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 STRUCTURAL ENGINEERS
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JOB TITLE PSE - OTC - TYPE 1 FENCE & GATE FOUNDATIONS

JOB NO. 21239
CALCULATED BY DL
CHECKED BY


SHEET NO.
DATE
DATE

CS2018 Ver 2020.09.26

www.struware.com

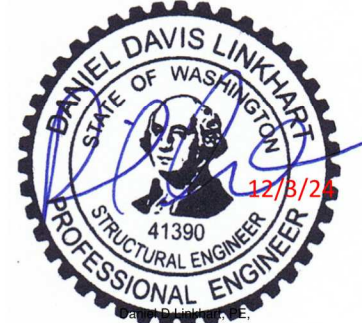
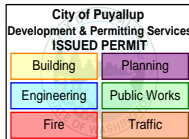
City of Puyallup
Building
REVIEWED
FOR
COMPLIANCE

BSnowden
 12/18/2024
 9:20:29 AM



Calculations required to be provided by the Permittee on site for all Inspections

PRFN20241253



DIGITAL SEAL
 ON PDF FILE

STRUCTURAL CALCULATIONS

FOR

PSE - OTC - TYPE 1 FENCE & GATE FOUNDATIONS

Puyallup, WA

Code: International Building Code 2021 Risk Category: II
 Loads:

Wind: 98mph / exp B

Soils: Basis: TERRA REPORT 4/6/23
 Allowable Passive Pressure: 300 PSF

Description:

Cast-in-place concrete foundations at posts for type 1 fences and gates. Posts and other non-foundation components by others.

Page	Item
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1	Cover Sheet
2-4	Wind Loads
5-10	Foundation Design

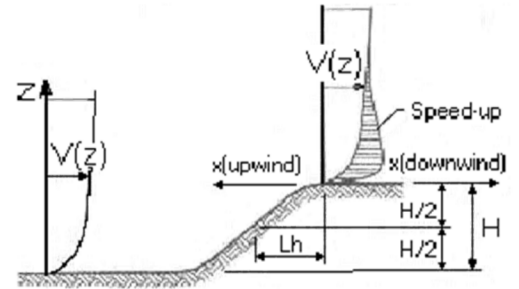
Wind Loads : ASCE 7- 16

Ultimate Wind Speed	98 mph
Nominal Wind Speed	75.9 mph
Risk Category	II
Exposure Category	B
Enclosure Classif.	Enclosed Building
Internal pressure	+/-0.18
Directionality (Kd)	0.85
Kh case 1	0.701
Kh case 2	0.653
Type of roof	Monoslope

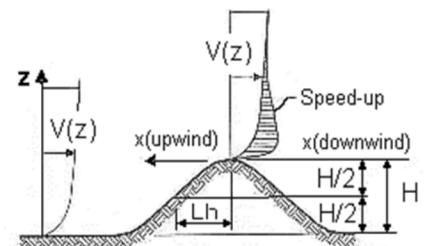
Topographic Factor (Kzt)

Topography	Flat
Hill Height (H)	0.0 ft
Half Hill Length (Lh)	0.0 ft
Actual H/Lh =	0.00
Use H/Lh =	0.00
Modified Lh =	0.0 ft
From top of crest: x =	0.0 ft
Bldg up/down wind?	downwind
H/Lh= 0.00	K ₁ = 0.000
x/Lh = 0.00	K ₂ = 0.000
z/Lh = 0.00	K ₃ = 1.000
At Mean Roof Ht:	Kzt = (1+K ₁ K ₂ K ₃) ² = 1.00

H < 60ft; exp B
∴ Kzt=1.0



ESCARPMENT



2D RIDGE or 3D AXISYMMETRICAL HILL

Gust Effect Factor

h =	23.5 ft
B =	208.0 ft
/z (0.6h) =	30.0 ft

Flexible structure if natural frequency < 1 Hz (T > 1 second).

