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| Job number |
| Sheet number |
| Date |
| Eng |
| Checked |

BS5950-1:2000

EXISTING COLUMN CHECK

PHILOSOPHY

COLUMN A IS VALIDATED IN THIS HAND CHECK. THE REMAINDER OF THE COLUMNS ARE CHECKED USING THE ATTACHED SPREADSHEET. IT IS NOTED THAT COMBINED BENDING & COMPRESSION WILL BE THE CRITICAL DESIGN CRITERIA WITH SOME ADDITIONAL RIVET CHECKS. INTERNAL FORCES ARE TAKEN FROM ROBOT STRUCTURAL ANALYSIS (RESULTS ATTACHED).

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

GEOMETRY

$$I_{xx} = \frac{1}{12} \times (440 \times 460^3 - 384 \times 460^3 + 384 \times 230^3 - 384 \times 200^3)$$

$$= 588 \times 10^6 \text{ mm}^4$$

ASSUMING 1/4 AREA IS REACHED WITHIN WEB:

$$1/4 A = 2 \times 28 \times z + 384(z - 115)$$

$$A = 37.3 \times 10^3 \text{ mm}^2$$

$$9320 = 56z + 384z - 44160$$

$$53480 = 440z$$

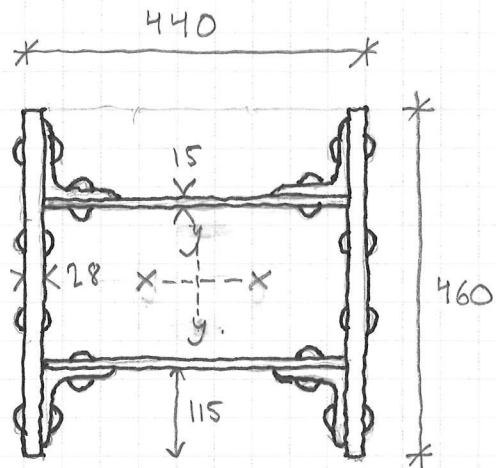
$$z = 121.5 \text{ mm} \quad \underline{OK}$$

$$W_{pl,xx} = (460 - 2 \times 121.5) \times \frac{37.3 \times 10^3}{2} = 4.05 \times 10^6 \text{ mm}^3 \quad (Z_x)$$

BY SIMILAR METHODS:

$$I_{yy} = 2.76 \times 10^9 \text{ mm}^4$$

$$W_{pl,yy} = 7.45 \times 10^6 \text{ mm}^3 \quad (Z_y)$$



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CROSS SECTION CLASS

TABLE 12

INTERNAL COMP. FLANGE $b/T = \frac{384}{15} = 25.6 \Rightarrow$ CLASS 1
 WEB = CLASS 1 BY INSPECTION

MEMBER BUCKLING RESISTANCE

§ 4.8.3.1

$$\frac{F_c}{P_c} + \frac{M_x M_x}{P_y Z_x} + \frac{M_y M_y}{P_y Z_y} \leq 1.0$$

$$\frac{F_c}{P_{cx}} + \frac{M_{LT} M_{LT}}{M_b} + \frac{M_y M_y}{P_y Z_y} \leq 1.0$$

THERE IS NO MINOR AXIS MOMENT

WORSE CASE

$F_c = 1225 \text{ kN}, M_x = 228 \text{ kNm}$

$P_{cx} = A_g p_c = 37.3 \times 10^3 p_c$

$i = \sqrt{\frac{I_x}{A}} = 126 \text{ mm}$

$\lambda = L_E / i = 4200 / 126 = 33.5$

§ 4.7.2

TABLE 24
(curve c)

$p_c = 230 \text{ MPa}$

$P_{cx} = 8579 \text{ kN}$

TABLES 18/26

$M_{LT} = m_x = 0.6$

TABLE 15

$M_b = M_c$ IF $L_E / i \leq 340$ OR (10%)

