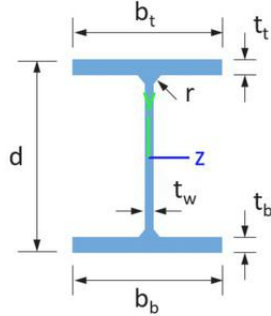


REFERENCES	CALCULATIONS	RESULTS
<p>Code: AS 4100-1998</p>	<h2 style="text-align: center;">MEMBER #11 DESIGN REPORT</h2> <h3>Project Details</h3> <p>Project Name: CSA-s16-frame Project ID: Company: Designer: Client: Project Notes: Project Units: metric</p> <h3>Section</h3> <p>Name: W1000x321 Shape: I-Beam</p>  <h4>Dimensions</h4> <p>Height $d = 990 \text{ mm}$ Web Thick $t_w = 16.5 \text{ mm}$ Top Flange Width $b_t = 400 \text{ mm}$ Top Flange Thick $t_t = 31 \text{ mm}$ Bottom Flange Width $b_b = 400 \text{ mm}$ Bottom Flange Thick $t_b = 31 \text{ mm}$ Fillet $r = 32 \text{ mm}$</p> <h4>Properties</h4> <p>Area $A = 40.9 \times 10^3 \text{ mm}^2$ Moment of Inertia about the z-axis $I_z = 6.96 \times 10^9 \text{ mm}^4$ Moment of Inertia about the y-axis $I_y = 331 \times 10^6 \text{ mm}^4$ Elastic Section Modulus about the y-axis $Z_y = 1.655 \times 10^6 \text{ mm}^3$ Elastic Section Modulus about the z-axis $Z_z = 14.061 \times 10^6 \text{ mm}^3$ Plastic Section Modulus about the y-axis $S_y = 2.55 \times 10^6 \text{ mm}^3$ Plastic Section Modulus about the z-axis $S_z = 15.8 \times 10^6 \text{ mm}^3$ Torsion Contant $J = 10.3 \times 10^6 \text{ mm}^4$ Warping Contant $I_w = 76.1 \times 10^{12} \text{ mm}^6$</p> <h4>Material</h4> <p>Name: Structural Steel Modulus of Elasticity $E = 200 \text{ GPa}$ Yield Strength $F_y = 260 \text{ MPa}$ Ultimate Tensile Strength $F_u = 410 \text{ MPa}$</p> <h3>Member Properties</h3> <p>Member length $L = 10.4 \text{ m}$ Length between braced points $L_b = 10.4 \text{ m}$ Effective Length factor for flexural buckling about y-axis $K_y = 1.00$ Effective Length factor for flexural buckling about z-axis $K_z = 1.00$</p> <h3>Design Internal Forces</h3> <p>Absolute Maximum Tension Force: -1.8518 kN Absolute Maximum Compression Force: 0.57886 kN Absolute Maximum Moment in y-axis: -0.92399 kN.m Absolute Maximum Moment in z-axis: -56.654 kN.m Absolute Maximum Shear Force in y-axis: -37.186 kN Absolute Maximum Shear Force in z-axis: 0.87965 kN</p> <h3>Design of Tension Members</h3> <p>Critical Load Combination: SW1</p>	

Critical Evaluation Point: -1.8518 kN @ 1.6766 m from the beginning of the element

- Yield Tensile Strength Capacity $N_t = 10.634 \times 10^3 \text{ kN}$

$$N_t = f_y \times A$$

$$N_t = 260 \text{ MPa} \times 40.9 \times 10^3 \text{ mm}^2$$

$$N_t = 10.634 \times 10^3 \text{ kN}$$

$$\frac{N^*}{\phi N_t} = \frac{|-1.8518 \text{ kN}|}{9.5706 \times 10^3 \text{ kN}} = 0.000 < 1.0$$

STATUS
PASS
UR =
0.000

Design of Compression Members**Critical Load Combination: SW1****Critical Evaluation Point: 0.57886 kN @ 0.53345 m from the beginning of the element**

Sec. 6.2.3

- Form Factor $k_f = 0.91935$

$$\text{Flanges} = \text{NONSLENDER}, \text{ Web} = \text{SLENDER}, \implies k_f = 0.91935$$

- Nominal Section Capacity $N_s = 9.7763 \times 10^3 \text{ kN}$

$$N_s = k_f \times A \times f_y$$

$$N_s = 0.91935 \times 40.9 \times 10^3 \text{ mm}^2 \times 260 \text{ MPa}$$

$$N_s = 9.7763 \times 10^3 \text{ kN}$$

$$\frac{N^*}{\phi N_s} = \frac{0.57886 \text{ kN}}{8.7987 \times 10^3 \text{ kN}} = 0.000 < 1.0$$

