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Shaw Substation Transformer #4 Foundation Design Calculations

Shaw Substation
Ocala, Florida

Prepared for: Ocala Electric Utilities - OEU
Prepared by: GAI Consultants, Inc.

GAI Project Number: R220058.06

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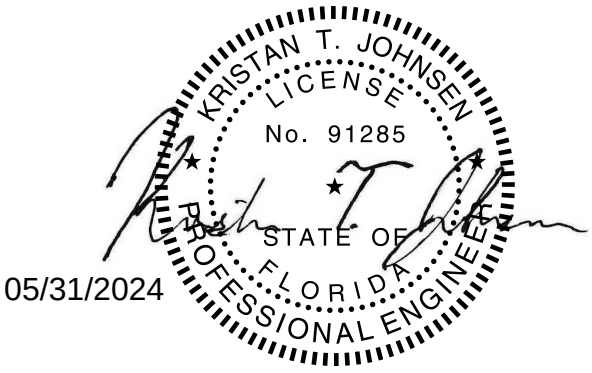
May/2024



05/31/2024

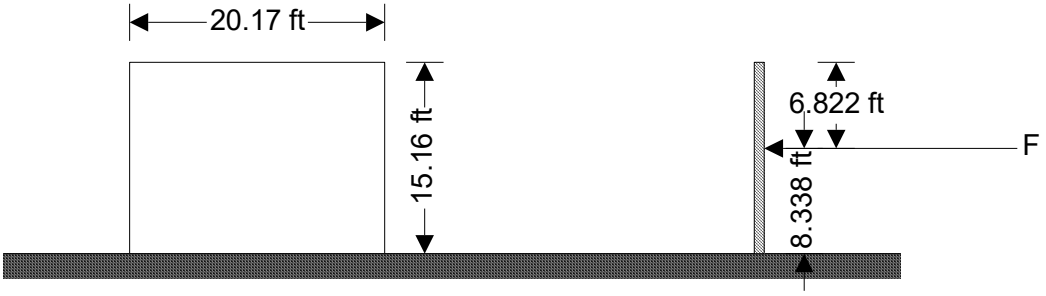
Tekla Tedds	Project: Ocala Shaw Substation				Job Ref.	
	Section: Transformer #4 Foundation				Sheet no./rev.: 1	
	Calc. by: KTJ	Date: 5/10/2024	Chk'd by	Date	App'd by	Date

WIND LOADING

In accordance with ASCE7-16

Using the directional design method

Tedds calculation version 2.1.13



Wall/sign data

Length of wall/sign	B = **20.17** ft
Height of wall/sign	s = **15.16** ft
Height to top of sign	h = **15.16** ft

General wind load requirements

Basic wind speed	V = **130.0** mph
Risk category	II
Velocity pressure exponent coef (Table 26.6-1)	K_d = **0.85**
Ground elevation above sea level	z_{gl} = **0** ft
Ground elevation factor	$K_e = \exp(-0.0000362 \times z_{gl}/1ft)$ = **1.00**
Exposure category (cl 26.7.3)	B

Gust effect factor for rigid structures

Terrain exposure constants (Table 26.11-1)	
Integral length scale factor	l = **320.0** ft
Turbulence intensity factor	c = **0.30**
Minimum equivalent height	z_{min} = **30.0** ft
Peak factor for background response	g_Q = **3.400**
Peak factor for wind response	g_v = **3.400**
Integral length scale power law exponent	$\bar{\varepsilon}$ = **0.333**
Equivalent height of the structure	$\bar{z} = \max(0.6 \times h, z_{min})$ = **30.00** ft
Intensity of turbulence (Eqn. 26.11-7)	$I_{\bar{z}} = c \times (33\ ft / \bar{z})^{1/6}$ = **0.30**
Integral length scale of turbulence (Eqn. 26.11-9)	$L_{\bar{z}} = l \times (\bar{z} / 33\ ft)^{\bar{\varepsilon}}$ = **310.00** ft
Background response (Eqn. 26.11-8)	$Q = \sqrt{(1 / (1 + 0.63 \times ((B + h) / L_{\bar{z}})^{0.63}))}$ = **0.928**
Gust effect factor (Eqn. 26.11-10)	$G = G_f = 0.925 \times (1 + 1.7 \times g_Q \times I_{\bar{z}} \times Q) / (1 + 1.7 \times g_v \times I_{\bar{z}})$ = **0.88**
Minimum design wind loading (cl.27.1.5)	p_{min_r} = **8** lb/ft^2

Topography

Topography factor not significant	K_{zt} = 1.0

Velocity pressure

Velocity pressure coefficient (Table 26.10-1)	K_z = **0.57**
Velocity pressure	$q_h = 0.00256 \times K_z \times K_{zt} \times K_d \times K_e \times V^2 \times 1psf/mph^2$ = **21.0** psf

