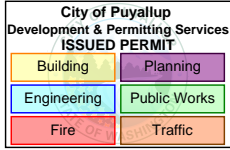


**FULL SIZED LEDGIBLE COLOR REPORT IS REQUIRED TO BE PROVIDED BY THE PERMITTEE ON SITE FOR ALL INSPECTIONS**

Project:	Tesla Charging Station		
Proj. No.:	N/A		
Designer:	CED	Date:	1/19/24
Sheet:		of	



# Equipment Anchor & Foundation Calculations

for

**TESLA CHARGING STATION**  
**Puyallup, WA**

Prepared by:



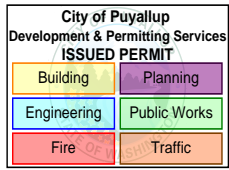
**GPD GROUP**  
Professional Corporation

**520 South Main Street; Suite 2531**  
**Akron, OH 44311**  
**(330) 572-2100**



EXPIRES 01/16/2025  
01/19/2024

This analysis was analyzed following the 2021 Washington State Building Code. The scope of these calculations is limited to the design of the equipment anchors and equipment foundations. The structural capacity of the equipment itself is outside of the scope of this analysis.

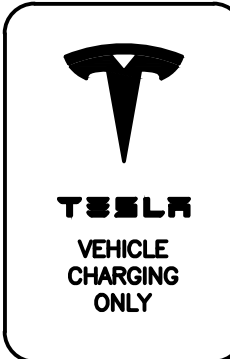




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4. V4 CHARGING POST ANCHOR CALCULATIONS
5. SWITCHGEAR ANCHOR CALCULATIONS
6. FOUNDATION CALCULATIONS
7. HILTI REFERENCE DOCUMENTATION

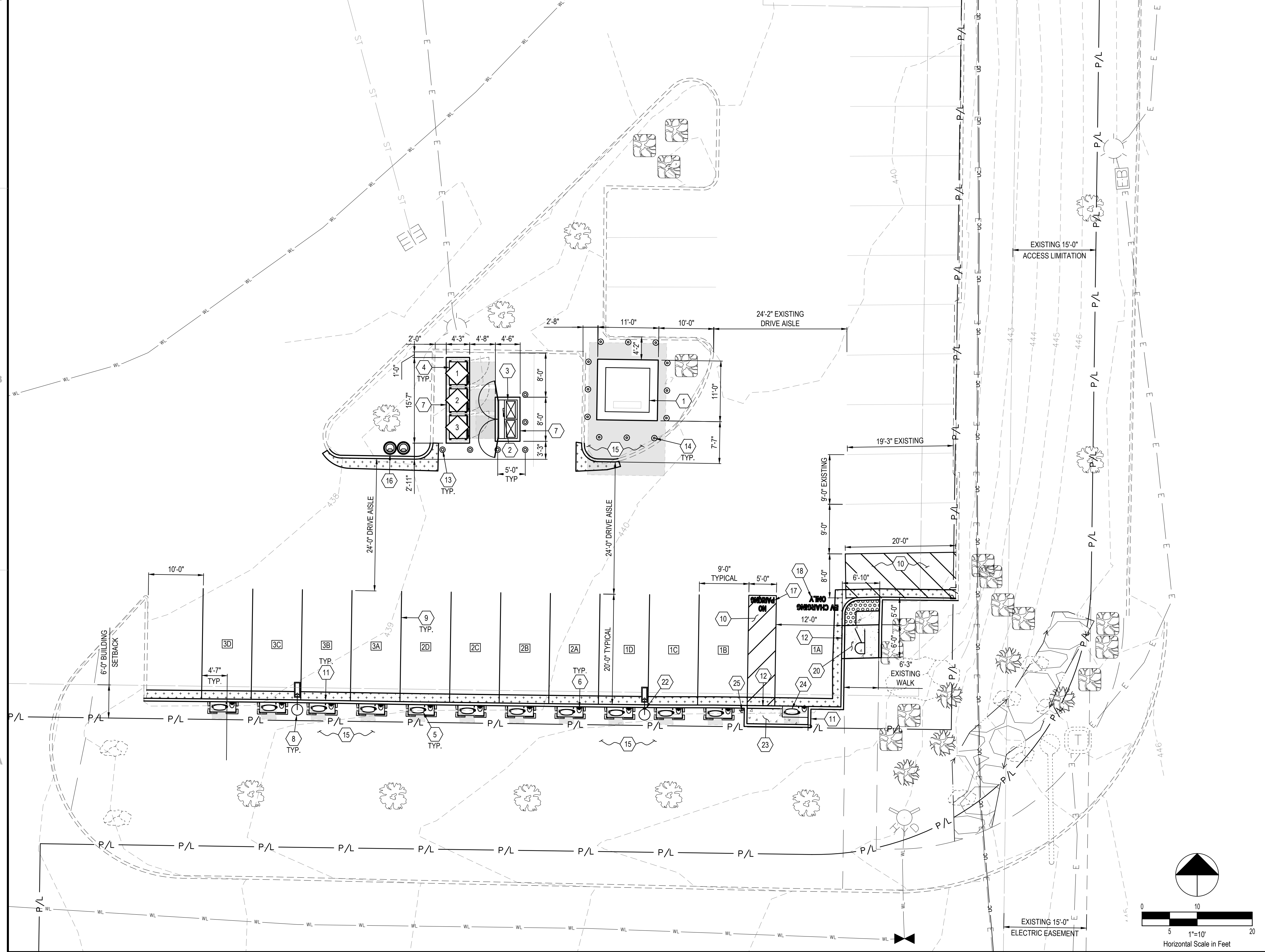
City of Puyallup Development & Permitting Services ISSUED PERMIT	
Building	Planning
Engineering	Public Works
Fire	Traffic

**1. PROPOSED SITE PLAN**

SUPERCHARGER POST SCHEDULE		SIGNAGE	
CABINET	POST	SIGN TYPE	DEDICATED
1	1A	DEDICATED PARKING, VAN ACCESSIBLE	 TESLA VEHICLE CHARGING ONLY
	1B	DEDICATED PARKING	
	1C	DEDICATED PARKING	
2	2A	DEDICATED PARKING	 VAN ACCESSIBLE
	2B	DEDICATED PARKING	
	2C	DEDICATED PARKING	
	2D	DEDICATED PARKING	
3	3A	DEDICATED PARKING	 DESIGNED FOR DISABLED ACCESS USE LAST
	3B	DEDICATED PARKING	
	3C	DEDICATED PARKING	
	3D	DEDICATED PARKING	

PARKING STALL ANALYSIS	
EXISTING STALLS UTILIZED AS A RESULT OF THIS PROJECT	18
PROPOSED DCFC TESLA STALLS	12
PROPOSED NON-EV STALLS	3
NET STALL COUNT	-3

WHITE SYMBOL  
WHITE TEXT  
SOLID FEDERAL BLUE #15090 IN FED STANDARD 595C BACKGROUND PAINT. SIGNS SHALL BE REFLECTORIZED.  
WHITE TEXT



**GENERAL SHEET NOTES**

- EXISTING PROPERTY LINES, RIGHT-OF-WAY BOUNDARIES, EASEMENT BOUNDARIES, SETBACKS, AND UTILITIES ARE SHOWN FOR REFERENCE ONLY.
- CONTRACTOR SHALL REMOVE EXISTING PAVEMENT AND/OR CURB USING CLEAN SAWCUTS TO INSTALL PROPOSED UNDERGROUND CONDUITS AND REPLACE PAVEMENT AND/OR CURB AFTER CONDUITS HAVE BEEN INSTALLED. SEE ELECTRICAL SHEETS FOR CONDUIT ROUTING, APPROXIMATE CONDUIT RUN LENGTHS AND TRENCH DETAIL. CONTRACTOR SHALL MEET OR EXCEED EXISTING PAVEMENT SPECIFICATIONS. NOTIFY ENGINEER OF ANY DISCREPANCIES PRIOR TO PERFORMING WORK.
- APPLY LIQUID ASPHALT AT ALL JOINTS BETWEEN CONCRETE AND ASPHALT AND WHERE PROPOSED ASPHALT MEETS EXISTING, INCLUDING SAW CUT JOINTS.
- CONTRACTOR SHALL FIELD VERIFY ALL EXISTING SLOPES AND GRADES PRIOR TO CONSTRUCTION. FINAL GRADES SHALL BE DETERMINED IN FIELD BY THE CONTRACTOR AND APPROVED BY THE CONSTRUCTION MANAGER.
- THE CONTRACTOR SHALL ENSURE POSITIVE DRAINAGE TOWARDS THE NEAREST EXISTING DRAINAGE STRUCTURE AND ENSURE NO PONDING OCCURS ON SITE.
- CONTRACTOR SHALL ENSURE SLOPES OF PARKING STALL 1A AND ADJACENT TRANSVERSE STRIPED AREA(S) ARE COMPLIANT WITH NATIONAL ADA STANDARDS. NO SLOPE SHALL EXCEED 2% IN ANY DIRECTION WITHIN PARKING STALL 1A AND ADJACENT TRANSVERSE STRIPED AREA(S). CONTRACTOR SHALL REMOVE AND REGRADE AREA(S) AS REQUIRED TO ACHIEVE NECESSARY SLOPES. CONTRACTOR SHALL INSTALL FINAL PAVEMENT MARKINGS IN ACCORDANCE WITH THE CURRENT AHJ'S REGULATIONS.

**PLAN KEYNOTES**

- PROPOSED PAD MOUNTED ELECTRICAL UTILITY TRANSFORMER (BY UTILITY). CONTRACTOR SHALL PROVIDE CONCRETE PAD AND VAULT PER UTILITY SPECIFICATIONS. COORDINATE FINAL LOCATION WITH UTILITY. SEE ELECTRICAL PLANS FOR PROPOSED ROUTING.
- PROPOSED UTILITY METER MOUNTED IN SWITCHGEAR PER ELECTRIC COMPANY SPECIFICATIONS AND DETAILS ON ELECTRICAL SHEETS.
- PROPOSED SWITCHGEAR ASSEMBLY WITH INTEGRATED TESLA SITE CONTROLLER AND PRIMARY BROADCAST UNIT PER ELECTRICAL DRAWINGS. SEE CIVIL DETAILS FOR ANCHORAGE.
- PROPOSED TESLA SUPERCHARGER CABINET (TYPICAL OF 3). SEE CIVIL DETAILS.
- PROPOSED TESLA SUPERCHARGER POST WITH INDIVIDUAL PRECAST CONCRETE FOUNDATION AND ATTACHED DETERRENT BOLLARD (TYPICAL OF 11). SEE CIVIL DETAILS.
- PROPOSED NON-ILLUMINATED PARKING SIGN (TYPICAL OF 12). SEE CIVIL DETAILS. SEE SUPERCHARGER POST SCHEDULE. THIS SHEET. MOUNT SIGN POST IN BOLLARD AS NOTED.
- PROPOSED CONCRETE EQUIPMENT PAD. SEE CIVIL DETAILS.
- PROPOSED LIGHT POLE (TOTAL OF 2), SEE CIVIL DETAILS. SEE ELECTRICAL DRAWINGS FOR POLE AND FIXTURE SPECIFICATIONS AND WIRING.
- PROPOSED PAINTED 4" WIDE SOLID STRIPE TO MATCH EXISTING STRIPING IN COLOR. SEE PAVEMENT MARKING NOTES ON SHEET C-003.
- PROPOSED PAINTED 4" WIDE TRANSVERSE STRIPING TO MATCH EXISTING STRIPING IN COLOR. STRIPING SHALL BE 3'-0" O.C. SEE PAVEMENT MARKING NOTES ON SHEET C-003 AND CIVIL DETAILS.
- PROPOSED CONCRETE CURB TO MATCH EXISTING. SEE CIVIL DETAILS.
- PROPOSED FLUSH CONCRETE CURB. SEE CIVIL DETAILS.
- PROPOSED CRASHCORE DETERRENT BOLLARD (TYPICAL OF 6). SEE CIVIL DETAILS.
- PROPOSED DETERRENT BOLLARD PER UTILITY SPECIFICATION (TYPICAL OF 12)
- ALL DISTURBED AREAS NOT TO BE PAVED SHALL BE RETURNED TO MATCH EXISTING GROUND CONDITIONS UNLESS OTHERWISE NOTED. FINAL MATERIAL SHALL BE COORDINATED WITH TESLA.
- PROPOSED TRASH CAN AND RECYCLING BIN (TYPICAL OF 1 EACH). SEE CIVIL DETAILS.
- PROPOSED "NO PARKING" IN WHITE LETTERS, 12 INCHES. SEE PAVEMENT MARKING NOTES ON SHEET C-003.
- PROPOSED "EV CHARGING ONLY" IN WHITE LETTERS, 12 INCHES. SEE PAVEMENT MARKING NOTES ON SHEET C-003.
- PROPOSED UTILITY JUNCTION BOX PER UTILITY SPECIFICATION.
- PROPOSED ACCESSIBLE CONCRETE RAMP. SEE CIVIL DETAILS.
- PROPOSED CONCRETE CURB TAPER. SEE CIVIL DETAILS.
- PROPOSED WIRELESS ACCESS POINT (TYPICAL OF 1). MOUNT PER MANUFACTURER'S SPECIFICATIONS AT MINIMUM 10'-0" ABOVE GRADE. WHERE APPLICABLE, CONTRACTOR SHALL MOUNT TO EXISTING LIGHT POLE.
- PROPOSED CONCRETE ACCESSIBLE WALK. SEE CIVIL DETAILS.
- PROPOSED TESLA SUPERCHARGER POST WITH INDIVIDUAL CAST-IN-PLACE CONCRETE FOUNDATION (TYPICAL OF 1). SEE CIVIL DETAILS.
- PROPOSED NO PARKING SIGN ON POST. SEE CIVIL DETAILS.

**LEGEND**  
(SEE SHEET C-003 FOR EXISTING LEGEND)

- PROPOSED EQUIPMENT CLEAR SPACE
- PROPOSED CONCRETE PAVEMENT TO MATCH EXISTING IN TYPE AND DEPTH. INCLUDE ENGINEERED COMPACTED BACKFILL BELOW PAVEMENT SECTION. TRENCHING NOT INCLUDED. CONTRACTOR SHALL REPLACE ANY FABRIC ENCOUNTERED DURING EXCAVATION INCLUDING BUT NOT LIMITED TO: GEOTEXTILE, WATER-PROOFING, PAVING FABRICS, ETC. THE REPLACEMENT MATERIAL(S) SHALL BE EQUAL TO OR BETTER THAN EXISTING AND SHALL BE CONFIRMED BY THE MANUFACTURER'S REPRESENTATIVE TO BE COMPATIBLE WITH THE EXISTING INSTALLATION.
- PROPOSED ASPHALT PAVEMENT TO MATCH EXISTING IN TYPE AND DEPTH. INCLUDE ENGINEERED COMPACTED BACKFILL BELOW PAVEMENT SECTION. TRENCHING NOT INCLUDED. FOR FULL DEPTH REPLACEMENT, CONTRACTOR SHALL REPLACE ANY FABRIC ENCOUNTERED DURING EXCAVATION INCLUDING BUT NOT LIMITED TO: GEOTEXTILE, WATER-PROOFING, PAVING FABRICS, ETC. THE REPLACEMENT MATERIAL(S) SHALL BE EQUAL TO OR BETTER THAN EXISTING AND SHALL BE CONFIRMED BY THE MANUFACTURER'S REPRESENTATIVE TO BE COMPATIBLE WITH THE EXISTING INSTALLATION. IN LIEU OF FULL DEPTH REPLACEMENT, CONTRACTOR CAN MILL AND OVERLAY (1.5" MIN.) PROPOSED ASPHALT PROVIDED THAT THE FINAL ASPHALT SECTION IS EQUAL TO OR GREATER THAN THE EXISTING SECTION AND DRAINAGE AND ADA COMPLIANCE IS NOT NEGATIVELY AFFECTED.

**TESLA**  
3500 DEER CREEK RD.  
PALO ALTO, CA 94304  
(650) 681-5000

**GPD GROUP**  
Professional Corporation  
520 South Main Street, Suite 2531  
Akron, OH 44311  
330.572.2100 Fax 330.572.2101

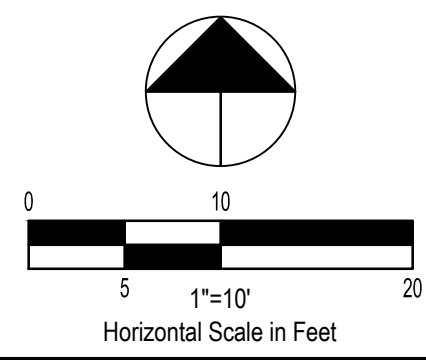
REV.	DATE	DESCRIPTION
A	08/11/2023	ISSUED FOR 50% REVIEW
B	09/11/2023	ISSUED FOR 50% REVIEW
C	09/13/2023	ISSUED FOR 90% REVIEW
D	10/30/2023	ISSUED FOR SIGN & SEAL
E	01/19/2024	ISSUED FOR SIGN & SEAL - UTILITY UPDATES

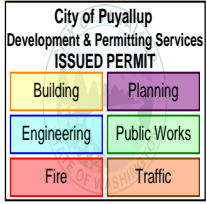
**TESLA SUPERCHARGER STATION**  
3310 S MERIDIAN ST. (TESLA SUPERCHARGER)  
PUYALLUP, WA 98373

PROJECT MANAGER: IM  
DESIGNER: MAM

JOB NO.  
**2023241.47**

**C-111**





2. **SITE SPECIFIC WIND SEISMIC DESIGN MAP SUMMARY REPORT**



# ASCE Hazards Report

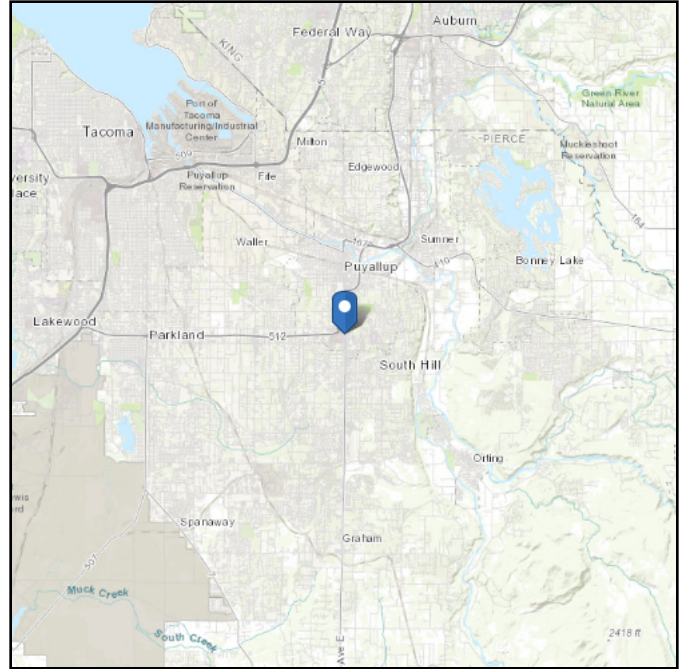
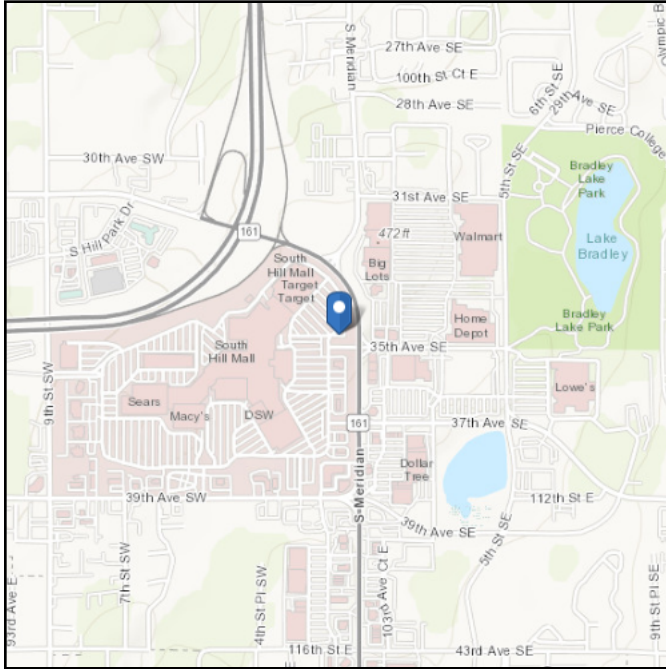
**Address:**  
No Address at This Location

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

**Latitude:** 47.15877  
**Longitude:** -122.29369  
**Elevation:** 439.38375362064716 ft (NAVD 88)

City of Puyallup  
Development & Permitting Services  
ISSUED PERMIT

Building	Planning
Engineering	Public Works
Fire	Traffic



## Wind

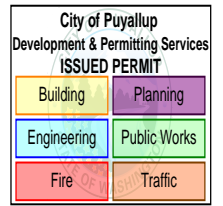
### Results:

Wind Speed	97 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: Thu Jan 18 2024

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.



