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Structural Design Calculations

OMIC Building 1 Machine Foundation
Scappoose, Oregon

Client Information

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101 St. Helens St.
St. Helens, OR 97051

Project Site

33701 Charles T Parker Way
Scappoose, OR 97056
45.768084, -122.873023

Prepared By

Peterson Structural Engineers
February 27, 2025
Project No. 2401-0097

Endorsement



Scope

To provide structural calculations for the design of a concrete foundation for an HM 1000 machining unit at the location given on the cover page. Elements under review include design of the reinforced concrete foundation and blockouts for the unit anchors. Anchors and support locations per manufacturer. Any other elements not specifically referenced in these calculations are outside the purview of these calculations and are designed by others.

References

1. 2022 Oregon Structural Specialty Code (OSSC)
2. 2021 International Building Code (IBC)
3. ASCE/SEI 7-16, Minimum Design Loads for Buildings and Other Structures, American Society of Civil Engineers (ASCE)
4. 2019 Building Code Requirements for Structural Concrete, ACI 318-19, and Commentary (ACI)
5. Geotechnical Report generated by GeoDesign, dated 09/27/2007, their report number HedgesCM-1-01: 092707 (Geotech)
6. ASCE 7 Hazard Tool, <https://asce7hazardtool.online/>
7. Large Horizontal Machining Center Brochure by DN Solutions provided on 11/14/2024 (Brochure)
8. HM 1000 Product Technical Quote by DN Solutions provided on 01/06/2025 (Quote)

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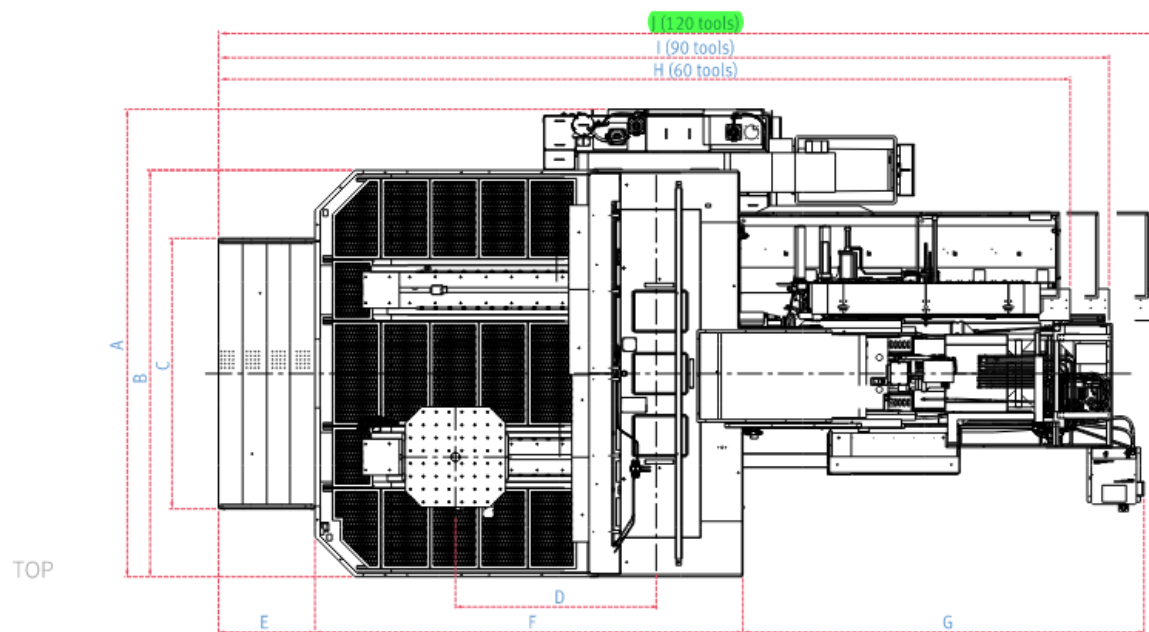
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Drawings



