

May 23, 2025

Building Plan Reviewer
City of Mercer Island
9611 SE 36th Street
Mercer Island, WA 98040

RE: Permit #: **2204-191_APPR**
Project Name: **Park Remodel**
Project Address: **8244 SE 30th St. 98040**
Parcel #: 545230-0816

Dear Sirs,

Per the general contractor's request, CS2 has reviewed the structural design revisions for the header in the basement and the ledger beam at the southeast corner of the basement.

Please find attached the design calculations for both the header and the ledger beam, as well as the revised drawings for your reference.

We hope that these responses and revisions meet your satisfaction regarding all related aspects. Should you require any further information, please do not hesitate to contact us at 425-408-2748 or via email at sung.cho@cs2engineers.com.

Respectfully Submitted,



Sung U. Cho, PE
CS2 Engineers
Principal Engineer



5/29/2025

DEMO EXISTING 2x4
WALL AND BUILD NEW
2x6 STUD WALL

NEW 4x10 DF#2
HEADER

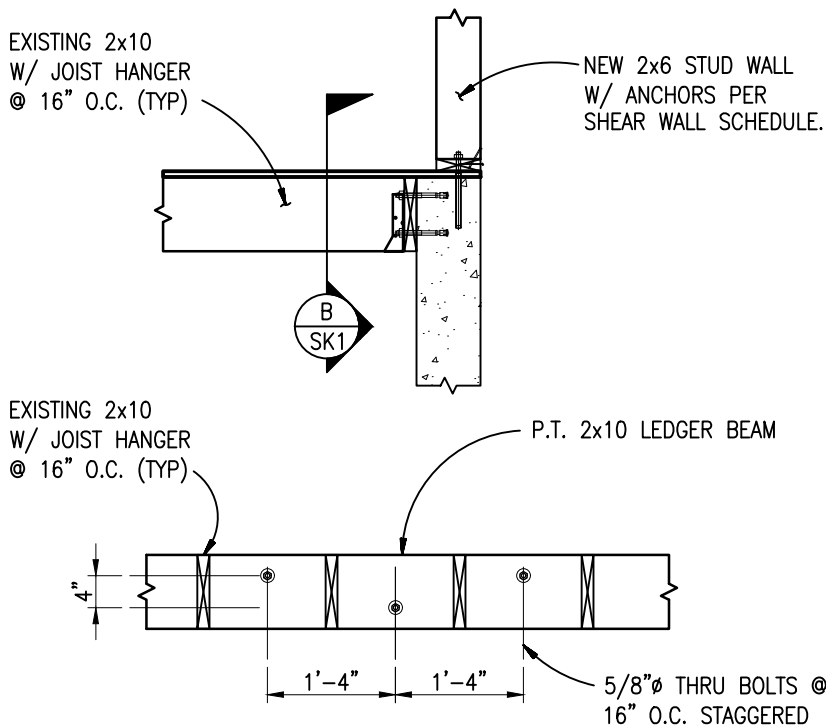
EXISTING 2x4
WALL BEYOND

EXISTING 2x10 FLOOR JOIST. CUT
END TO FIT FOR NEW HEADER &
INSTALL JOIST HANGER "U210" OR
APPROVED EQUAL.

NOTES:

1. SHEATHING IS NOT SHOWN
CLARITY.
2. SEE SHEAR WALL SCHEDULE FOR
SHEATHING & NAILING SCHEDULE.

(A) OPENING SECTION
SK1 SCALE: 3/4" = 1'-0"



(B) LEDGER BEAM SECTION
SK1 SCALE: 3/4" = 1'-0"

PREPARED BY:

CS2 ENGINEERS

Civil & Structural Challenge & Success
Green Design For Our Environment

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info@cs2engineers.com

PREPARED FOR:

8244 SE 30TH ST.
HOUSE REMODEL
MERCER ISLAND, WA

TITLE

DETAIL

SKETCH NO.

