DESIGN & B&T ENGINEERING

City of Puyallup
Building
ACCEPTED
JMontgomery
02/08/2023
3:32:54 PM

STRUCTURAL CALCULATIONS
FOR
THE LOCKWOOD RESIDENCE RETAINING WALL
3305 S FRUITLAND AVE
PUYALLUP, WA 98373

December 30, 2022

BUILDER:
FULL TILT CONSTRUCTION
10751 A Street South
Tacoma, WA 98444
CONTACT: PAUL LOCKWOOD
(425) 533-7315

THE APPROVED CONSTRUCTION PLANS, DOCUMENTS AND ALL ENGINEERING MUST BE POSTED ON THE JOB AT ALL INSPECTIONS IN A VISIBLE AND READILY ACCESSIBLE LOCATION.

FULL SIZED LEDGIBLE COLOR PLANS ARE REQUIRED TO BE PROVIDED BY THE PERMITEE ON SITE FOR INSPECTION

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LOCKWOOD RETAINING WALL

BUILDING CODES:

2018 IBC
ASCE7-16

GRAVITY LOADS:

Roof :

COMPOSITION ROOFING	2.5	PSF
3/4" PLYWOOD	2.7	PSF
FRAMING @ 24"o.c.	3.0	PSF
INSULATION	2.0	PSF
GYPBOARD CEILING	2.8	PSF
MECH & ELEC	1.0	PSF
SPRINKLERS	0.0	PSF
SOLAR PANELS	0.0	PSF
MISC.	1.0	PSF
TOTAL DL =	15	PSF
x Slope factor =	16	PSF
TOTAL LL [SNOW - min] =	25	PSF
TOTAL Roof DESIGN LOAD =	41	PSF

ROOF SLOPES: 5 : 12

RISE =	5
RUN =	12
m =	1.083

LD DUR = 115% [FOR WOOD MEMBERS]

Floor :

FINISH	2.0	PSF
3/4" PLYWOOD	3.0	PSF
FRAMING @ 16"o.c.	3.0	PSF
GYPBOARD CEILING	2.8	PSF
SPRINKLERS	0.0	PSF
MECH & ELEC	2.0	PSF
MISC.	2.0	PSF
TOTAL DL =	15	PSF
TOTAL LL =	40	PSF
TOTAL Floor DESIGN LOAD =	55	

LL @ CORRIDORS & EXITS =	100	PSF
WOOD WALL WT =	8	PSF
8" CIP CONC WALL =	100	PSF

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MATERIAL PROPERTIES

FOUNDATION:

qa (psf) =	1,500	soil weight (pcf) =	125
		weight of water (pcf) =	62.4
Lateral soil Loads			
E.F.P. (active - unrestrained) (pcf) =	45	E.F.P. (PASSIVE) =	250
E.F.P. (active - unrestrained, sloped) (pcf) =	50	Coefficient of friction (sliding) =	0.3
E.F.P. (at-rest) (pcf) =	55		
E.F.P. (at-rest, sloped) (pcf) =	60		

6	X "H" added for seismic (walls over 6 feet - active)
6	X "H" added for seismic (walls over 6 feet - at rest)

CONCRETE:

Structural Slabs on Grade fc (psi) =	2,500	weight (pcf) =	150
Retaining Walls & Ftgs fc (psi) =	2,500	t S.O.G. (in) =	4
fs (psi) =	60,000	Ec (psi) =	1.43E+08

STEEL:

WF & WT Shapes - Fy (psi) =	50,000	E (psi) =	29,000,000
HSS Shapes - Fy (psi) =	46,000		
Channels & Angles - Fy (psi) =	36,000		
Pipes - Fy (psi) =	36,000		

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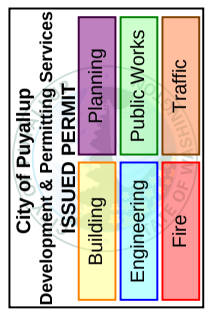

