12255 West 187th Street
Mokena, Illinois 60448
(708) 479-8385

File : ClaytonSgns912b.mcd

Site : Chick-Fil-A
US Highway 50 and MO State Route 291
Lee's Summit, Missouri 64081

Project : 8'-0" overall height x 1'-10 1/4" wide center structure with a 4'-1 3/16" x 2'-5 1/16" menuboards on each side of the center structure 1'-10 3/16" above grade for drive thru lane with a caisson footing. Two (2) of these menuboards will be installed at the site. One at each of the two drive thru lanes.
Drawing No. 2510066 rev. A

Design loads are based on the 2018 International Building Code (ASCE 7-16) using Exposure C and 115 mph wind speed.

Design Wind Speed : (mph.) $V := 115.0$ Based on Risk Category II

Velocity Pressure Coefficient at a Height of Less Than 15', Exposure C : $Kz := 0.85$ Based on Table 26.10-1

Topographic Factor : $Kzt := 1.00$ Based on Table 26.8-1

Wind Directionality Factor : $Kd := 0.85$ Based on Table 26.6-1

Velocity Pressure : (PSF) $qz := 0.00256 \cdot Kz \cdot Kzt \cdot Kd \cdot V^2$ $qz = 24.461$ Based on Equation 26.10-1

Force Coefficient : $Cf := 1.72$ Based on Figure 29.3-1

Gust Effect Factor : $G := 0.85$ Based on 26.11.4 for Other Structures

ASD Conversion Factor : $LCF := 0.60$

Design Pressure : (PSF) $F := qz \cdot Cf \cdot G \cdot LCF$ $F = 21.457$

STATE OF MISSOURI
ANDREW K. FENDRICH
NUMBER PE-28909
PROFESSIONAL ENGINEER
10-10-25
EXPIRES 12-31-25

Reference : Manual of Steel Construction, AISC 15th Edition.

Channel : ASTM A-36 Fy = 36.0 ksi. ; Fb = 23.76 ksi. ; Fv = 14.40 ksi.

Plate : ASTM A-36 Fy = 36.0 ksi. ; Fb = 27.00 ksi. ; Fv = 14.40 ksi.

Anchor Bolts : ASTM F-1554 Gr. 36 Fu = 58.0 ksi. ; Ft = 19.14 ksi. ; Fv = 14.40 ksi.

Reference : American Concrete Institute, Code 318.14

Rebar : ASTM A-615 Grade 60 Fy = 60.0 ksi.

Concrete : 3,000 psi. compressive strength at 28 days.

Design Loads at Grade :

Menuboards : $Mnbdrs := (2 \cdot (4.10 \cdot 2.42) \cdot F) \cdot \left(\left(\frac{4.10}{2}\right) + 1.85\right)$ $Mnbdrs = 1660.603$ ft.lbs.

Center Structure : $CntrStrc := (8.0 \cdot 1.85 \cdot F) \cdot \left(\frac{8.0}{2}\right)$ $CntrStrc = 1270.264$ ft.lbs.

Moment : (ft.lbs.) $MtGrd := Mnbdrs + CntrStrc$ $MtGrd = 2930.867$

Shear : (lbs.) $ShrGrd := (2 \cdot (4.10 \cdot 2.42) \cdot F) + (8.0 \cdot 1.85 \cdot F)$ $ShrGrd = 743.362$

Design of Center Structure at Grade :

Section Modulus of Channel - X Axis : (in.3) C8 x 18.75 - $ChnlSM := 11.0$

Moment per Channel : (ft.lbs.) $MtChnl := \frac{MtGrd}{2}$ $MtChnl = 1465.434$

Bending Stress - X Axis : (psi.) $f_b := \frac{MtChnl \cdot 12}{ChnlSM}$ $f_b = 1598.655$

Area of Channel : (in.2) C8 x 18.75 - $ChnlArea := 5.51$

Shear per Channel : (lbs.) $ShrChnl := \frac{ShrGrd}{2}$ $ShrChnl = 371.681$

Shear Stress : (psi.) $f_v := \frac{ShrChnl}{ChnlArea}$ $f_v = 67.456$

Unity Check - Channel Frame : $UCChnlFrm := \frac{f_b}{23760} + \frac{f_v}{14400}$ $UCChnlFrm = 0.072$ < 1.00 OK

Design of Anchor Bolts at Grade :

Anchor Bolt Diameter : (in.) $AncBltDia := 1.00$

Stress Area : (in.2) $AncBltArea := \frac{\pi \cdot AncBltDia^2}{4}$ $AncBltArea = 0.785$
(Based on nominal diameter per AISC 4-3)

Allowable Tension : (lbs.) $AllwTen := 19140 \cdot AncBltArea$ $AllwTen = 15033$

Allowable Shear : (lbs.) $AllwShr := 14400 \cdot AncBltArea$ $AllwShr = 11310$

Number of Anchor Bolts in Tension : $NoTen := 2$

Front to Back Distance Between Anchor Bolts : (in.) $LvrArm := 8.0$

Tension Load per Anchor Bolt : (lbs.) $TenAncBlt := \frac{MtGrd \cdot 12}{NoTen \cdot LvrArm}$ $TenAncBlt = 2198.15$

