PRCTI20230877

City of Puyallup
Development & Permitting Services
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Building | Planning
Engineering | Public Works
Fire | Traffic

Structural Calculations

PREPARED FOR:

BOE Architects, PLLC
1130 Broadway, Suite 207
Tacoma, WA 98402

PROJECT:

Korum Ford EV Court
DC Charger Foundations
2230458.20

PREPARED BY:

Andrew McEachern, P.E., S.E.
Principal

DATE:

June, 2023

City of Puyallup
Development & Permitting Services
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Building | Planning
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Structural Calculations

Korum Ford EV Court

100 River Road, Puyallup

Project # 2230458.20

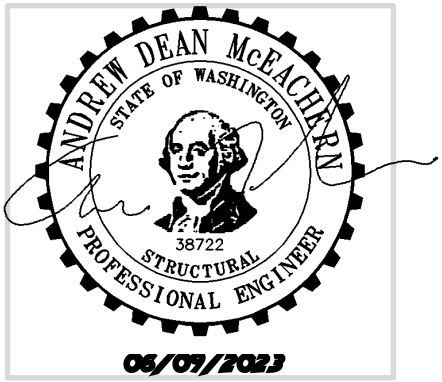
Project Principal Andrew D. McEachern, P.E., S.E.

Design Criteria

Design Codes and Standards

Codes and Standards: Structural design and construction shall be in accordance with the applicable sections of the following codes and standards as adopted and amended by the local building authority: International Building Code, 2018 Edition.

Structural Design Criteria:



Live Load Criteria:

Roof (Min Blanket Snow):	25 psf
Slab on Grade:	125 psf

Wind Load Criteria:

Basic Wind Speed:	98 mph
Risk Category:	II
Wind Exposure:	B
Topographic Factor:	1.0

Seismic Criteria:

Risk Category:	II		
Seismic Importance Factor:	1.0		
S_s =	1.274	S_1 =	0.438
S_{ds} =	1.019	S_{d1} =	N/A
Site Class:	D - default		
Seismic Design Category:	D		

Soil Criteria:

Soil Bearing Capacity: 1,500 psf (assumed). Allow 33% increase for wind or seismic loads.

Project Description

The structural scope of work for this project involves the structural design of foundations and anchorage for new exterior electric vehicle charging stations. It is the intention of the structural design to satisfy the force levels of the IBC 2018.

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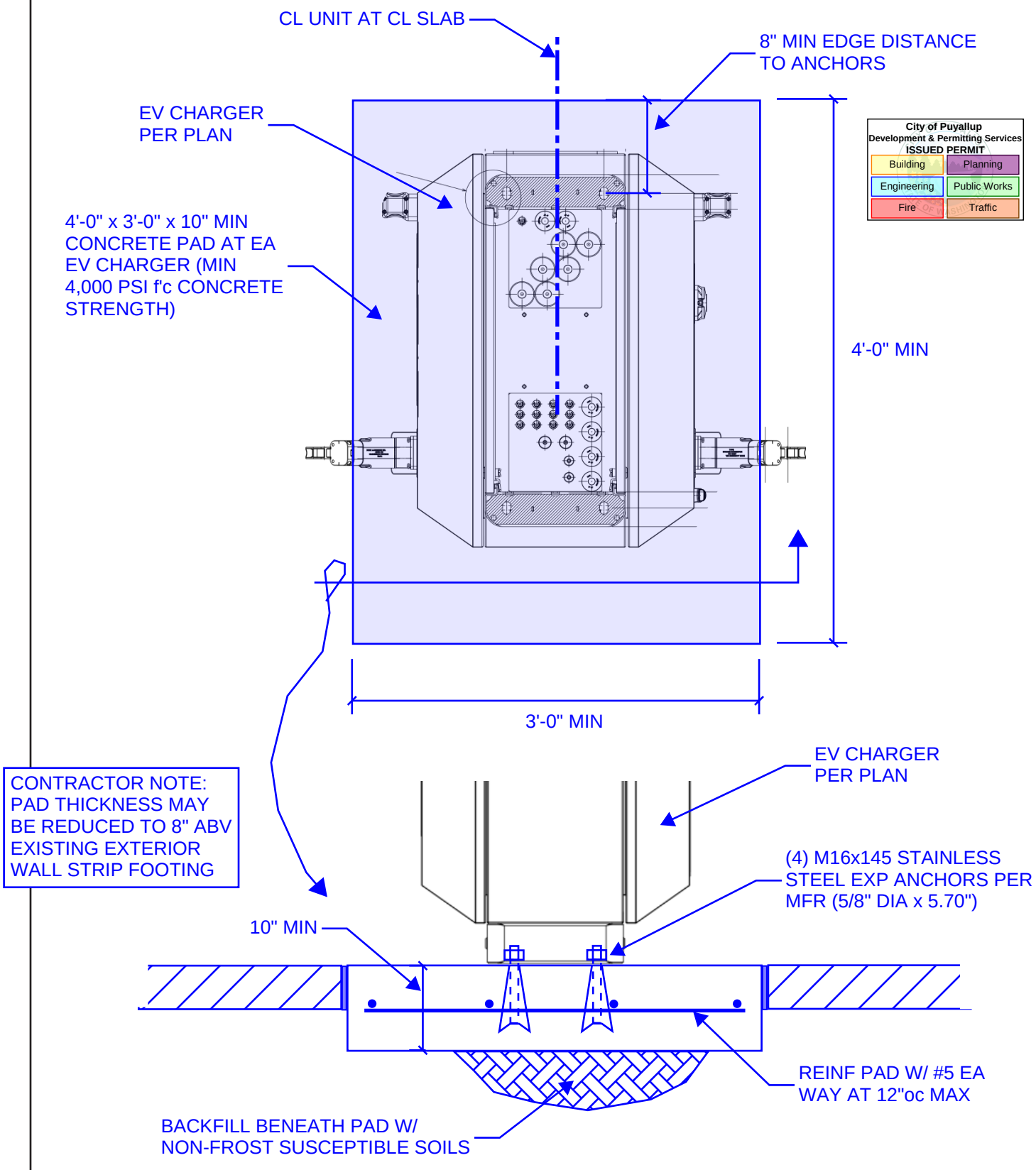

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AHBL
2215 North 30th Street, Suite 300
Tacoma, WA 98403
253.383.2422 TEL 253.383.2572 FAX

KORUM FORD EV COURT

EV CHARGER FOUNDATION AND ANCHORAGE

DRAWN BY: ADM | DATE: 6/6/2023 | JOB NO.: 2230458.20

SSK-01

KORUM FORD SERVICE CTR, 100 RIVER ROAD, PUYALLUP, WA (PARCEL NO. 0420281160)

EV COURT LAYOUT #5a

BOEarc; 5.05.2023

City of Puyallup
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(8) 60-DEGREE EV CHARGING SPACES (ONE VAN ACCESSIBLE)

(4) DC CHARGING STATIONS 240kW STANDALONE/300A w/CREDIT CARD READER

REACH OF 16-FT+ CHARGING CABLE

ADD DOWNLIGHTS ALONG CMU WALL

ELECTRICAL SWITCHGEAR AGAINST CMU EXTERIOR WALL

6-FT WIDE/6" CONCRETE PAVING FLUSH W/ASPHALT PAVING AT ELEV. 43.42'

21'-10" DEPTH (60-DEGREE SPACES)

SAFETY BOLLARDS (2 PER UNIT)

REPLACEMENT TRANSFORMER

EXISTING SERVICE PORTE COCHRE NO CHANGE

EXIST CB

2% SLOPE TO EXISTING CB

2% SLOPE TO EXISTING CB

RIDGE

ASPHALT PAVING GRIND + OVERLAY MAINTAINING EXISTING DRAINAGE CONVEYANCE

EXIST CB

18-FT TWO-WAY AISLE (60-DEGREE SPACES)

9-FT WIDE PARALLEL SPACES

4.5-FT

(5) PARALLEL PARKING SPACES

REPLACE VAULT LID W/TRAFFIC RATED LID

EXIST CB

EXIST MONUMENT SIGN TO REMAIN

EXIST FDC

EXIST BACK-FLOW HUTCH

EXIST HYDRANT

EXIST FDC

EXIST STREET LIGHT

MEDIAN LANDSCAPE SIMILAR TO RIVER ROAD - NEED TO CONFIRM UTILITY LOCATIONS PRIOR TO FINAL DESIGN

NO STREET TREE HERE DUE TO CONFLICT WITH EXISTING UNDERGROUND UTILITIES AND STREET LIGHT

EXISTING DRIVEWAY NO CHANGE

EXISTING DRIVEWAY - NO CHANGE

EXTENT OF PROJECT AREA

NORTH MERIDAN (STATE ROUTE 161)