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LOCKWOOD RETAINING WALL

Concrete Retaining Wall
SHEET: 1 OF 2
12/30/2022

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WALL CRITERIA

SECTION G/S3.1 ON STRUCTURAL PLANS

WALL THICKNESS (in) =	8
MAXIMUM WALL HEIGHT (ft) =	6.00
MAXIMUM HEIGHT OF RETAINAGE (ft) =	6.00
WIDTH OF TOE (ft) =	1.17
WIDTH OF FOOTING (ft) =	3.00
TOP OF FTG BELOW GRD (in) =	6
DEPTH OF FOOTING (in) =	12
DEPTH OF KEY (in) =	0
WALL RESTRAINED @ TOP?	NO
WALL RESTRAINED @ GRADE?	YES
INCLUDE SEISMIC?	YES

T.W. Roof (ft) =	9.25
T.W. Floor (ft) =	6

MAX % Restraint @ Backfill =	0.0%
FORCE (PLF) =	0

LOADING CRITERIA

Total DL (plf) =	239
Total LL (plf) =	381
Additional Load (plf) =	150
Total Load (plf) =	770
RETAINED MATERIAL (Sloped or Level?)	Level
Depth of soil to neglect at bottom of wall for passive resistance (ft) =	0.0
Depth of neglected soil to use for passive surcharge (ft) =	0.0
TRAFFIC SURCHARGE (PSF) =	0

STABILITY CALCULATIONS

WEIGHT OF WALL (plf) =	600	Xw (ft) =	1.50
WEIGHT OF SOIL ON HEEL (plf) =	945	Xs (ft) =	2.42
WEIGHT OF FOOTING (plf) =	450	Xf (ft) =	1.50
SUPERIMPOSED DL (plf) =	239	Xd (ft) =	1.50

OVERTURNING MOMENT (K-ft) =	2.27
RESISTING MOMENT (K-ft) =	4.22
SLIDING LOAD (plf) =	N.A.
RESISTING LOAD (plf) =	N.A.

BEARING CALCULATIONS

TOTAL LOAD ON WALL (K) =	2.62
M ABOUT CL OF WALL (K-ft) =	1.40
ECCENTRICITY (ft) =	0.53
B/6 (ft) =	0.50

e > B/6, THEREFORE Q =	2P/3aB
Q (KSF) =	1.81

RESULTS FOR SLIDING, OVERTURNING, & BEARING:

	TARGET	ACTUAL	
F.S. SLIDING =	1.25	1.50	*O.K.*
F.S. OVERTURNING =	1.25	1.86	*O.K.*
BEARING (psf) =	2,000	1,805	*O.K.*

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LOCKWOOD RETAINING WALL

WALL DESIGN

MAX % Restraint @ Backfill =	0%	FORCE (PLF) =	0	SHEAR @ BASE OF WALL DURING BACKFILL:
MAX % Restraint @ Rest =	0%	FORCE (PLF) =	0	Vu= 1,744 PLF
MIN % Restraint @ Rest =	0%	FORCE (PLF) =	0	Ast = 0.004 IN^2/FT

