Supplemental Structural Calculations for:

Yuan Residence

3611 W Mercer Way

Mercer Island, WA 98040

Prepared for: Brandt Design Group

Job #: 01519-2019-01-00

Date: October 9, 2019

STRUCTURAL ENGINEERING

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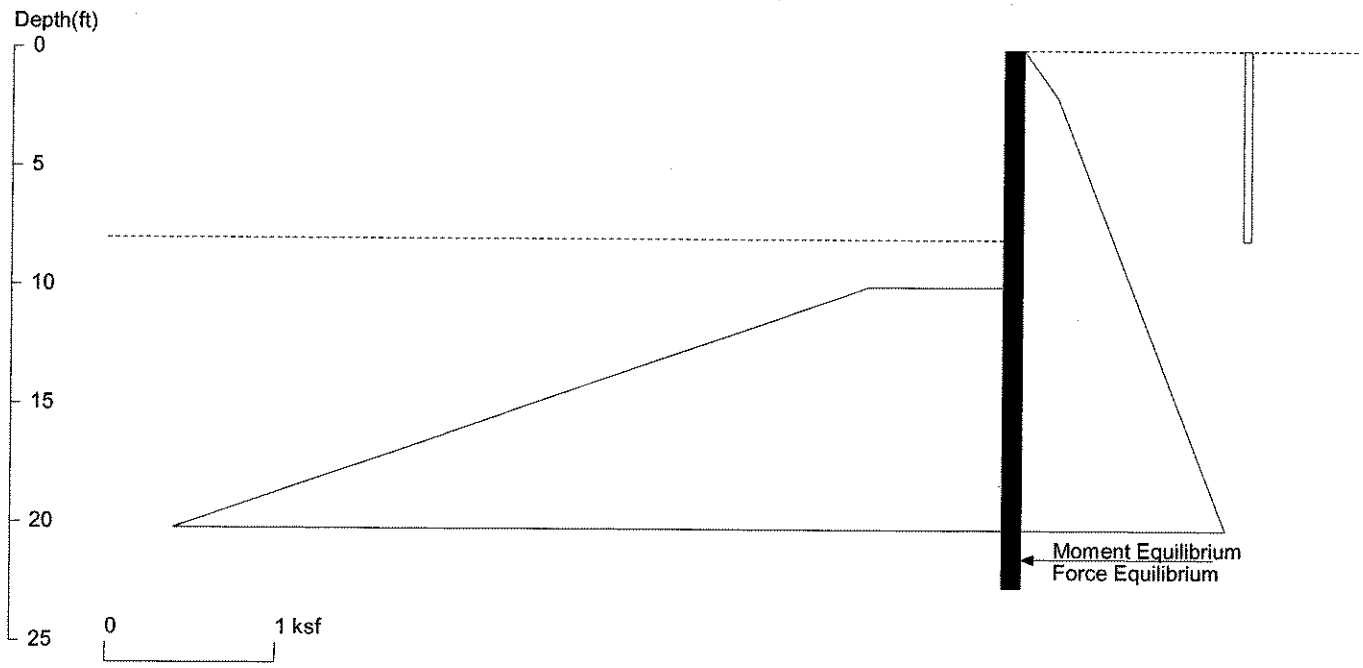
Yuan Residence
East wall of driveway



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

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Wall Height=8.0 Pile Diameter=2.0 Pile Spacing=8.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=14.66 Min. Pile Length=22.66
MOMENT IN PILE: Max. Moment=182.61 per Pile Spacing=8.0 at Depth=14.60

PILE SELECTION:
Request Min. Section Modulus = 66.4 in3/pile=1088.14 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
W16X45 has Section Modulus = 72.7 in3/pile=1191.33 cm3/pile. It is greater than Min. Requirements!
Top Deflection = 0.73(in) based on E (ksi)=29000.00 and I (in4)/pile=586.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

	Z1	P1	Z2	P2	Slope	
CATCHMENT	0	0	2	0.200	.1	100pcf
ACTIVE	2	.2	50	2.840	.055	55pcf
(EQ) UH	0	.048	8	0.048	0	

