Structural Calculations for:

Larsen Residence

8557 85th Ave SE, Mercer Island

Client: Ripple Design Studio

Code: 2018 International Building Code

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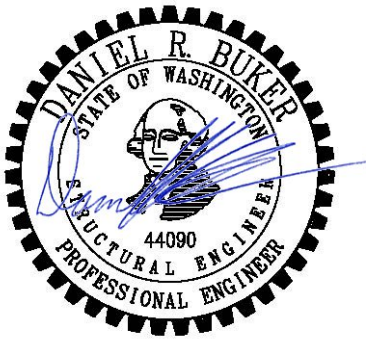
Scope: Structural Design of Renovation to Existing Residence

July 11, 2021



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Roof Framing

DL = 15psf
SL = 25psf

HDR @ Center BRG Line — (2)2x8

$\ell = 3'$, $w = \frac{28'}{2}(40) = 560plf$
$M = 630\#\text{-}'$, $f_b = 288psi$
$R = 840\#$, $f_v = 58psi$
$\Delta_{TL} = 0.01'' = \ell/4369$

BM @ Dormer — 4x10

$\ell = 10'$, $w = \frac{14'}{2}(40) = 280plf$
$M = 3.5k\text{-}'$, $f_b = 841psi$
$R = 1.4k$, $f_v = 65psi$
$\Delta_{TL} = 0.17'' = \ell/704$

2nd BM @ Dormer — 5 1/4x11 7/8 PSL

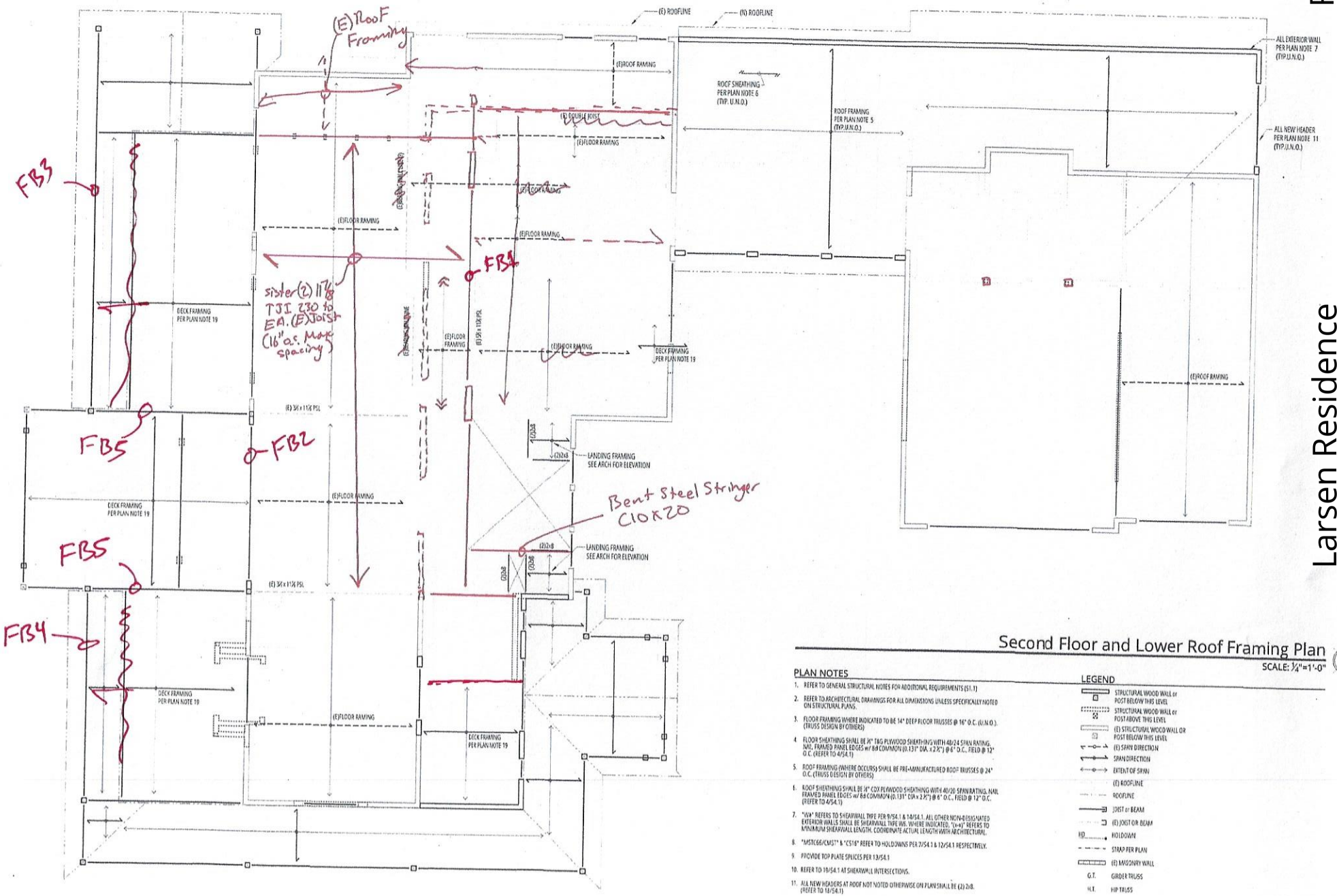
$\ell = 16.5'$, $P = 3.5k @ 5'$
$M = 12.2k\text{-}'$, $f_b = 1190psi$
$R = 2.44k$, $f_v = 58.1psi$
$\Delta_{TL} = 0.31'' = \ell/639$