Distance from top of wall "Y" (ft)	Triangular Loading (PCF)	Rect due to schrg (PSF)	Rect Loading due to EQ (PSF)	Bending Moment (K-ft)								Wall Thickness (in)	Min cover (in)	d1 (in)	bar size	spacing (in)	dur-ing back-fill max Mu (K-ft/ft)	at-rest max Mu (K-ft/ft)	phi*Mn (K-ft/ft)	du-ring back-fill Okay for bending?	at-rest Okay for bending?
				During backfill		at-rest [No Restraint]		at-rest													
								0 % Max Restraint		0 % Min Restraint											
	45	0	36	M	Mu	M	Mu	M	Mu	M	Mu										
0.0	0	0	36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	3.75	4.000	4	12	0.00	0.00	3.33	Okay	Okay
0.5	23	0	36	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	8.00	3.75	4.000	4	12	0.00	0.01	3.33	Okay	Okay
1.0	45	0	36	-0.01	-0.01	-0.03	-0.04	-0.03	-0.04	-0.03	-0.04	8.00	3.75	4.000	4	12	-0.01	0.04	3.33	Okay	Okay
1.5	68	0	36	-0.03	-0.04	-0.07	-0.11	-0.07	-0.11	-0.07	-0.11	8.00	3.75	4.000	4	12	-0.04	0.11	3.33	Okay	Okay
2.0	90	0	36	-0.06	-0.10	-0.13	-0.22	-0.13	-0.22	-0.13	-0.22	8.00	3.75	4.000	4	12	-0.10	0.22	3.33	Okay	Okay
2.5	113	0	36	-0.12	-0.20	-0.23	-0.39	-0.23	-0.39	-0.23	-0.39	8.00	3.75	4.000	4	12	-0.20	0.39	3.33	Okay	Okay
3.0	135	0	36	-0.20	-0.34	-0.36	-0.62	-0.36	-0.62	-0.36	-0.62	8.00	3.75	4.000	4	12	-0.34	0.62	3.33	Okay	Okay
3.5	158	0	36	-0.32	-0.55	-0.54	-0.92	-0.54	-0.92	-0.54	-0.92	8.00	3.75	4.000	4	12	-0.55	0.92	3.33	Okay	Okay
4.0	180	0	36	-0.48	-0.82	-0.77	-1.31	-0.77	-1.31	-0.77	-1.31	8.00	3.75	4.000	4	12	-0.82	1.31	3.33	Okay	Okay
4.5	203	0	36	-0.68	-1.16	-1.05	-1.78	-1.05	-1.78	-1.05	-1.78	8.00	3.75	4.000	4	12	-1.16	1.78	3.33	Okay	Okay
5.0	225	0	36	-0.94	-1.59	-1.39	-2.36	-1.39	-2.36	-1.39	-2.36	8.00	3.75	4.000	4	12	-1.59	2.36	3.33	Okay	Okay
5.5	248	0	36	-1.25	-2.12	-1.79	-3.05	-1.79	-3.05	-1.79	-3.05	8.00	3.75	4.000	4	12	-2.12	3.05	3.33	Okay	Okay
6.0	270	0	36	-1.62	-2.75	-2.27	-3.86	-2.27	-3.86	-2.27	-3.86	8.00	1.5	6.250	4	12	-2.75	3.86	5.32	Okay	Okay

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WALL DESIGN

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MAX % Restraint @ Rest =	0%	FORCE (PLF) =	0	Vu= 1,744 PLF
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Dist-ance from top of wall "Y" (ft)	Triang-ular Load-ing (PCF)	Rect due to schrg (PSF)	Rect Load-ing due to EQ (PSF)	Bending Moment (K-ft)								Wall Thick-ness (in)	Min cover (in)	d1 (in)	bar size	spac-ing (in)	dur-ing back-fill max Mu (K-ft/ft)	at-rest max Mu (K-ft/ft)	phi*Mn (K-ft/ft)	du-ring back-fill Okay for bend-ing?	at-rest Okay for bend-ing?
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								0 % Max Restraint		0 % Min Restraint											
	45	0	36	M	Mu	M	Mu	M	Mu	M	Mu										
0.0	0	0	36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	3.6875	4.000	5	15	0.00	0.00	4.10	Okay	Okay
0.5	23	0	36	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	8.00	3.6875	4.000	5	15	0.00	0.01	4.10	Okay	Okay
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3.5	158	0	36	-0.32	-0.55	-0.54	-0.92	-0.54	-0.92	-0.54	-0.92	8.00	3.6875	4.000	5	15	-0.55	0.92	4.10	Okay	Okay
4.0	180	0	36	-0.48	-0.82	-0.77	-1.31	-0.77	-1.31	-0.77	-1.31	8.00	3.6875	4.000	5	15	-0.82	1.31	4.10	Okay	Okay
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5.5	248	0	36	-1.25	-2.12	-1.79	-3.05	-1.79	-3.05	-1.79	-3.05	8.00	3.6875	4.000	5	15	-2.12	3.05	4.10	Okay	Okay
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PROJECT LOCKWOOD WALL SHEET NO. Sh. 1 OF Sh. 1
DESCRIPTION RETAINING WALL DES J.T. DATE 12/30/22
DESIGN CHK JOB NO. 22
3305 S. FRUITLAND AVE.
PUYALLUP, WA 98375

