MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350, San Diego, CA 92121 ▸ p 619-650-0010 ▸ *mulhernkulp.com*

CALCULATION PACKAGE

May 27, 2022

Architectural Innovations

3036 67TH Ave. SE

Mercer Island, Washington

MULHERN & KULP STRUCTURAL ENGINEERING, INC.

Prepared By:

Lillian G. Heng, P.E. *Project Engineer*

Nick J. Martignetti, P.E. *Associate Owner + San Diego Office Director*

Signature, Seal & Date

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

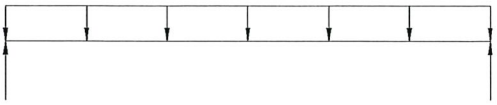
PROJECT NAME: 3036 67TH AVE. SE
ARCHITECTURAL INNOV
M&K PROJECT #: 203-22010
ENGINEER: LGH
DATE: 12-MAY-22

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: TYP. HEADER @ 2ND FLR — B1

PARAMETERS:

L = 5.0 FT
W = 0.483 KLF
P = N/A K



ANALYSIS:

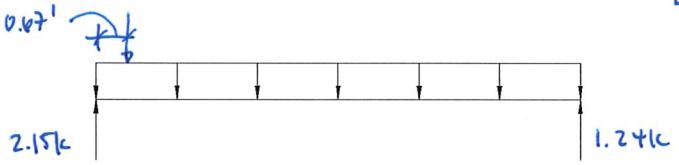
R_{MAX} =	1.207 K	V_D =		K	< V_{ALL} = 4.460 K	✓ ADEQUATE
M_{MAX} =	1.509 K-FT	< M_{ALL} =	5.166 K-FT			✓ ADEQUATE
Δ_{TL} =	0.018 IN.	L/	999+	< L/240		✓ ADEQUATE

DF-L NO.2 4x10 HDR

BEAM DESCRIPTION: HEADER @ 2ND FLR W/ P.L. — B2

PARAMETERS:

L = 6.0 FT
W = 0.371 KLF
P = 1.173 K



ANALYSIS:

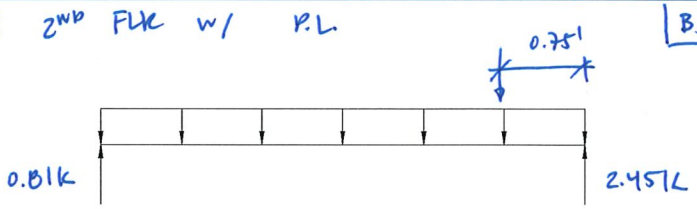
R_{MAX} =	2.15 K	V_D =		K	< V_{ALL} = 4.468 K	✓ ADEQUATE
M_{MAX} =	2.06 K-FT	< M_{ALL} =	5.166 K-FT			✓ ADEQUATE
Δ_{TL} =	0.037 IN.	L/	999+	< L/240		✓ ADEQUATE

DF-L NO.2 4x10 HDR

BEAM DESCRIPTION: HEADER @ 2ND FLR W/ P.L. — B3

PARAMETERS:

L = 4.0 FT
W = 0.158 KLF
P = 2.421 K



ANALYSIS:

R_{MAX} =	2.45 K	V_D =		K	< V_{ALL} = 4.460 K	✓ ADEQUATE
M_{MAX} =	4.086 K-FT	< M_{ALL} =	5.166 K-FT			✓ ADEQUATE
Δ_{TL} =	0.007 IN.	L/	999+	< L/240		✓ ADEQUATE

DF-L NO.2 4x10 HDR

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

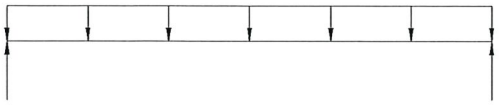
PROJECT NAME: 3036 67TH AVE. SE
ARCHITECTURAL INNOV
M&K PROJECT #: 203-22010
ENGINEER: LGH
DATE: 12-MAY-22

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: INTERIOR HDR @ 2ND FLR — B4

PARAMETERS:

L = 2.5 FT
W = 0.613 KLF
P = N/A K



ANALYSIS:

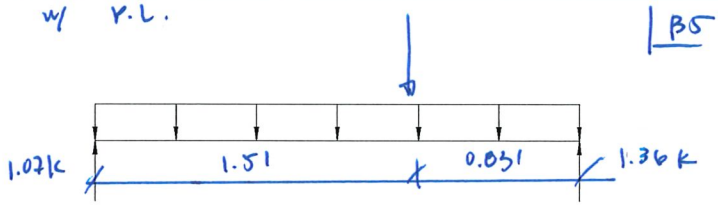
R_{MAX} =	0.766 K	V_D =	K	< V_{ALL} =	2.657 K	✓ ADEQUATE
M_{MAX} =	0.479 K-FT	< M_{ALL} =	1.979 K-FT			✓ ADEQUATE
Δ_{TL} =	0.007 IN.	L/	999+	< L/240		✓ ADEQUATE

DF-L NO.2 4x6 HDR

BEAM DESCRIPTION: INT. HEADER W/ P.L. — B5

PARAMETERS:

L = 2.33 FT
W = 0.613 KLF
P = 1.011 K



ANALYSIS:

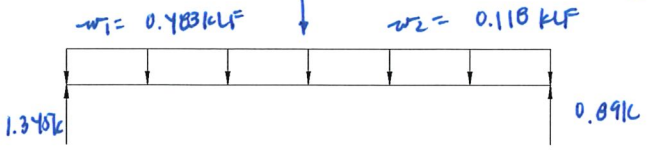
R_{MAX} =	1.36 K	V_D =	K	< V_{ALL} =	2.657 K	✓ ADEQUATE
M_{MAX} =	0.922 K-FT	< M_{ALL} =	1.979 K-FT			✓ ADEQUATE
Δ_{TL} =	0.009 IN.	L/	999+	< L/240		✓ ADEQUATE

DF-L NO.2 4x6 HDR

BEAM DESCRIPTION: EXT. HDR @ 2ND FLR W/ P.L. — B6

PARAMETERS:

L = 5.0 FT
W = VARIES KLF
P = 0.721 K



ANALYSIS:

R_{MAX} =	1.345 K	V_D =	K	< V_{ALL} =	4.460 K	ADEQUATE
M_{MAX} =	1.85 K-FT	< M_{ALL} =	5.146 K-FT			ADEQUATE
Δ_{TL} =	0.02 IN.	L/	999+	< L/240		ADEQUATE

DF-L NO.2 4x10 HDR

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

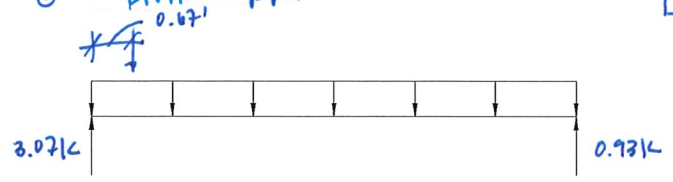
PROJECT NAME: 3036 67TH AVE. SE
ARCHITECTURAL INNOV
M&K PROJECT #: 203-22010
ENGINEER: LGH
DATE: 12-MAY-22

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: HEADER @ LIVING RM — B7

PARAMETERS:

L =	8.25	FT
W =	0.175	KLF
P =	2.553	K



ANALYSIS:

R_{MAX} =	3.07	K	V_D =		K	< V_{ALL} = 4.460 K	✓ ADEQUATE
M_{MAX} =	2.016	K-FT	< M_{ALL} =	5.166	K-FT		✓ ADEQUATE
Δ_{TL} =	0.05	IN.	L/	999+	< L/240		✓ ADEQUATE

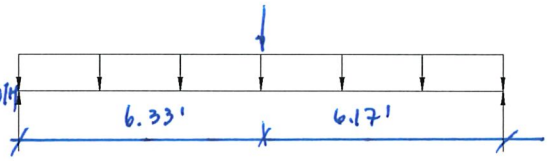
PF-L NO.2 4X10 HDK

BEAM DESCRIPTION: UPPER FLR FRMG - FLUSH BM NEAR ENTRY — B8

PARAMETERS:

L =	12.5	FT
W =	0.420	KLF
P =	VARIES	K

* SEE ENVELOPE OUTPUTS FOR HD & OVERSTRENGTH



ANALYSIS:

R_{MAX} =	2.625	K	V_D =		K	< V_{ALL} = 12.0 K	✓ ADEQUATE
M_{MAX} =	8.2	K-FT	< M_{ALL} =	43.97	K-FT		✓ ADEQUATE
Δ_{TL} =	0.098	IN.	L/	999+	< L/240		✓ ADEQUATE

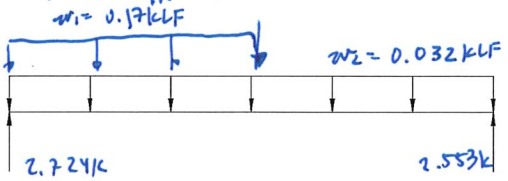
PF-DF 24F-V4 3½" X 10" GLB

BEAM DESCRIPTION: UPPER FLR FRMG - FLUSH BM IN ROOF NEAR ENTRY — B9

PARAMETERS:

L =	6.17	FT
W =	VARIES	KLF
P =	VARIES	K

* SEE ENVELOPE OUTPUTS FOR HD & OVERSTRENGTH



ANALYSIS:

R_{MAX} =	2.724	K	V_D =		K	< V_{ALL} = 19.15 K	✓ ADEQUATE
M_{MAX} =	7.16	K-FT	< M_{ALL} =	65.52	K-FT		✓ ADEQUATE
Δ_{TL} =	0.012	IN.	L/	999+	< L/240		✓ ADEQUATE

TJ MICRO LLAM 2.0E (2) 1¾" X 10" LVL

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

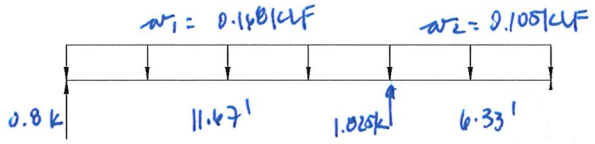
PROJECT NAME: 3036 67TH AVE. SE
ARCHITECTURAL INNOV
M&K PROJECT #: 203-22010
ENGINEER: LGH
DATE: 12-MAY-22

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: CANT'D FLUSH BEAM @ ENTRY ROOF — B10

PARAMETERS:

L = VARIES FT
W = VARIES KLF
P = N/A K



ANALYSIS:

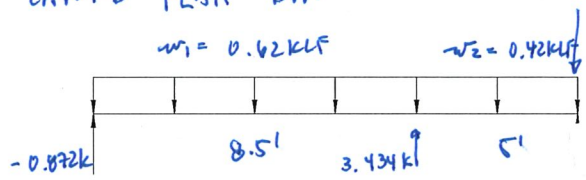
R_{MAX} =	1.825 K	V_D =		K	< V_{ALL} = 3.502 K	✓ ADEQUATE
M_{MAX} =	-2.10 K-FT	< M_{ALL} =	3.438 K-FT			✓ ADEQUATE
Δ_{TL} =	0.225 IN. @ CANT'D	L/	621	< L/240		✓ ADEQUATE

DF-L NO. 2 4x8

BEAM DESCRIPTION: UPPER FLR FRMG - CANT'D FLUSH BM — B11

PARAMETERS:

L = VARIES FT
W = VARIES KLF
P = 1.825 K



ANALYSIS:

R_{MAX} =	3.434 K	V_D =		K	< V_{ALL} = 13.41 K	✓ ADEQUATE
M_{MAX} =	-9.65 K-FT	< M_{ALL} =	23.402 K-FT			✓ ADEQUATE
Δ_{TL} =	0.252 IN. @ CANT'D	L/	476	< L/240		✓ ADEQUATE

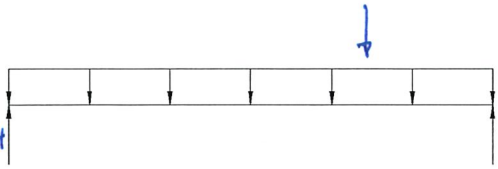
DF-DF 24F-V4 5 1/2" x 12" GLB

BEAM DESCRIPTION: UPPER FLR FRMG - FLUSH BM BELOW HD — B12

PARAMETERS:

L = 4.67 FT
W = 0.073 KLF
P = VARIES K

* SEE EVERALL OUTPUT FOR HD'S & OVERSTRENGTH



ANALYSIS:

R_{MAX} =	1.306 K	V_D =		K	< V_{ALL} = 17.81 K	✓ ADEQUATE
M_{MAX} =	1.39 K-FT	< M_{ALL} =	60.48 K-FT			✓ ADEQUATE
Δ_{TL} =	0.001 IN.	L/	9991	< L/240		✓ ADEQUATE

DF-DF 24F-V4 3 1/2" x 18" GLB

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

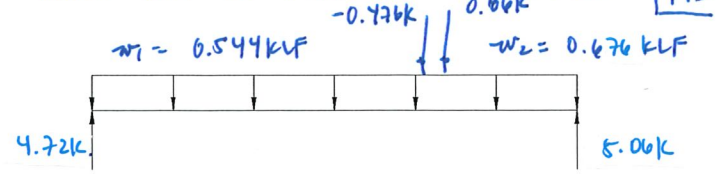
PROJECT NAME: 3036 67TH AVE. SE
ARCHITECTURAL INNOV
M&K PROJECT #: 203-22010
ENGINEER: LGH
DATE: 12-MAY-22

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: UPPER FLR FRMG - FLUSH BM @ OPEN TO ABOVE AREA (B13)

PARAMETERS:

L =	16.33	FT
W =	VARIES	KLF
P =	VARIES	K



ANALYSIS:

R_{MAX} =	5.04 K	V_D =	K	< V_{ALL} =	12.8 K	✓ ADEQUATE
M_{MAX} =	18.8 K-FT	< M_{ALL} =	43.47 K-FT			✓ ADEQUATE
Δ_{TL} =	0.298 IN.	L/	656	< L/240		✓ ADEQUATE

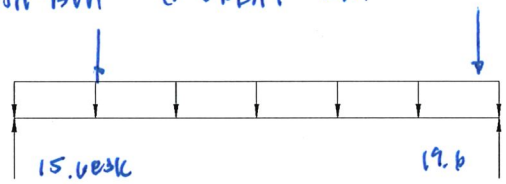
DF-DF 24F-V4 3½" x 18" GLB

BEAM DESCRIPTION: UPPER FLR FRMG - FLUSH BM @ GREAT RM (B14)

PARAMETERS:

L =	18.5	FT
W =	1.56	KLF
P =	VARIES	K

* SEE ENERCALC OUTPUT FOR HDR OVERSTRENGTH



ANALYSIS:

R_{MAX} =	19.6 K	V_D =	K	< V_{ALL} =	20.405 K	✓ ADEQUATE
M_{MAX} =	67.57 K-FT	< M_{ALL} =	76.80 K-FT			✓ ADEQUATE
Δ_{TL} =	0.596 IN.	L/	372	< L/240		✓ ADEQUATE

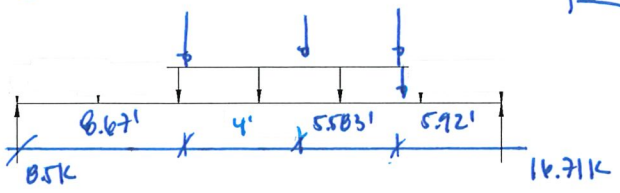
DF-DF 24F-V4 5½"x 21" GLB

BEAM DESCRIPTION: UPPER FLR FRMG - STEEL BM @ GREAT RM (B15)

PARAMETERS:

L =	24.17	FT
W =	0.161	KLF
P =	VARIES	K

* SEE ENERCALC OUTPUT FOR HDR OVERSTRENGTH



ANALYSIS:

R_{MAX} =	16.71 K	V_D =	K	< V_{ALL} =	111.09 K	✓ ADEQUATE
M_{MAX} =	102.3 K-FT	< M_{ALL} =	205.34 K-FT			✓ ADEQUATE
Δ_{TL} =	0.573 IN.	L/	506	< L/240		✓ ADEQUATE

W16X45 STEEL BM

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

PROJECT NAME: 3036 67TH AVE. SE
ARCHITECTURAL INNOV
M&K PROJECT #: 203-22010
ENGINEER: LGH
DATE: 12-MAY-22

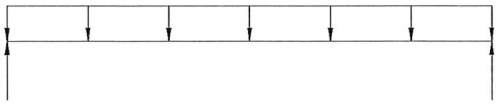
BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: WINDOW HDR @ GREAT RM

B16

PARAMETERS:

L = 15.75 FT
W = 0.675 KLF
P = N/A K



ANALYSIS:

R_{MAX} =	5.32 K	V_D =		K	< V_{ALL} =	15.085 K	✓ ADEQUATE
M_{MAX} =	21 K-FT	< M_{ALL} =	38.42 K-FT				✓ ADEQUATE
Δ_{TL} =	0.46 IN.	L/	410	< L/240			✓ ADEQUATE

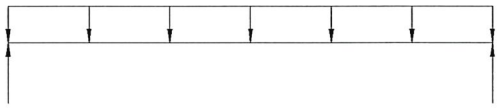
DF-DF 24F-V4 5½" X 13½" GLB

BEAM DESCRIPTION: SLIDER HDR @ DINING

B17

PARAMETERS:

L = 12.0 FT
W = 0.084 KLF
P = N/A K



ANALYSIS:

R_{MAX} =	0.504 K	V_D =		K	< V_{ALL} =	4.460 K	✓ ADEQUATE
M_{MAX} =	1.512 K-FT	< M_{ALL} =	5.166 K-FT				✓ ADEQUATE
Δ_{TL} =	0.106 IN.	L/	999+	< L/240			✓ ADEQUATE

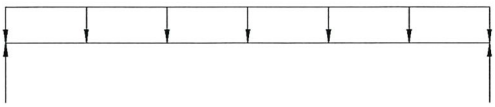
DF-L NO.2 4X10 HDR

BEAM DESCRIPTION: DROPPED BM @ LOWER DECK

B18

PARAMETERS:

L = 13.67 FT
W = 0.203 KLF
P = N/A K



ANALYSIS:

R_{MAX} =	1.39 K	V_D =		K	< V_{ALL} =	8.244 K	✓ ADEQUATE
M_{MAX} =	4.74 K-FT	< M_{ALL} =	10.166 K-FT				✓ ADEQUATE
Δ_{TL} =	0.176 IN.	L/	932	< L/240			✓ ADEQUATE

DF-L NO.2 6X12

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

PROJECT NAME: 3036 67TH AVE. SE
ARCHITECTURAL INNOV
M&K PROJECT #: 203-22010
ENGINEER: LGH
DATE: 12-MAY-22

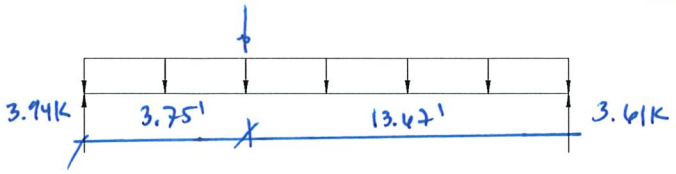
BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: DROPPED BEAM @ LOWER DECK

B19

PARAMETERS:

L =	17.42	FT
W =	0.400	KLF
P =	0.578	K



ANALYSIS:

R_{MAX} =	3.94	K	V_D =		K	< V_{ALL} = 13.4 K	✓ ADEQUATE
M_{MAX} =	16.3	K-FT	< M_{ALL} =	30.36	K-FT		✓ ADEQUATE
Δ_{TL} =	0.58	IN.	L/	359	< L/240		✓ ADEQUATE

DF-DF 24F-V4 5½" X 12" GLB

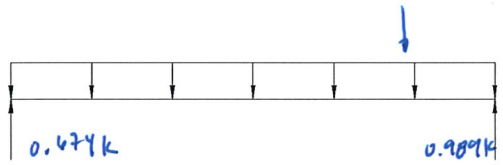
BEAM DESCRIPTION: MAIN FLR FRMG - FLUSH BM ABOVE GARAGE

B20

PARAMETERS:

L =	23.083	FT
W =	0.037	KLF
P =	VARIES	K

* SEE ENVELOPE FOR HD & OVERSTRENGTH OUTPUTS



ANALYSIS:

R_{MAX} =	0.989	K	V_D =		K	< V_{ALL} = 17.8 K	✓ ADEQUATE
M_{MAX} =	8.49	K-FT	< M_{ALL} =	46.07	K-FT		✓ ADEQUATE
Δ_{TL} =	0.214	IN.	L/	777	< L/240		✓ ADEQUATE

DF-DF 24F-V4 3½" X 18" GLB

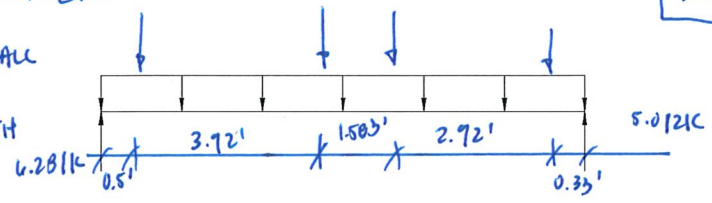
BEAM DESCRIPTION: GARAGE HEADER

B21

PARAMETERS:

L =	9.25	FT
W =	0.895	KLF
P =	VARIES	K

* SEE ENVELOPE FOR HD & OVERSTRENGTH OUTPUTS



ANALYSIS:

R_{MAX} =	6.281	K	V_D =		K	< V_{ALL} = 7.42 K	✓ ADEQUATE
M_{MAX} =	10.07	K-FT	< M_{ALL} =	16.8	K-FT		✓ ADEQUATE
Δ_{TL} =	0.208	IN.	L/	519	< L/240		✓ ADEQUATE

DF-DF 24F-V4 3½" X 12" GLB

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

PROJECT NAME: 3036 67TH AVE. SE
ARCHITECTURAL INNOV
M&K PROJECT #: 203-22010
ENGINEER: LGH
DATE: 12-MAY-22

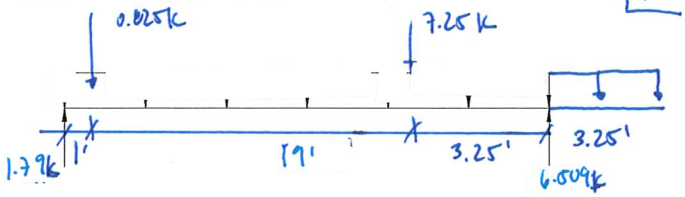
BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: MAIN FLR FRMG - CANT'D FLUSH BM

B22

PARAMETERS:

L =	23.25	FT
W =	0.07	KLF
P =	VARIES	K



ANALYSIS:

R_{MAX} =	6.51	K	V_D =		K	< V_{ALL} = 11.13 K	✓ ADEQUATE
M_{MAX} =	20.04	K-FT	< M_{ALL} =	37.33	K-FT		✓ ADEQUATE
Δ_{TL} =	0.539	IN.	L/	517	< L/240		✓ ADEQUATE

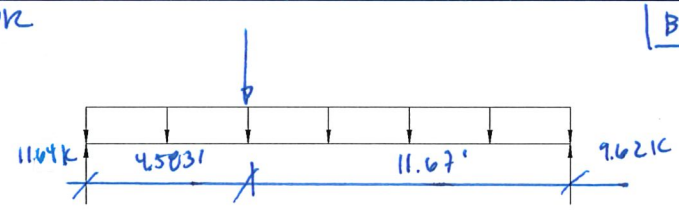
DF-DF 24F-V4 3½" X 18" GLB

BEAM DESCRIPTION: GARAGE HDR

B23

PARAMETERS:

L =	16.25	FT
W =	VARIES	KLF
P =	6.51	K



ANALYSIS:

R_{MAX} =	11.64	K	V_D =		K	< V_{ALL} = 17.49 K	✓ ADEQUATE
M_{MAX} =	44.94	K-FT	< M_{ALL} =	50.11	K-FT		✓ ADEQUATE
Δ_{TL} =	0.474	IN.	L/	411	< L/240		✓ ADEQUATE

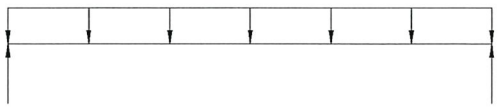
DF-DF 24F-V4 5½" X 18" GLB

BEAM DESCRIPTION: MAIN FRMG - FLUSH BM @ ENTRY WINDOW BTM

B24

PARAMETERS:

L =	5.17	FT
W =	0.106	KLF
P =	N/A	K



ANALYSIS:

R_{MAX} =	0.273	K	V_D =		K	< V_{ALL} = 3.085 K	✓ ADEQUATE
M_{MAX} =	0.353	K-FT	< M_{ALL} =	4.492	K-FT		✓ ADEQUATE
Δ_{TL} =	0.005	IN.	L/	9994	< L/240		✓ ADEQUATE

DF-L NO.2 4X10

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

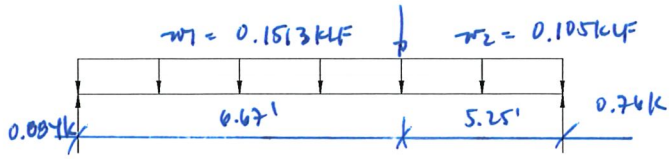
PROJECT NAME: 3036 67TH AVE. SE
ARCHITECTURAL INNOV
M&K PROJECT #: 203-22010
ENGINEER: LGH
DATE: 12-MAY-22

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: MAIN FLR FRMG - FLUSH BM @ OPEN TO ABOVE — B25

PARAMETERS:

L =	11.72	FT
W =	VARIES	KLF
P =	0.08	K



ANALYSIS:

R_{MAX} =	0.804 K	V_D =		K	< V_{ALL} = 11.13 K	✓ ADEQUATE
M_{MAX} =	2.58 K-FT	< M_{ALL} =	37.9	K-FT		✓ ADEQUATE
Δ_{TL} =	0.021 IN.	L/	999+	< L/240		✓ ADEQUATE

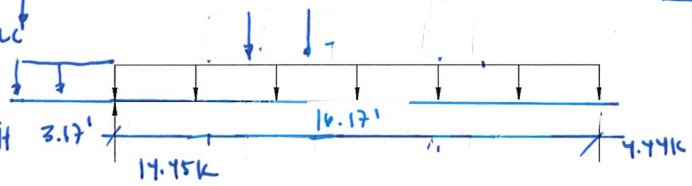
DF-DF 24F-V4 3½"X 18" GLBS

BEAM DESCRIPTION: MAIN FLR FRMG - CANT'D FLUSH BM @ OPEN TO ABOVE — B26

PARAMETERS:

L =	16.17	FT
W =	0.19	KLF
P =	VARIES	K

* SEE ENVELOPE OUTPUT FOR HDS OVERSTRENGTH



ANALYSIS:

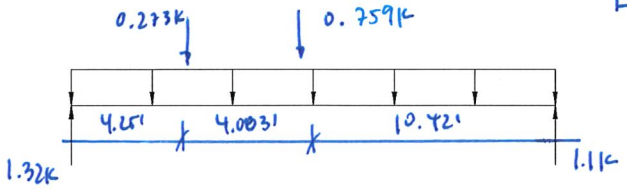
R_{MAX} =	14.45 K	V_D =		K	< V_{ALL} = 11.13 K	✓ ADEQUATE
M_{MAX} =	31.54 K-FT	< M_{ALL} =	43.47	K-FT		✓ ADEQUATE
Δ_{TL} =	0.493 IN.	L/	393	< L/240		✓ ADEQUATE

DF-DF 24F-V4 3½" X 18" GLBS

BEAM DESCRIPTION: MAIN FLR FRMG - FLUSH BM @ OPEN TO ABOVE — B27

PARAMETERS:

L =	18.75	FT
W =	0.0732	KLF
P =	VARIES	K



ANALYSIS:

R_{MAX} =	1.32 K	V_D =		K	< V_{ALL} = 11.13 K	✓ ADEQUATE
M_{MAX} =	7.33 K-FT	< M_{ALL} =	37.8	K-FT		✓ ADEQUATE
Δ_{TL} =	0.139 IN.	L/	999+	< L/240		✓ ADEQUATE

DF-DF 24F-V4 3½" X 18" GLBS

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

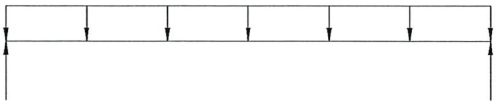
PROJECT NAME: 3036 67TH AVE. SE
ARCHITECTURAL INNOV
M&K PROJECT #: 203-22010
ENGINEER: LGH
DATE: 12-MAY-22

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: TYP. HDR @ BASEMENT LEVEL — B20

PARAMETERS:

L = 5.0 FT
W = 0.625 KLF
P = N/A K



ANALYSIS:

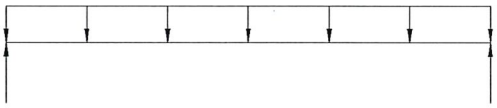
R_{MAX} =	1.562 K	V_D =		K	< V_{ALL} =	4.460 K	✓ ADEQUATE
M_{MAX} =	1.95 K-FT	< M_{ALL} =	5.166 K-FT				✓ ADEQUATE
Δ_{TL} =	0.024 IN.	L/	999+	< L/240			✓ ADEQUATE

DF-L NO.2 4x10 HDR

BEAM DESCRIPTION: INTERIOR HDR @ BASEMENT — B29

PARAMETERS:

L = 3.0 FT
W = 0.88 KLF
P = N/A K



ANALYSIS:

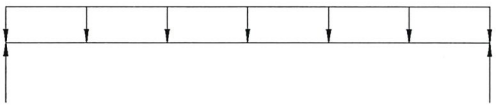
R_{MAX} =	1.32 K	V_D =		K	< V_{ALL} =	3.045 K	✓ ADEQUATE
M_{MAX} =	0.99 K-FT	< M_{ALL} =	2.989 K-FT				✓ ADEQUATE
Δ_{TL} =	0.009 IN.	L/	999+	< L/240			✓ ADEQUATE

DF-L 4X8 HDR

BEAM DESCRIPTION: TYP. HDR @ MAIN FLOOR — B30

PARAMETERS:

L = 6.0 FT
W = 0.896 KLF
P = N/A K



ANALYSIS:

R_{MAX} =	2.69 K	V_D =		K	< V_{ALL} =	4.460 K	✓ ADEQUATE
M_{MAX} =	4.03 K-FT	< M_{ALL} =	5.166 K-FT				✓ ADEQUATE
Δ_{TL} =	0.07 IN.	L/	999+	< L/240			✓ ADEQUATE

DF-L NO.2 4x10 HDR

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

PROJECT NAME: 3036 67TH AVE. SE
ARCHITECTURAL INNOV
M&K PROJECT #: 203-22010
ENGINEER: LGH
DATE: 12-MAY-22

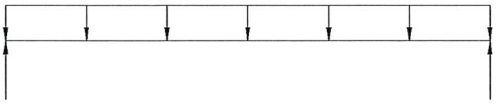
BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: UPPER FLR FRMG - FLUSH BTM BM @ LAUNDRY

B31

PARAMETERS:

L = 3.58 FT
W = 1.24 KLF
P = N/A K



ANALYSIS:

R_{MAX} =	2.22 K	V_D =		K	< V_{ALL} =	4.466 K	✓ ADEQUATE
M_{MAX} =	2.0 K-FT	< M_{ALL} =	5.166 K-FT				✓ ADEQUATE
Δ_{TL} =	0.012 IN.	L/	999+	< L/240			✓ ADEQUATE

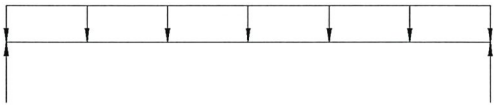
DF-L NO.2 4x10

BEAM DESCRIPTION: UPPER FLR FRMG - FLUSH BTM BM @ SLIDER

B32

PARAMETERS:

L = 6.0 FT
W = 0.954 KLF
P = N/A K



ANALYSIS:

R_{MAX} =	2.88 K	V_D =		K	< V_{ALL} =	4.466 K	✓ ADEQUATE
M_{MAX} =	4.29 K-FT	< M_{ALL} =	5.166 K-FT				✓ ADEQUATE
Δ_{TL} =	0.05 IN.	L/	999+	< L/240			✓ ADEQUATE

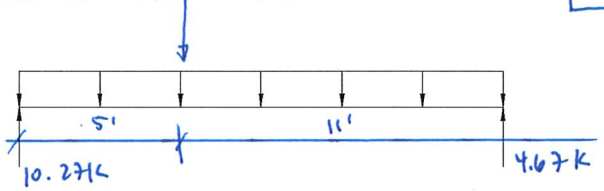
DF-L NO.2 4x10

BEAM DESCRIPTION: MAIN FLR FRMG - FLUSH BM BELOW B.A.

