MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 295, San Diego, CA 92121 ▸ p 619-650-0010 ▸ *mulhernkulp.com*

CALCULATION PACKAGE

Revised June 18, 2024

Design Built Homes

86th Ave SE
Lot 2

Mercer Island,
Washington

MULHERN & KULP STRUCTURAL ENGINEERING, INC.

Prepared By:

Ryan Chan, E.I.T. *Staff Engineer*

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

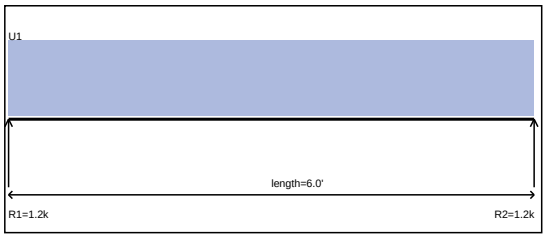
Signature, Seal & Date

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

BEAM & HEADER CALCULATIONS

M+K PROJECT #: 244-24010-T01 - 86th Ave SE - Lot 2
ENGINEER: Riley Denis
Date: 06/18/2025

Description - Roof Framing - H3-1 - Header



Uniform 1 = 0.39 klf (0.0'-6.0')

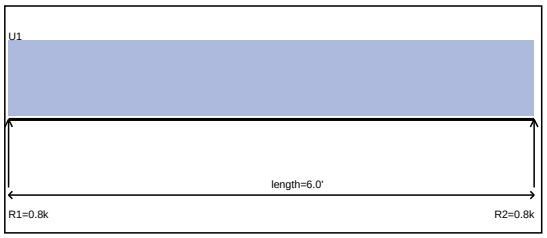
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 1.18k	Vall = 4.47k	Ratio = 0.26
M = 1.77k-ft	Mall = 5.17k-ft	Ratio = 0.34

Deflection
TL = 0.03" L/999+ > L/240 min
DL = 0.01"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Roof Framing - H3-2 - Header



Uniform 1 = 0.25 klf (0.0'-6.0')

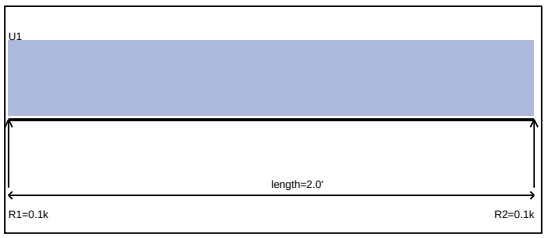
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.76k	Vall = 4.47k	Ratio = 0.17
M = 1.14k-ft	Mall = 5.17k-ft	Ratio = 0.22

Deflection
TL = 0.02" L/999+ > L/240 min
DL = 0.01"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Roof Framing - H3-3 - Header



Uniform 1 = 0.07 klf (0.0'-2.0')

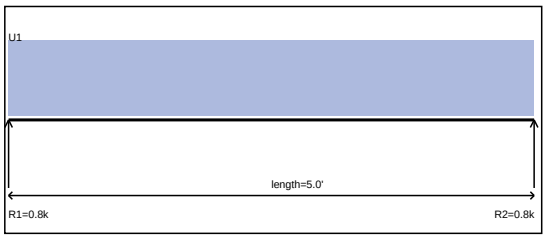
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.07k	Vall = 4.47k	Ratio = 0.02
M = 0.04k-ft	Mall = 5.17k-ft	Ratio = 0.01

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Roof Framing - H3-4 - Header



Uniform 1 = 0.31 klf (0.0'-5.0')

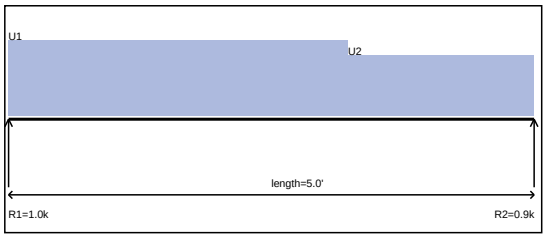
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.78k	Vall = 4.47k	Ratio = 0.17
M = 0.97k-ft	Mall = 5.17k-ft	Ratio = 0.19

Deflection
TL = 0.01" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Roof Framing - H3-5 - Header



Uniform 1 = 0.39 klf (0.0'-3.2')

Uniform 2 = 0.31 klf (3.2'-5.0')

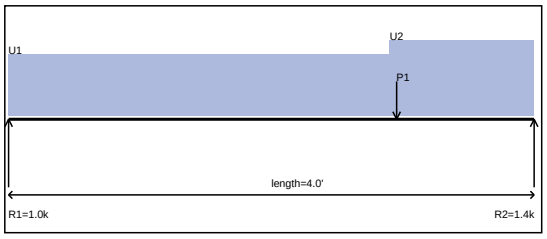
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.95k	Vall = 4.47k	Ratio = 0.21
M = 1.16k-ft	Mall = 5.17k-ft	Ratio = 0.22

Deflection
TL = 0.01" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Roof Framing - H3-6 - Header



Uniform 1 = 0.40 klf (0.0'-2.9')

P1 = 0.60 K (3.0')

Uniform 2 = 0.49 klf (2.9'-4.0')

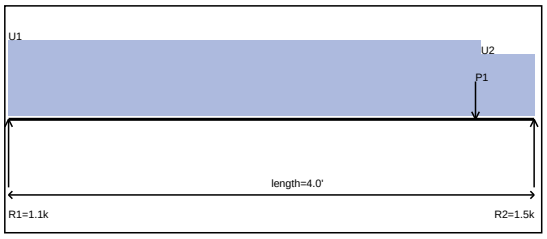
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 1.33k	Vall = 4.47k	Ratio = 0.30
M = 1.18k-ft	Mall = 5.17k-ft	Ratio = 0.23

Deflection
TL = 0.01" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Roof Framing - H3-7 - Header



Uniform 1 = 0.49 klf (0.0'-3.6')

P1 = 0.60 K (3.6')

Uniform 2 = 0.40 klf (3.6'-4.0')

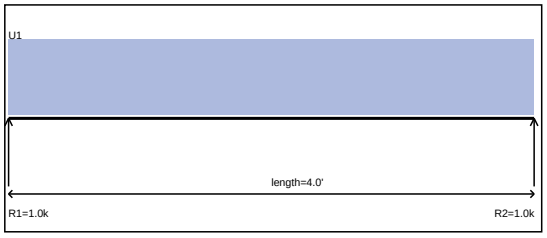
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 1.48k	Vall = 4.47k	Ratio = 0.33
M = 1.11k-ft	Mall = 5.17k-ft	Ratio = 0.21

Deflection
TL = 0.01" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Roof Framing - H3-8 - Header



Uniform 1 = 0.49 klf (0.0'-4.0')

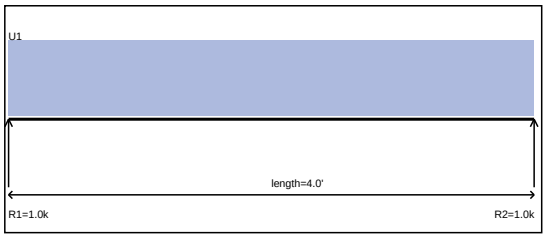
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.97k	Vall = 4.47k	Ratio = 0.22
M = 0.97k-ft	Mall = 5.17k-ft	Ratio = 0.19

Deflection
TL = 0.01" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Roof Framing - H3-9 - Header



Uniform 1 = 0.49 klf (0.0'-4.0')

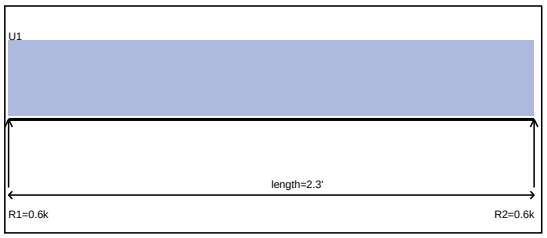
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.97k	Vall = 4.47k	Ratio = 0.22
M = 0.97k-ft	Mall = 5.17k-ft	Ratio = 0.19

Deflection
TL = 0.01" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Roof Framing - H3-10 - Header



Uniform 1 = 0.50 klf (0.0'-2.3')

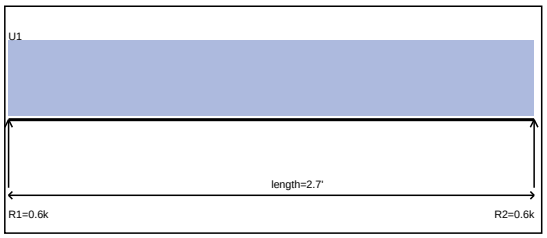
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.58k	Vall = 4.47k	Ratio = 0.13
M = 0.34k-ft	Mall = 5.17k-ft	Ratio = 0.07

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Roof Framing - H3-11 - Header



Uniform 1 = 0.42 klf (0.0'-2.7')

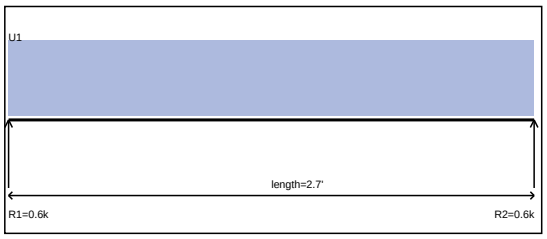
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.56k	Vall = 4.47k	Ratio = 0.13
M = 0.37k-ft	Mall = 5.17k-ft	Ratio = 0.07

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Roof Framing - H3-12 - Header



Uniform 1 = 0.44 klf (0.0'-2.7')

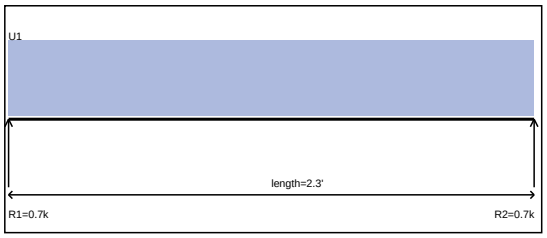
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.58k	Vall = 4.47k	Ratio = 0.13
M = 0.39k-ft	Mall = 5.17k-ft	Ratio = 0.07

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Roof Framing - H3-13 - Header



Uniform 1 = 0.52 klf (0.0'-2.3')

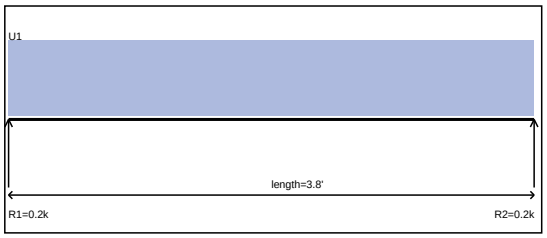
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.60k	Vall = 4.47k	Ratio = 0.13
M = 0.35k-ft	Mall = 5.17k-ft	Ratio = 0.07

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Roof Framing - H3-14 - Header



Uniform 1 = 0.07 klf (0.0'-3.8')

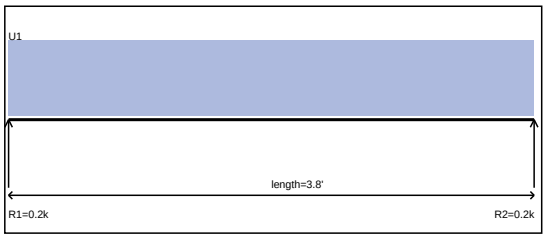
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.13k	Vall = 4.47k	Ratio = 0.03
M = 0.12k-ft	Mall = 5.17k-ft	Ratio = 0.02

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Roof Framing - H3-15 - Header



Uniform 1 = 0.07 klf (0.0'-3.8')

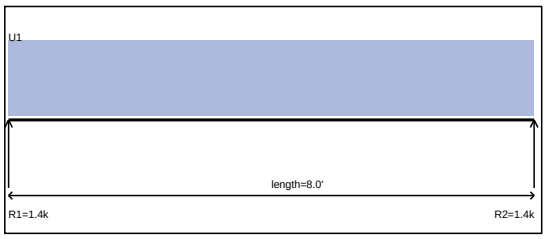
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.13k	Vall = 4.47k	Ratio = 0.03
M = 0.12k-ft	Mall = 5.17k-ft	Ratio = 0.02

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Roof Framing - H3-16 - Header



Uniform 1 = 0.34 klf (0.0'-8.0')

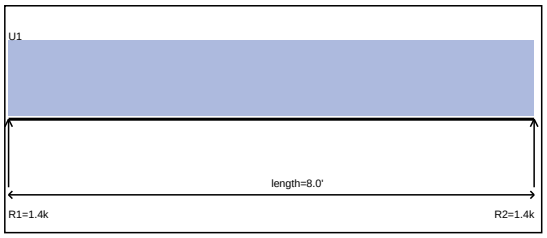
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 1.37k	Vall = 4.47k	Ratio = 0.31
M = 2.74k-ft	Mall = 5.17k-ft	Ratio = 0.53

Deflection
TL = 0.09" L/999+ > L/240 min
DL = 0.02"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Roof Framing - H3-17 - Header



Uniform 1 = 0.34 klf (0.0'-8.0')

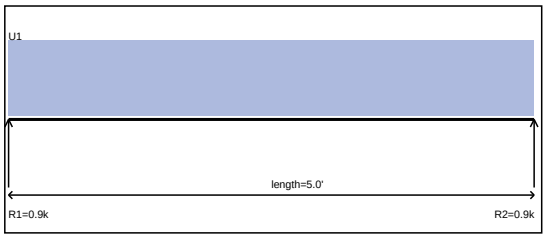
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 1.37k	Vall = 4.47k	Ratio = 0.31
M = 2.74k-ft	Mall = 5.17k-ft	Ratio = 0.53

Deflection
TL = 0.09" L/999+ > L/240 min
DL = 0.02"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Roof Framing - H3-18 - Header



Uniform 1 = 0.34 klf (0.0'-5.0')

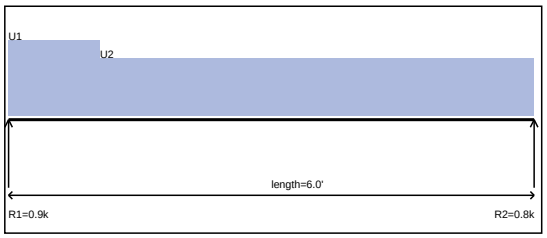
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.85k	Vall = 4.47k	Ratio = 0.19
M = 1.07k-ft	Mall = 5.17k-ft	Ratio = 0.21

Deflection
TL = 0.01" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Roof Framing - H3-19 - Header



Uniform 1 = 0.34 klf (0.0'-1.0')

Uniform 2 = 0.26 klf (1.0'-6.0')

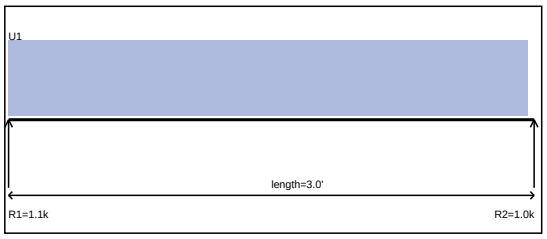
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.86k	Vall = 4.47k	Ratio = 0.19
M = 1.19k-ft	Mall = 5.17k-ft	Ratio = 0.23

Deflection
TL = 0.02" L/999+ > L/240 min
DL = 0.01"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Roof Framing - H3-20 - Header



Uniform 1 = 0.67 klf (0.0'-3.0')

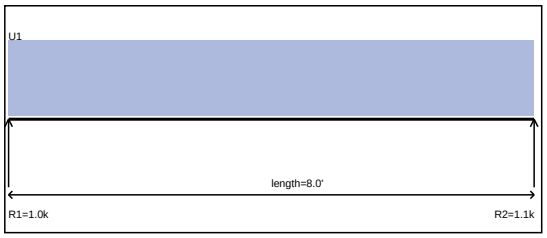
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 1.01k	Vall = 4.47k	Ratio = 0.23
M = 0.76k-ft	Mall = 5.17k-ft	Ratio = 0.15

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Roof Framing - B3-1 - Refer to External Design



Uniform 1 = 0.25 klf (0.0'-8.0')

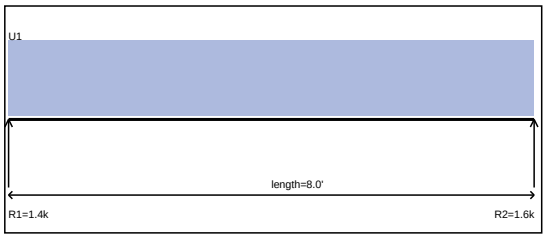
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = NA

V = 1.01k	Vall = 0 k	Ratio = 0
M = 1.86k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Roof Framing - B3-2 - Refer to External Design



Uniform 1 = 0.39 klf (0.0'-8.0')

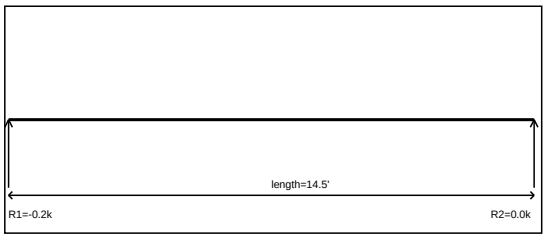
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = NA

V = 1.57k	Vall = 0 k	Ratio = 0
M = 2.17k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Roof Framing - B3-3 - Refer to External Design



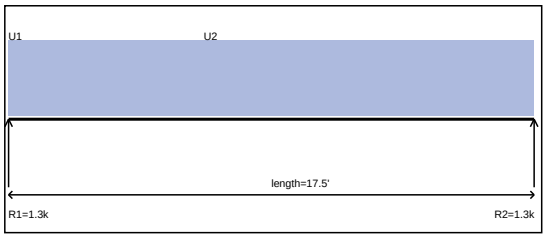
Controlling Load Combination/ Cd
V = NA Cd=1
M = NA Cd=1
△ = NA

V = 0.00k	Vall = 0 k	Ratio = 0
M = 0.00k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Roof Framing - B3-4 - Flush



Uniform 1 = 0.14 klf (0.0'-6.5')

Uniform 2 = 0.14 klf (6.5'-17.5')

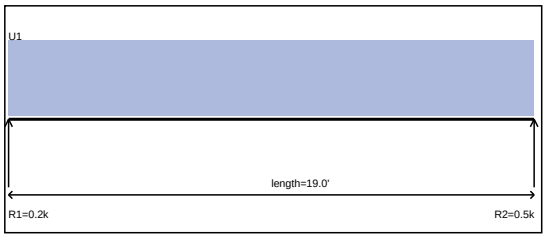
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 1.23k	Vall = 9.08k	Ratio = 0.14
M = 5.39k-ft	Mall = 20.50k-ft	Ratio = 0.26

Deflection
TL = 0.32" L/657 > L/240 min
DL = 0.09"
L = 0.00" L/999+ > L/360 min

(2)1-3/4x11-7/8 LVL

Description - Roof Framing - B3-5 - Refer to External Design



Uniform 1 = 0.05 klf (0.0'-19.0')

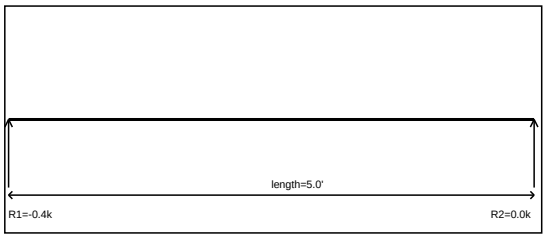
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = D Cd=0.9
△ = NA

V = 0.49k	Vall = 0 k	Ratio = 0
M = 3.51k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Roof Framing - B3-6 - Refer to External Design



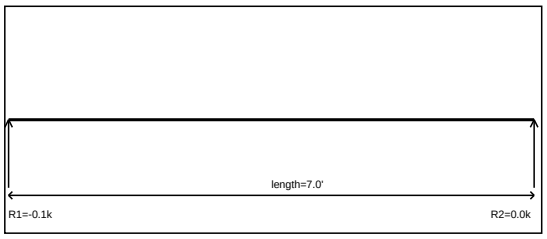
Controlling Load Combination/ Cd
V = NA Cd=1
M = NA Cd=1
△ = NA

V = 0.00k	Vall = 0 k	Ratio = 0
M = 0.00k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Roof Framing - B3-7 - Refer to External Design



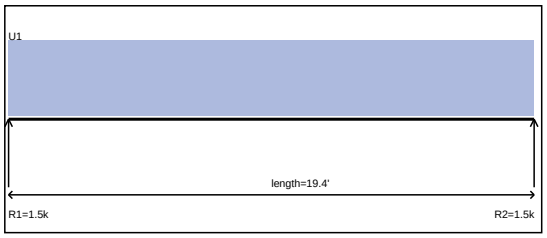
Controlling Load Combination/ Cd
V = NA Cd=1
M = NA Cd=1
△ = NA

V = 0.00k	Vall = 0 k	Ratio = 0
M = 0.00k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Roof Framing - B3-8 - Refer to External Design



Uniform 1 = 0.15 klf (0.0'-19.4')

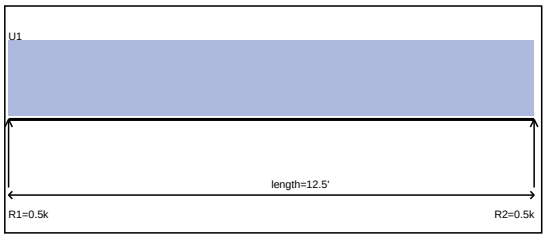
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = NA

V = 1.48k	Vall = 0 k	Ratio = 0
M = 7.22k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Roof Framing - B3-9 - Flush



Uniform 1 = 0.07 klf (0.0'-12.5')

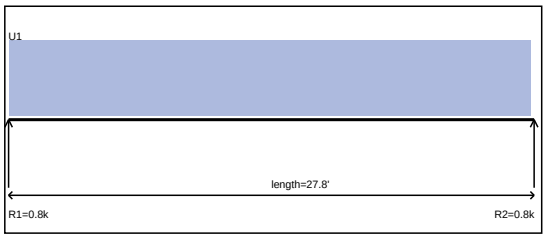
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.41k	Vall = 4.54k	Ratio = 0.09
M = 1.29k-ft	Mall = 10.25k-ft	Ratio = 0.13

Deflection
TL = 0.08" L/999+ > L/240 min
DL = 0.02"
L = 0.00" L/999+ > L/360 min

1-3/4x11-7/8 LVL

Description - Roof Framing - B3-10 - Flush



Uniform 1 = 0.05 klf (0.0'-27.7')

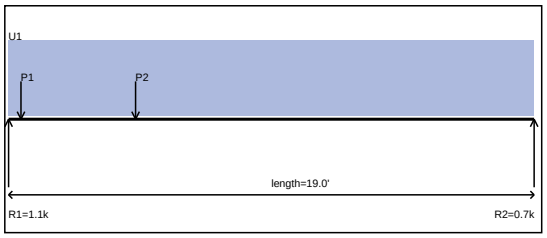
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.73k	Vall = 13.62k	Ratio = 0.05
M = 5.05k-ft	Mall = 30.74k-ft	Ratio = 0.16

Deflection
TL = 0.51" L/660 > L/240 min
DL = 0.14"
L = 0.00" L/999+ > L/360 min

(3)1-3/4x11-7/8 LVL

Description - Roof Framing - B3-19 - Flush



Uniform 1 = 0.05 klf (0.0'-19.0')

P1 = 0.17 K (0.4')

P2 = 0.65 K (4.6')

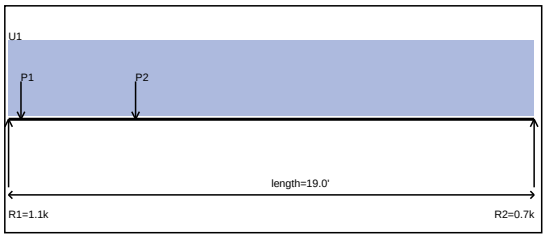
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 1.09k	Vall = 4.54k	Ratio = 0.24
M = 3.89k-ft	Mall = 10.25k-ft	Ratio = 0.38

Deflection
TL = 0.54" L/420 > L/240 min
DL = 0.15"
L = 0.00" L/999+ > L/360 min

1-3/4x11-7/8 LVL

Description - Roof Framing - B3-20 - Flush



Uniform 1 = 0.05 klf (0.0'-19.0')

P1 = 0.17 K (0.4')

P2 = 0.65 K (4.6')

