

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

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)

PRDK20241968

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

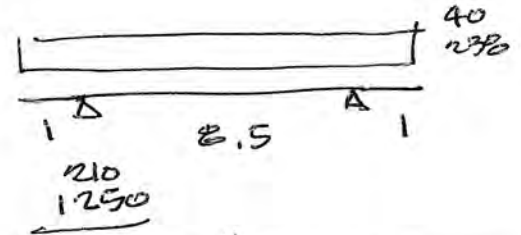
**City of Puyallup
Building
REVIEWED
FOR
COMPLIANCE**

SKinnear
12/20/2024
11:29:52 AM

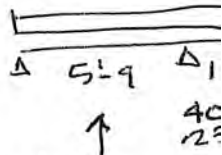




PLAN



6x8 H.F #2



(E) 2x JOIST
OK BY WSP

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

SINGLE DECK



$$5.5 + 3 + 3 = 11.5$$

$$5.5 + 3 + 3 = 11.5$$

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

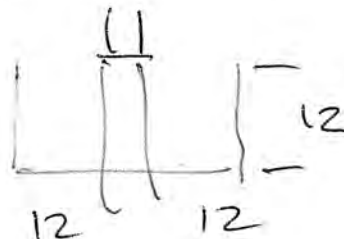
$$\frac{1590}{1500} = 1.06$$

OK
IF SUBS 3" +
THICK...

DOUBLE DECK

$$(1450)(2)$$

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



$$\frac{2900}{1500(2)^2} = 125 \text{ PSF OK}$$

Project: Meridian Firs Apartment Deck replacement

BENDING MEMBER

2018 NDS/2021 IBC

MEMBER LOADING

Reactions (Maxiur)	R_L							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)

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

Moment (lb-ft)

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
C_r	1.00
C_{fu}	1.00
Incising?	NO
C_i (Fb)	1.00
C_i (E)	1.00
Form C_t	1.00
Temp C_t	1.00
Wet Service?	NO
C_M (Fv)	1
C_M (Fb)	1.00
C_M (E)	1.00
C_D (Fv)	1.00
C_D (Fb)	1.00

(Eq 16-9) D + L

(Eq 16-9) D + L

BRACING COMPRESSION FLANGE

Full ?	YES
l_u (in)	102
l_e (in)	189
R_b	6.84
E_{min} (KSI)	402
COV_E	0.25
F_b^* (PSI)	575
F_{be}	28205
F_{be}/F_b^*	49.1
CL	1.0000

Table 3.3.3 conservative

≤50 (eq. 3.5-5)

D-4

Table F1

 $-(F_b^* C_D^* C_M^* C_t^* C_F^* C_i^* C_t^* C_i)$ $F_{be} = 1.2^* E_{min} / R_b^* 2$

[Eq. 3.3-6]

MEMBER STATUS

Shear	O.K.
V_{max} (#)	1182
f_v (PSI)	43
F_v^* (PSI)	140
Moment	N.G.
M_{max} (#-ft)	2511
f_b (PSI)	584
F_b^* (PSI)	575
Deflection	O.K.
Include W, E	NO
E' (KSI)	1100
DL (in)	-0.022
Δ_{LL}	O.K.
LL (in)	-0.131
$L_{Live} /$	776
LL (allow) /	360
Δ_{TL}	O.K.
TL (in)	-0.15
$L_{Total} /$	664
LT (allow) /	240

30.7%

(Eq 16-9) D + L

1.5V/A

 $=(F_v^* C_D^* C_M^* C_t^* C_i^* C_t^* C_i)$

101.6%

ok by inspect

(Eq 16-9) D + L

= M/S

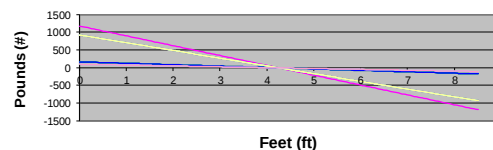
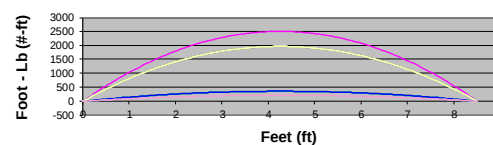
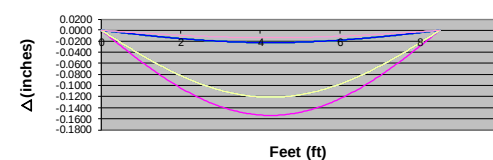
 $=(F_b^* C_D^* C_t^* C_i^* C_t^* C_i)$ $E' = (E^* C_M^* C_t^* C_i^* C_t^* C_i)$

46.4%

L

36.1%

(Eq 16-9) D + L

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

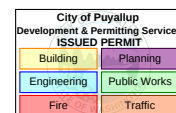
(1) 6 X 8 Hem Fir #2 N.G.



JOB #: 24.049

DESIGNED: TLC

DATE: 12/17/24

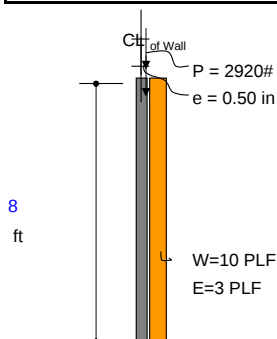


PROJECT: Meridian Firs Apartments Deck Replacement

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

$F_b \text{ (psi)} = 575$ Hem Fir
 $F_v \text{ (psi)} = 140$ #2
 $F_c \text{ (psi)} = 575$ Bending X-X axis
 $F_{cL} \text{ (psi)} = 405$ 405
 $E \text{ (psi)} = 1.10E+06$ Incised, No
 $E_{min} \text{ (psi)} = 4.00E+05$ Wet Use, No
 $L_u \text{ (in)} = 48$ Full Bracing, Yes
 $c = 0.8$ (Sawn Lumber)
 $K_e = 1$ (Appendix G)
 $C_b = 1.07$ (Bearing Area Factor)

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

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

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
$V_{applied} \text{ (#)} =$	15	2	12	42	42
$M_{applied} \text{ (ft-#)} =$	61	9	48	89	109
$P_{applied} \text{ (#)} =$	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)
$V_{allow} \text{ (#)} =$	2823	3247	3247	4517	4517
$M_{allow} \text{ (ft-#)} =$	1329	1528	1528	2126	2126
$P_{allow} \text{ (#)} =$	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
$(f_t/F_{cE})^2 + (f_t/F_{bE})^2 =$	0.09	0.01	0.07	0.01	0.07
$P_{c,allow} \text{ on PL (ft-#)} =$	13087	13087	13087	13087	13087
$P_{c,allow} \text{ on Beam (ft-#)} =$	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
$V_{applied}/V_{allow}$	0.5%	0.1%	0.4%	0.9%	0.9%
MOMENT M	OK	OK	OK	OK	OK
$M_{applied}/M_{allow}$	4.6%	0.6%	3.1%	4.2%	5.1%
AXIAL P	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%
$(f_t/F_{cE})^2 + (f_t/F_{bE})^2 =$	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
$P_{c,applied}/P_{c,allow}$	22.3%	3.2%	17.5%	3.2%	17.5%
AXIAL P_c on Beam	OK	OK	OK	OK	OK
$P_{c,applied}/P_{c,allow}$	7.4%	1.1%	5.8%	1.1%	5.8%
DEFLECTION	OK	OK	OK	OK	OK
$D_{actual}/D_{allowed}$	0.0%	0.0%	0.0%	2.7%	2.1%
Overall Check	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 Δ