B33

PARAMETERS:

L = 16 FT
W = N/A KLF
P = 14.93 K



ANALYSIS:

R_{MAX} =	10.27 K	V_D =		K	< V_{ALL} =	17.49 K	✓ ADEQUATE
M_{MAX} =	51.23 K-FT	< M_{ALL} =	57.4 K-FT				✓ ADEQUATE
Δ_{TL} =	0.435 IN.	L/	441	< L/240			✓ ADEQUATE

DF-DF 24F-V4 5½" x 18" GLB

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

PROJECT NAME: 3036 67TH AVE. SE
ARCHITECTURAL INNOV
M&K PROJECT #: 203-22010
ENGINEER: LGH
DATE: 12-MAY-22

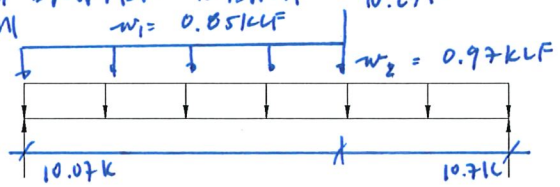
BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: MAIN FLR FRMG - 1 DROPPED BEAM B34

B34

PARAMETERS:

L = 7.083 FT
W = VARIES KLF
P = 10.27 K



ANALYSIS:

R_{MAX} =	10.71K	V_D =		< V_{ALL} =	11.13 K	✓ ADEQUATE
M_{MAX} =	26.34 K-FT	< M_{ALL} =	37.8 K-FT			✓ ADEQUATE
Δ_{TL} =	0.073 IN.	L/	999+	< L/240		✓ ADEQUATE

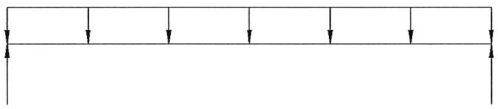
DF-DF 24F-V4 3½" x 18" GLB

BEAM DESCRIPTION: INTERIOR HDR @ BASEMENT

B35

PARAMETERS:

L = 3.25 FT
W = 0.965 KLF
P = N/A K



ANALYSIS:

R_{MAX} =	1.57 K	V_D =		< V_{ALL} =	3.805 K	✓ ADEQUATE
M_{MAX} =	1.274 K-FT	< M_{ALL} =	4.492 K-FT			✓ ADEQUATE
Δ_{TL} =	0.004 IN.	L/	999+	< L/240		✓ ADEQUATE

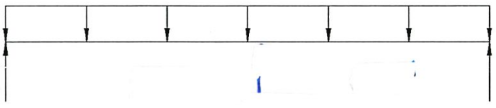
DF-L NO.2 4x8

BEAM DESCRIPTION: MAIN FLR FRMG - DECK FLUSH BM

B36

PARAMETERS:

L = 17.17 FT
W = 0.250 KLF
P = N/A K



ANALYSIS:

R_{MAX} =	2.15 K	V_D =		< V_{ALL} =	7.42 K	✓ ADEQUATE
M_{MAX} =	9.21 K-FT	< M_{ALL} =	12.95 K-FT			✓ ADEQUATE
Δ_{TL} =	0.54 IN.	L/	382	< L/240		✓ ADEQUATE

DF-DF 24F-V4 3½" x 12" GLB

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

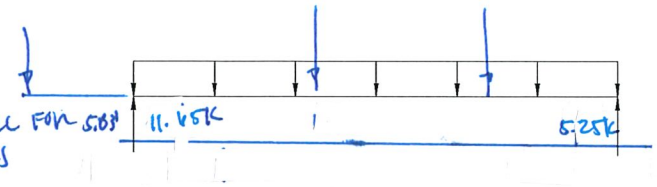
PROJECT NAME: 3036 67TH AVE. SE
ARCHITECTURAL INNOV
M&K PROJECT #: 203-22010
ENGINEER: LGH
DATE: 12-MAY-22

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: MAIN FLR FRMG - CANT'D STEEL FLUSH BTM BM — B37

PARAMETERS:

L = VARIES FT
W = 0.656 KLF
P = VARIES K



ANALYSIS:

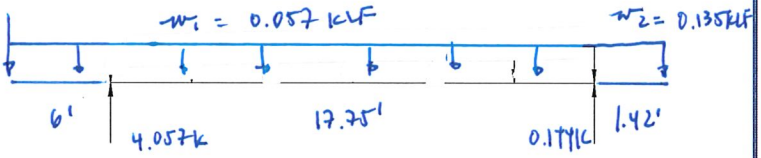
R_{MAX} =	7.09 K	V_D =	K	< V_{ALL} =	70.7 K	✓ ADEQUATE
M_{MAX} =	32.036 K-FT	< M_{ALL} =	136.98 K-FT			✓ ADEQUATE
Δ_{TL} =	0.229 IN.	L/	611	< L/240		✓ ADEQUATE

W10 X 45 STEEL BEAM

BEAM DESCRIPTION: MAIN FLR FRMG - EDGE BEAM @ DECK — B38

PARAMETERS:

L = VARIES FT
W = VARIES KLF
P = 2.15 K



ANALYSIS:

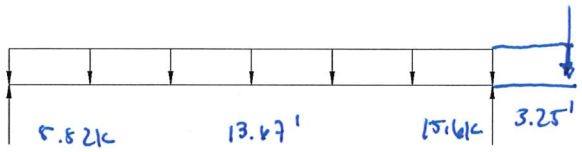
R_{MAX} =	4.057 K	V_D =	K	< V_{ALL} =	17.49 K	✓ ADEQUATE
M_{MAX} =	-14.25 K-FT	< M_{ALL} =	20.1 K-FT			✓ ADEQUATE
Δ_{TL} =	0.355 IN.	L/	404	< L/240		✓ ADEQUATE

DF-DF 24F-V4 5½" X 15" GLB

BEAM DESCRIPTION: MAIN FLR FRMG - INTERIOR BEAM @ DECK — B39

PARAMETERS:

L = VARIES FT
W = 0.992 KLF
P = 4.057 K



ANALYSIS:

R_{MAX} =	15.6 K	V_D =	7.23 K	< V_{ALL} =	11.66 K	✓ ADEQUATE
M_{MAX} =	-18.50 K-FT	< M_{ALL} =	20.35 K-FT			✓ ADEQUATE
Δ_{TL} =	0.3 IN.	L/	540	< L/240		✓ ADEQUATE

DF-DF 24F-V4 5½" X 12" GLB

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

PROJECT NAME: 3036 67TH AVE. SE
ARCHITECTURAL INNOV
M&K PROJECT #: 203-22010
ENGINEER: LGH
DATE: 12-MAY-22

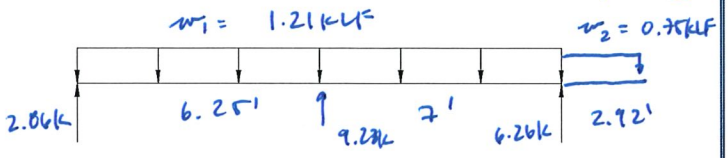
BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: MAIN FLR FRMG - FLUSH BTM BM @ DECK

B40

PARAMETERS:

L =	VARIES	FT
W =	VARIES	KLF
P =	0.144	K



ANALYSIS:

R_{MAX} =	9.23	K	V_D =		K	< V_{ALL} = 11.13 K	✓ ADEQUATE
M_{MAX} =	-5.74	K-FT	< M_{ALL} =	37.8	K-FT		✓ ADEQUATE
Δ_{TL} =	0.020	IN.	L/	999+	< L/240		✓ ADEQUATE

DF-DF 24F-V4 3 1/2" x 18" GLB

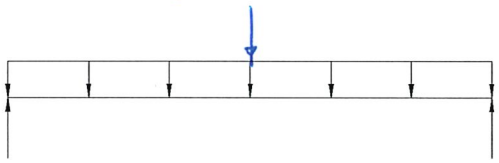
BEAM DESCRIPTION: UPPER FLR FRMG - HDR w/ HD

B41

PARAMETERS:

L =	2.5	FT
W =	0.767	KLF
P =	0.143	K

* SEE ENERCALC OUTPUT FOR HD



ANALYSIS:

R_{MAX} =	0.996	K	V_D =		K	< V_{ALL} = 4.468 K	✓ ADEQUATE
M_{MAX} =	0.65	K-FT	< M_{ALL} =	5.166	K-FT		✓ ADEQUATE
Δ_{TL} =	0.002	IN.	L/	999+	< L/240		✓ ADEQUATE

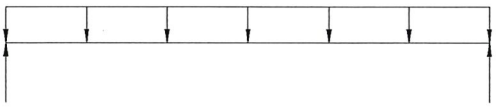
DF-L NO.2 4X10

BEAM DESCRIPTION: STAIR HDR

B42

PARAMETERS:

L =	5.33	FT
W =	0.423	KLF
P =	N/A	K



ANALYSIS:

R_{MAX} =	1.13	K	V_D =		K	< V_{ALL} = 4.21 K	✓ ADEQUATE
M_{MAX} =	1.504	K-FT	< M_{ALL} =	4.39	K-FT		✓ ADEQUATE
Δ_{TL} =	0.08	IN.	L/	806	< L/240		✓ ADEQUATE

TJ MICRO LAM 2.0E (2) 1 3/4" X 5 1/2" LVL

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B8 w/ HD's

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

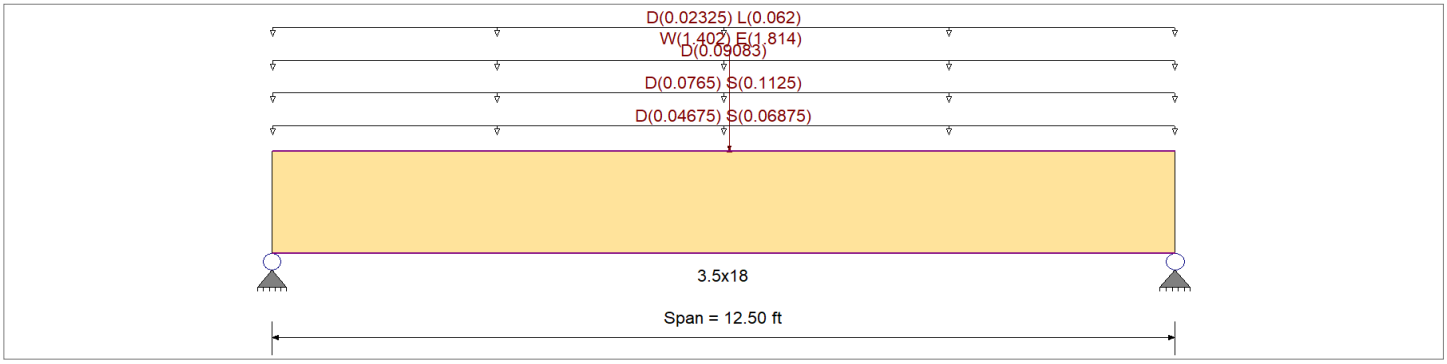
Wood Species : DF/DF
Wood Grade : 24F-V4

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

Fb +	2,400.0 psi
Fb -	1,850.0 psi
Fc - Prll	1,650.0 psi
Fc - Perp	650.0 psi
Fv	265.0 psi
Ft	1,100.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	1,600.0 ksi
Eminbend - yy	850.0 ksi
Density	31.210 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0170, S = 0.0250 ksf, Tributary Width = 2.750 ft, (Lower Roof)
Uniform Load : D = 0.0170, S = 0.0250 ksf, Tributary Width = 4.50 ft, (Roof)
Uniform Load : D = 0.010 ksf, Tributary Width = 9.083 ft, (Wall)
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 1.550 ft, (Floor)
Point Load : W = 1.402, E = 1.814 k @ 6.330 ft, (HD)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.189 : 1	Maximum Shear Stress Ratio	=	0.157 : 1
Section used for this span		3.5x18	Section used for this span		3.5x18
fb: Actual	=	520.55 psi	fv: Actual	=	47.87 psi
Fb: Allowable	=	2,760.00 psi	Fv: Allowable	=	304.75 psi
Load Combination		+D+0.750L+0.750S	Load Combination		+D+0.750L+0.750S
Location of maximum on span	=	6.250 ft	Location of maximum on span	=	11.040 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.042 in	Ratio =	3582 >=360	Span: 1 : E Only
Max Upward Transient Deflection	-0.042 in	Ratio =	3582 >=360	Span: 1 : E Only * -1.0
Max Downward Total Deflection	0.098 in	Ratio =	1534 >=180	Span: 1 : +D+0.750L+0.750S+0.5250E
Max Upward Total Deflection	-0.004 in	Ratio =	41464 >=180	Span: 1 : +0.60D-0.70E

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
Length = 12.50 ft	1	0.136	0.113	0.90	1.000	1.00	1.00	1.00	1.00	1.00	4.64	294.31	2160.00	1.14	27.07	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 = 12.50 ft	1	0.155	0.129	1.00	1.000	1.00	1.00	1.00	1.00	1.00	5.85	371.19	2400.00	1.43	34.14	265.00
+D+S					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	1	0.188	0.157	1.15	1.000	1.00	1.00	1.00	1.00	1.00	8.18	519.07	2760.00	2.01	47.74	304.75
+D+0.750L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	1	0.117	0.098	1.25	1.000	1.00	1.00	1.00	1.00	1.00	5.54	351.97	3000.00	1.36	32.37	331.25
+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

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B8 w/ HD's

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
Length = 12.50 ft	1	0.189	0.157	1.15	1.000	1.00	1.00	1.00	1.00	1.00	8.20	520.55	2760.00	2.01	47.87	304.75
+D+0.60W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	1	0.120	0.088	1.60	1.000	1.00	1.00	1.00	1.00	1.00	7.26	460.82	3840.00	1.56	37.21	424.00
+D-0.60W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	1	0.040	0.041	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.40	152.60	3840.00	0.72	17.18	424.00
+D+0.750L+0.450W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	1	0.124	0.094	1.60	1.000	1.00	1.00	1.00	1.00	1.00	7.51	476.83	3840.00	1.68	39.98	424.00
+D+0.750L-0.450W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	1	0.062	0.059	1.60	1.000	1.00	1.00	1.00	1.00	1.00	3.77	239.24	3840.00	1.05	24.96	424.00
+D+0.750L+0.750S+0.450W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	1	0.168	0.131	1.60	1.000	1.00	1.00	1.00	1.00	1.00	10.16	645.36	3840.00	2.33	55.48	424.00
+D+0.750L+0.750S-0.450W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	1	0.105	0.095	1.60	1.000	1.00	1.00	1.00	1.00	1.00	6.37	404.30	3840.00	1.70	40.46	424.00
+0.60D+0.60W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	1	0.089	0.062	1.60	1.000	1.00	1.00	1.00	1.00	1.00	5.40	343.12	3840.00	1.11	26.38	424.00
+0.60D-0.60W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	1	0.013	0.024	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.79	50.25	3840.00	0.42	10.04	424.00
+D+0.70E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	1	0.142	0.100	1.60	1.000	1.00	1.00	1.00	1.00	1.00	8.59	545.69	3840.00	1.78	42.38	424.00
+D-0.70E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	1	0.026	0.036	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.55	98.14	3840.00	0.64	15.18	424.00
+D+0.750L+0.750S+0.5250E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	1	0.185	0.140	1.60	1.000	1.00	1.00	1.00	1.00	1.00	11.17	709.02	3840.00	2.49	59.36	424.00
+D+0.750L+0.750S-0.5250E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	1	0.091	0.087	1.60	1.000	1.00	1.00	1.00	1.00	1.00	5.52	350.71	3840.00	1.54	36.68	424.00
+0.60D+0.70E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	1	0.111	0.074	1.60	1.000	1.00	1.00	1.00	1.00	1.00	6.74	427.99	3840.00	1.33	31.55	424.00
+0.60D-0.70E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	1	0.025	0.036	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.18	74.90	2960.00	0.63	15.08	424.00

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	0.0977	6.296		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	3.094	3.106
Overall MINimum	-0.895	-0.919
D Only	1.483	1.483
+D+L	1.871	1.871
+D+S	2.616	2.616
+D+0.750L	1.774	1.774
+D+0.750L+0.750S	2.624	2.624
+D+0.60W	1.899	1.909
+D-0.60W	1.068	1.057
+D+0.750L+0.450W	2.085	2.093
+D+0.750L-0.450W	1.463	1.454
+D+0.750L+0.750S+0.450W	2.935	2.943
+D+0.750L+0.750S-0.450W	2.312	2.304
+0.60D+0.60W	1.305	1.316
+0.60D-0.60W	0.475	0.464
+D+0.70E	2.110	2.126
+D-0.70E	0.857	0.840
+D+0.750L+0.750S+0.5250E	3.094	3.106
+D+0.750L+0.750S-0.5250E	2.153	2.141
+0.60D+0.70E	1.517	1.533
+0.60D-0.70E	0.263	0.247
L Only	0.388	0.388
S Only	1.133	1.133

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B8 w/ HD's

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
W Only	0.692	0.710
-W	-0.692	-0.710
E Only	0.895	0.919
E Only * -1.0	-0.895	-0.919

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B8 w/ Overstrength

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

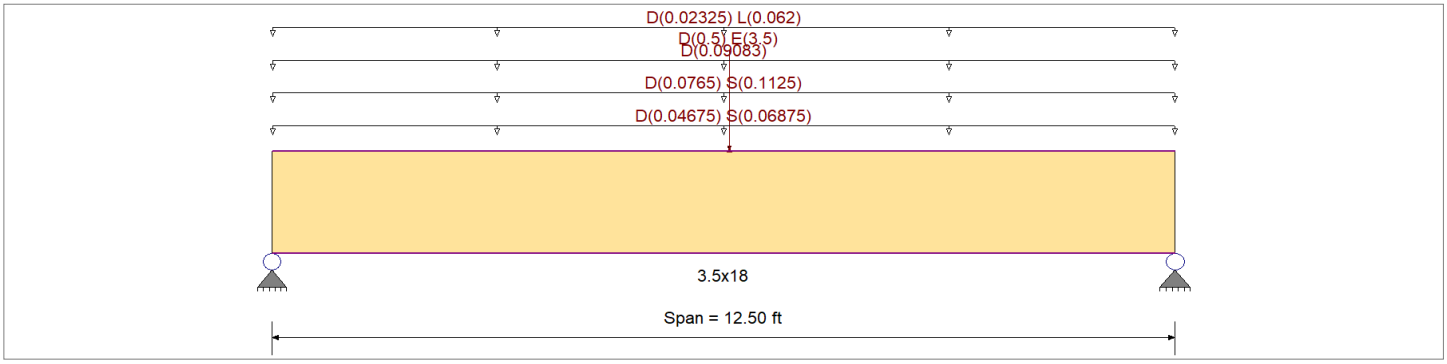
Wood Species : DF/DF
Wood Grade : 24F-V4

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

Fb +	2,880.0 psi
Fb -	2,220.0 psi
Fc - Prll	1,980.0 psi
Fc - Perp	780.0 psi
Fv	318.0 psi
Ft	1,320.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	1,600.0 ksi
Eminbend - yy	850.0 ksi
Density	31.210 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0170, S = 0.0250 ksf, Tributary Width = 2.750 ft, (Lower Roof)
Uniform Load : D = 0.0170, S = 0.0250 ksf, Tributary Width = 4.50 ft, (Roof)
Uniform Load : D = 0.010 ksf, Tributary Width = 9.083 ft, (Wall)
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 1.550 ft, (Floor)
Point Load : D = 0.50, E = 3.50 k @ 6.330 ft, (Shearwall #203)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.360 : 1	Maximum Shear Stress Ratio	=	0.221 : 1
Section used for this span		3.5x18	Section used for this span		3.5x18
fb: Actual	=	1,657.76 psi	fv: Actual	=	112.55 psi
Fb: Allowable	=	4,608.00 psi	Fv: Allowable	=	508.80 psi
Load Combination		+1.131D+1.750E	Load Combination		+1.098D+0.750L+0.750S+1.313E
Location of maximum on span	=	6.341 ft	Location of maximum on span	=	11.040 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.081 in	Ratio =	1856 >=360	Span: 1 : E Only
Max Upward Transient Deflection	-0.081 in	Ratio =	1856 >=360	Span: 1 : E Only * -1.0
Max Downward Total Deflection	0.130 in	Ratio =	1156 >=180	Span: 1 : +D+0.750L+0.750S+0.5250E
Max Upward Total Deflection	-0.024 in	Ratio =	6266 >=180	Span: 1 : +0.60D-0.70E

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
Length = 12.50 ft	1	0.152	0.116	0.90	1.000	1.00	1.00	1.00	1.00	1.00	6.19	393.25	2592.00	1.39	33.10	286.20
+D+L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	1	0.163	0.126	1.00	1.000	1.00	1.00	1.00	1.00	1.00	7.40	470.12	2880.00	1.69	40.17	318.00
+D+S					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	1	0.187	0.147	1.15	1.000	1.00	1.00	1.00	1.00	1.00	9.73	617.97	3312.00	2.26	53.77	365.70
+D+0.750L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	1	0.125	0.097	1.25	1.000	1.00	1.00	1.00	1.00	1.00	7.10	450.91	3600.00	1.61	38.40	397.50
+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

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B8 w/ Overstrength

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
Length = 12.50 ft	**1**	0.187	0.147	1.15	1.000	1.00	1.00	1.00	1.00	1.00	9.76	619.44	3312.00	2.26	53.90	365.70
+0.60D					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	**1**	0.051	0.039	1.60	1.000	1.00	1.00	1.00	1.00	1.00	3.72	235.95	4608.00	0.83	19.86	508.80
+1.131D+1.750E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	**1**	0.360	0.219	1.60	1.000	1.00	1.00	1.00	1.00	1.00	26.11	1,657.76	4608.00	4.67	111.29	508.80
+1.131D-1.750E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	**1**	0.216	0.131	1.60	1.000	1.00	1.00	1.00	1.00	1.00	12.10	767.97	3552.00	2.79	66.45	508.80
+1.098D+0.750L+0.750S+1.3					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	**1**	0.340	0.221	1.60	1.000	1.00	1.00	1.00	1.00	1.00	24.69	1,567.82	4608.00	4.73	112.55	508.80
+1.098D+0.750L+0.750S-1.31					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	**1**	0.071	0.094	1.60	1.000	1.00	1.00	1.00	1.00	1.00	3.96	251.47	3552.00	2.02	48.01	508.80
+0.4687D+1.750E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	**1**	0.303	0.176	1.60	1.000	1.00	1.00	1.00	1.00	1.00	22.01	1,397.18	4608.00	3.75	89.36	508.80
+0.4687D-1.750E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.50 ft	**1**	0.290	0.139	1.60	1.000	1.00	1.00	1.00	1.00	1.00	16.20	1,028.55	3552.00	2.97	70.78	508.80

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	0.1297	6.296		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	3.777	3.807
Overall MINimum	-1.728	-1.772
D Only	1.730	1.737
+D+L	2.118	2.124
+D+S	2.863	2.869
+D+0.750L	2.021	2.027
+D+0.750L+0.750S	2.870	2.877
+0.60D	1.038	1.042
+D+0.70E	2.939	2.977
+D-0.70E	0.521	0.496
+D+0.750L+0.750S+0.5250E	3.777	3.807
+D+0.750L+0.750S-0.5250E	1.963	1.946
+0.60D+0.70E	2.247	2.283
+0.60D-0.70E	-0.171	-0.199
L Only	0.388	0.388
S Only	1.133	1.133
E Only	1.728	1.772
E Only * -1.0	-1.728	-1.772

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B9 w/ HD's

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

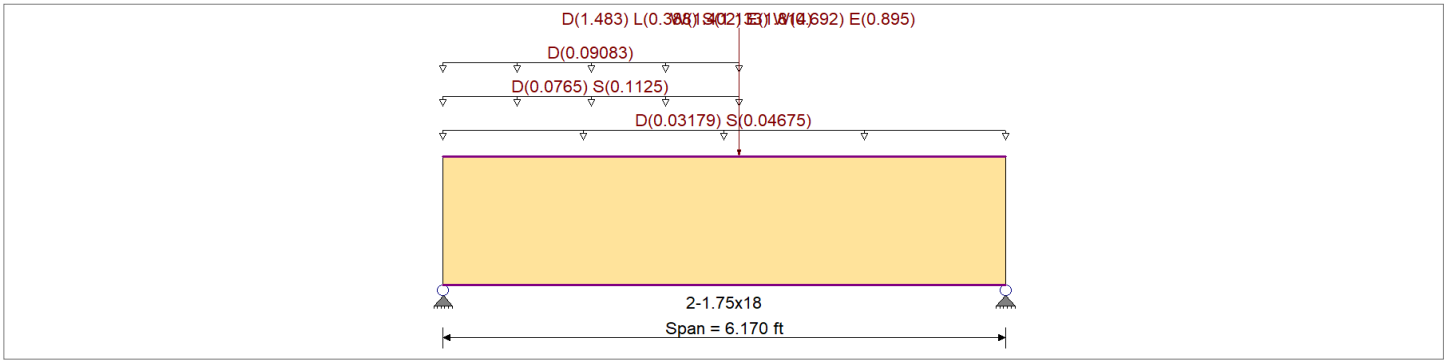
Wood Species : iLevel Truss Joist
Wood Grade : MicroLam LVL 2.0 E

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

Fb +	2,600.0 psi
Fb -	2,600.0 psi
Fc - Prll	2,510.0 psi
Fc - Perp	750.0 psi
Fv	285.0 psi
Ft	1,555.0 psi

E : Modulus of Elasticity

Ebend- xx	2,000.0 ksi
Eminbend - xx	1,016.54 ksi
Density	42.010 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0170, S = 0.0250 ksf, Tributary Width = 1.870 ft, (Lower Roof)
Uniform Load : D = 0.0170, S = 0.0250 ksf, Extent = 0.0 -->> 3.250 ft, Tributary Width = 4.50 ft, (Roof)
Uniform Load : D = 0.010 ksf, Extent = 0.0 -->> 3.250 ft, Tributary Width = 9.083 ft, (Wall)
Point Load : W = 1.402, E = 1.814 k @ 3.250 ft, (HD)
Point Load : D = 1.483, L = 0.3880, S = 1.133, W = 0.6920, E = 0.8950 k @ 3.250 ft, (B8)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.109 : 1	Maximum Shear Stress Ratio	=	0.128 : 1
Section used for this span		2-1.75x18	Section used for this span		2-1.75x18
fb: Actual	=	454.41 psi	fv: Actual	=	58.42 psi
Fb: Allowable	=	4,160.00 psi	Fv: Allowable	=	456.00 psi
Load Combination		+D+0.750L+0.750S+0.5250E	Load Combination		+D+0.750L+0.750S+0.5250E
Location of maximum on span	=	3.243 ft	Location of maximum on span	=	4.684 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.007 in	Ratio =	10978 >=360	Span: 1 : E Only
Max Upward Transient Deflection	-0.007 in	Ratio =	10978 >=360	Span: 1 : E Only * -1.0
Max Downward Total Deflection	0.012 in	Ratio =	6153 >=180	Span: 1 : +D+0.750L+0.750S+0.5250E
Max Upward Total Deflection	-0.002 in	Ratio =	41147 >=180	Span: 1 : +0.60D-0.70E

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
Length = 6.170 ft	1	0.077	0.091	0.90	1.000	1.00	1.00	1.00	1.00	1.00	2.85	180.70	2340.00	0.98	23.22	256.50
+D+L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.084	0.099	1.00	1.000	1.00	1.00	1.00	1.00	1.00	3.44	218.50	2600.00	1.18	28.09	285.00
+D+S					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.108	0.127	1.15	1.000	1.00	1.00	1.00	1.00	1.00	5.09	323.08	2990.00	1.74	41.50	327.75
+D+0.750L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.064	0.075	1.25	1.000	1.00	1.00	1.00	1.00	1.00	3.29	209.05	3250.00	1.13	26.87	356.25
+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

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B9 w/ HD's

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
Length = 6.170 ft	1	0.106	0.124	1.15	1.000	1.00	1.00	1.00	1.00	1.00	4.97	315.83	2990.00	1.70	40.58	327.75
+D+0.60W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.073	0.085	1.60	1.000	1.00	1.00	1.00	1.00	1.00	4.77	303.11	4160.00	1.64	38.98	456.00
+D-0.60W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.014	0.016	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.92	58.53	4160.00	0.31	7.46	456.00
+D+0.750L+0.450W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.072	0.085	1.60	1.000	1.00	1.00	1.00	1.00	1.00	4.74	300.86	4160.00	1.62	38.69	456.00
+D+0.750L-0.450W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.028	0.033	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.85	117.24	4160.00	0.63	15.05	456.00
+D+0.750L+0.750S+0.450W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.098	0.115	1.60	1.000	1.00	1.00	1.00	1.00	1.00	6.42	407.65	4160.00	2.20	52.40	456.00
+D+0.750L+0.750S-0.450W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.054	0.063	1.60	1.000	1.00	1.00	1.00	1.00	1.00	3.53	224.02	4160.00	1.21	28.76	456.00
+0.60D+0.60W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.055	0.065	1.60	1.000	1.00	1.00	1.00	1.00	1.00	3.64	230.83	4160.00	1.25	29.69	456.00
+0.60D-0.60W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.003	0.014	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.22	14.02	4160.00	0.26	6.23	456.00
+D+0.70E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.088	0.103	1.60	1.000	1.00	1.00	1.00	1.00	1.00	5.76	365.46	4160.00	1.97	47.00	456.00
+D-0.70E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.004	0.018	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.23	14.64	4160.00	0.34	8.16	456.00
+D+0.750L+0.750S+0.5250E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.109	0.128	1.60	1.000	1.00	1.00	1.00	1.00	1.00	7.16	454.41	4160.00	2.45	58.42	456.00
+D+0.750L+0.750S-0.5250E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.043	0.050	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.79	177.26	4160.00	0.96	22.74	456.00
+0.60D+0.70E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.070	0.083	1.60	1.000	1.00	1.00	1.00	1.00	1.00	4.62	293.18	4160.00	1.58	37.71	456.00
+0.60D-0.70E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.018	0.029	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.20	76.35	4160.00	0.56	13.44	456.00

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	0.0120	3.130		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	2.724	2.553
Overall MINimum	-1.282	-1.427
D Only	1.201	1.022
+D+L	1.384	1.227
+D+S	2.150	1.860
+D+0.750L	1.338	1.176
+D+0.750L+0.750S	2.051	1.804
+D+0.60W	1.795	1.684
+D-0.60W	0.606	0.361
+D+0.750L+0.450W	1.784	1.672
+D+0.750L-0.450W	0.892	0.679
+D+0.750L+0.750S+0.450W	2.496	2.300
+D+0.750L+0.750S-0.450W	1.605	1.307
+0.60D+0.60W	1.315	1.275
+0.60D-0.60W	0.126	-0.048
+D+0.70E	2.098	2.021
+D-0.70E	0.303	0.024
+D+0.750L+0.750S+0.5250E	2.724	2.553
+D+0.750L+0.750S-0.5250E	1.377	1.055
+0.60D+0.70E	1.618	1.612
+0.60D-0.70E	-0.177	-0.385
L Only	0.184	0.204
S Only	0.950	0.837

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B9 w/ HD's

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
W Only	0.991	1.103
-W	-0.991	-1.103
E Only	1.282	1.427
E Only * -1.0	-1.282	-1.427

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B9 w/ Overstrength

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

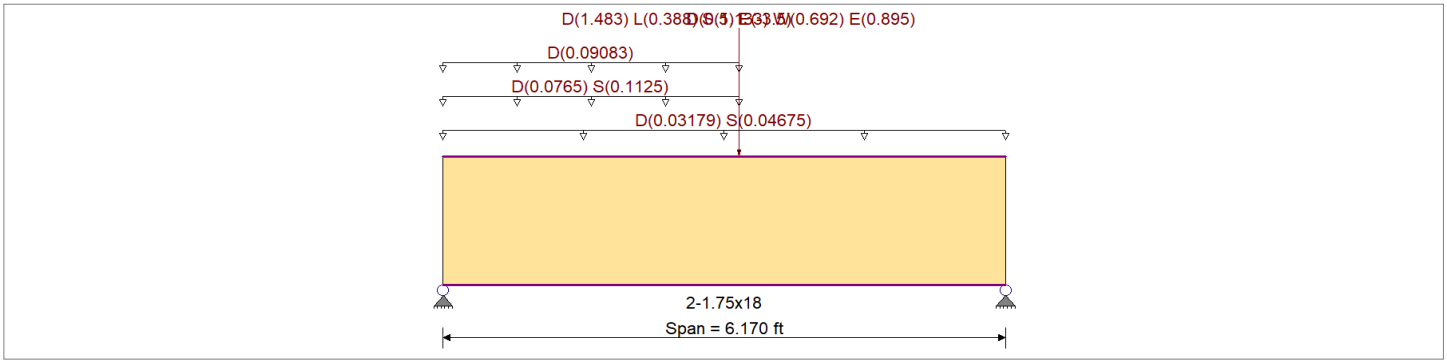
Wood Species : iLevel Truss Joist
Wood Grade : MicroLam LVL 2.0 E

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

Fb +	3,120.0 psi
Fb -	3,120.0 psi
Fc - Prll	3,012.0 psi
Fc - Perp	900.0 psi
Fv	342.0 psi
Ft	1,866.0 psi

E : Modulus of Elasticity

Ebend- xx	2,000.0 ksi
Eminbend - xx	1,016.54 ksi
Density	42.010 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0170, S = 0.0250 ksf, Tributary Width = 1.870 ft, (Lower Roof)
Uniform Load : D = 0.0170, S = 0.0250 ksf, Extent = 0.0 -->> 3.250 ft, Tributary Width = 4.50 ft, (Roof)
Uniform Load : D = 0.010 ksf, Extent = 0.0 -->> 3.250 ft, Tributary Width = 9.083 ft, (Wall)
Point Load : D = 0.50, E = -3.50 k @ 3.250 ft, (SW #203)
Point Load : D = 1.483, L = 0.3880, S = 1.133, W = 0.6920, E = 0.8950 k @ 3.250 ft, (B8)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.144 : 1	Maximum Shear Stress Ratio	=	0.169 : 1
Section used for this span		2-1.75x18	Section used for this span		2-1.75x18
fb: Actual	=	720.28 psi	fv: Actual	=	92.64 psi
Fb: Allowable	=	4,992.00 psi	Fv: Allowable	=	547.20 psi
Load Combination		+1.098D+0.750L+0.750S-1.313E	Load Combination		+1.098D+0.750L+0.750S-1.313E
Location of maximum on span	=	3.243 ft	Location of maximum on span	=	4.684 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.006 in	Ratio =	11416	>=360	Span: 1 : E Only * -1.0
Max Upward Transient Deflection	-0.006 in	Ratio =	11416	>=360	Span: 1 : E Only
Max Downward Total Deflection	0.013 in	Ratio =	5634	>=180	Span: 1 : +D+0.750L+0.750S-0.5250E
Max Upward Total Deflection	-0.001 in	Ratio =	84855	>=180	Span: 1 : +0.60D+0.70E

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
D Only													0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.082	0.096	0.90	1.000	1.00	1.00	1.00	1.00	1.00	3.61	229.41	2808.00	1.24	29.49	307.80
+D+L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.086	0.100	1.00	1.000	1.00	1.00	1.00	1.00	1.00	4.21	267.22	3120.00	1.44	34.36	342.00
+D+S					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.104	0.121	1.15	1.000	1.00	1.00	1.00	1.00	1.00	5.86	371.79	3588.00	2.01	47.77	393.30
+D+0.750L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.066	0.078	1.25	1.000	1.00	1.00	1.00	1.00	1.00	4.06	257.77	3900.00	1.39	33.14	427.50
+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

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B9 w/ Overstrength

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
Length = 6.170 ft	1	0.102	0.119	1.15	1.000	1.00	1.00	1.00	1.00	1.00	5.74	364.55	3588.00	1.97	46.85	393.30
+D+0.60W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.054	0.063	1.60	1.000	1.00	1.00	1.00	1.00	1.00	4.25	269.87	4992.00	1.46	34.70	547.20
+D-0.60W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.038	0.044	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.98	188.96	4992.00	1.02	24.28	547.20
+D+0.750L+0.450W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.058	0.068	1.60	1.000	1.00	1.00	1.00	1.00	1.00	4.54	288.11	4992.00	1.56	37.05	547.20
+D+0.750L-0.450W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.046	0.053	1.60	1.000	1.00	1.00	1.00	1.00	1.00	3.58	227.43	4992.00	1.23	29.23	547.20
+D+0.750L+0.750S+0.450W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.079	0.093	1.60	1.000	1.00	1.00	1.00	1.00	1.00	6.22	394.89	4992.00	2.13	50.76	547.20
+D+0.750L+0.750S-0.450W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.067	0.078	1.60	1.000	1.00	1.00	1.00	1.00	1.00	5.26	334.21	4992.00	1.80	42.95	547.20
+0.60D+0.60W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.036	0.042	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.81	178.10	4992.00	0.96	22.90	547.20
+0.60D-0.60W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.019	0.023	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.53	97.19	4992.00	0.52	12.49	547.20
+1.131D+1.750E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.037	0.055	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.91	184.64	4992.00	1.26	30.05	547.20
+1.131D-1.750E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.141	0.165	1.60	1.000	1.00	1.00	1.00	1.00	1.00	11.08	703.72	4992.00	3.80	90.54	547.20
+1.098D+0.750L+0.750S+1.3					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.012	0.013	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.97	61.69	4992.00	0.31	7.33	547.20
+1.098D+0.750L+0.750S-1.31					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.144	0.169	1.60	1.000	1.00	1.00	1.00	1.00	1.00	11.34	720.28	4992.00	3.89	92.64	547.20
+0.4687D+1.750E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.067	0.080	1.60	1.000	1.00	1.00	1.00	1.00	1.00	5.30	336.66	4992.00	1.84	43.86	547.20
+0.4687D-1.750E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.170 ft	1	0.111	0.130	1.60	1.000	1.00	1.00	1.00	1.00	1.00	8.69	551.70	4992.00	2.98	70.99	547.20

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	0.0131	3.130		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	2.934	2.787
Overall MINimum	1.233	1.372
D Only	1.437	1.286
+D+L	1.621	1.490
+D+S	2.387	2.123
+D+0.750L	1.575	1.439
+D+0.750L+0.750S	2.287	2.067
+D+0.60W	1.634	1.505
+D-0.60W	1.241	1.067
+D+0.750L+0.450W	1.722	1.603
+D+0.750L-0.450W	1.427	1.275
+D+0.750L+0.750S+0.450W	2.435	2.231
+D+0.750L+0.750S-0.450W	2.140	1.903
+0.60D+0.60W	1.059	0.990
+0.60D-0.60W	0.666	0.553
+D+0.70E	0.574	0.325
+D-0.70E	2.300	2.246
+D+0.750L+0.750S+0.5250E	1.640	1.347
+D+0.750L+0.750S-0.5250E	2.934	2.787
+0.60D+0.70E	-0.001	-0.189
+0.60D-0.70E	1.725	1.732
L Only	0.184	0.204
S Only	0.950	0.837

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B9 w/ Overstrength

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
W Only	0.327	0.365
-W	-0.327	-0.365
E Only	-1.233	-1.372
E Only * -1.0	1.233	1.372

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B12 w/ HD's

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

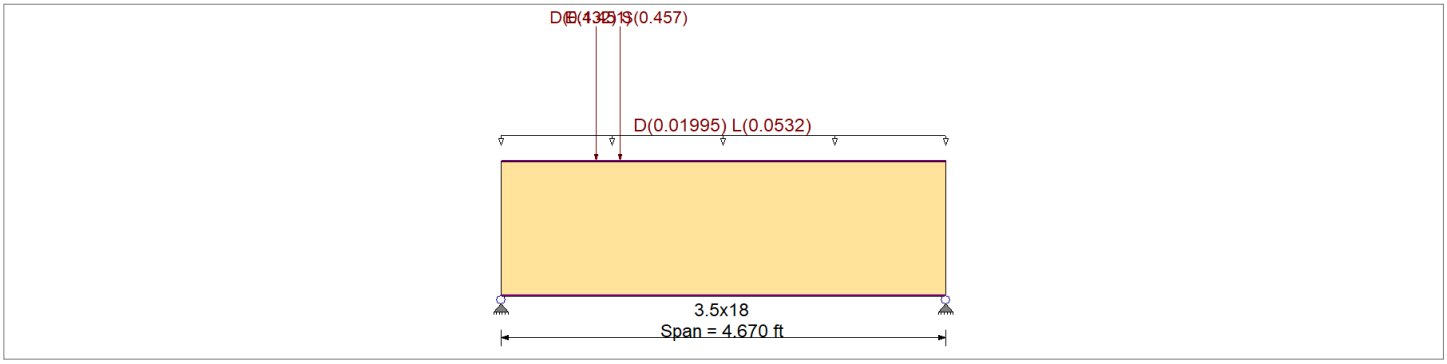
Wood Species : DF/DF
Wood Grade : 24F-V4

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

Fb +	2,400.0 psi
Fb -	1,850.0 psi
Fc - Prll	1,650.0 psi
Fc - Perp	650.0 psi
Fv	265.0 psi
Ft	1,100.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	1,600.0 ksi
Eminbend - yy	850.0 ksi
Density	31.210 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 1.330 ft, (Floor)
Point Load : E = 1.451 k @ 1.0 ft, (HD)
Point Load : D = 0.4320, S = 0.4570 k @ 1.250 ft, (B.W.A.)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.023 : 1	Maximum Shear Stress Ratio	=	0.024 : 1
Section used for this span		3.5x18	Section used for this span		3.5x18
fb: Actual	=	88.40 psi	fv: Actual	=	10.01 psi
Fb: Allowable	=	3,840.00 psi	Fv: Allowable	=	424.00 psi
Load Combination		+D+0.750L+0.750S+0.5250E	Load Combination		+D+0.750L+0.750S+0.5250E
Location of maximum on span	=	1.244 ft	Location of maximum on span	=	3.170 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.001 in	Ratio =	52108 >=360	Span: 1 : E Only
Max Upward Transient Deflection	-0.001 in	Ratio =	52108 >=360	Span: 1 : E Only * -1.0
Max Downward Total Deflection	0.001 in	Ratio =	38371 >=180	Span: 1 : +D+0.750L+0.750S+0.5250E
Max Upward Total Deflection	-0.000 in	Ratio =	116399 >=180	Span: 1 : +0.60D-0.70E

