



Bickel Residence

Mercer island, WA

Remodeling and Addition to existing Single-Family Residence

Structural Design Calculations Prepared for
John Bickel and BC+J Architecture



December 1, 2022

Bickel Residence

Design Criteria

Mercer island, WA

2018 International building Code/International Residential Code
2016 ASCE 7

Seismic analysis

I = 1.0
Ss= 140%
S1= 49%
Sds= 93%
Sd1= 58%
R = 6.5

Seismic Design Category D

Wind analysis

Wind Speed (V3s) mph 100
Exposure B
Importance Factor I = 1.0
topographic Factor Kzt = 1.00

Live Loads

| | | | |
|--------------------|-------------|--------|--------|
| Roof | 25 psf snow | Office | 50 psf |
| Residential | 40 psf | Garage | 50 psf |
| Stairs / Corridors | 60 psf | | |

Dead Loads

Roof Assmebly

| | |
|----------------------------|-----------------|
| Roofing | 4 psf |
| 1/2" CDX plywood sheathing | 1.4 psf |
| finish ceiling | 2.8 psf |
| Roof Framing @ 24" | 2.5 psf |
| Insulation | 2.0 psf |
| Beams and Framing | 0.5 psf |
| Misc. | 1.0 psf |
| | <u>15.0 psf</u> |

Exterior Light Framed Walls

| | |
|----------------------------|-----------------|
| Siding | 3.5 psf |
| Rainscreen | 0.5 psf |
| GWB finish | 2.5 psf |
| 1/2" CDX plywood sheathing | 1.4 psf |
| 2x6 studs @ 16" o.c. | 1.5 psf |
| Insulation | 1.5 psf |
| Misc | 1.1 psf |
| | <u>12.0 psf</u> |

Typical Floor

| | |
|--------------------------|-----------------|
| Finish Floor | 6.0 psf |
| Finished Ceiling | 2.8 psf |
| 3/4" plywood subfloor | 2.2 psf |
| floor joists at 16" o.c. | 2.5 psf |
| Insulation | 1.5 psf |
| beams & framing | 0.5 psf |
| Misc M&E | 1.0 psf |
| | <u>17.0 psf</u> |

Interior Light Framed Walls

| | |
|--------------------|--------------|
| GWB Finish Ea Side | 5.2 psf |
| 2x4 studs @ 16" oc | 1.1 psf |
| insulation | 1 psf |
| Misc | 0.7 psf |
| | <u>8 psf</u> |

Concrete walls

| | |
|------------------|----------------|
| Finish | 5 psf |
| 8" concrete wall | 95 psf |
| | <u>100 psf</u> |

New Deck

| | |
|---------|----------------|
| Decking | 2.5 psf |
| Framing | 3 psf |
| Misc | 4 psf |
| | <u>9.5 psf</u> |

Soil bearing pressure = 1500 psf
(Assumed)

Use 10 psf

Renovated Building Dimensions

| | |
|------------------|----------|
| Total Height | 20.9 ft |
| Avg. Roof Height | 17.67 ft |
| Length | 27.0 ft |
| Width | 47.3 ft |

Seismic Design

Bickel Residence

International Building Code Section 1613
ASCE7 Chapter 12

Maximum Considered Earthquake Spectral Response Acceleration Parameters

S_s = 140% S_{ds} = 112% F_a = 1.2 ASCE 7-16 11.4.4
 S₁ = 49% S_{d1} = 58% F_v = 1.8

Site Class **D** assumed **MCE**

Section 1613

Design Spectral Response Acceleration Parameters

(IBC 1613.2.1)

5% damped design

Approximate Fundamental Period

$T = C_t(h_n)^x$

(ASCE7 12.8.2.1)
table 12.8-2

Where: C_t = 0.02
 H_n = 17.67
 x = 0.75

T = 0.172 sec

'OK, no increase'

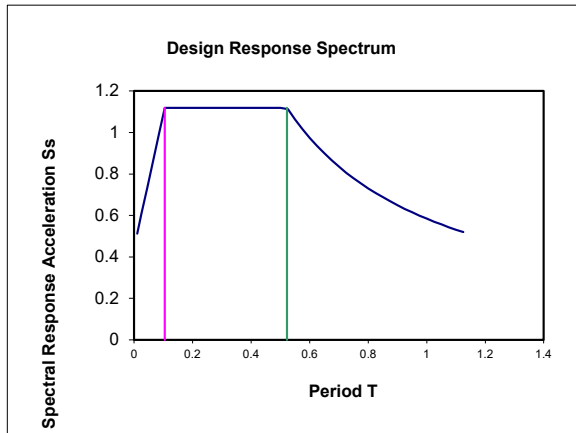
(ASCE 11.4.8)
(ASCE7 11.4.5)

General Resonse Spectrum

T₀ = 0.2 * S_{D1}/S_{DS} = 0.10 sec
 T_s = S_{D1}/S_{DS} = 0.52 sec
 T_L = 6 sec
 figure 22-12

S_a = 5.58501 11.4-5 if T, T₀
 S_a = 1.12 if T₀ < T < T_s
 S_a = 3.39089 11.4-6 if T_s < T < T_L
 S_a = 118.051 11.4-7 if T > T_L

S_a = 1.1192



S_s = 1.119

Importance Factor I = 1
 Seismic Use Group= II

(ASCE-7 Table 9.1.3)

Seismic Design Category D Table 11.6-1
 D Table 11.6-2

(ASCE-7 Table 11.6)

IBC Building Classification: Regular Building

(ASCE7 12.3.2)

Seismic Design

Bickel Residence

Equivalent Lateral Force Procedure (ASCE 7 section 12.8)

Requirements to use the Equivalent Lateral Force Procedure:

Regular Building

$T < 3.5 T_s$ okay

Building Type

Building Bearing Wall System, Light framed walls sheathed with wood structural panels.

$R = 6.5$ $W_o = 2.5$ $C_d = 4$ (ASCE7 Table 12.2.1)

Seismic Base Shear

$V = C_s W$ (ASCE7 Eq 12.8-1)

$C_s = \frac{S_{DS}}{R/I}$ $C_s = 0.172$ (ASCE7 Eq 12.8-2)

but need not be greater than,

$C_s = \frac{S_{D1}}{T(R/I)}$ For $T < T_L = 0.522$ (ASCE7 Eq 12.8-3)

$C_s = \frac{S_{D1} T_L}{T^2(R/I)}$ For $T > T_L = 18.162$ (ASCE7 Eq 12.8-4)

$C_s \text{ max} = 0.522$

but shall not be less than:

$C_s = .044 * S_{bs} / (R/I_e)$ $C_s \text{ min} = 0.0003$

$C_s = 0.5 * S_{d1} / (R/I_e)$

Therefore: $C_s = 0.172 W$

Total W = **68.9** kips

$V = 11.87$ kips

Redundancy Factor

$E = \rho E_h + E_v$ (ASCE7 EQ 12.3.4)

where $\rho = 1.3$ unless criteria of table 12.3-3 are met for SDC D,E,F

$\rho = 1.0$ for Seismic Design Categories A,B,C

$\rho = 1.30$

Therefore:

E = 15.43 kips

Building Weight

| | |
|----------------|------------------------|
| Roof = 15 psf | Roof 28.60 k |
| Floor = 17 psf | Upper 40.30 k |
| Walls = 11 psf | 1 0.00 k |
| | Total Building Wt 68.9 |

SEISMIC DISTRIBUTION

$k = 1$

STRENGTH / LRFD

ALLOW. STRESS DESIGN

| level | W (kips) | h^*k (ft) | Wh (kip-ft) | $\frac{Wh}{\Sigma Wh}$ | story shear (kips) | Σ (kips) | story shear (kips) | Σ (kips) |
|-------|-------------|----------------|----------------|------------------------|-----------------------|--------------------|-----------------------|--------------------|
| Roof | 28.6 | 14.5 | 414.7 | 0.55 | 8.45 | 8.45 | 6.04 | 6.04 |
| Upper | 40.3 | 8.5 | 342.6 | 0.45 | 6.98 | 15.43 | 4.99 | 11.02 |
| 1 | 0.0 | 0 | 0.0 | 0.00 | 0.00 | 15.43 | 0.00 | 11.02 |
| | 0 kips | | 0.0 | | | | | |

Lateral Force Summary

| Force | Vb (k) | Controlling force |
|----------|--------|-------------------|
| E/W Wind | 7.3 | --- |
| N/S Wind | 11.7 | --- |
| Seismic | 15.4 | CONTROLS |

Diaphragm Forces and Distribution

Per ASCE 7-10, Section 12.10.1.1

$F_{px} = (\sum F_i / \sum W_i) * W_{px}$ per 12.10.1.1, for internal diaphragm forces $\rho = 1.0$

per ASCE 12.10, $F_{px} \text{ Min} = 0.2 \times S_{Ds} \times I \times W_{px} = 0.22384 W_{px}$
 per ASCE 12.10, $F_{px} \text{ Max} = 0.4 \times S_{Ds} \times I \times W_{px} = 0.44768 W_{px}$

Shear DISTRIBUTION By Level

| level | W (kips) | h (ft) | Wh (kip-ft) | Wh Σ Wh | STRENGTH / LRFD | | ALLOW. STRESS DESIGN | |
|-------|-------------|-----------|----------------|------------|-----------------------|-------------|-----------------------|-------------|
| | | | | | story shear (kips) | Σ (kips) | story shear (kips) | Σ (kips) |
| Roof | 28.6 | 14.5 | 414.7 | 0.55 | 8.45 | 8.45 | 6.04 | 6.04 |
| Upper | 40.3 | 8.5 | 342.6 | 0.45 | 6.98 | 15.43 | 4.99 | 11.02 |
| 1 | 0.0 | 0 | 0.0 | 0.00 | 0.00 | 15.43 | 0.00 | 11.02 |
| | 0 kips | | 0.0 | | | | | |

LRDF Diaphragm Force Distribution

| Level | Wi | Fi | Σ Fi | Σ Wi | Fpx Min | Fpx Max | Fpx Calc | Fpx |
|-------|-------|-----|------|-------|---------|---------|----------|------|
| Roof | 28.60 | 6.5 | 6.5 | 28.63 | 6.40 | 12.80 | 6.49 | 6.49 |
| Upper | 40.30 | 5.4 | 11.9 | 68.93 | 9.02 | 18.04 | 6.94 | 9.02 |
| 1 | 0.00 | 0.0 | 11.9 | 68.93 | 0.00 | 0.00 | 0.00 | 0.00 |

ASD Diaphragm Force Distribution

| Level | Wi | Fi | Σ Fi | Σ Wi | Fpx Min | Fpx Max | Fpx Calc | Fpx |
|-------|-------|-----|------|-------|---------|---------|----------|------|
| Roof | 28.60 | 4.6 | 4.6 | 28.63 | 4.48 | 8.96 | 4.64 | 4.64 |
| Upper | 40.30 | 3.8 | 8.5 | 68.93 | 6.31 | 12.63 | 4.96 | 6.31 |
| 1 | 0.00 | 0.0 | 8.5 | 68.93 | 0.00 | 0.00 | 0.00 | 0.00 |

Typical Diaphragm Capacities:

| | | | |
|--|---------|---|---------|
| 15/32" CDX Plywood with 8d Common Nails spaced at | | 3/4" CDX Plywood with 10d Common Nails spaced at | |
| 6-6-12 unblocke | 180 plf | 6-6-12 unblocked | 215 plf |
| 6-6-12 blocked | 270 | 6-6-12 blocked | 320 |
| 4-6-12 blocked | 385 | 4-6-12 blocked | 425 |
| 2.5-4-12 blocked | 530 | 2.5-4-12 blocked | 640 |
| 2-3-12 blocked | 600 | 2-3-12 3x block | 820 |

Bickel Residence

Wind Analysis Using MWFRS Envelope Procedure - Method 2

for V= 100 mph Exp B

$$P_s = \lambda * I * P_{s30} * K_{zt}$$

$\lambda = 1$
 $I = 1$
 $h = 17.67$
 length= 27.042
 $K_{zt} = 1.00$
 Roof Slope 20 deg
 Width= 47.27

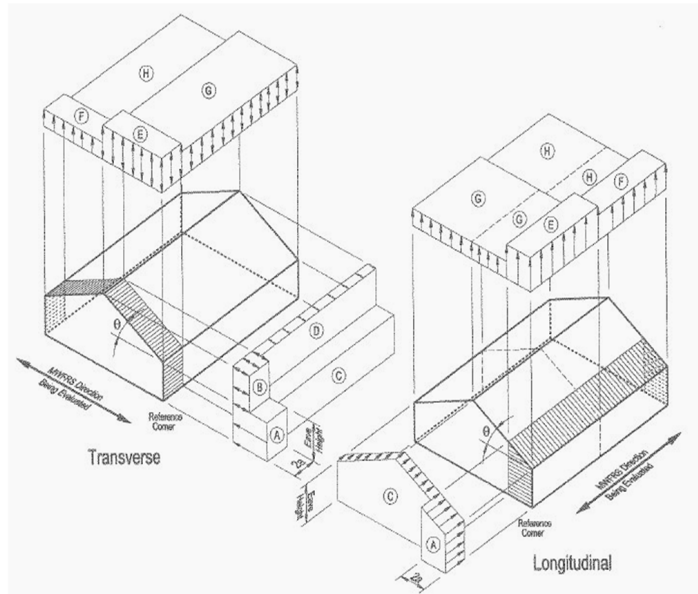
| | | | | | | | | | |
|------------|-------------|------------|-------------|------------|--------------|--------------|--------------|--------------|--------------|
| Ps30 | 26.6 | 7 | 17.7 | 3.9 | -23.1 | -16 | -16 | -12.2 | -25.3 |
| zone | A | B | C | D | E | F | G | H | OH |
| Ps= | 26.6 | 7.0 | 17.7 | 3.9 | -23.1 | -16.0 | -16.0 | -12.2 | -25.3 |

psf
psf

$\alpha = 3$ ft

**Adjustment Factor
for Building Height and Exposure, λ**

| Mean roof height (ft) | Exposure | | |
|-----------------------|----------|------|------|
| | B | C | D |
| 15 | 1.00 | 1.21 | 1.47 |
| 20 | 1.00 | 1.29 | 1.55 |
| 25 | 1.00 | 1.35 | 1.61 |
| 30 | 1.00 | 1.40 | 1.66 |
| 35 | 1.05 | 1.45 | 1.70 |
| 40 | 1.09 | 1.49 | 1.74 |
| 45 | 1.12 | 1.53 | 1.78 |
| 50 | 1.16 | 1.56 | 1.81 |
| 55 | 1.19 | 1.59 | 1.84 |
| 60 | 1.22 | 1.62 | 1.87 |



North-South Wind Load

Roof Wind loading

| Zone | AREA | FORCE | |
|------|--------|-------|-----|
| A | 13.95 | 371 | lbs |
| B | | 0 | lbs |
| C | 205.86 | 3644 | lbs |
| D | | 0 | lbs |

High Roof load = 4.01 kips

Upper floor wind Loading

| Zone | AREA | FORCE | |
|------|--------|-------|-----|
| A | 26.7 | 710 | lbs |
| B | | 0 | lbs |
| C | 394.01 | 6974 | lbs |
| D | | 0 | lbs |

Upper Floor loading = 7.68 kips

Total Wind Load N/S = 11.70 kips

East- West Wind Load

Roof Wind Load

| Zone | AREA | FORCE | |
|------|--------|-------|-----|
| A | 18.75 | 499 | lbs |
| B | 38 | 266 | lbs |
| C | 65.755 | 1164 | lbs |
| D | 171.26 | 668 | lbs |

Roof Wind Load = 2.60 kips

Upper floor wind Loading

| Zone | AREA | FORCE | |
|------|--------|-------|-----|
| A | 44.25 | 1177 | lbs |
| B | | 0 | lbs |
| C | 199.43 | 3530 | lbs |
| D | | 0 | lbs |

Upper Floor loading = 4.71 kips

Total Wind Load E/W = 7.30 kips

ASCE 7-16 Wind Forces Chpt 28, Pt2 & Chpt 30, Pt2

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: Components and Cladding

General Design Values

Calculations per ASCE 7-16

V : Basic Wind Speed per Sect 26.5-1 or 2 **100.0** mph
 User specified minimum design pressu 10.0 psf
 Occupancy per Table 1.5-1 II All Buildings and other structures except those listed
 Exposure Category per 26.7 Exposure B
 Topographic Factor Kzt per 26.8 1.00

"Lambda" is interpolated between height tabular values.

Main Force Resisting System Valu

MRH : Mean Roof Height 17.670 ft
 Roof Rise:Run Ratio 4:12

Component & Cladding Values

Effective Wind Area of Component & Clad 30.610 ft^2
 Roof pitch for cladding pressu Flat/Hip/Gable Roof
 LHD : Least Horizontal Dimension 27.0 ft
 a = max (0.04 * LHD, 3, min(0.10 * LHD, 0.4*MRH)) 3.00 ft

Lambda MWFRS: per Figure 26. 1.00

Lambda Component & Cladding : per Figure 0.86

Design Wind Pressures

Horizontal Pressures . . .

Zone: A = 22.00 psf Zone: C = 14.60 psf
 Zone: B = -10.00 psf Zone: D = -10.00 psf

Vertical Pressures . . .

Zone: E = -19.10 psf Zone: G = -13.30 psf
 Zone: F = -13.30 psf Zone: H = -10.10 psf

Overhangs . . .

Zone: Eoh = -26.70 psf Zone: Goh = -20.90 psf

ASCE 7-16 Section 28.5.4 Minimum Design Wind Loads requires that the load effects of the design wind pressures from Section 28.5.3 shall not be less than a minimum load defined by assuming the pressures, ps, for zones A and C equal to +16 psf, Zones B and D equal to +8 psf, while assuming ps for Zones E, F, G, and H are equal to 0 psf.

Component & Cladding Design Wind Press

*Design Wind Pressure = Lambda * Kzt * Ps30 / pe*

| Roof Pressures | Positive | Negative | Overhang Pressures | Negative |
|----------------|----------|-------------|--------------------|-------------|
| Zone 1 | 10.000 | -22.220 psf | Zone 1 | -21.681 psf |
| Zone 1' | 10.000 | -14.147 psf | Zone 1' | -21.681 psf |
| Zone 2 | 10.000 | -29.381 psf | Zone 2 | -25.961 psf |
| Zone 2e | *** | *** psf | Zone 2e | *** psf |
| Zone 2n | *** | *** psf | Zone 2n | *** psf |
| Zone 2r | *** | *** psf | Zone 2r | *** psf |
| Zone 3 | 10.000 | -38.069 psf | Zone 3 | -34.679 psf |
| Zone 3e | *** | *** psf | Zone 3e | *** psf |
| Zone 3r | *** | *** psf | Zone 3r | *** psf |

Wall Pressures

Wall Zone 4 : 14.413 -15.699 psf
 Wall Zone 5 : 14.413 -18.624 psf

*** : There is no value in Figure 30.4-1 Tabular Values

Bickel Residence

N/S Forces

Roof

| | | |
|----------------|-------|------|
| Story Shear | 8.45 | k |
| Building Width | 50.88 | ft |
| Linear Shear | 0.17 | k/ft |

| Wall Designation | Trib. Width, ft | Line Shear, k | Non Parallel Wall? | Perp. Trib Width, ft | Add'l Load, k | Total Load, k | Total Load, k (ASD) | Note |
|------------------|-----------------|---------------|--------------------|----------------------|---------------|---------------|---------------------|------|
| CC-2 | 7.84 | 1.3 | No | -- | -- | 1.3 | 0.9 | |
| SW-4 | 18.42 | 3.1 | No | -- | -- | 3.1 | 2.1 | |
| SW-5 | 13.64 | 2.3 | No | -- | -- | 2.3 | 1.6 | |
| Total | 39.90 | 6.6 | | | | | | |

Upper Floor/Lower Roof

| | | |
|----------------|-------|------|
| Story Shear | 6.98 | k |
| Building Width | 38.79 | ft |
| Linear Shear | 0.18 | k/ft |

Contribution From New Low Roof

| | | | |
|----------------|-------|------|--------------------------------|
| Story Shear | 1.82 | k | |
| Building Width | 12.08 | ft | Width of Contributing New Roof |
| Linear Shear | 0.15 | k/ft | |

| Wall Designation | Trib. Width, ft | Line Shear, k | Non Parallel Wall? | Perp. Trib Width, ft | Add'l Load, k | Story Total Load, k | Total Load, k | Story Load, k (ASD) | Total Load, k (ASD) | Note |
|------------------|-----------------|---------------|--------------------|----------------------|---------------|---------------------|---------------|---------------------|---------------------|---------------------|
| SW-1 | | 3.9 | No | -- | -- | 3.9 | 3.9 | 2.7 | 2.7 | See hand and printo |
| SW-2 | 18.44 | 3.3 | No | -- | -- | 3.3 | 4.6 | 2.3 | 3.2 | |
| SW-3 | | 7.9 | No | -- | -- | 7.9 | 7.9 | 5.5 | 5.5 | See hand and printo |
| SW-4 | | 3.2 | No | -- | -- | 3.2 | 3.2 | 2.3 | 2.3 | See hand and printo |
| SW-5 | 20.35 | 3.7 | No | -- | -- | 3.7 | 5.9 | 2.6 | 4.2 | |
| Total | | | | | | | 25.5 | | 17.9 | |

E/W Forces

Roof

| | |
|---------------------|-------|
| Story Shear, k | 8.45 |
| Building Length, ft | 27.46 |
| Linear Shear, k/ft | 0.31 |

| Wall Designation | Trib. Width, ft | Line Shear, k | Non Parallel Wall? | Perp. Trib Width, ft | Add'l Load, k | Total Load, k | Total Load, k (ASD) | Note |
|------------------|-----------------|---------------|--------------------|----------------------|---------------|---------------|---------------------|------|
| SW-AR | 9.71 | 3.0 | No | -- | -- | 3.0 | 2.1 | |
| SW-B | 17.75 | 5.5 | No | -- | -- | 5.5 | 3.8 | |
| Total | 27.46 | 8.4 | | | | | | |

Upper Floor

| | |
|---------------------|-------|
| Story Shear, k | 6.98 |
| Building Length, ft | 26.10 |
| Linear Shear, k/ft | 0.27 |

| Wall Designation | Trib. Width, ft | Line Shear, k | Non Parallel Wall? | Perp. Trib Width, ft | Add'l Load, k | Story Total Load, k | Total Load, k | Story Load, k (ASD) | Total Load, k (ASD) | Note |
|------------------|-----------------|---------------|--------------------|----------------------|---------------|---------------------|---------------|---------------------|---------------------|------|
| SW-AU | 10.91 | 2.9 | No | -- | -- | 2.9 | 5.91 | 2.0 | 4.1 | |
| SW-B | 15.20 | 4.1 | No | -- | -- | 4.1 | 9.54 | 2.8 | 6.7 | |
| Total | 26.10 | 7.0 | | | | | 15.45 | | 10.8 | |

UPPER FLOOR DIAPHRAGM DESIGN SHEAR:

N/S:
 $W^* = 9.02K \times 1.25 / 39.34FT \Rightarrow 0.286KLF$
 $0.7 \times 5.34K / (9'-6") = 0.394KLF$

E/W:
 $W^* = 9.02K \times 1.25 / 26FT \Rightarrow 0.434KLF$
 $0.7 \times 4.155K / (15'-6") = 0.188KLF$

FLOOR 3/4" PLYWOOD NAILING PATTERN: 4-6-12 - BLOCKED

*DIAPHRAGM FORCE INCREASED BY 25% DUE TO SYSTEM IRREGULARITIES

UPPER FLOOR/LOWER ROOF LFRS SHEAR:

UPPER FLOOR:
 1.0 KIPS
 LINE FORCES SHOWN ARE UNFACTORED

EXISTING ROOF:
 5.44 KIPS (UNFACTORED)
 $WE = 5.44 KIPS / (30'-1") \Rightarrow 0.1809 KLF$

EXISTING LOW ROOF DIAPHRAGM DESIGN SHEAR:

N/S:
 $W^* = 5.45K \times 1.25 / 30.0FT \Rightarrow 0.23KLF$

AT SW-2 & SW-3:
 $0.7 \times 6.06K / (15'-2") = 0.280KLF$

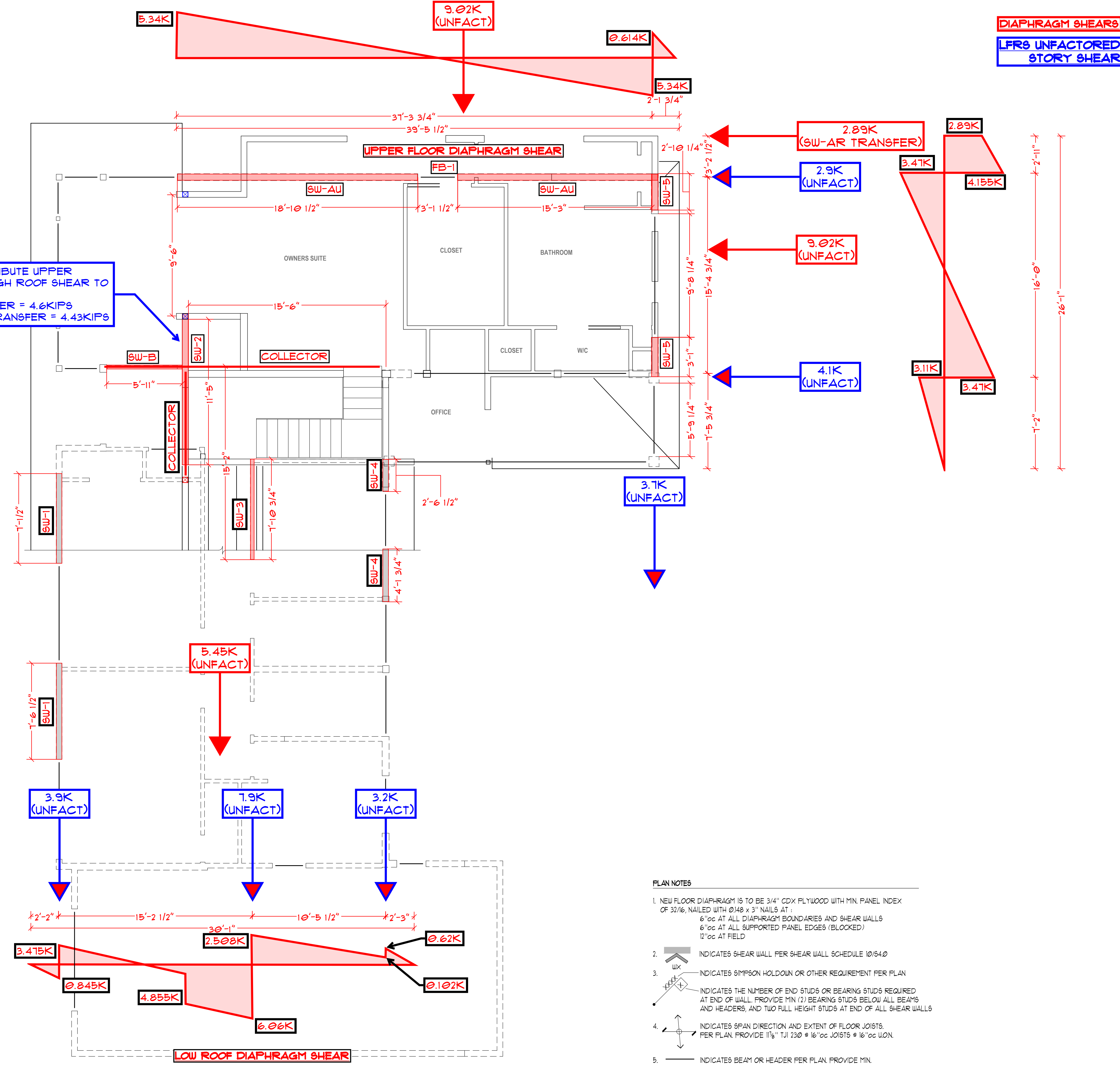
AT SW-1 & SW-4:
 $0.7 \times 3.475K / (14'-7") = 0.167KLF$

*DIAPHRAGM FORCE INCREASED BY 25% DUE TO SYSTEM IRREGULARITIES

SW-2 & SW-3 ROOF 1/2" PLYWOOD NAILING PATTERN:
 4-6-12 - BLOCKED

SW-1 & SW-4 ROOF EXISTING 1/2" PLYWOOD NAILING PATTERN:
 6-6-12 - UNBLOCKED

SHEAR WALL TO DISTRIBUTE UPPER FLOOR SHEAR AND HIGH ROOF SHEAR TO LOW ROOF
 TOTAL LFRS V TRANSFER = 4.6KIPS
 V FOR DIAPHRAGM TRANSFER = 4.43KIPS



- PLAN NOTES**
- NEW FLOOR DIAPHRAGM IS TO BE 3/4" CDX PLYWOOD WITH MIN. PANEL INDEX OF 32/16, NAILED WITH 0/148 x 3" NAILS AT:
 6"oc AT ALL DIAPHRAGM BOUNDARIES AND SHEAR WALLS
 6"oc AT ALL SUPPORTED PANEL EDGES (BLOCKED)
 12"oc AT FIELD
 - INDICATES SHEAR WALL PER SHEAR WALL SCHEDULE 10/640
 - INDICATES SIMPSON HOLDOWN OR OTHER REQUIREMENT PER PLAN
 - INDICATES THE NUMBER OF END STUDS OR BEARING STUDS REQUIRED AT END OF WALL. PROVIDE MIN (2) BEARING STUDS BELOW ALL BEAMS AND HEADERS, AND TWO FULL HEIGHT STUDS AT END OF ALL SHEAR WALLS
 - INDICATES SPAN DIRECTION AND EXTENT OF FLOOR JOISTS. PER PLAN, PROVIDE 1 1/8" TJI 230 @ 16"oc JOISTS @ 16"oc UON.
 - INDICATES BEAM OR HEADER PER PLAN. PROVIDE MIN. w/LSL 1 1/2 x 1 1/8 TYP AT FLOORS. PROVIDE MIN (2) END STUDS TO SUPPORT NEW BEAMS AND HEADERS
 - SEE SHEET S4.0 FOR TYPICAL WOOD FRAMING DETAILS
 - SEE 20/64.0 FOR TYPICAL HANGER SCHEDULE
 - CONTRACTOR SHALL NOT DRILL THRU SHEAR WALL END STUDS OR BEAM SUPPORTS FOR MECHANICAL PENETRATIONS.

1 UPPER FLOOR FRAMING PLAN
 SCALE: 1/4" = 1'-0"
 0 4 8

BICKEL RESIDENCE
 ADDRESS 1
 ADDRESS 2

REVISIONS

| NO. | DATE | DESCRIPTION |
|-----|------|-------------|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

TITLE
 UPPER FLOOR FRAMING PLAN

| | |
|------------|------------|
| DESIGNED | MTS |
| DRAWN | KPH |
| CHECKED | MTS |
| DATE | 11/09/2022 |
| JOB NUMBER | |

SHEET NO.
 S2.2

SDCI REVIEW

NEW ROOF DIAPHRAGM DESIGN SHEAR:

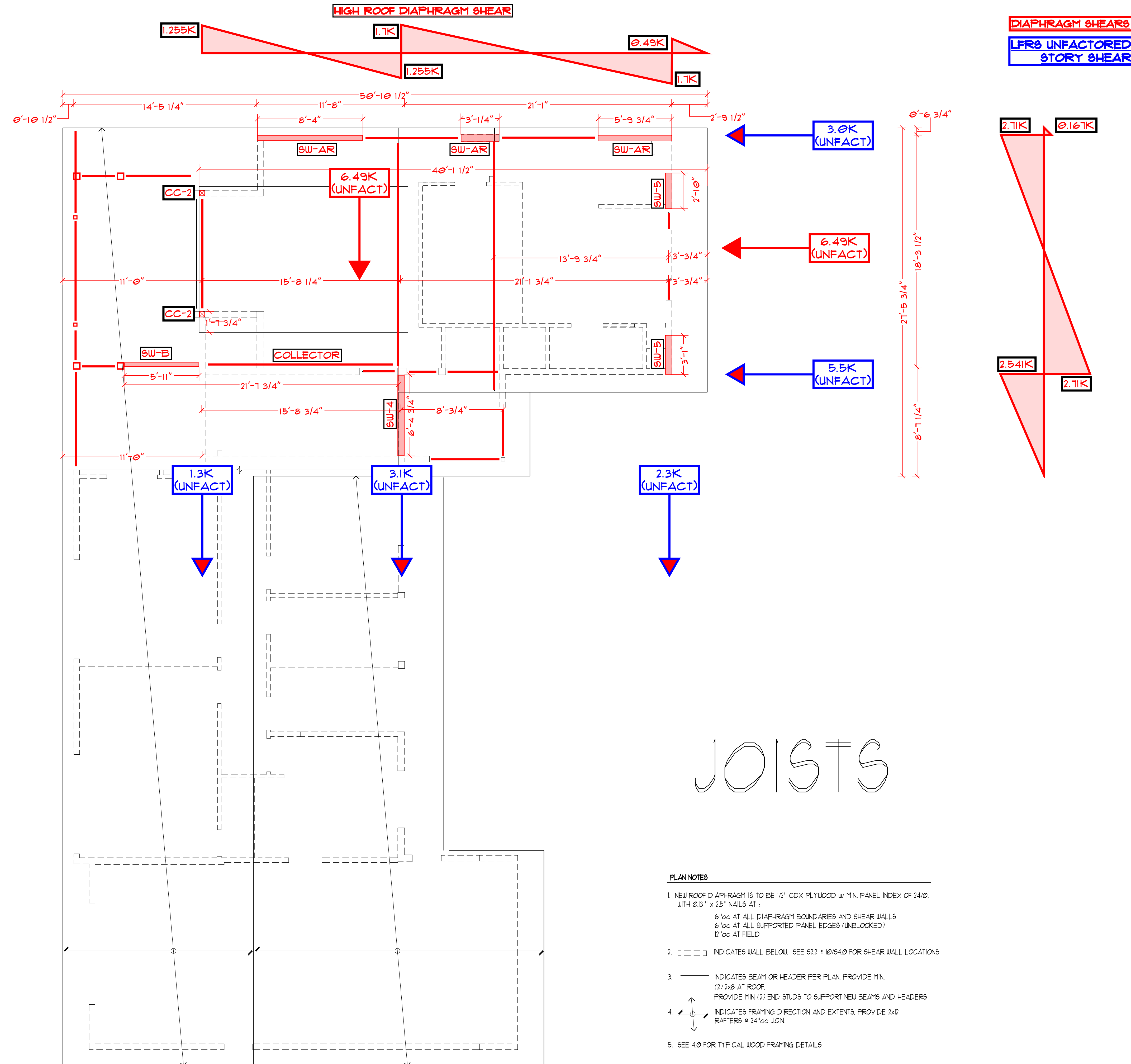
N/S:
 $W^* = 6.49K \times 1.25 / 50.84FT \Rightarrow 0.160KLF$
 $0.1 \times 1.7K / (5'-11") = 0.202KLF$

E/W:
 $W = 6.49K \times 1.25 / (21'-5.75") \Rightarrow 0.296KLF$
 $0.1 \times 2.71K / (21'-7.75") = 0.088KLF$

ROOF 1/2" PLYWOOD NAILING PATTERN: 6-6-12 - BLOCKED

*DIAPHRAGM FORCE INCREASED BY 25% DUE TO SYSTEM IRREGULARITIES

ROOF STORY SHEAR:
 8.45KIPS
 LINE FORCES SHOWN ARE UNFACTORED



JOISTS

- PLAN NOTES**
- NEW ROOF DIAPHRAGM IS TO BE 1/2" CDX PLYWOOD w/ MIN. PANEL INDEX OF 240, WITH 0.131" x 25" NAILS AT:
 6"oc AT ALL DIAPHRAGM BOUNDARIES AND SHEAR WALLS
 6"oc AT ALL SUPPORTED PANEL EDGES (UNBLOCKED)
 12"oc AT FIELD
 - [---] INDICATES WALL BELOW. SEE S22 & 10/1640 FOR SHEAR WALL LOCATIONS
 - INDICATES BEAM OR HEADER PER PLAN. PROVIDE MIN. (2) 2x8 AT ROOF. PROVIDE MIN (2) END STUDS TO SUPPORT NEW BEAMS AND HEADERS
 - ↔ INDICATES FRAMING DIRECTION AND EXTENTS. PROVIDE 2x12 RAFTERS @ 24"oc U.O.N.
 - SEE 4.0 FOR TYPICAL WOOD FRAMING DETAILS

1 ROOF FRAMING PLAN
 SCALE: 1/4" = 1'-0"
 0 4 8

BICKEL RESIDENCE
 ADDRESS 1
 ADDRESS 2

REVISIONS

| NO. | DATE | DESCRIPTION |
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TITLE

ROOF FRAMING PLAN

| | |
|------------|------------|
| DESIGNED | MTS |
| DRAWN | KPH |
| CHECKED | MTS |
| DATE | 11/09/2022 |
| JOB NUMBER | |

SHEET NO.

S2.3

UPPER FLOOR:
 DL = 20 PSF + 10 PSF (PARTITIONS) => 30 PSF
 LL = 40 PSF

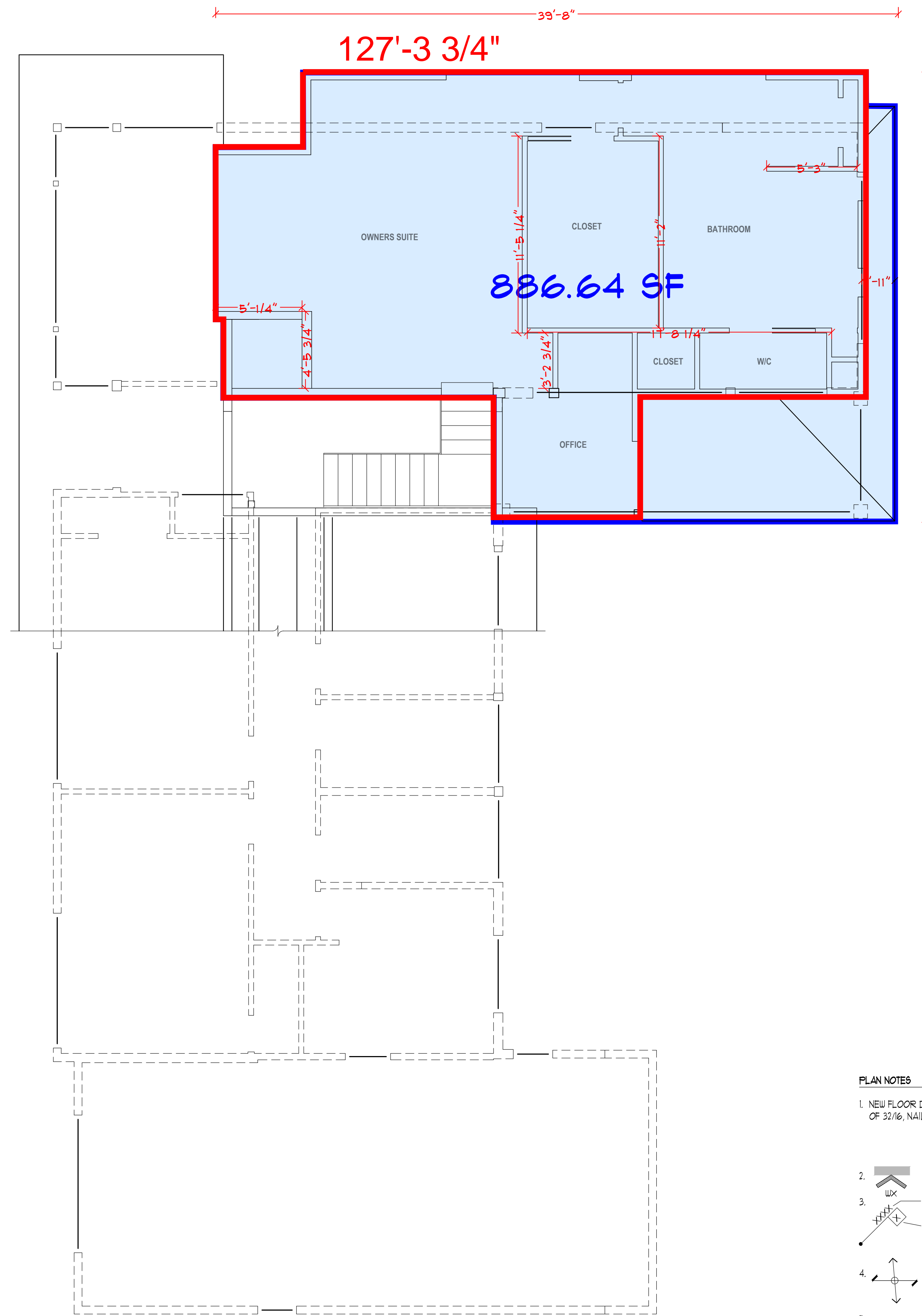
EXTERIOR WALL WEIGHT = 12 PSF

UPPER FLOOR WEIGHT TAKE-DOWN:

UPPER FLOOR WT = 890 SF X 30 PSF => 26.7 KIPS
 UPPER FLOOR WALL WT = 128' X 8.85' X 12 PSF => 13.6 KIPS
 TOTAL UPPER FLR WT = (26.7 + 13.6) KIPS => **40.3 KIPS**

TOTAL BUILDING WEIGHT:

TOTAL WT = 28.6 KIPS + 40.3 KIPS = **68.9 KIPS**



1 UPPER FLOOR FRAMING PLAN
 SCALE: 1/4" = 1'-0"

PLAN NOTES

- NEW FLOOR DIAPHRAGM IS TO BE 3/4" CDX PLYWOOD WITH MIN. PANEL INDEX OF 32/16, NAILED WITH 0/148 x 3" NAILS AT:
 6"oc AT ALL DIAPHRAGM BOUNDARIES AND SHEAR WALLS
 6"oc AT ALL SUPPORTED PANEL EDGES (BLOCKED)
 12"oc AT FIELD
- INDICATES SHEAR WALL PER SHEAR WALL SCHEDULE 10/54.0
- INDICATES SIMPSON HOLDOWN OR OTHER REQUIREMENT PER PLAN
- INDICATES THE NUMBER OF END STUDS OR BEARING STUDS REQUIRED AT END OF WALL. PROVIDE MIN (2) BEARING STUDS BELOW ALL BEAMS AND HEADERS, AND TWO FULL HEIGHT STUDS AT END OF ALL SHEAR WALLS
- INDICATES SPAN DIRECTION AND EXTENT OF FLOOR JOISTS. PER PLAN, PROVIDE 11 1/8" TJI 230 @ 16"oc JOISTS @ 16"oc UON.
- INDICATES BEAM OR HEADER PER PLAN. PROVIDE MIN. w/ LSL 1 1/2 x 11 1/2 TYP AT FLOORS. PROVIDE MIN (2) END STUDS TO SUPPORT NEW BEAMS AND HEADERS
- SEE SHEET S4.0 FOR TYPICAL WOOD FRAMING DETAILS
- INDICATES WALL BELOW
- SEE 20/54.0 FOR TYPICAL HANGER SCHEDULE
- CONTRACTOR SHALL NOT DRILL THRU SHEAR WALL END STUDS OR BEAM SUPPORTS FOR MECHANICAL PENETRATIONS.

23914 56th Avenue W. ~ Suite 200
 Mountlake Terrace, WA 98043-5263
 Ph: (206) 623-0769, (425) 640-7333
 www.ilgross.com



BICKEL RESIDENCE
 ADDRESS 1
 ADDRESS 2

REVISIONS

| NO. | DATE | DESCRIPTION |
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TITLE
UPPER FLOOR FRAMING PLAN

| | |
|------------|------------|
| DESIGNED | MTS |
| DRAWN | KPH |
| CHECKED | MTS |
| DATE | 11/09/2022 |
| JOB NUMBER | |

SHEET NO.
S2.2

SDCI REVIEW

ROOF:
 DL = 15 PSF
 LL = 25 PSF (SNOW)
 EXTERIOR WALL WEIGHT = 12 PSF

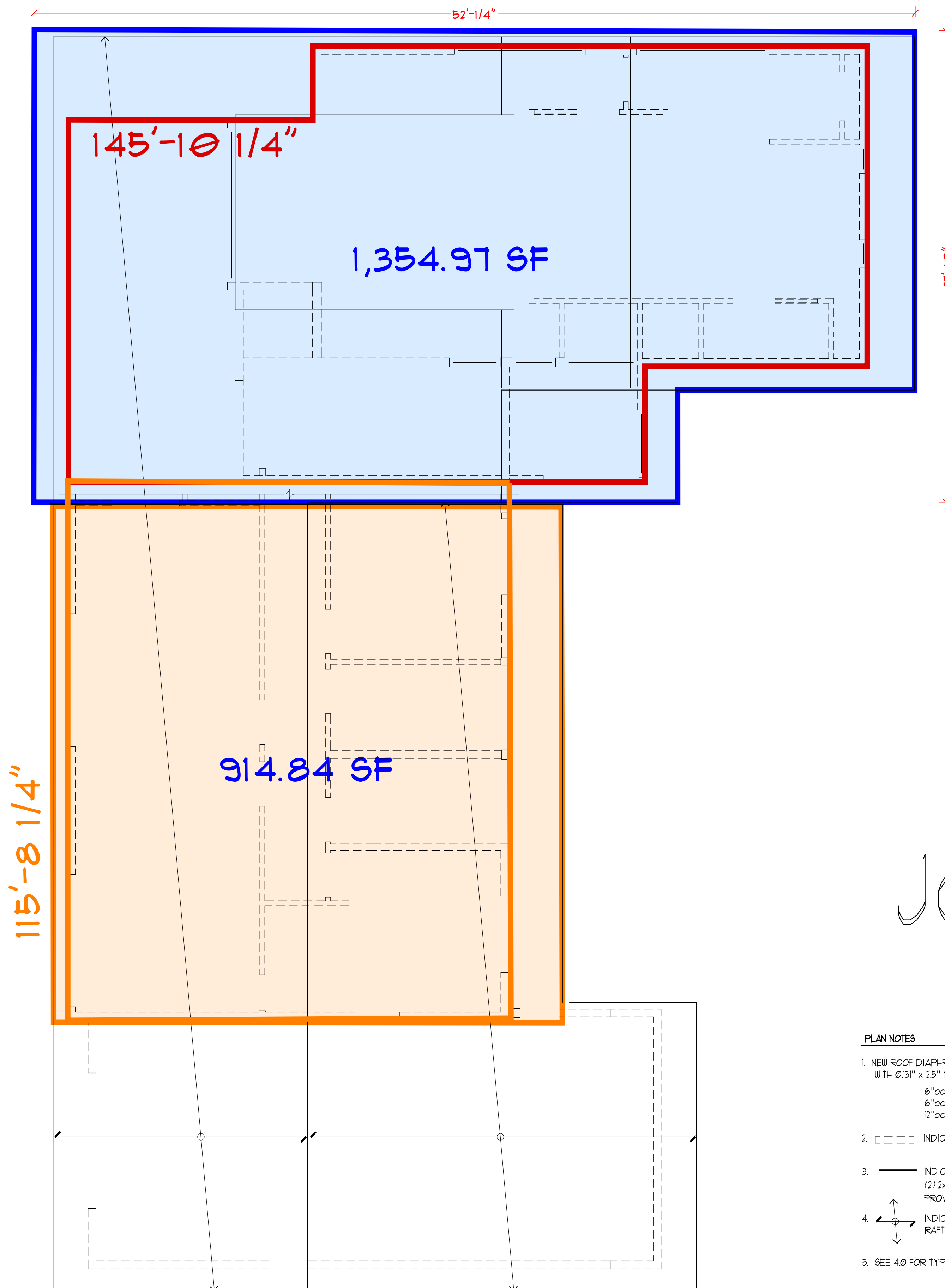
RENOVATED ROOF WEIGHT TAKE-DOWN:
 ROOF WT = 1355 SF X 15 PSF => 20.4 KIPS
 ROOF WALL WT = 146' X 4.63' X 12 PSF => 8.2 KIPS
 TOTAL UPPER FLR WT = (20.4 + 8.2) KIPS => 28.6 KIPS

EXISTING ROOF WEIGHT TAKE-DOWN:
 ROOF WT = 915 SF X 15 PSF => 13.8 KIPS
 ROOF WALL WT = 116' X 7.5' X 12 PSF => 10.5 KIPS
 TOTAL UPPER FLR WT = (13.8 + 10.5) KIPS => 24.3 KIPS

EXISTING ROOF SEISMIC FORCE:
 CS = 0.172
 SDS = 1.12
 I = 1.0
 RHO = 1.3

LFRS:
 VE = 0.172 X 24.3 KIPS X 1.3 => 5.44 KIPS

DIAPHRAGM -
 CALCULATED FPX: 5.44 KIPS / 1.3 = 4.19 KIPS
 MINIMUM FPX: 0.2 X 1.12 X 1.0 X 24.3 KIPS = 5.45 KIPS
 MAXIMUM FPX: 0.4 X 1.12 X 1.0 X 24.3 KIPS = 10.89 KIPS
 FPX = 5.45 KIPS



- PLAN NOTES**
- NEW ROOF DIAPHRAGM IS TO BE 1/2" CDX PLYWOOD w/ MIN. PANEL INDEX OF 24/0, WITH 0.131" x 25" NAILS AT :
 6"oc AT ALL DIAPHRAGM BOUNDARIES AND SHEAR WALLS
 6"oc AT ALL SUPPORTED PANEL EDGES (UNBLOCKED)
 12"oc AT FIELD
 - [---] INDICATES WALL BELOW. SEE S22 & 10/54/0 FOR SHEAR WALL LOCATIONS
 - INDICATES BEAM OR HEADER PER PLAN. PROVIDE MIN. (2) 2x8 AT ROOF. PROVIDE MIN (2) END STUDS TO SUPPORT NEW BEAMS AND HEADERS
 - ↕ INDICATES FRAMING DIRECTION AND EXTENTS. PROVIDE 2x12 RAFTERS @ 24"oc U.O.N.
 - SEE 4.0 FOR TYPICAL WOOD FRAMING DETAILS

1 ROOF FRAMING PLAN
 SCALE: 1/4" = 1'-0"
 0 4 8

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PRELIMINARY

BICKEL RESIDENCE
 ADDRESS 1
 ADDRESS 2

REVISIONS

| NO. | DATE | DESCRIPTION |
|-----|------|-------------|
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TITLE
 ROOF FRAMING PLAN

| | |
|------------|------------|
| DESIGNED | MTS |
| DRAWN | KPH |
| CHECKED | MTS |
| DATE | 11/09/2022 |
| JOB NUMBER | |

SHEET NO.