STATUS
PASS
UR =
0.000

Design of Members for Axial Buckling**Critical Load Combination: SW1****Critical Evaluation Point: 0.57886 kN @ 0.53345 m from the beginning of the element****MINOR AXIS**

Sec. 6.2.3

- Form Factor $k_f = 0.91935$

$$\text{Flanges} = \text{NONSLENDER}, \text{ Web} = \text{SLENDER}, \implies k_f = 0.91935$$

- Nominal Section Capacity $N_s = 9.7763 \times 10^3 \text{ kN}$

$$N_s = k_f \times A \times f_y$$

$$N_s = 0.91935 \times 40.9 \times 10^3 \text{ mm}^2 \times 260 \text{ MPa}$$

$$N_s = 9.7763 \times 10^3 \text{ kN}$$

- Radius of Gyration $r_y = 89.961 \text{ mm}$

$$r_y = \sqrt{\frac{I_y}{A}}$$

$$r_y = \sqrt{\frac{331 \times 10^6 \text{ mm}^4}{40.9 \times 10^3 \text{ mm}^2}}$$

$$r_y = 89.961 \text{ mm}$$

Effective Length $l_{ey} = k_{ey} \times L = 1 \times 10.439 \text{ m} = 10.439 \text{ m}$

- Modified Compression Member Slenderness $\lambda_{ny} = 113.47$

$$\lambda_{ny} = \frac{l_{ey}}{r_y} \times \sqrt{\frac{f_y}{250}}$$

$$\lambda_{ny} = \frac{10.439}{89.961 \text{ mm}} \times \sqrt{\frac{260 \text{ MPa}}{250 \text{ MPa}}}$$

$$\lambda_{ny} = 113.47$$

- ✓ Compression Member Factor $\alpha_{ay} = 15.917$

$$\alpha_{ay} = \frac{2100 \times (\lambda_{ny} - 13.5)}{\lambda_{ny}^2 - 15.3 \times \lambda_{ny} + 2050}$$

$$\alpha_{ay} = \frac{2100 \times (113.47 - 13.5)}{113.47^2 - 15.3 \times 113.47 + 2050}$$

$$\alpha_{ay} = 15.917$$

Tbl. 6.3.3(2)

- ✓ Member Section Constant $\alpha_{by} = 0$

$k_f < 1$, I-Beam section, flange thickness $< 40\text{mm}$, therefore $\alpha_{by} = 0$

- ✓ Elastic Buckling Load Factor $\lambda_y = 113.47$

$$\lambda_y = \lambda_{ny} + \alpha_{ay} \times \alpha_b$$

$$\lambda_y = 113.47 + 15.917 \times 0$$

$$\lambda_y = 113.47$$

- ✓ Compression Member Imperfection Factor $\eta_y = 0.32590$

$$\eta_y = 0.00326 \times (\lambda_y - 13.5) > 0$$

$$\eta_y = 0.00326 \times (113.47 - 13.5) > 0$$

$$\eta_y = 0.32590 > 0$$

$$\eta_y = 0.32590$$

- ✓ Compression Member Factor $\xi_y = 0.91707$

$$\xi_y = \frac{\left(\frac{\lambda_y}{90}\right)^2 + 1 + \eta}{2 \times \left(\frac{\lambda_y}{90}\right)^2}$$

$$\xi_y = \frac{\left(\frac{113.47}{90}\right)^2 + 1 + 0.32590}{2 \times \left(\frac{113.47}{90}\right)^2}$$

$$\xi_y = 0.91707$$

- ✓ Compression Member Slenderness Reduction Factor $\alpha_{cy} = 0.45674$

$$\alpha_{cy} = \xi_y \times \left[1 - \sqrt{\left[1 - \left(\frac{90}{\xi \times \lambda_y} \right)^2 \right]} \right]$$

$$\alpha_{cy} = 0.91707 \times \left[1 - \sqrt{\left[1 - \left(\frac{90}{0.91707 \times 113.47} \right)^2 \right]} \right]$$

$$\alpha_{cy} = 0.45674$$

- ✓ Nominal Member Axial Compression Capacity $N_{cy} = 4.4652 \times 10^3 \text{ kN}$

$$N_{cy} = \alpha_{cy} \times N_s \leq N_s$$

$$N_{cy} = 0.45674 \times 9.7763 \times 10^3 \text{ kN} \leq 9.7763 \times 10^3 \text{ kN}$$

$$N_{cy} = 4.4652 \times 10^3 \text{ kN}$$

Reduced Yield Compressive Strength Capacity $\phi N_{cy} = 4.0187 \times 10^3 \text{ kN}$

