

**Structural Calculations for Design of deck replacements.**

**Project & Location:**

**Structural Calculations**

**Meridian Firs Apartment Deck Replacement**

2923 S Meridian,  
Puyallup, WA 98373

**Client:**

Meridian Firs, LLC  
Attn: David Dearth  
[dearth@dmcimail.com](mailto:dearth@dmcimail.com)

**Professional Engineer:**

Solutions 4 Structures, Inc  
11605 135<sup>th</sup> St Ct E  
Puyallup, WA 98374  
Attn: Thomas Chase, PE  
[tom@solutions4structures.com](mailto:tom@solutions4structures.com)  
253-314-9822



**Project Number:**

24.049

**Code / Location:**

2021 IBC

**Loads:**

I. Vertical Loads: 12.17.2024

Roof (Ground Snow/live)	NA	PSF
Deck (dead)	10	PSF
Deck (live)	60.0	PSF
Allowable Soil Bearing	1500.0	Code Min


II. Lateral Loads: (NA existing)

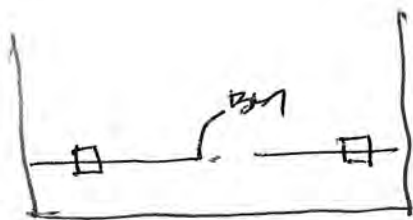
**PRDK20241969**

Calculations required to be provided by the Permittee on site for all inspections

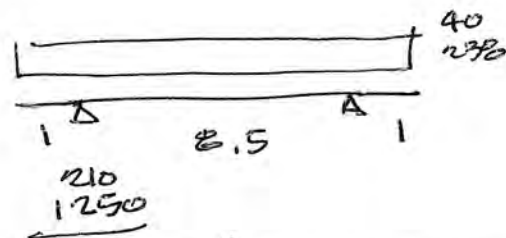
**City of Puyallup**  
**Building**  
**REVIEWED**  
**FOR**  
**COMPLIANCE**

SKinnear  
12/20/2024  
11:34:31 AM

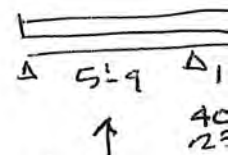




PLAN



∴ 6x8 H.F #2



(E) 2x JOIST  
ok BY W/SPE

$$W = \frac{L^2}{2} > \frac{L^2}{8} \text{ ok}$$

SINGLE DECK



$$5.5 + 3 + 3 = 11.5$$

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$$\frac{1450}{\left(\frac{11.5}{12}\right)^2} = 1590$$

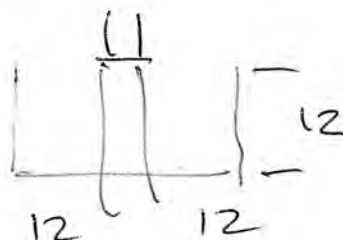
$$\frac{1590}{1500} = 1.06$$

ok  
IF SUAPS 3" + THICK...

DOUBLE DECK

$$(1450)(2)$$

F1.5 18" x 18" x DEPTH FOR FLOST



$$\frac{2900}{\frac{1500}{(2)^2}} = 125 \text{ psf ok}$$

Project: Meridian Firs Apartment Deck replacement

**BENDING MEMBER**

2018 NDS/2021 IBC

**MEMBER LOADING**

Reactions (Maxiur)  $R_L$  8.5 ft span  $R_R$

	D	L	Lr	S	W	E	Total
$R_L$	170	1012	0	0	0	0	1182
$R_R$	170	1012	0	0	0	0	1182

**Uniform (plf)**

ASD

check	$W_x$	Start	End	D	L	Lr	S	W*	E*
OK	$W_1 =$	0	8.5	40	238				
	$W_2 =$								
	$W_3 =$								
	$W_4 =$								
	$W_5 =$								

**Point (lb)**

ASD

check	$P_x$	Start	End	D	L	Lr	S	W*	E*
OK	$P_1 =$	0						0	0
OK	$P_2 =$	0						0	0
OK	$P_3 =$	0						0	0
OK	$P_4 =$	0						0	0
	$P_5 =$								
	$P_6 =$								