S2.3

SDCI REVIEW

Bickel Residence
Shear Wall Design
North - South Shear Walls

ASD

$S_{ds} = 1.12$

| N/S DIR ~ Low Roof- Main Floor | | | | | | | | | | SW | | 1 | | | | | | | | | | | |
|-----------------------------------|-------|------|-------------------|-------|---|--------|------|-----------------------|-----|-----|------|-----------|---------|-----------|-------|----------|---------|----------|--|----------|--|--|--|
| WALL | | | | | | | | | | SW | | .6-.14Sds | | .6-.14Sds | | RES | | # OF 2X4 | | # OF 2X6 | | | |
| b (FT) | TA | H | D ^{3/12} | % I | V | Vstory | H/L | 1/Aspect Ratio Factor | vlf | SW | USED | C | WALL WT | FL-R WT | T | HOLDOWN | STUDS | STUDS | | | | | |
| 7.0 | 9.77 | 8.4 | 29.1 | 0.45 | 1.2 | 1.2 | 1.2 | 1.0 | 172 | W6 | | 1.45 | 0.16 | 0.23 | 1.07 | HDU2 | (2) 2x4 | (2) 2x6 | | | | | |
| 7.5 | 9.77 | 8.4 | 35.7 | 0.55 | 1.5 | 1.5 | 1.1 | 1.0 | 198 | W6 | | 1.67 | 0.17 | 0.25 | 1.25 | HDU2 | (2) 2x4 | (2) 2x6 | | | | | |
| SUM I: | | | | 64.8 | FOR 2<H/b<3.5, MULT SHEAR DEMAND BY 1/(1.25-0.125H/b _s) | | | | | | | | | | | | | | | | | | |
| N/S DIR ~ Upper Floor- Low Roof | | | | | | | | | | SW | | 2 | | | | | | | | | | | |
| WALL | | | | | | | | | | SW | | .6-.14Sds | | .6-.14Sds | | RES | | # OF 2X4 | | # OF 2X6 | | | |
| b (FT) | TA | H | D ^{3/12} | % I | V | Vstory | H/L | 1/Aspect Ratio Factor | vlf | SW | USED | C | WALL WT | FL-R WT | T | HOLDOWN | STUDS | STUDS | | | | | |
| 11.4 | 7.26 | 3.0 | 124.0 | 1.00 | 3.2 | 3.2 | 0.3 | 1.0 | 284 | W4 | | 0.85 | 0.09 | 0.28 | 0.48 | LSTA24 | (2) 2x4 | (2) 2x6 | | | | | |
| SUM I: | | | | 124.0 | FOR 2<H/b<3.5, MULT SHEAR DEMAND BY 1/(1.25-0.125H/b _s) | | | | | | | | | | | | | | | | | | |
| N/S DIR ~ Low Roof- Main Floor | | | | | | | | | | SW | | 3 | | | | | | | | | | | |
| WALL | | | | | | | | | | SW | | .6-.14Sds | | .6-.14Sds | | RES | | # OF 2X4 | | # OF 2X6 | | | |
| b (FT) | TA | H | D ^{3/12} | % I | V | Vstory | H/L | 1/Aspect Ratio Factor | vlf | SW | USED | C | WALL WT | FL-R WT | T | HOLDOWN | STUDS | STUDS | | | | | |
| 6.5 | 12.83 | 13.0 | 22.9 | 1.00 | 5.5 | 5.5 | 2.0 | 1.0 | 849 | 2W3 | | 11.03 | 0.22 | 0.28 | 10.53 | (2) HDU5 | (3) 3X4 | (3) 2x6 | | | | | |
| SUM I: | | | | 22.9 | FOR 2<H/b<3.5, MULT SHEAR DEMAND BY 1/(1.25-0.125H/b _s) | | | | | | | | | | | | | | | | | | |
| N/S DIR ~ High Roof- Upper Floor | | | | | | | | | | SW | | 4 | | | | | | | | | | | |
| WALL | | | | | | | | | | SW | | .6-.14Sds | | .6-.14Sds | | RES | | # OF 2X4 | | # OF 2X6 | | | |
| b (FT) | TA | H | D ^{3/12} | % I | V | Vstory | H/L | 1/Aspect Ratio Factor | vlf | SW | USED | C | WALL WT | FL-R WT | T | HOLDOWN | STUDS | STUDS | | | | | |
| 6.4 | 11.90 | 9.3 | 21.8 | 1.00 | 2.1 | 2.1 | 1.4 | 1.0 | 335 | W4 | | 3.10 | 0.16 | 0.25 | 2.69 | MSTC40 | (2) 2x4 | (2) 2x6 | | | | | |
| SUM I: | | | | 21.8 | FOR 2<H/b<3.5, MULT SHEAR DEMAND BY 1/(1.25-0.125H/b _s) | | | | | | | | | | | | | | | | | | |
| N/S DIR ~ Low Roof- Main Floor | | | | | | | | | | SW | | 4 | | | | | | | | | | | |
| WALL | | | | | | | | | | SW | | .6-.14Sds | | .6-.14Sds | | RES | | # OF 2X4 | | # OF 2X6 | | | |
| LF | TA | H | D ^{3/12} | % I | V | Vstory | H/L | 1/Aspect Ratio Factor | vlf | SW | USED | C | WALL WT | FL-R WT | T | HOLDOWN | STUDS | STUDS | | | | | |
| 2.5 | 7.48 | 8.4 | 1.4 | 0.19 | 0.4 | 0.0 | 3.3 | 1.2 | 201 | W6 | | 1.4 | 0.06 | 0.06 | 1.3 | HDU2 | (2) 2x4 | (2) 2x6 | | | | | |
| 4.1 | 7.48 | 8.4 | 5.9 | 0.81 | 1.8 | 0.1 | 2.0 | 1.0 | 448 | W3 | | 3.8 | 0.09 | 0.10 | 3.6 | HDU4 | (2) 2x4 | (2) 2x6 | | | | | |
| SUM I: | | | | 7.3 | FOR 2<H/b<3.5, MULT SHEAR DEMAND BY 1/(1.25-0.125H/b _s) | | | | | | | | | | | | | | | | | | |
| N/S DIR ~ Roof- Upper Floor | | | | | | | | | | SW | | 5 | | | | | | | | | | | |
| WALL | | | | | | | | | | SW | | .6-.14Sds | | .6-.14Sds | | RES | | # OF 2X4 | | # OF 2X6 | | | |
| b (FT) | TA | H | D ^{3/12} | % I | V | Vstory | H/L | 1/Aspect Ratio Factor | vlf | SW | USED | C | WALL WT | FL-R WT | T | HOLDOWN | STUDS | STUDS | | | | | |
| 2.8 | 9.97 | 6.1 | 1.9 | 0.44 | 0.7 | 0.7 | 2.1 | 1.0 | 250 | W6 | | 1.49 | 0.05 | 0.09 | 1.35 | LSTA36 | (2) 2x4 | (2) 2x6 | | | | | |
| 3.1 | 9.97 | 6.1 | 2.4 | 0.56 | 0.9 | 0.9 | 2.0 | 1.0 | 290 | W4 | | 1.77 | 0.05 | 0.10 | 1.61 | LSTA36 | (2) 2x4 | (2) 2x6 | | | | | |
| SUM I: | | | | 4.3 | FOR 2<H/b<3.5, MULT SHEAR DEMAND BY 1/(1.25-0.125H/b _s) | | | | | | | | | | | | | | | | | | |
| N/S DIR ~ Upper Floor- Main Floor | | | | | | | | | | SW | | 5 | | | | | | | | | | | |
| WALL | | | | | | | | | | SW | | .6-.14Sds | | .6-.14Sds | | RES | | # OF 2X4 | | # OF 2X6 | | | |
| LF | TA | H | D ^{3/12} | % I | V | Vstory | H/L | 1/Aspect Ratio Factor | vlf | SW | USED | C | WALL WT | FL-R WT | T | HOLDOWN | STUDS | STUDS | | | | | |
| 2.8 | 1.33 | 8.4 | 1.9 | 0.44 | 1.8 | 1.1 | 2.98 | 1.1 | 730 | 2W4 | | 6.9 | 0.06 | 0.01 | 6.8 | HDU11 | (3) 2x4 | (2) 2x6 | | | | | |
| 3.1 | 1.33 | 8.4 | 2.4 | 0.56 | 2.3 | 1.4 | 2.7 | 1.1 | 836 | 2W3 | | 8.2 | 0.07 | 0.02 | 8.1 | HDU11 | (4) 2x4 | (2) 2x6 | | | | | |
| SUM I: | | | | 4.3 | FOR 2<H/b<3.5, MULT SHEAR DEMAND BY 1/(1.25-0.125H/b _s) | | | | | | | | | | | | | | | | | | |

V story = 2.7
V total = 2.7 kips

V story = 3.2
V total = 3.2 kips

V story = 5.5
V total = 5.5 kips

V story = 2.1
V total = 2.1 kips

V story = 0.1
V total = 2.3 kips

V story = 1.6
V total = 1.6 kips

V story = 2.6
V total = 4.2 kips

Bickel Residence
Shear Wall Design
East-West Shear Walls

ASD

$S_{ds} = 1.12$

V story = 2.1
V total = 2.1 kips

| E/W DIR ~ Roof- Upper Floor | | | | | | | | | | SW | | AR | | | | | | | | | | | | | | | | | |
|-----------------------------|--------|------|-----|--------------------|------|-----|--------|-----|-----------------------|------|----|------|------|-------------------|-------------------|-------|----------|----------------|----------------|---|--|--|--|--|--|--|--|--|--|
| WALL | b (FT) | TA | H | D ³ /12 | % I | V | Vstory | H/L | 1/Aspect Ratio Factor | vlf | SW | USED | C | .6-.14Sds WALL WT | .6-.14Sds FL-R WT | RES T | HOLDDOWN | # OF 2X4 STUDS | # OF 2X6 STUDS | | | | | | | | | | |
| | 8.3 | 0.67 | 9.3 | 48.2 | 0.72 | 1.5 | 1.5 | 1.1 | 1.0 | 180 | W6 | | 1.67 | 0.21 | 0.02 | 1.45 | LSTA36 | (2) 2x4 | (2) 2x6 | | | | | | | | | | |
| | 3.1 | 0.67 | 9.3 | 2.5 | 0.04 | 0.1 | 0.1 | 3.0 | 1.1 | 29 | W6 | | 0.23 | 0.08 | 0.01 | 0.15 | LSTA24 | (2) 2x4 | (2) 2x6 | | | | | | | | | | |
| | 5.8 | 0.67 | 9.3 | 16.4 | 0.24 | 0.5 | 0.5 | 1.6 | 1.0 | 88 | W6 | | 0.81 | 0.14 | 0.01 | 0.66 | LSTA24 | (2) 2x4 | (2) 2x6 | | | | | | | | | | |
| SUM I: | | | | | | | | | | 67.1 | | | | | | | | | | FOR 2<H/b<3.5, MULT SHEAR DEMAND BY 1/(1.25-0.125H/b _s) | | | | | | | | | |

V story = 2.0
V total = 4.1 kips

| E/W DIR ~ Upper Walls- Main Floor | | | | | | | | | | SW | | AU | | | | | | | | | | | | | | | | | |
|-----------------------------------|------|------|-----|--------------------|------|-----|--------|-----|-----------------------|-------|----|------|-----|-------------------|-------------------|------------|----------|----------------|----------------|--|--|--|--|--|--|--|--|--|--|
| WALL | LF | TA | H | D ³ /12 | % I | V | Vstory | H/L | 1/Aspect Ratio Factor | vlf | SW | USED | C | .6-.14Sds WALL WT | .6-.14Sds FL-R WT | RES T | HOLDDOWN | # OF 2X4 STUDS | # OF 2X6 STUDS | | | | | | | | | | |
| | 18.9 | 7.67 | 8.5 | 560.4 | 0.65 | 2.7 | 1.3 | 0.5 | 1.0 | 143 | W6 | | 0.6 | 0.6 | 0.6 | no hd reqd | HDU2 | (2) 2x4 | (2) 2x6 | | | | | | | | | | |
| | 15.3 | 7.67 | 8.5 | 295.5 | 0.35 | 1.4 | 0.7 | 0.6 | 1.0 | 94 | W6 | | 0.4 | 0.4 | 0.4 | no hd reqd | HDU2 | (2) 2x4 | (2) 2x6 | | | | | | | | | | |
| SUM I: | | | | | | | | | | 855.9 | | | | | | | | | | | | | | | | | | | |

V story = 3.8
V total = 3.8 kips

| E/W DIR ~ Roof- Upper Floor | | | | | | | | | | SW | | B | | | | | | | | | | | | | | | | | |
|-----------------------------|--------|------|-----|--------------------|------|-----|--------|-----|-----------------------|------|-----|------|------|-------------------|-------------------|-------|----------|----------------|----------------|---|--|--|--|--|--|--|--|--|--|
| WALL | b (FT) | TA | H | D ³ /12 | % I | V | Vstory | H/L | 1/Aspect Ratio Factor | vlf | SW | USED | C | .6-.14Sds WALL WT | .6-.14Sds FL-R WT | RES T | HOLDDOWN | # OF 2X4 STUDS | # OF 2X6 STUDS | | | | | | | | | | |
| | 5.7 | 8.41 | 3.0 | 15.4 | 1.00 | 3.8 | 3.8 | 0.5 | 1.0 | 672 | 2W4 | | 2.02 | 0.05 | 0.16 | 1.81 | MSTA30 | (2) 2x4 | (2) 2x6 | | | | | | | | | | |
| SUM I: | | | | | | | | | | 15.4 | | | | | | | | | | FOR 2<H/b<3.5, MULT SHEAR DEMAND BY 1/(1.25-0.125H/b _s) | | | | | | | | | |

V story = 2.8
V total = 6.7 kips

| E/W DIR ~ Upper Walls- Main Floor | | | | | | | | | | SW | | B | | | | | | | | | | | | | | | | | |
|-----------------------------------|-----|------|-----|--------------------|------|-----|--------|-----|-----------------------|------|-----|------|------|-------------------|-------------------|-------|----------|----------------|----------------|--|--|--|--|--|--|--|--|--|--|
| WALL | LF | TA | H | D ³ /12 | % I | V | Vstory | H/L | 1/Aspect Ratio Factor | vlf | SW | USED | C | .6-.14Sds WALL WT | .6-.14Sds FL-R WT | RES T | HOLDDOWN | # OF 2X4 STUDS | # OF 2X6 STUDS | | | | | | | | | | |
| | 5.7 | 0.00 | 8.5 | 15.4 | 1.00 | 6.7 | 2.8 | 1.5 | 1.0 | 1171 | 2W2 | | 12.0 | 0.2 | 0.2 | 11.6 | (2)HDU8 | (3) 3X4 | (3) 2x6 | | | | | | | | | | |
| SUM I: | | | | | | | | | | 15.4 | | | | | | | | | | | | | | | | | | | |

Roof SW-B Strap:

Shear At Collector

$$V = 5.25 \text{ KIPS (Diaphragm Shear Line B)}$$

$$T = 0.7 \times 5.25 \text{ K} = \underline{3.675 \text{ K}}$$

Use Simpson CMSTC16 Coil Strap w/
(40) 0.148" 2 1/2" Nails End Length = 19" (Every Hole)
 $T_a = 3.84 \text{ Kips}$

Roof SW-4:

Shear At Collector

$$V = 2.955 \text{ KIPS (Dia. Shear Line 4)}$$

$$T = 0.7 \times 2.955 \text{ K} = \underline{2.07 \text{ Kips}}$$

Use Simpson CS14 w/ (22) 0.148" 2 1/2" Nails
End Length = 13" (Every Hole)
 $T_a = 2.190 \text{ Kips}$

UPPER Floor SW-2:

Shear At Collector

$$V = 5.34 \text{ KIPS}$$

$$T = 0.7 \times 5.34 \text{ KIPS} = \underline{3.738 \text{ K}} \text{ (Dia. Shear Line 2)}$$

Use Simpson CMSTC16 w/ (40) 0.148" x 2 1/2" Nails
End Length = 16"
 $T_a = 3.840 \text{ Kips}$

UPPER Floor SW-B: ← No Longer Applicable

Shear At Collector

$$V = 6.58 \text{ KIPS}$$

$$T = 0.7 \times 6.58 \text{ K} = \underline{4.606 \text{ KIPS}}$$

Use Simpson CMSTC16 w/ (48) 0.148" x 2 1/2" Nails
End Length = 19"
 $T_a = 4.610 \text{ K}$

Low Roof SW-2: ← No Longer Applicable

Diaphragm Shear Uniform

$$V = 0.280 \text{ KLF}$$

Total Length = 15'-2"
Shear Wall Length = 11'-5"
Collector Length = 3'-9"
Collector Shear = $0.280 \text{ KLF} \times (3'-9") = \underline{1.05 \text{ Kips}}$

Use Simpson CS14 w/ (22) 0.148" x 2 1/2" Nails
End Length = 13"
 $T_a = 2.190 \text{ KIPS}$



I.L. GROSS
STRUCTURAL
ENGINEERS

Diaphragm Strap Design

SHEET TITLE

SCALE

08/18/2022

DATE

Bixel Residence Renovation

PROJECT

DESIGNED BY

CLIENT

CHECKED

SHEET

Low Roof SW-3: ← NO Longer APPLICABLE

Diaphragm Uniform Shear

$$V = 0.280 \text{ KLF}$$

Total Length = 15'-2"
Shear Wall Length = 7'-10 1/2"
Collector Length = 7'-3 1/2"

$$\text{Collector Shear} = 0.280 \text{ KLF} \times (7'-3\frac{1}{2}") = \underline{\underline{2.042 \text{ KIPS}}}$$

$$T = 2.042 \text{ KIPS}$$

Use Simpson CS 4 W1 (22) 0.148" x 2 1/2" Nails
nd Length = 13"
T_a = 2.190 KIPS

Low Roof SW-4 (New in roof SW-4 Drag strut)

SW-4 Shear

P = 1.3 (LFs) S = 1.0 Collectors

$$V = 3.1 \text{ KIPS} \quad (\text{LFs Unfactored})$$

$$T = 0.7 \times 3.1 \text{ KIPS} / 1.3 \times 1.25 = \underline{\underline{2.09 \text{ KIPS}}}$$

Use Simpson CS14 W1 (22) 0.148" x 2 1/2" Nails
End Length = 13"
T_a = 2.190 KIPS



I.L. GROSS
STRUCTURAL
ENGINEERS

Diaphragm Strap Design

SHEET TITLE

SCALE

08/18/2022

DATE

Bickel Residence Renovation

PROJECT

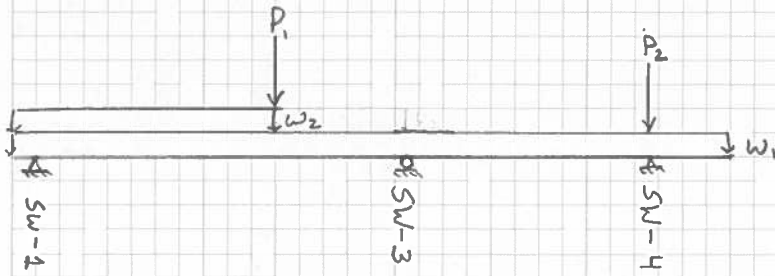
DESIGNED BY

CLIENT

CHECKED

SHEET

Low Roof:



W_1 - Existing Roof Shear

$$W_1 = \underline{0.23 \text{ KLF}}$$

W_2 - "New Roof" Shear Contribution

$$W_2 = \underline{0.160 \text{ KLF}}$$

P_1 - Transfer Force From SW-2 (LFRS Unfactored)

$$P_{1,n} = 4.6 \text{ kips}$$

$$P_1 = 4.6 \text{ kips} / 1.3 \times 1.25 \approx \underline{4.43 \text{ kips}} \quad (\phi = 1.0 \text{ \& } 25\% \uparrow \text{ due to Vertical \& } \text{Horiz. Irregularities})$$

P_2 - Transfer Force From SW-4 High Roof TO upper Floor (LFRS Unfactored)

$$P_{2,n} = 3.1 \text{ kips}$$

$$P_2 = 3.1 \text{ kips} / 1.3 \times 1.25 \approx \underline{2.99 \text{ kips}} \quad (\phi = 1.0 \text{ \& } 25\% \uparrow)$$

Reactions

$$SW-1 = 4.32 \text{ kips}$$

$$SW-3 = 8.56 \text{ kips}$$

$$SW-4 = 3.41 \text{ kips}$$

* See Printout for Distribution Calcs.



I.L. GROSS
STRUCTURAL
ENGINEERS

High & Low Roof Diaphragm Shear Distribution

SHEET TITLE

1/8" = 1'-0"

SCALE

DATE

Bickel Residence Renovation

PROJECT

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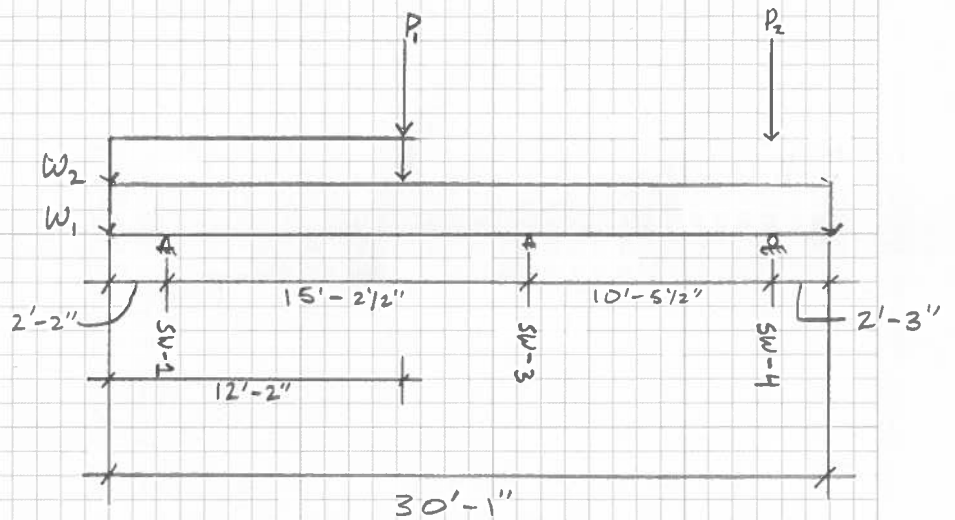
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SHEET

SW Loading Diagram

*All loads shown are unfactored



Loading

W_1 - Existing Building Roof Seismic

$$W_1 = 0.1809 \text{ KLF}$$

W_2 - New Low Roof Contribution

$$W_2 = 0.15 \text{ KLF}$$

P_1 - Shear From SW-2

$$P_1 = 4.6 \text{ kips}$$

P_2 - Shear From SW-4 on New Roof

$$P_2 = 3.1 \text{ kips}$$

Reactions

$$SW-1 = 3.86 \text{ kips}$$

$$SW-3 = 7.88 \text{ kips}$$

$$SW-4 = 3.23 \text{ kips}$$



I.L. GROSS
STRUCTURAL
ENGINEERS

SW-1, SW-3, and SW-4 Loading Diagram

SHEET TITLE

1/8" = 1'-0"

SCALE

DATE

Bickel Residence

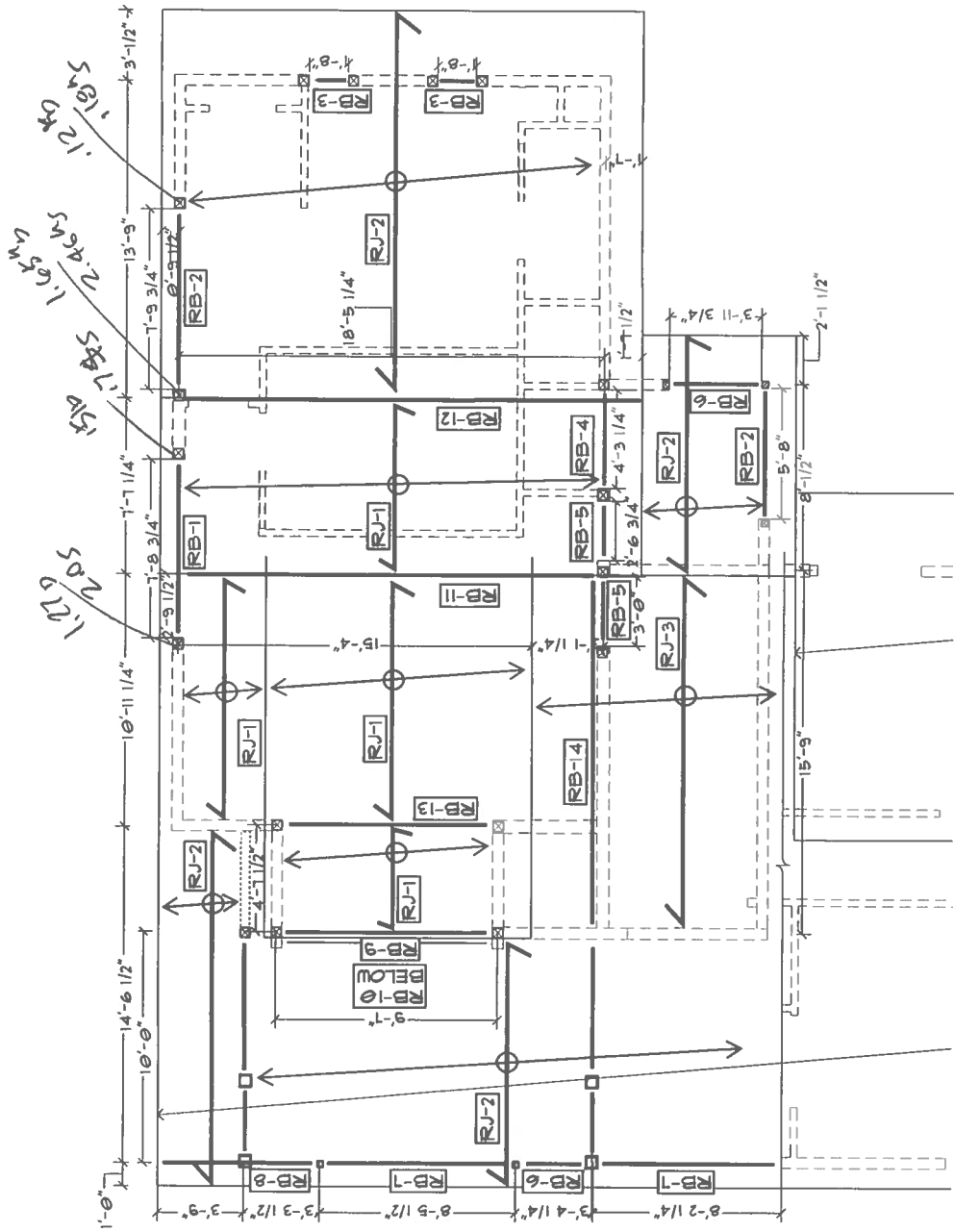
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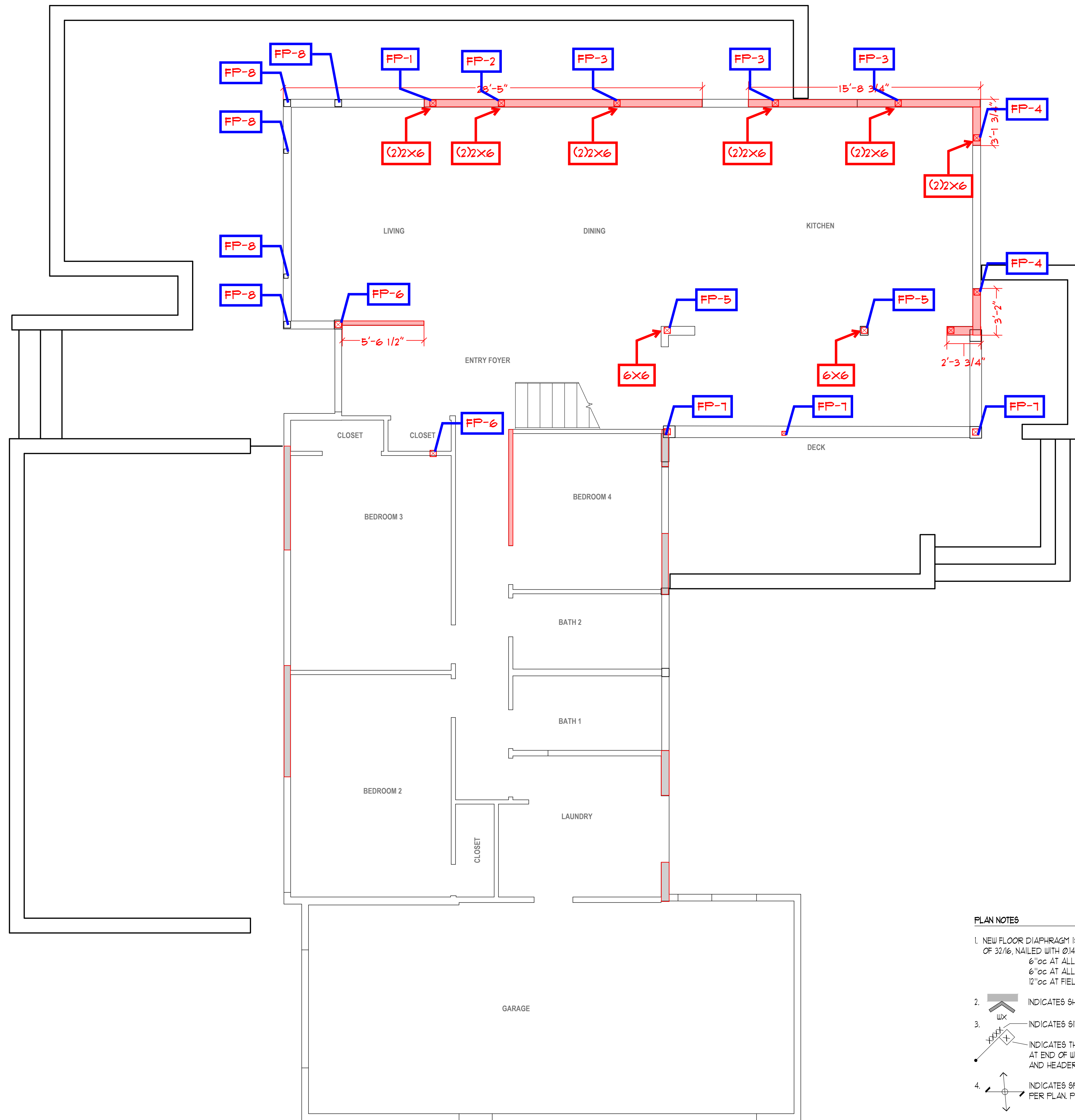
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CLIENT

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SHEET





1 MAIN FLOOR PLAN
SCALE: 1/4" = 1'-0"



PLAN NOTES

- NEW FLOOR DIAPHRAGM IS TO BE 3/4" CDX PLYWOOD WITH MIN. PANEL INDEX OF 32/16, NAILED WITH 0/148 x 3" NAILS AT:
6" OC AT ALL DIAPHRAGM BOUNDARIES AND SHEAR WALLS
6" OC AT ALL SUPPORTED PANEL EDGES (BLOCKED)
12" OC AT FIELD
- INDICATES SHEAR WALL PER SHEAR WALL SCHEDULE 10/54.0
- INDICATES SIMPSON HOLDOWN OR OTHER REQUIREMENT PER PLAN
- INDICATES THE NUMBER OF END STUDS OR BEARING STUDS REQUIRED AT END OF WALL. PROVIDE MIN (2) BEARING STUDS BELOW ALL BEAMS AND HEADERS, AND TWO FULL HEIGHT STUDS AT END OF ALL SHEAR WALLS
- INDICATES SPAN DIRECTION AND EXTENT OF FLOOR JOISTS. PER PLAN, PROVIDE 1 1/2" TJI 230 @ 16" OC JOISTS @ 16" OC UON.
- INDICATES BEAM OR HEADER PER PLAN. PROVIDE MIN. w/ LSL 1 1/2 x 1 1/2 TYP AT FLOORS. PROVIDE MIN (2) END STUDS TO SUPPORT NEW BEAMS AND HEADERS
- SEE SHEET S4.0 FOR TYPICAL WOOD FRAMING DETAILS
- INDICATES WALL BELOW
- SEE 20/54.0 FOR TYPICAL HANGER SCHEDULE
- CONTRACTOR SHALL NOT DRILL THRU SHEAR WALL END STUDS OR BEAM SUPPORTS FOR MECHANICAL PENETRATIONS.

23914 56th Avenue W. ~ Suite 200
Mountlake Terrace, WA 98043-5263
Ph: (206) 623-0769, (425) 640-7333
www.ilgross.com



BICKEL RESIDENCE
ADDRESS 1
ADDRESS 2

REVISIONS

| NO. | DATE | DESCRIPTION |
|-----|------|-------------|
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TITLE

MAIN FLOOR
FRAMING PLAN

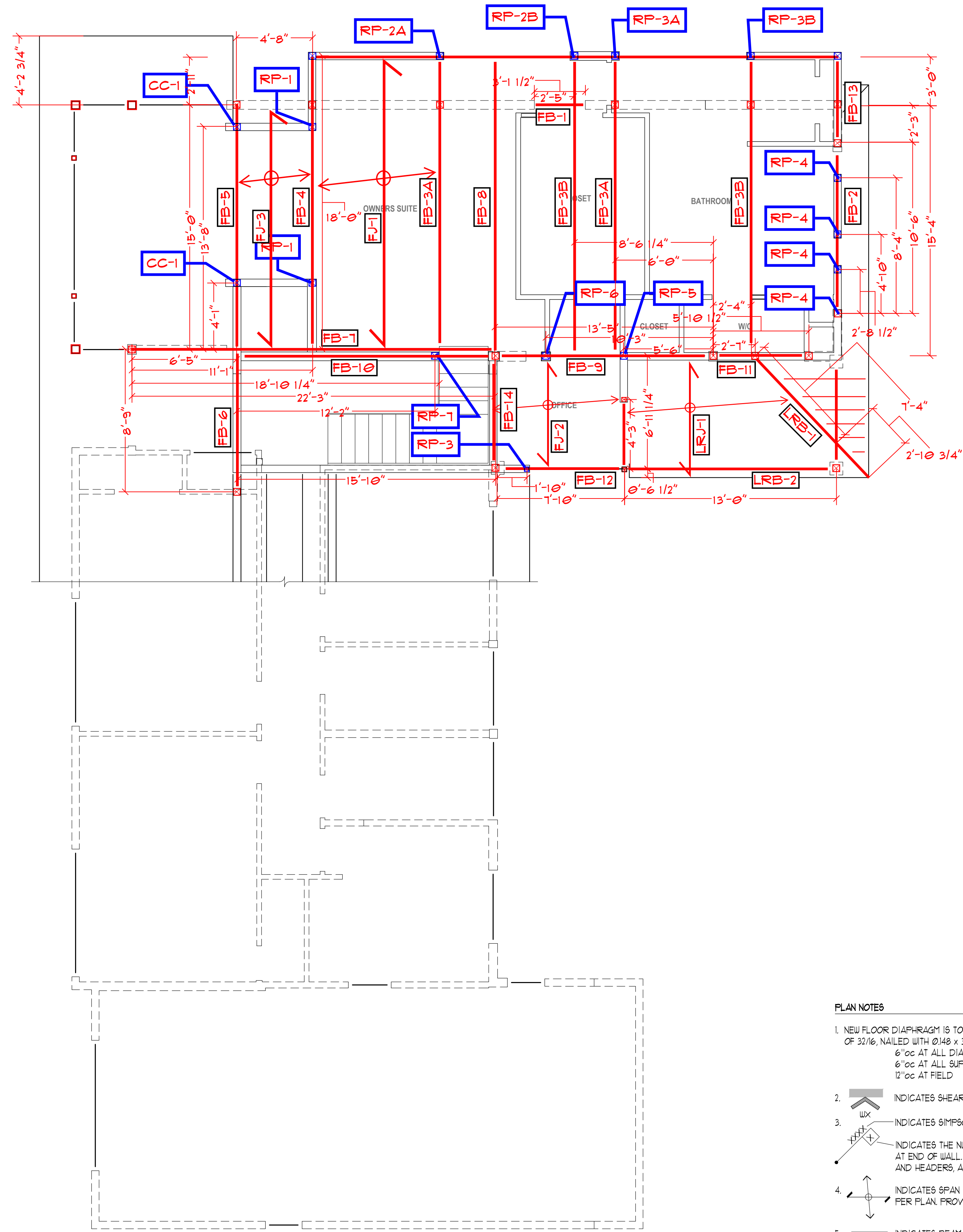
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| DESIGNED | MTS |
| DRAWN | KPH |
| CHECKED | MTS |
| DATE | 11/09/2022 |
| JOB NUMBER | |

SHEET NO.

S2.1

SDCI REVIEW

NOTES:
 1. BLUE POST ARE DISCONTINUOUS POSTS FROM ABOVE



PLAN NOTES

- NEW FLOOR DIAPHRAGM IS TO BE 3/4" CDX PLYWOOD WITH MIN. PANEL INDEX OF 32/16, NAILED WITH 0/148 x 3" NAILS AT:
 6" OC AT ALL DIAPHRAGM BOUNDARIES AND SHEAR WALLS
 6" OC AT ALL SUPPORTED PANEL EDGES (BLOCKED)
 12" OC AT FIELD
- INDICATES SHEAR WALL PER SHEAR WALL SCHEDULE 10/54.0
- INDICATES SIMPSON HOLDOWN OR OTHER REQUIREMENT PER PLAN
- INDICATES THE NUMBER OF END STUDS OR BEARING STUDS REQUIRED AT END OF WALL. PROVIDE MIN (2) BEARING STUDS BELOW ALL BEAMS AND HEADERS, AND TWO FULL HEIGHT STUDS AT END OF ALL SHEAR WALLS
- INDICATES SPAN DIRECTION AND EXTENT OF FLOOR JOISTS. PER PLAN, PROVIDE 1 1/8" TJI 230 @ 16" OC JOISTS @ 16" OC UON.
- INDICATES BEAM OR HEADER PER PLAN. PROVIDE MIN. w/ LSL 1 1/2 x 1 1/8 TYP AT FLOORS. PROVIDE MIN (2) END STUDS TO SUPPORT NEW BEAMS AND HEADERS
- SEE SHEET S4.0 FOR TYPICAL WOOD FRAMING DETAILS
- INDICATES WALL BELOW
- SEE 20/54.0 FOR TYPICAL HANGER SCHEDULE
- CONTRACTOR SHALL NOT DRILL THRU SHEAR WALL END STUDS OR BEAM SUPPORTS FOR MECHANICAL PENETRATIONS.

1 UPPER FLOOR FRAMING PLAN
 SCALE: 1/4" = 1'-0"

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 Mountlake Terrace, WA 98043-5263
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PRELIMINARY
 11/2022

BICKEL RESIDENCE
 ADDRESS 1
 ADDRESS 2

REVISIONS

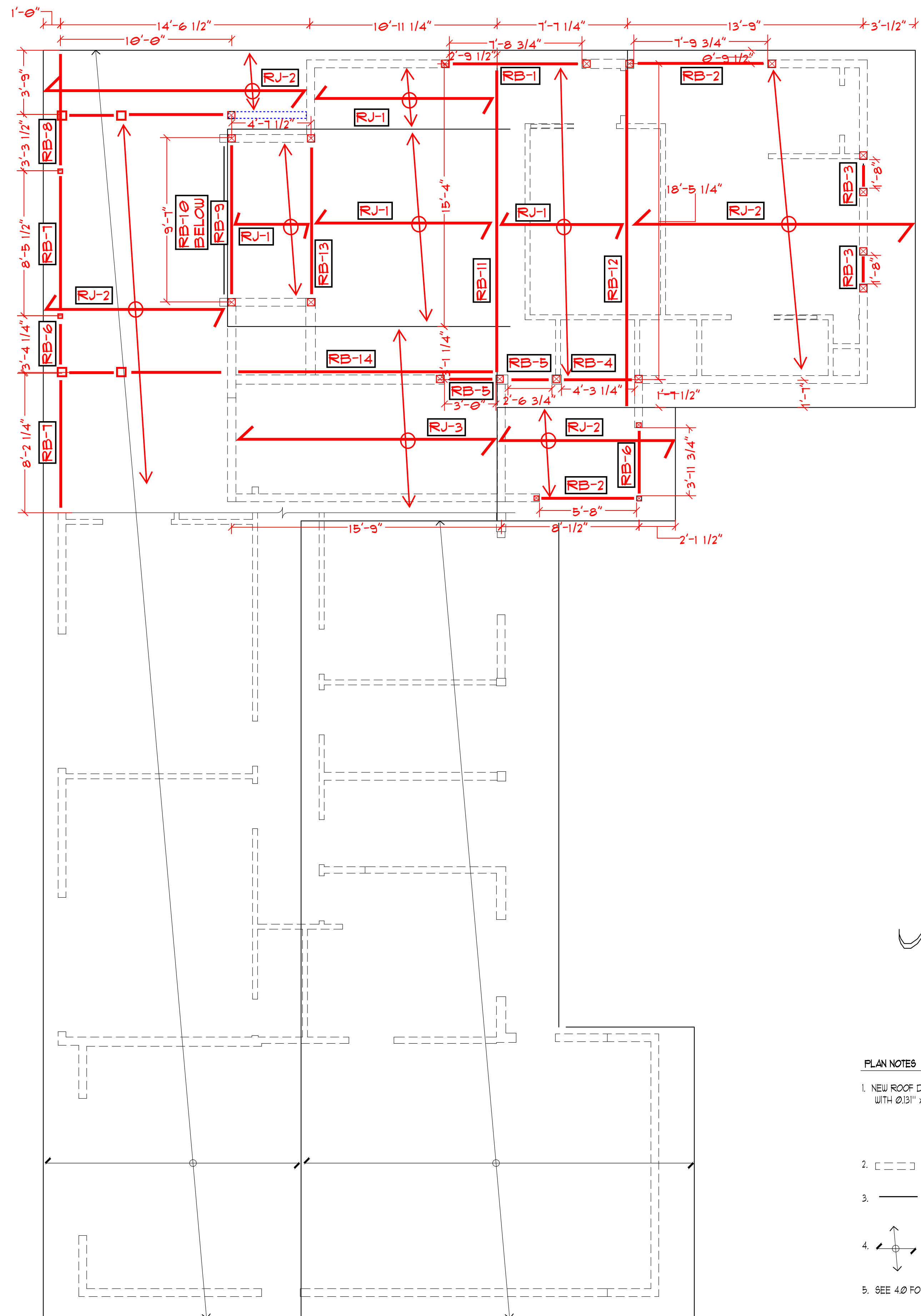
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TITLE
 UPPER FLOOR FRAMING PLAN

| | |
|------------|------------|
| DESIGNED | MTS |
| DRAWN | KPH |
| CHECKED | MTS |
| DATE | 11/09/2022 |
| JOB NUMBER | |

SHEET NO.
 S2.2

SDCI REVIEW



1 ROOF FRAMING PLAN
 SCALE: 1/4" = 1'-0"
 0 4 8

JOISTS

PLAN NOTES

- NEW ROOF DIAPHRAGM IS TO BE 1/2" CDX PLYWOOD w/ MIN. PANEL INDEX OF 24/0, WITH 13" x 25" NAILS AT :
 6"oc AT ALL DIAPHRAGM BOUNDARIES AND SHEAR WALLS
 6"oc AT ALL SUPPORTED PANEL EDGES (UNBLOCKED)
 12"oc AT FIELD
- [---] INDICATES WALL BELOW. SEE S22 & 10/1640 FOR SHEAR WALL LOCATIONS
- INDICATES BEAM OR HEADER PER PLAN. PROVIDE MIN. (2) 2x8 AT ROOF. PROVIDE MIN (2) END STUDS TO SUPPORT NEW BEAMS AND HEADERS
- ↔ INDICATES FRAMING DIRECTION AND EXTENTS. PROVIDE 2x12 RAFTERS @ 24"oc U.O.N.
- SEE 4.0 FOR TYPICAL WOOD FRAMING DETAILS

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 Mountlake Terrace, WA 98043-5263
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BICKEL RESIDENCE

ADDRESS 1
 ADDRESS 2

REVISIONS

| NO. | DATE | DESCRIPTION |
|-----|------|-------------|
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TITLE
ROOF FRAMING PLAN

| | |
|------------|------------|
| DESIGNED | MTS |
| DRAWN | KPH |
| CHECKED | MTS |
| DATE | 11/09/2022 |
| JOB NUMBER | |

SHEET NO.

S2.3

SDCI REVIEW

GENERAL LOADS & INFORMATION

ROOF

| | |
|-----------|--------|
| Dead | 15 psf |
| Roof Live | 20 psf |
| Snow | 25 psf |

BUILDING DIMENSIONS

| | |
|----------|-------------|
| Avg. Ht. | 17.67 ft |
| Length | 27.04167 ft |
| Width | 47.27 ft |

FLOOR

| | |
|------|--------|
| Dead | 17 psf |
| Live | 40 psf |

WALL

Ext. Wall

| | |
|------|--------|
| Dead | 12 psf |
| Wind | psf |

Int. Wall

| | |
|------|-------|
| Dead | 8 psf |
|------|-------|

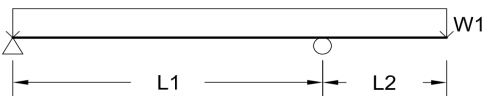
STAIRS

| | |
|------|--------|
| Dead | 10 psf |
| Live | 40 psf |

ROOF FRAMING LOADS & REACTIONS

JOISTS & BEAMS

| | VALUE | UNIT | SOURCE | Reaction | Value | Unit |
|----------------|-------|------|--------|-----------------|--------|------|
| RJ-1 | | | | | | |
| Span | 11.00 | ft | | | | |
| T.W. | 2.00 | ft | | | | |
| DL | 30.00 | plf | | R _{DL} | 165.00 | lbs |
| LR | 40.00 | plf | | R _{LR} | 220.00 | lbs |
| SL | 50.00 | plf | | R _{SL} | 275.00 | lbs |
| RJ-2 | | | | | | |
| L ₁ | 13.75 | ft | | | | |
| L ₂ | 3.04 | ft | | | | |
| T.W. | 2.00 | ft | | | | |
| DL | 30.00 | plf | | R _{DL} | 220.00 | lbs |
| LR | 40.00 | plf | | R _{LR} | 260.00 | lbs |
| SL | 50.00 | plf | | R _{SL} | 330.00 | lbs |
| | | | | <i>Left</i> | | |
| | | | | R _{DL} | 340.00 | lbs |
| | | | | R _{LR} | 410.00 | lbs |
| | | | | R _{SL} | 510.00 | lbs |
| | | | | <i>Right</i> | | |
| | | | | R _{DL} | 220.00 | lbs |
| | | | | R _{LR} | 260.00 | lbs |
| | | | | R _{SL} | 330.00 | lbs |
| RJ-3 | | | | | | |
| Span | 15.75 | ft | | | | |
| T.W. | 2.00 | ft | | | | |
| DL | 30.00 | plf | | R _{DL} | 236.25 | lbs |
| LR | 40.00 | plf | | R _{LR} | 315.00 | lbs |
| SL | 50.00 | plf | | R _{SL} | 393.75 | lbs |



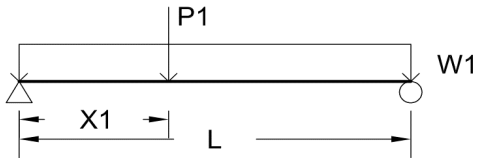
FRAMING LOADS AND REACTIONS

BICKEL RESIDENCE REMODEL

RB-1

| | |
|----------------------|-------------|
| L | 13.75 ft |
| X ₁ | 2.79 ft |
| W₁ | |
| T.W. | 1.75 ft |
| DL | 26.25 plf |
| LR | 35.00 plf |
| SL | 43.75 plf |
| P₁ | |
| DL | 1283.41 lbs |
| LR | 1711.22 lbs |
| SL | 2139.02 lbs |

RB-11



Left

| | |
|-----------------|-------------|
| R _{DL} | 1270.00 lbs |
| R _{LR} | 1610.00 lbs |
| R _{SL} | 2010.00 lbs |

Right

| | |
|-----------------|---------|
| R _{DL} | 510 lbs |
| R _{LR} | 590 lbs |
| R _{SL} | 740 lbs |

RB-2

| | |
|------|-----------|
| Span | 7.81 ft |
| T.W. | 1.81 ft |
| DL | 27.19 plf |
| LR | 36.25 plf |
| SL | 45.31 plf |

| | |
|-----------------|------------|
| R _{DL} | 106.20 lbs |
| R _{LR} | 141.60 lbs |
| R _{SL} | 177.00 lbs |

RB-3

| | |
|------|------------|
| Span | 1.67 ft |
| T.W. | 9.92 ft |
| DL | 148.75 plf |
| LR | 198.33 plf |
| SL | 247.92 plf |

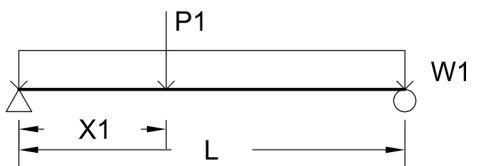
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|-----------------|------------|
| R _{DL} | 123.96 lbs |
| R _{LR} | 165.28 lbs |
| R _{SL} | 206.60 lbs |

RB-4

| | |
|----------------------|-------------|
| L | 4.27 ft |
| X ₁ | 3.75 ft |
| W₁ | |
| T.W. | 2.63 ft |
| DL | 39.38 plf |
| LR | 52.50 plf |
| SL | 65.63 plf |
| P₁ | |
| DL | 1610.00 lbs |
| LR | 1970.00 lbs |
| SL | 2460.00 lbs |

Roof Loading

RB-12



Right

| | |
|-----------------|-------------|
| R _{DL} | 1510.00 lbs |
| R _{LR} | 1840.00 lbs |
| R _{SL} | 2300.00 lbs |

Left

| | |
|-----------------|------------|
| R _{DL} | 290.00 lbs |
| R _{LR} | 350.00 lbs |
| R _{SL} | 440.00 lbs |

FRAMING LOADS AND REACTIONS

BICKEL RESIDENCE REMODEL

RB-5

| | |
|------|-----------|
| Span | 3.00 ft |
| T.W. | 2.63 ft |
| DL | 39.38 plf |
| LR | 52.50 plf |
| SL | 65.63 plf |

| | |
|-----------------|-----------|
| R _{DL} | 59.06 lbs |
| R _{LR} | 78.75 lbs |
| R _{SL} | 98.44 lbs |

RB-6

| | |
|-----------|-----------------------|
| Span | 4.00 ft |
| T.W. | 6.00 ft |
| DL | 90.00 plf |
| LR | 120.00 plf |
| SL | 150.00 plf |
| Wind T.W. | 3.04 ft |
| Wind T.A. | 12.17 ft ² |
| WL | 62.05 plf |

| | |
|-----------------|------------|
| R _{DL} | 180.00 lbs |
| R _{LR} | 240.00 lbs |
| R _{SL} | 300.00 lbs |

RB-7

| | |
|-----------|-----------------------|
| Span | 8.46 ft |
| T.W. | 6.00 ft |
| DL | 90.00 plf |
| LR | 120.00 plf |
| SL | 150.00 plf |
| Wind T.W. | 3.04 ft |
| Wind T.A. | 25.73 ft ² |
| WL | 57.79 plf |

| | |
|-----------------|------------|
| R _{DL} | 380.63 lbs |
| R _{LR} | 507.50 lbs |
| R _{SL} | 634.38 lbs |

RB-8

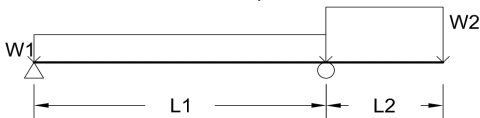
| | |
|----------------|---------|
| L ₁ | 3.29 ft |
| L ₂ | 3.75 ft |

| | |
|----------------|--------------|
| W ₁ | Roof Loading |
| T.W. | 6.00 ft |
| DL | 90.00 plf |
| LR | 120.00 plf |
| SL | 150.00 plf |

| | |
|-----------------|-------------|
| <i>Left</i> | |
| R _{DL} | -120.00 lbs |
| R _{LR} | -160.00 lbs |
| R _{SL} | -200.00 lbs |

| | |
|----------------|--------------|
| W ₂ | Roof Loading |
| T.W. | 8.27 ft |
| DL | 124.06 plf |
| LR | 165.42 plf |
| SL | 206.77 plf |

| | |
|-----------------|-------------|
| <i>Right</i> | |
| R _{DL} | 880.00 lbs |
| R _{LR} | 1170.00 lbs |
| R _{SL} | 1460.00 lbs |



| | |
|-----------|-----------------------|
| Wind T.W. | 3.04 ft |
| Wind T.A. | 10.01 ft ² |
| WL | 62.96 plf |

FRAMING LOADS AND REACTIONS

BICKEL RESIDENCE REMODEL

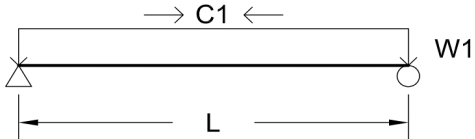
RB-9

| | |
|-------|-----------|
| Span | 9.58 ft |
| W_1 | |
| T.W. | 2.31 ft |
| DL | 34.69 plf |
| LR | 46.25 plf |
| SL | 57.81 plf |

| | |
|----------|------------|
| R_{DL} | 166.21 lbs |
| R_{LR} | 221.61 lbs |
| R_{SL} | 277.02 lbs |

C_1

| | | | |
|-----------|-----------------------|----------------|------------|
| E | 1.30 lbs | Roof Diaphragm | Unfactored |
| Wind T.W. | 1.34 ft | | |
| Wind T.A. | 30.61 ft ² | | |
| WL | 25.13 plf | | |



RB-10

| | |
|------|------------|
| Span | 9.58 ft |
| T.W. | 5.00 ft |
| DL | 75.00 plf |
| LR | 100.00 plf |
| SL | 125.00 plf |

| | |
|----------|------------|
| R_{DL} | 359.38 lbs |
| R_{LR} | 479.17 lbs |
| R_{SL} | 598.96 lbs |

RB-11

| | |
|------|------------|
| Span | 18.42 ft |
| T.W. | 9.29 ft |
| DL | 139.38 plf |
| LR | 185.83 plf |
| SL | 232.29 plf |

| | |
|----------|-------------|
| R_{DL} | 1283.41 lbs |
| R_{LR} | 1711.22 lbs |
| R_{SL} | 2139.02 lbs |

RB-12

| | |
|------|------------|
| Span | 18.42 ft |
| T.W. | 10.67 ft |
| DL | 160.00 plf |
| LR | 213.33 plf |
| SL | 266.67 plf |

| | |
|----------|-------------|
| R_{DL} | 1610.00 lbs |
| R_{LR} | 1970.00 lbs |
| R_{SL} | 2460.00 lbs |

RB-13

| | |
|------|------------|
| Span | 9.58 ft |
| T.W. | 7.78 ft |
| DL | 116.72 plf |
| LR | 155.63 plf |
| SL | 194.53 plf |

| | |
|----------|------------|
| R_{DL} | 559.28 lbs |
| R_{LR} | 745.70 lbs |
| R_{SL} | 932.13 lbs |

RB-14

| | |
|------|-----------|
| Span | 15.42 ft |
| T.W. | 2.00 ft |
| DL | 30.00 plf |
| LR | 40.00 plf |
| SL | 50.00 plf |

| | |
|----------|-------------|
| R_{DL} | 231.25 lbs |
| R_{LR} | 308.33 lbs |
| R_{SL} | 385.42 lbs |
| R_E | 5250.00 lbs |

C_1

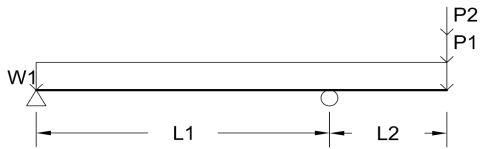
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|---|----------|----------------|------------|
| E | 5.25 lbs | Roof Diaphragm | Unfactored |
|---|----------|----------------|------------|



FLOOR FRAMING LOADS & REACTIONS

JOISTS & BEAMS

| | VALUE UNIT | SOURCE | Reaction | Value Unit |
|----------------|-------------------------|-----------------------|----------------------------|----------------------------|
| FJ-1 | | | | |
| | L ₁ 15.33 ft | | | |
| | L ₂ 3.00 ft | | | |
| W ₁ | T.W. 1.33 ft | Floor Loading | | |
| | DL 22.67 plf | | <i>Left</i> | R _{DL} 210.00 lbs |
| | LL 26.67 plf | | R _{LR} -10.00 lbs | R _{SL} -10.00 lbs |
| P ₁ | | Roof Loading | R _{LL} 400.00 lbs | |
| | Roof TW 1.79 ft | | <i>Right</i> | R _{DL} 660.00 lbs |
| | Spacing 1.33 ft | | R _{LR} 60.00 lbs | R _{SL} 70.00 lbs |
| | DL 35.83 lbs | | R _{LL} 590.00 lbs | |
| | LR 47.78 lbs | | | |
| | SL 59.72 lbs | | | |
| P ₂ | | Exterior Wall Loading | | |
| | Wall Ht. 12.42 ft | | | |
| | Floor TW 1.33 ft | | | |
| | DL 198.67 lbs | | | |



FJ-2

| | | | | |
|------|-----------|--|-----------------|------------|
| Span | 7.00 ft | | | |
| T.W. | 1.33 ft | | | |
| DL | 22.67 plf | | R _{DL} | 79.33 lbs |
| LL | 53.33 plf | | R _{LL} | 186.67 lbs |

