

# NorthWoods Software

**Program Name:** Incremental\_Active\_Soil\_Pressure

**Project Name:** -

**Project Number:** -

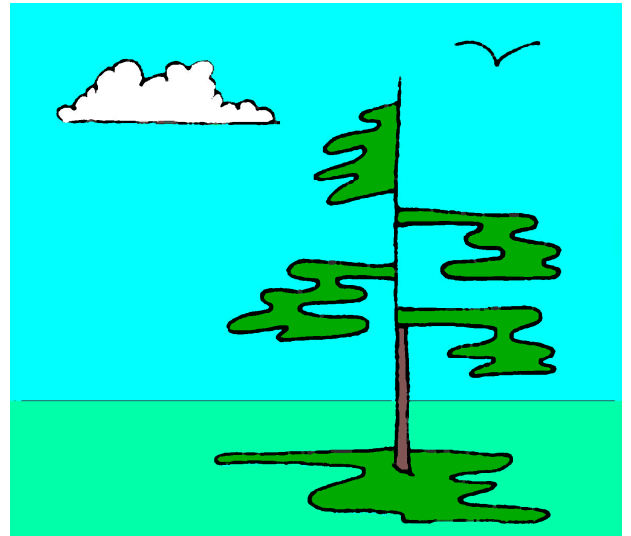
**Project Description:** -

**Project Designer:** Dik

**Last Revised (yy-mm-dd):** 21-03-01

**Reference:** NBCC

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



## Menu:

<span style="background-color: yellow; border: 1px solid black; padding: 2px;">.....</span> Input Data	<span style="background-color: cyan; border: 1px solid black; padding: 2px;">.....</span> Important Output	<span style="background-color: lightgreen; border: 1px solid black; padding: 2px;">.....</span> Logical Constructs	<span style="border: 1px solid blue; padding: 2px;">Blue</span> Units
<span style="background-color: pink; border: 1px solid black; padding: 2px;">.....</span> Sum / For	<span style="border: 1px solid red; padding: 2px;">Red</span> Important Note		

## Defined Units:

$K := \text{kip}$		Force			
$K_{ft} := K \text{ ft}$	$kN_m := kN \text{ m}$	$K_{in} := K \text{ in}$	$kN_{mm} := kN \text{ mm}$	$lb_{in} := lbf \text{ in}$	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
$pci := \frac{lbf}{in^3}$					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

## User Defined Functions:

```
Check (arg) := if arg = 1
                Check := "...OK"
            else
                Check := "...NG"
```

```
Check (2 = 3) = "...NG"
```

```
Check (2 ≤ 3) = "...OK"
```

```
Check (2 ≠ 3) = "...OK"
```

```
Check (3 ≥ 2) = "...OK"
```

**Material Property Factors:**

$$\varphi_s := 0.9$$

**Load Factors:**

$$\alpha_L := 1.50$$

c

b

a

$$\alpha_D := 1.25$$

**Soils:**

$$\gamma_s := 18 \text{ kNpcm}$$

$$\gamma_s = 114.59 \text{ pcf}$$

$$\gamma_s = 18.00 \text{ kNpcm}$$

$$k_a := 0.50$$

$$k_p := 3.00$$

**Surcharge:**

$$q_s := 100 \text{ psf}$$

**Soil Pressure per Unit Depth:**

$$K_a := k_a \cdot \gamma_s$$

$$K_a = 57.3 \text{ psfpf}$$

$$K_a = 9.0 \text{ kPapm}$$

$$K_p := k_p \cdot \gamma_s$$

$$K_p = 343.8 \text{ psfpf}$$

$$K_p = 54.0 \text{ kPapm}$$

**Soldier Pile Section:**

$$S := \text{"W12x74"}$$

$$S_{zx} := 105 \text{ in}^3$$

**Waler Section**

$$\bar{W} := \text{"W24x94"}$$

$$\bar{W}_{zx} := 254 \text{ in}^3$$

$$data := \begin{pmatrix} 1 & (-2) \text{ ft} \\ 2 & 0 \text{ ft} \\ 3 & 3.28125 \text{ ft} \\ 4 & 13.125 \text{ ft} \\ 5 & 22.96875 \text{ ft} \\ 6 & 29.53125 \text{ ft} \\ 7 & 39.53125 \text{ ft} \end{pmatrix} \begin{array}{l} \text{Top of Pile} \\ \text{Grade} \\ \\ \text{Depth of Excavation} \\ \text{End of Pile} \end{array}$$

Enter incremental depth from Top of Pile in Column 2. Grade is Located at Data Point 2

$$data_{13} := 0 \text{ ft}$$

$$data_{14} := 0 \text{ psf}$$

$$data_{15} := 0 \text{ psf}$$

$$data_{16} := 0 \text{ ft}$$

```

for i ∈ [2..rows(data)]
  datai 3 := datai 2 - data(i-1) 2
  datai 4 := datai 2 · Ka
  datai 5 := datai 4 + qs · ka
  datai 6 := (datai 2 - data(i-1) 2) · 0.5
  if i = rows(data)
    datai 7 := 0 ft
  else
    datai 7 := (data(i+1) 2 - datai 2) · 0.5
  if (i = 1) ∨ (i = 2)
    datai 8 := 0 psf
  else
    datai 8 := ((data(i-1) 5 + datai 5) · 0.5 + datai 5) · .5
  if (i = 1) ∨ (i = rows(data))
    datai 9 := 0 psf
  else
    datai 9 := ((data(i+1) 5 + datai 5) · 0.5 + datai 5) · .5
  datai 10 := datai 8 · datai 6 + datai 9 · datai 7

```

$$\text{col}(\text{data}, 9) = \begin{bmatrix} 0 \\ 0.0375 \\ 0.1785 \\ 0.6015 \\ 1.0245 \\ 1.3064 \\ 0 \end{bmatrix} \text{ Ksf}$$

i := 5

data<sub>i 5</sub> = 1.37 Ksf

data<sub>i+1 5</sub> = 1.74 Ksf

data<sub>i 5</sub> + data<sub>(i+1) 5</sub> = 3.11 Ksf

(data<sub>i 5</sub> + data<sub>(i+1) 5</sub>) · 0.5 = 1.55 Ksf

((data<sub>(i+1) 5</sub> + data<sub>i 5</sub>) · 0.5 + data<sub>i 5</sub>) · .5 = 1.46 Ksf

$$Q_s = \begin{bmatrix} 0.00 \\ 0.06 \\ 1.19 \\ 6.21 \\ 9.39 \\ 11.94 \\ 10.86 \end{bmatrix} \text{ klf}$$

Column 5 Contains Active Soil Pressure and Surcharge at Level Col 2

Column 6 Contains Tributary Width Above

Column 7 Contains Tributary Width Below

Column 8 Contains Average Service Soil Pressure Above

Column 9 Contains Average Service Soil Pressure Below

Column 10 Contains Sum of Service Soil Pressure Above and Below