

Northwoods Software

Uniform Beam Load Reactions, Moments and Deflection

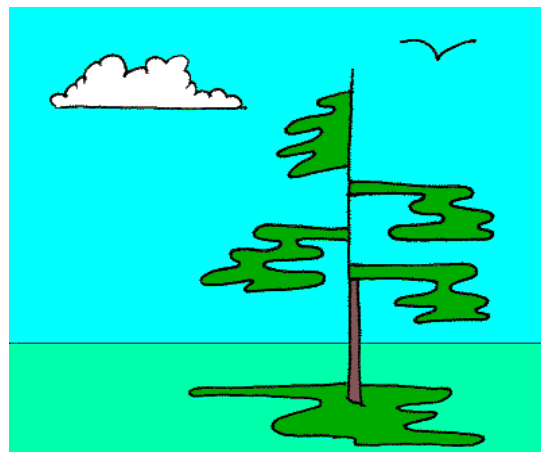
Last Revised: July 9, 2018

Applicable Codes

CSA S16

Project Information

Date: Monday, July 09, 2018
Project Number:
Project Name:
Description:
Designer: Dik
Checked: Dik
Date:



Load Factors

α_{DL} = 1.25

Dead Load Factor

α_{LL} = 1.5

Live Load Factor

Material

Steel

F_y = 350 Mpa

Yield Strength of Steel

ϕ_s = 0.9

Material Property Factor

Deflection Limits (L / nnn)

Total Load = 180

Live Load = 240

Loading Uniform)

| | Service (Ksf) | Factored (Ksf) | Service (KPa) | Factored (KPa) | |
|--------------------|------------------|-------------------|------------------|-------------------|--------------------|
| q _{SDL} = | 0.152 | 0.190 | 7.28 | 9.10 | Uniform Dead Load |
| q _{SLL} = | 0.042 | 0.063 | 2.00 | 3.00 | Uniform Live Load |
| q _{STL} = | 0.194 | 0.253 | 9.28 | 12.10 | Uniform Total Load |

| | | | | | | | |
|--------------------|--------|-----------------------------|-------------------|------------------------------------|--------------------|--------------------|---------------------------|
| Beam: Eng Tips | | Service (Ksf) | Factored (Ksf) | Service (KPa) | Factored (KPa) | | |
| | | 0.152 | 0.190 | 7.28 | 9.10 | | |
| | | 0.042 | 0.063 | 2.00 | 3.00 | | |
| W = | 20.000 | ft | | 6.096 | m | Tributary Width | |
| L = | 32.500 | ft | | 9.906 | m | Span | |
| Loading | | Service (Klf) | Factored (Klf) | Service (KN/m) | Factored (KN/m) | | |
| q_{SDL} = | 3.210 | | 4.013 | 46.85 | 58.56 | Uniform Dead Load | |
| q_{SLL} = | 0.836 | | 1.254 | 12.20 | 18.30 | Uniform Live Load | |
| q_{STL} = | 4.046 | | 5.267 | 59.05 | 76.86 | Uniform Total Load | |
| Design Information | | Reactions | Service (K) | Factored (K) | Service (KN) | Factored (KN) | |
| | | $R_A = R_B =$ | 52.16 | 65.20 | 232.03 | 290.04 | Dead Load Beam Reactions |
| | | $R_A = R_B =$ | 13.59 | 20.38 | 60.43 | 90.64 | Live Load Beam Reactions |
| | | $R_A = R_B =$ | 65.75 | 85.58 | 292.46 | 380.68 | Total Load Beam Reactions |
| | | Moments | Service (K-ft) | Factored (K-ft) | Service (KN-m) | Factored (KN-m) | |
| | | $M_{LL} =$ | 110.4 | 165.6 | 149.65 | 224.48 | Live Load Beam Moment |
| | | $M_{TL} =$ | 534.2 | 695.3 | 724.28 | 942.76 | Total Load Beam Moment |
| Section: | | W12x170 | | W310x253 | | | |
| Class: | | 1 | | | | Class of Section | |
| | | h = 14.0 in | | 25 mm | | | |
| | | b = 12.6 in | | 319 mm | | | |
| | | t = 1.6 in | | 40 mm | | | |
| | | w = 1.0 in | | 24 mm | | | |
| | | $S_x = 235.0 \text{ in}^3$ | | $3851 \cdot 10^3 \text{ x mm}^3$ | | | |
| | | $Z_x = 275.0 \text{ in}^3$ | | $4506 \cdot 10^3 \text{ x mm}^3$ | | | |
| | | $I_x = 1650.0 \text{ in}^4$ | | $686.78 \cdot 10^6 \text{ x mm}^4$ | | I_x provided | |
| | | 0 | Class 1 | Class 2 | Class 3 | | |
| Web h/w = | | 11.36 | 58.80 | 90.87 | 101.56 | | |
| Flange b/t = | | 4.03 | 7.75 | 9.09 | 10.69 | | |
| $M_r =$ | | 1047.0 | K-ft | 1419.5 | KN-m | OK | |
| Deflections | | | | | | | |
| $\Delta_{LL} =$ | | 0.44 | in | 11.2 | | OK | L / 885 Defl Ratio for LL |
| $\Delta_{TL} =$ | | 2.13 | in | 54.2 | | OK | L / 183 Defl Ratio for TL |
| Beam: Eng Tips | | Service (Ksf) | Factored (Ksf) | Service (KPa) | Factored (KPa) | | |
| | | 0.152 | 0.190 | 7.28 | 9.10 | | |
| | | 0.042 | 0.063 | 2.00 | 3.00 | | |
| W = | 20.000 | ft | | 6.096 | m | Tributary Width | |
| L = | 32.500 | ft | | 9.906 | m | Span | |
| Loading | | Service | Factored | Service | Factored | | |