LRJ-1

| | | | | |
|------|-----------|--|-----------------|------------|
| Span | 7.00 ft | | | |
| T.W. | 2.00 ft | | | |
| DL | 30.00 plf | | R _{DL} | 105.00 lbs |
| LR | 40.00 plf | | R _{LR} | 140.00 lbs |
| SL | 50.00 plf | | R _{SL} | 175.00 lbs |

FRAMING LOADS AND REACTIONS

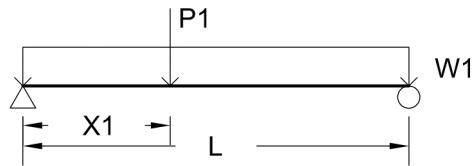
BICKEL RESIDENCE REMODEL

FB-1

| | |
|----------------|---------------|
| L | 3.17 ft |
| X ₁ | 2.42 ft |
| W ₁ | Floor Loading |
| T.W. | 10.67 ft |
| DL | 181.33 plf |
| LL | 426.67 plf |

| | |
|----------------|-------------|
| P ₁ | FB-3B |
| DL | 1250.00 lbs |
| LR | 710.00 lbs |
| SL | 880.00 lbs |
| LL | 590.00 lbs |
| E | 180.00 lbs |

| | |
|-----------------|-------------|
| R _{DL} | 1290.00 lbs |
| R _{LR} | 540.00 lbs |
| R _{SL} | 670.00 lbs |
| R _{LL} | 1130.00 lbs |
| R _E | 140.00 lbs |



FB-2

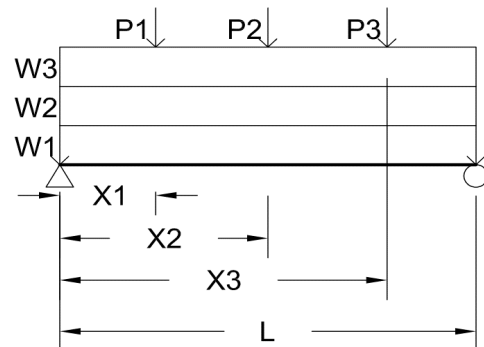
| | |
|----------------|------------|
| L | 10.50 ft |
| X ₁ | 2.71 ft |
| X ₂ | 4.83 ft |
| X ₃ | 8.33 ft |
| W ₁ | RJ-2 |
| DL | 110.00 plf |
| LR | 130.00 plf |
| SL | 165.00 plf |

| | |
|-----------------|-------------|
| R _{DL} | 1340.00 lbs |
| R _{LR} | 930.00 lbs |
| R _{SL} | 1180.00 lbs |
| R _{LL} | 280.00 lbs |

| | |
|----------------|-----------------------|
| W ₂ | Exterior Wall Loading |
| Wall HT | 6.08 ft |
| DL | 73.00 plf |

| | |
|----------------|---------------|
| W ₃ | Floor Loading |
| T.W. | 1.33 ft |
| DL | 22.67 plf |
| LL | 53.33 plf |

| | |
|--|------------|
| P ₁ , P ₂ , P ₃ | RP-4 |
| DL | 123.96 lbs |
| LR | 165.28 lbs |
| SL | 206.60 lbs |

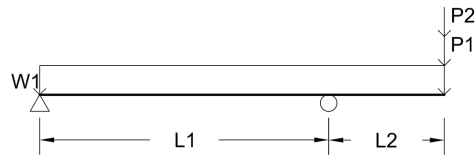


FRAMING LOADS AND REACTIONS

BICKEL RESIDENCE REMODEL

FB-3A & FB-3B

| | | | | |
|-------|----------|-------------|-----------------------|------------|
| | L_1 | 15.33 ft | | |
| | L_2 | 3.00 ft | | |
| W_1 | | | Floor Loading | |
| | T.W. | 1.33 ft | | |
| | DL | 22.67 plf | | |
| | LL | 53.33 plf | | |
| P_1 | | | | |
| | RP-2A | | RP-2B | |
| | DL | 1270.00 lbs | DL | 510.00 lbs |
| | LR | 1610.00 lbs | LR | 590.00 lbs |
| | SL | 2010.00 lbs | SL | 740.00 lbs |
| | E | 1450.00 lbs | E | 150.00 lbs |
| P_2 | | | Exterior Wall Loading | |
| | Wall Ht. | 12.42 ft | | |
| | Floor TW | 1.33 ft | | |
| | DL | 198.67 lbs | | |



FB-3A Reactions

Left

| | |
|----------|-------------|
| R_{DL} | 40.00 lbs |
| R_{LR} | -320.00 lbs |
| R_{SL} | -390.00 lbs |
| R_{LL} | 400.00 lbs |
| R_E | 280.00 lbs |

Right

| | |
|----------|-------------|
| R_{DL} | 2240.00 lbs |
| R_{LR} | 1930.00 lbs |
| R_{SL} | 2400.00 lbs |
| R_{LL} | 590.00 lbs |
| R_E | 1730.00 lbs |

FB-3B Reactions

Left

| | |
|----------|-------------|
| R_{DL} | 130.00 lbs |
| R_{LR} | -120.00 lbs |
| R_{SL} | -140.00 lbs |
| R_{LL} | 400.00 lbs |
| R_E | 30.00 lbs |

Right

| | |
|----------|-------------|
| R_{DL} | 1250.00 lbs |
| R_{LR} | 710.00 lbs |
| R_{SL} | 880.00 lbs |
| R_{LL} | 590.00 lbs |
| R_E | 180.00 lbs |

FRAMING LOADS AND REACTIONS

BICKEL RESIDENCE REMODEL

FB-4

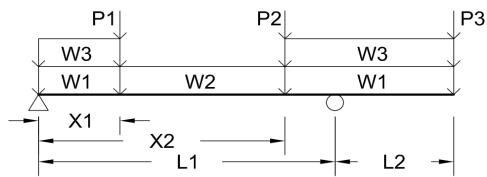
| | | | |
|---------------------------------|----------------|------------|------------------------------|
| | L ₁ | 15.00 ft | |
| | L ₂ | 2.92 ft | |
| | X ₁ | 4.08 ft | |
| | X ₂ | 13.67 ft | |
| W ₁ | | | Floor Loading 1 |
| | T.W. | 0.67 ft | |
| | DL | 11.33 plf | |
| | LL | 26.67 plf | |
| W ₂ | | | Floor Loading 2 |
| | T.W. | 1.33 ft | |
| | DL | 22.67 plf | |
| | LL | 53.33 plf | |
| W ₃ | | | Roof Loading + Wall Weight |
| | Wall HT | 8.125 ft | |
| | T.W. | 12.74 ft | |
| | DL | 288.59 plf | |
| | Lr | 254.79 plf | |
| | SL | 318.49 | |
| P ₁ , P ₂ | | | RP-1 |
| | DL | 559.28 lbs | |
| | LR | 745.70 lbs | |
| | SL | 932.13 lbs | |
| P ₃ | | | |
| | E | 1450.0 lbs | SW-AR Chord Force Unfactored |

Left

| | |
|-----------------|-------------|
| R _{DL} | 1660.00 lbs |
| R _{LR} | 1450.00 lbs |
| R _{SL} | 1810.00 lbs |
| R _{LL} | 300.00 lbs |
| R _E | 290.00 lbs |

Right

| | |
|-----------------|-------------|
| R _{DL} | 2510.00 lbs |
| R _{LR} | 2190.00 lbs |
| R _{SL} | 2740.00 lbs |
| R _{LL} | 440.00 lbs |
| R _E | 1740.00 lbs |

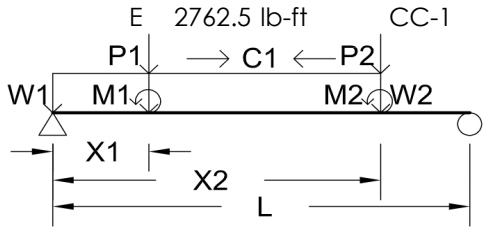


FRAMING LOADS AND REACTIONS

BICKEL RESIDENCE REMODEL

FB-5

| | | | | |
|------------|--------------|------------------|------------|--|
| L_1 | 15.00 ft | | | |
| X_1 | 4.08 ft | | | |
| X_2 | 13.67 ft | | | |
| Ω | 3.00 | | | |
| <hr/> | | | | |
| W_1 | | Roof Loading | | |
| T.W. | 7.31 ft | | | |
| DL | 109.69 plf | | | |
| LR | 146.25 plf | | | |
| SL | 182.81 plf | | | |
| W_2 | | Floor Loading | | |
| T.W. | 0.67 ft | | | |
| DL | 11.33 plf | | | |
| LL | 26.67 plf | | | |
| P_1, P_2 | | CC-1 | | |
| DL | 525.59 lbs | | | |
| LR | 700.78 lbs | | | |
| SL | 875.98 lbs | | | |
| C_1 | | | | |
| E | 1300.0 lbs | Roof LFRS | Unfactored | |
| E | 3300.0 lbs | Upper Floor LFRS | Unfactored | |
| M_1, M_2 | | | | |
| E | 2762.5 lb-ft | CC-1 | | |



FB-6

| | | | | |
|---------|------------|-------------------|------------|--|
| Span | 8.75 ft | | | |
| W_1 | | Roof Loading | | |
| T.W. | 12.88 ft | | | |
| DL | 193.13 plf | | | |
| LR | 257.50 plf | | | |
| SL | 321.88 plf | | | |
| W_2 | | Ext. Wall Loading | | |
| Wall HT | 3.17 ft | | | |
| DL | 38.00 plf | | | |
| C_1 | | | | |
| E | 4600.0 lbs | LFRS | Unfactored | |

| | |
|--------------|-------------|
| <i>Left</i> | |
| R_{DL} | 870.00 lbs |
| R_{LR} | 1090.00 lbs |
| R_{SL} | 1360.00 lbs |
| R_{LL} | 104.00 lbs |
| R_E | 640.00 lbs |
| <i>Right</i> | |
| R_{DL} | 760.00 |
| R_{LR} | 910.00 |
| R_{SL} | 1140.00 |
| R_{LL} | 150.00 |
| R_E | 640.00 |

FRAMING LOADS AND REACTIONS

BICKEL RESIDENCE REMODEL

FB-7

| | |
|-------|----------|
| L_1 | 22.25 ft |
| X_1 | 6.42 ft |
| X_2 | 11.08 ft |
| X_3 | 18.83 ft |

W_1 Floor Loading

| | |
|------|------------|
| T.W. | 7.67 ft |
| DL | 130.33 plf |
| LL | 306.67 plf |

P_1 FB-5+FB-6

| | |
|----|-------------|
| DL | 1881.17 lbs |
| LR | 2216.56 lbs |
| SL | 2768.20 lbs |
| LL | 104.00 lbs |
| E | 640.00 lbs |

P_2 FB-4

| | |
|----|-------------|
| DL | 1660.00 lbs |
| LR | 1450.00 lbs |
| SL | 1810.00 lbs |
| LL | 300.00 lbs |
| E | 290.00 lbs |

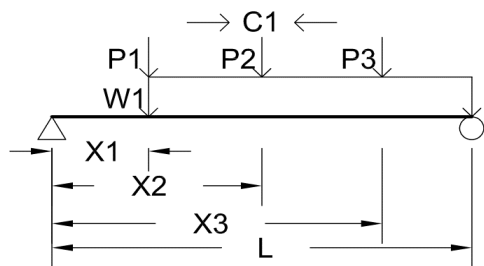
P_3 FB-3A

| | |
|----|-------------|
| DL | 40.00 lbs |
| LR | -320.00 lbs |
| SL | -390.00 lbs |
| LL | 400.00 lbs |
| E | 280.00 lbs |

C_1

E 4100.0 lbs Floor LFRS

Unfactored



Left

| | |
|----------|-------------|
| R_{DL} | 3884.00 lbs |
| R_{LR} | 5668.00 lbs |
| R_{SL} | 2819.00 lbs |
| R_{LL} | 286.00 lbs |
| R_E | 644.00 lbs |

Right

| | |
|----------|-------------|
| R_{DL} | 3109.00 lbs |
| R_{LR} | 4503.00 lbs |
| R_{SL} | 1370.00 lbs |
| R_{LL} | 518.00 lbs |
| R_E | 566.00 lbs |

FRAMING LOADS AND REACTIONS

BICKEL RESIDENCE REMODEL

FB-8

| | | | |
|-------|-------|-----------|---------------|
| | L_1 | 15.33 ft | |
| | L_2 | 3.00 ft | |
| | X_1 | 0.50 ft | |
| W_1 | | | Floor Loading |
| | T.W. | 1.33 ft | |
| | DL | 22.67 plf | |
| | LL | 26.67 plf | |

| | | | |
|-------|----------|------------|--------------------------------|
| P_2 | | | Roof Loading+Ext. Wall Loading |
| | Wall Ht. | 12.42 ft | |
| | Floor TW | 1.33 ft | |
| | Roof TW | 1.79 ft | |
| | Spacing | 1.33 ft | |
| | DL | 234.50 lbs | |
| | LR | 47.78 lbs | |
| | SL | 59.72 lbs | |

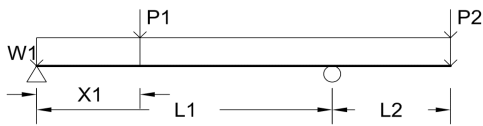
| | | | |
|-------|----|-------------|------|
| P_1 | | | FB-7 |
| | DL | 3109.00 lbs | |
| | LR | 4503.00 lbs | |
| | SL | 1370.00 lbs | |
| | LL | 518.00 lbs | |
| | E | 566.00 lbs | |

Left

| | |
|----------|-------------|
| R_{DL} | 3230.00 lbs |
| R_{LR} | 4350.00 lbs |
| R_{SL} | 1310.00 lbs |
| R_{LL} | 900.00 lbs |
| R_E | 550.00 lbs |

Right

| | |
|----------|------------|
| R_{DL} | 780.00 lbs |
| R_{LR} | 200.00 lbs |
| R_{SL} | 120.00 lbs |
| R_{LL} | 600.00 lbs |
| R_E | 20.00 lbs |



FRAMING LOADS AND REACTIONS

BICKEL RESIDENCE REMODEL

FB-9

| | |
|----------------|----------|
| L ₁ | 13.42 ft |
| X ₁ | 5.50 ft |
| X ₂ | 6.00 ft |
| X ₃ | 8.50 ft |
| X ₄ | 10.25 ft |

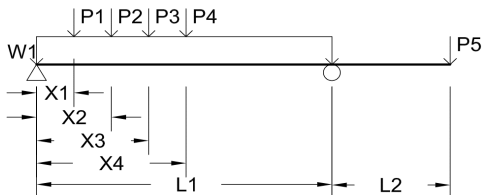
| | | |
|----------------|------|------------------|
| W ₁ | | Floor Loading |
| | T.W. | 7.67 ft |
| | DL | 130.33 plf |
| | LL | 306.67 plf |
| W ₂ | | Floor Loading |
| | T.W. | 11.17 ft |
| | DL | 189.83 plf |
| | LL | 446.67 plf |
| W ₃ | | Low Roof Loading |
| | T.W. | 3.50 ft |
| | DL | 52.50 plf |
| | LR | 70.00 plf |
| | SL | 87.50 plf |
| P ₁ | | RP-5 |
| | DL | 1510.00 lbs |
| | LR | 1840.00 lbs |
| | SL | 2300.00 lbs |
| P ₂ | | FB-3A |
| | DL | 40.00 lbs |
| | LR | -320.00 lbs |
| | SL | -390.00 lbs |
| | LL | 400.00 lbs |
| | E | 280.00 lbs |
| P ₃ | | FB-3B |
| | DL | 130.00 lbs |
| | LR | -120.00 lbs |
| | SL | -140.00 lbs |
| | LL | 400.00 lbs |
| | E | 30.00 lbs |
| P ₄ | | RP-6 |
| | DL | 349.06 lbs |
| | LR | 428.75 lbs |
| | SL | 538.44 lbs |

Left

| | |
|-----------------|-------------|
| R _{DL} | 2600.00 lbs |
| R _{LR} | 1270.00 lbs |
| R _{SL} | 1600.00 lbs |
| R _{LL} | 2750.00 lbs |
| R _E | 170.00 lbs |

Right

| | |
|-----------------|-------------|
| R _{DL} | 2600.00 lbs |
| R _{LR} | 940.00 lbs |
| R _{SL} | 1190.00 lbs |
| R _{LL} | 3270.00 lbs |
| R _E | 140.00 lbs |



FRAMING LOADS AND REACTIONS

BICKEL RESIDENCE REMODEL

FB-10

| | | | | | |
|----------------|----------------------|---------------------|--|-----------------|-------------|
| Span | 15.83 ft | | | | |
| X ₁ | 12.17 ft | | | | |
| <hr/> | | | | | |
| W ₁ | | Ext. Wall Loading | | <i>Left</i> | |
| Wall HT | 9.25 ft | | | R _{DL} | 980.00 lbs |
| DL | 111.00 plf | | | R _{LR} | 20.00 lbs |
| P ₁ | | RP-7+Stair Stringer | | R _{SL} | 20.00 lbs |
| Stringer T.A. | 4.75 ft ² | | | R _{LL} | 40.00 lbs |
| DL | 106.563 lbs | | | <i>Right</i> | |
| LR | 78.75 lbs | | | R _{DL} | 1040.00 lbs |
| SL | 98.44 lbs | | | R _{LR} | 60.00 lbs |
| LL | 190.00 lbs | | | R _{SL} | 80.00 lbs |
| | | | | R _{LL} | 150.00 lbs |

FB-11

| | | | | | |
|----------------|-------------|-----------------------|--|-----------------|-------------|
| L | 5.83 ft | | | | |
| <hr/> | | | | | |
| W ₁ | | High Roof Loading | | <i>Left</i> | |
| T.W. | 1.00 ft | | | R _{DL} | 1140.00 lbs |
| DL | 15.00 plf | | | R _{LR} | 460.00 lbs |
| LR | 20.00 plf | | | R _{SL} | 570.00 lbs |
| SL | 25.00 plf | | | R _{LL} | 1140.00 lbs |
| W ₂ | | Exterior Wall Loading | | R _E | 20.00 lbs |
| Wall HT | 8.50 ft | | | <i>Right</i> | |
| DL | 102.00 plf | | | R _{DL} | 1010.00 lbs |
| W ₃ | | Floor Loading | | R _{LR} | 300.00 lbs |
| T.W. | 7.67 ft | | | R _{SL} | 370.00 lbs |
| DL | 130.33 plf | | | R _{LL} | 1060.00 lbs |
| LL | 306.67 plf | | | R _E | 10.00 lbs |
| W ₄ | | Partial Roof Loading | | | |
| T.W. | 3.50 ft | | | | |
| DL | 52.50 plf | | | | |
| LR | 70.00 plf | | | | |
| SL | 87.50 plf | | | | |
| P ₁ | | LRB-1 - Left | | | |
| DL | 280.00 lbs | | | | |
| LR | 340.00 lbs | | | | |
| SL | 430.00 lbs | | | | |
| P ₂ | | FB-3B - Left | | | |
| DL | 130.00 lbs | | | | |
| LR | -120.00 lbs | | | | |
| SL | -140.00 lbs | | | | |
| LL | 400.00 lbs | | | | |
| E | 30.00 lbs | | | | |

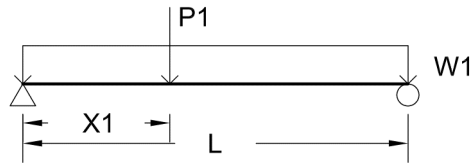
FRAMING LOADS AND REACTIONS

BICKEL RESIDENCE REMODEL

FB-12

| | | | |
|----------------|----------------|------------|---------------|
| | L | 7.83 ft | |
| | X ₁ | 1.83 ft | |
| W ₁ | | | Floor Loading |
| | T.W. | 3.50 ft | |
| | DL | 59.50 plf | |
| | LL | 140.00 plf | |

| | | | |
|----------------|----|------------|------|
| P ₁ | | | RB-2 |
| | DL | 106.20 lbs | |
| | LR | 141.60 lbs | |
| | SL | 177.00 lbs | |



Left

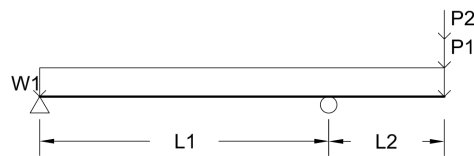
| | |
|-----------------|------------|
| R _{DL} | 830.00 lbs |
| R _{LR} | 110.00 lbs |
| R _{SL} | 140.00 lbs |
| R _{LL} | 550.00 lbs |

Right

| | |
|-----------------|------------|
| R _{DL} | 770 lbs |
| R _{LR} | 30 lbs |
| R _{SL} | 40 lbs |
| R _{LL} | 550.00 lbs |

FB-13

| | | | |
|----------------|----------------|------------|------------------------|
| | L ₁ | 2.25 ft | |
| | L ₂ | 3.00 ft | |
| W ₁ | | | Floor Loading |
| | T.W. | 1.33 ft | |
| | DL | 22.67 plf | |
| | LL | 26.67 plf | |
| W ₂ | | | Roof+Ext. Wall Loading |
| | Wall HT | 6.08333 ft | |
| | DL | 155.50 plf | |
| | LR | 110.00 plf | |
| | SL | 137.50 plf | |
| P ₁ | | | SW-AR Loading |
| | E | 660.00 lbs | |



Left

| | |
|-----------------|-------------|
| R _{DL} | -170.00 lbs |
| R _{LR} | -100.00 lbs |
| R _{SL} | -120.00 lbs |
| R _{LL} | -30.00 lbs |
| R _E | -880.00 lbs |

Right

| | |
|-----------------|-------------|
| R _{DL} | 1200.00 lbs |
| R _{LR} | 670.00 lbs |
| R _{SL} | 840.00 lbs |
| R _{LL} | 220.00 lbs |
| R _E | 1540.00 lbs |

FRAMING LOADS AND REACTIONS

BICKEL RESIDENCE REMODEL

FB-14

| | | | |
|-------|---------|------------|-----------------------|
| | L | 7.00 ft | |
| W_1 | | | High Roof Loading |
| | T.W. | 11.88 ft | |
| | DL | 178.13 plf | |
| | LR | 237.50 plf | |
| | SL | 296.88 plf | |
| W_2 | | | Exterior Wall Loading |
| | Wall HT | 9.00 ft | |
| | DL | 108.00 plf | |
| W_3 | | | Floor Loading |
| | T.W. | 0.67 ft | |
| | DL | 11.33 plf | |
| | LL | 26.67 plf | |
| C | | | Shear Wall |
| | E | 3.10 | |

| | |
|----------|-------------|
| R_{DL} | 1051.00 lbs |
| R_{LR} | 819.00 lbs |
| R_{SL} | 1040.00 lbs |
| R_{LL} | 93.00 lbs |
| R_E | lbs |

LRB-1

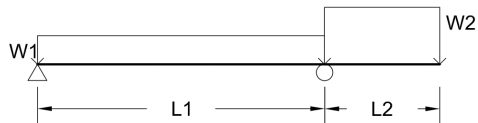
| | | |
|-------|-------|------------|
| | L_1 | 7.33 ft |
| | L_2 | 2.83 ft |
| W_1 | | |
| | T.W. | 5.40 ft |
| | DL | 81.00 plf |
| | LR | 108.00 plf |
| | SL | 135.00 plf |
| W_2 | | |
| | T.W. | 5.40 ft |
| | DL | 81.00 plf |
| | LR | 108.00 plf |
| | SL | 135.00 plf |

Left

| | |
|----------|------------|
| R_{DL} | 280.00 lbs |
| R_{LR} | 340.00 lbs |
| R_{SL} | 430.00 lbs |

Right

| | |
|----------|-------------|
| R_{DL} | 940.00 lbs |
| R_{LR} | 870.00 lbs |
| R_{SL} | 1080.00 lbs |



LRB-2

| | |
|------|-----------|
| Span | 13.00 ft |
| T.W. | 3.50 ft |
| DL | 52.50 plf |
| LR | 70.00 plf |
| SL | 87.50 plf |

| | |
|----------|------------|
| R_{DL} | 341.25 lbs |
| R_{LR} | 455.00 lbs |
| R_{SL} | 568.75 lbs |

FRAMING LOADS AND REACTIONS

BICKEL RESIDENCE REMODEL

STUD LOADS

EXTERIOR STUDS

| | Value | Unit | Source | Reaction | Value | Unit |
|---------------------|--------|-----------------|--------------------|-----------------|--------|------|
| Typical Stud | | | | | | |
| Height | 7.5 | ft | | | | |
| T.W. | 1.33 | FT | | | | |
| A _{eff} | 18.75 | ft ² | C&C | | | |
| DL | 277.67 | lbs | RJ-2+Floor Loading | R _{DL} | 277.67 | kips |
| LR | 273.33 | lbs | RJ-2+Floor Loading | R _{LR} | 273.33 | kips |
| LL | 71.47 | lbs | Floor Loading | R _{LL} | 71.47 | kips |
| SL | 340.00 | lbs | RJ-2 | R _{SL} | 340.00 | kips |
| WL | 26.00 | plf | | R _{WL} | 0.10 | kips |
| Δ _{Limit} | 0.38 | in | | | | |

POST LOADS

ROOF POSTS

| | Value | Unit | Source | Reaction | Value | Unit |
|-------------|--------|------|------------|--------------------------|---------|--------|
| CC-1 | | | | | | |
| Height | 4.25 | ft | | | | |
| DL | 525.59 | lbs | RB-9+RB-10 | R _{DL} | 525.59 | lbs |
| LR | 700.78 | lbs | RB-9+RB-10 | R _{LR} | 700.78 | lbs |
| SL | 875.98 | lbs | RB-9+RB-10 | R _{SL} | 875.98 | lbs |
| E | 650.00 | lbs | LFRS Shear | R _E | 650.00 | lbs |
| | | | Unfactored | M _E | 2762.50 | lbs-ft |
| | | | | Reaction Force For Strap | | |
| | | | | R _E | 1550.00 | lbs |

RP-1

| | | | | | | |
|--------|--------|-----|-------|-----------------|--------|-----|
| Height | 8.125 | ft | | | | |
| DL | 559.28 | lbs | RB-13 | R _{DL} | 559.28 | lbs |
| LR | 745.70 | lbs | RB-13 | R _{LR} | 745.70 | lbs |
| SL | 932.13 | lbs | RB-13 | R _{SL} | 932.13 | lbs |

RP-2A

| | | | | | | |
|--------|---------|-----|-------------|-----------------|---------|-----|
| Height | 12.4167 | ft | | | | |
| DL | 1270.00 | lbs | RB-1 | R _{DL} | 1270.00 | lbs |
| LR | 1610.00 | lbs | RB-1 | R _{LR} | 1610.00 | lbs |
| SL | 2010.00 | lbs | RB-1 | R _{SL} | 2010.00 | lbs |
| E | 1450.00 | lbs | SW-AR Chord | R _E | 1450.00 | lbs |
| | | | Unfactored | | | |



FRAMING LOADS AND REACTIONS

BICKEL RESIDENCE REMODEL

RP-2B

Height 12.4167 ft

| | | | | | |
|----|------------|-------------|------------|-----------------|------------|
| DL | 510.00 lbs | RB-1 | | R _{DL} | 510.00 lbs |
| LR | 590.00 lbs | RB-1 | | R _{LR} | 590.00 lbs |
| SL | 740.00 lbs | RB-1 | | R _{SL} | 740.00 lbs |
| E | 150.00 lbs | SW-AR Chord | Unfactored | R _E | 150.00 lbs |

RP-3A

Height 12.4167 ft

| | | | | | |
|----|-------------|-------------|------------|-----------------|-------------|
| DL | 2076.20 lbs | RB-2+RB-12 | | R _{DL} | 2076.20 lbs |
| LR | 2601.60 lbs | RB-2+RB-12 | | R _{LR} | 2601.60 lbs |
| SL | 177.00 lbs | RB-2+RB-12 | | R _{SL} | 177.00 lbs |
| E | 150.00 lbs | SW-AR Chord | Unfactored | R _E | 150.00 lbs |

RP-3B

Height 12.4167 ft

| | | | | | |
|----|------------|-------------|------------|-----------------|------------|
| DL | 106.20 lbs | RB-2 | | R _{DL} | 106.20 lbs |
| LR | 141.60 lbs | RB-2 | | R _{LR} | 141.60 lbs |
| SL | 177.00 lbs | RB-2 | | R _{SL} | 177.00 lbs |
| E | 660.00 lbs | SW-AR Chord | Unfactored | R _E | 660.00 lbs |

RP-4

Height 6.08333 ft

| | | | | | |
|----|------------|------|--|-----------------|------------|
| DL | 123.96 lbs | RB-3 | | R _{DL} | 123.96 lbs |
| LR | 165.28 lbs | RB-3 | | R _{LR} | 165.28 lbs |
| SL | 206.60 lbs | RB-3 | | R _{SL} | 206.60 lbs |

RP-5

Height 12.4167 ft

| | | | | | |
|----|-------------|------|--|-----------------|-------------|
| DL | 1510.00 lbs | RB-4 | | R _{DL} | 1510.00 lbs |
| LR | 1840.00 lbs | RB-4 | | R _{LR} | 1840.00 lbs |
| SL | 2300.00 lbs | RB-4 | | R _{SL} | 2300.00 lbs |

RP-6

Height 12.4167 ft

| | | | | | |
|----|------------|-----------|--|-----------------|------------|
| DL | 349.06 lbs | RB-5+RB-4 | | R _{DL} | 349.06 lbs |
| LR | 428.75 lbs | RB-5+RB-4 | | R _{LR} | 428.75 lbs |
| SL | 538.44 lbs | RB-5+RB-4 | | R _{SL} | 538.44 lbs |

FRAMING LOADS AND REACTIONS

BICKEL RESIDENCE REMODEL

RP-7

Height 8.41667 ft

| | | | | |
|----|-----------|------|-----------------|-----------|
| DL | 59.06 lbs | RB-5 | R _{DL} | 59.06 lbs |
| LR | 78.75 lbs | RB-5 | R _{LR} | 78.75 lbs |
| SL | 98.44 lbs | RB-5 | R _{SL} | 98.44 lbs |

FLOOR POSTS

FP-1

Height 8.42 ft

| | | | | |
|----|-------------|------|-----------------|-------------|
| DL | 870.00 lbs | FB-5 | R _{DL} | 870.00 lbs |
| LR | 1090.00 lbs | FB-5 | R _{LR} | 1090.00 lbs |
| SL | 1360.00 lbs | FB-5 | R _{SL} | 1360.00 lbs |
| LL | 104.00 lbs | FB-5 | R _{LL} | 104.00 lbs |
| E | 640.00 lbs | FB-5 | R _E | 640.00 lbs |

FP-2

Height 8.42 ft

| | | | | |
|----|-------------|------|-----------------|-------------|
| DL | 2510.00 lbs | FB-4 | R _{DL} | 2510.00 lbs |
| LR | 2190.00 lbs | FB-4 | R _{LR} | 2190.00 lbs |
| SL | 2740.00 lbs | FB-4 | R _{SL} | 2740.00 lbs |
| LL | 440.00 lbs | FB-4 | R _{LL} | 440.00 lbs |
| E | 1740.00 lbs | FB-4 | R _E | 1740.00 lbs |

FP-3

Height 8.42 ft

| | | | | |
|----|-------------|-------|-----------------|-------------|
| DL | 2240.00 lbs | FB-3A | R _{DL} | 2240.00 lbs |
| LR | 1930.00 lbs | FB-3A | R _{LR} | 1930.00 lbs |
| SL | 2400.00 lbs | FB-3A | R _{SL} | 2400.00 lbs |
| LL | 590.00 lbs | FB-3A | R _{LL} | 590.00 lbs |
| E | 1730.00 lbs | FB-3A | R _E | 1730.00 lbs |

FP-4

Height 8.42 ft

| | | | | |
|----|-------------|------|-----------------|-------------|
| DL | 1340.00 lbs | FB-2 | R _{DL} | 1340.00 lbs |
| LR | 930.00 lbs | FB-2 | R _{LR} | 930.00 lbs |
| SL | 1180.00 lbs | FB-2 | R _{SL} | 1180.00 lbs |
| LL | 280.00 lbs | FB-2 | R _{LL} | 280.00 lbs |

FP-5

Height 8.42 ft

| | | | | |
|----|-------------|----------------------------------|-----------------|-------------|
| DL | 7921.00 lbs | FB-8+FB-9+FB-10+FB-14 | R _{DL} | 7921.00 lbs |
| LR | 6499.00 lbs | FB-8+FB-9+FB-10+FB-14 | R _{LR} | 6499.00 lbs |
| SL | 4030.00 lbs | FB-8+FB-9+FB-10+FB-14 | R _{SL} | 4030.00 lbs |
| LL | 3893.00 lbs | FB-8+FB-9+FB-10+FB-14 | R _{LL} | 3893.00 lbs |
| E | 3410.00 lbs | FB-8+FB-9+FB-10+FB-14+SW-4 Chord | R _E | 3410.00 lbs |



FRAMING LOADS AND REACTIONS

BICKEL RESIDENCE REMODEL

FP-6

Height 8.42 ft

| | | | | |
|----|-------------|------------------------|-----------------|--------------|
| DL | 3884.00 lbs | FB-7 | R _{DL} | 3884.00 lbs |
| LR | 5668.00 lbs | FB-7 | R _{LR} | 5668.00 lbs |
| SL | 2819.00 lbs | FB-7 | R _{SL} | 2819.00 lbs |
| LL | 286.00 lbs | FB-7 | R _{LL} | 286.00 lbs |
| E | 11200.0 lbs | SW-B Compression Chord | R _E | 11200.00 lbs |

FP-7

Height 8.42 ft

| | | | | |
|----|-------------|-------------|-----------------|-------------|
| DL | 1881.00 lbs | FB-12+FB-14 | R _{DL} | 1881.00 lbs |
| LR | 929.00 lbs | FB-12+FB-14 | R _{LR} | 929.00 lbs |
| SL | 1180.00 lbs | FB-12+FB-14 | R _{SL} | 1180.00 lbs |
| LL | 643.00 lbs | FB-12+FB-14 | R _{LL} | 643.00 lbs |
| E | 2690.0 lbs | SW-B Chord | R _E | 2690.00 lbs |

FP-8

Height 8.42 ft

Wind T.W. 5.88 ft

Wind T.A. 49.45 ft²

| | | | | |
|----|-------------|-----------|-----------------|-------------|
| DL | 1260.63 lbs | RB-7+RB-8 | R _{DL} | 1260.63 lbs |
| LR | 1677.50 lbs | RB-7+RB-8 | R _{LR} | 1677.50 lbs |
| SL | 2094.38 lbs | RB-7+RB-8 | R _{SL} | 2094.38 lbs |
| W | 102.81 plf | | | |

FB-7 - Revised w/ Added Post Support 10/22

Span 1 = 12' + 5'

TA = 2'R + 1'WW + 6'

1 1/2'R + 3'WW + 2'R + 6'

7 1/2'R + 9'WW + 4'R + 6' - 12'

+ P_{10.5'} = 1.45k_s
(FB-5) 0.3k_L
1.73k_s
0.6k_E

+ P_{2.6'} = 2.47k_s
FB-4 + RB-10 0.3k_L
2.6k_s

PSL 5'4x14

R₁ = 3.12k_D
2.0k_L
3.3k_S

R₂ = 6.0k_D
4.5k_L
4.8k_S

R₃ = 0.8k_D
0.3k_L
1.0k_S



I.L. GROSS
STRUCTURAL
ENGINEERS

SHEET TITLE

PROJECT

CLIENT

SCALE

DESIGNED BY

CHECKED

DATE

SHEET

FB-7

DRAIN LOAD = 4.1k

Span = 22'

TA = 2'R + 4'WW 0-6'

1 1/2' RD + 3'WW 6'-11'

7 1/2' F + 9'WW + 4'R 6'-22'

PSL 7x18

R1 = 5.3k
3.5k
4.3k
.4kE

R2 = 5.4k
4.2k
3.2k
0.2kE

PieG' = 1.45k
(FB-5) = .3k
1.73k
.6kE

P2011' = 1.7k
FB-7 + RB-14 = 0.3k + .7k
1.8k

FB-5

Span = 15'

TA = 5'R + (1.5'R 0-1.5')

+ (1.5' RD + 4'WW) 1.5' -> 10.5'

+ 1.5'R 10.5' -> 15'

+ Pie 1.5' = 4.76k EQ (from comb. col)
+ 10.5' + 1.5k
.98k

PSL 5 1/4 x 9 1/2 or 3 1/2 x 11 3/8

R1 = 1.76k
.43k
2.1k
+ .6kE

R2 = 1.45k
.3k
1.73k
5.16kE



SHEET TITLE

SCALE

DATE

PROJECT

DESIGNED BY

CLIENT

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SHEET

I.L. GROSS
STRUCTURAL ENGINEERS

General Beam Analysis

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.7.25

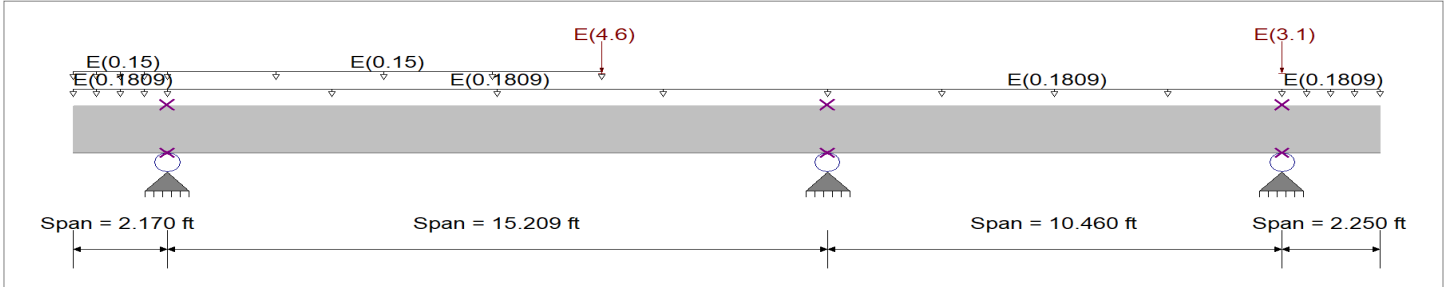
I.L. GROSS STRUCTURAL ENGINEERS

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DESCRIPTION: SW-1, SW-3, and SW-4 Seismic Distribution

General Beam Properties

| | | | |
|-----------------|---------------|-----------|---|
| Elastic Modulus | 29,000.0 ksi | | |
| Span #1 | Span Length = | 2.170 ft | Area = 10.0 in ² |
| Span #2 | Span Length = | 15.209 ft | Area = 10.0 in ² |
| Span #3 | Span Length = | 10.460 ft | Area = 10.0 in ² |
| Span #4 | Span Length = | 2.250 ft | Area = 10.0 in ² |
| | | | Moment of Inertia = 100.0 in ⁴ |



Applied Loads

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

Load for Span Number 1

Uniform Load : E = 0.1809 k/ft, Tributary Width = 1.0 ft, (W1 - Existing Building Roof Seismic)

Uniform Load : E = 0.150 k/ft, Tributary Width = 1.0 ft, (W2 - New Low Roof Contribution)

Load for Span Number 2

Uniform Load : E = 0.1809 k/ft, Tributary Width = 1.0 ft, (W1 - Existing Building Roof Seismic)

Uniform Load : E = 0.150 k/ft, Extent = 0.0 --> 10.0 ft, Tributary Width = 1.0 ft, (W2 - New Low Roof Contribution)

Point Load : E = 4.60 k @ 10.0 ft, (P - Shear From SW-2)

Load for Span Number 3

Uniform Load : E = 0.1809 k/ft, Tributary Width = 1.0 ft, (W1 - Existing Building Roof Seismic)

Point Load : E = 3.10 k @ 10.460 ft, (P2 - Shear From SW-4 at Roof)

Load for Span Number 4

Uniform Load : E = 0.1809 k/ft, Tributary Width = 1.0 ft, (W1 - Existing Building Roof Seismic)

DESIGN SUMMARY

| | | | |
|-----------------------------------|-------------|-----------------------------|-----------|
| Maximum Bending = | 14.090 k-ft | Maximum Shear = | 5.714 k |
| Load Combination | E Only | Load Combination | E Only |
| Span # where maximum occurs | Span # 2 | Span # where maximum occurs | Span # 2 |
| Location of maximum on span | 9.622 ft | Location of maximum on span | 15.209 ft |
| Maximum Deflection | | | |
| Max Downward Transient Deflection | 0.180 in | 1014 | |
| Max Upward Transient Deflection | -0.077 in | 678 | |
| Max Downward Total Deflection | 0.126 in | 1448 | |
| Max Upward Total Deflection | -0.054 in | 970 | |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values (k-ft) | | | | | Shear Values (k) | | |
|--------------------------|----------------|--------|-------------------|---|---------------------------------|--------|----------|-----|--------------|------------------|--------|---------------|
| | | | M | V | Mmax + | Mmax - | Ma - Max | Mnx | Mnx/Omega Cb | Rm | Va Max | Vnx/Vnx/Omega |
| Overall MAXimum Envelope | | | | | | | | | | | | |
| Dsgn. L = | 2.17 ft | 1 | | | | -0.78 | 0.78 | | | | | 3.14 |
| Dsgn. L = | 15.21 ft | 2 | | | 14.09 | -13.26 | 14.09 | | | | | 5.71 |
| Dsgn. L = | 10.46 ft | 3 | | | -0.00 | -13.26 | 13.26 | | | | | 2.17 |
| Dsgn. L = | 2.25 ft | 4 | | | | -0.46 | 0.46 | | | | | 0.41 |

Project Title: Bickell Residence
 Engineer: Mark Speidel
 Project ID:
 Project Descr: Remodeling of existing SFR

General Beam Analysis

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

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DESCRIPTION: SW-1, SW-3, and SW-4 Seismic Distribution

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values (k-ft) | | | | | Shear Values (k) | | |
|------------------|----------------|--------|-------------------|---|---------------------------------|--------|----------|-------|--------------|------------------|--------|---------------|
| | | | M | V | Mmax + | Mmax - | Ma - Max | Mnx | Mnx/Omega Cb | Rm | Va Max | Vnx/Vnx/Omega |
| Dsgn. L = | 2.17 ft | 1 | | | | | | | | | | -0.00 |
| Dsgn. L = | 15.21 ft | 2 | | | | | | | | | | -0.00 |
| Dsgn. L = | 10.46 ft | 3 | | | | | | | | | | -0.00 |
| Dsgn. L = | 2.25 ft | 4 | | | | | | | | | | -0.00 |
| E Only | | | | | | | | | | | | |
| Dsgn. L = | 2.17 ft | 1 | | | | | -0.78 | 0.78 | | | | 3.14 |
| Dsgn. L = | 15.21 ft | 2 | | | 14.09 | | -13.26 | 14.09 | | | | 5.71 |
| Dsgn. L = | 10.46 ft | 3 | | | -0.00 | | -13.26 | 13.26 | | | | 2.17 |
| Dsgn. L = | 2.25 ft | 4 | | | | | -0.46 | 0.46 | | | | 0.41 |
| E Only * -1.0 | | | | | | | | | | | | |
| Dsgn. L = | 2.17 ft | 1 | | | 0.78 | | | 0.78 | | | | 3.14 |
| Dsgn. L = | 15.21 ft | 2 | | | 13.26 | | -14.09 | 14.09 | | | | 5.71 |
| Dsgn. L = | 10.46 ft | 3 | | | 13.26 | | 0.46 | 13.26 | | | | 2.17 |
| Dsgn. L = | 2.25 ft | 4 | | | 0.46 | | | 0.46 | | | | 0.41 |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| | 1 | 0.0000 | 0.000 | E Only | -0.0766 | 0.000 |
| E Only | 2 | 0.1800 | 7.760 | | 0.0000 | 0.000 |
| | 3 | 0.0000 | 7.760 | E Only | -0.0435 | 4.269 |
| E Only | 4 | 0.0219 | 2.250 | | 0.0000 | 4.269 |

Vertical Reactions

| Load Combination | Support 1 | Support 2 | Support notation : Far left is # | | | Values in KIPS |
|------------------|-----------|-----------|----------------------------------|-----------|-----------|----------------|
| | | | Support 3 | Support 4 | Support 5 | |
| Overall MAXimum | | 3.855 | 7.884 | 3.229 | | |
| Overall MINimum | | | | | | |
| E Only * 0.70 | | 2.699 | 5.519 | 2.260 | | |
| E Only * 0.5250 | | 2.024 | 4.139 | 1.695 | | |
| E Only | | 3.855 | 7.884 | 3.229 | | |

General Beam Analysis

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.7.25

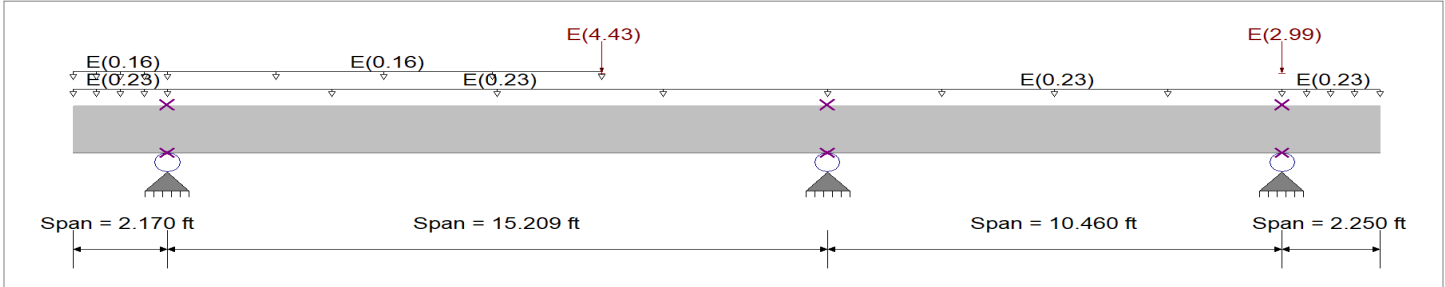
I.L. GROSS STRUCTURAL ENGINEERS

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DESCRIPTION: Low Roof Diaphragm Shear Distribution

General Beam Properties

| | | | |
|-----------------|---------------|-----------|---|
| Elastic Modulus | 29,000.0 ksi | | |
| Span #1 | Span Length = | 2.170 ft | Area = 10.0 in ² Moment of Inertia = 100.0 in ⁴ |
| Span #2 | Span Length = | 15.209 ft | Area = 10.0 in ² Moment of Inertia = 100.0 in ⁴ |
| Span #3 | Span Length = | 10.460 ft | Area = 10.0 in ² Moment of Inertia = 100.0 in ⁴ |
| Span #4 | Span Length = | 2.250 ft | Area = 10.0 in ² Moment of Inertia = 100.0 in ⁴ |



Applied Loads

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

Load for Span Number 1

Uniform Load : E = 0.230 k/ft, Tributary Width = 1.0 ft, (W1 - Existing Building Roof Seismic)

Uniform Load : E = 0.160 k/ft, Tributary Width = 1.0 ft, (W2 - New Low Roof Contribution)

Load for Span Number 2

Uniform Load : E = 0.230 k/ft, Tributary Width = 1.0 ft, (W1 - Existing Building Roof Seismic)

Uniform Load : E = 0.160 k/ft, Extent = 0.0 -->> 10.0 ft, Tributary Width = 1.0 ft, (W2 - New Low Roof Contribution)

Point Load : E = 4.430 k @ 10.0 ft, (P - Shear From SW-2)

Load for Span Number 3

Uniform Load : E = 0.230 k/ft, Tributary Width = 1.0 ft, (W1 - Existing Building Roof Seismic)

Point Load : E = 2.990 k @ 10.460 ft, (P2 - Shear From SW-4 at Roof)

Load for Span Number 4

Uniform Load : E = 0.230 k/ft, Tributary Width = 1.0 ft, (W1 - Existing Building Roof Seismic)

DESIGN SUMMARY

| | | | |
|-----------------------------------|-------------|-----------------------------|-----------|
| Maximum Bending = | 14.525 k-ft | Maximum Shear = | 6.057 k |
| Load Combination | E Only | Load Combination | E Only |
| Span # where maximum occurs | Span # 2 | Span # where maximum occurs | Span # 2 |
| Location of maximum on span | 9.001 ft | Location of maximum on span | 15.209 ft |
| Maximum Deflection | | | |
| Max Downward Transient Deflection | 0.189 in | 967 | |
| Max Upward Transient Deflection | -0.081 in | 642 | |
| Max Downward Total Deflection | 0.132 in | 1382 | |
| Max Upward Total Deflection | -0.057 in | 918 | |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values (k-ft) | | | | | Shear Values (k) | | |
|--------------------------|----------------|--------|-------------------|---|---------------------------------|--------|----------|-------|-----------|------------------|----|--------|
| | | | M | V | Mmax + | Mmax - | Ma - Max | Mnx | Mnx/Omega | Cb | Rm | Va Max |
| Overall MAXimum Envelope | | | | | | | | | | | | |
| Dsgn. L = | 2.17 ft | 1 | | | | | -0.92 | 0.92 | | | | 3.47 |
| Dsgn. L = | 15.21 ft | 2 | | | 14.53 | | -14.14 | 14.53 | | | | 6.06 |
| Dsgn. L = | 10.46 ft | 3 | | | -0.00 | | -14.14 | 14.14 | | | | 2.50 |
| Dsgn. L = | 2.25 ft | 4 | | | | | -0.58 | 0.58 | | | | 0.52 |

Project Title: Bickell Residence
 Engineer: Mark Speidel
 Project ID:
 Project Descr: Remodeling of existing SFR

General Beam Analysis

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

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DESCRIPTION: Low Roof Diaphragm Shear Distribution

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values (k-ft) | | | | | Shear Values (k) | | |
|------------------|----------------|--------|-------------------|---|---------------------------------|--------|----------|-------|--------------|------------------|--------|---------------|
| | | | M | V | Mmax + | Mmax - | Ma - Max | Mnx | Mnx/Omega Cb | Rm | Va Max | Vnx/Vnx/Omega |
| Dsgn. L = | 2.17 ft | 1 | | | | | | | | | | -0.00 |
| Dsgn. L = | 15.21 ft | 2 | | | | | | | | | | -0.00 |
| Dsgn. L = | 10.46 ft | 3 | | | | | | | | | | -0.00 |
| Dsgn. L = | 2.25 ft | 4 | | | | | | | | | | -0.00 |
| E Only | | | | | | | | | | | | |
| Dsgn. L = | 2.17 ft | 1 | | | | | -0.92 | 0.92 | | | | 3.47 |
| Dsgn. L = | 15.21 ft | 2 | | | 14.53 | | -14.14 | 14.53 | | | | 6.06 |
| Dsgn. L = | 10.46 ft | 3 | | | -0.00 | | -14.14 | 14.14 | | | | 2.50 |
| Dsgn. L = | 2.25 ft | 4 | | | | | -0.58 | 0.58 | | | | 0.52 |
| E Only * -1.0 | | | | | | | | | | | | |
| Dsgn. L = | 2.17 ft | 1 | | | | | 0.92 | 0.92 | | | | 3.47 |
| Dsgn. L = | 15.21 ft | 2 | | | 14.14 | | -14.53 | 14.53 | | | | 6.06 |
| Dsgn. L = | 10.46 ft | 3 | | | 14.14 | | 0.58 | 14.14 | | | | 2.50 |
| Dsgn. L = | 2.25 ft | 4 | | | 0.58 | | | 0.58 | | | | 0.52 |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| | 1 | 0.0000 | 0.000 | E Only | -0.0810 | 0.000 |
| E Only | 2 | 0.1886 | 7.760 | | 0.0000 | 0.000 |
| | 3 | 0.0000 | 7.760 | E Only | -0.0433 | 4.056 |
| E Only | 4 | 0.0215 | 2.250 | | 0.0000 | 4.056 |

Vertical Reactions

| Load Combination | Support 1 | Support 2 | Support notation : Far left is # | | | Values in KIPS |
|------------------|-----------|-----------|----------------------------------|-----------|-----------|----------------|
| | | | Support 3 | Support 4 | Support 5 | |
| Overall MAXimum | | 4.317 | 8.556 | 3.414 | | |
| Overall MINimum | | | | | | |
| E Only * 0.70 | | 3.022 | 5.989 | 2.390 | | |
| E Only * 0.5250 | | 2.267 | 4.492 | 1.793 | | |
| E Only | | 4.317 | 8.556 | 3.414 | | |



Multiple Simple Beam

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

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Description : Upper Floor Joists and Beams

Wood Beam Design : FJ-1

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2-2x8, Sawn, Fully Braced**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : Douglas Fir-Larch

Wood Grade : No.2

| | | | | | | | | | |
|--------------|-----------|-----------|-------------|----|-----------|---------------|-------------|---------|------------|
| Fb - Tension | 900.0 psi | Fc - Prll | 1,350.0 psi | Fv | 180.0 psi | Ebend- xx | 1,600.0 ksi | Density | 31.210 pcf |
| Fb - Compr | 900.0 psi | Fc - Perp | 625.0 psi | Ft | 575.0 psi | Eminbend - xx | 580.0 ksi | | |

Applied Loads

Beam self weight calculated and added to loads

Unif Load: D = 0.0170, L = 0.040 k/ft, Trib= 1.330 ft

1Point: D = 0.03583, Lr = 0.04778, S = 0.05972 k @ 18.330 ft

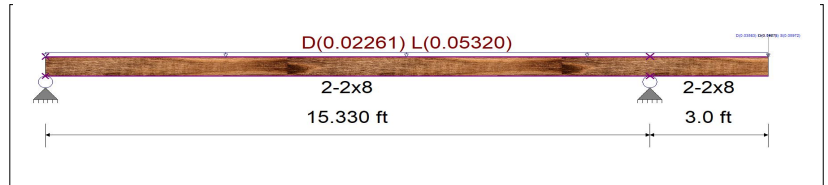
2Point: D = 0.1987 k @ 18.330 ft

Design Summary

Max fb/Fb Ratio = **0.822** : 1
fb : Actual : 850.42 psi at 6.822 ft in Span # 1
Fb : Allowable : 1,035.00 psi
Load Comb : +D+L

