

NorthWoods Software

Program Name: Weld-Design

Project Number: -

Project Description: -

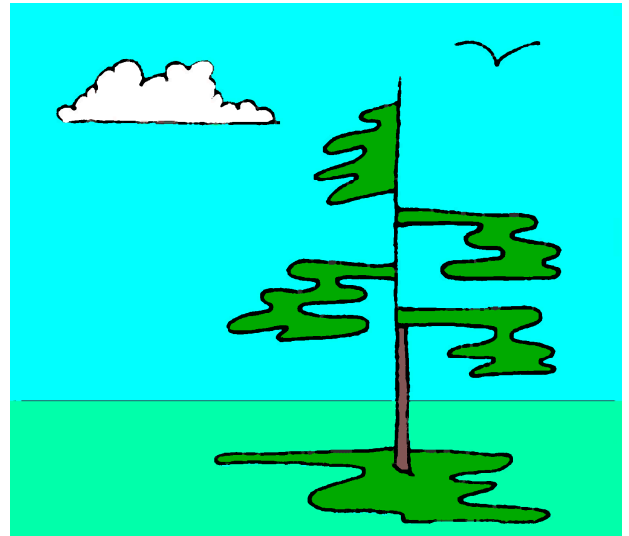
Project Designer: Dik

Last Revised (yy-mm-dd): 21.09.08

Reference: NBCC, CSA S16

Disclaimer:

Created using SMath Studio, a MathCAD workalike from <https://en.smstudio.info/view/SMathStudio>. The User is responsible to verify data and calculations using an alternative method



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Defined Units:

$K := kip$					Force
$K_{ft} := K ft$	$kN_m := kN m$	$K_{in} := K in$	$kN_{mm} := kN mm$	$lb_{in} := lbf in$	Moment
	$kN_{mpm} := \frac{kN m}{m}$	$iK_{pi} := \frac{K in}{in}$			Moment
$pcf := \frac{lbf}{ft^3}$	$kN_{pcm} := \frac{kN}{m^3}$	$kg_{pcm} := \frac{kg}{m^3}$			Density
$K_{lf} := \frac{K}{ft}$	$plf := \frac{lbf}{ft}$	$kN_{pm} := \frac{kN}{m}$	$K_{pi} := \frac{K}{in}$	$kN_{pmm} := \frac{kN}{mm}$	Force/Unit Length
$psf := \frac{lbf}{ft^2}$	$K_{sf} := \frac{K}{ft^2}$	$K_{si} := \frac{K}{in^2}$	$kN_{psm} := \frac{kN}{m^2}$	$psi := \frac{lbf}{in^2}$	Pressure
$N_{psmm} := \frac{N}{mm^2}$					Pressure
$pci := \frac{lbf}{in^3}$					Subgrade Modulus
$psf_{pf} := \frac{psf}{ft}$	$kPa_{pm} := \frac{kPa}{m}$				Pressure per Depth
$pmcf := \frac{lb}{ft^3}$	$lb := lbf$				Force
$mph := \frac{mi}{hr}$	$kph := \frac{km}{hr}$				Velocity
$ispf := \frac{in^2}{ft}$	$mm_{spm} := \frac{mm^2}{m}$				Area per Unit Length



Input Data**Material Property Factors:**

$$\phi_s := 0.90$$

$$\phi_w := 0.67$$

Load Factors:

$$\alpha_L := 1.50$$

$$\alpha_D := 1.25$$

Welded Material: $stl_{NDX} := 1$

NDX	des	fy	Fu
1	"G40.21-350W"	50 Ksi	65 Ksi
2	"G40.21-300W"	44 Ksi	65 Ksi
3	"A36"	36 Ksi	58 Ksi

$$stl := \begin{cases} 1 & \text{"G40.21-350W"} & 50 \text{ Ksi} & 65 \text{ Ksi} \\ 2 & \text{"G40.21-300W"} & 44 \text{ Ksi} & 65 \text{ Ksi} \\ 3 & \text{"A36"} & 36 \text{ Ksi} & 58 \text{ Ksi} \end{cases}$$

$$desI_1 := stl_{NDX} \quad f_{y1} := stl_{NDX} \quad F_{u1} := stl_{NDX}$$

$$E_s := 29000 \text{ Ksi} \quad \nu := 0.3 \quad \gamma_s := 489 \text{ pcf}$$

$$G_s = 11153.8462 \text{ Ksi} \quad G_s := \frac{E_s}{2 \cdot (1 + \nu)}$$

Base Material: $stl_{NDX} := 2$

$$desI_2 := stl_{NDX} \quad f_{y2} := stl_{NDX} \quad F_{u2} := stl_{NDX}$$

Weld Electrodes: $we_{NDX} := 2$

NDX	DesI	DesM	UTS
1	"E60xx"	"E43xx"	60 ksi
2	"E70xx"	"E49xx"	70 ksi
3	"E80xx"	"E55xx-x"	80 ksi
4	"E90xx"	"E62xx-x"	90 ksi