NORTH MERIDIAN (STATE ROUTE 161)

CONCRETE SIDEWALK

CONC C&G

CONC CURB

ASPHALT

CONCRETE

COMMERCIAL BUILDING

BUILDING COLUMN

TRENCH DRAIN EL=42.61 IE(E)6"RCP=41.88

CB TYPE 1 RIM EL=42.54 IE(SE)8"DIP=41.07 IE(W)6"RCP=41.09

CB TYPE 1 RIM EL=42.42 IE(NE)8"DIP=40.92

CB TYPE 1 RIM EL=42.58 IE(NE)8"DIP=40.93 IE(W)8"DIP=40.96

CB TYPE 1 RIM EL=42.76 IE(E)8"DIP=40.40 IE(SW)8"DIP=40.76

SSMH RIM EL=42.73 IE(N)12"RCP=39.08 IE(S)12"RCP=39.35

CB TYPE 1 RIM EL=42.594 IE(E)8"CMP=40.40 IE(W)8"DIP=40.69

CB TYPE 1 (SOLID LID) RIM EL=43.16 IE(E)8"STL=40.28 IE(SW)8"DIP=40.46 IE(W)6"PVC=40.38 IE(NW)8"DIP=41.06

CB TYPE 1 RIM EL=42.23 IE(E)6"RCP=40.23 IE(W)8"STL=40.28

444.43'

N0°47'07"E 908.82'

464.39'

0 10' 20' 40'

SCALE: 1" = 20'-0"

N

City of Puyallup
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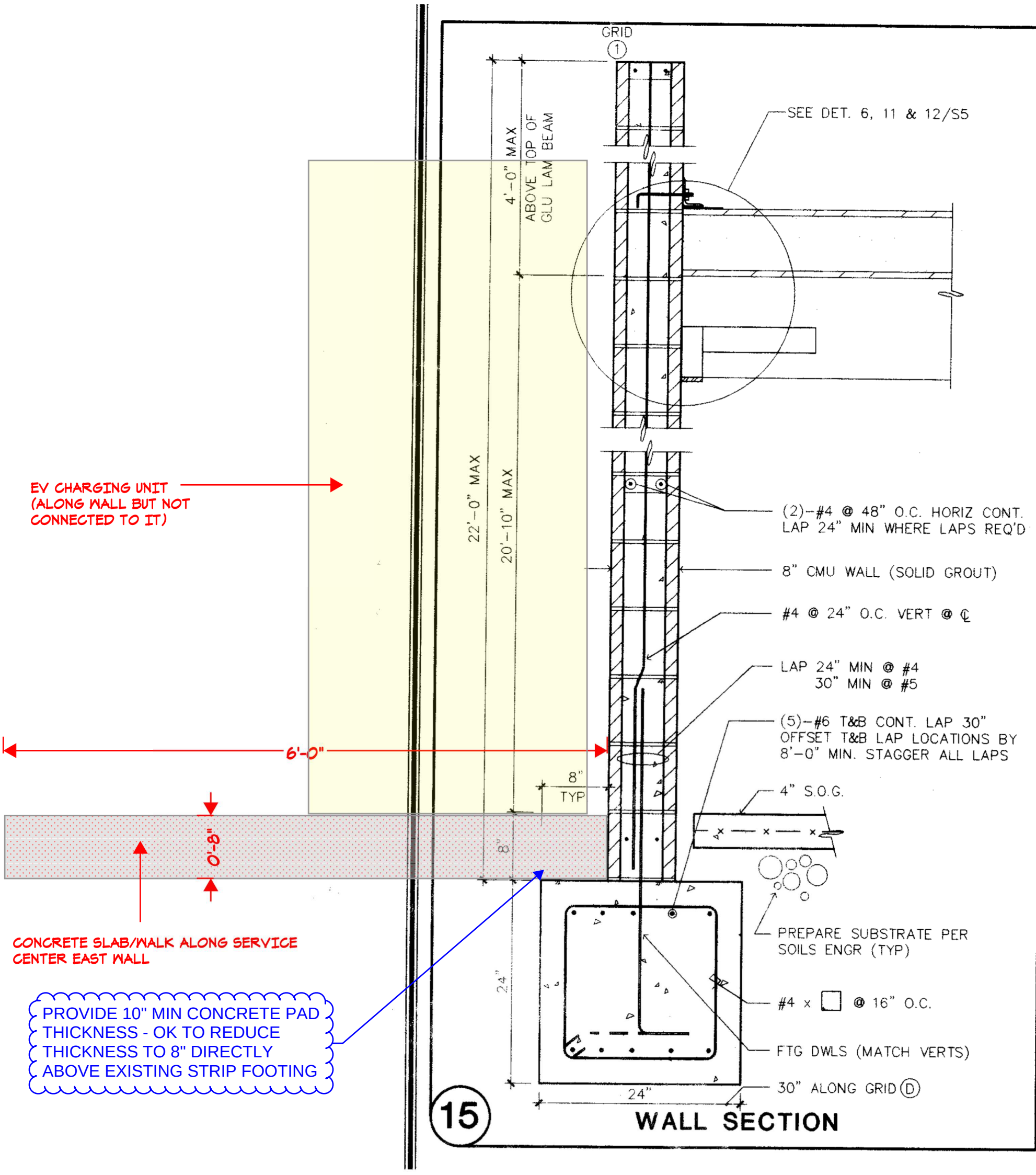

KORUM FORD E.V. COURT

STRUCTURAL DETAIL FOR SLAB/FOUNDATION AT CHARGERS

BOEarc; 6.05.2023

Installation Manual

Ford Pro™ DC Charging Station 240kW

City of Puyallup
Development & Permitting Services
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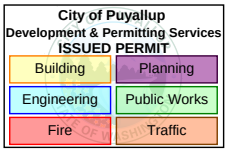
Building	Planning
Engineering	Public Works
Fire	Traffic

2. TECHNICAL CHARACTERISTICS

2



Depending on the regulation to be followed, the equipment will fulfill different technical characteristics.

Standalone NB 240 – IEC / UL

REFERENCE		NB1500H NB1500U NB150SH NB150SU	NB1800H NB1800U NB180SH NB180SU	NB2100H NB2100U NB210SH NB210SU	NB2400H NB2400U NB240SH NB240SU
DC OUTPUT	Maximum power [kW]	150	180	210	240
	Voltage range [V]	150 – 1000 [1]			
	Available connectors	CCS-1, CCS-2, CHAdeMO			
	Maximum continuous current CCS [A]	300			
	Peak current CCS [A] [2]	500			
	CCS nominal current [A]	Standard: 200. Optional: 250 (only for IEC) or 300			
	Maximum current CHAdeMO [A]	125			
	Maximum number of EVs charging simultaneously	2			
AC OUTPUT (OPTIONAL, ONLY FOR IEC)	Power [kW]	22			
	Voltage range [V]	400 ± 10%			
	Maximum current [A]	32			
	Available connectors	AC Type 2 Socket			
DC OUTPUT FOR ADDITIONAL SATELLITE DISPENSER (OPTIONAL)	Voltage range [V]	-	150 – 1000 [1]		
	Available connectors	-	CCS-1, CCS-2, CHAdeMO		
	CCS connector nominal current [A]	-	Standard: 200. Optional: 250 (only for IEC), 300, 500 (cooled)		
	Peak current CCS [A] [2]	-	500		
	Maximum current CHAdeMO [A]	-	125		
	Number of additional EVs charging simultaneously	-	1	1	2 (slim) / 1 (cooled)
AC INPUT FOR DC OUTPUT	Power [kVA]	158	189	221	253
	Voltage [V]	400 IEC / 480 UL (3ph + N + PE) ± 10%			
	Power factor	> 0.99			
	Frequency [Hz]	50 (IEC) / 60 (IEC & UL)			
	Efficiency	95%			
GENERAL	Interface	10" Touchscreen			
		E-stop pushbutton			
		Credit / debit card reader (optional)			
	RFID reader	ISO14443 A/B, MIFARE, Calypso, ISO18092, ISO15693 and more			
	Protections	Isolation monitor			
		Surge arrester Type 2 (optional)			
		DC Charge: RCD Type A (optional) + MCB			
		AC charge (optional): MCB + RCD Type A + RCM			
	Others	Smart Fleet Management (optional)			
		Smart Power Balance (optional)			