Max fv/FvRatio = **0.263** : 1
fv : Actual : 47.36 psi at 15.330 ft in Span # 1
Fv : Allowable : 180.00 psi
Load Comb : +D+L

| | | | | | | | |
|-------------------|------|-------|------|-------|---|---|---|
| Max Reactions (k) | D | Lr | L | S | W | E | H |
| Left Support | 0.16 | -0.01 | 0.39 | -0.01 | | | |
| Right Support | 0.58 | 0.06 | 0.58 | 0.07 | | | |



Max Deflections

| | | | |
|--------------------|------------|----------------|-----------|
| Transient Downward | 0.397 in | Total Downward | 0.484 in |
| Ratio | 463 | Ratio | 379 |
| | LC: L Only | | LC: +D+L |
| Transient Upward | -0.224 in | Total Upward | -0.193 in |
| Ratio | 320 | Ratio | 372 |
| | LC: L Only | | LC: +D+L |

Wood Beam Design : FJ-2

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2x8, Sawn, Fully Braced**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : Douglas Fir-Larch

Wood Grade : No.2

| | | | | | | | | | |
|--------------|-----------|-----------|-------------|----|-----------|---------------|-------------|---------|------------|
| Fb - Tension | 900.0 psi | Fc - Prll | 1,350.0 psi | Fv | 180.0 psi | Ebend- xx | 1,600.0 ksi | Density | 31.210 pcf |
| Fb - Compr | 900.0 psi | Fc - Perp | 625.0 psi | Ft | 575.0 psi | Eminbend - xx | 580.0 ksi | | |

Applied Loads

Beam self weight calculated and added to loads

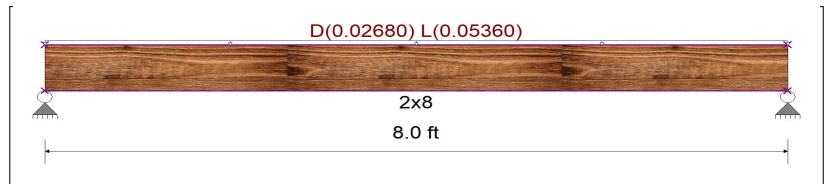
Unif Load: D = 0.020, L = 0.040 k/ft, Trib= 1.340 ft

Design Summary

Max fb/Fb Ratio = **0.584** : 1
fb : Actual : 604.59 psi at 4.000 ft in Span # 1
Fb : Allowable : 1,035.00 psi
Load Comb : +D+L

Max fv/FvRatio = **0.216** : 1
fv : Actual : 38.96 psi at 0.000 ft in Span # 1
Fv : Allowable : 180.00 psi
Load Comb : +D+L

| | | | | | | | |
|-------------------|------|----|------|---|---|---|---|
| Max Reactions (k) | D | Lr | L | S | W | E | H |
| Left Support | 0.12 | | 0.21 | | | | |
| Right Support | 0.12 | | 0.21 | | | | |



Max Deflections

| | | | |
|--------------------|------------|----------------|----------|
| Transient Downward | 0.065 in | Total Downward | 0.101 in |
| Ratio | 1473 | Ratio | 954 |
| | LC: L Only | | LC: +D+L |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| | LC: | | LC: |



Multiple Simple Beam

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

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Wood Beam Design : LRJ-1

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2x8, Sawn, Fully Braced**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : Douglas Fir-Larch

Wood Grade : No.2

Fb - Tension 900.0 psi Fc - Prll 1,350.0 psi Fv 180.0 psi Ebend- xx 1,600.0 ksi Density 31.210 pcf
Fb - Compr 900.0 psi Fc - Perp 625.0 psi Ft 575.0 psi Eminbend - xx 580.0 ksi

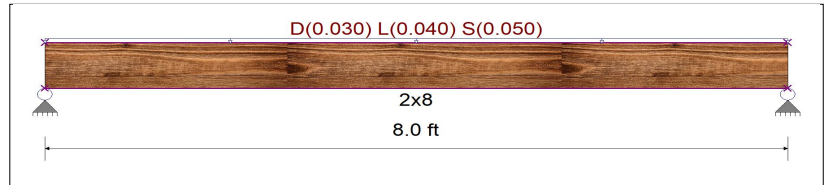
Applied Loads

Beam self weight calculated and added to loads

Unif Load: D = 0.0150, L = 0.020, S = 0.0250 k/ft, Trib= 2.0 ft

Design Summary

Max fb/Fb Ratio = **0.613** : 1
fb : Actual : 729.51 psi at 4.000 ft in Span # 1
Fb : Allowable : 1,190.25 psi
Load Comb : +D+0.750L+0.750S
Max fv/FvRatio = **0.227** : 1
fv : Actual : 47.01 psi at 0.000 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+0.750L+0.750S



| Max Reactions (k) | D | Lr | L | S | W | E | H |
|-------------------|------|----|------|------|---|---|---|
| Left Support | 0.13 | | 0.16 | 0.20 | | | |
| Right Support | 0.13 | | 0.16 | 0.20 | | | |

Max Deflections

| | | | |
|--------------------|----------|----------------------|----------|
| Transient Downward | 0.061 in | Total Downward | 0.121 in |
| Ratio | 1579 | Ratio | 790 |
| LC: S Only | | LC: +D+0.750L+0.750S | |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: | | LC: | |

Wood Beam Design : FB-1

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2-2x8, Sawn, Defined Brace Spacing, 1st at ft and spaced at 1.340 ft**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : Douglas Fir-Larch

Wood Grade : No.2

Fb - Tension 900.0 psi Fc - Prll 1,350.0 psi Fv 180.0 psi Ebend- xx 1,600.0 ksi Density 31.210 pcf
Fb - Compr 900.0 psi Fc - Perp 625.0 psi Ft 575.0 psi Eminbend - xx 580.0 ksi

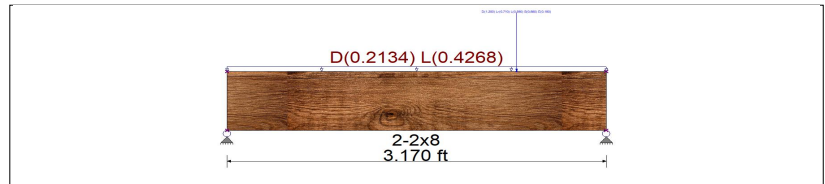
Applied Loads

Unif Load: D = 0.020, L = 0.040 k/ft, Trib= 10.670 ft

1Point: D = 1.250, Lr = 0.710, L = 0.590, S = 0.880, E = 0.180 k @ 2.420 ft

Design Summary

Max fb/Fb Ratio = **0.835** : 1
fb : Actual : 749.81 psi at 2.261 ft in Span # 1
Fb : Allowable : 898.40 psi
Load Comb : +D+L
Max fv/FvRatio = **0.779** : 1
fv : Actual : 140.26 psi at 2.568 ft in Span # 1
Fv : Allowable : 180.00 psi
Load Comb : +D+L



| Max Reactions (k) | D | Lr | L | S | W | E | H |
|-------------------|------|------|------|------|---|------|---|
| Left Support | 0.63 | 0.17 | 0.82 | 0.21 | | 0.04 | |
| Right Support | 1.29 | 0.54 | 1.13 | 0.67 | | 0.14 | |

Max Deflections

| | | | |
|--------------------|----------|------------------------|----------|
| Transient Downward | 0.009 in | Total Downward | 0.020 in |
| Ratio | 4072 | Ratio | 1877 |
| LC: L Only | | +0.750L+0.750S+0.5250E | |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: | | LC: | |



Multiple Simple Beam

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

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Wood Beam Design : FB-2

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **3-1.75x7.25, Microllam LVL, Fully Braced**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : iLevel Truss Joist

Wood Grade : MicroLam LVL 2.0 E

Fb - Tension 2,600.0 psi Fc - Prll 2,510.0 psi Fv 285.0 psi Ebend- xx 2,000.0 ksi Density 42.010 pcf
Fb - Compr 2,600.0 psi Fc - Perp 750.0 psi Ft 1,555.0 psi Eminbend - xx 1,016.54 ksi

Applied Loads

Beam self weight calculated and added to loads

Unif Load: D = 0.110, Lr = 0.130, S = 0.1650 k/ft, Trib= 1.0 ft

Unif Load: D = 0.0730 k/ft, Trib= 1.0 ft

Unif Load: D = 0.020, L = 0.040 k/ft, Trib= 1.340 ft

1Point: D = 0.1240, Lr = 0.1660, S = 0.2070 k @ 2.710 ft

2Point: D = 0.1240, Lr = 0.1660, S = 0.2070 k @ 4.830 ft

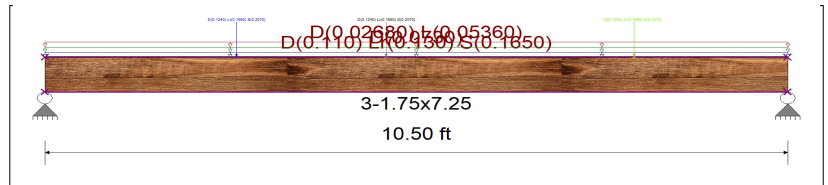
3Point: D = 0.1240, Lr = 0.1660, S = 0.2070 k @ 8.330 ft

Design Summary

Max fb/Fb Ratio = **0.608** : 1
fb : Actual : 1,816.56 psi at 4.830 ft in Span # 1
Fb : Allowable : 2,990.00 psi
Load Comb : +D+S

Max fv/FvRatio = **0.276** : 1
fv : Actual : 90.51 psi at 9.905 ft in Span # 1
Fv : Allowable : 327.75 psi
Load Comb : +D+S

Max Reactions (k) D Lr L S W E H
Left Support 1.34 0.93 0.28 1.17
Right Support 1.35 0.93 0.28 1.18



Max Deflections

| | | | |
|--------------------|----------|----------------|----------|
| Transient Downward | 0.195 in | Total Downward | 0.413 in |
| Ratio | 644 | Ratio | 305 |
| LC: S Only | | LC: +D+S | |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: | | LC: | |

Wood Beam Design : FB-3A

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2-1.75x7.25, Microllam LVL, Fully Braced**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : Truss Joist

Wood Grade : MicroLam LVL 2.0 E

Fb - Tension 2,600.0 psi Fc - Prll 2,510.0 psi Fv 285.0 psi Ebend- xx 2,000.0 ksi Density 42.010 pcf
Fb - Compr 2,600.0 psi Fc - Perp 750.0 psi Ft 1,555.0 psi Eminbend - xx 1,016.54 ksi

Applied Loads

Beam self weight calculated and added to loads

Unif Load: D = 0.0170, L = 0.040 k/ft, Trib= 1.340 ft

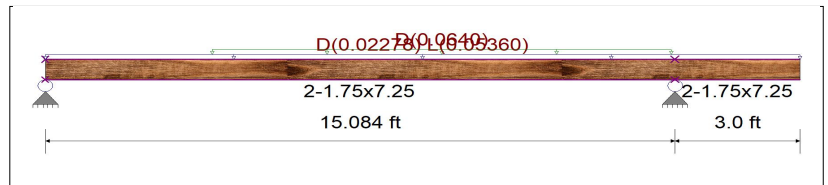
Unif Load: D = 0.0080 k/ft, 4.0 to 15.0 ft, Trib= 8.0 ft

Design Summary

Max fb/Fb Ratio = **0.566** : 1
fb : Actual : 1,471.05 psi at 7.617 ft in Span # 1
Fb : Allowable : 2,600.00 psi
Load Comb : +D+L

Max fv/FvRatio = **0.211** : 1
fv : Actual : 60.09 psi at 14.481 ft in Span # 1
Fv : Allowable : 285.00 psi
Load Comb : +D+L

Max Reactions (k) D Lr L S W E H
Left Support 0.48 0.39
Right Support 0.77 0.58



Max Deflections

| | | | |
|--------------------|-----------|----------------|-----------|
| Transient Downward | 0.256 in | Total Downward | 0.684 in |
| Ratio | 706 | Ratio | 264 |
| LC: L Only | | LC: +D+L | |
| Transient Upward | -0.146 in | Total Upward | -0.413 in |
| Ratio | 492 | Ratio | 174 <240 |
| LC: L Only | | LC: +D+L | |



Multiple Simple Beam

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

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Wood Beam Design : FB-3B

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2-1.75x9.5, Microllam LVL, Fully Braced**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : iLevel Truss Joist

Wood Grade : MicroLam LVL 2.0 E

Fb - Tension 2,600.0 psi Fc - Prll 2,510.0 psi Fv 285.0 psi Ebend- xx 2,000.0 ksi Density 42.010 pcf
Fb - Compr 2,600.0 psi Fc - Perp 750.0 psi Ft 1,555.0 psi Eminbend - xx 1,016.54 ksi

Applied Loads

Beam self weight calculated and added to loads

Unif Load: D = 0.020, L = 0.040 k/ft, Trib= 1.340 ft

1Point: D = 0.510, Lr = 0.590, S = 0.740, E = 0.150 k @ 18.330 ft

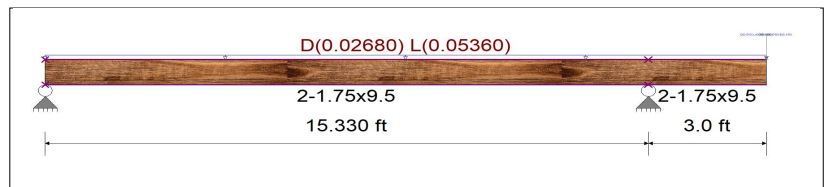
2Point: D = 0.1990 k @ 18.330 ft

Design Summary

Max fb/Fb Ratio = **0.344** : 1
fb : Actual : 1,028.29 psi at 15.330 ft in Span # 1
fb : Allowable : 2,990.00 psi
Load Comb : +D+S

Max fv/FvRatio = **0.211** : 1
fv : Actual : 69.02 psi at 15.330 ft in Span # 1
Fv : Allowable : 327.75 psi
Load Comb : +D+S

| Max Reactions (k) | D | Lr | L | S | W | E |
|-------------------|------|-------|------|-------|---|-------|
| Left Support | 0.13 | -0.12 | 0.40 | -0.14 | | -0.03 |
| Right Support | 1.25 | 0.71 | 0.59 | 0.88 | | 0.18 |



Max Deflections

| Transient Downward | 0.141 in | Total Downward | 0.228 in |
|--------------------|-----------|----------------|-----------|
| Ratio | 512 | Ratio | 314 |
| LC: S Only | | | |
| Transient Upward | -0.116 in | Total Upward | -0.149 in |
| Ratio | 1046 | Ratio | 1231 |
| LC: L Only | | | |
| LC: +D+S | | | |

Wood Beam Design : FB-4

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **3-1.75x9.25, Microllam LVL, Fully Braced**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : iLevel Truss Joist

Wood Grade : MicroLam LVL 2.0 E

Fb - Tension 2,600.0 psi Fc - Prll 2,510.0 psi Fv 285.0 psi Ebend- xx 2,000.0 ksi Density 42.010 pcf
Fb - Compr 2,600.0 psi Fc - Perp 750.0 psi Ft 1,555.0 psi Eminbend - xx 1,016.54 ksi

Applied Loads

Beam self weight calculated and added to loads

Unif Load: D = 0.020, L = 0.040 k/ft, 0.0 ft to 4.080 ft, Trib= 0.670 ft

Unif Load: D = 0.020, L = 0.040 k/ft, 4.080 to 13.670 ft, Trib= 1.340 ft

Unif Load: D = 0.020, L = 0.040 k/ft, 13.670 to 18.0 ft, Trib= 0.670 ft

Unif Load: D = 0.2886, Lr = 0.2548, S = 0.3185 k/ft, 0.0 to 4.080 ft, Trib= 1.0 ft

1Point: D = 0.5593, Lr = 0.7457, S = 0.9321 k @ 4.080 ft

2Point: D = 0.5593, Lr = 0.7457, S = 0.9321 k @ 13.670 ft

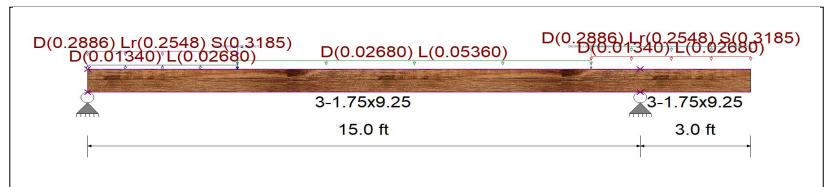
Unif Load: D = 0.2886, Lr = 0.2548, S = 0.3185 k/ft, 13.670 to 18.0 ft

Design Summary

Max fb/Fb Ratio = **0.473** : 1
fb : Actual : 1,413.52 psi at 4.050 ft in Span # 1
fb : Allowable : 2,990.00 psi
Load Comb : +D+S

Max fv/FvRatio = **0.315** : 1
fv : Actual : 103.37 psi at 15.000 ft in Span # 1
Fv : Allowable : 327.75 psi
Load Comb : +D+S

| Max Reactions (k) | D | Lr | L | S | W | E |
|-------------------|------|------|------|------|---|---|
| Left Support | 1.66 | 1.45 | 0.30 | 1.81 | | |
| Right Support | 2.51 | 2.19 | 0.44 | 2.74 | | |



Max Deflections

| Transient Downward | 0.217 in | Total Downward | 0.424 in |
|----------------------|-----------|----------------|-----------|
| Ratio | 830 | Ratio | 424 |
| LC: S Only | | | |
| Transient Upward | -0.102 in | Total Upward | -0.207 in |
| Ratio | 704 | Ratio | 348 |
| LC: S Only | | | |
| LC: +D+0.750L+0.750S | | | |



Multiple Simple Beam

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

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Wood Beam Design : FB-8

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **5.25x9.25, Parallam PSL, Fully Braced**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : Truss Joist

Wood Grade : Parallam PSL 2.2E

| | | | | | | | | | |
|--------------|-------------|-----------|-------------|----|-------------|---------------|--------------|---------|------------|
| Fb - Tension | 2,900.0 psi | Fc - Prll | 2,900.0 psi | Fv | 290.0 psi | Ebend- xx | 2,200.0 ksi | Density | 45.070 pcf |
| Fb - Compr | 2,900.0 psi | Fc - Perp | 625.0 psi | Ft | 2,025.0 psi | Eminbend - xx | 1,118.19 ksi | | |

Applied Loads

Beam self weight calculated and added to loads

Unif Load: D = 0.0170, L = 0.040 k/ft, Trib= 1.330 ft

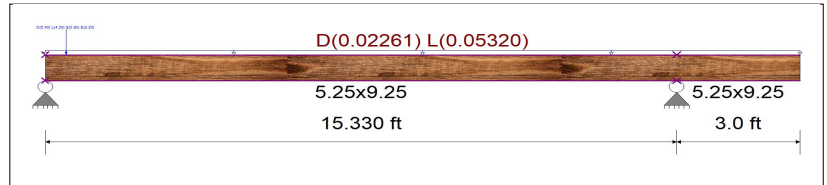
1Point: D = 5.40, L = 4.20, S = 3.80, E = 0.20 k @ 0.50 ft

Design Summary

Max fb/Fb Ratio = **0.304** : 1
fb : Actual : 882.07 psi at 3.909 ft in Span # 1
Fb : Allowable : 2,900.00 psi
Load Comb : +D+L

Max fv/FvRatio = **0.110** : 1
fv : Actual : 32.04 psi at 15.330 ft in Span # 1
Fv : Allowable : 290.00 psi
Load Comb : +D+L

| | | | | | | |
|-------------------|------|----|------|------|---|------|
| Max Reactions (k) | D | Lr | L | S | W | E |
| Left Support | 5.50 | | 4.46 | 3.68 | | 0.19 |
| Right Support | 0.59 | | 0.72 | 0.12 | | 0.01 |



Max Deflections

| | | | |
|--------------------|------------|----------------|------------------------|
| Transient Downward | 0.151 in | Total Downward | 0.313 in |
| Ratio | 1216 | Ratio | 587 |
| | LC: L Only | | +0.750L+0.750S+0.5250E |
| Transient Upward | -0.081 in | Total Upward | -0.165 in |
| Ratio | 884 | Ratio | 434 |
| | LC: L Only | | +0.750L+0.750S+0.5250E |

Wood Beam Design : FB-9

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2-1.75x9.25, MicroLam LVL, Fully Braced**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : iLevel Truss Joist

Wood Grade : MicroLam LVL 2.0 E

| | | | | | | | | | |
|--------------|-------------|-----------|-------------|----|-------------|---------------|--------------|---------|------------|
| Fb - Tension | 2,600.0 psi | Fc - Prll | 2,510.0 psi | Fv | 285.0 psi | Ebend- xx | 2,000.0 ksi | Density | 42.010 pcf |
| Fb - Compr | 2,600.0 psi | Fc - Perp | 750.0 psi | Ft | 1,555.0 psi | Eminbend - xx | 1,016.54 ksi | | |

Applied Loads

Beam self weight calculated and added to loads

Unif Load: D = 0.020, L = 0.040 k/ft, Trib= 1.340 ft

1Point: D = 3.109, Lr = 4.503, L = 0.5180, S = 1.370, E = 0.5660 k @ 0.50 ft

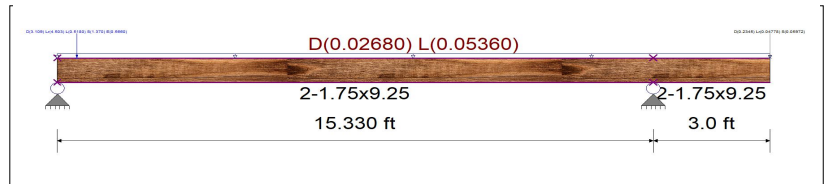
2Point: D = 0.2345, Lr = 0.04778, S = 0.05972 k @ 18.330 ft

Design Summary

Max fb/Fb Ratio = **0.295** : 1
fb : Actual : 767.97 psi at 5.519 ft in Span # 1
Fb : Allowable : 2,600.00 psi
Load Comb : +D+L

Max fv/FvRatio = **0.143** : 1
fv : Actual : 40.74 psi at 15.330 ft in Span # 1
Fv : Allowable : 285.00 psi
Load Comb : +D+L

| | | | | | | |
|-------------------|------|------|------|------|---|------|
| Max Reactions (k) | D | Lr | L | S | W | E |
| Left Support | 3.23 | 4.35 | 0.90 | 1.31 | | 0.55 |
| Right Support | 0.78 | 0.20 | 0.60 | 0.12 | | 0.02 |



Max Deflections

| | | | |
|--------------------|------------|----------------|-----------------------|
| Transient Downward | 0.147 in | Total Downward | 0.339 in |
| Ratio | 1254 | Ratio | 542 |
| | LC: L Only | | LC: +D+0.750Lr+0.750L |
| Transient Upward | -0.082 in | Total Upward | -0.149 in |
| Ratio | 878 | Ratio | 482 |
| | LC: L Only | | LC: +D+0.750Lr+0.750L |



Multiple Simple Beam

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

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Description : Upper Floor Joists and Beams (FJ-3)

Wood Beam Design : FJ-3

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2-2x8, Sawn, Fully Braced**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : Douglas Fir-Larch

Wood Grade : No.2

| | | | | | | | | | |
|--------------|-----------|-----------|-------------|----|-----------|---------------|-------------|---------|------------|
| Fb - Tension | 900.0 psi | Fc - Prll | 1,350.0 psi | Fv | 180.0 psi | Ebend- xx | 1,600.0 ksi | Density | 31.210 pcf |
| Fb - Compr | 900.0 psi | Fc - Perp | 625.0 psi | Ft | 575.0 psi | Eminbend - xx | 580.0 ksi | | |

Applied Loads

Beam self weight calculated and added to loads

Unif Load: D = 0.020, L = 0.040 k/ft, 4.080 ft to 13.670 ft, Trib= 1.340 ft

1Point: D = 0.1327 k @ 4.080 ft

2Point: D = 0.1327 k @ 13.670 ft

3Point: D = 0.04020, Lr = 0.05360, S = 0.0670 k @ 4.080 ft

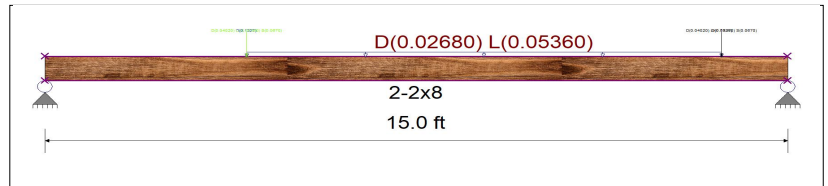
4Point: D = 0.04020, Lr = 0.05360, S = 0.0670 k @ 13.670 ft

Design Summary

Max fb/Fb Ratio = **1.099** : 1
fb : Actual : 1,137.74 psi at 7.600 ft in Span # 1
Fb : Allowable : 1,035.00 psi
Load Comb : +D+L

Max fv/FvRatio = **0.266** : 1
fv : Actual : 47.82 psi at 14.400 ft in Span # 1
Fv : Allowable : 180.00 psi
Load Comb : +D+L

| | | | | | | | |
|-------------------|------|------|------|------|---|---|---|
| Max Reactions (k) | D | Lr | L | S | W | E | H |
| Left Support | 0.28 | 0.04 | 0.21 | 0.05 | | | |
| Right Support | 0.39 | 0.06 | 0.30 | 0.08 | | | |



Max Deflections

| | | | |
|--------------------|----------|----------------|----------|
| Transient Downward | 0.327 in | Total Downward | 0.664 in |
| Ratio | 550 | Ratio | 270 |
| | | LC: L Only | LC: +D+L |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| | | LC: | LC: |

Wood Beam Design : LRB-1

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2-2x8, Sawn, Defined Brace Spacing, 1st at ft and spaced at 2.0 ft**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : Douglas Fir-Larch

Wood Grade : No.2

| | | | | | | | | | |
|--------------|-----------|-----------|-------------|----|-----------|---------------|-------------|---------|------------|
| Fb - Tension | 900.0 psi | Fc - Prll | 1,350.0 psi | Fv | 180.0 psi | Ebend- xx | 1,600.0 ksi | Density | 31.210 pcf |
| Fb - Compr | 900.0 psi | Fc - Perp | 625.0 psi | Ft | 575.0 psi | Eminbend - xx | 580.0 ksi | | |

Applied Loads

Beam self weight calculated and added to loads

Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, Trib= 5.40 ft

1Point: D = 0.1327 k @ 4.080 ft

2Point: D = 0.1327 k @ 10.160 ft

3Point: D = 0.04020, Lr = 0.05360, S = 0.0670 k @ 4.080 ft

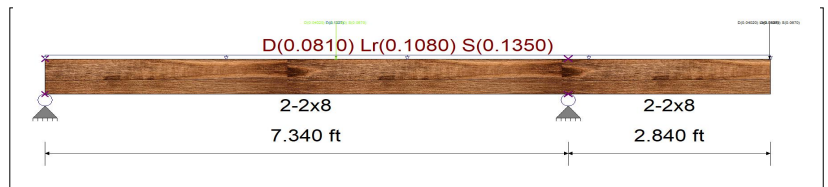
4Point: D = 0.04020, Lr = 0.05360, S = 0.0670 k @ 10.160 ft

Design Summary

Max fb/Fb Ratio = **0.603** : 1
fb : Actual : 715.31 psi at 0.000 ft in Span # 2
Fb : Allowable : 1,185.96 psi
Load Comb : +D+S

Max fv/FvRatio = **0.342** : 1
fv : Actual : 70.84 psi at 6.753 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+S

| | | | | | | | |
|-------------------|------|------|---|------|---|---|---|
| Max Reactions (k) | D | Lr | L | S | W | E | H |
| Left Support | 0.28 | 0.34 | | 0.43 | | | |
| Right Support | 0.94 | 0.87 | | 1.08 | | | |



Max Deflections

| | | | |
|--------------------|-----------|----------------|-----------|
| Transient Downward | 0.037 in | Total Downward | 0.058 in |
| Ratio | 2400 | Ratio | 1512 |
| | | LC: S Only | LC: +D+S |
| Transient Upward | -0.004 in | Total Upward | -0.002 in |
| Ratio | 9999 | Ratio | 9999 |
| | | LC: S Only | LC: +D+S |



Multiple Simple Beam

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

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Wood Beam Design : LRB-2

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **6x8, Sawn, Defined Brace Spacing, 1st at ft and spaced at 2.0 ft**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : Douglas Fir-Larch

Wood Grade : No.2

| | | | | | | | | | |
|--------------|-----------|-----------|-------------|----|-----------|---------------|-------------|---------|------------|
| Fb - Tension | 900.0 psi | Fc - Prll | 1,350.0 psi | Fv | 180.0 psi | Ebend- xx | 1,600.0 ksi | Density | 31.210 pcf |
| Fb - Compr | 900.0 psi | Fc - Perp | 625.0 psi | Ft | 575.0 psi | Eminbend - xx | 580.0 ksi | | |

Applied Loads

Beam self weight calculated and added to loads

Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, Trib= 4.50 ft

Design Summary

Max fb/Fb Ratio = **0.898** : 1
fb : Actual : 928.90 psi at 6.500 ft in Span # 1
Fb : Allowable : 1,034.04 psi
Load Comb : +D+S

Max fv/FvRatio = **0.196** : 1
fv : Actual : 40.49 psi at 12.393 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+S

| | | | | | | | |
|-------------------|------|------|---|------|---|---|---|
| Max Reactions (k) | D | Lr | L | S | W | E | H |
| Left Support | 0.50 | 0.59 | | 0.73 | | | |
| Right Support | 0.50 | 0.59 | | 0.73 | | | |



Max Deflections

| | | | |
|--------------------|----------|----------------|----------|
| Transient Downward | 0.235 in | Total Downward | 0.395 in |
| Ratio | 664 | Ratio | 395 |
| LC: S Only | | LC: +D+S | |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: | | LC: | |

Wood Beam Design : FB-10

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2-1.75x9.25, Microllam LVL, Defined Brace Locations, 1st at 12.170 f**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : iLevel Truss Joist

Wood Grade : MicroLam LVL 2.0 E

| | | | | | | | | | |
|--------------|-------------|-----------|-------------|----|-------------|---------------|--------------|---------|------------|
| Fb - Tension | 2,600.0 psi | Fc - Prll | 2,510.0 psi | Fv | 285.0 psi | Ebend- xx | 2,000.0 ksi | Density | 42.010 pcf |
| Fb - Compr | 2,600.0 psi | Fc - Perp | 750.0 psi | Ft | 1,555.0 psi | Eminbend - xx | 1,016.54 ksi | | |

Applied Loads

Beam self weight calculated and added to loads

Unif Load: D = 0.1110 k/ft, Trib= 1.0 ft

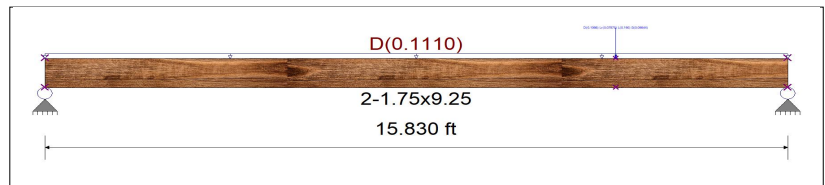
1Point: D = 0.1066, Lr = 0.07875, L = 0.190, S = 0.09844 k @ 12.170 ft

Design Summary

Max fb/Fb Ratio = **0.420** : 1
fb : Actual : 954.58 psi at 8.126 ft in Span # 1
Fb : Allowable : 2,271.35 psi
Load Comb : D Only

Max fv/FvRatio = **0.178** : 1
fv : Actual : 50.61 psi at 15.091 ft in Span # 1
Fv : Allowable : 285.00 psi
Load Comb : +D+L

| | | | | | | | |
|-------------------|------|------|------|------|---|---|---|
| Max Reactions (k) | D | Lr | L | S | W | E | H |
| Left Support | 0.98 | 0.02 | 0.04 | 0.02 | | | |
| Right Support | 1.04 | 0.06 | 0.15 | 0.08 | | | |



Max Deflections

| | | | |
|--------------------|----------|----------------------|----------|
| Transient Downward | 0.039 in | Total Downward | 0.435 in |
| Ratio | 4908 | Ratio | 436 |
| LC: L Only | | LC: +D+0.750L+0.750S | |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: | | LC: | |



Multiple Simple Beam

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

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Wood Beam Design : FB-11

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **1.75x9.25, Microllam LVL, Defined Brace Locations, 1st at 12.170 ft,**
Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending
Wood Species : iLevel Truss Joist Wood Grade : MicroLam LVL 2.0 E
Fb - Tension 2,600.0 psi Fc - Prll 2,510.0 psi Fv 285.0 psi Ebend- xx 2,000.0 ksi Density 42.010 pcf
Fb - Compr 2,600.0 psi Fc - Perp 750.0 psi Ft 1,555.0 psi Eminbend - xx 1,016.54 ksi

Applied Loads

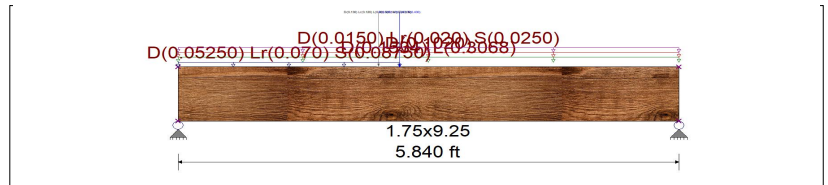
Beam self weight calculated and added to loads
Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, 0.0 ft to 2.584 ft, Trib= 3.50 ft
Unif Load: D = 0.020, L = 0.040 k/ft, Trib= 7.670 ft
Unif Load: D = 0.1020 k/ft, Trib= 1.0 ft
Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, Trib= 1.0 ft
1Point: D = 0.280, Lr = 0.340, S = 0.430 k @ 2.584 ft
2Point: D = 0.130, Lr = 0.120, L = 0.40, S = 0.140, E = 0.030 k @ 2.340 ft

Design Summary

Max fb/Fb Ratio = **0.806 : 1**
fb : Actual : 1,917.72 psi at 2.589 ft in Span # 1
Fb : Allowable : 2,380.11 psi
Load Comb : +D+0.750L+0.750S

Max fv/FvRatio = **0.584 : 1**
fv : Actual : 166.51 psi at 0.000 ft in Span # 1
Fv : Allowable : 285.00 psi
Load Comb : +D+L

| Max Reactions (k) | D | Lr | L | S | W | E | H |
|-------------------|------|------|------|------|---|------|---|
| Left Support | 1.14 | 0.46 | 1.14 | 0.57 | | 0.02 | |
| Right Support | 1.01 | 0.30 | 1.06 | 0.37 | | 0.01 | |



| Max Deflections | | | |
|-----------------------------------|----------|----------------|----------|
| Transient Downward | 0.047 in | Total Downward | 0.100 in |
| Ratio | 1497 | Ratio | 700 |
| LC: L Only +0.750L+0.750S+0.5250E | | | |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: | | | |

Wood Beam Design : FB-11

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **1.75x9.25, Microllam LVL, Defined Brace Locations, 1st at 12.170 ft,**
Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending
Wood Species : iLevel Truss Joist Wood Grade : MicroLam LVL 2.0 E
Fb - Tension 2,600.0 psi Fc - Prll 2,510.0 psi Fv 285.0 psi Ebend- xx 2,000.0 ksi Density 42.010 pcf
Fb - Compr 2,600.0 psi Fc - Perp 750.0 psi Ft 1,555.0 psi Eminbend - xx 1,016.54 ksi

Applied Loads

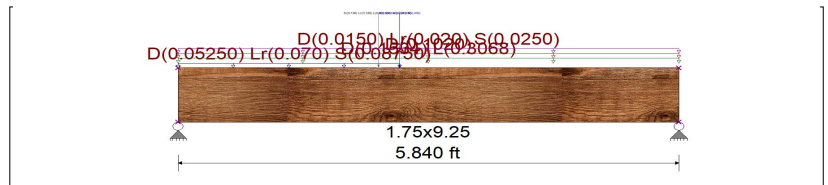
Beam self weight calculated and added to loads
Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, 0.0 ft to 2.584 ft, Trib= 3.50 ft
Unif Load: D = 0.020, L = 0.040 k/ft, Trib= 7.670 ft
Unif Load: D = 0.1020 k/ft, Trib= 1.0 ft
Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, Trib= 1.0 ft
1Point: D = 0.280, Lr = 0.340, S = 0.430 k @ 2.584 ft
2Point: D = 0.130, Lr = 0.120, L = 0.40, S = 0.140, E = 0.030 k @ 2.340 ft

Design Summary

Max fb/Fb Ratio = **0.806 : 1**
fb : Actual : 1,917.72 psi at 2.589 ft in Span # 1
Fb : Allowable : 2,380.11 psi
Load Comb : +D+0.750L+0.750S

Max fv/FvRatio = **0.584 : 1**
fv : Actual : 166.51 psi at 0.000 ft in Span # 1
Fv : Allowable : 285.00 psi
Load Comb : +D+L

| Max Reactions (k) | D | Lr | L | S | W | E | H |
|-------------------|------|------|------|------|---|------|---|
| Left Support | 1.14 | 0.46 | 1.14 | 0.57 | | 0.02 | |
| Right Support | 1.01 | 0.30 | 1.06 | 0.37 | | 0.01 | |



| Max Deflections | | | |
|-----------------------------------|----------|----------------|----------|
| Transient Downward | 0.047 in | Total Downward | 0.100 in |
| Ratio | 1497 | Ratio | 700 |
| LC: L Only +0.750L+0.750S+0.5250E | | | |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: | | | |



Multiple Simple Beam

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

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Description : Roof Joists and Beams (RJ1-RB12)

Wood Beam Design : RJ-1

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2x8, Sawn, Fully Braced**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : Douglas Fir-Larch

Wood Grade : No.2

| | | | | | | | | | |
|--------------|-----------|-----------|-------------|----|-----------|---------------|-------------|---------|------------|
| Fb - Tension | 900.0 psi | Fc - Prll | 1,350.0 psi | Fv | 180.0 psi | Ebend- xx | 1,600.0 ksi | Density | 31.210 pcf |
| Fb - Compr | 900.0 psi | Fc - Perp | 625.0 psi | Ft | 575.0 psi | Eminbend - xx | 580.0 ksi | | |

Applied Loads

Beam self weight calculated and added to loads

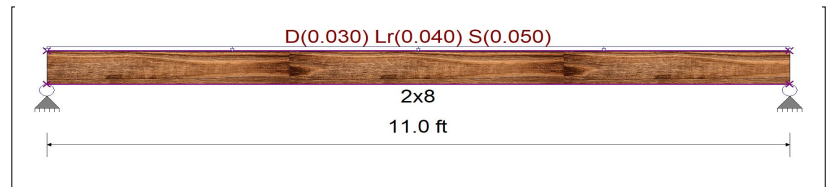
Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, Trib= 2.0 ft

Design Summary

Max fb/Fb Ratio = **0.956** : 1
fb : Actual : 1,137.53 psi at 5.500 ft in Span # 1
Fb : Allowable : 1,190.25 psi
Load Comb : +D+S

Max fv/FvRatio = **0.270** : 1
fv : Actual : 55.81 psi at 0.000 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+S

| | | | | | | | |
|-------------------|------|------|---|------|---|---|---|
| Max Reactions (k) | D | Lr | L | S | W | E | H |
| Left Support | 0.18 | 0.22 | | 0.28 | | | |
| Right Support | 0.18 | 0.22 | | 0.28 | | | |



Max Deflections

| | | | |
|--------------------|------------|----------------|----------|
| Transient Downward | 0.217 in | Total Downward | 0.358 in |
| Ratio | 607 | Ratio | 368 |
| | LC: S Only | | LC: +D+S |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| | LC: | | LC: |

Wood Beam Design : RJ-2

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2x10, Sawn, Fully Braced**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : Douglas Fir-Larch

Wood Grade : No.2

| | | | | | | | | | |
|--------------|-----------|-----------|-------------|----|-----------|---------------|-------------|---------|------------|
| Fb - Tension | 900.0 psi | Fc - Prll | 1,350.0 psi | Fv | 180.0 psi | Ebend- xx | 1,600.0 ksi | Density | 31.210 pcf |
| Fb - Compr | 900.0 psi | Fc - Perp | 625.0 psi | Ft | 575.0 psi | Eminbend - xx | 580.0 ksi | | |

Applied Loads

Beam self weight calculated and added to loads

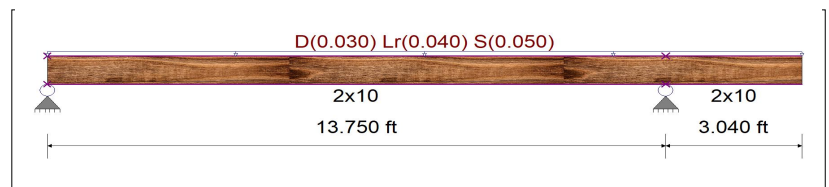
Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, Trib= 2.0 ft

Design Summary

Max fb/Fb Ratio = **0.836** : 1
fb : Actual : 995.54 psi at 6.531 ft in Span # 1
Fb : Allowable : 1,190.25 psi
Load Comb : +D+S

Max fv/FvRatio = **0.280** : 1
fv : Actual : 57.92 psi at 12.994 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+S

| | | | | | | | |
|-------------------|------|------|---|------|---|---|---|
| Max Reactions (k) | D | Lr | L | S | W | E | H |
| Left Support | 0.22 | 0.26 | | 0.33 | | | |
| Right Support | 0.34 | 0.41 | | 0.51 | | | |



Max Deflections

| | | | |
|--------------------|------------|----------------|-----------|
| Transient Downward | 0.226 in | Total Downward | 0.375 in |
| Ratio | 729 | Ratio | 439 |
| | LC: S Only | | LC: +D+S |
| Transient Upward | -0.139 in | Total Upward | -0.230 in |
| Ratio | 524 | Ratio | 316 |
| | LC: S Only | | LC: +D+S |



Multiple Simple Beam

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

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Wood Beam Design : RJ-3

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2x12, Sawn, Fully Braced**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : Douglas Fir-Larch

Wood Grade : No.2

| | | | | | | | | | |
|--------------|-----------|-----------|-------------|----|-----------|---------------|-------------|---------|------------|
| Fb - Tension | 900.0 psi | Fc - Prll | 1,350.0 psi | Fv | 180.0 psi | Ebend- xx | 1,600.0 ksi | Density | 31.210 pcf |
| Fb - Compr | 900.0 psi | Fc - Perp | 625.0 psi | Ft | 575.0 psi | Eminbend - xx | 580.0 ksi | | |

Applied Loads

Beam self weight calculated and added to loads

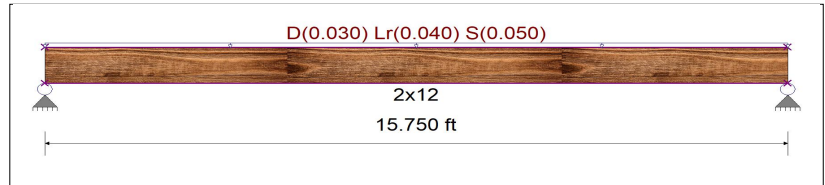
Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, Trib= 2.0 ft

Design Summary

Max fb/Fb Ratio = **0.827** : 1
fb : Actual : 983.81 psi at 7.875 ft in Span # 1
Fb : Allowable : 1,190.25 psi
Load Comb : +D+S

Max fv/FvRatio = **0.251** : 1
fv : Actual : 51.92 psi at 0.000 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+S

| | | | | | | |
|-------------------|------|------|------|---|---|---|
| Max Reactions (k) | D | Lr | S | W | E | H |
| Left Support | 0.27 | 0.32 | 0.39 | | | |
| Right Support | 0.27 | 0.32 | 0.39 | | | |



Max Deflections

| | | | |
|--------------------|----------|----------------|----------|
| Transient Downward | 0.244 in | Total Downward | 0.409 in |
| Ratio | 773 | Ratio | 462 |
| LC: S Only | | LC: +D+S | |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: | | LC: | |

Wood Beam Design : RB-1

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2-1.75x9.25, Microllam LVL, Fully Braced**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : iLevel Truss Joist

Wood Grade : MicroLam LVL 2.0 E

| | | | | | | | | | |
|--------------|-------------|-----------|-------------|----|-------------|---------------|--------------|---------|------------|
| Fb - Tension | 2,600.0 psi | Fc - Prll | 2,510.0 psi | Fv | 285.0 psi | Ebend- xx | 2,000.0 ksi | Density | 42.010 pcf |
| Fb - Compr | 2,600.0 psi | Fc - Perp | 750.0 psi | Ft | 1,555.0 psi | Eminbend - xx | 1,016.54 ksi | | |

Applied Loads

Beam self weight calculated and added to loads

Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, Trib= 1.750 ft

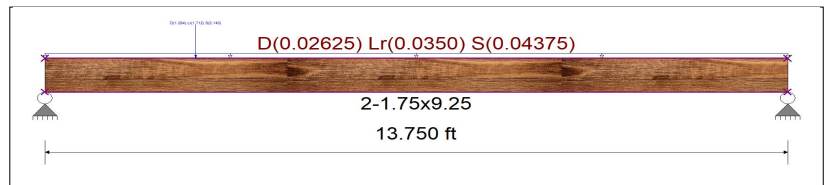
1Point: D = 1.284, Lr = 1.712, S = 2.140 k @ 2.790 ft

Design Summary

Max fb/Fb Ratio = **0.710** : 1
fb : Actual : 2,122.25 psi at 2.796 ft in Span # 1
Fb : Allowable : 2,990.00 psi
Load Comb : +D+S

Max fv/FvRatio = **0.455** : 1
fv : Actual : 149.06 psi at 0.000 ft in Span # 1
Fv : Allowable : 327.75 psi
Load Comb : +D+S

| | | | | | | |
|-------------------|------|------|------|---|---|---|
| Max Reactions (k) | D | Lr | S | W | E | H |
| Left Support | 1.27 | 1.61 | 2.01 | | | |
| Right Support | 0.51 | 0.59 | 0.74 | | | |



Max Deflections

| | | | |
|--------------------|----------|----------------|----------|
| Transient Downward | 0.332 in | Total Downward | 0.547 in |
| Ratio | 497 | Ratio | 301 |
| LC: S Only | | LC: +D+S | |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: | | LC: | |



Multiple Simple Beam

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

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Wood Beam Design : RB-2

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2x8, Sawn, Fully Unbraced**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : Douglas Fir-Larch

Wood Grade : No.2

Fb - Tension 900.0 psi Fc - Prll 1,350.0 psi Fv 180.0 psi Ebend- xx 1,600.0 ksi Density 31.210 pcf
Fb - Compr 900.0 psi Fc - Perp 625.0 psi Ft 575.0 psi Eminbend - xx 580.0 ksi

Applied Loads

Beam self weight calculated and added to loads

Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, Trib= 1.810 ft

Design Summary

Max fb/Fb Ratio = **0.572** : 1
fb : Actual : 520.51 psi at 3.905 ft in Span # 1
Fb : Allowable : 909.19 psi
Load Comb : +D+S
Max fv/FvRatio = **0.165** : 1
fv : Actual : 34.09 psi at 0.000 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+S



Max Reactions (k) D Lr L S W E H
Left Support 0.12 0.14 0.18
Right Support 0.12 0.14 0.18

Max Deflections

| | | | |
|--------------------|----------|----------------|----------|
| Transient Downward | 0.050 in | Total Downward | 0.083 in |
| Ratio | 1875 | Ratio | 1135 |
| LC: S Only | | LC: +D+S | |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: | | LC: | |

Wood Beam Design : RB-3

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2x8, Sawn, Defined Brace Spacing, 1st at ft and spaced at 2.0 ft**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : Douglas Fir-Larch

Wood Grade : No.2

Fb - Tension 900.0 psi Fc - Prll 1,350.0 psi Fv 180.0 psi Ebend- xx 1,600.0 ksi Density 31.210 pcf
Fb - Compr 900.0 psi Fc - Perp 625.0 psi Ft 575.0 psi Eminbend - xx 580.0 ksi

Applied Loads

Beam self weight calculated and added to loads

Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, Trib= 9.920 ft

Design Summary

Max fb/Fb Ratio = **0.124** : 1
fb : Actual : 127.07 psi at 0.835 ft in Span # 1
Fb : Allowable : 1,022.58 psi
Load Comb : +D+S
Max fv/FvRatio = **0.062** : 1
fv : Actual : 12.87 psi at 1.069 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+S



Max Reactions (k) D Lr L S W E H
Left Support 0.13 0.17 0.21
Right Support 0.13 0.17 0.21

Max Deflections

| | | | |
|--------------------|----------|----------------|----------|
| Transient Downward | 0.001 in | Total Downward | 0.001 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: S Only | | LC: +D+S | |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: | | LC: | |



Multiple Simple Beam

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

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Wood Beam Design : RB-4

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **1.75x11.25, Microllam LVL, Fully Unbraced**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : iLevel Truss Joist

Wood Grade : MicroLam LVL 2.0 E

Fb - Tension 2,600.0 psi Fc - Prll 2,510.0 psi Fv 285.0 psi Ebend- xx 2,000.0 ksi Density 42.010 pcf
Fb - Compr 2,600.0 psi Fc - Perp 750.0 psi Ft 1,555.0 psi Eminbend - xx 1,016.54 ksi

Applied Loads

Beam self weight calculated and added to loads

Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, Trib= 2.630 ft

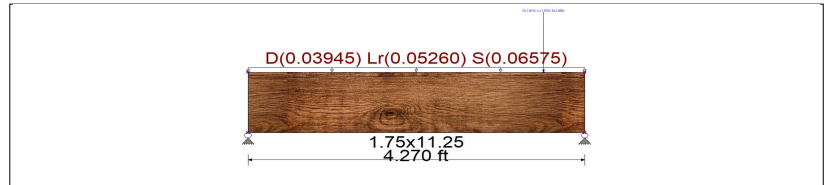
1Point: D = 1.610, Lr = 1.970, S = 2.460 k @ 3.750 ft

Design Summary

Max fb/Fb Ratio = **0.255** : 1
fb : Actual : 638.69 psi at 3.743 ft in Span # 1
Fb : Allowable : 2,502.91 psi
Load Comb : +D+S

Max fv/FvRatio = **0.886** : 1
fv : Actual : 290.38 psi at 4.270 ft in Span # 1
Fv : Allowable : 327.75 psi
Load Comb : +D+S

| Max Reactions (k) | D | Lr | S | W | E | H |
|-------------------|------|------|------|---|---|---|
| Left Support | 0.29 | 0.35 | 0.44 | | | |
| Right Support | 1.51 | 1.84 | 2.30 | | | |



Max Deflections

| Transient Downward | Ratio | Total Downward | Ratio |
|--------------------|-------|----------------|-------|
| 0.007 in | 7038 | 0.012 in | 4240 |
| LC: S Only | | | |
| Transient Upward | Ratio | Total Upward | Ratio |
| 0.000 in | 9999 | 0.000 in | 9999 |
| LC: LC: | | | |

Wood Beam Design : RB-5

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2x8, Sawn, Defined Brace Spacing, 1st at ft and spaced at 2.0 ft**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : Douglas Fir-Larch

Wood Grade : No.2

Fb - Tension 900.0 psi Fc - Prll 1,350.0 psi Fv 180.0 psi Ebend- xx 1,600.0 ksi Density 31.210 pcf
Fb - Compr 900.0 psi Fc - Perp 625.0 psi Ft 575.0 psi Eminbend - xx 580.0 ksi

Applied Loads

Beam self weight calculated and added to loads

Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, Trib= 2.630 ft

Design Summary

Max fb/Fb Ratio = **0.108** : 1
fb : Actual : 110.50 psi at 1.500 ft in Span # 1
Fb : Allowable : 1,019.48 psi
Load Comb : +D+S

Max fv/FvRatio = **0.065** : 1
fv : Actual : 13.35 psi at 2.400 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+S

| Max Reactions (k) | D | Lr | S | W | E | H |
|-------------------|------|------|------|---|---|---|
| Left Support | 0.06 | 0.08 | 0.10 | | | |
| Right Support | 0.06 | 0.08 | 0.10 | | | |



Max Deflections

| Transient Downward | Ratio | Total Downward | Ratio |
|--------------------|-------|----------------|-------|
| 0.002 in | 9999 | 0.003 in | 9999 |
| LC: S Only | | | |
| Transient Upward | Ratio | Total Upward | Ratio |
| 0.000 in | 9999 | 0.000 in | 9999 |
| LC: LC: | | | |



Multiple Simple Beam

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

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Wood Beam Design : RB-10

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2-2x8, Sawn, Defined Brace Spacing, 1st at ft and spaced at 2.0 ft**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : Douglas Fir-Larch

Wood Grade : No.2

| | | | | | | | | | |
|--------------|-----------|-----------|-------------|----|-----------|---------------|-------------|---------|------------|
| Fb - Tension | 900.0 psi | Fc - Prll | 1,350.0 psi | Fv | 180.0 psi | Ebend- xx | 1,600.0 ksi | Density | 31.210 pcf |
| Fb - Compr | 900.0 psi | Fc - Perp | 625.0 psi | Ft | 575.0 psi | Eminbend - xx | 580.0 ksi | | |

Applied Loads

Beam self weight calculated and added to loads

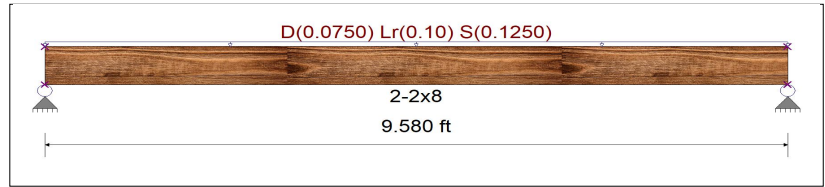
Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, Trib= 5.0 ft

Design Summary

Max fb/Fb Ratio = **1.039** : 1
fb : Actual : 1,072.32 psi at 4.790 ft in Span # 1
Fb : Allowable : 1,031.74 psi
Load Comb : +D+S

Max fv/FvRatio = **0.287** : 1
fv : Actual : 59.51 psi at 9.005 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+S

| | | | | | | | |
|-------------------|------|------|---|------|---|---|---|
| Max Reactions (k) | D | Lr | L | S | W | E | H |
| Left Support | 0.38 | 0.48 | | 0.60 | | | |
| Right Support | 0.38 | 0.48 | | 0.60 | | | |