**Triangular (plf)**

ASD

check	$T_{XS} / T_{XE}$	Start	End	D	L	Lr	S	W	E*
Not Yet Useable									

**Moment (lb-ft)**

ASD

check	$M_x$	Start	End	D	L	Lr	S	W	E*
Not Yet Useable									

\* W and E is ASD level

- (Eq 16-8) D
- (Eq 16-9) D + L
- (Eq 16-10) D + Lr
- (Eq 16-10) D + S
- (Eq 16-11) D + 0.75(L + Lr)
- (Eq 16-11) D + 0.75(L + S)
- (Eq 16-12) D + W
- (Eq 16-12) D + E
- (Eq 16-13) D + 0.75(W + L + Lr)
- (Eq 16-13) D + 0.75(E + L + Lr)
- (Eq 16-13) D + 0.75(E + L + Lr)
- (Eq 16-13) D + 0.75(E + L + S)
- (Eq 16-14) 0.6D + W
- (Eq 16-15) 0.6D + E

(1) 6 X 8 Hem Fir #2 N.G. ok by inspection

**MEMBER GEOMETRY**

Quantity	1
b (in)	5.5
Custom =	3
d (in)	7.5
Custom =	3.5
A (in <sup>2</sup> )	41.25
S <sub>x</sub> (in <sup>3</sup> )	51.56
I <sub>x</sub> (in <sup>4</sup> )	193.36
Bending X-X axis	

d/b = 1.36

**BRACING COMPRESSION FLANGE**

Full ?	YES
I <sub>y</sub> (in)	102
I <sub>e</sub> (in)	189
R <sub>b</sub>	6.84
Emin' (KSI)	402
COV <sub>E</sub>	0.25
F <sub>b</sub> * (PSI)	575
F <sub>be</sub>	28205
F <sub>be</sub> /F <sub>b</sub> *	49.1
CL	1.0000

Table 3.3.3 conservative  
≤50 (eq. 3.5-5)  
D-4  
Table F1  
=(F<sub>b</sub>\*C<sub>1</sub>\*C<sub>2</sub>\*C<sub>3</sub>\*C<sub>4</sub>\*C<sub>5</sub>)  
F<sub>be</sub> = 1.2\*Emin'/R<sub>b</sub>\*2  
[Eq. 3.3-6]

**MATERIAL PROPERTIES**

Sawn	
Hem Fir	
#2	
F <sub>b</sub> (PSI)	575
F <sub>v</sub> (PSI)	140
E (KSI)	1100

**MEMBER STATUS**

Shear	O.K.	30.7%
V <sub>max</sub> (#)	1182	(Eq 16-9) D + L
f <sub>v</sub> (PSI)	43	1.5VA
F <sub>v</sub> ' (PSI)	140	=(F <sub>v</sub> '*C <sub>1</sub> *C <sub>2</sub> *C <sub>3</sub> *C <sub>4</sub> )
Moment	N.G.	101.6% ok by inspectic
M <sub>max</sub> (#-ft)	2511	(Eq 16-9) D + L
f <sub>b</sub> (PSI)	584	= M/S
F <sub>b</sub> ' (PSI)	575	=(F <sub>b</sub> '*C <sub>1</sub> *C <sub>2</sub> )

**Adjustment Factors**

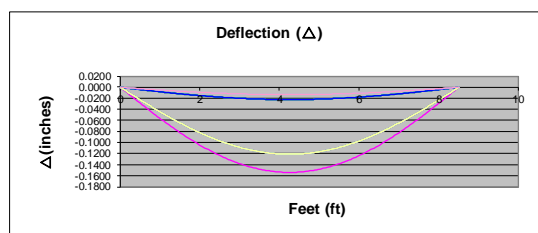
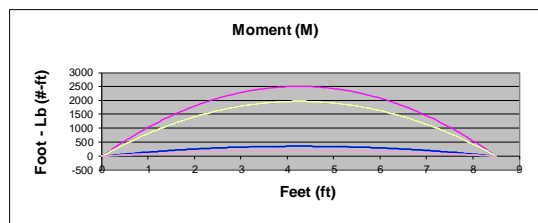
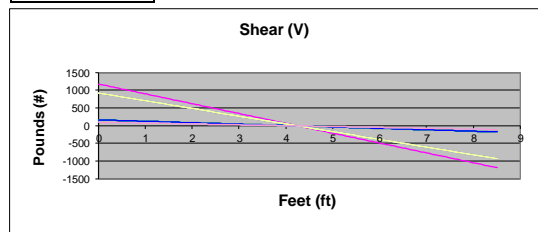
Size: C <sub>F</sub>	1.00
Repetitive?	NO
Cr	1.00
C <sub>TU</sub>	1.00
Incising?	NO
C <sub>i</sub> (Fb)	1.00
C <sub>i</sub> (E)	1.00
Form C <sub>F</sub>	1.00
Temp C <sub>t</sub>	1.00
Wet Service?	NO
C <sub>M</sub> (Fv)	1
C <sub>M</sub> (Fb)	1.00
C <sub>M</sub> (E)	1.00
C <sub>D</sub> (Fv)	1.00
C <sub>D</sub> (Fb)	1.00