Garage Ridge — 5 1/2x18 GLB

$\ell = 24'$, $w = \frac{21'}{2}(40) = 420plf$
$M = 30.24k\text{-}'$, $f_b = 1222psi$
$R = 5.04k$, $f_v = 76psi$
$\Delta_{TL} = 0.65'' = \ell/442$

Garage Ridge Support BM — 5 1/4x11 7/8 PSL

$\ell = 8'$, $P = \frac{34'}{2}(\frac{21'}{2})(40) = 7.14k$
$M = 14.3k\text{-}'$, $f_b = 1390psi$
$R = 3.57k$, $f_v = 85.9psi$
$\Delta_{TL} = 0.1'' = \ell/9600$



Second Floor and Lower Roof Framing Plan

SCALE: ¼"=1'-0"

PLAN NOTES

1. REFER TO GENERAL STRUCTURAL NOTES FOR ADDITIONAL REQUIREMENTS (S1.1)
2. REFER TO ARCHITECTURAL DRAWINGS FOR ALL DIMENSIONS UNLESS SPECIFICALLY NOTED ON STRUCTURAL PLANS.
3. FLOOR FRAMING WHERE INDICATED TO BE 14" DEEP FLOOR TRUSSES @ 16" O.C. (U.N.O.). (TRUSS DESIGN BY OTHERS)
4. FLOOR SHEATHING SHALL BE ¾" TAG PLYWOOD SHEATHING WITH 48/24 SPAN RATING, NAIL FRAMED PANEL EDGES w/ 8d COMMON (0.131" DIA. x 2½") @ 6" O.C., FIELD @ 12" O.C. (REFER TO 4/S4.1)
5. ROOF FRAMING (WHERE OCCURS) SHALL BE PRE-MANUFACTURED ROOF TRUSSES @ 24" O.C. (TRUSS DESIGN BY OTHERS)
6. ROOF SHEATHING SHALL BE ½" CDX PLYWOOD SHEATHING WITH 40/20 SPAN RATING, NAIL FRAMED PANEL EDGES w/ 8d COMMON (0.131" DIA x 2½") @ 6" O.C., FIELD @ 12" O.C. (REFER TO 4/S4.1)
7. "WA" REFERS TO SHEARWALL TYPE PER 9/S4.1 & 10/S4.1. ALL OTHER NON-DESIGNATED EXTERIOR WALLS SHALL BE SHEARWALL TYPE WS. WHERE INDICATED, "(x+x)" REFERS TO MINIMUM SHEARWALL LENGTH. COORDINATE ACTUAL LENGTH WITH ARCHITECTURAL.
8. "MSTC66/CMST" & "CS16" REFER TO HOLDOWNS PER 7/S4.1 & 12/S4.1 RESPECTIVELY.
9. PROVIDE TOP PLATE SPLICES PER 13/S4.1
10. REFER TO 10/S4.1 AT SHEARWALL INTERSECTIONS.
11. ALL NEW HEADERS AT ROOF NOT NOTED OTHERWISE ON PLAN SHALL BE (2) 2x8. (REFER TO 18/S4.1)

LEGEND

- STRUCTURAL WOOD WALL or POST BELOW THIS LEVEL
- STRUCTURAL WOOD WALL or POST ABOVE THIS LEVEL
- (E) STRUCTURAL WOOD WALL OR POST BELOW THIS LEVEL
- (E) SPAN DIRECTION
- SPAN DIRECTION
- EXTENT OF SPAN
- (E) ROOFLINE
- ROOFLINE
- JOIST or BEAM
- (E) JOIST OR BEAM
- HD — HOLDOWN
- STRAP PER PLAN
- (E) MASONRY WALL
- G.T. GIRDER TRUSS
- H.T. HIP TRUSS