Max Deflections

| | | | |
|--------------------|----------|----------------|----------|
| Transient Downward | 0.156 in | Total Downward | 0.256 in |
| Ratio | 735 | Ratio | 449 |
| LC: S Only | | LC: +D+S | |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: | | LC: | |

Wood Beam Design : RB-11

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2-1.75x11.25, Microllam LVL, Defined Brace Spacing, 1st at ft and s**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : iLevel Truss Joist

Wood Grade : MicroLam LVL 2.0 E

| | | | | | | | | | |
|--------------|-------------|-----------|-------------|----|-------------|---------------|--------------|---------|------------|
| Fb - Tension | 2,600.0 psi | Fc - Prll | 2,510.0 psi | Fv | 285.0 psi | Ebend- xx | 2,000.0 ksi | Density | 42.010 pcf |
| Fb - Compr | 2,600.0 psi | Fc - Perp | 750.0 psi | Ft | 1,555.0 psi | Eminbend - xx | 1,016.54 ksi | | |

Applied Loads

Beam self weight calculated and added to loads

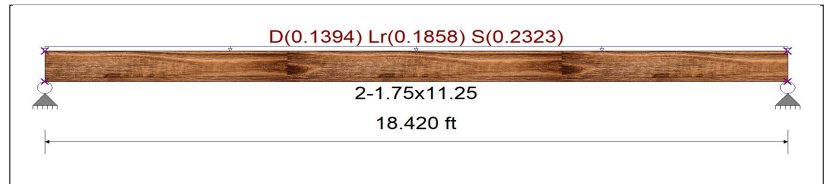
Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, Trib= 9.290 ft

Design Summary

Max fb/Fb Ratio = **0.889** : 1
fb : Actual : 2,640.87 psi at 9.210 ft in Span # 1
Fb : Allowable : 2,971.25 psi
Load Comb : +D+S

Max fv/FvRatio = **0.369** : 1
fv : Actual : 120.97 psi at 0.000 ft in Span # 1
Fv : Allowable : 327.75 psi
Load Comb : +D+S

| | | | | | | | |
|-------------------|------|------|---|------|---|---|---|
| Max Reactions (k) | D | Lr | L | S | W | E | H |
| Left Support | 1.39 | 1.71 | | 2.14 | | | |
| Right Support | 1.39 | 1.71 | | 2.14 | | | |



Max Deflections

| | | | |
|--------------------|----------|----------------|----------|
| Transient Downward | 0.728 in | Total Downward | 1.201 in |
| Ratio | 303 | Ratio | 184 |
| LC: S Only | | LC: +D+S | |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: | | LC: | |



Multiple Simple Beam

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

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Wood Beam Design : RB-12

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **5.25x11.25, Parallam PSL, Defined Brace Spacing, 1st at ft and spar**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : iLevel Truss Joist

Wood Grade : Parallam PSL 2.0E

Fb - Tension 2,900.0 psi Fc - Prll 2,900.0 psi Fv 290.0 psi Ebend- xx 2,000.0 ksi Density 45.070 pcf
Fb - Compr 2,900.0 psi Fc - Perp 750.0 psi Ft 2,025.0 psi Eminbend - xx 1,016.54 ksi

Applied Loads

Beam self weight calculated and added to loads

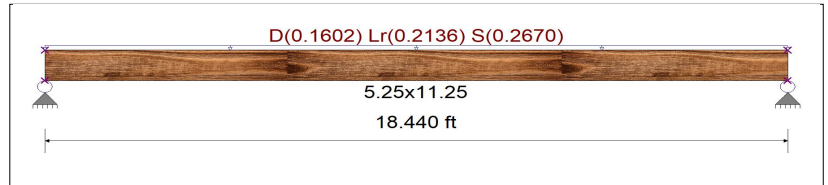
Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, Trib= 10.680 ft

Design Summary

Max fb/Fb Ratio = **0.617** : 1
fb : Actual : 2,052.72 psi at 9.220 ft in Span # 1
Fb : Allowable : 3,325.18 psi
Load Comb : +D+S

Max fv/FvRatio = **0.282** : 1
fv : Actual : 93.93 psi at 0.000 ft in Span # 1
Fv : Allowable : 333.50 psi
Load Comb : +D+S

| Max Reactions (k) | D | Lr | L | S | W | E | H |
|-------------------|------|------|---|------|---|---|---|
| Left Support | 1.65 | 1.97 | | 2.46 | | | |
| Right Support | 1.65 | 1.97 | | 2.46 | | | |



Max Deflections

| | | | |
|--------------------|----------|----------------|----------|
| Transient Downward | 0.561 in | Total Downward | 0.936 in |
| Ratio | 394 | Ratio | 236 |
| LC: S Only | | LC: +D+S | |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: | | LC: | |

Wood Beam Design : RB-12

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **5.25x11.25, Parallam PSL, Defined Brace Spacing, 1st at ft and spar**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : iLevel Truss Joist

Wood Grade : Parallam PSL 2.0E

Fb - Tension 2,900.0 psi Fc - Prll 2,900.0 psi Fv 290.0 psi Ebend- xx 2,000.0 ksi Density 45.070 pcf
Fb - Compr 2,900.0 psi Fc - Perp 750.0 psi Ft 2,025.0 psi Eminbend - xx 1,016.54 ksi

Applied Loads

Beam self weight calculated and added to loads

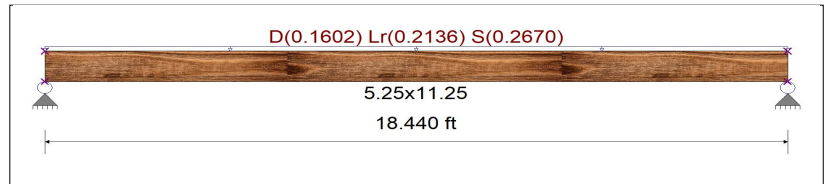
Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, Trib= 10.680 ft

Design Summary

Max fb/Fb Ratio = **0.617** : 1
fb : Actual : 2,052.72 psi at 9.220 ft in Span # 1
Fb : Allowable : 3,325.18 psi
Load Comb : +D+S

Max fv/FvRatio = **0.282** : 1
fv : Actual : 93.93 psi at 0.000 ft in Span # 1
Fv : Allowable : 333.50 psi
Load Comb : +D+S

| Max Reactions (k) | D | Lr | L | S | W | E | H |
|-------------------|------|------|---|------|---|---|---|
| Left Support | 1.65 | 1.97 | | 2.46 | | | |
| Right Support | 1.65 | 1.97 | | 2.46 | | | |



Max Deflections

| | | | |
|--------------------|----------|----------------|----------|
| Transient Downward | 0.561 in | Total Downward | 0.936 in |
| Ratio | 394 | Ratio | 236 |
| LC: S Only | | LC: +D+S | |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: | | LC: | |

Multiple Simple Beam

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

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Description : Roof Joists and Beams (RB8 & RB13)

Wood Beam Design : RB-13

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

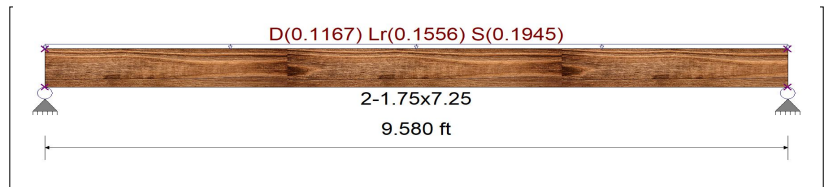
BEAM Size : **2-1.75x7.25, Microllam LVL, Defined Brace Spacing, 1st at ft and sp**
 Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending
 Wood Species : iLevel Truss Joist Wood Grade : MicroLam LVL 2.0 E
 Fb - Tension 2,600.0 psi Fc - Prll 2,510.0 psi Fv 285.0 psi Ebend- xx 2,000.0 ksi Density 42.010 pcf
 Fb - Compr 2,600.0 psi Fc - Perp 750.0 psi Ft 1,555.0 psi Eminbend - xx 1,016.54 ksi

Applied Loads

Beam self weight calculated and added to loads
 Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, Trib= 7.780 ft

Design Summary

Max fb/Fb Ratio = **0.480** : 1
 fb : Actual : 1,430.47 psi at 4.790 ft in Span # 1
 Fb : Allowable : 2,978.47 psi
 Load Comb : +D+S
 Max fv/FvRatio = **0.242** : 1
 fv : Actual : 79.39 psi at 9.005 ft in Span # 1
 Fv : Allowable : 327.75 psi
 Load Comb : +D+S



| Max Reactions (k) | D | Lr | L | S | W | E | H | Max Deflections | Transient Downward | Total Downward | Ratio | LC: S Only | LC: +D+S |
|-------------------|------|------|---|------|---|---|---|--------------------|--------------------|----------------|-------|------------|----------|
| Left Support | 0.59 | 0.75 | | 0.93 | | | | Transient Downward | 0.167 in | 0.273 in | 689 | | 420 |
| Right Support | 0.59 | 0.75 | | 0.93 | | | | Ratio | | | | | |
| | | | | | | | | Transient Upward | 0.000 in | 0.000 in | 9999 | | 9999 |
| | | | | | | | | Ratio | | | | | |
| | | | | | | | | LC: | | | | | LC: |

Wood Beam Design : RB-8

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

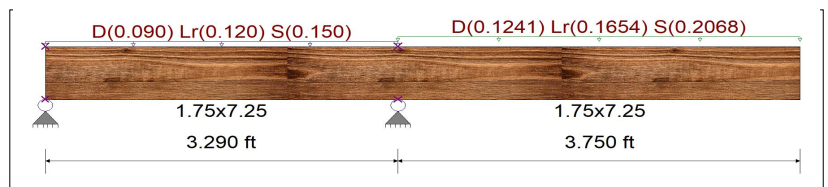
BEAM Size : **1.75x7.25, Microllam LVL, Defined Brace Spacing, 1st at ft and spac**
 Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending
 Wood Species : iLevel Truss Joist Wood Grade : MicroLam LVL 2.0 E
 Fb - Tension 2,600.0 psi Fc - Prll 2,510.0 psi Fv 285.0 psi Ebend- xx 2,000.0 ksi Density 42.010 pcf
 Fb - Compr 2,600.0 psi Fc - Perp 750.0 psi Ft 1,555.0 psi Eminbend - xx 1,016.54 ksi

Applied Loads

Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, 0.0 ft to 3.290 ft, Trib= 6.0 ft
 Unif Load: D = 0.0150, Lr = 0.020, S = 0.0250 k/ft, 3.290 to 7.040 ft, Trib= 8.270 ft

Design Summary

Max fb/Fb Ratio = **0.621** : 1
 fb : Actual : 1,820.61 psi at 0.000 ft in Span # 2
 Fb : Allowable : 2,933.06 psi
 Load Comb : +D+S
 Max fv/FvRatio = **0.376** : 1
 fv : Actual : 123.19 psi at 3.290 ft in Span # 1
 Fv : Allowable : 327.75 psi
 Load Comb : +D+S



| Max Reactions (k) | D | Lr | L | S | W | E | H | Max Deflections | Transient Downward | Total Downward | Ratio | LC: S Only | LC: +D+S |
|-------------------|-------|-------|---|-------|---|---|---|--------------------|--------------------|----------------|-------|------------|----------|
| Left Support | -0.12 | -0.16 | | -0.20 | | | | Transient Downward | 0.159 in | 0.255 in | 564 | | 352 |
| Right Support | 0.88 | 1.17 | | 1.46 | | | | Ratio | | | | | |
| | | | | | | | | Transient Upward | -0.012 in | -0.020 in | 3198 | | 1999 |
| | | | | | | | | Ratio | | | | | |
| | | | | | | | | LC: | | | | | LC: |

Multiple Simple Beam

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

Wood Beam Design : CC1 - Cantilever Column Design

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **6x6, Sawn, Fully Unbraced**

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

Wood Species : Douglas Fir-Larch

Wood Grade : No.2

| | | | | | | | | | |
|--------------|-----------|-----------|-------------|----|-----------|---------------|-------------|---------|------------|
| Fb - Tension | 900.0 psi | Fc - Prll | 1,350.0 psi | Fv | 180.0 psi | Ebend- xx | 1,600.0 ksi | Density | 31.210 pcf |
| Fb - Compr | 900.0 psi | Fc - Perp | 625.0 psi | Ft | 575.0 psi | Eminbend - xx | 580.0 ksi | | |

Applied Loads

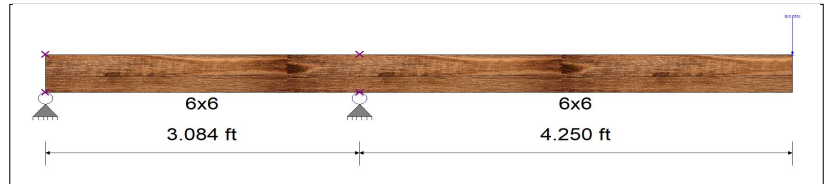
1Point: E = 0.650 k @ 7.334 ft

Design Summary

Max fb/Fb Ratio = **0.581** : 1
 fb : Actual : 836.83 psi at 3.084 ft in Span # 1
 Fb : Allowable : 1,440.00 psi
 Load Comb : E Only * 0.70

Max fv/FvRatio = **0.108** : 1
 fv : Actual : 31.09 psi at 0.000 ft in Span # 1
 Fv : Allowable : 288.00 psi
 Load Comb : E Only * 0.70

| | | | | | | | |
|-------------------|---|----|---|---|---|-------|---|
| Max Reactions (k) | D | Lr | L | S | W | E | H |
| Left Support | | | | | | -0.90 | |
| Right Support | | | | | | 1.55 | |



Max Deflections

| | | | |
|--------------------|------------|----------------|-------------------|
| Transient Downward | 0.406 in | Total Downward | 0.284 in |
| Ratio | 250 | Ratio | 358 |
| | LC: E Only | | LC: E Only * 0.70 |
| Transient Upward | -0.024 in | Total Upward | -0.017 in |
| Ratio | 1540 | Ratio | 2200 |
| | LC: E Only | | LC: E Only * 0.70 |

Wood Column

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: RB-6

Code References

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
 Load Combinations Used : IBC 2018

General Information

| | | | | | |
|--|-------------------------|-------------|------------|-----------------------------------|---|
| Analysis Method | Allowable Stress Design | | | Wood Section Name | 2-2x8 |
| End Fixities | Top & Bottom Pinned | | | Wood Grading/Manuf. | Graded Lumber |
| Overall Column Height | 4 ft | | | Wood Member Type | Sawn |
| <i>(Used for non-slender calculations)</i> | | | | | |
| Wood Species | Douglas Fir-Larch | | | Exact Width | 3.0 in |
| Wood Grade | No.2 | | | Exact Depth | 7.250 in |
| Fb + | 900.0 psi | Fv | 180.0 psi | Area | 21.750 in ² |
| Fb - | 900.0 psi | Ft | 575.0 psi | Ix | 95.270 in ⁴ |
| Fc - Prll | 1,350.0 psi | Density | 31.210 pcf | Iy | 16.313 in ⁴ |
| Fc - Perp | 625.0 psi | | | Allow Stress Modification Factors | |
| E : Modulus of Elasticity . . . | x-x Bending | y-y Bending | Axial | Cf or Cv for Bending 1.20 | |
| | Basic | 1,600.0 | 1,600.0 | 1,600.0 ksi | Cf or Cv for Compression 1.050 |
| | Minimum | 580.0 | 580.0 | | Cf or Cv for Tension 1.20 |
| | | | | | Cm : Wet Use Factor 1.0 |
| | | | | | Ct : Temperature Fact 1.0 |
| | | | | | Cfu : Flat Use Factor 1.0 |
| | | | | | Kf : Built-up columns 1.0 <i>NDS 15.3.2</i> |
| | | | | | Use Cr : Repetitive ? No |
| Brace condition for deflection (buckling) along columns : | | | | | |
| X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 2.0 ft, I | | | | | |
| Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 4 ft, K : | | | | | |

Applied Loads

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

Column self weight included : 18.856 lbs * Dead Load Factor

BENDING LOADS . . .

Roof Loading: Lat. Uniform Load creating Mx-x, D = 0.090, LR = 0.120, S = 0.150 k/ft

Lat. Uniform Load creating My-y, W = 0.06250 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

| | | | |
|---|-------------------|---|------------------------------------|
| PASS Max. Axial+Bending Stress Ratio = | 0.1771 : 1 | Maximum SERVICE Lateral Load Reactions . . | |
| Load Combination | +D+S | Top along Y-Y | 0.480 k Bottom along Y-Y 0.480 k |
| Governing NDS Forumla Comp + Mxx, NDS Eq. 3.9-3 | | Top along X-X | 0.1250 k Bottom along X-X 0.1250 k |
| Location of max.above base | 1.987 ft | Maximum SERVICE Load Lateral Deflections . . . | |
| At maximum location values are . | | Along Y-Y | 0.009167 in at 2.013 ft above base |
| Applied Axial | 0.01886 k | for load combination : +D+S | |
| Applied Mx | 0.480 k-ft | Along X-X | 0.01394 in at 2.013 ft above base |
| Applied My | 0.0 k-ft | for load combination : W Only | |
| Fc : Allowable | 1,548.82 psi | Other Factors used to calculate allowable stresses . . . | |
| PASS Maximum Shear Stress Ratio = | 0.1599 : 1 | Bending | Compression |
| Load Combination | +D+S | Tension | |
| Location of max.above base | 0.0 ft | | |
| Applied Design Shear | 33.103 psi | | |
| Allowable Shear | 207.0 psi | | |

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|-------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| D Only | 0.900 | 0.962 | 0.08481 | PASS | 2.013 ft | 0.07663 | PASS | 0.0 ft |
| +D+Lr | 1.250 | 0.945 | 0.1427 | PASS | 1.987 ft | 0.1287 | PASS | 0.0 ft |
| +D+S | 1.150 | 0.950 | 0.1771 | PASS | 1.987 ft | 0.1599 | PASS | 0.0 ft |
| +D+0.750Lr | 1.250 | 0.945 | 0.1223 | PASS | 1.987 ft | 0.1103 | PASS | 0.0 ft |
| +D+0.750S | 1.150 | 0.950 | 0.1495 | PASS | 1.987 ft | 0.1349 | PASS | 0.0 ft |
| +D+0.60W | 1.600 | 0.927 | 0.09572 | PASS | 2.013 ft | 0.04310 | PASS | 0.0 ft |
| +D+0.750Lr+0.450W | 1.600 | 0.927 | 0.1316 | PASS | 2.013 ft | 0.08621 | PASS | 0.0 ft |
| +D+0.750S+0.450W | 1.600 | 0.927 | 0.1435 | PASS | 1.987 ft | 0.09698 | PASS | 0.0 ft |
| +0.60D+0.60W | 1.600 | 0.927 | 0.07659 | PASS | 1.987 ft | 0.02586 | PASS | 0.0 ft |
| +0.60D | 1.600 | 0.927 | 0.02869 | PASS | 1.987 ft | 0.02586 | PASS | 0.0 ft |

Project Title: Bickell Residence
 Engineer: Mark Speidel
 Project ID:
 Project Descr: Remodeling of existing SFR

Wood Column

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: RB-6

Maximum Deflections for Load Combinations

| Load Combination | Max. X-X Deflection | Distance | Max. Y-Y Deflection | Distance |
|-------------------|---------------------|----------|---------------------|----------|
| D Only | 0.0000 in | 0.000ft | 0.003 in | 2.013ft |
| +D+Lr | 0.0000 in | 0.000ft | 0.008 in | 2.013ft |
| +D+S | 0.0000 in | 0.000ft | 0.009 in | 2.013ft |
| +D+0.750Lr | 0.0000 in | 0.000ft | 0.007 in | 2.013ft |
| +D+0.750S | 0.0000 in | 0.000ft | 0.008 in | 2.013ft |
| +D+0.60W | 0.0084 in | 2.013ft | 0.003 in | 2.013ft |
| +D+0.750Lr+0.450W | 0.0063 in | 2.013ft | 0.007 in | 2.013ft |
| +D+0.750S+0.450W | 0.0063 in | 2.013ft | 0.008 in | 2.013ft |
| +0.60D+0.60W | 0.0084 in | 2.013ft | 0.002 in | 2.013ft |
| +0.60D | 0.0000 in | 0.000ft | 0.002 in | 2.013ft |
| Lr Only | 0.0000 in | 0.000ft | 0.005 in | 2.013ft |
| S Only | 0.0000 in | 0.000ft | 0.006 in | 2.013ft |
| W Only | 0.0139 in | 2.013ft | 0.000 in | 0.000ft |

Wood Column

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: RB-7

Code References

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
 Load Combinations Used : IBC 2018

General Information

| | | | | | |
|--|-------------------------|-------------|------------|-----------------------------------|---|
| Analysis Method | Allowable Stress Design | | | Wood Section Name | 2-2x8 |
| End Fixities | Top & Bottom Pinned | | | Wood Grading/Manuf. | Graded Lumber |
| Overall Column Height | 8.46 ft | | | Wood Member Type | Sawn |
| <i>(Used for non-slender calculations)</i> | | | | | |
| Wood Species | Douglas Fir-Larch | | | Exact Width | 3.0 in |
| Wood Grade | No.2 | | | Exact Depth | 7.250 in |
| Fb + | 900.0 psi | Fv | 180.0 psi | Area | 21.750 in ² |
| Fb - | 900.0 psi | Ft | 575.0 psi | Ix | 95.270 in ⁴ |
| Fc - Prll | 1,350.0 psi | Density | 31.210 pcf | Iy | 16.313 in ⁴ |
| Fc - Perp | 625.0 psi | | | Allow Stress Modification Factors | |
| E : Modulus of Elasticity . . . | x-x Bending | y-y Bending | Axial | Cf or Cv for Bending 1.20 | |
| | Basic | 1,600.0 | 1,600.0 | 1,600.0 ksi | Cf or Cv for Compression 1.050 |
| | Minimum | 580.0 | 580.0 | | Cf or Cv for Tension 1.20 |
| | | | | | Cm : Wet Use Factor 1.0 |
| | | | | | Ct : Temperature Fact 1.0 |
| | | | | | Cfu : Flat Use Factor 1.0 |
| | | | | | Kf : Built-up columns 1.0 <i>NDS 15.3.2</i> |
| | | | | | Use Cr : Repetitive ? No |
| Brace condition for deflection (buckling) along columns : | | | | | |
| X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 2.0 ft, I | | | | | |
| Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 8.46 ft, | | | | | |

Applied Loads

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

Column self weight included : 39.881 lbs * Dead Load Factor

BENDING LOADS . . .

Roof Loading: Lat. Uniform Load creating Mx-x, D = 0.090, LR = 0.120, S = 0.150 k/ft

Wind Wall Loading: Lat. Uniform Load creating My-y, W = 0.05779 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

| | | | |
|---|-------------------|---|------------------------------------|
| PASS Max. Axial+Bending Stress Ratio = | 0.7929 : 1 | Maximum SERVICE Lateral Load Reactions . . | |
| Load Combination | +D+S | Top along Y-Y | 1.015 k Bottom along Y-Y 1.015 k |
| Governing NDS Forumla Comp + Mxx, NDS Eq. 3.9-3 | | Top along X-X | 0.2445 k Bottom along X-X 0.2445 k |
| Location of max.above base | 4.202 ft | Maximum SERVICE Load Lateral Deflections . . . | |
| At maximum location values are . | | Along Y-Y | 0.1834 in at 4.258 ft above base |
| Applied Axial | 0.03988 k | for load combination : +D+S | |
| Applied Mx | 2.147 k-ft | Along X-X | 0.2579 in at 4.258 ft above base |
| Applied My | 0.0 k-ft | for load combination : W Only | |
| Fc : Allowable | 1,318.06 psi | Other Factors used to calculate allowable stresses . . . | |
| PASS Maximum Shear Stress Ratio = | 0.3382 : 1 | Bending | Compression |
| Load Combination | +D+S | Tension | |
| Location of max.above base | 8.460 ft | | |
| Applied Design Shear | 70.014 psi | | |
| Allowable Shear | 207.0 psi | | |

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|-------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| D Only | 0.900 | 0.859 | 0.3796 | PASS | 4.202 ft | 0.1621 | PASS | 8.460 ft |
| +D+Lr | 1.250 | 0.788 | 0.6385 | PASS | 4.202 ft | 0.2723 | PASS | 8.460 ft |
| +D+S | 1.150 | 0.809 | 0.7929 | PASS | 4.202 ft | 0.3382 | PASS | 8.460 ft |
| +D+0.750Lr | 1.250 | 0.788 | 0.5473 | PASS | 4.202 ft | 0.2334 | PASS | 8.460 ft |
| +D+0.750S | 1.150 | 0.809 | 0.6690 | PASS | 4.202 ft | 0.2854 | PASS | 8.460 ft |
| +D+0.60W | 1.600 | 0.714 | 0.4123 | PASS | 4.202 ft | 0.09116 | PASS | 8.460 ft |
| +D+0.750Lr+0.450W | 1.600 | 0.714 | 0.5770 | PASS | 4.202 ft | 0.1823 | PASS | 8.460 ft |
| +D+0.750S+0.450W | 1.600 | 0.714 | 0.6306 | PASS | 4.202 ft | 0.2051 | PASS | 8.460 ft |
| +0.60D+0.60W | 1.600 | 0.714 | 0.3265 | PASS | 4.202 ft | 0.05470 | PASS | 8.460 ft |
| +0.60D | 1.600 | 0.714 | 0.1284 | PASS | 4.202 ft | 0.05470 | PASS | 8.460 ft |

Project Title: Bickell Residence
 Engineer: Mark Speidel
 Project ID:
 Project Descr: Remodeling of existing SFR

Wood Column

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: RB-7

Maximum Deflections for Load Combinations

| Load Combination | Max. X-X Deflection | Distance | Max. Y-Y Deflection | Distance |
|-------------------|---------------------|----------|---------------------|----------|
| D Only | 0.0000 in | 0.000ft | 0.069 in | 4.258 ft |
| +D+Lr | 0.0000 in | 0.000ft | 0.160 in | 4.258 ft |
| +D+S | 0.0000 in | 0.000ft | 0.183 in | 4.258 ft |
| +D+0.750Lr | 0.0000 in | 0.000ft | 0.138 in | 4.258 ft |
| +D+0.750S | 0.0000 in | 0.000ft | 0.155 in | 4.258 ft |
| +D+0.60W | 0.1548 in | 4.258ft | 0.069 in | 4.258 ft |
| +D+0.750Lr+0.450W | 0.1161 in | 4.258ft | 0.138 in | 4.258 ft |
| +D+0.750S+0.450W | 0.1161 in | 4.258ft | 0.155 in | 4.258 ft |
| +0.60D+0.60W | 0.1548 in | 4.258ft | 0.041 in | 4.258 ft |
| +0.60D | 0.0000 in | 0.000ft | 0.041 in | 4.258 ft |
| Lr Only | 0.0000 in | 0.000ft | 0.092 in | 4.258 ft |
| S Only | 0.0000 in | 0.000ft | 0.115 in | 4.258 ft |
| W Only | 0.2579 in | 4.258ft | 0.000 in | 0.000 ft |



Wood Column

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.8.17

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FB-5

Code References

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
Load Combinations Used : IBC 2018

General Information

| | | | |
|--|-------------------------|---------------------|---|
| Analysis Method | Allowable Stress Design | Wood Section Name | 5.25x9.25 |
| End Fixities | Top & Bottom Pinned | Wood Grading/Manuf. | Trus Joist |
| Overall Column Height | 15.0 ft | Wood Member Type | Parallam PSL |
| <i>(Used for non-slender calculations)</i> | | | |
| Wood Species | iLevel Truss Joist | Exact Width | 5.250 in Allow Stress Modification Factors |
| Wood Grade | Parallam PSL 2.0E | Exact Depth | 9.250 in Cf or Cv for Bending 1.0 |
| Fb + | 2,900.0 psi | Area | 48.563 in ² Cf or Cv for Compression 1.0 |
| Fb - | 2,900.0 psi | Ix | 346.261 in ⁴ Cf or Cv for Tension 1.0 |
| Fc - Prll | 2,900.0 psi | Iy | 111.542 in ⁴ Cm : Wet Use Factor 1.0 |
| Fc - Perp | 750.0 psi | | Ct : Temperature Fact 1.0 |
| E : Modulus of Elasticity . . . | x-x Bending | y-y Bending | Axial |
| | Basic | 2,000.0 | 2,000.0 |
| | Minimum | 1,016.54 | 1,016.54 |
| | | | 2,000.0 ksi |
| | | | Use Cr : Repetitive ? No |
| | | | Brace condition for deflection (buckling) along columns : |
| | | | X-X (width) axis : Fully braced against buckling ABOUT Y-Y Axis |
| | | | Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 10 ft, k |

Applied Loads

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

Column self weight included : 227.993 lbs * Dead Load Factor

AXIAL LOADS . . .

LFRS: Axial Load at 15.0 ft, E = 4.60 k

BENDING LOADS . . .

Roof Loading: Lat. Uniform Load from 0.0-->4.080 ft creating Mx-x, D = 0.1097, LR = 0.1463, S = 0.1828 k/ft

Floor Loading: Lat. Uniform Load from 4.080-->13.670 ft creating Mx-x, D = 0.01330, L = 0.02667 k/ft

CC-1: Moment acting about X-X axis at 4.080 ft, E = 4.767 k-ft

CC-1: Moment acting about X-X axis at 13.670 ft, E = 4.767 k-ft

CC-1: Lat. Point Load at 4.080 ft creating Mx-x, D = 0.5256, LR = 0.7008, S = 0.8760 k

CC-1: Lat. Point Load at 13.670 ft creating Mx-x, D = 0.5256, LR = 0.7008, S = 0.8760 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.3564 : 1**
 Load Combination +D+0.750L+0.750S+1.575E
 Governing NDS Formula Comp + Mxx, NDS Eq. 3.9-3
 Location of max.above base 4.027 ft
 At maximum location values are .
 Applied Axial 7.473 k
 Applied Mx 9.947 k-ft
 Applied My 0.0 k-ft
 Fc : Allowable 3,640.01 psi

Maximum SERVICE Lateral Load Reactions . .
 Top along Y-Y 1.896 k Bottom along Y-Y 2.30 k
 Top along X-X 0.0 k Bottom along X-X 0.0 k

Maximum SERVICE Load Lateral Deflections . . .
 Along Y-Y 0.3504 in at 7.047 ft above base
 for load combination : +D+S
 Along X-X 0.0 in at 0.0 ft above base
 for load combination : n/a

PASS Maximum Shear Stress Ratio = **0.2063 : 1**
 Load Combination +D+S
 Location of max.above base 0.0 ft
 Applied Design Shear 68.812 psi
 Allowable Shear 333.50 psi

Other Factors used to calculate allowable stresses . . .
Bending Compression Tension

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| D Only | 0.900 | 0.915 | 0.1613 | PASS | 4.128 ft | 0.1027 | PASS | 0.0 ft |
| +D+L | 1.000 | 0.900 | 0.1690 | PASS | 4.128 ft | 0.1036 | PASS | 0.0 ft |
| +D+Lr | 1.250 | 0.857 | 0.2582 | PASS | 4.128 ft | 0.1667 | PASS | 0.0 ft |
| +D+S | 1.150 | 0.875 | 0.3193 | PASS | 4.128 ft | 0.2063 | PASS | 0.0 ft |



Wood Column

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.8.17

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FB-5

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|-------------------------|----------------|----------------|---------------------------------------|--------|-----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| +D+0.750Lr+0.750L | 1.250 | 0.857 | 0.2370 | PASS | 4.128 ft | 0.1502 | PASS | 0.0 ft |
| +D+0.750L+0.750S | 1.150 | 0.875 | 0.2866 | PASS | 4.128 ft | 0.1821 | PASS | 0.0 ft |
| +D+2.10E | 1.600 | 0.784 | 0.3329 | PASS | 13.591 ft | 0.1466 | PASS | 0.0 ft |
| +D+0.750L+0.750S+1.575E | 1.600 | 0.784 | 0.3564 | PASS | 4.027 ft | 0.1975 | PASS | 0.0 ft |
| +0.60D | 1.600 | 0.784 | 0.05441 | PASS | 4.128 ft | 0.03467 | PASS | 0.0 ft |
| +0.60D+2.10E | 1.600 | 0.784 | 0.3180 | PASS | 13.591 ft | 0.1235 | PASS | 0.0 ft |

Maximum Reactions

Note: Only non-zero reactions are listed.

| Load Combination | X-X Axis Reaction | | k | Y-Y Axis Reaction | | Axial Reaction | My - End Moments | | Mx - End Moments | |
|--------------------------|-------------------|-------|---|-------------------|--------|----------------|------------------|--------|------------------|--------|
| | @ Base | @ Top | | @ Base | @ Top | | @ Base | @ Base | @ Top | @ Base |
| D Only | | | | 0.868 | 0.758 | 0.228 | | | | |
| +D+L | | | | 0.972 | 0.910 | 0.228 | | | | |
| +D+Lr | | | | 1.956 | 1.669 | 0.228 | | | | |
| +D+S | | | | 2.228 | 1.896 | 0.228 | | | | |
| +D+0.750Lr+0.750L | | | | 1.762 | 1.555 | 0.228 | | | | |
| +D+0.750L+0.750S | | | | 1.966 | 1.725 | 0.228 | | | | |
| +D+0.70E | | | | 1.313 | 0.313 | 3.448 | | | | |
| +D+0.750L+0.750S+0.5250E | | | | 2.300 | 1.392 | 2.643 | | | | |
| +0.60D | | | | 0.521 | 0.455 | 0.137 | | | | |
| +0.60D+0.70E | | | | 0.966 | 0.010 | 3.357 | | | | |
| Lr Only | | | | 1.088 | 0.910 | | | | | |
| L Only | | | | 0.104 | 0.151 | | | | | |
| S Only | | | | 1.360 | 1.138 | | | | | |
| E Only | | | | 0.636 | -0.636 | 4.600 | | | | |

Maximum Deflections for Load Combinations

| Load Combination | Max. X-X Deflection | | Max. Y-Y Deflection | |
|--------------------------|---------------------|----------|---------------------|-----------|
| | Distance | Distance | Distance | Distance |
| D Only | 0.0000 in | 0.000ft | 0.143 in | 7.148 ft |
| +D+L | 0.0000 in | 0.000ft | 0.178 in | 7.248 ft |
| +D+Lr | 0.0000 in | 0.000ft | 0.309 in | 7.047 ft |
| +D+S | 0.0000 in | 0.000ft | 0.350 in | 7.047 ft |
| +D+0.750Lr+0.750L | 0.0000 in | 0.000ft | 0.294 in | 7.148 ft |
| +D+0.750L+0.750S | 0.0000 in | 0.000ft | 0.325 in | 7.148 ft |
| +D+0.70E | 0.0000 in | 0.000ft | 0.174 in | 8.054 ft |
| +D+0.750L+0.750S+0.5250E | 0.0000 in | 0.000ft | 0.348 in | 7.450 ft |
| +0.60D | 0.0000 in | 0.000ft | 0.086 in | 7.148 ft |
| +0.60D+0.70E | 0.0000 in | 0.000ft | 0.119 in | 8.557 ft |
| Lr Only | 0.0000 in | 0.000ft | 0.166 in | 7.047 ft |
| L Only | 0.0000 in | 0.000ft | 0.036 in | 7.752 ft |
| S Only | 0.0000 in | 0.000ft | 0.208 in | 7.047 ft |
| E Only | 0.0000 in | 0.000ft | 0.061 in | 10.671 ft |



Wood Column

Project File: Bickell Remodel.ec6

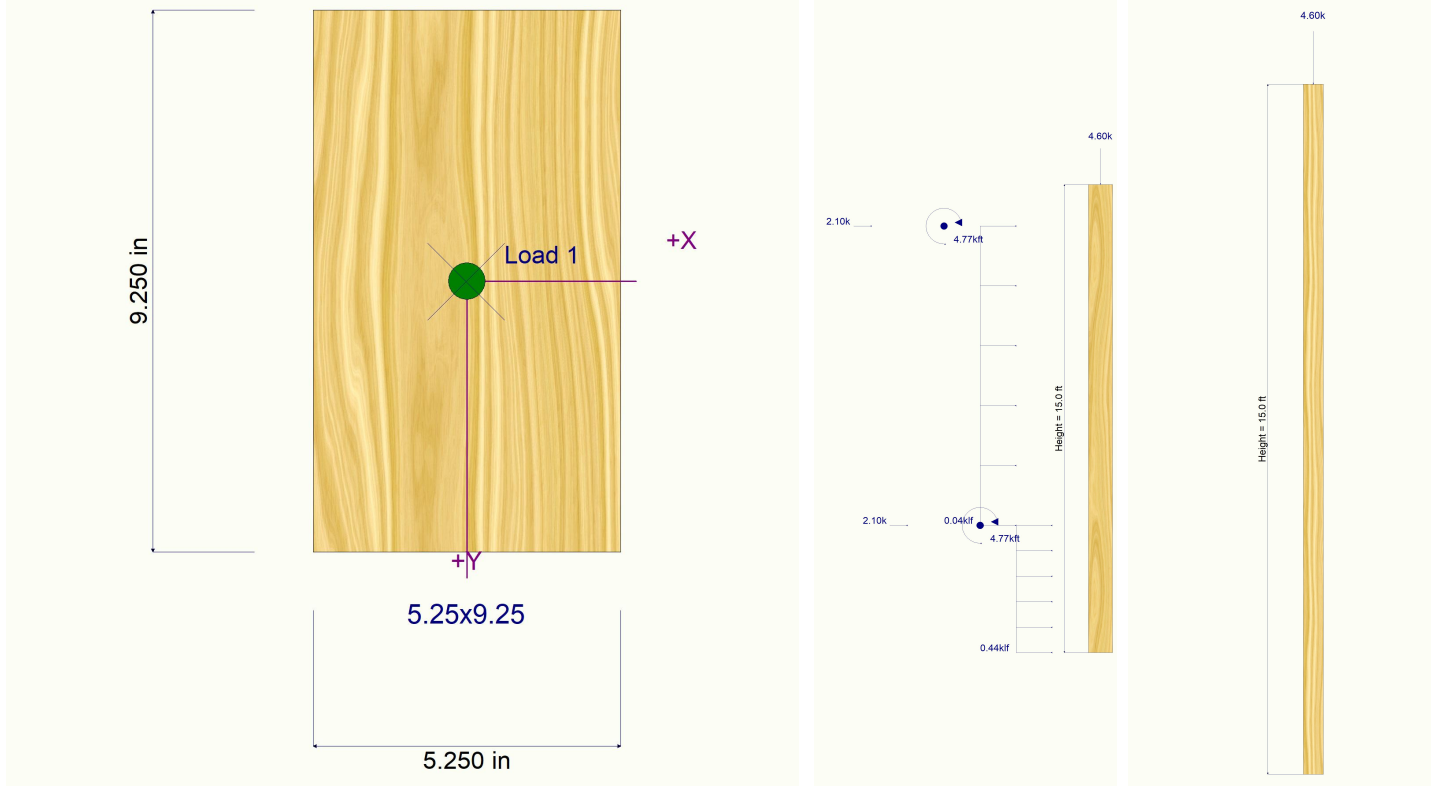
LIC# : KW-06016108, Build:20.22.8.17

I.L. GROSS STRUCTURAL ENGINEERS

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DESCRIPTION: FB-5

Sketches





Wood Beam

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.8.17

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FB-5

CODE REFERENCES

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
Load Combination Set : IBC 2018

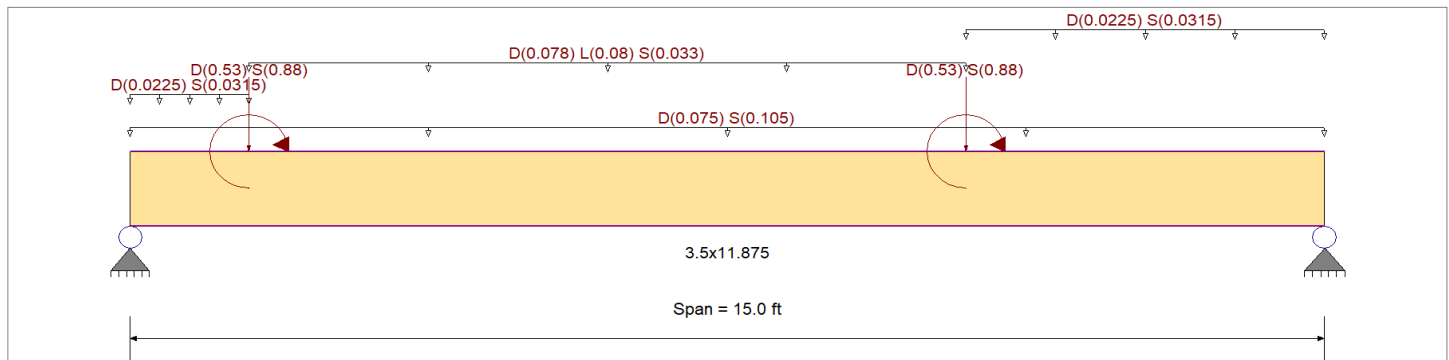
Material Properties

Analysis Method : Allowable Stress Design
Load Combination : IBC 2018

Wood Species : Trus Joist
Wood Grade : Parallam PSL 2.2E

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

| | | | |
|-----------|-------------|---------------------------|-------------|
| Fb + | 2,900.0 psi | E : Modulus of Elasticity | |
| Fb - | 2,900.0 psi | Ebend- xx | 2,200.0ksi |
| Fc - Prll | 2,900.0 psi | Eminbend - xx | 1,118.19ksi |
| Fc - Perp | 625.0 psi | | |
| Fv | 290.0 psi | | |
| Ft | 2,025.0 psi | Density | 45.070pcf |



Applied Loads

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

Beam self weight calculated and added to loading

- Uniform Load : D = 0.0150, S = 0.0210 ksf, Tributary Width = 5.0 ft, (Roof)
- Uniform Load : D = 0.0150, S = 0.0210 ksf, Extent = 0.0 --> 1.50 ft, Tributary Width = 1.50 ft, (1.5' R)
- Uniform Load : D = 0.0780, L = 0.080, S = 0.0330 k/ft, Extent = 1.50 --> 10.50 ft, Tributary Width = 1.0 ft, (2.5' RD+ 4'WW)
- Uniform Load : D = 0.0150, S = 0.0210 ksf, Extent = 10.50 --> 15.0 ft, Tributary Width = 1.50 ft, (1.5' R)
- Point Load : D = 0.530, S = 0.880 k @ 1.50 ft, (P1 from Column)
- Point Load : D = 0.530, S = 0.880 k @ 10.50 ft, (P1 from Column)
- Moment : E = 4.760 k-ft, Location = 1.50 ft from left end of this span, (P1)
- Moment : E = 4.760 k-ft, Location = 10.50 ft from left end of this span, (P1)

DESIGN SUMMARY

Design OK

| | | | | | | | |
|-------------------------------------|---|-------------------|---------|-----------------------------------|----|-------------------|------------------------------------|
| Maximum Bending Stress Ratio | = | 0.549 | 1 | Maximum Shear Stress Ratio | = | 0.391 | 1 |
| Section used for this span | | 3.5x11.875 | | Section used for this span | | 3.5x11.875 | |
| fb: Actual | = | 1,832.35psi | | fv: Actual | = | 130.25 psi | |
| Fb: Allowable | = | 3,335.00psi | | Fv: Allowable | = | 333.50 psi | |
| Load Combination | | +D+S | | Load Combination | | +D+S | |
| Location of maximum on span | = | 8.321 ft | | 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 | | 0.256 in | Ratio = | 703 | >= | 360 | Span: 1 : S Only |
| Max Upward Transient Deflection | | 0 in | Ratio = | 0 | < | 360 | n/a |
| Max Downward Total Deflection | | 0.489 in | Ratio = | 368 | >= | 240 | Span: 1 : +D+0.750L+0.750S+0.5250E |
| Max Upward Total Deflection | | 0 in | Ratio = | 0 | < | 240 | n/a |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | | | | | | | | Moment Values | | | Shear Values | | | | | | | | | |
|------------------|------------------|--------|-------------------|-------|----------------|------------------|----------------|----------------|----------------|----------------|----------------|---------------|------|------|--------------|-------|----------|---------|------|------|------|------|--------|--------|
| | | | M | V | C _d | C _{F/V} | C _i | C _r | C _m | C _t | C _L | M | fb | F'b | V | fv | F'v | | | | | | | |
| D Only | Length = 15.0 ft | 1 | 0.333 | 0.229 | 0.90 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 5.96 | 869.84 | 2610.00 | 0.00 | 0.00 | 0.00 | 1.66 | 59.75 | 261.00 |
| +D+L | Length = 15.0 ft | 1 | 0.390 | 0.260 | 1.00 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 7.75 | 1,130.29 | 2900.00 | 0.00 | 0.00 | 0.00 | 2.09 | 75.34 | 290.00 |
| +D+S | Length = 15.0 ft | 1 | 0.549 | 0.391 | 1.15 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 12.56 | 1,832.35 | 3335.00 | 0.00 | 0.00 | 0.00 | 3.61 | 130.25 | 333.50 |



Wood Beam

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.8.17

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FB-5

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | | | | | | | | Moment Values | | | Shear Values | | | |
|---------------------------|----------------|--------|-------------------|-------|----------------|------------------|----------------|----------------|----------------|----------------|----------------|---------------|----------|---------|--------------|----------------|----------------|------|
| | | | M | V | C _d | C _{F/V} | C _i | C _r | C _m | C _t | C _L | M | fb | F'b | V | f _v | F _v | |
| +D+0.750L | | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Length = 15.0 ft | 1 | | 0.294 | 0.197 | 1.25 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 7.30 | 1,064.90 | 3625.00 | 1.98 | 71.44 | 362.50 | |
| +D+0.750L+0.750S | | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 | |
| Length = 15.0 ft | 1 | | 0.535 | 0.373 | 1.15 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 12.22 | 1,783.27 | 3335.00 | 3.44 | 124.32 | 333.50 | |
| +1.130D+1.344E | | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 | |
| Length = 15.0 ft | 1 | | 0.313 | 0.184 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 9.94 | 1,450.13 | 4640.00 | 2.37 | 85.59 | 464.00 | |
| +1.130D-1.344E | | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 | |
| Length = 15.0 ft | 1 | | 0.272 | 0.212 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 8.67 | 1,264.17 | 4640.00 | 2.72 | 98.32 | 464.00 | |
| +1.098D+0.750L+0.750S+1.0 | | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 | |
| Length = 15.0 ft | 1 | | 0.458 | 0.275 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 14.58 | 2,127.02 | 4640.00 | 3.53 | 127.39 | 464.00 | |
| +1.098D+0.750L+0.750S-1.0 | | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 | |
| Length = 15.0 ft | 1 | | 0.431 | 0.330 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 13.72 | 2,001.84 | 4640.00 | 4.25 | 153.24 | 464.00 | |
| +0.60D | | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 | |
| Length = 15.0 ft | 1 | | 0.112 | 0.077 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 3.58 | 521.91 | 4640.00 | 0.99 | 35.85 | 464.00 | |
| +0.4698D+1.344E | | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 | |
| Length = 15.0 ft | 1 | | 0.200 | 0.115 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 6.37 | 929.19 | 4640.00 | 1.48 | 53.57 | 464.00 | |
| +0.4698D-1.344E | | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 | |
| Length = 15.0 ft | 1 | | 0.160 | 0.127 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 5.08 | 740.43 | 4640.00 | 1.63 | 58.86 | 464.00 | |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|--------------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+0.750L+0.750S+0.5250E | 1 | 0.4889 | 7.445 | | 0.0000 | 0.000 |

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

| Load Combination | Support 1 | Support 2 |
|--------------------------|-----------|-----------|
| Overall MAXimum | 3.852 | 3.302 |
| Overall MINimum | -0.635 | 0.635 |
| D Only | 1.765 | 1.453 |
| +D+L | 2.197 | 1.741 |
| +D+S | 3.852 | 3.186 |
| +D+0.750L | 2.089 | 1.669 |
| +D+0.750L+0.750S | 3.654 | 2.968 |
| +D+0.70E | 1.320 | 1.897 |
| +D+0.750L+0.750S+0.5250E | 3.321 | 3.302 |
| +0.60D | 1.059 | 0.872 |
| +0.60D+0.70E | 0.614 | 1.316 |
| L Only | 0.432 | 0.288 |
| S Only | 2.088 | 1.733 |
| E Only | -0.635 | 0.635 |



Wood Beam

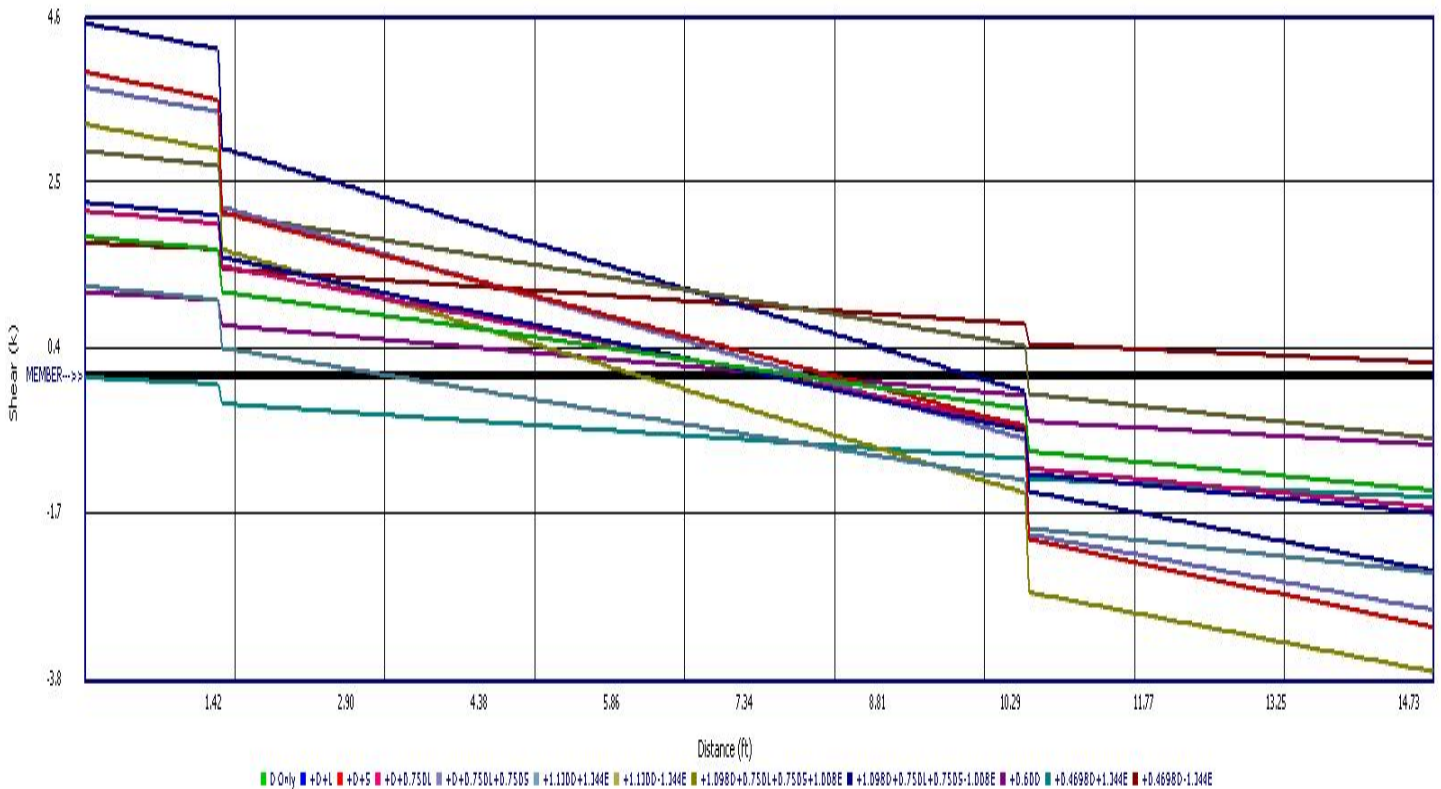
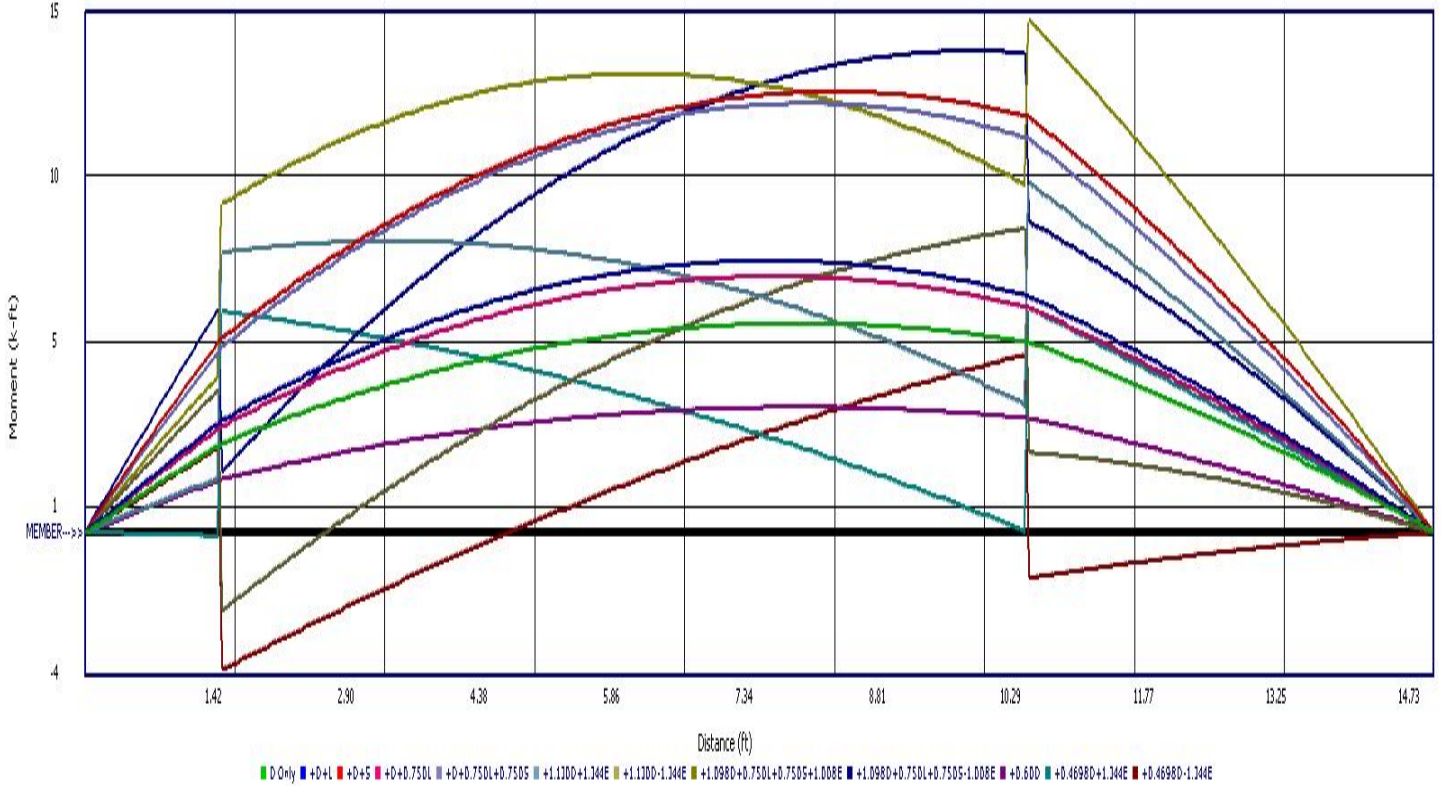
Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.8.17

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FB-5





Wood Beam

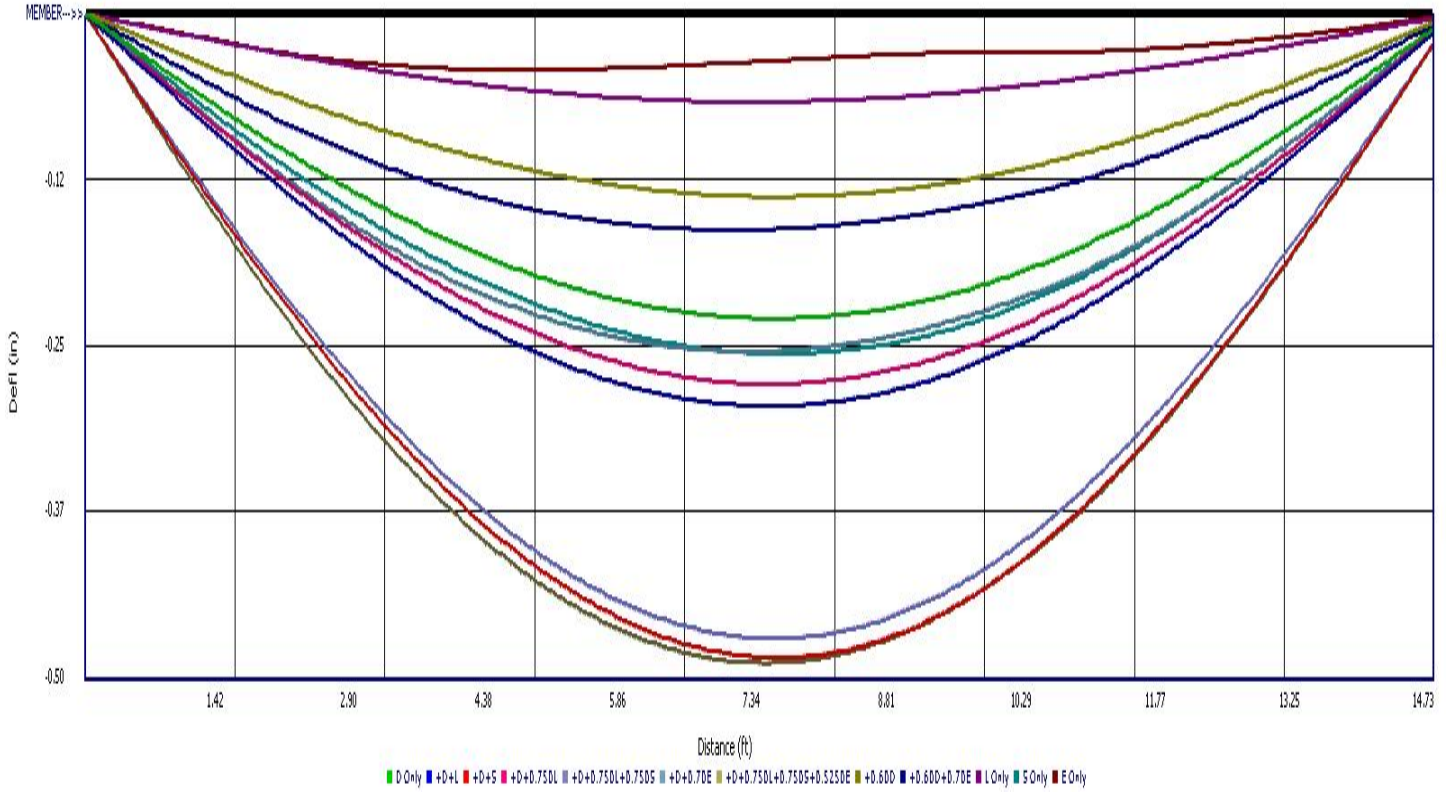
Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.8.17

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FB-5



Wood Column

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FB-6

Code References

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
 Load Combinations Used : IBC 2018

General Information

| | | | |
|--|-----------------------------------|---------------------|---|
| Analysis Method | Allowable Stress Design | Wood Section Name | 2-1.75x7.25 |
| End Fixities | Top & Bottom Pinned | Wood Grading/Manuf. | Trus Joist |
| Overall Column Height | 8.75 ft | Wood Member Type | MicroLam LVL |
| <i>(Used for non-slender calculations)</i> | | | |
| Wood Species | iLevel Truss Joist | Exact Width | 3.50 in Allow Stress Modification Factors |
| Wood Grade | MicroLam LVL 2.0 E | Exact Depth | 7.250 in Cf or Cv for Bending 1.0 |
| Fb + | 2,600.0 psi Fv | Area | 25.375 in ² Cf or Cv for Compression 1.0 |
| Fb - | 2,600.0 psi Ft | Ix | 111.148 in ⁴ Cf or Cv for Tension 1.0 |
| Fc - Prll | 2,510.0 psi Density | Iy | 25.904 in ⁴ Cm : Wet Use Factor 1.0 |
| Fc - Perp | 750.0 psi | | Ct : Temperature Fact 1.0 |
| E : Modulus of Elasticity . . . | x-x Bending y-y Bending Axial | | Cfu : Flat Use Factor 1.0 |
| | Basic 2,000.0 2,000.0 2,000.0 ksi | | Kf : Built-up columns 1.0 <i>NDS 15.3.2</i> |
| | Minimum 1,016.54 1,016.54 | | Use Cr : Repetitive ? No |
| Brace condition for deflection (buckling) along columns : | | | |
| X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 8.75 ft | | | |
| Y-Y (depth) axis : Fully braced against buckling ABOUT X-X Axis | | | |

Applied Loads

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

Column self weight included : 64.775 lbs * Dead Load Factor

AXIAL LOADS . . .