If building h/B > 4 then may be flexible and should be investigated.

h/B = 0.11 Rigid structure (low rise bldg)

G = 0.85 Using rigid structure default

Rigid Structure

\bar{e} =	0.33
l =	320 ft
Z _{min} =	30 ft
c =	0.30
g _Q , g _v =	3.4
L _z =	310.0 ft
Q =	0.81
I _z =	0.30
G =	0.81

Flexible or Dynamically Sensitive Structure

34 rcy (η ₁) =	0.0 Hz
Damping ratio (β) =	0
/b =	0.45
/α =	0.25
Vz =	63.2
N ₁ =	0.00
R _n =	0.000
R _n =	28.282
R _B =	28.282
R _L =	28.282
g _R =	0.000
R =	0.000
Gf =	0.000
η =	0.000
η =	0.000
η =	0.000
h =	23.5 ft

Enclosure Classification

Test for Enclosed Building: $A_o < 0.01A_g$ or 4 sf, whichever is smaller

Test for Open Building: All walls are at least 80% open.
 $A_o \geq 0.8A_g$

Test for Partially Enclosed Building: Predominately open on one side only

	Input		Test	
Ao	500.0	sf	$A_o \geq 1.1A_{oi}$	NO
Ag	600.0	sf	$A_o > 4'$ or $0.01A_g$	YES
Aoi	1000.0	sf	$A_{oi} / A_{gi} \leq 0.20$	YES
Agi	10000.0	sf		

Building is NOT Partially Enclosed

Conditions to qualify as Partially Enclosed Building. Must satisfy all of the following:

- $A_o \geq 1.1A_{oi}$
- $A_o >$ smaller of 4' or 0.01 Ag
- $A_{oi} / A_{gi} \leq 0.20$

Where:

- Ao = the total area of openings in a wall that receives positive external pressure.
- Ag = the gross area of that wall in which Ao is identified.
- Aoi = the sum of the areas of openings in the building envelope (walls and roof) not including Ao.
- Agi = the sum of the gross surface areas of the building envelope (walls and roof) not including Ag.

Test for Partially Open Building: A building that does not qualify as open, enclosed or partially enclosed.
(This type building will have same wind pressures as an enclosed building.)

Reduction Factor for large volume partially enclosed buildings (Ri) :

If the partially enclosed building contains a single room that is unpartitioned , the internal pressure coefficient may be multiplied by the reduction factor Ri.

Total area of all wall & roof openings (Aog): 0 sf
Unpartitioned internal volume (Vi) : 0 cf
Ri = 1.00

Ground Elevation Factor (Ke)

Grd level above sea level = 0.0 ft
Constant = 0.00256
Adj Constant = 0.00256
Ke = 1.0000

Wind Loads - Other Structures:

ASCE 7- 16

Ultimate Wind Pressures

Wind Factor = 1.00
 Gust Effect Factor (G) = 0.85 Ultimate Wind Speed = 98 mph
 Kzt = 1.00 Exposure = B

A. Solid Freestanding Walls & Solid Signs (& open signs with less than 30% open)

Dist to sign top (h)	8.0 ft	s/h =	1.00	Case A & B
Height (s)	8.0 ft	B/s =	25.00	C _f = 1.30
Width (B)	200.0 ft	Lr/s =	0.00	F = q _z G C _f A _s = 16.0 As
Wall Return (Lr) =		Kz =	0.575	A _s = 10.0 sf
Directionality (Kd)	0.85	qz =	12.0 psf	F = 160 lbs
Percent of open area to gross area	0.0%	Open reduction factor =	1.00	Case C
		Case C reduction factors		Horiz dist from windward edge
		Factor if s/h>0.8 =	0.80	0 to s
		Wall return factor for C _f at 0 to s =	1.00	s to 2s
				2s to 3s
				3s to 4s
				4s to 5s
				5s to 10s
				>10s
				C _f
				F=q _z G C _f A _s (psf)
				3.29
				2.07
				1.59
				1.31
				1.23
				0.78
				0.44
				33.6 As
				21.1 As
				16.2 As
				16.0 As
				16.0 As
				16.0 As

B. Open Signs & Single-Plane Open Frames (openings 30% or more of gross area)

Height to centroid of A _f (z)	4.0 ft	Kz =	0.575
Width (zero if round)	0.0 ft	Base pressure (q _z) =	12.0 psf
Diameter (zero if rect)	0.0 ft	D(qz) ^{0.5} =	0.04
Percent of open area to gross area	65.0%	I =	0.35
Directionality (Kd)	0.85	C _f =	1.5
		F = q _z G C _f A _f =	16.0 Af
		Solid Area: A _f =	10.0 sf
		F =	160 lbs

wire diameter = 0.155"