REFERENCE		NB1500H NB1500U NB150SH NB150SU	NB1800H NB1800U NB180SH NB180SU	NB2100H NB2100U NB210SH NB210SU	NB2400H NB2400U NB240SH NB240SU
GENERAL	Energy meter	Internal DC energy measurement			
		DC meter for DC output (optional)			
		AC MID meter for AC output			
	Cable length [m/ft]	5 / 16.4 with cable management system (optionally, 7.6 / 25)			
	Enclosure / foot / glass color	White (RAL 9016) / Grey (RAL 7016) / Black			
	Customization [3]	Enclosure / Foot / Glass / Logo / Display			
	Protection rating	NEMA 3R | IP54 | IK10 (IK08 for ventilation grilles)			
	Operating temperature range [ºC/ºF]	-30 to 50 / -22 to 122			
	Relative humidity	From 4% to 95%			
	Maximum altitude above sea [m/ft]	Without derating: 2000 / 6561. Max: 3000 / 9842			
	Communications	Ethernet (10/100) + Wi-Fi			
		Cellular data: 4G, 3G, GSM			
	Charge protocols	Autocharge, ISO 15118, CHAdeMO 1.1, IEC 61851, OCPP 1.6J, DIN 70121			
	Dimensions (WxDxH) [mm/ft]	670 x 950 x 2000 / 2.19 x 3.12 x 6.56			
	Regulation	IEC 61851-1, IEC 61851-23, IEC 61851-24, IEC 61851-21-2			
		UL 2202, NEC 625, FCC Part 15 Class A			

Notes: [1] 150 - 500 Vdc for CHAdeMO. Maximum power from 300 V.
[2] Consult with Power Electronics for more information about the connector overload capability.
[3] Consult with Power Electronics for further information.

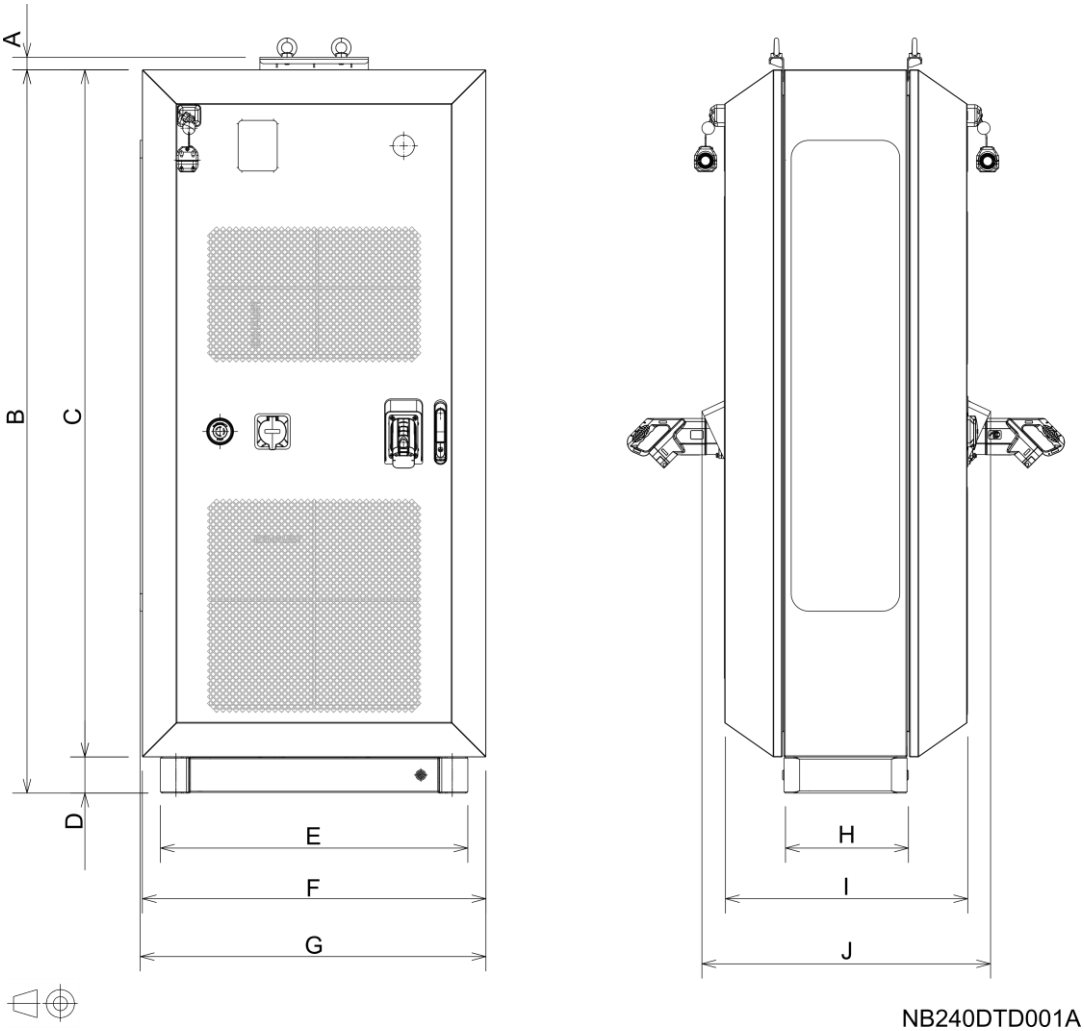
Be aware that Power Electronics is not responsible for the charger's input power connection, nor its installation.

3. DIMENSIONS AND WEIGHT

3

The dimensions, gravity center and the weight of the **NB 240** equipment are detailed in this section.

The right and front view, from left to right, are shown below:

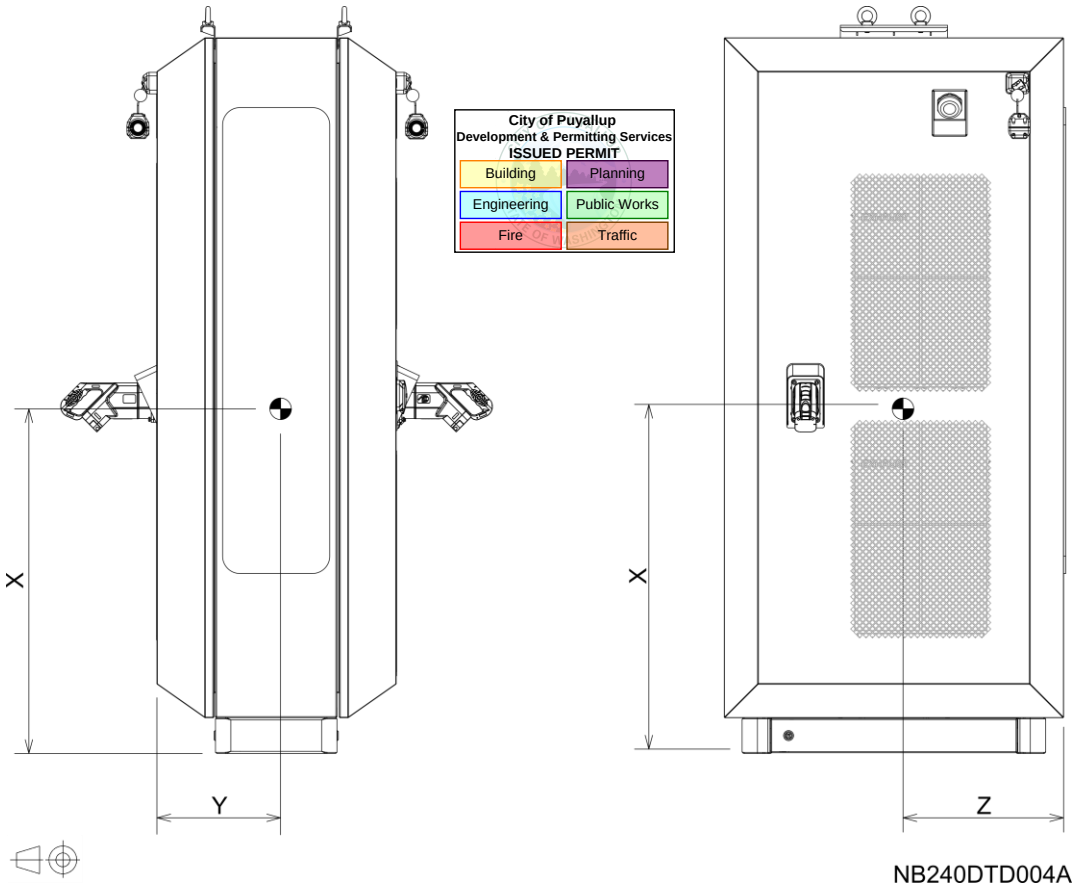


NB240DTD001A

GENERAL DIMENSIONS										
	A	B	C	D	E	F	G	H	I	J
mm	35	2000	1900	100	850	950	956	340	670	798
in.	1.38	78.74	74.80	3.94	33.46	37.40	37.64	13.39	26.39	31.42

Note: The bottom-up view is shown in the "Anchoring of the equipment" and "Access" section of this document.