UH = 6×8 = 48

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
10	.8	50	16.800	.4

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	8.00
2	8.00	2.00

PASSIVE SPACING:

No.	Z depth	Spacing
1	8.00	4.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

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SHORING WALL CALCULATION SUMMARY
The leading shoring design and calculation software

www.civiltech.com

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ShoringSuite Software is developed by CivilTech Software, Bellevue, WA, USA.
The calculation method is based on the following references:

1. FHWA 98-011, FHWA-RD-97-130, FHWA SA 96-069, FHWA-IF-99-015
2. STEEL SHEET PILING DESIGN MANUAL by Pile Buck Inc., 1987
3. DESIGN MANUAL DM-7 (NAVFAC), Department of the Navy, May 1982
4. TRENCHING AND SHORING MANUAL Revision 12, California Department of Transportation, January 2000
6. EARTH SUPPORT SYSTEM & RETAINING STRUCTURES, Pile Buck Inc. 2002
5. DESIGN OF SHEET PILE WALLS, EM 1110-2-2504, U.S. Army Corps of Engineers, 31 March 1994
7. EARTH RETENTION SYSTEMS HANDBOOK, Alan Macnab, McGraw-Hill. 2002
8. Temporary Structures in Construction, Robert T. Ratay (Co-author of Chapter 7: John J. Peirce), McGraw-Hill. 2012
9. AASHTO HB-17, American Association of State and Highway Transportation Officials, 2 September 2002

UNITS: Width/Spacing/Diameter/Length/Depth - ft, Force - kip, Moment - kip-ft, Friction/Bearing/Pressure - ksf, Pres. Slope - kip/ft3, Deflection - in

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Title: Yuan Residence
Subtitle: East wall of driveway

**********INPUT DATA**********

Wall Type: 2. Soldier Pile, Drilled
Wall Height: 8.00
Pile Diameter: 2.00
Pile Spacing: 8.00
Factor of Safety (F.S.): 1.00
Lateral Support Type (Braces): 1. No
Top Brace Increase (Multi-Bracing): Add 15%*
Embedment Option: 1. Yes
Friction at Pile Tip: No
Pile Properties:
Steel Strength, Fy: 50 ksi = 345 MPa
Allowable Fb/Fy: 0.66
Elastic Module, E: 29000.00
Moment of Inertia, I: 612.00
User Input Pile: w16x45

* DRIVING PRESSURE (ACTIVE, WATER, & SURCHARGE) *

No.	Z1 top	Top Pres.	Z2 bottom	Bottom Pres.	Slope
1	0	0	2	0.200	.1
2	2	.2	50	2.840	.055
3	0	.048	8	0.048	0

* PASSIVE PRESSURE *

No.	Z1 top	Top Pres.	Z2 bottom	Bottom Pres.	Slope
1	10	.8	50	16.800	.4

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* ACTIVE SPACE *
 No.     Z depth          Spacing
-------------------------------------------------------------------------------
 1       0.00             8.00
 2       8.00             2.00
-------------------------------------------------------------------------------

* PASSIVE SPACE *
 No.     Z depth          Spacing
-------------------------------------------------------------------------------
 1       8.00             4.00
-------------------------------------------------------------------------------
*For Tieback:  Input1 = Diameter;  Input2 = Bond Strength
*For Plate:  Input1 = Diameter;  Input2 = Allowable Pressure
*For Deadman:  Input1 = Horz. Width;  Input2 = Passive Pressure;
*For Sheet Pile Anchor:  Input1 = Horz. Width;  Input2 = Passive Slope;

**********CALCULATION**********
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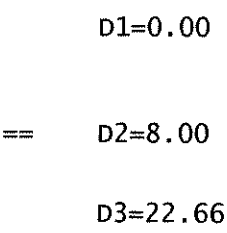
The calculated moment and shear are per pile spacing. Sheet piles are per one foot or meter; Soldier piles are per pile.

