Project:

Susan Knedler

1711 Congress Street
PORTLAND, ME 04101

Foundation Loading Calculations

and

Pier Calculations

Contractor:

TC Hafford Basement Systems

356 N. Berwick Road
WELLS, ME 04090

Calculations Prepared by:

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Date:

June 21, 2013

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HE13040007

Design Notes

Owner:	Susan Knedler
Address:	1711 Congress Street
City, State, ZIP:	PORTLAND, ME 04101
PN:	HE13040007

1 These calculations provided in support of a contract between the contractor and the owner. The calculations are to provide engineering design and review of the proposed scope of work provided in the terms of the contract. This design represents a proposed solution agreed upon in the contract used to address the areas of concern identified to the engineer. The owner should be alert to possible changes to the condition of the structure and continue to monitor the building's condition.

2 Hayman Engineering warrants that this design is based on sound engineering principles but makes no warranty or guarantee regarding the work performed by the Contractor.

3 This design is based on information supplied by the Contractor. Field verify that no system's placing violates the notes in this drawing set.

4 Install the system shown in accordance with the manufacturer's recommendations.

5 The building weight assumptions used to calculate pier load are estimates. Drive each pier until a slight lifting of the building occurs to indicate that the structure's load has transferred from the soil to the pier.

Foundation Load Calculation

Owner:	Susan Knedler
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Calculate linear load on foundation perpendicular to roof ridge

Half Width	15
Stories	2
Basement Ht	5
Backfill Ht	5
Side wall Ht	9
Roof pitch in 12	12
rafter length +1	22.2

Calculate Snow Load:
If pitch <=1/2 in 12 and pg <=20,
pf = I x pg not used
If pitch <=1/2 in 12 and pg >20,
pf = 20 x I not used
Else use Pf from Eq 7-1

County:	CUMBERLAND	
pg:	70	psf, ground snow load
Pf = 0.7 x Ce x Ct x I x p		Eq 7-1, Flat Roof Snow Load
Ce:	1	Table 7-2, ASCE 7-05, p 92
Ct:	1	Table 7-3, ASCE 7-05, p 93
I:	1	Table 7-4, ASCE 7-05, p 93
Pf =	49	psf
Ps = Cs x Pf		Sloped Roof Snow Load
Cs:	1	Figure 7-2, ASCE 7-05, p 86
Ps =	49	psf

									RUNNING TOTAL
ROOF	**Metal**	**Roll**	**Wood**	**Shingle Comp**	**Clay tile**	**Deck**	**Snow**	**rafter**	
		0	0	1	0		49		
	0.0	0.0	0.0	44.4	0.0	41.8	544.2	57.8	**688**
ATTIC		**LL**	**Ins**	**Sheetrock**	**Joists**				
with steps	1	750.0	22.5	18.8	12.0				**803**
without steps	0	0.0	0.0	0.0	0.0				**0**
SIDEWALLS	**Brick**	**CMU**	**Siding**	**Stucco**	**Studs**	**Sheetrock**	**Insulation**		
	0.0	0.0	2.0	0.0					
	0.0	0.0	22.5	0.0	14.4	22.5	22.5		**82**
FLOORS	**LL**	**Finish**	**Joists**	**Sub**					
	750.0	225.0	39.0	33.8					**1,048**
BSMT WALL	**Conc**	**CMU**	**Limest**	**Footing**					
	1	0	0	ht	width				
Thickness=	8			8	16				
	500.0	0.0	0.0		133.3				**633**
				Assumed footer size					
OVERBURDEN									
(lip in inches)	4 (half the difference between ftr width and wall thickness)								
	0.5 (reduced to 50% because only stabilizing)								
	779.2								**779**
						PLF ON FOUNDATION			**4,034**

Pier Load Calculations

Owner:	Susan Knedler
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Calculate moment and shear strength in wall to get max spacing.