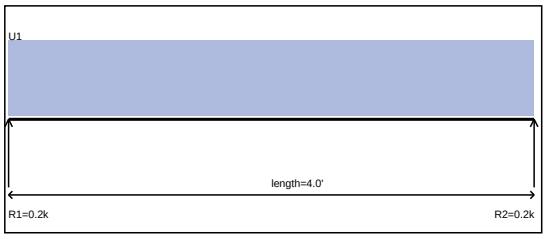
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 1.09k	Vall = 4.54k	Ratio = 0.24
M = 3.89k-ft	Mall = 10.25k-ft	Ratio = 0.38

Deflection
TL = 0.54" L/420 > L/240 min
DL = 0.15"
L = 0.00" L/999+ > L/360 min

1-3/4x11-7/8 LVL

Description - Roof Framing - B3-21 - Flush



Uniform 1 = 0.08 klf (0.0'-4.0')

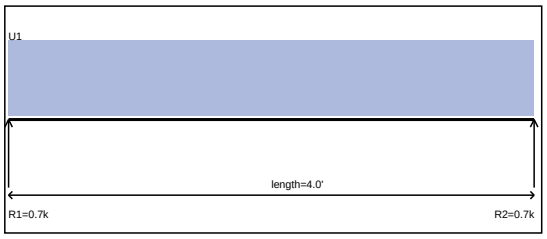
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.17k	Vall = 4.54k	Ratio = 0.04
M = 0.17k-ft	Mall = 10.25k-ft	Ratio = 0.02

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

1-3/4x11-7/8 LVL

Description - Roof Framing - B3-22 - Flush



Uniform 1 = 0.32 klf (0.0'-4.0')

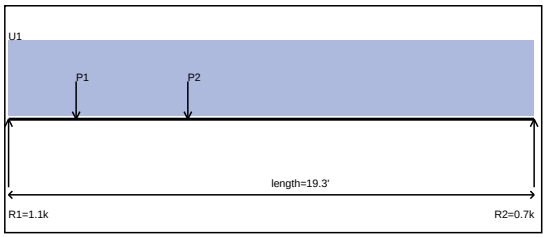
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.65k	Vall = 4.54k	Ratio = 0.14
M = 0.65k-ft	Mall = 10.25k-ft	Ratio = 0.06

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

1-3/4x11-7/8 LVL

Description - Roof Framing - B3-23 - Flush



Uniform 1 = 0.05 klf (0.0'-19.3')

P1 = 0.24 K (2.5')

P2 = 0.59 K (6.6')

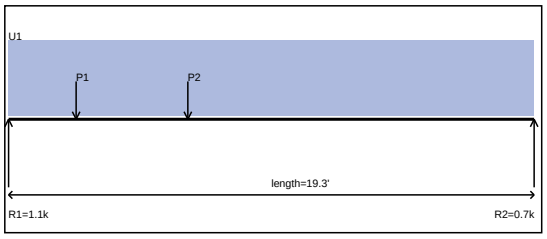
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 1.04k	Vall = 9.08k	Ratio = 0.11
M = 4.88k-ft	Mall = 20.50k-ft	Ratio = 0.24

Deflection
TL = 0.35" L/657 > L/240 min
DL = 0.10"
L = 0.00" L/999+ > L/360 min

(2)1-3/4x11-7/8 LVL

Description - Roof Framing - B3-24 - Flush



Uniform 1 = 0.05 klf (0.0'-19.3')

P1 = 0.24 K (2.5')

P2 = 0.59 K (6.6')

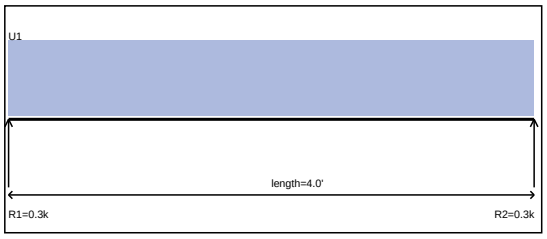
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 1.04k	Vall = 9.08k	Ratio = 0.11
M = 4.88k-ft	Mall = 20.50k-ft	Ratio = 0.24

Deflection
TL = 0.35" L/657 > L/240 min
DL = 0.10"
L = 0.00" L/999+ > L/360 min

(2)1-3/4x11-7/8 LVL

Description - Roof Framing - B3-25 - Flush



Uniform 1 = 0.12 klf (0.0'-4.0')

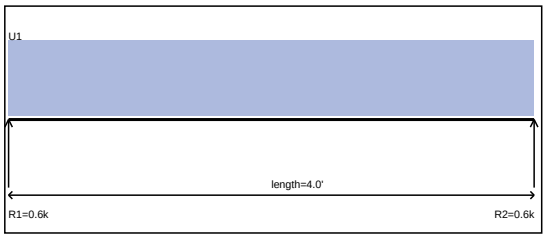
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.24k	Vall = 9.08k	Ratio = 0.03
M = 0.24k-ft	Mall = 20.50k-ft	Ratio = 0.01

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

(2)1-3/4x11-7/8 LVL

Description - Roof Framing - B3-26 - Flush



Uniform 1 = 0.29 klf (0.0'-4.0')

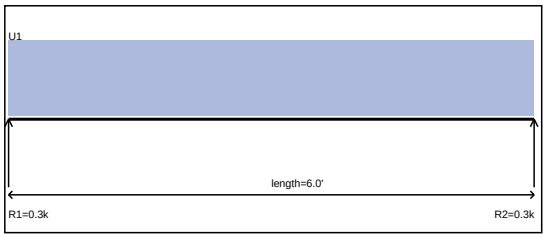
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.59k	Vall = 9.08k	Ratio = 0.06
M = 0.59k-ft	Mall = 20.50k-ft	Ratio = 0.03

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

(2)1-3/4x11-7/8 LVL

Description - Upper Floor Framing - H2-1 - Header



Uniform 1 = 0.07 klf (0.0'-6.0')

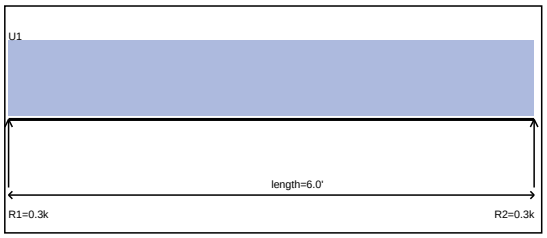
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.21k	Vall = 4.54k	Ratio = 0.05
M = 0.32k-ft	Mall = 10.25k-ft	Ratio = 0.03

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

1-3/4x11-7/8 LVL

Description - Upper Floor Framing - H2-2 - Header



Uniform 1 = 0.07 klf (0.0'-6.0')

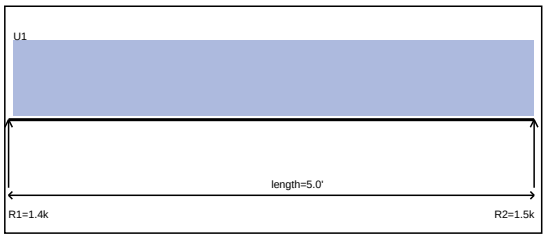
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.21k	Vall = 4.54k	Ratio = 0.05
M = 0.31k-ft	Mall = 10.25k-ft	Ratio = 0.03

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

1-3/4x11-7/8 LVL

Description - Upper Floor Framing - H2-3 - Header



Uniform 1 = 0.57 klf (0.0'-5.0')

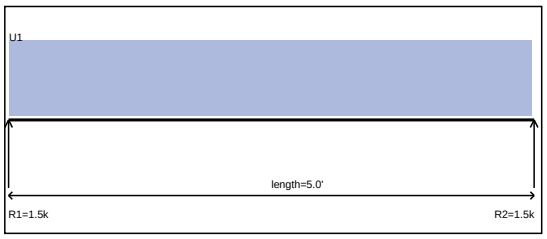
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 1.30k	Vall = 9.28k	Ratio = 0.14
M = 1.62k-ft	Mall = 26.25k-ft	Ratio = 0.06

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

3-1/2x15 GLB

Description - Upper Floor Framing - H2-4 - Header



Uniform 1 = 0.57 klf (0.0'-5.0')

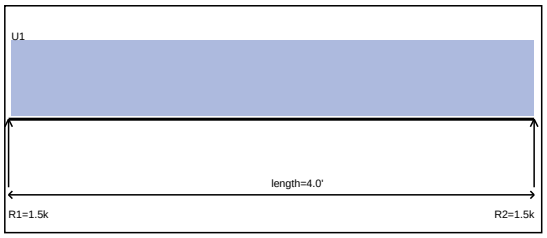
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 1.29k	Vall = 9.28k	Ratio = 0.14
M = 1.62k-ft	Mall = 26.25k-ft	Ratio = 0.06

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

3-1/2x15 GLB

Description - Upper Floor Framing - H2-5 - Header



Uniform 1 = 0.71 klf (0.0'-4.0')

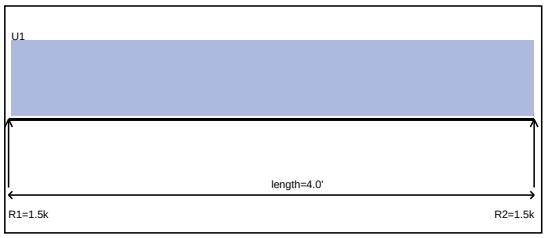
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + 0.75 * (L + S))

V = 1.20k	Vall = 9.28k	Ratio = 0.13
M = 1.20k-ft	Mall = 26.25k-ft	Ratio = 0.05

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

3-1/2x15 GLB

Description - Upper Floor Framing - H2-6 - Header



Uniform 1 = 0.71 klf (0.0'-4.0')

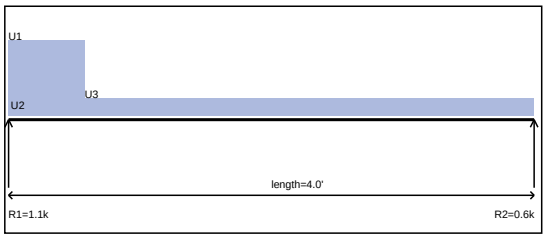
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + 0.75 * (L + S))

V = 1.20k	Vall = 9.28k	Ratio = 0.13
M = 1.20k-ft	Mall = 26.25k-ft	Ratio = 0.05

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

3-1/2x15 GLB

Description - Upper Floor Framing - H2-7 - Header



Uniform 1 = 1.12 klf (0.0'-0.6')

Uniform 2 = 0.10 klf (0.0'-0.6')

Uniform 3 = 0.26 klf (0.6'-4.0')

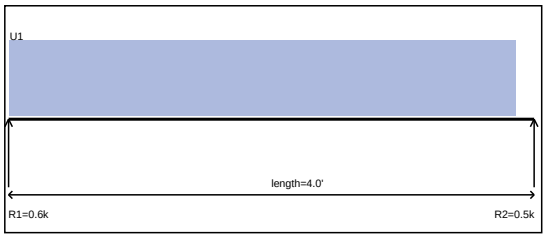
Controlling Load Combination/ Cd
V = (D + 0.75 * (L + S)) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.89k	Vall = 10.67k	Ratio = 0.08
M = 0.57k-ft	Mall = 30.19k-ft	Ratio = 0.02

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

3-1/2x15 GLB

Description - Upper Floor Framing - H2-8 - Header



Uniform 1 = 0.26 klf (0.0'-3.9')

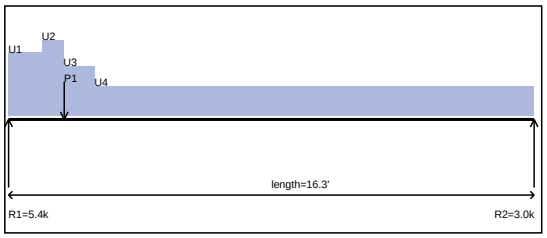
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.51k	Vall = 10.67k	Ratio = 0.05
M = 0.51k-ft	Mall = 30.19k-ft	Ratio = 0.02

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

3-1/2x15 GLB

Description - Upper Floor Framing - H2-9 - Header



Uniform 1 = 0.70 klf (0.0'-1.0')

P1 = 2.00 K (1.7')

Uniform 2 = 0.84 klf (1.0'-1.7')

Uniform 3 = 0.55 klf (1.7'-2.7')

Uniform 4 = 0.33 klf (2.7'-16.3')

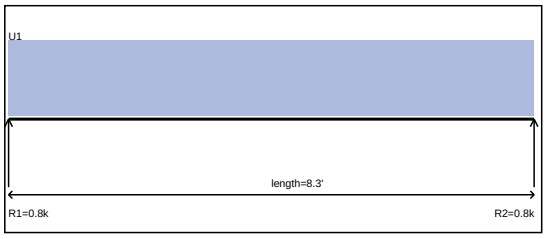
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = NA

V = 4.82k	Vall = 0 k	Ratio = 0
M = 12.93k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Upper Floor Framing - H2-10 - Header



Uniform 1 = 0.19 klf (0.0'-8.3')

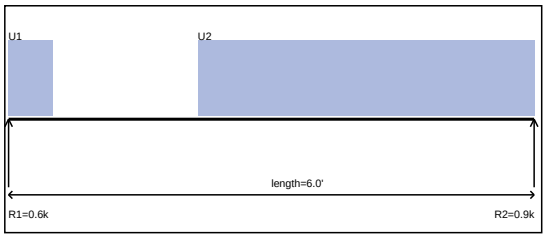
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.80k	Vall = 8.24k	Ratio = 0.10
M = 1.65k-ft	Mall = 10.17k-ft	Ratio = 0.16

Deflection
TL = 0.02" L/999+ > L/240 min
DL = 0.01"
L = 0.00" L/999+ > L/360 min

6x12 DF #2

Description - Upper Floor Framing - H2-11 - Header



Uniform 1 = 0.32 klf (0.0'-0.5')

Uniform 2 = 0.32 klf (2.2'-6.0')

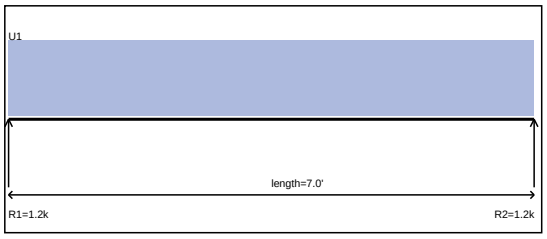
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.85k	Vall = 4.54k	Ratio = 0.19
M = 1.12k-ft	Mall = 10.25k-ft	Ratio = 0.11

Deflection
TL = 0.02" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

1-3/4x11-7/8 LVL

Description - Upper Floor Framing - H2-12 - Header



Uniform 1 = 0.32 klf (0.0'-7.0')

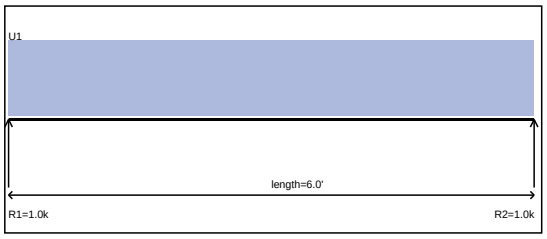
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 1.13k	Vall = 4.54k	Ratio = 0.25
M = 1.98k-ft	Mall = 10.25k-ft	Ratio = 0.19

Deflection
TL = 0.04" L/999+ > L/240 min
DL = 0.01"
L = 0.00" L/999+ > L/360 min

1-3/4x11-7/8 LVL

Description - Upper Floor Framing - H2-13 - Header



Uniform 1 = 0.32 klf (0.0'-6.0')

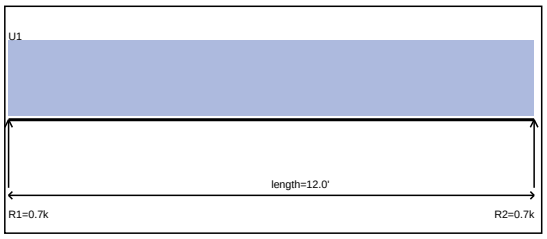
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.97k	Vall = 4.54k	Ratio = 0.21
M = 1.45k-ft	Mall = 10.25k-ft	Ratio = 0.14

Deflection
TL = 0.02" L/999+ > L/240 min
DL = 0.01"
L = 0.00" L/999+ > L/360 min

1-3/4x11-7/8 LVL

Description - Upper Floor Framing - H2-14 - Header



Uniform 1 = 0.11 klf (0.0'-12.0')

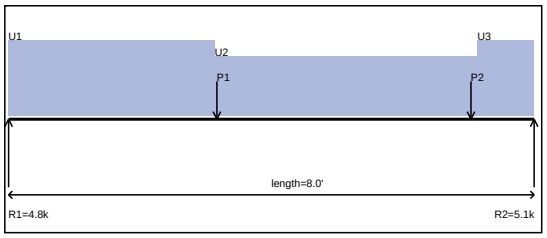
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 0.66k	Vall = 9.28k	Ratio = 0.07
M = 1.98k-ft	Mall = 26.25k-ft	Ratio = 0.08

Deflection
TL = 0.03" L/999+ > L/240 min
DL = 0.01"
L = 0.02" L/999+ > L/360 min

3-1/2x15 GLB

Description - Upper Floor Framing - H2-15 - Header



Uniform 1 = 1.04 klf (0.0'-3.1')

Uniform 2 = 0.82 klf (3.1'-7.1')

Uniform 3 = 1.04 klf (7.1'-8.0')

P1 = 1.23 K (3.2')

P2 = 1.12 K (7.0')

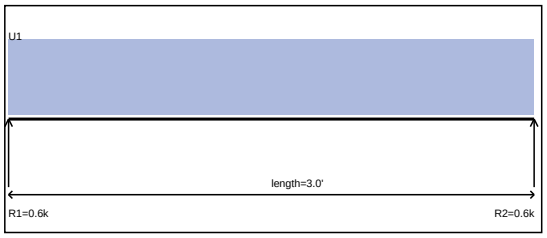
Controlling Load Combination/ Cd
V = (D + 0.75 * (L + S)) Cd=1.15
M = (D + 0.75 * (L + S)) Cd=1.15
△ = (D + 0.75 * (L + S))

V = 4.24k	Vall = 10.67k	Ratio = 0.40
M = 8.18k-ft	Mall = 30.19k-ft	Ratio = 0.27

Deflection
TL = 0.05" L/999+ > L/240 min
DL = 0.02"
L = 0.02" L/999+ > L/360 min

3-1/2x15 GLB

Description - Upper Floor Framing - H2-16 - Header



Uniform 1 = 0.34 klf (0.0'-3.0')

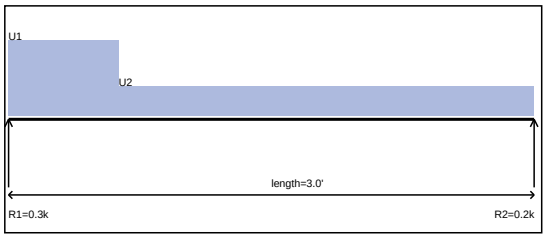
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 0.51k	Vall = 9.28k	Ratio = 0.05
M = 0.38k-ft	Mall = 26.25k-ft	Ratio = 0.01

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

3-1/2x15 GLB

Description - Upper Floor Framing - H2-17 - Header



Uniform 1 = 0.31 klf (0.0'-0.6')

Uniform 2 = 0.12 klf (0.6'-3.0')

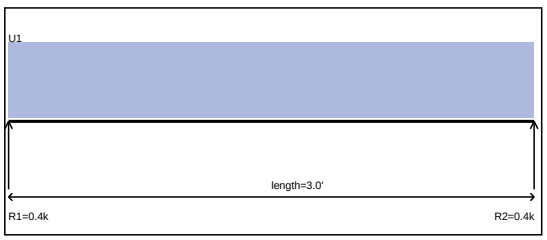
Controlling Load Combination/ Cd
V = (D + 0.75 * (L + S)) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.24k	Vall = 10.67k	Ratio = 0.02
M = 0.14k-ft	Mall = 30.19k-ft	Ratio = 0.00

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

3-1/2x15 GLB

Description - Upper Floor Framing - H2-18 - Header



Uniform 1 = 0.25 klf (0.0'-3.0')

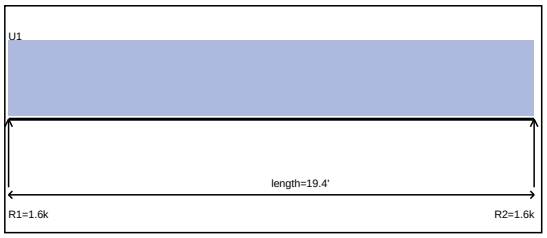
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.37k	Vall = 10.67k	Ratio = 0.03
M = 0.28k-ft	Mall = 30.19k-ft	Ratio = 0.01

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

3-1/2x15 GLB

Description - Upper Floor Framing - B2-1 - Flush



Uniform 1 = 0.16 klf (0.0'-19.4')

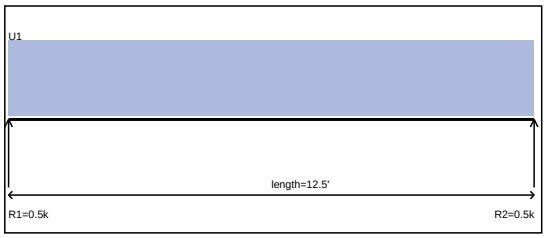
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = NA

V = 1.52k	Vall = 0 k	Ratio = 0
M = 7.40k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Upper Floor Framing - B2-2 - Flush



Uniform 1 = 0.07 klf (0.0'-12.5')

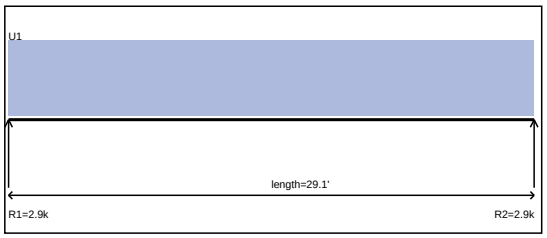
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.44k	Vall = 4.54k	Ratio = 0.10
M = 1.38k-ft	Mall = 10.25k-ft	Ratio = 0.13

Deflection
TL = 0.08" L/999+ > L/240 min
DL = 0.02"
L = 0.00" L/999+ > L/360 min

1-3/4x11-7/8 LVL

Description - Upper Floor Framing - B2-3 - Flush



Uniform 1 = 0.19 klf (0.0'-29.1')

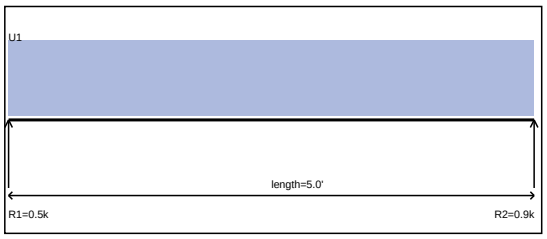
Controlling Load Combination/ Cd
V = (D + S) Cd= NA
M = (D + S) Cd= NA
△ = (D + S)

V = 2.82k	Vall = 56.40k	Ratio = 0.05
M = 20.50k-ft	Mall = 96.80k-ft	Ratio = 0.21

Deflection
TL = 0.63" L/555 > L/240 min
DL = 0.18"
L = 0.00" L/999+ > L/360 min

W10x33 Steel

Description - Upper Floor Framing - B2-4 - Flush



Uniform 1 = 0.32 klf (0.0'-5.0')

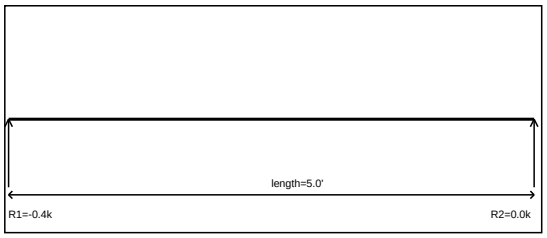
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = D Cd=0.9
△ = NA

V = 0.81k	Vall = 0 k	Ratio = 0
M = 0.28k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Upper Floor Framing - B2-5 - Refer to External Design



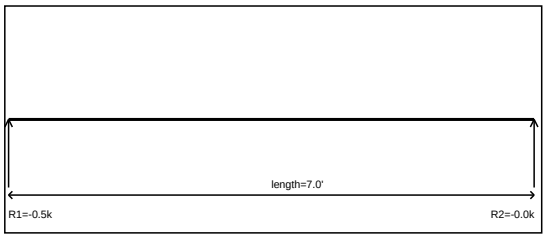
Controlling Load Combination/ Cd
V = NA Cd=1
M = NA Cd=1
△ = NA

V = 0.00k	Vall = 0 k	Ratio = 0
M = 0.00k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Upper Floor Framing - B2-6 - Flush



