TRASH ENCLOSURE

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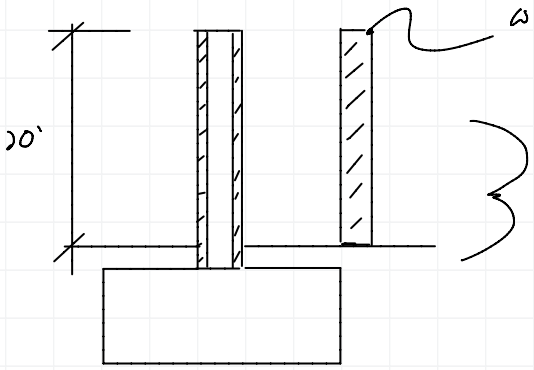

- SEE PROVIDED DESIGN SPREADSHEET FOR RESULTS

Description

Trash Enclosure Walls — IBC 2018 / TMS 402-16

Design Criteria

Masonry Strength	$f_m := 1900 \cdot psi$	Wall Thickness(nominal)	$t_n := 8 \cdot in$
Concrete Strength	$f_c := 3000 \cdot psi$	Wall Thickness (actual)	$t_a = 7.63\ in$
Steel Strength	$f_y := 60000 \cdot psi$	Section Width (wall & footing)	$b := 12 \cdot in$
Wall Height	$h := 10 \cdot ft$	Section Depth (wall)	$d_{wall} := 3.75 \cdot in$
Wall Weight	$w := 85 \cdot psf$	Gross Area (masonry)	$A_g = 91.5\ in^2$

Modulus of Elasticity

$E_s := 29000000 \cdot psi$ $\quad E_m = 1710000\ psi$ $\quad n := \frac{E_s}{E_m} = 16.96$

Loads

SEISMIC (ASCE 7-16 Section 13.3)

$S_{DS} := .845$	Spectral Acceleration (ASCE 7-16 Section 11.4.5)
$I_p := 1.0$	Component Importance Factor (ASCE 7-16 Section 13.1.3)
$a_p := 2.5$	Component Amplification Factor (ASCE 7-16 Table 13.5-1)
$R_p := 3.0$	Component Response Modification Factor (ASCE 7-16 Table 13.5-1)
$z := 0 \cdot ft$	Height in structure of anchorage (cantilevered from footing)
$W_p := 85 \cdot psf$	Seismic Wall Weight (includes veneer, etc.)

ASCE 7-16 Equation 13.3-1, 13.3-2, 13.3-3:

$$F_p := \left(\frac{0.4 \cdot a_p \cdot S_{DS} \cdot W_p}{\frac{R_p}{I_p}} \right) \cdot \left(1 + 2 \cdot \frac{z}{h} \right) = 23.9\ psf$$

WIND (ASCE 7-16 Section 29.3.1)

$K_d := .85$	Wind Directionality Factor (ASCE 7-16 Section 26.6 - Table 26.6-1)
$K_z := .85$	Velocity Pressure Exposure Coefficient (ASCE 7-16 Section 26.10.1 - Table 26.10-1)
$K_{zt} := 1.0$	Topographic Factor (ASCE 7-16 Section 26.8)
$V_{wind} := 97$	Wind Speed (mph)

ASCE 7-16 Equation 26.10-1:

$$q_z := \left(.00256 \cdot K_d \cdot K_z \cdot K_{zt} \cdot V_{wind}^2 \right) \cdot psf = 17.4\ psf$$

$G := .85$	Gust Effect Factor (ASCE 7-16 Section 26.11)
$C_f := 1.45$	Net Force Coefficient (ASCE 7-16 Fig. 29.3-1)

Shall not be less than: $F'_p := 0.3 \cdot S_{DS} \cdot I_p \cdot W_p$

$F'_p = 21.5\ psf$

ASCE 7-16 Equation 29.3-1:

$F_{wind} := q_z \cdot G \cdot C_f = 21.4\ psf$

Shall not exceed: $F''_p := 1.6 \cdot S_{DS} \cdot I_p \cdot W_p$

$F''_p = 114.9\ psf$

$F_{seismic} = 23.9\ psf$

CONTROLLING

$W_{latULT} = 23.9\ psf$ (Ultimate)

$W_{latASD} = 16.8\ psf$ (Allowable)

Footing Design

$B := 4 \cdot ft$ (Footing width)