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
Length = 4.670 ft	1	0.013	0.013	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.44	27.75	2160.00	0.13	3.15	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 = 4.670 ft	1	0.015	0.016	1.00	1.000	1.00	1.00	1.00	1.00	1.00	0.55	35.01	2400.00	0.18	4.21	265.00
+D+S					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.670 ft	1	0.020	0.020	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.85	54.22	2760.00	0.25	6.06	304.75
+D+0.750L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.670 ft	1	0.011	0.012	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.52	33.19	3000.00	0.17	3.94	331.25
+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 = 4.670 ft	1	0.019	0.020	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.84	53.05	2760.00	0.26	6.13	304.75
+0.60D					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B12 w/ HD's

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
Length = 4.670 ft	1	0.004	0.004	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.26	16.65	3840.00	0.08	1.89	424.00
+D+0.70E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.670 ft	1	0.020	0.020	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.18	75.00	3840.00	0.35	8.33	424.00
+D-0.70E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.670 ft	1	0.009	0.007	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.44	28.07	2960.00	0.12	2.82	424.00
+D+0.750L+0.750S+0.5250E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.670 ft	1	0.023	0.024	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.39	88.40	3840.00	0.42	10.01	424.00
+D+0.750L+0.750S-0.5250E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.670 ft	1	0.005	0.005	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.28	17.96	3840.00	0.09	2.24	424.00
+0.60D+0.70E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.670 ft	1	0.017	0.017	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.01	64.12	3840.00	0.30	7.07	424.00
+0.60D-0.70E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.670 ft	1	0.013	0.009	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.58	37.08	2960.00	0.16	3.76	424.00

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	0.0015	2.113		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.306	0.510
Overall MINimum	-1.140	-0.311
D Only	0.363	0.162
+D+L	0.487	0.286
+D+S	0.698	0.285
+D+0.750L	0.456	0.255
+D+0.750L+0.750S	0.707	0.347
+0.60D	0.218	0.097
+D+0.70E	1.161	0.380
+D-0.70E	-0.435	-0.055
+D+0.750L+0.750S+0.5250E	1.306	0.510
+D+0.750L+0.750S-0.5250E	0.108	0.184
+0.60D+0.70E	1.016	0.315
+0.60D-0.70E	-0.580	-0.120
L Only	0.124	0.124
S Only	0.335	0.122
E Only	1.140	0.311
E Only * -1.0	-1.140	-0.311

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B12 w/ Overstrength

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

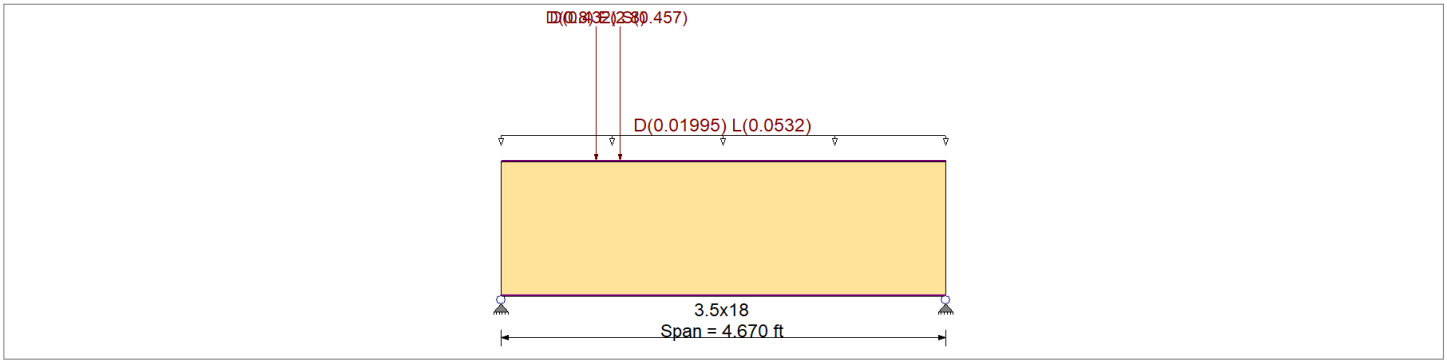
Wood Species : DF/DF
Wood Grade : 24F-V4

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

Fb +	2,880.0 psi
Fb -	2,220.0 psi
Fc - Prll	1,980.0 psi
Fc - Perp	780.0 psi
Fv	318.0 psi
Ft	1,320.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	1,600.0 ksi
Eminbend - yy	850.0 ksi
Density	31.210 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 1.330 ft, (Floor)
Point Load : D = 0.80, E = 2.80 k @ 1.0 ft, (SW #210)
Point Load : D = 0.4320, S = 0.4570 k @ 1.250 ft, (B.W.A.)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.068 : 1	Maximum Shear Stress Ratio	=	0.065 : 1
Section used for this span		3.5x18	Section used for this span		3.5x18
fb: Actual	=	314.70 psi	fv: Actual	=	33.16 psi
Fb: Allowable	=	4,608.00 psi	Fv: Allowable	=	508.80 psi
Load Combination		+1.131D+1.750E	Load Combination		+1.131D+1.750E
Location of maximum on span	=	1.006 ft	Location of maximum on span	=	3.170 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.002 in	Ratio =	27003 >=360	Span: 1 : E Only
Max Upward Transient Deflection	-0.002 in	Ratio =	27003 >=360	Span: 1 : E Only * -1.0
Max Downward Total Deflection	0.003 in	Ratio =	21739 >=180	Span: 1 : +D+0.750L+0.750S+0.5250E
Max Upward Total Deflection	-0.001 in	Ratio =	67887 >=180	Span: 1 : +0.60D-0.70E

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
Length = 4.670 ft	1	0.025	0.025	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.02	64.95	2592.00	0.30	7.23	286.20
+D+L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.670 ft	1	0.025	0.026	1.00	1.000	1.00	1.00	1.00	1.00	1.00	1.14	72.15	2880.00	0.35	8.29	318.00
+D+S					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.670 ft	1	0.028	0.028	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.44	91.39	3312.00	0.43	10.14	365.70
+D+0.750L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.670 ft	1	0.020	0.020	1.25	1.000	1.00	1.00	1.00	1.00	1.00	1.11	70.35	3600.00	0.34	8.02	397.50
+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 = 4.670 ft	1	0.027	0.028	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.42	90.18	3312.00	0.43	10.21	365.70
+0.60D					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B12 w/ Overstrength

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
Length = 4.670 ft	**1**	0.008	0.009	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.61	38.97	4608.00	0.18	4.34	508.80
+1.131D+1.750E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.670 ft	**1**	0.068	0.065	1.60	1.000	1.00	1.00	1.00	1.00	1.00	4.96	314.70	4608.00	1.39	33.16	508.80
+1.131D-1.750E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.670 ft	**1**	0.049	0.035	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.73	173.54	3552.00	0.74	17.70	508.80
+1.098D+0.750L+0.750S+1.3					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.670 ft	**1**	0.059	0.058	1.60	1.000	1.00	1.00	1.00	1.00	1.00	4.29	272.32	4608.00	1.25	29.65	508.80
+1.098D+0.750L+0.750S-1.31					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.670 ft	**1**	0.026	0.020	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.48	93.86	3552.00	0.43	10.28	508.80
+0.4687D+1.750E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.670 ft	**1**	0.059	0.056	1.60	1.000	1.00	1.00	1.00	1.00	1.00	4.31	273.36	4608.00	1.19	28.37	508.80
+0.4687D-1.750E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.670 ft	**1**	0.060	0.043	1.60	1.000	1.00	1.00	1.00	1.00	1.00	3.38	214.88	3552.00	0.92	21.97	508.80

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	0.0026	2.079		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	2.532	0.833
Overall MINimum	-2.200	-0.600
D Only	0.992	0.334
+D+L	1.116	0.458
+D+S	1.326	0.456
+D+0.750L	1.085	0.427
+D+0.750L+0.750S	1.336	0.518
+0.60D	0.595	0.200
+D+0.70E	2.532	0.753
+D-0.70E	-0.549	-0.086
+D+0.750L+0.750S+0.5250E	2.491	0.833
+D+0.750L+0.750S-0.5250E	0.181	0.204
+0.60D+0.70E	2.135	0.620
+0.60D-0.70E	-0.945	-0.220
L Only	0.124	0.124
S Only	0.335	0.122
E Only	2.200	0.600
E Only * -1.0	-2.200	-0.600

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B14 w/ HD's

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

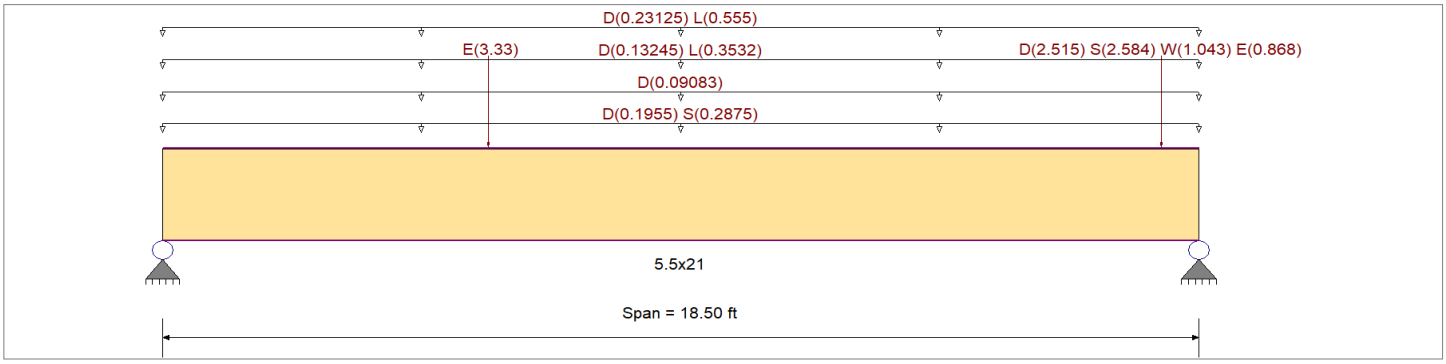
Wood Species : DF/DF
Wood Grade : 24F-V4

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

Fb +	2,400.0 psi
Fb -	1,850.0 psi
Fc - Prll	1,650.0 psi
Fc - Perp	650.0 psi
Fv	265.0 psi
Ft	1,100.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	1,600.0 ksi
Eminbend - yy	850.0 ksi
Density	31.210 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0170, S = 0.0250 ksf, Tributary Width = 11.50 ft, (Roof)
Uniform Load : D = 0.010 ksf, Tributary Width = 9.083 ft, (Wall)
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 8.830 ft, (Floor)
Uniform Load : D = 0.0250, L = 0.060 ksf, Tributary Width = 9.250 ft, (Deck)
Point Load : D = 2.515, S = 2.584, W = 1.043, E = 0.8680 k @ 17.830 ft, (Floor G.T.)
Point Load : E = 3.330 k @ 5.830 ft, (HD)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.878 : 1	Maximum Shear Stress Ratio	=	0.825 : 1
Section used for this span		5.5x21	Section used for this span		5.5x21
fb: Actual	=	2,003.95 psi	fv: Actual	=	218.67 psi
Fb: Allowable	=	2,282.16 psi	Fv: Allowable	=	265.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	9.318 ft	Location of maximum on span	=	18.500 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.315 in	Ratio =	704 >=360	Span: 1 : L Only
Max Upward Transient Deflection	-0.086 in	Ratio =	2592 >=360	Span: 1 : E Only * -1.0
Max Downward Total Deflection	0.596 in	Ratio =	372 >=180	Span: 1 : +D+0.750L+0.750S+0.5250E
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

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
Length = 18.50 ft	1	0.414	0.459	0.90	0.951	1.00	1.00	1.00	1.00	1.00	28.66	850.70	2053.94	8.44	109.57	238.50
+D+L					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.878	0.825	1.00	0.951	1.00	1.00	1.00	1.00	1.00	67.51	2,003.95	2282.16	16.84	218.67	265.00
+D+S					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.473	0.579	1.15	0.951	1.00	1.00	1.00	1.00	1.00	41.84	1,241.86	2624.48	13.59	176.45	304.75
+D+0.750L					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.601	0.578	1.25	0.951	1.00	1.00	1.00	1.00	1.00	57.80	1,715.63	2852.69	14.74	191.39	331.25

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B14 w/ HD's

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+D+0.750L+0.750S					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.765	0.793	1.15	0.951	1.00	1.00	1.00	1.00	1.00	67.67	2,008.87	2624.48	18.60	241.55	304.75
+D+0.60W					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.235	0.277	1.60	0.951	1.00	1.00	1.00	1.00	1.00	28.87	857.02	3651.45	9.04	117.40	424.00
+D-0.60W					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.231	0.240	1.60	0.951	1.00	1.00	1.00	1.00	1.00	28.45	844.39	3651.45	7.83	101.73	424.00
+D+0.750L+0.450W					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.471	0.465	1.60	0.951	1.00	1.00	1.00	1.00	1.00	57.95	1,720.33	3651.45	15.19	197.27	424.00
+D+0.750L-0.450W					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.469	0.438	1.60	0.951	1.00	1.00	1.00	1.00	1.00	57.64	1,710.93	3651.45	14.28	185.52	424.00
+D+0.750L+0.750S+0.450W					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.551	0.584	1.60	0.951	1.00	1.00	1.00	1.00	1.00	67.83	2,013.60	3651.45	19.05	247.43	424.00
+D+0.750L+0.750S-0.450W					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.549	0.556	1.60	0.951	1.00	1.00	1.00	1.00	1.00	67.51	2,004.16	3651.45	18.15	235.68	424.00
+0.60D+0.60W					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.142	0.174	1.60	0.951	1.00	1.00	1.00	1.00	1.00	17.41	516.76	3651.45	5.67	73.57	424.00
+0.60D-0.60W					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.138	0.137	1.60	0.951	1.00	1.00	1.00	1.00	1.00	16.98	504.12	3651.45	4.46	57.91	424.00
+D+0.70E					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.292	0.299	1.60	0.951	1.00	1.00	1.00	1.00	1.00	35.95	1,067.08	3651.45	9.76	126.71	424.00
+D-0.70E					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.180	0.218	1.60	0.951	1.00	1.00	1.00	1.00	1.00	22.15	657.51	3651.45	7.12	92.42	424.00
+D+0.750L+0.750S+0.5250E					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.593	0.600	1.60	0.951	1.00	1.00	1.00	1.00	1.00	72.96	2,165.76	3651.45	19.59	254.41	424.00
+D+0.750L+0.750S-0.5250E					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.509	0.539	1.60	0.951	1.00	1.00	1.00	1.00	1.00	62.57	1,857.46	3651.45	17.61	228.70	424.00
+0.60D+0.70E					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.201	0.195	1.60	0.951	1.00	1.00	1.00	1.00	1.00	24.74	734.53	3651.45	6.38	82.89	424.00
+0.60D-0.70E					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.089	0.115	1.60	0.951	1.00	1.00	1.00	1.00	1.00	10.95	324.96	3651.45	3.74	48.60	424.00

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	0.5957	9.250		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	15.683	19.590
Overall MINimum	-2.312	-1.886
D Only	6.104	8.437
+D+L	14.505	16.838
+D+S	8.857	13.586
+D+0.750L	12.404	14.737
+D+0.750L+0.750S	14.469	18.600
+D+0.60W	6.127	9.040
+D-0.60W	6.081	7.834
+D+0.750L+0.450W	12.421	15.190
+D+0.750L-0.450W	12.388	14.285
+D+0.750L+0.750S+0.450W	14.486	19.052
+D+0.750L+0.750S-0.450W	14.452	18.147
+0.60D+0.60W	3.685	5.665
+0.60D-0.60W	3.640	4.459
+D+0.70E	7.722	9.757
+D-0.70E	4.485	7.117
+D+0.750L+0.750S+0.5250E	15.683	19.590
+D+0.750L+0.750S-0.5250E	13.255	17.610
+0.60D+0.70E	5.281	6.382
+0.60D-0.70E	2.044	3.742

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

DESCRIPTION: B14 w/ HD's

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
L Only	8.401	8.401
S Only	2.753	5.150
W Only	0.038	1.005
-W	-0.038	-1.005
E Only	2.312	1.886
E Only * -1.0	-2.312	-1.886

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B14 w/ Overstrength

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

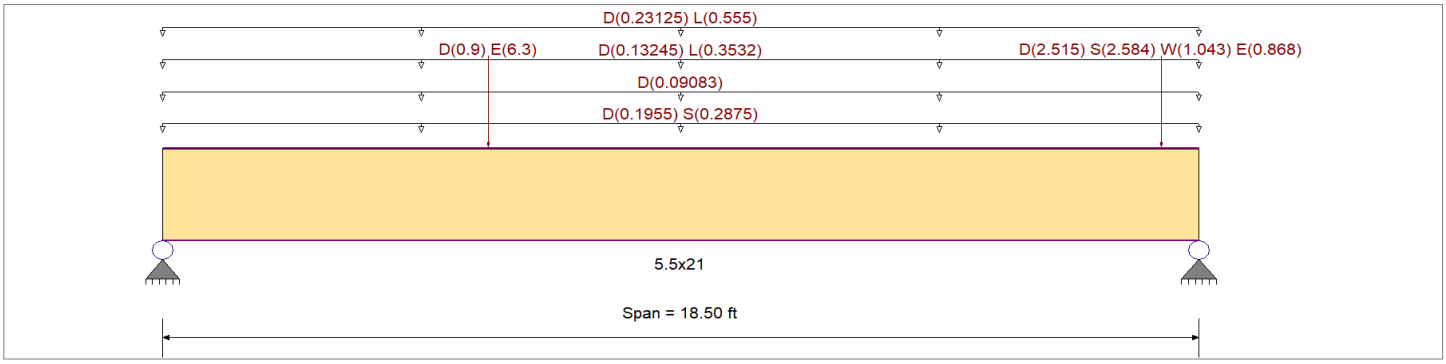
Wood Species : DF/DF
Wood Grade : 24F-V4

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

Fb +	2,880.0 psi
Fb -	2,220.0 psi
Fc - Prll	1,980.0 psi
Fc - Perp	780.0 psi
Fv	318.0 psi
Ft	1,320.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	1,600.0 ksi
Eminbend - yy	850.0 ksi
Density	31.210 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0170, S = 0.0250 ksf, Tributary Width = 11.50 ft, (Roof)
Uniform Load : D = 0.010 ksf, Tributary Width = 9.083 ft, (Wall)
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 8.830 ft, (Floor)
Uniform Load : D = 0.0250, L = 0.060 ksf, Tributary Width = 9.250 ft, (Deck)
Point Load : D = 2.515, S = 2.584, W = 1.043, E = 0.8680 k @ 17.830 ft, (Floor G.T.)
Point Load : D = 0.90, E = 6.30 k @ 5.830 ft, (SW #202)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.760 : 1	Maximum Shear Stress Ratio	=	0.699 : 1
Section used for this span		5.5x21	Section used for this span		5.5x21
fb: Actual	=	2,082.10 psi	fv: Actual	=	222.35 psi
Fb: Allowable	=	2,738.59 psi	Fv: Allowable	=	318.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	9.115 ft	Location of maximum on span	=	18.500 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.315 in	Ratio =	704 >=360	Span: 1 : L Only
Max Upward Transient Deflection	-0.160 in	Ratio =	1390 >=360	Span: 1 : E Only * -1.0
Max Downward Total Deflection	0.656 in	Ratio =	338 >=180	Span: 1 : +D+0.750L+0.750S+0.5250E
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

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
Length = 18.50 ft	1	0.377	0.396	0.90	0.951	1.00	1.00	1.00	1.00	1.00	31.30	929.23	2464.73	8.72	113.25	286.20
+D+L					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.760	0.699	1.00	0.951	1.00	1.00	1.00	1.00	1.00	70.14	2,082.10	2738.59	17.12	222.35	318.00
+D+S					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.419	0.493	1.15	0.951	1.00	1.00	1.00	1.00	1.00	44.45	1,319.34	3149.38	13.87	180.13	365.70
+D+0.750L					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.524	0.491	1.25	0.951	1.00	1.00	1.00	1.00	1.00	60.43	1,793.82	3423.23	15.02	195.08	397.50

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B14 w/ Overstrength

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+D+0.750L+0.750S					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.663	0.671	1.15	0.951	1.00	1.00	1.00	1.00	1.00	70.29	2,086.66	3149.38	18.88	245.24	365.70
+D+0.60W					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.213	0.238	1.60	0.951	1.00	1.00	1.00	1.00	1.00	31.51	935.27	4381.74	9.32	121.08	508.80
+D-0.60W					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.211	0.207	1.60	0.951	1.00	1.00	1.00	1.00	1.00	31.10	923.22	4381.74	8.12	105.42	508.80
+D+0.750L+0.450W					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.410	0.395	1.60	0.951	1.00	1.00	1.00	1.00	1.00	60.58	1,798.42	4381.74	15.47	200.95	508.80
+D+0.750L-0.450W					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.408	0.372	1.60	0.951	1.00	1.00	1.00	1.00	1.00	60.27	1,789.22	4381.74	14.57	189.20	508.80
+D+0.750L+0.750S+0.450W					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.477	0.494	1.60	0.951	1.00	1.00	1.00	1.00	1.00	70.45	2,091.29	4381.74	19.34	251.11	508.80
+D+0.750L+0.750S-0.450W					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.475	0.470	1.60	0.951	1.00	1.00	1.00	1.00	1.00	70.14	2,082.02	4381.74	18.43	239.36	508.80
+0.60D+0.60W					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.129	0.149	1.60	0.951	1.00	1.00	1.00	1.00	1.00	18.99	563.58	4381.74	5.84	75.78	508.80
+0.60D-0.60W					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.126	0.118	1.60	0.951	1.00	1.00	1.00	1.00	1.00	18.58	551.54	4381.74	4.63	60.12	508.80
+1.131D+1.750E					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.516	0.388	1.60	0.951	1.00	1.00	1.00	1.00	1.00	76.12	2,259.51	4381.74	15.21	197.51	508.80
+1.131D-1.750E					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.109	0.145	1.60	0.951	1.00	1.00	1.00	1.00	1.00	12.41	368.51	3377.59	5.68	73.82	508.80
+1.098D+0.750L+0.750S+1.31					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.678	0.598	1.60	0.951	1.00	1.00	1.00	1.00	1.00	100.13	2,972.24	4381.74	23.45	304.49	508.80
+1.098D+0.750L+0.750S-1.31					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.344	0.409	1.60	0.951	1.00	1.00	1.00	1.00	1.00	50.71	1,505.22	4381.74	16.04	208.29	508.80
+0.4687D+1.750E					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.389	0.275	1.60	0.951	1.00	1.00	1.00	1.00	1.00	57.42	1,704.39	4381.74	10.76	139.68	508.80
+0.4687D-1.750E					0.951	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 18.50 ft	1	0.273	0.159	1.60	0.951	1.00	1.00	1.00	1.00	1.00	31.01	920.52	3377.59	6.23	80.84	508.80

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	0.6564	9.182		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	17.367	20.365
Overall MINimum	-4.346	-2.822
D Only	6.720	8.720
+D+L	15.121	17.121
+D+S	9.473	13.870
+D+0.750L	13.021	15.021
+D+0.750L+0.750S	15.086	18.883
+D+0.60W	6.743	9.323
+D-0.60W	6.698	8.117
+D+0.750L+0.450W	13.038	15.473
+D+0.750L-0.450W	13.004	14.569
+D+0.750L+0.750S+0.450W	15.103	19.336
+D+0.750L+0.750S-0.450W	15.069	18.431
+0.60D+0.60W	4.055	5.835
+0.60D-0.60W	4.009	4.629
+D+0.70E	9.762	10.696
+D-0.70E	3.678	6.745
+D+0.750L+0.750S+0.5250E	17.367	20.365
+D+0.750L+0.750S-0.5250E	12.804	17.402
+0.60D+0.70E	7.074	7.208
+0.60D-0.70E	0.990	3.257

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B14 w/ Overstrength

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
L Only	8.401	8.401
S Only	2.753	5.150
W Only	0.038	1.005
-W	-0.038	-1.005
E Only	4.346	2.822
E Only * -1.0	-4.346	-2.822

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Steel Beam

Project File: Beams.ec6

DESCRIPTION: B15 w/ HD's

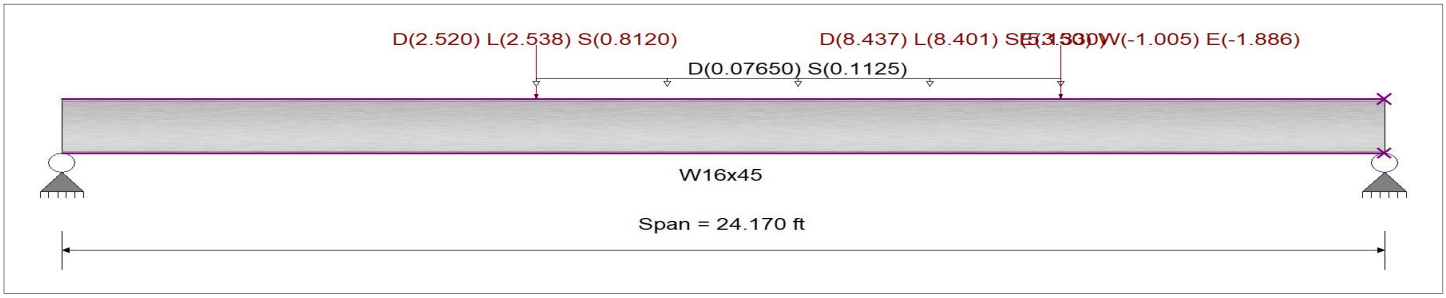
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

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

Beam self weight NOT internally calculated and added
Load(s) for Span Number 1

Point Load : D = 2.520, L = 2.538, S = 0.8120 k @ 8.670 ft, (B13)

Point Load : D = 8.437, L = 8.401, S = 5.150, W = -1.005, E = -1.886 k @ 18.250 ft, (B14)

Uniform Load : D = 0.0170, S = 0.0250 ksf, Extent = 8.670 -->> 18.250 ft, Tributary Width = 4.50 ft, (Roof)

Point Load : E = 3.330 k @ 18.250 ft, (HD)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.498 : 1	Maximum Shear Stress Ratio =	0.156 : 1
Section used for this span	W16x45	Section used for this span	W16x45
Ma : Applied	102.260 k-ft	Va : Applied	17.280 k
Mn / Omega : Allowable	205.339 k-ft	Vn/Omega : Allowable	111.090 k
Load Combination	+D+0.750L+0.750S+0.5250E	Load Combination	+D+0.750L+0.750S+0.5250E
		Location of maximum on span	18.300 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.240 in	Ratio =	1,210	>=360	Span: 1 : W Only
Max Upward Transient Deflection	-0.021 in	Ratio =	13,983	>=360	Span: 1 : L Only
Max Downward Total Deflection	0.573 in	Ratio =	506	>=180	Span: 1 : +D+0.750L+0.750S+0.5250E
Max Upward Total Deflection	0.000 in	Ratio =	0	<180	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
D Only													
Dsgn. L = 24.17 ft	1	0.221	0.069	45.47		45.47	342.92	205.34	1.00	1.00	7.68	166.64	111.09
+D+L													
Dsgn. L = 24.17 ft	1	0.430	0.134	88.39		88.39	342.92	205.34	1.00	1.00	14.94	166.64	111.09
+D+S													
Dsgn. L = 24.17 ft	1	0.359	0.112	73.76		73.76	342.92	205.34	1.00	1.00	12.46	166.64	111.09
+D+0.750L													
Dsgn. L = 24.17 ft	1	0.378	0.118	77.66		77.66	342.92	205.34	1.00	1.00	13.12	166.64	111.09
+D+0.750L+0.750S													
Dsgn. L = 24.17 ft	1	0.482	0.150	98.88		98.88	342.92	205.34	1.00	1.00	16.71	166.64	111.09
+D+0.60W													
Dsgn. L = 24.17 ft	1	0.208	0.065	42.77		42.77	342.92	205.34	1.00	1.00	7.23	166.64	111.09
+D+0.750L+0.450W													

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Steel Beam

Project File: Beams.ec6

DESCRIPTION: B15 w/ HD's

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
Dsgn. L = 24.17 ft +D+0.750L+0.750S+0.450W	1	0.368	0.115	75.64		75.64	342.92	205.34	1.00	1.00	12.78	166.64	111.09
Dsgn. L = 24.17 ft +0.60D+0.60W	1	0.472	0.147	96.86		96.86	342.92	205.34	1.00	1.00	16.37	166.64	111.09
Dsgn. L = 24.17 ft +D+0.70E	1	0.120	0.037	24.59		24.59	342.92	205.34	1.00	1.00	4.15	166.64	111.09
Dsgn. L = 24.17 ft +D+0.750L+0.750S+0.5250E	1	0.243	0.076	49.98		49.98	342.92	205.34	1.00	1.00	8.45	166.64	111.09
Dsgn. L = 24.17 ft +0.60D+0.70E	1	0.498	0.156	102.26		102.26	342.92	205.34	1.00	1.00	17.28	166.64	111.09
Dsgn. L = 24.17 ft	1	0.155	0.048	31.79		31.79	342.92	205.34	1.00	1.00	5.37	166.64	111.09

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	0.5728	12.914		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	8.652	17.280
Overall MINimum	-0.246	-0.759
D Only	4.007	7.683
+D+L	7.693	14.936
+D+S	6.267	12.463
+D+0.750L	6.771	13.123
+D+0.750L+0.750S	8.466	16.708
+D+0.60W	3.860	7.227
+D+0.750L+0.450W	6.660	12.781
+D+0.750L+0.750S+0.450W	8.355	16.366
+0.60D+0.60W	2.257	4.154
+D+0.70E	4.255	8.446
+D+0.750L+0.750S+0.5250E	8.652	17.280
+0.60D+0.70E	2.652	5.373
L Only	3.685	7.254
S Only	2.260	4.780
W Only	-0.246	-0.759
E Only	0.354	1.090

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Steel Beam

Project File: Beams.ec6

DESCRIPTION: B15 w/ HD's

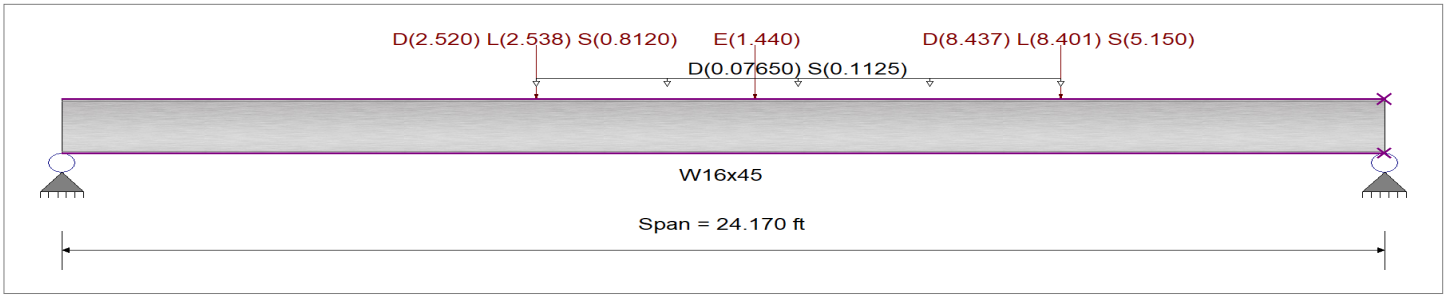
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

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

Beam self weight NOT internally calculated and added
Load(s) for Span Number 1
Point Load : D = 2.520, L = 2.538, S = 0.8120 k @ 8.670 ft, (B13)

Point Load : D = 8.437, L = 8.401, S = 5.150 k @ 18.250 ft, (B14)

Uniform Load : D = 0.0170, S = 0.0250 ksf, Extent = 8.670 -->> 18.250 ft, Tributary Width = 4.50 ft, (Roof)

Point Load : E = 1.440 k @ 12.670 ft, (HD)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.493 : 1	Maximum Shear Stress Ratio =	0.154 : 1
Section used for this span	W16x45	Section used for this span	W16x45
Ma : Applied	101.229 k-ft	Va : Applied	17.104 k
Mn / Omega : Allowable	205.339 k-ft	Vn/Omega : Allowable	111.090 k
Load Combination	+D+0.750L+0.750S+0.5250E	Load Combination	+D+0.750L+0.750S+0.5250E
		Location of maximum on span	18.300 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.240 in	Ratio =	1,210	>=360	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<360	Span: 1 : L Only
Max Downward Total Deflection	0.580 in	Ratio =	500	>=180	Span: 1 : +D+0.750L+0.750S+0.5250E
Max Upward Total Deflection	0.000 in	Ratio =	0	<180	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
D Only													
Dsgn. L = 24.17 ft	1	0.221	0.069	45.47		45.47	342.92	205.34	1.00	1.00	7.68	166.64	111.09
+D+L													
Dsgn. L = 24.17 ft	1	0.430	0.134	88.39		88.39	342.92	205.34	1.00	1.00	14.94	166.64	111.09
+D+S													
Dsgn. L = 24.17 ft	1	0.359	0.112	73.76		73.76	342.92	205.34	1.00	1.00	12.46	166.64	111.09
+D+0.750L													
Dsgn. L = 24.17 ft	1	0.378	0.118	77.66		77.66	342.92	205.34	1.00	1.00	13.12	166.64	111.09
+D+0.750L+0.750S													
Dsgn. L = 24.17 ft	1	0.482	0.150	98.88		98.88	342.92	205.34	1.00	1.00	16.71	166.64	111.09
+0.60D													
Dsgn. L = 24.17 ft	1	0.133	0.041	27.28		27.28	342.92	205.34	1.00	1.00	4.61	166.64	111.09
+D+0.70E													

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Steel Beam

Project File: Beams.ec6

DESCRIPTION: B15 w/ HD's

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
Dsgn. L = 24.17 ft +D+0.750L+0.750S+0.5250E	1	0.237	0.074	48.60		48.60	342.92	205.34	1.00	1.00	8.21	166.64	111.09
Dsgn. L = 24.17 ft +0.60D+0.70E	1	0.493	0.154	101.23		101.23	342.92	205.34	1.00	1.00	17.10	166.64	111.09
Dsgn. L = 24.17 ft	1	0.148	0.046	30.48		30.48	342.92	205.34	1.00	1.00	5.14	166.64	111.09

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	0.5798	12.845		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	8.826	17.104
Overall MINimum	0.685	0.755
D Only	4.007	7.683
+D+L	7.693	14.936
+D+S	6.267	12.463
+D+0.750L	6.771	13.123
+D+0.750L+0.750S	8.466	16.708
+0.60D	2.404	4.610
+D+0.70E	4.487	8.211
+D+0.750L+0.750S+0.5250E	8.826	17.104
+0.60D+0.70E	2.884	5.138
L Only	3.685	7.254
S Only	2.260	4.780
E Only	0.685	0.755

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Steel Beam

Project File: Beams.ec6

DESCRIPTION: B15 w/ Overstrength

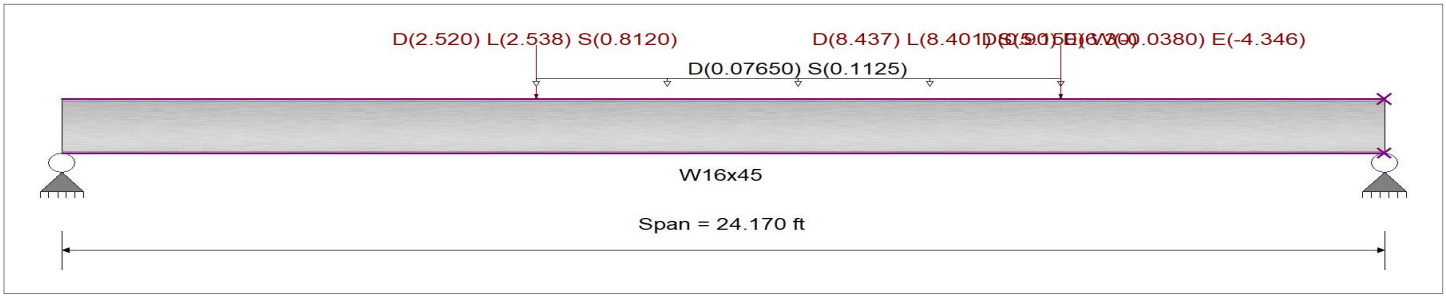
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

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

Beam self weight NOT internally calculated and added
Load(s) for Span Number 1

Point Load : D = 2.520, L = 2.538, S = 0.8120 k @ 8.670 ft, (B13)

Point Load : D = 8.437, L = 8.401, S = 5.150, W = -0.0380, E = -4.346 k @ 18.250 ft, (B14)

Uniform Load : D = 0.0170, S = 0.0250 ksf, Extent = 8.670 -->> 18.250 ft, Tributary Width = 4.50 ft, (Roof)

