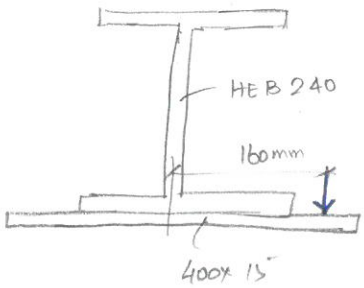

Length : 7000mm

Span left & Right : 6000 mm

HEB 240

H : 240 mm

b_f : 240 mm

t_f : 17 mm

t_w : 10 mm

$W_{pl,y}$: 1053×10^3 mm^3

I_y : 3.923×10^7 mm^4

I_w : 0.487×10^{12} mm^6

I_z : 11260×10^4 mm^4

I_T = 1.027×10^6 mm^4

A = 10600 mm^2

HEB with Base plate (400x 15)

A = 16600 mm^2

c_{Gy} = 89 mm

I_y = 1.750×10^8

I_z = 1.192×10^8

I_w = 0.8848×10^{12}

$W_{pl,y}$ = 1.253×10^4 mm^4

Shear centre = 37mm

I_T as individual plates = 1.477×10^6

I_T as single plate : 3.435×10^6

Actions:

Case 1 : DL = $3.5 \times 6.0/2$ = 10.5 kN/m

T_q = $[1.35 \times 10.5] \times 0.16 \times 7.0$ = 15.88 kN-m

For uniform Torque with on SS beam,

Case 4, Table C.1 of SCI P385,

$$\phi = \frac{Ta^2}{GI_{TL}} \left[\frac{xL - x^2}{2a^2} + \cosh(x/a) - \tanh(b/2a).\sinh(x/a) - 1 \right]$$

$$\phi'' = \frac{T_{Ed}}{G I_T L}\left[\cosh(z/a) - \tanh(L/2a)\sinh(z/a) - 1\right]$$

$$M_{w,Ed} = \frac{E I_w \phi''}{(h - t_f)} \quad ; \quad M_{bRd} = \chi_{LT} W_{ply} f_y / \gamma_{M1}$$

$$a = \sqrt{\frac{EI_w}{GI_T}} \quad ; \quad L = 7000 \text{ mm} \quad ; \quad T_{Ed} = 15.88 \text{ kN-m}$$

$$E = 2.1 \times 10^5 \text{ MPa} \quad ; \quad G = 8.1 \times 10^4 \text{ MPa}$$

Sl. No	Parameter	$I_T = 1.477 \times 10^6$	$I_T = 3.435 \times 10^6$
1.	a ≈ 1246 mm 'a' - Torsional bending constant	$a = 1246$	$a = 817$ mm
2.	ϕ ⇒	$\phi = 0.09023$	$\phi = 0.04464$
3	ϕ'' ⇒	$\phi'' = -1.67 \times 10^{-8}$	$\phi'' = -79.28 \times 10^{-8}$
4	M_{wEd} ⇒	$M_{wEd} = 13.37 \times 10^6$ N-mm	$M_{wEd} = 6.34 \times 10^6$ N-mm
5	χ_{LT}	$\chi_{LT} = 0.905$	$\chi_{LT} = 0.945$
6	M_{bRd}	$M_{bRd} = 402.7 \times 10^6$ N-mm	$M_{bRd} = 420.1 \times 10^6$ N-m
7	$M_{plf,Rd}$ → Plastic Resistance of weak flange (Top)	$M_{plf,Rd} = 86.9 \times 10^6$ N-mm	$M_{plf,Rd} = 86.9 \times 10^6$ N-mm