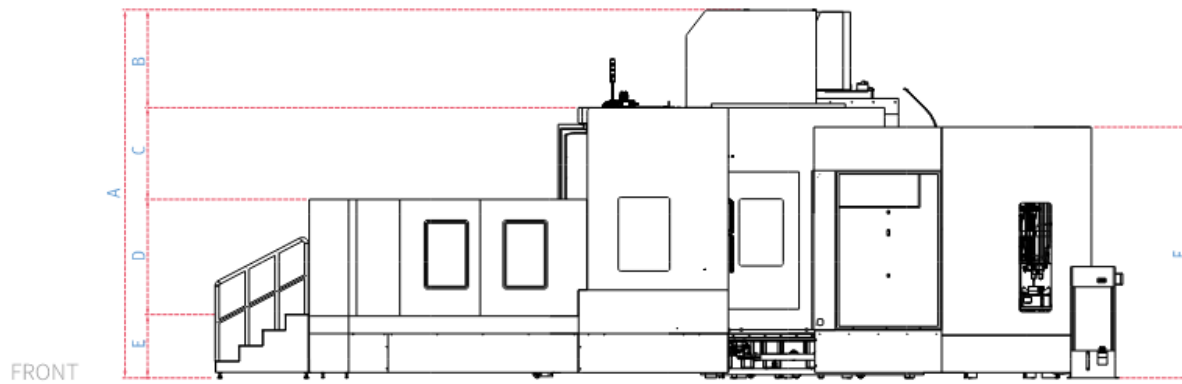
HM 1000 – Isometric

Units : mm (inch)



Model	A	B	C	D	E	F	G	H	I	J
HM 1000	5822 (229.2)	5064 (199.4)	3370 (132.7)	2100 (82.7)	1162 (45.7)	4780 (188.2)	3715 (146.3)	9928 (390.9)	10411 (409.9)	11035 (434.4)
HM 1250	5822 (229.2)	5064 (199.4)	3370 (132.7)	2500 (98.4)	1200 (47.2)	5330 (209.8)	4000 (157.5)	10530 (414.6)	11000 (433.1)	11623 (457.6)
HM 1250W	5822 (229.2)	5064 (199.4)	3370 (132.7)	2500 (98.4)	1200 (47.2)	5330 (209.8)	4996 (196.7)	10606 (417.6)	11089 (436.6)	11713 (461.1)

HM 1000 – Plan



Model	A	B	C	D	E	F
HM 1000	3885 (153.0)	660 (26.0)	929 (36.6)	1493 (58.8)	803 (31.6)	3225 (127.0)
HM 1250	4130 (162.6)	660 (26.0)	1179 (46.4)	1493 (58.8)	803 (31.6)	3225 (127.0)
HM 1250W	4581 (180.4)	1106 (43.5)	1179 (46.4)	1481 (58.3)	815 (32.1)	3225 (127.0)

HM 1000 – Elevation

Design Criteria

Risk Category	II	
Elevation above sea level;	EL = 48 ft;	per ASCE 7 Hazard Tool

Concrete Properties

Concrete Strength;	$f'_c = 2500$ psi;
--------------------	--------------------

Geometry (120 Tool)

Length;	$L = 434.5$ in = 36.21 ft;	per Brochure
Width;	$W = 229.2$ in = 19.10 ft;	per Brochure
Height;	$H = 150.2$ in = 12.52 ft;	per Brochure
Vertical Center of Gravity;	$CG = 2/3 * H = 8.3$ ft;	assumed
Horizontal CG (x-dir.);	$CG_x = 248.0$ in = 20.7 ft; (assumed at Table Center)	
Horizontal CG (y-dir.);	$CG_y = 129.5$ in = 10.8 ft; (assumed at Table Center)	

Gravity Loading

Dead Load

Machine Dead Load w/120ATC;	$W_m = 67682$ lb;	per Brochure
Allowable Table Load;	$W_T = 2 * 11023$ lb; (Standard 2 Pallets)	per Brochure
Total Dead Load;	$W_{TOT} = W_m + W_T = 89728$ lb;	

Thrust Loading

X Axis Feed Thrust;	$F_x = 6238$ lb;	per Brochure
Y Axis Feed Thrust;	$F_y = 8240$ lb;	per Brochure
Z Axis Feed Thrust;	$F_z = 6238$ lb;	per Brochure

Soil Design Values

Allowable Soil Bearing;	$P_{b,a} = 2000$ psf;	per Geotech
Coefficient of Sliding Friction;	$\mu_s = 0.30$;	per OSSC Table 1806.2