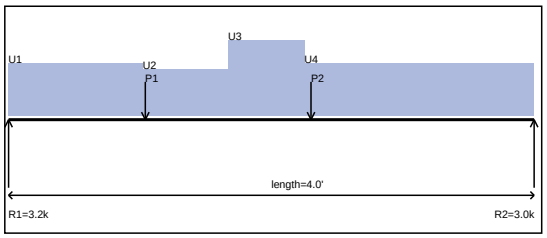
Controlling Load Combination/ Cd
V = NA Cd=1
M = NA Cd=1
△ = NA

V = 0.00k	Vall = 0 k	Ratio = 0
M = 0.00k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Upper Floor Framing - B2-7 - Flush



Uniform 1 = 1.09 klf (0.0'-1.0')
Uniform 2 = 0.96 klf (1.0'-1.7')
Uniform 3 = 1.56 klf (1.7'-2.3')
Uniform 4 = 1.09 klf (2.3'-4.0')

P1 = 0.76 K (1.0')
P2 = 0.76 K (2.3')

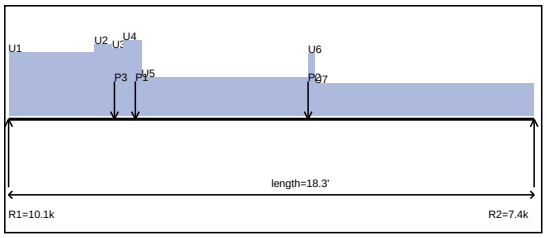
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + 0.75 * (L + S))

V = 2.41k	Vall = 11.13k	Ratio = 0.22
M = 2.48k-ft	Mall = 37.80k-ft	Ratio = 0.07

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

3-1/2x18 GLB

Description - Upper Floor Framing - B2-8 - Flush



Uniform 1 = 1.05 klf (0.0'-3.0')

Uniform 2 = 1.18 klf (3.0'-3.6')

Uniform 3 = 1.11 klf (3.6'-4.0')

Uniform 4 = 1.25 klf (4.0'-4.6')

Uniform 5 = 0.64 klf (4.6'-10.4')

Uniform 6 = 1.03 klf (10.4'-10.6')

Uniform 7 = 0.54 klf (10.6'-18.3')

P1 = 1.18 K (4.4')

P2 = 2.49 K (10.4')

P3 = 0.77 K (3.7')

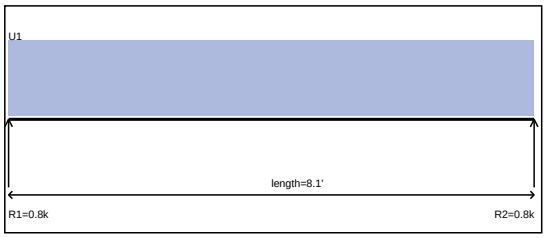
Controlling Load Combination/ Cd
V = (D + 0.75 * (L + S)) Cd=1.15
M = (D + 0.75 * (L + S)) Cd=1.15
△ = NA

V = 8.44k	Vall = 0 k	Ratio = 0
M = 34.66k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Upper Floor Framing - B2-9 - Flush



Uniform 1 = 0.19 klf (0.0'-8.1')

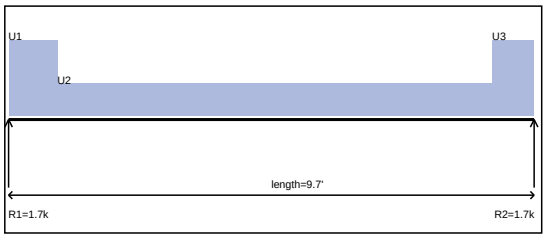
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + 0.75 * (L + S))

V = 0.67k	Vall = 11.13k	Ratio = 0.06
M = 1.34k-ft	Mall = 37.80k-ft	Ratio = 0.04

Deflection
TL = 0.01" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

3-1/2x18 GLB

Description - Upper Floor Framing - B2-10 - Flush



Uniform 1 = 0.66 klf (0.0'-0.9')

Uniform 2 = 0.28 klf (0.9'-8.9')

Uniform 3 = 0.66 klf (8.9'-9.7')

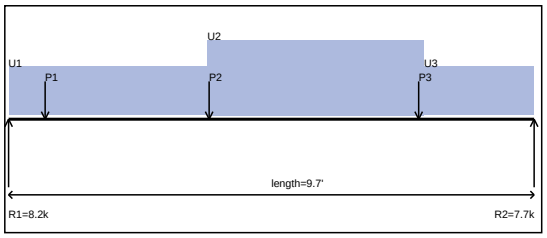
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 1.69k	Vall = 11.13k	Ratio = 0.15
M = 3.42k-ft	Mall = 37.80k-ft	Ratio = 0.09

Deflection
TL = 0.02" L/999+ > L/240 min
DL = 0.00"
L = 0.01" L/999+ > L/360 min

3-1/2x18 GLB

Description - Upper Floor Framing - B2-11 - Flush



Uniform 1 = 1.06 klf (0.0'-3.7')
Uniform 2 = 1.64 klf (3.7'-7.7')
Uniform 3 = 1.06 klf (7.7'-9.7')

P1 = 1.02 K (0.7')
P2 = 1.49 K (3.7')
P3 = 0.61 K (7.6')

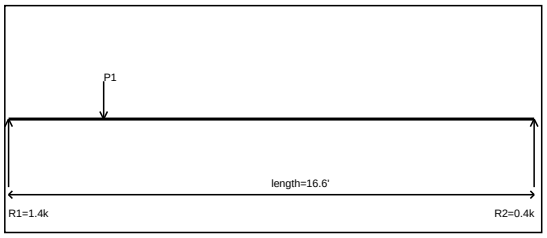
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + 0.75 * (L + S))

V = 6.10k	Vall = 11.13k	Ratio = 0.55
M = 15.23k-ft	Mall = 37.80k-ft	Ratio = 0.40

Deflection
TL = 0.09" L/999+ > L/240 min
DL = 0.03"
L = 0.05" L/999+ > L/360 min

3-1/2x18 GLB

Description - Upper Floor Framing - B2-12 - Flush



P1 = 1.69 K (3.0')

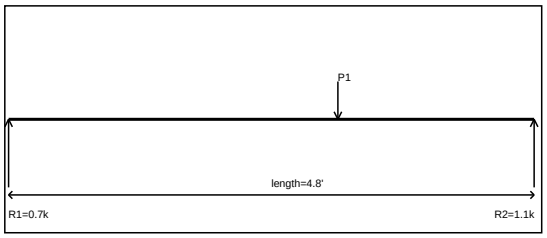
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 1.39k	Vall = 11.13k	Ratio = 0.12
M = 4.16k-ft	Mall = 37.80k-ft	Ratio = 0.11

Deflection
TL = 0.07" L/999+ > L/240 min
DL = 0.02"
L = 0.05" L/999+ > L/360 min

3-1/2x18 GLB

Description - Upper Floor Framing - B2-13 - Flush



P1 = 1.65 K (3.0')

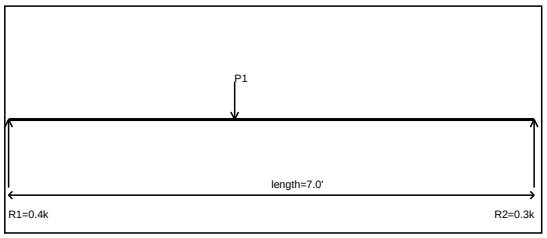
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = NA

V = 1.04k	Vall = 0 k	Ratio = 0
M = 1.85k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Upper Floor Framing - B2-14 - Flush



P1 = 0.56 K (3.0')

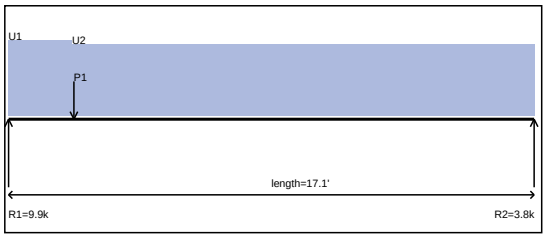
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.32k	Vall = 12.80k	Ratio = 0.02
M = 0.96k-ft	Mall = 43.47k-ft	Ratio = 0.02

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

3-1/2x18 GLB

Description - Upper Floor Framing - B2-15 - Flush



Uniform 1 = 0.34 klf (0.0'-2.1')

P1 = 8.11 K (2.1')

Uniform 2 = 0.32 klf (2.1'-17.1')

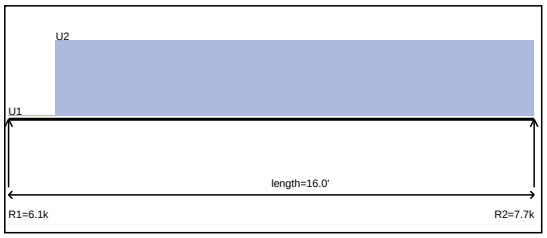
Controlling Load Combination/ Cd
V = (D + 0.75 * (L + S)) Cd=1.15
M = (D + 0.75 * (L + S)) Cd=1.15
△ = NA

V = 8.13k	Vall = 0 k	Ratio = 0
M = 18.07k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Upper Floor Framing - B2-17 - Flush



Uniform 1 = 0.00 klf (0.0'-1.4')

Uniform 2 = 0.98 klf (1.4'-16.0')

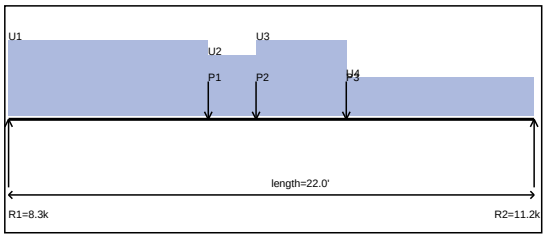
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = NA

V = 5.75k	Vall = 0 k	Ratio = 0
M = 19.40k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Upper Floor Framing - B2-18 - Flush



Uniform 1 = 0.35 klf (0.0'-8.4')

P1 = 0.07 K (8.4')

Uniform 2 = 0.28 klf (8.4'-10.4')

P2 = 0.07 K (10.4')

Uniform 3 = 0.35 klf (10.4'-14.1')

P3 = 13.00 K (14.1')

Uniform 4 = 0.18 klf (14.1'-22.0')

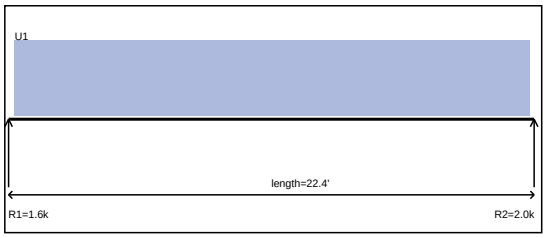
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + 0.75 * (L + S)) Cd=1.15
△ = NA

V = 9.34k	Vall = 0 k	Ratio = 0
M = 67.95k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Upper Floor Framing - B2-19 - Flush



Uniform 1 = 0.18 klf (0.3'-22.3')

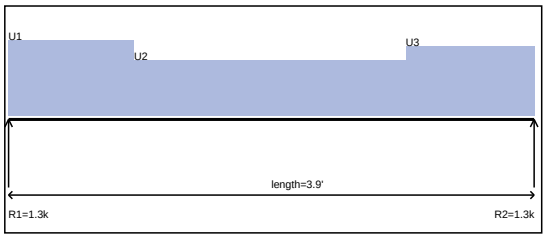
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = NA

V = 1.99k	Vall = 0 k	Ratio = 0
M = 7.34k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Upper Floor Framing - B2-20 - Flush



Uniform 1 = 0.73 klf (0.0'-0.9')

Uniform 2 = 0.54 klf (0.9'-3.0')

Uniform 3 = 0.67 klf (3.0'-3.9')

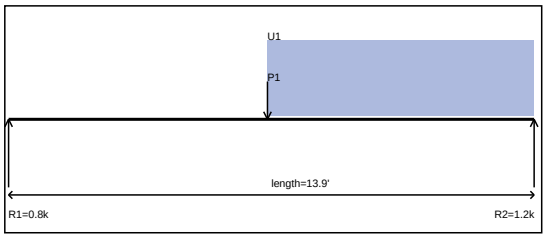
Controlling Load Combination/ Cd
V = (D + 0.75 * (L + S)) Cd=1.15
M = (D + 0.75 * (L + S)) Cd=1.15
△ = (D + 0.75 * (L + S))

V = 1.06k	Vall = 12.80k	Ratio = 0.08
M = 0.96k-ft	Mall = 43.47k-ft	Ratio = 0.02

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

3-1/2x18 GLB

Description - Upper Floor Framing - B2-23 - Flush



Uniform 1 = 0.10 klf (6.8'-13.9') P1 = 1.20 K (6.8')

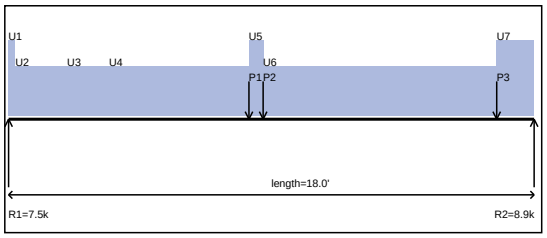
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + 0.75 * (L + S)) Cd=1.15
△ = NA

V = 0.91k	Vall = 0 k	Ratio = 0
M = 4.76k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Upper Floor Framing - B2-24 - Flush



Uniform 1 = 0.98 klf (0.0'-0.2')
Uniform 2 = 0.64 klf (0.2'-2.0')
Uniform 3 = 0.64 klf (2.0'-3.4')
Uniform 4 = 0.64 klf (3.4'-8.2')
Uniform 5 = 0.98 klf (8.2'-8.7')
Uniform 6 = 0.64 klf (8.7'-16.7')
Uniform 7 = 0.98 klf (16.7'-18.0')

P1 = 1.37 K (8.2')
P2 = 1.37 K (8.7')
P3 = 1.37 K (16.7')

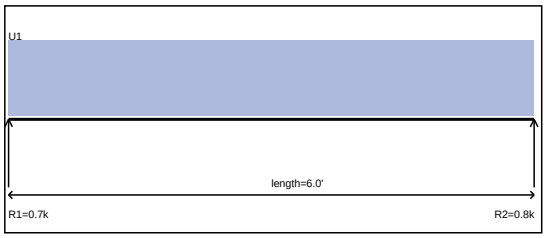
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = NA

V = 6.63k	Vall = 0 k	Ratio = 0
M = 29.77k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Upper Floor Framing - B2-25 - Flush



Uniform 1 = 0.25 klf (0.0'-6.0')

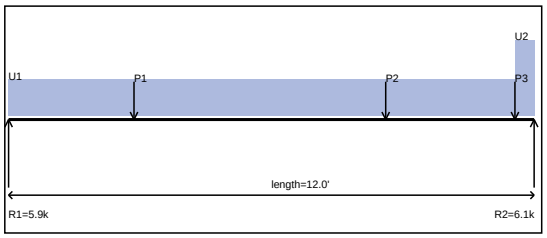
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = NA

V = 0.74k	Vall = 0 k	Ratio = 0
M = 0.94k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Main Floor Framing - H1-1 - Header



Uniform 1 = 0.10 klf (0.0'-11.6')
Uniform 2 = 0.21 klf (11.6'-12.0')

P1 = 4.97 K (2.9')
P2 = 4.95 K (8.6')
P3 = 0.66 K (11.6')

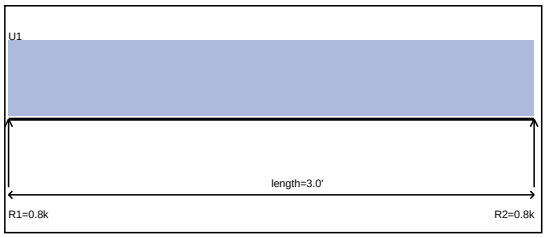
Controlling Load Combination/ Cd
V = (D + L) Cd= NA
M = (D + L) Cd= NA
△ = (D + L)

V = 6.02k	Vall = 41.40k	Ratio = 0.15
M = 17.82k-ft	Mall = 50.90k-ft	Ratio = 0.35

Deflection
TL = 0.21" L/681 > L/240 min
DL = 0.08"
L = 0.14" L/999+ > L/360 min

W8x21 Steel

Description - Main Floor Framing - H1-2 - Header



Uniform 1 = 0.52 klf (0.0'-3.0')

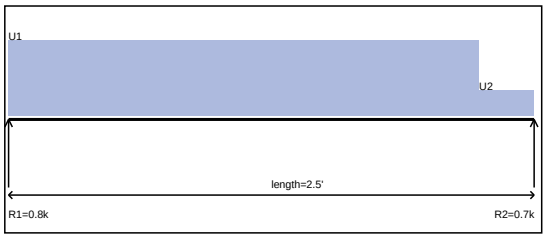
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 0.78k	Vall = 3.88k	Ratio = 0.20
M = 0.59k-ft	Mall = 4.49k-ft	Ratio = 0.13

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Main Floor Framing - H1-3 - Header



Uniform 1 = 0.60 klf (0.0'-2.2')

Uniform 2 = 0.20 klf (2.2'-2.5')

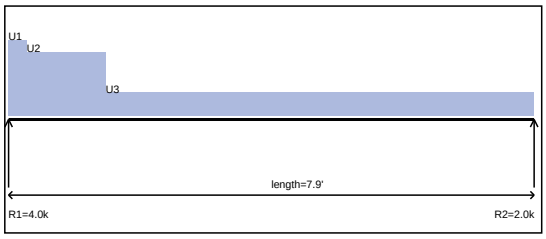
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 0.66k	Vall = 3.88k	Ratio = 0.17
M = 0.41k-ft	Mall = 4.49k-ft	Ratio = 0.09

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Main Floor Framing - B1-1 - Refer to External Design



Uniform 1 = 2.03 klf (0.0'-0.3')

Uniform 2 = 1.70 klf (0.3'-1.5')

Uniform 3 = 0.62 klf (1.5'-7.9')

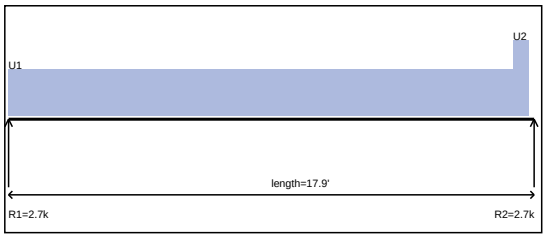
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = NA

V = 3.67k	Vall = 0 k	Ratio = 0
M = 5.35k-ft	Mall = 0 k-ft	Ratio = 0

Deflection
TL = NA L/ NA > L/240 min
DL = NA
L = NA L/ NA > L/360 min

Refer to External Design

Description - Main Floor Framing - B1-3 - Flush



Uniform 1 = 0.30 klf (0.0'-17.2')

Uniform 2 = 0.49 klf (17.2'-17.7')

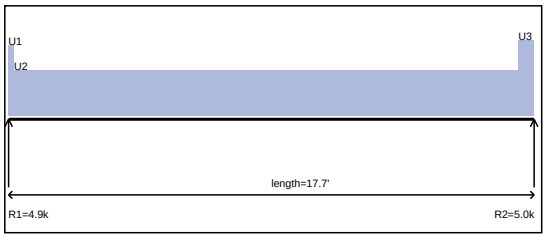
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 2.69k	Vall = 11.85k	Ratio = 0.23
M = 11.89k-ft	Mall = 26.73k-ft	Ratio = 0.44

Deflection
TL = 0.49" L/436 > L/240 min
DL = 0.15"
L = 0.35" L/617 > L/360 min

(3)1-3/4x11-7/8 LVL

Description - Main Floor Framing - B1-4 - Flush Bottom



Uniform 1 = 0.83 klf (0.0'-0.2')

Uniform 2 = 0.54 klf (0.2'-17.2')

Uniform 3 = 0.89 klf (17.2'-17.7')

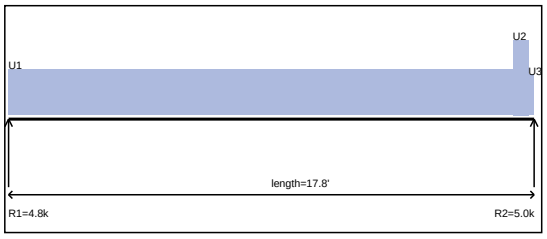
Controlling Load Combination/ Cd
V = (D + L) Cd= NA
M = (D + L) Cd= NA
△ = (D + L)

V = 4.97k	Vall = 51.00k	Ratio = 0.10
M = 21.26k-ft	Mall = 53.90k-ft	Ratio = 0.39

Deflection
TL = 0.43" L/494 > L/240 min
DL = 0.13"
L = 0.30" L/699 > L/360 min

W10x19 Steel

Description - Main Floor Framing - B1-5 - Flush Bottom



Uniform 1 = 0.54 klf (0.0'-17.0')

Uniform 2 = 0.89 klf (17.0'-17.6')

Uniform 3 = 0.48 klf (17.6'-17.8')

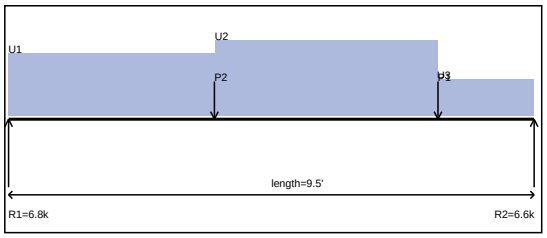
Controlling Load Combination/ Cd
V = (D + L) Cd= NA
M = (D + L) Cd= NA
△ = (D + L)

V = 4.95k	Vall = 51.00k	Ratio = 0.10
M = 21.26k-ft	Mall = 53.90k-ft	Ratio = 0.39

Deflection
TL = 0.43" L/494 > L/240 min
DL = 0.13"
L = 0.30" L/699 > L/360 min

W10x19 Steel

Description - Main Floor Framing - B1-6 - Flush



Uniform 1 = 1.25 klf (0.0'-3.7')
Uniform 2 = 1.52 klf (3.7'-7.7')
Uniform 3 = 0.74 klf (7.7'-9.5')

P1 = 0.66 K (7.7')
P2 = 0.66 K (3.7')

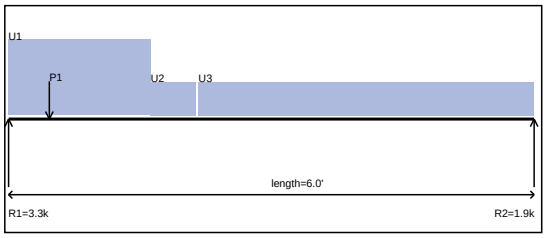
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 6.18k	Vall = 7.90k	Ratio = 0.78
M = 14.96k-ft	Mall = 17.82k-ft	Ratio = 0.84

Deflection
TL = 0.26" L/438 > L/240 min
DL = 0.10"
L = 0.16" L/696 > L/360 min

(2)1-3/4x11-7/8 LVL

Description - Main Floor Framing - B1-7 - Dropped



Uniform 1 = 1.27 klf (0.0'-1.6')
Uniform 2 = 0.56 klf (1.6'-2.1')
Uniform 3 = 0.56 klf (2.2'-6.0')

P1 = 0.62 K (0.5')

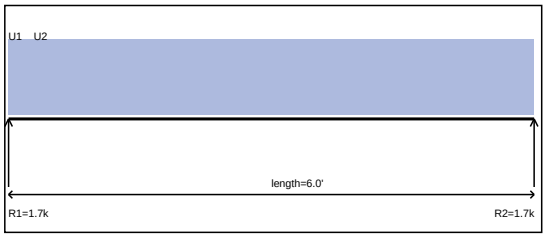
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 2.83k	Vall = 3.88k	Ratio = 0.73
M = 3.04k-ft	Mall = 4.49k-ft	Ratio = 0.68

Deflection
TL = 0.05" L/999+ > L/240 min
DL = 0.02"
L = 0.04" L/999+ > L/360 min

4x10 DF #2

Description - Main Floor Framing - B1-8 - Dropped



Uniform 1 = 0.56 klf (0.0'-0.3')
Uniform 2 = 0.56 klf (0.3'-6.0')

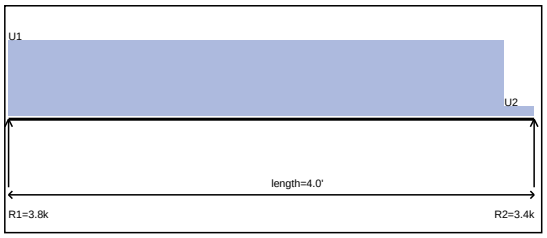
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 1.69k	Vall = 3.88k	Ratio = 0.43
M = 2.53k-ft	Mall = 4.49k-ft	Ratio = 0.56