The front and left view, from left to right, are shown below:



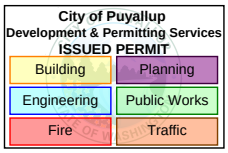
GRAVITY CENTER			
	X	Y	Z
mm	963	346	449,5
in.	37.92	13.62	17.70

The approximate weight for the NB 240 is 600 kg (1322.77 lb)[1].

[1] For other equipment of the NB 240 range, consult Power Electronics.

5. PREPARATION FOR INSTALLING THE EQUIPMENT

5



Site recommendations

When deciding the location of the equipment and planning its installation, it is recommended to follow a series of guidelines derived from its characteristics.

CAUTION

To guarantee proper electrical installation, it is very important to comply with the bend radius of the cable. The customer must ensure the cables enter the equipment perpendicularly and the spacing between them is appropriate.

Avoid corrosive environments that may affect the equipment´s proper functioning.

NOTICE

The instructions given in this section must not replace in any way the mandatory regulations of the country in which the equipment will be installed.

Prior to installation, a geotechnical study of the terrain where the equipment will be installed must be carried out to determine its characteristics and to decide the most suitable type of foundation.

It is the customer's responsibility to design and build concrete foundations with the necessary piping and ground network in accordance with the applicable regulatory requirements.

Proper installation is absolutely necessary, and it is not within the scope of the manufacturer's responsibility.

Soil

The soil should have the following characteristics:

- It must be dry, compacted, stable and homogeneous.
- The land will be gravel, ballast, or pebble.
- It must have hard or medium harshness characteristics.
- The calculation of the maximum permissible pressure on the ground must comply with local and national standards, as well as with any other requirements regarding natural disasters (hurricanes, earthquakes, etc.) that may apply to the place of installation.
- Do not install on floodplains.
- The soil must be provided with a drainage system, especially in locations with high water tables and / or heavy precipitation sites.
- It is recommended that the ground should not exceed the level of the foundation.
- Soil compaction degree of 98 %.
- Maximum slope is 0,25 %.
- It must not be a direct place of passage so that the load cables do not interrupt the movement of pedestrians or traffic.

Site basis

Power Electronics recommends making a concrete foundation slab to support the charger. **The support surface for the equipment must be perfectly level. The client is responsible for the correct dimensioning and construction of the foundation in accordance with current regulations**. The foundation must meet the following characteristics:

- It is recommended that a layer of cleaning concrete be installed between the ground and the foundation.
- The sizing should be appropriate for the weight of the equipment and the characteristics of the soil
- It must be thick enough to support the equipment.
- It must have trenches wide enough to ensure proper wiring passage (the suggested cable access size is shown below).
- It is advisable to leave the slab at the same level as the ground to facilitate maintenance works.
- If the slab is above ground level, the maximum height allowed is 200 m (7.87 in.).

NOTICE

The client is responsible for building a solid concrete base perfectly leveled and elevated with respect to the user's floor height.

The equipment is not designed for mobile installations. In case of installing the equipment over a mobile platform, the warranty may be voided.
For further information on this kind of applications, please contact Power Electronics.

In case of specification of variable actions such as snow, wind or earthquake, the slab must comply with the following requirements, **not being excluding those indicated by the specific regulations of the country of installation:**

- Ability to withstand compression forces of 25 N/mm^2. (3,625 psi)
- Steel reinforcement capable of withstanding tensile forces of 500 N/mm^2. (72,519 psi)
- Taking into account severe wind conditions (60 m/s), the reinforcement should be dimensioned as follows: (134 mph)
  - The longitudinal side of the reinforcement must be able to withstand forces of up to 80 kN. (17,985 lbs)
  - The transverse side of the reinforcement must be able to withstand forces of up to 10 kN. (2,248 lbs)

Note that the thickness of the slab must be determined from the results of the geotechnical study.

See anchor recommendations at the "Anchoring of the equipment" section.

NOTICE

Each charger must be anchored to a foundation which guarantees its stability towards vertical and horizontal actions.
It is customer's responsibility to design and build the foundation to guarantee stability of each equipment.

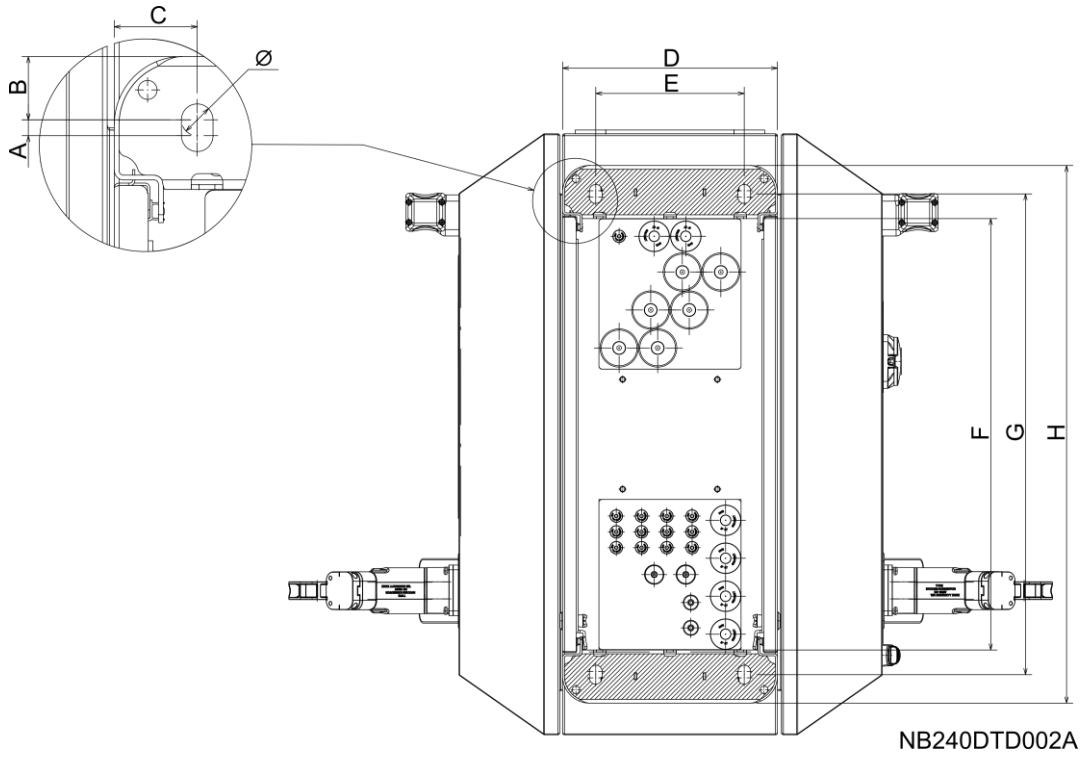
Anchoring of the equipment

NOTICE

It is the customer's responsibility to dimension correctly posts anchoring to the foundation, guaranteeing stability towards horizontal actions.

The equipment must be anchored to a solid and leveled surface (slab), see slab recommendations at the "Site basis" section.

The following image (bottom-up view) shows the location and diameter of the charger´s anchoring holes. They are located at the foot of the charger.