Seismic Loading

Seismic Importance Factor;	$I_e = 1.0$;	per ASCE 7 Table 1.5-2
Soil Class	E	per Geotech
Seismic Design Category	D	per ASCE 7 Hazard Tool
Spectral Response (short);	$S_s = 0.864$; g	per ASCE 7 Hazard Tool
Spectral Response (1s);	$S_1 = 0.415$; g	per ASCE 7 Hazard Tool
Spectral Acceleration (short);	$S_{DS} = 0.723$; g	per Seismic Load Generation
Spectral Acceleration (1s);	$S_{D1} = 0.656$; g	per Seismic Load Generation
Seismic Response Coefficient;	$C_s = 0.217$;	per Seismic Load Generation
Vertical Seismic Coefficient;	$C_{sv} = 0.2 \times S_{DS} = 0.145$	

Load Generation

Seismic Load Generation

Building Code Information

Risk Category =	II	
S_s =	0.864	Fig. 22-1, 22-3, & 22-5 to 22-8
S_1 =	0.415	Fig. 22-2, 22-4, & 22-5 to 22-8
Long Transition Period, T_L =	16	Fig. 22-14 to 22-17
Soil Site Class =	E	

Design Spectral Acceleration Parameters - ASCE 7-16 Chapter 11

Short-Period Site Coefficient, F_a =	1.2544	Table 11.4-1
Long-Period Site Coefficient, F_v =	2.37	Table 11.4-2
S_{MS} =	1.084	$S_{MS} = F_a \cdot S_s$, Eq. 11.4-1
S_{M1} =	0.984	$S_{M1} = F_v \cdot S_1$, Eq. 11.4-2
S_{DS} =	0.723	$S_{DS} = 2/3 \cdot S_{MS}$, Eq. 11.4-3
S_{D1} =	0.656	$S_{D1} = 2/3 \cdot S_{M1}$, Eq. 11.4-4
T_s =	0.908	$T_s = S_{D1}/S_{DS}$, Sect. 11.4.6

Seismic Design Category - ASCE 7-16 Chapter 11

Seismic Design Category for S_{DS} =	D	Table 11.6-1
Seismic Design Category for S_{D1} =	D	Table 11.6-2
Seismic Design Category =	D	Most critical of the cases above

Exception 1 per section 11.4.8 Item 2 is applicable

Seismic Base Shear - Non-Structural Components - ASCE 7-16 Chapter 13

Importance Factor, I_p =	1.00	Section 13.1.3
Height, h =	12.52	ft
Attachment Height, z =	0.00	ft
Structure Type =	Seismic Coefficients for Mechanical and Electrical Components (ASCE Table 13.6-1): Other mechanical or electrical components	
Amplification Factor, a_p =	1.0	Table 13.5-1 & Table 13.6-1
Response Mod. Coef., R_p =	1.50	Table 13.5-1 & Table 13.6-1
Overstrength Factor, Ω_o =	2.00	Table 13.5-1 & Table 13.6-1

Horizontal Component - Seismic Design Coefficients

F_{ph}/W_p =	0.193	$F_{ph} = (0.4 \cdot a_p \cdot S_{DS} \cdot W_p) \cdot (1 + 2 \cdot z/h) / (R_p / I_p)$, Eqn. 13.3-1
$F_{ph(max)}/W_p$ =	1.156	$F_{ph} = 1.6 \cdot S_{DS} \cdot W_p \cdot I_p$, Eqn. 13.3-2
$F_{ph(min)}/W_p$ =	0.217	$F_{ph} = 0.3 \cdot S_{DS} \cdot W_p \cdot I_p$, Eqn. 13.3-3

Seismic Coefficients

F_{ph}/W_p =	0.217	$F_{pv} = 0.2 \cdot S_{DS} \cdot W_p$, ASCE 7 Eqn. 12.4-4
F_{pv}/W_p =	0.145	

W_p = working load

multiply (F_p/W_p) by W_p to find force on component

Structural Calculations

Seismic Loading

Seismic Horizontal Load; $E_h = W_{TOT} * C_s = \mathbf{19471 \text{ lb;}}$
Seismic Vertical Load; $E_v = W_{TOT} * C_{sv} = \mathbf{12975 \text{ lb;}}$