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

**Results:**

$S_s$ :	1.263	$S_{D1}$ :	N/A
$S_1$ :	0.436	$T_L$ :	6
$F_a$ :	1.2	PGA :	0.5
$F_v$ :	N/A	PGA <sub>M</sub> :	0.6
$S_{MS}$ :	1.515	$F_{PGA}$ :	1.2
$S_{M1}$ :	N/A	$I_e$ :	1
$S_{DS}$ :	1.01	$C_v$ :	1.353

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

**Data Accessed:** Thu Jan 18 2024

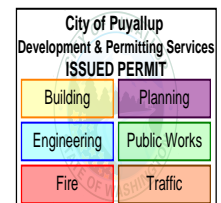
**Date Source:** [USGS Seismic Design Maps](https://www.usgs.gov/seismic-design-maps)



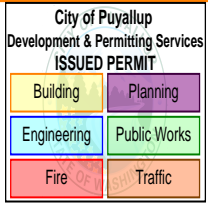
The ASCE Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 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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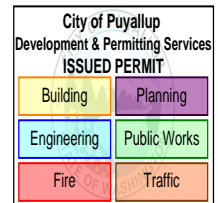




TESLA CHARGING STATION

3. V3 CHARGING CABINET ANCHOR CALCULATIONS

**ASCE 7-16 Wind Calculations**  
**V3 Charging Cabinet Equipment Anchor Calculations**



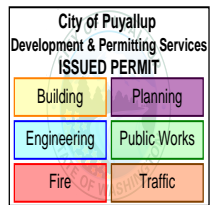
Wind Force Calculation		
Basic Wind Speed (Ultimate)	97	mph (Fig. 26.5-1B)
Risk Category	II	(Table 1.5-1)
Exposure Category	C	(Section 26.7)
Topographic Category	1	(Section 26.8 and Figure 26.8-1)
Z <sub>g</sub>	900	(Table 26.11-1)
α	9.5	(Table 26.11-1)
K <sub>d</sub>	0.85	(Section 26.6 and Table 26.6-1)
K <sub>zmin</sub>	0.85	
K <sub>zt</sub>	1.000	(Section 26.8.2)
K <sub>e</sub>	1.000	(Section 26.9)
K <sub>z</sub>	0.85	(Table 26.10-1) Max. of: (K <sub>z</sub> = 2.01 * (15 / Z <sub>g</sub> ) <sup>2/α</sup> , or K <sub>zmin</sub> )
q <sub>z</sub>	17.380	(Eq. 26.10-1 -- q <sub>z</sub> = 0.00256 * K <sub>z</sub> * K <sub>zt</sub> * K <sub>d</sub> * K <sub>e</sub> * V <sup>2</sup> )
G	0.850	(Section 26.11)
C <sub>f</sub>	1.314	(Fig. 29.4-1)
<b>Wind Force on Equipment, F</b>	<b>593.4</b>	lbs (Eq. 29.4-1 -- F = q <sub>z</sub> * G * C <sub>f</sub> * A <sub>f</sub> )
<b>Overturning Moment, M</b>	<b>2213.0</b>	ft-lbs (M = F * d)
Equipment Properties		
Height (y) =	89.5	in
Width (x) =	37.8	in
Weight (w) =	2448	lbs
Length (b) =	49.2	in
Distance from Resultant Force (d) =	44.750	in (d = y / 2)**
Total Wind Area (A) =	30.58	ft <sup>2</sup>
Equipment Anchorage Parameters		
Hilti Kwik Bolt TZ2 S.S. Anchor Dia. =	5/8	in
Anchor Embedment =	3.25	in
Concrete Strength =	2500	psi
Equipment Anchor in Tension (n <sub>T</sub> ) =	2	Anchors
Equipment Anchor in Shear (n <sub>V</sub> ) =	4	Anchors
Equipment Front Anchor Distance (x <sub>front</sub> ) =	0	in
Equipment Back Anchor Distance (x <sub>back</sub> ) =	33.86	in
Anchor ⊥ Edge Distance, (c1) =	8	in > c min (3.25 in)
Anchor    Edge Distance, (c2) =	8	in > c min (3.25 in)
Equipment Anchor Spacing (s) =	6	in > s min (2.75 in)
Concrete Pad Thickness =	8	in > h min (5.5 in)
Equipment Reactions		
<b>Max Tensile Reaction per Anchor (T) =</b>	<b>-158.7</b>	lbs. (T = (LF * F * d - 0.9 * w * s/2) / (s * n <sub>T</sub> ))
<b>Max Shear Reaction per Anchor (V) =</b>	<b>148.4</b>	lbs. (V = LF * F / n <sub>V</sub> )
<b>0.625" Dia. Hilti Kwik Anchor TZ2 S.S. Anchor (3.25" hef)</b> (ESR #:4266)		
Anchor Tensile Strength (φNSA) =	14125.0	lbs. (φNSA = φ * A <sub>se,N</sub> * f <sub>uta</sub> ) ACI 318-14 Chapter 17
Anchor Shear Strength (φVSA) =	8030.0	lbs. determined by static shear tests with φVsa < φ 0.60 Ase,V futa as noted in ACI 318-14 Chapter 17.
Anchor Tension Pullout Capacity =	4000.0	lbs. Design Strength from HILTI Simplified Design Tables (Cracked Concrete)
Tension Spacing Factor, f <sub>AN</sub> =	0.81	} Adjustment Factors from HILTI Simplified Design Tables for stainless steel anchor in cracked concrete
Tension Edge Distance Factor, f <sub>RN</sub> =	1	
Factored Anchor Tension Pullout Capacity =	3240.0	lbs. (φNn * f <sub>AN</sub> * f <sub>m</sub> )
Anchor Shear Capacity =	8615.0	lbs. Design Strength from HILTI Simplified Design Tables (Cracked Concrete)
Shear Spacing Factor, f <sub>AV</sub> =	0.6	} Adjustment Factors from HILTI Simplified Design Tables for stainless steel anchor in cracked concrete
Shear ⊥ to Edge Factor, f <sub>RV⊥</sub> =	0.71	
Shear    to Edge Factor, f <sub>RV  </sub> =	1	
Shear Conc. Thickness Factor, f <sub>HV</sub> =	0.73	
Factored Anchor Shear Capacity =	2679.1	lbs. (φVn * f <sub>AV</sub> * f <sub>RV</sub> * f <sub>HV</sub> )

Reduction factors based on Anchor spacing 6 in, an edge distance of 8 in, and a pad thickness of 8 in with 2500 psi concrete.

<b>% Capacity Tension</b>	<b>N/A</b>	<b>Acceptable - No Tension on Anchors</b>
<b>% Capacity Shear</b>	<b>5.5%</b>	<b>Acceptable</b>
<b>% Shear &amp; Tension Interaction</b>	<b>5.5%</b>	<b>Acceptable</b>

\*Assumed: (1) row of Anchors withstands tension created by overturning, while all Anchors share shear equally.

\*\*Center of gravity is assumed to be at the middle of equipment.



**Seismic Demands on Nonbuilding Structure (ASCE 7-16)**  
**V3 Charging Cabinet Equipment Anchor Calculations**

Seismic Force Calculations (ASCE 7-16 Chapter 15)		
Component Weight, W =	2448	lbs.
S <sub>DS</sub> =	1.011	
S <sub>D1</sub> =	0.542	
S <sub>1</sub> =	0.436	
Seismic Design Category =	D	
Importance Factor, I <sub>e</sub> =	1.0	Table 1.5-2
structure height, h <sub>n</sub> =	7.458333333	ft
Nonbuilding Structure Type =	Mechanically anchored flat-bottom ground-supported tanks	
R =	3.00	Table 15.4-2
C <sub>t</sub> =	0.02	Table 12.8-2
x =	0.75	Table 12.8-2
T <sub>a</sub> =	0.090	T <sub>a</sub> = C <sub>t</sub> * h <sub>n</sub> <sup>x</sup> -- Eq: 12.8-7
T <sub>L</sub> =	6.000	
C <sub>s max</sub> =	2.00	when T <sub>a</sub> < T <sub>L</sub> , C <sub>s</sub> = S <sub>D1</sub> / (T <sub>a</sub> * R / I <sub>e</sub> ) -- ASCE 7-16 Eq: 12.8-3
C <sub>s min1</sub> =	0.044	C <sub>s</sub> = max of: 0.044 * S <sub>DS</sub> * I <sub>e</sub> ; 0.03 -- ASCE 7-16 Eq: 15.4-1
C <sub>s min2</sub> =	N/A	C <sub>s</sub> > 0.8 * S <sub>1</sub> / (R / I <sub>e</sub> ) if S <sub>1</sub> > 0.6g -- ASCE 7-16 Eq: 15.4-2
C <sub>s</sub> =	0.34	C <sub>s</sub> = S <sub>DS</sub> / (R / I <sub>e</sub> ) -- ASCE 7-16 Eq: 12.8-2 -- <u>Controls</u>
<b>Seismic Force, F =</b>	<b>825.0</b>	lbs. F = W * C <sub>s</sub> -- Eq: 12.8-1
<b>Overturning Seismic Moment, M =</b>	<b>3076.5</b>	ft-lbs. (M = F * d)
Overstrength Factor, Ω =	2.0	Table 15.4-2
<b>Factored Seismic Force, F' =</b>	<b>1650.0</b>	lbs. (F' = F * Ω)
<b>Factored Seismic Moment, M' =</b>	<b>6152.9</b>	ft-lbs. (M' = M * Ω)
Equipment Properties		
Height (y) =	89.5	in
Width (x) =	37.8	in
Length (b) =	49.21	in
Weight (w) =	2448	lbs
Distance from Resultant Force (d) =	44.750	in (d = y / 2)**
Equipment Anchorage Parameters		
Hilti Kwik Bolt TZ2 S.S. Anchor Dia. =	5/8	in
Anchor Embedment =	3.25	in
Concrete Strength =	2500	psi
Equipment Anchor in Tension (n <sub>T</sub> ) =	2	Anchors
Equipment Anchor in Shear (n <sub>V</sub> ) =	4	Anchors
Equipment Front Anchor Distance (x <sub>front</sub> ) =	0	in
Equipment Back Anchor Distance (x <sub>back</sub> ) =	33.86	in
Anchor ⊥ Edge Distance, (c1) =	8	in > c min (3.25 in)
Anchor // Edge Distance, (c2) =	8	in > c min (3.25 in)
Equipment Anchor Spacing (s) =	6	in > s min (2.75 in)
Concrete Pad Thickness =	8	in > h min (5.5 in)
Equipment Anchor Reactions		
<b>Max Tensile Reaction per Anchor (T) =</b>	<b>663.2</b>	lbs. (T = (Ω * F * d - (0.9 - 0.2 * S <sub>DS</sub> ) * w * s/2) / (s * n <sub>T</sub> ))
<b>Max Shear Reaction per Anchor (V) =</b>	<b>412.5</b>	lbs. (V = Ω * F / n <sub>V</sub> )
<b>0.625" Dia. HILTI KB-TZ2 S.S. Anchor (3.25" hef)</b> (ESR #:4266)		
Anchor Tensile Strength (φNSA) =	14125	lbs. (φN <sub>sA</sub> = φ * A <sub>se,N</sub> * f <sub>uta</sub> ) ACI 318-19 Chapter 17
Anchor Shear Strength (φVSA) =	8030	lbs. determined by static shear tests with φV <sub>sa</sub> < φ * 0.60 A <sub>se,V</sub> f <sub>uta</sub> as noted in ACI 318-19 Chapter 17.
Anchor Seismic Shear Strength (φV <sub>sa,eq</sub> ) =	8030	lbs. determined by seismic shear tests with φV <sub>sa,eq</sub> < φ * 0.60 A <sub>se,V</sub> f <sub>uta</sub> as noted in ACI 318-19 Chapter 17.
Anchor Tension Pullout Capacity, φN <sub>n</sub> =	4000	lbs. Design Strength from HILTI Simplified Design Tables (Cracked Concrete)
α <sub>N,seis</sub> =	0.75	} Adjustment Factors from HILTI Simplified Design Tables for stainless steel anchor in cracked concrete
Tension Spacing Factor, f <sub>AN</sub> =	0.81	
Tension Edge Distance Factor, f <sub>RN</sub> =	1	
Anchor Tension Pullout Capacity =	2430.0	lbs. (φN <sub>n</sub> * α <sub>N,seis</sub> * f <sub>AN</sub> * f <sub>rn</sub> )
Anchor Shear Capacity, φV <sub>n</sub> =	8615	lbs. Design Strength from HILTI Simplified Design Tables (Cracked Concrete)
Shear Spacing Factor, f <sub>AV</sub> =	0.6	} Adjustment Factors from HILTI Simplified Design Tables for stainless steel anchor in cracked concrete
Shear ⊥ to Edge Factor, f <sub>RV⊥</sub> =	0.71	
Shear // to Edge Factor, f <sub>RV//</sub> =	1	
Shear Conc. Thickness Factor, f <sub>HV</sub> =	0.73	
Anchor Shear Capacity (Cr. Conc.) =	2679.1	lbs. (φV <sub>n</sub> * f <sub>AV</sub> * f <sub>RV⊥</sub> * f <sub>RV//</sub> * f <sub>HV</sub> )

Reduction factors based on Anchor spacing 6 in, an edge distance of 8 in, and a pad thickness of 8 in with 2500 psi concrete.

<b>% Capacity Tension</b>	<b>27.3%</b>	<b>Acceptable</b>
<b>% Capacity Shear</b>	<b>15.4%</b>	<b>Acceptable</b>
<b>% Shear &amp; Tension Interaction</b>	<b>42.7%</b>	<b>Acceptable</b>

\*Assumed: (1) row of Anchors withstands tension created by overturning, while all Anchors share shear equally.

\*\*Center of gravity is assumed to be at the middle of equipment.

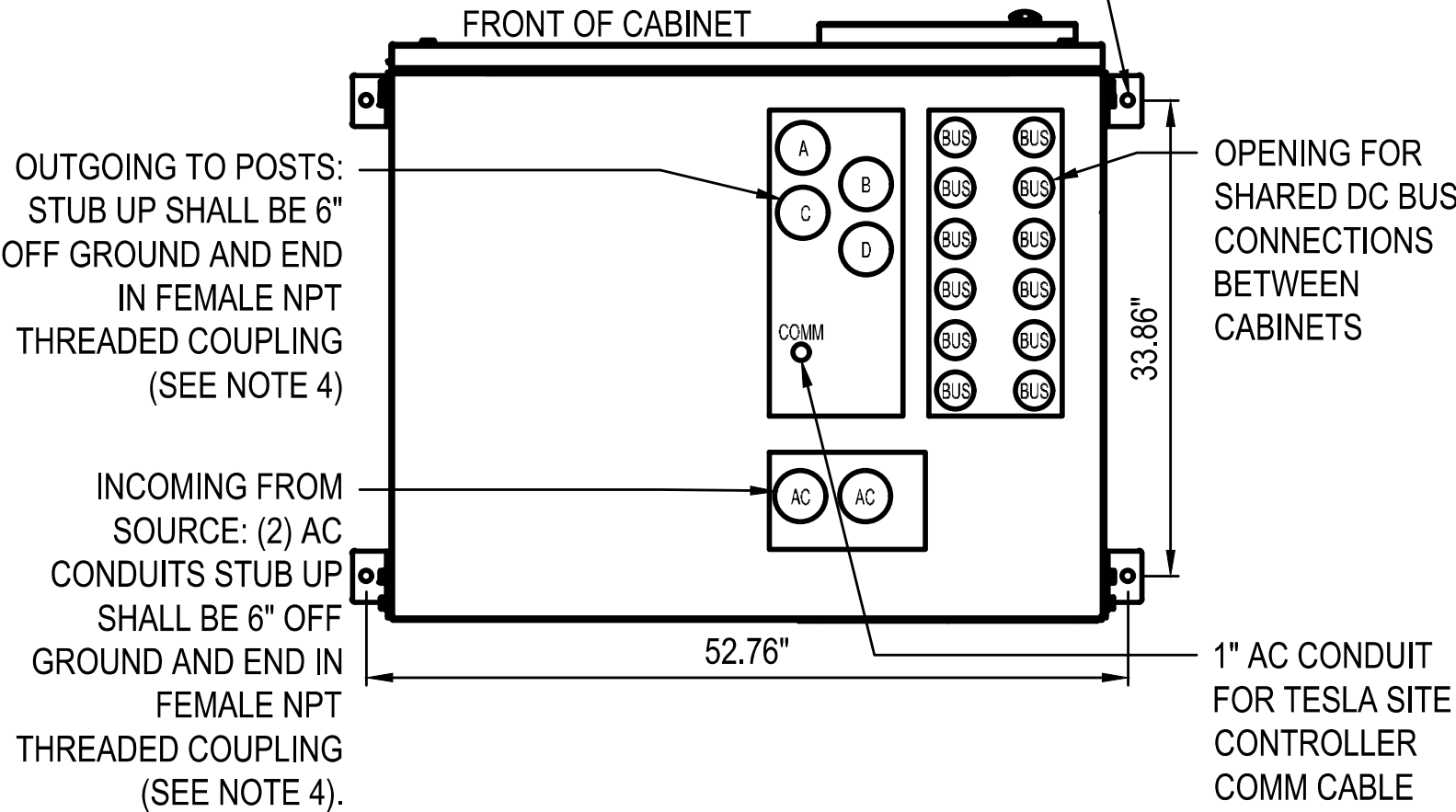
CAST-IN-PLACE FOUNDATION:

(4) 5/8"Ø HILTI KWIK BOLT TZ2 STAINLESS STEEL ANCHORS, 3 1/8" MIN. EMBEDMENT PROVIDED AND INSTALLED BY CONTRACTOR.

PRECAST FOUNDATION:

(4) 5/8"Ø STAINLESS GRADE 304 BOLTS PROVIDED BY TESLA AND INSTALLED BY CONTRACTOR

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



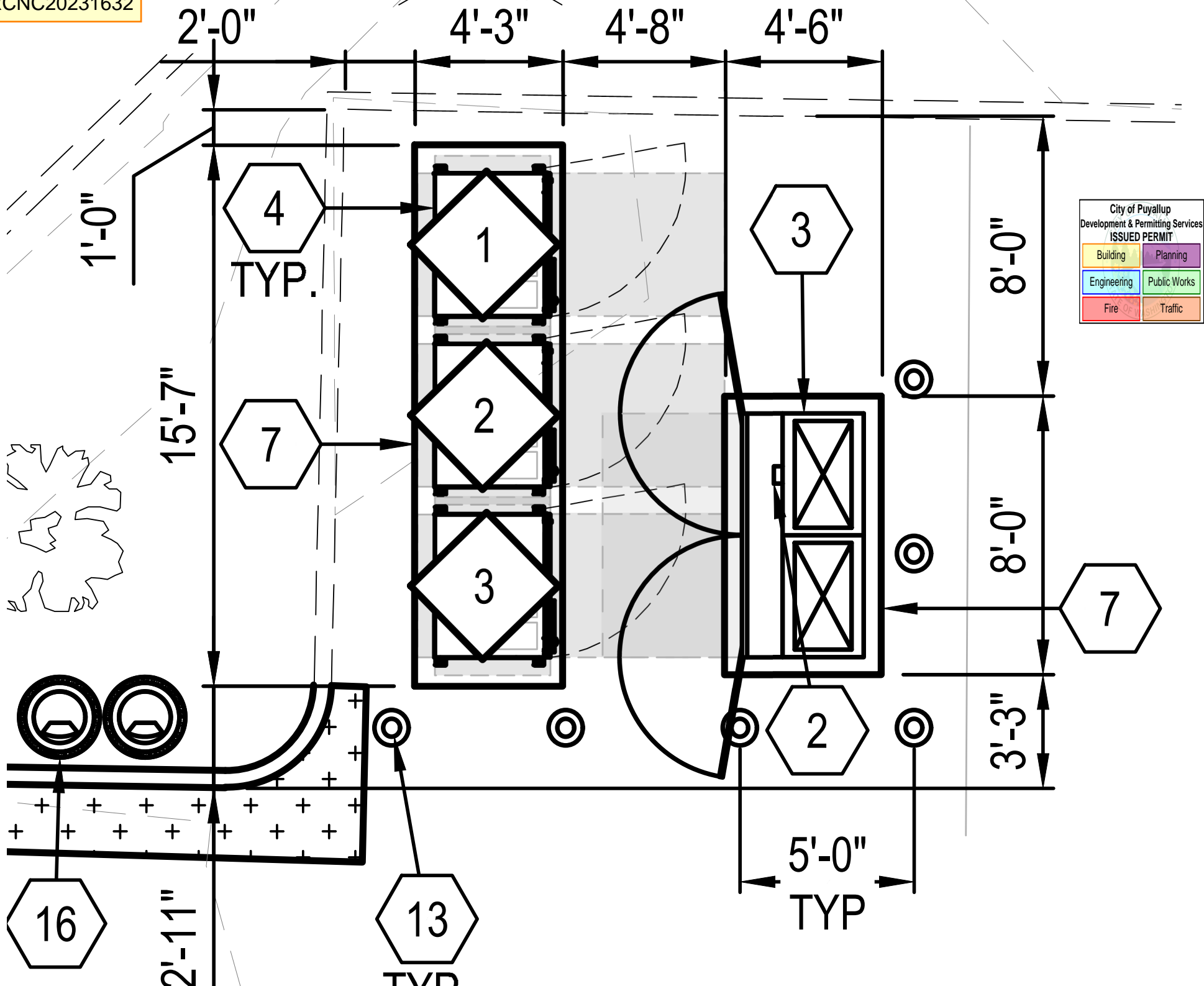
NOTE:

1. TESLA PROVIDED TEMPLATE PLATE TO BE USED TO LAYOUT CHARGING CABINET ANCHORING BOLT LOCATIONS AND CONDUIT STUB UP LOCATIONS.
2. BOLT HOLES FOR REFERENCE ONLY.
3. USE DOTTIE DUCT SEAL COMPOUND PC 6130 (CAT NO LHD1) TO SEAL ENDS OF CONDUIT (TYP. ALL CONDUITS FOR CHARGING CABINETS AND CHARGE POSTS)
4. USE BELL FITTINGS ON ALL AC AND DC CONDUIT STUBS
5. SEE DETAIL THIS SHEET FOR FOUNDATION DETAIL IF APPLICABLE

C-5

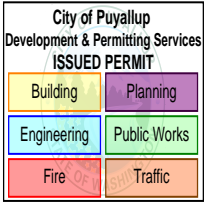
TESLA SUPERCHARGER CABINET ANCHOR BOLT PLAN

NTS



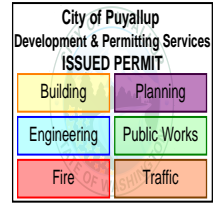
City of Puyallup  
Development & Permitting Services  
ISSUED PERMIT

Building	Planning
Engineering	Public Works
Fire	Traffic



4. V4 CHARGING POST ANCHOR CALCULATIONS

**ASCE 7-16 Wind Calculations - Charging Post Anchor Calculations**  
**Tesla Supercharging Station**  
 (values used for calculations are assumed worst case values)