Top Pressures start at depth = 0.00



D1 - TOP DEPTH
D2 - EXCAVATION BASE
D3 - PILE TIP

MOMENT equilibrium AT DEPTH=20.21 WITH EMBEDMENT OF 12.21
FORCE equilibrium AT DEPTH=22.66 WITH EMBEDMENT OF 14.66

The program calculates an embedment for moment equilibrium, then increase the embedment by 1.2

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**********RESULTS**********

* EMBEDMENT Notes *
Based on USS Design Manual, first calculate embedment for moment equilibrium, then
increased the embedment to get the design depth.
The embedment for moment equilibrium is 12.21
The program calculates an embedment for moment equilibrium, then increase the
embedment by 1.2
The total desigh embedment is 14.66

Embedment Information:
If 20% increased, the total design embedment is 14.66
If 30% increased, the total design embedment is 15.88
If 40% increased, the total design embedment is 17.10
If 50% increased, the total design embedment is 18.32
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* MOMENT IN PILE (per pile spacing)*
Pile Spacing:  sheet piles are one foot or one meter; soldier piles are one pile.
Overall Maximum Moment = 182.61 at 14.60
Maximum Shear = 72.51
Moment and Shear are per pile spacing: 8.0 foot or meter

* VERTICAL LOADING *
Vertical Loading from Braces = 0.00
Vertical Loading from External Load = 0.00
Total Vertical Loading = 0.00


*****************************SPECIFIED PILE ***********************************

   Overall Maximum Moment = 182.61 at 14.60
   The pile selection is based on the magnitude of the moment only. Axial force is
neglected.

   Request Min. Section Modulus = 66.40 in3/pile = 1088.14 cm3/pile, Fy= 50 ksi =
345 MPa, Fb/Fy=0.66

   W16X45 has been found in Soldier Pile list!
   (English Units):
   Area= 13.3 in.  Depth= 16.1 in.  Width= 7.04 in.  Height= 16 in.
   Flange thickness= 0.565 in.   Web thickness= 0.345 in.
   Ix= 586 in4/pile   Sx= 72.7 in3/pile   Iy= 32.8 in4/pile   Sy= 9.34 in3/pile
   (Metric Units):
   Ix= 243.89 x100cm4/pile   Sx= 1191.33 cm3/pile   Iy= 13.65 x100cm4/pile   Sy=
153.05 cm3/pile


   The pile selection is based on the magnitude of the moment only. Axial force is
neglected.

   W16X45 is capable to support the shoring!
   Top deflection = 0.726(in)
   Max. deflection = 0.726(in)

************************ LAGGING SIZE ESTIMATION ************************
Max. Pressure above base = 0.58
Piles are more rigid than timber lagging, due to arching, only portion of pressures
are acting to lagging, 30-50% loading is suggested.
     If 50% loading is used for lagging design, Design Pressure = 0.29
     Pile Spacing =8.0, Max. Moment in lagging = 2.31
     For 4"x12" Timber, Section Modules S=23.47 in3.  The request allowable bending
strength, fb=M/S=1.18
     For 6"x12" Timber, Section Modules S=57.98 in3.  The request allowable bending
strength, fb=M/S=0.48

     If 30% loading is used for lagging design, Design Pressure = 0.17
     Pile Spacing =8.0, Max. Moment in lagging = 1.39
     For 4"x12" Timber, Section Modules S=23.47 in3.  The request allowable bending
strength, fb=M/S=0.71
     For 6"x12" Timber, Section Modules S=57.98 in3.  The request allowable bending
strength, fb=M/S=0.29

