Structural Calculations for:

Mangini-Zaborowski Residence

8429 SE 62nd St, Mercer Island

Client: CTA Design Builders, Inc.

Code: 2018 International Building Code

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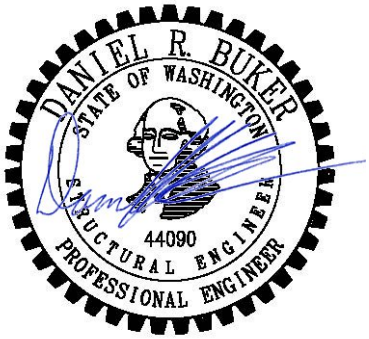
Scope: Structural Design of small addition to existing single family residence

August 5, 2021



Buker Engineering, llc
PO Box 55124
Seattle, WA 98155
Ph: 206.258.6333

Seismic Design Loads (ASCE 7-16)

for a Wood Framed Structure

RISK CATEGORY	II				
OCCUPANCY CAT.	II	Table 1.5-1			
IMP. FACTOR	1	Table 1.5-2			
SITE CLASS	D	Table 20.3-1	SEISMIC		
R =	6.5	Table 12.2-1	DESIGN CATEGORY	D	11.6
S_s =	1.349		T_0 =	0.10	
S_1 =	0.469		Ts =	0.52	
F_a =	1.20	Table 11.4-1	T_L =	6	Fig 22-14
F_v =	1.80	Table 11.4-2	T =	0.21	
S_{DS}=	1.079		Seismic Dead Load:	15 psf	Roof
S_{D1}=	0.563			15 psf	Floor
				20 psf	Walls
Cs_{ULT}=	0.166	Eqn. 12.8-2	W_{roof}=15 + 10=	25 psf	
Cs_{ASD}=	0.119		W_{floor}=10 + 10 + 10=	30 psf	

Vertical Design Loads

Criteria
ASCE 7-16
IBC 2018

Dead Loads

Flooring	1	psf
Sheathing	2.3	psf
Joist	2.6	psf
5/8" GWB	3.1	psf
Misc. Mech	1	psf
	10	psf
Use	15	psf

Live Loads

Snow	25	psf
Deck	60	psf

Soil Bearing

2000 psf

buker ENGINEERING LLC

Project: Wilson-Fashana Deck
2537 1st Ave W
Seattle, WA 98119

Date: 7/19/2021
Design: CRB

C1

Wind Design Loads (ASCE 7-16)

Directional Procedure - Part 1

Exposure	B		Roof Angle =	0	degrees
V=	97	mph	Ground to top of roof	7.625	ft
K_d=	0.85	Table 26.6-1	Bottom of roof to top of roof	0	ft
I=	1		(mean roof height) h=	7.6	ft
G=	0.85	26.11.1			
Ke=	1.00	Table 26.9-1			

K_{zt}= 1.38

Pressure Coefficients from Figure 27.4-1:

Bldg Face	C_p
Windward Wall	0.8
Leeward Wall	-0.5
Windward Roof	0.3
Leeward Roof	-0.6

*Note= Cp values are conservative worst case values

Pressures:	Calculated using ASCE7-16 Ch. 27 (Directional Procedure)					
Ht	K_z	q_z	$P_{ww\ walls}$	$P_{lwwalls}$	Ultimate P_{walls} (psf)	**Allowable P_{walls} (psf)**
0-15	0.57	16.10	10.95	6.84	17.80	**10.68**
15-20	0.62	17.52	11.91	6.84	18.76	**11.25**
20-25	0.66	18.65	12.68	6.84	19.52	**11.71**
25-30	0.7	19.78	13.45	6.84	20.29	**12.18**
30-40	0.76	21.47	14.60	6.84	21.45	**12.87**

$P_{ww\ roof}$	$P_{lw\ roof}$	P_{roof} (psf)	**P_{roof} (psf)**
4.11	8.21	12.32	**7.39**

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Project: Wilson-Fashana Deck
2537 1st Ave W
Seattle, WA 98119