C. Chimneys, Tanks, & Similar Structures

Height to centroid of A _f (z)	12.7 ft	Kz =	0.575
Cross-Section	Round	Base pressure (q _z) =	13.4 psf
Directionality (Kd)	0.95	h/D =	46.15
Height (h)	25.0 ft	D(qz) ^{0.5} =	1.98
Width (D)	0.5 ft		
Type of Surface	Moderately smooth		
		Round	
		C _f =	1.20
		F = q _z G C _f A _r =	16.0 Af
		A _r =	19.0 sf
		F =	304 lbs

D. Trussed Towers

Height to centroid of A _f (z)	15.0 ft	Kz =	0.575
ε =	0.27	Base pressure (q _z) =	13.4 psf
Tower Cross Section	triangle	Diagonal wind factor =	1
Member Shape	flat	Round member factor =	1.000
Directionality (Kd)	0.95		
		Triangular Cross Section	
		C _f =	2.38
		F = q _z G C _f A _r =	27.1 Af
		Solid Area: A _r =	10.0 sf
		F =	271 lbs

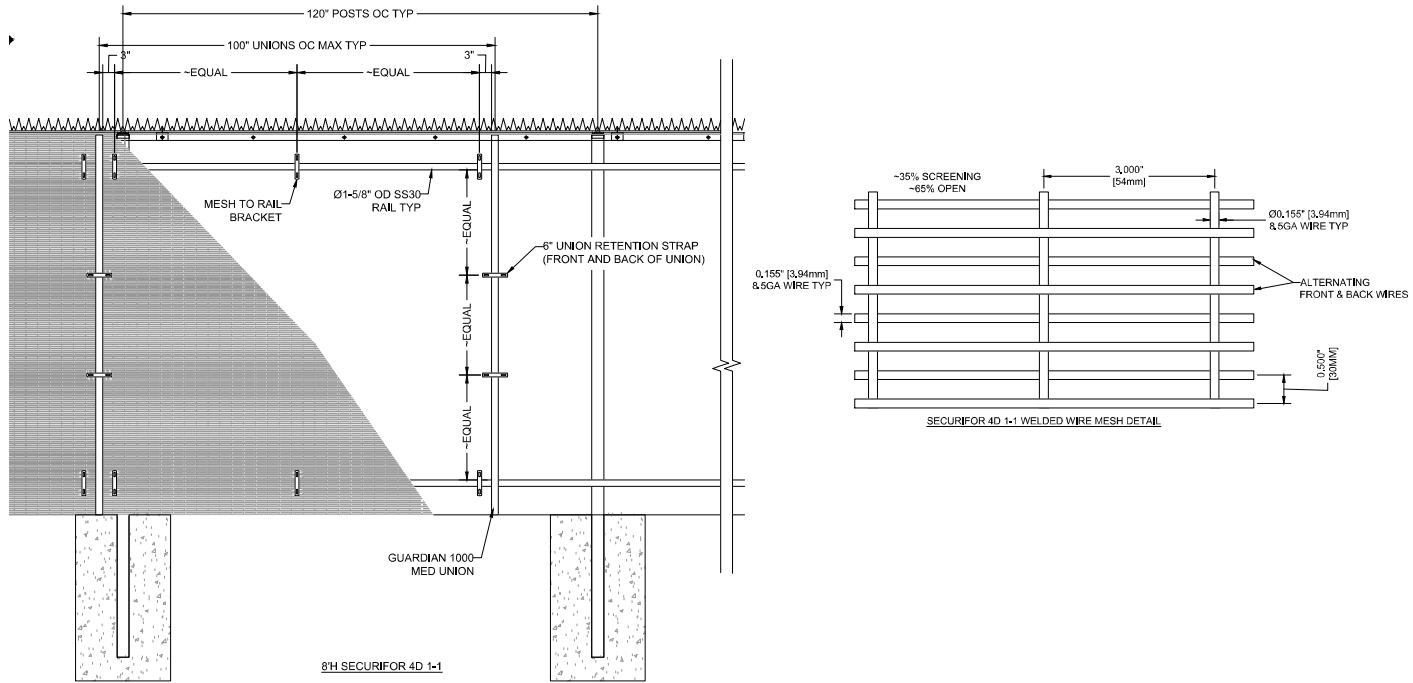


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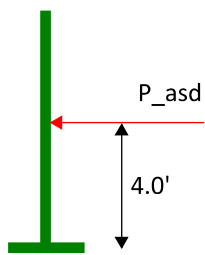
PROJECT	PSE - OTC		
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ENGINEER	PROJECT NO.	DATE	PAGE
DL	21239	12/3/24	