Deflection
TL = 0.04" L/999+ > L/240 min
DL = 0.01"
L = 0.03" L/999+ > L/360 min

4x10 DF #2

Description - Main Floor Framing - B1-9 - Dropped



Uniform 1 = 1.86 klf (0.0'-3.8')

Uniform 2 = 0.24 klf (3.8'-4.0')

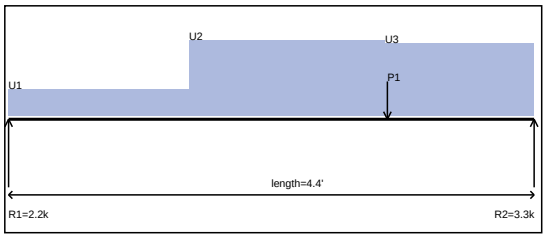
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 3.20k	Vall = 3.88k	Ratio = 0.82
M = 3.19k-ft	Mall = 4.49k-ft	Ratio = 0.71

Deflection
TL = 0.02" L/999+ > L/240 min
DL = 0.01"
L = 0.02" L/999+ > L/360 min

4x10 DF #2

Description - Main Floor Framing - B1-10 - Dropped



Uniform 1 = 0.53 klf (0.0'-1.5')

P1 = 0.38 K (3.2')

Uniform 2 = 1.50 klf (1.5'-3.2')

Uniform 3 = 1.43 klf (3.2'-4.4')

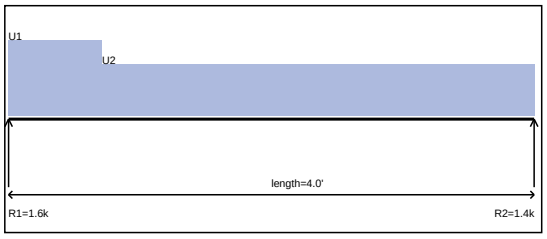
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 3.06k	Vall = 3.88k	Ratio = 0.79
M = 3.15k-ft	Mall = 4.49k-ft	Ratio = 0.70

Deflection
TL = 0.03" L/999+ > L/240 min
DL = 0.01"
L = 0.02" L/999+ > L/360 min

4x10 DF #2

Description - Main Floor Framing - B1-12 - Flush



Uniform 1 = 0.99 klf (0.0'-0.7')

Uniform 2 = 0.67 klf (0.7'-4.0')

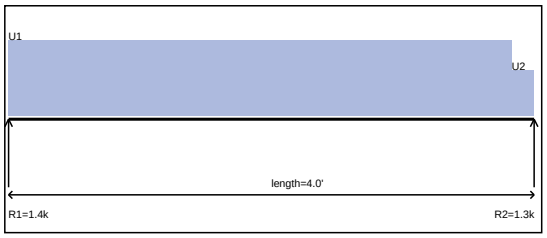
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 1.55k	Vall = 3.95k	Ratio = 0.39
M = 1.39k-ft	Mall = 8.91k-ft	Ratio = 0.16

Deflection
TL = 0.01" L/999+ > L/240 min
DL = 0.00"
L = 0.01" L/999+ > L/360 min

1-3/4x11-7/8 LVL

Description - Main Floor Framing - B1-13 - Dropped



Uniform 1 = 0.66 klf (0.0'-3.8')

Uniform 2 = 0.40 klf (3.8'-4.0')

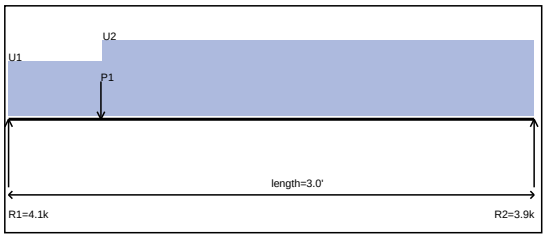
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 1.33k	Vall = 3.88k	Ratio = 0.34
M = 1.32k-ft	Mall = 4.49k-ft	Ratio = 0.29

Deflection
TL = 0.01" L/999+ > L/240 min
DL = 0.00"
L = 0.01" L/999+ > L/360 min

4x10 DF #2

Description - Main Floor Framing - B1-14 - Dropped



Uniform 1 = 1.82 klf (0.0'-0.5') P1 = 0.76 K (0.6')

Uniform 2 = 2.51 klf (0.5'-3.0')

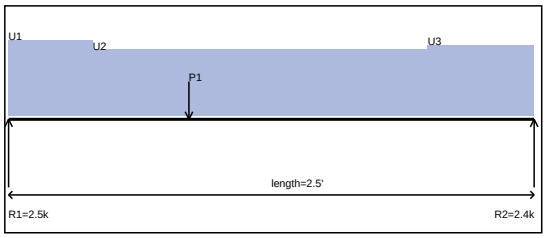
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + 0.75 * (L + S))

V = 3.13k	Vall = 3.88k	Ratio = 0.81
M = 2.35k-ft	Mall = 4.49k-ft	Ratio = 0.52

Deflection
TL = 0.01" L/999+ > L/240 min
DL = 0.00"
L = 0.01" L/999+ > L/360 min

4x10 DF #2

Description - Main Floor Framing - B1-15 - Dropped



Uniform 1 = 1.89 klf (0.0'-0.4') P1 = 0.45 K (0.9')

Uniform 2 = 1.65 klf (0.4'-2.0')

Uniform 3 = 1.76 klf (2.0'-2.5')

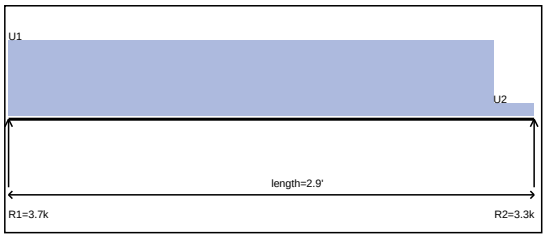
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 2.28k	Vall = 3.88k	Ratio = 0.59
M = 1.41k-ft	Mall = 4.49k-ft	Ratio = 0.31

Deflection
TL = 0.00" L/999+ > L/240 min
DL = 0.00"
L = 0.00" L/999+ > L/360 min

4x10 DF #2

Description - Main Floor Framing - B1-16 - Dropped



Uniform 1 = 2.51 klf (0.0'-2.7')

Uniform 2 = 0.40 klf (2.7'-2.9')

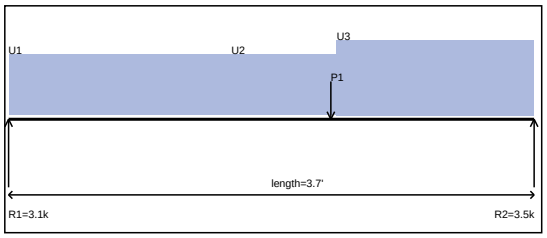
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + 0.75 * (L + S))

V = 2.99k	Vall = 3.88k	Ratio = 0.77
M = 2.18k-ft	Mall = 4.49k-ft	Ratio = 0.49

Deflection
TL = 0.01" L/999+ > L/240 min
DL = 0.00"
L = 0.01" L/999+ > L/360 min

4x10 DF #2

Description - Main Floor Framing - B1-17 - Dropped



Uniform 1 = 1.50 klf (0.0'-1.6')

P1 = 0.42 K (2.3')

Uniform 2 = 1.50 klf (1.6'-2.3')

Uniform 3 = 1.86 klf (2.3'-3.7')

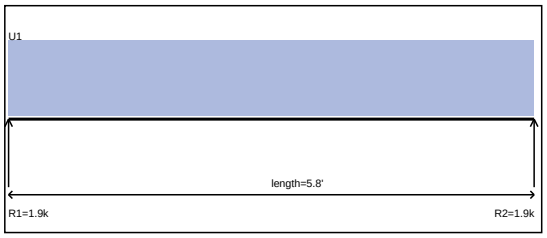
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 3.01k	Vall = 3.88k	Ratio = 0.77
M = 2.78k-ft	Mall = 4.49k-ft	Ratio = 0.62

Deflection
TL = 0.02" L/999+ > L/240 min
DL = 0.01"
L = 0.01" L/999+ > L/360 min

4x10 DF #2

Description - Main Floor Framing - B1-18 - Dropped



Uniform 1 = 0.66 klf (0.0'-5.8')

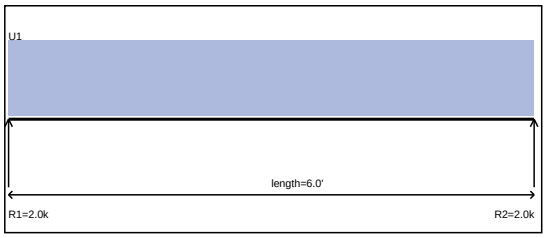
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 1.89k	Vall = 3.88k	Ratio = 0.49
M = 2.72k-ft	Mall = 4.49k-ft	Ratio = 0.61

Deflection
TL = 0.04" L/999+ > L/240 min
DL = 0.01"
L = 0.03" L/999+ > L/360 min

4x10 DF #2

Description - Main Floor Framing - B1-19 - Dropped



Uniform 1 = 0.66 klf (0.0'-6.0')

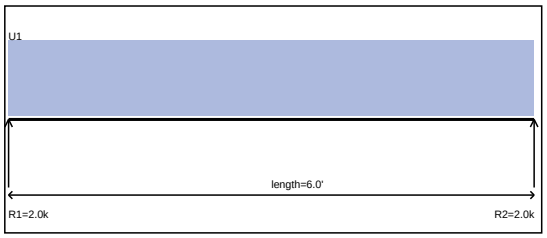
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 1.98k	Vall = 3.88k	Ratio = 0.51
M = 2.96k-ft	Mall = 4.49k-ft	Ratio = 0.66

Deflection
TL = 0.05" L/999+ > L/240 min
DL = 0.01"
L = 0.04" L/999+ > L/360 min

4x10 DF #2

Description - Main Floor Framing - B1-20 - Dropped



Uniform 1 = 0.66 klf (0.0'-6.0')

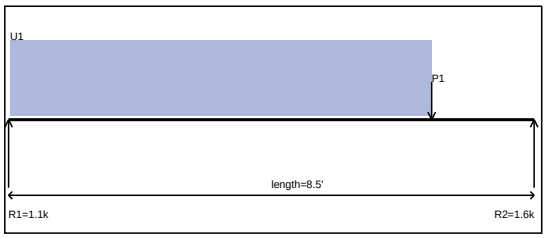
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + L)

V = 1.99k	Vall = 3.88k	Ratio = 0.51
M = 3.00k-ft	Mall = 4.49k-ft	Ratio = 0.67

Deflection
TL = 0.05" L/999+ > L/240 min
DL = 0.01"
L = 0.04" L/999+ > L/360 min

4x10 DF #2

Description - Main Floor Framing - B1-22 - Flush



Uniform 1 = 0.20 klf (0.0'-6.9') P1 = 1.25 K (6.9')

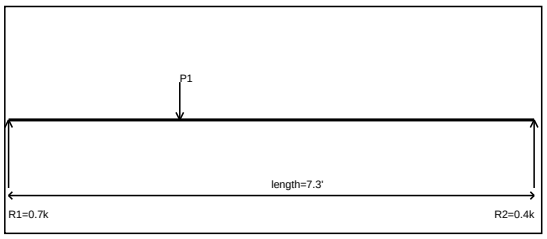
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
△ = (D + 0.75 * (L + S))

V = 1.27k	Vall = 3.95k	Ratio = 0.32
M = 2.47k-ft	Mall = 8.91k-ft	Ratio = 0.28

Deflection
TL = 0.07" L/999+ > L/240 min
DL = 0.06"
L = 0.02" L/999+ > L/360 min

1-3/4x11-7/8 LVL

Description - Main Floor Framing - B1-23 - Flush



P1 = 0.98 K (2.4')

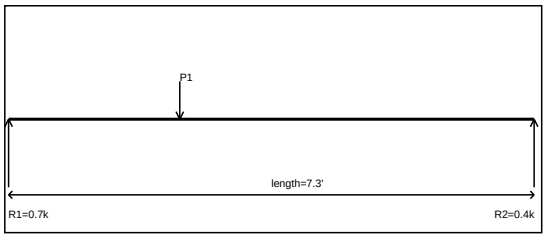
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.66k	Vall = 4.54k	Ratio = 0.15
M = 1.58k-ft	Mall = 10.25k-ft	Ratio = 0.15

Deflection
TL = 0.03" L/999+ > L/240 min
DL = 0.01"
L = 0.00" L/999+ > L/360 min

1-3/4x11-7/8 LVL

Description - Main Floor Framing - B1-24 - Flush



P1 = 0.98 K (2.4')

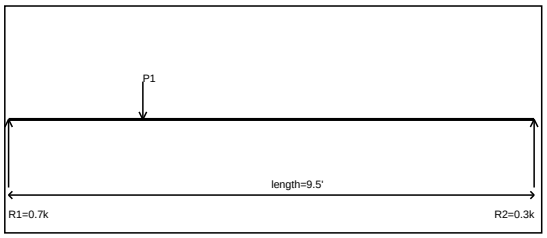
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.66k	Vall = 4.54k	Ratio = 0.15
M = 1.58k-ft	Mall = 10.25k-ft	Ratio = 0.15

Deflection
TL = 0.03" L/999+ > L/240 min
DL = 0.01"
L = 0.00" L/999+ > L/360 min

1-3/4x11-7/8 LVL

Description - Main Floor Framing - B1-25 - Flush



P1 = 0.84 K (2.4')

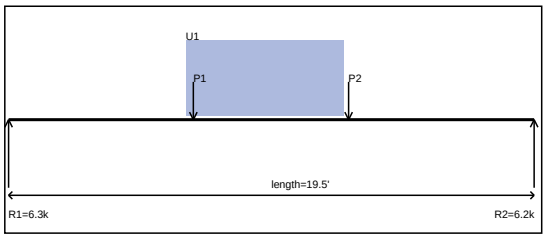
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
△ = (D + S)

V = 0.62k	Vall = 4.54k	Ratio = 0.14
M = 1.51k-ft	Mall = 10.25k-ft	Ratio = 0.15

Deflection
TL = 0.05" L/999+ > L/240 min
DL = 0.02"
L = 0.00" L/999+ > L/360 min

1-3/4x11-7/8 LVL

Description - Main Floor Framing - B1-26 - Flush



Uniform 1 = 0.27 klf (6.6'-12.4')

P1 = 5.40 K (6.8')

P2 = 5.38 K (12.6')

Controlling Load Combination/ Cd
V = (D + L) Cd= NA
M = (D + L) Cd= NA
△ = (D + L)

V = 5.89k	Vall = 62.50k	Ratio = 0.09
M = 41.08k-ft	Mall = 117.00k-ft	Ratio = 0.35

Deflection
TL = 0.46" L/506 > L/240 min
DL = 0.20"
L = 0.26" L/891 > L/360 min

W10x39 Steel

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING
7220 Trade Street, Suite 295, San Diego, CA 92121 ▸ p 619-650-0010 ▸ mulhernkulp.com

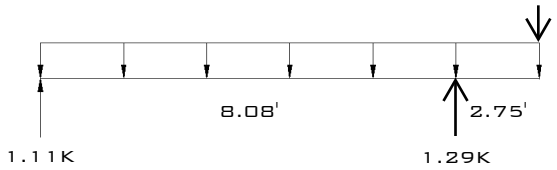
Project Name: Design Built Homes
86th Ave SE
M&K Project #: 244-24010
Engineer: RSC
Date: 15-Oct-24

Beam & Header Calculations

Beam Description: ROOF FRAMING - B3-1 - CANT'D FLUSH BM

Parameters:

L =	10.83	ft
w =	0.25	klf
P =	-0.47	k



Analysis:

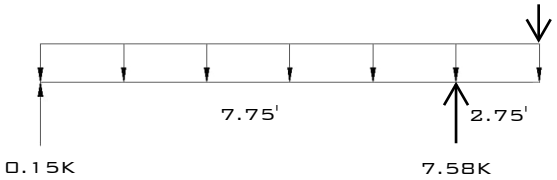
R_{MAX} =	1.29	K	V_D =	0.72	K	< V_{ALL} = 7.90 K	☑ Adequate
M_{MAX} =	2.31	K-FT	< M_{ALL} =	17.85	K-FT		☑ Adequate
Δ_{TL} =	0.03	IN.	L/	999+	< L/240		☑ Adequate

3-1/2"x11-7/8" LVL

Beam Description: ROOF FRAMING - B3-2 - CANT'D FLUSH BM

Parameters:

L =	10.5	ft
w =	0.40	klf
P =	3.46	k



Analysis:

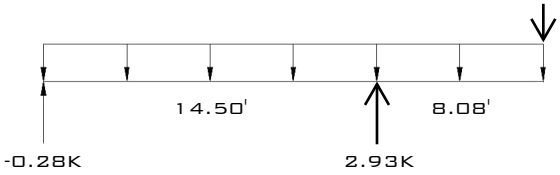
R_{MAX} =	8.29	K	V_D =	4.18	K	< V_{ALL} = 7.90 K	☑ Adequate
M_{MAX} =	11.05	K-FT	< M_{ALL} =	17.85	K-FT		☑ Adequate
Δ_{TL} =	0.18	IN.	L/	991	< L/240	@ CANT'L	☑ Adequate

3-1/2"x11-7/8" LVL

Beam Description: ROOF FRAMING - B3-3 - CANT'D FLUSH BTM BM

Parameters:

L =	22.58	ft
w =	0.05	klf
P =	1.3	k



Analysis:

R_{MAX} =	2.93	K	V_D =	1.59	K	< V_{ALL} = 13.97 K	☑ Adequate
M_{MAX} =	11.22	K-FT	< M_{ALL} =	36.39	K-FT		☑ Adequate
Δ_{TL} =	0.45	IN.	L/	426	< L/240	@ CANT'L	☑ Adequate

5-1/4"x14" LVL

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING
7220 Trade Street, Suite 295, San Diego, CA 92121 ▸ p 619-650-0010 ▸ mulhernkulp.com

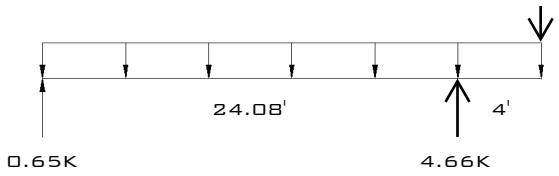
PROJECT NAME: DESIGN BUILT HOMES
86TH AVE SE
M&K PROJECT #: 244-24010
ENGINEER: RSC
DATE: 15-Oct-24

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: ROOF FRAMING - B3-5 - CANT'D FLUSH BM

PARAMETERS:

L =	28.08	FT
W =	0.08	KLF
P =	2.55	K



ANALYSIS:

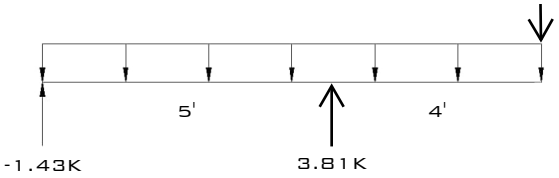
R_{MAX} =	4.66	K	V_D =	2.98	K	< V_{ALL} = 11.85 K	☑ ADEQUATE
M_{MAX} =	11.64	K-FT	< M_{ALL} =	26.78	K-FT		☑ ADEQUATE
Δ_{TL} =	0.27	IN.	L/	358	< L/240	@ CANT'L	☑ ADEQUATE

5-1/4"x11-7/8" LVL

BEAM DESCRIPTION: ROOF FRAMING - B3-6 - CANT'D FLUSH BM

PARAMETERS:

L =	9	FT
W =	0.05	KLF
P =	1.85	K



ANALYSIS:

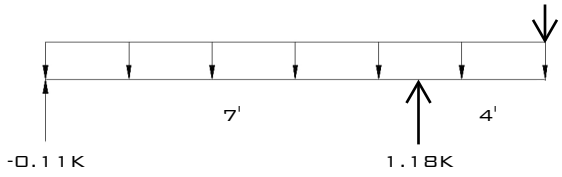
R_{MAX} =	3.81	K	V_D =	2.03	K	< V_{ALL} = 7.90 K	☑ ADEQUATE
M_{MAX} =	7.88	K-FT	< M_{ALL} =	17.85	K-FT		☑ ADEQUATE
Δ_{TL} =	0.17	IN.	L/	556	< L/240	@ CANT'L	☑ ADEQUATE

3-1/2"x11-7/8" LVL

BEAM DESCRIPTION: ROOF FRAMING - B3-7 - CANT'D FLUSH BM

PARAMETERS:

L =	11	FT
W =	0.05	KLF
P =	0.17	K



ANALYSIS:

R_{MAX} =	1.18	K	V_D =	0.61	K	< V_{ALL} = 7.90 K	☑ ADEQUATE
M_{MAX} =	2.19	K-FT	< M_{ALL} =	17.85	K-FT		☑ ADEQUATE
Δ_{TL} =	0.05	IN.	L/	999+	< L/240	@ CANT'L	☑ ADEQUATE

3-1/2"x11-7/8" LVL

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING
7220 Trade Street, Suite 295, San Diego, CA 92121 ▸ p 619-650-0010 ▸ mulhernkulp.com

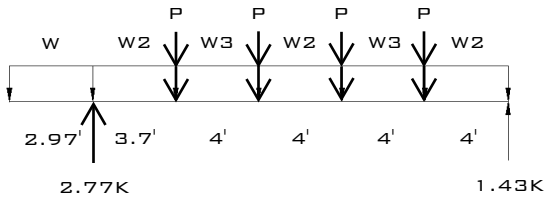
PROJECT NAME: DESIGN BUILT HOMES
86TH AVE SE
M&K PROJECT #: 244-24010
ENGINEER: RSC
DATE: 15-OCT-24

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: ROOF FRAMING - B3-8 - CANT'D FLUSH BM

PARAMETERS:

L =	22.37	FT	W3=0.03KLF
W =	0.07	KLF	W2=0.15KLF
P =	0.24	K	



ANALYSIS:

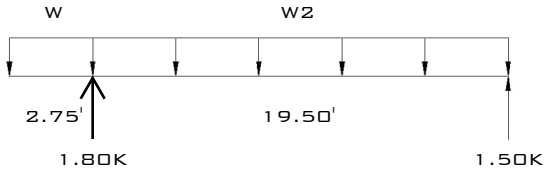
R_{MAX} =	2.55	K	V_D =	1.49	K	< V_{ALL} =	7.90	K	☑ ADEQUATE
M_{MAX} =	4.36	K-FT	< M_{ALL} =	17.85	K-FT				☑ ADEQUATE
Δ_{TL} =	0.24	IN.	L/	967	< L/240	@ CANT'L			☑ ADEQUATE

3-1/2"x11-7/8" LVL

BEAM DESCRIPTION: UPPER FLOOR FRAMING - B2-1 - CANT'D FLUSH BM

PARAMETERS:

L =	22.25	FT	
W =	0.08	KLF	W2=0.16KLF
P =	-	K	



ANALYSIS:

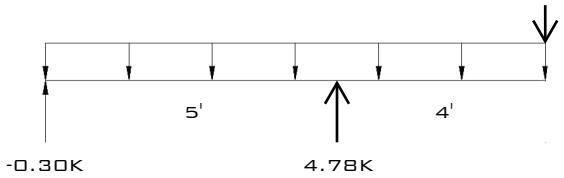
R_{MAX} =	1.80	K	V_D =	1.38	K	< V_{ALL} =	11.85	K	☑ ADEQUATE
M_{MAX} =	7.20	K-FT	< M_{ALL} =	26.78	K-FT				☑ ADEQUATE
Δ_{TL} =	0.36	IN.	L/	658	< L/240	@ CANT'L			☑ ADEQUATE

5-1/4"x11-7/8" LVL

BEAM DESCRIPTION: UPPER FLOOR FRAMING - B2-4 - CANT'D FLUSH BM

PARAMETERS:

L =	9	FT
W =	0.05	KLF
P =	1.79	K



ANALYSIS:

R_{MAX} =	3.70	K	V_D =	1.97	K	< V_{ALL} =	7.90	K	☑ ADEQUATE
M_{MAX} =	7.63	K-FT	< M_{ALL} =	17.85	K-FT				☑ ADEQUATE
Δ_{TL} =	0.17	IN.	L/	574	< L/240	@ CANT'L			☑ ADEQUATE

3-1/2"x11-7/8" LVL

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING
7220 Trade Street, Suite 295, San Diego, CA 92121 ▸ p 619-650-0010 ▸ mulhernkulp.com

