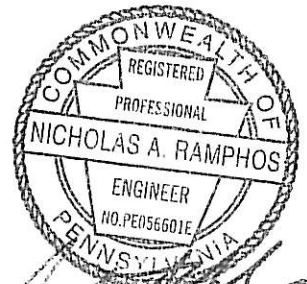


Structural Engineering Calculations for:

Akers Signs

LRC
JOB # 16284

Per PA Building Code
Nominal Wind Speed = 90 MPH



SEP 19 2016

WIND LOADS

Project: Akers Signs
 Descript:
 Ref:

Note # 1 Basic Wind Speed is the 3 second gust @ 33 ft.above ground, exposure

Basic Wind Speed= 90 mph
 Exposure= C flat terrain, generally open for 1/2 mile.
 Cq= 1.2 signs, flagpoles and lightpoles

Note #4 Cq= Pressure Coefficient

<i>Calculation of Design Wind Pressures</i>						Kz
Height (ft):	(qs)	(G)	(Cf)	= Wind Pressure		
						0.85
						0.9
						0.94
						0.98
15	17.6	0.85	1.2	18.0 psf		1.04
20	18.7	0.85	1.2	19.0 psf		1.09
25	19.5	0.85	1.2	19.9 psf		1.13
30	20.3	0.85	1.2	20.7 psf		1.17
40	21.6	0.85	1.2	22.0 psf		1.21
60	23.4	0.85	1.2	23.9 psf		1.24
80	25.1	0.85	1.2	25.6 psf		1.26
100	21.3	0.85	1.2	21.8 psf		1.31
120	21.9	0.85	1.2	22.3 psf		
160	22.2	0.85	1.2	22.7 psf		
200	23.1	0.85	1.2	23.6 psf		
300	15.0	0.85	1.2	15.3 psf		
400	15.0	0.85	1.2	15.3 psf		

Note # 5 Design Wind Pressu

Seismic Load Comparison

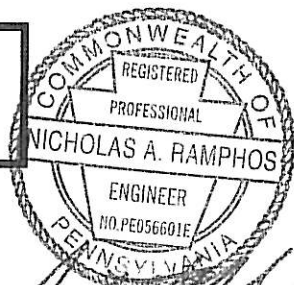
Seismic Zone= 1
 Z= 0.1
 I= 1.0 standard structures
 Cp= 2.0
 Wp= 15.0 psf, typical sign box with structure
 Fp= (Z)(I)(Cp)(Wp)= 2.3 psf **Design Base Shear**

Note: Less than wind pressure above, so seismic not a factor and wind governs calculations

Note # 2 Signs use a Wind Importance Factor, (Iw) of 1.0

Note # 3 Not Applicable

Seismic Use Group
 Spectral response coefficients Sds = .17 Sd1 = .04
 Site class D
 Basic seismic force resisting system from Table 1617.6 #7



Nicholas A. Ramphos

SEP 19 2016

STEEL COLUMN DESIGN

Descript: Akers Signs

Ref: Manual of Steel Construction, AISC 9th Edition

Areas Subject to Wind Forces

Description	Height (ft)	Width (ft)	Area (sqft)	Centroid (ft)	Wind (psf)
1) sign wind	8.67	14.00	121.38	19.7	18.0
2) cover					18.0
3)					
4)					
5)					
6)					
7)					
8)					

Calculation of Design Forces at Critical Heights

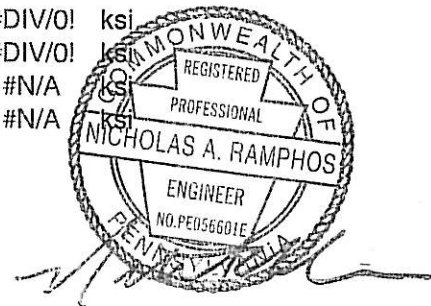
y (ft)	M (#)	V (#)	y (ft)	M (#)	V (#)
@ grade	43,041	2,185			
25.33			72.50		
			72.50		

Column Support Design Table

# of Cols	Column Type (P, TS)	Column Size	Length (ft)	Start Elev (ft)	End Elev (ft)	Sleeve Depth (in)	S act (in ³)	fb (ksi)
1	ts	8XX.25	24.00		24.00	N/A	18.80	27.5
	ts	#DIV/0!	5.00	10.00	15.00	#DIV/0!	#DIV/0!	#DIV/0!
	ts	#DIV/0!				#DIV/0!	#DIV/0!	#DIV/0!
	TS	#DIV/0!		72.50	72.50	#DIV/0!	#DIV/0!	#DIV/0!
		FALSE		72.50	72.50		FALSE	#DIV/0!
		FALSE		72.50	72.50		FALSE	#DIV/0!

