SULLAWAY
ENGINEERING

10815 RANCHO BERNARDO RD. STE. 260, SAN DIEGO, CA 92127
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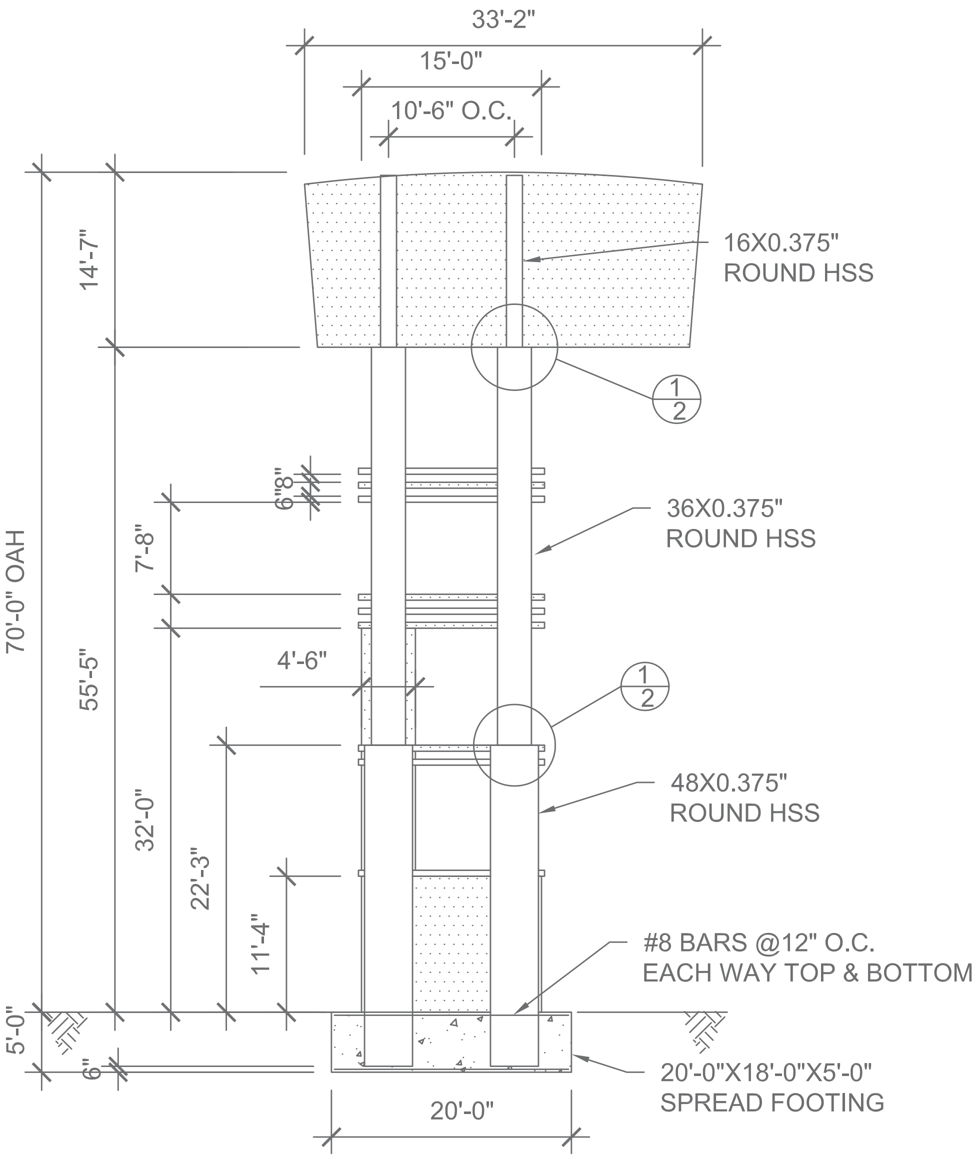
PHONE: 1-858-312-5150 FAX: 1-858-777-3534

PROJECT:	22ND STREET GEM SHOW, I-10 & 22ND ST., TUCSON, AZ	DATE:	1/16/17
PROJECT #:	13388	ENGINEER:	LS
CLIENT:	PEARSON SIGNS-TUCSON	DATE REVISED:	