Point Load : D = 0.90, E = 6.30 k @ 18.250 ft, (SW #202)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.581 : 1	Maximum Shear Stress Ratio =	0.181 : 1
Section used for this span	W16x45	Section used for this span	W16x45
Ma : Applied	119.220 k-ft	Va : Applied	20.148 k
Mn / Omega : Allowable	205.339 k-ft	Vn/Omega : Allowable	111.090 k
Load Combination	+1.098D+0.750L+0.750S+1.313E	Load Combination	+1.098D+0.750L+0.750S+1.313E
		Location of maximum on span	18.300 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.240 in	Ratio =	1,210	>=360	Span: 1 : W Only
Max Upward Transient Deflection	0.000 in	Ratio =	0	<360	Span: 1 : L Only
Max Downward Total Deflection	0.597 in	Ratio =	486	>=180	Span: 1 : +D+0.750L+0.750S+0.5250E
Max Upward Total Deflection	0.000 in	Ratio =	0	<180	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
D Only													
Dsgn. L = 24.17 ft	1	0.241	0.075	49.49		49.49	342.92	205.34	1.00	1.00	8.36	166.64	111.09
+D+L													
Dsgn. L = 24.17 ft	1	0.450	0.141	92.41		92.41	342.92	205.34	1.00	1.00	15.62	166.64	111.09
+D+S													
Dsgn. L = 24.17 ft	1	0.379	0.118	77.78		77.78	342.92	205.34	1.00	1.00	13.14	166.64	111.09
+D+0.750L													
Dsgn. L = 24.17 ft	1	0.398	0.124	81.68		81.68	342.92	205.34	1.00	1.00	13.80	166.64	111.09
+D+0.750L+0.750S													
Dsgn. L = 24.17 ft	1	0.501	0.157	102.89		102.89	342.92	205.34	1.00	1.00	17.39	166.64	111.09
+D+0.60W													
Dsgn. L = 24.17 ft	1	0.240	0.075	49.38		49.38	342.92	205.34	1.00	1.00	8.34	166.64	111.09
+D+0.750L+0.450W													

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Steel Beam

Project File: Beams.ec6

DESCRIPTION: B15 w/ Overstrength

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
Dsgn. L = 24.17 ft +D+0.750L+0.750S+0.450W	1	0.397	0.124	81.60		81.60	342.92	205.34	1.00	1.00	13.79	166.64	111.09
Dsgn. L = 24.17 ft +0.60D+0.60W	1	0.501	0.156	102.82		102.82	342.92	205.34	1.00	1.00	17.37	166.64	111.09
Dsgn. L = 24.17 ft +1.131D+1.750E	1	0.144	0.045	29.59		29.59	342.92	205.34	1.00	1.00	5.00	166.64	111.09
Dsgn. L = 24.17 ft +1.098D+0.750L+0.750S+1.313E	1	0.347	0.108	71.25		71.25	342.92	205.34	1.00	1.00	12.04	166.64	111.09
Dsgn. L = 24.17 ft +0.4687D+1.750E	1	0.581	0.181	119.22		119.22	342.92	205.34	1.00	1.00	20.15	166.64	111.09
Dsgn. L = 24.17 ft	1	0.187	0.059	38.46		38.46	342.92	205.34	1.00	1.00	6.50	166.64	111.09

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	0.5969	12.914		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	8.938	18.162
Overall MINimum	-0.009	-0.029
D Only	4.228	8.362
+D+L	7.913	15.616
+D+S	6.487	13.142
+D+0.750L	6.992	13.802
+D+0.750L+0.750S	8.686	17.387
+D+0.60W	4.222	8.345
+D+0.750L+0.450W	6.987	13.790
+D+0.750L+0.750S+0.450W	8.682	17.375
+0.60D+0.60W	2.531	5.000
+D+0.70E	4.563	9.395
+D+0.750L+0.750S+0.5250E	8.938	18.162
+0.60D+0.70E	2.872	6.050
L Only	3.685	7.254
S Only	2.260	4.780
W Only	-0.009	-0.029
E Only	0.479	1.475

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Steel Beam

Project File: Beams.ec6

DESCRIPTION: B15 w/ Overstrength

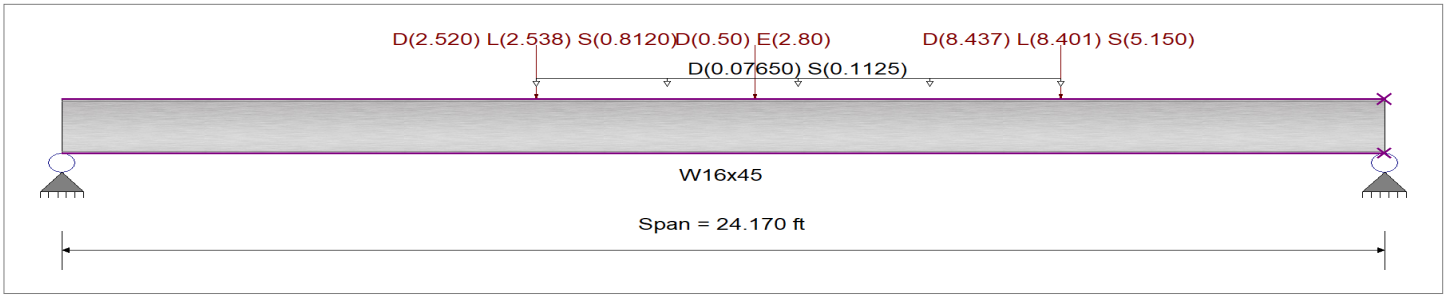
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

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

Beam self weight NOT internally calculated and added
Load(s) for Span Number 1

Point Load : D = 2.520, L = 2.538, S = 0.8120 k @ 8.670 ft, (B13)

Point Load : D = 8.437, L = 8.401, S = 5.150 k @ 18.250 ft, (B14)

Uniform Load : D = 0.0170, S = 0.0250 ksf, Extent = 8.670 -->> 18.250 ft, Tributary Width = 4.50 ft, (Roof)

Point Load : D = 0.50, E = 2.80 k @ 12.670 ft, (SW #207)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.568 : 1	Maximum Shear Stress Ratio =	0.177 : 1
Section used for this span	W16x45	Section used for this span	W16x45
Ma : Applied	116.682 k-ft	Va : Applied	19.679 k
Mn / Omega : Allowable	205.339 k-ft	Vn/Omega : Allowable	111.090 k
Load Combination	+1.098D+0.750L+0.750S+1.313E	Load Combination	+1.098D+0.750L+0.750S+1.313E
		Location of maximum on span	18.300 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.240 in	Ratio =	1,210	>=360	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<360	Span: 1 : L Only
Max Downward Total Deflection	0.616 in	Ratio =	471	>=180	Span: 1 : +D+0.750L+0.750S+0.5250E
Max Upward Total Deflection	0.000 in	Ratio =	0	<180	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
D Only													
Dsgn. L = 24.17 ft	1	0.229	0.072	47.02		47.02	342.92	205.34	1.00	1.00	7.94	166.64	111.09
+D+L													
Dsgn. L = 24.17 ft	1	0.438	0.137	89.94		89.94	342.92	205.34	1.00	1.00	15.20	166.64	111.09
+D+S													
Dsgn. L = 24.17 ft	1	0.367	0.115	75.31		75.31	342.92	205.34	1.00	1.00	12.72	166.64	111.09
+D+0.750L													
Dsgn. L = 24.17 ft	1	0.386	0.120	79.21		79.21	342.92	205.34	1.00	1.00	13.38	166.64	111.09
+D+0.750L+0.750S													
Dsgn. L = 24.17 ft	1	0.489	0.153	100.43		100.43	342.92	205.34	1.00	1.00	16.97	166.64	111.09
+0.60D													
Dsgn. L = 24.17 ft	1	0.137	0.043	28.21		28.21	342.92	205.34	1.00	1.00	4.77	166.64	111.09
+1.131D+1.750E													

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Steel Beam

Project File: Beams.ec6

DESCRIPTION: B15 w/ Overstrength

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
Dsgn. L = 24.17 ft	1	0.381	0.104	78.24		78.24	342.92	205.34	1.00	1.00	11.56	166.64	111.09
+1.098D+0.750L+0.750S+1.313E													
Dsgn. L = 24.17 ft	1	0.568	0.177	116.68		116.68	342.92	205.34	1.00	1.00	19.68	166.64	111.09
+0.4687D+1.750E													
Dsgn. L = 24.17 ft	1	0.242	0.057	49.66		49.66	342.92	205.34	1.00	1.00	6.29	166.64	111.09

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	0.6161	12.845		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	9.403	17.741
Overall MINimum	1.332	1.468
D Only	4.245	7.945
+D+L	7.930	15.198
+D+S	6.505	12.725
+D+0.750L	7.009	13.385
+D+0.750L+0.750S	8.704	16.970
+0.60D	2.547	4.767
+D+0.70E	5.178	8.972
+D+0.750L+0.750S+0.5250E	9.403	17.741
+0.60D+0.70E	3.480	5.794
L Only	3.685	7.254
S Only	2.260	4.780
E Only	1.332	1.468

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B20 w/ HD's

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

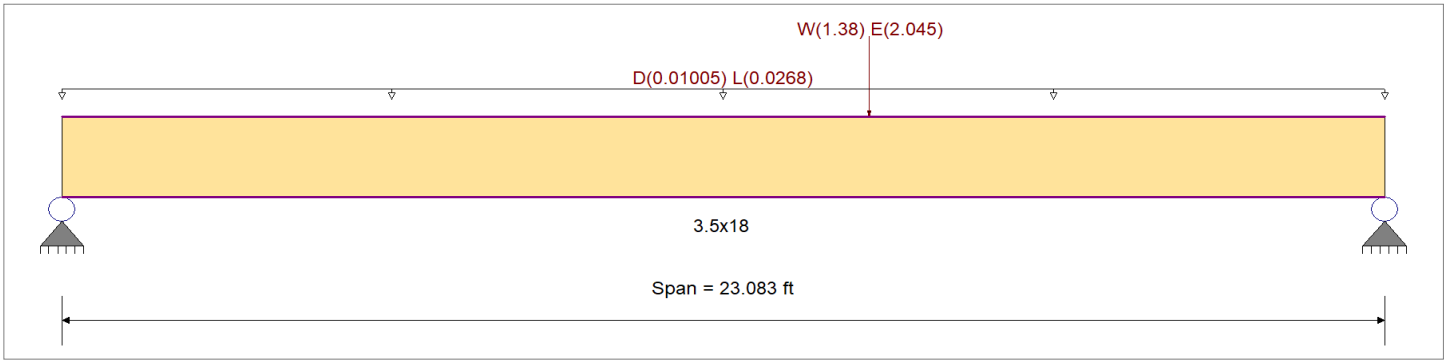
Wood Species : DF/DF
Wood Grade : 24F-V4

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

Fb +	2,400.0 psi
Fb -	1,850.0 psi
Fc - Prll	1,650.0 psi
Fc - Perp	650.0 psi
Fv	265.0 psi
Ft	1,100.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	1,600.0 ksi
Eminbend - yy	850.0 ksi
Density	31.210 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 0.670 ft, (Floor)
Point Load : W = 1.380, E = 2.045 k @ 14.083 ft, (HD)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.162 : 1	Maximum Shear Stress Ratio	=	0.055 : 1
Section used for this span		3.5x18	Section used for this span		3.5x18
fb: Actual	=	474.29 psi	fv: Actual	=	23.21 psi
Fb: Allowable	=	2,925.08 psi	Fv: Allowable	=	424.00 psi
Load Combination		+0.60D-0.70E	Load Combination		+D+0.70E
Location of maximum on span	=	14.069 ft	Location of maximum on span	=	21.651 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.279 in	Ratio =	993	>=360	Span: 1 : E Only
Max Upward Transient Deflection	-0.279 in	Ratio =	993	>=360	Span: 1 : E Only * -1.0
Max Downward Total Deflection	0.216 in	Ratio =	1281	>=180	Span: 1 : +D+0.70E
Max Upward Total Deflection	-0.182 in	Ratio =	1517	>=180	Span: 1 : +0.60D-0.70E

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
Length = 23.083 ft	1	0.020	0.010	0.90	0.988	1.00	1.00	1.00	1.00	1.00	0.67	42.50	2134.52	0.10	2.42	238.50
+D+L					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.066	0.033	1.00	0.988	1.00	1.00	1.00	1.00	1.00	2.45	155.83	2371.69	0.37	8.87	265.00
+D+0.750L					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.043	0.022	1.25	0.988	1.00	1.00	1.00	1.00	1.00	2.01	127.50	2964.61	0.30	7.26	331.25
+D+0.60W					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.087	0.034	1.60	0.988	1.00	1.00	1.00	1.00	1.00	5.18	328.84	3794.70	0.61	14.45	424.00
+D-0.60W					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.085	0.027	1.60	0.988	1.00	1.00	1.00	1.00	1.00	3.90	247.91	2925.08	0.48	11.40	424.00
+D+0.750L+0.450W					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.089	0.038	1.60	0.988	1.00	1.00	1.00	1.00	1.00	5.32	337.67	3794.70	0.68	16.28	424.00

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B20 w/ HD's

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+D+0.750L-0.450W					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.032	0.018	1.60	0.988	1.00	1.00	1.00	1.00	1.00	1.49	94.90	2925.08	0.32	7.58	424.00
+0.60D+0.60W					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.082	0.032	1.60	0.988	1.00	1.00	1.00	1.00	1.00	4.92	312.65	3794.70	0.57	13.48	424.00
+0.60D-0.60W					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.090	0.027	1.60	0.988	1.00	1.00	1.00	1.00	1.00	4.16	264.10	2925.08	0.49	11.65	424.00
+D+0.70E					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.142	0.055	1.60	0.988	1.00	1.00	1.00	1.00	1.00	8.49	539.02	3794.70	0.97	23.21	424.00
+D-0.70E					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.157	0.048	1.60	0.988	1.00	1.00	1.00	1.00	1.00	7.22	458.10	2925.08	0.85	20.17	424.00
+D+0.750L+0.5250E					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.131	0.054	1.60	0.988	1.00	1.00	1.00	1.00	1.00	7.80	495.31	3794.70	0.96	22.85	424.00
+D+0.750L-0.5250E					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.086	0.032	1.60	0.988	1.00	1.00	1.00	1.00	1.00	3.98	252.54	2925.08	0.58	13.72	424.00
+0.60D+0.70E					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.138	0.052	1.60	0.988	1.00	1.00	1.00	1.00	1.00	8.23	522.84	3794.70	0.93	22.25	424.00
+0.60D-0.70E					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.162	0.048	1.60	0.988	1.00	1.00	1.00	1.00	1.00	7.47	474.29	2925.08	0.86	20.42	424.00

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 * -1.0	-0.2787	12.300

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	-0.797	-1.248
Overall MINimum	-0.797	-1.248
D Only	0.116	0.116
+D+L	0.425	0.425
+D+0.750L	0.348	0.348
+D+0.60W	0.439	0.621
+D-0.60W	-0.207	-0.389
+D+0.750L+0.450W	0.590	0.727
+D+0.750L-0.450W	0.106	-0.031
+0.60D+0.60W	0.392	0.575
+0.60D-0.60W	-0.253	-0.436
+D+0.70E	0.674	0.989
+D-0.70E	-0.442	-0.757
+D+0.750L+0.5250E	0.767	1.003
+D+0.750L-0.5250E	-0.071	-0.307
+0.60D+0.70E	0.628	0.943
+0.60D-0.70E	-0.489	-0.804
L Only	0.309	0.309
W Only	0.538	0.842
-W	-0.538	-0.842
E Only	0.797	1.248
E Only * -1.0	-0.797	-1.248

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B20 w/ Overstrength

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

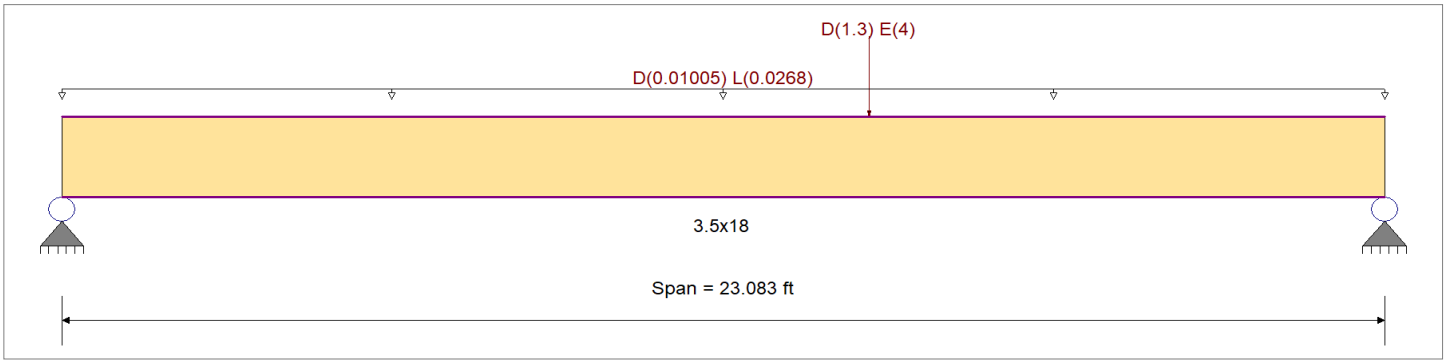
Wood Species : DF/DF
Wood Grade : 24F-V4

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

Fb +	2,800.0 psi
Fb -	2,220.0 psi
Fc - Prll	1,980.0 psi
Fc - Perp	780.0 psi
Fv	318.0 psi
Ft	1,320.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	1,600.0 ksi
Eminbend - yy	850.0 ksi
Density	31.210 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 0.670 ft, (Floor)
Point Load : D = 1.30, E = 4.0 k @ 14.083 ft, (SW #104)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.677 : 1	Maximum Shear Stress Ratio	=	0.247 : 1
Section used for this span		3.5x18	Section used for this span		3.5x18
fb: Actual	=	2,995.95 psi	fv: Actual	=	125.78 psi
Fb: Allowable	=	4,427.15 psi	Fv: Allowable	=	508.80 psi
Load Combination		+1.131D+1.750E	Load Combination		+1.131D+1.750E
Location of maximum on span	=	14.069 ft	Location of maximum on span	=	21.651 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.545 in	Ratio =	508 >=360	Span: 1 : E Only
Max Upward Transient Deflection	-0.545 in	Ratio =	508 >=360	Span: 1 : E Only * -1.0
Max Downward Total Deflection	0.580 in	Ratio =	477 >=180	Span: 1 : +D+0.70E
Max Upward Total Deflection	-0.263 in	Ratio =	1054 >=180	Span: 1 : +0.60D-0.70E

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
Length = 23.083 ft	1	0.198	0.074	0.90	0.988	1.00	1.00	1.00	1.00	1.00	7.77	493.22	2490.27	0.89	21.30	286.20
+D+L					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.217	0.087	1.00	0.988	1.00	1.00	1.00	1.00	1.00	9.47	601.12	2766.97	1.17	27.75	318.00
+D+0.750L					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.166	0.066	1.25	0.988	1.00	1.00	1.00	1.00	1.00	9.04	574.15	3458.71	1.10	26.14	397.50
+0.60D					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.067	0.025	1.60	0.988	1.00	1.00	1.00	1.00	1.00	4.66	295.93	4427.15	0.54	12.78	508.80
+1.131D+1.750E					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.677	0.247	1.60	0.988	1.00	1.00	1.00	1.00	1.00	47.19	2,995.95	4427.15	5.28	125.78	508.80
+1.131D-1.750E					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.536	0.156	1.60	0.988	1.00	1.00	1.00	1.00	1.00	29.61	1,879.96	3510.10	3.34	79.61	508.80

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B20 w/ Overstrength

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+1.098D+0.750L+1.313E					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.554	0.205	1.60	0.988	1.00	1.00	1.00	1.00	1.00	38.61	2,451.19	4427.15	4.39	104.50	508.80
+1.098D+0.750L-1.313E					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.344	0.105	1.60	0.988	1.00	1.00	1.00	1.00	1.00	18.99	1,205.74	3510.10	2.25	53.58	508.80
+0.4687D+1.750E					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.603	0.219	1.60	0.988	1.00	1.00	1.00	1.00	1.00	42.04	2,669.12	4427.15	4.69	111.67	508.80
+0.4687D-1.750E					0.988	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 23.083 ft	1	0.629	0.182	1.60	0.988	1.00	1.00	1.00	1.00	1.00	34.76	2,206.79	3510.10	3.89	92.54	508.80

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.70E	1	0.5797	12.300		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.715	2.617
Overall MINimum	-1.560	-2.440
D Only	0.623	0.909
+D+L	0.932	1.218
+D+0.750L	0.855	1.141
+0.60D	0.374	0.545
+D+0.70E	1.715	2.617
+D-0.70E	-0.469	-0.799
+D+0.750L+0.5250E	1.674	2.422
+D+0.750L-0.5250E	0.036	-0.140
+0.60D+0.70E	1.465	2.254
+0.60D-0.70E	-0.718	-1.163
L Only	0.309	0.309
E Only	1.560	2.440
E Only * -1.0	-1.560	-2.440

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B21 w/ HD's

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

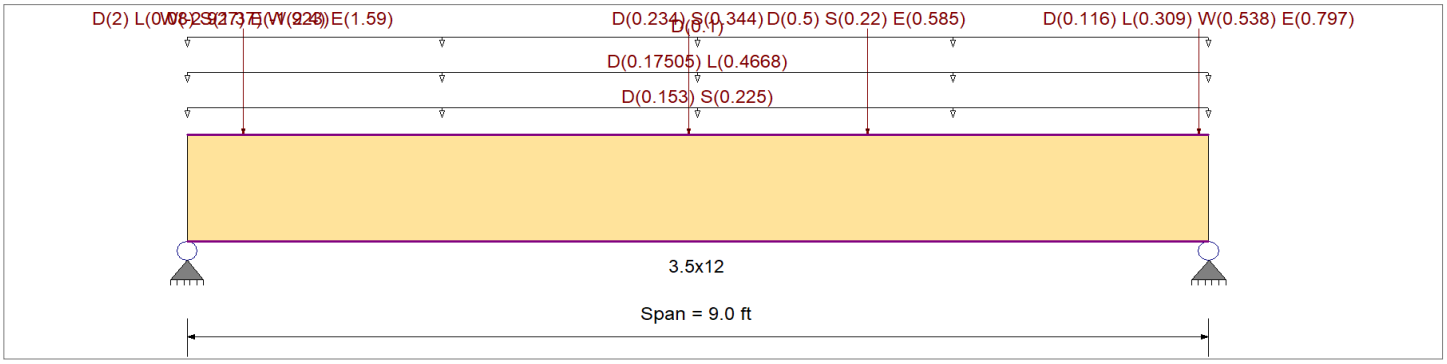
Wood Species : DF/DF
Wood Grade : 24F-V4

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

Fb +	2,400.0 psi
Fb -	1,850.0 psi
Fc - Prll	1,650.0 psi
Fc - Perp	650.0 psi
Fv	265.0 psi
Ft	1,100.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	1,600.0 ksi
Eminbend - yy	850.0 ksi
Density	31.210 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0170, S = 0.0250 ksf, Tributary Width = 9.0 ft, (Roof)
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 11.670 ft, (Floor)
Uniform Load : D = 0.010 ksf, Tributary Width = 10.0 ft, (Wall)
Point Load : D = 2.0, L = 0.080, S = 1.370, W = 2.40, E = 1.590 k @ 0.50 ft, (Floor G.T.)
Point Load : W = -2.927, E = -1.923 k @ 0.50 ft, (HD)
Point Load : D = 0.2340, S = 0.3440 k @ 4.420 ft, (P.A.)
Point Load : D = 0.50, S = 0.220, E = 0.5850 k @ 6.0 ft, (Floor G.T.)
Point Load : D = 0.1160, L = 0.3090, W = 0.5380, E = 0.7970 k @ 8.920 ft, (B20)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.647 : 1	Maximum Shear Stress Ratio	=	0.499 : 1
Section used for this span		3.5x12	Section used for this span		3.5x12
fb: Actual	=	1,552.36 psi	fv: Actual	=	132.32 psi
Fb: Allowable	=	2,400.00 psi	Fv: Allowable	=	265.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	4.434 ft	Location of maximum on span	=	8.015 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.077 in	Ratio =	1402 >=360	Span: 1 : L Only
Max Upward Transient Deflection	-0.002 in	Ratio =	48246 >=360	Span: 1 : W Only
Max Downward Total Deflection	0.208 in	Ratio =	519 >=180	Span: 1 : +D+0.750L+0.750S+0.5250E
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

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
Length = 9.0 ft	1	0.404	0.309	0.90	1.000	1.00	1.00	1.00	1.00	1.00	6.11	872.67	2160.00	2.06	73.67	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 = 9.0 ft	1	0.647	0.499	1.00	1.000	1.00	1.00	1.00	1.00	1.00	10.87	1,552.36	2400.00	3.71	132.32	265.00
+D+S					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B21 w/ HD's

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
Length = 9.0 ft	1	0.509	0.380	1.15	1.000	1.00	1.00	1.00	1.00	1.00	9.83	1,404.34	2760.00	3.25	115.90	304.75
+D+0.750L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 9.0 ft	1	0.461	0.355	1.25	1.000	1.00	1.00	1.00	1.00	1.00	9.68	1,382.44	3000.00	3.29	117.66	331.25
+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 = 9.0 ft	1	0.645	0.490	1.15	1.000	1.00	1.00	1.00	1.00	1.00	12.47	1,781.19	2760.00	4.18	149.33	304.75
+D+0.60W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 9.0 ft	1	0.225	0.172	1.60	1.000	1.00	1.00	1.00	1.00	1.00	6.04	863.03	3840.00	2.04	72.94	424.00
+D+0.750L+0.450W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 9.0 ft	1	0.358	0.276	1.60	1.000	1.00	1.00	1.00	1.00	1.00	9.63	1,375.21	3840.00	3.28	117.11	424.00
+D+0.750L+0.750S+0.450W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 9.0 ft	1	0.462	0.351	1.60	1.000	1.00	1.00	1.00	1.00	1.00	12.42	1,773.96	3840.00	4.17	148.79	424.00
+0.60D+0.60W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 9.0 ft	1	0.134	0.103	1.60	1.000	1.00	1.00	1.00	1.00	1.00	3.60	513.96	3840.00	1.22	43.47	424.00
+D+0.70E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 9.0 ft	1	0.249	0.195	1.60	1.000	1.00	1.00	1.00	1.00	1.00	6.69	956.41	3840.00	2.32	82.78	424.00
+D+0.750L+0.750S+0.5250E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 9.0 ft	1	0.480	0.368	1.60	1.000	1.00	1.00	1.00	1.00	1.00	12.89	1,842.06	3840.00	4.37	156.17	424.00
+0.60D+0.70E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 9.0 ft	1	0.159	0.126	1.60	1.000	1.00	1.00	1.00	1.00	1.00	4.27	609.93	3840.00	1.49	53.31	424.00

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	0.2081	4.533		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	7.652	6.072
Overall MINimum	-0.493	1.161
D Only	4.102	2.601
+D+L	6.281	5.012
+D+S	6.657	4.005
+D+0.750L	5.736	4.409
+D+0.750L+0.750S	7.652	5.462
+D+0.60W	3.806	2.903
+D+0.750L+0.450W	5.514	4.636
+D+0.750L+0.750S+0.450W	7.430	5.689
+0.60D+0.60W	2.165	1.863
+D+0.70E	4.023	3.414
+D+0.750L+0.750S+0.5250E	7.593	6.072
+0.60D+0.70E	2.382	2.373
L Only	2.179	2.411
S Only	2.555	1.404
W Only	-0.493	0.504
E Only	-0.112	1.161

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B26 w/ HD's

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

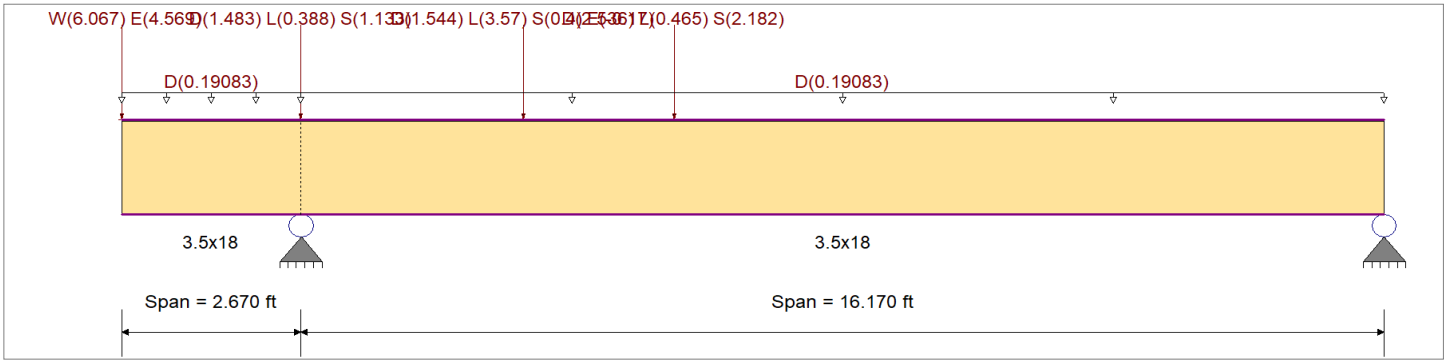
Wood Species : DF/DF
Wood Grade : 24F-V4

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

Fb +	2,400.0 psi
Fb -	1,850.0 psi
Fc - Prll	1,650.0 psi
Fc - Perp	650.0 psi
Fv	265.0 psi
Ft	1,100.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	1,600.0 ksi
Eminbend - yy	850.0 ksi
Density	31.210 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Load for Span Number 1
Point Load : W = 6.067, E = 4.569 k @ 0.0 ft, (HD)
Uniform Load : D = 0.010 ksf, Tributary Width = 19.083 ft, (Wall)
Point Load : D = 1.483, L = 0.3880, S = 1.133 k @ 2.670 ft, (B8)
Load for Span Number 2
Point Load : D = 1.544, L = 3.570, S = 0.40, E = -0.170 k @ 3.330 ft, (P.A.)
Uniform Load : D = 0.010 ksf, Tributary Width = 19.083 ft, (Wall)
Point Load : D = 2.536, L = 0.4650, S = 2.182 k @ 5.583 ft, (B13)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.726 : 1	Maximum Shear Stress Ratio	=	0.659 : 1
Section used for this span		3.5x18	Section used for this span		3.5x18
fb: Actual	=	2,002.80 psi	fv: Actual	=	174.64 psi
Fb: Allowable	=	2,760.00 psi	Fv: Allowable	=	265.00 psi
Load Combination		+D+0.750L+0.750S	Load Combination		+D+L
Location of maximum on span	=	5.601 ft	Location of maximum on span	=	2.670 ft
Span # where maximum occurs	=	Span # 2	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.153 in	Ratio =	416 >=360	Span: 2 : -W
Max Upward Transient Deflection	-0.153 in	Ratio =	416 >=360	Span: 2 : W Only
Max Downward Total Deflection	0.493 in	Ratio =	393 >=180	Span: 2 : +D+0.750L+0.750S-0.450W
Max Upward Total Deflection	-0.312 in	Ratio =	204 >=180	Span: 1 : +D+0.750L+0.750S-0.450W

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
D Only													0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.026	0.419	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.68	43.19	1665.00	4.20	99.89	238.50
Length = 16.080 ft	2	0.524	0.419	0.90	1.000	1.00	1.00	1.00	1.00	1.00	17.82	1,131.34	2160.00	4.20	99.89	238.50
Length = 0.09034 ft	2	0.007	0.419	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.24	15.40	2160.00	2.42	99.89	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 = 2.670 ft	1	0.023	0.659	1.00	1.000	1.00	1.00	1.00	1.00	1.00	0.68	43.19	1850.00	7.33	174.64	265.00

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B26 w/ HD's

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
Length = 16.080 ft	2	0.722	0.659	1.00	1.000	1.00	1.00	1.00	1.00	1.00	27.29	1,732.44	2400.00	7.33	174.64	265.00
Length = 0.09034 ft	2	0.009	0.659	1.00	1.000	1.00	1.00	1.00	1.00	1.00	0.32	20.54	2400.00	3.31	174.64	265.00
+D+S					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.020	0.464	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.68	43.19	2127.50	5.94	141.47	304.75
Length = 16.080 ft	2	0.613	0.464	1.15	1.000	1.00	1.00	1.00	1.00	1.00	26.65	1,692.18	2760.00	5.94	141.47	304.75
Length = 0.09034 ft	2	0.007	0.464	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.32	20.20	2760.00	3.25	141.47	304.75
+D+0.750L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.019	0.471	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.68	43.19	2312.50	6.55	155.95	331.25
Length = 16.080 ft	2	0.527	0.471	1.25	1.000	1.00	1.00	1.00	1.00	1.00	24.92	1,582.17	3000.00	6.55	155.95	331.25
Length = 0.09034 ft	2	0.006	0.471	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.30	19.26	3000.00	3.09	155.95	331.25
+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 = 2.670 ft	1	0.020	0.614	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.68	43.19	2127.50	7.86	187.13	304.75
Length = 16.080 ft	2	0.726	0.614	1.15	1.000	1.00	1.00	1.00	1.00	1.00	31.54	2,002.80	2760.00	7.86	187.13	304.75
Length = 0.09034 ft	2	0.008	0.614	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.36	22.85	2760.00	3.72	187.13	304.75
+D+0.60W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.223	0.269	1.60	1.000	1.00	1.00	1.00	1.00	1.00	10.40	660.29	2960.00	4.80	114.21	424.00
Length = 16.080 ft	2	0.190	0.269	1.60	1.000	1.00	1.00	1.00	1.00	1.00	11.47	727.99	3840.00	4.80	114.21	424.00
Length = 0.09034 ft	2	0.003	0.269	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.19	11.96	3840.00	1.82	114.21	424.00
+D-0.60W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.149	0.204	1.60	1.000	1.00	1.00	1.00	1.00	1.00	9.04	573.91	3840.00	3.64	86.67	424.00
Length = 16.080 ft	2	0.400	0.204	1.60	1.000	1.00	1.00	1.00	1.00	1.00	24.17	1,534.70	3840.00	3.59	86.67	424.00
Length = 0.09034 ft	2	0.005	0.204	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.30	18.85	3840.00	3.02	86.67	424.00
+D+0.750L+0.450W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.171	0.393	1.60	1.000	1.00	1.00	1.00	1.00	1.00	7.97	506.01	2960.00	7.00	166.69	424.00
Length = 16.080 ft	2	0.333	0.393	1.60	1.000	1.00	1.00	1.00	1.00	1.00	20.15	1,279.65	3840.00	7.00	166.69	424.00
Length = 0.09034 ft	2	0.004	0.393	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.26	16.67	3840.00	2.64	166.69	424.00
+D+0.750L-0.450W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.109	0.342	1.60	1.000	1.00	1.00	1.00	1.00	1.00	6.61	419.64	3840.00	6.10	145.22	424.00
Length = 16.080 ft	2	0.491	0.342	1.60	1.000	1.00	1.00	1.00	1.00	1.00	29.68	1,884.69	3840.00	6.10	145.22	424.00
Length = 0.09034 ft	2	0.006	0.342	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.34	21.84	3840.00	3.54	145.22	424.00
+D+0.750L+0.750S+0.450W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.171	0.467	1.60	1.000	1.00	1.00	1.00	1.00	1.00	7.97	506.01	2960.00	8.31	197.87	424.00
Length = 16.080 ft	2	0.443	0.467	1.60	1.000	1.00	1.00	1.00	1.00	1.00	26.78	1,700.28	3840.00	8.31	197.87	424.00
Length = 0.09034 ft	2	0.005	0.467	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.32	20.27	3840.00	3.27	197.87	424.00
+D+0.750L+0.750S-0.450W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.109	0.416	1.60	1.000	1.00	1.00	1.00	1.00	1.00	6.61	419.64	3840.00	7.41	176.40	424.00
Length = 16.080 ft	2	0.600	0.416	1.60	1.000	1.00	1.00	1.00	1.00	1.00	36.31	2,305.32	3840.00	7.41	176.40	424.00
Length = 0.09034 ft	2	0.007	0.416	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.40	25.44	3840.00	4.17	176.40	424.00
+0.60D+0.60W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.217	0.214	1.60	1.000	1.00	1.00	1.00	1.00	1.00	10.13	643.01	2960.00	3.81	90.78	424.00
Length = 16.080 ft	2	0.217	0.214	1.60	1.000	1.00	1.00	1.00	1.00	1.00	10.13	643.01	2960.00	3.12	90.78	424.00
Length = 0.09034 ft	2	0.002	0.214	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.09	5.80	3840.00	0.85	90.78	424.00
+0.60D-0.60W					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.154	0.204	1.60	1.000	1.00	1.00	1.00	1.00	1.00	9.31	591.19	3840.00	3.64	86.67	424.00
Length = 16.080 ft	2	0.282	0.204	1.60	1.000	1.00	1.00	1.00	1.00	1.00	17.04	1,082.16	3840.00	2.05	86.67	424.00
Length = 0.09034 ft	2	0.003	0.204	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.20	12.69	3840.00	2.05	86.67	424.00
+D+0.70E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.198	0.260	1.60	1.000	1.00	1.00	1.00	1.00	1.00	9.22	585.38	2960.00	4.63	110.22	424.00
Length = 16.080 ft	2	0.198	0.260	1.60	1.000	1.00	1.00	1.00	1.00	1.00	11.98	760.51	3840.00	4.63	110.22	424.00
Length = 0.09034 ft	2	0.003	0.260	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.19	12.23	3840.00	1.87	110.22	424.00
+D-0.70E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.130	0.211	1.60	1.000	1.00	1.00	1.00	1.00	1.00	7.86	499.00	3840.00	3.76	89.57	424.00
Length = 16.080 ft	2	0.391	0.211	1.60	1.000	1.00	1.00	1.00	1.00	1.00	23.66	1,502.18	3840.00	3.76	89.57	424.00
Length = 0.09034 ft	2	0.005	0.211	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.29	18.57	3840.00	2.97	89.57	424.00
+D+0.750L+0.750S+0.5250E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.152	0.460	1.60	1.000	1.00	1.00	1.00	1.00	1.00	7.08	449.83	2960.00	8.18	194.88	424.00
Length = 16.080 ft	2	0.449	0.460	1.60	1.000	1.00	1.00	1.00	1.00	1.00	27.16	1,724.67	3840.00	8.18	194.88	424.00
Length = 0.09034 ft	2	0.005	0.460	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.32	20.48	3840.00	3.30	194.88	424.00
+D+0.750L+0.750S-0.5250E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B26 w/ HD's