SK1

DWN/CHK: SC

ENG/APPR: SC

DATE: 5/29/25

JOB NO. 2207

Wood Beam

Project File: 2207 Mercer Island House Addition.ec6

LIC# : KW-06013944, Build:20.25.05.28

CS2 ENGINEERS

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DESCRIPTION: Opening Header

CODE REFERENCES

Calculations per NDS 2018, IBC 2021

Load Combination Set : IBC 2021

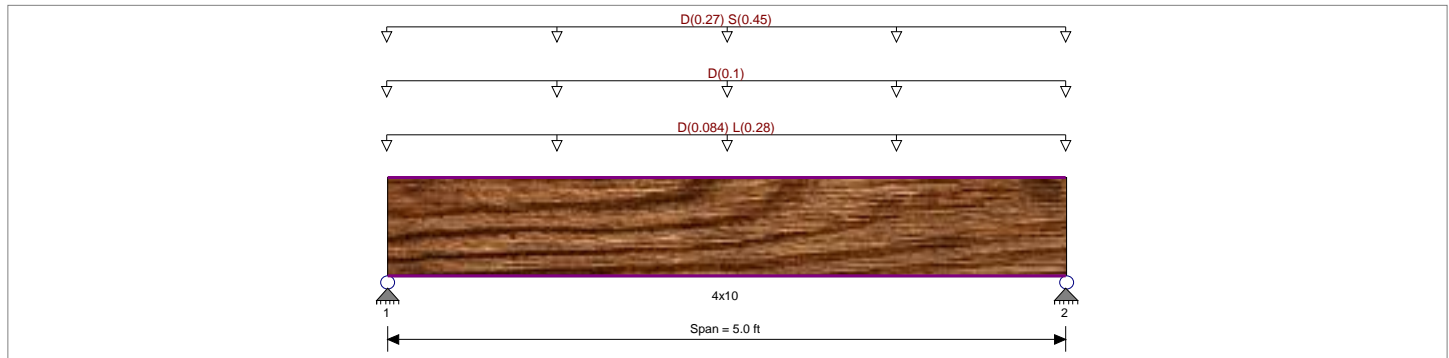
Material Properties

Analysis Method : Allowable Stress Design
Load Combination : IBC 2021

Wood Species : Douglas Fir-Larch
Wood Grade : No.2

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	900.0 psi	E : Modulus of Elasticity	
Fb -	900.0 psi	Ebend- xx	1,600.0ksi
Fc - Prll	1,350.0 psi	Eminbend - xx	580.0ksi
Fc - Perp	625.0 psi		
Fv	180.0 psi		
Ft	575.0 psi	Density	31.210pcf



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added

Uniform Load : D = 0.0120, L = 0.040 ksf, Tributary Width = 7.0 ft, (Floor)

Uniform Load : D = 0.10, Tributary Width = 1.0 ft, (Wall)

Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 18.0 ft, (Roof)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.606 : 1	Maximum Shear Stress Ratio	=	0.389 : 1
Section used for this span		4x10	Section used for this span		4x10
fb: Actual	=	752.46psi	fv: Actual	=	80.44 psi
F'b	=	1,242.00psi	F'v	=	207.00 psi
Load Combination		+D+0.750L+0.750S	Load Combination		+D+0.750L+0.750S
Location of maximum on span	=	2.500ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.017 in	Ratio =	3481 >=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.038 in	Ratio =	1564 >=180	Span: 1 : +D+0.750L+0.750S
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios										Moment Values			Shear Values			
			M	V	CD	CM	C _t	CLx	C _F	C _{fu}	C _i	C _r	M	fb	F'b	V	fv	F'v	
D Only																0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.351	0.225	0.90	1.00	1.00	1.00	1.200	1.00	1.00	1.00	1.42	341.1	972.0	0.79	36.5	162.0	
+D+L																0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.511	0.328	1.00	1.00	1.00	1.00	1.200	1.00	1.00	1.00	2.29	551.5	1,080.0	1.27	59.0	180.0	
+D+S																0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.547	0.351	1.15	1.00	1.00	1.00	1.200	1.00	1.00	1.00	2.83	679.2	1,242.0	1.57	72.6	207.0	
+D+0.750L																0.0	0.00	0.0	0.0

Wood Beam

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DESCRIPTION: Opening Header

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios										Moment Values			Shear Values		
			M	V	CD	CM	C _t	CLx	C _F	C _{fu}	C _i	C _r	M	fb	F'b	V	fv	F'v
Length = 5.0 ft	1	0.370	0.237	1.25	1.00	1.00	1.00	1.200	1.00	1.00	1.00	2.08	498.9	1,350.0	1.15	53.3	225.0	
+D+0.750L+0.750S							1.00	1.00	1.00	1.200	1.00	1.00	1.00	0.0	0.00	0.0	0.0	
Length = 5.0 ft	1	0.606	0.389	1.15	1.00	1.00	1.00	1.200	1.00	1.00	1.00	3.13	752.5	1,242.0	1.74	80.4	207.0	
+0.60D							1.00	1.00	1.00	1.200	1.00	1.00	1.00	0.0	0.00	0.0	0.0	
Length = 5.0 ft	1	0.118	0.076	1.60	1.00	1.00	1.00	1.200	1.00	1.00	1.00	0.85	204.7	1,728.0	0.47	21.9	288.0	

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+0.750L+0.750S	0.0384	2.518		0.0000	0.000