$M_c = p_y Z_x = 255 \times 4.05 \times 10^6 = 1033 \text{ kNm}$

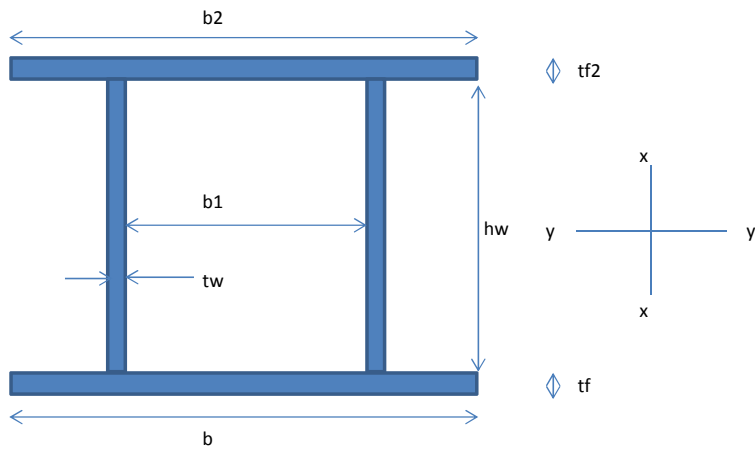
COMBINED

$\frac{1225}{8579} + \frac{0.6 \times 228}{1033} = 27.5\%$

BENDING

$\frac{228}{1033} = 22\%$

→ BASED ON THESE FINDINGS IT IS CLEAR THAT BUCKLING CAN BE IGNORED FOR ALL COLUMNS AS DIMENSIONS ARE SIMILAR



| Col | hw | b1 | b | b2 | tw | tf | tf2 | | | |
|-------|-------|-------|-------|---------|-----|------------------|-------------|----------|------|--|
| A | 384 | 200 | 460 | 460 | 15 | 28 | 28 | | | |
| B | 390 | 200 | 460 | 460 | 9 | 15 | 15 | | | |
| C | 390 | 200 | 460 | 460 | 9 | 15 | 15 | | | |
| D | 358 | 200 | 460 | 460 | 15 | 45 | 37 | | | |
| G | 459 | 264 | 460 | 460 | 8 | 14 | 14 | | | |
| E | 390 | 200 | 460 | 460 | 9 | 15 | 15 | | | |
| F | 386 | 200 | 430 | 430 | 15 | 12 | 12 | | | |
| y-bar | A | w loc | y 1/4 | Wpl | py | LE | I | r | LE/r | |
| 230 | 37280 | 115 | 122 | 4043185 | 255 | 4200 | 587578666.7 | 125.5437 | 33 | |
| 230 | 20820 | 121 | 125 | 2191305 | 255 | 4200 | 320047540 | 123.9844 | 34 | |
| 230 | 20820 | 121 | 125 | 2191305 | 255 | 4200 | 320047540 | 123.9844 | 34 | |
| 230 | 48460 | 115 | 121 | 5277184 | 255 | 4200 | 789444833.3 | 127.6348 | 33 | |
| 230 | 20224 | 90 | 95 | 2726046 | 255 | 4200 | 362991125.3 | 133.9721 | 31 | |
| 230 | 20820 | 121 | 125 | 2191305 | 255 | 4200 | 320047540 | 123.9844 | 34 | |
| 215 | 21900 | 100 | 108 | 2354250 | 275 | 4200 | 293052500 | 115.678 | 36 | |
| mm | mm2 | mm | mm | mm3 | MPa | mm | mm4 | mm | | |
| pc | Pc | Fc | Mx | | | Check | Check 2 | | | |
| 230 | 8574 | 1225 | 228 | | | 28% | 22% | | | |
| 230 | 4789 | 1670 | 347 | | | 72% | 62% | | | |
| 230 | 4789 | 1144 | 237 | | | 49% | 42% | | | |
| 230 | 11146 | 1790 | 301 | | | 29% | 22% | | | |
| 230 | 4652 | 1299 | 209 | | | 46% | 30% | | | |
| 230 | 4789 | 1319 | 266 | | | 56% | 48% | | | |
| 103 | 2256 | 845 | 0 | | | 37% | 0% | | | |
| MPa | kN | kN | kNm | | | COMBINED BENDING | | | | |