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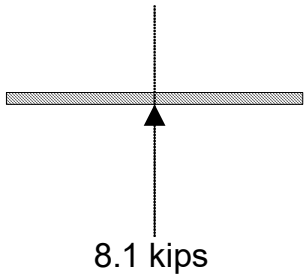
Area of sign $A_f = B \times s =$ **305.777** ft^2

Ratio of solid area to gross area $\varepsilon =$ **1.00**

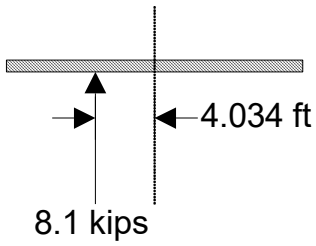
Wall/sign forces – Case A and B

Force coefficient (Figure 29.3-1) $C_{f\_A} =$ **1.43**

Resultant force $F_A = \max(16psf, q_h \times G_f \times C_{f\_A}) \times A_f =$ **8.1** kips



Plan - Case A



Plan - Case B

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BEARING PRESSURES FOR RECTANGULAR FOOTINGS

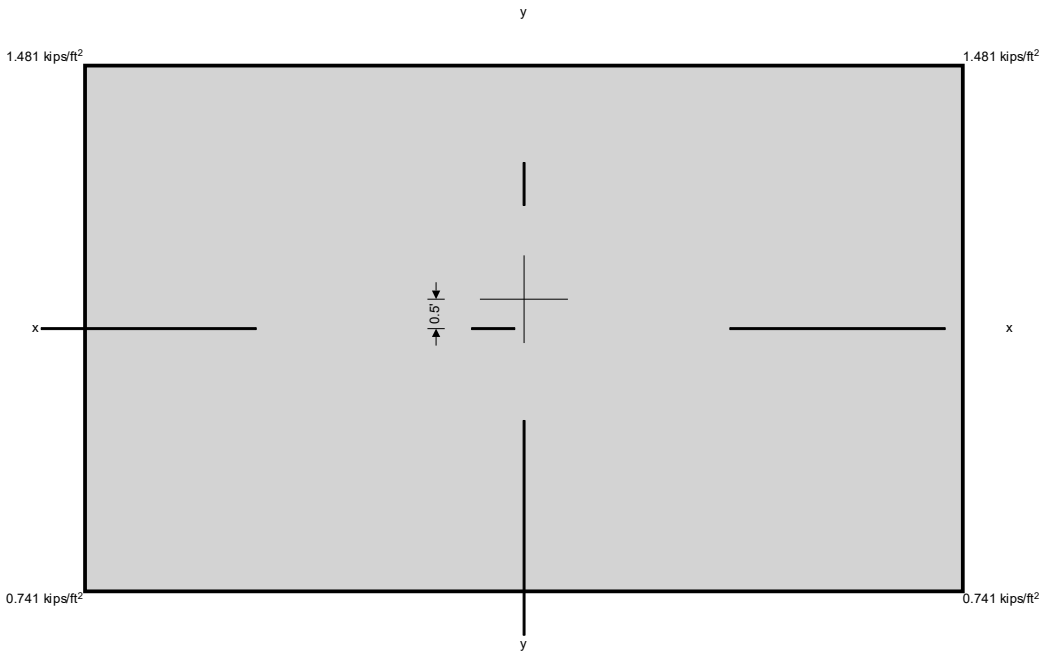
Tedds calculation version 1.0.05

Design summary

Description	
Four corners are in bearing	
100 % of footing area is acting in bearing	
Maximum bearing pressure is 1.481 kips/ft^2	

Footing details

Length of footing	Lx = **15** ft
Width of footing	Ly = **9** ft
Total base reaction	Pz = **150** kips
Eccentricity of base reaction in x-axis	ex = **0** ft
Eccentricity of base reaction in y-axis	ey = **0.5** ft



Corner base pressures	q1 = Pz × (1 - 6 × ex / Lx - 6 × ey / Ly) / (Lx × Ly) = **0.741** kips/ft^2
	q2 = Pz × (1 - 6 × ex / Lx + 6 × ey / Ly) / (Lx × Ly) = **1.481** kips/ft^2
	q3 = Pz × (1 + 6 × ex / Lx - 6 × ey / Ly) / (Lx × Ly) = **0.741** kips/ft^2
	q4 = Pz × (1 + 6 × ex / Lx + 6 × ey / Ly) / (Lx × Ly) = **1.481** kips/ft^2
Maximum bearing pressure	qmax = max(q1, q2, q3, q4) = **1.481** kips/ft^2
Percentage of footing area acting in bearing	BearingPercentage = **100** %