GENERAL DIMENSIONS

	A	B	C	D	E	F	G	H	Ø
mm	10	40	52,5	340	235	682	760	850	20
in.	0.40	1.57	2.07	13.39	9.25	26.85	29.92	33.46	0.79

APPROXIMATELY 5/8" DIA x 5.70" EXP ANCHORS

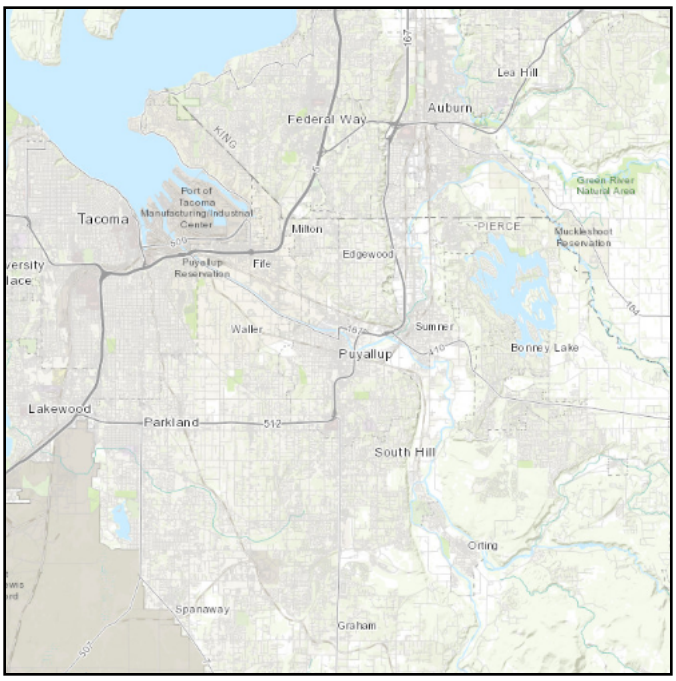
It is recommended to use an expansive anchoring M16x145, with a tightening torque of 120 Nm (manufacturer's recommendation). To guarantee the proper fixing of the equipment, install a total of 4 anchors.

ASCE 7 Hazards Report

Address:
100 River Rd
Puyallup, Washington
98371

Standard: ASCE/SEI 7-16
Risk Category: II
Soil Class: D - Default (see Section 11.4.3)

Latitude: 47.198106
Longitude: -122.294367
Elevation: 43.09182229757344 ft (NAVD 88)



Wind

Results:

Wind Speed	98 Vmph
10-year MRI	67 Vmph
25-year MRI	73 Vmph
50-year MRI	78 Vmph
100-year MRI	83 Vmph

Data Source: ASCE/SEI 7-16, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed: Tue Jun 06 2023

Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-16 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years).

Site is not in a hurricane-prone region as defined in ASCE/SEI 7-16 Section 26.2.

Seismic

Site Soil Class: D - Default (see Section 11.4.3)

Results:

S_S :	1.274	S_{D1} :	N/A
S_1 :	0.438	T_L :	6
F_a :	1.2	PGA :	0.5
F_v :	N/A	PGA_M :	0.6
S_{MS} :	1.529	F_{PGA} :	1.2
S_{M1} :	N/A	I_e :	1
S_{DS} :	1.019	C_v :	1.355

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Tue Jun 06 2023

Date Source: USGS Seismic Design Maps

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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AHBL Inc.
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Tacoma, WA 98403
253-383-2422

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JOB TITLE Korum Ford EV Court

JOB NO. 2230458.20 **SHEET NO.**
CALCULATED BY **DATE**
CHECKED BY ADM **DATE** 6/6/23

Wind Loads - Other Structures:

ASCE 7- 16

Ultimate Wind Pressures

Wind Factor = 1.00
Gust Effect Factor (G) = 0.85 Ultimate Wind Speed = 98 mph
Kzt = 1.00 Exposure = B

A. Solid Freestanding Walls & Solid Signs (& open signs with less than 30% open)

		s/h =	0.93	**Case A & B**		
Dist to sign top (h)	7.0 ft	B/s =	0.50	C_f =	1.59	
Height (s)	6.5 ft	Lr/s =	0.00	F = qz G Cf As =	**16.2**	**As**
Width (B)	3.3 ft	Kz =	0.575	As =	22.0	sf
Wall Return (Lr) =		qz =	12.0 psf	F =	356	lbs
Directionality (Kd)	0.85					
Percent of open area to gross area	0.0%	Open reduction factor =	1.00	**CaseC**		

Horiz dist from windward edge	Cf	F=qzGCfAs (psf)
0 to s	1.96	20.0 **As**
s to 2s	1.31	16.0 **As**

Case C reduction factors
Factor if s/h>0.8 = 0.87
Wall return factor for Cf at 0 to s = 1.00

Project KORUM EV

Subject

With/To

Address

Date 6/6/23

Project No. 2230458.20

Phone

Fax #

Faxed Pages

By ADM

☐ Page ____ of ____
☒ Calculations
☐ Fax
☐ Memorandum
☐ Meeting Minutes
☐ Telephone Memo

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Civil Engineers

Structural Engineers

Landscape Architects

Community Planners

Land Surveyors

City of Puyallup
Development & Permitting Services
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SEISMIC LOADS

PER ASCE 7-16 SECTION 13.3

$$F_p = \frac{0.4\, a_p\, S_{DS}\, W_p}{(R_p / I_p)} \left(1 + 2\, z/h\right)$$

$$= \frac{0.4(1.0)(1.019)W_p}{(2.5/1.0)} \left(1 + 2(0)\right)$$

$$= 0.163\, W_p$$

GIVEN
$a_p = 1.0$
$R_p = 2.5$
$I_p = 1.0$
$z/h = 0.0$
$S_{DS} = 1.019$

$F_{p\,MIN} = 0.3\, S_{DS}\, I_p\, W_p$

$= 0.3(1.019)(1.0)W_p$

$= 0.3057\, W_p$

$\therefore$ USE $0.31\, W_p$

Project KORUM EV | Project No. 2230498.20

Subject | Phone

With/To | Fax #

Address | # Faxed Pages

Date 6/6/23 | By ADH

☐ Page ____ of ____
☑ Calculations
☐ Fax
☐ Memorandum
☐ Meeting Minutes
☐ Telephone Memo

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Civil Engineers
Structural Engineers
Landscape Architects
Community Planners
Land Surveyors

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Development & Permitting Services
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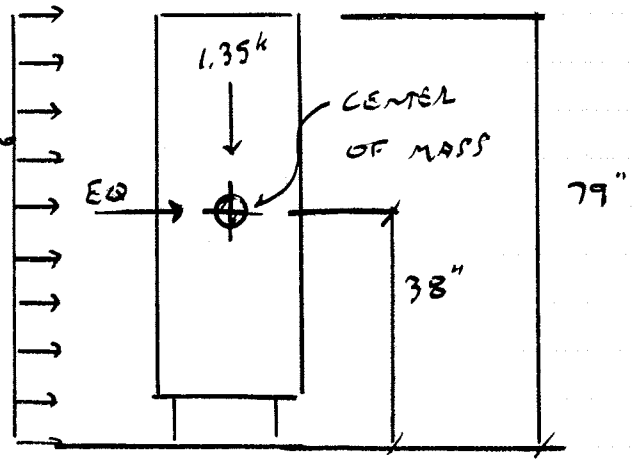
EQUIPMENT ANCHORAGE

REVIEW LOADING IN TRANSVERSE DIRECTION ONLY (CONTROLS BY INSPECTION)



EQ = 0.31 WP
= 420 # ULT

W = 16.2 PSF (38")(79")
= 16.2 PSF (21 SF)
= 340 # ULT

MAX SHEAR

V = 420 # ULT = 294 # ASD

MAX MOMENT

M_{EQ} = 420# (38")
= 1.33 k-ft ULT

M_W = 16.2 PSF (38")(79")(79"/2)
= 1.1 k-ft ULT

∴ USE 1.33 k-ft ULT / 0.93 k-ft ASD

If this does not meet with your understanding, please contact us in writing within seven days. THANK YOU.