LFRS: Axial Load at 8.750 ft, E = 4.60 k

BENDING LOADS . . .

Roof Loading: Lat. Uniform Load creating Mx-x, D = 0.1931, LR = 0.2575, S = 0.3219 k/ft

Ext. Wall Loading: Lat. Uniform Load creating Mx-x, D = 0.0380 k/ft

FB-10 Reaction: Lat. Point Load at 0.50 ft creating Mx-x, D = 0.980, LR = 0.020, L = 0.040, S = 0.020 k

DESIGN SUMMARY

Bending & Shear Check Results

| | | | |
|---|-------------------|---|--|
| PASS Max. Axial+Bending Stress Ratio = | 0.7396 : 1 | Maximum SERVICE Lateral Load Reactions . . | |
| Load Combination | +D+S | Top along Y-Y | 2.477 k Bottom along Y-Y 3.362 k |
| Governing NDS Formula Comp + Mxx, NDS Eq. 3.9-3 | | Top along X-X | 0.0 k Bottom along X-X 0.0 k |
| Location of max.above base | 4.287 ft | Maximum SERVICE Load Lateral Deflections . . . | |
| At maximum location values are . | | Along Y-Y | 0.3505 in at 4.346 ft above base |
| Applied Axial | 0.06478 k | for load combination : +D+S | |
| Applied Mx | 5.545 k-ft | Along X-X | 0.0 in at 0.0 ft above base |
| Applied My | 0.0 k-ft | for load combination : n/a | |
| Fc : Allowable | 888.89 psi | Other Factors used to calculate allowable stresses . . . | |
| PASS Maximum Shear Stress Ratio = | 0.6064 : 1 | | <u>Bending</u> <u>Compression</u> <u>Tension</u> |
| Load Combination | +D+S | | |
| Location of max.above base | 0.0 ft | | |
| Applied Design Shear | 198.755 psi | | |
| Allowable Shear | 327.750 psi | | |

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|-------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| D Only | 0.900 | 0.387 | 0.4178 | PASS | 4.111 ft | 0.4460 | PASS | 0.0 ft |
| +D+L | 1.000 | 0.351 | 0.3783 | PASS | 4.111 ft | 0.4092 | PASS | 0.0 ft |
| +D+Lr | 1.250 | 0.285 | 0.6062 | PASS | 4.287 ft | 0.5112 | PASS | 0.0 ft |
| +D+S | 1.150 | 0.308 | 0.7396 | PASS | 4.287 ft | 0.6064 | PASS | 0.0 ft |
| +D+0.750Lr+0.750L | 1.250 | 0.285 | 0.5314 | PASS | 4.228 ft | 0.4684 | PASS | 0.0 ft |
| +D+0.750L+0.750S | 1.150 | 0.308 | 0.6378 | PASS | 4.228 ft | 0.5472 | PASS | 0.0 ft |
| +D+2.10E | 1.600 | 0.225 | 0.4329 | PASS | 4.111 ft | 0.2509 | PASS | 0.0 ft |

Project Title: Bickell Residence
 Engineer: Mark Speidel
 Project ID:
 Project Descr: Remodeling of existing SFR

Wood Column

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FB-6

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|-------------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| +D+0.750L+0.750S+1.575E | 1.600 | 0.225 | 0.5655 | PASS | 4.228 ft | 0.3933 | PASS | 0.0 ft |
| +0.60D | 1.600 | 0.225 | 0.1433 | PASS | 4.111 ft | 0.1505 | PASS | 0.0 ft |
| +0.60D+2.10E | 1.600 | 0.225 | 0.4266 | PASS | 4.111 ft | 0.1505 | PASS | 0.0 ft |

Maximum Deflections for Load Combinations

| Load Combination | Max. X-X Deflection | Distance | Max. Y-Y Deflection | Distance |
|--------------------------|---------------------|----------|---------------------|----------|
| D Only | 0.0000 in | 0.000ft | 0.157 in | 4.346 ft |
| +D+L | 0.0000 in | 0.000ft | 0.158 in | 4.346 ft |
| +D+Lr | 0.0000 in | 0.000ft | 0.312 in | 4.346 ft |
| +D+S | 0.0000 in | 0.000ft | 0.350 in | 4.346 ft |
| +D+0.750Lr+0.750L | 0.0000 in | 0.000ft | 0.274 in | 4.346 ft |
| +D+0.750L+0.750S | 0.0000 in | 0.000ft | 0.303 in | 4.346 ft |
| +D+0.70E | 0.0000 in | 0.000ft | 0.157 in | 4.346 ft |
| +D+0.750L+0.750S+0.5250E | 0.0000 in | 0.000ft | 0.303 in | 4.346 ft |
| +0.60D | 0.0000 in | 0.000ft | 0.094 in | 4.346 ft |
| +0.60D+0.70E | 0.0000 in | 0.000ft | 0.094 in | 4.346 ft |
| Lr Only | 0.0000 in | 0.000ft | 0.155 in | 4.404 ft |
| L Only | 0.0000 in | 0.000ft | 0.001 in | 3.758 ft |
| S Only | 0.0000 in | 0.000ft | 0.193 in | 4.404 ft |
| E Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |



Wood Beam

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

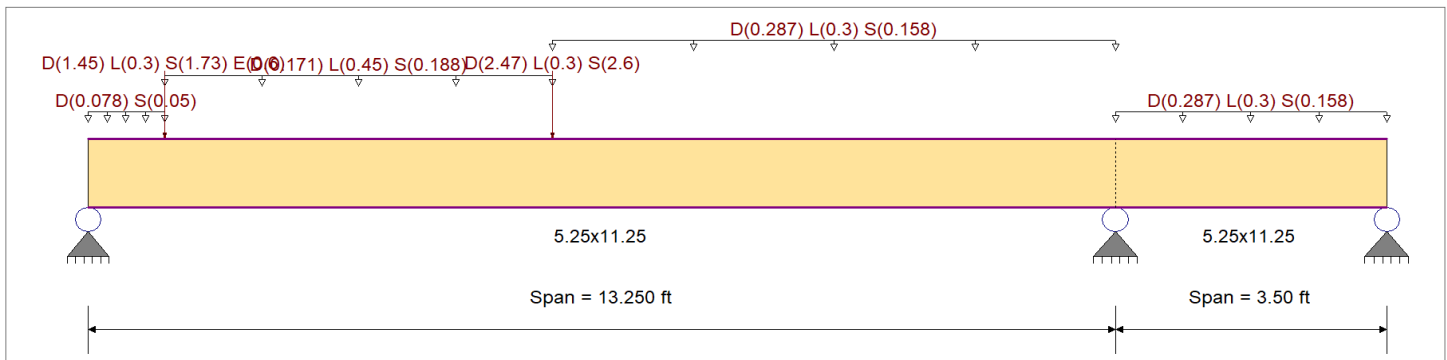
DESCRIPTION: Floor Beam FB-7 REVISED Design

CODE REFERENCES

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
 Load Combination Set : IBC 2018

Material Properties

| | | | |
|--|-----------|-------------|---------------------------|
| Analysis Method : Allowable Stress Design | Fb + | 2,900.0 psi | E : Modulus of Elasticity |
| Load Combination : IBC 2018 | Fb - | 2,900.0 psi | Ebend- xx |
| | Fc - Prll | 2,900.0 psi | Eminbend - xx |
| Wood Species : Trus Joist | Fc - Perp | 625.0 psi | |
| Wood Grade : Parallam PSL 2.2E | Fv | 290.0 psi | Density |
| | Ft | 2,025.0 psi | 45.070pcf |
| Beam Bracing : Beam is Fully Braced against lateral-torsional buckling | | | |



Applied Loads

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

Beam self weight calculated and added to loading

Load for Span Number 1

- Uniform Load : D = 0.0780, S = 0.050 k/ft, Extent = 0.0 --> 1.0 ft, Tributary Width = 1.0 ft, (2' R + 4'SW)
- Uniform Load : D = 0.1710, L = 0.450, S = 0.1880 k/ft, Extent = 1.0 --> 6.0 ft, Tributary Width = 1.0 ft, (7.5' RD+ 3' WW)
- Uniform Load : D = 0.2870, L = 0.30, S = 0.1580 k/ft, Extent = 6.0 --> 13.250 ft, Tributary Width = 1.0 ft, (7.5' F+9'WW +4'R)
- Point Load : D = 1.450, L = 0.30, S = 1.730, E = 0.60 k @ 1.0 ft, (P1)
- Point Load : D = 2.470, L = 0.30, S = 2.60 k @ 6.0 ft, (P2)

Load for Span Number 2

- Uniform Load : D = 0.2870, L = 0.30, S = 0.1580, Tributary Width = 1.0 ft, (7.5' F+9'WW +4'R)

DESIGN SUMMARY

Design OK

| | | | | | |
|-------------------------------------|---|------------------------------|------------------------------------|---|-------------------|
| Maximum Bending Stress Ratio | = | 0.691 : 1 | Maximum Shear Stress Ratio | = | 0.584 : 1 |
| Section used for this span | | 5.25x11.25 | Section used for this span | | 5.25x11.25 |
| fb: Actual | = | 2,321.26psi | fv: Actual | = | 194.87 psi |
| F'b | = | 3,358.98psi | F'v | = | 333.50 psi |
| Load Combination | = | +D+0.750L+0.750S | Load Combination | = | +D+0.750L+0.750S |
| Location of maximum on span | = | 13.250ft | Location of maximum on span | = | 12.362 ft |
| Span # where maximum occurs | = | Span # 1 | Span # where maximum occurs | = | Span # 1 |
| Maximum Deflection | | | | | |
| Max Downward Transient Deflection | | 0.153 in Ratio = 1036 >=400 | Span: 1 : S Only | | |
| Max Upward Transient Deflection | | -0.008 in Ratio = 5117 >=400 | Span: 2 : S Only | | |
| Max Downward Total Deflection | | 0.368 in Ratio = 431 >=240 | Span: 1 : +D+0.750L+0.750S+0.5250E | | |
| Max Upward Total Deflection | | -0.020 in Ratio = 2089 >=240 | Span: 2 : +D+0.750L+0.750S+0.5250E | | |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | | | | | | | | Moment Values | | | Shear Values | | | | |
|------------------|--------------------|--------|-------------------|-------|------|------|----------------|-----------------|----------------|-----------------|----------------|----------------|------|---------|--------------|------|------|-------|-----|
| | | | M | V | CD | CM | C _t | CL _x | C _F | C _{fu} | C _i | C _r | M | fb | F'b | V | fv | F'v | |
| D Only | | | | | | | | | | | | | | | | | | | |
| | Length = 13.250 ft | 1 | 0.408 | 0.347 | 0.90 | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | 9.91 | 1,073.3 | 2,628.8 | 3.56 | 90.5 | 261.0 | |
| | Length = 3.50 ft | 2 | 0.407 | 0.347 | 0.90 | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | 9.87 | 1,069.7 | 2,628.8 | 3.07 | 90.5 | 261.0 | |
| +D+L | | | | | | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | | | | 0.0 | 0.00 | 0.0 | 0.0 |



Wood Beam

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: Floor Beam FB-7 REVISED Design

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 = 13.250 ft | 1 | 0.621 | 0.538 | 1.00 | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | 16.73 | 1,812.7 | 2,920.8 | 6.15 | 156.1 | 290.0 | |
| Length = 3.50 ft | 2 | 0.621 | 0.538 | 1.00 | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | 16.73 | 1,812.7 | 2,920.8 | 5.28 | 156.1 | 290.0 | |
| +D+S | | | | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | | | | 0.0 | 0.00 | 0.0 | 0.0 | |
| Length = 13.250 ft | 1 | 0.620 | 0.506 | 1.15 | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | 19.21 | 2,081.6 | 3,359.0 | 6.64 | 168.7 | 333.5 | |
| Length = 3.50 ft | 2 | 0.594 | 0.506 | 1.15 | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | 18.41 | 1,995.4 | 3,359.0 | 5.65 | 168.7 | 333.5 | |
| +D+0.750L | | | | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | | | | 0.0 | 0.00 | 0.0 | 0.0 | |
| Length = 13.250 ft | 1 | 0.446 | 0.385 | 1.25 | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | 15.01 | 1,627.0 | 3,651.1 | 5.50 | 139.7 | 362.5 | |
| Length = 3.50 ft | 2 | 0.446 | 0.385 | 1.25 | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | 15.01 | 1,627.0 | 3,651.1 | 4.73 | 139.7 | 362.5 | |
| +D+0.750L+0.750S | | | | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | | | | 0.0 | 0.00 | 0.0 | 0.0 | |
| Length = 13.250 ft | 1 | 0.691 | 0.584 | 1.15 | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | 21.42 | 2,321.3 | 3,359.0 | 7.67 | 194.9 | 333.5 | |
| Length = 3.50 ft | 2 | 0.691 | 0.584 | 1.15 | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | 21.42 | 2,321.3 | 3,359.0 | 6.66 | 194.9 | 333.5 | |
| +D+0.70E | | | | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | | | | 0.0 | 0.00 | 0.0 | 0.0 | |
| Length = 13.250 ft | 1 | 0.233 | 0.199 | 1.60 | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | 10.06 | 1,090.1 | 4,673.4 | 3.63 | 92.3 | 464.0 | |
| Length = 3.50 ft | 2 | 0.233 | 0.199 | 1.60 | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | 10.04 | 1,087.5 | 4,673.4 | 3.12 | 92.3 | 464.0 | |
| +D+0.750L+0.750S+0.5250E | | | | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | | | | 0.0 | 0.00 | 0.0 | 0.0 | |
| Length = 13.250 ft | 1 | 0.500 | 0.422 | 1.60 | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | 21.55 | 2,334.7 | 4,673.4 | 7.71 | 195.8 | 464.0 | |
| Length = 3.50 ft | 2 | 0.500 | 0.422 | 1.60 | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | 21.55 | 2,334.7 | 4,673.4 | 6.70 | 195.8 | 464.0 | |
| +0.60D | | | | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | | | | 0.0 | 0.00 | 0.0 | 0.0 | |
| Length = 13.250 ft | 1 | 0.138 | 0.117 | 1.60 | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | 5.94 | 644.0 | 4,673.4 | 2.14 | 54.3 | 464.0 | |
| Length = 3.50 ft | 2 | 0.137 | 0.117 | 1.60 | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | 5.92 | 641.8 | 4,673.4 | 1.84 | 54.3 | 464.0 | |
| +0.60D+0.70E | | | | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | | | | 0.0 | 0.00 | 0.0 | 0.0 | |
| Length = 13.250 ft | 1 | 0.141 | 0.128 | 1.60 | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | 6.10 | 660.8 | 4,673.4 | 2.33 | 59.2 | 464.0 | |
| Length = 3.50 ft | 2 | 0.141 | 0.128 | 1.60 | 1.00 | 1.00 | 1.00 | 1.007 | 1.00 | 1.00 | 1.00 | 6.09 | 659.7 | 4,673.4 | 1.89 | 59.2 | 464.0 | |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|--------------------------|------|---------------|------------------|--------------------------|---------------|------------------|
| +D+0.750L+0.750S+0.5250E | 1 | 0.3682 | 5.848 | +D+0.750L+0.750S+0.5250E | 0.0000 | 0.000 |
| | 2 | 0.0000 | 5.848 | | -0.0201 | 1.466 |

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

| Load Combination | Support 1 | Support 2 | Support 3 |
|---------------------------------------|-----------|-----------|-----------|
| Max Upward from all Load Conditions | 7.829 | 15.574 | |
| Max Upward from Load Combinations | 7.829 | 15.574 | |
| Max Upward from Load Cases | 3.431 | 7.191 | |
| Max Downward from all Load Conditions | | | -5.020 |
| Max Downward from Load Combinations | | | -5.020 |
| Max Downward from Load Cases (Resis) | | | -2.286 |
| D Only | 3.343 | 7.191 | -2.286 |
| +D+L | 5.518 | 12.525 | -3.720 |
| +D+S | 6.774 | 12.943 | -4.450 |
| +D+0.750L | 4.974 | 11.192 | -3.361 |
| +D+0.750L+0.750S | 7.547 | 15.506 | -4.985 |
| +D+0.70E | 3.719 | 7.282 | -2.333 |
| +D+0.750L+0.750S+0.5250E | 7.829 | 15.574 | -5.020 |
| +0.60D | 2.006 | 4.314 | -1.371 |
| +0.60D+0.70E | 2.382 | 4.406 | -1.419 |
| L Only | 2.175 | 5.335 | -1.434 |
| S Only | 3.431 | 5.752 | -2.164 |
| E Only | 0.537 | 0.131 | -0.067 |



Wood Beam

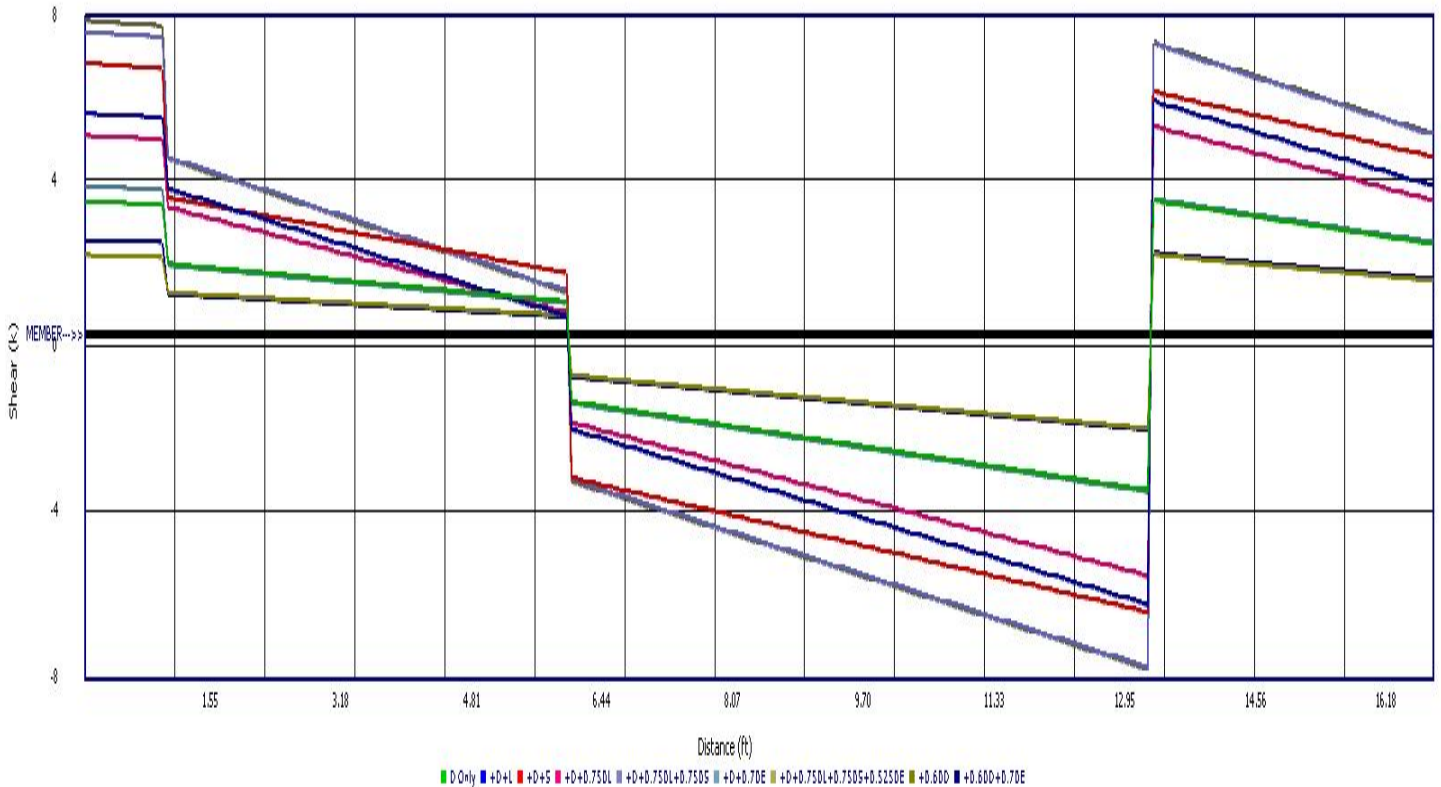
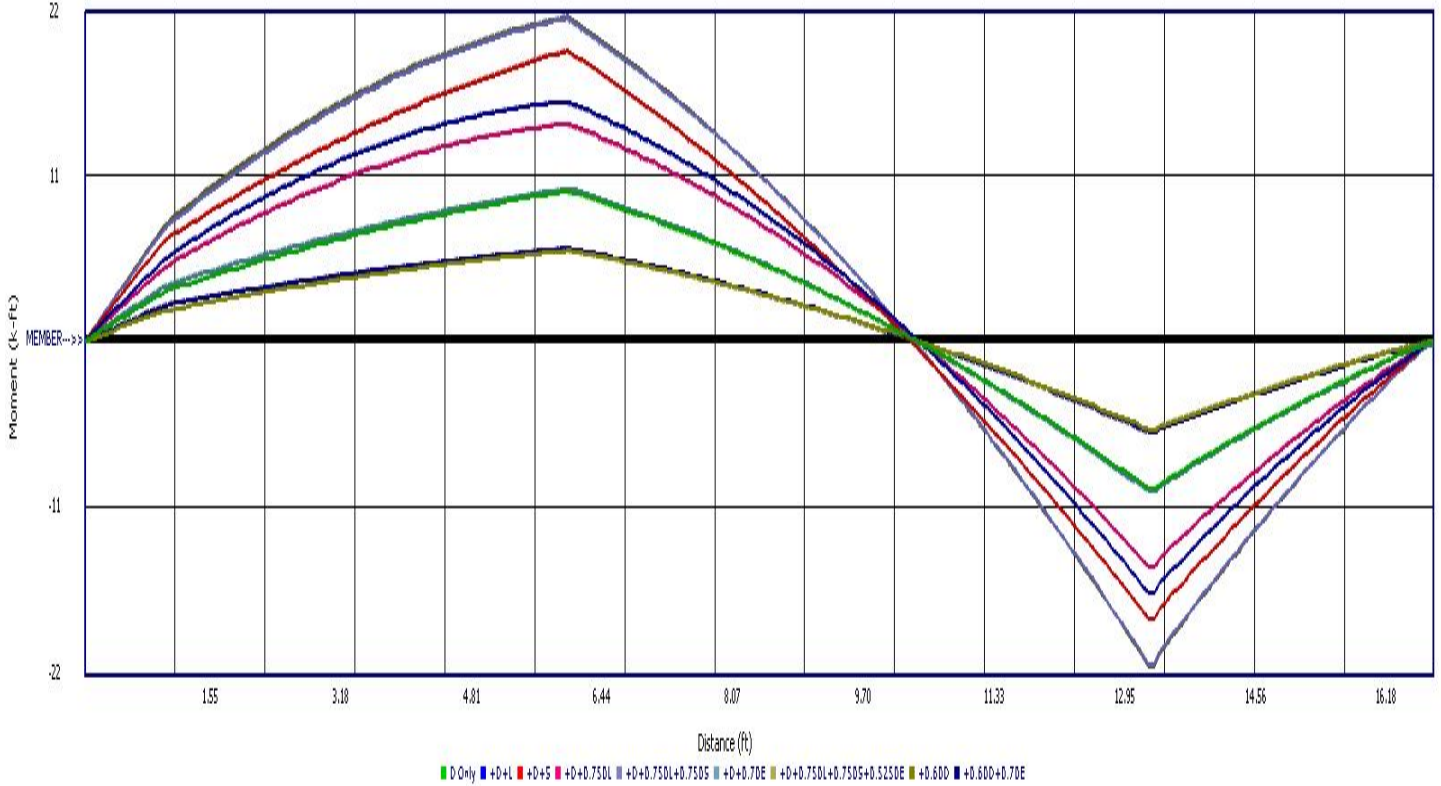
Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: Floor Beam FB-7 REVISED Design





Wood Beam

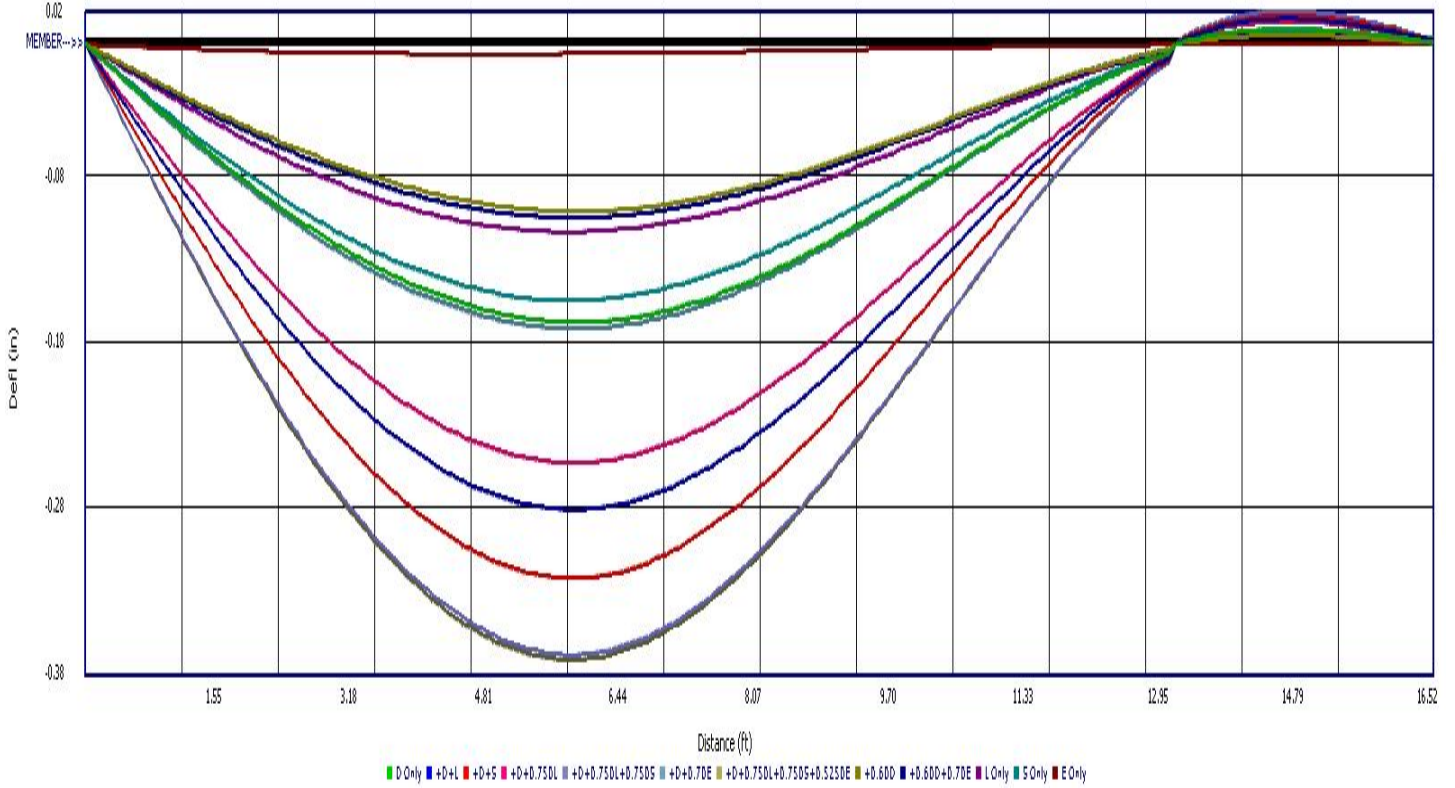
Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: Floor Beam FB-7 REVISED Design





Wood Column

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FB-14

Code References

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
Load Combinations Used : IBC 2018

General Information

| | | | |
|--|-----------------------------------|---------------------|---|
| Analysis Method | Allowable Stress Design | Wood Section Name | 2-1.75x7.25 |
| End Fixities | Top & Bottom Pinned | Wood Grading/Manuf. | Trus Joist |
| Overall Column Height | 8 ft | Wood Member Type | Microllam LVL |
| <i>(Used for non-slender calculations)</i> | | | |
| Wood Species | iLevel Truss Joist | Exact Width | 3.50 in Allow Stress Modification Factors |
| Wood Grade | MicroLam LVL 2.0 E | Exact Depth | 7.250 in Cf or Cv for Bending 1.0 |
| Fb + | 2,600.0 psi | Area | 25.375 in ² Cf or Cv for Compression 1.0 |
| Fb - | 2,600.0 psi | Ix | 111.148 in ⁴ Cf or Cv for Tension 1.0 |
| Fc - Prll | 2,510.0 psi | Iy | 25.904 in ⁴ Cm : Wet Use Factor 1.0 |
| Fc - Perp | 750.0 psi | | Ct : Temperature Fact 1.0 |
| E : Modulus of Elasticity . . . | x-x Bending y-y Bending Axial | | Cfu : Flat Use Factor 1.0 |
| | Basic 2,000.0 2,000.0 2,000.0 ksi | | Kf : Built-up columns 1.0 <i>NDS 15.3.2</i> |
| | Minimum 1,016.54 1,016.54 | | Use Cr : Repetitive ? No |
| Brace condition for deflection (buckling) along columns : | | | |
| X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 8 ft, K : | | | |
| Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 8 ft, K : | | | |

Applied Loads

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

Column self weight included : 59.222 lbs * Dead Load Factor

AXIAL LOADS . . .

ROOF LFRS: Axial Load at 8.0 ft, E = 3.10 k

BENDING LOADS . . .

High Roof Loading: Lat. Uniform Load creating Mx-x, D = 0.1790, LR = 0.2340, S = 0.2970 k/ft

Exterior Wall Loading: Lat. Uniform Load creating Mx-x, D = 0.1080 k/ft

Floor Loading: Lat. Uniform Load creating Mx-x, D = 0.01333, L = 0.02670 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

| | | | | |
|---|-------------------|---|----------------------------------|----------------|
| PASS Max. Axial+Bending Stress Ratio = | 0.6364 : 1 | Maximum SERVICE Lateral Load Reactions . . | | |
| Load Combination | +D+S | Top along Y-Y | 2.389 k Bottom along Y-Y 2.389 k | |
| Governing NDS Formula Comp + Mxx, NDS Eq. 3.9-3 | | Top along X-X | 0.0 k Bottom along X-X 0.0 k | |
| Location of max.above base | 4.027 ft | Maximum SERVICE Load Lateral Deflections . . . | | |
| At maximum location values are . | | Along Y-Y | 0.2503 in at 4.027 ft above base | |
| Applied Axial | 0.05922 k | for load combination : +D+S | | |
| Applied Mx | 4.778 k-ft | Along X-X | 0.0 in at 0.0 ft above base | |
| Applied My | 0.0 k-ft | for load combination : n/a | | |
| Fc : Allowable | 1,050.57 psi | Other Factors used to calculate allowable stresses . . . | | |
| PASS Maximum Shear Stress Ratio = | 0.4309 : 1 | <u>Bending</u> | <u>Compression</u> | <u>Tension</u> |
| Load Combination | +D+S | | | |
| Location of max.above base | 0.0 ft | | | |
| Applied Design Shear | 141.241 psi | | | |
| Allowable Shear | 327.750 psi | | | |

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|-------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| D Only | 0.900 | 0.454 | 0.4071 | PASS | 4.027 ft | 0.2769 | PASS | 0.0 ft |
| +D+L | 1.000 | 0.413 | 0.3996 | PASS | 3.973 ft | 0.2713 | PASS | 0.0 ft |
| +D+Lr | 1.250 | 0.337 | 0.5248 | PASS | 3.973 ft | 0.3547 | PASS | 0.0 ft |
| +D+S | 1.150 | 0.364 | 0.6364 | PASS | 4.027 ft | 0.4309 | PASS | 0.0 ft |
| +D+0.750Lr+0.750L | 1.250 | 0.337 | 0.4870 | PASS | 3.973 ft | 0.3291 | PASS | 0.0 ft |
| +D+0.750L+0.750S | 1.150 | 0.364 | 0.5787 | PASS | 4.027 ft | 0.3918 | PASS | 0.0 ft |
| +D+2.10E | 1.600 | 0.267 | 0.3038 | PASS | 4.027 ft | 0.1557 | PASS | 0.0 ft |



Wood Column

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FB-14

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|-------------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| +D+0.750L+0.750S+1.575E | 1.600 | 0.267 | 0.4707 | PASS | 4.027 ft | 0.2816 | PASS | 0.0 ft |
| +0.60D | 1.600 | 0.267 | 0.1393 | PASS | 3.973 ft | 0.09344 | PASS | 0.0 ft |
| +0.60D+2.10E | 1.600 | 0.267 | 0.2431 | PASS | 3.973 ft | 0.09344 | PASS | 0.0 ft |

Maximum Reactions

Note: Only non-zero reactions are listed.

| Load Combination | X-X Axis Reaction | | k | Y-Y Axis Reaction | | Axial Reaction | My - End Moments | | k-ft | Mx - End Moments | |
|--------------------------|-------------------|-------|---|-------------------|-------|----------------|------------------|-------|------|------------------|-------|
| | @ Base | @ Top | | @ Base | @ Top | | @ Base | @ Top | | @ Base | @ Top |
| D Only | | | | 1.201 | 1.201 | 0.059 | | | | | |
| +D+L | | | | 1.308 | 1.308 | 0.059 | | | | | |
| +D+Lr | | | | 2.137 | 2.137 | 0.059 | | | | | |
| +D+S | | | | 2.389 | 2.389 | 0.059 | | | | | |
| +D+0.750Lr+0.750L | | | | 1.983 | 1.983 | 0.059 | | | | | |
| +D+0.750L+0.750S | | | | 2.172 | 2.172 | 0.059 | | | | | |
| +D+0.70E | | | | 1.201 | 1.201 | 2.229 | | | | | |
| +D+0.750L+0.750S+0.5250E | | | | 2.172 | 2.172 | 1.687 | | | | | |
| +0.60D | | | | 0.721 | 0.721 | 0.036 | | | | | |
| +0.60D+0.70E | | | | 0.721 | 0.721 | 2.206 | | | | | |
| Lr Only | | | | 0.936 | 0.936 | | | | | | |
| L Only | | | | 0.107 | 0.107 | | | | | | |
| S Only | | | | 1.188 | 1.188 | | | | | | |
| E Only | | | | | | 3.100 | | | | | |

Maximum Deflections for Load Combinations

| Load Combination | Max. X-X Deflection | | Max. Y-Y Deflection | |
|--------------------------|---------------------|----------|---------------------|----------|
| | Distance | Distance | Distance | Distance |
| D Only | 0.0000 in | 0.000ft | 0.126 in | 4.027 ft |
| +D+L | 0.0000 in | 0.000ft | 0.137 in | 4.027 ft |
| +D+Lr | 0.0000 in | 0.000ft | 0.224 in | 4.027 ft |
| +D+S | 0.0000 in | 0.000ft | 0.250 in | 4.027 ft |
| +D+0.750Lr+0.750L | 0.0000 in | 0.000ft | 0.208 in | 4.027 ft |
| +D+0.750L+0.750S | 0.0000 in | 0.000ft | 0.228 in | 4.027 ft |
| +D+0.70E | 0.0000 in | 0.000ft | 0.126 in | 4.027 ft |
| +D+0.750L+0.750S+0.5250E | 0.0000 in | 0.000ft | 0.228 in | 4.027 ft |
| +0.60D | 0.0000 in | 0.000ft | 0.076 in | 4.027 ft |
| +0.60D+0.70E | 0.0000 in | 0.000ft | 0.076 in | 4.027 ft |
| Lr Only | 0.0000 in | 0.000ft | 0.098 in | 4.027 ft |
| L Only | 0.0000 in | 0.000ft | 0.011 in | 4.027 ft |
| S Only | 0.0000 in | 0.000ft | 0.124 in | 4.027 ft |
| E Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |



Wood Column

Project File: Bickell Remodel.ec6

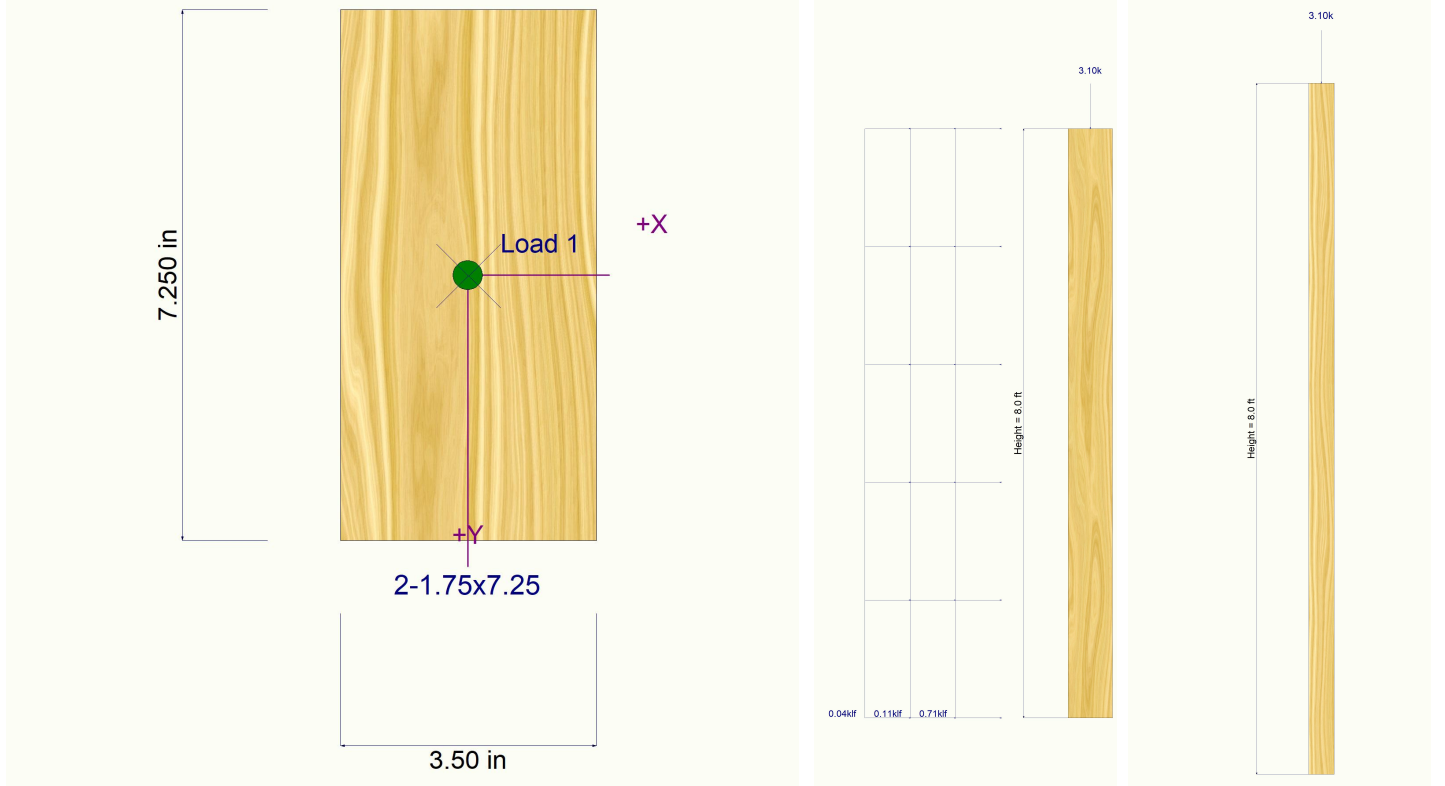
LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FB-14

Sketches



Wood Column

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: RB-9

Code References

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
 Load Combinations Used : IBC 2018

General Information

| | | | | | |
|--|-------------------------|-------------|------------|-----------------------------------|---|
| Analysis Method | Allowable Stress Design | | | Wood Section Name | 2-2x8 |
| End Fixities | Top & Bottom Pinned | | | Wood Grading/Manuf. | Graded Lumber |
| Overall Column Height | 9.58 ft | | | Wood Member Type | Sawn |
| <i>(Used for non-slender calculations)</i> | | | | | |
| Wood Species | Douglas Fir-Larch | | | Exact Width | 3.0 in |
| Wood Grade | No.2 | | | Exact Depth | 7.250 in |
| Fb + | 900.0 psi | Fv | 180.0 psi | Area | 21.750 in ² |
| Fb - | 900.0 psi | Ft | 575.0 psi | Ix | 95.270 in ⁴ |
| Fc - Prll | 1,350.0 psi | Density | 31.210 pcf | Iy | 16.313 in ⁴ |
| Fc - Perp | 625.0 psi | | | Allow Stress Modification Factors | |
| E : Modulus of Elasticity . . . | x-x Bending | y-y Bending | Axial | Cf or Cv for Bending 1.20 | |
| | Basic | 1,600.0 | 1,600.0 | 1,600.0 ksi | Cf or Cv for Compression 1.050 |
| | Minimum | 580.0 | 580.0 | | Cf or Cv for Tension 1.20 |
| | | | | | Cm : Wet Use Factor 1.0 |
| | | | | | Ct : Temperature Fact 1.0 |
| | | | | | Cfu : Flat Use Factor 1.0 |
| | | | | | Kf : Built-up columns 1.0 <i>NDS 15.3.2</i> |
| | | | | | Use Cr : Repetitive ? No |
| Brace condition for deflection (buckling) along columns : | | | | | |
| X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 2.0 ft, I | | | | | |
| Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 9.58 ft, | | | | | |

Applied Loads

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

Column self weight included : 45.160 lbs * Dead Load Factor

AXIAL LOADS . . .

Collector Force: Axial Load at 9.580 ft, E = 1.30 k

BENDING LOADS . . .

Roof Loading: Lat. Uniform Load creating Mx-x, D = 0.0350, LR = 0.04625, S = 0.05781 k/ft

Wind Wall Loading: Lat. Uniform Load creating My-y, W = 0.02513 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

| | | | |
|---|---------------------------|---|----------------------------------|
| PASS Max. Axial+Bending Stress Ratio = | 0.3933 : 1 | Maximum SERVICE Lateral Load Reactions . . | |
| Load Combination | +D+S | Top along Y-Y | 0.4446 k |
| Governing NDS Formula | Comp + Mxx, NDS Eq. 3.9-3 | Bottom along Y-Y | 0.4446 k |
| Location of max.above base | 4.758 ft | Top along X-X | 0.1204 k |
| At maximum location values are . | | Bottom along X-X | 0.1204 k |
| Applied Axial | 0.04516 k | Maximum SERVICE Load Lateral Deflections . . . | |
| Applied Mx | 1.065 k-ft | Along Y-Y | 0.1166 in at 4.822 ft above base |
| Applied My | 0.0 k-ft | for load combination : +D+S | |
| Fc : Allowable | 1,207.15 psi | Along X-X | 0.1844 in at 4.822 ft above base |
| | | for load combination : W Only | |
| PASS Maximum Shear Stress Ratio = | 0.1481 : 1 | Other Factors used to calculate allowable stresses . . . | |
| Load Combination | +D+S | <u>Bending</u> | <u>Compression</u> |
| Location of max.above base | 0.0 ft | <u>Tension</u> | |
| Applied Design Shear | 30.659 psi | | |
| Allowable Shear | 207.0 psi | | |

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|-------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| D Only | 0.900 | 0.808 | 0.1894 | PASS | 4.822 ft | 0.07137 | PASS | 0.0 ft |
| +D+Lr | 1.250 | 0.714 | 0.3169 | PASS | 4.822 ft | 0.1193 | PASS | 0.0 ft |
| +D+S | 1.150 | 0.741 | 0.3933 | PASS | 4.758 ft | 0.1481 | PASS | 0.0 ft |
| +D+0.750Lr | 1.250 | 0.714 | 0.2718 | PASS | 4.758 ft | 0.1023 | PASS | 0.0 ft |
| +D+0.750S | 1.150 | 0.741 | 0.3321 | PASS | 4.758 ft | 0.1250 | PASS | 0.0 ft |
| +D+0.60W | 1.600 | 0.626 | 0.2173 | PASS | 4.822 ft | 0.04015 | PASS | 0.0 ft |
| +D+0.70E | 1.600 | 0.626 | 0.1102 | PASS | 4.822 ft | 0.04015 | PASS | 0.0 ft |
| +D+0.750Lr+0.450W | 1.600 | 0.626 | 0.2955 | PASS | 4.758 ft | 0.07993 | PASS | 0.0 ft |

Wood Column

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: RB-9

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|-------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| +D+0.750S+0.450W | 1.600 | 0.626 | 0.3220 | PASS | 4.758 ft | 0.08988 | PASS | 0.0 ft |
| +D+0.750S+0.5250E | 1.600 | 0.626 | 0.2437 | PASS | 4.758 ft | 0.08988 | PASS | 0.0 ft |
| +0.60D+0.60W | 1.600 | 0.626 | 0.1745 | PASS | 4.758 ft | 0.02409 | PASS | 0.0 ft |
| +0.60D+0.70E | 1.600 | 0.626 | 0.06641 | PASS | 4.758 ft | 0.02409 | PASS | 0.0 ft |

Maximum Deflections for Load Combinations

| Load Combination | Max. X-X Deflection | Distance | Max. Y-Y Deflection | Distance |
|-------------------|---------------------|----------|---------------------|----------|
| D Only | 0.0000 in | 0.000ft | 0.044 in | 4.822 ft |
| +D+Lr | 0.0000 in | 0.000ft | 0.102 in | 4.822 ft |
| +D+S | 0.0000 in | 0.000ft | 0.117 in | 4.822 ft |
| +D+0.750Lr | 0.0000 in | 0.000ft | 0.088 in | 4.822 ft |
| +D+0.750S | 0.0000 in | 0.000ft | 0.098 in | 4.822 ft |
| +D+0.60W | 0.1107 in | 4.822ft | 0.044 in | 4.822 ft |
| +D+0.70E | 0.0000 in | 0.000ft | 0.044 in | 4.822 ft |
| +D+0.750Lr+0.450W | 0.0830 in | 4.822ft | 0.088 in | 4.822 ft |
| +D+0.750S+0.450W | 0.0830 in | 4.822ft | 0.098 in | 4.822 ft |
| +D+0.750S+0.5250E | 0.0000 in | 0.000ft | 0.098 in | 4.822 ft |
| +0.60D+0.60W | 0.1107 in | 4.822ft | 0.026 in | 4.822 ft |
| +0.60D+0.70E | 0.0000 in | 0.000ft | 0.026 in | 4.822 ft |
| Lr Only | 0.0000 in | 0.000ft | 0.058 in | 4.822 ft |
| S Only | 0.0000 in | 0.000ft | 0.073 in | 4.822 ft |
| W Only | 0.1844 in | 4.822ft | 0.000 in | 0.000ft |
| E Only | 0.0000 in | 0.000ft | 0.000 in | 0.000ft |

Wood Column

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: RB-14

Code References

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
 Load Combinations Used : IBC 2018

General Information

| | | | | | |
|--|-------------------------|-------------|------------|-----------------------------------|---|
| Analysis Method | Allowable Stress Design | | | Wood Section Name | 2x12 |
| End Fixities | Top & Bottom Pinned | | | Wood Grading/Manuf. | Graded Lumber |
| Overall Column Height | 15.43 ft | | | Wood Member Type | Sawn |
| <i>(Used for non-slender calculations)</i> | | | | | |
| Wood Species | Douglas Fir-Larch | | | Exact Width | 1.50 in |
| Wood Grade | No.2 | | | Exact Depth | 11.250 in |
| Fb + | 900.0 psi | Fv | 180.0 psi | Area | 16.875 in ² |
| Fb - | 900.0 psi | Ft | 575.0 psi | Ix | 177.979 in ⁴ |
| Fc - Prll | 1,350.0 psi | Density | 31.210 pcf | Iy | 3.164 in ⁴ |
| Fc - Perp | 625.0 psi | | | Allow Stress Modification Factors | |
| E : Modulus of Elasticity . . . | x-x Bending | y-y Bending | Axial | Cf or Cv for Bending 1.0 | |
| | Basic | 1,600.0 | 1,600.0 | 1,600.0 ksi | Cf or Cv for Compression 1.0 |
| | Minimum | 580.0 | 580.0 | | Cf or Cv for Tension 1.0 |
| | | | | | Cm : Wet Use Factor 1.0 |
| | | | | | Ct : Temperature Fact 1.0 |
| | | | | | Cfu : Flat Use Factor 1.0 |
| | | | | | Kf : Built-up columns 1.0 <i>NDS 15.3.2</i> |
| | | | | | Use Cr : Repetitive ? No |
| Brace condition for deflection (buckling) along columns : | | | | | |
| X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 4.0 ft, | | | | | |
| Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 15.43 f | | | | | |

Applied Loads

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

Column self weight included : 56.434 lbs * Dead Load Factor

AXIAL LOADS . . .

