

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
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Professional Engineer:

Solutions 4 Structures, Inc
11605 135th St Ct E
Puyallup, WA 98374
Attn: Thomas Chase, PE
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)

PRDK20241965

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

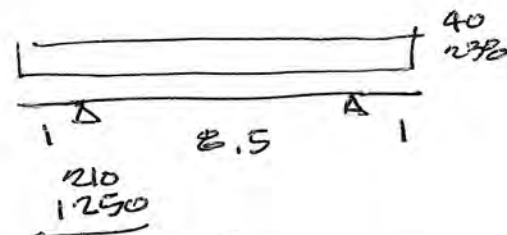
**City of Puyallup
Building
REVIEWED
FOR
COMPLIANCE**

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12/20/2024
10:38:25 AM

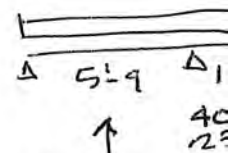




PLAN



$\therefore 6 \times 8$ H.F #2



(E) 2x Joist
ok by WSP

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

SINGLE DECK



$$5.5 + 3 + 3 = 11.5$$

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$$\frac{1450}{\left(\frac{11.5}{12}\right)^2} = 159$$

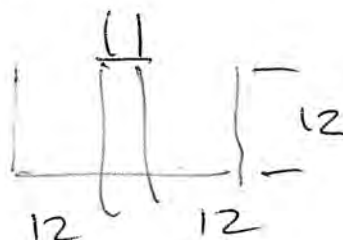
$$\frac{1590}{1500} = 1.06$$

ok
if SUBS 3" +
THICK...

DOUBLE DECK

$$(1450)(2)$$

F1.5 $18'' \times 18'' \times \text{DEPTH FOR FIRST}$



$$\frac{2900}{\frac{1500}{(2)^2}} = 725 \text{ psf}$$

ok.

Project: Meridian Firs Apartment Deck replacement

BENDING MEMBER

2018 NDS/2021 IBC

MEMBER LOADING

Reactions (Maxiur)		8.5 ft span							
		R_L							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)		Start	End	D	L	Lr	S	W*	E*
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)		Start	End	D	L	Lr	S	W*	E*
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)		Start	End	D	L	Lr	S	W	E*
check	T_{XS} / T_{XE}	Start	End	D	L	Lr	S	W	E*
Not Yet Useable									

Moment (lb-ft)		Start	End	D	L	Lr	S	W	E*
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 + 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 ²)	41.25
S_x (in ³)	51.56
I_x (in ⁴)	193.36
Bending X-X axis	

d/b = 1.36

MATERIAL PROPERTIES

Sawn
Hem Fir
#2
F_b (PSI) = 575
F_v (PSI) = 140
E (KSI) = 1100

Adjustment Factors

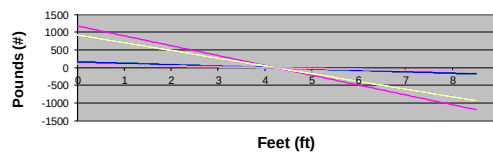
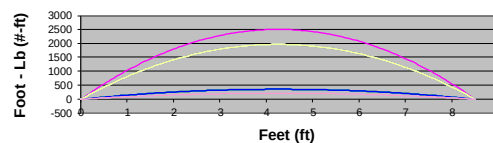
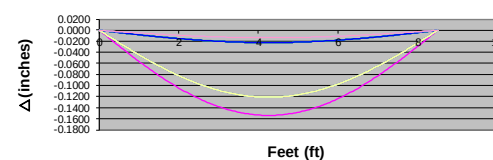
Size: C_F	1.00
Repetitive? NO	N/A
C_r	1.00
C_{fu}	1.00
Incising? NO	N/A
C_i (Fb)	1.00
C_i (E)	1.00
Form C_t	1.00
Temp C_t	1.00
Wet Service? NO	N/A
C_M (Fv)	1
C_M (Fb)	1.00
C_M (E)	1.00
C_D (Fv)	1.00 (Eq 16-9) D + L
C_D (Fb)	1.00 (Eq 16-9) D + L

BRACING COMPRESSION FLANGE

Full ? YES	
I_y (in) = 102	Table 3.3.3 conservative
I_e (in) = 189	≤ 50 (eq. 3.5-5)
R_b = 6.84	D-4
E_{min} (KSI) = 402	Table F1
COV_E = 0.25	$F_{be} = 1.2 * E_{min} / R_b^2$
F_b^* (PSI) = 575	[Eq. 3.3-6]
F_{be} = 28205	
$F_{be} / F_b^* = 49.1$	
CL = 1.0000	

MEMBER STATUS

Shear	O.K.	30.7%
V_{max} (#) = 1182	(Eq 16-9) D + L	
f_v (PSI) = 43	1.5V/A	
F_v^* (PSI) = 140	$= (F_v^* C_D^* C_M^* C_t^* C_i^*)$	
Moment	N.G.	101.6% ok by inspect
M_{max} (#-ft) = 2511	(Eq 16-9) D + L	
f_b (PSI) = 584	= M/S	
F_b^* (PSI) = 575	$= (F_b^* C_D^* C_t^*)$	
Deflection	O.K.	
Include W, E	NO	
E' (KSI) = 1100	$E' = (E^* C_M^* C_t^* C_i^*)$	
DL (in) = -0.022	D	46.4%
Δ_{LL}	O.K.	
LL (in) = -0.131	L	
$L_{Live} /$	776	
LL (allow) /	360	
Δ_{TL}	O.K.	36.1%
TL (in) = -0.15	(Eq 16-9) D + L	
$L_{Total} /$	664	
LT (allow) /	240	

Shear (V)**Moment (M)****Deflection (Δ)**

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



JOB #: 24.049

DESIGNED: TLC

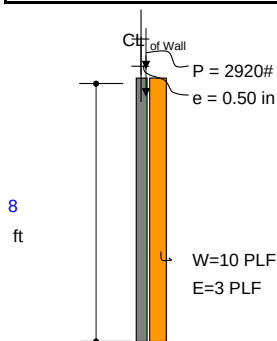
DATE: 12/17/24

PROJECT: Meridian Firs Apartments Deck Replacement

STUD WALL DESIGN

Typ deck (including double stacked)

2018 NDS/2018 IBC

**AXIAL LOADS P**

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

LATERAL LOADS W

$W \text{ (PSF)} = 20.00$
 $E \text{ (PSF)} = 5.00$
 $TRIB. \text{ (IN)} = 6$

DESIGN VALUES

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

Hem Fir
 #2
 Bending X-X axis
 405
 Incised, No
 Wet Use, No
 Full Bracing, Yes
 (Sawn Lumber)
 (Appendix G)
 (Bearing Area Factor)

Bearing wall Fire rated? No
 Fire Retardant FirePRO? No
 Header Bearing Area (in²) = 63.25

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

625 = F_{cL} (psi)

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

63.25

625 = F_{cL} (psi)