Maximum Deflections for Load Combinations

Load Combination	Span	Max. Downward Defl	Location in Span	Max. Upward Defl	Location in Span
D Only	1	0.0174 in	2.518 ft	0.0000 in	0.000 ft
+D+L	1	0.0281 in	2.518 ft	0.0000 in	0.000 ft
+D+S	1	0.0346 in	2.518 ft	0.0000 in	0.000 ft
+D+0.750L	1	0.0254 in	2.518 ft	0.0000 in	0.000 ft
+D+0.750L+0.750S	1	0.0384 in	2.518 ft	0.0000 in	0.000 ft
+0.60D	1	0.0104 in	2.518 ft	0.0000 in	0.000 ft
L Only	1	0.0107 in	2.518 ft	0.0000 in	0.000 ft
S Only	1	0.0172 in	2.518 ft	0.0000 in	0.000 ft

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	2.504	2.504
Max Upward from Load Combinations	2.504	2.504
Max Upward from Load Cases	1.135	1.135
D Only	1.135	1.135
+D+L	1.835	1.835
+D+S	2.260	2.260
+D+0.750L	1.660	1.660
+D+0.750L+0.750S	2.504	2.504
+0.60D	0.681	0.681
L Only	0.700	0.700
S Only	1.125	1.125

Wood Ledger

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DESCRIPTION: Wood ledger

DESIGN SUMMARY

Design OK

Maximum Ledger Bending

Load Combination . . .	+D+L
Moment	0.04622 ft-lb
fb : Actual Stress	0.02593 psi
Fb : Allowable Stress	850.0 psi
Stress Ratio	.0000310 :1

Maximum Bolt Bearing Summary

Load Combination . . .	+D+L
Max. Vertical Load	0.4160 lbs
Bolt Allow Vertical Load	421.875 lbs
Max. Horizontal Load	0.0 lbs
Bolt Allow Horizontal Load	862.71 lbs

Dowel Bearing Strengths

(for specific gravity & bolt diameter)

Ledger, Perp to Grain	7,500.0 psi
Ledger, Parallel to Grain	7,500.0 psi
Supporting Member, Perp to Gr	2,250.0 psi
Supporting Member, Parallel to Gr	4,800.0 psi

Maximum Ledger Shear

Load Combination . . .	+D+L	Angle of Resultant	90.0 deg
Shear	0.2080 lbs	Diagonal Component	0.4160 lbs
fv : Actual Stress	0.02998 psi	Allow Diagonal Bolt Force	421.875 lbs
Fv : Allowable Stress	100.0 psi	Stress Ratio, Wood @ Bolt	0.000986 :1
Stress Ratio	0.00030 :1		

Allowable Bolt Capacity

Note! Refer to NDS Section 11.3 for Bolt Capacity calculation method.

Governing Load Combination D+L

Resultant Load Angle : Theta = 90.0 deg Ktheta = 1.250 Fe theta = 421.875

Bolt Capacity - Load Perpendicular to Grain

Fem	7,500.0	Fes	2,250.0	Fyb	45,000.0
Re	3.333	Rt	4.0		
k1	3.676	k2	2.0	k3	1.511
Im : Eq 11.3-1	Rd = 5.0	Z =	0.0 lbs		
Is : Eq 11.3-2	Rd = 5.0	Z =	421.875 lbs		
II : Eq 11.3-3	Rd = 4.50	Z =	1,723.28 lbs		
IIIIm : Eq 11.3-4	Rd = 4.0	Z =	1,834.15 lbs		
IIIIs : Eq 11.3-5	Rd = 4.0	Z =	497.917 lbs		
IV : Eq 11.3-6	Rd = 4.0	Z =	703.69 lbs		
min : Basic Design Value =			421.875 lbs		

Bolt Capacity - Load Parallel to Grain

Fem	7,500.0	Fes	4,800.0	Fyb	45,000.0
Re	1.563	Rt	4.0		
k1	1.966	k2	1.303	k3	1.399
Im : Eq 11.3-1	Rd = 4.0	Z =	0.0 lbs		
Is : Eq 11.3-2	Rd = 4.0	Z =	1,125.0 lbs		
II : Eq 11.3-3	Rd = 3.60	Z =	2,457.59 lbs		
IIIIm : Eq 11.3-4	Rd = 3.20	Z =	2,776.38 lbs		
IIIIs : Eq 11.3-5	Rd = 3.20	Z =	862.71 lbs		
IV : Eq 11.3-6	Rd = 3.20	Z =	1,143.85 lbs		
Zmin : Basic Design Value =			862.71 lbs		

Reference design value - Perpendicular to Grain :

$$Z * CM * CD * Ct * Cg * Cdelta = 421.875 \text{ lbs}$$

Reference design value - Parallel to Grain :

$$Z * CM * CD * Ct * Cg * Cdelta = 862.71 \text{ lbs}$$