1/- FRONT ELEVATION

GENERAL NOTES

1. DESIGN CODE: IBC 2012
2. DESIGN LOADS: ASCE 7-10
3. WIND VELOCITY 115 MPH EXPOSURE C
4. CONCRETE 2500 PSI MIN.
5. ROUND HSS STEEL ASTM A500 GR.B, F_y=42 KSI MIN.
6. PROVIDE MIN. 3" CLEAR COVER ON ALL STEEL EMBEDDED IN CONCRETE
7. PROVIDE PROTECTION AGAINST DISSIMILAR METALS
8. WELDING STRENGTH Fexx= 70 KSI
9. VERTICAL SOIL BEARING PER IBC CLASS 4 (2000 PSF)

Registered Professional Engineer (Civil)
CERTIFICATE NO. 50863
MICHAEL FRANKLIN SULLAWAY
Date Signed
ARIZONA U.S.A.

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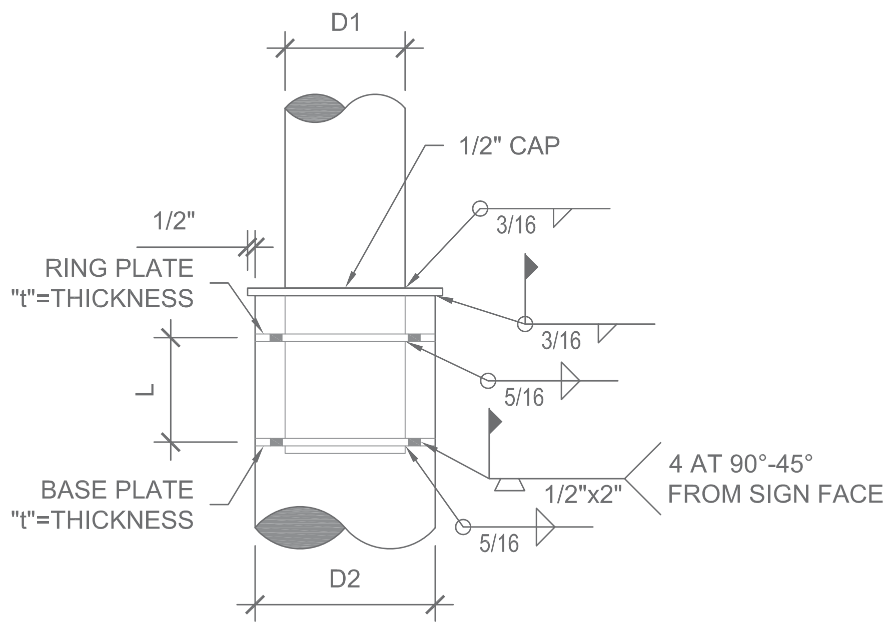

1/2 SPLICE DETAIL

NOTES:

1. THIS DETAIL MAY BE USED FOR PIPE AND SQUARE TUBE SECTIONS.
2. L = 1.5xD1 OR 12" , WHICHEVER IS LARGEST

THICKNESS (t)

FOR D1 THRU 16" DIA., USE t = 1/2" PL.
FOR 16" DIA. < D1 < 30" DIA., USE t = 3/4" PL.
FOR D1 > 30" DIA., USE t = 1" PL.

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PROJ. NO.: 13388 — ENGINEER: LS
CLIENT: PEARSON SIGNS- TUCSON

V3.0 building code; IBC 2012 — units; pounds, feet unless noted otherwise

Applied Wind Loads; from ASCE 7-10

$F=q_z*G*C_f*A_f$ with $q_z = 0.00256K_zK_{zt}K_dV^2$ (29.3.2 & 29.4)

C_f= 1.800 (Fig. 29.4-1) — max. height= 70.0

K_{zt}= 1.0 (26.8.2) (=1.0 unless unusual landscape)

K_z= from table 28.3-1 — Exposure= c

K_d= 0.85 for signs (table 26.6-1)

