

Structural Calculations for Design of deck replacements.

Structural Calculations

Meridian Firs Apartment Deck Replacement

2923 S Meridian,
Puyallup, WA 98373

Project & Location:

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)

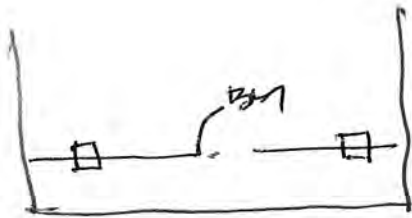
PRDK20241965

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

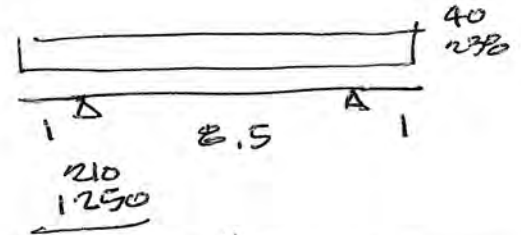
**City of Puyallup
Building
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FOR
COMPLIANCE**

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12/20/2024
10:53:00 AM

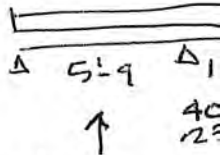
City of Puyallup Development & Permitting Services ISSUED PERMIT	
Building	Planning
Engineering	Public Works
Fire	Traffic



PLAN



∴ 6x8 H.F #2



(E) 2x JOIST
OK BY W/SPE

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

SINGLE DECK



$$5.5 + 3 + 3 = 11.5$$

$$5.5 + 3 + 3 = 11.5$$

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

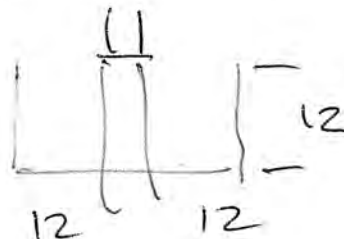
$$\frac{1590}{1500} = 1.06$$

OK
IF SUAPS 3" + THICK...

DOUBLE DECK

$$(1450)(2)$$

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



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

Project: Meridian Firs Apartment Deck replacement

2018 NDS/2021 IBC

BENDING MEMBER

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	$W_1 = 0$	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 + 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

BRACING COMPRESSION FLANGE

Full ?	YES
I _y (in)	102
I _e (in)	189
R _b	6.84
Emin' (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*C₁*C₂*C₃*C₄*C₅)
F_{be} = 1.2*Emin'/R_b*2
[Eq. 3.3-6]

MATERIAL PROPERTIES

Sawn	
Hem Fir	
#2	
F _b (PSI)	575
F _v (PSI)	140
E (KSI)	1100

MEMBER STATUS

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

Adjustment Factors

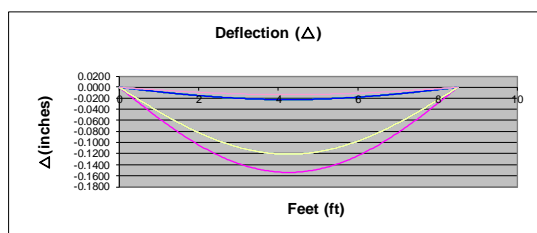
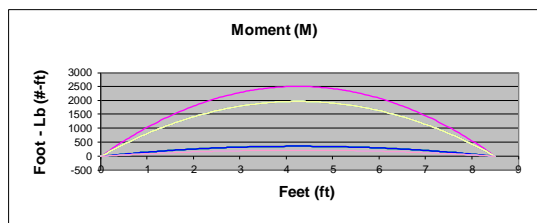
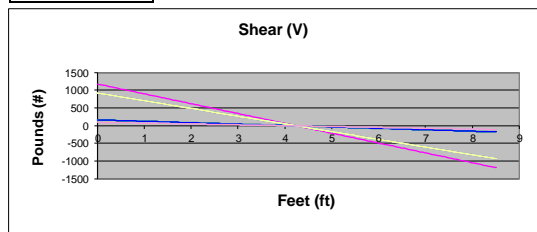
Size: C _F	1.00
Repetitive?	NO
Cr	1.00
C _{TU}	1.00
Incising?	NO
C _I (Fb)	1.00
C _I (E)	1.00
Form C _F	1.00
Temp C _t	1.00
Wet Service?	NO
C _M (Fv)	1
C _M (Fb)	1.00
C _M (E)	1.00
C _D (Fv)	1.00
C _D (Fb)	1.00

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

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

E'=(E'*C₁*C₂*C₃)
D
46.4%
L
36.1%
(Eq 16-9) D + L



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



JOB #: 24.049
 DESIGNED: TLC
 DATE: 12/17/24

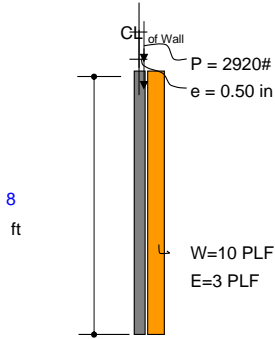
City of Puyallup Development & Permitting Services ISSUED PERMIT	
Building	Planning
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PROJECT: Meridian Firs Apartments Deck Replacement

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 _e =	1
C _b =	1.07

Hem Fir	▼
#2	▼
Bending X-X axis	▼
405	▼
Inced, No	▼
Wet Use, No	▼
Full Bracing, Yes	▼
(Sawn Lumber)	
1 (Appendix G)	
(Bearing Area Factor)	
Bearing wall Fire rated ?	No ▼
Fire Retardant FirePRO?	No ▼
Header Bearing Area (in ²) =	63.25

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

63.25 = F_{cL} (psi)

MEMBER SIZE	SECTION PROPERTIES				
QUANTITY	1				
b =	5.5 in				
d =	5.5 in				
	(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 (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
BENDING STRESS CALCS	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
AXIAL STRESS CALCS	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
ALLOWABLES	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 _v /F _v) ² + f _v /(F _v (1-(f _v /F _{vE}))) =	0.09	0.01	0.05	0.04	0.07
(f _v /F _{vE}) + (f _v /F _{vE}) ² =	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
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 _c /F _c) ² + f _c /(F _c (1-(f _c /F _{cE}))) =	OK	OK	OK	OK	OK
(f _c /F _{cE}) + (f _c /F _{cE}) ² =	8.9%	0.6%	5.3%	4.3%	6.8%
(f _c /F _{cE}) + (f _v /F _{vE}) ² =	OK	OK	OK	OK	OK
(f _c /F _{cE}) + (f _v /F _{vE}) 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