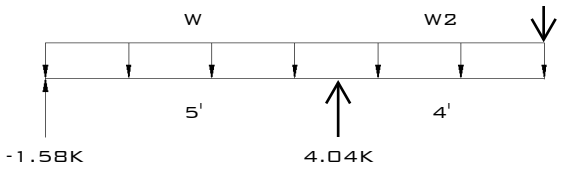
PROJECT NAME: DESIGN BUILT HOMES
86TH AVE SE
M&K PROJECT #: 244-24010
ENGINEER: RSC
DATE: 15-Oct-24

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: UPPER FLOOR FRAMING - B2-5 - CANT'D FLUSH BM

PARAMETERS:

L =	9	FT	
w =	0.05	KLF	W2=0.04KLF
P =	1.69	K	



ANALYSIS:

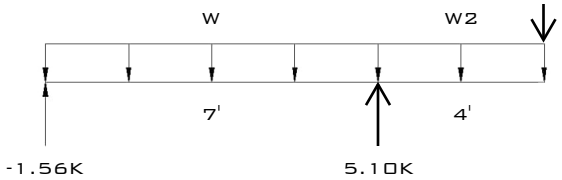
R_{MAX} =	4.04	K	V_D =	-	K	< V_{ALL} = 7.90 K	☑ ADEQUATE
M_{MAX} =	8.47	K-FT	< M_{ALL} =	17.85	K-FT		☑ ADEQUATE
Δ_{TL} =	0.19	IN.	L/	516	< L/240 @ CANT'L		☑ ADEQUATE

3-1/2"x11-7/8" LVL

BEAM DESCRIPTION: UPPER FLOOR FRAMING - B2-6 - CANT'D FLUSH BM

PARAMETERS:

L =	11	FT	
w =	0.05	KLF	W2=0.04KLF
P =	3.4	K	



ANALYSIS:

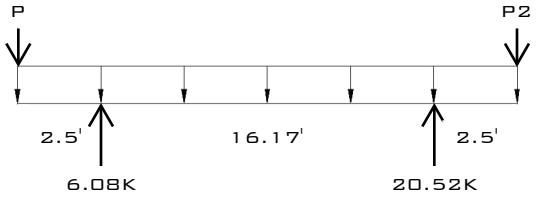
R_{MAX} =	5.10	K	V_D =	3.18	K	< V_{ALL} = 51.0 K	☑ ADEQUATE
M_{MAX} =	12.18	K-FT	< M_{ALL} =	53.9	K-FT		☑ ADEQUATE
Δ_{TL} =	0.11	IN.	L/	888	< L/240 @ CANT'L		☑ ADEQUATE

W10x19 STEEL BEAM

BEAM DESCRIPTION: UPPER FLOOR FRAMING - B2-17 - CANT'D FLUSH BM

PARAMETERS:

L =	17.13	FT	
w =	0.84	KLF	
P =	-2.62	K	P2=9.48K



ANALYSIS:

R_{MAX} =	20.52	K	V_D =	12.10	K	< V_{ALL} = 17.5 K	☑ ADEQUATE
M_{MAX} =	27.41	K-FT	< M_{ALL} =	59.4	K-FT		☑ ADEQUATE
Δ_{TL} =	0.2	IN.	L/	965	< L/240		☑ ADEQUATE

5 1/2"x18" GLB

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING
7220 Trade Street, Suite 295, San Diego, CA 92121 ▸ p 619-650-0010 ▸ mulhernkulp.com

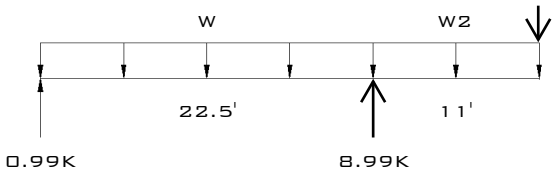
PROJECT NAME: DESIGN BUILT HOMES
86TH AVE SE
M&K PROJECT #: 244-24010
ENGINEER: RSC
DATE: 15-OCT-24

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: UPPER FLOOR FRAMING - B2-19 - CANT'D FLUSH BTM. STEEL BM

PARAMETERS:

L =	33.5	FT	
W =	0.18	KLF	W2=0.07KLF
P =	2.9	K	



ANALYSIS:

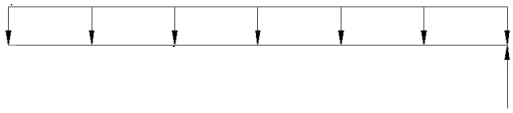
R_{MAX} =	8.99	K	V_D =	4.13	K	< V_{ALL} = 97.8 K	☑ ADEQUATE
M_{MAX} =	40.25	K-FT	< M_{ALL} =	213	K-FT		☑ ADEQUATE
Δ_{TL} =	0.54	IN.	L/	490		< L/240	☑ ADEQUATE

W10X68 STEEL BM

BEAM DESCRIPTION: NOT USED

PARAMETERS:

L =		FT
W =		KLF
P =		K



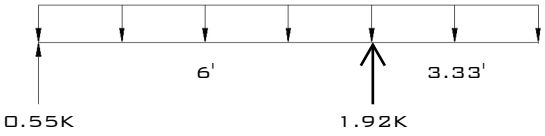
ANALYSIS:

R_{MAX} =		K	V_D =		K	< V_{ALL} =	K ☑ ADEQUATE
M_{MAX} =		K-FT	< M_{ALL} =		K-FT		☑ ADEQUATE
Δ_{TL} =		IN.	L/			< L/240	☑ ADEQUATE

BEAM DESCRIPTION: UPPER FLOOR FRAMING - B2-25 - CANT'D FLUSH BTM. STEEL BM

PARAMETERS:

L =	9.33	FT	
W =	0.25	KLF	
P =	-	K	



ANALYSIS:

R_{MAX} =	1.92	K	V_D =	0.78	K	< V_{ALL} = 7.90	K ☑ ADEQUATE
M_{MAX} =	1.47	K-FT	< M_{ALL} =	17.85	K-FT		☑ ADEQUATE
Δ_{TL} =	0.01	IN.	L/	999+		< L/240	☑ ADEQUATE

3-1/2"x11-7/8" LVL

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING
7220 Trade Street, Suite 295, San Diego, CA 92121 ▸ p 619-650-0010 ▸ mulhernkulp.com

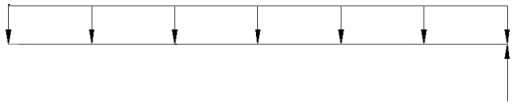
PROJECT NAME: DESIGN BUILT HOMES
86TH AVE SE
M&K PROJECT #: 244-24010
ENGINEER: RSC
DATE: 15-OCT-24

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: NOT USED

PARAMETERS:

L = FT
w = KLF
P = K



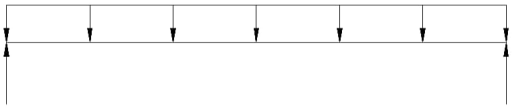
ANALYSIS:

R_{MAX} =		K	V_D =		K	< V_{ALL} =		K	☑ ADEQUATE
M_{MAX} =		K-FT	< M_{ALL} =		K-FT				☑ ADEQUATE
Δ_{TL} =		IN.	L/		< L/240				☑ ADEQUATE

BEAM DESCRIPTION: EXT. HDR @ OPEN TO BELOW - H3-21 - FLUSH HDR

PARAMETERS:

L = 6 FT
w = 0.32 KLF
P = - K



ANALYSIS:

R_{MAX} =	0.96	K	V_D =	-	K	< V_{ALL} =	3.95	K	☑ ADEQUATE
M_{MAX} =	1.44	K-FT	< M_{ALL} =	8.93	K-FT				☑ ADEQUATE
Δ_{TL} =	0.02	IN.	L/	999+	< L/240				☑ ADEQUATE

1-3/4"x11-7/8" LVL

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING
7220 Trade Street, Suite 295, San Diego, CA 92121 ▸ p 619-650-0010 ▸ mulhernkulp.com

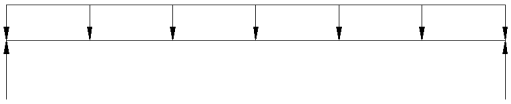
PROJECT NAME: DESIGN BUILT HOMES
86TH AVE SE
M&K PROJECT #: 244-24010
ENGINEER: RSC
DATE: 15-OCT-24

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: EXT. HDR @ OPEN TO BELOW - H3-21 - FLUSH HDR

PARAMETERS:

L =	6	FT
W =	0.07	KLF
P =	-	K



ANALYSIS:

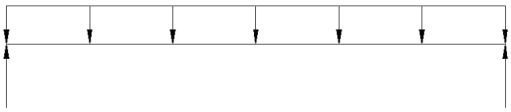
R_{MAX} =	0.21	K	V_D =	-	K	< V_{ALL} = 3.95 K	☑ ADEQUATE
M_{MAX} =	0.32	K-FT	< M_{ALL} =	8.93	K-FT		☑ ADEQUATE
Δ_{TL} =	0.01	IN.	L/	999+	< L/240		☑ ADEQUATE

1-3/4"x11-7/8" LVL

BEAM DESCRIPTION: -

PARAMETERS:

L =	-	FT
W =	-	KLF
P =	-	K



ANALYSIS:

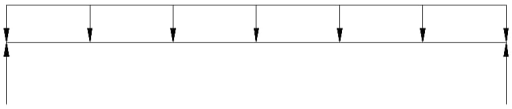
R_{MAX} =	-	K	V_D =	-	K	< V_{ALL} = - K	☐ ADEQUATE
M_{MAX} =	-	K-FT	< M_{ALL} =	-	K-FT		☐ ADEQUATE
Δ_{TL} =	-	IN.	L/	-	< L/240		☐ ADEQUATE

-

BEAM DESCRIPTION: -

PARAMETERS:

L =	-	FT
W =	-	KLF
P =	-	K



ANALYSIS:

R_{MAX} =	-	K	V_D =	-	K	< V_{ALL} = - K	☐ ADEQUATE
M_{MAX} =	-	K-FT	< M_{ALL} =	-	K-FT		☐ ADEQUATE
Δ_{TL} =	-	IN.	L/	-	< L/240		☐ ADEQUATE

-

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING
7220 Trade Street, Suite 295, San Diego, CA 92121 ▸ p 619-650-0010 ▸ *mulhernkulp.com*

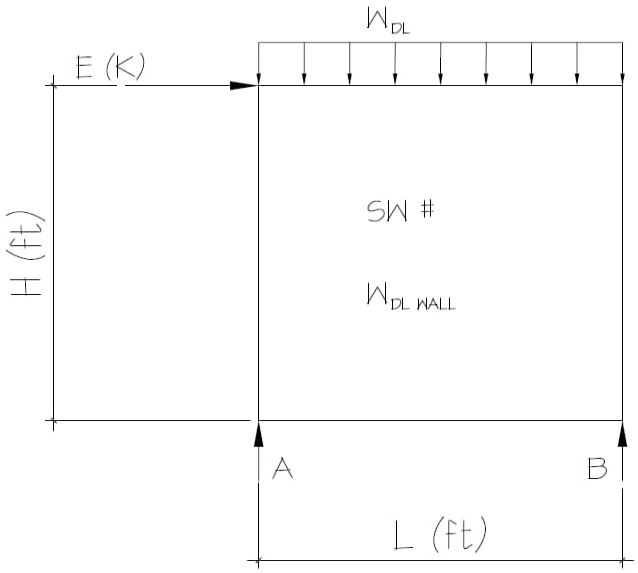
Project Name: Design Built
86th Ave SE
M&K Project #: 244-24010
Engineer: RSC
Date: 23-Oct-24

Overstrength Calculations

Wall Description/SW #: 302

Parameters:

L =	4.0	ft
H =	9.1	ft
E =	0.20	k
W_{DLwall} =	0.10	klf
W_{DL} =	0.151	klf
Ω_0 =	2.5	(ASCE table 12.2.1 footnote
SDS =	1.124	



Analysis:

E (unfactored) = 0.29

$E_{MH} = \Omega_0 * E$ = 0.71 k

$E_V = 0.2*SDS*DL$ = 0.226 k

$E_M = E_{MH} + E_V$

$E_M = E_{MH} - E_V$

$E_M = E_{MH} + E_V$ = 0.940 k

$E_M = E_{MH} - E_V$ = 0.489 k

E_M (max) $= \sum M_A = 0$ = 0.94(9.1) + 0.251(4)(2) - R_B(4)

R_B = 0.5DL + 2.1E

R_A = 0.5DL - 2.1E

E_M (min) $= \sum M_A = 0$ = 0.49(9.1) + 0.251(4)(2) - R_B(4)

R_B = 0.5DL + 1.1E

R_A = 0.5DL - 1.1E

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 295, San Diego, CA 92121 ▸ p 619-650-0010 ▸ *mulhernkulp.com*

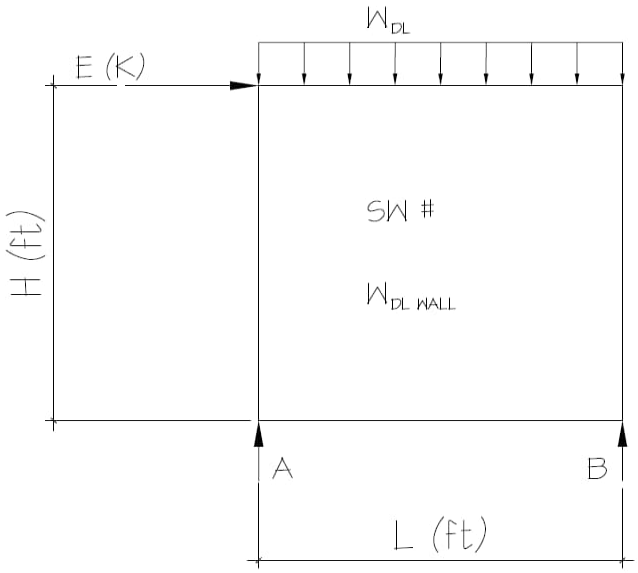
Project Name: Design Built
86th Ave SE
M&K Project #: 244-24010
Engineer: RSC
Date: 23-Oct-24

Overstrength Calculations

Wall Description/SW #: 303

Parameters:

L =	8.3	ft
H =	9.1	ft
E =	0.70	k
W_{DLwall} =	0.10	klf
W_{DL} =	0.114	klf
Ω_0 =	2.5	(ASCE table 12.2.1 footnote
SDS =	1.124	



Analysis:

E (unfactored) = 1.00

$E_{MH} = \Omega_0 * E$ = 2.50 k

$E_V = 0.2*SDS*DL$ = 0.399 k

$E_M = E_{MH} + E_V$

$E_M = E_{MH} - E_V$

$E_M = E_{MH} + E_V$ = 2.899 k

$E_M = E_{MH} - E_V$ = 2.101 k

E_M (max) $= \sum M_A = 0$ = 2.90(9.1) + 0.214(8.3)(4.15) - R_B(8.3)

R_B = 0.9DL + 3.2E

R_A = 0.9DL - 3.2E

E_M (min) $= \sum M_A = 0$ = 2.10(9.1) + 0.214(8.3)(4.15) - R_B(8.3)

R_B = 0.9DL + 2.3E

R_A = 0.9DL - 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 295, San Diego, CA 92121 ▸ p 619-650-0010 ▸ *mulhernkulp.com*

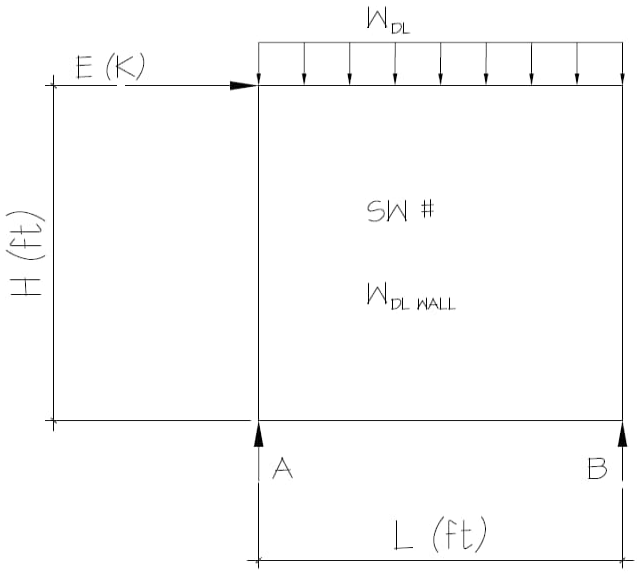
Project Name: Design Built
86th Ave SE
M&K Project #: 244-24010
Engineer: RSC
Date: 23-Oct-24

Overstrength Calculations

Wall Description/SW #: 304

Parameters:

L =	36.1	ft
H =	9.1	ft
E =	1.90	k
W_{DLwall} =	0.10	klf
W_{DL} =	0.094	klf
Ω_0 =	2.5	(ASCE table 12.2.1 footnote
SDS =	1.124	



Analysis:

E (unfactored) = 2.71

$E_{MH} = \Omega_0 * E$ = 6.79 k

$E_V = 0.2*SDS*DL$ = 1.574 k

$E_M = E_{MH} + E_V$

$E_M = E_{MH} - E_V$

$E_M = E_{MH} + E_V$ = 8.360 k

$E_M = E_{MH} - E_V$ = 5.211 k

E_M (max) $= \sum M_A = 0$ = 8.36(9.1) + 0.194(36.1)(18.05) - R_B(36.1)

R_B = 3.5DL + 2.1E

R_A = 3.5DL - 2.1E

E_M (min) $= \sum M_A = 0$ = 5.21(9.1) + 0.194(36.1)(18.05) - R_B(36.1)

R_B = 3.5DL + 1.3E

R_A = 3.5DL - 1.3E

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 295, San Diego, CA 92121 ▸ p 619-650-0010 ▸ *mulhernkulp.com*

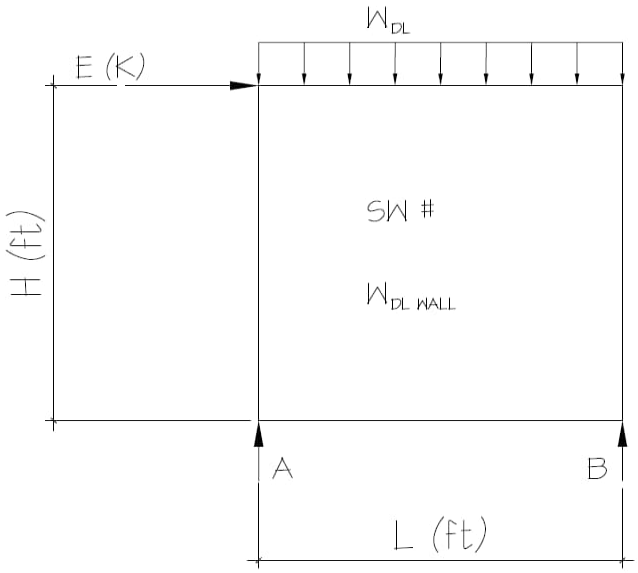
Project Name: Design Built
86th Ave SE
M&K Project #: 244-24010
Engineer: RSC
Date: 23-Oct-24

Overstrength Calculations

Wall Description/SW #: 305

Parameters:

L =	21.5	ft
H =	9.1	ft
E =	1.70	k
W_{DLwall} =	0.10	klf
W_{DL} =	0.106	klf
Ω_0 =	2.5	(ASCE table 12.2.1 footnote
SDS =	1.124	



Analysis:

E (unfactored) = 2.43

$E_{MH} = \Omega_0 * E$ = 6.07 k

$E_V = 0.2*SDS*DL$ = 0.996 k

$E_M = E_{MH} + E_V$

$E_M = E_{MH} - E_V$

$E_M = E_{MH} + E_V$ = 7.067 k

$E_M = E_{MH} - E_V$ = 5.076 k

E_M (max) $= \sum M_A = 0$ = 7.07(9.1) + 0.206(21.5)(10.75) - R_B(21.5)

R_B = 2.2DL + 3.0E

R_A = 2.2DL - 3.0E

E_M (min) $= \sum M_A = 0$ = 5.08(9.1) + 0.206(21.5)(10.75) - R_B(21.5)

R_B = 2.2DL + 2.1E

R_A = 2.2DL - 2.1E

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 295, San Diego, CA 92121 ▸ p 619-650-0010 ▸ *mulhernkulp.com*

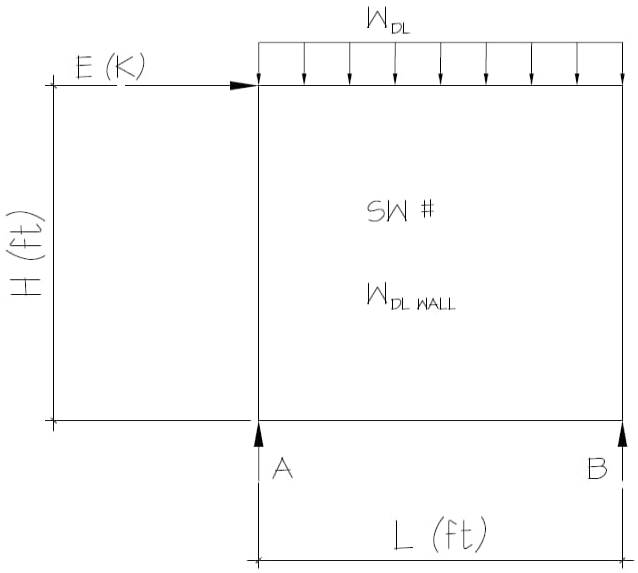
Project Name: Design Built
86th Ave SE
M&K Project #: 244-24010
Engineer: RSC
Date: 23-Oct-24

Overstrength Calculations

Wall Description/SW #: 306

Parameters:

L =	16.6	ft
H =	9.1	ft
E =	1.80	k
W_{DLwall} =	0.10	klf
W_{DL} =	0.195	klf
Ω_0 =	2.5	(ASCE table 12.2.1 footnote
SDS =	1.124	



Analysis:

E (unfactored) = 2.57

$E_{MH} = \Omega_0 * E$ = 6.43 k

$E_V = 0.2*SDS*DL$ = 1.101 k

$E_M = E_{MH} + E_V$

$E_M = E_{MH} - E_V$

$E_M = E_{MH} + E_V$ = 7.529 k

$E_M = E_{MH} - E_V$ = 5.328 k

E_M (max) $= \sum M_A = 0$ = 7.53(9.1) + 0.295(16.6)(8.3) - R_B(16.6)

R_B = 2.4DL + 4.1E

R_A = 2.4DL - 4.1E

E_M (min) $= \sum M_A = 0$ = 5.33(9.1) + 0.295(16.6)(8.3) - R_B(16.6)

R_B = 2.4DL + 2.9E

R_A = 2.4DL - 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 295, San Diego, CA 92121 ▸ p 619-650-0010 ▸ *mulhernkulp.com*

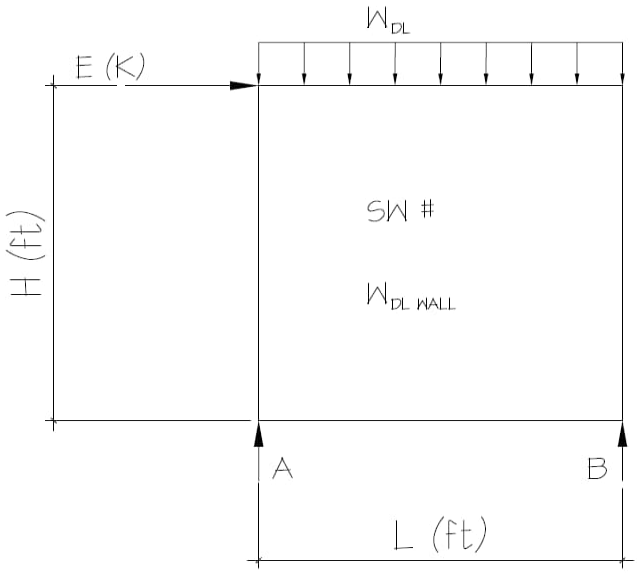
Project Name: Design Built
86th Ave SE
M&K Project #: 244-24010
Engineer: RSC
Date: 23-Oct-24

Overstrength Calculations

Wall Description/SW #: 307

Parameters:

L =	11.1	ft
H =	9.1	ft
E =	0.70	k
W_{DLwall} =	0.10	klf
W_{DL} =	0.013	klf
Ω_0 =	2.5	(ASCE table 12.2.1 footnote
SDS =	1.124	