Wind Force Calculation on Charging Post		
Basic Wind Speed (Ultimate)	97	mph (Fig. 26.5-1B)
Risk Category	II	(Table 1.5-1)
Exposure Category	c	(Section 26.7)
Topographic Category	1	(Section 26.8 and Figure 26.8-1)
Z <sub>g</sub>	900	(Table 26.11-1)
α	9.5	(Table 26.11-1)
K <sub>d</sub>	0.85	(Section 26.6 and Table 26.6-1)
K <sub>zmin</sub>	0.85	
K <sub>zt</sub>	1.00	(Section 26.8.2)
K <sub>e</sub>	1.000	(Section 26.9)
K <sub>z</sub>	0.85	(Table 26.10-1) Max. of: (K <sub>z</sub> = 2.01 * (15 / Z <sub>g</sub> ) <sup>2/α</sup> , or K <sub>zmin</sub> )
q <sub>z</sub>	16.67	(Eq. 26.10-1 -- q <sub>z</sub> = 0.00256 * K <sub>z</sub> * K <sub>zt</sub> * K <sub>d</sub> * K <sub>e</sub> * V <sup>2</sup> )
G	0.85	(Section 26.11)
C <sub>f</sub>	1.33	(Fig. 29.4-1)
<b>Wind Force on Charge Post (F<sub>post</sub>)</b>	<b>269.7</b>	lbs (Eq. 29.4-1 -- F = q <sub>z</sub> * G * C <sub>f</sub> * A <sub>f</sub> )
<b>Load Factor (LF)</b>	<b>1.0</b>	

Charging Post Properties		
Height (y) =	76.6	in (provided in Supercharger Datasheet)
Weight (Wp) =	200	lbs (provided in Supercharger Datasheet)
Width (b) =	26.77	in (provided in Supercharger Datasheet)
z =	3.19	ft
Area (A <sub>f</sub> ) =	14.30	ft <sup>2</sup> (Area determined by CAD file provided by Tesla)

Max. Resultant Wind Forces on Bolts		
Distance from Resultant Force (d) =	38.3	in (d = y / 2)**
Anchor Bolt Quantity (n) =	4	bolts
Anchor Bolt Spacing (s) =	4.72	in (provided in Supercharger Datasheet)
<b>Max Bolt Tension (T<sub>post</sub>)*</b>	<b>1139.26</b>	lbs. T <sub>post</sub> = (LF * F <sub>post</sub> * d + 0.9 * Wp * s/2) / (s * n/2)
<b>Max Bolt Shear (V<sub>post</sub>)*</b>	<b>67.4</b>	lbs. (V <sub>post</sub> = LF * F <sub>post</sub> / n)

1/2" ø HAS-R Threaded Rod (6" embed)		
Bolt Tensile Strength (øN <sub>t</sub> ) =	10,650	lbs. (øN <sub>t</sub> = ø * A <sub>net</sub> * f <sub>ut</sub> ) = (0.75 * 0.142in <sup>2</sup> * 100,000psi)
Bolt Shear Strength (øN <sub>v</sub> ) =	7,644	lbs. (øN <sub>v</sub> = ø * 0.6 * A <sub>g</sub> * f <sub>v</sub> ) = (1.0 * 0.60 * 0.196in <sup>2</sup> * 65,000psi)
Bolt Tension Pullout Capacity (Cr. Conc.) =	4,267	lbs. (øNn * f <sub>AN</sub> * f <sub>RN</sub> ) = (6,995lbs * 0.61 * 1.0)
Bolt Shear Pullout Capacity (Cr. Conc.) =	3,756	lbs. (øV <sub>n</sub> * f <sub>AV</sub> * f <sub>RV</sub> * f <sub>HV</sub> ) = (14,975lbs * 0.55 * 0.48 * 0.95)

--Reduction factors based on bolt spacing 4-23/32", an edge distance of 9", and a concrete pad thickness of 1'-9" with 2500psi concrete.--

<b>% Capacity Tension</b>	<b>26.7%</b>	<b>Acceptable</b>
<b>% Capacity Shear</b>	<b>1.8%</b>	<b>Acceptable</b>
<b>% Combined Shear &amp; Tension</b>	<b>26.7%</b>	<b>Acceptable</b>

\*Assumed: (1) row of bolts withstands tension created by overturning, while all bolts share shear equally.  
 \*\*Center of gravity is assumed to be at the geometric center of charging post

**Seismic Demands on Nonstructural Components (ASCE 7-16)**  
**Charging Post Anchor Calculations**  
(values used for calculations are assumed worst case values)

Seismic Force Calculations (ASCE 7-16 Chapter 15)	
Component Weight, $W_{post}$ =	200 lbs.
$S_{DS}$ =	1.010
Importance Factor, $I_e$ =	1.0 Table 1.5-2
structure height, $h_n$ =	6.383333333 ft
Nonbuilding Structure Type =	Mechanically anchored flat-bottom ground-supported tanks
$R$ =	3.00 Table 15.4-2
$C_t$ =	0.02 Table 12.8-2
$x$ =	0.75 Table 12.8-2
$T_a$ =	0.080 $T_a = C_t * h_n^x$ -- Eq: 12.8-7
$T_L$ =	6.000
$C_{s,max}$ =	4.15 when $T_a < T_L$ , $C_s = S_{D1} / (T_a * R / I_e)$ -- ASCE 7-10 Eq: 12.8-3
$C_{s,min1}$ =	0.044 $C_s = \max$ of: $0.044 * S_{DS} * I_e$ ; $0.03$ -- ASCE 7-10 Eq: 15.4-1
$C_{s,min2}$ =	0.27 $C_s = 0.8 * S_1 / (R / I_e)$ if $S_1 > 0.6g$ -- ASCE 7-10 Eq: 15.4-2
$C_s$ =	0.34 $C_s = S_{DS} / (R / I_e)$ -- ASCE 7-10 Eq: 12.8-2 -- <b>Controls</b>
<b>Seismic Force, <math>F_{post}</math></b> =	<b>67.33</b> lbs. $F = W * C_s$ -- Eq: 12.8-1
Overstrength Factor ( $\Omega$ )	2.0 Table 15.4-2

Required Anchor Bolt Strength	
Center of Gravity Elevation (d) =	38.3 in ( $d = y / 2$ )**
Anchor Bolt Quantity (n) =	4 bolts
Anchor Bolt Spacing (s) =	4.72 in (provided in Supercharger Datasheet)
<b>Max Bolt Tension (<math>T_{post}</math>)*</b> =	<b>581.27</b> lbs. $T_{post} = (\Omega * F_{post} * d + (0.9 - 0.2 * S_{DS}) * W_{post} * s/2) / (s * n/2)$
<b>Max Bolt Shear (<math>V_{post}</math>)*</b> =	<b>33.67</b> lbs. ( $V_{post} = \Omega * F_{post} / n$ )

1/2" ø HAS-R Threaded Rod (6" embed)	
Bolt Tensile Strength ( $\phi N_t$ ) =	10,650 lbs. ( $\phi N_t = \phi * A_{net} * f_{ut}$ ) = (0.75 * 0.142in <sup>2</sup> * 100,000psi)
Bolt Shear Strength ( $\phi N_v$ ) =	7,644 lbs. ( $\phi N_v = \phi * 0.6 * A_r * f_v$ ) = (1.0 * 0.60 * 0.196in <sup>2</sup> * 65,000psi)
Bolt Tension Pullout Capacity (Cr. Conc.) =	3,158 lbs. ( $\phi N_n * \alpha_{seis} * f_{AN} * f_{RN}$ ) = (6,995lbs * 0.61 * 1.0 * 0.74)
Bolt Shear Pullout Capacity (Cr. Conc.) =	2,779 lbs. ( $\phi V_n * f_{AV} * f_{RV} * f_{HV} * \alpha_{seis}$ ) = (14,975lbs * 0.55 * 0.48 * 0.95 * 0.74)

--Reduction factors based on bolt spacing 4-23/32", an edge distance of 9", and a concrete pad thickness of 1'-9" with 2500psi concrete.--

<b>% Capacity Tension</b>	<b>18.4%</b>	<b>Acceptable</b>
<b>% Capacity Shear</b>	<b>1.2%</b>	<b>Acceptable</b>
<b>% Combined Shear &amp; Tension</b>	<b>19.6%</b>	<b>Acceptable</b>

\*Assumed: (1) row of bolts withstands tension created by overturning, while all bolts share shear equally.  
\*\*Center of gravity is assumed to be at the geometric center of charging post



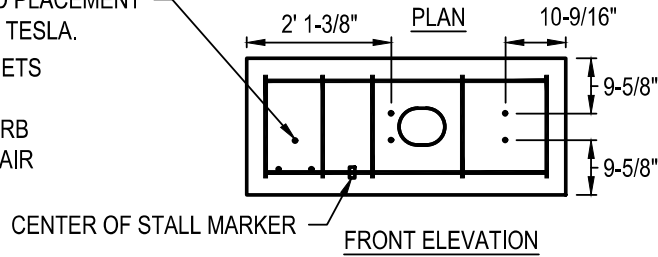
NOTES

1. SEE FROST NOTES ON GENERAL NOTES SHEETS FOR FOUNDATION PREPARATION.
2. CONTRACTOR SHALL PROTECT EXISTING CURB AND PAVEMENT DURING INSTALLATION. REPAIR OR REPLACE AS REQUIRED, MATCHING OR EXCEEDING EXISTING CONDITIONS/SPECIFICATIONS.
3. CONTRACTOR SHALL PLACE REBAR IN A CONFIGURATION THAT DOES NOT CONFLICT WITH ANCHORS AND CONDUIT WINDOW

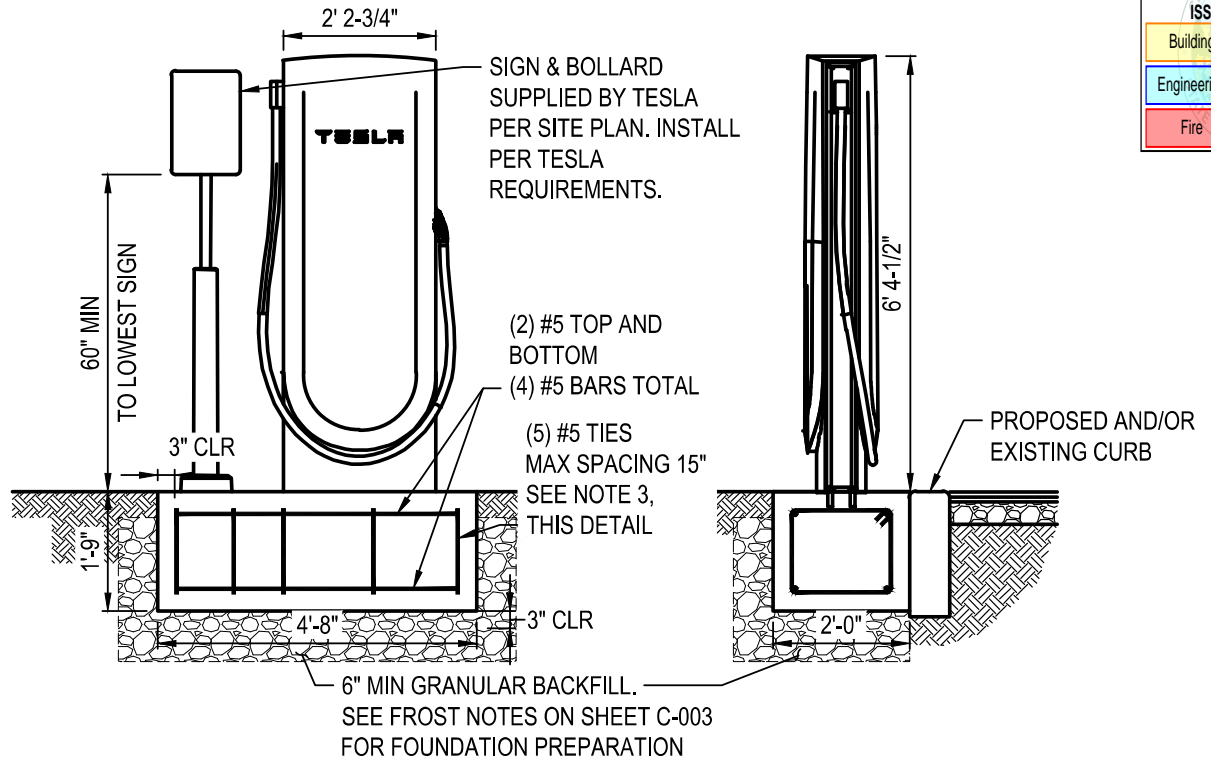
ANCHORAGE NOTES

1. 1/2" DIA SS THREADED ROD WITH HILTI HIT-HY 200 V3 ADHESIVE ANCHOR SYSTEM WITH 6" MIN EMBEDMENT PER ESR-4868, OR APPROVED EQUAL.

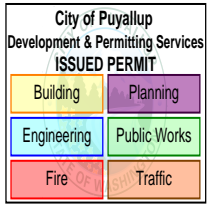
COORDINATE BOLLARD PLACEMENT ON FOUNDATION WITH TESLA.



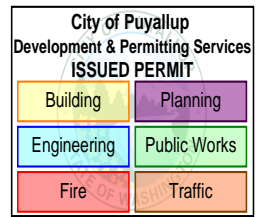
THIS FOUNDATION IS RATED FOR WIND SPEEDS UP TO 107 MPH.



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



5. SWITCHGEAR ANCHOR CALCULATIONS



**ASCE 7-16 Wind Calculations**  
**Switchgear Equipment Anchor Calculations**

Wind Force Calculation		
Basic Wind Speed (Ultimate)	97	mph (Fig. 26.5-1B)
Risk Category	II	(Table 1.5-1)
Exposure Category	C	(Section 26.7)
Topographic Category	1	(Section 26.8 and Figure 26.8-1)
Z <sub>g</sub>	900	(Table 26.11-1)
α	9.5	(Table 26.11-1)
K <sub>d</sub>	0.85	(Section 26.6 and Table 26.6-1)
K <sub>zmin</sub>	0.85	
K <sub>zt</sub>	1.000	(Section 26.8.2)
K <sub>e</sub>	1.000	(Section 26.9)
K <sub>z</sub>	0.85	(Table 26.10-1) Max. of: (K <sub>z</sub> = 2.01 * (15 / Z <sub>g</sub> ) <sup>2/α</sup> , or K <sub>zmin</sub> )
q <sub>z</sub>	17.380	(Eq. 26.10-1 -- q <sub>z</sub> = 0.00256 * K <sub>z</sub> * K <sub>zt</sub> * K <sub>d</sub> * K <sub>e</sub> * V <sup>2</sup> )
G	0.850	(Section 26.11)
C <sub>f</sub>	1.301	(Fig. 29.4-1)
<b>Wind Force on Equipment, F</b>	<b>1009.2</b>	lbs (Eq. 29.4-1 -- F = q <sub>z</sub> * G * C <sub>f</sub> * A <sub>f</sub> )
<b>Overturning Moment, M</b>	<b>3784.4</b>	ft-lbs (M = F * d)
Equipment Properties		
Height (y) =	90	in
Width (x) =	42	in
Weight (w) =	2600	lbs
Length (b) =	84	in
Distance from Resultant Force (d) =	45.000	in (d = y / 2)**
Total Wind Area (A) =	52.50	ft <sup>2</sup>
Equipment Anchorage Parameters		
Hilti Kwik Bolt TZ2 S.S. Anchor Dia. =	1/2	in
Anchor Embedment =	3.25	in
Concrete Strength =	2500	psi
Equipment Anchor in Tension (n <sub>T</sub> ) =	6	Anchors
Equipment Anchor in Shear (n <sub>V</sub> ) =	12	Anchors
Equipment Front Anchor Distance (x <sub>front</sub> ) =	17.25	in
Equipment Back Anchor Distance (x <sub>back</sub> ) =	38.75	in
Anchor ⊥ Edge Distance, (c1) =	8	in > c min (2.25 in)
Anchor    Edge Distance, (c2) =	8	in > c min (2.25 in)
Equipment Anchor Spacing (s) =	12	in > s min (2 in)
Concrete Pad Thickness =	8	in > h min (5.5 in)
Equipment Reactions		
<b>Max Tensile Reaction per Anchor (T) =</b>	<b>157.0</b>	lbs. (T = (LF * F * d - 0.9 * w * s/2) / (s * n <sub>T</sub> ))
<b>Max Shear Reaction per Anchor (V) =</b>	<b>84.1</b>	lbs. (V = LF * F / n <sub>V</sub> )
<b>0.5" Dia. Hilti Kwik Anchor TZ2 S.S. Anchor (3.25" hef)</b> (ESR #4266)		
Anchor Tensile Strength (φNSA) =	8905.0	lbs. (φN <sub>SA</sub> = φ * A <sub>se,N</sub> * f <sub>uta</sub> ) ACI 318-14 Chapter 17
Anchor Shear Strength (φVSA) =	5425.0	lbs. determined by static shear tests with φV <sub>sa</sub> < φ * 0.60 A <sub>se,V</sub> f <sub>uta</sub> as noted in ACI 318-14 Chapter 17.
Anchor Tension Pullout Capacity =	3235.0	lbs. Design Strength from HILTI Simplified Design Tables (Cracked Concrete)
Tension Spacing Factor, f <sub>AN</sub> =	1	} Adjustment Factors from HILTI Simplified Design Tables for stainless steel anchor in cracked concrete
Tension Edge Distance Factor, f <sub>RN</sub> =	1	
Factored Anchor Tension Pullout Capacity =	3235.0	lbs. (φNn * f <sub>AN</sub> * f <sub>m</sub> )
Anchor Shear Capacity =	6970.0	lbs. Design Strength from HILTI Simplified Design Tables (Cracked Concrete)
Shear Spacing Factor, f <sub>AV</sub> =	0.72	} Adjustment Factors from HILTI Simplified Design Tables for stainless steel anchor in cracked concrete
Shear ⊥ to Edge Factor, f <sub>RV⊥</sub> =	0.82	
Shear    to Edge Factor, f <sub>RV  </sub> =	1	
Shear Conc. Thickness Factor, f <sub>HV</sub> =	0.76	
Factored Anchor Shear Capacity =	3127.5	lbs. (φV <sub>n</sub> * f <sub>AV</sub> * f <sub>RV⊥</sub> * f <sub>HV</sub> )

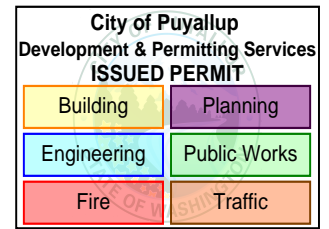
Reduction factors based on Anchor spacing 12 in, an edge distance of 8 in, and a pad thickness of 8 in with 2500 psi concrete.

<b>% Capacity Tension</b>	<b>4.9%</b>	<b>Acceptable</b>
<b>% Capacity Shear</b>	<b>2.7%</b>	<b>Acceptable</b>
<b>% Shear &amp; Tension Interaction</b>	<b>7.5%</b>	<b>Acceptable</b>

\*Assumed: (1) row of Anchors withstands tension created by overturning, while all Anchors share shear equally.

\*\*Center of gravity is assumed to be at the middle of equipment.