QUESTION

Q1.10.1

1. $y'' + 2y' + 2y = 0$

2. $y'' + 2y' + 2y = 0$ with $y(0) = 1$ and $y(\pi) = 0$

3. $y'' + 2y' + 2y = 0$ with $y(0) = 1$ and $y(\pi) = 0$

$$y'' + 2y' + 2y = 0$$

$$y'' + 2y' + 2y = 0$$

$$y'' + 2y' + 2y = 0$$

4. $y'' + 2y' + 2y = 0$ with $y(0) = 1$ and $y(\pi) = 0$

$$y'' + 2y' + 2y = 0$$

$$y'' + 2y' + 2y = 0$$

$$y'' + 2y' + 2y = 0$$

5. $y'' + 2y' + 2y = 0$ with $y(0) = 1$ and $y(\pi) = 0$

6. $y'' + 2y' + 2y = 0$ with $y(0) = 1$ and $y(\pi) = 0$

$$y'' + 2y' + 2y = 0$$

$$y'' + 2y' + 2y = 0$$

$$y'' + 2y' + 2y = 0$$

7. $y'' + 2y' + 2y = 0$ with $y(0) = 1$ and $y(\pi) = 0$

$$y'' + 2y' + 2y = 0$$

$$y'' + 2y' + 2y = 0$$

$$y'' + 2y' + 2y = 0$$

Q1.10.2

1. $y'' + 2y' + 2y = 0$

2. $y'' + 2y' + 2y = 0$ with $y(0) = 1$ and $y(\pi) = 0$

3. $y'' + 2y' + 2y = 0$ with $y(0) = 1$ and $y(\pi) = 0$

$$y'' + 2y' + 2y = 0$$

$$y'' + 2y' + 2y = 0$$

$$y'' + 2y' + 2y = 0$$

4. $y'' + 2y' + 2y = 0$ with $y(0) = 1$ and $y(\pi) = 0$

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5. $y'' + 2y' + 2y = 0$ with $y(0) = 1$ and $y(\pi) = 0$

$$y'' + 2y' + 2y = 0$$

$$y'' + 2y' + 2y = 0$$

$$y'' + 2y' + 2y = 0$$

$$\frac{(\hat{\mu})^2 - 1}{n(\hat{\mu})^2}$$

$$\mu = 100$$

• known true mean and known true var $\mu = 100$

$$\mu = 100 \left(1 + \sqrt{\frac{1}{n}} \right)$$

$$\mu = 100 \left(1 + \sqrt{\frac{1}{1000000}} \right)$$

$$\mu = 1000$$

• known true var and unknown true $\mu = 1000$ of all

$$\mu = 1000$$

$$\mu = 1000 \left(1 + \frac{1}{1000} \right)$$

$$\mu = 1000$$

• known true unknown true $\mu = 1000$ of all

• $\mu = 1000$ given exactly

$$\frac{\mu}{\hat{\mu}} = \frac{1000000}{1000000} = 1000$$

1000
1000
1000

Design of Future Experiments - ideal growth

• ideal case estimator (10)

• ideal estimator (10) - ideal of a 1000000. Non-terminology of the estimator

• $\mu = 1000$ of all μ

$$\mu = 1000$$

$$\mu = 1000 \left(1 + \frac{1}{1000} \right)$$

$$\mu = 1000$$

$$\frac{\mu}{\hat{\mu}} = \frac{1000000}{1000000} = 1000$$

1000
1000
1000

Design of Future Experiments - ideal growth

• ideal case estimator (10)

• ideal estimator (10) - ideal of a 1000000. Non-terminology of the estimator

• $\mu = 1000$ of all μ

$$\mu = 1000$$

$$\mu = 1000 \left(1 + \frac{1}{1000} \right)$$

$$\mu = 1000$$

$$\frac{\mu}{\hat{\mu}} = \frac{1000000}{1000000} = 1000$$

1000
1000
1000

$$s = \frac{(\sigma^2)^{1/2} + \text{mean}}{n + (\sigma^2)^{1/2}}$$

$$s = 1000$$

• known mean (known variance) $\mu = 1000$

$$s = 1000 + \frac{1}{\sqrt{n}} \left(\sqrt{\frac{R^2}{4}} \right)$$

$$s = 1000 + \frac{1}{\sqrt{n}} \left(\sqrt{\frac{R^2}{4 \times 1000^2}} \right)$$

$$s = 1000$$

• known mean and known variance $\mu = 1000$ of all

$$R_1 = 1000 + 1000 \cdot R$$

$$R_2 = 1000 + 1000 \cdot R_1 = 1000 + 1000 \cdot (1000 + 1000 \cdot R)$$

$$R_3 = 1000 + 1000 \cdot R_2$$

known mean known length known $\mu = 1000$ of all

known mean known variance

$$\frac{R_1}{R_2} = \frac{1000 + 1000 \cdot R}{1000 + 1000 \cdot (1000 + 1000 \cdot R)}$$