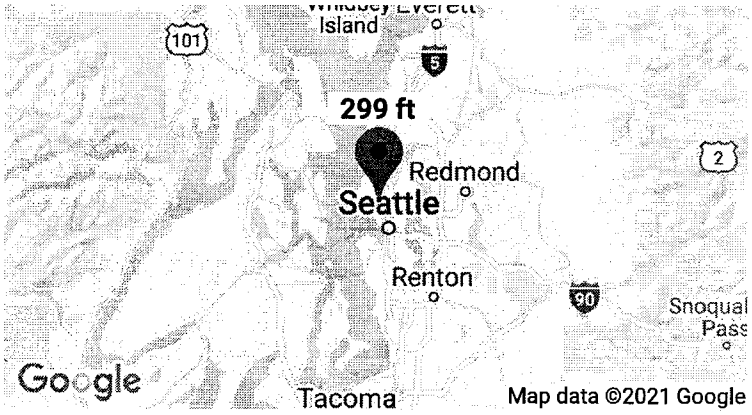
Date: 7/19/2021

Design: CRB

Hazards by Location

Search Information

Address:	2537 1st Ave W, Seattle, WA 98119, USA
Coordinates:	47.6426001, -122.3585478
Elevation:	299 ft
Timestamp:	2021-07-19T17:27:13.054Z
Hazard Type:	Seismic
Reference Document:	ASCE7-16
Risk Category:	II
Site Class:	D-default



Basic Parameters

Name	Value	Description
S_S	1.349	MCE_R ground motion (period=0.2s)
S_1	0.469	MCE_R ground motion (period=1.0s)
S_{MS}	1.618	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	1.079	Numeric seismic design value at 0.2s SA
S_{D1}	* null	Numeric seismic design value at 1.0s SA

* See Section 11.4.8

Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F_a	1.2	Site amplification factor at 0.2s
F_v	* null	Site amplification factor at 1.0s
CR_S	0.908	Coefficient of risk (0.2s)
CR_1	0.896	Coefficient of risk (1.0s)
PGA	0.572	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.687	Site modified peak ground acceleration

Wilson-Fashana Deck

T_L	6	Long-period transition period (s)
SsRT	1.349	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.486	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	2.168	Factored deterministic acceleration value (0.2s)
S1RT	0.469	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.523	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.85	Factored deterministic acceleration value (1.0s)
PGAd	0.749	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

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Deck

Cs = 0.166

Level	Wx (K)	hx (ft)	Wxhx	Cvx	Fx (K)
Deck	4.745	19	90	1.00	**0.6**
Sum	4.745		90	1.0	**0.6**

Allowable Base Shear

Wilson- Fashana Deck

Lateral Analysis

By Inspectron Deck is controlled by seismic loading

$V = 0.6^k$

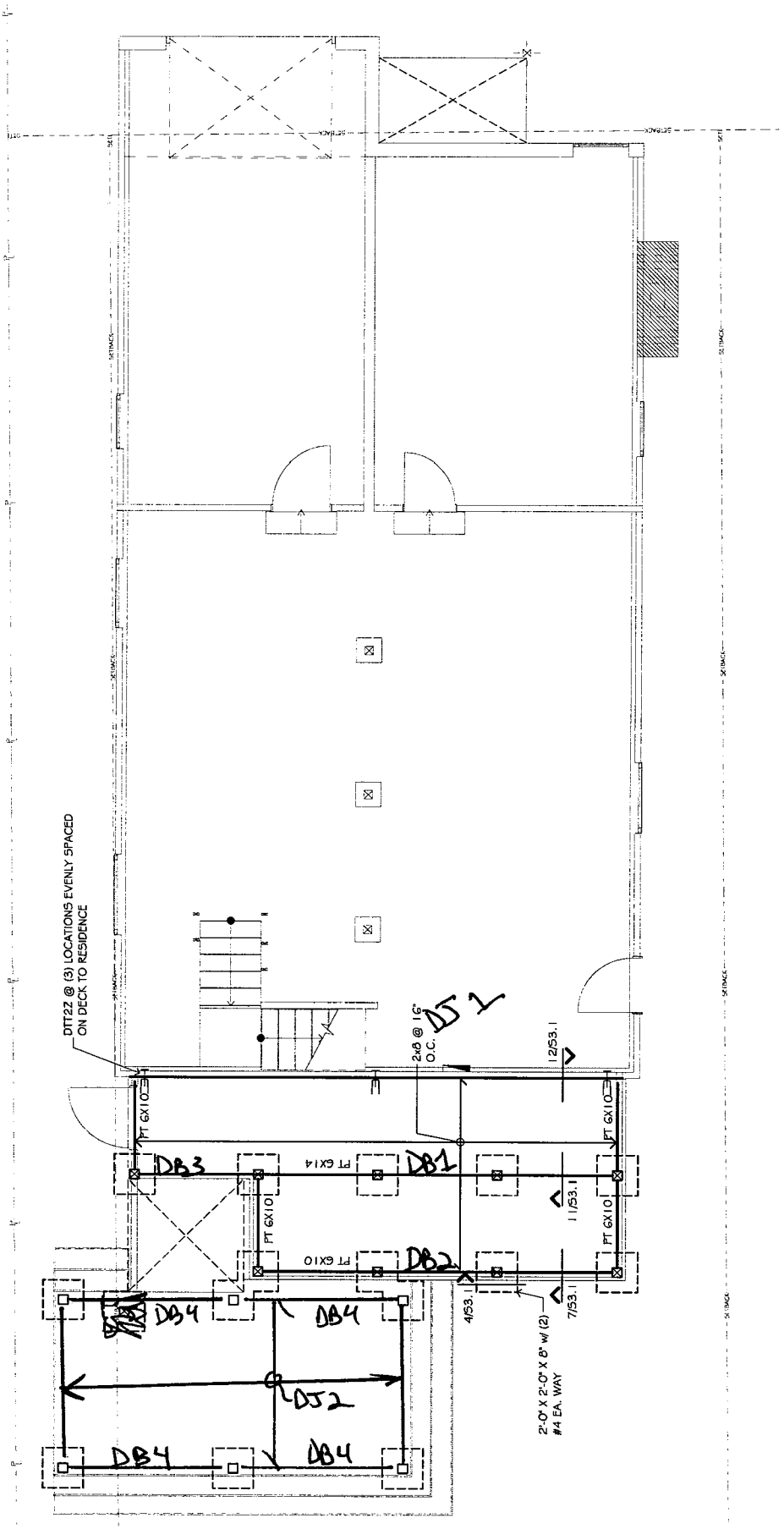
@ Each End of Deck 0.3^k okay w/ DTT2Z connection