**Seismic Demands on Nonbuilding Structure (ASCE 7-16)**  
**Switchgear Equipment Anchor Calculations**



Seismic Force Calculations (ASCE 7-16 Chapter 15)		
Component Weight, $W$ =	2600	lbs.
$S_{DS}$ =	1.011	
$S_{D1}$ =	0.542	
$S_1$ =	0.436	
Seismic Design Category =	D	
Importance Factor, $I_e$ =	1.0	Table 1.5-2
structure height, $h_n$ =	7.5	ft
Nonbuilding Structure Type =	Mechanically anchored flat-bottom ground-supported tanks	
$R$ =	3.00	Table 15.4-2
$C_t$ =	0.02	Table 12.8-2
$x$ =	0.75	Table 12.8-2
$T_a$ =	0.091	$T_a = C_t * h_n^x$ -- Eq: 12.8-7
$T_L$ =	6.000	
$C_{s\ max}$ =	1.99	when $T_a < T_L$ , $C_s = S_{D1} / (T_a * R / I_e)$ -- ASCE 7-16 Eq: 12.8-3
$C_{s\ min1}$ =	0.044	$C_s = \max$ of: $0.044 * S_{DS} * I_e$ ; $0.03$ -- ASCE 7-16 Eq: 15.4-1
$C_{s\ min2}$ =	N/A	$C_s > 0.8 * S_1 / (R / I_e)$ if $S_1 > 0.6g$ -- ASCE 7-16 Eq: 15.4-2
$C_s$ =	0.34	$C_s = S_{DS} / (R / I_e)$ -- ASCE 7-16 Eq: 12.8-2 -- <u>Controls</u>
<b>Seismic Force, <math>F</math> =</b>	<b>876.2</b>	lbs. $F = W * C_s$ -- Eq: 12.8-1
<b>Overtaking Moment, <math>M</math> =</b>	<b>3285.8</b>	ft-lbs. ( $M = F * d$ )
Overstrength Factor, $\Omega$ =	2.0	Table 15.4-2
<b>Factored Seismic Force, <math>F'</math> =</b>	<b>1752.4</b>	lbs. ( $F' = F * \Omega$ )
<b>Factored Seismic Moment, <math>M'</math> =</b>	<b>6571.5</b>	ft-lbs. ( $M' = M * \Omega$ )

Equipment Properties		
Height ( $y$ ) =	90	in
Width ( $x$ ) =	42	in
Length ( $b$ ) =	84	in
Weight ( $w$ ) =	2600	lbs
Distance from Resultant Force ( $d$ ) =	45.000	in ( $d = y / 2$ )**

Equipment Anchorage Parameters		
Hilti Kwik Bolt T22 S.S. Anchor Dia. =	1/2	in
Anchor Embedment =	3.25	in
Concrete Strength =	2500	psi
Equipment Anchor in Tension ( $n_T$ ) =	6	Anchors
Equipment Anchor in Shear ( $n_V$ ) =	12	Anchors
Equipment Front Anchor Distance ( $x_{front}$ ) =	17.25	in
Equipment Back Anchor Distance ( $x_{back}$ ) =	38.75	in
Anchor $\perp$ Edge Distance, ( $c1$ ) =	8	in > $c$ min (2.25 in)
Anchor $\parallel$ Edge Distance, ( $c2$ ) =	8	in > $c$ min (2.25 in)
Equipment Anchor Spacing ( $s$ ) =	12	in > $s$ min (2 in)
Concrete Pad Thickness =	8	in > $h$ min (5.5 in)

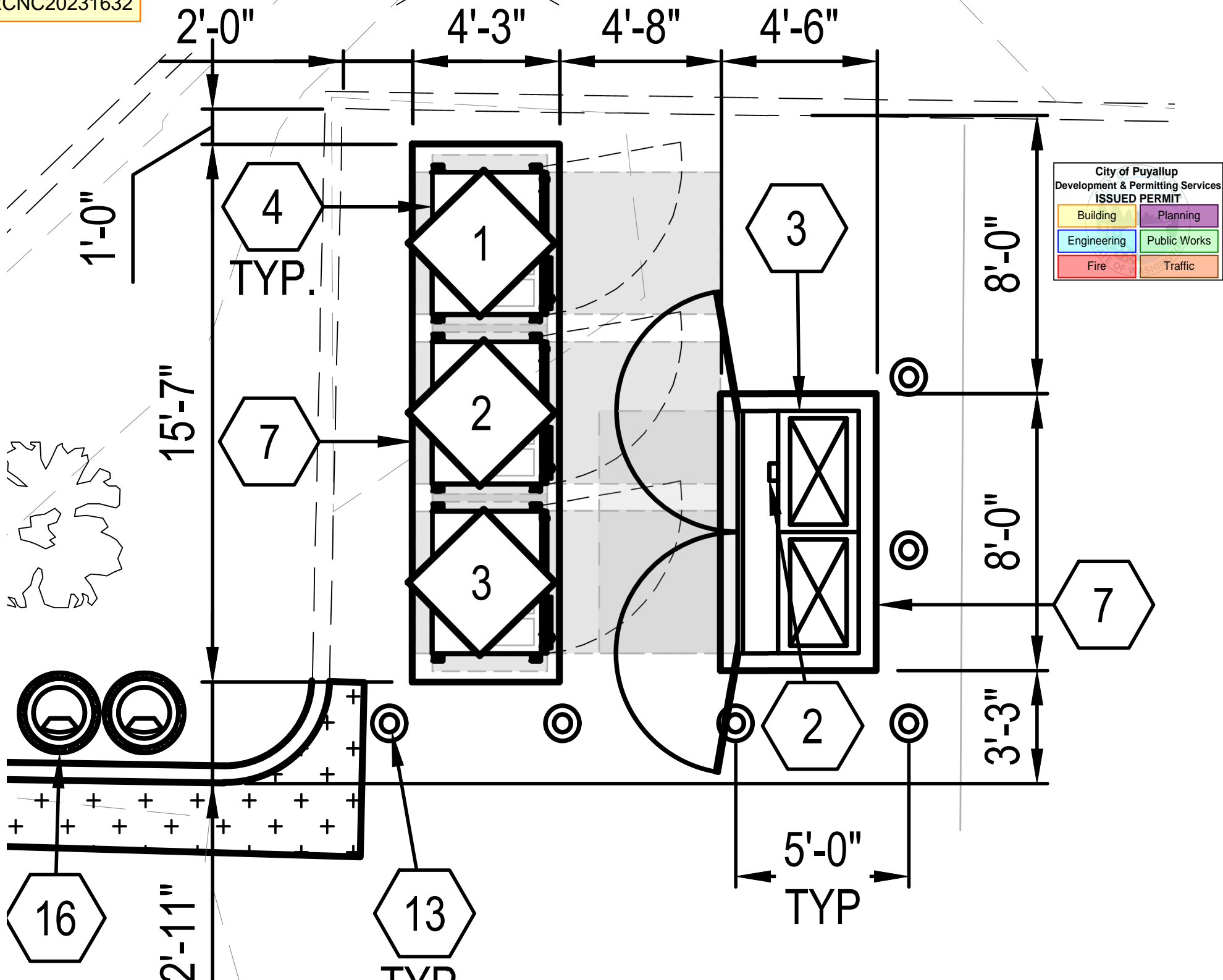
Equipment Anchor Reactions		
<b>Max Tensile Reaction per Anchor (<math>T</math>) =</b>	<b>460.1</b>	lbs. ( $T = (\Omega * F * d - (0.9 - 0.2 * S_{DS}) * w * s/2) / (s * n_T)$ )
<b>Max Shear Reaction per Anchor (<math>V</math>) =</b>	<b>146.0</b>	lbs. ( $V = \Omega * F / n_V$ )
<b>0.5" Dia. HILTI KB-T22 S.S. Anchor (3.25" hef)</b> (ESR #:4266)		

Anchor Tensile Strength ( $\phi N_{SA}$ ) =	8905	lbs. ( $\phi N_{SA} = \phi * A_{se,N} * f_{uta}$ ) ACI 318-19 Chapter 17
Anchor Shear Strength ( $\phi V_{SA}$ ) =	5425	lbs. determined by static shear tests with $\phi V_{sa} < \phi * 0.60 A_{se,V} f_{uta}$ as noted in ACI 318-19 Chapter 17.
Anchor Seismic Shear Strength ( $\phi V_{sa,eq}$ ) =	5425	lbs. determined by seismic shear tests with $\phi V_{sa,eq} < \phi * 0.60 A_{se,V} f_{uta}$ as noted in ACI 318-19 Chapter 17.
Anchor Tension Pullout Capacity, $\phi N_n$ =	3235	lbs. Design Strength from HILTI Simplified Design Tables (Cracked Concrete)
$\alpha_{N,seis}$ =	0.75	} Adjustment Factors from HILTI Simplified Design Tables for stainless steel anchor in cracked concrete
Tension Spacing Factor, $f_{AN}$ =	1	
Tension Edge Distance Factor, $f_{RN}$ =	1	
Anchor Tension Pullout Capacity =	2426.3	lbs. ( $\phi N_n * \alpha_{N,seis} * f_{AN} * f_{rn}$ )
Anchor Shear Capacity, $\phi V_n$ =	6970	lbs. Design Strength from HILTI Simplified Design Tables (Cracked Concrete)
Shear Spacing Factor, $f_{AV}$ =	0.72	} Adjustment Factors from HILTI Simplified Design Tables for stainless steel anchor in cracked concrete
Shear $\perp$ to Edge Factor, $f_{RV\perp}$ =	0.82	
Shear $\parallel$ to Edge Factor, $f_{RV\parallel}$ =	1	
Shear Conc. Thickness Factor, $f_{HV}$ =	0.76	
Anchor Shear Capacity (Cr. Conc.) =	3127.5	lbs. ( $\phi V_n * f_{AV} * f_{RV\perp} * f_{RV\parallel} * f_{HV}$ )

Reduction factors based on Anchor spacing 12 in, an edge distance of 8 in, and a pad thickness of 8 in with 2500 psi concrete.

<b>% Capacity Tension</b>	<b>19.0%</b>	<b>Acceptable</b>
<b>% Capacity Shear</b>	<b>4.7%</b>	<b>Acceptable</b>
<b>% Shear &amp; Tension Interaction</b>	<b>23.6%</b>	<b>Acceptable</b>

\*Assumed: (1) row of Anchors withstands tension created by overturning, while all Anchors share shear equally.  
 \*\*Center of gravity is assumed to be at the middle of equipment.




City of Puyallup  
Development & Permitting Services  
ISSUED PERMIT

Building	Planning
Engineering	Public Works
Fire	Traffic

**SPECIFICATIONS**

**1. CONSTRUCTION**

UL TYPE 3R, GA. STEEL, OSHPD OSP-0308-10, UL 891 FILE E337533 

**2. FINISH**

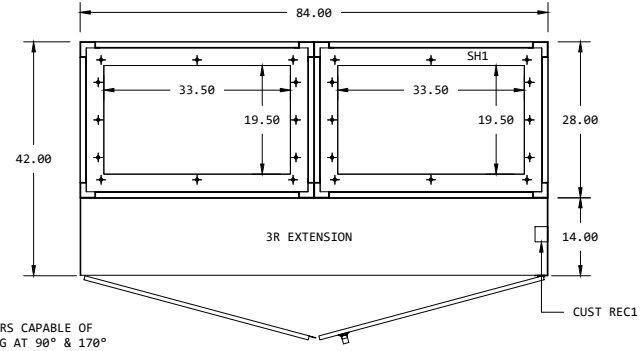
CARDINAL T007-WH121 POWDER COAT, WHITE, 70% GLOSS

**3. SERVICE**

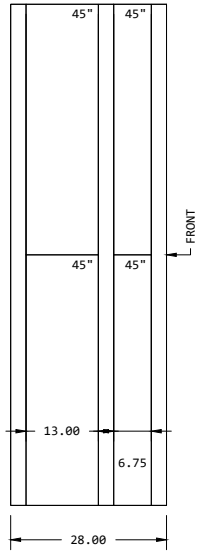
PUGET SOUND ENERGY, 1600A BUS, 480Y/277VAC, 3φ 4W, 65KAIC

**4. BUS**

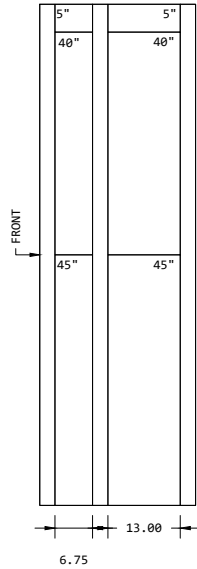
PLATED COPPER



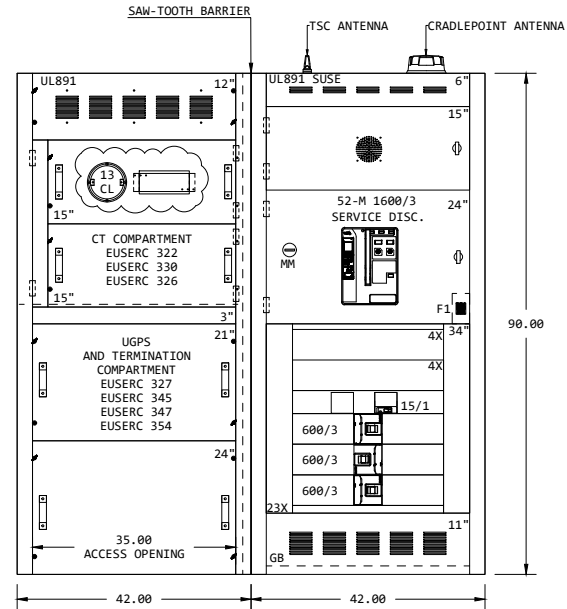
BASE LAYOUT/CONDUIT PLAN



LEFT ELEVATION  
SHOWN WITH 3R COMPONENTS  
REMOVED FOR CLARITY



RIGHT ELEVATION  
SHOWN WITH 3R COMPONENTS  
REMOVED FOR CLARITY



= WT 2600 LBS

FRONT ELEVATION  
SHOWN WITH 3R COMPONENTS  
REMOVED FOR CLARITY



16450 PHOEBE AVENUE  
LA MIRADA, CA 90638  
PHONE: (714)-307-9198

CUSTOMER APPROVAL:  
Development & Permitting Services  
ISSUED PERMIT

Building	Planning
Engineering	Public Works
Fire	Traffic

SITE NAME/LOCATION:  
TESLA SUPERCHARGER  
SERVICE SWBD "MDP-1"  
3310 S MERIDIAN ST.  
PUYALLUP, WA 98373

#	REVISION	DATE
0	ISSUED FOR APPROVAL	11/24/23
1	INTERNAL METER	11/24/23

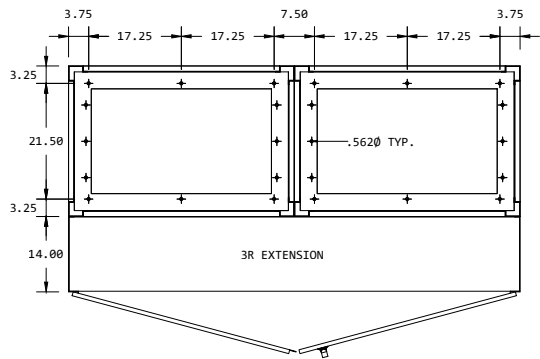
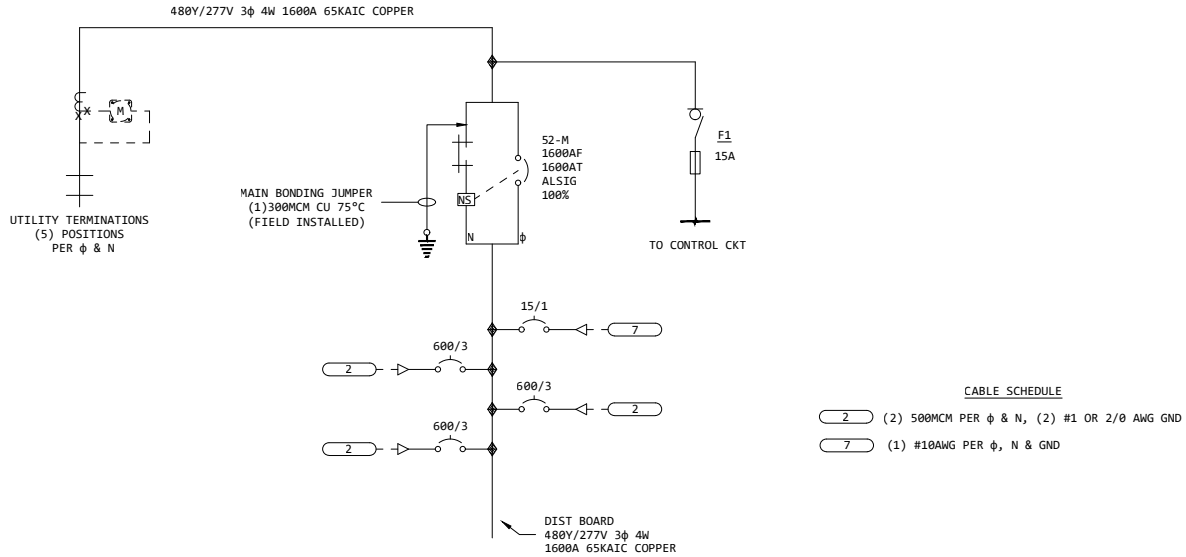
DRAWING:  
2310-3-16478

SHEET DESCRIPTION:  
ELEVATIONS/SPECS.

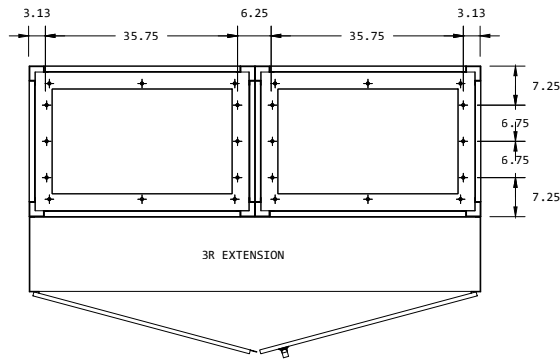
DRAWN BY: AB SHEET: 1

REV: 1 PAPER: 8.5"X 11"

PLOT DATE: 11/24/2023 11:51 AM BY: ANHBJU Y:\T\Tesla-ALL\TESLA\_Superchargers\1\_Washington\_3310 S Meridian St Puyallup, WA\_1600A\_16478



BASE PLAN - FRONT AND BACK ANCHORING OPTION



BASE PLAN - SIDES ANCHORING OPTION

POWER & DISTRIBUTION

16450 PHOEBE AVENUE  
LA MIRADA, CA 90638  
PHONE: (714)-307-9198

CUSTOMER APPROVAL:  
Development & Permitting Services

**ISSUED PERMIT**

Building	Planning
Engineering	Public Works
Fire	Traffic

**SITE NAME/LOCATION:**  
TESLA SUPERCHARGER  
SERVICE SWBD "MDP-1"

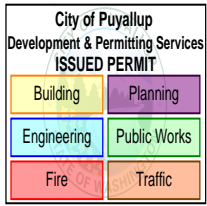
3310 S MERIDIAN ST.  
PUYALLUP, WA 98373

#	REVISION	DATE
0	ISSUED FOR APPROVAL	10/20/23

**DRAWING:**  
2310-3-16478

**SHEET DESCRIPTION:**  
SLD/  
ANCHORING LOCATIONS

<b>DRAWN BY:</b> AB	<b>SHEET:</b> 2
<b>REV:</b> 1	<b>PAPER:</b> 8.5"X 11"



6. FOUNDATION CALCULATIONS



**General Footing**

Project File: 2023345.09\_Bloom\_MCH000\_Equip. Foundation Calcs.ec6

LIC# : KW-06016111, Build:20.23.10.31

GPD ASSOCIATES

(c) ENERCALC INC 1983-2023

**DESCRIPTION: CABINET FOUNDATION PAD**

**Code References**

Calculations per ACI 318-19, IBC 2021, ASCE 7-16  
 Load Combinations Used : ASCE 7-16

**General Information**

**Material Properties**

f <sub>c</sub> : Concrete 28 day strength	=	2.50 ksi
f <sub>y</sub> : Rebar Yield	=	60.0 ksi
E <sub>c</sub> : Concrete Elastic Modulus	=	2,850.0 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	=	100.0 pcf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	100.0 pcf
Soil/Concrete Friction Coeff.	=	0.350

**Increases based on footing depth**

Footing base depth below soil surface	=	0.50 ft
Allow press. increase per foot of depth when footing base is below	=	ksf ft

**Increases based on footing plan dimension**

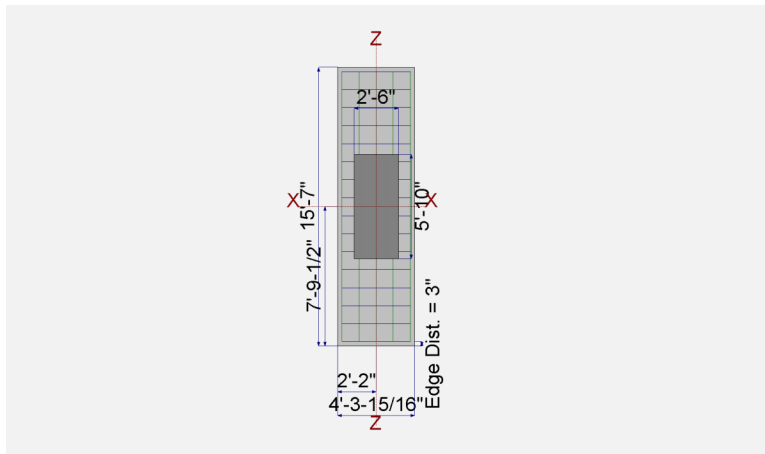
Allowable pressure increase per foot of depth when max. length or width is greater than	=	ksf ft
---	---	--------

**Dimensions**

Width parallel to X-X Axis	=	4.330 ft
Length parallel to Z-Z Axis	=	15.583 ft
Footing Thickness	=	8.0 in

**Pedestal dimensions...**

px : parallel to X-X Axis	=	30.0 in
pz : parallel to Z-Z Axis	=	70.0 in
Height	=	0.010 in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.50 in



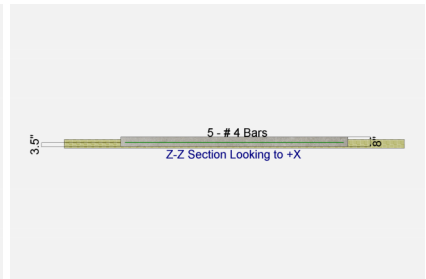
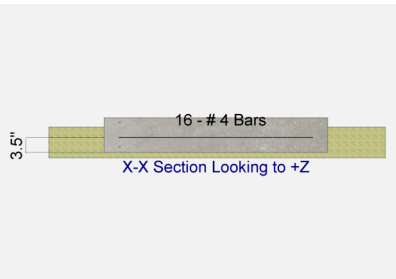
**Reinforcing**

<b>Bars parallel to X-X Axis</b>	=	
Number of Bars	=	16
Reinforcing Bar Size	=	# 4
<b>Bars parallel to Z-Z Axis</b>	=	
Number of Bars	=	5
Reinforcing Bar Size	=	# 4

**Bandwidth Distribution Check (ACI 15.4.4.2)**

Direction Requiring Closer Separation

		Bars along X-X Axis
# Bars required within zone	=	43.5 %
# Bars required on each side of zone	=	56.5 %



**Applied Loads**

	D	L <sub>r</sub>	L	S	W	E	H
P : Column Load	=	7.344					k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=				6.639	9.230	k-ft
V-x	=				1.780	2.475	k
V-z	=						k

**General Footing**

Project File: 2023345.09\_Bloom\_MCH000\_Equip. Foundation Calcs.ec6

LIC#: KW-06016111, Build:20.23.10.31

GPD ASSOCIATES

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**DESCRIPTION: CABINET FOUNDATION PAD**

**DESIGN SUMMARY**

**Design OK**

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.2403	Soil Bearing	0.3604 ksf	1.50 ksf	+D-0.70E about Z-Z axis
PASS	n/a	Overturing - X-X	0.0 k-ft	0.0 k-ft	No Overturing
PASS	2.365	Overturing - Z-Z	7.617 k-ft	18.013 k-ft	+0.60D+0.70E
PASS	1.793	Sliding - X-X	1.733 k	3.107 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	0.06197	Z Flexure (+X)	0.2438 k-ft/ft	3.935 k-ft/ft	+1.402D+2.0E
PASS	0.06197	Z Flexure (-X)	0.2438 k-ft/ft	3.935 k-ft/ft	+1.402D-2.0E
PASS	0.4126	X Flexure (+Z)	1.813 k-ft/ft	4.394 k-ft/ft	+1.402D+2.0E
PASS	0.4126	X Flexure (-Z)	1.813 k-ft/ft	4.394 k-ft/ft	+1.402D+2.0E
PASS	0.1799	1-way Shear (+X)	5.716 psi	31.777 psi	+1.402D+2.0E
PASS	0.1799	1-way Shear (-X)	5.716 psi	31.777 psi	+1.402D-2.0E
PASS	0.1780	1-way Shear (+Z)	12.772 psi	71.759 psi	+1.402D+2.0E
PASS	0.1780	1-way Shear (-Z)	12.772 psi	71.759 psi	+1.402D+2.0E
PASS	0.08005	2-way Punching	8.482 psi	105.963 psi	+1.402D-2.0E