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
Length = 2.670 ft	1	0.095	0.423	1.60	1.000	1.00	1.00	1.00	1.00	1.00	5.72	363.45	3840.00	7.53	179.39	424.00
Length = 16.080 ft	2	0.594	0.423	1.60	1.000	1.00	1.00	1.00	1.00	1.00	35.92	2,280.93	3840.00	7.53	179.39	424.00
Length = 0.09034 ft	2	0.007	0.423	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.40	25.23	3840.00	4.13	179.39	424.00
+0.60D+0.70E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.192	0.189	1.60	1.000	1.00	1.00	1.00	1.00	1.00	8.95	568.10	2960.00	3.37	80.26	424.00
Length = 16.080 ft	2	0.192	0.189	1.60	1.000	1.00	1.00	1.00	1.00	1.00	8.95	568.10	2960.00	2.95	80.26	424.00
Length = 0.09034 ft	2	0.002	0.189	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.10	6.07	3840.00	0.90	80.26	424.00
+0.60D-0.70E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.134	0.180	1.60	1.000	1.00	1.00	1.00	1.00	1.00	8.13	516.28	3840.00	3.20	76.15	424.00
Length = 16.080 ft	2	0.273	0.180	1.60	1.000	1.00	1.00	1.00	1.00	1.00	16.53	1,049.64	3840.00	2.08	76.15	424.00
Length = 0.09034 ft	2	0.003	0.180	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.20	12.41	3840.00	2.00	76.15	424.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
	1	0.0000	0.000	+D+0.750L+0.750S-0.450W	-0.3116	0.000
+D+0.750L+0.750S-0.450W	2	0.4932	7.407		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum		14.450	4.444
Overall MINimum		-7.069	0.789
D Only		6.464	2.694
+D+L		9.991	3.590
+D+S		9.343	3.530
+D+0.750L		9.109	3.366
+D+0.750L+0.750S		11.269	3.993
+D+0.60W		10.705	2.093
+D-0.60W		2.223	3.295
+D+0.750L+0.450W		12.290	2.915
+D+0.750L-0.450W		5.928	3.817
+D+0.750L+0.750S+0.450W		14.450	3.542
+D+0.750L+0.750S-0.450W		8.088	4.444
+0.60D+0.60W		8.120	1.016
+0.60D-0.60W		-0.363	2.218
+D+0.70E		10.096	2.142
+D-0.70E		2.832	3.247
+D+0.750L+0.750S+0.5250E		13.993	3.579
+D+0.750L+0.750S-0.5250E		8.545	4.407
+0.60D+0.70E		7.510	1.064
+0.60D-0.70E		0.246	2.169
L Only		3.527	0.896
S Only		2.879	0.836
W Only		7.069	-1.002
-W		-7.069	1.002
E Only		5.188	-0.789
E Only * -1.0		-5.188	0.789

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B26 w/ Overstrength

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

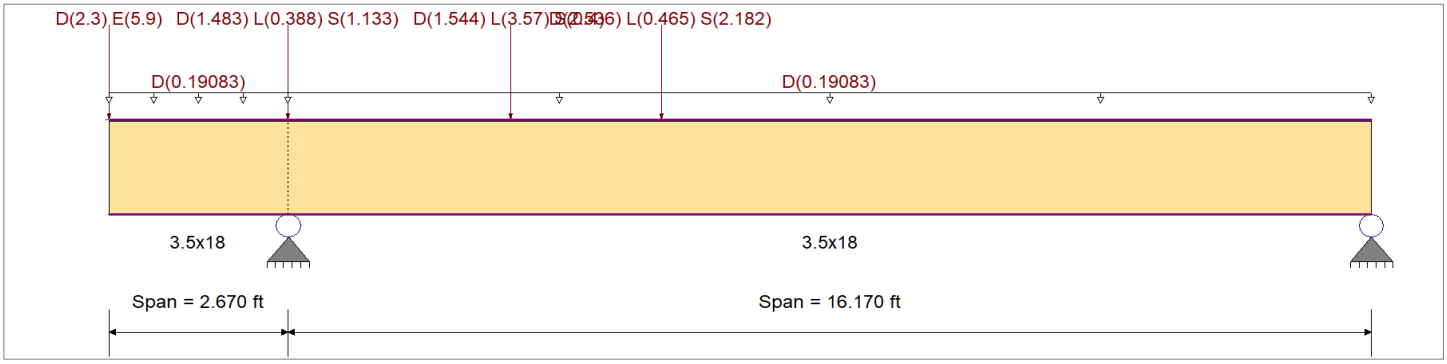
Wood Species : DF/DF
Wood Grade : 24F-V4

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

Fb +	2,880.0 psi
Fb -	2,220.0 psi
Fc - Prll	1,980.0 psi
Fc - Perp	780.0 psi
Fv	318.0 psi
Ft	1,320.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	1,600.0 ksi
Eminbend - yy	850.0 ksi
Density	31.210 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Load for Span Number 1
Point Load : D = 2.30, E = 5.90 k @ 0.0 ft, (SW #111)
Uniform Load : D = 0.010 ksf, Tributary Width = 19.083 ft, (Wall)
Point Load : D = 1.483, L = 0.3880, S = 1.133 k @ 2.670 ft, (B8)
Load for Span Number 2
Point Load : D = 1.544, L = 3.570, S = 0.40 k @ 3.330 ft, (P.A.)
Uniform Load : D = 0.010 ksf, Tributary Width = 19.083 ft, (Wall)
Point Load : D = 2.536, L = 0.4650, S = 2.182 k @ 5.583 ft, (B13)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.631 : 1	Maximum Shear Stress Ratio	=	0.620 : 1
Section used for this span		3.5x18	Section used for this span		3.5x18
fb: Actual	=	2,240.30 psi	fv: Actual	=	315.53 psi
Fb: Allowable	=	3,552.00 psi	Fv: Allowable	=	508.80 psi
Load Combination		+1.131D+1.750E	Load Combination		+1.131D+1.750E
Location of maximum on span	=	2.670 ft	Location of maximum on span	=	1.507 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.149 in	Ratio =	428 >=360	Span: 2 : E Only * -1.0
Max Upward Transient Deflection	-0.149 in	Ratio =	428 >=360	Span: 2 : E Only
Max Downward Total Deflection	0.444 in	Ratio =	437 >=180	Span: 2 : +D+0.750L+0.750S-0.5250E
Max Upward Total Deflection	-0.263 in	Ratio =	242 >=180	Span: 2 : +0.60D+0.70E

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
Length = 2.670 ft	1	0.217	0.381	0.90	1.000	1.00	1.00	1.00	1.00	1.00	6.82	433.09	1998.00	4.58	108.94	286.20
Length = 16.080 ft	2	0.338	0.381	0.90	1.000	1.00	1.00	1.00	1.00	1.00	13.80	876.49	2592.00	4.58	108.94	286.20
Length = 0.09034 ft	2	0.005	0.381	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.21	13.23	2592.00	2.04	108.94	286.20
+D+L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.195	0.578	1.00	1.000	1.00	1.00	1.00	1.00	1.00	6.82	433.09	2220.00	7.71	183.68	318.00

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B26 w/ Overstrength

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
Length = 16.080 ft	2	0.513	0.578	1.00	1.000	1.00	1.00	1.00	1.00	1.00	23.27	1,477.59	2880.00	7.71	183.68	318.00
Length = 0.09034 ft	2	0.006	0.578	1.00	1.000	1.00	1.00	1.00	1.00	1.00	0.29	18.36	2880.00	2.93	183.68	318.00
+D+S					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.170	0.412	1.15	1.000	1.00	1.00	1.00	1.00	1.00	6.82	433.09	2553.00	6.32	150.51	365.70
Length = 16.080 ft	2	0.434	0.412	1.15	1.000	1.00	1.00	1.00	1.00	1.00	22.64	1,437.33	3312.00	6.32	150.51	365.70
Length = 0.09034 ft	2	0.005	0.412	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.28	18.02	3312.00	2.87	150.51	365.70
+D+0.750L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.156	0.415	1.25	1.000	1.00	1.00	1.00	1.00	1.00	6.82	433.09	2775.00	6.93	164.99	397.50
Length = 16.080 ft	2	0.369	0.415	1.25	1.000	1.00	1.00	1.00	1.00	1.00	20.91	1,327.31	3600.00	6.93	164.99	397.50
Length = 0.09034 ft	2	0.005	0.415	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.27	17.08	3600.00	2.71	164.99	397.50
+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 = 2.670 ft	1	0.170	0.536	1.15	1.000	1.00	1.00	1.00	1.00	1.00	6.82	433.09	2553.00	8.24	196.18	365.70
Length = 16.080 ft	2	0.528	0.536	1.15	1.000	1.00	1.00	1.00	1.00	1.00	27.53	1,747.95	3312.00	8.24	196.18	365.70
Length = 0.09034 ft	2	0.006	0.536	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.33	20.67	3312.00	3.34	196.18	365.70
+0.60D					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.073	0.128	1.60	1.000	1.00	1.00	1.00	1.00	1.00	4.09	259.86	3552.00	2.75	65.36	508.80
Length = 16.080 ft	2	0.114	0.128	1.60	1.000	1.00	1.00	1.00	1.00	1.00	8.28	525.89	4608.00	2.75	65.36	508.80
Length = 0.09034 ft	2	0.002	0.128	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.12	7.94	4608.00	1.22	65.36	508.80
+1.131D+1.750E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.631	0.620	1.60	1.000	1.00	1.00	1.00	1.00	1.00	35.28	2,240.30	3552.00	13.25	315.53	508.80
Length = 16.080 ft	2	0.631	0.620	1.60	1.000	1.00	1.00	1.00	1.00	1.00	35.28	2,240.30	3552.00	6.88	315.53	508.80
Length = 0.09034 ft	2	0.001	0.620	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.08	5.18	4608.00	0.60	315.53	508.80
+1.131D-1.750E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.274	0.361	1.60	1.000	1.00	1.00	1.00	1.00	1.00	19.85	1,260.37	4608.00	7.72	183.88	508.80
Length = 16.080 ft	2	0.463	0.361	1.60	1.000	1.00	1.00	1.00	1.00	1.00	33.64	2,135.66	4608.00	4.01	183.88	508.80
Length = 0.09034 ft	2	0.005	0.361	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.39	24.74	4608.00	4.01	183.88	508.80
+1.098D+0.750L+0.750S+1.3					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.504	0.495	1.60	1.000	1.00	1.00	1.00	1.00	1.00	28.17	1,788.50	3552.00	10.59	252.05	508.80
Length = 16.080 ft	2	0.504	0.495	1.60	1.000	1.00	1.00	1.00	1.00	1.00	28.17	1,788.50	3552.00	9.97	252.05	508.80
Length = 0.09034 ft	2	0.003	0.495	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.23	14.64	4608.00	2.26	252.05	508.80
+1.098D+0.750L+0.750S-1.31					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.182	0.347	1.60	1.000	1.00	1.00	1.00	1.00	1.00	13.18	837.00	4608.00	7.41	176.46	508.80
Length = 16.080 ft	2	0.584	0.347	1.60	1.000	1.00	1.00	1.00	1.00	1.00	42.40	2,692.33	4608.00	7.41	176.46	508.80
Length = 0.09034 ft	2	0.006	0.347	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.46	29.31	4608.00	4.82	176.46	508.80
+0.4687D+1.750E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.550	0.540	1.60	1.000	1.00	1.00	1.00	1.00	1.00	30.76	1,953.32	3552.00	11.54	274.71	508.80
Length = 16.080 ft	2	0.550	0.540	1.60	1.000	1.00	1.00	1.00	1.00	1.00	30.76	1,953.32	3552.00	3.85	274.71	508.80
Length = 0.09034 ft	2	0.001	0.540	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.06	3.58	3552.00	0.62	274.71	508.80
+0.4687D-1.750E					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.670 ft	1	0.336	0.433	1.60	1.000	1.00	1.00	1.00	1.00	1.00	24.37	1,547.35	4608.00	9.25	220.17	508.80
Length = 16.080 ft	2	0.355	0.433	1.60	1.000	1.00	1.00	1.00	1.00	1.00	25.76	1,635.76	4608.00	2.66	220.17	508.80
Length = 0.09034 ft	2	0.003	0.433	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.25	15.98	4608.00	2.66	220.17	508.80

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
	1	0.0000	0.000	+D+0.750L+0.750S-0.5250E	-0.2628	0.000
+D+0.750L+0.750S-0.5250E	2	0.4439	7.498		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum		17.557	4.125
Overall MINimum		-6.874	0.974
D Only		9.144	2.315
+D+L		12.671	3.210
+D+S		12.023	3.150
+D+0.750L		11.789	2.986
+D+0.750L+0.750S		13.949	3.613
+0.60D		5.486	1.389
+D+0.70E		13.956	1.633

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B26 w/ Overstrength

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
+D-0.70E		4.332	2.997
+D+0.750L+0.750S+0.5250E		17.557	3.102
+D+0.750L+0.750S-0.5250E		10.340	4.125
+0.60D+0.70E		10.298	0.707
+0.60D-0.70E		0.674	2.071
L Only		3.527	0.896
S Only		2.879	0.836
E Only		6.874	-0.974
E Only * -1.0		-6.874	0.974

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Steel Beam

Project File: Beams.ec6

DESCRIPTION: B37 w/ HD's

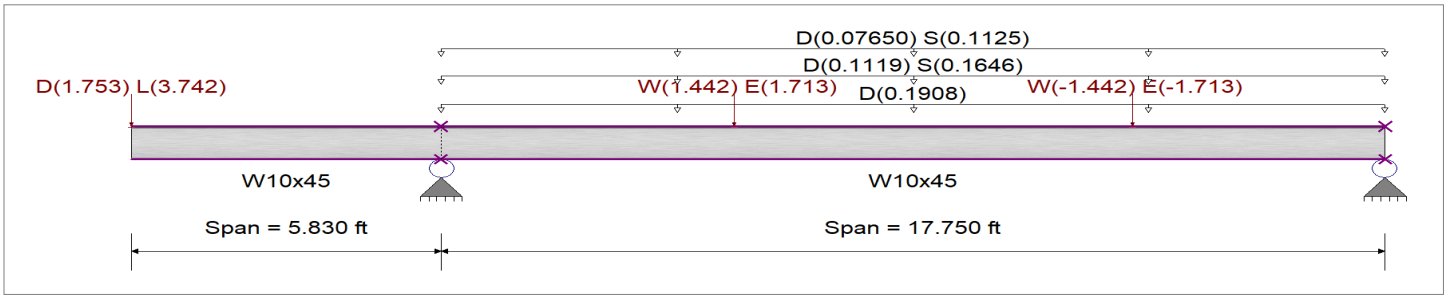
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

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

Beam self weight NOT internally calculated and added
Load(s) for Span Number 1
Point Load : D = 1.753, L = 3.742 k @ 0.0 ft, (B36)

Load(s) for Span Number 2
Point Load : W = 1.442, E = 1.713 k @ 5.50 ft, (HD)

Point Load : W = -1.442, E = -1.713 k @ 13.0 ft, (HD)

Uniform Load : D = 0.010 ksf, Tributary Width = 19.083 ft, (Wall)

Uniform Load : D = 0.0170, S = 0.0250 ksf, Tributary Width = 6.585 ft, (Roof)

Uniform Load : D = 0.0170, S = 0.0250 ksf, Tributary Width = 4.50 ft, (Roof)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.234 : 1	Maximum Shear Stress Ratio =	0.100 : 1
Section used for this span	W10x45	Section used for this span	W10x45
Ma : Applied	32.036 k-ft	Va : Applied	7.088 k
Mn / Omega : Allowable	136.976 k-ft	Vn/Omega : Allowable	70.70 k
Load Combination	+D+L	Load Combination	+D+0.750L+0.750S+0.5250E
		Location of maximum on span	5.830 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.240 in	Ratio =	582	>=	Span: 2 : S Only
Max Upward Transient Deflection	-0.090 in	Ratio =	1,546	>=	Span: 2 : L Only
Max Downward Total Deflection	0.229 in	Ratio =	611	>=	Span: 2 : +D+L
Max Upward Total Deflection	-0.102 in	Ratio =	1377	>=	Span: 2 : +D+S

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
D Only													
Dsgn. L = 5.83 ft	1	0.075	0.056		-10.22	10.22	228.75	136.98	1.00	1.00	3.94	106.05	70.70
Dsgn. L = 17.75 ft	2	0.075	0.056	10.26	-10.22	10.26	228.75	136.98	1.00	1.00	3.94	106.05	70.70
+D+L													
Dsgn. L = 5.83 ft	1	0.234	0.078		-32.04	32.04	228.75	136.98	1.00	1.00	5.50	106.05	70.70
Dsgn. L = 17.75 ft	2	0.234	0.073	3.21	-32.04	32.04	228.75	136.98	1.00	1.00	5.17	106.05	70.70
+D+S													

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Steel Beam

Project File: Beams.ec6

DESCRIPTION: B37 w/ HD's

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
Dsgn. L = 5.83 ft	1	0.075	0.091		-10.22	10.22	228.75	136.98	1.00	1.00	6.40	106.05	70.70
Dsgn. L = 17.75 ft	2	0.153	0.091	20.99	-10.22	20.99	228.75	136.98	1.00	1.00	6.40	106.05	70.70
+D+0.750L													
Dsgn. L = 5.83 ft	1	0.194	0.069		-26.58	26.58	228.75	136.98	1.00	1.00	4.86	106.05	70.70
Dsgn. L = 17.75 ft	2	0.194	0.069	4.60	-26.58	26.58	228.75	136.98	1.00	1.00	4.86	106.05	70.70
+D+0.750L+0.750S													
Dsgn. L = 5.83 ft	1	0.194	0.095		-26.58	26.58	228.75	136.98	1.00	1.00	6.71	106.05	70.70
Dsgn. L = 17.75 ft	2	0.194	0.095	11.74	-26.58	26.58	228.75	136.98	1.00	1.00	6.71	106.05	70.70
+D+0.60W													
Dsgn. L = 5.83 ft	1	0.075	0.061		-10.22	10.22	228.75	136.98	1.00	1.00	4.31	106.05	70.70
Dsgn. L = 17.75 ft	2	0.075	0.061	10.16	-10.22	10.22	228.75	136.98	1.00	1.00	4.31	106.05	70.70
+D-0.60W													
Dsgn. L = 5.83 ft	1	0.075	0.051		-10.22	10.22	228.75	136.98	1.00	1.00	3.58	106.05	70.70
Dsgn. L = 17.75 ft	2	0.081	0.051	11.03	-10.22	11.03	228.75	136.98	1.00	1.00	3.58	106.05	70.70
+D+0.750L+0.450W													
Dsgn. L = 5.83 ft	1	0.194	0.073		-26.58	26.58	228.75	136.98	1.00	1.00	5.14	106.05	70.70
Dsgn. L = 17.75 ft	2	0.194	0.073	3.55	-26.58	26.58	228.75	136.98	1.00	1.00	5.14	106.05	70.70
+D+0.750L-0.450W													
Dsgn. L = 5.83 ft	1	0.194	0.065		-26.58	26.58	228.75	136.98	1.00	1.00	4.59	106.05	70.70
Dsgn. L = 17.75 ft	2	0.194	0.065	5.90	-26.58	26.58	228.75	136.98	1.00	1.00	4.59	106.05	70.70
+D+0.750L+0.750S+0.450W													
Dsgn. L = 5.83 ft	1	0.194	0.099		-26.58	26.58	228.75	136.98	1.00	1.00	6.98	106.05	70.70
Dsgn. L = 17.75 ft	2	0.194	0.099	11.15	-26.58	26.58	228.75	136.98	1.00	1.00	6.98	106.05	70.70
+D+0.750L+0.750S-0.450W													
Dsgn. L = 5.83 ft	1	0.194	0.091		-26.58	26.58	228.75	136.98	1.00	1.00	6.43	106.05	70.70
Dsgn. L = 17.75 ft	2	0.194	0.091	12.57	-26.58	26.58	228.75	136.98	1.00	1.00	6.43	106.05	70.70
+0.60D+0.60W													
Dsgn. L = 5.83 ft	1	0.045	0.039		-6.13	6.13	228.75	136.98	1.00	1.00	2.73	106.05	70.70
Dsgn. L = 17.75 ft	2	0.046	0.039	6.27	-6.13	6.27	228.75	136.98	1.00	1.00	2.73	106.05	70.70
+0.60D-0.60W													
Dsgn. L = 5.83 ft	1	0.045	0.028		-6.13	6.13	228.75	136.98	1.00	1.00	2.00	106.05	70.70
Dsgn. L = 17.75 ft	2	0.052	0.029	7.14	-6.13	7.14	228.75	136.98	1.00	1.00	2.04	106.05	70.70
+D+0.70E													
Dsgn. L = 5.83 ft	1	0.075	0.063		-10.22	10.22	228.75	136.98	1.00	1.00	4.45	106.05	70.70
Dsgn. L = 17.75 ft	2	0.075	0.063	10.29	-10.22	10.29	228.75	136.98	1.00	1.00	4.45	106.05	70.70
+D-0.70E													
Dsgn. L = 5.83 ft	1	0.075	0.049		-10.22	10.22	228.75	136.98	1.00	1.00	3.44	106.05	70.70
Dsgn. L = 17.75 ft	2	0.084	0.049	11.50	-10.22	11.50	228.75	136.98	1.00	1.00	3.44	106.05	70.70
+D+0.750L+0.750S+0.5250E													
Dsgn. L = 5.83 ft	1	0.194	0.100		-26.58	26.58	228.75	136.98	1.00	1.00	7.09	106.05	70.70
Dsgn. L = 17.75 ft	2	0.194	0.100	10.98	-26.58	26.58	228.75	136.98	1.00	1.00	7.09	106.05	70.70
+D+0.750L+0.750S-0.5250E													
Dsgn. L = 5.83 ft	1	0.194	0.090		-26.58	26.58	228.75	136.98	1.00	1.00	6.33	106.05	70.70
Dsgn. L = 17.75 ft	2	0.194	0.090	12.96	-26.58	26.58	228.75	136.98	1.00	1.00	6.33	106.05	70.70
+0.60D+0.70E													
Dsgn. L = 5.83 ft	1	0.045	0.041		-6.13	6.13	228.75	136.98	1.00	1.00	2.87	106.05	70.70
Dsgn. L = 17.75 ft	2	0.048	0.041	6.61	-6.13	6.61	228.75	136.98	1.00	1.00	2.87	106.05	70.70
+0.60D-0.70E													
Dsgn. L = 5.83 ft	1	0.045	0.026		-6.13	6.13	228.75	136.98	1.00	1.00	1.86	106.05	70.70
Dsgn. L = 17.75 ft	2	0.057	0.031	7.79	-6.13	7.79	228.75	136.98	1.00	1.00	2.18	106.05	70.70

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
L Only	1	0.2404	0.000		0.0000	0.000
+D+S	2	0.1566	9.301	L Only	-0.0710	2.982

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum		11.648	5.250
Overall MINimum		-0.609	0.609
D Only		5.695	2.790
+D+L		10.666	1.561
+D+S		8.154	5.250

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Steel Beam

Project File: Beams.ec6

DESCRIPTION: B37 w/ HD's

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
+D+0.750L		9.423	1.868
+D+0.750L+0.750S		11.268	3.713
+D+0.60W		6.060	2.425
+D-0.60W		5.329	3.156
+D+0.750L+0.450W		9.697	1.594
+D+0.750L-0.450W		9.149	2.143
+D+0.750L+0.750S+0.450W		11.542	3.439
+D+0.750L+0.750S-0.450W		10.994	3.987
+0.60D+0.60W		3.782	1.309
+0.60D-0.60W		3.051	2.040
+D+0.70E		6.202	2.284
+D-0.70E		5.188	3.297
+D+0.750L+0.750S+0.5250E		11.648	3.333
+D+0.750L+0.750S-0.5250E		10.888	4.093
+0.60D+0.70E		3.924	1.168
+0.60D-0.70E		2.910	2.181
L Only		4.971	-1.229
S Only		2.459	2.459
W Only		0.609	-0.609
-W		-0.609	0.609
E Only		0.724	-0.724
E Only * -1.0		-0.724	0.724

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B41 w/ HD's

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

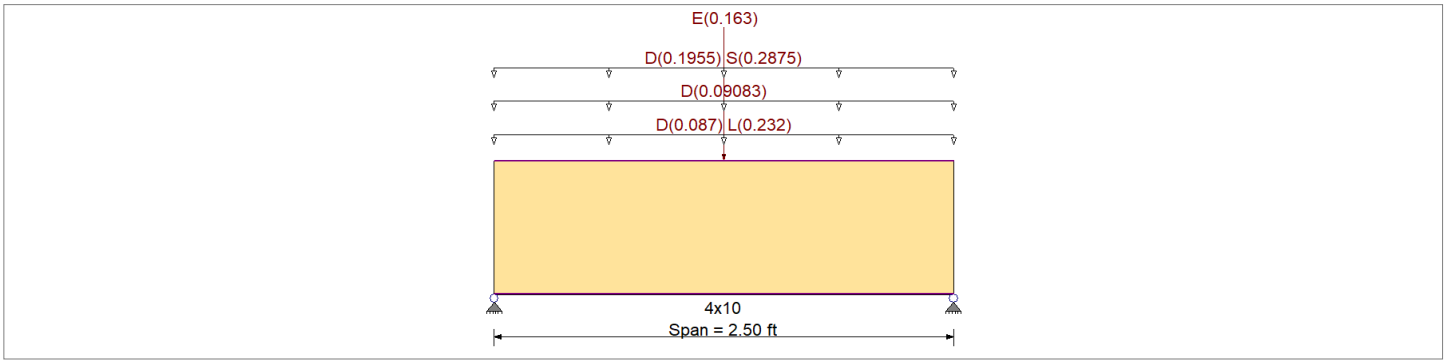
Wood Species : Douglas Fir-Larch
Wood Grade : No.2

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

Fb +	900.0 psi
Fb -	900.0 psi
Fc - Prll	1,350.0 psi
Fc - Perp	625.0 psi
Fv	180.0 psi
Ft	575.0 psi

E : Modulus of Elasticity

Ebend- xx	1,600.0 ksi
Eminbend - xx	580.0 ksi
Density	31.210 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Point Load : E = 0.1630 k @ 1.250 ft, (HD)
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 5.80 ft, (Floor)
Uniform Load : D = 0.010 ksf, Tributary Width = 9.083 ft, (Wall)
Uniform Load : D = 0.0170, S = 0.0250 ksf, Tributary Width = 11.50 ft, (Roof)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.115 : 1	Maximum Shear Stress Ratio	=	0.083 : 1
Section used for this span		4x10	Section used for this span		4x10
fb: Actual	=	143.31 psi	fv: Actual	=	17.09 psi
Fb: Allowable	=	1,242.00 psi	Fv: Allowable	=	207.00 psi
Load Combination		+D+0.750L+0.750S	Load Combination		+D+0.750L+0.750S
Location of maximum on span	=	1.250 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 in	Ratio =	0 <360	n/a
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.002 in	Ratio =	15328 >=180	Span: 1 : +D+0.750L+0.750S+0.5250E
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

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
Length = 2.50 ft	1	0.072	0.052	0.90	1.200	1.00	1.00	1.00	1.00	1.00	0.29	70.12	972.00	0.18	8.36	162.00
+D+L					1.200	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.50 ft	1	0.105	0.075	1.00	1.200	1.00	1.00	1.00	1.00	1.00	0.47	113.70	1080.00	0.29	13.56	180.00
+D+S					1.200	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.50 ft	1	0.100	0.072	1.15	1.200	1.00	1.00	1.00	1.00	1.00	0.52	124.13	1242.00	0.32	14.81	207.00
+D+0.750L					1.200	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.50 ft	1	0.076	0.055	1.25	1.200	1.00	1.00	1.00	1.00	1.00	0.43	102.81	1350.00	0.26	12.26	225.00
+D+0.750L+0.750S					1.200	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.50 ft	1	0.115	0.083	1.15	1.200	1.00	1.00	1.00	1.00	1.00	0.60	143.31	1242.00	0.37	17.09	207.00

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title: Architectural Innovations
Engineer: LGH
Project ID: 203-22010
Project Descr: 3036 67th Ave. SE

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B41 w/ HD's

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+0.60D					1.200	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.50 ft	**1**	0.024	0.017	1.60	1.200	1.00	1.00	1.00	1.00	1.00	0.17	42.07	1728.00	0.11	5.02	288.00
+D+0.70E					1.200	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.50 ft	**1**	0.051	0.038	1.60	1.200	1.00	1.00	1.00	1.00	1.00	0.36	87.27	1728.00	0.24	11.01	288.00
+D-0.70E					1.200	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.50 ft	**1**	0.031	0.020	1.60	1.200	1.00	1.00	1.00	1.00	1.00	0.22	54.03	1728.00	0.12	5.72	288.00
+D+0.750L+0.750S+0.5250E					1.200	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.50 ft	**1**	0.090	0.066	1.60	1.200	1.00	1.00	1.00	1.00	1.00	0.65	156.17	1728.00	0.41	19.08	288.00
+D+0.750L+0.750S-0.5250E					1.200	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.50 ft	**1**	0.076	0.052	1.60	1.200	1.00	1.00	1.00	1.00	1.00	0.54	130.74	1728.00	0.33	15.11	288.00
+0.60D+0.70E					1.200	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.50 ft	**1**	0.034	0.027	1.60	1.200	1.00	1.00	1.00	1.00	1.00	0.25	59.22	1728.00	0.17	7.66	288.00
+0.60D-0.70E					1.200	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.50 ft	**1**	0.015	0.009	1.60	1.200	1.00	1.00	1.00	1.00	1.00	0.11	26.68	1728.00	0.06	2.64	288.00

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	0.0020	1.259		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.996	0.996
Overall MINimum	-0.082	-0.082
D Only	0.467	0.467
+D+L	0.757	0.757
+D+S	0.826	0.826
+D+0.750L	0.684	0.684
+D+0.750L+0.750S	0.954	0.954
+0.60D	0.280	0.280
+D+0.70E	0.524	0.524
+D-0.70E	0.410	0.410
+D+0.750L+0.750S+0.5250E	0.996	0.996
+D+0.750L+0.750S-0.5250E	0.911	0.911
+0.60D+0.70E	0.337	0.337
+0.60D-0.70E	0.223	0.223
L Only	0.290	0.290
S Only	0.359	0.359
E Only	0.082	0.082
E Only * -1.0	-0.082	-0.082

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING
7220 Trade Street, Suite 350 ▸ San Diego, CA 92121
p 619-650-0010 ▸ *mulhernkulp.com*

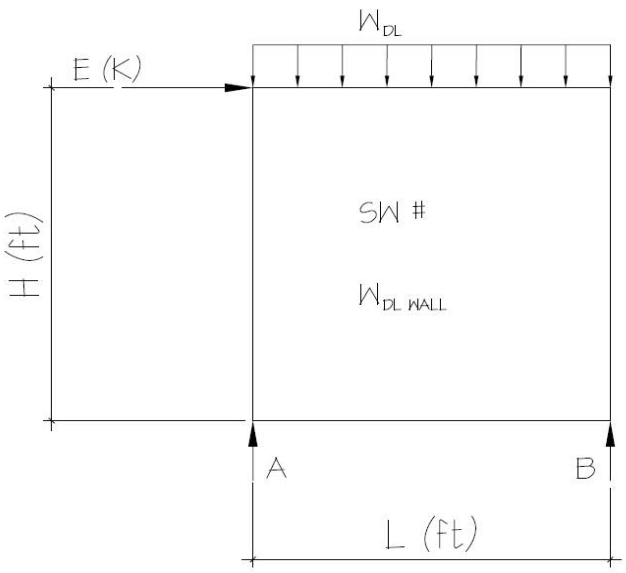
Project Name: Architectural Innovations
3036 67th Ave. SE
M&K Project #: 203-22010
Engineer: LGH
Date: 13-May-22

Overstrength Calculations

Wall Description/SW #: 202

Parameters:

L =	6.0	ft
H =	9.1	ft
E =	1.54	k
W_{DLwall} =	0.09	klf
W_{DL} =	0.195	klf
Ω_0 =	2.5	(ASCE TABLE 12.2.1 FOOTNOTE G)
SDS =	0.938	



analysis:

$E_{mh} = \Omega 0 * E$ =	3.85	K	$E_v = 0.2*SDS*DL$ =	0.322 K
$E_m = E_{mh} + E_v$			$E_m = E_{mh} + E_v$ =	4.172 K
$E_m = E_{mh} - E_v$			$E_m = E_{mh} - E_v$ =	3.528 K

E_m (max) = $\sum M_A = 0$ =	4.17(9.1) + 0.28603(6)(3) - Rb(6)	R_B =	0.9DL + 6.3E
		Ra =	0.9DL - 6.3E
E_m (min) = $\sum M_A = 0$ =	3.53(9.1) + 0.28603(6)(3) - Rb(6)	R_B =	0.9DL + 5.3E
		Ra =	0.9DL - 5.3E

check beams for axial forces shown using load combos per section 12.4.3.1 (asd)

allowable stess permitted to be increased by 1.2

see following beam calcs for load application

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING
7220 Trade Street, Suite 350 ▸ San Diego, CA 92121
p 619-650-0010 ▸ mulhernkulp.com

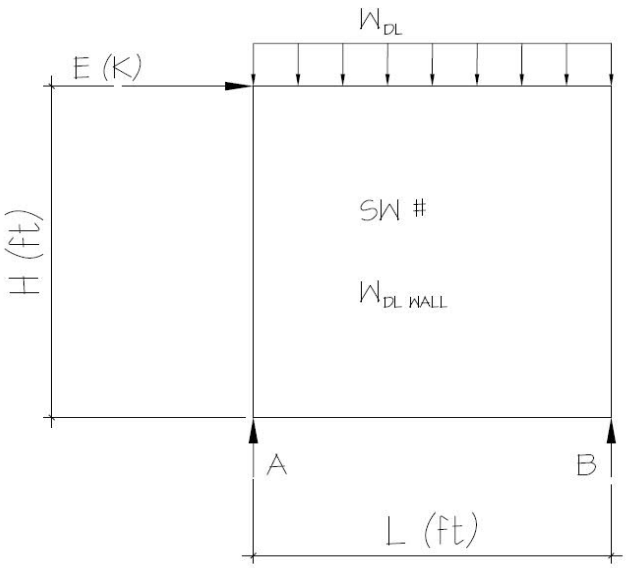
Project Name: Architectural Innovations
3036 67th Ave. S
M&K Project #: 203-22010
Engineer: LGH
Date: 13-May-22

Overstrength Calculations

Wall Description/SW #: 203

Parameters:

L =	6.8	ft
H =	9.1	ft
E =	0.94	k
W_{DLWall} =	0.09	klf
W_{DL} =	0.071	klf
Ω_0 =	2.5	(ASCE TABLE 12.2.1 FOOTNOTE G)
SDS =	0.938	



analysis:

$E_{mh} = \Omega 0 * E =$ 2.36 K

$E_v = 0.2*SDS*DL =$ 0.205 K

$E_m = E_{mh} + E_v$ $E_m = E_{mh} + E_v =$ 2.565 K

$E_m = E_{mh} - E_v$ $E_m = E_{mh} - E_v =$ 2.155 K

E_m (max) $= \sum M_A = 0 =$ 2.57(9.1) + 0.162(6.75)(3.375) - Rb(6.75)

$R_B =$ 0.5DL + 3.5E

Ra= 0.5DL - 3.5E

E_m (min) $= \sum M_A = 0 =$ 2.15(9.1) + 0.162(6.75)(3.375) - Rb(6.75)

$R_B =$ 0.5DL + 2.9E

Ra= 0.5DL - 2.9E

check beams for axial forces shown using load combos per section 12.4.3.1 (asd)

allowable stess permitted to be increased by 1.2

see following beam calcs for load application

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING
7220 Trade Street, Suite 350 ▸ San Diego, CA 92121
p 619-650-0010 ▸ mulhernkulp.com

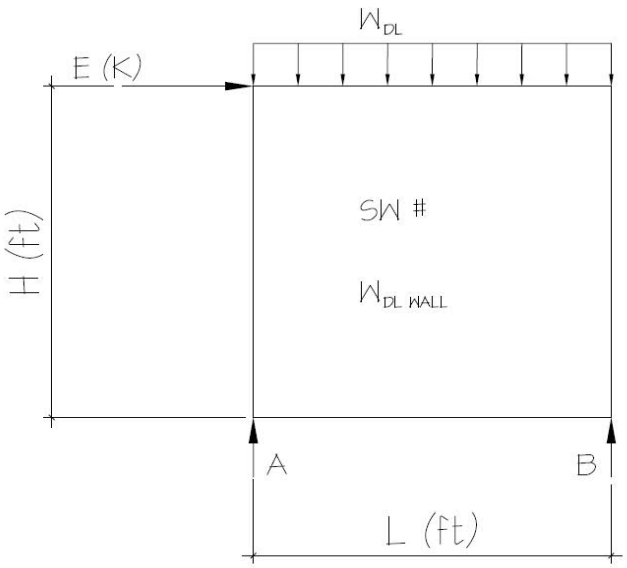
Project Name: Architectural Innovations
3036 67th Ave. S
M&K Project #: 203-22010
Engineer: LGH
Date: 13-May-22