Forces in Direction w/ Longer Resisting Moment Arm

Overturning Moment About x; $M_{Ex} = E_h * CG + E_v * CG_y = \mathbf{302493 \text{ lb_ft;}}$
Resisting Moment About x; $M_{Dx} = W_{TOT} * CG_y = \mathbf{968315 \text{ lb_ft}}$
Factored Resisting Moment; $0.9 * M_{Dx} = \mathbf{871483 \text{ lb_ft}}$

Factored Applied Moment; $M_{EOTx} = M_{Ex} - 0.9 * M_{Dx} = \mathbf{-568990 \text{ lb_ft;}}$ (0.9D + 1.0E)

No Overturning due to Seismic Forces

Forces in Direction w/ Shorter Resisting Moment Arm

Overturning Moment About x; $M_{Ex} = E_h * CG + E_v * (W - CG_y) = \mathbf{270272 \text{ lb_ft;}}$
Resisting Moment About x; $M_{Dx} = W_{TOT} * (W - CG_y) = \mathbf{745490 \text{ lb_ft}}$
Factored Resisting Moment; $0.9 * M_{Dx} = \mathbf{670941 \text{ lb_ft}}$

Factored Applied Moment; $M_{EOTx} = M_{Ex} - 0.9 * M_{Dx} = \mathbf{-400669 \text{ lb_ft;}}$ (0.9D + 1.0E)

No Overturning due to Seismic Forces

Loading Summary

Seismic Base Shear; $V_E = E_h = \mathbf{19.471 \text{ kips;}}$ (Transverse direction)
Seismic Vertical Force; $E_v = \mathbf{12.975 \text{ kips;}}$

Anchor Design

Number of Anchors; $N_a = 34;$ per Manufacturer Dwgs
Shear to Single Anchor; $V_a = V_E / N_a = \mathbf{573 \text{ lb;}}$

Note: Anchor Capacity is based off the Manufacturer's anchorage provided in their drawings.
Steel strength capacity is using a 36 ksi, 3/4" diameter generic cast-in-place anchor bolt from Dewalt Design Assist.

Anchor Capacity; $C_a = 7566 \text{ lb;}$ (Steel Strength) per Dewalt Output
Capacity > Seismic Shear to Single Anchor, OK

Slab Design

Bearing Check

Allowable Soil Bearing;	$P_{b,a} = 2000$ psf;	
Total Dead Load;	$P_D = W_{TOT} = 89728$ lb;	
Total Area of Foundation;	$A_f = 45506.15 \text{ in}^2 = 316.01 \text{ ft}^2$;	per Dwgs
Eccentricity (x-direction);	$e_x = 3.109$ ft; (from centroid to C.O.G., longitudinal direction)	
Eccentricity (y-direction);	$e_y = 1.052$ ft; (from centroid to C.O.G., transverse direction)	
Eccentric Moment (about x);	$M_x = P_D * e_y = 94394$ lb_ft;	
Eccentric Moment (about y);	$M_y = P_D * e_x = 278964$ lb_ft;	
Moment of Intertia (about x);	$I_x = 83468274 \text{ in}^4$;	per Dwgs
Moment of Intertia (about y);	$I_y = 452203051 \text{ in}^4$;	per Dwgs
Distance to Edge (x-direction);	$x_{bar} = 210.66977625$ in;	per Dwgs
Distance to Edge (y-direction);	$y_{bar} = 92.34982248$ in;	per Dwgs
Section Modulus (x-direction);	$S_x = I_x / x_{bar} = 396204 \text{ in}^3$;	
Section Modulus (y-direction);	$S_y = I_y / y_{bar} = 4896632 \text{ in}^3$;	

X-Direction

	$M_x / S_x = 412$ psf;
	$P_D / A_f = 284$ psf;
Bearing on Foundation;	$M_x / S_x + P_D / A_f = 696$ psf; < $P_{b,a}$, OK

Y-Direction

	$M_y / S_y = 98$ psf;
	$P_D / A_f = 284$ psf;
Bearing on Foundation;	$M_y / S_y + P_D / A_f = 382$ psf; < $P_{b,a}$, OK

Sliding Check

Coefficient of Friction;	$\mu_s = 0.30$;
Total Dead Load;	$P_D = 89728$ lb;
Sliding Resistance;	$R_D = P_D * \mu_s = 26918$ lb;
Seismic Base Shear;	$V_E = 19471$ lb;
	Sliding Resistance > Base Shear, OK

Slab Reinforcing

Note: Per the Geotechnical report, the site is located on liquefiable soil. ASCE 7 12.13.9 states specific requirements for foundations on liquefiable sites. When detailing for mat foundations per ASCE 7 12.13.9.2.1.2, they must be detailed in accordance with the requirements of ACI 318 section 18.6.3.1.