V= 115 mph

G= 0.85 (26.9) — weight= 10.173 kips

s/h= 0.208 — M_{DL}= 0.00 k-ft

B/s= 2.27

Pole Loads	structure component	height at section c.g.	K_z	q_z	pressure q_z*G*C_f	A_f	shear	Wind Moment M_W
	1	5.9166667	0.85	24.46	37.43	177.5	6643	39304
	2	13.416667	0.85	24.46	37.43	24.3	909	12190
	3	17.5	0.876	25.21	38.57	38.3	1479	25874
	4	20.291667	0.90	25.99	39.77	4.5	178	3609
	5	21.416667	0.91	26.27	40.19	25.8	1038	22236
	7	23.625	0.93	26.77	40.97	21.1	864	20405
	8	27.5	0.96	27.65	42.30	38.3	1622	44595
	9	31	0.99	28.41	43.47	15.3	666	20661
	10	33.416667	1.00	28.82	44.10	43.9	1937	64719
	11	34.916667	1.01	29.07	44.47	0.9	42	1466
	12	37.5	1.03	29.51	45.16	28.3	1279	47979
	13	41.25	1.05	30.13	46.10	14.2	653	26939
	14	43.916667	1.06	30.50	46.67	43.9167	2050	90014
	15	50.375	1.09	31.41	48.06	57.1389	2746	138343
	17	57.708333	1.12	32.27	49.37	152.014	7504	433063
	18	65	1.15	33.12	50.67	331.667	16805	1092348
					sums:	1017.3	46415	2083.75 (M_w) k-ft
	two pole distribution factor (asce fig. 29.4-1):				x 1.00		46415	2083.75

arm= 44.9

P_u= 12.21 kip — M= 2083.75 k-ft — $M=M_{DL}+M_w$

$M_u=1.2M_{DL}+1.0M_W$= 2084 k-ft

Pole Design

section; pipe

$M_u \geq \phi M_n$ with $M_n = f_yZ$ — f_y= 42 ksi — ϕ= 0.9

H	M_u(k-ft)	Z req'd. (in)	Size(in)	t (in)	Z	USE
at grade	2083.7	661.51	48	0.375	850.6	48X0.375" ROUND HSS ϕMn=2332.6 k-ft
at 22.25 ft	1330.7	422.4	34	0.375	424.0	36x0.375" ROUND HSS ϕMn=1347.4 k-ft
at 55.42 ft	201.7	64.0	16	0.375	91.6	16x0.375" ROUND HSS ϕMn=269 k-ft

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DATE: 1/17/17
ENGINEER: LS

V3 building code; IBC 2012 units; pounds, feet unless noted otherwise

Check Buckling for Round HSS Section

Pole Design-AISC section; HSS(>12") weight= 10.173 kips

F_y= 42 ksi ϕ= 0.9 E= 29,000 ksi

H	M_u(k-ft)		Size(in)	t (in)	Z	S
at grade	2083.75	661.51	**48**	**0.375**	**850.6**	**662.8**

spec wt= 0.289 kcf
signage wt; 10.173 k
pipe weight 2.201 k
P= 12.374 k
P_r= 14.85 k

r= **16.84**
A= **56.11**
h (L) = 22.625

D/t= 128.0
KL/r= 32.2
K= 2
Fe= 284.7 ksi (E3-4)
4.71sqrt(E/f_y)= 125.9

F_{cr}= 39.49 for KL/r<sqrt(E/f_y) AISC Chap. E3
F_{cr}= 249.70 for KL/r>sqrt(E/f_y)
use F_{cr}= 39.49

for D/t < 0.07 E/Fy section is compact 0.07 E/F_y= 48
for D/t < 0.31 E/Fy section is non-compact 0.31 E/F_y= 214
Section is **non-compact**

$P_n=F_{cr}A_g$= 2215.4 k $P_c=\phi Pn$= 1993.9 k
M_n=(0.021E/(D/t) + F_y)S= 2591.8 k (non-compact) (F8-2)
$M_n=F_yZ$= 2977.0 k-ft (compact)
$M_n=F_{cr}S$= 2181.1 k-ft (slender - slender sections NOT USED)
use M_n= 2591.8 k-ft
$M_c=\phi M_n$= 2332.6 k-ft

P_r/P_c= 0.0074 AISC Chap. H1
$P_r/2P_c$= 0.0037

P_r/P_c + 8/9 * M_r/M_c = 0.801
For P_r/P_c<0.2; $P_r/2P_c$ + M_r/M_c = 0.897
use **0.897** less than 1? ok

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V3 building code; IBC 2012 — units; pounds, feet unless noted otherwise

Check Buckling for Round HSS Section

Pole Design-AISC

section; HSS(>12") weight= 10.173 kips

F_y= 42 ksi ϕ= 0.9 E= 29,000 ksi

H	M_u(k-ft)		Size(in)	t (in)	Z	S
at 22.63 ft	1330.68	422.44	**36**	**0.375**	**475.9**	**369.9**

r= **12.60**
A= **41.97**
h (L) = 10.792

spec wt= 0.289 kcf
signage wt; 10.173 k
pipe weight 0.785 k
P= 10.958 k
P_r= 13.15 k