(Eq 16-9) D + L  
(Eq 16-9) D + L

**Deflection O.K.**

Include W, E	NO
E' (KSI)	1100
DL (in)	-0.022
Δ <sub>LL</sub>	O.K.
LL (in)	-0.131
L <sub>Live</sub> /	776
LL (allow) /	360
Δ <sub>TL</sub>	O.K.
TL (in)	-0.15
L <sub>Total</sub> /	664
LT (allow) /	240

E'=(E'\*C<sub>M</sub>\*C<sub>t</sub>\*C<sub>i</sub>)  
D  
46.4%  
L  
36.1%  
(Eq 16-9) D + L



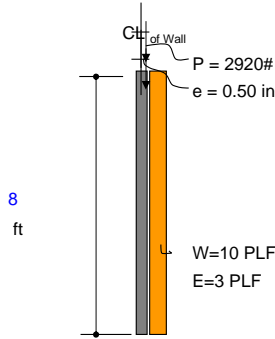
(1) 6 X 8 Hem Fir #2 N.G.

PROJECT: Meridian Firs Apartments Deck Replacement

## STUD WALL DESIGN

Typ deck (including double stacked)

2018 NDS/2018 IBC



AXIAL LOADS P
$P_{DL}$ (#/ft) = 420
$P_{SL}$ (#/ft) = 0
$P_{LL}$ (#/ft) = 2,500
$P_{TOT}$ (#/ft) = 2,920
e (IN) = 0.5
TRIB. (IN) = 12

LATERAL LOADS W
W (PSF) = 20.00
E (PSF) = 5.00
TRIB. (IN) = 6

DESIGN VALUES	
$F_b$ (psi) =	575
$F_v$ (psi) =	140
$F_c$ (psi) =	575
$F_{cL}$ (psi) =	405
E (psi) =	1.10E+06
$E_{min}$ (psi) =	4.00E+05
$L_u$ (in) =	48
c =	0.8
$K_o$ =	1
$C_b$ =	1.07

$F_b$ (psi) = 575	Hem Fir
$F_v$ (psi) = 140	#2
$F_c$ (psi) = 575	Bending X-X axis
$F_{cL}$ (psi) = 405	405
E (psi) = 1.10E+06	Incised, No
$E_{min}$ (psi) = 4.00E+05	Wet Use, No
$L_u$ (in) = 48	Full Bracing, Yes
c = 0.8	(Sawn Lumber)
$K_o$ = 1	(Appendix G)
$C_b$ = 1.07	(Bearing Area Factor)
Bearing wall Fire rated ?	No
Fire Retardant FirePRO?	No
Header Bearing Area (in <sup>2</sup> ) =	63.25

Use: (1) 6" X 6" @ 6" O.C. OK

625 =  $F_{cL}$  (psi)