or

$$V = \frac{0.6^k(10')}{25'} = 0.24^k$$

∴ Okay w/ (3) DTT2 Evenly spaced @ Deck to House connection

Deck Framing
Key Plan



Wilson-Fashana Deck

F1

Section Properties & Capacities of Sawn Lumber

	b (in)	d (in)	Sx (in^3)	Ix (in^4)
2x4	1.5	3.5	3.06	5.36
2x6	1.5	5.5	7.56	20.80
2x8	1.5	7.25	13.14	47.63
2x10	1.5	9.25	21.39	98.93
2x12	1.5	11.25	31.64	177.98
2x14	1.5	13.25	43.89	290.78
3x4	2.5	3.5	5.10	8.93
3x6	2.5	5.5	12.60	34.66
3x8	2.5	7.25	21.90	79.39
3x10	2.5	9.25	35.65	164.89
3x12	2.5	11.25	52.73	296.63
3x14	2.5	13.25	73.15	484.63
4x4	3.5	3.5	7.15	12.51
4x6	3.5	5.5	17.65	48.53
4x8	3.5	7.25	30.66	111.15
4x10	3.5	9.25	49.91	230.84
4x12	3.5	11.25	73.83	415.28
4x14	3.5	13.25	102.41	678.48
6x6	5.5	5.5	27.73	76.26
6x8	5.5	7.5	51.56	193.36
6x10	5.5	9.5	82.73	392.96
6x12	5.5	11.5	121.23	697.07
6x14	5.5	13.5	167.06	1127.67
6x16	5.5	15.5	220.23	1706.78

	Hem-Fir No. 2		
M(#-ft)	Cd=1.0	Cd=1.15	Cd=1.6
(2)2x4	651	748	1,041
(2)2x6	1,393	1,602	2,228
(2)2x8	2,234	2,569	3,574
(2)2x10	3,333	3,833	5,333
(2)2x12	4,482	5,155	7,172
(2)2x14	5,596	6,435	8,954
	DF-L No. 2		
3x4	574	660	919
3x6	1,229	1,413	1,966
3x8	1,971	2,267	3,154
3x10	2,941	3,382	4,706
3x12	3,955	4,548	6,328
3x14	4,938	5,678	7,900
	DF-L No. 2		
4x4	804	924	1,286
4x6	1,720	1,979	2,753
4x8	2,989	3,438	4,783
4x10	4,492	5,166	7,187
4x12	6,091	7,004	9,745
4x14	7,681	8,833	12,289
	DF-L No. 1		
6x6	3,120	3,587	4,991
6x8	5,801	6,671	9,281
6x10	9,307	10,703	14,891
6x12	13,638	15,684	21,821
6x14	18,550	21,333	29,680
6x16	24,081	27,693	38,530

Deck Joist	DJ1				
L =	6 ft 6 in		Lumber Type =	Hem-Fir #2	
w_{DL} =	15 psf		F_b =	850 psi	
w_{LL}	64 psf		F_v =	150 psi	
Spacing =	16 in o.c.		E =	1,300,000 psi	
Joist Size	2x8		C_D =	1.15	
S =	13.14 in^3		C_r =	1.15	
I =	47.63 in^4		C_F =	1.2	
A =	10.88 in^2		incised	yes	
M =	556 #-ft				
R1 = R2 =	342 #		E' =	1235000 psi	
f_b =	508 psi		F_b' =	1079 psi	**OK**
f_v =	47.2 psi		F_v' =	138 psi	**OK**
Δ_{DL} =	0.014 in	=	L/	5712	
Δ_{LL} =	0.058 in	=	L/	1339	
Δ_{TL} =	0.072 in	=	L/	1085	