1000
1000
1000

Design of Future Experiments - fixed growth

critical path estimator (CPE)

critical path estimator (CPE) - critical path estimator (CPE) - New Technology of the Moment

• $R_1 = 1000 + 1000 \cdot R$

$$R_2 = 1000 + 1000 \cdot R_1$$

$$R_3 = 1000 + 1000 \cdot R_2$$

$$R_4 = 1000 + 1000 \cdot R_3$$

$$\frac{R_1}{R_2} = \frac{1000 + 1000 \cdot R}{1000 + 1000 \cdot (1000 + 1000 \cdot R)}$$

1000
1000
1000

Design of Future Experiments - fixed growth

critical path estimator (CPE)

critical path estimator (CPE) - critical path estimator (CPE) - New Technology of the Moment

• $R_1 = 1000 + 1000 \cdot R$

$$R_2 = 1000 + 1000 \cdot R_1$$

$$R_3 = 1000 + 1000 \cdot R_2$$

$$R_4 = 1000 + 1000 \cdot R_3$$

$$\frac{R_1}{R_2} = \frac{1000 + 1000 \cdot R}{1000 + 1000 \cdot (1000 + 1000 \cdot R)}$$

1000
1000
1000

$$M_{11} = \frac{2EI}{L} \left(\frac{1}{2} + \frac{1}{2} \right) = \frac{2EI}{L}$$

$$M_{22} = \frac{2EI}{L} \left(\frac{1}{2} + \frac{1}{2} \right) = \frac{2EI}{L}$$

$$M_{33} = \frac{2EI}{L} \left(\frac{1}{2} + \frac{1}{2} \right) = \frac{2EI}{L}$$

$$\frac{2EI}{L} = \frac{2EI}{L} \left(\frac{1}{2} + \frac{1}{2} \right) = \frac{2EI}{L}$$

2020
10/10/20

Design of Members for Steel - steel joists

critical load combination (ULS)

critical load combination (ULS) - 1.2 dead + 1.5 live + 0.5 wind (for topography of the ground)

1.2 dead + 1.5 live + 0.5 wind

$$M_{11} = 1.2 \times 100 + 1.5 \times 100 + 0.5 \times 100$$

$$M_{22} = 1.2 \times 100 + 1.5 \times 100 + 0.5 \times 100$$

$$M_{33} = 1.2 \times 100 + 1.5 \times 100 + 0.5 \times 100$$

1.2 dead + 1.5 live

$$M_{11} = 1.2 \times 100 + 1.5 \times 100$$

$$M_{22} = 1.2 \times 100 + 1.5 \times 100$$

$$M_{33} = 1.2 \times 100 + 1.5 \times 100$$

1.2 dead + 1.5 live + 0.5 wind

$$M_{11} = 1.2 \times 100 + 1.5 \times 100 + 0.5 \times 100$$

$$M_{22} = 1.2 \times 100 + 1.5 \times 100 + 0.5 \times 100$$

$$M_{33} = 1.2 \times 100 + 1.5 \times 100 + 0.5 \times 100$$

2020/10/10

1.2 dead + 1.5 live

$$\frac{2EI}{L} = \frac{2EI}{L} \left(\frac{1}{2} + \frac{1}{2} \right) = \frac{2EI}{L}$$

$$\frac{2EI}{L} = \frac{2EI}{L} \left(\frac{1}{2} + \frac{1}{2} \right) = \frac{2EI}{L}$$

$$M_{11} = 1.2 \times 100 + 1.5 \times 100 + 0.5 \times 100$$

1.2 dead + 1.5 live + 0.5 wind

$$M_{11} = 1.2 \times 100 + 1.5 \times 100 + 0.5 \times 100$$

$$M_{22} = 1.2 \times 100 + 1.5 \times 100 + 0.5 \times 100$$

$$M_{33} = 1.2 \times 100 + 1.5 \times 100 + 0.5 \times 100$$

$$\frac{2EI}{L} = \frac{2EI}{L} \left(\frac{1}{2} + \frac{1}{2} \right) = \frac{2EI}{L}$$