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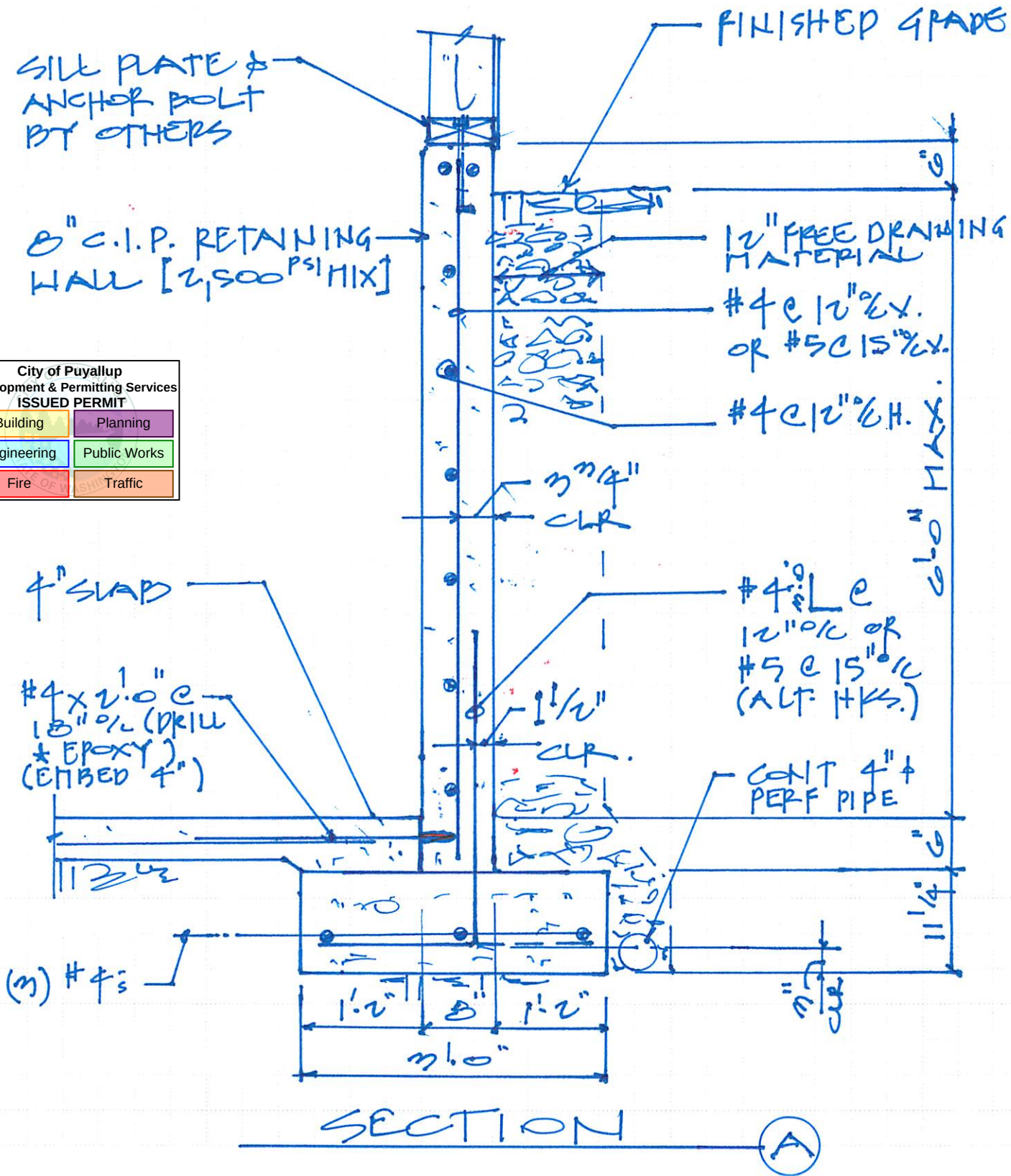

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