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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

STRUCTURAL
REGISTERED PROFESSIONAL
ENGINEER
82232PE
OREGON
SEP. 12, 2017
EDWARD FON-HON LING
EXPIRES 12/31/26

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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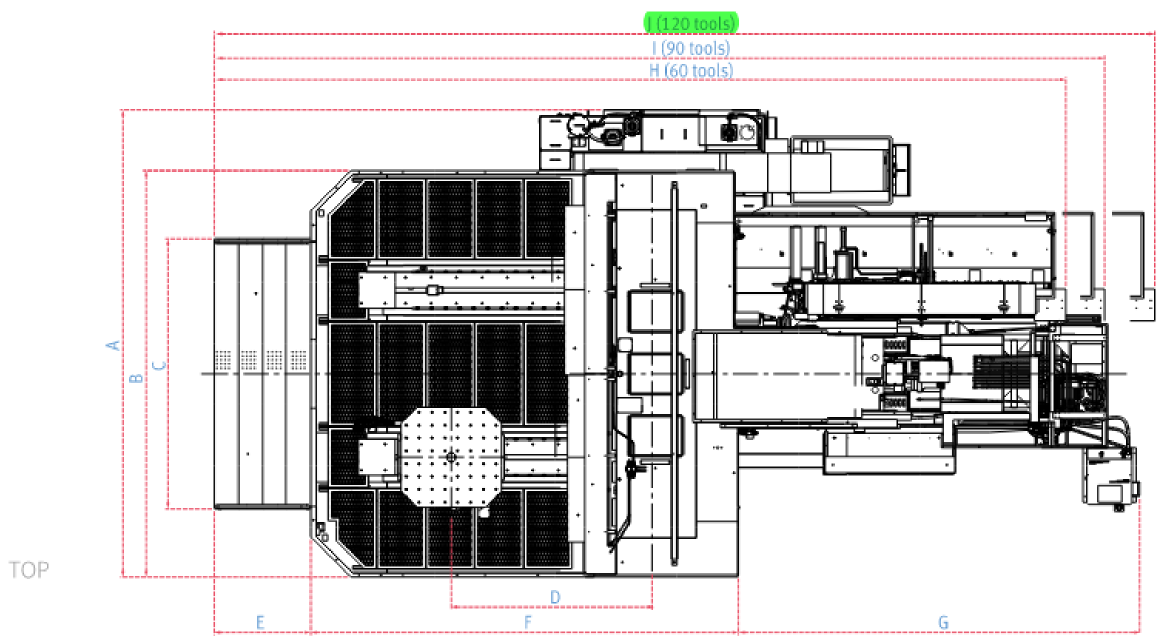
Drawings

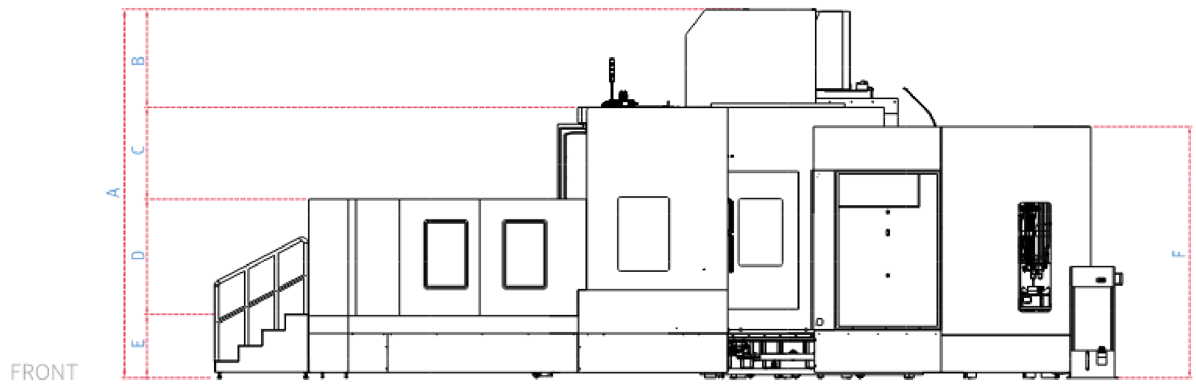
HM 1000 – Isometric

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;	μ_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	$S_{M1} =$ Fv·S1, 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	$F_{ph} = (0.4*a_p*S_{DS}*W_p)*(1+2*z/h)/(R_p/I_p)$, Eqn. 13.3-1
$F_{ph(max)}/W_p$ =	1.156	$F_{ph} = 1.6*S_{DS}*W_p*I_p$, Eqn. 13.3-2
$F_{ph(min)}/W_p$ =	0.217	$F_{ph} = 0.3*S_{DS}*W_p*I_p$, Eqn. 13.3-3

Seismic Coefficients

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

W_p = working load

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

Structural Calculations

Seismic Loading

Seismic Horizontal Load; $E_h = W_{TOT} * C_s =$ **19471** lb;

Seismic Vertical Load; $E_v = W_{TOT} * C_{sv} =$ **12975** lb;

Forces in Direction w/ Longer Resisting Moment Arm

Overturning Moment About x; $M_{Ex} = E_h * CG + E_v * CG_y =$ **302493** lb_ft;