2020
10/10/20

Design of Members for Steel - steel joists

critical load combination (ULS)

critical load combination (ULS) - 1.2 dead + 1.5 live + 0.5 wind (for topography of the ground)

1.2 dead + 1.5 live + 0.5 wind

$$y = 100 - 2x$$

$$y = 100 - 2(10) = 80$$

$$y = 100 - 2(20) = 60$$

1. Demand curve - linear

$$y = 100 - 2x$$

$$y = 100 - 2(10) = 80$$

2. Demand curve - non-linear

$$y = 100 - 2x^2$$

$$y = 100 - 2(10)^2 = 80$$

$$y = 100 - 2(20)^2 = 60$$

3. Demand curve - non-linear

$$y = 100 - \frac{2x}{x+1}$$

$$y = 100 - \frac{2(10)}{10+1} = 80$$

$$y = 100 - \frac{2(20)}{20+1} = 60$$

4. Demand curve - non-linear

$$y = 100 - 2x^2$$

$$y = 100 - 2(10)^2 = 80$$

$$y = 100 - 2(20)^2 = 60$$

$$\frac{dy}{dx} = \frac{d}{dx}(100 - 2x^2) = -4x$$

Example of Demand Curve for Goodness (Milkshake) (Quantity)

Linear Demand Curve (Quantity)

Linear Demand Curve (Quantity) - (100 - 2x) (Quantity) (Price) (Quantity)

$$y = 100 - 2x$$

$$y = 100 - 2(10) = 80$$

$$y = 100 - 2(20) = 60$$

$$y = 100 - 2(30) = 40$$

Example of Demand Curve for Goodness (Milkshake) (Quantity)

Linear Demand Curve (Quantity) - (100 - 2x) (Quantity) (Price) (Quantity)

$$y = 100 - 2x$$

$$\frac{dy}{dx} = \frac{d}{dx}(100 - 2x) = -2$$

$$y = 100 - 2x$$

Example of Demand Curve for Goodness (Milkshake) (Quantity)

Linear Demand Curve (Quantity) - (100 - 2x) (Quantity) (Price) (Quantity)

$$y = 100 - 2x$$

$$V = \frac{1000000}{1000000} + \frac{1000000}{1000000}$$

$$V = 2000000$$

Answer: 2000000

2000000 = 2000000

$$V = \frac{1000000}{1000000} + \frac{1000000}{1000000}$$

$$V = \frac{1000000}{1000000} + \frac{1000000}{1000000} + \frac{1000000}{1000000}$$

$$V = 3000000$$

$$V = 4000000$$

Example of Newton's for Constant Action (Newton's Method)

Initial value: $x_0 = 1.0$

Initial function value: $f(x_0) = 1.0$ (from the beginning of the process)

$x_1 = 0.5$

$x_2 = 0.25$

$x_3 = 0.125$

Newton's method: $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$

2000000 = 2000000

$$V = \frac{1000000}{1000000} + \frac{1000000}{1000000}$$

$$V = \frac{1000000}{1000000} + \frac{1000000}{1000000}$$

$$V = 2000000$$

Answer: 2000000

2000000 = 2000000

$$V = 2000000$$

$$V = 2000000 + 2000000$$

$$V = 4000000$$

2000000 = 2000000

$$V = \left(\frac{1000000}{1000000}\right)^2 + \left(\frac{1000000}{1000000}\right)^2$$

$$V = \left(\frac{1000000}{1000000}\right)^2 + \left(\frac{1000000}{1000000}\right)^2$$

$$V = 2000000$$

$$V = 4000000$$

Answer: 2000000

2000000 = 2000000

2000000 = 2000000

2000000 = 2000000

	$100 - \frac{100}{1.05}$ $100 - \frac{1000}{1.05}$ $100 - 10000$ $100 - 100$	
Kompensierter Standardabweichungs-Vorteil Standardabweichung: $\sigma = 100$ Standardabweichung: $\sigma = 1000$ Standardabweichung: $\sigma = 10000$	$100 - \frac{100}{1.05}$ $100 - \frac{1000}{1.05}$ $100 - 10000$ $100 - 100$	
Reflektierter Vorteil Standardabweichung: $\sigma = 100$ Standardabweichung: $\sigma = 1000$ Standardabweichung: $\sigma = 10000$	$100 - \frac{100}{1.05}$ $100 - \frac{100}{1.05}$ $100 - 100$ $1000 - 100$	