Larsen Residence

Floor Framing

Floor DL = 15psf

Floor LL = 40

Deck DL = 20psf

Deck LL = 60psf

Roof DL = 15psf

Roof SL = 25psf

FB1

5½x24 GLB

$l = 20'$, $w = \frac{40'}{2}(55) + \frac{35'}{2}(40)$

$= 1.8klf$

$M = 90.0k\text{-}'$, $f_b = 2045psi$

$R = 18.0k$, $f_v = 205psi$

$\Delta_{TL} = 0.57'' = l/422$

FB2

5½x18GLB

$l = 15'$, $w = \frac{23'}{2}(55) + \frac{5}{21}(35/2)(40)$

$= 800plf$

$M = 22.5k\text{-}'$, $f_b = 909psi$

$R = 6.0k$, $f_v = 91psi$

$\Delta_{TL} = 0.19'' = 1/950$

FB3

W18x86

$l = 37'$, $w = \frac{15}{2}(80) = 600plf$

$M = 103k\text{-}'$, $R = 11.1k$

$\Delta_{TL} = 0.57' = 1/779$

FB4

5½x18GLB

$l = 20'$ $w = \frac{15'}{2}(60+20) = 600plf$

$M = 30.0k\text{-}'$, $f_b = 1212psi$

$R = 6.0k$, $f_v = 91psi$

$\Delta_{TL} = 0.45'' = l/535$

FB5

5½x18GLB

$l = 15'$, $w = \frac{18'}{2}(80) = 720plf$

$M = 20.25k\text{-}'$, $f_b = 818psi$

$R = 5.4k$, $f_v = 82psi$

$\Delta_{TL} = 0.17'', = l/1056$

Deck Joists - P.T. 2x12 @ 12" o.c. - 15' span						
L =	15 ft 0 in			Lumber Type =	DF-L #2	
w_{DL} =	15 psf			F_b =	900 psi	
w_{LL}	60 psf			F_v =	180 psi	
Spacing =	12 in o.c.			E =	1,600,000 psi	
Joist Size	2x12			C_D =	1	
S =	31.64 in^3			C_r =	1.15	
I =	177.98 in^4			C_F =	1	
A =	16.88 in^2			incised	yes	
M =	2109 #-ft					
R1 = R2 =	563 #			E' =	1520000 psi	
f_b =	800 psi			F_b' =	828 psi	OK
f_v =	50.0 psi			F_v' =	144 psi	OK
Δ_{DL} =	0.063 in	=		L/	2850	
Δ_{LL} =	0.253 in	=		L/	713	
Δ_{TL} =	0.316 in	=		L/	570	

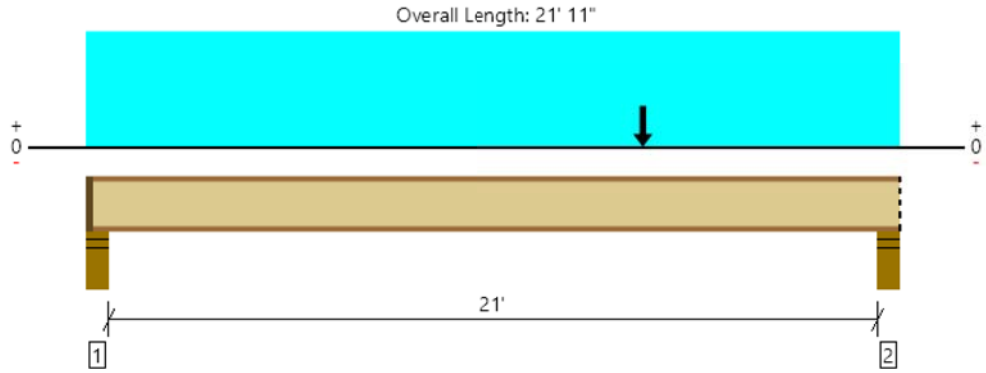
FORTE WEB

MEMBER REPORT

PASSED

2nd, Joist over great room

2 piece(s) 11 7/8" TJI® 230 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1204 @ 21' 6 1/2"	3416 (3.50")	Passed (35%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	1176 @ 21' 5 1/2"	3807	Passed (31%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	6444 @ 15'	9695	Passed (66%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.421 @ 11' 4 9/16"	0.529	Passed (L/603)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.682 @ 11' 5 1/8"	1.058	Passed (L/372)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
TJ-Pro™ Rating	47	45	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Total	
1 - Stud wall - HF	5.50"	3.75"	1.75"	328	584	181	1093	1 3/4" Rim Board
2 - Stud wall - HF	5.50"	5.50"	1.75"	461	584	405	1450	Blocking

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 8" o/c	
Bottom Edge (Lu)	21' 9" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 21' 11"	16"	15.0	40.0	-	Default Load
2 - Point (PLF)	15'	16"	263.0	-	440.0	

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Larsen Residence

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ForteWEB Software Operator	Job Notes
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