Overstrength Calculations

Wall Description/SW #: 204

Parameters:

L =	11.0	ft
H =	9.1	ft
E =	0.60	k
W_{DLWall} =	0.09	klf
W_{DL} =	0.076	klf
Ω_0 =	2.5	(ASCE TABLE 12.2.1 FOOTNOTE G)
SDS =	0.938	



analysis:

$E_{mh} = \Omega 0 * E$ =	1.50 K	$E_v = 0.2*SDS*DL$ =	0.345 K
$E_m = E_{mh} + E_v$		$E_m = E_{mh} + E_v$ =	1.845 K
$E_m = E_{mh} - E_v$		$E_m = E_{mh} - E_v$ =	1.155 K

E_m (max) = $\sum M_A = 0$ =	1.84(9.1) + 0.16703(11)(5.5) - Rb(11)	R_B =	0.9DL + 1.5E
		Ra =	0.9DL - 1.5E
E_m (min) = $\sum M_A = 0$ =	1.16(9.1) + 0.16703(11)(5.5) - Rb(11)	R_B =	0.9DL + 1.0E
		Ra =	0.9DL - 1.0E

check beams for axial forces shown using load combos per section 12.4.3.1 (asd)

allowable stess permitted to be increased by 1.2

see following beam calcs for load application

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING
7220 Trade Street, Suite 350 ▸ San Diego, CA 92121
p 619-650-0010 ▸ *mulhernkulp.com*

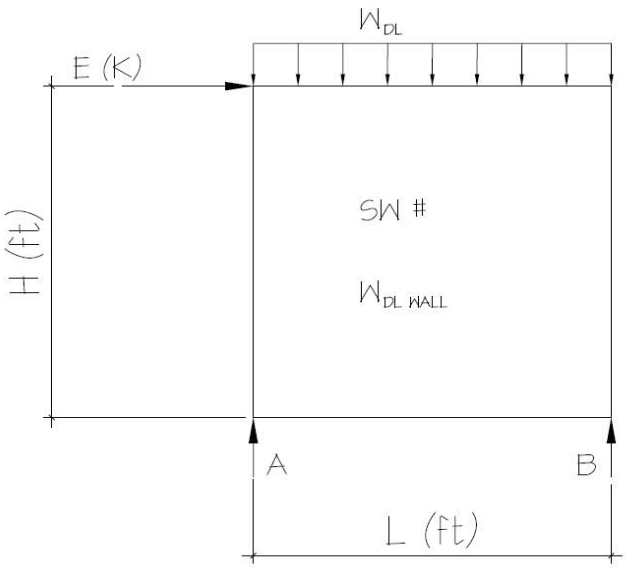
Project Name: Architectural Innovations
3036 67th Ave. S
M&K Project #: 203-22010
Engineer: LGH
Date: 13-May-22

Overstrength Calculations

Wall Description/SW #: 205

Parameters:

L =	9.6	ft
H =	9.1	ft
E =	0.51	k
W_{DLWall} =	0.09	klf
W_{DL} =	0.076	klf
Ω_0 =	2.5	(ASCE TABLE 12.2.1 FOOTNOTE G)
SDS =	0.938	



analysis:

$E_{mh} = \Omega 0 * E$ =	1.28 K	$E_v = 0.2*SDS*DL$ =	0.300 K
$E_m = E_{mh} + E_v$		$E_m = E_{mh} + E_v$ =	1.578 K
$E_m = E_{mh} - E_v$		$E_m = E_{mh} - E_v$ =	0.977 K

E_m (max) = $\sum M_A = 0$ =	1.58(9.1) + 0.16703(9.583)(4.7915) - Rb(9.583)	R_B =	0.8DL + 1.5E
		Ra =	0.8DL - 1.5E
E_m (min) = $\sum M_A = 0$ =	0.98(9.1) + 0.16703(9.583)(4.7915) - Rb(9.583)	R_B =	0.8DL + 0.9E
		Ra =	0.8DL - 0.9E

check beams for axial forces shown using load combos per section 12.4.3.1 (asd)

allowable stess permitted to be increased by 1.2

see following beam calcs for load application

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING
7220 Trade Street, Suite 350 ▸ San Diego, CA 92121
p 619-650-0010 ▸ mulhernkulp.com

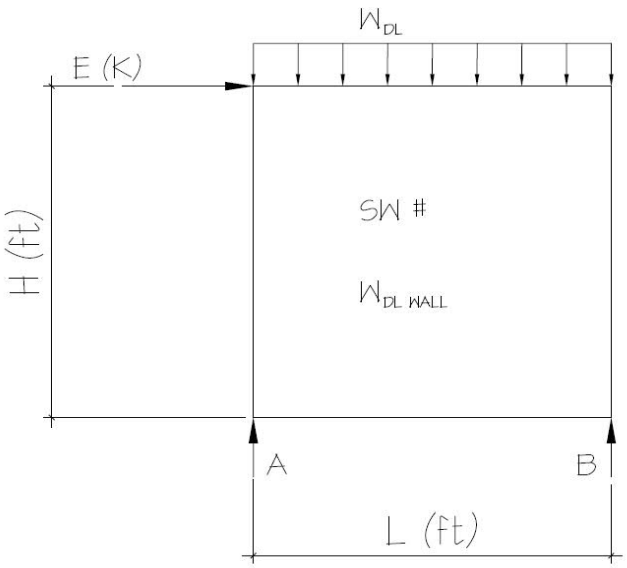
Project Name: Architectural Innovations
3036 67th Ave. S
M&K Project #: 203-22010
Engineer: LGH
Date: 13-May-22

Overstrength Calculations

Wall Description/SW #: 207

Parameters:

L =	5.5	ft
H =	9.1	ft
E =	0.61	k
W_{DLWall} =	0.09	klf
W_{DL} =	0.080	klf
Ω_0 =	2.5	(ASCE TABLE 12.2.1 FOOTNOTE G)
SDS =	0.938	



analysis:

$E_{mh} = \Omega 0 * E$ = 1.53 K

$E_v = 0.2*SDS*DL$ = 0.176 K

$E_m = E_{mh} + E_v$ = 1.706 K

$E_m = E_{mh} - E_v$ = 1.354 K

E_m (max) $= \sum M_A = 0 =$ 1.71(9.1) + 0.17083(5.5)(2.75) - Rb(5.5)

R_B = 0.5DL + 2.8E

Ra = 0.5DL - 2.8E

E_m (min) $= \sum M_A = 0 =$ 1.35(9.1) + 0.17083(5.5)(2.75) - Rb(5.5)

R_B = 0.5DL + 2.2E

Ra = 0.5DL - 2.2E

check beams for axial forces shown using load combos per section 12.4.3.1 (asd)

allowable stess permitted to be increased by 1.2

see following beam calcs for load application

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING
7220 Trade Street, Suite 350 ▸ San Diego, CA 92121
p 619-650-0010 ▸ *mulhernkulp.com*

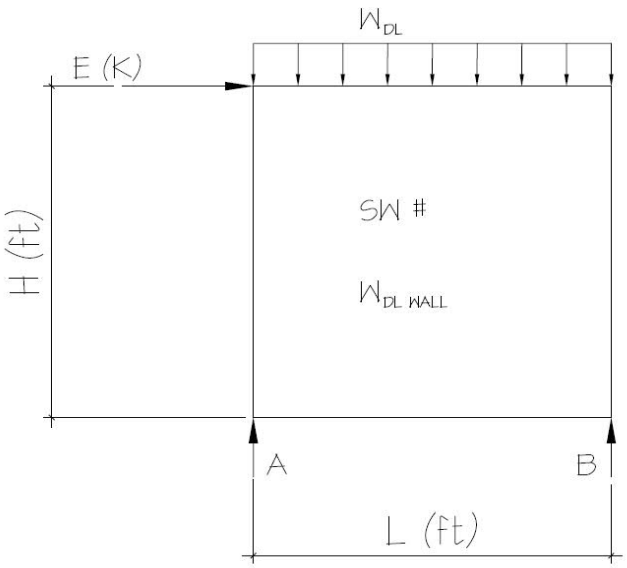
Project Name: Architectural Innovations
3036 67th Ave. S
M&K Project #: 203-22010
Engineer: LGH
Date: 13-May-22

Overstrength Calculations

Wall Description/SW #: 210

Parameters:

L =	12.3	ft
H =	9.1	ft
E =	1.37	k
W_{DLWall} =	0.09	klf
W_{DL} =	0.034	klf
Ω_0 =	2.5	(ASCE TABLE 12.2.1 FOOTNOTE G)
SDS =	0.938	



analysis:

$E_{mh} = \Omega 0 * E$ =	3.43 K	$E_v = 0.2*SDS*DL$ =	0.287 K
$E_m = E_{mh} + E_v$		$E_m = E_{mh} + E_v$ =	3.712 K
$E_m = E_{mh} - E_v$		$E_m = E_{mh} - E_v$ =	3.138 K

E_m (max) = $\sum M_A = 0$ =	3.71(9.1) + 0.12503(12.25)(6.125) - Rb(12.25)	R_B =	0.8DL + 2.8E
		Ra =	0.8DL - 2.8E
E_m (min) = $\sum M_A = 0$ =	3.14(9.1) + 0.12503(12.25)(6.125) - Rb(12.25)	R_B =	0.8DL + 2.3E
		Ra =	0.8DL - 2.3E

check beams for axial forces shown using load combos per section 12.4.3.1 (asd)

allowable stess permitted to be increased by 1.2

see following beam calcs for load application

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING
7220 Trade Street, Suite 350 ▸ San Diego, CA 92121
p 619-650-0010 ▸ *mulhernkulp.com*

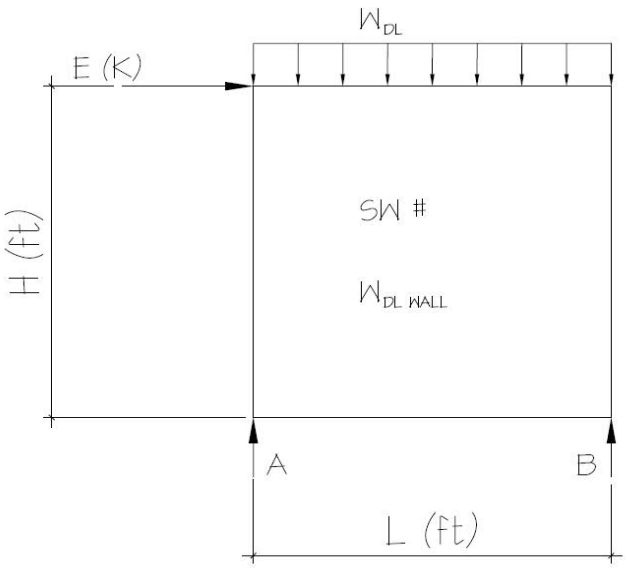
Project Name: Architectural Innovations
3036 67th Ave. S
M&K Project #: 203-22010
Engineer: LGH
Date: 13-May-22

Overstrength Calculations

Wall Description/SW #: 104

Parameters:

L =	11.2	ft
H =	10.0	ft
E =	1.60	k
W_{DLWall} =	0.10	klf
W_{DL} =	0.128	klf
Ω_0 =	2.5	(ASCE TABLE 12.2.1 FOOTNOTE G)
SDS =	0.938	



analysis:

$E_{mh} = \Omega 0 * E$ =	4.00	K	$E_v = 0.2*SDS*DL$ =	0.478 K
$E_m = E_{mh} + E_v$			$E_m = E_{mh} + E_v$ =	4.478 K
$E_m = E_{mh} - E_v$			$E_m = E_{mh} - E_v$ =	3.522 K

E_m (max) = $\sum M_A = 0$ =	4.48(10.0) + 0.228(11.17)(5.585) - Rb(11.17)	R_B =	1.3DL + 4.0E
		Ra =	1.3DL - 4.0E
E_m (min) = $\sum M_A = 0$ =	3.52(10.0) + 0.228(11.17)(5.585) - Rb(11.17)	R_B =	1.3DL + 3.2E
		Ra =	1.3DL - 3.2E

check beams for axial forces shown using load combos per section 12.4.3.1 (asd)

allowable stess permitted to be increased by 1.2

see following beam calcs for load application

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING
7220 Trade Street, Suite 350 ▸ San Diego, CA 92121
p 619-650-0010 ▸ mulhernkulp.com

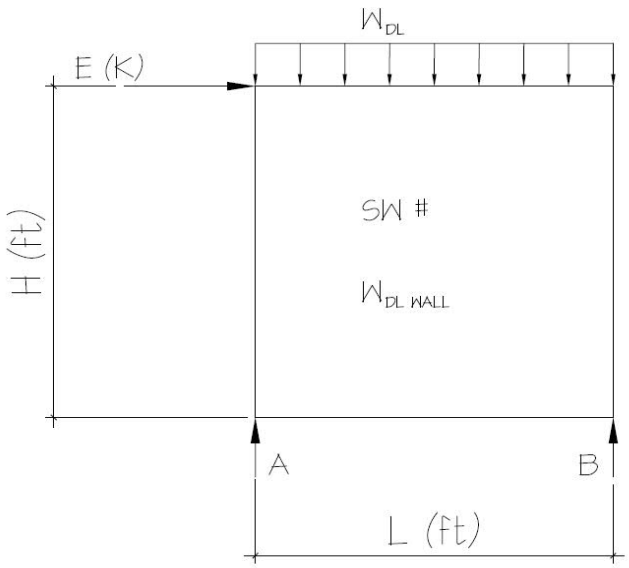
Project Name: Architectural Innovations
3036 67th Ave. S
M&K Project #: 203-22010
Engineer: LGH
Date: 13-May-22

Overstrength Calculations

Wall Description/SW #: 111

Parameters:

L =	19.0	ft
H =	10.0	ft
E =	4.15	k
W_{DLWall} =	0.10	klf
W_{DL} =	0.145	klf
Ω_0 =	2.5	(ASCE TABLE 12.2.1 FOOTNOTE G)
SDS =	0.938	



analysis:

$E_{mh} = \Omega 0 * E$ =	10.38	K	$E_v = 0.2*SDS*DL$ =	0.873 K
$E_m = E_{mh} + E_v$			$E_m = E_{mh} + E_v$ =	11.248 K
$E_m = E_{mh} - E_v$			$E_m = E_{mh} - E_v$ =	9.502 K

E_m (max) = $\sum M_A = 0$ =	11.25(10.0) + 0.245(19)(9.5) - Rb(19)	R_B =	2.3DL + 5.9E
		Ra =	2.3DL - 5.9E
E_m (min) = $\sum M_A = 0$ =	9.50(10.0) + 0.245(19)(9.5) - Rb(19)	R_B =	2.3DL + 5.0E
		Ra =	2.3DL - 5.0E

check beams for axial forces shown using load combos per section 12.4.3.1 (asd)

allowable stess permitted to be increased by 1.2

see following beam calcs for load application

SYMBOLS AND LEGEND

- (F) FAN- DIRECT VENT TO OUTSIDE
  -BATHROOMS/LAUNDRY 50 CFM MIN.
  -KITCHEN EXHAUST HOOD TO BE MIN. OF 1000CFM. IF EXHAUST HOOD EXCEEDS 400 CFM MAKE UP AIR MUST BE PROVIDED PER SECTION M1503.6.
- (WF) WHOLE-HOUSE FAN ON TIMER. SYSTEMS TO CONFORM TO IRC, M1505.4. FAN SIZE PER PLAN. TIMER TO BE LOCATED AT THE FAU WITH A MANUAL OVERRIDE SWITCH AT THE FAN LOCATION. TIMER TO BE SET TO RUN 50% IN EACH 4-HOUR SEGMENT. FRESH AIR TO BE PROVIDED BY THE FORCED AIR SYSTEM DUCTS PER SECTION M1505.4.1.
- (HD) R314.2.3. A HEAT DETECTOR OR HEAT ALARM RATED FOR THE AMBIENT OUTDOOR TEMPERATURES AND HUMIDITY SHALL BE INSTALLED IN NEW GARAGES THAT ARE ATTACHED TO OR LOCATED UNDER NEW AND EXISTING DWELLINGS PER SECTION R314.2.3
- (T) THERMOSTAT @ 58" ABOVE FLOOR
- (S) 110v SMOKE ALARM PER I.R.C. R314 WITH BATTERY BACKUP INTERCONNECTED USE A COMBINATION SMOKE/CARBON MONOXIDE ALARM WHEN NOTED

MECHANICAL, PLUMBING, AND ELECTRICAL SYSTEM FOR UNITS: PER DIV. 15,16 SEE SHEET A1

FURN WH

A. PROVIDE 6" DIAMETER FRESH AIR INTAKE FROM OUTSIDE TO RETURN AIR PLENUM AT FURNACE WITH MOTORIZED FLOW DAMPERS.
B. PROVIDE THERMAL EXPANSION TANK AT WATER HEATER.
C. STRAP WATER HEATER TO FRAMING TOP AND BOTTOM.
D. PROVIDE PRESSURE RELIEF LINE PLUMBED TO OUTSIDE.

FLOOR PLAN KEY NOTES

- P-1 OCCUPANCY SEPARATION: APPLY (1) LAYER OF ½" G.W.B. TO GARAGE SIDE OF RESIDENCE, ATTIC SPACES, & TO ALL BEAMS & POSTS SUPPORTING A FLOOR-CEILING ASSEMBLY. APPLY (1) LAYER OF ½" TYPE 'X' G.W.B. TO GARAGE CEILING WHEN UNDER HABITABLE ROOMS. DUCTS THROUGH WALL OR CEILING COMMON TO HOUSE SHALL HAVE MINIMUM 26 GAUGE STEEL.
  SEE DIV. 01 0026.A. SHEET A-1.
- P-2 1⅜" MIN. SELF CLOSING SOLID WOOD CORE, HONEY-COMB CORE STEEL, OR 20-MINUTE FIRE RATED DOOR, W/ SELF-CLOSER.
  SEE DIV. 01 0026.B. SHEET A-1
- P-3 SAFETY GLAZING PER I.R.C. SECTION R308
  A. WINDOWS WITHIN 18" OF FLOOR
  B. WINDOWS WITHIN A 24" ARC OF DOORS
  C. WINDOWS AT TUBS AND SHOWERS
  D. GLAZING IN DOORS
  E. WITHIN STAIRWELLS
  F. LESS THAN 60" HORIZ. FROM THE BOT. STAIR TREAD NOSING, & BOT. EDGE OF GLAZING IS LESS THAN 36" ABV. LANDING/WALKING SURFACE
  SEE DIV. 08 0800 SHEET A-1
- P-4 STAIR ASSEMBLY NOTES: PER I.R.C. SECTION R311.5 AND DETAIL 12/D2.
  A. HEADROOM MIN. 6'-8", WIDTH MIN. 3'-0".
  B. TREADS 10" MIN. DEPTH AND MIN. WIDTH OF 36" ABOVE HANDRAIL HEIGHT, RISERS 7¾" MAX. HT. TREAD NOSING TO BE MINIMUM 3/4" AND A MAXIMUM OF 1 1/4" ON STAIRS W/ SOLID RISERS.
  C. HANDRAIL MIN. 34" TO MAX 38" ABOVE TREAD NOSING. HANDRAIL TYPE 1 CIRCULAR TO HAVE 1¼" MIN. TO 2" MAX. CROSS SECTION DIMENSION AND 1 1/2" MIN. CLEAR FROM WALL. RETURN RAIL ENDS. HANDRAILS SHALL BE STRONG ENOUGH TO RESIST A 200# P.L. IN ANY DIRECTION PER I.R.C. TABLE R301.5
  D. INSTALL FIRE BLOCKING BETWEEN STRINGERS AT THE TOP AND BOTTOM OF EACH RUN PER I.R.C. SECTION R302.11.
  E. COVER USABLE SPACE UNDER STAIR W/½"G.W.B. PER I.R.C. SECTION R302.7.
  F. INTERMEDIATE BALUSTERS SHALL BE SPACED W/ LESS THAN 4" BETWEEN BALUSTERS.
  G. PROVIDE STAIRWAY ILLUMINATION PER I.R.C. SECTION R303.6.
  SEE DIV. 01 0001.6 SHEET A-1.

FLOOR PLAN KEY NOTES

- P-5 EGRESS WINDOW PER I.R.C., SECTION R310 SEE DIV. 08 0800 SHEET A-1
- P-6 IGNITERS FOR GAS FIRED APPLIANCES IN GARAGE TO BE 18" MIN. ABOVE TOP OF SLAB. SEE DIV. 15 SHEET A-1
- P-7 COVER WALLS ADJACENT TO TUBS AND SHOWERS WITH NON-ABSORBENT MATERIAL TO 72" ABOVE DRAIN INLETS, PER I.R.C. SECTION 307.2. SEE DIV. 09250 SHEET A-1
- P-8 (2) LAYERS OF FLOOR SHEATHING OVER FRAMING.
- P-9 7¾" MAX. RISER WITH 10" MIN. RUN, IF MORE THAN (3) RISERS, HANDRAIL REQUIRED PER I.R.C. SECTION R311.7.8. SEE DIV. 01 0002.1 SHEET A-1
- P-10 18"x24" CRAWL SPACE ACCESS. INSULATE AND WEATHER STRIP. SEE DIV. 01 0002.1 SHEET A-1
- P-11 22"x30" ATTIC SPACE ACCESS W/ 30" HEAD CLEARANCE. INSULATE AND WEATHER STRIP. SEE DIV. 01 0002.2 SHEET A-1
- P-12 FLOOR MATERIAL BREAK LINE

FLOOR PLAN KEY NOTES

- P-13 WALL LINE ABOVE
- P-14 WALL LINE BELOW
- P-15 FIREPLACE ASSEMBLY NOTES:
  A. DIRECT VENT FIREPLACES. INSTALL PER MFG. SPECIFICATIONS, SHALL CONFORM TO I.R.C. REQUIREMENTS. SEE DIV. 01 0002.8 SHEET A-1
  B. ZERO CLEARANCE FIREPLACES SHALL CONFORM TO I.R.C. REQUIREMENTS. SEE DIV. 01 0002.8 SHEET A-1
  C. HEARTH SHALL CONFORM TO I.R.C. REQUIREMENTS. SEE DIV. 01 0002.8 AND 9 SHEET A-1
  D. FIRE-BLOCK OPENINGS AROUND PENETRATIONS AT EACH FLOOR PER I.R.C. SECTION R1003.13.
- P-16 SEE SITE PLAN FOR EXTENT OF WALKS AND DRIVEWAYS
- P-17 3" DIAMETER STEEL POST

FLOOR PLAN KEY NOTES

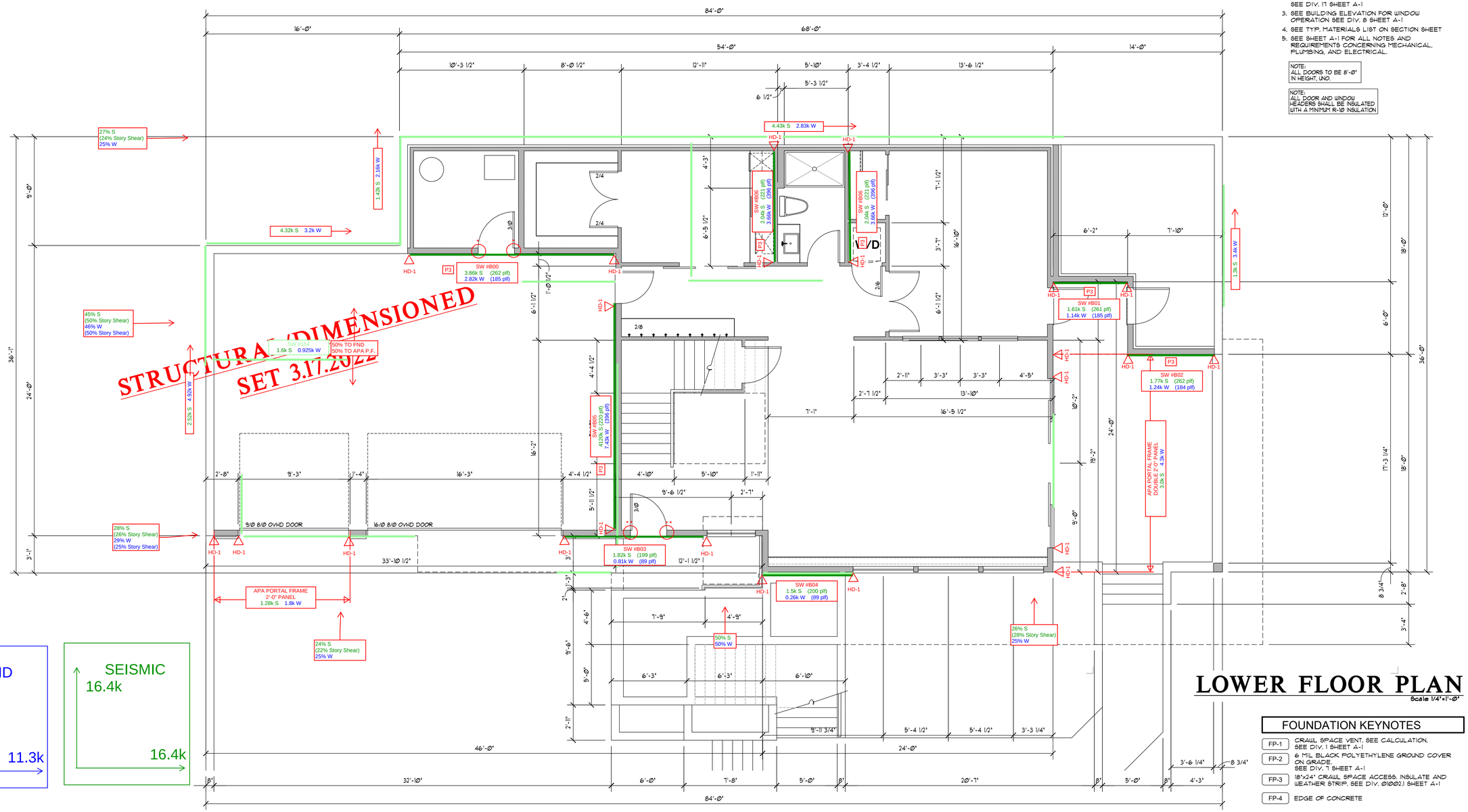
- P-18 42" GUARDRAIL PER I.R.C. SECTION R312 & TABLE R301.5 AT STAIRS SLOPES AT 34" ABOVE STAIR NOSING. CONTRACTOR TO VERIFY TO INSPECTOR THAT ALL GUARDRAILS ARE CAPABLE OF RESISTING 200LB LOAD ON TOP RAIL IN ANY DIRECTION PER R301.5.
- P-19 8" VENT FOR MECHANICAL. 1" CLEARANCE ALL SIDES PER I.R.C. SECTION R1003.3. SEE DIV. 15 SHEET A-1
- P-20 PLANT SHELF
- P-21 UPPER AND LOWER LINEN CABINETS
- P-22 SOFFIT AREA
- P-23 INTEGRATED MAKE UP AIR
- P-24 2x6 STUDS W/ R-21 INSUL. MIN.

GENERAL PLAN NOTES

1. SEE SHEET A-1 FOR ALL GENERAL NOTES AND REQUIREMENTS.
2. ENERGY AND AIR QUALITY INFORMATION SEE DIV. 17 SHEET A-1
3. SEE BUILDING ELEVATION FOR WINDOW OPERATION SEE DIV. 8 SHEET A-1
4. SEE TYP. MATERIALS LIST ON SECTION SHEET
5. SEE SHEET A-1 FOR ALL NOTES AND REQUIREMENTS CONCERNING MECHANICAL, PLUMBING, AND ELECTRICAL.

NOTE:
ALL DOORS TO BE 8'-0" IN HEIGHT, UNO.

NOTE:
ALL DOOR AND WINDOW HEADERS SHALL BE INSULATED WITH A MINIMUM R-10 INSULATION



WIND
29.5k
11.3k

SEISMIC
16.4k
16.4k

INDICATES SHEAR WALL ABOVE

LOWER FLOOR PLAN

Scale 1/4"=1'-0"

FOUNDATION KEYNOTES

- FP-1 CRAWL SPACE VENT. SEE CALCULATION. SEE DIV. 1 SHEET A-1
- FP-2 6 MIL BLACK POLYETHYLENE GROUND COVER ON GRADE. SEE DIV. 7 SHEET A-1
- FP-3 18"x24" CRAWL SPACE ACCESS. INSULATE AND WEATHER STRIP. SEE DIV. 01 0002.1 SHEET A-1
- FP-4 EDGE OF CONCRETE

Date	By	Description
DATE	BY	DESC
11/19/21	REY	Preliminary Design
11/24/21	REY	Revised Preliminary design
12/7/21	REY	REVISED GRAPHICS PACKAGE
12/23/21	REY	REVISED GRAPHICS PACKAGE
1/5/22	REY	REVISED GRAPHICS PACKAGE
1/22/22	REY	REVISED GRAPHICS PACKAGE
3/17/22	REY	STRUCTURAL/DIMENSIONED SET

Buchan Homes
Westview Plan
3036 67th AveSE Mercer Island , WA

ARCHITECTURAL INNOVATIONS, P.S.
Forward Thinking Design Solutions For Your Environment
14311 SE 16th St
Bellevue, WA 98007
1-800-888-4517
www.kanglehomeplans.com

TITLE

JOB NO. : 21076.05
STARTING NO. : 21076.03

SHEET
A2

SYMBOLS AND LEGEND

(F) FAN- DIRECT VENT TO OUTSIDE
-BATHROOMS/LAUNDRY 50 CFM MIN.
-KITCHEN EXHAUST HOOD TO BE MIN. OF 1200CFM. IF EXHAUST HOOD EXCEEDS 400 CFM MAKE UP AIR MUST BE PROVIDED PER SECTION M1503.6.

(WF) WHOLE-HOUSE FAN ON TIMER. SYSTEMS TO CONFORM TO IRC, M1505.4. FAN SIZE PER PLAN. TIMER TO BE LOCATED AT THE FAU WITH A MANUAL OVERRIDE SWITCH AT THE FAN LOCATION. TIMER TO BE SET TO RUN 50% IN EACH 4-HOUR SEGMENT. FRESH AIR TO BE PROVIDED BY THE FORCED AIR SYSTEM DUCTS PER SECTION M1505.4.1.

(HD) R314.2.3. A HEAT DETECTOR OR HEAT ALARM RATED FOR THE AMBIENT OUTDOOR TEMPERATURES AND HUMIDITY SHALL BE INSTALLED IN NEW GARAGES THAT ARE ATTACHED TO OR LOCATED UNDER NEW AND EXISTING DWELLINGS PER SECTION R314.2.3

(T) THERMOSTAT @ 50" ABOVE FLOOR

(●) 110v SMOKE ALARM PER I.R.C. R314 WITH BATTERY BACKUP INTERCONNECTED USE A COMBINATION SMOKE/CARBON MONOXIDE ALARM WHEN NOTED

MECHANICAL, PLUMBING, AND ELECTRICAL SYSTEM FOR UNITS: PER DIV. 15,16 SEE SHEET A1

FURN WH

A. PROVIDE 6" DIAMETER FRESH AIR INTAKE FROM OUTSIDE TO RETURN AIR PLENUM AT FURNACE WITH MOTORIZED FLOW DAMPERS.
B. PROVIDE THERMAL EXPANSION TANK AT WATER HEATER.
C. STRAP WATER HEATER TO FRAMING TOP AND BOTTOM.
D. PROVIDE PRESSURE RELIEF LINE PLUMBED TO OUTSIDE.

FLOOR PLAN KEY NOTES

P-1 OCCUPANCY SEPARATION: APPLY (1) LAYER OF ½" G.W.B. TO GARAGE SIDE OF RESIDENCE, ATTIC SPACES, & TO ALL BEAMS & POSTS SUPPORTING A FLOOR-CEILING ASSEMBLY. APPLY (1) LAYER OF ½" TYPE 'X' G.W.B. TO GARAGE CEILING WHEN UNDER HABITABLE ROOMS. DUCTS THROUGH WALL OR CEILING COMMON TO HOUSE SHALL HAVE MINIMUM 26 GAUGE STEEL.
SEE DIV. Ø1ØØ2.6.A. SHEET A-1.

P-2 1⅜" MIN. SELF CLOSING SOLID WOOD CORE, HONEY-COMB CORE STEEL, OR 20-MINUTE FIRE RATED DOOR, W/ SELF-CLOSER.
SEE DIV. Ø1ØØ2.6.B. SHEET A-1

P-3 SAFETY GLAZING PER I.R.C. SECTION R308
A. WINDOWS WITHIN 18" OF FLOOR
B. WINDOWS WITHIN A 24" ARC OF DOORS
C. WINDOWS AT TUBS AND SHOWERS
D. GLAZING IN DOORS
E. WITHIN STAIRWELLS
F. LESS THAN 60" HORIZ. FROM THE BOT. STAIR TREAD NOSING, & BOT. EDGE OF GLAZING IS LESS THAN 36" ABV. LANDING/WALKING SURFACE
SEE DIV. Ø8ØØØ SHEET A-1

P-4 STAIR ASSEMBLY NOTES: PER I.R.C. SECTION R311.5 AND DETAIL 12/D2.
A. HEADROOM MIN. 6'-8", WIDTH MIN. 3'-Ø".
B. TREADS 10" MIN. DEPTH AND MIN. WIDTH OF 36" ABOVE HANDRAIL HEIGHT, RISERS 7¾" MAX. HT. TREAD NOSING TO BE MINIMUM 3/4" AND A MAXIMUM OF 1 1/4" ON STAIRS W/ SOLID RISERS.
C. HANDRAIL MIN. 34" TO MAX 38" ABOVE TREAD NOSING. HANDRAIL TYPE 1 CIRCULAR TO HAVE 1¼" MIN. TO 2" MAX. CROSS SECTION DIMENSION AND 1 1/2" MIN. CLEAR FROM WALL. RETURN RAIL ENDS. HANDRAILS SHALL BE STRONG ENOUGH TO RESIST A 200# P.L. IN ANY DIRECTION PER I.R.C. TABLE R301.5
D. INSTALL FIRE BLOCKING BETWEEN STRINGERS AT THE TOP AND BOTTOM OF EACH RUN PER I.R.C. SECTION R302.11.
E. COVER USABLE SPACE UNDER STAIR W/½"G.W.B. PER I.R.C. SECTION R302.7.
F. INTERMEDIATE BALUSTERS SHALL BE SPACED W/ LESS THAN 4" BETWEEN BALUSTERS.
G. PROVIDE STAIRWAY ILLUMINATION PER I.R.C. SECTION R303.6.
SEE DIV. Ø1ØØ2.6 SHEET A-1.

P-5 EGRESS WINDOW PER I.R.C. SECTION R310 SEE DIV. Ø8ØØØ SHEET A-1

P-6 IGNITERS FOR GAS FIRED APPLIANCES IN GARAGE TO BE 18" MIN. ABOVE TOP OF SLAB. SEE DIV. 15 SHEET A-1

P-7 COVER WALLS ADJACENT TO TUBS AND SHOWERS WITH NON-ABSORBENT MATERIAL TO 72" ABOVE DRAIN INLETS, PER I.R.C. SECTION 3Ø12. SEE DIV. Ø9250 SHEET A-1

P-8 (2) LAYERS OF FLOOR SHEATHING OVER FRAMING.

P-9 7¾" MAX. RISER WITH 10" MIN. RUN, IF MORE THAN (3) RISERS, HANDRAIL REQUIRED PER I.R.C. SECTION R311.7.8. SEE DIV. Ø1ØØ2.1 SHEET A-1

P-10 18"x24" CRAWL SPACE ACCESS. INSULATE AND WEATHER STRIP. SEE DIV. Ø1ØØ2.1 SHEET A-1

P-11 22"x30" ATTIC SPACE ACCESS W/ 30" HEAD CLEARANCE. INSULATE AND WEATHER STRIP. SEE DIV. Ø1ØØ2.2 SHEET A-1

P-12 FLOOR MATERIAL BREAK LINE

P-13 WALL LINE ABOVE

P-14 WALL LINE BELOW

P-15 FIREPLACE ASSEMBLY NOTES:
A. DIRECT VENT FIREPLACES. INSTALL PER MFG. SPECIFICATIONS, SHALL CONFORM TO I.R.C. REQUIREMENTS. SEE DIV. Ø1ØØ2.8 SHEET A-1
B. ZERO CLEARANCE FIREPLACES SHALL CONFORM TO I.R.C. REQUIREMENTS. SEE DIV. Ø1ØØ2.8 SHEET A-1
C. HEARTH SHALL CONFORM TO I.R.C. REQUIREMENTS. SEE DIV. Ø1ØØ2.8 AND 9 SHEET A-1
D. FIRE-BLOCK OPENINGS AROUND PENETRATIONS AT EACH FLOOR PER I.R.C. SECTION R1ØØ3.19.

P-16 SEE SITE PLAN FOR EXTENT OF WALKS AND DRIVEWAYS

P-17 3" DIAMETER STEEL POST

P-18 42" GUARDRAIL PER I.R.C. SECTION R312 & TABLE R3Ø1.5 AT STAIRS SLOPES AT 34" ABOVE STAIR NOSING. CONTRACTOR TO VERIFY TO INSPECTOR THAT ALL GUARDRAILS ARE CAPABLE OF RESISTING 2ØØ#.LB LOAD ON TOP RAIL IN ANY DIRECTION PER R3Ø15.