Concrete Strength; $f'_c = 2500$; psi;
Steel Yield Strength; $f_y = 60000$; psi;
Width of Slab (per foot); $b_w = 12$; in;
Depth to Reinforcement; $d = 32 - 3 = 29$; in;

Maximum Reinf. Ratio (Gr.60); $\rho_{max} = 0.025$; per ACI 18.6.3.1

Minimum Reinforcing Area; $A_{s,min} = \max((3*\sqrt{f'_c})*b_w*d/f_y, (200*b_w*d/f_y));$
 $A_{s,min} = 1.160$;in²; (per foot) per ACI 9.6.1.2

#7 @ 6" oc; $A_{7,6} = 1.2$ in²; (per foot)
Actual Reinforcing > Required Reinforcing, OK

#9 @ 10" oc; $A_{9,8} = 1.2$ in²; (per foot)
Actual Reinforcing > Required Reinforcing, OK

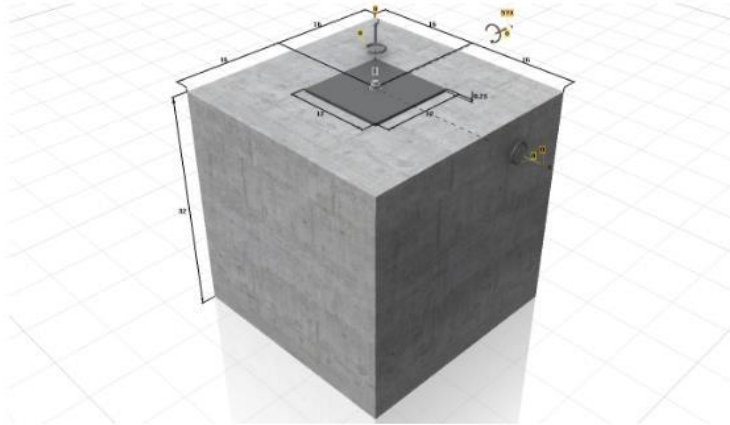
Use #7 at 6" oc Longitudinal Top Reinforcing Each Way.

Use #9 at 10" oc Longitudinal Bottom Reinforcing Each Way.

Appendix A – Dewalt Design Assist

DEWALT		DEWALT DESIGN ASSIST 1.7.3.0	Page 1
		2025_02_12 Anchorage 2401-0097	2/12/2025
1. Project Information			
Company: Project Engineer: Address: Phone: M: P: Email: cabe.nieth@psengineers.com Project Name: Untitled Project Address: Untitled Notes:			
2. Selected Anchor Information			
Selected Anchor :		Hooked L Bolt	
Brand:		Generic	
Material:		3/4" Ø Threaded Bolt Hooked Head ASTM F1554 GR36/A36	
Embedment:		h _{ef} 10.25 in h _{nom} 11 in	
Approval:		--	
Issued/Revision:		-	
3. Design Principles			
Design Method:		ACI 318-19	
Load Combinations:		Section 5.3 User Defined Loads	
4. Base Material Information			
Concrete:		Cracked Normal Weight Concrete	
Type:			
Strength		2500 psi	
Reinforcement:			
Edge Reinforcement		None or < #4 Rebar	
Spacing		Tension No (Condition B) Shear No (Condition B)	
Controls Breakout		Tension False Shear False	
Base Plate:			
Sizing		Thickness 0.25 in Length 12 in Width 12 in	
Standoff		None Height 0 in	
Strength		36000 psi	
Profile:		None	
Torqued Anchor Bolt:			
Concrete Covers:		Base Cover: 0.25 in End Cover: 0.25 in	
Input data and results must be checked for agreement with the existing conditions, the standards and guidelines and must be checked for plausibility			

