

NorthWoods Software

Program Name: Masonry-Prop

Project Number: -

Project Description: -

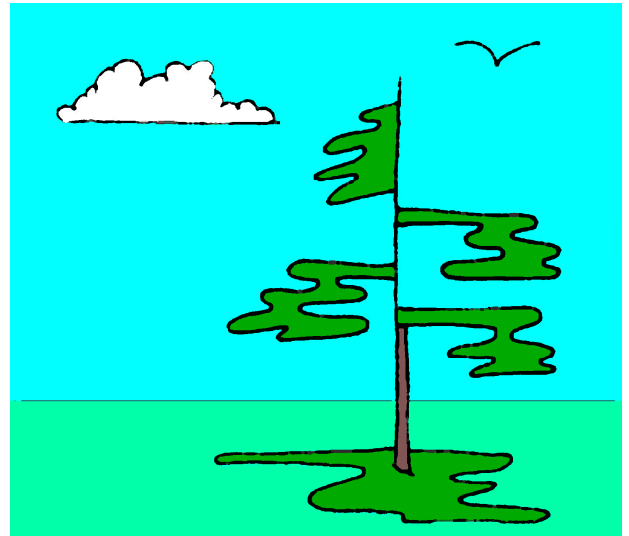
Project Designer: Dik

Last Revised (yy-mm-dd): 22.04.24

Reference: NBCC, CSA S16

Disclaimer:

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



Menu:

- Input Data
- Important Output
- Logical Constructs
- Blue Units
- Sum / For
- Red Important Note
- Temporary Variables

Input Data

Material Property Factors:

$\varphi_m := 0.55$ Masonry

$\varphi_s := 0.85$ Rebar

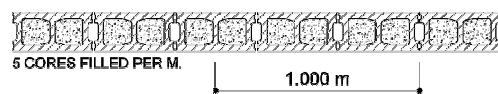
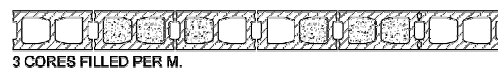
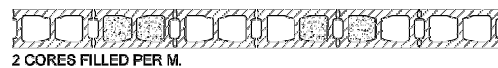
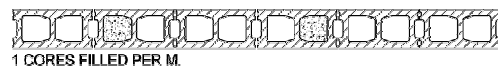
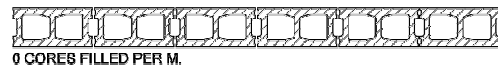
Load Factors:

$\alpha_L := 1.50$

$\alpha_D := 1.25$

Check $(\alpha_D \geq 1.25) = "...OK"$

Check $(\alpha_L \geq 1.5) = "...OK"$



Masonry Thickness: $ma_{NDX} := 4$

c

b

a

NDX	desI	desM	t	fs	Solid	Ae
1	"4 inch"	"100 mm"	90 mm	26 mm	0.74	52.0
2	"6 inch"	"150 mm"	140 mm	26 mm	0.57	52.0
3	"8 inch"	"200 mm"	190 mm	32 mm	0.54	75.4
4	"10 inch"	"250 mm"	240 mm	35 mm	0.51	81.7
5	"12 inch"	"300 mm"	290 mm	38 mm	0.50	88.3

$$desI_t := ma_{NDX}^2$$

$$desM_t := ma_{NDX}^3$$

$$t_m := ma_{NDX}^4$$

$$t_s := ma_{NDX}^5$$

$$vs := ma_{NDX}^6$$

$$\gamma_m := 131 \text{ pcf}$$

$$\gamma_c := 145 \text{ pcf}$$

$$A'_e := ma_{NDX}^7 \cdot 10^3 \text{ mm}^2$$

Masonry Wall Properties:

$$l_m := 1000 \text{ mm}$$

$$l_m = 39.37 \text{ in}$$

$$l_m = 1000 \text{ mm}$$

Length of Masonry Unit

$$h_m := 1000 \text{ mm}$$

$$h_m = 39.37 \text{ in}$$

$$h_m = 1000 \text{ mm}$$

Height of Masonry Unit

$$L_m := 6 \text{ m}$$

$$L_m = 19.69 \text{ ft}$$

$$L_m = 6.000 \text{ m}$$

Length of Masonry Wall

$$H_m := 2.45 \text{ m}$$

$$H_m = 8.04 \text{ ft}$$

$$H_m = 2.450 \text{ m}$$

Height of Masonry Wall

$$N_v := 0$$

$N_v = 0$ Voids Filled per 1000mm Length of Wall (0 to 5)
0 Being UngROUTed, and 5 Being Fully Grouted.