Typ Type 1 fence



① TYPICAL ELEVATION
SCALE: NTS

p_{1.0W} = 16.0 PSF per attached

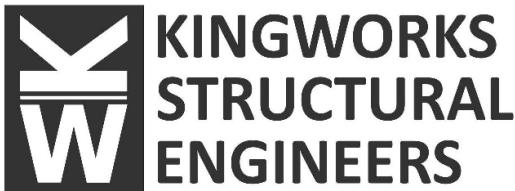


conservative, includes frame plus some debris coverage

$$P_{asd} = 8'h \times 10'w \times 16 \text{ psf} \times 0.6 \text{ asd} \times 0.5 \text{ solid} = 384\#$$

Passive resistance = 300 psf/ft per geotech report

Min fdn per mfr = 24"Ø x 42" deep --> OK per attached spreadsheet

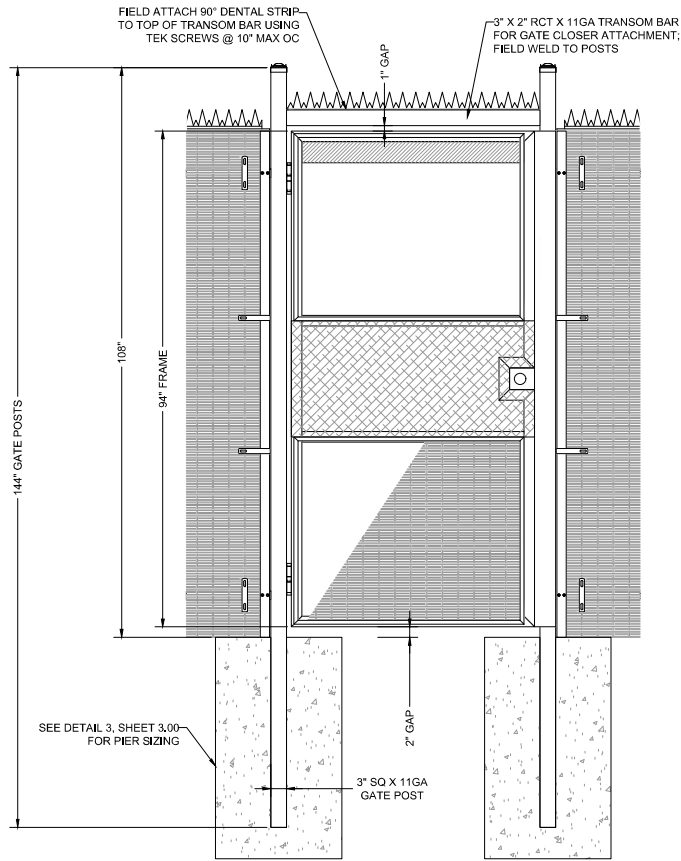


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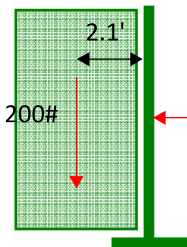
PROJECT PSE - OTC			
DESCRIPTION TYPE 1 FENCE & GATE FOUNDATIONS			
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Pedestrian gate



1 TYPICAL ELEVATION
SCALE: NTS

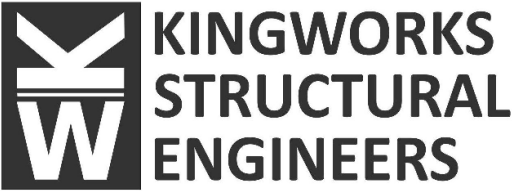
p_1.0W = 16.0 PSF per attached



conservative, includes frame plus some debris coverage

$$P_{equiv_asd} = [8'h \times (10'/2 + 4.3') \times 16 \text{ psf} \times 0.6 \text{ asd} \times 0.5 \text{ solid}] + [200\# \times 2.3'/4.0'] = 472\#$$