AHBL Engineers
2215 North 30th Street
Suite 300
Tacoma, WA 98403
253.383.2422

City of Puyallup
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Project Title: Korum Ford EV Court
Engineer: ADM
Project ID: 2230458.20
Project Descr: Foundation for Exterior EV Charging Station

General Footing

Project File: 2230458.ec6

LIC# : KW-06014847, Build:20.23.04.05 AHBL, INC (c) ENERCALC INC 1983-2023

DESCRIPTION: EV Foundation

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : IBC 2018

General Information

Material Properties

f'c : Concrete 28 day strength	=	3.0	ksi
fy : Rebar Yield	=	60.0	ksi
Ec : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	145.0	pcf
φ Values Flexure	=	0.90	
Shear	=	0.750	

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Soil Design Values

Allowable Soil Bearing	=	1.50	ksf
Soil Density	=	110.0	pcf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.30	

Increases based on footing Depth

Footing base depth below soil surface	=	0.670	ft
Allow press. increase per foot of depth	=		ksf
when footing base is below	=		ft

Increases based on footing plan dimension

Allowable pressure increase per foot of depth	=	ksf
when max. length or width is greater than	=	ft

Dimensions

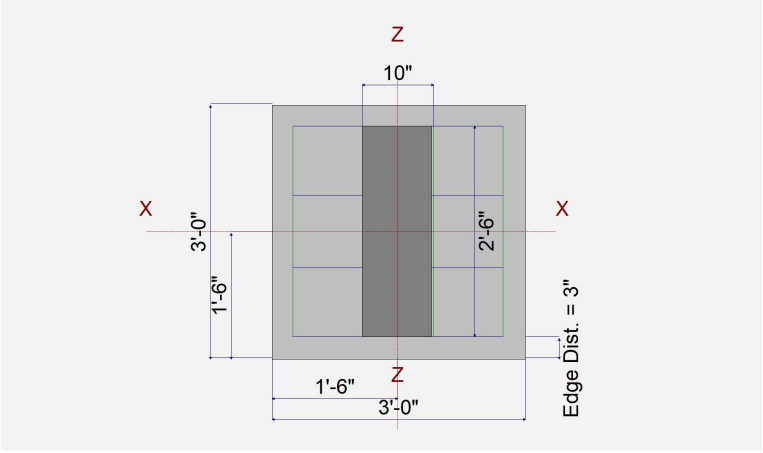
Width parallel to X-X Axis	=	3.0 ft
Length parallel to Z-Z Axis	=	3.0 ft
Footing Thickness	=	8.0 in

Pedestal dimensions...

px : parallel to X-X Axis	=	10.0 in
pz : parallel to Z-Z Axis	=	30.0 in
Height	=	6.0 in

Rebar Centerline to Edge of Concrete...

at Bottom of footing	=	4.0 in

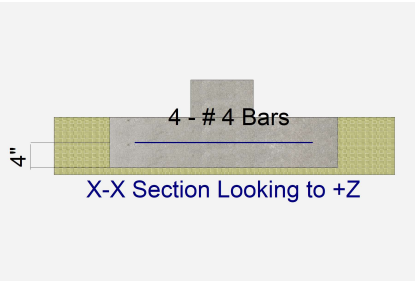


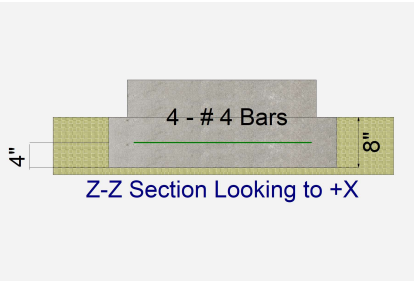
Reinforcing

Bars parallel to X-X Axis			
Number of Bars	=		4
Reinforcing Bar Size	=	#	4
Bars parallel to Z-Z Axis			
Number of Bars	=		4
Reinforcing Bar Size	=	#	4

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation	n/a
# Bars required within zone	n/a
# Bars required on each side of zone	n/a





Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	1.40				0.0			k
OB : Overburden	=								ksf
M-xx	=								k-ft
M-zz	=					1.10	1.40		k-ft
V-x	=					0.340	0.420		k
V-z	=								k

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DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.3777	Soil Bearing	0.5666 ksf	1.50 ksf	+0.60D+0.70E about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	1.546	Overturning - Z-Z	1.323 k-ft	2.045 k-ft	+0.60D+0.70E
PASS	1.964	Sliding - X-X	0.2940 k	0.5774 k	+0.60D+0.70E
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.07022	Z Flexure (+X)	0.3150 k-ft/ft	4.486 k-ft/ft	+0.90D+E
PASS	0.02847	Z Flexure (-X)	0.1277 k-ft/ft	4.486 k-ft/ft	+1.40D
PASS	0.001514	X Flexure (+Z)	0.006791 k-ft/ft	4.486 k-ft/ft	+1.40D
PASS	0.001514	X Flexure (-Z)	0.006791 k-ft/ft	4.486 k-ft/ft	+1.40D
PASS	0.1009	1-way Shear (+X)	8.290 psi	82.158 psi	+0.90D+E
PASS	0.04140	1-way Shear (-X)	3.401 psi	82.158 psi	+1.40D
PASS	n/a	1-way Shear (+Z)	0.0 psi	82.158 psi	n/a
PASS	n/a	1-way Shear (-Z)	0.0 psi	82.158 psi	n/a
PASS	0.02395	2-way Punching	3.279 psi	136.931 psi	+1.40D

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc (in)	Zecc (in)	Actual Soil Bearing Stress @ Location Bottom, -Z	Top, +Z	Left, -X	Right, +X	Actual / Allow Ratio
X-X, D Only	1.50	n/a	0.0	0.2525	0.2525	n/a	n/a	0.168
X-X, +D+0.60W	1.50	n/a	0.0	0.2525	0.2525	n/a	n/a	0.168
X-X, +D+0.70E	1.50	n/a	0.0	0.2525	0.2525	n/a	n/a	0.168
X-X, +D+0.450W	1.50	n/a	0.0	0.2525	0.2525	n/a	n/a	0.168
X-X, +D+0.5250E	1.50	n/a	0.0	0.2525	0.2525	n/a	n/a	0.168
X-X, +0.60D+0.60W	1.50	n/a	0.0	0.1515	0.1515	n/a	n/a	0.101
X-X, +0.60D+0.70E	1.50	n/a	0.0	0.1515	0.1515	n/a	n/a	0.101
Z-Z, D Only	1.50	0.0	n/a	n/a	n/a	0.2525	0.2525	0.168
Z-Z, +D+0.60W	1.50	4.742	n/a	n/a	n/a	0.05494	0.4501	0.300
Z-Z, +D+0.70E	1.50	6.986	n/a	n/a	n/a	0.0	0.5472	0.365
Z-Z, +D+0.450W	1.50	3.556	n/a	n/a	n/a	0.1043	0.4007	0.267
Z-Z, +D+0.5250E	1.50	5.240	n/a	n/a	n/a	0.03421	0.4708	0.314
Z-Z, +0.60D+0.60W	1.50	7.903	n/a	n/a	n/a	0.0	0.3580	0.239
Z-Z, +0.60D+0.70E	1.50	11.643	n/a	n/a	n/a	0.0	0.5666	0.378

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
X-X, D Only	None	0.0 k-ft	Infinity	OK
X-X, +D+0.60W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.70E	None	0.0 k-ft	Infinity	OK
X-X, +D+0.450W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.5250E	None	0.0 k-ft	Infinity	OK
X-X, +0.60D+0.60W	None	0.0 k-ft	Infinity	OK
X-X, +0.60D+0.70E	None	0.0 k-ft	Infinity	OK
Z-Z, D Only	None	0.0 k-ft	Infinity	OK
Z-Z, +D+0.60W	0.8980 k-ft	3.409 k-ft	3.796	OK
Z-Z, +D+0.70E	1.323 k-ft	3.409 k-ft	2.577	OK
Z-Z, +D+0.450W	0.6735 k-ft	3.409 k-ft	5.061	OK
Z-Z, +D+0.5250E	0.9923 k-ft	3.409 k-ft	3.435	OK
Z-Z, +0.60D+0.60W	0.8980 k-ft	2.045 k-ft	2.278	OK
Z-Z, +0.60D+0.70E	1.323 k-ft	2.045 k-ft	1.546	OK

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Sliding Stability

All units k

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
X-X, D Only	0.0 k	0.8501 k	No Sliding	OK
X-X, +D+0.60W	0.2040 k	0.8501 k	4.167	OK
X-X, +D+0.70E	0.2940 k	0.8501 k	2.891	OK
X-X, +D+0.450W	0.1530 k	0.8501 k	5.556	OK
X-X, +D+0.5250E	0.2205 k	0.8501 k	3.855	OK
X-X, +0.60D+0.60W	0.2040 k	0.5774 k	2.830	OK
X-X, +0.60D+0.70E	0.2940 k	0.5774 k	1.964	OK
Z-Z, D Only	0.0 k	0.8501 k	No Sliding	OK
Z-Z, +D+0.60W	0.0 k	0.8501 k	No Sliding	OK
Z-Z, +D+0.70E	0.0 k	0.8501 k	No Sliding	OK
Z-Z, +D+0.450W	0.0 k	0.8501 k	No Sliding	OK
Z-Z, +D+0.5250E	0.0 k	0.8501 k	No Sliding	OK
Z-Z, +0.60D+0.60W	0.0 k	0.5774 k	No Sliding	OK
Z-Z, +0.60D+0.70E	0.0 k	0.5774 k	No Sliding	OK