Wilson- Fashana Deck

Deck Joist FJ2

L =	8 ft 6 in		Lumber Type =	Hem-Fir #2	
w_{DL} =	15 psf		F_b =	850 psi	
w_{LL} =	64 psf		F_v =	150 psi	
Spacing =	16 in o.c.		E =	1,300,000 psi	
Joist Size	2x8		C_D =	1.15	
S =	13.14 in^3		C_r =	1.15	
I =	47.63 in^4		C_F =	1.2	
A =	10.88 in^2		incised	yes	
M =	951 #-ft				
R1 = R2 =	448 #		E' =	1235000 psi	
f_b =	869 psi		F_b' =	1079 psi	**OK**
f_v =	61.7 psi		F_v' =	138 psi	**OK**
Δ_{DL} =	0.040 in	=	L/	2554	
Δ_{LL} =	0.170 in	=	L/	599	
Δ_{TL} =	0.210 in	=	L/	485	

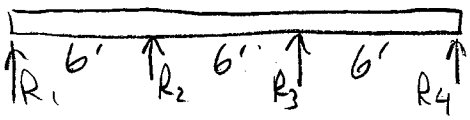
Deck Framing

DL = 15psf
SL = 25psf
LL = 60psf

DB1

PT 6x8

$\ell = 18.0'$



$w = \left(\frac{6.5}{2} + \frac{3.5}{2}\right)(15 + 0.75(60) + 0.75(25)) = 395$plf

$M = 1420^{\#-1}$, $R_1 = 948$ $R_2 = 2610^{\#}$, $R_3 = 2610^{\#}$, $R_4 = 948^{\#}$ ftg: $d = \sqrt{\frac{2610}{5000}} = 1.14$

$f_b = 331$ psi $\leq F'_b = 1240$psi ∴ use 2'□ ftg

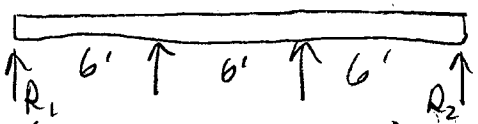
$f_v = 95$ psi $\leq F'_v = 156$psi w/(2) #4 Ea way

$\Delta_{TL} = 0.0197" = \ell/3654$

DB2

PT 4x8

$\ell = 18.0'$



$w = (3.5/2)(15 + 0.75(60) + 0.75(25)) = 140$plf

$M = 504^{\#-1}$, $R_1 = 336^{\#}$ $R_2 = 924^{\#}$ $R_3 = 924^{\#}$ $R_4 = 336^{\#}$

$f_b = 197$psi $\leq F'_b = 828$ psi

$f_v = 60$psi $\leq F'_v = 165$ psi

$\Delta_{TL} = 0.0121" = \ell/5950$

ftg: $d = \sqrt{\frac{924}{5000}} = 0.7$

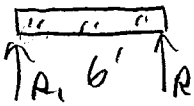
∴ use 2'□ ftg

w/(2) #4 Ea way

DB3

PT 4x8

$\ell = 6'$



$w = 395$plf

$M = 1778^{\#-1}$, $R_1 = R_2 = 1185^{\#}$

$f_b = 696$psi $\leq F'_b = 828$psi

$f_v = 70$psi $\leq F'_v = 165$psi

$\Delta_{TL} = 0.065" = \ell/1111$

ftg: $d = \sqrt{\frac{4839}{5000}} = 1.6$

∴ use 2'□ ftg

w/(2) #4 Ea way

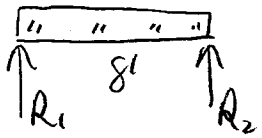
Deck Framing (cont)

DL = 15psf
LL = 60psf
SL = 25psf

DB4

1PT6x8

$\ell = 8'$



$w = (8.5'/2)(15 + 0.75(60) + 0.75(25)) = 335plf$

$M = 2680^{\#-1}$, $R_1 = R_2 = 1340^{\#}$

$f_b = 624psi \leq F'_b = 1240psi$

$f_v = 50psi \leq F'_v = 156psi$

$\Delta_{TL} = 0.0998" = \ell/961$

ftg: $d = \sqrt{2680/800} = 1.16'$

∴ use 2'□ w/(2)#4 Ea. Way

buker ENGINEERING LLC

Wilson-Fashana Deck
Project

Project #
CAB
Designer
Date

F6
Sheet