MEMBER SIZE	SECTION PROPERTIES				
QUANTITY 1	$A = 30.25 \text{ in}^2$				
b = 5.5 in	$S = 27.73 \text{ in}^3$				
d = 5.5 in	$I = 76.26 \text{ in}^4$				
	(Eq. 16-9)	(Eq. 16-10)	(Eq. 16-11)	(Eq. 16-12)	(Eq. 16-13)
<b>LOAD CASES</b>	DL + LL	DL + SL	DL+0.75(LL+SL)	DL + W	DL+0.75(LL+SL+W)
$L_u$ (ft) =	8	8	8	8	8
$V_{applied}$ (#) =	15	2	12	42	42
$M_{applied}$ (ft-#) =	61	9	48	89	109
$P_{applied}$ (#) =	2920	420	2295	420	2295
$C_D$ =	1	1.15	1.15	1.6	1.6
<b>BENDING STRESS CALCS</b>	$F_{bE}$ (psi) = 213592			$C_{DF} = 1$	
$F_b^*$ (psi) =	575	661	661	920	920
$C_L$ =	1	1	1	1	1
$F_b'$ (psi) =	575	661	661	920	920
<b>AXIAL STRESS CALCS</b>	$F_{cE} = 1079$			$C_{CF} = 1$	
$L_e/d$ =	17.45	17.45	17.45	17.45	17.45
$F_c^*$ (psi) =	575	661	661	920	920
$C_P$ =	0.85630919	0.828910674	0.828910674	0.743122182	0.743122182
$F_c'$ (psi) =	492	548	548	684	684
<b>ALLOWABLES</b>	DL + LL	DL + SL	DL+0.75(LL+SL)	DL + W	DL+0.75(LL+SL+W)
$V_{allow}$ (#) =	2823	3247	3247	4517	4517
$M_{allow}$ (ft - #) =	1329	1528	1528	2126	2126
$P_{allow}$ (#) =	14894	16581	16581	20681	20681
$(f_t/F_c)^2 + f_t/(F_b(1-f_t/F_{cE}))$ =	0.09	0.01	0.05	0.04	0.07
$(f_t/F_{cE})^2 + f_t/(F_b(1-f_t/F_{cE}))$ =	0.09	0.01	0.07	0.01	0.07
$P_{c,allow}$ on PL (#) =	13087	13087	13087	13087	13087
$P_{c,allow}$ on Beam (#) =	39531	39531	39531	39531	39531
Deflection L/	NA	NA	NA	L/8738	L/11650
240	0.00	0.00	0.00	0.01	0.01
<b>CHECKS</b>	DL + LL	DL + SL	DL+0.75(LL+SL)	DL + W	DL+0.75(LL+SL+W)
<b>SHEAR V</b>	OK	OK	OK	OK	OK
$V_{applied}/V_{allow}$	0.5%	0.1%	0.4%	0.9%	0.9%
<b>MOMENT M</b>	OK	OK	OK	OK	OK
$M_{applied}/M_{allow}$	4.6%	0.6%	3.1%	4.2%	5.1%
<b>AXIAL P</b>	OK	OK	OK	OK	OK
$P_{applied}/P_{allow}$	19.6%	2.5%	13.8%	2.0%	11.1%
$(f_t/F_c)^2 + f_t/(F_b(1-f_t/F_{cE}))$	OK	OK	OK	OK	OK
$(f_t/F_{cE})^2 + f_t/(F_b(1-f_t/F_{cE}))$	8.9%	0.6%	5.3%	4.3%	6.8%
$(f_t/F_{cE}) + (f_t/F_{bE})^2$	OK	OK	OK	OK	OK
$(f_t/F_{cE}) + (f_t/F_{bE})^2$	8.9%	1.3%	7.0%	1.3%	7.0%
<b>AXIAL P<sub>c</sub> on PL</b>	OK	OK	OK	OK	OK
$P_{c,applied}/P_{c,allow}$	22.3%	3.2%	17.5%	3.2%	17.5%
<b>AXIAL P<sub>c</sub> on Beam</b>	OK	OK	OK	OK	OK
$P_{c,applied}/P_{c,allow}$	7.4%	1.1%	5.8%	1.1%	5.8%
<b>DEFLECTION</b>	OK	OK	OK	OK	OK
$D_{actual}/D_{allowed}$	0.0%	0.0%	0.0%	2.7%	2.1%
<b>Overall Check</b>	OK	OK	OK	OK	OK

(Table 4a Bending)

(Eq. 3.7-1)

(Eq. 3.7-1)

(Table 4.3.1)

(Table 4a Compression)

(3.7.1.4) <50

$L_e = (K_e)L$

(Eq. 3.7-1)

(Eq. 3.7-1)

(Table 4.3.1)

$V_{allow} = A * F_v * C_D / 1.5$

$M_{allow} = S * F_b * C_D * C_F * C_L * C_r$

$P_{allow} = A * F_c * C_D * C_F * C_P$

(Eq. 3.9-3)

(Eq. 3.9-4)

$P_{c,allow} = A * F_c * C_b$

$P_{c,allow} = A * F_c$

$L/(I * E / 15 * L * M_{applied})$

(1.0) \* W Table 1604.3(f)

Actual  $\Delta$