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.006791	+Z	Bottom	0.1728	AsMin	0.2667	4.486	OK
X-X, +1.40D	0.006791	-Z	Bottom	0.1728	AsMin	0.2667	4.486	OK
X-X, +1.20D	0.005821	+Z	Bottom	0.1728	AsMin	0.2667	4.486	OK
X-X, +1.20D	0.005821	-Z	Bottom	0.1728	AsMin	0.2667	4.486	OK
X-X, +1.20D+0.50W	0.005821	+Z	Bottom	0.1728	AsMin	0.2667	4.486	OK
X-X, +1.20D+0.50W	0.005821	-Z	Bottom	0.1728	AsMin	0.2667	4.486	OK
X-X, +1.20D+W	0.005821	+Z	Bottom	0.1728	AsMin	0.2667	4.486	OK
X-X, +1.20D+W	0.005821	-Z	Bottom	0.1728	AsMin	0.2667	4.486	OK
X-X, +1.20D+E	0.005821	+Z	Bottom	0.1728	AsMin	0.2667	4.486	OK
X-X, +1.20D+E	0.005821	-Z	Bottom	0.1728	AsMin	0.2667	4.486	OK
X-X, +0.90D+W	0.004366	+Z	Bottom	0.1728	AsMin	0.2667	4.486	OK
X-X, +0.90D+W	0.004366	-Z	Bottom	0.1728	AsMin	0.2667	4.486	OK
X-X, +0.90D+E	0.004366	+Z	Bottom	0.1728	AsMin	0.2667	4.486	OK
X-X, +0.90D+E	0.004366	-Z	Bottom	0.1728	AsMin	0.2667	4.486	OK
Z-Z, +1.40D	0.1277	-X	Bottom	0.1728	AsMin	0.2667	4.486	OK
Z-Z, +1.40D	0.1277	+X	Bottom	0.1728	AsMin	0.2667	4.486	OK
Z-Z, +1.20D	0.1095	-X	Bottom	0.1728	AsMin	0.2667	4.486	OK
Z-Z, +1.20D	0.1095	+X	Bottom	0.1728	AsMin	0.2667	4.486	OK
Z-Z, +1.20D+0.50W	0.03539	-X	Bottom	0.1728	AsMin	0.2667	4.486	OK
Z-Z, +1.20D+0.50W	0.1836	+X	Bottom	0.1728	AsMin	0.2667	4.486	OK
Z-Z, +1.20D+W	0.03772	-X	Top	0.1728	AsMin	0.2667	5.686	OK
Z-Z, +1.20D+W	0.2582	+X	Bottom	0.1728	AsMin	0.2667	4.486	OK
Z-Z, +1.20D+E	0.06170	-X	Top	0.1728	AsMin	0.2667	5.686	OK
Z-Z, +1.20D+E	0.3066	+X	Bottom	0.1728	AsMin	0.2667	4.486	OK
Z-Z, +0.90D+W	0.04874	-X	Top	0.1728	AsMin	0.2667	5.686	OK
Z-Z, +0.90D+W	0.2415	+X	Bottom	0.1728	AsMin	0.2667	4.486	OK
Z-Z, +0.90D+E	0.05125	-X	Top	0.1728	AsMin	0.2667	5.686	OK
Z-Z, +0.90D+E	0.3150	+X	Bottom	0.1728	AsMin	0.2667	4.486	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	3.40 psi	3.40 psi	0.00 psi	0.00 psi	3.40 psi	82.16 psi	0.04	OK
+1.20D	2.92 psi	2.92 psi	0.00 psi	0.00 psi	2.92 psi	82.16 psi	0.04	OK
+1.20D+0.50W	0.97 psi	4.86 psi	0.00 psi	0.00 psi	4.86 psi	82.16 psi	0.06	OK
+1.20D+W	0.97 psi	6.83 psi	0.00 psi	0.00 psi	6.83 psi	82.16 psi	0.08	OK
+1.20D+E	1.73 psi	8.10 psi	0.00 psi	0.00 psi	8.10 psi	82.16 psi	0.10	OK
+0.90D+W	1.36 psi	6.38 psi	0.00 psi	0.00 psi	6.38 psi	82.16 psi	0.08	OK
+0.90D+E	1.37 psi	8.29 psi	0.00 psi	0.00 psi	8.29 psi	82.16 psi	0.10	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	3.28 psi	136.93 psi	0.02395	OK
+1.20D	2.81 psi	136.93 psi	0.02053	OK
+1.20D+0.50W	2.81 psi	136.93 psi	0.02053	OK

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Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.20D+W	2.82 psi	136.93 psi	0.02057	OK
+1.20D+E	2.85 psi	136.93 psi	0.02078	OK
+0.90D+W	2.14 psi	136.93 psi	0.01564	OK
+0.90D+E	2.19 psi	136.93 psi	0.01601	OK

SIMPSON Strong-Tie®

Anchor Designer™ Software

Version 3.1.2209.3

Company:	AHBL	Date:	9/8/2022
Engineer:	ADM	Page:	1/6
Project:	Korum Ford EV Court		
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City of Puyallup
Development & Permitting Services
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1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment: Seismic forces have been increased by overstrength factor (2.0) per ACI.

Project description: Anchorage of EV Chargers
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-19
Units: Imperial units

Anchor Information:
Anchor type: Torque controlled expansion anchor
Material: Carbon Steel
Diameter (inch): 0.625
Nominal Embedment depth (inch): 5.125
Effective Embedment depth, h_{ef} (inch): 4.500
Code report: ICC-ES ESR-3037
Anchor category: 1
Anchor ductility: Yes
h_{min} (inch): 7.88
c_{ac} (inch): 9.00
C_{min} (inch): 8.00
S_{min} (inch): 2.75

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 8.00
State: Cracked
Compressive strength, f'_c (psi): 3000
$\Psi_{c,V}$: 1.0
Reinforcement condition: Supplementary reinforcement not present
Supplemental edge reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Ignore 6do requirement: Not applicable
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 33.50 x 13.25 x 0.25

Recommended Anchor
Anchor Name: Strong-Bolt® 2 - 5/8"Ø CS Strong-Bolt 2, hnom:5.125" (130mm)
Code Report: ICC-ES ESR-3037

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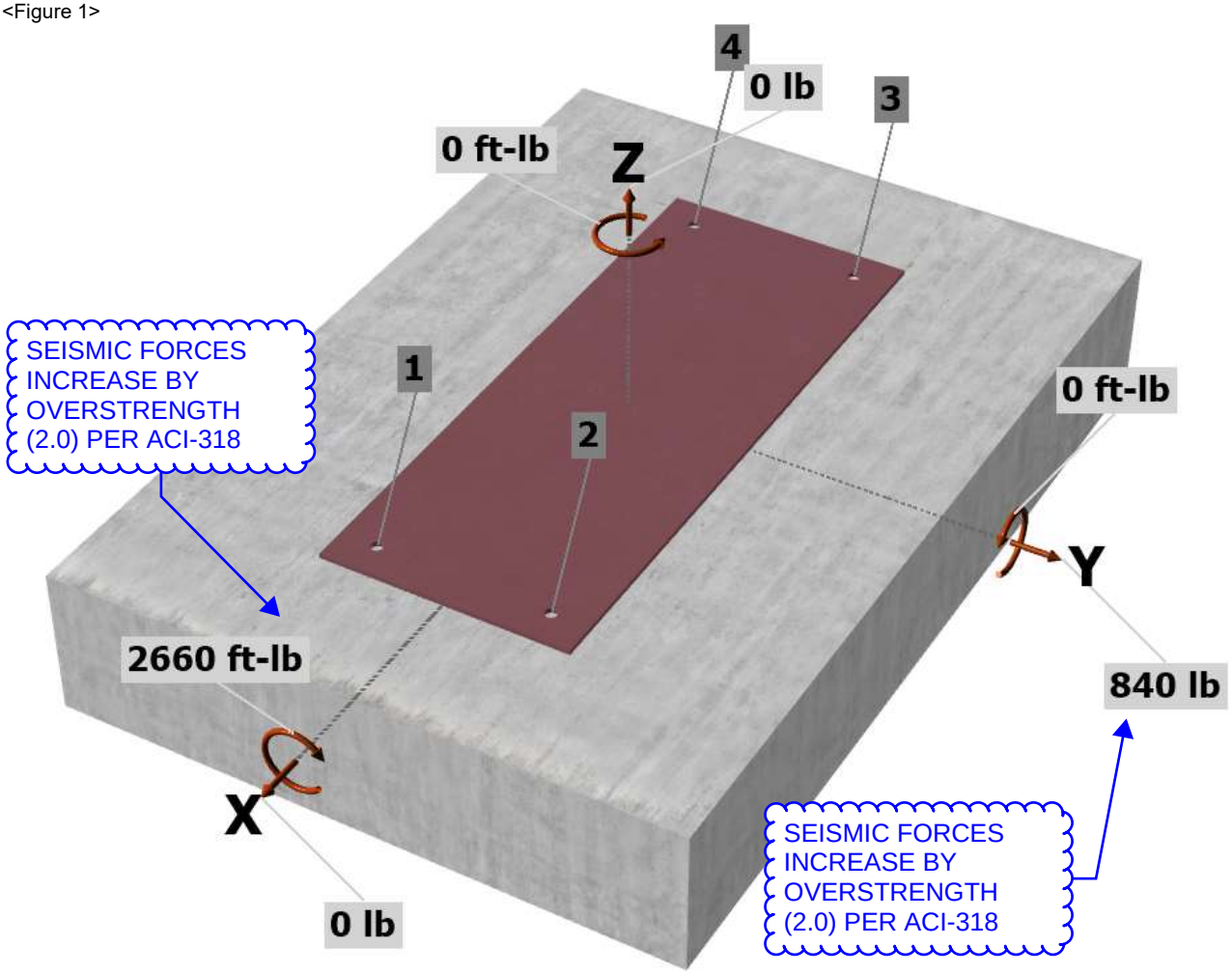
E-mail:	dmceachern@ahbl.com		