D/t= 96.0
KL/r= 20.6
K= 2 — F_{cr}= 40.96 for KL/r<sqrt(E/f_y) — AISC Chap. E3
Fe= 700.3 ksi (E3-4) — F_{cr}= 614.17 for KL/r>sqrt(E/f_y)
4.71sqrt(E/f_y)= 125.9 — use F_{cr}= 40.96

for D/t < 0.07 E/Fy section is compact — 0.07 E/F_y= 48
for D/t < 0.31 E/Fy section is non-compact — 0.31 E/F_y= 214
Section is **non-compact**

$P_n=F_{cr}A_g$= 1719.0 k — $P_c=\phi Pn$= 1547.1 k
$M_n=(0.021E/(D/t) + F_y)S$= 1497.1 k (non-compact) — (F8-2)
$M_n=F_yZ$= 1665.8 k-ft (compact)
$M_n=F_{cr}S$= 1262.7 k-ft (slender - slender sections NOT USED)
use M_n= 1497.1 k-ft
$M_c=\phi M_n$= 1347.4 k-ft

P_r/P_c= 0.0085 — AISC Chap. H1
$P_r/2P_c$= 0.0042

P_r/P_c + 8/9 * M_r/M_c = 0.886
For P_r/P_c<0.2; $P_r/2P_c$ + M_r/M_c = 0.992
use **0.992** less than 1? ok

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Version 3.0

building code; IBC 2012 — **Longitude Direction** — units; pounds, feet unless noted otherwise

applied shear at grade	v=	**29**	kip	unfactored load	46.4	kips	(factored)
applied moment at grade	m=	**1302**	kip-ft	unfactored load	2084	k-ft	(factored)
depth of soil above footing	h_s=	**0**	ft				
allowable soil bearing	p=	**2.7**	ksf				
(use a factor of 1.33 for wind or seismic)							

Spread Footing Design

moment m= 1447.4 k-ft
Footing size (ft) b= **20.00** L= **18.0** h= **5.00** S= 1080.2
Footing Weight= 270.0 k signage weight= **10.2** k soil 0.00 total= 280.17
Overturning; M_c= 2521.6 M_c>1.5M 1.7421 ok
soil pressure; max= 2.436 ksf ok
forces on concrete pad; V= 261 k V_r= 417.08 k (=1.6V)
M= 1173 k-ft M_r= 1876.9 k-ft

Check Slab;

ϕ= 0.9 f_y= 60 ksi f_c= 2.5 ksi 150 lbs/ft3

Flexure A_s= **8.00** d= 56.0 in
$\phi M_n=\phi A_s f_y(d-a/2)$= 23989 k-in = 1999 k-ft $M_r<\phi M_n$ ok
$a=A_s f_y/0.85 f_c b$= 0.941 in

Check minimum $A_{smin}=2sqrt(f_c)bd/f_y$ = 33.6 200bd/fy= 44.80 or $1.333A_s$= 10.66 in^2

Use A_s= 10.66 in^2

short direction $\gamma_s=2/(\beta+1)$ = 0.8 with β= 1.5 short direction; γA_s= 8.53 in^2

USE #8@12" EACH WAY

Shear; $\phi V_n=\phi 2sqrt(f_c)bd$ ϕV_c= 1008.0 ϕ= 0.75 $V_r<\phi V_n$ ok

Top Slab

Assume half of footing is in uplift
weight= 135.00 kip arm= 4.5 ft
M= 607.50 k-ft M_r= 729 k-ft

Flexure A_s= **8.0**
$\phi M_n=\phi A_s f_y(d-a/2)$= 23966 k-in = 1997 k-ft $M_r<\phi M_n$ ok
$a=A_s f_y/0.85 f_c b$= 1.046 in

Check minimum $A_{smin}=2sqrt(f_c)bd/f_y$ = 30.2 200bd/fy= 40.32 or $1.333A_s$= 10.66 in^2

Use A_s= 10.66 in^2

short direction $\gamma_s=2/(\beta+1)$ = 0.8 with β= 1.5 short direction; γA_s= 8.53 in^2

USE #8@12" EACH WAY