$$we := \begin{cases} 1 & \text{"E60xx"} & \text{"E43xx"} & 60 \text{ ksi} \\ 2 & \text{"E70xx"} & \text{"E49xx"} & 70 \text{ ksi} \\ 3 & \text{"E80xx"} & \text{"E55xx-x"} & 80 \text{ ksi} \\ 4 & \text{"E90xx"} & \text{"E62xx-x"} & 90 \text{ ksi} \end{cases}$$

$$desI_w := we_{NDX} \quad desM_w := we_{NDX} \quad X_u := we_{NDX}$$

Weld Sizes: $ws_{NDX} := 7$

NDX	desI	desM	D
1	"	"3mm"	0.11811 in
2	"1/8"	"	0.125 in
3	"	"4mm"	0.15748 in
4	"3/16"	"	0.1875 in
5	"	"5mm"	0.19685 in
6	"	"6mm"	0.23622 in
7	"1/4"	"	0.25 in
8	"	"7mm"	0.275591 in
9	"5/16"	"	0.3125 in
10	"	"8mm"	0.314961 in
11	"	"9mm"	0.354331 in
12	"3/8"	"	0.375 in
13	"	"10mm"	0.3937 in
14	"	"11mm"	0.4331 in
15	"7/16"	"	0.4375 in
16	"	"12mm"	0.4724 in
17	"1/2"	"	0.50 in

$$ws := \begin{cases} 1 & \text{""} & \text{"3mm"} & 0.11811 \text{ in} \\ 2 & \text{"1/8"} & \text{""} & 0.125 \text{ in} \\ 3 & \text{""} & \text{"4mm"} & 0.15748 \text{ in} \\ 4 & \text{"3/16"} & \text{""} & 0.1875 \text{ in} \\ 5 & \text{""} & \text{"5mm"} & 0.19685 \text{ in} \\ 6 & \text{""} & \text{"6mm"} & 0.23622 \text{ in} \\ 7 & \text{"1/4"} & \text{""} & 0.25 \text{ in} \\ 8 & \text{""} & \text{"7mm"} & 0.275591 \text{ in} \\ 9 & \text{"5/16"} & \text{""} & 0.3125 \text{ in} \\ 10 & \text{""} & \text{"8mm"} & 0.314961 \text{ in} \\ 11 & \text{""} & \text{"9mm"} & 0.354331 \text{ in} \\ 12 & \text{"3/8"} & \text{""} & 0.375 \text{ in} \\ 13 & \text{""} & \text{"10mm"} & 0.3937 \text{ in} \\ 14 & \text{""} & \text{"11mm"} & 0.4331 \text{ in} \\ 15 & \text{"7/16"} & \text{""} & 0.4375 \text{ in} \\ 16 & \text{""} & \text{"12mm"} & 0.4724 \text{ in} \\ 17 & \text{"1/2"} & \text{""} & 0.50 \text{ in} \end{cases}$$

$$desI_D := ws_{NDX} \quad desM_D := ws_{NDX} \quad D := ws_{NDX}$$

Weld Design:**Weld Material Strength**

$$v_{rw} := \phi_w \cdot 0.67 \cdot \frac{X_u}{\sqrt{2}}$$

$$v_{rw} = 22.22 \text{ ksi}$$

$$v_{rw} = 153.20 \text{ MPa}$$

Base Metal Strength

$$v_{rb1} := \phi_w \cdot 0.67 \cdot F_{u1}$$

$$v_{rb1} = 29.18 \text{ Ksi}$$

$$v_{rb1} = 201.18 \text{ MPa}$$

$$v_{rb2} := \phi_w \cdot 0.67 \cdot F_{u2}$$

$$v_{rb2} = 29.18 \text{ Ksi}$$

$$v_{rb2} = 201.18 \text{ MPa}$$

Minimum Weld Capacity

$$V_{rw} := \min \left(\left[v_{rw} \quad v_{rb1} \quad v_{rb2} \right] \right)$$

$$V_{rw} = 22.22 \text{ Ksi}$$

$$V_{rw} = 153.20 \text{ MPa}$$