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: Yes
Anchors subjected to sustained tension: Not applicable
Ductility section for tension: 17.10.5.3 (d) is satisfied
Ductility section for shear: 17.10.6.3 (c) is satisfied
Ω_0 factor: not set
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: Yes

Strength level loads:

N_{ua} [lb]: 0
V_{uax} [lb]: 0
V_{uay} [lb]: 840
M_{ux} [ft-lb]: -2660
M_{uy} [ft-lb]: 0
M_{uz} [ft-lb]: 0

<Figure 1>



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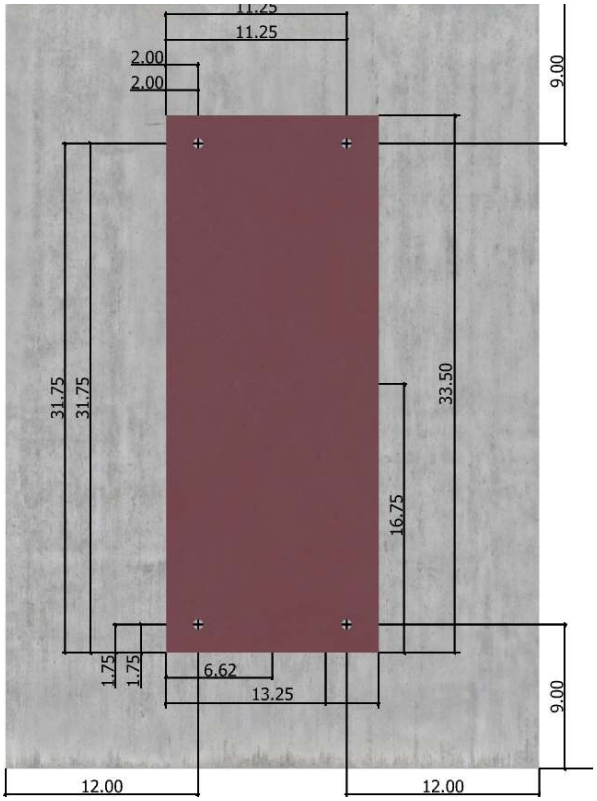
<Figure 2>

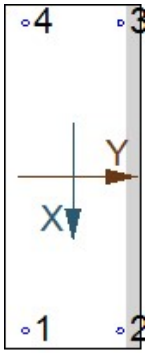


3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	1466.6	0.0	210.0	210.0
2	90.9	0.0	210.0	210.0
3	90.9	0.0	210.0	210.0
4	1466.6	0.0	210.0	210.0
Sum	3115.0	0.0	840.0	840.0

Maximum concrete compression strain (‰): 0.03
Maximum concrete compression stress (psi): 134
Resultant tension force (lb): 3115
Resultant compression force (lb): 3115
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 4.08
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. 17.6.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
19070	0.75	14303

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.6.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.6.2.2.1)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
17.0	1.00	3000	4.500	8888

$0.75\phi N_{cbg} = 0.75\phi \left(A_{Nc} / A_{Nco}\right) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b$ (Sec. 17.5.1.2 & Eq. 17.6.2.1a)

A_{Nc} (in^2)	A_{Nco} (in^2)	$c_{a,min}$ (in)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	$0.75\phi N_{cbg}$ (lb)
614.25	182.25	9.00	0.623	1.000	1.00	1.000	8888	0.65	9098

6. Pullout Strength of Anchor in Tension (Sec. 17.6.3)

$0.75\phi N_{pn} = 0.75\phi \Psi_{c,P} \lambda_a N_p (f'_c / 2{,}500)^n$ (Sec. 17.5.1.2, Eq. 17.6.3.1 & Code Report)

$\Psi_{c,P}$	λ_a	N_p (lb)	f'_c (psi)	n	ϕ	$0.75\phi N_{pn}$ (lb)
1.0	1.00	6895	3000	0.50	0.65	3682

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8. Steel Strength of Anchor in Shear (Sec. 17.7.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
9930	1.0	0.65	6455

9. Concrete Breakout Strength of Anchor in Shear (Sec. 17.7.2)

Shear perpendicular to edge in y-direction:

$V_{by} = \min|7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5};\ 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}|$ (Eq. 17.7.2.2.1a & Eq. 17.7.2.2.1b)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{by} (lb)
4.50	0.625	1.00	3000	10.00	14225

$\phi V_{cbgy} = \phi\,(A_{Vc} / A_{Vco})\,\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{by}$ (Sec. 17.5.1.2 & Eq. 17.7.2.1b)

A_{Vc} (in^2)	A_{Vco} (in^2)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{cbgy} (lb)
384.00	450.00	1.000	0.880	1.000	1.369	14225	0.70	10239

Shear parallel to edge in x-direction:

$V_{by} = \min|7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5};\ 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}|$ (Eq. 17.7.2.2.1a & Eq. 17.7.2.2.1b)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{by} (lb)
4.50	0.625	1.00	3000	8.00	10179

$\phi V_{cbgx} = \phi\,(2)(A_{Vc} / A_{Vco})\,\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{by}$ (Sec. 17.5.1.2, 17.7.2.1(c) & Eq. 17.7.2.1b)

A_{Vc} (in^2)	A_{Vco} (in^2)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{cbgx} (lb)
266.00	288.00	1.000	1.000	1.000	1.225	10179	0.70	16120

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.7.3)

$\phi V_{cpg} = \phi k_{cp} N_{cbg} = \phi k_{cp}(A_{Nc} / A_{Nco})\,\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b$ (Sec. 17.5.1.2 & Eq. 17.7.3.1b)

k_{cp}	A_{Nc} (in^2)	A_{Nco} (in^2)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cpg} (lb)
2.0	614.25	182.25	1.000	1.000	1.000	1.000	8888	0.70	41941

11. Results

Interaction of Tensile and Shear Forces (Sec. 17.8)

Tension	Factored Load, N_{ua} (lb)	Design Strength, øN_n (lb)	Ratio	Status
Steel	1467	14303	0.10	Pass
Concrete breakout	3115	9098	0.34	Pass
Pullout	**1467**	**3682**	**0.40**	**Pass (Governs)**

Shear	Factored Load, V_{ua} (lb)	Design Strength, øV_n (lb)	Ratio	Status
Steel	210	6455	0.03	Pass
T Concrete breakout y+	**840**	**10239**	**0.08**	**Pass (Governs)**
|| Concrete breakout x-	**420**	**16120**	**0.03**	**Pass (Governs)**
Pryout	840	41941	0.02	Pass

Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.8.1	0.40	0.00	39.8%	1.0	Pass

5/8"Ø CS Strong-Bolt 2, hnom:5.125" (130mm) meets the selected design criteria.

12. Warnings

- Per designer input, ductility requirements for tension have been determined to be satisfied – designer to verify.

- Per designer input, ductility requirements for shear have been determined to be satisfied – designer to verify.

- Designer must exercise own judgement to determine if this design is suitable.

- Refer to manufacturer's product literature for hole cleaning and installation instructions.