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RE: B&J Metal Fab. - Sign Structure

The attached drawing shws a proposed sign structure that is existing. The proposed signs are shown on the drawing. Total height will be 22 Ft.

Calculations are attached for:

1. Pole bending strength.	Existing Poles OK
2. Soil Lateral Strength.	Lateral Strength OK
3. Concrete pullout from wind uplift	Pullout OK

Recommendation: Add steel angles between vertical columns and brace columns to cause 4 columns to act together to resist wind forces. Angles may be similar to existing angles.

11/20/19

Patricia Rogers

Applicable Codes

ICC International Building Code IBC2012

Minimum Design Loads for Buildings ASCE7-10
American Concrete Institute ACI 318-08
WF&PA NDS 2012

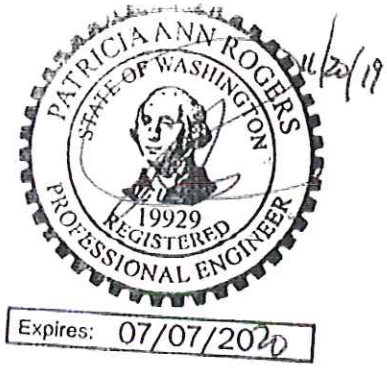
Design Criteria Structural

Wind Speed	100 ult MPH
Terrain Exposure Category	B

Use ASCE7-10 Procedure Chapter 29
Section 29.4 for Freestanding Walls & Solid Signs

Dimensions

Height	22.0
Average Width	12.5
Height of Bottom of Sign	0
Height of Brace	6
Area SF	275 ft2
Area Above Brace	200



11/20/19

Expires: 07/07/2020

Lateral Calculations **B&J Metal Fab** **P2**

Calculate Wind Forces

$q_z=0.00256\ K_z\ K_{zt}\ K_d\ V^2$

Kz	0.66	ASCE7-10 Sec 29.3.1
Kzt	1.00	
Kd	0.85	ASCE7-10 Sec 26.6
qz=	14.4	

$F=q_h G\ C_f\ A_s$

Clearance Ratio	0.00
Aspect Ratio	0.43
Cf	1.85 From Table 29.4.1

Wind Factor in Load Combinations 0.6
For Category I Structure

G 0.85 ASCE7-10 Sec 26.9

	Force		Arm	Moment Ft Lb	
F1=	2,710	X1=	8	21,680	Above Strut
F1=	3,726	X1=	11	29,810	Above base

Force Tens/ Comp at Attach to Pole	3416 Lb
Strut Tension	4816 Lb
Bolt Diameter	0.625
Bolt Area	0.30664
Number of Bolts	2
Tension bolt	7,853 PSI
Live Load Factor	1.6
LRFD Tension	12,565 psi
Yield Strength	120,000 psi

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ASD Load Combinations for ASCE7-10

1	D
2	D+L
3	D+(Lr or S ro R)
4	D+0.75L+0.75(Lr or S ro R)
5	D+(0.6W or 0.7E)
6a	D+0.75L+0.75(0.6W)+0.75(Lr or S ro R)
6b	D+0.75L+0.75(0.7E)+0.75S
7	0.6D+0.6W
8	0.6D+0.7E

Governing Combinations for this project

5	0.6W	Use Full Wind
7	0.6W	Use Full Wind

Tubing Sizing

Moment at attach Point	21,680 Ft Lb
Moment at Attach	260,163 In Lb
Ultimate Tensile Steel	60,000 psi
Live Load Factor	1.6
Allowable Tensile	37,500 psi
Section Modulus	6.9 in3
Modulus per Column	3.5 in3

Lateral Calculations **B&J Metal Fab** **P4**

pi r4/4

	out	In
Diameter	4	3.36
Radius	2	1.68
Ix	12.56	6.25326

Net Area Moment	6.30674
Modulus	3.15337
Stress	41,252
With LL Factor	66,003
Grade B Pipe	
Ultimate	65000 psi

Pipe strength equal to Requirement Design OK

Footings		
Lateral	3,726	
Force per Column	932	
Lateral Soil Bearing	100	Lb/SF/Ft
Double for poles	200	Lb/SF/Ft
Lateral Bearing at top	0	PSF
Pole Depth	3.5	Ft
Lateral Pressure at Bottom	700	PSF
Average Lateral Bearing	350	PSF
Pole width	1.5	
Number Poles	4	
Poles area	21	
Pole Lateral Strength	7350	**Lb**
50 percent safety factor for soils		
Factored Lateral Force	5,589	

Lateral Strength Greater than Factored Force
Design OK

Lateral Calculations **B&J Metal Fab** **P5**

Pole Uplift
Calculate Moment at base

Total Lateral Force	3,726	Lb
Moment at Base	29810	Ft Lb
Uplift at Poles	4968	Lb
Uplift per Pole	2484	Lb
50 percent safety factor for soils		
Factored uplift	3726.3	

Soil Uplift Calculation
Calculate Soil Weight for Uplift

Outside Column	Symbol	Units	Value
Grade to Top of Collar	Dt	In	42
Collar Diameter	Rc	In	18
Internal soil Friction Angle	Phi	Deg	36
Post Cross Section	Ap	IN2	1
Soil Density	Ds	PCF	120
Tangent Friction Angle			0.72647
Post Area SF			0.00694
Collar Radius Ft			0.75
Term 1			0.5625
Term2			1.90699
Term3			2.15503
Soil Volume	Vs	51 FT3	
Soil Weight	Ws	6,096 LB	Design OK

Pole Uplift Capacity Greater than predicted uplift
Design OK