Enter load per linear foot (calculated elsewhere):
w - total plf **4,034** plf

Calculate Strength of Unreinforced Section

Foundation dimensions
Note: For thickened slab, enter thickening as footer and slab as wall)

T =	8	in (thickness of wall)
H =	60	in (ht of wall)
S =	8	in (ht of footer)
B =	16	in (width of footer)
D =	68	in (total ht of foundation)

Centroid sum (AiYi)/ sum(Ai)
= d-(d^2 * t + s^2 8 (b-t))/(2 * (b * s + h * t))
= 37.16 in

Moment of Inertia (I) =

I stem =	144,000	In^4
parallel axis	24,593	In^4
I footer =	683	In^4
parallel axis	92,224	In^4
I =	261,500	In^4
S =	7,038	in^3 - I/c
f'c =	2,500	psi – (assume 1,500 for CMU, 2,500 for conc)
Mn =	146,615	ft lb - 5 x sqrt(f'c) x S
Mu =	95,300	ft lb - 0.65 x Mn

Note: Assumes homogeneous material in wall & footing. If L allow below is no good, consider f'c = 2,500 in footer &

Calculate Strength of Reinforced Section
Note: This analysis neglects the "ears" of the footer, using wall thickness as "b" and assumes 3" clear to the steel.

fy:	40,000	psi
k1:	0.85	
As:	0	in^2, assume none
phi:	0.9	
qmax =	0.371	= 0.6375*k1*(87,000/(87,000+fy)
q =	0.000	= [As/b*d]*fy/f'c
Mu =	0	ft lb, phi*As*fy*d(1-0.59q)
Ma =	0	ft lb allowable, Mux0.65
Mx =	95,300	ft lb, Max of unreinforced and reinforced

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Calculate maximum span to achieve Moment strength

Mx = (wl^2)/8

L allow = **13.75** ft - sqrt(8M/w)

Calculate Individual Pier Loadings and Drive Requirements

Pier Type:	Push	(Push or Helical)
Factor of Safety:	1.6	(1.5 for Push, 2 for Helical)
Eff Head Area (EH)	9.62	sq in (head area for push piers)
K:	9	1/ft (torque correlation factor for helical piers)
Pier Allow. Ld:	44,000	lbs, per mfr literature
Pier Allow. T:	n/a	ft-lb, allowable torque if helical
Max Pier Space:	10.91	ft; min of (Pier Allow/w) and L allow
Max Rec Space:	8	ft unless noted otherwise

Pier No.	Spacing (ft)	Linear Load (psf)	Load Allow (lbs)	Ck	Ult (lbs)	Drive psi req'd	Comments
1	5	4,034	20,170	OK	32,272	3,355	
2	5	4,034	20,170	OK	32,272	3,355	
3	5	4,034	20,170	OK	32,272	3,355	
4	5.5	4,034	22,187	OK	35,499	3,690	
5	5.5	4,034	22,187	OK	35,499	3,690	
6	5.5	4,034	22,187	OK	35,499	3,690	
7	5.5	4,034	22,187	OK	35,499	3,690	
8	5.5	4,034	22,187	OK	35,499	3,690	
9	5.5	4,034	22,187	OK	35,499	3,690	
10	5.5	4,034	22,187	OK	35,499	3,690	
11	5.5	4,034	22,187	OK	35,499	3,690	
12	5.5	4,034	22,187	OK	35,499	3,690	
13	5.5	4,034	22,187	OK	35,499	3,690	
14	5.5	4,034	22,187	OK	35,499	3,690	
15	5	4,034	20,170	OK	32,272	3,355	Applies to piers 15-26
16							
17							
18							
19							
20							
Max:	5.5	OK	22,187		35,499	3,690	

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Check shear for foundation section (assumes no shear reinforcing)

Concrete:

Vc = 4/3 x phi x (sqrt f'c) x b x h

	Sect above	Other	
Phi =	0.65	0.65	
(sqrt f'c) =	50	50	(min of f'c^0.5 and 100)
Footer shear strength:			
Hf = s-2	6		in (reduction accounts for uneven excavation)
Bf =	16		in (from above)
Vf =	4,160	0	lb
Wall shear:			
Hw =	60		in (from above)
Bw =	8		in (from above)
Vw =	20,800	0	lb
Conc. Vu tot =	**24,960**	**0**	lb (total allowable shear in the concrete)