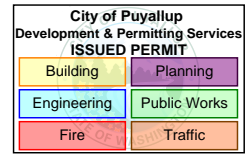
**Detailed Results**

**Soil Bearing**

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Zecc (in)	Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	1.50	n/a	0.0	0.2055	0.2055	n/a	n/a	0.137
X-X, +D+0.60W	1.50	n/a	0.0	0.2055	0.2055	n/a	n/a	0.137
X-X, +D-0.60W	1.50	n/a	0.0	0.2055	0.2055	n/a	n/a	0.137
X-X, +D+0.450W	1.50	n/a	0.0	0.2055	0.2055	n/a	n/a	0.137
X-X, +D-0.450W	1.50	n/a	0.0	0.2055	0.2055	n/a	n/a	0.137
X-X, +0.60D+0.60W	1.50	n/a	0.0	0.1233	0.1233	n/a	n/a	0.082
X-X, +0.60D-0.60W	1.50	n/a	0.0	0.1233	0.1233	n/a	n/a	0.082
X-X, +D+0.70E	1.50	n/a	0.0	0.2055	0.2055	n/a	n/a	0.137
X-X, +D-0.70E	1.50	n/a	0.0	0.2055	0.2055	n/a	n/a	0.137
X-X, +D+0.5250E	1.50	n/a	0.0	0.2055	0.2055	n/a	n/a	0.137
X-X, +D-0.5250E	1.50	n/a	0.0	0.2055	0.2055	n/a	n/a	0.137
X-X, +0.60D+0.70E	1.50	n/a	0.0	0.1233	0.1233	n/a	n/a	0.082
X-X, +0.60D-0.70E	1.50	n/a	0.0	0.1233	0.1233	n/a	n/a	0.082
Z-Z, D Only	1.50	0.0	n/a	n/a	n/a	0.2055	0.2055	0.137
Z-Z, +D+0.60W	1.50	4.064	n/a	n/a	n/a	0.110	0.3010	0.201
Z-Z, +D-0.60W	1.50	-4.064	n/a	n/a	n/a	0.3010	0.110	0.201
Z-Z, +D+0.450W	1.50	3.048	n/a	n/a	n/a	0.1339	0.2771	0.185
Z-Z, +D-0.450W	1.50	-3.048	n/a	n/a	n/a	0.2771	0.1339	0.185
Z-Z, +0.60D+0.60W	1.50	6.774	n/a	n/a	n/a	0.02782	0.2188	0.146
Z-Z, +0.60D-0.60W	1.50	-6.774	n/a	n/a	n/a	0.2188	0.02782	0.146
Z-Z, +D+0.70E	1.50	6.592	n/a	n/a	n/a	0.05064	0.3604	0.240
Z-Z, +D-0.70E	1.50	-6.592	n/a	n/a	n/a	0.3604	0.05064	0.240
Z-Z, +D+0.5250E	1.50	4.944	n/a	n/a	n/a	0.08936	0.3217	0.215
Z-Z, +D-0.5250E	1.50	-4.944	n/a	n/a	n/a	0.3217	0.08936	0.215
Z-Z, +0.60D+0.70E	1.50	10.987	n/a	n/a	n/a	0.0	0.2832	0.189
Z-Z, +0.60D-0.70E	1.50	-10.987	n/a	n/a	n/a	0.2832	0.0	0.189

**Overturing Stability**

Rotation Axis & Load Combination...	Overturing 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-0.60W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.450W	None	0.0 k-ft	Infinity	OK
X-X, +D-0.450W	None	0.0 k-ft	Infinity	OK
X-X, +0.60D+0.60W	None	0.0 k-ft	Infinity	OK



**General Footing**

Project File: 2023345.09\_Bloom\_MCH000\_Equip. Foundation Calcs.ec6

LIC# : KW-06016111, Build:20.23.10.31

GPD ASSOCIATES

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**DESCRIPTION: CABINET FOUNDATION PAD**

**Overturning Stability**

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
X-X, +0.60D-0.60W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.70E	None	0.0 k-ft	Infinity	OK
X-X, +D-0.70E	None	0.0 k-ft	Infinity	OK
X-X, +D+0.5250E	None	0.0 k-ft	Infinity	OK
X-X, +D-0.5250E	None	0.0 k-ft	Infinity	OK
X-X, +0.60D+0.70E	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	4.696 k-ft	30.021 k-ft	6.393	OK
Z-Z, +D-0.60W	4.696 k-ft	30.021 k-ft	6.393	OK
Z-Z, +D+0.450W	3.522 k-ft	30.021 k-ft	8.523	OK
Z-Z, +D-0.450W	3.522 k-ft	30.021 k-ft	8.523	OK
Z-Z, +0.60D+0.60W	4.696 k-ft	18.013 k-ft	3.836	OK
Z-Z, +0.60D-0.60W	4.696 k-ft	18.013 k-ft	3.836	OK
Z-Z, +D+0.70E	7.617 k-ft	30.021 k-ft	3.941	OK
Z-Z, +D-0.70E	7.617 k-ft	30.021 k-ft	3.941	OK
Z-Z, +D+0.5250E	5.713 k-ft	30.021 k-ft	5.255	OK
Z-Z, +D-0.5250E	5.713 k-ft	30.021 k-ft	5.255	OK
Z-Z, +0.60D+0.70E	7.617 k-ft	18.013 k-ft	2.365	OK
Z-Z, +0.60D-0.70E	7.617 k-ft	18.013 k-ft	2.365	OK

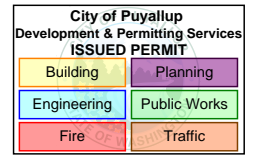
All units k

**Sliding Stability**

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
X-X, D Only	0.0 k	5.048 k	No Sliding	OK
X-X, +D+0.60W	1.068 k	5.048 k	4.727	OK
X-X, +D-0.60W	-1.068 k	5.048 k	4.727	OK
X-X, +D+0.450W	0.8010 k	5.048 k	6.302	OK
X-X, +D-0.450W	-0.8010 k	5.048 k	6.302	OK
X-X, +0.60D+0.60W	1.068 k	3.107 k	2.909	OK
X-X, +0.60D-0.60W	-1.068 k	3.107 k	2.909	OK
X-X, +D+0.70E	1.733 k	5.048 k	2.914	OK
X-X, +D-0.70E	-1.733 k	5.048 k	2.914	OK
X-X, +D+0.5250E	1.299 k	5.048 k	3.885	OK
X-X, +D-0.5250E	-1.299 k	5.048 k	3.885	OK
X-X, +0.60D+0.70E	1.733 k	3.107 k	1.793	OK
X-X, +0.60D-0.70E	-1.733 k	3.107 k	1.793	OK
Z-Z, D Only	0.0 k	4.907 k	No Sliding	OK
Z-Z, +D+0.60W	0.0 k	4.907 k	No Sliding	OK
Z-Z, +D-0.60W	0.0 k	4.907 k	No Sliding	OK
Z-Z, +D+0.450W	0.0 k	4.907 k	No Sliding	OK
Z-Z, +D-0.450W	0.0 k	4.907 k	No Sliding	OK
Z-Z, +0.60D+0.60W	0.0 k	2.966 k	No Sliding	OK
Z-Z, +D+0.5250E	0.0 k	4.907 k	No Sliding	OK
Z-Z, +D-0.5250E	0.0 k	4.907 k	No Sliding	OK
Z-Z, +0.60D+0.70E	0.0 k	2.966 k	No Sliding	OK
Z-Z, +0.60D-0.70E	0.0 k	2.966 k	No Sliding	OK
Z-Z, +0.60D-0.60W	0.0 k	2.966 k	No Sliding	OK
Z-Z, +D+0.70E	0.0 k	4.907 k	No Sliding	OK
Z-Z, +D-0.70E	0.0 k	4.907 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	1.810	+Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +1.40D	1.810	-Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +1.20D	1.552	+Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +1.20D	1.552	-Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +1.20D+0.50W	1.552	+Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +1.20D+0.50W	1.552	-Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +1.20D-0.50W	1.552	+Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +1.20D-0.50W	1.552	-Z	Bottom	0.1728	AsMin	0.2309	4.394	OK



**General Footing**

Project File: 2023345.09\_Bloom\_MCH000\_Equip. Foundation Calcs.ec6

LIC# : KW-06016111, Build:20.23.10.31

GPD ASSOCIATES

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**DESCRIPTION: CABINET FOUNDATION PAD**

**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, +1.20D+W	1.552	+Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +1.20D+W	1.552	-Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +1.20D-W	1.552	+Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +1.20D-W	1.552	-Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +0.90D+W	1.164	+Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +0.90D+W	1.164	-Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +0.90D-W	1.164	+Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +0.90D-W	1.164	-Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +1.402D+2.0E	1.813	+Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +1.402D+2.0E	1.813	-Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +1.402D-2.0E	1.813	+Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +1.402D-2.0E	1.813	-Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +0.6978D+2.0E	0.9024	+Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +0.6978D+2.0E	0.9024	-Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +0.6978D-2.0E	0.9024	+Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
X-X, +0.6978D-2.0E	0.9024	-Z	Bottom	0.1728	AsMin	0.2309	4.394	OK
Z-Z, +1.40D	0.06379	-X	Bottom	0.1728	AsMin	0.2054	3.935	OK
Z-Z, +1.40D	0.06379	+X	Bottom	0.1728	AsMin	0.2054	3.935	OK
Z-Z, +1.20D	0.05467	-X	Bottom	0.1728	AsMin	0.2054	3.935	OK
Z-Z, +1.20D	0.05467	+X	Bottom	0.1728	AsMin	0.2054	3.935	OK
Z-Z, +1.20D+0.50W	0.02577	-X	Bottom	0.1728	AsMin	0.2054	3.935	OK
Z-Z, +1.20D+0.50W	0.08357	+X	Bottom	0.1728	AsMin	0.2054	3.935	OK
Z-Z, +1.20D-0.50W	0.08357	-X	Bottom	0.1728	AsMin	0.2054	3.935	OK
Z-Z, +1.20D-0.50W	0.02577	+X	Bottom	0.1728	AsMin	0.2054	3.935	OK
Z-Z, +1.20D+W	0.003124	-X	Top	0.1728	AsMin	0.2054	4.397	OK
Z-Z, +1.20D+W	0.1125	+X	Bottom	0.1728	AsMin	0.2054	3.935	OK
Z-Z, +1.20D-W	0.1125	-X	Bottom	0.1728	AsMin	0.2054	3.935	OK
Z-Z, +1.20D-W	0.003124	+X	Top	0.1728	AsMin	0.2054	4.397	OK
Z-Z, +0.90D+W	0.01679	-X	Top	0.1728	AsMin	0.2054	4.397	OK
Z-Z, +0.90D+W	0.09880	+X	Bottom	0.1728	AsMin	0.2054	3.935	OK
Z-Z, +0.90D-W	0.09880	-X	Bottom	0.1728	AsMin	0.2054	3.935	OK
Z-Z, +0.90D-W	0.01679	+X	Top	0.1728	AsMin	0.2054	4.397	OK
Z-Z, +1.402D+2.0E	0.05674	-X	Top	0.1728	AsMin	0.2054	4.397	OK
Z-Z, +1.402D+2.0E	0.2438	+X	Bottom	0.1728	AsMin	0.2054	3.935	OK
Z-Z, +1.402D-2.0E	0.2438	-X	Bottom	0.1728	AsMin	0.2054	3.935	OK
Z-Z, +1.402D-2.0E	0.05674	+X	Top	0.1728	AsMin	0.2054	4.397	OK
Z-Z, +0.6978D+2.0E	0.02824	-X	Top	0.1728	AsMin	0.2054	4.397	OK
Z-Z, +0.6978D+2.0E	0.02824	+X	Top	0.1728	AsMin	0.2054	4.397	OK
Z-Z, +0.6978D-2.0E	0.02824	-X	Top	0.1728	AsMin	0.2054	4.397	OK
Z-Z, +0.6978D-2.0E	0.02824	+X	Top	0.1728	AsMin	0.2054	4.397	OK

**One Way Shear X**

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	1.47 psi	1.47 psi	1.47 psi	31.78 psi	0.05	OK
+1.20D	1.26 psi	1.26 psi	1.26 psi	31.78 psi	0.04	OK
+1.20D+0.50W	0.58 psi	1.94 psi	1.94 psi	31.78 psi	0.06	OK
+1.20D-0.50W	1.94 psi	0.58 psi	1.94 psi	31.78 psi	0.06	OK
+1.20D+W	0.10 psi	2.62 psi	2.62 psi	31.78 psi	0.08	OK
+1.20D-W	2.62 psi	0.10 psi	2.62 psi	31.78 psi	0.08	OK
+0.90D+W	0.42 psi	2.30 psi	2.30 psi	31.78 psi	0.07	OK
+0.90D-W	2.30 psi	0.42 psi	2.30 psi	31.78 psi	0.07	OK
+1.402D+2.0E	1.30 psi	5.72 psi	5.72 psi	31.78 psi	0.18	OK
+1.402D-2.0E	5.72 psi	1.30 psi	5.72 psi	31.78 psi	0.18	OK
+0.6978D+2.0E	0.65 psi	0.65 psi	0.65 psi	31.78 psi	0.02	OK
+0.6978D-2.0E	0.65 psi	0.65 psi	0.65 psi	31.78 psi	0.02	OK

**One Way Shear Z**

Load Combination...	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	12.75 psi	12.75 psi	12.75 psi	71.76 psi	0.18	OK
+1.20D	10.93 psi	10.93 psi	10.93 psi	71.76 psi	0.15	OK
+1.20D+0.50W	10.93 psi	10.93 psi	10.93 psi	71.76 psi	0.15	OK
+1.20D-0.50W	10.93 psi	10.93 psi	10.93 psi	71.76 psi	0.15	OK
+1.20D+W	10.93 psi	10.93 psi	10.93 psi	71.76 psi	0.15	OK

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

City of Puyallup  
 Development & Permitting Services  
**ISSUED PERMIT**

Building	Planning
Engineering	Public Works
Fire	Traffic

**General Footing**

Project File: 2023345.09\_Bloom\_MCH000\_Equip. Foundation Calcs.ec6

LIC# : KW-06016111, Build:20.23.10.31

GPD ASSOCIATES

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**DESCRIPTION: CABINET FOUNDATION PAD**

**One Way Shear Z**

Load Combination...	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.20D-W	10.93 psi	10.93 psi	10.93 psi	71.76 psi	0.15	OK
+0.90D+W	8.20 psi	8.20 psi	8.20 psi	71.76 psi	0.11	OK
+0.90D-W	8.20 psi	8.20 psi	8.20 psi	71.76 psi	0.11	OK
+1.402D+2.0E	12.77 psi	12.77 psi	12.77 psi	71.76 psi	0.18	OK
+1.402D-2.0E	12.77 psi	12.77 psi	12.77 psi	71.76 psi	0.18	OK
+0.6978D+2.0E	6.36 psi	6.36 psi	6.36 psi	71.76 psi	0.09	OK
+0.6978D-2.0E	6.36 psi	6.36 psi	6.36 psi	71.76 psi	0.09	OK

All units k

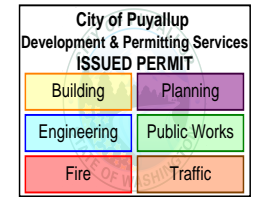
**Two-Way "Punching" Shear**

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	7.71 psi	105.96psi	0.0728	OK
+1.20D	6.61 psi	105.96psi	0.0624	OK
+1.20D+0.50W	6.61 psi	105.96psi	0.0624	OK
+1.20D-0.50W	6.61 psi	105.96psi	0.0624	OK
+1.20D+W	6.61 psi	105.96psi	0.0624	OK
+1.20D-W	6.61 psi	105.96psi	0.0624	OK
+0.90D+W	4.96 psi	109.09psi	0.04546	OK
+0.90D-W	4.96 psi	105.96psi	0.0468	OK
+1.402D+2.0E	8.48 psi	109.09psi	0.07775	OK
+1.402D-2.0E	8.48 psi	105.96psi	0.08005	OK
+0.6978D+2.0E	3.85 psi	109.09psi	0.03524	OK
+0.6978D-2.0E	3.85 psi	109.09psi	0.03524	OK

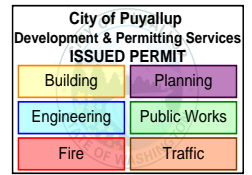
ASCE 7-16 Wind Calculations - Worst Case Scenario Alt Charging Post Wind reactions

Tesla Supercharging Station - Generic Site Calculations

Basic Wind Speed (Ultimate)	97	mph
Risk Category	II	
Exposure Category	C	
Topographic Category	1	
Z <sub>g</sub>	900	ft
α	9.5	
K <sub>zmin</sub>	0.85	
K <sub>zt</sub>	1.00	



Component	Z (ft)	Vertical (in)	Horizontal (in)	Area (ft <sup>2</sup> )	K <sub>d</sub>	K <sub>zt</sub>	K <sub>e</sub>	K <sub>z</sub>	q <sub>z</sub>	G	C <sub>f</sub>	Horizontal Wind Force on Component (lb)	Resultant moment at base kip*ft
Signage	6.3	18	12	1.50	0.85	1.00	1.00	0.85	17.38	0.85	1.31	29.0	0.2
Sign - use last	5.3	6	12	0.50	0.85	1.00	1.00	0.85	17.38	0.85	1.30	9.6	0.050
Bollard 1	1.8	42	4	1.17	0.85	1.00	1.00	0.85	17.38	0.85	0.88	15.1	0.0
ALT Post	3.2	76.6	26.77	14.30	0.85	1.00	1.00	0.85	17.38	0.85	1.33	281.2	0.9
<b>Total:</b>												<b>334.9</b>	<b>1.156</b>



Mat Foundation Analysis

General Info	
Code	ASCE 7-16
Concrete Code	ACI 318-14
Seismic Design Category	D
Bearing On	Soil
Foundation Type	Pad
Reinforcing Known	Yes
Max Bearing Capacity	100%
Max Overturning Capacity	100%

Reactions	
Moment, M	1.156 k-ft
Axial, P	0.2 k
Shear, V	0.3349 k

Pad & Pier Geometry	
Pier N/A	
Pad Length, L [y]	2 ft
Pad Width, W [x]	4.67 ft
Pad Thickness, t	1.75 ft
Depth, D	1.75 ft
Height Above Grade, HG	0 ft
Centroid, X	2.335 ft
Centroid, Y	1 ft
Eccentricity	0.0000 ft

Pad & Pier Reinforcing	
Rebar Fy	60 ksi
Concrete F'c	2.5 ksi
Pad Reinforcing Clear Cover	3 in
Reinforced Top & Bottom?	Yes
Top and Bot. Reinf. Different?	No
Direction of Reinforcing	L W
Pad Reinforcing Size	# 4 # 4
Pad Quantity Per Layer	2 6

Soil Properties	
Soil Type	Granular
Soil Unit Weight	100 pcf
Angle of Friction, $\phi$	19.47
Base Friction Coefficient, $\mu$	0.35
Bearing Type	Gross
Ultimate Bearing	3 ksf
Water Table Depth	10 ft
Neglected Depth	0.5 ft

GPD Mat Foundation Analysis - V4.4  
Section 1806 Presumptive Load-Bearing Values of Soils

1806.1 Load combinations

The presumptive load-bearing values provided in Table 1806.2 shall be used with the allowable stress design load combinations specified in Section 1806.3. The values of vertical foundation pressure and lateral bearing pressure given in Table 1806.2 shall be permitted to be increased by one-third where used with the alternative basic load combinations of section 1806.3.2 that include wind or earthquake loads.

TABLE 1806.2

CLASS OF MATERIALS	VERTICAL FOUNDATION PRESSURE (psf)	LATERAL BEARING PRESSURE (psf/ft below natural grade)	LATERAL SLIDING RESISTANCE	
			Coefficient of friction <sup>a</sup>	Cohesion (psf) <sup>b</sup>
1. Crystalline bedrock	12,000	1,200	0.70	—
2. Sedimentary and foliated rock	4,000	400	0.35	—
3. Sandy gravel and/or gravel (GW and GP)	3,000	300	0.35	—
4. Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	2,000	150	0.25	—
5. Clay, sandy clay, silty clay, clayey silt, silty and sandy silt (CL, ML, MH and CH)	1,500	100	—	130

Top 3: 1 pound per square foot = 0.0479 kPa, 1 pound per square foot = 0.157 kPa/m.

<sup>a</sup> Coefficient of friction to be multiplied by the lateral load.

<sup>b</sup> Cohesion value to be multiplied by the contact area, as limited by Section 1806.3.2.

Bearing Summary					
Case	Demand/Limits	Capacity/Availability	Check	Eccentricity	Load Case
Q <sub>max</sub>	0.76 ksf	2.25 ksf	OK, <= 105%	L/3.0	0.9D+1.0W
Q <sub>ymax</sub>	0.48 ksf	2.25 ksf	OK, <= 105%	W/9.3	1.2D+1.0W
Q <sub>max @ 45°</sub>	0.61 ksf	2.25 ksf	OK, <= 105%	L/5.7	1.2D+1.0W
<b>Controlling Capacity</b>		<b>33.7%</b>	<b>Pass</b>		

Overturning Summary					
Case	Demand/Limits	Capacity/Availability	Check	Load Case	
O <sub>vtx</sub>	1.6 k-ft	3.1 k-ft	66.7% OK	0.9D+1.0W	
O <sub>vty</sub>	1.6 k-ft	7.3 k-ft	28.6% OK	0.9D+1.0W	
O <sub>vtxy</sub>	1.1 k-ft	3.1 k-ft	47.2% OK	0.9D+1.0W	
<b>Controlling Capacity</b>		<b>66.7%</b>	<b>Pass</b>		

Sliding Summary					
Case	Demand/Limits	Capacity/Availability	Check	Load Case	
Sliding <sub>x</sub>	0.3 k	1.6 k	20.9% OK	0.9D+1.0W	
Sliding <sub>y</sub>	0.3 k	1.0 k	32.2% OK	0.9D+1.0W	
<b>Controlling Capacity</b>		<b>32.2%</b>	<b>Pass</b>		

Reinforcement Summary					
Component	Demand/Limits	Capacity/Availability	Check	Load Case	
Pad Flexural Bending	0.9 k-ft	30.6 k-ft	2.9% OK	1.2D+1.0W	
One-Way Shear in Pad	0.4 k	31.1 k	1.1% OK	1.2D+1.0W	
Two-Way Shear in Pad	1.2 k	178.5 k	0.7% OK	0.9D+1.0W	
As Min Pad Met?	0.40 sq. in.	0.03 sq. in.	Yes		
<b>Controlling Capacity</b>		<b>2.9%</b>	<b>Pass</b>		

SOIL CALCULATIONS TO DETERMINE EQUIVALENT FRICTION ANGLE ( $\phi$ ) BASED ON PROVIDED LATERAL BEARING PRESSURE VALUES FROM TABLE 1806.2.