Unit: Pressure: ksf,  Spacing: ft,  Moment: kip-ft, Bending Strength, fb: ksi
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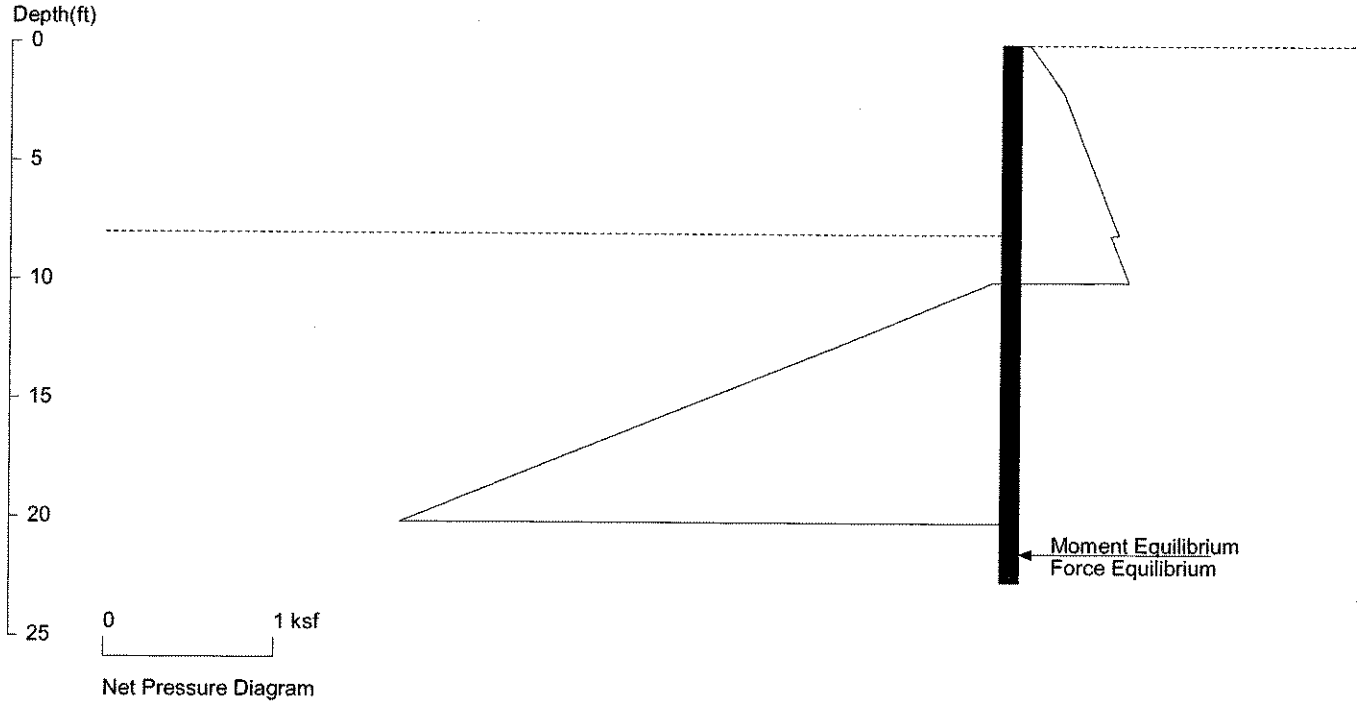
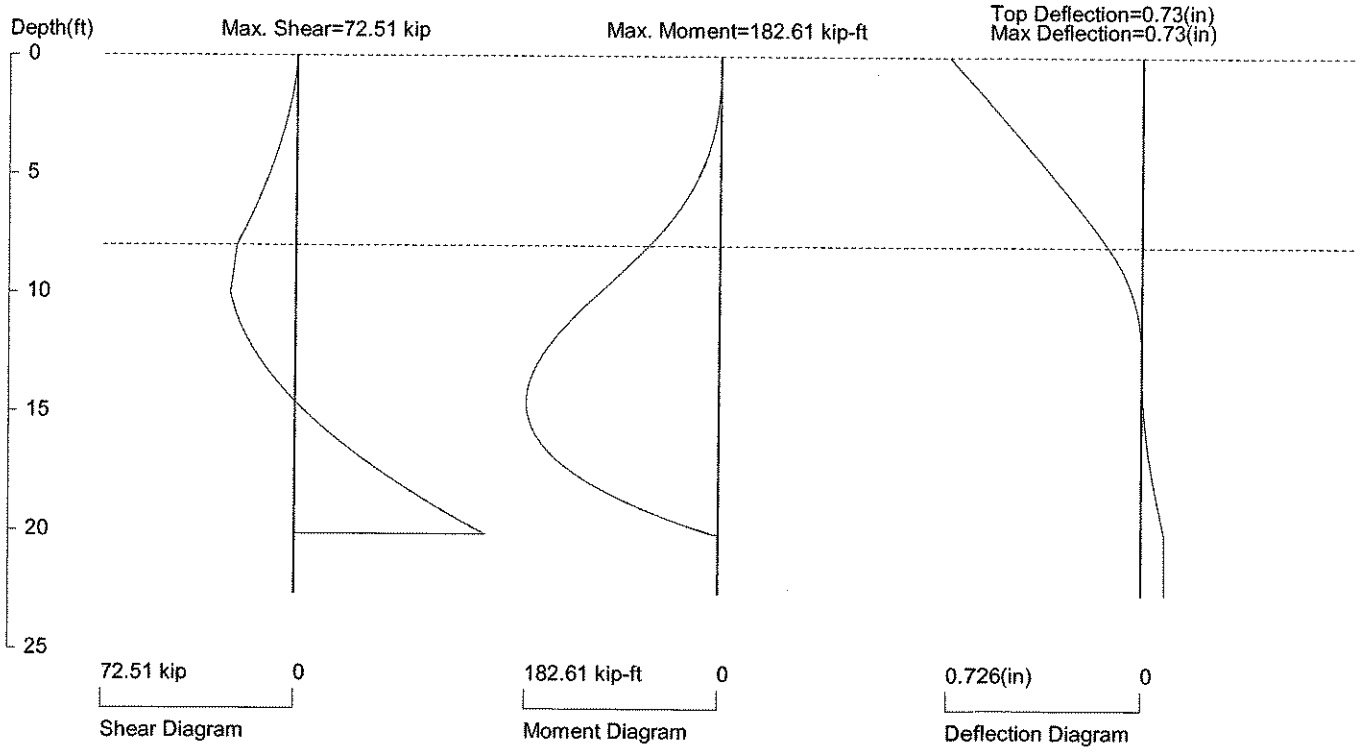
Yuan Residence
East wall of driveway





PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 8.0 foot or meter

User Input Pile, w16x45: E (ksi)=29000.0, I (in4)/pile=586.0

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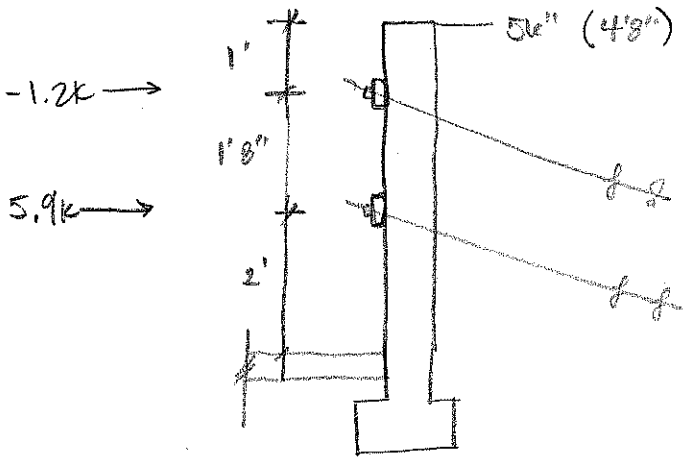
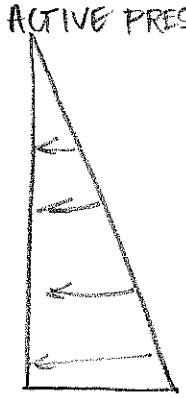
HELICAL ANCHER DESIGN





P = 55 pcf (4'8")
= 254 psf
S = 8' OC
254 psf (8') = 2k/LF

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STRUCTURAL ENGINEERING

PROJECT

DATE

PROJ. #

DESIGN

SHEET