5.Geometric Conditions



h_{slab}	32	in	h_{min}	11.250	in
Edge Cx-	16	in	c_{min}	0.625	in
Edge Cx+	16	in	c_{ac}	15.375	in
Edge Cy-	16	in	s_{min}	3.000	in
Edge Cy+	16	in			

6.Summary Results

Tension Loading

Design Proof	Demand(lb)	Capacity(lb)	Utilization	Status	Critical
Steel Strength:	0.00	0.00	0.000	OK	Controls
Concrete Breakout Strength:	0.00	0.00	0.000	OK	
Pullout Strength:	0.00	0.00	0.000	OK	

Shear Loading

Design Proof	Demand(lb)	Capacity(lb)	Utilization	Status	Critical
Steel Strength	573.00	7566.00	0.076	OK	Controls
Concrete Breakout Strength:	573.00	12096.00	0.047	OK	
Pryout Strength	573.00	55131.00	0.010	OK	

Input data and results must be checked for agreement with the existing conditions, the standards and guidelines and must be checked for plausibility

11.Design Proof Shear Loading

Reference

Steel Strength

ACI 318-19 17.7.1

Variables

V_{sa} (lb)	ϕ
11639.23	0.65

Results

ϕV_{sa}	=	7566	lb
V_{ua}	=	573	lb
Utilization	=	7.6%	

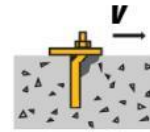


Table 17.5.2

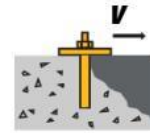
Concrete Breakout Strength

ACI 318-19 17.7.2

Equations

$$V_{cb} = (A_{Vc} / A_{Vc0}) \cdot \Psi_{ed,V} \cdot \Psi_{c,V} \cdot \Psi_{h,V} \cdot V_b$$

$$V_b = 9 \cdot \lambda_a \cdot (f'_c)^{0.5} \cdot (c_{al})^{1.5}$$



Eqn. 17.7.2.1a

Eqn.
17.7.2.2.1b

Variables

A_{Vc} (in ²)	A_{Vc0} (in ²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$
768.000	1152.000	1.000	0.900	1.000	1.000
$\Psi_{a,V}$	l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{al} (in)
1.000	6.000	0.750	1.000	2500	16.000
V_b (lb)	ϕ				
28800.000	0.70				
		V_{cb} (lb)			
		17280.000			

Results

ϕV_{cb}	=	12096	lb
Direction	=	Y+	
V_{ua}	=	573	lb
Utilization	=	4.7%	

Table 17.5.2

Shear Breakout Case 2 Controls

Input data and results must be checked for agreement with the existing conditions, the standards and guidelines and must be checked for plausibility

Pryout Strength

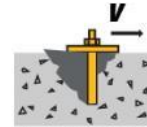
ACI 318-19 17.7.3

Equations

$$V_{cp} = k_{cp} \cdot N_{cp}$$

$$N_{cb} = (A_{Nc} / A_{Nc0}) \cdot \Psi_{ed,N} \cdot \Psi_{c,N} \cdot \Psi_{cp,N} \cdot N_b$$

$$N_b = 16 \cdot \lambda_a \cdot (f'_c)^{0.5} \cdot h_{ef}^{5/3}$$



Eqn. 17.7.3.1a

Eqn. 17.6.2.1a

Eqn. 17.6.2.2.3

Variables

A_{Nc} (in ²)	A_{Nc0} (in ²)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$
945.563	945.563	1.000	1.000	1.000	1.000
c_{ac} (in)	k_c	λ_a	h'_{ef} (in)	f'_c (psi)	C_{amin} (in)
15.375	24.000	1.000	10.250	2500.000	16.000
N_b (lb)	k_{cp}	N_{cp} (lb)	ϕ		
39379.214	2.000	39379.214	0.70		

Results

ϕV_{cp}	=	55131.00 lb
V_{ua}	=	573 lb
Utilization	=	1.0%

Table 17.5.2

ANCHOR DESIGN CRITERIA IS SATISFIED



Input data and results must be checked for agreement with the existing conditions, the standards and guidelines and must be checked for plausibility