Collector Force: Axial Load at 15.430 ft, E = 5.250 k

BENDING LOADS . . .

Roof Loading: Lat. Uniform Load creating Mx-x, D = 0.030, LR = 0.040, S = 0.050 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

| | | | | | |
|---|-------------------|---|-----------|------------------|----------|
| PASS Max. Axial+Bending Stress Ratio = | 0.9620 : 1 | Maximum SERVICE Lateral Load Reactions . . | | | |
| Load Combination | +D+S | Top along Y-Y | 0.6172 k | Bottom along Y-Y | 0.6172 k |
| Governing NDS Formula Comp + Mxx, NDS Eq. 3.9-3 | | Top along X-X | 0.0 k | Bottom along X-X | 0.0 k |
| Location of max.above base | 7.663 ft | Maximum SERVICE Load Lateral Deflections . . . | | | |
| At maximum location values are . | | Along Y-Y | 0.3622 in | at | 7.767 ft |
| Applied Axial | 0.05643 k | for load combination : +D+S | | | |
| Applied Mx | 2.381 k-ft | Along X-X | 0.0 in | at | 0.0 ft |
| Applied My | 0.0 k-ft | for load combination : n/a | | | |
| Fc : Allowable | 432.232 psi | Other Factors used to calculate allowable stresses . . . | | | |
| PASS Maximum Shear Stress Ratio = | 0.2650 : 1 | Bending Compression Tension | | | |
| Load Combination | +D+S | | | | |
| Location of max.above base | 0.0 ft | | | | |
| Applied Design Shear | 54.862 psi | | | | |
| Allowable Shear | 207.0 psi | | | | |

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|-------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| D Only | 0.900 | 0.346 | 0.4438 | PASS | 7.663 ft | 0.1270 | PASS | 0.0 ft |
| +D+Lr | 1.250 | 0.258 | 0.7904 | PASS | 7.663 ft | 0.2134 | PASS | 0.0 ft |
| +D+S | 1.150 | 0.278 | 0.9620 | PASS | 7.663 ft | 0.2650 | PASS | 0.0 ft |
| +D+0.750Lr | 1.250 | 0.258 | 0.6775 | PASS | 7.663 ft | 0.1829 | PASS | 0.0 ft |
| +D+0.750S | 1.150 | 0.278 | 0.8117 | PASS | 7.767 ft | 0.2236 | PASS | 0.0 ft |
| +D+0.70E | 1.600 | 0.205 | 0.5823 | PASS | 7.663 ft | 0.07144 | PASS | 0.0 ft |
| +D+0.750S+0.5250E | 1.600 | 0.205 | 0.8651 | PASS | 7.767 ft | 0.1607 | PASS | 0.0 ft |
| +0.60D | 1.600 | 0.205 | 0.1749 | PASS | 7.663 ft | 0.04286 | PASS | 0.0 ft |
| +0.60D+0.70E | 1.600 | 0.205 | 0.5172 | PASS | 7.663 ft | 0.04286 | PASS | 0.0 ft |

Project Title: Bickell Residence
Engineer: Mark Speidel
Project ID:
Project Descr: Remodeling of existing SFR

Wood Column

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

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DESCRIPTION: RB-14

Maximum Deflections for Load Combinations

| Load Combination | Max. X-X Deflection | Distance | Max. Y-Y Deflection | Distance |
|-------------------|---------------------|----------|---------------------|----------|
| D Only | 0.0000 in | 0.000ft | 0.136 in | 7.767 ft |
| +D+Lr | 0.0000 in | 0.000ft | 0.317 in | 7.767 ft |
| +D+S | 0.0000 in | 0.000ft | 0.362 in | 7.767 ft |
| +D+0.750Lr | 0.0000 in | 0.000ft | 0.272 in | 7.767 ft |
| +D+0.750S | 0.0000 in | 0.000ft | 0.306 in | 7.767 ft |
| +D+0.70E | 0.0000 in | 0.000ft | 0.136 in | 7.767 ft |
| +D+0.750S+0.5250E | 0.0000 in | 0.000ft | 0.306 in | 7.767 ft |
| +0.60D | 0.0000 in | 0.000ft | 0.081 in | 7.767 ft |
| +0.60D+0.70E | 0.0000 in | 0.000ft | 0.081 in | 7.767 ft |
| Lr Only | 0.0000 in | 0.000ft | 0.181 in | 7.767 ft |
| S Only | 0.0000 in | 0.000ft | 0.226 in | 7.767 ft |
| E Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |

Project Title: Bickell Residence
 Engineer: Mark Speidel
 Project ID:
 Project Descr: Remodeling of existing SFR

Wood Column

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: CC1 - Cantilever Column Design

Code References

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
 Load Combinations Used : IBC 2018

General Information

| | | | | | | | |
|---|-------------------------|-------------|-----------|---------------------|------------------------------|-----------------------------------|-------------------------------|
| Analysis Method | Allowable Stress Design | | | Wood Section Name | 6x6 | | |
| End Fixities | Top Free, Bottom Fixed | | | Wood Grading/Manuf. | Graded Lumber | | |
| Overall Column Height | 4.25 ft | | | Wood Member Type | Sawn | | |
| <i>(Used for non-slender calculations)</i> | | | | | | | |
| Wood Species | Douglas Fir-Larch | | | Exact Width | 5.50 in | Allow Stress Modification Factors | |
| Wood Grade | No.2 | | | Exact Depth | 5.50 in | Cf or Cv for Bending | 1.0 |
| Fb + | 900 psi | Fv | 180 psi | Area | 30.250 in ² | Cf or Cv for Compression | 1.0 |
| Fb - | 900 psi | Ft | 575 psi | Ix | 76.255 in ⁴ | Cf or Cv for Tension | 1.0 |
| Fc - Prll | 1350 psi | Density | 31.21 pcf | Iy | 76.255 in⁴ | Cm : Wet Use Factor | 1.0 |
| Fc - Perp | 625 psi | | | | | Ct : Temperature Fact | 1.0 |
| E : Modulus of Elasticity . . . | x-x Bending | y-y Bending | Axial | | | Cfu : Flat Use Factor | 1.0 |
| | Basic | 1600 | 1600 | 1600 ksi | | Kf : Built-up columns | 1.0 <small>NDS 15.3.2</small> |
| | Minimum | 580 | 580 | | | Use Cr : Repetitive ? | No |
| Brace condition for deflection (buckling) along columns : | | | | | | | |
| X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 4.25 ft. | | | | | | | |
| Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 4.25 ft. | | | | | | | |

Applied Loads

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

Column self weight included : 27.864 lbs * Dead Load Factor

AXIAL LOADS . . .

Roof Loading: Axial Load at 4.250 ft, D = 0.5260, Lr = 0.7010, S = 0.8760 k

BENDING LOADS . . .

Roof Seismic: Moment acting about X-X axis at 4.250 ft, E = 2.763 k-ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.5832 : 1**

Load Combination +D+0.70E

Governing NDS Formula Comp + Mxx, NDS Eq. 3.9-3

Location of max.above base 0.0 ft

At maximum location values are .

Applied Axial 0.5539 k

Applied Mx 1.934 k-ft

Applied My 0.0 k-ft

Fc : Allowable 1,948.78 psi

PASS Maximum Shear Stress Ratio = **0.0 : 1**

Load Combination +0.60D+0.70E

Location of max.above base 4.250 ft

Applied Design Shear 0.0 psi

Allowable Shear 288.0 psi

Maximum SERVICE Lateral Load Reactions . .

| | | | |
|---------------|---------|------------------|-------|
| Top along Y-Y | 0.650 k | Bottom along Y-Y | 0.0 k |
| Top along X-X | 0.0 k | Bottom along X-X | 0.0 k |

Maximum SERVICE Load Lateral Deflections . . .

| | | | | |
|-------------------------------|------------|----|----------|------------|
| Along Y-Y | -0.3510 in | at | 4.250 ft | above base |
| for load combination : E Only | | | | |
| Along X-X | 0.0 in | at | 0.0 ft | above base |
| for load combination : n/a | | | | |

Other Factors used to calculate allowable stresses . . .

| | | |
|----------------|--------------------|----------------|
| <u>Bending</u> | <u>Compression</u> | <u>Tension</u> |
|----------------|--------------------|----------------|

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|-------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| D Only | 0.900 | 0.950 | 0.01586 | PASS | 0.0 ft | 0.0 | PASS | 4.250 ft |
| +D+Lr | 1.250 | 0.927 | 0.02652 | PASS | 0.0 ft | 0.0 | PASS | 4.250 ft |
| +D+S | 1.150 | 0.934 | 0.03260 | PASS | 0.0 ft | 0.0 | PASS | 4.250 ft |
| +D+0.750Lr | 1.250 | 0.927 | 0.02281 | PASS | 0.0 ft | 0.0 | PASS | 4.250 ft |
| +D+0.750S | 1.150 | 0.934 | 0.02761 | PASS | 0.0 ft | 0.0 | PASS | 4.250 ft |
| +D+0.70E | 1.600 | 0.902 | 0.5832 | PASS | 0.0 ft | 0.0 | PASS | 4.250 ft |
| +D+0.750S+0.5250E | 1.600 | 0.902 | 0.4394 | PASS | 3.337 ft | 0.0 | PASS | 4.250 ft |
| +0.60D | 1.600 | 0.902 | 0.005637 | PASS | 0.0 ft | 0.0 | PASS | 4.250 ft |
| +0.60D+0.70E | 1.600 | 0.902 | 0.5823 | PASS | 0.0 ft | 0.0 | PASS | 4.250 ft |

Project Title: Bickell Residence
 Engineer: Mark Speidel
 Project ID:
 Project Descr: Remodeling of existing SFR

Wood Column

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: CC1 - Cantilever Column Design

Maximum Deflections for Load Combinations

| Load Combination | Max. X-X Deflection | Distance | Max. Y-Y Deflection | Distance |
|-------------------|---------------------|----------|---------------------|----------|
| D Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+Lr | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+S | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.750Lr | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.750S | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.70E | 0.0000 in | 0.000ft | -0.246 in | 4.250 ft |
| +D+0.750S+0.5250E | 0.0000 in | 0.000ft | -0.184 in | 4.250 ft |
| +0.60D | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +0.60D+0.70E | 0.0000 in | 0.000ft | -0.246 in | 4.250 ft |
| Lr Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| S Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| E Only | 0.0000 in | 0.000ft | -0.346 in | 4.221 ft |



Wood Column

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.8.17

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: Col below FB-7

Code References

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
 Load Combinations Used : IBC 2018

General Information

| | | | |
|--|-------------------------|---------------------|--|
| Analysis Method | Allowable Stress Design | Wood Section Name | 6x6 |
| End Fixities | Top & Bottom Pinned | Wood Grading/Manuf. | Graded Lumber |
| Overall Column Height | 10 ft | Wood Member Type | Sawn |
| <i>(Used for non-slender calculations)</i> | | | |
| Wood Species | Douglas Fir - Larch | Exact Width | 5.50 in |
| Wood Grade | No.1 | Exact Depth | 5.50 in |
| Fb + | 1200 psi | Area | 30.250 in ² |
| Fb - | 1200 psi | Ix | 76.255 in ⁴ |
| Fc - Prll | 1000 psi | Iy | 76.255 in ⁴ |
| Fc - Perp | 625 psi | | |
| E : Modulus of Elasticity . . . | x-x Bending | y-y Bending | Axial |
| | Basic | 1600 | 1600 |
| | Minimum | 580 | 580 |
| | | | 1600 ksi |
| | | | Allow Stress Modification Factors |
| | | | Cf or Cv for Bending 1.0 |
| | | | Cf or Cv for Compression 1.0 |
| | | | Cf or Cv for Tension 1.0 |
| | | | Cm : Wet Use Factor 1.0 |
| | | | Ct : Temperature Fact 1.0 |
| | | | Cfu : Flat Use Factor 1.0 |
| | | | Kf : Built-up columns 1.0 <i>NDS 15.3.2</i> |
| | | | Use Cr : Repetitive ? No |
| | | | Brace condition for deflection (buckling) along columns : |
| | | | X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 8 ft, K |
| | | | Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 8 ft, K |

Applied Loads

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

Column self weight included : 65.563 lbs * Dead Load Factor

AXIAL LOADS . . .

P1: Axial Load at 10.0 ft, Xecc = 0.50 in, Yecc = 0.250 in, D = 6.0, L = 4.50, S = 4.80, E = 0.30 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.5764 : 1**
 Load Combination +D+0.750L+0.750S
 Governing NDS Formula + Mxx + Myy, NDS Eq. 3.9-
 Location of max.above base 9.933 ft
 At maximum location values are .
 Applied Axial 13.041 k
 Applied Mx -0.2685 k-ft
 Applied My -0.5370 k-ft
 Fc : Allowable 903.32 psi

Maximum SERVICE Lateral Load Reactions . .
 Top along Y-Y 0.02736 k Bottom along Y-Y 0.02736 k
 Top along X-X 0.05472 k Bottom along X-X 0.05472 k

Maximum SERVICE Load Lateral Deflections . . .
 Along Y-Y -0.02507 in at 5.839 ft above base
 for load combination : +D+0.750L+0.750S+0.5250E
 Along X-X -0.05015 in at 5.839 ft above base
 for load combination : +D+0.750L+0.750S+0.5250E

Other Factors used to calculate allowable stresses . . .
Bending Compression Tension

PASS Maximum Shear Stress Ratio = **0.01371 : 1**
 Load Combination +D+0.750L+0.750S
 Location of max.above base 10.0 ft
 Applied Design Shear 2.681 psi
 Allowable Shear 195.50 psi

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|--------------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| D Only | 0.900 | 0.842 | 0.2646 | PASS | 0.0 ft | 0.008102 | PASS | 10.0 ft |
| +D+L | 1.000 | 0.820 | 0.4842 | PASS | 9.933 ft | 0.01276 | PASS | 10.0 ft |
| +D+S | 1.150 | 0.785 | 0.4310 | PASS | 9.933 ft | 0.01141 | PASS | 10.0 ft |
| +D+0.750L | 1.250 | 0.762 | 0.3275 | PASS | 0.0 ft | 0.009115 | PASS | 10.0 ft |
| +D+0.750L+0.750S | 1.150 | 0.785 | 0.5764 | PASS | 9.933 ft | 0.01371 | PASS | 10.0 ft |
| +D+0.70E | 1.600 | 0.683 | 0.1898 | PASS | 0.0 ft | 0.004717 | PASS | 10.0 ft |
| +D+0.750L+0.750S+0.5250E | 1.600 | 0.683 | 0.4141 | PASS | 9.933 ft | 0.009975 | PASS | 10.0 ft |
| +0.60D | 1.600 | 0.683 | 0.110 | PASS | 0.0 ft | 0.002735 | PASS | 10.0 ft |
| +0.60D+0.70E | 1.600 | 0.683 | 0.1164 | PASS | 0.0 ft | 0.002894 | PASS | 10.0 ft |



Wood Column

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.8.17

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: Col below FB-7

Maximum Reactions

Note: Only non-zero reactions are listed.

| Load Combination | X-X Axis Reaction | | k | Y-Y Axis Reaction | | Axial Reaction | My - End Moments | | k-ft | Mx - End Moments | |
|--------------------------|-------------------|-------|---|-------------------|-------|----------------|------------------|-------|------|------------------|-------|
| | @ Base | @ Top | | @ Base | @ Top | | @ Base | @ Top | | @ Base | @ Top |
| D Only | -0.025 | 0.025 | | -0.013 | 0.013 | 6.066 | | | | | |
| +D+L | -0.044 | 0.044 | | -0.022 | 0.022 | 10.566 | | | | | |
| +D+S | -0.045 | 0.045 | | -0.023 | 0.023 | 10.866 | | | | | |
| +D+0.750L | -0.039 | 0.039 | | -0.020 | 0.020 | 9.441 | | | | | |
| +D+0.750L+0.750S | -0.054 | 0.054 | | -0.027 | 0.027 | 13.041 | | | | | |
| +D+0.70E | -0.026 | 0.026 | | -0.013 | 0.013 | 6.276 | | | | | |
| +D+0.750L+0.750S+0.5250E | -0.055 | 0.055 | | -0.027 | 0.027 | 13.198 | | | | | |
| +0.60D | -0.015 | 0.015 | | -0.008 | 0.008 | 3.639 | | | | | |
| +0.60D+0.70E | -0.016 | 0.016 | | -0.008 | 0.008 | 3.849 | | | | | |
| L Only | -0.019 | 0.019 | | -0.009 | 0.009 | 4.500 | | | | | |
| S Only | -0.020 | 0.020 | | -0.010 | 0.010 | 4.800 | | | | | |
| E Only | -0.001 | 0.001 | | -0.001 | 0.001 | 0.300 | | | | | |

Maximum Deflections for Load Combinations

| Load Combination | Max. X-X Deflection | | Distance | Max. Y-Y Deflection | | Distance |
|--------------------------|---------------------|-------|----------|---------------------|-------|----------|
| | in | ft | | in | ft | |
| D Only | -0.0229 | 5.839 | ft | -0.011 | 5.839 | ft |
| +D+L | -0.0401 | 5.839 | ft | -0.020 | 5.839 | ft |
| +D+S | -0.0412 | 5.839 | ft | -0.021 | 5.839 | ft |
| +D+0.750L | -0.0358 | 5.839 | ft | -0.018 | 5.839 | ft |
| +D+0.750L+0.750S | -0.0495 | 5.839 | ft | -0.025 | 5.839 | ft |
| +D+0.70E | -0.0237 | 5.839 | ft | -0.012 | 5.839 | ft |
| +D+0.750L+0.750S+0.5250E | -0.0501 | 5.839 | ft | -0.025 | 5.839 | ft |
| +0.60D | -0.0137 | 5.839 | ft | -0.007 | 5.839 | ft |
| +0.60D+0.70E | -0.0145 | 5.839 | ft | -0.007 | 5.839 | ft |
| L Only | -0.0172 | 5.839 | ft | -0.009 | 5.839 | ft |
| S Only | -0.0183 | 5.839 | ft | -0.009 | 5.839 | ft |
| E Only | -0.0011 | 5.839 | ft | -0.001 | 5.839 | ft |

Sketches





Cantilevered Retaining Wall

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: Patio Edge Wall

Code Reference.

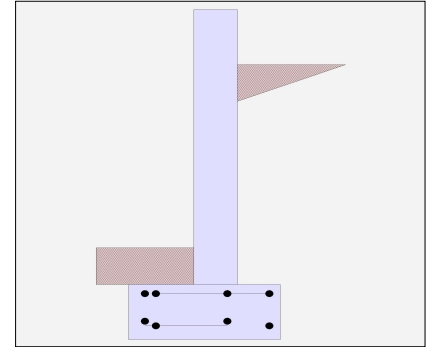
Calculations per IBC 2015 1807.3, CBC 2016, ASCE 7-10

Criteria

| | | |
|-------------------------|---|---------|
| Retained Height | = | 4.00 ft |
| Wall height above soil | = | 1.00 ft |
| Slope Behind Wall | = | 0.00 |
| Height of Soil over Toe | = | 8.00 in |
| Water height over heel | = | 0.0 ft |

Soil Data

| | | |
|---|---|--------------|
| Allow Soil Bearing | = | 1,500.0 psf |
| Equivalent Fluid Pressure Method | | |
| Active Heel Pressure | = | 35.0 psf/ft |
| | = | |
| Passive Pressure | = | 250.0 psf/ft |
| Soil Density, Heel | = | 110.00 pcf |
| Soil Density, Toe | = | 110.00 pcf |
| Footing Soil Friction | = | 0.400 |
| Soil height to ignore for passive pressure | = | 12.00 in |



Surcharge Loads

| | | |
|--------------------------------------|---|----------|
| Surcharge Over Heel | = | 50.0 psf |
| Used To Resist Sliding & Overturning | | |
| Surcharge Over Toe | = | 0.0 |
| Used for Sliding & Overturning | | |

Axial Load Applied to Stem

| | | |
|-------------------------|---|---------|
| Axial Dead Load | = | 0.0 lbs |
| Axial Live Load | = | 0.0 lbs |
| Axial Load Eccentricity | = | 0.0 in |

Lateral Load Applied to Stem

| | | |
|----------------------|---|-----------------------------|
| Lateral Load | = | 0.0 #/ft |
| ...Height to Top | = | 0.00 ft |
| ...Height to Bottom | = | 0.00 ft |
| Load Type | = | Wind (W) (Service Level) |
| Wind on Exposed Stem | = | 0.0 psf (Strength Level) |

Adjacent Footing Load

| | | |
|--|---|----------------|
| Adjacent Footing Load | = | 0.0 lbs |
| Footing Width | = | 0.00 ft |
| Eccentricity | = | 0.00 in |
| Wall to Ftg CL Dist | = | 0.00 ft |
| Footing Type | = | Spread Footing |
| Base Above/Below Soil at Back of Wall | = | 0.0 ft |
| Poisson's Ratio | = | 0.300 |



Cantilevered Retaining Wall

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: Patio Edge Wall

Design Summary

Wall Stability Ratios

| | | | |
|-----------------------------------|---|-----------|----|
| Overturning | = | 1.90 | OK |
| Sliding | = | 1.54 | OK |
| Global Stability | = | 2.56 | |
| | | | |
| Total Bearing Load | = | 1,441 lbs | |
| ...resultant ecc. | = | 1.65 in | |
| Eccentricity within middle third | | | |
| Soil Pressure @ Toe | = | 725 psf | OK |
| Soil Pressure @ Heel | = | 346 psf | OK |
| Allowable | = | 1,500 psf | |
| Soil Pressure Less Than Allowable | | | |
| ACI Factored @ Toe | = | 1,016 psf | |
| ACI Factored @ Heel | = | 484 psf | |
| Footing Shear @ Toe | = | 2.0 psi | OK |
| Footing Shear @ Heel | = | 1.3 psi | OK |
| Allowable | = | 75.0 psi | |

Sliding Calcs

| | | | |
|--------------------------|---|-----------|----|
| Lateral Sliding Force | = | 517.0 lbs | |
| less 100% Passive Force | = | 222.2 lbs | |
| less 100% Friction Force | = | 576.4 lbs | |
| Added Force Req'd | = | 0.0 lbs | OK |
| ...for 1.5 Stability | = | 0.0 lbs | OK |

Vertical component of active lateral soil pressure IS considered in the calculation of soil bearing pressures.

Load Factors

| | |
|---------------|-------|
| Building Code | |
| Dead Load | 1.200 |
| Live Load | 1.600 |
| Earth, H | 1.600 |
| Wind, W | 1.600 |
| Seismic, E | 1.000 |

Stem Construction

| | | | | |
|--------------------------|------|----------|----|----|
| Design Height Above Ftg | ft = | Stem OK | | |
| Wall Material Above "Ht" | = | Concrete | | |
| Design Method | = | SD | SD | SD |
| Thickness | = | 8.00 | | |
| Rebar Size | = | # 5 | | |
| Rebar Spacing | = | 18.00 | | |
| Rebar Placed at | = | Edge | | |

Design Data

| | | |
|---------------|---|-------|
| fb/FB + fa/Fa | = | 0.144 |
|---------------|---|-------|

Total Force @ Section

| | | |
|----------------|-------|-------|
| Service Level | lbs = | |
| Strength Level | lbs = | 549.8 |

Moment....Actual

| | | |
|----------------|--------|-------|
| Service Level | ft-# = | |
| Strength Level | ft-# = | 801.0 |

| | | |
|----------------------|---|---------|
| Moment.....Allowable | = | 5,527.6 |
|----------------------|---|---------|

Shear.....Actual

| | | |
|----------------|-------|-----|
| Service Level | psi = | |
| Strength Level | psi = | 7.4 |

| | | |
|---------------------|-------|------|
| Shear.....Allowable | psi = | 75.0 |
|---------------------|-------|------|

| | | |
|----------------|-------|--|
| Anet (Masonry) | in2 = | |
|----------------|-------|--|

| | | |
|-------------|-------|-------|
| Wall Weight | psf = | 100.0 |
|-------------|-------|-------|

| | | |
|-----------------|------|------|
| Rebar Depth 'd' | in = | 6.19 |
|-----------------|------|------|

Masonry Data

| | | |
|-----------------------|-------|-----|
| f'm | psi = | |
| Fs | psi = | |
| Solid Grouting | = | |
| Modular Ratio 'n' | = | |
| Equiv. Solid Thick. | = | |
| Masonry Block Type | = | |
| Masonry Design Method | = | ASD |

Concrete Data

| | | |
|-----|-------|----------|
| f'c | psi = | 2,500.0 |
| Fy | psi = | 60,000.0 |



Cantilevered Retaining Wall

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: **Patio Edge Wall**

Concrete Stem Rebar Area Details

| | <u>Vertical Reinforcing</u> | <u>Horizontal Reinforcing</u> | |
|------------------------------------|-----------------------------|--|--------------|
| Bottom Stem | | | |
| As (based on applied moment) : | 0.0303 in2/ft | | |
| (4/3) * As : | 0.0404 in2/ft | Min Stem T&S Reinf Area 0.960 in2 | |
| 200bd/fy : 200(12)(6.1875)/60000 : | 0.2475 in2/ft | Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft | |
| 0.0018bh : 0.0018(12)(8) : | 0.1728 in2/ft | Horizontal Reinforcing Options : | |
| | ===== | <u>One layer of :</u> <u>Two layers of :</u> | |
| Required Area : | 0.1728 in2/ft | #4@ 12.50 in | #4@ 25.00 in |
| Provided Area : | 0.2067 in2/ft | #5@ 19.38 in | #5@ 38.75 in |
| Maximum Area : | 0.8382 in2/ft | #6@ 27.50 in | #6@ 55.00 in |

Footing Data

| | | |
|--------------------------|-----------|-----------------|
| Toe Width | = | 1.00 ft |
| Heel Width | = | 1.33 |
| Total Footing Width | = | 2.33 |
| Footing Thickness | = | 12.00 in |
| Key Width | = | 0.00 in |
| Key Depth | = | 0.00 in |
| Key Distance from Toe | = | 0.00 ft |
| f'c = | 2,500 psi | Fy = 60,000 psi |
| Footing Concrete Density | = | 150.00 pcf |
| Min. As % | = | 0.0018 |
| Cover @ Top | 2.00 | @ Btm = 3.00 in |

Footing Design Results

| | <u>Toe</u> | <u>Heel</u> | |
|--------------------------------|------------|----------------|-------------|
| Factored Pressure | = | 1,016 | 484 psf |
| Mu' : Upward | = | 470 | 118 ft-# |
| Mu' : Downward | = | 134 | 173 ft-# |
| Mu: Design | = | 336 OK | 56 ft-# OK |
| phiMn | = | 26,913 | 23,913 ft-# |
| Actual 1-Way Shear | = | 1.96 | 1.33 psi |
| Allow 1-Way Shear | = | 75.00 | 75.00 psi |
| Toe Reinforcing | = | # 8 @ 12.00 in | |
| Heel Reinforcing | = | # 7 @ 12.00 in | |
| Key Reinforcing | = | None Spec'd | |
| Footing Torsion, Tu | = | | 0.00 ft-lbs |
| Footing Allow. Torsion, phi Tu | = | | 0.00 ft-lbs |

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46.29 in, #10@ 58.79 in

Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46.29 in, #10@ 58.79 in

Key: No key defined

| | | |
|-------------------------------------|------|---------|
| Min footing T&S reinf Area | 0.60 | in2 |
| Min footing T&S reinf Area per foot | 0.26 | in2 /ft |

If one layer of horizontal bars:

#4@ 9.26 in
 #5@ 14.35 in
 #6@ 20.37 in

If two layers of horizontal bars:

#4@ 18.52 in
 #5@ 28.70 in
 #6@ 40.74 in



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I.L. GROSS
 STRUCTURAL
 ENGINEERS

Project Title: Bickell Residence
 Engineer: Mark Speidel
 Project ID:
 Project Descr: Remodeling of existing SFR

Cantilevered Retaining Wall

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: Patio Edge Wall

Summary of Overturning & Resisting Forces & Moments

| Item |OVERTURNING..... | | |RESISTING..... | | | |
|---|-----------------------|-----------------|----------------|---|--------------------|----------------|----------------|
| | Force lbs | Distance ft | Moment ft-# | Force lbs | Distance ft | Moment ft-# | |
| HL Act Pres (ab water tbl) | 437.5 | 1.67 | 729.2 | Soil Over HL (ab. water tbl) | 291.9 | 2.00 | 583.2 |
| HL Act Pres (be water tbl) | | | | Soil Over HL (bel. water tbl) | | 2.00 | 583.2 |
| Hydrostatic Force | | | | Water Table | | | |
| Buoyant Force = | | | | Sloped Soil Over Heel = | | | |
| Surcharge over Heel = | 79.5 | 2.50 | 198.9 | Surcharge Over Heel = | 33.2 | 2.00 | 66.3 |
| Surcharge Over Toe = | | | | Adjacent Footing Load = | | | |
| Adjacent Footing Load = | | | | Axial Dead Load on Stem = | | | |
| Added Lateral Load = | | | | * Axial Live Load on Stem = | | | |
| Load @ Stem Above Soil = | | | | Soil Over Toe = | 73.3 | 0.50 | 36.7 |
| | | | | Surcharge Over Toe = | | | |
| | | | | Stem Weight(s) = | 500.0 | 1.33 | 666.7 |
| | | | | Earth @ Stem Transitions = | | | |
| Total | = 517.0 | O.T.M. = | 928.0 | Footing Weight = | 349.5 | 1.17 | 407.2 |
| | | | | Key Weight = | | | |
| | | | | Vert. Component = | | | |
| Resisting/Overturning Ratio | | = 1.90 | | Total = | 1,247.9 lbs | R.M.= | 1,760.0 |
| Vertical Loads used for Soil Pressure = | | 1,441.0 lbs | | * Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation. | | | |

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci
 Horizontal Defl @ Top of Wall (approximate only) 0.043 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.



Mark Speidel, PE, SE
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Engineer: Mark Speidel
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Cantilevered Retaining Wall

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: [Patio Edge Wall](#)

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment = 23.40 in

Development length for #5 bar specified in this stem design segment = 18.00 in

Hooked embedment length into footing for #5 bar specified in this stem design segment = 8.78 in

As Provided = 0.2067 in²/ft

As Required = 0.1728 in²/ft



Cantilevered Retaining Wall

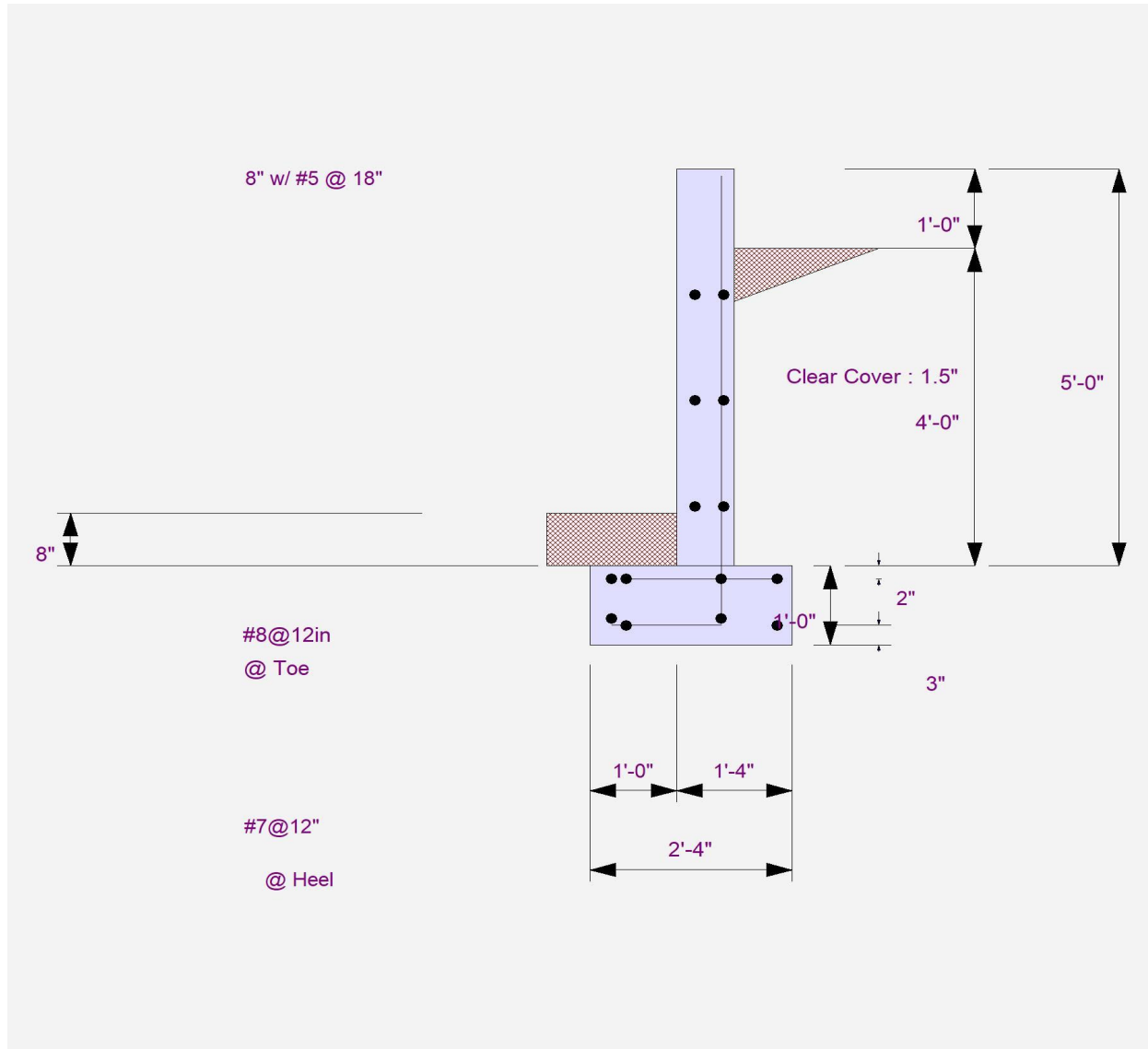
Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: Patio Edge Wall





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Project Title: Bickell Residence
Engineer: Mark Speidel
Project ID:
Project Descr: Remodeling of existing SFR

I.L. GROSS
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Cantilevered Retaining Wall

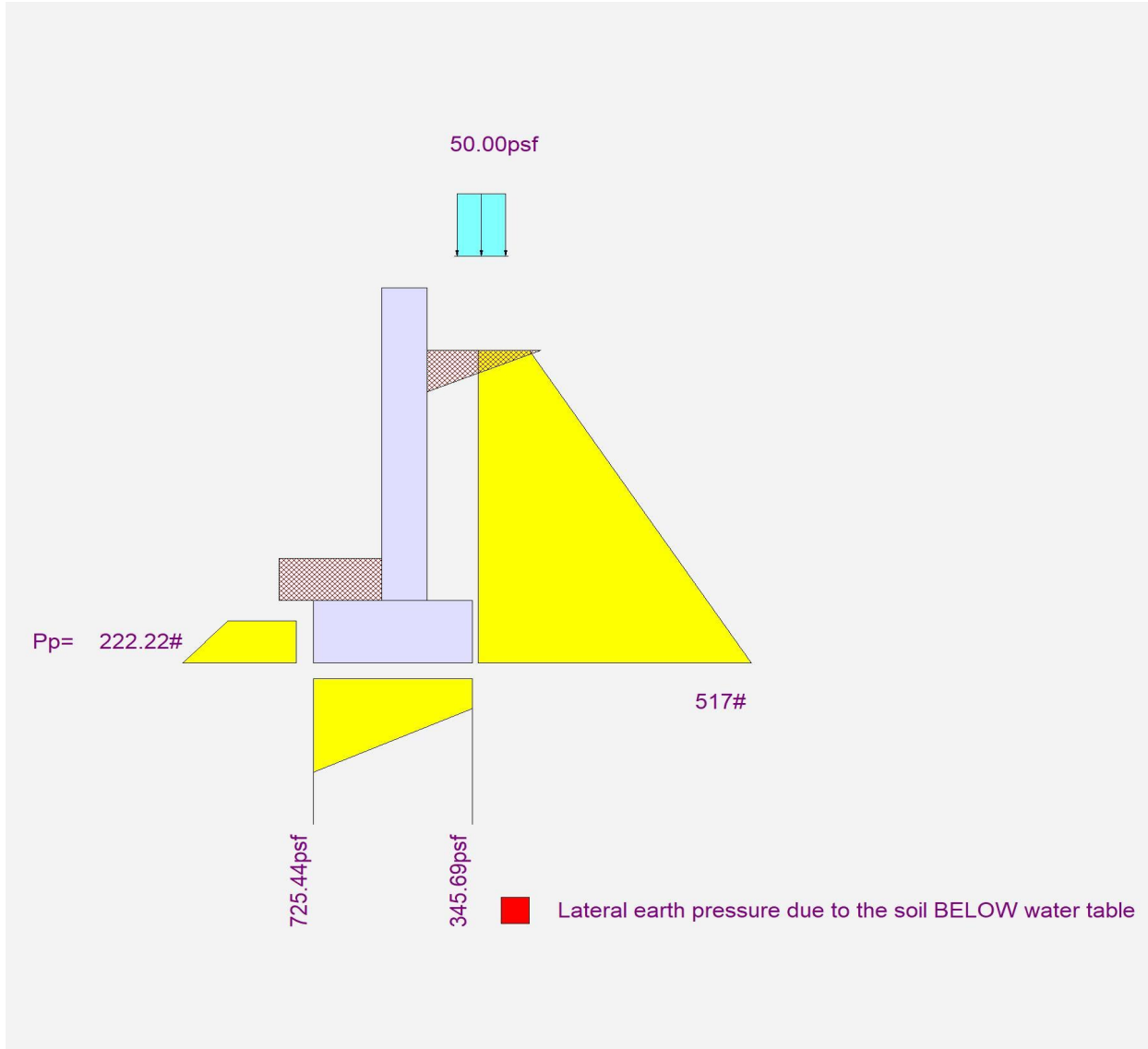
Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.10.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: Patio Edge Wall





Multiple Simple Beam

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.1.27

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2021

Description : existing framing checks

Wood Beam Design : Loft Joists - Ex 2x8

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : 2x8, Sawn, Fully Braced

Using Allowable Stress Design with ASCE 7-10 Load Combinations, Major Axis Bending

Wood Species : DouglasFir-Larch

Wood Grade : No.2

| | | | | | | | | | |
|--------------|-----------|-----------|-------------|----|-----------|---------------|-------------|---------|------------|
| Fb - Tension | 900.0 psi | Fc - Prll | 1,350.0 psi | Fv | 180.0 psi | Ebend- xx | 1,600.0 ksi | Density | 31.210 pcf |
| Fb - Compr | 900.0 psi | Fc - Perp | 625.0 psi | Ft | 575.0 psi | Eminbend - xx | 580.0 ksi | | |

Applied Loads

Unif Load: D = 0.0150, L = 0.040 k/ft, Trib= 1.330 ft

Design Summary

Max fb/Fb Ratio = **1.602** : 1
fb : Actual : 1,989.91 psi at 8.320 ft in Span # 2
Fb : Allowable : 1,242.00 psi
Load Comb : +D+L

Max fv/FvRatio = **0.433** : 1
fv : Actual : 77.90 psi at 3.000 ft in Span # 1
Fv : Allowable : 180.00 psi
Load Comb : +D+L

| | | | | | | | |
|-------------------|------|------|----|---|---|---|---|
| Max Reactions (k) | D | L | Lr | S | W | E | H |
| Left Support | 0.23 | 0.60 | | | | | |
| Right Support | 0.15 | 0.41 | | | | | |



Max Deflections

| | | | |
|--------------------|-----------|----------------|-----------|
| Transient Downward | 0.950 in | Total Downward | 1.306 in |
| Ratio | 202 <0 | Ratio | 147 <240 |
| LC: L Only | | LC: +D+L | |
| Transient Upward | -0.518 in | Total Upward | -0.713 in |
| Ratio | 138 <0 | Ratio | 100 <240 |
| LC: L Only | | LC: +D+L | |

Wood Beam Design : rafters

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : 2x6, Sawn, Fully Braced

Using Allowable Stress Design with ASCE 7-10 Load Combinations, Major Axis Bending

Wood Species : DouglasFir-Larch

Wood Grade : No.2

| | | | | | | | | | |
|--------------|-----------|-----------|-------------|----|-----------|---------------|-------------|---------|------------|
| Fb - Tension | 900.0 psi | Fc - Prll | 1,350.0 psi | Fv | 180.0 psi | Ebend- xx | 1,600.0 ksi | Density | 31.210 pcf |
| Fb - Compr | 900.0 psi | Fc - Perp | 625.0 psi | Ft | 575.0 psi | Eminbend - xx | 580.0 ksi | | |

Applied Loads

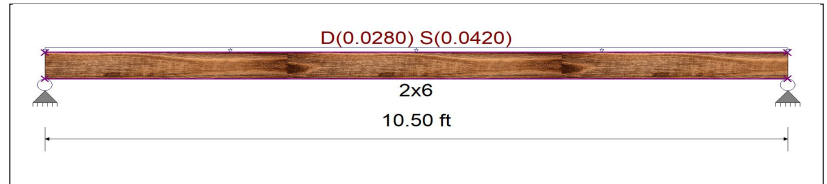
Unif Load: D = 0.0140, S = 0.0210 k/ft, Trib= 2.0 ft

Design Summary

Max fb/Fb Ratio = **0.989** : 1
fb : Actual : 1,530.74 psi at 5.250 ft in Span # 1
Fb : Allowable : 1,547.33 psi
Load Comb : +D+S

Max fv/FvRatio = **0.295** : 1
fv : Actual : 61.03 psi at 10.045 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+S

| | | | | | | | |
|-------------------|------|---|----|------|---|---|---|
| Max Reactions (k) | D | L | Lr | S | W | E | H |
| Left Support | 0.15 | | | 0.22 | | | |
| Right Support | 0.15 | | | 0.22 | | | |



Max Deflections

| | | | |
|--------------------|----------|----------------|----------|
| Transient Downward | 0.347 in | Total Downward | 0.578 in |
| Ratio | 363 | Ratio | 217 <300 |
| LC: S Only | | LC: +D+S | |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: | | LC: | |



Multiple Simple Beam

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.1.27

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Wood Beam Design : rafters - span 2

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2x6, Sawn, Fully Braced**

Using Allowable Stress Design with ASCE 7-10 Load Combinations, Major Axis Bending

Wood Species : DouglasFir-Larch

Wood Grade : No.2

Fb - Tension 900.0 psi Fc - Prll 1,350.0 psi Fv 180.0 psi Ebend- xx 1,600.0 ksi Density 31.210 pcf
Fb - Compr 900.0 psi Fc - Perp 625.0 psi Ft 575.0 psi Eminbend - xx 580.0 ksi

Applied Loads

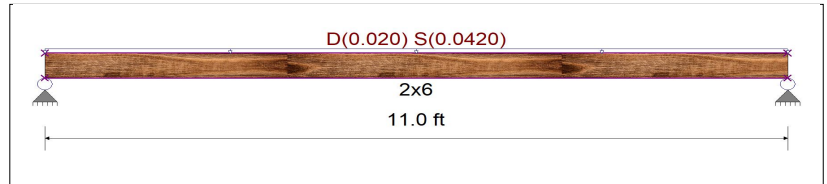
Unif Load: D = 0.010, S = 0.0210 k/ft, Trib= 2.0 ft

Design Summary

Max fb/Fb Ratio = **0.962** : 1
fb : Actual : 1,488.00 psi at 5.500 ft in Span # 1
Fb : Allowable : 1,547.33 psi
Load Comb : +D+S

Max fv/FvRatio = **0.276** : 1
fv : Actual : 57.04 psi at 0.000 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+S

Max Reactions (k) $\frac{D}{L}$ $\frac{L}{L_r}$ $\frac{S}{W}$ $\frac{E}{H}$
Left Support 0.11 0.23
Right Support 0.11 0.23



Max Deflections

| | | | |
|--------------------|----------|----------------|----------|
| Transient Downward | 0.418 in | Total Downward | 0.617 in |
| Ratio | 315 | Ratio | 213 <300 |
| LC: S Only | | LC: +D+S | |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: | | LC: | |

Wood Beam Design : Ex Roof BM

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **6x12, Sawn, Fully Braced**

Using Allowable Stress Design with ASCE 7-10 Load Combinations, Major Axis Bending

Wood Species : DF Old Growth joists

Wood Grade : Sawn, Construction & Standard

Fb - Tension 1,200.0 psi Fc - Prll 390.0 psi Fv 95.0 psi Ebend- xx 1,760.0 ksi Density 35.020 pcf
Fb - Compr 1,200.0 psi Fc - Perp 650.0 psi Ft 1,200.0 psi Eminbend - xx 1,600.0 ksi

Applied Loads

Beam self weight calculated and added to loads

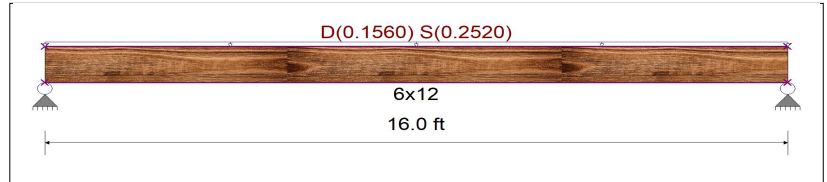
Unif Load: D = 0.1560, S = 0.2520 k/ft, Trib= 1.0 ft

Design Summary

Max fb/Fb Ratio = **0.972** : 1
fb : Actual : 1,341.09 psi at 8.000 ft in Span # 1
Fb : Allowable : 1,380.00 psi
Load Comb : +D+S

Max fv/FvRatio = **0.652** : 1
fv : Actual : 71.22 psi at 0.000 ft in Span # 1
Fv : Allowable : 109.25 psi
Load Comb : +D+S

Max Reactions (k) $\frac{D}{L}$ $\frac{L}{L_r}$ $\frac{S}{W}$ $\frac{E}{H}$
Left Support 1.37 2.02
Right Support 1.37 2.02



Max Deflections

| | | | |
|--------------------|----------|----------------|----------|
| Transient Downward | 0.304 in | Total Downward | 0.512 in |
| Ratio | 630 | Ratio | 375 |
| LC: S Only | | LC: +D+S | |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: | | LC: | |



Multiple Simple Beam

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.1.27

I.L. GROSS STRUCTURAL ENGINEERS

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Wood Beam Design : Loft Joists with added 2x8

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2-2x8, Sawn, Fully Braced**

Using Allowable Stress Design with ASCE 7-10 Load Combinations, Major Axis Bending

Wood Species : Douglas Fir-Larch

Wood Grade : No.2

Fb - Tension 900 psi Fc - Prll 1350 psi Fv 180 psi Ebend- xx 1600 ksi Density 31.21 pcf
 Fb - Compr 900 psi Fc - Perp 625 psi Ft 575 psi Eminbend - xx 580 ksi

Applied Loads

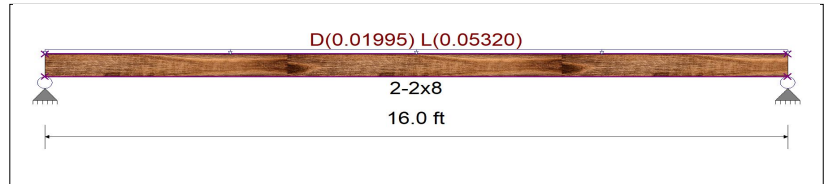
Unif Load: D = 0.0150, L = 0.040 k/ft, Trib= 1.330 ft

Design Summary

Max fb/Fb Ratio = **0.861** : 1
 fb : Actual : 1,068.81 psi at 8.000 ft in Span # 1
 Fb : Allowable : 1,242.00 psi
 Load Comb : +D+L

Max fv/FvRatio = **0.208** : 1
 fv : Actual : 37.40 psi at 0.000 ft in Span # 1
 Fv : Allowable : 180.00 psi
 Load Comb : +D+L

Max Reactions (k) $\frac{D}{L}$ $\frac{L}{L_r}$ $\frac{S}{W}$ $\frac{E}{H}$
 Left Support 0.16 0.43
 Right Support 0.16 0.43



Max Deflections

| | | | |
|--------------------|----------|----------------|----------|
| Transient Downward | 0.517 in | Total Downward | 0.711 in |
| Ratio | 371 | Ratio | 269 |
| LC: L Only | | LC: +D+L | |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: | | LC: | |

Wood Beam Design : Loft Joists with added 1.75" LVL

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **3.250 X 7.250, Sawn, Fully Braced**

Using Allowable Stress Design with ASCE 7-10 Load Combinations, Major Axis Bending

Wood Species : DouglasFir-Larch

Wood Grade : No.2

Fb - Tension 1,700.0 psi Fc - Prll 1,350.0 psi Fv 180.0 psi Ebend- xx 1,800.0 ksi Density 31.210 pcf
 Fb - Compr 1,700.0 psi Fc - Perp 625.0 psi Ft 575.0 psi Eminbend - xx 900.0 ksi

Applied Loads

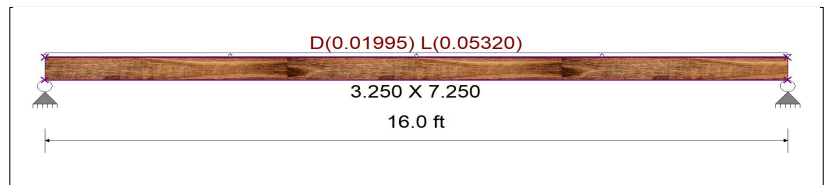
Unif Load: D = 0.0150, L = 0.040 k/ft, Trib= 1.330 ft

Design Summary

Max fb/Fb Ratio = **0.421** : 1
 fb : Actual : 986.59 psi at 8.000 ft in Span # 1
 Fb : Allowable : 2,346.00 psi
 Load Comb : +D+L

Max fv/FvRatio = **0.192** : 1
 fv : Actual : 34.52 psi at 0.000 ft in Span # 1
 Fv : Allowable : 180.00 psi
 Load Comb : +D+L

Max Reactions (k) $\frac{D}{L}$ $\frac{L}{L_r}$ $\frac{S}{W}$ $\frac{E}{H}$
 Left Support 0.16 0.43
 Right Support 0.16 0.43



Max Deflections

| | | | |
|--------------------|----------|----------------|----------|
| Transient Downward | 0.425 in | Total Downward | 0.584 in |
| Ratio | 452 | Ratio | 328 |
| LC: L Only | | LC: +D+L | |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| LC: | | LC: | |



Multiple Simple Beam

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.1.27

I.L. GROSS STRUCTURAL ENGINEERS

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Wood Beam Design : Loft Joists with added 2x8 + 1.75" LVL

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **2-2x8 + 1.75x5.5 LVL, Sawn - General, Fully Braced**

Using Allowable Stress Design with ASCE 7-10 Load Combinations, Major Axis Bending

Wood Species : DouglasFir-Larch

Wood Grade : No.2

| | | | | | | | | | |
|--------------|-------------|-----------|-------------|----|-----------|---------------|-------------|---------|----------|
| Fb - Tension | 1,466.0 psi | Fc - Prll | 1,350.0 psi | Fv | 225.0 psi | Ebend- xx | 1,700.0 ksi | Density | 33.0 pcf |
| Fb - Compr | 1,466.0 psi | Fc - Perp | 625.0 psi | Ft | 575.0 psi | Eminbend - xx | 850.0 ksi | | |

Applied Loads

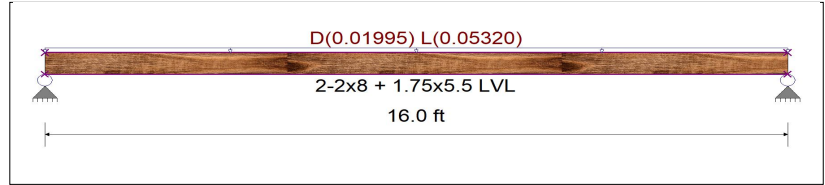
Unif Load: D = 0.0150, L = 0.040 k/ft, Trib= 1.330 ft

Design Summary

Max fb/Fb Ratio = **0.463** : 1
 fb : Actual : 780.99 psi at 8.000 ft in Span # 1
 Fb : Allowable : 1,685.90 psi
 Load Comb : +D+L

Max fv/FvRatio = **0.117** : 1
 fv : Actual : 26.29 psi at 0.000 ft in Span # 1
 Fv : Allowable : 225.00 psi
 Load Comb : +D+L

| | | | | | | | |
|-------------------|----------|----------|-----------|----------|----------|----------|----------|
| Max Reactions (k) | <u>D</u> | <u>L</u> | <u>Lr</u> | <u>S</u> | <u>W</u> | <u>E</u> | <u>H</u> |
| Left Support | 0.16 | 0.43 | | | | | |
| Right Support | 0.16 | 0.43 | | | | | |



Max Deflections

| | | | |
|--------------------|----------|----------------|----------|
| Transient Downward | 0.373 in | Total Downward | 0.512 in |
| Ratio | 515 | Ratio | 374 |
| | | LC: L Only | LC: +D+L |
| Transient Upward | 0.000 in | Total Upward | 0.000 in |
| Ratio | 9999 | Ratio | 9999 |
| | | LC: | LC: |



Wood Beam

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.8.17

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: Edge Beam below 2nd Floor at GL -1

CODE REFERENCES

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
 Load Combination Set : IBC 2018

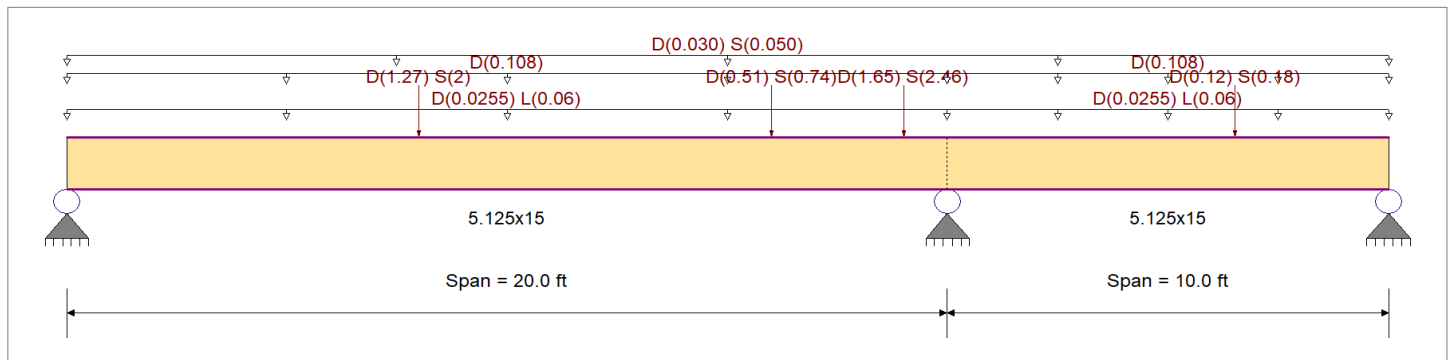
Material Properties

Analysis Method : Allowable Stress Design
 Load Combination : IBC 2018

Wood Species : DF/DF
 Wood Grade : 24F - V8

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

| | | | |
|-----------|-------------|---------------------------|------------|
| Fb + | 2,400.0 psi | E : Modulus of Elasticity | |
| Fb - | 2,400.0 psi | Ebend- xx | 1,800.0ksi |
| Fc - Prll | 1,650.0 psi | Eminbend - xx | 950.0ksi |
| Fc - Perp | 650.0 psi | Ebend- yy | 1,600.0ksi |
| Fv | 265.0 psi | Eminbend - yy | 850.0ksi |
| Ft | 1,100.0 psi | Density | 31.210pcf |



Applied Loads

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

Beam self weight calculated and added to loading

Loads on all spans...

