MHA Engineers Inc
1623 Wright Avenue
Sunnyvale California 94087
408-735-1524

WIND RESISTANCE CALCULATIONS
WIND PRESSURE WITHOUT GUST LOADING
104 mph

HOMELAND VINLY INC.

7/8" X 13" T & G PANELS

2x7 RAIL MASTER

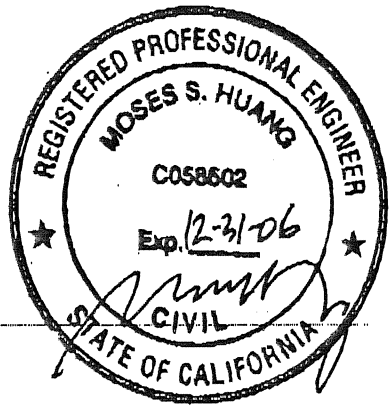
5x5x0.155 STANDARD POSTS

8 FT SPAN, 6FT HIGH FENCES WITH CONCRETE PIER FOUNDATION DESIGN.

REPORT H100304A

BY

MHA CONSULTING ENGINEERS INC



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HOMELAND VINYL - WIND LOAD CALCULATIONS

PANEL 7/8 x 13 T&G
(7)x 13 x 7/8" Interlocking T&G 5 FT RAIL TO RAIL with 8' span post to post

Calculate Section Properties
Post properties 5"x5" x 0.155 THK

$t := 0.155 \cdot in \quad b := 5.0 \cdot in \quad h := b - 2 \cdot t \quad h = 4.69\,in \quad h1 := b - t \quad h1 = 4.845\,in$

$$I1 := 2 \cdot b \cdot t \cdot \left(\frac{h1}{2}\right)^2 + 2 \cdot t \cdot \frac{h^3}{12} \qquad I1 = 11.761\,in^4$$

$$psf := \frac{lb}{ft^2}$$

Fence is 72" to top of rail from ground (74" - 2")

Horizontal members

Rail Master 2x7 top & bottom

$$I2 := \left(0.09 \cdot 5.75 \cdot 1.2 + 2 \cdot 0.09 \cdot \frac{2^2}{6}\right) \cdot in^4 \qquad I2 = 1.155\,in^4$$

rail section is closed section

Tongue and Grove Verticals 7/8" x 13"

13" wide x .05 Thk x 0.875" (depth) span 60" top to bottom rail

$$I4 := \left[2 \cdot 0.05 \cdot 13 \cdot (0.413)^2\right] \cdot in^4 + 6 \cdot 0.04 \cdot \frac{0.875^3}{12} \cdot in^4 \qquad I4 = 0.235\,in^4$$

Wind load factor ASCE 7-98
104 mph maximum wind speed
Design for other structures and open buildings

Basic wind speed $V := 104$ **mph**

$I := 0.77$ **importance factor asume 1 Category 1 minor structures for fence**

Pressure equation

$Kzt := 1$ **topographical assume level ground**

$Kd := 0.85$ **directionality assume normal to fence Table 6-6**
Struct type Solid signs

$Kz := 1.4$ **velocity pressure exposure assume C**
open area

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HOMELAND VINYL - WIND LOAD CALCULATIONS

$qz := 0.00256 Kz \cdot Kzt \cdot Kd \cdot I \cdot V^2 \cdot \frac{lb}{ft^2}$ $qz = 25.371\ lb\,ft^{-2}$

$qf := qz$ **No gust factor**

6ft fence at 8 feet post spacing

Loading to top & bot rails

$P := qf \cdot 3 \cdot ft$ $P = 76.114\ lb\,ft^{-1}$

Wind load for Panels

Post Case 1 8 ft spacing 6ft high

$Wfp := 8 \cdot ft \cdot P$ $Wfp = 608.913\ lb$ **Panel Loading from Ground up**

Post Moment Calculation with post considered fixed at ground and post as cantilever from ground level 0.0

$Mw := Wfp \cdot (6 \cdot ft) + Wfp \cdot .25 \cdot ft$ $Mw = 3.806 \times 10^3\ lb\,ft$

$psi := \frac{lb}{in^2}$

Post Stress calculation for 5"x5"x0.155" thk section

$St := Mw \cdot \frac{5 \cdot in}{I1 \cdot 2}$ $St = 9.707 \times 10^3\ psi$ **OK ~ 9756 psi Ultimate stress**

8 ft Post spacing, 5x5 post x0.135 wall

This is the limit of Utility posts. Tests of PVC flexural strength shows it to be 9756 psi using ASTM D790 procedures.