Min fdn per mfr = 24"Ø x 42" deep --> OK per attached spreadsheet



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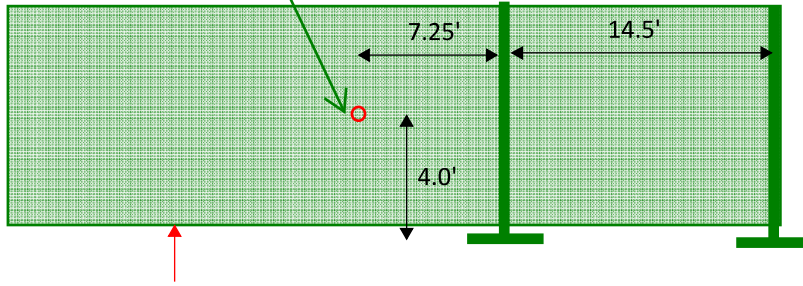
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PROJECT PSE - OTC		12/03/24	
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Vehicle gate - CONT'D

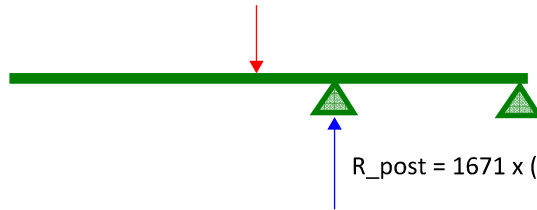
DOUBLE POST

centroid of wind force on gate cantilevering perpendicular to posts



self wt resisted by rollers on ground

$$P_{asd} = 8'h \times 43.5'w \times 16 \text{ psf} \times 0.6 \text{ asd} \times 0.5 \text{ solid} = 1671\#$$



$$R_{post} = 1671 \times (21.75'/14.5') = 2506\#$$

Min fdn per mfr = 36"Ø x 90" deep --> OK per attached spreadsheet

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IBC 1807.3 Pole Foundation

Project	PSE - OTC	#21239
Description	type 1 fence & gate foundations	
Engineer	DL	Date

	typ 10ft oc		DBL POST	DBL SWING	CATCH	PEDGATE	CASE 6	
Nonconstrained:	TRUE		TRUE	TRUE	TRUE	TRUE		
b=Diameter of round or diagonal dimension of square footing:	2	FT	3	2.5	3	2		
h=Distance in feet from ground surface to point of load application:	4	FT	4	4	4	4		
P=Applied load	384	LB	2506	723	749	472		
Presumptive Lateral Bearing Pressure:	300		300	300	300	300		
Nonconstrained only:								
S1=Allowable lateral soil bearing pressure as set forth in section 1806.2 based on a depth of one - third the depth of embedment								
	S1=	325	PSF	584	381	360	350	
	A=	1.38		3.35	1.78	1.62	1.58	N/A
d=Depth of embedment in earth but not over 12 feet		3.24	FT	5.84	3.81	3.59	3.53	N/A
	calculated S1	324		584	381	359	353	N/A
Constrained only:	covergence test	TRUE		TRUE	TRUE	TRUE	TRUE	N/A
S3=Allowable lateral soil bearing pressure as set for the in section 1806.2 based on a depth equal to the depth of embedment								
	S3=		PSF					
d=Depth of embedment in earth but not over 12 feet		N/A	FT	N/A	N/A	N/A	N/A	N/A
	calculated S3	N/A		N/A	N/A	N/A	N/A	N/A
	covergence test	N/A		N/A	N/A	N/A	N/A	N/A

Table 1806.2 Presumptive Load Bearing Values

Lateral Bearing Pressure

Bedrock	400 to 1200 psf/ft
Sandy gravel or or gravel	200 psf/ft
sand, silty sand, silty gravel and clayey gravel	150 psf/ft
clay sandy clay, silty clay, clayey silt, silt, and sandy silt	100 psf/ft

1806.1 Lateral loads may be increased by 1/3 where used with the alternative basic load combinations of section 1605.3.2 that include wind or earthquake loads

1806.3.3 Lateral loads may be increased by the value above for each additional foot of depth to a maximum of 15 times the tabular value

1806.3.4 Increase for poles: Isolated poles for uses such as flagpoles or signs and poles used to support buildings that are not adversely affected by a 1/2 inch motion at the ground surface due to short term lateral loads shall be permitted to be designed using lateral bearing pressures equal to two times the tabular values