Allowable Bending Stresses

Column Type	Column Size	Criteria	Stress increase factor=	1.00
ts	8XX.25	b/t <238/sqr(Fy)	so... Fb= 0.6Fy	27.6 ksi
ts	#DIV/0!	b/t #DIV/0!	so... Fb= #DIV/0!	#DIV/0! ksi
ts	#DIV/0!	b/t #DIV/0!	so... Fb= #DIV/0!	#DIV/0! ksi
TS	#DIV/0!	b/t #DIV/0!	so... Fb= #DIV/0!	#DIV/0! ksi
	FALSE	help #N/A	so... Fb= #N/A	#N/A
	FALSE	help #N/A	so... Fb= #N/A	#N/A



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LATERAL BEARING PIER AND CAISSON FOOTINGS

# Footings= 1		Moment/Footing, M=	43,041 lb-ft
Pass lat soil res, q=	200 psf	Composite Centroid, h=	19.70 ft
		Equiv Concentrated Load, P= M/h=	2,185 lb

Rectangular Pier

Width, W=	8.0	ft, parallel to sign face	
Length, L=	8.0	ft, perpendicular to sign face	
Depth, D= $(A/2)(1 + \text{SQR}(1 + (4.36h)/A))=$	4.4	ft	
S1= $(2)(q)(D/3)=$	599	psf	
b= $\text{Sqrt}(W^2 + L^2)=$	11.3	ft	
A= $(2.34)(P) / (S1)(b)=$	0.8		

Round Caisson

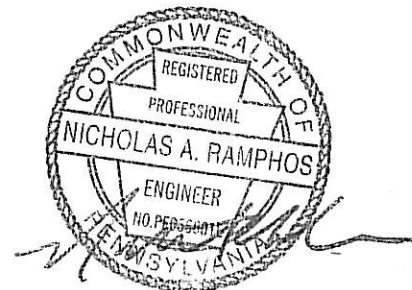
Diameter, b=	3.00	ft, round augered hole	
Depth, D= $(A/2)(1 + \text{SQR}(1 + (4.36h)/A))=$	4.46	ft	
S1= $(q)(2)(D/3)=$	607	psf	
A= $(2.34 P) / (S1)(b)=$	1.36		

Foundation Bearing Check

Allowable Bearing Pressure= 2,000 psf		
<i>Square</i>		<i>Round</i>
Sign Wt= 1,100 lb		Sign Wt= 1,260 lb
Base Wt= 42,430 lb		Base Wt= 4,725 lb
Area= 64.0 sq ft		Area= 7.1 sq ft
q max= 680 psf, soil		q max= 847 psf, soil
OK, with depth increase		OK, with depth increase

Concrete Volume

Outside Width of Column=	8	in
Depth of Column in Footing=	0	ft
Volume of Concrete per Footing=	1.2	cubic yards (+)
Total Order Volume of Concrete=	1.2	cubic yards (+)



SEP 19 2016

BASE PLATE AND ANCHOR BOLTS

Project: *Akers Signs*

Descript:

Ref: *AISC Steel Design Guide Series 1 (1990), Column Base Plates*

Plate Design

# of Base Plates=	1	
Maximum Column Dimension, OD=	8.00	in, perpendicular to sign face
Number of Bolts, n=	2	per line front and back
Compressive Strength of Concrete, f'c=	3,000	psi at 28 days
Moment / Base Plate, M=	43,041	lb-ft
Bolt Line Spacing, L=	24.00	in, from front to back
Base Plate Dimensions:	N= 36.00	in B= 36.00 in
Tension per Bolt Line, T=	21,521	lb, = M/L (simple moment couple)
Maximum Moment on the Plate, Mpl=	172,165	lb-in, = (T)((L-OD)/2)
Plate Thickness w/o Gussets, t=	1.09	in, = Sqrt((6M)/(0.75Fy(4/3) Beff))

Anchor Bolt Design

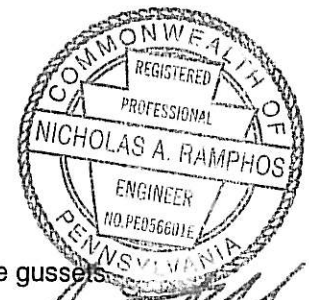
(using A36 threaded rod with embeded end nut)