Resisting Moment About x; $M_{Dx} = W_{TOT} * CG_y =$ **968315** lb_ft

Factored Resisting Moment; $0.9 * M_{Dx} =$ **871483** lb_ft

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

No Overturning due to Seismic Forces

Forces in Direction w/ Shorter Resisting Moment Arm

Overturning Moment About x; $M_{Ex} = E_h * CG + E_v * (W - CG_y) =$ **270272** lb_ft;

Resisting Moment About x; $M_{Dx} = W_{TOT} * (W - CG_y) =$ **745490** lb_ft

Factored Resisting Moment; $0.9 * M_{Dx} =$ **670941** lb_ft

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

No Overturning due to Seismic Forces

Loading Summary

Seismic Base Shear; $V_E = E_h =$ **19.471** kips; (Transverse direction)

Seismic Vertical Force; $E_v =$ **12.975** kips;

Anchor Design

Number of Anchors; $N_a = 34$; per Manufacturer Dwgs

Shear to Single Anchor; $V_a = V_E / N_a =$ **573** 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; $C_a = 7566$ 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 in^2 = **316.01** 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 in^4;	per Dwgs
Moment of Intertia (about y);	I_y = 452203051 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** in^3 ;	
Section Modulus (y-direction);	$S_y = I_y / y_{bar}$ = **4896632** 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;	μ_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);	ρ_{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** ;in^2; (per foot)	per ACI 9.6.1.2
#7 @ 6" oc;	$A_{7,6}$ = 1.2 in^2; (per foot)	
	Actual Reinforcing > Required Reinforcing, OK	
#9 @ 10" oc;	$A_{9,8}$ = 1.2 in^2; (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 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

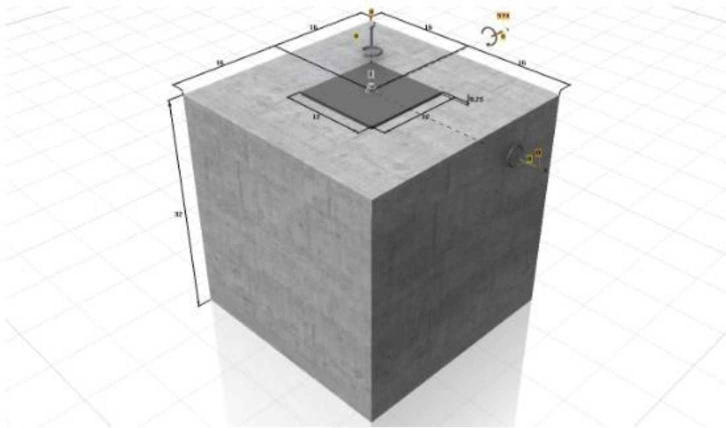
Design Method:	ACI 318-19	
Load Combinations:	Section 5.3	User Defined Loads

4.Base Material Information

Concrete:								
Type:	Cracked		Normal Weight Concrete					
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	

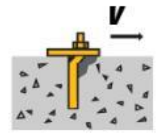
Shear Loading

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	

11.Design Proof Shear Loading | Reference

Steel Strength

ACI 318-19 17.7.1



Variables

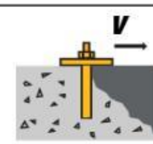
V_{sa} (lb)	φ
11639.23	0.65

Results

φV_{sa}	=	7566	lb	
V_{ua}	=	573	lb	Table 17.5.2
Utilization	=	7.6%		

Concrete Breakout Strength

ACI 318-19 17.7.2



Equations

$V_{cb} = (A_{Vc} / A_{Vc0}) \cdot \Psi_{ed,V} \cdot \Psi_{c,V} \cdot \Psi_{h,V} \cdot V_b$ Eqn. 17.7.2.1a

$V_b = 9 \cdot \lambda_a \cdot (f'_c)^{0.5} \cdot (c_{a1})^{1.5}$ Eqn. 17.7.2.2.1b

Variables

A_{Vc} (in²)	A_{Vc0} (in²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$
768.000	1152.000	1.000	0.900	1.000	1.000

$\Psi_{\alpha,V}$	l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)
1.000	6.000	0.750	1.000	2500	16.000

V_b (lb)	φ	V_{cb} (lb)
28800.000	0.70	17280.000

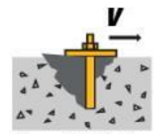
Results

φV_{cb}	=	12096	lb	
Direction	=	Y+		
V_{ua}	=	573	lb	Table 17.5.2
Utilization	=	4.7%		

Shear Breakout Case 2 Controls

Pryout Strength

ACI 318-19 17.7.3



Equations

$V_{cp} = k_{cp} \cdot N_{cp}$ Eqn. 17.7.3.1a

$N_{cb} = (A_{Nc} / A_{Nc0}) \cdot \Psi_{ed,N} \cdot \Psi_{c,N} \cdot \Psi_{cp,N} \cdot N_b$ Eqn. 17.6.2.1a

$N_b = 16 \cdot \lambda_a \cdot (f'_c)^{0.5} \cdot h_{ef}^{5/3}$ Eqn. 17.6.2.2.3

Variables

A_{Nc} (in²)	A_{Nc0} (in²)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$
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	Table 17.5.2
V_{ua}	=	573	lb	
Utilization	=	1.0%		

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