PER TABLE 1806.2 ALLOWABLE LATERAL BEARING PRESSURE FOR CLASS 5 MATERIAL (ASSUMED WORST CASE) = 100 PSF/FT

Passive Lateral Earth Pressure,  $\sigma_p = K_p \times \sigma'_v$

$K_p = \sigma_p / \sigma'_v = \text{lateral earth pressure} / \text{vertical effective pressure}$

$\sigma_p$ , lateral earth pressure (assuming Factor of Safety = 2) = 100psf/ft \* 2 = 200psf/ft  
 $\sigma'_v$ , vertical effective pressure = assumed soil unit weight = assumed value of 100 psf/ft

$K_p = \sigma_p / \sigma'_v = 200\text{psf/ft} / 100\text{psf/ft} = 2.0$

Rankine Theory where  $B = 0$ :

$K_p = \tan^2(45 + \phi/2)$

$2.0 = \tan^2(45 + \phi/2)$

$\phi = 19.4712$

**General Footing**

Project File: FOUndation Calcs.ec6

LIC# : KW-06016111, Build:20.23.10.31

GPD ASSOCIATES

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**DESCRIPTION: SWITCHGEAR FOUNDATION PAD**

**Code References**

Calculations per ACI 318-19, IBC 2021, ASCE 7-16  
 Load Combinations Used : ASCE 7-16

**General Information**

**Material Properties**

f <sub>c</sub> : Concrete 28 day strength	=	2.50 ksi
f <sub>y</sub> : Rebar Yield	=	60.0 ksi
E <sub>c</sub> : Concrete Elastic Modulus	=	2,850.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

**Soil Design Values**

Allowable Soil Bearing	=	1.50 ksf
Soil Density	=	100.0 pcf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	100.0 pcf
Soil/Concrete Friction Coeff.	=	0.350

**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

**Increases based on footing depth**

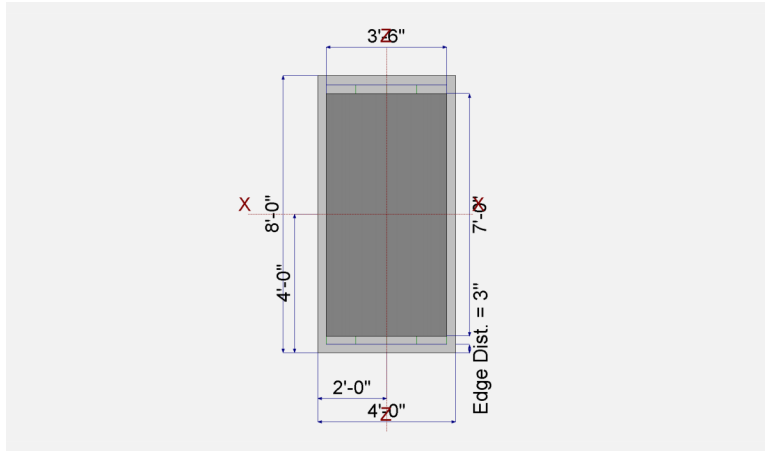
Footing base depth below soil surface	=	0.50 ft
Allow press. increase per foot of depth when footing base is below	=	ksf ft

**Increases based on footing plan dimension**

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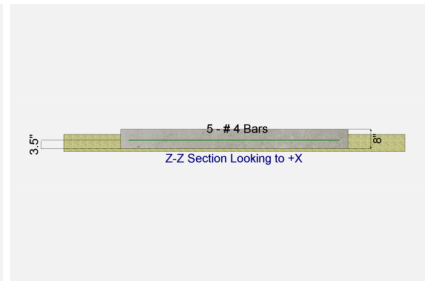
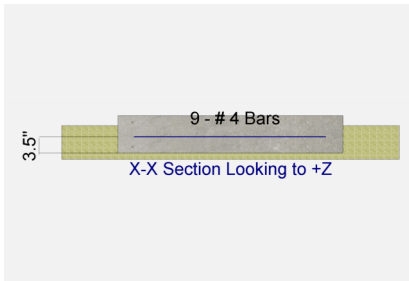
**Dimensions**

Width parallel to X-X Axis	=	4.0 ft
Length parallel to Z-Z Axis	=	8.0 ft
Footing Thickness	=	8.0 in
Pedestal dimensions...		
px : parallel to X-X Axis	=	42.0 in
pz : parallel to Z-Z Axis	=	84.0 in
Height	=	0.010 in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.50 in



**Reinforcing**

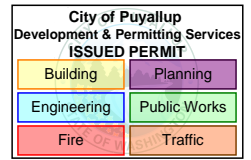
Bars parallel to X-X Axis		
Number of Bars	=	9.0
Reinforcing Bar Size	=	# 4
Bars parallel to Z-Z Axis		
Number of Bars	=	5.0
Reinforcing Bar Size	=	# 4
<b>Bandwidth Distribution Check (ACI 15.4.4.2)</b>		
Direction Requiring Closer Separation		
	Bars along X-X Axis	
# Bars required within zone	=	66.7 %
# Bars required on each side of zone	=	33.3 %



**Applied Loads**

	D	L <sub>r</sub>	L	S	W	E	H
P : Column Load	=	2.60					k
OB : Overburden	=						ksf
M-xx	=						k-ft
M-zz	=				3.784	3.286	k-ft
V-x	=				1.009	0.8762	k
V-z	=						k





**General Footing**

Project File: F0undation Calcs.ecb

LIC# : KW-06016111, Build:20.23.10.31

GPD ASSOCIATES

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**DESCRIPTION: SWITCHGEAR FOUNDATION PAD**

**DESIGN SUMMARY**

**Design OK**

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.2025	Soil Bearing	0.3037 ksf	1.50 ksf	+D-0.70E about Z-Z axis
PASS	n/a	Overturing - X-X	0.0 k-ft	0.0 k-ft	No Overturing
PASS	2.521	Overturing - Z-Z	2.710 k-ft	6.832 k-ft	+0.60D+0.70E
PASS	2.112	Sliding - X-X	0.6133 k	1.296 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	0.02229	Z Flexure (+X)	0.09560 k-ft/ft	4.288 k-ft/ft	+0.6978D+2.0E
PASS	0.02229	Z Flexure (-X)	0.09560 k-ft/ft	4.288 k-ft/ft	+0.6978D-2.0E
PASS	0.003005	X Flexure (+Z)	0.01422 k-ft/ft	4.732 k-ft/ft	+1.402D-2.0E
PASS	0.003005	X Flexure (-Z)	0.01422 k-ft/ft	4.732 k-ft/ft	+1.402D+2.0E
PASS	n/a	1-way Shear (+X)	0.0 psi	39.685 psi	n/a
PASS	0.0	1-way Shear (-X)	0.0 psi	0.0 psi	n/a
PASS	0.005550	1-way Shear (+Z)	0.3376 psi	60.822 psi	+1.402D+2.0E
PASS	0.005550	1-way Shear (-Z)	0.3376 psi	60.822 psi	+1.402D+2.0E
PASS	n/a	2-way Punching	3.057 psi	39.685 psi	+0.6978D-2.0E

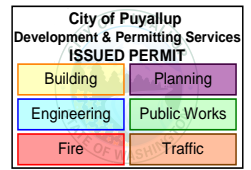
**Detailed Results**

**Soil Bearing**

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Zecc (in)	Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	1.50	n/a	0.0	0.1779	0.1779	n/a	n/a	0.119
X-X, +D+0.60W	1.50	n/a	0.0	0.1779	0.1779	n/a	n/a	0.119
X-X, +D-0.60W	1.50	n/a	0.0	0.1779	0.1779	n/a	n/a	0.119
X-X, +D+0.450W	1.50	n/a	0.0	0.1779	0.1779	n/a	n/a	0.119
X-X, +D-0.450W	1.50	n/a	0.0	0.1779	0.1779	n/a	n/a	0.119
X-X, +0.60D+0.60W	1.50	n/a	0.0	0.1068	0.1068	n/a	n/a	0.071
X-X, +0.60D-0.60W	1.50	n/a	0.0	0.1068	0.1068	n/a	n/a	0.071
X-X, +D+0.70E	1.50	n/a	0.0	0.1779	0.1779	n/a	n/a	0.119
X-X, +D-0.70E	1.50	n/a	0.0	0.1779	0.1779	n/a	n/a	0.119
X-X, +D+0.5250E	1.50	n/a	0.0	0.1779	0.1779	n/a	n/a	0.119
X-X, +D-0.5250E	1.50	n/a	0.0	0.1779	0.1779	n/a	n/a	0.119
X-X, +0.60D+0.70E	1.50	n/a	0.0	0.1068	0.1068	n/a	n/a	0.071
X-X, +0.60D-0.70E	1.50	n/a	0.0	0.1068	0.1068	n/a	n/a	0.071
Z-Z, D Only	1.50	0.0	n/a	n/a	n/a	0.1779	0.1779	0.119
Z-Z, +D+0.60W	1.50	5.637	n/a	n/a	n/a	0.05380	0.3020	0.201
Z-Z, +D-0.60W	1.50	-5.637	n/a	n/a	n/a	0.3020	0.05380	0.201
Z-Z, +D+0.450W	1.50	4.228	n/a	n/a	n/a	0.08483	0.2710	0.181
Z-Z, +D-0.450W	1.50	-4.228	n/a	n/a	n/a	0.2710	0.08483	0.181
Z-Z, +0.60D+0.60W	1.50	9.395	n/a	n/a	n/a	0.0	0.2326	0.155
Z-Z, +0.60D-0.60W	1.50	-9.395	n/a	n/a	n/a	0.2326	0.0	0.155
Z-Z, +D+0.70E	1.50	5.711	n/a	n/a	n/a	0.05217	0.3037	0.203
Z-Z, +D-0.70E	1.50	-5.711	n/a	n/a	n/a	0.3037	0.05217	0.203
Z-Z, +D+0.5250E	1.50	4.283	n/a	n/a	n/a	0.08361	0.2722	0.182
Z-Z, +D-0.5250E	1.50	-4.283	n/a	n/a	n/a	0.2722	0.08361	0.182
Z-Z, +0.60D+0.70E	1.50	9.519	n/a	n/a	n/a	0.0	0.2346	0.156
Z-Z, +0.60D-0.70E	1.50	-9.519	n/a	n/a	n/a	0.2346	0.0	0.156

**Overturing Stability**

Rotation Axis & Load Combination...	Overturing 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-0.60W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.450W	None	0.0 k-ft	Infinity	OK
X-X, +D-0.450W	None	0.0 k-ft	Infinity	OK
X-X, +0.60D+0.60W	None	0.0 k-ft	Infinity	OK



**General Footing**

Project File: FOUndation Calcs.ec6

LIC# : KW-06016111, Build:20.23.10.31

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**DESCRIPTION: SWITCHGEAR FOUNDATION PAD**

**Overturning Stability**

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
X-X, +0.60D-0.60W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.70E	None	0.0 k-ft	Infinity	OK
X-X, +D-0.70E	None	0.0 k-ft	Infinity	OK
X-X, +D+0.5250E	None	0.0 k-ft	Infinity	OK
X-X, +D-0.5250E	None	0.0 k-ft	Infinity	OK
X-X, +0.60D+0.70E	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	2.675 k-ft	11.387 k-ft	4.257	OK
Z-Z, +D-0.60W	2.675 k-ft	11.387 k-ft	4.257	OK
Z-Z, +D+0.450W	2.006 k-ft	11.387 k-ft	5.677	OK
Z-Z, +D-0.450W	2.006 k-ft	11.387 k-ft	5.677	OK
Z-Z, +0.60D+0.60W	2.675 k-ft	6.832 k-ft	2.554	OK
Z-Z, +0.60D-0.60W	2.675 k-ft	6.832 k-ft	2.554	OK
Z-Z, +D+0.70E	2.710 k-ft	11.387 k-ft	4.202	OK
Z-Z, +D-0.70E	2.710 k-ft	11.387 k-ft	4.202	OK
Z-Z, +D+0.5250E	2.032 k-ft	11.387 k-ft	5.603	OK
Z-Z, +D-0.5250E	2.032 k-ft	11.387 k-ft	5.603	OK
Z-Z, +0.60D+0.70E	2.710 k-ft	6.832 k-ft	2.521	OK
Z-Z, +0.60D-0.70E	2.710 k-ft	6.832 k-ft	2.521	OK

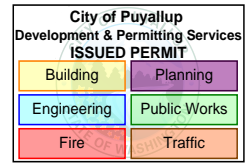
All units k

**Sliding Stability**

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
X-X, D Only	0.0 k	2.093 k	No Sliding	OK
X-X, +D+0.60W	0.6054 k	2.093 k	3.457	OK
X-X, +D-0.60W	-0.6054 k	2.093 k	3.457	OK
X-X, +D+0.450W	0.4541 k	2.093 k	4.609	OK
X-X, +D-0.450W	-0.4541 k	2.093 k	4.609	OK
X-X, +0.60D+0.60W	0.6054 k	1.296 k	2.140	OK
X-X, +0.60D-0.60W	-0.6054 k	1.296 k	2.140	OK
X-X, +D+0.70E	0.6133 k	2.093 k	3.412	OK
X-X, +D-0.70E	-0.6133 k	2.093 k	3.412	OK
X-X, +D+0.5250E	0.460 k	2.093 k	4.549	OK
X-X, +D-0.5250E	-0.460 k	2.093 k	4.549	OK
X-X, +0.60D+0.70E	0.6133 k	1.296 k	2.112	OK
X-X, +0.60D-0.70E	-0.6133 k	1.296 k	2.112	OK
Z-Z, D Only	0.0 k	2.043 k	No Sliding	OK
Z-Z, +D+0.60W	0.0 k	2.043 k	No Sliding	OK
Z-Z, +D-0.60W	0.0 k	2.043 k	No Sliding	OK
Z-Z, +D+0.450W	0.0 k	2.043 k	No Sliding	OK
Z-Z, +D-0.450W	0.0 k	2.043 k	No Sliding	OK
Z-Z, +0.60D+0.60W	0.0 k	1.246 k	No Sliding	OK
Z-Z, +D+0.5250E	0.0 k	2.043 k	No Sliding	OK
Z-Z, +D-0.5250E	0.0 k	2.043 k	No Sliding	OK
Z-Z, +0.60D+0.70E	0.0 k	1.246 k	No Sliding	OK
Z-Z, +0.60D-0.70E	0.0 k	1.246 k	No Sliding	OK
Z-Z, +0.60D-0.60W	0.0 k	1.246 k	No Sliding	OK
Z-Z, +D+0.70E	0.0 k	2.043 k	No Sliding	OK
Z-Z, +D-0.70E	0.0 k	2.043 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	0.01420	+Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +1.40D	0.01420	-Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +1.20D	0.01217	+Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +1.20D	0.01217	-Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +1.20D+0.50W	0.01217	+Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +1.20D+0.50W	0.01217	-Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +1.20D-0.50W	0.01217	+Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +1.20D-0.50W	0.01217	-Z	Bottom	0.1728	AsMin	0.250	4.732	OK



**General Footing**

Project File: F0undation Calcs.ecb

LIC# : KW-06016111, Build:20.23.10.31

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**DESCRIPTION: SWITCHGEAR FOUNDATION PAD**

**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, +1.20D+W	0.01217	+Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +1.20D+W	0.01217	-Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +1.20D-W	0.01217	+Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +1.20D-W	0.01217	-Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +0.90D+W	0.009126	+Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +0.90D+W	0.009126	-Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +0.90D-W	0.009126	+Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +0.90D-W	0.009126	-Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +1.402D+2.0E	0.01422	+Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +1.402D+2.0E	0.01422	-Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +1.402D-2.0E	0.01422	+Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +1.402D-2.0E	0.01422	-Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +0.6978D+2.0E	0.007076	+Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +0.6978D+2.0E	0.007076	-Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +0.6978D-2.0E	0.007076	+Z	Bottom	0.1728	AsMin	0.250	4.732	OK
X-X, +0.6978D-2.0E	0.007076	-Z	Bottom	0.1728	AsMin	0.250	4.732	OK
Z-Z, +1.40D	0.003549	-X	Bottom	0.1728	AsMin	0.2250	4.288	OK
Z-Z, +1.40D	0.003549	+X	Bottom	0.1728	AsMin	0.2250	4.288	OK
Z-Z, +1.20D	0.003042	-X	Bottom	0.1728	AsMin	0.2250	4.288	OK
Z-Z, +1.20D	0.003042	+X	Bottom	0.1728	AsMin	0.2250	4.288	OK
Z-Z, +1.20D+0.50W	.000080	-X	Top	0.1728	AsMin	0.2250	4.794	OK
Z-Z, +1.20D+0.50W	0.006164	+X	Bottom	0.1728	AsMin	0.2250	4.288	OK
Z-Z, +1.20D-0.50W	0.006164	-X	Bottom	0.1728	AsMin	0.2250	4.288	OK
Z-Z, +1.20D-0.50W	.000080	+X	Top	0.1728	AsMin	0.2250	4.794	OK
Z-Z, +1.20D+W	0.003203	-X	Top	0.1728	AsMin	0.2250	4.794	OK
Z-Z, +1.20D+W	0.009287	+X	Bottom	0.1728	AsMin	0.2250	4.288	OK
Z-Z, +1.20D-W	0.009287	-X	Bottom	0.1728	AsMin	0.2250	4.288	OK
Z-Z, +1.20D-W	0.003203	+X	Top	0.1728	AsMin	0.2250	4.794	OK
Z-Z, +0.90D+W	0.002714	-X	Top	0.1728	AsMin	0.2250	4.794	OK
Z-Z, +0.90D+W	0.008782	+X	Bottom	0.1728	AsMin	0.2250	4.288	OK
Z-Z, +0.90D-W	0.008782	-X	Bottom	0.1728	AsMin	0.2250	4.288	OK
Z-Z, +0.90D-W	0.002714	+X	Top	0.1728	AsMin	0.2250	4.794	OK
Z-Z, +1.402D+2.0E	0.004229	-X	Top	0.1728	AsMin	0.2250	4.794	OK
Z-Z, +1.402D+2.0E	0.01537	+X	Bottom	0.1728	AsMin	0.2250	4.288	OK
Z-Z, +1.402D-2.0E	0.01537	-X	Bottom	0.1728	AsMin	0.2250	4.288	OK
Z-Z, +1.402D-2.0E	0.004229	+X	Top	0.1728	AsMin	0.2250	4.794	OK
Z-Z, +0.6978D+2.0E	0.002105	-X	Top	0.1728	AsMin	0.2250	4.794	OK
Z-Z, +0.6978D+2.0E	0.09560	+X	Bottom	0.1728	AsMin	0.2250	4.288	OK
Z-Z, +0.6978D-2.0E	0.09560	-X	Bottom	0.1728	AsMin	0.2250	4.288	OK
Z-Z, +0.6978D-2.0E	0.002105	+X	Top	0.1728	AsMin	0.2250	4.794	OK

**One Way Shear X**

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0.00 psi	0.00 psi	0.00 psi	39.69 psi	0.00	OK
+1.20D	0.00 psi	0.00 psi	0.00 psi	39.69 psi	0.00	OK
+1.20D+0.50W	0.00 psi	0.00 psi	0.00 psi	39.69 psi	0.00	OK
+1.20D-0.50W	0.00 psi	0.00 psi	0.00 psi	39.69 psi	0.00	OK
+1.20D+W	0.00 psi	0.00 psi	0.00 psi	39.69 psi	0.00	OK
+1.20D-W	0.00 psi	0.00 psi	0.00 psi	39.69 psi	0.00	OK
+0.90D+W	0.00 psi	0.00 psi	0.00 psi	39.69 psi	0.00	OK
+0.90D-W	0.00 psi	0.00 psi	0.00 psi	39.69 psi	0.00	OK
+1.402D+2.0E	0.00 psi	0.00 psi	0.00 psi	39.69 psi	0.00	OK
+1.402D-2.0E	0.00 psi	0.00 psi	0.00 psi	39.69 psi	0.00	OK
+0.6978D+2.0E	0.00 psi	0.00 psi	0.00 psi	39.69 psi	0.00	OK
+0.6978D-2.0E	0.00 psi	0.00 psi	0.00 psi	39.69 psi	0.00	OK

**One Way Shear Z**

Load Combination...	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0.34 psi	0.34 psi	0.34 psi	60.82 psi	0.01	OK
+1.20D	0.29 psi	0.29 psi	0.29 psi	60.82 psi	0.00	OK
+1.20D+0.50W	0.29 psi	0.29 psi	0.29 psi	60.82 psi	0.00	OK
+1.20D-0.50W	0.29 psi	0.29 psi	0.29 psi	60.82 psi	0.00	OK
+1.20D+W	0.29 psi	0.29 psi	0.29 psi	60.82 psi	0.00	OK

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

City of Puyallup  
 Development & Permitting Services  
**ISSUED PERMIT**

Building	Planning
Engineering	Public Works
Fire	Traffic

**General Footing**

Project File: F0undation Calcs.ec6

LIC# : KW-06016111, Build:20.23.10.31

GPD ASSOCIATES

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**DESCRIPTION: SWITCHGEAR FOUNDATION PAD**

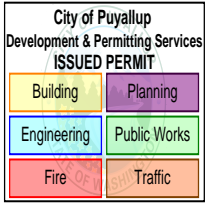
**One Way Shear Z**

Load Combination...	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.20D-W	0.29 psi	0.29 psi	0.29 psi	60.82 psi	0.00	OK
+0.90D+W	0.22 psi	0.22 psi	0.22 psi	60.82 psi	0.00	OK
+0.90D-W	0.22 psi	0.22 psi	0.22 psi	60.82 psi	0.00	OK
+1.402D+2.0E	0.34 psi	0.34 psi	0.34 psi	60.82 psi	0.01	OK
+1.402D-2.0E	0.34 psi	0.34 psi	0.34 psi	60.82 psi	0.01	OK
+0.6978D+2.0E	0.17 psi	0.17 psi	0.17 psi	60.82 psi	0.00	OK
+0.6978D-2.0E	0.17 psi	0.17 psi	0.17 psi	60.82 psi	0.00	OK