| | (Klf) | (Klf) | (KN/m) | (KN/m) | |
|-------------|--------------|--------------|--------|--------|--------------------|
| $q_{SDL} =$ | 3.116 | 3.895 | 45.47 | 56.84 | Uniform Dead Load |
| $q_{SLL} =$ | 0.836 | 1.254 | 12.20 | 18.30 | Uniform Live Load |
| $q_{STL} =$ | 3.952 | 5.149 | 57.68 | 75.14 | Uniform Total Load |

Design Information

| Reactions | Service (K) | Factored (K) | Service (KN) | Factored (KN) | |
|---------------|----------------|-----------------|-----------------|------------------|---------------------------|
| $R_A = R_B =$ | 50.64 | 63.29 | 225.24 | 281.54 | Dead Load Beam Reactions |
| $R_A = R_B =$ | 13.59 | 20.38 | 60.43 | 90.64 | Live Load Beam Reactions |
| $R_A = R_B =$ | 64.22 | 83.67 | 285.66 | 372.19 | Total Load Beam Reactions |

| Moments | Service (K-ft) | Factored (K-ft) | Service (KN-m) | Factored (KN-m) | |
|------------|-------------------|--------------------|-------------------|--------------------|------------------------|
| $M_{LL} =$ | 110.4 | 165.6 | 149.65 | 224.48 | Live Load Beam Moment |
| $M_{TL} =$ | 521.8 | 679.8 | 707.45 | 921.72 | Total Load Beam Moment |

| | | | |
|----------|------------------------|------------------------------------------|------------------|
| Section: | W24x76 | W610x113 | |
| Class: | 1 | | Class of Section |
| $h =$ | 23.9 in | 25 mm | |
| $b =$ | 9.0 in | 228 mm | |
| $t =$ | 0.7 in | 17 mm | |
| $w =$ | 0.4 in | 11 mm | |
| $S_x =$ | 176.0 in ³ | 2884 10 ³ x mm ³ | |
| $Z_x =$ | 200.0 in ³ | 3277 10 ³ x mm ³ | |
| $I_x =$ | 2100.0 in ⁴ | 874.09 10 ⁶ x mm ⁴ | I_x provided |

| | 0 | Class 1 | Class 2 | Class 3 |
|----------------|-------|---------|---------|---------|
| Web $h/w =$ | 51.27 | 58.80 | 90.87 | 101.56 |
| Flange $b/t =$ | 6.61 | 7.75 | 9.09 | 10.69 |

$M_r =$ **761.4** K-ft 1032.4 KN-m OK

Deflections

| | | | | | |
|-----------------|---------|------|----|----------|-------------------|
| $\Delta_{LL} =$ | 0.35 in | 8.8 | OK | L / 1126 | Defl Ratio for LL |
| $\Delta_{TL} =$ | 1.64 in | 41.6 | OK | L / 238 | Defl Ratio for TL |