P-19 8" VENT FOR MECHANICAL. 1" CLEARANCE ALL SIDES PER I.R.C. SECTION R1ØØ5.3. SEE DIV. 15 SHEET A-1

P-20 PLANT SHELF

P-21 UPPER AND LOWER LINEN CABINETS

P-22 SOFFIT AREA

P-23 INTEGRATED MAKE UP AIR

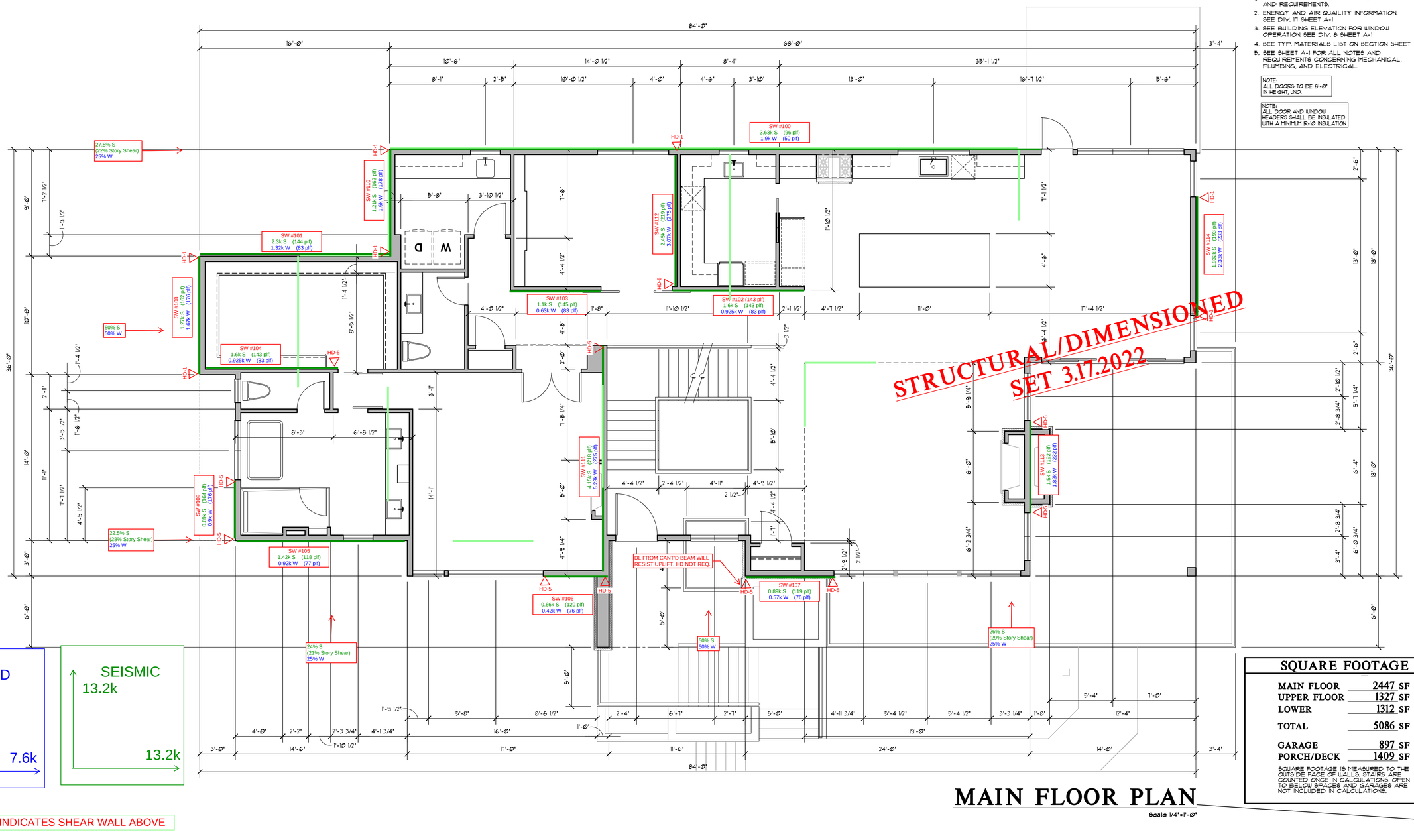
P-24 2x6 STUDS W/ R-21 INSUL. MIN.

GENERAL PLAN NOTES

1. SEE SHEET A-1 FOR ALL GENERAL NOTES AND REQUIREMENTS.
2. ENERGY AND AIR QUALITY INFORMATION SEE DIV. 17 SHEET A-1
3. SEE BUILDING ELEVATION FOR WINDOW OPERATION SEE DIV. 8 SHEET A-1
4. SEE TYP. MATERIALS LIST ON SECTION SHEET
5. SEE SHEET A-1 FOR ALL NOTES AND REQUIREMENTS CONCERNING MECHANICAL, PLUMBING, AND ELECTRICAL.

NOTE:
ALL DOORS TO BE 8'-Ø" IN HEIGHT, UNO.

NOTE:
ALL DOOR AND WINDOW HEADERS SHALL BE INSULATED WITH A MINIMUM R-10 INSULATION



WIND
16.6k
7.6k

SEISMIC
13.2k
13.2k

INDICATES SHEAR WALL ABOVE

SQUARE FOOTAGE

MAIN FLOOR	2447 SF
UPPER FLOOR	1327 SF
LOWER	1312 SF
TOTAL	5086 SF
GARAGE	897 SF
PORCH/DECK	1409 SF

SQUARE FOOTAGE IS MEASURED TO THE OUTSIDE FACE OF WALLS. STAIRS ARE COUNTED ONCE IN CALCULATIONS. OPEN TO BELOW SPACES AND GARAGES ARE NOT INCLUDED IN CALCULATIONS.

MAIN FLOOR PLAN

Scale 1/4"=1'-Ø"

Date	By	Description
DATE	BY	DESC
11/19/21	REY	Preliminary Design
11/24/21	REY	Revised Preliminary design
12/7/21	REY	REVISED GRAPHICS PACKAGE
12/23/21	REY	REVISED GRAPHICS PACKAGE
1/5/22	REY	REVISED GRAPHICS PACKAGE
1/22/22	REY	REVISED GRAPHICS PACKAGE
3/17/22	REY	STRUCTURAL/DIMENSIONED SET

Buchan Homes
Westview Plan
AveSE Mercer Island , WA
3036 67th AveSE

ARCHITECTURAL INNOVATIONS, P.S.
Forward Thinking Design Solutions For Your Environment
14311 SE 16th St
Bellevue, WA 98007
1-800-888-4517
www.kaplerhomeplans.com

TITLE

JOB NO.: 21076.05
STARTING NO.: 21076.03

SHEET
A3

SYMBOLS AND LEGEND

- (F) FAN- DIRECT VENT TO OUTSIDE
  -BATHROOMS/LAUNDRY 50 CFM MIN.
  -KITCHEN EXHAUST HOOD TO BE MIN. OF 100CFM. IF EXHAUST HOOD EXCEEDS 400 CFM MAKE UP AIR MUST BE PROVIDED PER SECTION M1503.6.
- (WF) WHOLE-HOUSE FAN ON TIMER. SYSTEMS TO CONFORM TO IRC, M1505.4. FAN SIZE PER PLAN. TIMER TO BE SET TO RUN 50% IN EACH 4-HOUR SEGMENT. FRESH AIR TO BE PROVIDED BY THE FORCED AIR SYSTEM DUCTS PER SECTION M1505.4.1.
- (HD) R314.2.3. A HEAT DETECTOR OR HEAT ALARM RATED FOR THE AMBIENT OUTDOOR TEMPERATURES AND HUMIDITY SHALL BE INSTALLED IN NEW GARAGES THAT ARE ATTACHED TO OR LOCATED UNDER NEW AND EXISTING DWELLINGS PER SECTION R314.2.3
- (T) THERMOSTAT @ 58" ABOVE FLOOR
- (●) 110v SMOKE ALARM PER I.R.C. R314 WITH BATTERY BACKUP INTERCONNECTED USE A COMBINATION SMOKE/CARBON MONOXIDE ALARM WHEN NOTED

MECHANICAL, PLUMBING, AND ELECTRICAL SYSTEM FOR UNITS: PER DIV. 15,16 SEE SHEET A1

FURN WH

A. PROVIDE 6" DIAMETER FRESH AIR INTAKE FROM OUTSIDE TO RETURN AIR PLENUM AT FURNACE WITH MOTORIZED FLOW DAMPERS.
B. PROVIDE THERMAL EXPANSION TANK AT WATER HEATER.
C. STRAP WATER HEATER TO FRAMING TOP AND BOTTOM.
D. PROVIDE PRESSURE RELIEF LINE PLUMBED TO OUTSIDE.

FLOOR PLAN KEY NOTES

- P-1 OCCUPANCY SEPARATION: APPLY (1) LAYER OF ½" G.W.B. TO GARAGE SIDE OF RESIDENCE, ATTIC SPACES, & TO ALL BEAMS & POSTS SUPPORTING A FLOOR-CEILING ASSEMBLY. APPLY (1) LAYER OF ½" TYPE 'X' G.W.B. TO GARAGE CEILING WHEN UNDER HABITABLE ROOMS. DUCTS THROUGH WALL OR CEILING COMMON TO HOUSE SHALL HAVE MINIMUM 26 GAUGE STEEL.
  SEE DIV. Ø1ØØ2.6.A. SHEET A-1.
- P-2 1⅜" MIN. SELF CLOSING SOLID WOOD CORE, HONEY-COMB CORE STEEL, OR 20-MINUTE FIRE RATED DOOR, W/ SELF-CLOSER.
  SEE DIV. Ø1ØØ2.6.B. SHEET A-1
- P-3 SAFETY GLAZING PER I.R.C. SECTION R308
  A. WINDOWS WITHIN 18" OF FLOOR
  B. WINDOWS WITHIN A 24" ARC OF DOORS
  C. WINDOWS AT TUBS AND SHOWERS
  D. GLAZING IN DOORS
  E. WITHIN STAIRWELLS
  F. LESS THAN 60" HORIZ. FROM THE BOT. STAIR TREAD NOSING, & BOT. EDGE OF GLAZING IS LESS THAN 36" ABV. LANDING/WALKING SURFACE
  SEE DIV. Ø8800 SHEET A-1

FLOOR PLAN KEY NOTES

- P-4 STAIR ASSEMBLY NOTES: PER I.R.C. SECTION R311.5 AND DETAIL 12/D2.
  A. HEADROOM MIN. 6'-8", WIDTH MIN. 3'-Ø".
  B. TREADS 10" MIN. DEPTH AND MIN. WIDTH OF 36" ABOVE HANDRAIL HEIGHT, RISERS 7¾" MAX. HT. TREAD NOSING TO BE MINIMUM 3/4" AND A MAXIMUM OF 1 1/4" ON STAIRS W/ SOLID RISERS.
  C. HANDRAIL MIN. 34" TO MAX 38" ABOVE TREAD NOSING. HANDRAIL TYPE 1 CIRCULAR TO HAVE 1¼" MIN. TO 2" MAX. CROSS SECTION DIMENSION AND 1 1/2" MIN. CLEAR FROM WALL. RETURN RAIL ENDS. HANDRAILS SHALL BE STRONG ENOUGH TO RESIST A 200# P.L. IN ANY DIRECTION PER I.R.C. TABLE R301.5
  D. INSTALL FIRE BLOCKING BETWEEN STRINGERS AT THE TOP AND BOTTOM OF EACH RUN PER I.R.C. SECTION R302.11.
  E. COVER USABLE SPACE UNDER STAIR W/½"G.W.B. PER I.R.C. SECTION R302.7.
  F. INTERMEDIATE BALUSTERS SHALL BE SPACED W/ LESS THAN 4" BETWEEN BALUSTERS.
  G. PROVIDE STAIRWAY ILLUMINATION PER I.R.C. SECTION R303.6.
  SEE DIV. Ø1ØØ1.6 SHEET A-1.

FLOOR PLAN KEY NOTES

- P-5 EGRESS WINDOW PER I.R.C. SECTION R310 SEE DIV. Ø8600 SHEET A-1
- P-6 IGNITERS FOR GAS FIRED APPLIANCES IN GARAGE TO BE 18" MIN. ABOVE TOP OF SLAB. SEE DIV. 15 SHEET A-1
- P-7 COVER WALLS ADJACENT TO TUBS AND SHOWERS WITH NON-ABSORBENT MATERIAL TO 72" ABOVE DRAIN INLETS, PER I.R.C. SECTION 307.2. SEE DIV. Ø9250 SHEET A-1
- P-8 (2) LAYERS OF FLOOR SHEATHING OVER FRAMING.
- P-9 7¾" MAX. RISER WITH 10" MIN. RUN, IF MORE THAN (3) RISERS, HANDRAIL REQUIRED PER I.R.C. SECTION R311.7.8. SEE DIV. Ø1ØØ2.1 SHEET A-1
- P-10 18"x24" CRAWL SPACE ACCESS. INSULATE AND WEATHER STRIP. SEE DIV. Ø1ØØ2.1 SHEET A-1
- P-11 22"x30" ATTIC SPACE ACCESS W/ 30" HEAD CLEARANCE. INSULATE AND WEATHER STRIP. SEE DIV. Ø1ØØ2.2 SHEET A-1
- P-12 FLOOR MATERIAL BREAK LINE

FLOOR PLAN KEY NOTES

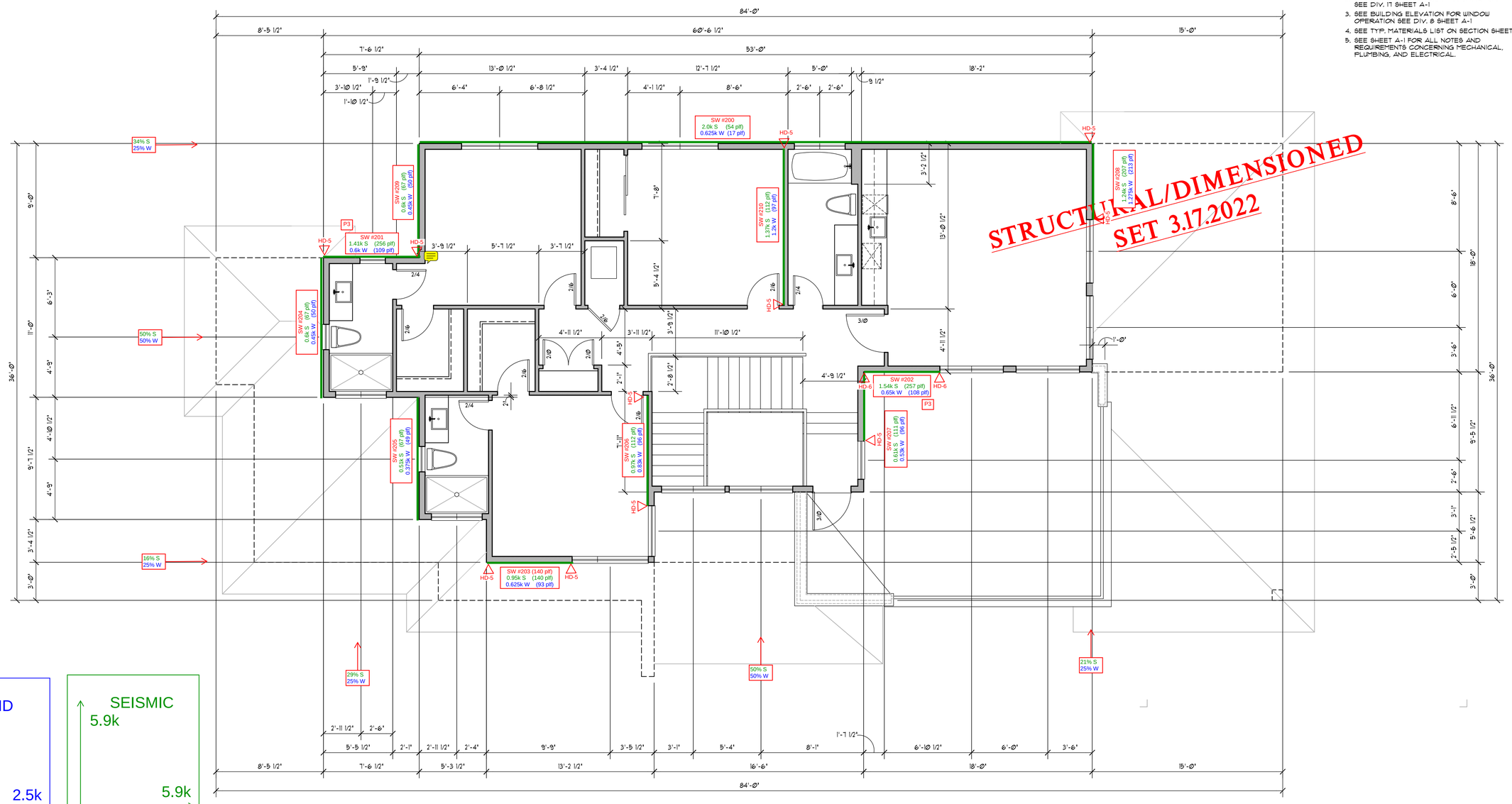
- P-13 WALL LINE ABOVE
- P-14 WALL LINE BELOW
- P-15 FIREPLACE ASSEMBLY NOTES:
  A. DIRECT VENT FIREPLACES. INSTALL PER MFG. SPECIFICATIONS, SHALL CONFORM TO I.R.C. REQUIREMENTS. SEE DIV. Ø1ØØ2.8 SHEET A-1
  B. ZERO CLEARANCE FIREPLACES SHALL CONFORM TO I.R.C. REQUIREMENTS. SEE DIV. Ø1ØØ2.8 SHEET A-1
  C. HEARTH SHALL CONFORM TO I.R.C. REQUIREMENTS. SEE DIV. Ø1ØØ2.8 AND 9 SHEET A-1
  D. FIRE-BLOCK OPENINGS AROUND PENETRATIONS AT EACH FLOOR PER I.R.C. SECTION R1ØØ3.19.
- P-16 SEE SITE PLAN FOR EXTENT OF WALKS AND DRIVEWAYS
- P-17 3" DIAMETER STEEL POST

FLOOR PLAN KEY NOTES

- P-18 42" GUARDRAIL PER I.R.C. SECTION R312 & TABLE R301.5 AT STAIRS SLOPES AT 34" ABOVE STAIR NOSING. CONTRACTOR TO VERIFY TO INSPECTOR THAT ALL GUARDRAILS ARE CAPABLE OF RESISTING 200LB LOAD ON TOP RAIL IN ANY DIRECTION PER R312.1.3.
- P-19 8" VENT FOR MECHANICAL. 1" CLEARANCE ALL SIDES PER I.R.C. SECTION R1ØØ3.3. SEE DIV. 15 SHEET A-1
- P-20 PLANT SHELF
- P-21 UPPER AND LOWER LINEN CABINETS
- P-22 SOFFIT AREA
- P-23 INTEGRATED MAKE UP AIR
- P-24 2x6 STUDS W/ R-21 INSUL. MIN.

GENERAL PLAN NOTES

1. SEE SHEET A-1 FOR ALL GENERAL NOTES AND REQUIREMENTS.
2. ENERGY AND AIR QUALITY INFORMATION SEE DIV. 17 SHEET A-1
3. SEE BUILDING ELEVATION FOR WINDOW OPERATION SEE DIV. 8 SHEET A-1
4. SEE TYP. MATERIALS LIST ON SECTION SHEET
5. SEE SHEET A-1 FOR ALL NOTES AND REQUIREMENTS CONCERNING MECHANICAL, PLUMBING, AND ELECTRICAL.



STRUCTURAL/DIMENSIONED SET 3.17.2022

WIND 5.1k 2.5k

SEISMIC 5.9k 5.9k

UPPER FLOOR PLAN

Scale 1/4"=1'-Ø"

Date	By	Description
DATE	BY	DESC
11/19/21	REY	Preliminary Design
11/24/21	REY	Revised Preliminary design
12/7/21	REY	REVISED GRAPHICS PACKAGE
12/23/21	REY	REVISED GRAPHICS PACKAGE
1/5/22	REY	REVISED GRAPHICS PACKAGE
1/22/22	REY	REVISED GRAPHICS PACKAGE
3/17/22	REY	STRUCTURAL/DIMENSIONED SET

Buchan Homes

Westview Plan

3036 67th AveSE Mercer Island , WA

ARCHITECTURAL INNOVATIONS, P.S.
Forward Thinking Design Solutions For Your Environment
14311 SE 16th St
Bellevue, WA 98007
1-800-888-4517
www.kapplerhomeplans.com

TITLE

JOB NO. : 21076.05
STARTING NO. : 21076.03

SHEET

A4

Architectural Innovations

3036 67th Ave SE

Mercer Island, WA

Seismic Shear Wall Calculations

Reviewed By: NJM

May 4, 2022

Parameters:

Single Family Home

Design Wind Speed: 100 MPH

wind Exposure Category: C

Seismic Design Category: D

Code & Design Standard: 2018 IBC Ch. 1609, ASCE 7-16 Ch. 26-30

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: 3036 67th Ave. SE
Architectural Innovations
M&K Project #: 203-22010
Engineer: LGH
Date: 03-May-22

SEISMIC CALCULATION - ASCE 7-16

Seismic Design Category:

User Inputs:

Site Class	D
Spectral Response Acceleration 0.2 sec, **Ss**	1.407
Spectral Response Acceleration 1.0 sec, **S1**	0.490
Occupancy Category	II

Variables:

Site coefficient, Fa	1.00
Site coefficient, Fv	1.81

Calculated Values:

Maximum spectral response acceleration, S_{ms}	1.407
Maximum spectral response acceleration, S_{m1}	0.887
Design spectral response acceleration, S_{ds}	0.938
Design spectral response acceleration, S_{d1}	0.591
Seismic Design Category (short term)	D
Seismic Design Category (1.0 second term)	D

Building period Determination:

User Inputs:

Building period coefficient, C_t	0.020
Long-Period Trans Period, T_L (sec)	6
Ht. abv base to highest level, h_n	32

Calculated Values:

Approximate Fundamental Period, T_a	0.270
T_0	0.126
T_S	0.630
Spectral Response Acc., S_a (g)	0.938

Site Class Assumption

No — Per ASCE 7-16 Section 11.4.3 the Site Class may be assumed to be D

Equivalent lateral force procedure

Dead Load Calculation:

Level	Story Ht. (ft.)	Area (ft^2)	Dead Load (psf)	DL of ext wall trib. to level (kips)	Total level DL
1	11.5	3022	15	12.6	58 k
2	11.5	3300	16	13.9	66 k
3	9.1	1945	17	5.5	39 k
4	0.0	0	0	0.0	0 k
5	0.0	0	0	0.0	0 k
6	0.0	0	0	0.0	0 k
7	0.0	0	0	0.0	0 k
8	0.0	0	0	0.0	0 k
9	0.0	0	0	0.0	0 k
10	0.0	0	0	0.0	0 k
11	0.0	0	0	0.0	0 k
12	0.0	0	0	0.0	0 k
13	0.0	0	0	0.0	0 k
14	0.0	0	0	0.0	0 k
15	0.0	0	0	0.0	0 k
16	0.0	0	0	0.0	0 k
17	0.0	0	0	0.0	0 k
18	0.0	0	0	0.0	0 k
19	0.0	0	0	0.0	0 k
20	0.0	0	0	0.0	0 k

Total Dead Load Of Structure 163 Kips

Seismic Response Coefficient:

	Transverse	Longitudinal
Response modification factor, **R**	6.5	6.5
Occupancy Importance Factor, I_E	1.00	1.00
Seismic Response Coefficient, C_s	0.144	0.144

Base Shears:

Ultimate Loads		x 0.7 =	Allowable Loads	
Transverse	Longitudinal		Transverse	Longitudinal
23 k	23 k		16.4 k	16.4 k

Story Shear Calculation:

Distribution exponent, 1.00

Level	Vert. Dist. Factor, C_{vx}	Ultimate Loads: Transverse *Story Shear, F_x*	Ultimate Loads: Longitudinal *Story Shear, F_x*	Allowable Loads: Transverse *Story Shear, F_x*	Allowable Loads: Transverse *Σ Story Shear*	Allowable Loads: Longitudinal *Story Shear, F_x*	Allowable Loads: Longitudinal *Σ Story Shear*
1	0.194	4.6 k	4.6 k	3.2 k	16.4 k	3.2 k	16.4 k
2	0.445	10.4 k	10.4 k	7.3 k	13.2 k	7.3 k	13.2 k
3	0.361	8.5 k	8.5 k	5.9 k	5.9 k	5.9 k	5.9 k
4	0.000	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k
5	0.00	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k
6	0.00	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k
7	0.00	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k
8	0.00	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k
9	0.00	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k
10	0.00	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k
11	0.00	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k
12	0.00	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k
13	0.00	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k
14	0.00	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k
15	0.00	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k
16	0.00	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k
17	0.00	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k
18	0.00	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k
19	0.00	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k
20	0.00	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k	0.0 k

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 200: 2nd - Back Ext. Wall

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, H_c	5.0	ft.		
Wall Length, L	53.0	ft.	Qualifying Wall Length, L	37.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
2006 lbs	<	8843 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	241	plf	Overturning Moment	18.2	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	635	lbs	Resistive Moment	164.6	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall 201: 2nd - Back Ext. Wall @ Bathroom

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, Hc	4.0	ft.		
Wall Length, L	7.5	ft.	Qualifying Wall Length, L	5.5	ft.	Shearwall Assembly	P3

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1410 lbs	<	2481 lbs

Shearwall Assembly Specification

P3 - 1-side 7/16" OSB
fastened w/ 8d nails at 3"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	150	plf	Overturning Moment	12.8	k-ft	Hold Down Design Load	1110	lbs
DL at ends of wall	788	lbs	Resistive Moment	4.5	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 202: 2nd - Front Ext. Wall @ Deck

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	6.0	ft.	Qualifying Wall Length, L	6.0	ft.	Shearwall Assembly	P3

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1540 lbs	<	2706 lbs

Shearwall Assembly Specification

P3 - 1-side 7/16" OSB
fastened w/ 8d nails at 3"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	286	plf	Overturning Moment	14.0	k-ft	Hold Down Design Load	1735	lbs
DL at ends of wall	489	lbs	Resistive Moment	3.6	k-ft	Holdown Capacity	2655	lbs

Hold-down Specification

SIMPSON MSTC40 STRAP TIE (12" END LENGTH)

Shearwall 203: 2nd - Front Ext. Wall

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	6.8	ft.	Qualifying Wall Length, L	6.8	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
944 lbs	<	1613 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	162	plf	Overturning Moment	8.6	k-ft	Hold Down Design Load	935	lbs
DL at ends of wall	213	lbs	Resistive Moment	2.3	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 204: 2nd - Side Ext. Wall @ Bath

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, H_c	4.0	ft.		
Wall Length, L	11.0	ft.	Qualifying Wall Length, L	9.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
600 lbs	<	2151 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	167	plf	Overturning Moment	5.4	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	533	lbs	Resistive Moment	7.1	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall 205: 2nd - Side Ext. Wall @ Bath

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, Hc	4.0	ft.		
Wall Length, L	9.6	ft.	Qualifying Wall Length, L	7.6	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
511 lbs	<	1812 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	167	plf	Overturning Moment	4.6	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	533	lbs	Resistive Moment	5.7	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 206: 2nd - Interior Wall @ Stairs

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	8.7	ft.	Qualifying Wall Length, L	8.7	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
968 lbs	<	2072 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	125	plf	Overturning Moment	8.8	k-ft	Hold Down Design Load	598	lbs
DL at ends of wall	400	lbs	Resistive Moment	3.6	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

Shearwall 207: 2nd - Side Ext. Wall @ Stairs

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	5.5	ft.	Qualifying Wall Length, L	5.5	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
612 lbs	<	1315 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	170	plf	Overturning Moment	5.6	k-ft	Hold Down Design Load	297	lbs
DL at ends of wall	1145	lbs	Resistive Moment	3.9	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 208: 2nd - Side Ext. Wall

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	6.0	ft.	Qualifying Wall Length, L	6.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1239 lbs	<	1434 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	184	plf	Overturning Moment	11.3	k-ft	Hold Down Design Load	1528	lbs
DL at ends of wall	234	lbs	Resistive Moment	2.1	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

Shearwall 209: 2nd - Side Ext. Wall

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	9.0	ft.	Qualifying Wall Length, L	9.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
600 lbs	<	2151 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	167	plf	Overturning Moment	5.4	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	1189	lbs	Resistive Moment	7.7	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 210: 2nd - Int. Wall @ Bdrm/ Bath

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	12.3	ft.	Qualifying Wall Length, L	12.3	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1370 lbs	<	2928 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	125	plf	Overturning Moment	12.4	k-ft	Hold Down Design Load	114	lbs
DL at ends of wall	1273	lbs	Resistive Moment	11.0	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

Shearwall XXX: - Not Used

Shearwall Properties:

Wall height, H	0.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	0.0	ft.	Qualifying Wall Length, L	0.0	ft.	Shearwall Assembly	P0

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
0 lbs	####	#DIV/0! lbs

Shearwall Assembly Specification

P0 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - UNBLOCKED
#DIV/0!

Overturning Evaluation:

Resistive DL	0	plf	Overturning Moment	0.0	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	0	lbs	Resistive Moment	0.0	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 100: 1st - Back Ext. Wall

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	5.7	ft.		
Wall Length, L	55.0	ft.	Qualifying Wall Length, L	37.9	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
3630 lbs	<	9063 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	428	plf	Overturning Moment	55.2	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	839	lbs	Resistive Moment	306.7	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall 101: 1st - Back Ext. Wall

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	16.0	ft.	Qualifying Wall Length, L	16.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
2300 lbs	<	3824 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	228	plf	Overturning Moment	23.0	k-ft	Hold Down Design Load	320	lbs
DL at ends of wall	706	lbs	Resistive Moment	17.9	k-ft	Holdown Capacity	3695	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 102: 1st - Interior Wall @ Kitchen

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	11.2	ft.	Qualifying Wall Length, L	11.2	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1600 lbs	<	2670 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	592	plf	Overturning Moment	16.0	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	771	lbs	Resistive Moment	20.1	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall 103: 1st - Interior Wall @ Hall

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	7.6	ft.	Qualifying Wall Length, L	7.6	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1100 lbs	<	1812 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	664	plf	Overturning Moment	11.0	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	836	lbs	Resistive Moment	11.3	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 104: 1st - Interior Wall

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	11.2	ft.	Qualifying Wall Length, L	11.2	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1600 lbs	<	2670 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	228	plf	Overturning Moment	16.0	k-ft	Hold Down Design Load	692	lbs
DL at ends of wall	400	lbs	Resistive Moment	8.3	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

Shearwall 105: 1st - Front Ext. Wall @ Bath

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, Hc	6.5	ft.		
Wall Length, L	14.5	ft.	Qualifying Wall Length, L	12.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1420 lbs	<	2849 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	232	plf	Overturning Moment	14.2	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	535	lbs	Resistive Moment	14.2	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 106: 1st - Front Ext. Wall

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	5.5	ft.	Qualifying Wall Length, L	5.5	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
660 lbs	<	1315 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	175	plf	Overturning Moment	6.6	k-ft	Hold Down Design Load	804	lbs
DL at ends of wall	413	lbs	Resistive Moment	2.2	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

Shearwall 107: 1st - Front Ext Wall @ Closet

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	7.5	ft.	Qualifying Wall Length, L	7.5	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
890 lbs	<	1793 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	168	plf	Overturning Moment	8.9	k-ft	Hold Down Design Load	439	lbs
DL at ends of wall	1063	lbs	Resistive Moment	5.6	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 108: 1st - Side Ext. Wall

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	9.5	ft.	Qualifying Wall Length, L	9.5	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1270 lbs	<	2271 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	177	plf	Overturning Moment	12.7	k-ft	Hold Down Design Load	714	lbs
DL at ends of wall	570	lbs	Resistive Moment	5.9	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

Shearwall 109: 1st - Side Ext. Wall @ Bedroom

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	5.1	ft.	Qualifying Wall Length, L	5.1	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
690 lbs	<	1225 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	177	plf	Overturning Moment	6.9	k-ft	Hold Down Design Load	862	lbs
DL at ends of wall	641	lbs	Resistive Moment	2.5	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 110: 1st - Side Ext. Wall @ Bath

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	9.0	ft.	Qualifying Wall Length, L	9.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1210 lbs	<	2151 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	301	plf	Overturning Moment	17.5	k-ft	Hold Down Design Load	1028	lbs
DL at ends of wall	730	lbs	Resistive Moment	8.3	k-ft	Holdown Capacity	3695	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

Shearwall 111: 1st - Interior Wall @ Stairs

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	19.0	ft.	Qualifying Wall Length, L	19.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
4150 lbs	<	4541 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	245	plf	Overturning Moment	60.8	k-ft	Hold Down Design Load	1994	lbs
DL at ends of wall	395	lbs	Resistive Moment	22.9	k-ft	Holdown Capacity	2655	lbs

Hold-down Specification

SIMPSON MSTC40 STRAP TIE (12" END LENGTH)

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 112: 1st - Interior Wall @ Kitchen

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	11.2	ft.	Qualifying Wall Length, L	11.2	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
2450 lbs	<	2670 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	120	plf	Overturning Moment	24.5	k-ft	Hold Down Design Load	1366	lbs
DL at ends of wall	1200	lbs	Resistive Moment	9.2	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

Shearwall 113: 1st - Side Ext. Wall @ Chimney

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	7.8	ft.	Qualifying Wall Length, L	7.8	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1500 lbs	<	1871 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	240	plf	Overturning Moment	15.0	k-ft	Hold Down Design Load	1199	lbs
DL at ends of wall	681	lbs	Resistive Moment	5.6	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 114: 1st - Side Ext. Wall @ Dining

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	10.0	ft.	Qualifying Wall Length, L	10.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1932 lbs	<	2390 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	269	plf	Overturning Moment	19.3	k-ft	Hold Down Design Load	1226	lbs
DL at ends of wall	253	lbs	Resistive Moment	7.1	k-ft	Holdown Capacity	3695	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

Shearwall xxx: - Not Used

Shearwall Properties:

Wall height, H	0.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	0.0	ft.	Qualifying Wall Length, L	0.0	ft.	Shearwall Assembly	P0

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
0 lbs	####	#DIV/0! lbs

Shearwall Assembly Specification

P0 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - UNBLOCKED
#DIV/0!

Overturning Evaluation:

Resistive DL	0	plf	Overturning Moment	0.0	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	0	lbs	Resistive Moment	0.0	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall xxx: - Not Used

Shearwall Properties:

Wall height, H	0.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	0.0	ft.	Qualifying Wall Length, L	0.0	ft.	Shearwall Assembly	P0

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity	
0 lbs	####	#DIV/0!	lbs

Shearwall Assembly Specification

P0 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - UNBLOCKED
#DIV/0!