Analysis:

E (unfactored) = 1.00

$E_{MH} = \Omega_0 * E$ = 2.50 k

$E_V = 0.2*SDS*DL$ = 0.282 k

$E_M = E_{MH} + E_V$

$E_M = E_{MH} - E_V$

$E_M = E_{MH} + E_V$ = 2.782 k

$E_M = E_{MH} - E_V$ = 2.218 k

E_M (max) $= \sum M_A = 0$ = 2.78(9.1) + 0.113(11.1)(5.55) - R_B(11.1)

R_B = 0.6DL + 2.3E

R_A = 0.6DL - 2.3E

E_M (min) $= \sum M_A = 0$ = 2.22(9.1) + 0.113(11.1)(5.55) - R_B(11.1)

R_B = 0.6DL + 1.8E

R_A = 0.6DL - 1.8E

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 295, San Diego, CA 92121 ▸ p 619-650-0010 ▸ *mulhernkulp.com*

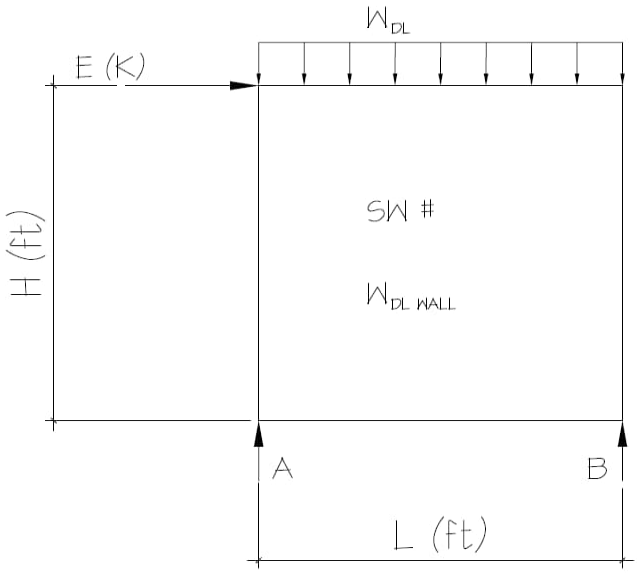
Project Name: Design Built
86th Ave SE
M&K Project #: 244-24010
Engineer: RSC
Date: 23-Oct-24

Overstrength Calculations

Wall Description/SW #: 309

Parameters:

L =	8.1	ft
H =	9.1	ft
E =	0.50	k
W_{DLwall} =	0.10	klf
W_{DL} =	0.013	klf
Ω_0 =	2.5	(ASCE table 12.2.1 footnote
SDS =	1.124	



Analysis:

E (unfactored) = 0.71

$E_{MH} = \Omega_0 * E$ = 1.79 k

$E_V = 0.2*SDS*DL$ = 0.206 k

$E_M = E_{MH} + E_V$

$E_M = E_{MH} - E_V$

$E_M = E_{MH} + E_V$ = 1.991 k

$E_M = E_{MH} - E_V$ = 1.580 k

E_M (max) $= \sum M_A = 0$ = 1.99(9.1) + 0.113(8.1)(4.05) - R_B(8.1)

R_B = 0.5DL + 2.2E

R_A = 0.5DL - 2.2E

E_M (min) $= \sum M_A = 0$ = 1.58(9.1) + 0.113(8.1)(4.05) - R_B(8.1)

R_B = 0.5DL + 1.8E

R_A = 0.5DL - 1.8E

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 295, San Diego, CA 92121 ▸ p 619-650-0010 ▸ *mulhernkulp.com*

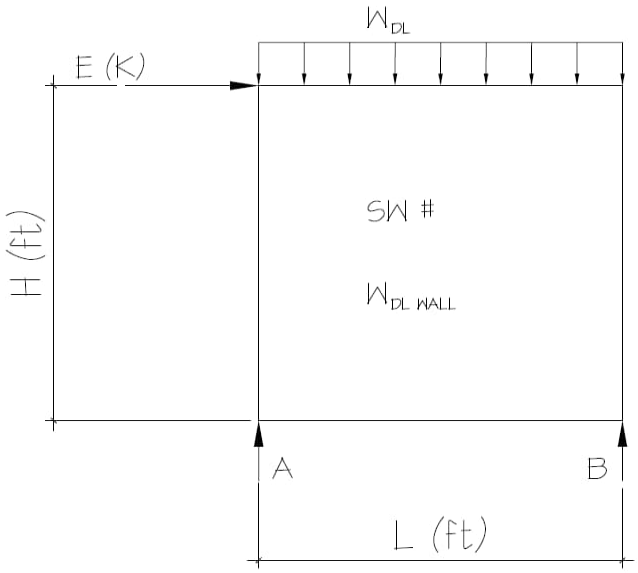
Project Name: Design Built
86th Ave SE
M&K Project #: 244-24010
Engineer: RSC
Date: 23-Oct-24

Overstrength Calculations

Wall Description/SW #: 310

Parameters:

L =	7.2	ft
H =	9.1	ft
E =	0.40	k
W_{DLwall} =	0.10	klf
W_{DL} =	0.013	klf
Ω_0 =	2.5	(ASCE table 12.2.1 footnote
SDS =	1.124	



Analysis:

E (unfactored) = 0.57

$E_{MH} = \Omega_0 * E$ = 1.43 k

$E_V = 0.2*SDS*DL$ = 0.183 k

$E_M = E_{MH} + E_V$

$E_M = E_{MH} - E_V$

$E_M = E_{MH} + E_V$ = 1.611 k

$E_M = E_{MH} - E_V$ = 1.246 k

E_M (max) $= \sum M_A = 0$ = 1.61(9.1) + 0.113(7.2)(3.6) - R_B(7.2)

R_B = 0.4DL + 2.0E

R_A = 0.4DL - 2.0E

E_M (min) $= \sum M_A = 0$ = 1.25(9.1) + 0.113(7.2)(3.6) - R_B(7.2)

R_B = 0.4DL + 1.6E

R_A = 0.4DL - 1.6E

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 295, San Diego, CA 92121 ▸ p 619-650-0010 ▸ *mulhernkulp.com*

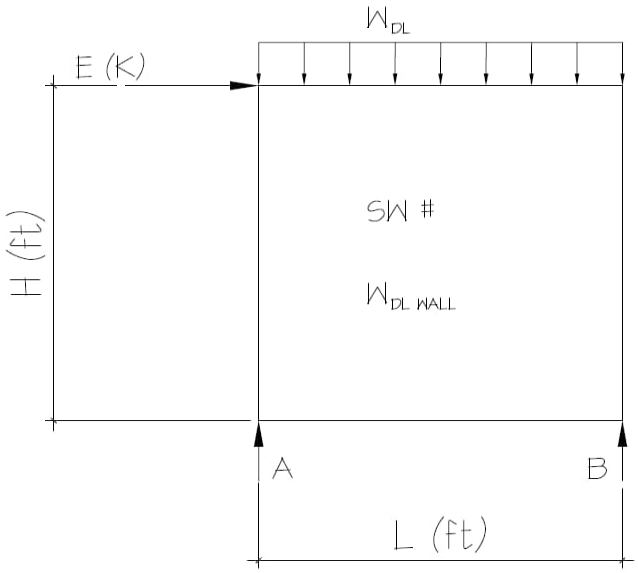
Project Name: Design Built
86th Ave SE
M&K Project #: 244-24010
Engineer: RSC
Date: 23-Oct-24

Overstrength Calculations

Wall Description/SW #: 311

Parameters:

L =	14.9	ft
H =	9.1	ft
E =	1.40	k
W_{DLwall} =	0.10	klf
W_{DL} =	0.013	klf
Ω_0 =	2.5	(ASCE table 12.2.1 footnote
SDS =	1.124	



Analysis:

E (unfactored) = 2.00

$E_{MH} = \Omega_0 * E$ = 5.00 k

$E_V = 0.2*SDS*DL$ = 0.378 k

$E_M = E_{MH} + E_V$

$E_M = E_{MH} - E_V$

$E_M = E_{MH} + E_V$ = 5.378 k

$E_M = E_{MH} - E_V$ = 4.622 k

E_M (max) $= \sum M_A = 0$ = 5.38(9.1) + 0.113(14.9)(7.45) - R_B(14.9)

R_B = 0.8DL + 3.3E

R_A = 0.8DL - 3.3E

E_M (min) $= \sum M_A = 0$ = 4.62(9.1) + 0.113(14.9)(7.45) - R_B(14.9)

R_B = 0.8DL + 2.8E

R_A = 0.8DL - 2.8E

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 295, San Diego, CA 92121 ▸ p 619-650-0010 ▸ mulhernkulp.com

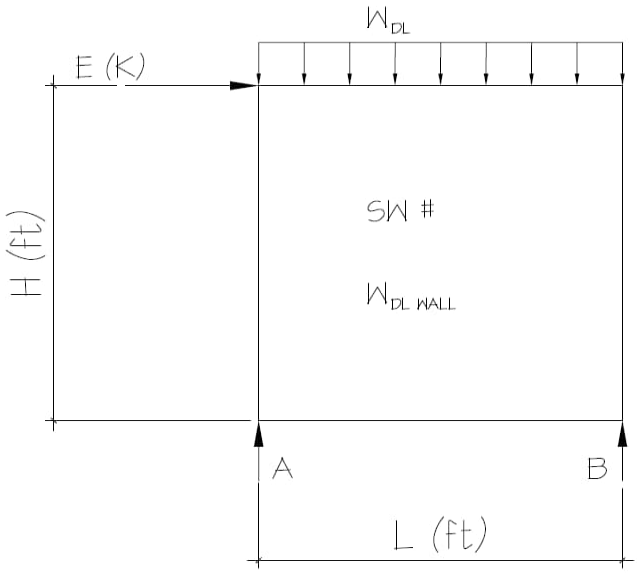
PROJECT NAME: DESIGN BUILT
86TH AVE SE
M&K PROJECT #: 244-24010
ENGINEER: RSC
DATE: 23-OCT-24

OVERSTRENGTH CALCULATIONS

WALL DESCRIPTION/SW #: 312

PARAMETERS:

L =	14.2	FT
H =	9.1	FT
E =	1.20	K
W_{DLWALL} =	0.10	KLF
W_{DL} =	0.013	KLF
Ω_0 =	2.5	(ASCE TABLE 12.2.1 FOOTNOTE
SDS =	1.124	



ANALYSIS:

E (UNFACTORED) = 1.71

$E_{MH} = \Omega_0 * E$ = 4.29 K

$E_V = 0.2*SDS*DL$ = 0.361 K

$E_M = E_{MH} + E_V$

$E_M = E_{MH} + E_V$ = 4.646 K

$E_M = E_{MH} - E_V$

$E_M = E_{MH} - E_V$ = 3.925 K

E_M (MAX) $= \sum M_A = 0 =$ 4.65(9.1) + 0.113(14.2)(7.1) - R_B(14.2)

R_B = 0.8DL + 3.0E

R_A = 0.8DL - 3.0E

E_M (MIN) $= \sum M_A = 0 =$ 3.93(9.1) + 0.113(14.2)(7.1) - R_B(14.2)

R_B = 0.8DL + 2.5E

R_A = 0.8DL - 2.5E

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 295, San Diego, CA 92121 ▸ p 619-650-0010 ▸ *mulhernkulp.com*

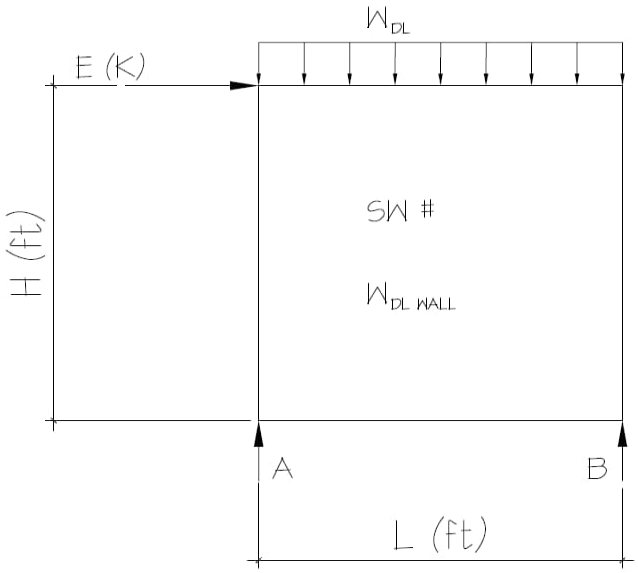
Project Name: Design Built
86th Ave SE
M&K Project #: 244-24010
Engineer: RSC
Date: 23-Oct-24

Overstrength Calculations

Wall Description/SW #: 313

Parameters:

L =	18.8	ft
H =	9.1	ft
E =	1.50	k
W_{DLwall} =	0.10	klf
W_{DL} =	0.000	klf
Ω_0 =	2.5	(ASCE table 12.2.1 footnote
SDS =	1.124	



Analysis:

E (unfactored) = 2.14

$E_{MH} = \Omega_0 * E$ = 5.36 k

$E_V = 0.2*SDS*DL$ = 0.423 k

$E_M = E_{MH} + E_V$

$E_M = E_{MH} - E_V$

$E_M = E_{MH} + E_V$ = 5.780 k

$E_M = E_{MH} - E_V$ = 4.935 k

E_M (max) $= \sum M_A = 0 =$ 5.78(9.1) + 0.1(18.8)(9.4) - R_B(18.8)

R_B = 0.9DL + 2.8E

R_A = 0.9DL - 2.8E

E_M (min) $= \sum M_A = 0 =$ 4.93(9.1) + 0.1(18.8)(9.4) - R_B(18.8)

R_B = 0.9DL + 2.4E

R_A = 0.9DL - 2.4E

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

Wood Beam

Project File: beam calcs with overstrength.ec6

DESCRIPTION: B2-17 OS 305

CODE REFERENCES

Calculations per NDS 2018, IBC 2021, ASCE 7-16
Load Combination Set : ASCE 7-16

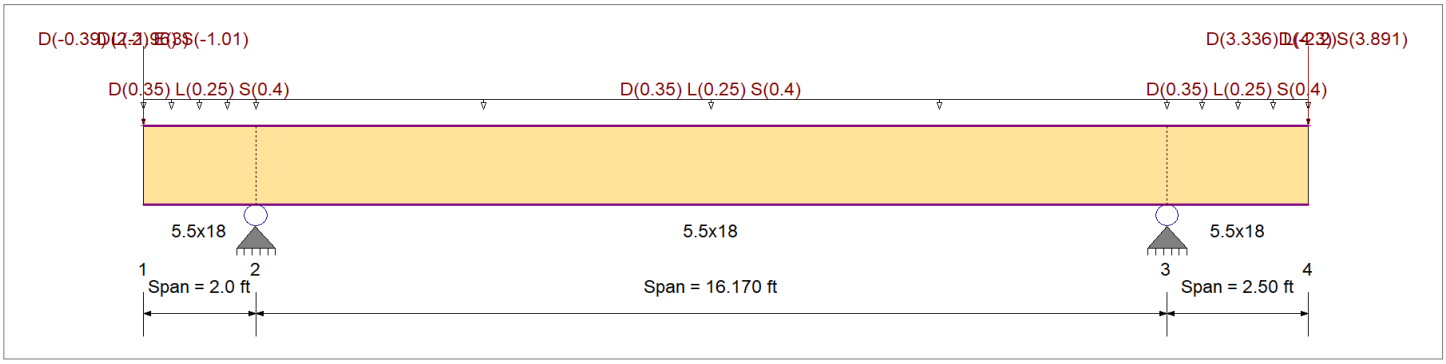
Material Properties

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	650.0 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 calculated and added to loading
Load for Span Number 1
Uniform Load : D = 0.350, L = 0.250, S = 0.40 , Tributary Width = 1.0 ft
Point Load : D = -0.390, L = -1.960, S = -1.010 k @ 0.0 ft
Point Load : D = 2.20, E = 3.0 k @ 0.0 ft
Load for Span Number 2
Uniform Load : D = 0.350, L = 0.250, S = 0.40 , Tributary Width = 1.0 ft
Load for Span Number 3
Uniform Load : D = 0.350, L = 0.250, S = 0.40 , Tributary Width = 1.0 ft
Point Load : D = 3.336, L = 4.30, S = 3.891 k @ 2.50 ft
Point Load : D = -2.20 k @ 2.50 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.338 : 1	Maximum Shear Stress Ratio	=	0.337 : 1
Section used for this span		5.5x18	Section used for this span		5.5x18
fb: Actual	=	843.73 psi	fv: Actual	=	123.42 psi
F'b	=	2,498.77 psi	F'v	=	365.70 psi
Load Combination		+D+0.750L+0.750S+H, LL Comb Run (**L)	Load Combination		+D+0.750L+0.750S+H, LL Comb Run (LLL)
Location of maximum on span	=	16.170 ft	Location of maximum on span	=	16.170 ft
Span # where maximum occurs	=	Span # 2	Span # where maximum occurs	=	Span # 2

Maximum Deflection

Max Downward Transient Deflection	0.064 in	Ratio =	934 >=360	Span: 3 : L Only, LL Comb Run (**L)
Max Upward Transient Deflection	-0.047 in	Ratio =	1030 >=360	Span: 1 : L Only, LL Comb Run (LL*)
Max Downward Total Deflection	0.201 in	Ratio =	965 >=180	Span: 2 : +D+0.750L+0.750S+H, LL Comb Run (LL*)
Max Upward Total Deflection	-0.081 in	Ratio =	588 >=180	Span: 1 : +D+0.750L+0.750S+H, LL Comb Run (LL*)

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios										Moment Values			Shear Values		
Segment Length	Span #	M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
+D+H														0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.088	0.131	0.90	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.36	176.3	1,998.0	2.47	37.4	286.2

DESCRIPTION: B2-17 OS 305

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
Length = 16.170 ft	**2**	0.127	0.131	0.90	1.00	1.00	1.00	0.979	1.00	1.00	1.00	7.96	321.6	2,536.9	2.47	37.4	286.2
Length = 2.50 ft	**3**	0.081	0.131	0.90	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.00	161.6	1,998.0	1.51	37.4	286.2
+D+L+H, LL Comb Run (**L)					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.079	0.113	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.36	176.3	2,220.0	2.37	35.9	318.0
Length = 16.170 ft	**2**	0.289	0.289	1.00	1.00	1.00	1.00	0.979	1.00	1.00	1.00	15.53	627.6	2,172.8	6.06	91.9	318.0
Length = 2.50 ft	**3**	0.283	0.289	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	15.53	627.6	2,220.0	6.06	91.9	318.0
+D+L+H, LL Comb Run (*L*)					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.079	0.196	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.36	176.3	2,220.0	4.12	62.4	318.0
Length = 16.170 ft	**2**	0.231	0.196	1.00	1.00	1.00	1.00	0.979	1.00	1.00	1.00	16.13	651.7	2,818.8	4.12	62.4	318.0
Length = 2.50 ft	**3**	0.073	0.196	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.00	161.6	2,220.0	1.51	62.4	318.0
+D+L+H, LL Comb Run (*LL)					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.079	0.162	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.36	176.3	2,220.0	3.40	51.6	318.0
Length = 16.170 ft	**2**	0.289	0.289	1.00	1.00	1.00	1.00	0.979	1.00	1.00	1.00	15.53	627.6	2,172.8	6.06	91.9	318.0
Length = 2.50 ft	**3**	0.283	0.289	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	15.53	627.6	2,220.0	6.06	91.9	318.0
+D+L+H, LL Comb Run (L**)					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.017	0.108	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.94	38.1	2,220.0	2.26	34.2	318.0
Length = 16.170 ft	**2**	0.139	0.126	1.00	1.00	1.00	1.00	0.979	1.00	1.00	1.00	9.72	392.6	2,818.8	2.64	40.0	318.0
Length = 2.50 ft	**3**	0.073	0.126	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.00	161.6	2,220.0	1.51	40.0	318.0
+D+L+H, LL Comb Run (L*L)					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.017	0.074	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.94	38.1	2,220.0	1.55	23.4	318.0
Length = 16.170 ft	**2**	0.289	0.289	1.00	1.00	1.00	1.00	0.979	1.00	1.00	1.00	15.53	627.6	2,172.8	6.06	91.9	318.0
Length = 2.50 ft	**3**	0.283	0.289	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	15.53	627.6	2,220.0	6.06	91.9	318.0
+D+L+H, LL Comb Run (LL*)					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.017	0.186	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.94	38.1	2,220.0	3.91	59.2	318.0
Length = 16.170 ft	**2**	0.256	0.204	1.00	1.00	1.00	1.00	0.979	1.00	1.00	1.00	17.87	721.9	2,818.8	4.28	64.9	318.0
Length = 2.50 ft	**3**	0.073	0.204	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.00	161.6	2,220.0	1.51	64.9	318.0
+D+L+H, LL Comb Run (LLL)					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.017	0.152	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.94	38.1	2,220.0	3.19	48.4	318.0
Length = 16.170 ft	**2**	0.289	0.289	1.00	1.00	1.00	1.00	0.979	1.00	1.00	1.00	15.53	627.6	2,172.8	6.06	91.9	318.0
Length = 2.50 ft	**3**	0.283	0.289	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	15.53	627.6	2,220.0	6.06	91.9	318.0
+D+Lr+H, LL Comb Run (**L)					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.064	0.094	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.36	176.3	2,775.0	2.47	37.4	397.5
Length = 16.170 ft	**2**	0.091	0.094	1.25	1.00	1.00	1.00	0.979	1.00	1.00	1.00	7.96	321.6	3,523.5	2.47	37.4	397.5
Length = 2.50 ft	**3**	0.058	0.094	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.00	161.6	2,775.0	1.51	37.4	397.5
+D+Lr+H, LL Comb Run (*L*)					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.064	0.094	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.36	176.3	2,775.0	2.47	37.4	397.5
Length = 16.170 ft	**2**	0.091	0.094	1.25	1.00	1.00	1.00	0.979	1.00	1.00	1.00	7.96	321.6	3,523.5	2.47	37.4	397.5
Length = 2.50 ft	**3**	0.058	0.094	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.00	161.6	2,775.0	1.51	37.4	397.5
+D+Lr+H, LL Comb Run (*LL)					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.064	0.094	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.36	176.3	2,775.0	2.47	37.4	397.5
Length = 16.170 ft	**2**	0.091	0.094	1.25	1.00	1.00	1.00	0.979	1.00	1.00	1.00	7.96	321.6	3,523.5	2.47	37.4	397.5
Length = 2.50 ft	**3**	0.058	0.094	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.00	161.6	2,775.0	1.51	37.4	397.5
+D+Lr+H, LL Comb Run (L**)					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.064	0.094	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.36	176.3	2,775.0	2.47	37.4	397.5
Length = 16.170 ft	**2**	0.091	0.094	1.25	1.00	1.00	1.00	0.979	1.00	1.00	1.00	7.96	321.6	3,523.5	2.47	37.4	397.5
Length = 2.50 ft	**3**	0.058	0.094	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.00	161.6	2,775.0	1.51	37.4	397.5
+D+Lr+H, LL Comb Run (L*L)					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0