Section Properties:

$$A_g := l_m \cdot t_m$$

$$A_g = 372.00 \text{ in}^2$$

$$A_g = 0.24 \text{ m}^2$$

Gross X-Section Area

$$A_n := A_g \cdot vs$$

$$A_n = 189.72 \text{ in}^2$$

$$A_n = 1.22 \cdot 10^5 \text{ mm}^2$$

Conc X-Section Area (weight)

$$A_v := A_g - A_n$$

$$A_v = 182.28 \text{ in}^2$$

$$A_v = 1.18 \cdot 10^5 \text{ mm}^2$$

X-Section Void Area

$$A'_e = 126.64 \text{ in}^2$$

$$A'_e = 81700.00 \text{ mm}^2$$

CMU Effective Masonry Area

$$A'_v := A_g - A'_e$$

$$A'_v = 245.37 \text{ in}^2$$

$$A'_v = 1.58 \cdot 10^5 \text{ mm}^2$$

Effective X-Section Void Area

$$A_c := A'_v \cdot \left(\frac{N_v}{5} \right)$$

$$A_c = 0.00 \text{ in}^2$$

$$A_c = 0.00 \text{ mm}^2$$

Total Grout X-Section Area

$$wt_s := \gamma_m \cdot A_n \cdot h_m$$

$$wt_s = 566.25 \text{ lb}$$

$$wt_s = 2.52 \text{ kN}$$

Weight of Masonry Shell in Unit

$$wt_c := \gamma_c \cdot A_c \cdot h_m$$

$$wt_c = 0.00 \text{ lb}$$

$$wt_c = 0.00 \text{ kN}$$

Weight of Grout in Unit

$$wt_t := wt_s + wt_c$$

$$wt_t = 566.25 \text{ lb}$$

$$wt_t = 2.52 \text{ kN}$$

Total Weight of Masonry Unit

$$wt_m := \frac{wt_t}{h_m \cdot l_m}$$

$$wt_m = 52.61 \text{ psf}$$

$$wt_m = 2.52 \text{ kNpsm}$$

Weight per Unit Area

$$d_v := t_m - 2 \cdot t_s$$

$$d_v = 6.69 \text{ in}$$

$$d_v = 170.00 \text{ mm}$$

Equivalent Depth of Void

$$l_v := \frac{A'_v}{d_v} \cdot \left(\frac{5 - N_v}{5} \right)$$

$$l_v = 36.66 \text{ in}$$

$$l_v = 931.18 \text{ mm}$$

Length of Void

Properties at Bed Joint:

$$A_e := A'_e + A_c$$

$$A_e = 126.64 \text{ in}^2$$

$$A_e = 81700.00 \text{ mm}^2$$

Design Effective Masonry Area

$$Ix_m := \frac{l_m \cdot t_m^3 - l_v \cdot d_v^3}{12}$$

$$Ix_m = 1851.76 \text{ in}^4$$

$$Ix_m = 7.71 \cdot 10^8 \text{ mm}^4$$

Moment of Inertia

$$Sx_m := \frac{2 \cdot Ix_m}{t_m}$$

$$Sx_m = 391.96 \text{ in}^3$$

$$Sx_m = 6.42 \cdot 10^6 \text{ mm}^3$$

Section Modulus

Summary:**Material Property Factors**

$\varphi_m = 0.55$ Masonry

$\varphi_s = 0.85$ Rebar

Load Factors

$\alpha_L = 1.5$ Live Load

$\alpha_D = 1.25$ Dead Load

Wall Properties

Thickness Designation

$desI_t = "10 \text{ inch}"$

$desM_t = "250 \text{ mm}"$

Thickness of Masonry Unit

$t_m = 9.45 \text{ in}$

$t_m = 240.00 \text{ mm}$

Face Shell Thickness of Masonry Unit

$t_s = 1.38 \text{ in}$

$t_s = 35.00 \text{ mm}$

Density of Masonry Concrete

$\gamma_m := 131 \text{ pcf}$

Density of Void Grout

$\gamma_c := 145 \text{ pcf}$

Solid to Gross Area Ratio

$vs = 0.51$

Effective Area

$A_e = 126.64 \text{ in}^2$

$A_e = 81700 \text{ mm}^2$

Length of Unit Masonry

$l_m = 39.37 \text{ in}$

$l_m = 1000 \text{ mm}$

Height of Unit Masonry

$h_m = 39.37 \text{ in}$

$h_m = 1000 \text{ mm}$

Length of Masonry Wall

$L_m = 19.69 \text{ ft}$

$L_m = 6.000 \text{ m}$

Height of Masonry Wall

$H_m = 8.04 \text{ ft}$

$H_m = 2.450 \text{ m}$

Voids Filled per 1000mm Length of Wall (0 to 5)

$N_v = 0$

Wall Properties

Weight per Unit Area

$wt_m = 52.61 \text{ psf}$

$wt_m = 2.52 \text{ kNpsm}$

Design Effective Masonry Bedded Area

$A_e = 126.64 \text{ in}^2$

$A_e = 81700.00 \text{ mm}^2$

Moment of Inertia

$Ix_m = 1851.76 \text{ in}^4$

$Ix_m = 7.71 \cdot 10^8 \text{ mm}^4$

Section Modulus

$Sx_m = 391.96 \text{ in}^3$

$Sx_m = 6.42 \cdot 10^6 \text{ mm}^3$