Overturning Evaluation:

Resistive DL	0	plf	Overturning Moment	0.0	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	0	lbs	Resistive Moment	0.0	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall B00: - Interior Wall @ Garage

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, Hc	8.0	ft.		
Wall Length, L	17.3	ft.	Qualifying Wall Length, L	15.3	ft.	Shearwall Assembly	P3

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity	
4000 lbs	<	6878	lbs

Shearwall Assembly Specification

P3 - 1-side 7/16" OSB
fastened w/ 8d nails at 3"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	341	plf	Overturning Moment	40.0	k-ft	Hold Down Design Load	840	lbs
DL at ends of wall	400	lbs	Resistive Moment	25.5	k-ft	Holdown Capacity	3695	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall B01: - Back Ext. Wall

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	6.2	ft.	Qualifying Wall Length, L	6.2	ft.	Shearwall Assembly	P3

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1610 lbs	<	2783 lbs

Shearwall Assembly Specification

P3 - 1-side 7/16" OSB
fastened w/ 8d nails at 3"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	235	plf	Overturning Moment	16.1	k-ft	Hold Down Design Load	2112	lbs
DL at ends of wall	400	lbs	Resistive Moment	3.1	k-ft	Holdown Capacity	3695	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

Shearwall B02: - Back Ext. Wall

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	6.8	ft.	Qualifying Wall Length, L	6.8	ft.	Shearwall Assembly	P3

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1770 lbs	<	3044 lbs

Shearwall Assembly Specification

P3 - 1-side 7/16" OSB
fastened w/ 8d nails at 3"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	370	plf	Overturning Moment	17.7	k-ft	Hold Down Design Load	1893	lbs
DL at ends of wall	400	lbs	Resistive Moment	4.9	k-ft	Holdown Capacity	3695	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall B03: - Front Ext. Wall @ Entry

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	9.0	ft.		
Wall Length, L	11.9	ft.	Qualifying Wall Length, L	9.2	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1820 lbs	<	2119 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	326	plf	Overturning Moment	18.2	k-ft	Hold Down Design Load	632	lbs
DL at ends of wall	80	lbs	Resistive Moment	10.7	k-ft	Holdown Capacity	3695	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

Shearwall B04: - Front Ext. Wall @ Front Room

Shearwall Properties:

Wall height, H	4.3	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	7.5	ft.	Qualifying Wall Length, L	7.5	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1500 lbs	<	1793 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	246	plf	Overturning Moment	15.3	k-ft	Hold Down Design Load	655	lbs
DL at ends of wall	2200	lbs	Resistive Moment	10.4	k-ft	Holdown Capacity	3695	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall B05: - Int. Wall @ Garage

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	18.8	ft.	Qualifying Wall Length, L	18.8	ft.	Shearwall Assembly	P3

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
4120 lbs	<	8456 lbs

Shearwall Assembly Specification

P3 - 1-side 7/16" OSB
fastened w/ 8d nails at 3"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	345	plf	Overturning Moment	101.2	k-ft	Hold Down Design Load	3433	lbs
DL at ends of wall	1200	lbs	Resistive Moment	36.8	k-ft	Holdown Capacity	3695	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

Shearwall B06: - Int. Wall @ Bath

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	9.3	ft.	Qualifying Wall Length, L	9.3	ft.	Shearwall Assembly	P3

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
2040 lbs	<	4172 lbs

Shearwall Assembly Specification

P3 - 1-side 7/16" OSB
fastened w/ 8d nails at 3"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	120	plf	Overturning Moment	20.4	k-ft	Hold Down Design Load	1783	lbs
DL at ends of wall	400	lbs	Resistive Moment	3.9	k-ft	Holdown Capacity	3695	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

Architectural Innovations

3036 67th Ave SE

Mercer Island, WA

Wind Shear Wall Calculations

Reviewed By: NJM

May 4, 2022

Parameters:

Single Family Home

Design Wind Speed: 100 MPH

wind Exposure Category: C

Seismic Design Category: D

Code & Design Standard: 2018 IBC Ch. 1609, ASCE 7-16 Ch. 26-30

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: 3036 67th Ave. SE
M&K Project #: 203-22010
Engineer: LGH
date: 03-May-22

Wind Design Summary per ASCE 7-16

Parameters:

Wind Speed	100	
Exposure Category	C	
Risk Category	II	
Wind Directionality Factor, K_d	0.85	
Topographic Factor, K_{zt}	1.00	
Gust Factor, G	0.85	
Ground Elev. Above Sea Level [ft]	0	
Design Type	ASD	0.60

Roof Geometry:

Trans. Roof Pitch	0.3	:12
Long. Roof Pitch	0.3	:12
Mean Roof Height, H	33.25	ft

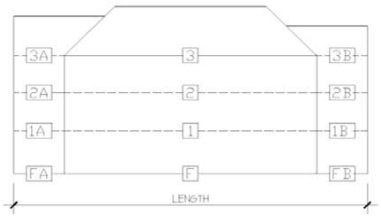
Building Geometry:

length	84	ft
Width	36	ft
Number of stories	3	

Transverse Direction (Perpendicular to Main Ridge Line)

Tributary Design Areas:

Diaphragm Level	Floor-to-Floor Height		Section A	Section O	Section B	
3	9.083 ft	Roof Surface	0	0	0	sq ft
		Wall surface	0	353	0	sq ft
2	11.5 ft	Roof Surface	0	0	0	sq ft
		Wall surface	0	835	0	sq ft
1	11.5 ft	Roof Surface	0	0	0	sq ft
		Wall surface	0	979.26	0	sq ft
FND		Roof Surface	0	0	0	sq ft
		Wall surface	0	0	0	sq ft



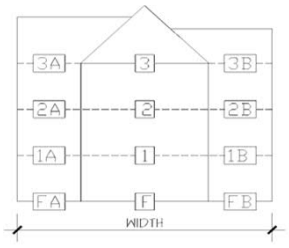
Tributary Design Loads: (0.6W)

	Section A	Section O	Section B	
Story Shear	0.00	5.09	0.00	kips
Total Shear	0.00	5.09	0.00	kips
		5.09		kips
Story Shear	0.00	11.54	0.00	kips
Total Shear	0.00	16.62	0.00	kips
		16.62		kips
Story Shear	0.00	12.83	0.00	kips
Total Shear	0.00	29.46	0.00	kips
		29.46		kips
Story Shear	0.00	0.00	0.00	kips
Total Shear	0.00	29.46	0.00	kips
		29.46		kips

Longitudinal Direction (Parallel to Main Ridge Line)

Tributary Design Areas:

Diaphragm Level	Floor-to-Floor Height		Section A	Section O	Section B	
3	9.083 ft	Roof Surface	0	0	0	sq ft
		Wall surface	0	206.314	0	sq ft
2	11.5 ft	Roof Surface	0	0	0	sq ft
		Wall surface	0	452	0	sq ft
1	11.5 ft	Roof Surface	0	0	0	sq ft
		Wall surface	0	343	0	sq ft
FND		Roof Surface	0	0	0	sq ft
		Wall surface	0	0	0	sq ft



Tributary Design Loads: (0.6W)

	Section A	Section O	Section B	
Story Shear	0.00	2.48	0.00	kips
Total Shear	0.00	2.48	0.00	kips
		2.48		kips
Story Shear	0.00	5.16	0.00	kips
Total Shear	0.00	7.63	0.00	kips
		7.63		kips
Story Shear	0.00	3.67	0.00	kips
Total Shear	0.00	11.30	0.00	kips
		11.30		kips
Story Shear	0.00	0.00	0.00	kips
Total Shear	0.00	11.30	0.00	kips
		11.30		kips

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 200: 2nd - Back Ext. Wall

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, H_c	5.0	ft.		
Wall Length, L	53.0	ft.	Qualifying Wall Length, L	37.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
625 lbs	<	12432 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	241	plf	Overturning Moment	5.7	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	635	lbs	Resistive Moment	334.8	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall 201: 2nd - Back Ext. Wall @ Bathroom

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, Hc	4.0	ft.		
Wall Length, L	7.5	ft.	Qualifying Wall Length, L	5.5	ft.	Shearwall Assembly	P3

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
600 lbs	<	3465 lbs

Shearwall Assembly Specification

P3 - 1-side 7/16" OSB
fastened w/ 8d nails at 3"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	150	plf	Overturning Moment	5.4	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	788	lbs	Resistive Moment	9.1	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 202: 2nd - Front Ext. Wall @ Deck

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	6.0	ft.	Qualifying Wall Length, L	6.0	ft.	Shearwall Assembly	P3

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
650 lbs	<	3780 lbs

Shearwall Assembly Specification

P3 - 1-side 7/16" OSB
fastened w/ 8d nails at 3"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	286	plf	Overturning Moment	5.9	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	489	lbs	Resistive Moment	7.3	k-ft	Holdown Capacity	2655	lbs

Hold-down Specification

No Holdown Required

Shearwall 203: 2nd - Front Ext. Wall

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	6.8	ft.	Qualifying Wall Length, L	6.8	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
625 lbs	<	2268 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	162	plf	Overturning Moment	5.7	k-ft	Hold Down Design Load	158	lbs
DL at ends of wall	213	lbs	Resistive Moment	4.6	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 204: 2nd - Side Ext. Wall @ Bath

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, H_c	4.0	ft.		
Wall Length, L	11.0	ft.	Qualifying Wall Length, L	9.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
450 lbs	<	3024 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	167	plf	Overturning Moment	4.1	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	533	lbs	Resistive Moment	14.4	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall 205: 2nd - Side Ext. Wall @ Bath

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, Hc	4.0	ft.		
Wall Length, L	9.6	ft.	Qualifying Wall Length, L	7.6	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
375 lbs	<	2548 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	167	plf	Overturning Moment	3.4	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	533	lbs	Resistive Moment	11.5	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 206: 2nd - Interior Wall @ Stairs

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	8.7	ft.	Qualifying Wall Length, L	8.7	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
830 lbs	<	2913 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	125	plf	Overturning Moment	7.5	k-ft	Hold Down Design Load	23	lbs
DL at ends of wall	400	lbs	Resistive Moment	7.3	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

Shearwall 207: 2nd - Side Ext. Wall @ Stairs

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	5.5	ft.	Qualifying Wall Length, L	5.5	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
530 lbs	<	1848 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	170	plf	Overturning Moment	4.8	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	1145	lbs	Resistive Moment	8.0	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 208: 2nd - Side Ext. Wall

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	6.0	ft.	Qualifying Wall Length, L	6.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1275 lbs	<	2016 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	184	plf	Overturning Moment	11.6	k-ft	Hold Down Design Load	1222	lbs
DL at ends of wall	234	lbs	Resistive Moment	4.2	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

Shearwall 209: 2nd - Side Ext. Wall

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	9.0	ft.	Qualifying Wall Length, L	9.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
450 lbs	<	3024 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	167	plf	Overturning Moment	4.1	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	1189	lbs	Resistive Moment	15.7	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 210: 2nd - Int. Wall @ Bdrm/ Bath

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	12.3	ft.	Qualifying Wall Length, L	12.3	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1190 lbs	<	4116 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	125	plf	Overturning Moment	10.8	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	1273	lbs	Resistive Moment	22.5	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

No Holdown Required

Shearwall xxx: - Not Used

Shearwall Properties:

Wall height, H	0.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	0.0	ft.	Qualifying Wall Length, L	0.0	ft.	Shearwall Assembly	P0

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
0 lbs	####	#DIV/0! lbs

Shearwall Assembly Specification

P0 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - UNBLOCKED
#DIV/0!

Overturning Evaluation:

Resistive DL	0	plf	Overturning Moment	#DIV/0!	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	0	lbs	Resistive Moment	0.0	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 100: 1st - Back Ext. Wall

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	5.7	ft.		
Wall Length, L	55.0	ft.	Qualifying Wall Length, L	37.9	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1900 lbs	<	12741 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	428	plf	Overturning Moment	24.9	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	839	lbs	Resistive Moment	624.0	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall 101: 1st - Back Ext. Wall

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	16.0	ft.	Qualifying Wall Length, L	16.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1320 lbs	<	5376 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	228	plf	Overturning Moment	13.2	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	706	lbs	Resistive Moment	36.4	k-ft	Holdown Capacity	4935	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 102: 1st - Interior Wall @ Kitchen

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	11.2	ft.	Qualifying Wall Length, L	11.2	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
925 lbs	<	3753 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	592	plf	Overturning Moment	9.3	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	771	lbs	Resistive Moment	41.0	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall 103: 1st - Interior Wall @ Hall

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	7.6	ft.	Qualifying Wall Length, L	7.6	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
630 lbs	<	2548 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	664	plf	Overturning Moment	6.3	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	836	lbs	Resistive Moment	22.9	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 104: 1st - Interior Wall

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	11.2	ft.	Qualifying Wall Length, L	11.2	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
925 lbs	<	3753 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	228	plf	Overturning Moment	9.3	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	400	lbs	Resistive Moment	16.8	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

No Holdown Required

Shearwall 105: 1st - Front Ext. Wall @ Bath

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, Hc	6.5	ft.		
Wall Length, L	14.5	ft.	Qualifying Wall Length, L	12.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
920 lbs	<	4005 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	232	plf	Overturning Moment	9.2	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	535	lbs	Resistive Moment	28.9	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 106: 1st - Front Ext. Wall

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	5.5	ft.	Qualifying Wall Length, L	5.5	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
420 lbs	<	1848 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	175	plf	Overturning Moment	4.2	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	413	lbs	Resistive Moment	4.4	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

No Holdown Required

Shearwall 107: 1st - Front Ext Wall @ Closet

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	7.5	ft.	Qualifying Wall Length, L	7.5	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
570 lbs	<	2520 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	168	plf	Overturning Moment	5.7	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	1063	lbs	Resistive Moment	11.4	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 108: 1st - Side Ext. Wall

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	9.5	ft.	Qualifying Wall Length, L	9.5	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1670 lbs	<	3192 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	177	plf	Overturning Moment	16.7	k-ft	Hold Down Design Load	490	lbs
DL at ends of wall	570	lbs	Resistive Moment	12.0	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

Shearwall 109: 1st - Side Ext. Wall @ Bedroom

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	5.1	ft.	Qualifying Wall Length, L	5.1	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
900 lbs	<	1722 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	177	plf	Overturning Moment	9.0	k-ft	Hold Down Design Load	771	lbs
DL at ends of wall	641	lbs	Resistive Moment	5.0	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 110: 1st - Side Ext. Wall @ Bath

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	9.0	ft.	Qualifying Wall Length, L	9.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1600 lbs	<	3024 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	301	plf	Overturning Moment	20.1	k-ft	Hold Down Design Load	356	lbs
DL at ends of wall	730	lbs	Resistive Moment	16.9	k-ft	Holdown Capacity	4935	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

Shearwall 111: 1st - Interior Wall @ Stairs

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	19.0	ft.	Qualifying Wall Length, L	19.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
5230 lbs	<	6384 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	245	plf	Overturning Moment	68.8	k-ft	Hold Down Design Load	1172	lbs
DL at ends of wall	395	lbs	Resistive Moment	46.6	k-ft	Holdown Capacity	2655	lbs

Hold-down Specification

SIMPSON MSTC40 STRAP TIE (12" END LENGTH)

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 112: 1st - Interior Wall @ Kitchen

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	11.2	ft.	Qualifying Wall Length, L	11.2	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
3070 lbs	<	3753 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	120	plf	Overturning Moment	30.7	k-ft	Hold Down Design Load	1065	lbs
DL at ends of wall	1200	lbs	Resistive Moment	18.8	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

Shearwall 113: 1st - Side Ext. Wall @ Chimney

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	7.8	ft.	Qualifying Wall Length, L	7.8	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1820 lbs	<	2631 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	240	plf	Overturning Moment	18.2	k-ft	Hold Down Design Load	865	lbs
DL at ends of wall	681	lbs	Resistive Moment	11.4	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall 114: 1st - Side Ext. Wall @ Dining

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	10.0	ft.	Qualifying Wall Length, L	10.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
2330 lbs	<	3360 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	269	plf	Overturning Moment	23.3	k-ft	Hold Down Design Load	893	lbs
DL at ends of wall	253	lbs	Resistive Moment	14.4	k-ft	Holdown Capacity	4935	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

Shearwall xxx: - Not Used

Shearwall Properties:

Wall height, H	0.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	0.0	ft.	Qualifying Wall Length, L	0.0	ft.	Shearwall Assembly	P0

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
0 lbs	####	#DIV/0! lbs

Shearwall Assembly Specification

P0 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - UNBLOCKED
#DIV/0!

Overturning Evaluation:

Resistive DL	0	plf	Overturning Moment	#DIV/0!	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	0	lbs	Resistive Moment	0.0	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall xxx: - Not Used

Shearwall Properties:

Wall height, H	0.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	0.0	ft.	Qualifying Wall Length, L	0.0	ft.	Shearwall Assembly	P0

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
0 lbs	####	#DIV/0! lbs

Shearwall Assembly Specification

P0 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - UNBLOCKED
#DIV/0!

Overturning Evaluation:

Resistive DL	0	plf	Overturning Moment	#DIV/0!	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	0	lbs	Resistive Moment	0.0	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall B00: - Interior Wall @ Garage

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, Hc	8.0	ft.		
Wall Length, L	17.3	ft.	Qualifying Wall Length, L	15.3	ft.	Shearwall Assembly	P3

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
2820 lbs	<	9608 lbs

Shearwall Assembly Specification

P3 - 1-side 7/16" OSB
fastened w/ 8d nails at 3"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	341	plf	Overturning Moment	28.2	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	400	lbs	Resistive Moment	51.9	k-ft	Holdown Capacity	4935	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall B01: - Back Ext. Wall

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	6.2	ft.	Qualifying Wall Length, L	6.2	ft.	Shearwall Assembly	P3

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1140 lbs	<	3887 lbs

Shearwall Assembly Specification

P3 - 1-side 7/16" OSB
fastened w/ 8d nails at 3"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	235	plf	Overturning Moment	11.4	k-ft	Hold Down Design Load	835	lbs
DL at ends of wall	400	lbs	Resistive Moment	6.2	k-ft	Holdown Capacity	4935	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

Shearwall B02: - Back Ext. Wall

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	6.8	ft.	Qualifying Wall Length, L	6.8	ft.	Shearwall Assembly	P3

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1240 lbs	<	4253 lbs

Shearwall Assembly Specification

P3 - 1-side 7/16" OSB
fastened w/ 8d nails at 3"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	370	plf	Overturning Moment	12.4	k-ft	Hold Down Design Load	353	lbs
DL at ends of wall	400	lbs	Resistive Moment	10.0	k-ft	Holdown Capacity	4935	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall B03: - Front Ext. Wall @ Entry

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	9.0	ft.		
Wall Length, L	11.9	ft.	Qualifying Wall Length, L	9.2	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
812 lbs	<	2979 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	326	plf	Overturning Moment	8.1	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	80	lbs	Resistive Moment	21.7	k-ft	Holdown Capacity	4935	lbs

Hold-down Specification

No Holdown Required

Shearwall B04: - Front Ext. Wall @ Front Room

Shearwall Properties:

Wall height, H	4.3	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	7.5	ft.	Qualifying Wall Length, L	7.5	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
665 lbs	<	2520 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	246	plf	Overturning Moment	8.5	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	2200	lbs	Resistive Moment	21.1	k-ft	Holdown Capacity	4935	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: Architectural Innovations
3036 67th Ave SE
M&K Project #: 203-22010
Engineer: LGH
Date: 04-May-22

Shearwall Design Summary

Shearwall B05: - Int. Wall @ Garage

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	18.8	ft.	Qualifying Wall Length, L	18.8	ft.	Shearwall Assembly	P3

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
7430 lbs	<	11813 lbs

Shearwall Assembly Specification

P3 - 1-side 7/16" OSB
fastened w/ 8d nails at 3"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	345	plf	Overturning Moment	142.2	k-ft	Hold Down Design Load	3592	lbs
DL at ends of wall	1200	lbs	Resistive Moment	74.9	k-ft	Holdown Capacity	4935	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

Shearwall B06: - Int. Wall @ Bath

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	9.3	ft.	Qualifying Wall Length, L	9.3	ft.	Shearwall Assembly	P3

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
3660 lbs	<	5828 lbs

Shearwall Assembly Specification

P3 - 1-side 7/16" OSB
fastened w/ 8d nails at 3"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	120	plf	Overturning Moment	36.6	k-ft	Hold Down Design Load	3097	lbs
DL at ends of wall	400	lbs	Resistive Moment	8.0	k-ft	Holdown Capacity	4935	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

This Wall in File: p:\client files\203 - architectural innovations\2022\22010 - 3036 67th ave. se -

RetainPro (c) 1987-2019, Build 11.20.03.31
License : KW-06059959
License To : MULHERN & KULP STRUCTURAL ENGINEERING INC

Cantilevered Retaining Wall

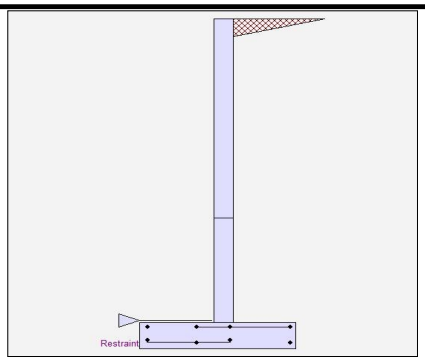
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	11.58 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,667.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.300
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

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

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 (Service Level)	=	0.0 psf

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		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

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

Earth Pressure Seismic Load

Method : Uniform

Multiplier Used	=	8.000
(Multiplier used on soil density)		
Uniform Seismic Force	=	100.640
Total Seismic Force	=	1,266.051

Design Summary

Wall Stability Ratios

Overturning	=	1.33 Ratio < 1.5!
Slab Resists All Sliding !		
Total Bearing Load	=	5,822 lbs
...resultant ecc.	=	16.51 in
Soil Pressure @ Toe	=	2,454 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,667 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	3,436 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	42.8 psi OK
Footing Shear @ Heel	=	47.0 psi OK
Allowable	=	75.0 psi

Sliding Calcs

Lateral Sliding Force	=	3,655.7 lbs

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

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		3rd	2nd	Bottom
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	ft =	11.58	4.00	0.00
Wall Material Above "Ht"	=	Concrete	Concrete	Concrete
Design Method	=	LRFD	LRFD	LRFD
Thickness	=	8.00	8.00	8.00
Rebar Size	=	# 5	# 5	# 6
Rebar Spacing	=	12.00	12.00	6.00
Rebar Placed at	=	6.5 in	6.5 in	6.5 in
Design Data				
fb/FB + fa/Fa	=	**0.000**	**0.812**	**0.982**
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =		2,371.6	4,920.1
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =		6,956.1	21,240.9
Moment.....Allowable	ft-# =	8,557.2	8,557.2	21,627.9
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =		30.4	63.1
Shear.....Allowable	psi =	75.0	75.0	75.0
Anet (Masonry)	in2 =			
Rebar Depth 'd'	in =	6.50	6.50	6.50
Masonry Data				
f'm	psi =			
Fs	psi =			
Solid Grouting	=			
Modular Ratio 'n'	=			
Wall Weight	psf =	100.0	100.0	100.0
Short Term Factor	=			
Equiv. Solid Thick.	=			
Masonry Block Type	=	Medium Weight		
Masonry Design Method	=	ASD		
Concrete Data				
f'c	psi =	2,500.0	2,500.0	2,500.0
Fy	psi =	60,000.0	60,000.0	60,000.0

Concrete Stem Rebar Area Details

3rd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0 in2/ft		
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 0.000 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.000 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 0.00 in	#4@ 0.00 in
Provided Area :	0.31 in2/ft	#5@ 0.00 in	#5@ 0.00 in
Maximum Area :	0.8805 in2/ft	#6@ 0.00 in	#6@ 0.00 in

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2501 in2/ft		
(4/3) * As :	0.3334 in2/ft	Min Stem T&S Reinf Area 1.455 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 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 :	
	==========	One layer of :	Two layers of :
Required Area :	0.26 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.31 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8805 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.7636 in2/ft		
(4/3) * As :	1.0182 in2/ft	Min Stem T&S Reinf Area 0.768 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 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 :	
	==========	One layer of :	Two layers of :
Required Area :	0.7636 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.88 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8805 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	2.50 ft
Heel Width	=	2.75
Total Footing Width	=	5.25
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

		Toe	Heel	
Factored Pressure	=	3,436	0	psf
Mu' : Upward	=	100,195	30	ft-#
Mu' : Downward	=	6,750	7,783	ft-#
Mu: Design	=	7,787	7,753	ft-#
Actual 1-Way Shear	=	42.76	47.02	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing = # 5 @ 13.19 in
Heel Reinforcing = # 5 @ 14.35 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@ 8.51 in, #5@ 13.19 in, #6@ 18.72 in, #7@ 25.53 in, #8@ 33.61 in, #9@ 42
Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46
Key: No key defined

Min footing T&S reinf Area 1.36 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

This Wall in File: p:\client files\203 - architectural innovations\2022\22010 - 3036 67th ave. se -

Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		2,769.5	4.19	11,613.4	Soil Over HL (ab. water tbl)	2,653.8	4.21	11,167.9
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		4.21	11,167.9
Hydrostatic Force					Watre Table			
Buoyant Force	=				Sloped Soil Over Heel	=		
Surcharge over Heel	=				Surcharge Over Heel	=		
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	=		
Seismic Earth Load	=	886.2	6.29	5,574.4	Surcharge Over Toe	=		
	=				Stem Weight(s)	=	1,158.0	2.83	3,281.0
					Earth @ Stem Transitions	=			
Total	=	3,655.7	**O.T.M.** =	17,187.8	Footing Weight	=	787.5	2.63	2,067.2
					Key Weight	=			
					Vert. Component	=	1,222.5	5.25	6,418.1
					Total =		5,821.8 lbs	**R.M.=**	22,934.2

Resisting/Overturning Ratio = **1.33**
Vertical Loads used for Soil Pressure = 5,821.8 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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

Vertical component of active lateral soil pressure IS 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)	0.150	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.

This Wall in File: p:\client files\203 - architectural innovations\2022\22010 - 3036 67th ave. se -

RetainPro (c) 1987-2019, Build 11.20.03.31
License : KW-06059959
License To : MULHERN & KULP STRUCTURAL ENGINEERING INC

Cantilevered Retaining Wall

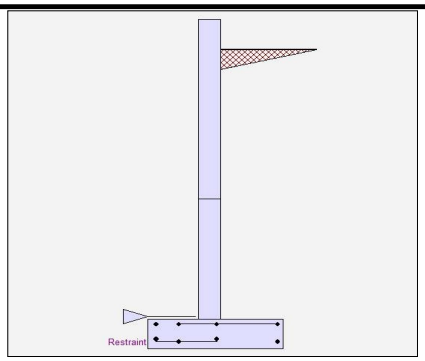
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	9.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,667.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.300
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

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

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 (Service Level)	=	0.0 psf

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		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

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

Earth Pressure Seismic Load

Method : Uniform

Multiplier Used	=	8.000
(Multiplier used on soil density)		
Uniform Seismic Force	=	80.000
Total Seismic Force	=	800.000

Design Summary

Wall Stability Ratios

Overturning	=	1.36 Ratio < 1.5!

Slab Resists All Sliding !

Total Bearing Load	=	4,187 lbs
...resultant ecc.	=	13.16 in
Soil Pressure @ Toe	=	2,519 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,667 psf

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	3,527 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	22.0 psi OK
Footing Shear @ Heel	=	31.2 psi OK
Allowable	=	75.0 psi

Sliding Calcs

Lateral Sliding Force	=	2,310.0 lbs

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

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		3rd	2nd	Bottom
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	ft =	10.00	4.00	0.00
Wall Material Above "Ht"	=	Concrete	Concrete	Concrete
Design Method	=	LRFD	LRFD	LRFD
Thickness	=	8.00	8.00	8.00
Rebar Size	=	# 5	# 5	# 5
Rebar Spacing	=	16.00	16.00	8.00
Rebar Placed at	=	6.5 in	6.5 in	6.5 in
Design Data				
fb/FB + fa/Fa	=	**0.000**	**0.332**	**0.806**
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =		1,100.0	2,988.0
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =		2,166.7	10,044.0
Moment.....Allowable	ft-# =	6,513.6	6,513.6	12,453.1
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =		14.1	38.3
Shear.....Allowable	psi =	75.0	75.0	75.0
Anet (Masonry)	in2 =			
Rebar Depth 'd'	in =	6.50	6.50	6.50
Masonry Data				
f'm	psi =			
Fs	psi =			
Solid Grouting	=			
Modular Ratio 'n'	=			
Wall Weight	psf =	100.0	100.0	100.0
Short Term Factor	=			
Equiv. Solid Thick.	=			
Masonry Block Type	=	Medium Weight		
Masonry Design Method	=	ASD		
Concrete Data				
f'c	psi =	2,500.0	2,500.0	2,500.0
Fy	psi =	60,000.0	60,000.0	60,000.0

Concrete Stem Rebar Area Details

3rd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0 in2/ft		
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 0.000 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.000 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 0.00 in	#4@ 0.00 in
Provided Area :	0.2325 in2/ft	#5@ 0.00 in	#5@ 0.00 in
Maximum Area :	0.8805 in2/ft	#6@ 0.00 in	#6@ 0.00 in

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0779 in2/ft		
(4/3) * As :	0.1039 in2/ft	Min Stem T&S Reinf Area 1.152 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 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 :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2325 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8805 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.3611 in2/ft		
(4/3) * As :	0.4815 in2/ft	Min Stem T&S Reinf Area 0.768 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 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 :	
	==========	One layer of :	Two layers of :
Required Area :	0.3611 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.465 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8805 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	1.50 ft
Heel Width	=	2.50
Total Footing Width	=	4.00
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

		Toe	Heel	
Factored Pressure	=	3,527	0	psf
Mu' : Upward	=	38,832	35	ft-#
Mu' : Downward	=	2,430	4,565	ft-#
Mu: Design	=	3,034	4,530	ft-#
Actual 1-Way Shear	=	21.98	31.15	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing = # 5 @ 13.19 in
Heel Reinforcing = # 5 @ 14.35 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
Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46
Key: No key defined

Min footing T&S reinf Area 1.04 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

This Wall in File: p:\client files\203 - architectural innovations\2022\22010 - 3036 67th ave. se -

RetainPro (c) 1987-2019, Build 11.20.03.31
License : KW-06059959
License To : MULHERN & KULP STRUCTURAL ENGINEERING INC

Cantilevered Retaining Wall

Code: IBC 2018,ACI 318-14,TMS 402-16

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	1,750.0	3.33	5,833.3	Soil Over HL (ab. water tbl)	1,815.0	3.08	5,596.3
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		3.08	5,596.3
Hydrostatic Force				Watre Table			
Buoyant Force =				Sloped Soil Over Heel =			
Surcharge over Heel =				Surcharge Over Heel =			
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 =			
Seismic Earth Load =	560.0	5.00	2,800.0	Surcharge Over Toe =			
=				Stem Weight(s) =	1,000.0	1.83	1,833.3
				Earth @ Stem Transitions =			
Total =	2,310.0	**O.T.M.** =	8,633.3	Footing Weight =	600.0	2.00	1,200.0
				Key Weight =			
				Vert. Component =	772.5	4.00	3,089.9
				Total =	4,187.5 lbs	**R.M.=**	11,719.5

Resisting/Overturning Ratio = **1.36**
Vertical Loads used for Soil Pressure = 4,187.5 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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

Vertical component of active lateral soil pressure IS 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)	0.175	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.

This Wall in File: p:\client files\203 - architectural innovations\2022\22010 - 3036 67th ave. se -

RetainPro (c) 1987-2019, Build 11.20.03.31
License : KW-06059959
License To : MULHERN & KULP STRUCTURAL ENGINEERING INC

Cantilevered Retaining Wall

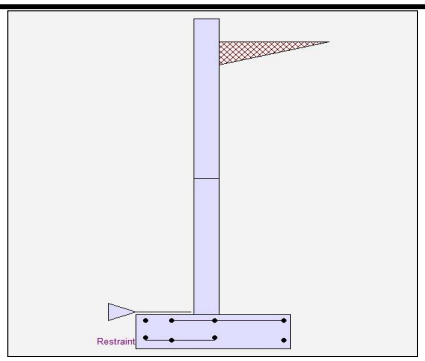
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	8.00 ft
Wall height above soil	=	0.67 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,667.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.300
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

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

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 (Service Level)	=	0.0 psf

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		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

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

Earth Pressure Seismic Load

Method : Uniform

Multiplier Used	=	8.000
(Multiplier used on soil density)		
Uniform Seismic Force	=	72.000
Total Seismic Force	=	648.000

Design Summary

Wall Stability Ratios

Overturning	=	1.63	OK

Slab Resists All Sliding !

Total Bearing Load	=	3,706 lbs	
...resultant ecc.	=	8.52 in	
Soil Pressure @ Toe	=	1,592 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,667 psf	

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	2,229 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	14.1 psi	OK
Footing Shear @ Heel	=	21.3 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,871.1 lbs

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

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		3rd	2nd	Bottom
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	ft =	8.67	4.00	0.00
Wall Material Above "Ht"	=	Concrete	Concrete	Concrete
Design Method	=	LRFD	LRFD	LRFD
Thickness	=	8.00	8.00	8.00
Rebar Size	=	# 5	# 5	# 5
Rebar Spacing	=	16.00	16.00	8.00
Rebar Placed at	=	6.5 in	6.5 in	6.5 in
Design Data				
fb/FB + fa/Fa	=	**0.000**	**0.180**	**0.568**
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =		736.0	2,368.0
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =		1,173.3	7,082.7
Moment.....Allowable	ft-# =	6,513.6	6,513.6	12,453.1
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =		9.4	30.4
Shear.....Allowable	psi =	75.0	75.0	75.0
Anet (Masonry)	in2 =			
Rebar Depth 'd'	in =	6.50	6.50	6.50
Masonry Data				
f'm	psi =			
Fs	psi =			
Solid Grouting	=			
Modular Ratio 'n'	=			
Wall Weight	psf =	100.0	100.0	100.0
Short Term Factor	=			
Equiv. Solid Thick.	=			
Masonry Block Type	=	Medium Weight		
Masonry Design Method	=	ASD		
Concrete Data				
f'c	psi =	2,500.0	2,500.0	2,500.0
Fy	psi =	60,000.0	60,000.0	60,000.0

Concrete Stem Rebar Area Details

3rd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0 in2/ft		
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 0.000 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.000 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 0.00 in	#4@ 0.00 in
Provided Area :	0.2325 in2/ft	#5@ 0.00 in	#5@ 0.00 in
Maximum Area :	0.8805 in2/ft	#6@ 0.00 in	#6@ 0.00 in

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0422 in2/ft		
(4/3) * As :	0.0562 in2/ft	Min Stem T&S Reinf Area 0.897 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 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 :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2325 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8805 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2546 in2/ft		
(4/3) * As :	0.3395 in2/ft	Min Stem T&S Reinf Area 0.768 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 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 :	
	==========	One layer of :	Two layers of :
Required Area :	0.26 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.465 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8805 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	1.50 ft
Heel Width	=	2.50
Total Footing Width	=	4.00
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

		Toe	Heel	
Factored Pressure	=	2,229	0	psf
Mu' : Upward	=	26,203	474	ft-#
Mu' : Downward	=	2,430	3,913	ft-#
Mu: Design	=	1,981	3,439	ft-#
Actual 1-Way Shear	=	14.13	21.33	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing = # 5 @ 8.00 in
Heel Reinforcing = # 5 @ 14.35 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
Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46
Key: No key defined

Min footing T&S reinf Area 1.04 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		1,417.5	3.00	4,252.5	Soil Over HL (ab. water tbl)	1,613.3	3.08	4,974.4
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		3.08	4,974.4
Hydrostatic Force					Watre Table			
Buoyant Force	=				Sloped Soil Over Heel	=		
Surcharge over Heel	=				Surcharge Over Heel	=		
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	=		
Seismic Earth Load	=	453.6	4.50	2,041.2	Surcharge Over Toe	=		
	=				Stem Weight(s)	=	867.0	1.83	1,589.5
					Earth @ Stem Transitions	=			
Total	=	1,871.1	**O.T.M.** =	6,293.7	Footing Weight	=	600.0	2.00	1,200.0
					Key Weight	=			
					Vert. Component	=	625.7	4.00	2,502.8
					Total =		3,706.0 lbs	**R.M.=**	10,266.8

Resisting/Overturning Ratio = **1.63**
Vertical Loads used for Soil Pressure = 3,706.0 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

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

Vertical component of active lateral soil pressure IS 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)	0.096	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.

This Wall in File: P:\Client Files\203 - Architectural Innovations\2022\22010 - 3036 67th Ave. SE -

RetainPro (c) 1987-2019, Build 11.20.03.31
License : KW-06059959
License To : MULHERN & KULP STRUCTURAL ENGINEERING INC

Cantilevered Retaining Wall

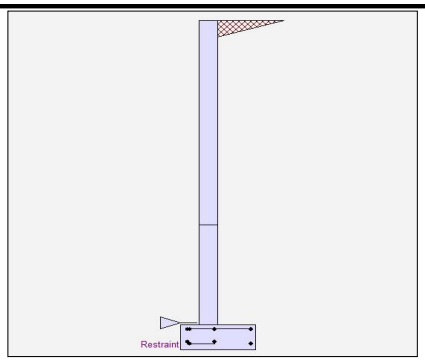
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	12.17 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing||Soil Friction	=	0.300
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
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 (Service Level)	=	0.0 psf

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		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios

Overturning	=	0.67 UNSTABLE!
Slab Resists All Sliding !		
Total Bearing Load	=	4,742 lbs
...resultant ecc.	=	31.60 in
Soil Pressure @ Toe	=	0 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	0 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	0.1 psi OK
Footing Shear @ Heel	=	39.7 psi OK
Allowable	=	75.0 psi

Sliding Calcs

Lateral Sliding Force	=	3,035.4 lbs

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

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		3rd	2nd	Bottom
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	ft =	12.17	4.00	0.00
Wall Material Above "Ht"	=	Concrete	Concrete	Concrete
Design Method	=	LRFD	LRFD	LRFD
Thickness	=	8.00	8.00	8.00
Rebar Size	=	# 5	# 5	# 6
Rebar Spacing	=	12.00	12.00	6.00
Rebar Placed at	=	6.5 in	6.5 in	6.5 in
Design Data				
fb/FB + fa/Fa	=	**0.000**	**0.594**	**0.777**
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =		1,869.0	4,147.0
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =		5,089.8	16,823.2
Moment.....Allowable	ft-# =	8,557.2	8,557.2	21,627.9
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =		24.0	53.2
Shear.....Allowable	psi =	75.0	75.0	75.0
Anet (Masonry)	in2 =			
Rebar Depth 'd'	in =	6.50	6.50	6.50
Masonry Data				
f'm	psi =			
Fs	psi =			
Solid Grouting	=			
Modular Ratio 'n'	=			
Wall Weight	psf =	100.0	100.0	100.0
Short Term Factor	=			
Equiv. Solid Thick.	=			
Masonry Block Type	=	Medium Weight		
Masonry Design Method	=	ASD		
Concrete Data				
f'c	psi =	2,500.0	2,500.0	2,500.0
Fy	psi =	60,000.0	60,000.0	60,000.0

Concrete Stem Rebar Area Details

3rd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0 in2/ft		
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 0.000 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.000 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 0.00 in	#4@ 0.00 in
Provided Area :	0.31 in2/ft	#5@ 0.00 in	#5@ 0.00 in
Maximum Area :	0.8805 in2/ft	#6@ 0.00 in	#6@ 0.00 in

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.183 in2/ft		
(4/3) * As :	0.244 in2/ft	Min Stem T&S Reinf Area 1.569 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 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 :	
	==========	One layer of :	Two layers of :
Required Area :	0.244 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.31 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8805 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.6048 in2/ft		
(4/3) * As :	0.8064 in2/ft	Min Stem T&S Reinf Area 0.768 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 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 :	
	==========	One layer of :	Two layers of :
Required Area :	0.6048 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.88 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.8805 in2/ft	#6@ 27.50 in	#6@ 55.00 in

12'-2" SITE RETAINING WALL LOCATED AT ENTRY WILL HAVE A CONT. SLAB (SEE PLAN). THE ENTIRE ENTRY STAIR RETAINING WALL & FOUNDATION WILL ACT AS ONCE COMPONENT.