DESCRIPTION: B2-17 OS 305

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios										Moment Values			Shear Values		
Segment Length	Span #	M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
Length = 2.0 ft	1	0.064	0.094	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.36	176.3	2,775.0	2.47	37.4	397.5
Length = 16.170 ft	2	0.091	0.094	1.25	1.00	1.00	1.00	0.979	1.00	1.00	1.00	7.96	321.6	3,523.5	2.47	37.4	397.5
Length = 2.50 ft	3	0.058	0.094	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.00	161.6	2,775.0	1.51	37.4	397.5
+D+Lr+H, LL Comb Run (LL*)					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.064	0.094	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.36	176.3	2,775.0	2.47	37.4	397.5
Length = 16.170 ft	2	0.091	0.094	1.25	1.00	1.00	1.00	0.979	1.00	1.00	1.00	7.96	321.6	3,523.5	2.47	37.4	397.5
Length = 2.50 ft	3	0.058	0.094	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.00	161.6	2,775.0	1.51	37.4	397.5
+D+Lr+H, LL Comb Run (LLL)					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.064	0.094	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.36	176.3	2,775.0	2.47	37.4	397.5
Length = 16.170 ft	2	0.091	0.094	1.25	1.00	1.00	1.00	0.979	1.00	1.00	1.00	7.96	321.6	3,523.5	2.47	37.4	397.5
Length = 2.50 ft	3	0.058	0.094	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.00	161.6	2,775.0	1.51	37.4	397.5
+D+S+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.050	0.180	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.14	127.0	2,553.0	4.35	65.9	365.7
Length = 16.170 ft	2	0.206	0.241	1.15	1.00	1.00	1.00	0.979	1.00	1.00	1.00	16.50	666.6	3,241.6	5.82	88.1	365.7
Length = 2.50 ft	3	0.237	0.241	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	14.98	605.2	2,553.0	5.80	88.1	365.7
+D+0.750Lr+0.750L+H, LL Co					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.064	0.090	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.36	176.3	2,775.0	2.37	35.9	397.5
Length = 16.170 ft	2	0.188	0.188	1.25	1.00	1.00	1.00	0.979	1.00	1.00	1.00	12.65	511.1	2,716.1	4.92	74.6	397.5
Length = 2.50 ft	3	0.184	0.188	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.65	511.1	2,775.0	4.92	74.6	397.5
+D+0.750Lr+0.750L+H, LL Co					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.064	0.141	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.36	176.3	2,775.0	3.71	56.2	397.5
Length = 16.170 ft	2	0.162	0.141	1.25	1.00	1.00	1.00	0.979	1.00	1.00	1.00	14.09	569.2	3,523.5	3.71	56.2	397.5
Length = 2.50 ft	3	0.058	0.141	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.00	161.6	2,775.0	1.51	56.2	397.5
+D+0.750Lr+0.750L+H, LL Co					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.064	0.121	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.36	176.3	2,775.0	3.17	48.0	397.5
Length = 16.170 ft	2	0.188	0.188	1.25	1.00	1.00	1.00	0.979	1.00	1.00	1.00	12.65	511.1	2,716.1	4.92	74.6	397.5
Length = 2.50 ft	3	0.184	0.188	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.65	511.1	2,775.0	4.92	74.6	397.5
+D+0.750Lr+0.750L+H, LL Co					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.026	0.088	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.80	72.6	2,775.0	2.31	35.0	397.5
Length = 16.170 ft	2	0.106	0.099	1.25	1.00	1.00	1.00	0.979	1.00	1.00	1.00	9.27	374.4	3,523.5	2.58	39.2	397.5
Length = 2.50 ft	3	0.058	0.099	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.00	161.6	2,775.0	1.51	39.2	397.5
+D+0.750Lr+0.750L+H, LL Co					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.026	0.068	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.80	72.6	2,775.0	1.78	26.9	397.5
Length = 16.170 ft	2	0.188	0.188	1.25	1.00	1.00	1.00	0.979	1.00	1.00	1.00	12.65	511.1	2,716.1	4.92	74.6	397.5
Length = 2.50 ft	3	0.184	0.188	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.65	511.1	2,775.0	4.92	74.6	397.5
+D+0.750Lr+0.750L+H, LL Co					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.026	0.135	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.80	72.6	2,775.0	3.55	53.7	397.5
Length = 16.170 ft	2	0.176	0.146	1.25	1.00	1.00	1.00	0.979	1.00	1.00	1.00	15.39	621.6	3,523.5	3.82	57.9	397.5
Length = 2.50 ft	3	0.058	0.146	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.00	161.6	2,775.0	1.51	57.9	397.5
+D+0.750Lr+0.750L+H, LL Co					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.026	0.115	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.80	72.6	2,775.0	3.01	45.6	397.5
Length = 16.170 ft	2	0.188	0.188	1.25	1.00	1.00	1.00	0.979	1.00	1.00	1.00	12.65	511.1	2,716.1	4.92	74.6	397.5
Length = 2.50 ft	3	0.184	0.188	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.65	511.1	2,775.0	4.92	74.6	397.5
+D+0.750L+0.750S+H, LL Cor					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.055	0.139	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.45	139.3	2,553.0	3.35	50.7	365.7
Length = 16.170 ft	2	0.338	0.337	1.15	1.00	1.00	1.00	0.979	1.00	1.00	1.00	20.88	843.7	2,498.8	8.15	123.4	365.7
Length = 2.50 ft	3	0.330	0.337	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	20.88	843.7	2,553.0	8.15	123.4	365.7

DESCRIPTION: B2-17 OS 305

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+D+0.750L+0.750S+H, LL Cor					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.055	0.212	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.45	139.3	2,553.0	5.12	77.5	365.7
Length = 16.170 ft	2	0.254	0.257	1.15	1.00	1.00	1.00	0.979	1.00	1.00	1.00	20.40	824.4	3,241.6	6.20	94.0	365.7
Length = 2.50 ft	3	0.194	0.257	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.23	494.3	2,553.0	4.73	94.0	365.7
+D+0.750L+0.750S+H, LL Cor					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.055	0.190	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.45	139.3	2,553.0	4.58	69.4	365.7
Length = 16.170 ft	2	0.338	0.337	1.15	1.00	1.00	1.00	0.979	1.00	1.00	1.00	20.88	843.7	2,498.8	8.15	123.4	365.7
Length = 2.50 ft	3	0.330	0.337	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	20.88	843.7	2,553.0	8.15	123.4	365.7
+D+0.750L+0.750S+H, LL Cor					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.014	0.154	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.88	35.7	2,553.0	3.72	56.4	365.7
Length = 16.170 ft	2	0.196	0.212	1.15	1.00	1.00	1.00	0.979	1.00	1.00	1.00	15.75	636.5	3,241.6	5.13	77.7	365.7
Length = 2.50 ft	3	0.194	0.212	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.23	494.3	2,553.0	4.73	77.7	365.7
+D+0.750L+0.750S+H, LL Cor					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.014	0.132	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.88	35.7	2,553.0	3.19	48.3	365.7
Length = 16.170 ft	2	0.338	0.337	1.15	1.00	1.00	1.00	0.979	1.00	1.00	1.00	20.88	843.7	2,498.8	8.15	123.4	365.7
Length = 2.50 ft	3	0.330	0.337	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	20.88	843.7	2,553.0	8.15	123.4	365.7
+D+0.750L+0.750S+H, LL Cor					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.014	0.205	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.88	35.7	2,553.0	4.96	75.1	365.7
Length = 16.170 ft	2	0.272	0.264	1.15	1.00	1.00	1.00	0.979	1.00	1.00	1.00	21.80	880.8	3,241.6	6.36	96.4	365.7
Length = 2.50 ft	3	0.194	0.264	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.23	494.3	2,553.0	4.73	96.4	365.7
+D+0.750L+0.750S+H, LL Cor					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.014	0.183	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.88	35.7	2,553.0	4.42	67.0	365.7
Length = 16.170 ft	2	0.338	0.337	1.15	1.00	1.00	1.00	0.979	1.00	1.00	1.00	20.88	843.7	2,498.8	8.15	123.4	365.7
Length = 2.50 ft	3	0.330	0.337	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	20.88	843.7	2,553.0	8.15	123.4	365.7
+D+0.60W+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.050	0.074	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.36	176.3	3,552.0	2.47	37.4	508.8
Length = 16.170 ft	2	0.071	0.074	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	7.96	321.6	4,510.1	2.47	37.4	508.8
Length = 2.50 ft	3	0.046	0.074	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.00	161.6	3,552.0	1.51	37.4	508.8
+D+0.750Lr+0.750L+0.450W+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.050	0.071	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.36	176.3	3,552.0	2.37	35.9	508.8
Length = 16.170 ft	2	0.147	0.147	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	12.65	511.1	3,476.5	4.92	74.6	508.8
Length = 2.50 ft	3	0.144	0.147	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.65	511.1	3,552.0	4.92	74.6	508.8
+D+0.750Lr+0.750L+0.450W+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.050	0.110	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.36	176.3	3,552.0	3.71	56.2	508.8
Length = 16.170 ft	2	0.126	0.110	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	14.09	569.2	4,510.1	3.71	56.2	508.8
Length = 2.50 ft	3	0.046	0.110	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.00	161.6	3,552.0	1.51	56.2	508.8
+D+0.750Lr+0.750L+0.450W+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.050	0.094	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.36	176.3	3,552.0	3.17	48.0	508.8
Length = 16.170 ft	2	0.147	0.147	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	12.65	511.1	3,476.5	4.92	74.6	508.8
Length = 2.50 ft	3	0.144	0.147	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.65	511.1	3,552.0	4.92	74.6	508.8
+D+0.750Lr+0.750L+0.450W+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.020	0.069	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.80	72.6	3,552.0	2.31	35.0	508.8
Length = 16.170 ft	2	0.083	0.077	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	9.27	374.4	4,510.1	2.58	39.2	508.8
Length = 2.50 ft	3	0.046	0.077	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.00	161.6	3,552.0	1.51	39.2	508.8
+D+0.750Lr+0.750L+0.450W+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.020	0.053	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.80	72.6	3,552.0	1.78	26.9	508.8
Length = 16.170 ft	2	0.147	0.147	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	12.65	511.1	3,476.5	4.92	74.6	508.8

DESCRIPTION: B2-17 OS 305

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios										Moment Values			Shear Values		
Segment Length	Span #	M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
Length = 2.50 ft	**3**	0.144	0.147	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.65	511.1	3,552.0	4.92	74.6	508.8
+D+0.750Lr+0.750L+0.450W+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.020	0.106	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.80	72.6	3,552.0	3.55	53.7	508.8
Length = 16.170 ft	**2**	0.138	0.114	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	15.39	621.6	4,510.1	3.82	57.9	508.8
Length = 2.50 ft	**3**	0.046	0.114	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.00	161.6	3,552.0	1.51	57.9	508.8
+D+0.750Lr+0.750L+0.450W+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.020	0.090	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.80	72.6	3,552.0	3.01	45.6	508.8
Length = 16.170 ft	**2**	0.147	0.147	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	12.65	511.1	3,476.5	4.92	74.6	508.8
Length = 2.50 ft	**3**	0.144	0.147	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.65	511.1	3,552.0	4.92	74.6	508.8
+D+0.750L+0.750S+0.450W+l					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.039	0.100	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.45	139.3	3,552.0	3.35	50.7	508.8
Length = 16.170 ft	**2**	0.243	0.243	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	20.88	843.7	3,476.5	8.15	123.4	508.8
Length = 2.50 ft	**3**	0.238	0.243	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	20.88	843.7	3,552.0	8.15	123.4	508.8
+D+0.750L+0.750S+0.450W+l					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.039	0.152	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.45	139.3	3,552.0	5.12	77.5	508.8
Length = 16.170 ft	**2**	0.183	0.185	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	20.40	824.4	4,510.1	6.20	94.0	508.8
Length = 2.50 ft	**3**	0.139	0.185	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.23	494.3	3,552.0	4.73	94.0	508.8
+D+0.750L+0.750S+0.450W+l					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.039	0.136	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.45	139.3	3,552.0	4.58	69.4	508.8
Length = 16.170 ft	**2**	0.243	0.243	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	20.88	843.7	3,476.5	8.15	123.4	508.8
Length = 2.50 ft	**3**	0.238	0.243	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	20.88	843.7	3,552.0	8.15	123.4	508.8
+D+0.750L+0.750S+0.450W+l					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.010	0.111	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.88	35.7	3,552.0	3.72	56.4	508.8
Length = 16.170 ft	**2**	0.141	0.153	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	15.75	636.5	4,510.1	5.13	77.7	508.8
Length = 2.50 ft	**3**	0.139	0.153	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.23	494.3	3,552.0	4.73	77.7	508.8
+D+0.750L+0.750S+0.450W+l					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.010	0.095	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.88	35.7	3,552.0	3.19	48.3	508.8
Length = 16.170 ft	**2**	0.243	0.243	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	20.88	843.7	3,476.5	8.15	123.4	508.8
Length = 2.50 ft	**3**	0.238	0.243	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	20.88	843.7	3,552.0	8.15	123.4	508.8
+D+0.750L+0.750S+0.450W+l					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.010	0.148	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.88	35.7	3,552.0	4.96	75.1	508.8
Length = 16.170 ft	**2**	0.195	0.189	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	21.80	880.8	4,510.1	6.36	96.4	508.8
Length = 2.50 ft	**3**	0.139	0.189	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.23	494.3	3,552.0	4.73	96.4	508.8
+D+0.750L+0.750S+0.450W+l					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.010	0.132	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.88	35.7	3,552.0	4.42	67.0	508.8
Length = 16.170 ft	**2**	0.243	0.243	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	20.88	843.7	3,476.5	8.15	123.4	508.8
Length = 2.50 ft	**3**	0.238	0.243	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	20.88	843.7	3,552.0	8.15	123.4	508.8
+0.60D+0.60W+0.60H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.030	0.044	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.62	105.8	3,552.0	1.48	22.5	508.8
Length = 16.170 ft	**2**	0.043	0.044	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	4.78	193.0	4,510.1	1.48	22.5	508.8
Length = 2.50 ft	**3**	0.027	0.044	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.40	97.0	3,552.0	0.91	22.5	508.8
+D+0.70E+0.60H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.097	0.133	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	8.56	346.0	3,552.0	4.47	67.8	508.8
Length = 16.170 ft	**2**	0.100	0.133	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	8.56	346.0	3,476.5	2.73	67.8	508.8
Length = 2.50 ft	**3**	0.046	0.133	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.00	161.6	3,552.0	1.51	67.8	508.8
+D-0.70E+0.60H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.002	0.066	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.16	6.6	3,552.0	2.21	33.5	508.8

DESCRIPTION: B2-17 OS 305

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios										Moment Values			Shear Values		
Segment Length	Span #	M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
Length = 16.170 ft	**2**	0.091	0.080	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	10.13	409.5	4,510.1	2.69	40.7	508.8
Length = 2.50 ft	**3**	0.046	0.080	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.00	161.6	3,552.0	1.51	40.7	508.8
+D+0.750L+0.750S+0.5250E+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.075	0.108	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	6.60	266.6	3,552.0	3.64	55.2	508.8
Length = 16.170 ft	**2**	0.243	0.243	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	20.88	843.7	3,476.5	8.15	123.4	508.8
Length = 2.50 ft	**3**	0.238	0.243	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	20.88	843.7	3,552.0	8.15	123.4	508.8
+D+0.750L+0.750S+0.5250E+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.075	0.158	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	6.60	266.6	3,552.0	5.31	80.5	508.8
Length = 16.170 ft	**2**	0.168	0.179	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	18.73	756.6	4,510.1	6.01	91.1	508.8
Length = 2.50 ft	**3**	0.139	0.179	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.23	494.3	3,552.0	4.73	91.1	508.8
+D+0.750L+0.750S+0.5250E+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.075	0.142	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	6.60	266.6	3,552.0	4.78	72.4	508.8
Length = 16.170 ft	**2**	0.243	0.243	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	20.88	843.7	3,476.5	8.15	123.4	508.8
Length = 2.50 ft	**3**	0.238	0.243	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	20.88	843.7	3,552.0	8.15	123.4	508.8
+D+0.750L+0.750S+0.5250E+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.046	0.117	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.03	162.9	3,552.0	3.92	59.4	508.8
Length = 16.170 ft	**2**	0.125	0.147	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	14.00	565.8	4,510.1	4.93	74.7	508.8
Length = 2.50 ft	**3**	0.139	0.147	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.23	494.3	3,552.0	4.73	74.7	508.8
+D+0.750L+0.750S+0.5250E+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.046	0.101	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.03	162.9	3,552.0	3.38	51.3	508.8
Length = 16.170 ft	**2**	0.243	0.243	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	20.88	843.7	3,476.5	8.15	123.4	508.8
Length = 2.50 ft	**3**	0.238	0.243	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	20.88	843.7	3,552.0	8.15	123.4	508.8
+D+0.750L+0.750S+0.5250E+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.046	0.153	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.03	162.9	3,552.0	5.15	78.1	508.8
Length = 16.170 ft	**2**	0.180	0.184	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	20.09	811.7	4,510.1	6.17	93.5	508.8
Length = 2.50 ft	**3**	0.139	0.184	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.23	494.3	3,552.0	4.73	93.5	508.8
+D+0.750L+0.750S+0.5250E+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.046	0.138	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.03	162.9	3,552.0	4.62	70.0	508.8
Length = 16.170 ft	**2**	0.243	0.243	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	20.88	843.7	3,476.5	8.15	123.4	508.8
Length = 2.50 ft	**3**	0.238	0.243	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	20.88	843.7	3,552.0	8.15	123.4	508.8
+D+0.750L+0.750S-0.5250E+I					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.003	0.094	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.30	12.0	3,552.0	3.15	47.8	508.8
Length = 16.170 ft	**2**	0.243	0.243	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	20.88	843.7	3,476.5	8.15	123.4	508.8
Length = 2.50 ft	**3**	0.238	0.243	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	20.88	843.7	3,552.0	8.15	123.4	508.8
+D+0.750L+0.750S-0.5250E+I					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.003	0.147	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.30	12.0	3,552.0	4.92	74.6	508.8
Length = 16.170 ft	**2**	0.198	0.191	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	22.12	893.9	4,510.1	6.40	97.0	508.8
Length = 2.50 ft	**3**	0.139	0.191	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.23	494.3	3,552.0	4.73	97.0	508.8
+D+0.750L+0.750S-0.5250E+I					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.003	0.131	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.30	12.0	3,552.0	4.39	66.5	508.8
Length = 16.170 ft	**2**	0.243	0.243	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	20.88	843.7	3,476.5	8.15	123.4	508.8
Length = 2.50 ft	**3**	0.238	0.243	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	20.88	843.7	3,552.0	8.15	123.4	508.8
+D+0.750L+0.750S-0.5250E+I					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	**1**	0.020	0.105	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.27	91.6	4,608.0	3.53	53.5	508.8
Length = 16.170 ft	**2**	0.157	0.158	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	17.56	709.5	4,510.1	5.32	80.6	508.8
Length = 2.50 ft	**3**	0.139	0.158	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.23	494.3	3,552.0	4.73	80.6	508.8
+D+0.750L+0.750S-0.5250E+I					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0

DESCRIPTION: B2-17 OS 305

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios										Moment Values			Shear Values		
Segment Length	Span #	M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
Length = 2.0 ft	1	0.020	0.089	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.27	91.6	4,608.0	2.99	45.4	508.8
Length = 16.170 ft	2	0.243	0.243	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	20.88	843.7	3,476.5	8.15	123.4	508.8
Length = 2.50 ft	3	0.238	0.243	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	20.88	843.7	3,552.0	8.15	123.4	508.8
+D+0.750L+0.750S-0.5250E+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.020	0.142	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.27	91.6	4,608.0	4.76	72.2	508.8
Length = 16.170 ft	2	0.211	0.195	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	23.56	951.8	4,510.1	6.56	99.4	508.8
Length = 2.50 ft	3	0.139	0.195	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.23	494.3	3,552.0	4.73	99.4	508.8
+D+0.750L+0.750S-0.5250E+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.020	0.126	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.27	91.6	4,608.0	4.23	64.1	508.8
Length = 16.170 ft	2	0.243	0.243	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	20.88	843.7	3,476.5	8.15	123.4	508.8
Length = 2.50 ft	3	0.238	0.243	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	20.88	843.7	3,552.0	8.15	123.4	508.8
+0.60D+0.70E+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.078	0.105	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	6.82	275.5	3,552.0	3.52	53.4	508.8
Length = 16.170 ft	2	0.079	0.105	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	6.82	275.5	3,476.5	1.74	53.4	508.8
Length = 2.50 ft	3	0.027	0.105	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.40	97.0	3,552.0	0.91	53.4	508.8
+0.60D-0.70E+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.014	0.036	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.58	63.9	4,608.0	1.22	18.5	508.8
Length = 16.170 ft	2	0.063	0.051	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	7.01	283.3	4,510.1	1.72	26.0	508.8
Length = 2.50 ft	3	0.027	0.051	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.40	97.0	3,552.0	0.91	26.0	508.8
+1.140D+0.70E					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.104	0.143	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	9.17	370.7	3,552.0	4.80	72.8	508.8
Length = 16.170 ft	2	0.107	0.143	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	9.17	370.7	3,476.5	3.08	72.8	508.8
Length = 2.50 ft	3	0.052	0.143	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.56	184.3	3,552.0	1.72	72.8	508.8
+1.140D-0.70E					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.009	0.076	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.77	31.3	3,552.0	2.56	38.7	508.8
Length = 16.170 ft	2	0.101	0.090	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	11.24	454.0	4,510.1	3.02	45.8	508.8
Length = 2.50 ft	3	0.052	0.090	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.56	184.3	3,552.0	1.72	45.8	508.8
+1.105D+0.750L+0.750S+0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.080	0.116	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	7.06	285.1	3,552.0	3.89	59.0	508.8
Length = 16.170 ft	2	0.248	0.247	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	21.30	860.7	3,476.5	8.30	125.8	508.8
Length = 2.50 ft	3	0.242	0.247	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	21.30	860.7	3,552.0	8.30	125.8	508.8
+1.105D+0.750L+0.750S+0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.080	0.166	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	7.06	285.1	3,552.0	5.57	84.4	508.8
Length = 16.170 ft	2	0.175	0.187	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	19.56	790.3	4,510.1	6.26	94.9	508.8
Length = 2.50 ft	3	0.144	0.187	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.65	511.3	3,552.0	4.89	94.9	508.8
+1.105D+0.750L+0.750S+0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.080	0.150	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	7.06	285.1	3,552.0	5.04	76.3	508.8
Length = 16.170 ft	2	0.248	0.247	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	21.30	860.7	3,476.5	8.30	125.8	508.8
Length = 2.50 ft	3	0.242	0.247	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	21.30	860.7	3,552.0	8.30	125.8	508.8
+1.105D+0.750L+0.750S+0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.051	0.124	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.49	181.5	3,552.0	4.18	63.3	508.8
Length = 16.170 ft	2	0.133	0.154	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	14.83	599.1	4,510.1	5.19	78.6	508.8
Length = 2.50 ft	3	0.144	0.154	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.65	511.3	3,552.0	4.89	78.6	508.8
+1.105D+0.750L+0.750S+0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.051	0.108	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.49	181.5	3,552.0	3.64	55.2	508.8
Length = 16.170 ft	2	0.248	0.247	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	21.30	860.7	3,476.5	8.30	125.8	508.8
Length = 2.50 ft	3	0.242	0.247	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	21.30	860.7	3,552.0	8.30	125.8	508.8

DESCRIPTION: B2-17 OS 305

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+1.105D+0.750L+0.750S+0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.051	0.161	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.49	181.5	3,552.0	5.41	82.0	508.8
Length = 16.170 ft	2	0.187	0.191	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	20.92	845.1	4,510.1	6.42	97.3	508.8
Length = 2.50 ft	3	0.144	0.191	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.65	511.3	3,552.0	4.89	97.3	508.8
+1.105D+0.750L+0.750S+0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.051	0.145	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.49	181.5	3,552.0	4.88	73.9	508.8
Length = 16.170 ft	2	0.248	0.247	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	21.30	860.7	3,476.5	8.30	125.8	508.8
Length = 2.50 ft	3	0.242	0.247	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	21.30	860.7	3,552.0	8.30	125.8	508.8
+1.105D+0.750L+0.750S-0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.009	0.102	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.76	30.5	3,552.0	3.41	51.7	508.8
Length = 16.170 ft	2	0.248	0.247	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	21.30	860.7	3,476.5	8.30	125.8	508.8
Length = 2.50 ft	3	0.242	0.247	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	21.30	860.7	3,552.0	8.30	125.8	508.8
+1.105D+0.750L+0.750S-0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.009	0.154	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.76	30.5	3,552.0	5.18	78.5	508.8
Length = 16.170 ft	2	0.206	0.198	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	22.94	927.0	4,510.1	6.65	100.8	508.8
Length = 2.50 ft	3	0.144	0.198	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.65	511.3	3,552.0	4.89	100.8	508.8
+1.105D+0.750L+0.750S-0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.009	0.138	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.76	30.5	3,552.0	4.65	70.4	508.8
Length = 16.170 ft	2	0.248	0.247	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	21.30	860.7	3,476.5	8.30	125.8	508.8
Length = 2.50 ft	3	0.242	0.247	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	21.30	860.7	3,552.0	8.30	125.8	508.8
+1.105D+0.750L+0.750S-0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.016	0.113	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.81	73.1	4,608.0	3.79	57.4	508.8
Length = 16.170 ft	2	0.164	0.166	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	18.36	741.8	4,510.1	5.58	84.5	508.8
Length = 2.50 ft	3	0.144	0.166	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.65	511.3	3,552.0	4.89	84.5	508.8
+1.105D+0.750L+0.750S-0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.016	0.097	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.81	73.1	4,608.0	3.25	49.3	508.8
Length = 16.170 ft	2	0.248	0.247	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	21.30	860.7	3,476.5	8.30	125.8	508.8
Length = 2.50 ft	3	0.242	0.247	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	21.30	860.7	3,552.0	8.30	125.8	508.8
+1.105D+0.750L+0.750S-0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.016	0.150	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.81	73.1	4,608.0	5.02	76.1	508.8
Length = 16.170 ft	2	0.218	0.203	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	24.37	984.7	4,510.1	6.81	103.2	508.8
Length = 2.50 ft	3	0.144	0.203	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.65	511.3	3,552.0	4.89	103.2	508.8
+1.105D+0.750L+0.750S-0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.016	0.134	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.81	73.1	4,608.0	4.49	68.0	508.8
Length = 16.170 ft	2	0.248	0.247	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	21.30	860.7	3,476.5	8.30	125.8	508.8
Length = 2.50 ft	3	0.242	0.247	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	21.30	860.7	3,552.0	8.30	125.8	508.8
+0.460D+0.70E					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.071	0.095	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	6.21	250.8	3,552.0	3.19	48.3	508.8
Length = 16.170 ft	2	0.072	0.095	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	6.21	250.8	3,476.5	1.40	48.3	508.8
Length = 2.50 ft	3	0.021	0.095	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.84	74.4	3,552.0	0.69	48.3	508.8
+0.460D-0.70E					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 2.0 ft	1	0.019	0.038	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.19	88.6	4,608.0	1.27	19.2	508.8
Length = 16.170 ft	2	0.053	0.041	1.60	1.00	1.00	1.00	0.979	1.00	1.00	1.00	5.94	240.1	4,510.1	1.38	20.8	508.8
Length = 2.50 ft	3	0.021	0.041	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.84	74.4	3,552.0	0.69	20.8	508.8