All units k

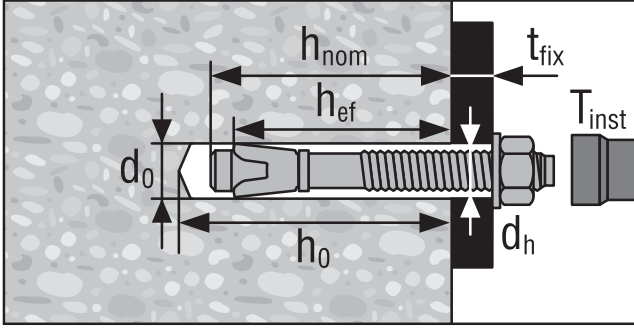
**Two-Way "Punching" Shear**

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	0.35 psi	100.00psi	0.003499	OK
+1.20D	0.30 psi	100.00psi	0.002999	OK
+1.20D+0.50W	0.30 psi	100.00psi	0.002999	OK
+1.20D-0.50W	0.30 psi	100.00psi	0.002999	OK
+1.20D+W	0.30 psi	102.57psi	0.002924	OK
+1.20D-W	0.30 psi	100.00psi	0.002999	OK
+0.90D+W	0.27 psi	102.57psi	0.002673	OK
+0.90D-W	0.27 psi	100.00psi	0.002742	OK
+1.402D+2.0E	0.48 psi	102.57psi	0.004699	OK
+1.402D-2.0E	0.48 psi	100.00psi	0.00482	OK
+0.6978D+2.0E	3.06 psi	102.57psi	0.02981	OK
+0.6978D-2.0E	3.06 psi	100.00psi	0.03057	OK



7. HILTI REFERENCE DOCUMENTATION

Figure 1 — Hilti KWIK Bolt TZ 2 specifications



City of Puyallup  
Development & Permitting Services  
ISSUED PERMIT

Building	Planning
Engineering	Public Works
Fire	Traffic

DESIGN INFORMATION IN CONCRETE PER ACI 318

ACI 318 Chapter 17 Design

The load values contained in this section are Hilti Simplified Design Tables. The load tables in this section were developed using the Strength Design parameters and variables of ICC-ES ESR-4266 and the equations within ACI 318 Chapter 17. For a detailed explanation of the Hilti Simplified Design Tables refer to section 3.1.8. Data tables from ESR-4266 are not contained in this section but can be found at [www.icc-es.org](http://www.icc-es.org) or at [www.hilti.com](http://www.hilti.com)

Table 2 — Hilti Carbon Steel KB-TZ2 design strength based on concrete failure modes in uncracked concrete per ACI 318 Ch. 17, applicable for both hammer and core drilled installations <sup>1,2,3,4</sup>

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Tension (lesser of concrete breakout / pullout) - $\Phi N_n$				Shear (lesser of concrete breakout or pryout) - $\Phi V_n$			
			$f'_c = 2,500$ psi (17.2 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 6,000$ psi (41.1 MPa) lb (kN)	$f'_c = 2,500$ psi (17.2 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 6,000$ psi (41.1 MPa) lb (kN)
1/4	1-1/2 (38)	1 3/4 (44)	945 (4.2)	980 (4.4)	1,040 (4.6)	1,125 (5.0)	1,545 (6.9)	1,690 (7.5)	1,950 (8.7)	2,390 (10.6)
	1-1/2 (38)	1 7/8 (48)	1,435 (6.4)	1,570 (7.0)	1,815 (8.1)	2,220 (9.9)	1,545 (6.9)	1,690 (7.5)	1,950 (8.7)	2,390 (10.6)
3/8	2 (51)	2 1/2 (64)	2,205 (9.8)	2,415 (10.7)	2,790 (12.4)	3,420 (15.2)	2,375 (10.6)	2,605 (11.6)	3,005 (13.4)	3,680 (16.4)
	2-1/2 (64)	3 (76)	2,715 (12.1)	2,895 (12.9)	3,205 (14.3)	3,690 (16.4)	6,640 (29.5)	7,275 (32.4)	8,400 (37.4)	10,290 (45.8)
1/2	1-1/2 (38)	2 (51)	1,610 (7.2)	1,765 (7.9)	2,040 (9.1)	2,495 (11.1)	1,735 (7.7)	1,900 (8.5)	2,195 (9.8)	2,690 (12.0)
	2 (51)	2 1/2 (64)	2,480 (11.0)	2,720 (12.1)	3,140 (14.0)	3,845 (17.1)	2,675 (11.9)	2,930 (13.0)	3,380 (15.0)	4,140 (18.4)
	2-1/2 (64)	3 (76)	3,085 (13.7)	3,375 (15.0)	3,900 (17.3)	4,775 (21.2)	6,640 (29.5)	7,275 (32.4)	8,400 (37.4)	10,290 (45.8)
	3-1/4 (83)	3 3/4 (95)	4,570 (20.3)	5,005 (22.3)	5,780 (25.7)	7,080 (31.5)	9,845 (43.8)	10,785 (48.0)	12,450 (55.4)	15,250 (67.8)
5/8	2-3/4 (70)	3 1/4 (83)	3,495 (15.5)	3,830 (17.0)	4,425 (19.7)	5,420 (24.1)	7,660 (34.1)	8,395 (37.3)	9,690 (43.1)	11,870 (52.8)
	3-1/4 (83)	3 3/4 (95)	4,570 (20.3)	5,005 (22.3)	5,780 (25.7)	7,080 (31.5)	9,845 (43.8)	10,785 (48.0)	12,450 (55.4)	15,250 (67.8)
	4 (102)	4 1/2 (114)	5,845 (26.0)	6,405 (28.5)	7,395 (32.9)	9,060 (40.3)	13,440 (59.8)	14,725 (65.5)	17,000 (75.6)	20,820 (92.6)
3/4	3-1/4 (83)	4 (102)	5,140 (22.9)	5,630 (25.0)	6,505 (28.9)	7,965 (35.4)	11,075 (49.3)	12,130 (54.0)	14,005 (62.3)	17,155 (76.3)
	3-3/4 (95)	4 1/2 (114)	6,370 (28.3)	6,980 (31.0)	8,060 (35.9)	9,870 (43.9)	13,725 (61.1)	15,035 (66.9)	17,360 (77.2)	21,265 (94.6)
	4-3/4 (121)	5 1/2 (140)	8,075 (35.9)	8,845 (39.3)	10,215 (45.4)	12,510 (55.6)	17,390 (77.4)	19,050 (84.7)	22,000 (97.9)	26,945 (119.9)
1	4 (102)	4 5/8 (117)	7,020 (31.2)	7,690 (34.2)	8,880 (39.5)	10,875 (48.4)	15,120 (67.3)	16,565 (73.7)	19,125 (85.1)	23,425 (104.2)
	5-3/4 (146)	6 3/8 (162)	10,755 (47.8)	11,780 (52.4)	13,605 (60.5)	16,660 (74.1)	23,165 (103.0)	25,375 (112.9)	29,300 (130.3)	35,885 (159.6)

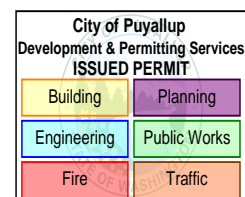
1 See Section 3.1.8 to convert design strength value to ASD value.  
 2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.  
 3 Apply spacing, edge distance, and concrete thickness factors in tables 6 to 15 as necessary. Compare to the steel values in table 4. The lesser of the values is to be used for the design.  
 4 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by  $\lambda_s$  as follows: For sand-lightweight,  $\lambda_s = 0.68$ ; for all-lightweight,  $\lambda_s = 0.60$ .  
 5 For core drilled installations of 3/4" anchors installed at 3-3/4" effective embedment, apply a reduction factor of 0.89 to the design tension strength.

**Table 3 – Hilti Carbon Steel KB-TZ2 design strength based on concrete failure modes in cracked concrete per ACI 318 Ch. 17, applicable for both hammer and core drilled installations<sup>1,2,3,4,5</sup>**

Nominal anchor diameter in.	Effective embedment in. (mm)	Nominal embedment in. (mm)	Tension (lesser of concrete breakout / pullout) - $\Phi N_n$				Shear (lesser of concrete breakout or pryout) - $\Phi V_n$			
			$f'_c = 2,500$ psi (17.2 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 6,000$ psi (41.1 MPa) lb (kN)	$f'_c = 2,500$ psi (17.2 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 6,000$ psi (41.1 MPa) lb (kN)
1/4	1-1/2 (38)	1 3/4 (44)	280 (1.2)	300 (1.3)	340 (1.5)	395 (1.8)	1,095 (4.9)	1,195 (5.3)	1,385 (6.2)	1,695 (7.5)
	3/8	1 7/8 (48)	1,255 (5.6)	1,375 (6.1)	1,585 (7.1)	1,940 (8.6)	1,350 (6.0)	1,480 (6.6)	1,710 (7.6)	2,090 (9.3)
1/2	2 (51)	2 1/2 (64)	1,930 (8.6)	2,115 (9.4)	2,440 (10.9)	2,990 (13.3)	2,080 (9.3)	2,275 (10.1)	2,630 (11.7)	3,220 (14.3)
	2-1/2 (64)	3 (76)	2,185 (9.7)	2,390 (10.6)	2,765 (12.3)	3,385 (15.1)	4,705 (20.9)	5,155 (22.9)	5,950 (26.5)	7,285 (32.4)
3/4	1-1/2 (38)	2 (51)	1,435 (6.4)	1,570 (7.0)	1,815 (8.1)	2,220 (9.9)	1,545 (6.9)	1,690 (7.5)	1,950 (8.7)	2,390 (10.6)
	2 (51)	2 1/2 (64)	1,930 (8.6)	2,115 (9.4)	2,440 (10.9)	2,990 (13.3)	2,080 (9.3)	2,275 (10.1)	2,630 (11.7)	3,220 (14.3)
	2-1/2 (64)	3 (76)	2,700 (12.0)	2,955 (13.1)	3,415 (15.2)	4,180 (18.6)	5,810 (25.8)	6,365 (28.3)	7,350 (32.7)	9,000 (40.0)
	3-1/4 (83)	3 3/4 (95)	3,235 (14.4)	3,545 (15.8)	4,095 (18.2)	5,015 (22.3)	6,970 (31.0)	7,640 (34.0)	8,820 (39.2)	10,800 (48.0)
5/8	2-3/4 (70)	3 1/4 (83)	3,110 (13.8)	3,410 (15.2)	3,935 (17.5)	4,820 (21.4)	6,705 (29.8)	7,345 (32.7)	8,480 (37.7)	10,385 (46.2)
	3-1/4 (83)	3 3/4 (95)	4,000 (17.8)	4,380 (19.5)	5,060 (22.5)	6,195 (27.6)	8,615 (38.3)	9,435 (42.0)	10,895 (48.5)	13,345 (59.4)
	4 (102)	4 1/2 (114)	4,420 (19.7)	4,840 (21.5)	5,590 (24.9)	6,845 (30.4)	9,520 (42.3)	10,430 (46.4)	12,040 (53.6)	14,750 (65.6)
3/4	3-1/4 (83)	4 (102)	4,000 (17.8)	4,380 (19.5)	5,060 (22.5)	6,195 (27.6)	8,615 (38.3)	9,435 (42.0)	10,895 (48.5)	13,345 (59.4)
	3-3/4 (95)	4 1/2 (114)	4,955 (22.0)	5,430 (24.2)	6,270 (27.9)	7,680 (34.2)	10,675 (47.5)	11,695 (52.0)	13,505 (60.1)	16,540 (73.6)
	4-3/4 (121)	5 1/2 (140)	5,745 (25.6)	6,055 (26.9)	6,580 (29.3)	7,405 (32.9)	15,220 (67.7)	16,670 (74.2)	19,250 (85.6)	23,575 (104.9)
1	4 (102)	4 5/8 (117)	5,460 (24.3)	5,980 (26.6)	6,905 (30.7)	8,460 (37.6)	11,760 (52.3)	12,880 (57.3)	14,875 (66.2)	18,220 (81.0)
	5-3/4 (146)	6 3/8 (162)	7,675 (34.1)	8,410 (37.4)	9,710 (43.2)	11,890 (52.9)	20,270 (90.2)	22,205 (98.8)	25,640 (114.1)	31,400 (139.7)

3.3.5

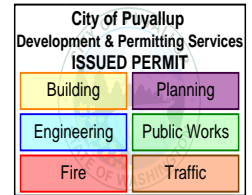
1 See Section 3.1.8 to convert design strength value to ASD value.  
 2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.  
 3 Apply spacing, edge distance, and concrete thickness factors in tables 6 to 17 as necessary. Compare to the steel values in table 4. The lesser of the values is to be used for the design.  
 4 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by  $\lambda_a$  as follows: For sand-lightweight,  $\lambda_a = 0.68$ ; for all-lightweight,  $\lambda_a = 0.60$ .  
 5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension only by  $\alpha_{N,seis} = 0.75$ , except for 3/4 x 4-3/4  $h_{ef}$  where  $\alpha_{N,seis} = 0.73$ . No reduction needed for seismic shear. See Section 3.1.8 for additional information on seismic applications.



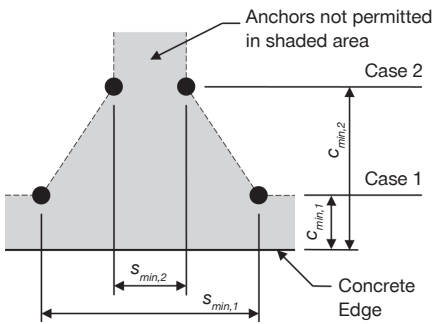
**Table 20 – Hilti Stainless Steel KB-TZ2 design strength based on steel failure per ACI 318 Ch. 17 1,2**

Nominal anchor diameter in.	Effective embedment depth in. (mm)			Tensile <sup>3</sup> ΦN <sub>sa</sub> lb (kN)	Shear <sup>4</sup> ΦV <sub>sa</sub> lb (kN)	Seismic Shear <sup>5</sup> ΦV <sub>sa</sub> lb (kN)
1/4	1-1/2 (38)			2,190 (9.7)	950 (4.2)	720 (3.2)
3/8	1-1/2 (38)			4,635 (20.6)	3,000 (13.3)	3,000 (13.3)
3/8	2 (51)	2-1/2 (64)	3-1/4 (83)	4,635 (20.6)	3,175 (14.1)	3,175 (14.1)
1/2	2 (51)	2-1/2 (64)	3-1/4 (83)	8,905 (39.6)	5,425 (24.1)	5,425 (24.1)
5/8	2-3/4 (70)	3-1/4 (83)	4 (102)	14,125 (62.8)	8,030 (35.7)	8,030 (35.7)
3/4	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	18,035 (80.2)	10,765 (47.9)	8,755 (38.9)
1 (25.4)	4 (102)			35,215 (156.6)	14,920 (66.4)	8,755 (38.9)
1 (25.4)	5-3/4 (146)			35,215 (156.6)	20,410 (90.8)	8,755 (38.9)

- 1 See Section 3.1.8 to convert design strength value to ASD value.
- 2 Hilti KB-TZ2 stainless steel anchors are to be considered ductile steel elements.
- 3 Tensile  $\Phi N_{sa} = \Phi A_{se,N} f_{uta}$  as noted in ACI 318 Ch. 17.
- 4 Shear values determined by static shear tests with  $\Phi V_{sa} < \Phi 0.60 A_{se,V} f_{uta}$  as noted in ACI 318 Ch. 17.
- 5 Seismic shear values determined by seismic shear tests with  $\Phi V_{sa} \leq \Phi 0.60 A_{se,V} f_{uta}$  as noted in ACI 318 Ch. 17. See Section 3.1.8 for additional information on seismic applications.

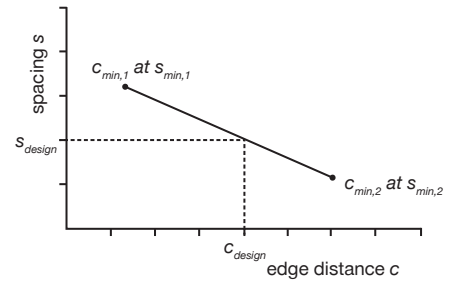


**Figure 3**



For a specific edge distance, the permitted spacing is calculated as follows:

$$s \geq s_{min,2} + \frac{(s_{min,1} - s_{min,2})}{(c_{min,1} - c_{min,2})} (c - c_{min,2})$$



**Table 21 – Hilti KB-TZ2 stainless steel installation parameters<sup>1</sup>**

Setting information	Symbol	Units	Nominal Anchor diameter (in.)														
			1/4	3/8	1/2		5/8		3/4		1						
Effective embedment	$h_{ef}$	in. (mm)	1-1/2 (38)	1-1/2 (38)	2 (51)	2-1/2 (64)	2 (51)	2-1/2 (64)	3 1/4 (83)	2-3/4 (70)	3-1/4 (83)	4 (102)	3-1/4 (83)	3-3/4 (95)	4-3/4 (121)	4 (102)	5-3/4 (146)
Min. member thickness	$h_{min}$	in. (mm)	3-1/4 (83)	3-1/4 (83)	4 (102)	5 (127)	4 (102)	5 (127)	5-1/2 (140)	5 (127)	5-1/2 (140)	6 (152)	5-1/2 (140)	6 (152)	8 (203)	8 (203)	10 (254)
Case 1	$c_{min,1}$	in. (mm)	1-1/2 (38)	5 (127)	2-1/2 (64)	2-1/2 (64)	2-3/4 (70)	2-1/2 (64)	2-1/4 (57)	4 (102)	3-1/4 (83)	2-1/4 (57)	5 (127)	4 (102)	3 3/4 (95)	3-3/4 (95)	3 (76)
	for $s_{min,1} \geq$	in. (mm)	1-1/2 (38)	8 (203)	5 (127)	5 (127)	5-1/2 (140)	4-1/2 (114)	5-1/4 (133)	7 (178)	5-1/2 (140)	7 (178)	11 (279)	7-1/2 (191)	5 3/4 (146)	10 (254)	6-3/4 (171)
Case 2	$c_{min,2}$	in. (mm)	1-1/2 (38)	8 (203)	4 (102)	3-1/2 (89)	4-1/8 (105)	4-1/2 (114)	4-1/2 (114)	5-1/2 (140)	4 (102)	4-1/4 (108)	8 (203)	6 (152)	5-1/4 (133)	4-1/4 (108)	3-3/4 (95)
	for $s_{min,2} \geq$	in. (mm)	1-1/2 (38)	5 (127)	2-1/4 (57)	2-1/4 (57)	2-3/4 (70)	2-1/2 (64)	2 (51)	5-1/2 (140)	2-3/4 (70)	3 (76)	5 (127)	4 (102)	4 (102)	5 (127)	4-3/4 (121)

<sup>1</sup> Linear interpolation is permitted to establish an edge distance and spacing combination between Case 1 and Case 2. Linear interpolation for a specific edge distance  $c$ , where  $c_{min,1} < c < c_{min,2}$ , will determine the permissible spacings.