Uniform Load on ALL spans : D = 0.0150, S = 0.0250 ksf, Tributary Width = 2.0 ft

Load for Span Number 1

Uniform Load : D = 0.0170, L = 0.040 ksf, Tributary Width = 1.50 ft, (floor loads)

Uniform Load : D = 0.0120 ksf, Tributary Width = 9.0 ft, (L2 Wall weight)

Point Load : D = 1.270, S = 2.0 k @ 8.0 ft, (P1)

Point Load : D = 0.510, S = 0.740 k @ 16.0 ft, (P2)

Point Load : D = 1.650, S = 2.460 k @ 19.0 ft, (P3)

Load for Span Number 2

Uniform Load : D = 0.0170, L = 0.040 ksf, Tributary Width = 1.50 ft, (floor loads)

Uniform Load : D = 0.0120 ksf, Tributary Width = 9.0 ft, (L2 Wall weight)

Point Load : D = 0.120, S = 0.180 k @ 6.50 ft, (P4)

DESIGN SUMMARY

Design OK

| | | | | | |
|-------------------------------------|-----------|--------------------|-----------------------------------|---|------------------|
| Maximum Bending Stress Ratio | = | 0.504 < 1 | Maximum Shear Stress Ratio | = | 0.331 < 1 |
| Section used for this span | | 5.125x15 | Section used for this span | | 5.125x15 |
| fb: Actual | = | 1,367.67 psi | fv: Actual | = | 100.95 psi |
| Fb: Allowable | = | 2,712.30 psi | Fv: Allowable | = | 304.75 psi |
| Load Combination | | +D+S | Load Combination | | +D+S |
| Location of maximum on span | = | 8.045 ft | Location of maximum on span | = | 18.771 ft |
| Span # where maximum occurs | = | Span # 1 | Span # where maximum occurs | = | Span # 1 |
| Maximum Deflection | | | | | |
| Max Downward Transient Deflection | 0.215 in | Ratio = 1116 >=400 | Span: 1 : S Only | | |
| Max Upward Transient Deflection | -0.034 in | Ratio = 3487 >=400 | Span: 2 : S Only | | |
| Max Downward Total Deflection | 0.469 in | Ratio = 511 >=300 | Span: 1 : +D+S | | |
| Max Upward Total Deflection | -0.068 in | Ratio = 1752 >=300 | Span: 2 : +D+S | | |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Max Stress Ratios | Moment Values | | | | | | | | | | Shear Values | | | | | | |
|------------------|-------------------|----------------|--------|---|---|----------------|------------------|----------------|----------------|----------------|----------------|----------------|---|----|------|------|------|------|
| | | Segment Length | Span # | M | V | C _d | C _{F/V} | C _i | C _r | C _m | C _t | C _L | M | fb | F'b | V | fv | F'v |
| D Only | | | | | | | | | | | | | | | 0.00 | 0.00 | 0.00 | 0.00 |



Wood Beam

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.8.17

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: Edge Beam below 2nd Floor at GL -1

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | | | | | | | | Moment Values | | | Shear Values | | |
|------------------|------------------|--------|-------------------|-------|----------------|------------------|----------------|----------------|----------------|----------------|----------------|---------------|---------|---------|--------------|--------|--------|
| | | | M | V | C _d | C _{F/V} | C _i | C _r | C _m | C _t | C _L | M | fb | F'b | V | fv | F'v |
| | Length = 20.0 ft | 1 | 0.343 | 0.245 | 0.90 | 0.983 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 11.66 | 728.06 | 2122.67 | 3.00 | 58.47 | 238.50 |
| | Length = 10.0 ft | 2 | 0.337 | 0.245 | 0.90 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 11.66 | 728.06 | 2160.00 | 1.89 | 58.47 | 238.50 |
| +D+L | | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 |
| | Length = 20.0 ft | 1 | 0.368 | 0.268 | 1.00 | 0.983 | 1.00 | 1.00 | 1.00 | 1.00 | 13.91 | 868.55 | 2358.52 | 3.64 | 70.94 | 265.00 | |
| | Length = 10.0 ft | 2 | 0.362 | 0.268 | 1.00 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 13.91 | 868.55 | 2400.00 | 2.34 | 70.94 | 265.00 | |
| +D+S | | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 | |
| | Length = 20.0 ft | 1 | 0.504 | 0.331 | 1.15 | 0.983 | 1.00 | 1.00 | 1.00 | 1.00 | 21.90 | 1,367.67 | 2712.30 | 5.17 | 100.95 | 304.75 | |
| | Length = 10.0 ft | 2 | 0.476 | 0.331 | 1.15 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 21.05 | 1,314.18 | 2760.00 | 3.08 | 100.95 | 304.75 | |
| +D+0.750L | | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 | |
| | Length = 20.0 ft | 1 | 0.283 | 0.205 | 1.25 | 0.983 | 1.00 | 1.00 | 1.00 | 1.00 | 13.35 | 833.43 | 2948.15 | 3.48 | 67.82 | 331.25 | |
| | Length = 10.0 ft | 2 | 0.278 | 0.205 | 1.25 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 13.35 | 833.43 | 3000.00 | 2.23 | 67.82 | 331.25 | |
| +D+0.750L+0.750S | | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 | |
| | Length = 20.0 ft | 1 | 0.479 | 0.327 | 1.15 | 0.983 | 1.00 | 1.00 | 1.00 | 1.00 | 20.80 | 1,298.48 | 2712.30 | 5.11 | 99.68 | 304.75 | |
| | Length = 10.0 ft | 2 | 0.461 | 0.327 | 1.15 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 20.39 | 1,273.01 | 2760.00 | 3.12 | 99.68 | 304.75 | |
| +0.60D | | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 | |
| | Length = 20.0 ft | 1 | 0.116 | 0.083 | 1.60 | 0.983 | 1.00 | 1.00 | 1.00 | 1.00 | 7.00 | 436.84 | 3773.63 | 1.80 | 35.08 | 424.00 | |
| | Length = 10.0 ft | 2 | 0.114 | 0.083 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 7.00 | 436.84 | 3840.00 | 1.13 | 35.08 | 424.00 | |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+S | 1 | 0.4690 | 9.162 | | 0.0000 | 0.000 |
| | 2 | 0.0000 | 9.162 | +D+S | -0.0685 | 3.966 |

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

| Load Combination | Support 1 | Support 2 | Support 3 |
|------------------|-----------|-----------|-----------|
| Overall MAXimum | 3.667 | 12.927 | -0.759 |
| Overall MINimum | 1.502 | 5.950 | -0.187 |
| D Only | 2.165 | 6.977 | -0.187 |
| +D+L | 2.653 | 8.214 | -0.112 |
| +D+S | 3.667 | 12.927 | -0.759 |
| +D+0.750L | 2.531 | 7.905 | -0.131 |
| +D+0.750L+0.750S | 3.657 | 12.368 | -0.560 |
| +0.60D | 1.299 | 4.186 | -0.112 |
| L Only | 0.488 | 1.237 | 0.075 |
| S Only | 1.502 | 5.950 | -0.572 |



Wood Beam

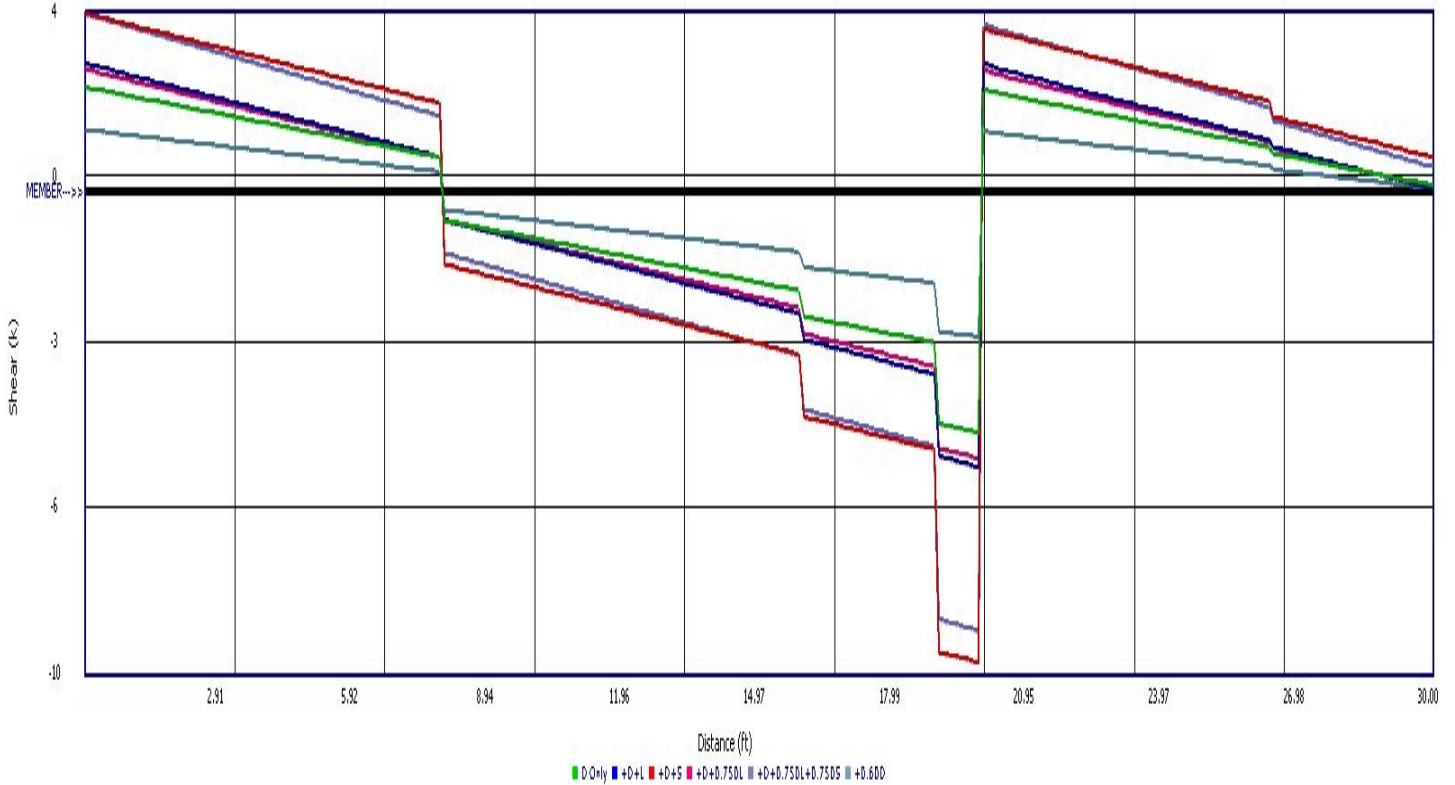
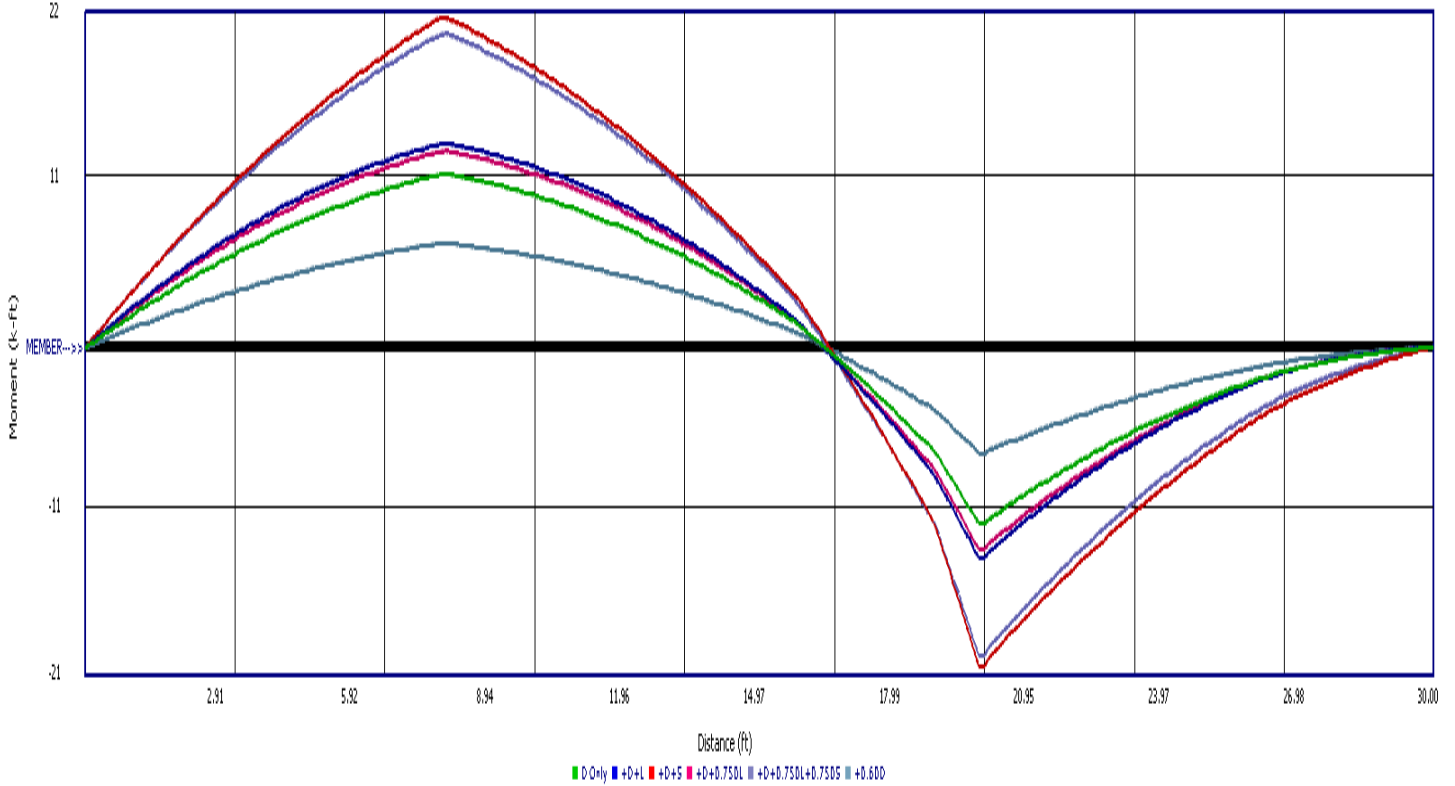
Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.8.17

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: Edge Beam below 2nd Floor at GL -1





Wood Beam

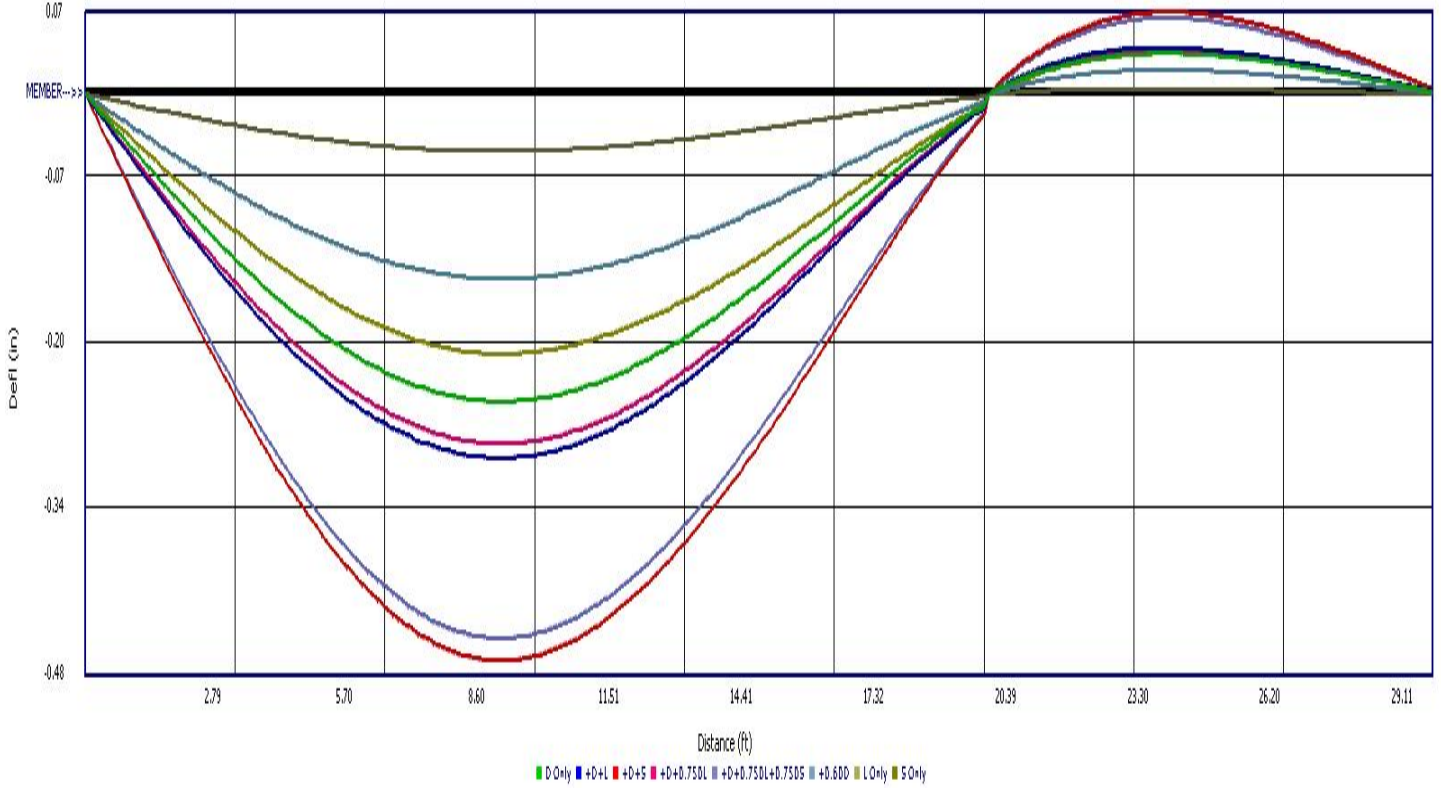
Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.8.17

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: Edge Beam below 2nd Floor at GL -1



Wood Column

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FP-2

Code References

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
 Load Combinations Used : IBC 2018

General Information

| | | | |
|--|-------------------------|---------------------|---|
| Analysis Method | Allowable Stress Design | Wood Section Name | 2-2x6 |
| End Fixities | Top & Bottom Pinned | Wood Grading/Manuf. | Graded Lumber |
| Overall Column Height | 8.42 ft | Wood Member Type | Sawn |
| <i>(Used for non-slender calculations)</i> | | | |
| Wood Species | Douglas Fir-Larch | Exact Width | 3.0 in Allow Stress Modification Factors |
| Wood Grade | No.2 | Exact Depth | 5.50 in Cf or Cv for Bending 1.30 |
| Fb + | 900 psi | Area | 16.50 in ² Cf or Cv for Compression 1.10 |
| Fb - | 900 psi | Ix | 41.594 in ⁴ Cf or Cv for Tension 1.30 |
| Fc - Prll | 1350 psi | Iy | 12.375 in ⁴ Cm : Wet Use Factor 1.0 |
| Fc - Perp | 625 psi | | Ct : Temperature Fact 1.0 |
| E : Modulus of Elasticity . . . | x-x Bending | y-y Bending | Axial |
| | Basic | 1600 | 1600 |
| | Minimum | 580 | 580 |
| | | | 1600 ksi |
| | | | Kf : Built-up columns 1.0 <i>NDS 15.3.2</i> |
| | | | Use Cr : Repetitive ? No |
| | | | Brace condition for deflection (buckling) along columns : |
| | | | X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 4.0 ft, |
| | | | Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 8.42 ft, |

Applied Loads

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

Column self weight included : 30.111 lbs * Dead Load Factor

AXIAL LOADS . . .

Axial Load at 8.420 ft, D = 2.510, Lr = 2.190, L = 0.440, S = 2.740, E = 1.740 k

BENDING LOADS . . .

Wind Components and Cladding: Lat. Uniform Load creating Mx-x, W = 0.0260 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.3012 : 1**
 Load Combination +D+S
 Governing NDS Formula Comp Only, fc/Fc'
 Location of max.above base 0.0 ft
 At maximum location values are .
 Applied Axial 5.280 k
 Applied Mx 0.0 k-ft
 Applied My 0.0 k-ft
 Fc : Allowable 1,062.61 psi

Maximum SERVICE Lateral Load Reactions . .
 Top along Y-Y 0.1095 k Bottom along Y-Y 0.1095 k
 Top along X-X 0.0 k Bottom along X-X 0.0 k

Maximum SERVICE Load Lateral Deflections . . .
 Along Y-Y 0.04466 in at 4.238 ft above base
 for load combination : W Only
 Along X-X 0.0 in at 0.0 ft above base
 for load combination : n/a

Other Factors used to calculate allowable stresses . . .
 Bending Compression Tension

PASS Maximum Shear Stress Ratio = **0.02073 : 1**
 Load Combination +D+0.60W
 Location of max.above base 8.420 ft
 Applied Design Shear 5.971 psi
 Allowable Shear 288.0 psi

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|--------------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| D Only | 0.900 | 0.710 | 0.1623 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+L | 1.000 | 0.673 | 0.1806 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+Lr | 1.250 | 0.591 | 0.2615 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+S | 1.150 | 0.622 | 0.3012 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.750Lr+0.750L | 1.250 | 0.591 | 0.2495 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.750L+0.750S | 1.150 | 0.622 | 0.2809 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.60W | 1.600 | 0.497 | 0.1306 | PASS | 4.182 ft | 0.02073 | PASS | 8.420 ft |
| +D+0.70E | 1.600 | 0.497 | 0.1930 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.750Lr+0.750L+0.450W | 1.600 | 0.497 | 0.2318 | PASS | 4.182 ft | 0.01555 | PASS | 8.420 ft |

Project Title: Bickell Residence
 Engineer: Mark Speidel
 Project ID:
 Project Descr: Remodeling of existing SFR

Wood Column

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FP-2

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|--------------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| +D+0.750L+0.750S+0.450W | 1.600 | 0.497 | 0.2530 | PASS | 4.182 ft | 0.01555 | PASS | 8.420 ft |
| +D+0.750L+0.750S+0.5250E | 1.600 | 0.497 | 0.2999 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +0.60D+0.60W | 1.600 | 0.497 | 0.07837 | PASS | 4.182 ft | 0.02073 | PASS | 8.420 ft |
| +0.60D+0.70E | 1.600 | 0.497 | 0.1408 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |

Maximum Deflections for Load Combinations

| Load Combination | Max. X-X Deflection | Distance | Max. Y-Y Deflection | Distance |
|--------------------------|---------------------|----------|---------------------|----------|
| D Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+L | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+Lr | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+S | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.750Lr+0.750L | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.750L+0.750S | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.60W | 0.0000 in | 0.000ft | 0.027 in | 4.238 ft |
| +D+0.70E | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.750Lr+0.750L+0.450W | 0.0000 in | 0.000ft | 0.020 in | 4.238 ft |
| +D+0.750L+0.750S+0.450W | 0.0000 in | 0.000ft | 0.020 in | 4.238 ft |
| +D+0.750L+0.750S+0.5250E | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +0.60D+0.60W | 0.0000 in | 0.000ft | 0.027 in | 4.238 ft |
| +0.60D+0.70E | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| Lr Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| L Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| S Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| W Only | 0.0000 in | 0.000ft | 0.045 in | 4.238 ft |
| E Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |

Wood Column

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FP-3

Code References

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
 Load Combinations Used : IBC 2018

General Information

| | | | | | |
|---|-------------------------|-------------|------------|-----------------------------------|---|
| Analysis Method | Allowable Stress Design | | | Wood Section Name | 2-2x6 |
| End Fixities | Top & Bottom Pinned | | | Wood Grading/Manuf. | Graded Lumber |
| Overall Column Height | 8.42 ft | | | Wood Member Type | Sawn |
| <i>(Used for non-slender calculations)</i> | | | | | |
| Wood Species | Douglas Fir-Larch | | | Exact Width | 3.0 in |
| Wood Grade | No.2 | | | Exact Depth | 5.50 in |
| Fb + | 900.0 psi | Fv | 180.0 psi | Area | 16.50 in ² |
| Fb - | 900.0 psi | Ft | 575.0 psi | Ix | 41.594 in ⁴ |
| Fc - Prll | 1,350.0 psi | Density | 31.210 pcf | Iy | 12.375 in ⁴ |
| Fc - Perp | 625.0 psi | | | Allow Stress Modification Factors | |
| E : Modulus of Elasticity . . . | x-x Bending | y-y Bending | Axial | Cf or Cv for Bending 1.30 | |
| | Basic | 1,600.0 | 1,600.0 | 1,600.0 ksi | Cf or Cv for Compression 1.10 |
| | Minimum | 580.0 | 580.0 | | Cf or Cv for Tension 1.30 |
| | | | | | Cm : Wet Use Factor 1.0 |
| | | | | | Ct : Temperature Fact 1.0 |
| | | | | | Cfu : Flat Use Factor 1.0 |
| | | | | | Kf : Built-up columns 1.0 <i>NDS 15.3.2</i> |
| | | | | | Use Cr : Repetitive ? No |
| Brace condition for deflection (buckling) along columns : | | | | | |
| X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 4.0 ft, | | | | | |
| Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 8.42 ft, | | | | | |

Applied Loads

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

Column self weight included : 30.111 lbs * Dead Load Factor

AXIAL LOADS . . .

Axial Load at 8.420 ft, D = 2.240, Lr = 1.930, L = 0.590, S = 2.40, E = 1.740 k

BENDING LOADS . . .

Wind Components and Cladding: Lat. Uniform Load creating Mx-x, W = 0.0260 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.2787 : 1**
 Load Combination +D+0.750L+0.750S+0.5250E
 Governing NDS Formula Comp Only, fc/Fc'
 Location of max.above base 0.0 ft
 At maximum location values are .
 Applied Axial 5.426 k
 Applied Mx 0.0 k-ft
 Applied My 0.0 k-ft
 Fc : Allowable 1,179.89 psi

Maximum SERVICE Lateral Load Reactions . .
 Top along Y-Y 0.1095 k Bottom along Y-Y 0.1095 k
 Top along X-X 0.0 k Bottom along X-X 0.0 k

Maximum SERVICE Load Lateral Deflections . . .
 Along Y-Y 0.04466 in at 4.238 ft above base
 for load combination : W Only
 Along X-X 0.0 in at 0.0 ft above base
 for load combination : n/a

Other Factors used to calculate allowable stresses . . .
 Bending Compression Tension

PASS Maximum Shear Stress Ratio = **0.02073 : 1**
 Load Combination +D+0.60W
 Location of max.above base 8.420 ft
 Applied Design Shear 5.971 psi
 Allowable Shear 288.0 psi

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|--------------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| D Only | 0.900 | 0.710 | 0.1450 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+L | 1.000 | 0.673 | 0.1733 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+Lr | 1.250 | 0.591 | 0.2322 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+S | 1.150 | 0.622 | 0.2664 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.750Lr+0.750L | 1.250 | 0.591 | 0.230 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.750L+0.750S | 1.150 | 0.622 | 0.2574 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.60W | 1.600 | 0.497 | 0.1167 | PASS | 4.182 ft | 0.02073 | PASS | 8.420 ft |
| +D+0.70E | 1.600 | 0.497 | 0.1792 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.750Lr+0.750L+0.450W | 1.600 | 0.497 | 0.2137 | PASS | 4.182 ft | 0.01555 | PASS | 8.420 ft |

Wood Column

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FP-3

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|--------------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| +D+0.750L+0.750S+0.450W | 1.600 | 0.497 | 0.2318 | PASS | 4.182 ft | 0.01555 | PASS | 8.420 ft |
| +D+0.750L+0.750S+0.5250E | 1.600 | 0.497 | 0.2787 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +0.60D+0.60W | 1.600 | 0.497 | 0.07005 | PASS | 4.182 ft | 0.02073 | PASS | 8.420 ft |
| +0.60D+0.70E | 1.600 | 0.497 | 0.1325 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |

Maximum Deflections for Load Combinations

| Load Combination | Max. X-X Deflection | Distance | Max. Y-Y Deflection | Distance |
|--------------------------|---------------------|----------|---------------------|----------|
| D Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+L | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+Lr | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+S | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.750Lr+0.750L | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.750L+0.750S | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.60W | 0.0000 in | 0.000ft | 0.027 in | 4.238 ft |
| +D+0.70E | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.750Lr+0.750L+0.450W | 0.0000 in | 0.000ft | 0.020 in | 4.238 ft |
| +D+0.750L+0.750S+0.450W | 0.0000 in | 0.000ft | 0.020 in | 4.238 ft |
| +D+0.750L+0.750S+0.5250E | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +0.60D+0.60W | 0.0000 in | 0.000ft | 0.027 in | 4.238 ft |
| +0.60D+0.70E | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| Lr Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| L Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| S Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| W Only | 0.0000 in | 0.000ft | 0.045 in | 4.238 ft |
| E Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |

Wood Column

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FP-5

Code References

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
 Load Combinations Used : IBC 2018

General Information

| | | | | | |
|---|-------------------------|-------------|------------|-----------------------------------|---|
| Analysis Method | Allowable Stress Design | | | Wood Section Name | 6x6 |
| End Fixities | Top & Bottom Pinned | | | Wood Grading/Manuf. | Graded Lumber |
| Overall Column Height | 8.42 ft | | | Wood Member Type | Sawn |
| <i>(Used for non-slender calculations)</i> | | | | | |
| Wood Species | Douglas Fir-Larch | | | Exact Width | 5.50 in |
| Wood Grade | No.2 | | | Exact Depth | 5.50 in |
| Fb + | 900.0 psi | Fv | 180.0 psi | Area | 30.250 in ² |
| Fb - | 900.0 psi | Ft | 575.0 psi | Ix | 76.255 in ⁴ |
| Fc - Prll | 1,350.0 psi | Density | 31.210 pcf | Iy | 76.255 in ⁴ |
| Fc - Perp | 625.0 psi | | | Allow Stress Modification Factors | |
| E : Modulus of Elasticity . . . | x-x Bending | y-y Bending | Axial | Cf or Cv for Bending 1.0 | |
| | Basic | 1,600.0 | 1,600.0 | 1,600.0 ksi | Cf or Cv for Compression 1.0 |
| | Minimum | 580.0 | 580.0 | | Cf or Cv for Tension 1.0 |
| | | | | | Cm : Wet Use Factor 1.0 |
| | | | | | Ct : Temperature Fact 1.0 |
| | | | | | Cfu : Flat Use Factor 1.0 |
| | | | | | Kf : Built-up columns 1.0 <i>NDS 15.3.2</i> |
| | | | | | Use Cr : Repetitive ? No |
| Brace condition for deflection (buckling) along columns : | | | | | |
| X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 8.42 ft. | | | | | |
| Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 8.42 ft. | | | | | |

Applied Loads

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

Column self weight included : 55.204 lbs * Dead Load Factor

AXIAL LOADS . . .

Axial Load at 8.420 ft, D = 7.921, Lr = 6.499, L = 3.893, S = 4.030, E = 3.410 k

BENDING LOADS . . .

Wind Components and Cladding: Lat. Uniform Load creating Mx-x, W = 0.0260 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.4930 : 1**
 Load Combination +D+0.750Lr+0.750L
 Governing NDS Formula Comp Only, fc/Fc'
 Location of max.above base 0.0 ft
 At maximum location values are .
 Applied Axial 15.770 k
 Applied Mx 0.0 k-ft
 Applied My 0.0 k-ft
 Fc : Allowable 1,057.57 psi

Maximum SERVICE Lateral Load Reactions . .
 Top along Y-Y 0.1095 k Bottom along Y-Y 0.1095 k
 Top along X-X 0.0 k Bottom along X-X 0.0 k

Maximum SERVICE Load Lateral Deflections . . .
 Along Y-Y 0.02436 in at 4.238 ft above base
 for load combination : W Only
 Along X-X 0.0 in at 0.0 ft above base
 for load combination : n/a

Other Factors used to calculate allowable stresses . . .
 Bending Compression Tension

PASS Maximum Shear Stress Ratio = **0.01131 : 1**
 Load Combination +D+0.60W
 Location of max.above base 8.420 ft
 Applied Design Shear 3.257 psi
 Allowable Shear 288.0 psi

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|--------------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| D Only | 0.900 | 0.740 | 0.2931 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+L | 1.000 | 0.706 | 0.4114 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+Lr | 1.250 | 0.627 | 0.4525 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+S | 1.150 | 0.657 | 0.3888 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.750Lr+0.750L | 1.250 | 0.627 | 0.4930 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.750L+0.750S | 1.150 | 0.657 | 0.4508 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.60W | 1.600 | 0.533 | 0.2292 | PASS | 4.182 ft | 0.01131 | PASS | 8.420 ft |
| +D+0.70E | 1.600 | 0.533 | 0.2978 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.750Lr+0.750L+0.450W | 1.600 | 0.533 | 0.4532 | PASS | 4.182 ft | 0.008481 | PASS | 8.420 ft |

Wood Column

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FP-5

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|--------------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| +D+0.750L+0.750S+0.450W | 1.600 | 0.533 | 0.3999 | PASS | 4.182 ft | 0.008481 | PASS | 8.420 ft |
| +D+0.750L+0.750S+0.5250E | 1.600 | 0.533 | 0.4514 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +0.60D+0.60W | 1.600 | 0.533 | 0.1375 | PASS | 4.182 ft | 0.01131 | PASS | 8.420 ft |
| +0.60D+0.70E | 1.600 | 0.533 | 0.2061 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |

Maximum Deflections for Load Combinations

| Load Combination | Max. X-X Deflection | Distance | Max. Y-Y Deflection | Distance |
|--------------------------|---------------------|----------|---------------------|----------|
| D Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+L | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+Lr | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+S | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.750Lr+0.750L | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.750L+0.750S | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.60W | 0.0000 in | 0.000ft | 0.015 in | 4.238ft |
| +D+0.70E | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.750Lr+0.750L+0.450W | 0.0000 in | 0.000ft | 0.011 in | 4.238ft |
| +D+0.750L+0.750S+0.450W | 0.0000 in | 0.000ft | 0.011 in | 4.238ft |
| +D+0.750L+0.750S+0.5250E | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +0.60D+0.60W | 0.0000 in | 0.000ft | 0.015 in | 4.238ft |
| +0.60D+0.70E | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| Lr Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| L Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| S Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| W Only | 0.0000 in | 0.000ft | 0.024 in | 4.238ft |
| E Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |

Wood Column

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FP-6

Code References

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
 Load Combinations Used : IBC 2018

General Information

| | | | | | |
|---|-------------------------|-------------|------------|-----------------------------------|---|
| Analysis Method | Allowable Stress Design | | | Wood Section Name | 4x8 |
| End Fixities | Top & Bottom Pinned | | | Wood Grading/Manuf. | Graded Lumber |
| Overall Column Height | 8.42 ft | | | Wood Member Type | Sawn |
| <i>(Used for non-slender calculations)</i> | | | | | |
| Wood Species | Douglas Fir-Larch | | | Exact Width | 3.50 in |
| Wood Grade | No.2 | | | Exact Depth | 7.250 in |
| Fb + | 900.0 psi | Fv | 180.0 psi | Area | 25.375 in ² |
| Fb - | 900.0 psi | Ft | 575.0 psi | Ix | 111.148 in ⁴ |
| Fc - Prll | 1,350.0 psi | Density | 31.210 pcf | Iy | 25.904 in ⁴ |
| Fc - Perp | 625.0 psi | | | Allow Stress Modification Factors | |
| E : Modulus of Elasticity . . . | x-x Bending | y-y Bending | Axial | Cf or Cv for Bending 1.30 | |
| | Basic | 1,600.0 | 1,600.0 | 1,600.0 ksi | Cf or Cv for Compression 1.050 |
| | Minimum | 580.0 | 580.0 | | Cf or Cv for Tension 1.20 |
| | | | | | Cm : Wet Use Factor 1.0 |
| | | | | | Ct : Temperature Fact 1.0 |
| | | | | | Cfu : Flat Use Factor 1.0 |
| | | | | | Kf : Built-up columns 1.0 <i>NDS 15.3.2</i> |
| | | | | | Use Cr : Repetitive ? No |
| Brace condition for deflection (buckling) along columns : | | | | | |
| X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 8.42 ft. | | | | | |
| Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 8.42 ft. | | | | | |

Applied Loads

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

Column self weight included : 46.307 lbs * Dead Load Factor

AXIAL LOADS . . .

Axial Load at 8.420 ft, D = 3.884, Lr = 5.668, L = 0.2860, S = 2.819, E = 11.20 k

BENDING LOADS . . .

Wind Components and Cladding: Lat. Uniform Load creating Mx-x, W = 0.0260 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.8883 : 1**
 Load Combination +D+0.750L+0.750S+0.5250E
 Governing NDS Formula Comp Only, fc/Fc'
 Location of max.above base 0.0 ft
 At maximum location values are .
 Applied Axial 12.139 k
 Applied Mx 0.0 k-ft
 Applied My 0.0 k-ft
 Fc : Allowable 538.53 psi

Maximum SERVICE Lateral Load Reactions . .
 Top along Y-Y 0.1095 k Bottom along Y-Y 0.1095 k
 Top along X-X 0.0 k Bottom along X-X 0.0 k

Maximum SERVICE Load Lateral Deflections . . .
 Along Y-Y 0.01671 in at 4.238 ft above base
 for load combination : W Only
 Along X-X 0.0 in at 0.0 ft above base
 for load combination : n/a

Other Factors used to calculate allowable stresses . . .
 Bending Compression Tension

PASS Maximum Shear Stress Ratio = **0.01348 : 1**
 Load Combination +D+0.60W
 Location of max.above base 8.420 ft
 Applied Design Shear 3.882 psi
 Allowable Shear 288.0 psi

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|--------------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| D Only | 0.900 | 0.396 | 0.3063 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+L | 1.000 | 0.362 | 0.3235 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+Lr | 1.250 | 0.298 | 0.7172 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+S | 1.150 | 0.321 | 0.5088 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.750Lr+0.750L | 1.250 | 0.298 | 0.6274 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.750L+0.750S | 1.150 | 0.321 | 0.4719 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.60W | 1.600 | 0.237 | 0.2877 | PASS | 4.182 ft | 0.01348 | PASS | 8.420 ft |
| +D+0.70E | 1.600 | 0.237 | 0.8613 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.750Lr+0.750L+0.450W | 1.600 | 0.237 | 0.6144 | PASS | 4.182 ft | 0.01011 | PASS | 8.420 ft |

Wood Column

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FP-6

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|--------------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| +D+0.750L+0.750S+0.450W | 1.600 | 0.237 | 0.4581 | PASS | 4.182 ft | 0.01011 | PASS | 8.420 ft |
| +D+0.750L+0.750S+0.5250E | 1.600 | 0.237 | 0.8883 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +0.60D+0.60W | 1.600 | 0.237 | 0.1726 | PASS | 4.182 ft | 0.01348 | PASS | 8.420 ft |
| +0.60D+0.70E | 1.600 | 0.237 | 0.7463 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |

Maximum Deflections for Load Combinations

| Load Combination | Max. X-X Deflection | Distance | Max. Y-Y Deflection | Distance |
|--------------------------|---------------------|----------|---------------------|----------|
| D Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+L | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+Lr | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+S | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.750Lr+0.750L | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.750L+0.750S | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.60W | 0.0000 in | 0.000ft | 0.010 in | 4.238ft |
| +D+0.70E | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.750Lr+0.750L+0.450W | 0.0000 in | 0.000ft | 0.008 in | 4.238ft |
| +D+0.750L+0.750S+0.450W | 0.0000 in | 0.000ft | 0.008 in | 4.238ft |
| +D+0.750L+0.750S+0.5250E | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +0.60D+0.60W | 0.0000 in | 0.000ft | 0.010 in | 4.238ft |
| +0.60D+0.70E | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| Lr Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| L Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| S Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| W Only | 0.0000 in | 0.000ft | 0.017 in | 4.238ft |
| E Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |

Wood Column

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FP-7

Code References

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
 Load Combinations Used : IBC 2018

General Information

| | | | | | |
|---|-------------------------|-------------|------------|-----------------------------------|---|
| Analysis Method | Allowable Stress Design | | | Wood Section Name | 6x6 |
| End Fixities | Top & Bottom Pinned | | | Wood Grading/Manuf. | Graded Lumber |
| Overall Column Height | 8.42 ft | | | Wood Member Type | Sawn |
| <i>(Used for non-slender calculations)</i> | | | | | |
| Wood Species | Douglas Fir-Larch | | | Exact Width | 5.50 in |
| Wood Grade | No.2 | | | Exact Depth | 5.50 in |
| Fb + | 900.0 psi | Fv | 180.0 psi | Area | 30.250 in ² |
| Fb - | 900.0 psi | Ft | 575.0 psi | Ix | 76.255 in ⁴ |
| Fc - Prll | 1,350.0 psi | Density | 31.210 pcf | Iy | 76.255 in ⁴ |
| Fc - Perp | 625.0 psi | | | Allow Stress Modification Factors | |
| E : Modulus of Elasticity . . . | x-x Bending | y-y Bending | Axial | Cf or Cv for Bending 1.0 | |
| | Basic | 1,600.0 | 1,600.0 | 1,600.0 ksi | Cf or Cv for Compression 1.0 |
| | Minimum | 580.0 | 580.0 | | Cf or Cv for Tension 1.0 |
| | | | | | Cm : Wet Use Factor 1.0 |
| | | | | | Ct : Temperature Fact 1.0 |
| | | | | | Cfu : Flat Use Factor 1.0 |
| | | | | | Kf : Built-up columns 1.0 <i>NDS 15.3.2</i> |
| | | | | | Use Cr : Repetitive ? No |
| Brace condition for deflection (buckling) along columns : | | | | | |
| X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 8.42 ft. | | | | | |
| Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 8.42 ft. | | | | | |

Applied Loads

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

Column self weight included : 55.204 lbs * Dead Load Factor

AXIAL LOADS . . .

Axial Load at 8.420 ft, D = 1.881, Lr = 0.9290, L = 0.6430, S = 1.180, E = 2.690 k

BENDING LOADS . . .

Wind Components and Cladding: Lat. Uniform Load creating Mx-x, W = 0.0260 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.1355 : 1**
 Load Combination +D+0.750L+0.750S+0.5250E
 Governing NDS Formula Comp Only, fc/Fc'
 Location of max.above base 0.0 ft
 At maximum location values are .
 Applied Axial 4.716 k
 Applied Mx 0.0 k-ft
 Applied My 0.0 k-ft
 Fc : Allowable 1,150.46 psi

Maximum SERVICE Lateral Load Reactions . .
 Top along Y-Y 0.1095 k Bottom along Y-Y 0.1095 k
 Top along X-X 0.0 k Bottom along X-X 0.0 k

Maximum SERVICE Load Lateral Deflections . . .
 Along Y-Y 0.02436 in at 4.238 ft above base
 for load combination : W Only
 Along X-X 0.0 in at 0.0 ft above base
 for load combination : n/a

Other Factors used to calculate allowable stresses . . .
 Bending Compression Tension

PASS Maximum Shear Stress Ratio = **0.01131 : 1**
 Load Combination +D+0.60W
 Location of max.above base 8.420 ft
 Applied Design Shear 3.257 psi
 Allowable Shear 288.0 psi

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|--------------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| D Only | 0.900 | 0.740 | 0.07115 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+L | 1.000 | 0.706 | 0.08940 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+Lr | 1.250 | 0.627 | 0.08956 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+S | 1.150 | 0.657 | 0.1009 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.750Lr+0.750L | 1.250 | 0.627 | 0.09738 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.750L+0.750S | 1.150 | 0.657 | 0.1070 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.60W | 1.600 | 0.533 | 0.05565 | PASS | 4.182 ft | 0.01131 | PASS | 8.420 ft |
| +D+0.70E | 1.600 | 0.533 | 0.1097 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.750Lr+0.750L+0.450W | 1.600 | 0.533 | 0.08952 | PASS | 4.182 ft | 0.008481 | PASS | 8.420 ft |

Wood Column

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FP-7

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|--------------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| +D+0.750L+0.750S+0.450W | 1.600 | 0.533 | 0.09493 | PASS | 4.182 ft | 0.008481 | PASS | 8.420 ft |
| +D+0.750L+0.750S+0.5250E | 1.600 | 0.533 | 0.1355 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +0.60D+0.60W | 1.600 | 0.533 | 0.04382 | PASS | 4.238 ft | 0.01131 | PASS | 8.420 ft |
| +0.60D+0.70E | 1.600 | 0.533 | 0.08749 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |

Maximum Deflections for Load Combinations

| Load Combination | Max. X-X Deflection | Distance | Max. Y-Y Deflection | Distance |
|--------------------------|---------------------|----------|---------------------|----------|
| D Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+L | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+Lr | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+S | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.750Lr+0.750L | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.750L+0.750S | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.60W | 0.0000 in | 0.000ft | 0.015 in | 4.238 ft |
| +D+0.70E | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.750Lr+0.750L+0.450W | 0.0000 in | 0.000ft | 0.011 in | 4.238 ft |
| +D+0.750L+0.750S+0.450W | 0.0000 in | 0.000ft | 0.011 in | 4.238 ft |
| +D+0.750L+0.750S+0.5250E | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +0.60D+0.60W | 0.0000 in | 0.000ft | 0.015 in | 4.238 ft |
| +0.60D+0.70E | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| Lr Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| L Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| S Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| W Only | 0.0000 in | 0.000ft | 0.024 in | 4.238 ft |
| E Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |

Wood Column

Project File: Bickell Remodel.ec6

LIC#: KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FP-8

Code References

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
 Load Combinations Used : IBC 2018

General Information

| | | | |
|--|-------------------------|---------------------|---|
| Analysis Method | Allowable Stress Design | Wood Section Name | 4x4 |
| End Fixities | Top & Bottom Pinned | Wood Grading/Manuf. | Graded Lumber |
| Overall Column Height | 8.42 ft | Wood Member Type | Sawn |
| <i>(Used for non-slender calculations)</i> | | | |
| Wood Species | Douglas Fir-Larch | Exact Width | 3.50 in |
| Wood Grade | No.2 | Exact Depth | 3.50 in |
| Fb + | 900.0 psi | Fv | 180.0 psi |
| Fb - | 900.0 psi | Ft | 575.0 psi |
| Fc - Prll | 1,350.0 psi | Density | 31.210 pcf |
| Fc - Perp | 625.0 psi | | |
| E : Modulus of Elasticity . . . | x-x Bending | y-y Bending | Axial |
| | Basic | 1,600.0 | 1,600.0 |
| | Minimum | 580.0 | 580.0 |
| | | | 1,600.0 ksi |
| | | | Brace condition for deflection (buckling) along columns : |
| | | | X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 8.42 ft. |
| | | | Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 8.42 ft. |
| | | | Allow Stress Modification Factors |
| | | | Cf or Cv for Bending 1.50 |
| | | | Cf or Cv for Compression 1.150 |
| | | | Cf or Cv for Tension 1.50 |
| | | | Cm : Wet Use Factor 1.0 |
| | | | Ct : Temperature Fact 1.0 |
| | | | Cfu : Flat Use Factor 1.0 |
| | | | Kf : Built-up columns 1.0 <i>NDS 15.3.2</i> |
| | | | Use Cr : Repetitive ? No |

Applied Loads

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

Column self weight included : 22.355 lbs * Dead Load Factor

AXIAL LOADS . . .

Axial Load at 8.420 ft, D = 1.261, Lr = 1.678, S = 2.095 k

BENDING LOADS . . .

Wind Components and Cladding: Lat. Uniform Load creating Mx-x, W = 0.1030 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.7238 : 1**
 Load Combination +D+0.750S+0.450W
 Governing NDS Formula Comp + Mxx, NDS Eq. 3.9-3
 Location of max.above base 4.182 ft
 At maximum location values are .
 Applied Axial 2.855 k
 Applied Mx 0.4107 k-ft
 Applied My 0.0 k-ft
 Fc : Allowable 541.84 psi

Maximum SERVICE Lateral Load Reactions . .
 Top along Y-Y 0.4336 k Bottom along Y-Y 0.4336 k
 Top along X-X 0.0 k Bottom along X-X 0.0 k

Maximum SERVICE Load Lateral Deflections . . .
 Along Y-Y 0.5885 in at 4.238 ft above base
 for load combination : W Only
 Along X-X 0.0 in at 0.0 ft above base
 for load combination : n/a

Other Factors used to calculate allowable stresses . . .
 Bending Compression Tension

PASS Maximum Shear Stress Ratio = **0.1106 : 1**
 Load Combination +D+0.60W
 Location of max.above base 0.0 ft
 Applied Design Shear 31.859 psi
 Allowable Shear 288.0 psi

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|-------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| D Only | 0.900 | 0.367 | 0.2044 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+Lr | 1.250 | 0.274 | 0.4545 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+S | 1.150 | 0.296 | 0.5225 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.750Lr | 1.250 | 0.274 | 0.3901 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.750S | 1.150 | 0.296 | 0.4415 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |
| +D+0.60W | 1.600 | 0.218 | 0.5586 | PASS | 4.238 ft | 0.1106 | PASS | 0.0 ft |
| +D+0.750Lr+0.450W | 1.600 | 0.218 | 0.6477 | PASS | 4.182 ft | 0.08297 | PASS | 8.420 ft |
| +D+0.750S+0.450W | 1.600 | 0.218 | 0.7238 | PASS | 4.182 ft | 0.08297 | PASS | 8.420 ft |
| +0.60D+0.60W | 1.600 | 0.218 | 0.4918 | PASS | 4.238 ft | 0.1106 | PASS | 0.0 ft |

Project Title: Bickell Residence
 Engineer: Mark Speidel
 Project ID:
 Project Descr: Remodeling of existing SFR

Wood Column

Project File: Bickell Remodel.ec6

LIC# : KW-06016108, Build:20.22.7.25

I.L. GROSS STRUCTURAL ENGINEERS

(c) ENERCALC INC 1983-2022

DESCRIPTION: FP-8

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| +0.60D | 1.600 | 0.218 | 0.1160 | PASS | 0.0 ft | 0.0 | PASS | 8.420 ft |

Maximum Deflections for Load Combinations

| Load Combination | Max. X-X Deflection | Distance | Max. Y-Y Deflection | Distance |
|-------------------|---------------------|----------|---------------------|----------|
| D Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+Lr | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+S | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.750Lr | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.750S | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| +D+0.60W | 0.0000 in | 0.000ft | 0.353 in | 4.238 ft |
| +D+0.750Lr+0.450W | 0.0000 in | 0.000ft | 0.265 in | 4.238 ft |
| +D+0.750S+0.450W | 0.0000 in | 0.000ft | 0.265 in | 4.238 ft |
| +0.60D+0.60W | 0.0000 in | 0.000ft | 0.353 in | 4.238 ft |
| +0.60D | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| Lr Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| S Only | 0.0000 in | 0.000ft | 0.000 in | 0.000 ft |
| W Only | 0.0000 in | 0.000ft | 0.588 in | 4.238 ft |