Number of Anchor Bolts in Shear : $NoShr := 4$

Shear Load per Anchor Bolt : (lbs.) $ShrAncBlt := \frac{ShrGrd}{NoShr}$ $ShrAncBlt = 185.84$

Unity Check : $UCAncBlts := \frac{TenAncBlt}{AllwTen} + \frac{ShrAncBlt}{AllwShr}$ $UCAncBlts = 0.163$ < 1.00 OK
Anchor Bolts

Allowable Bond Stress : (lbs./ in.2) $U := \left(\frac{1}{2}\right) \cdot \left(\frac{4.8 \cdot \sqrt{3000}}{AncBltDia}\right)$ $U = 131.453$

Development Length : (in.) $Ld := \frac{TenAncBlt}{U \cdot \pi \cdot AncBltDia}$ $Ld = 5.323$

Embedment Length : (in.) $AncBltEmb := 36 - 6$ $AncBltEmb = 30$
(36" overall length minus 6" of thread projection.)

Unity Check :
Anchor Bolt Embedment $UCABEmb := \frac{Ld}{AncBltEmb}$ $UCABEmb = 0.177$ < 1.00 OK

Use : Four (4) 1" Dia. x 36" anchor bolts with 6" of top thread and 3" bottom thread.

Design of Base Plate at Grade :

Plate Thickness : (in.) $PltThk := 1.00$ Plate Width : (in.) $PltWdth := 24.0$

Transfer Distance : (in.) $PLS := 4.5$ (Measured in AutoCAD from leg of channel.)

Minimum Thickness Required : (in.) $ReqdThk := \sqrt{\left(\frac{TenAncBlt \cdot NoTen \cdot PLS \cdot 6}{(PltWdth \cdot 27000)}\right)}$ $ReqdThk = 0.428$

Unity Check - Base Plate : $UCBasePlt := \frac{ReqdThk}{PltThk}$ $UCBasePlt = 0.428$ < 1.00 OK

Use : 1" thick x 24" x 14" base plates with four (4) 1-1/4" x 2" radial slots on a 8" square bolt pattern.

Design of Caisson Footing :

Overturning Moment : (ft.lbs.) $Ma := MtGrd$ $Ma = 2930.867$

Shear : (lbs.) $Va := ShrGrd$ $Va = 743.362$

Applied Lateral Force : (lbs.) $P := Va$ $P = 743.362$

Allowable Lateral Soil Pressure : (lbs./ft.2 per ft.) $LP := 150$

Diameter of Round Footing : (ft.) $b1 := 2.0$

Distance in Feet From Ground Surface
to Point of Application of "P" $h := \frac{Ma}{Va}$ $h = 3.943$

Depth of Footing Below Grade : (ft.) $d1 := 4.5$

Allowable Lateral Soil Bearing Pressure Pursuant
to Section 1807.3.2.1 and Table 1806.2 with 100%
increase for allowable 1/2" deflection at grade. $S1 := \frac{d1}{3} \cdot (2 \cdot LP)$ $S1 = 450$

$A := 2.34 \cdot \frac{P}{S1 \cdot b1}$ $A = 1.933$

$d2 := \left(\frac{A}{2}\right) \cdot \left(1 + \left(\sqrt{1 + 4.36 \cdot \frac{h}{A}}\right)\right)$ $d2 = 4.006$ $\leq$ $d1 = 4.5$ OK

Check Tensile Stress in Footing :

Overturning Moment About Heel Point : (ft.lbs.)
Treat as a cantilever at bottom. $Mh := Ma + (Va \cdot d1)$ $Mh = 6275.994$

Compressive Strength of Concrete : (psi.) $fc := 3000$

Yield Strength of Rebar : (psi.) $fy := 60000$

Section Modulus of Footing : (in.3) $Sw := \frac{\pi \cdot (b1 \cdot 12)^3}{32}$ $Sw = 1357.168$

Tensile Stress in Concrete : (psi.) $ft := \left(\frac{1.6 \cdot (Mh \cdot 12)}{Sw}\right)$ $ft = 88.787$

Allowable Concrete Stress : (psi.) $\phi Ft := 0.60 \cdot \left(3 \cdot \sqrt{fc}\right)$ $\phi Ft = 98.59$ > $ft = 88.787$

REBAR NOT REQUIRED FOR STRESS

Design of Shrinkage and Temperature Steel in Caisson :

Rebar Size : $Number := 5$

Rebar Area : (in.2) $Area := \frac{\pi \cdot \left(\frac{Number}{8}\right)^2}{4}$ $Area = 0.31$

Area of Footing : (in.2) $A_f := \frac{\pi \cdot (b1 \cdot 12)^2}{4}$ $A_f = 452.389$

Minimum Area of Steel : (in. 2) $A_s := 0.0025 \cdot A_f$ $A_s = 1.13$

Number of vertical bars required : $\left(\frac{A_s}{Area}\right) = 3.686$

Use (4) #5 Rebar x 4'-0" LG. equally spaced on a 17" circle with (10) #3 rebar ties, top (3) in first 5", (5) on 5" centers, remaining (2) on 10" centers.

Quantity of Concrete : (yds.3) $CY := \frac{\pi \cdot b1^2 \cdot d1}{4 \cdot 27}$ $CY = 0.524$