Tension per Anchor, Ta=	10,760	lb, = T/n
Req. Gross Area of Anchor Bolts, Ag=	0.42	sq in, = Ta\0.33Fu (1/3 inc)
Min. Diameter of Anchor Bolts, D=	0.73	in
Actual Bolt Diameter to be Used=	1.000	in
Req Proj Concrete Surface Area, Ap=	85	sq in, = Ta/(2 sqrt(f'c)) (1/3 inc)
Req Embeded Bolt Length, L=	20.00	in, = sqrt(Ap/3.14), min 20D
Min. Spacing to Edge of Concrete=	20.00	in
Min. Spacing Between Bolts in a Line, s=	40.00	in, = 2L
Actual Spacing Between Bolts in a Line, s=	24.00	in
# of Overlaps=	1	
Revised Ap Based on Overlap=	925.72	in^2
Actual Shear Capacity of Concrete Cone=	134,872	lb (1/3 inc) OK
Shear stress per bolt, fv=	695	psi, = Va/Ab
Allowed Tension Stress with Shear, Ft=	25,456	psi, = 0.43Fu - 1.8fv, max 0.33Fu (1/3 inc)
Actual Tension Stress per Bolt, ft=	13,700	psi, = Ta/Ab
	OK	

Weld Design

(check connection of base column to plate, pipe and square tube only)

Shape of Column=	s	(R=round, S=square)
Fillet Weld Leg Size, a=	0.25	in
Section Modulus of Weld, Sw=	21.44	in ³ , = 1.34(b ²)(a)
Actual Weld Stress, fw=	24,090	psi, = M/Sw NG, use gussets

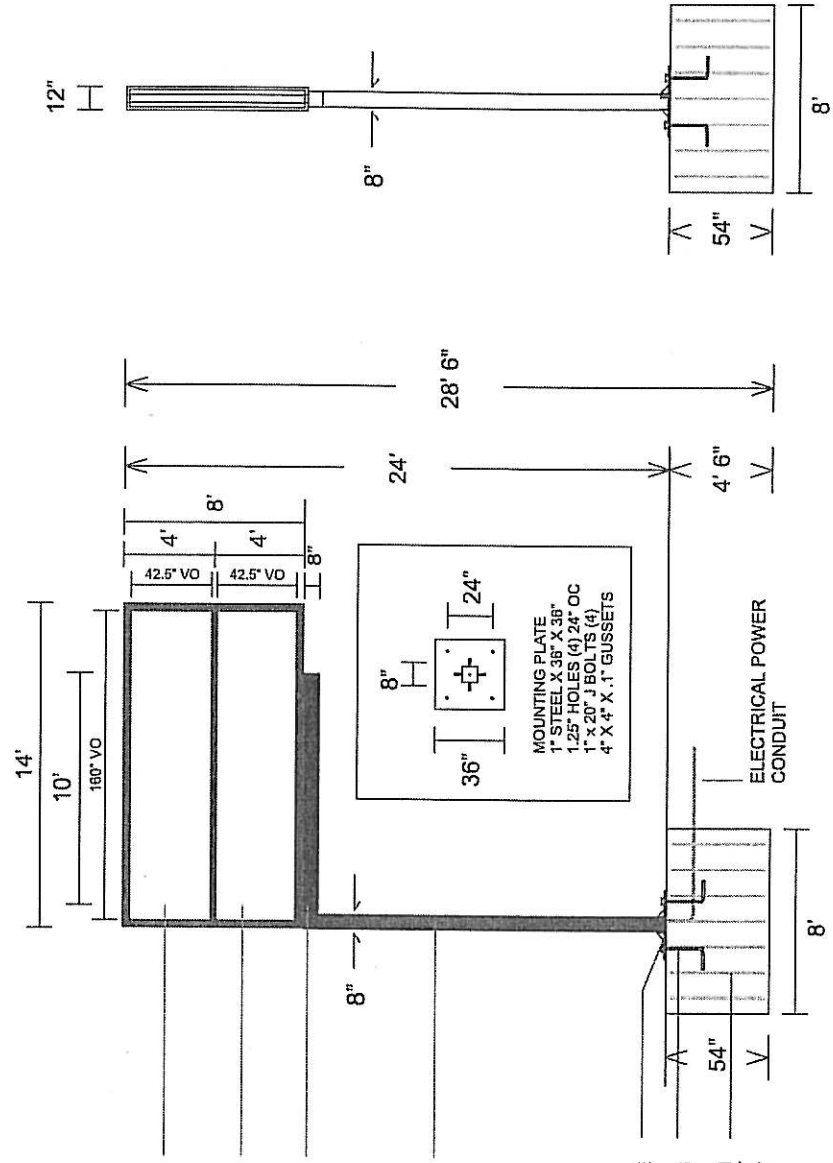


SEP 19 2016

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Page	1 OF 2
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CUSTOMERS ADDRESS	
RA	
SL	
Design#	00-00-00
Rev/Date	

COLOR KEY
TBD

- WHITE LED LIGHTS
- 8' X 14' X 12' SIGN CABINET
- 4" RETAINERS
- BLACK CABINET
- WHITE FLAT POLYCARBONATE
- FACES / 2 SIDES
- BLACK 8" SQUARE STEEL
- PERPENDICULAR
- SUPPORT POLE
- BLACK 8" X 8" STEEL
- STRUCTURAL POLE