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HOMELAND VINYL - WIND LOAD CALCULATIONS

Check Horizontals for max wind condition of 104 mph which is post limit

Top & Bottom Rails Calculation considered as simply support with the Horizontal members as support beams for the 13" interlocking Panels Horizontals spans 8 ft

Slotted rail 2"x7" 6 ft span at 104 mph

$$Mw := qf \cdot 5.5 \cdot \frac{ft}{2} \cdot \frac{(8 \cdot ft)^2}{8} \qquad Mw = 558.171\ lb\,ft$$

$$St := Mw \cdot \frac{2 \cdot \frac{in}{2}}{I2} \qquad St = 5.799 \times 10^3\ psi$$ **OK <<9700 psi Ultimate stress**

Vertical Tongue & Grove 11.3" wide privacy panels

Max Span 5 ft for 7/8x13 T&G panels

$$w := 13 \cdot in \cdot qf \qquad w = 27.486\ lb\,ft^{-1}$$

$$M := \frac{w \cdot (5 \cdot ft)^2}{8} \qquad M = 85.893\ lb\,ft \qquad Sy := \frac{I4}{0.438 \cdot in}$$

$$Stress := \frac{M}{Sy} \qquad Stress = 1.92 \times 10^3\ psi$$

Post is limiting at 104 mph in all cases other components are adequate

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HOMELAND VINYL - WIND LOAD CALCULATIONS

Post Foundation Calculation

Based on 104 mph Florida fence wind speed criteria

12" diameter piers depth to be determined

Soils criteria, sandy clays

Generalized soil categories	cohesion	internal friction angle ϕ
Clean Gravel sand mixture	0	36 degrees
Sand-Silt Clay mixture	7 psi	32
Inorganic Clays	12psi	27

Rankine Formula for passive earth pressure

Pressure coefficent Kp without considering cohesion

$\phi := 32 \cdot deg$

$Kp := \tan\left(45 \cdot deg + \frac{\phi}{2}\right)^2$ $Kp = 3.255$ $\gamma := 120 \cdot \frac{lb}{ft^3}$ soil density

Passive pressure is a function of depth

$d := 3.33 \cdot ft$ **depth** $Dp := 1 \cdot ft$ **pier diameter**

$Pp := Dp\,Kp \cdot \gamma \cdot d$ $Pp = 1.301 \times 10^3\ lb\,ft^{-1}$

Overturning moment at point of fixity (12" diameter pier)

point of fixity is where shear is zero

$h := 6 \cdot ft$ **fence height**

$hf := \left(\frac{Wfp \cdot 2}{Dp \cdot Kp \cdot \gamma}\right)^{0.5}$ $hf = 1.766\,ft$ **Rails loads top & bot so x 2**

$OTM := Wfp \cdot \left(\frac{h}{2} + hf\right)$ $OTM = 2.902 \times 10^3\ lb\,ft$

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HOMELAND VINYL - WIND LOAD CALCULATIONS

Soil restoring moment consider pier has effective resistance area of 2.5 diameters 30 deg spread

$$RM := Pp \cdot 2.5 \cdot \frac{d}{2} \cdot \frac{d}{3} \qquad RM = 6.009 \times 10^{3}\ lb\,ft \qquad SF := \frac{RM}{OTM} \qquad SF = 2.071$$

Foundation requires o 3 ft - 4 in depth for a SF = 2.0 which is normal

Please note:
Foundation depth will vary with soil properties. The above are some typical values for generalized soil types as a basis of calculation.

Specifiic engineering calculations may be performed for fences installed in soils which have known properties.