**Table 26 – Load adjustment factors for Stainless Steel 1/2-in. diameter KB-TZ2 in uncracked concrete** <sup>1,2</sup>

1/2-in. KB-TZ2 uncracked concrete	Spacing factor in tension $f_{AN}$	Edge distance factor in tension $f_{RN}$			Spacing factor in shear <sup>3</sup> $f_{AV}$			Edge distance in shear						Concrete thickness factor in shear <sup>4</sup> $f_{HV}$					
								⊥ Toward edge $f_{RV}$			∥ To edge $f_{RV}$								
Effective Embedment $h_{ef}$	in. (mm)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)
Nominal Embedment $h_{nom}$	in. (mm)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)
Spacing (s) / Edge Distance (c <sub>g</sub> ) / Concrete Thickness (h) - in. (mm)	2 (51)	n/a	n/a	0.60	n/a	n/a	n/a	n/a	n/a	0.54	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2-1/4 (57)	n/a	n/a	0.62	n/a	n/a	0.40	n/a	n/a	0.54	n/a	n/a	0.12	n/a	n/a	0.24	n/a	n/a	n/a
	2-1/2 (64)	n/a	n/a	0.63	n/a	0.45	0.42	n/a	n/a	0.55	n/a	0.20	0.14	n/a	0.40	0.28	n/a	n/a	n/a
	2-3/4 (70)	n/a	0.68	0.64	0.51	0.48	0.44	n/a	0.56	0.55	0.35	0.23	0.16	0.51	0.46	0.33	n/a	n/a	n/a
	3 (76)	0.75	0.70	0.65	0.55	0.51	0.46	0.59	0.57	0.55	0.40	0.26	0.19	0.55	0.51	0.37	n/a	n/a	n/a
	4 (102)	0.83	0.77	0.71	0.73	0.64	0.56	0.62	0.59	0.57	0.62	0.40	0.29	0.73	0.64	0.56	0.70	n/a	n/a
	4-1/8 (105)	0.84	0.78	0.71	0.75	0.66	0.57	0.63	0.59	0.57	0.65	0.42	0.30	0.75	0.66	0.57	0.71	n/a	n/a
	4-1/2 (114)	0.88	0.80	0.73	0.82	0.72	0.61	0.64	0.60	0.58	0.74	0.48	0.34	0.82	0.72	0.61	0.74	n/a	n/a
	4-3/4 (121)	0.90	0.82	0.74	0.86	0.76	0.64	0.64	0.61	0.59	0.80	0.52	0.37	0.86	0.76	0.64	0.76	n/a	n/a
	5 (127)	0.92	0.83	0.76	0.91	0.80	0.67	0.65	0.61	0.59	0.87	0.56	0.40	0.91	0.80	0.67	0.78	0.67	n/a
	5-1/4 (133)	0.94	0.85	0.77	0.95	0.84	0.70	0.66	0.62	0.60	0.93	0.61	0.43	0.95	0.84	0.70	0.80	0.69	n/a
	5-1/2 (140)	0.96	0.87	0.78	1.00	0.88	0.73	0.67	0.63	0.60	1.00	0.65	0.46	1.00	0.88	0.73	0.82	0.71	0.63
	6 (152)	1.00	0.90	0.81		0.96	0.80	0.68	0.64	0.61		0.74	0.53		0.96	0.80	0.85	0.74	0.66
	8 (203)		1.00	0.91		1.00	1.00	0.74	0.68	0.64		1.00	0.81		1.00	1.00	0.98	0.85	0.76
	12 (305)			1.00				0.86	0.77	0.72			1.00				1.00	1.00	0.93
	18 (457)							1.00	0.91	0.83									1.00
	24 (610)								1.00	0.93									
> 30 (762)									1.00										



3.3.5

**Table 27 – Load adjustment factors for Stainless Steel 1/2-in. diameter KB-TZ2 in cracked concrete** <sup>1,2</sup>

1/2-in. KB-TZ2 cracked concrete	Spacing factor in tension $f_{AN}$	Edge distance factor in tension $f_{RN}$			Spacing factor in shear <sup>3</sup> $f_{AV}$			Edge distance in shear						Concrete thickness factor in shear <sup>4</sup> $f_{HV}$					
								⊥ Toward edge $f_{RV}$			∥ To edge $f_{RV}$								
Effective Embedment $h_{ef}$	in. (mm)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)	2 (51)	2-1/2 (64)	3-1/4 (83)
Nominal Embedment $h_{nom}$	in. (mm)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)	2-1/2 (64)	3 (76)	3-3/4 (95)
Spacing (s) / Edge Distance (c <sub>g</sub> ) / Concrete Thickness (h) - in. (mm)	2 (51)	n/a	n/a	0.60	n/a	n/a	n/a	n/a	n/a	0.54	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2-1/4 (57)	n/a	n/a	0.62	n/a	n/a	0.61	n/a	n/a	0.54	n/a	n/a	0.12	n/a	n/a	0.24	n/a	n/a	n/a
	2-1/2 (64)	n/a	n/a	0.63	n/a	0.75	0.65	n/a	n/a	0.55	n/a	0.16	0.14	n/a	0.33	0.29	n/a	n/a	n/a
	2-3/4 (70)	n/a	0.68	0.64	0.93	0.80	0.68	n/a	0.55	0.55	0.62	0.19	0.16	0.93	0.38	0.33	n/a	n/a	n/a
	3 (76)	0.75	0.70	0.65	1.00	0.85	0.71	0.63	0.56	0.55	0.71	0.21	0.19	1.00	0.43	0.38	n/a	n/a	n/a
	4 (102)	0.83	0.77	0.71	1.00	1.00	0.86	0.68	0.58	0.57	1.00	0.33	0.29	1.00	0.66	0.58	0.84	n/a	n/a
	4-1/8 (105)	0.84	0.78	0.71	1.00	1.00	0.88	0.68	0.58	0.58	1.00	0.34	0.30	1.00	0.69	0.61	0.85	n/a	n/a
	4-1/2 (114)	0.88	0.80	0.73		1.00	0.94	0.70	0.59	0.58		0.39	0.34		0.79	0.69	0.89	n/a	n/a
	4-3/4 (121)	0.90	0.82	0.74			0.98	0.71	0.59	0.59		0.43	0.37		0.85	0.75	0.91	n/a	n/a
	5 (127)	0.92	0.83	0.76			1.00	0.72	0.60	0.59		0.46	0.40		0.92	0.81	0.94	0.63	n/a
	5-1/4 (133)	0.94	0.85	0.77				0.73	0.60	0.60		0.49	0.43		0.99	0.87	0.96	0.65	n/a
	5-1/2 (140)	0.96	0.87	0.78				0.74	0.61	0.60		0.53	0.47		1.00	0.93	0.98	0.66	0.63
	6 (152)	1.00	0.90	0.81				0.76	0.62	0.61		0.60	0.53			1.00	1.00	0.69	0.66
	8 (203)		1.00	0.91				0.85	0.66	0.65		0.93	0.82					0.80	0.76
	12 (305)			1.00				1.00	0.74	0.72		1.00	1.00					0.98	0.94
	18 (457)								0.86	0.83								1.00	1.00
	24 (610)								0.98	0.94									
> 30 (762)								1.00	1.00										

1 Linear interpolation not permitted

2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative.

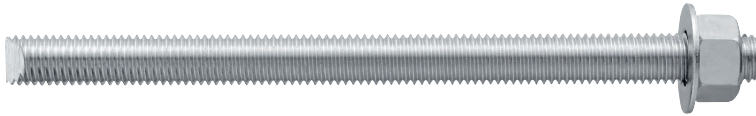
To optimize the design, use Hilti PROFIS Engineering Design software or perform anchor calculation using design equations from ACI 318 Ch. 17 or CSA A23.3 Annex D.

3 Spacing factor reduction in shear,  $f_{AV}$ , is applicable when edge distance  $c < 3h_{ef}$ . If  $c \geq 3h_{ef}$  then  $f_{AV} = f_{AN}$ .

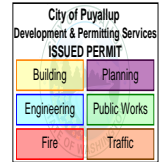
4 Concrete thickness reduction factor in shear,  $f_{HV}$ , is applicable when edge distance  $c < 3h_{ef}$ . If  $c \geq 3h_{ef}$  then  $f_{HV} = 1.0$ .

■ If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check with Figure 3 and Table 21 to calculate permissible edge distance, spacing and concrete thickness combinations.

HIT-HY 200 V3 Adhesive with HAS Threaded Rod



Hilti HAS threaded rod



3.2.2

Figure 9 – Hilti HAS threaded rod installation conditions

Permissible concrete conditions	Uncracked concrete	Dry concrete	Permissible drilling method	Hammer drilling with carbide tipped drill bit
	Cracked concrete	Water saturated concrete		Hilti TE-CD or TE-YD Hollow Drill Bit
		Water-filled holes		

Table 38 – Hilti HAS threaded rod specifications

Setting information		Symbol	Units	Nominal rod diameter, d						
Nominal bit diameter		d <sub>o</sub>	in.	3/8	1/2	5/8	3/4	7/8	1	1-1/4
Effective embedment	minimum	h <sub>ef,min</sub>	in. (mm)	2-3/8 (60)	2-3/4 (70)	3-1/8 (79)	3-1/2 (89)	3-1/2 (89)	4 (102)	5 (127)
	maximum	h <sub>ef,max</sub>	in. (mm)	7-1/2 (191)	10 (254)	12-1/2 (318)	15 (381)	17-1/2 (445)	20 (508)	25 (635)
Diameter of fixture hole	through-set		in.	1/2	5/8	13/16 <sup>1</sup>	15/16 <sup>1</sup>	1-1/8 <sup>1</sup>	1-1/4 <sup>1</sup>	1-1/2 <sup>1</sup>
Diameter of fixture hole	preset		in.	7/16	9/16	11/16	13/16	15/16	1-1/8	1-3/8
Installation torque		T <sub>inst</sub>	ft-lb (Nm)	15 (20)	30 (40)	60 (80)	100 (136)	125 (169)	150 (203)	200 (271)
Minimum concrete thickness		h <sub>min</sub>	in. (mm)	h <sub>ef</sub> +1-1/4 (h <sub>ef</sub> +30)			h <sub>ef</sub> +2d <sub>o</sub>			
Minimum edge distance		c <sub>min</sub>	in. (mm)	1-3/4 (45)	1-3/4 (45)	2 <sup>2</sup> (50) <sup>2</sup>	2-1/8 <sup>2</sup> (55) <sup>2</sup>	2-1/4 <sup>2</sup> (60) <sup>2</sup>	2-3/4 <sup>2</sup> (70) <sup>2</sup>	3-1/8 <sup>2</sup> (80) <sup>2</sup>
Minimum anchor spacing		s <sub>min</sub>	in. (mm)	1-7/8 (48)	2-1/2 (64)	3-1/8 (79)	3-3/4 (95)	4-3/4 (111)	5 (127)	6-1/4 (159)

Figure 10 – Hilti HAS threaded rods

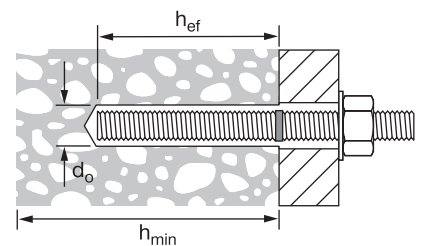


Figure 11 – Installation with (2) washers



1 Install using (2) washers. See Figure 11.

2 Edge distance of 1-3/4-inch (44mm) is permitted provided the installation torque is reduced to 0.30 T<sub>inst</sub> for 5d < s < 16-in. and to 0.5 T<sub>inst</sub> for s > 16-in.

**Table 40 — Hilti HIT-HY 200 V3 adhesive design strength with concrete / bond failure for threaded rod in cracked concrete** <sup>1,2,3,4,5,6,7,8,9</sup>

Nominal anchor diameter in.	Effective embedment in. (mm)	Tension — $\Phi N_n$				Shear — $\Phi V_n$			
		$f'_c = 2,500$ psi (17.2 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 6,000$ psi (41.4 MPa) lb (kN)	$f'_c = 2,500$ psi (17.2 MPa) lb (kN)	$f'_c = 3,000$ psi (20.7 MPa) lb (kN)	$f'_c = 4,000$ psi (27.6 MPa) lb (kN)	$f'_c = 6,000$ psi (41.4 MPa) lb (kN)
3/8	2-3/8 (60)	1,900 (8.5)	1,935 (8.6)	1,990 (8.9)	2,075 (9.2)	2,045 (9.1)	2,085 (9.3)	2,145 (9.5)	2,235 (9.9)
	3-3/8 (86)	2,700 (12.0)	2,750 (12.2)	2,830 (12.6)	2,950 (13.1)	5,815 (25.9)	5,925 (26.4)	6,095 (27.1)	6,350 (28.2)
	4-1/2 (114)	3,600 (16.0)	3,665 (16.3)	3,775 (16.8)	3,930 (17.5)	7,755 (34.5)	7,900 (35.1)	8,130 (36.2)	8,465 (37.7)
	7-1/2 (191)	6,000 (26.7)	6,110 (27.2)	6,290 (28.0)	6,550 (29.1)	12,925 (57.5)	13,165 (58.6)	13,550 (60.3)	14,110 (62.8)
1/2	2-3/4 (70)	2,520 (11.2)	2,760 (12.3)	3,185 (14.2)	3,480 (15.5)	5,425 (24.1)	5,945 (26.4)	6,865 (30.5)	7,490 (33.3)
	4-1/2 (114)	5,215 (23.2)	5,310 (23.6)	5,465 (24.3)	5,690 (25.3)	11,230 (50.0)	11,440 (50.9)	11,770 (52.4)	12,260 (54.5)
	6 (152)	6,955 (30.9)	7,080 (31.5)	7,290 (32.4)	7,590 (33.8)	14,975 (66.6)	15,250 (67.8)	15,695 (69.8)	16,345 (72.7)
	10 (254)	11,590 (51.6)	11,800 (52.5)	12,145 (54.0)	12,650 (56.3)	24,960 (111.0)	25,420 (113.1)	26,160 (116.4)	27,245 (121.2)
5/8	3-1/8 (79)	3,050 (13.6)	3,345 (14.9)	3,860 (17.2)	4,730 (21.0)	6,575 (29.2)	7,200 (32.0)	8,315 (37.0)	10,185 (45.3)
	5-5/8 (143)	7,370 (32.8)	8,075 (35.9)	8,805 (39.2)	9,170 (40.8)	15,875 (70.6)	17,390 (77.4)	18,960 (84.3)	19,745 (87.8)
	7-1/2 (191)	11,200 (49.8)	11,405 (50.7)	11,740 (52.2)	12,225 (54.4)	24,120 (107.3)	24,565 (109.3)	25,280 (112.5)	26,330 (117.1)
	12-1/2 (318)	18,665 (83.0)	19,010 (84.6)	19,565 (87.0)	20,375 (90.6)	40,205 (178.8)	40,940 (182.1)	42,135 (187.4)	43,880 (195.2)
3/4	3-1/2 (89)	3,620 (16.1)	3,965 (17.6)	4,575 (20.4)	5,605 (24.9)	7,790 (34.7)	8,535 (38.0)	9,855 (43.8)	12,070 (53.7)
	6-3/4 (171)	9,690 (43.1)	10,615 (47.2)	12,255 (54.5)	14,215 (63.2)	20,870 (92.8)	22,860 (101.7)	26,395 (117.4)	30,620 (136.2)
	9 (229)	14,920 (66.4)	16,340 (72.7)	18,205 (81.0)	18,955 (84.3)	32,130 (142.9)	35,195 (156.6)	39,205 (174.4)	40,830 (181.6)
	15 (381)	28,945 (128.8)	29,480 (131.1)	30,340 (135.0)	31,595 (140.5)	62,345 (277.3)	63,490 (282.4)	65,345 (290.7)	68,050 (302.7)
7/8	3-1/2 (89)	3,620 (16.1)	3,965 (17.6)	4,575 (20.4)	5,605 (24.9)	7,790 (34.7)	8,535 (38.0)	9,855 (43.8)	12,070 (53.7)
	7-7/8 (200)	12,210 (54.3)	13,375 (59.5)	15,445 (68.7)	18,915 (84.1)	26,300 (117.0)	28,810 (128.2)	33,265 (148.0)	40,740 (181.2)
	10-1/2 (267)	18,800 (83.6)	20,590 (91.6)	23,780 (105.8)	26,415 (117.5)	40,490 (180.1)	44,355 (197.3)	51,215 (227.8)	56,895 (253.1)
	17-1/2 (445)	40,335 (179.4)	41,080 (182.7)	42,280 (188.1)	44,025 (195.8)	86,880 (386.5)	88,475 (393.6)	91,060 (405.1)	94,830 (421.8)
1	4 (102)	4,420 (19.7)	4,840 (21.5)	5,590 (24.9)	6,845 (30.4)	9,520 (42.3)	10,430 (46.4)	12,040 (53.6)	14,750 (65.6)
	9 (229)	14,920 (66.4)	16,340 (72.7)	18,770 (83.9)	23,110 (102.8)	32,130 (142.9)	35,195 (156.6)	40,640 (180.8)	49,775 (221.4)
	12 (305)	22,965 (102.2)	25,160 (111.9)	29,050 (129.2)	35,440 (157.6)	49,465 (220.0)	54,190 (241.0)	62,570 (278.3)	76,330 (339.5)
	20 (508)	49,415 (219.8)	54,135 (240.8)	56,720 (252.3)	59,065 (262.7)	106,435 (473.4)	116,595 (518.6)	122,160 (543.4)	127,215 (565.9)
1-1/4	5 (127)	6,175 (27.5)	6,765 (30.1)	7,815 (34.8)	9,570 (42.6)	13,305 (59.2)	14,575 (64.8)	16,830 (74.9)	20,610 (91.7)
	11-1/4 (286)	20,850 (92.7)	22,840 (101.6)	26,370 (117.3)	32,295 (143.7)	44,905 (199.7)	49,190 (218.8)	56,800 (252.7)	69,565 (309.4)
	15 (381)	32,095 (142.8)	35,160 (156.4)	40,600 (180.6)	49,725 (221.2)	69,135 (307.5)	75,730 (336.9)	87,445 (389.0)	107,100 (476.4)
	25 (635)	69,060 (307.2)	75,655 (336.5)	87,360 (388.6)	96,120 (427.6)	148,750 (661.7)	162,945 (724.8)	188,155 (837.0)	207,030 (920.9)

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- See section 3.1.8 for explanation on development of load values.
- See section 3.1.8 to convert design strength (factored resistance) value to ASD value.
- Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
- Apply spacing, edge distance, and concrete thickness factors in tables 42 - 55 as necessary to the above values. Compare to the steel values in table 41. The lesser of the values is to be used for the design.
- Data is for temperature range A: Max. short term temperature = 130° F (55° C), max. long term temperature = 110° F (43° C).  
For temperature range B: Max. short term temperature = 176° F (80° C), max. long term temperature = 110° F (43° C).  
For temperature range C: Max. short term temperature = 248° F (120° C), max. long term temperature = 162° F (72° C) multiply above values by 0.82.  
Short term elevated concrete temperatures are those that occur over brief intervals, e.g., as a result of diurnal cycling. Long term concrete temperatures are roughly constant over significant periods of time.
- Tabular values are for dry and water saturated concrete conditions. For water-filled concrete multiply design strength value by 0.42.
- Tabular values are for short term loads only. For sustained loads including overhead use, see section 3.1.8.
- Tabular values are for normal-weight concrete only. For lightweight concrete, multiply design strength (factored resistance) by  $\lambda_s$  as follows:  
For sand-lightweight,  $\lambda_s = 0.51$ . For all-lightweight,  $\lambda_s = 0.45$ .
- Tabular values are for static loads only. For seismic loads, multiply cracked concrete tabular values in tension and shear by the following reduction factors:  
3/8-in diameter -  $\alpha_{seis} = 0.66$   
3/4-in and 7/8-in diameter -  $\alpha_{seis} = 0.75$   
1-in diameter -  $\alpha_{seis} = 0.71$   
1/2-in, 5/8-in, and 1-1/4-in diameter -  $\alpha_{seis} = 0.74$   
See section 3.1.8 for additional information on seismic applications.

**Table 41 — Steel design strength for Hilti HAS threaded rods for use with ACI 318 Chapter 17**

Nominal anchor diameter in.	HAS-V-36 / HAS-V-36 HDG ASTM F1554 Gr. 36 <sup>4,6</sup>			HAS-E-55 / HAS-E-55 HDG ASTM F1554 Gr. 55 <sup>4,6</sup>			HAS-B-105 and HAS-B-105 HDG ASTM A193 B7 and ASTM F 1554 Gr.105 <sup>4,6</sup>			HAS-R stainless steel ASTM F593 (3/8-in to 1-in) <sup>5</sup> ASTM A193 (1-1/8-in to 2-in) <sup>4</sup>		
	Tensile <sup>1</sup> ΦN <sub>sa</sub> lb (kN)	Shear <sup>2</sup> ΦV <sub>sa</sub> lb (kN)	Seismic Shear <sup>3</sup> ΦV <sub>sa,eq</sub> lb (kN)	Tensile <sup>1</sup> ΦN <sub>sa</sub> lb (kN)	Shear <sup>2</sup> ΦV <sub>sa</sub> lb (kN)	Seismic Shear <sup>3</sup> ΦV <sub>sa,eq</sub> lb (kN)	Tensile <sup>1</sup> ΦN <sub>sa</sub> lb (kN)	Shear <sup>2</sup> ΦV <sub>sa</sub> lb (kN)	Seismic Shear <sup>3</sup> ΦV <sub>sa,eq</sub> lb (kN)	Tensile <sup>1</sup> ΦN <sub>sa</sub> lb (kN)	Shear <sup>2</sup> ΦV <sub>sa</sub> lb (kN)	Seismic Shear <sup>3</sup> ΦV <sub>sa,eq</sub> lb (kN)
3/8	3,370 (15.0)	1,750 (7.8)	1,050 (4.7)	4,360 (19.4)	2,270 (10.1)	1,590 (7.1)	7,270 (32.3)	3,780 (16.8)	2,645 (11.8)	5,040 (22.4)	2,790 (12.4)	1,955 (8.7)
1/2	6,175 (27.5)	3,210 (14.3)	1,925 (8.6)	7,985 (35.5)	4,150 (18.5)	2,905 (12.9)	13,305 (59.2)	6,920 (30.8)	4,845 (21.6)	9,225 (41.0)	5,110 (22.7)	3,575 (15.9)
5/8	9,835 (43.7)	5,110 (22.7)	3,065 (13.6)	12,715 (56.6)	6,610 (29.4)	4,625 (20.6)	21,190 (94.3)	11,020 (49.0)	7,715 (34.3)	14,690 (65.3)	8,135 (36.2)	5,695 (25.3)
3/4	14,550 (64.7)	7,565 (33.7)	4,540 (20.2)	18,820 (83.7)	9,785 (43.5)	6,850 (30.5)	31,360 (139.5)	16,310 (72.6)	11,415 (50.8)	18,485 (82.2)	10,235 (45.5)	7,165 (31.9)
7/8	20,085 (89.3)	10,445 (46.5)	6,265 (27.9)	25,975 (115.5)	13,505 (60.1)	9,455 (42.1)	43,285 (192.5)	22,510 (100.1)	15,755 (70.1)	25,510 (113.5)	14,125 (62.8)	9,890 (44.0)
1	26,350 (117.2)	13,700 (60.9)	8,220 (36.6)	34,075 (151.6)	17,720 (78.8)	12,405 (55.2)	56,785 (252.6)	29,530 (131.4)	20,670 (91.9)	33,465 (148.9)	18,535 (82.4)	12,975 (57.7)
1-1/4	42,160 (187.5)	21,920 (97.5)	13,150 (58.5)	54,515 (242.5)	28,345 (126.1)	19,840 (88.3)	90,855 (404.1)	47,245 (210.2)	33,070 (147.1)	41,430 (184.3)	21,545 (95.8)	12,925 (57.5)

1 Tensile =  $\phi A_{sa} f_{sa}$  as noted in ACI 318 17.4.1.2  
 2 Shear =  $\phi 0.60 A_{sa} f_{sa}$  as noted in ACI 318 17.5.1.2b.  
 3 Seismic Shear =  $\alpha_{V_{sa}} \phi V_{sa}$  : Reduction factor for seismic shear only. See ACI 318 for additional information on seismic applications.  
 4 HAS-V, HAS-E (3/8-in to 1-1/4-in), HAS-B, and HAS-R (Class 1; 1-1/4-in) threaded rods are considered ductile steel elements (including HDG rods).  
 5 HAS-R (CW1 and CW2; 3/8-in to 1-in) threaded rods are considered brittle steel elements.  
 6 3/8-inch dia. threaded rods are not included in the ASTM F1554 standard. Hilti 3/8-inch dia. HAS-V, HAS-E, and HAS-E-B (incl. HDG) threaded rods meet the chemical composition and mechanical property requirements of ASTM F1554.