- MOUNTING PLATE
- FOUR 1' X 20" J BOLTS
- CONCRETE FOOTING WITH
- #4 REBAR REINFORCEMENT
- EVERY 12" VERTICALLY

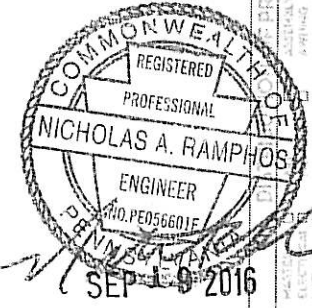
120 VOLT 277 VOLT

FINAL ELECTRICAL CONNECTION BY CUSTOMER

SCALE:
1/8" = 1'

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	Signature	

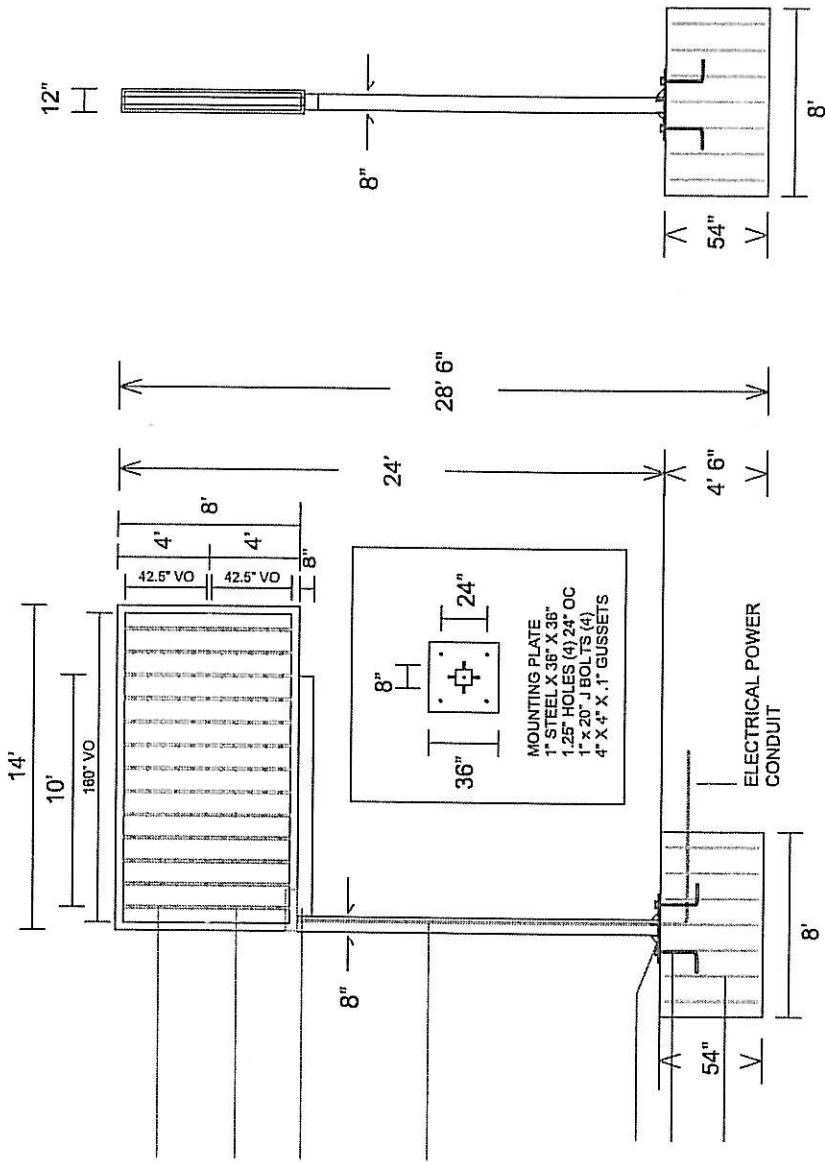
WORK ORDER

Entry

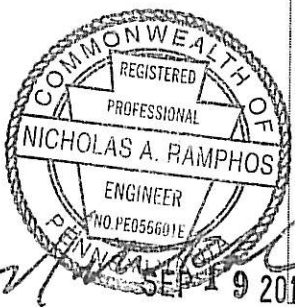
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Page	2 OF 2
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RA	
SL	
Acct. Rep.	
Designer	
Rev Date	00-00-00

COLOR KEY

- WHITE LED LIGHTS
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MOUNTING PLATE
FOUR 1" X 20" J BOLTS
CONCRETE FOOTING WITH #4 REBAR REINFORCEMENT EVERY 12" VERTICALLY



120 VOLT 277 VOLT

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FINAL ELECTRICAL CONNECTION BY CUSTOMER

SCALE:
1/8"=1'

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WORK ORDER