$t_f := 15 \cdot in$ (Footing thickness)

$p_{allow} := 1500 \cdot psf$ (Allowable soil bearing pressure)

$W_{ftg} := b \cdot t_f \cdot B \cdot 150 \cdot \frac{lb}{ft^3} = 750\ lb$

$W_{wall} := w \cdot h \cdot b = 850\ lb$

$W_{total} := W_{ftg} + W_{wall}$

$W_{total} = 1600\ lb$

(ASCE 7-16 Section 2.4.1 & 12.14.3.2):

$W_{totalASD} := 0.6 \cdot W_{total} = 960\ lb$

$W_{total5} := \left(1.0 + 0.14 \cdot S_{DS}\right) \cdot W_{total} = 1789.28\ lb$

$W_{total8} := \left(0.6 - 0.14 \cdot S_{DS}\right) \cdot W_{total} = 770.72\ lb$

$M_{res8} := W_{total8} \cdot \frac{B}{2} = 1541\ lb \cdot ft$

$M_{ovtASD} := W_{latASD} \cdot b \cdot h \cdot \left(\left(\frac{h}{2}\right) + t_f\right) = 1047\ lb \cdot ft$

Overturning

$M_{res8} = 1541\ lb \cdot ft$

$M_{ovtASD} = 1047\ lb \cdot ft$

$Overturning_{check}$ = "Overturning okay"

Sliding

(ASCE 7-16 Section 12.14.3.1 Exception 2)

$u := 0.35$ Friction Coefficient (Including FOS)

$FOS := 1.5$

$F_{slidingASD} := W_{latASD} \cdot b \cdot h = 168\ lb$

$F_{slidingASD} = 167.59\ lb$

$F_{res} := 0.6 \cdot W_{total} \cdot u \cdot FOS = 504\ lb$

$Sliding_{check}$ = "Sliding okay"

Soil Bearing

(ASCE 7-16 Section 12.14.3.1 Exception 2)

$e := \frac{M_{ovtASD}}{W_{totalASD}} = 1.09\ ft$

$resultant$ = "In Outer Third"

$p_{soil.max} = 704\ psf$

$Bearing_{check}$ = "Bearing okay"

$Stability_{check}$ = "Stability okay"

Footing Rebar (ACI 318-14 Section 22.3)

Try #6 at 12" o.c (Transverse rebar)

$A_{s.footing} := 0.44 \cdot in^2$ (Area of steel in section width "b")

$d_{footing} := 11 \cdot in$ (Adjust based on footing thickness)

$$a_{footing} := \frac{A_{s.footing} \cdot f_y}{0.85 \cdot f_c \cdot b} = 0.86\ in$$

$$\phi M_{footing.nominal} := .9 \cdot A_{s.footing} \cdot f_y \cdot \left(d_{footing} - \frac{a_{footing}}{2}\right) = 20926\ lb \cdot ft$$

$M_{footingULT} = 1844\ lb \cdot ft$

$A_{s.footing.min} := 0.0018 \cdot t_f \cdot b = 0.32\ in^2$

$Footing_{check} =$ "Footing okay"

$Rebar_{check} =$ "Rebar meets minimum reinforcement requirement"

Footing Shear (ACI 318-14 Section 22.5.5)

$$\phi V_{footing.nominal} := 0.75 \cdot 2 \cdot \sqrt{\frac{f_c}{psi}} \cdot psi \cdot b \cdot d_{footing} = 10845\ lb$$

$V_{footingULT} = 1656\ lb$

$Shear_{check} =$ "Shear okay"

Wall Design (TMS 402-16 Section 9.3.5.2)

Try #5 at 24" o.c

$A_{s.wall} := 0.155 \cdot in^2$ (Area of steel in section width "b")

$$a_{wall} := \frac{A_{s.wall} \cdot f_y}{0.8 \cdot f_m \cdot b} = 0.51\ in$$

$$\phi M_{wall.nominal} := .9 \cdot A_{s.wall} \cdot f_y \cdot \left(d_{wall} - \frac{a_{wall}}{2}\right) = 2438\ lb \cdot ft$$

$$M_{wallULT} := W_{latULT} \cdot b \cdot h \cdot \left(\frac{h}{2}\right) = 1197\ lb \cdot ft$$

$Wall_{check} =$ "Wall okay"