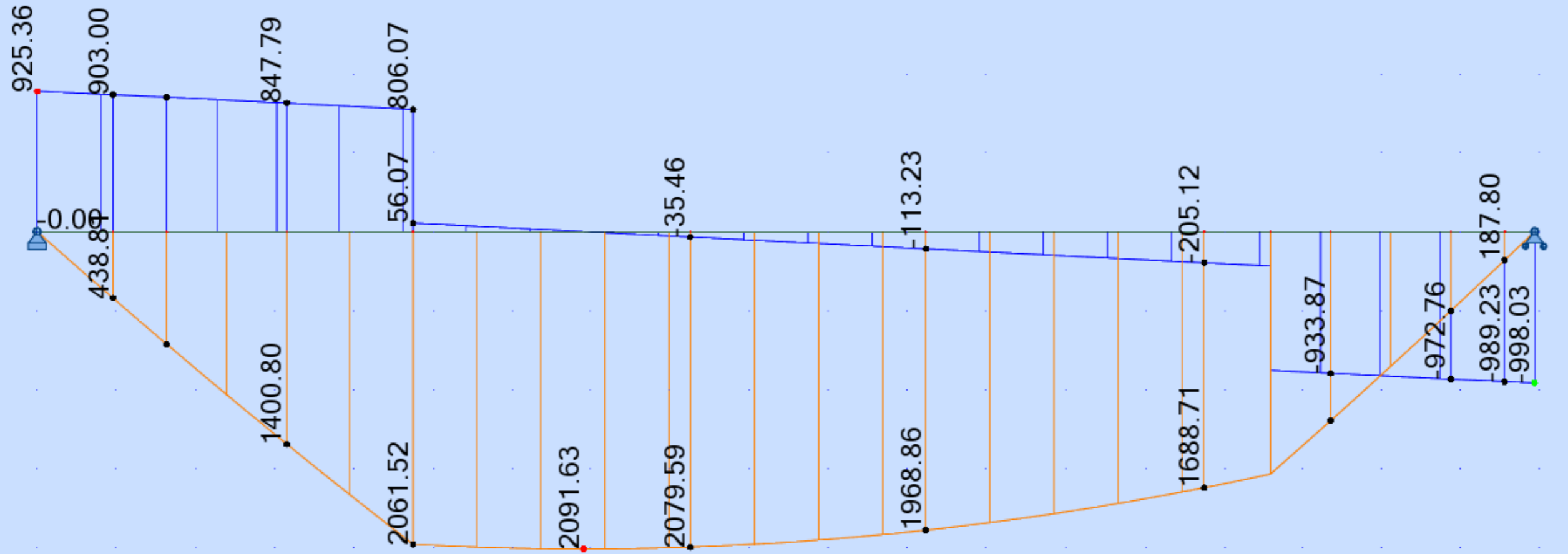
S	Sf	Sv	RHO	pyf	Mc	um	mLT	ly	ry
25381142.9	19060915.4	6320227.5	0.06	265	6921	37%	0.925	3143128378	236
57725307	46418202	11307105	0.08	255	14119	33%	0.925	17564035021	372
12181554	7444800	4736754	0.11	265	2251	50%	0.925	697611568.5	172
33613531	25299560	8313971.01	0.00	255	11243	23%	0.925	4951149667	235
82855500	58695000	24160500	0.26	255	15384	20%	0.925	4933780313	233

LE	lambda	x	u	BETA	lambda / x	v	Lam LT	pb	Mb	M	ub
9800	41	39	1	1.04	1.06	0.99	41.8	265	6984	2593	37%
9500	26	24	1	0.97	1.04	0.99	24.9	255	14267	4715	33%
9165	53	66	1	0.73	0.81	0.99	44.9	224	1980	1125	57%
9130	39	27	1	1.31	1.42	0.97	43.2	218	9613	2553	27%
11360	49	37	1	0.78	1.30	0.97	41.8	220	14202	3007	21%





GIRDER A
NTS



GIRDER B
NTS