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+H, LI	-0.0814	0.000

DESCRIPTION: B2-17 OS 305

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750L+0.750S+0.450W+H, Ll	2	0.2009	7.745		0.0000	0.000
	3	0.0000	7.745	+D+L+H, LL Comb Run (LL*)	-0.0739	2.500

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4
Max Upward from all Load Conditions		10.567	17.803	
Max Upward from Load Combinations		10.567	17.803	
Max Upward from Load Cases		5.579	8.879	
Max Downward from all Load Conditio		-3.371	-0.371	
Max Downward from Load Cases (Resis		-3.371	-0.371	
+D+H		5.579	5.045	
+D+L+H, LL Comb Run (**L)		4.865	10.684	
+D+L+H, LL Comb Run (*L*)		7.600	7.067	
+D+L+H, LL Comb Run (*LL)		6.887	12.705	
+D+L+H, LL Comb Run (L**)		3.907	5.257	
+D+L+H, LL Comb Run (L*L)		3.194	10.895	
+D+L+H, LL Comb Run (LL*)		5.928	7.278	
+D+L+H, LL Comb Run (LLL)		5.215	12.916	
+D+Lr+H, LL Comb Run (**L)		5.579	5.045	
+D+Lr+H, LL Comb Run (*L*)		5.579	5.045	
+D+Lr+H, LL Comb Run (*LL)		5.579	5.045	
+D+Lr+H, LL Comb Run (L**)		5.579	5.045	
+D+Lr+H, LL Comb Run (L*L)		5.579	5.045	
+D+Lr+H, LL Comb Run (LL*)		5.579	5.045	
+D+Lr+H, LL Comb Run (LLL)		5.579	5.045	
+D+S+H		7.848	13.925	
+D+0.750Lr+0.750L+H, LL Comb Run (*		5.044	9.274	
+D+0.750Lr+0.750L+H, LL Comb Run (*		7.094	6.561	
+D+0.750Lr+0.750L+H, LL Comb Run (*		6.560	10.790	
+D+0.750Lr+0.750L+H, LL Comb Run (L		4.325	5.204	
+D+0.750Lr+0.750L+H, LL Comb Run (L		3.790	9.433	
+D+0.750Lr+0.750L+H, LL Comb Run (L		5.841	6.720	
+D+0.750Lr+0.750L+H, LL Comb Run (L		5.306	10.949	
+D+0.750L+0.750S+H, LL Comb Run (**		6.746	15.934	
+D+0.750L+0.750S+H, LL Comb Run (*L		8.797	13.221	
+D+0.750L+0.750S+H, LL Comb Run (*L		8.262	17.450	
+D+0.750L+0.750S+H, LL Comb Run (L*		6.027	11.864	
+D+0.750L+0.750S+H, LL Comb Run (L*		5.492	16.092	
+D+0.750L+0.750S+H, LL Comb Run (LL		7.543	13.380	
+D+0.750L+0.750S+H, LL Comb Run (LL		7.008	17.608	
+D+0.60W+H		5.579	5.045	
+D+0.750Lr+0.750L+0.450W+H, LL Comb		5.044	9.274	
+D+0.750Lr+0.750L+0.450W+H, LL Comb		7.094	6.561	
+D+0.750Lr+0.750L+0.450W+H, LL Comb		6.560	10.790	
+D+0.750Lr+0.750L+0.450W+H, LL Comb		4.325	5.204	
+D+0.750Lr+0.750L+0.450W+H, LL Comb		3.790	9.433	
+D+0.750Lr+0.750L+0.450W+H, LL Comb		5.841	6.720	
+D+0.750Lr+0.750L+0.450W+H, LL Comb		5.306	10.949	
+D+0.750L+0.750S+0.450W+H, LL Comb		6.746	15.934	
+D+0.750L+0.750S+0.450W+H, LL Comb		8.797	13.221	
+D+0.750L+0.750S+0.450W+H, LL Comb		8.262	17.450	
+D+0.750L+0.750S+0.450W+H, LL Comb		6.027	11.864	
+D+0.750L+0.750S+0.450W+H, LL Comb		5.492	16.092	
+D+0.750L+0.750S+0.450W+H, LL Comb		7.543	13.380	
+D+0.750L+0.750S+0.450W+H, LL Comb		7.008	17.608	
+0.60D+0.60W+0.60H		3.347	3.027	
+D+0.70E+0.60H		7.938	4.786	
+D-0.70E+0.60H		3.219	5.305	
+D+0.750L+0.750S+0.5250E+H, LL Comb		8.516	15.739	

DESCRIPTION: B2-17 OS 305

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4
+D+0.750L+0.750S+0.5250E+H, LL Comb		10.567	13.026	
+D+0.750L+0.750S+0.5250E+H, LL Comb		10.032	17.255	
+D+0.750L+0.750S+0.5250E+H, LL Comb		7.797	11.669	
+D+0.750L+0.750S+0.5250E+H, LL Comb		7.262	15.897	
+D+0.750L+0.750S+0.5250E+H, LL Comb		9.313	13.185	
+D+0.750L+0.750S+0.5250E+H, LL Comb		8.778	17.413	
+D+0.750L+0.750S-0.5250E+H, LL Comb		4.976	16.128	
+D+0.750L+0.750S-0.5250E+H, LL Comb		7.027	13.416	
+D+0.750L+0.750S-0.5250E+H, LL Comb		6.492	17.644	
+D+0.750L+0.750S-0.5250E+H, LL Comb		4.257	12.058	
+D+0.750L+0.750S-0.5250E+H, LL Comb		3.723	16.287	
+D+0.750L+0.750S-0.5250E+H, LL Comb		5.773	13.574	
+D+0.750L+0.750S-0.5250E+H, LL Comb		5.238	17.803	
+0.60D+0.70E+H		5.707	2.768	
+0.60D-0.70E+H		0.987	3.287	
D Only		5.579	5.045	
L Only, LL Comb Run (**L)		-0.713	5.638	
L Only, LL Comb Run (*L*)		2.021	2.021	
L Only, LL Comb Run (*LL)		1.308	7.659	
L Only, LL Comb Run (L**)		-1.672	0.212	
L Only, LL Comb Run (L*L)		-2.385	5.850	
L Only, LL Comb Run (LL*)		0.350	2.233	
L Only, LL Comb Run (LLL)		-0.363	7.871	
S Only		2.270	8.879	
E Only		3.371	-0.371	
E Only * -1.0		-3.371	0.371	
H Only				

Wood Beam

Project File: beam calcs with overstrength.ec6

DESCRIPTION: B2-8 OS 303

CODE REFERENCES

Calculations per NDS 2018, IBC 2021, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

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

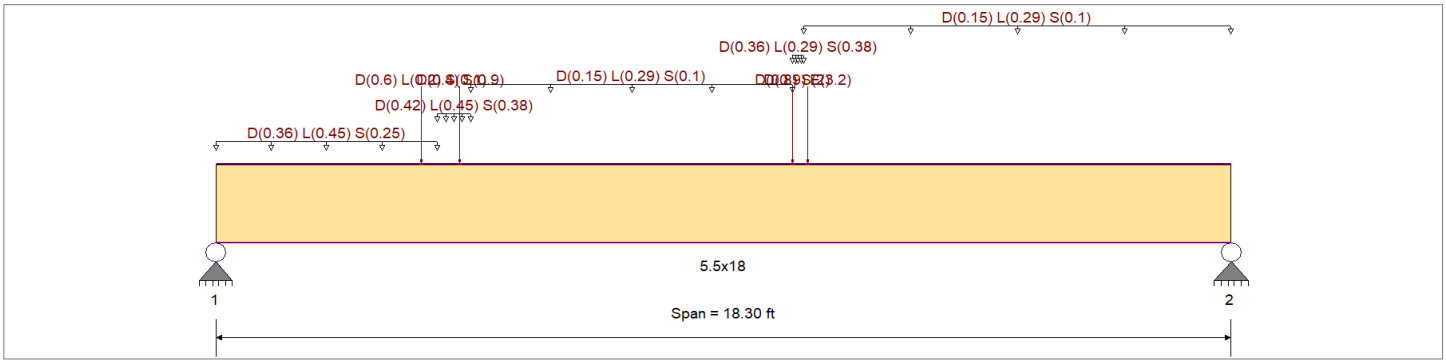
Wood Species : 24-V4 GLB OS
Wood Grade : GLB - Western

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	318.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	ksi
Eminbend - yy	ksi
Density	35.0 pcf



Applied Loads

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

Beam self weight calculated and added to loading
Load for Span Number 1
Uniform Load : D = 0.360, L = 0.450, S = 0.250 k/ft, Extent = 0.0 -->> 4.0 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.420, L = 0.450, S = 0.380 k/ft, Extent = 4.0 -->> 4.60 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.150, L = 0.290, S = 0.10 k/ft, Extent = 4.60 -->> 10.40 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.360, L = 0.290, S = 0.380 k/ft, Extent = 10.40 -->> 10.60 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.150, L = 0.290, S = 0.10 k/ft, Extent = 10.60 -->> 18.30 ft, Tributary Width = 1.0 ft
Point Load : D = 0.60, L = 0.20, S = 0.10 k @ 3.70 ft
Point Load : D = 0.40, S = 0.90 k @ 4.40 ft
Point Load : D = 0.80, S = 2.0 k @ 10.40 ft
Point Load : D = 0.90, E = 3.20 k @ 10.670 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.496 : 1	Maximum Shear Stress Ratio	=	0.318 : 1
Section used for this span		5.5x18	Section used for this span		5.5x18
fb: Actual	=	1,588.58 psi	fv: Actual	=	116.12 psi
F'b	=	3,201.78 psi	F'v	=	365.70 psi
Load Combination		+D+0.750L+0.750S+H	Load Combination		+D+0.750L+0.750S+H
Location of maximum on span	=	10.352 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	0.189 in	Ratio =	1160 >=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.559 in	Ratio =	392 >=180	Span: 1 : +D+0.750L+0.750S+0.5250E+H
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+D+H														0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.283	0.181	0.90	1.00	1.00	1.00	0.967	1.00	1.00	1.00	17.57	709.8	2,505.7	3.42	51.8	286.2

DESCRIPTION: B2-8 OS 303

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+D+L+H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.445	0.296	1.00	1.00	1.00	1.00	0.967	1.00	1.00	1.00	30.65	1,238.4	2,784.2	6.22	94.2	318.0
+D+Lr+H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.204	0.130	1.25	1.00	1.00	1.00	0.967	1.00	1.00	1.00	17.57	709.8	3,480.2	3.42	51.8	397.5
+D+S+H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.424	0.260	1.15	1.00	1.00	1.00	0.967	1.00	1.00	1.00	33.58	1,356.8	3,201.8	6.28	95.2	365.7
+D+0.750Lr+0.750L+H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.317	0.210	1.25	1.00	1.00	1.00	0.967	1.00	1.00	1.00	27.35	1,105.0	3,480.2	5.52	83.6	397.5
+D+0.750L+0.750S+H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.496	0.318	1.15	1.00	1.00	1.00	0.967	1.00	1.00	1.00	39.32	1,588.6	3,201.8	7.66	116.1	365.7
+D+0.60W+H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.159	0.102	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	17.57	709.8	4,454.6	3.42	51.8	508.8
+D+0.750Lr+0.750L+0.450W+					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.248	0.164	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	27.35	1,105.0	4,454.6	5.52	83.6	508.8
+D+0.750L+0.750S+0.450W+I					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.357	0.228	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	39.32	1,588.6	4,454.6	7.66	116.1	508.8
+0.60D+0.60W+0.60H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.096	0.061	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	10.54	425.9	4,454.6	2.05	31.1	508.8
+D+0.70E+0.60H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.248	0.130	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	27.35	1,104.9	4,454.6	4.36	66.0	508.8
+D-0.70E+0.60H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.086	0.074	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	9.52	384.8	4,454.6	2.49	37.7	508.8
+D+0.750L+0.750S+0.5250E+					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.422	0.249	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	46.58	1,882.0	4,454.6	8.36	126.7	508.8
+D+0.750L+0.750S-0.5250E+I					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.294	0.207	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	32.40	1,309.2	4,454.6	6.96	105.5	508.8
+0.60D+0.70E+H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.185	0.089	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	20.37	823.2	4,454.6	2.99	45.3	508.8
+0.60D-0.70E+H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.036	0.040	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	3.93	158.6	4,454.6	1.36	20.6	508.8
+1.140D+0.70E					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.270	0.144	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	29.79	1,203.5	4,454.6	4.83	73.2	508.8
+1.140D-0.70E					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.106	0.088	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	11.69	472.2	4,454.6	2.97	44.9	508.8
+1.105D+0.750L+0.750S+0.52					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.439	0.260	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	48.42	1,956.5	4,454.6	8.72	132.2	508.8
+1.105D+0.750L+0.750S-0.52					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.310	0.218	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	34.21	1,382.3	4,454.6	7.32	111.0	508.8
+0.460D+0.70E					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.163	0.076	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	17.93	724.6	4,454.6	2.54	38.5	508.8
+0.460D-0.70E					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.019	0.037	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	2.12	85.6	4,454.6	1.26	19.1	508.8

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+H	1	0.5591	9.217		0.0000	0.000

DESCRIPTION: B2-8 OS 303

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	9.700	7.832
Max Upward from Load Combinations	9.700	7.832
Max Upward from Load Cases	3.986	2.944
Max Downward from all Load Conditio	-1.334	-1.866
Max Downward from Load Cases (Resis	-1.334	-1.866
+D+H	3.986	2.944
+D+L+H	7.442	5.730
+D+Lr+H	3.986	2.944
+D+S+H	7.214	5.369
+D+0.750Lr+0.750L+H	6.578	5.033
+D+0.750L+0.750S+H	9.000	6.852
+D+0.60W+H	3.986	2.944
+D+0.750Lr+0.750L+0.450W+H	6.578	5.033
+D+0.750L+0.750S+0.450W+H	9.000	6.852
+0.60D+0.60W+0.60H	2.391	1.766
+D+0.70E+0.60H	4.920	4.250
+D-0.70E+0.60H	3.052	1.637
+D+0.750L+0.750S+0.5250E+H	9.700	7.832
+D+0.750L+0.750S-0.5250E+H	8.299	5.873
+0.60D+0.70E+H	3.325	3.072
+0.60D-0.70E+H	1.458	0.460
D Only	3.986	2.944
L Only	3.457	2.786
S Only	3.229	2.425
E Only	1.334	1.866
E Only * -1.0	-1.334	-1.866
H Only		

Wood Beam

Project File: beam calcs with overstrength.ec6

DESCRIPTION: B2-8 OS 309

CODE REFERENCES

Calculations per NDS 2018, IBC 2021, ASCE 7-16
Load Combination Set : ASCE 7-16

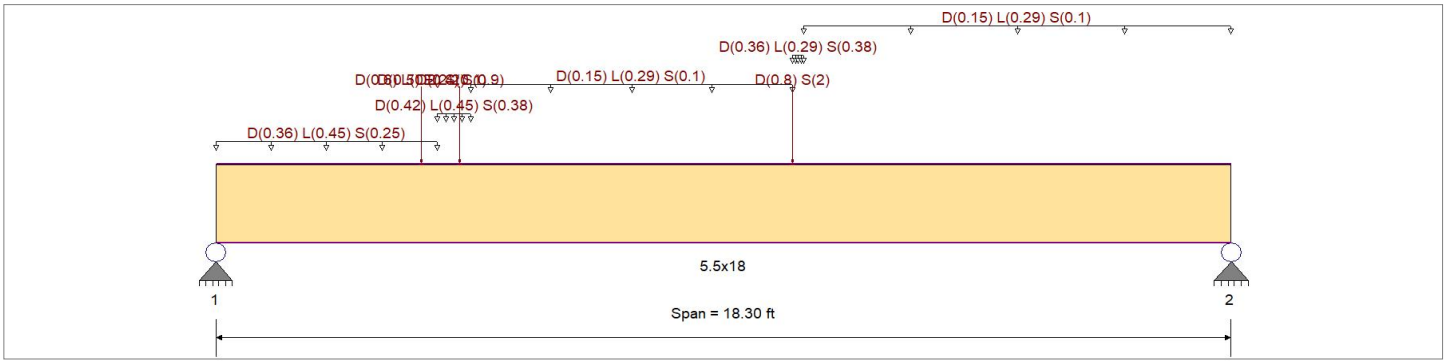
Material Properties

Analysis Method :	Allowable Stress Design
Load Combination :	ASCE 7-16
Wood Species :	24-V4 GLB OS
Wood Grade :	GLB - Western
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	318.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	ksi
Eminbend - yy	ksi
Density	35.0 pcf



Applied Loads

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

Beam self weight calculated and added to loading
Load for Span Number 1
Uniform Load : D = 0.360, L = 0.450, S = 0.250 k/ft, Extent = 0.0 -->> 4.0 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.420, L = 0.450, S = 0.380 k/ft, Extent = 4.0 -->> 4.60 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.150, L = 0.290, S = 0.10 k/ft, Extent = 4.60 -->> 10.40 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.360, L = 0.290, S = 0.380 k/ft, Extent = 10.40 -->> 10.60 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.150, L = 0.290, S = 0.10 k/ft, Extent = 10.60 -->> 18.30 ft, Tributary Width = 1.0 ft
Point Load : D = 0.60, L = 0.20, S = 0.10 k @ 3.70 ft
Point Load : D = 0.40, S = 0.90 k @ 4.40 ft
Point Load : D = 0.80, S = 2.0 k @ 10.40 ft
Point Load : D = 0.50, E = 2.20 k @ 3.70 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.459 : 1	Maximum Shear Stress Ratio	=	0.319 : 1
Section used for this span		5.5x18	Section used for this span		5.5x18
fb: Actual	=	1,468.99 psi	fv: Actual	=	116.48 psi
F'b	=	3,201.78 psi	F'v	=	365.70 psi
Load Combination		+D+0.750L+0.750S+H	Load Combination		+D+0.750L+0.750S+H
Location of maximum on span	=	9.618 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	0.189 in	Ratio =	1160	>=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.489 in	Ratio =	449	>=180	Span: 1 : +D+0.750L+0.750S+0.5250E+H
Max Upward Total Deflection	0 in	Ratio =	0	<180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+D+H														0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.238	0.182	0.90	1.00	1.00	1.00	0.967	1.00	1.00	1.00	14.73	595.3	2,505.7	3.45	52.2	286.2

DESCRIPTION: B2-8 OS 309

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+D+L+H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.408	0.297	1.00	1.00	1.00	1.00	0.967	1.00	1.00	1.00	28.12	1,136.2	2,784.2	6.24	94.6	318.0
+D+Lr+H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.171	0.131	1.25	1.00	1.00	1.00	0.967	1.00	1.00	1.00	14.73	595.3	3,480.2	3.45	52.2	397.5
+D+S+H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.385	0.261	1.15	1.00	1.00	1.00	0.967	1.00	1.00	1.00	30.50	1,232.3	3,201.8	6.31	95.6	365.7
+D+0.750Lr+0.750L+H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.288	0.211	1.25	1.00	1.00	1.00	0.967	1.00	1.00	1.00	24.77	1,001.0	3,480.2	5.54	84.0	397.5
+D+0.750L+0.750S+H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.459	0.319	1.15	1.00	1.00	1.00	0.967	1.00	1.00	1.00	36.36	1,469.0	3,201.8	7.69	116.5	365.7
+D+0.60W+H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.134	0.103	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	14.73	595.3	4,454.6	3.45	52.2	508.8
+D+0.750Lr+0.750L+0.450W+					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.225	0.165	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	24.77	1,001.0	4,454.6	5.54	84.0	508.8
+D+0.750L+0.750S+0.450W+I					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.330	0.229	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	36.36	1,469.0	4,454.6	7.69	116.5	508.8
+0.60D+0.60W+0.60H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.080	0.062	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	8.84	357.2	4,454.6	2.07	31.3	508.8
+D+0.70E+0.60H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.163	0.139	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	18.01	727.9	4,454.6	4.67	70.8	508.8
+D-0.70E+0.60H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.109	0.066	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	12.01	485.3	4,454.6	2.22	33.6	508.8
+D+0.750L+0.750S+0.5250E+					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.349	0.256	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	38.44	1,553.2	4,454.6	8.61	130.4	508.8
+D+0.750L+0.750S-0.5250E+I					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.312	0.201	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	34.39	1,389.6	4,454.6	6.77	102.5	508.8
+0.60D+0.70E+H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.112	0.098	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	12.31	497.2	4,454.6	3.30	49.9	508.8
+0.60D-0.70E+H					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.056	0.036	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	6.22	251.2	4,454.6	1.20	18.1	508.8
+1.140D+0.70E					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.182	0.154	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	20.04	809.8	4,454.6	5.16	78.1	508.8
+1.140D-0.70E					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.127	0.080	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	14.04	567.3	4,454.6	2.70	40.9	508.8
+1.105D+0.750L+0.750S+0.52					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.363	0.267	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	39.99	1,615.6	4,454.6	8.97	135.9	508.8
+1.105D+0.750L+0.750S-0.52					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.326	0.212	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	35.92	1,451.3	4,454.6	7.13	108.0	508.8
+0.460D+0.70E					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.094	0.084	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	10.38	419.6	4,454.6	2.81	42.6	508.8
+0.460D-0.70E					1.00	1.00	1.00	0.967	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.30 ft	1	0.038	0.029	1.60	1.00	1.00	1.00	0.967	1.00	1.00	1.00	4.19	169.4	4,454.6	0.99	15.0	508.8

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+H	1	0.4890	8.950		0.0000	0.000

DESCRIPTION: B2-8 OS 309

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	9.945	6.662
Max Upward from Load Combinations	9.945	6.662
Max Upward from Load Cases	4.009	2.786
Max Downward from all Load Conditio	-1.755	-0.445
Max Downward from Load Cases (Resis	-1.755	-0.445
+D+H	4.009	2.520
+D+L+H	7.466	5.306
+D+Lr+H	4.009	2.520
+D+S+H	7.238	4.945
+D+0.750Lr+0.750L+H	6.602	4.610
+D+0.750L+0.750S+H	9.023	6.429
+D+0.60W+H	4.009	2.520
+D+0.750Lr+0.750L+0.450W+H	6.602	4.610
+D+0.750L+0.750S+0.450W+H	9.023	6.429
+0.60D+0.60W+0.60H	2.406	1.512
+D+0.70E+0.60H	5.238	2.831
+D-0.70E+0.60H	2.781	2.208
+D+0.750L+0.750S+0.5250E+H	9.945	6.662
+D+0.750L+0.750S-0.5250E+H	8.102	6.195
+0.60D+0.70E+H	3.634	1.823
+0.60D-0.70E+H	1.177	1.201
D Only	4.009	2.520
L Only	3.457	2.786
S Only	3.229	2.425
E Only	1.755	0.445
E Only * -1.0	-1.755	-0.445
H Only		

Wood Beam

Project File: beam calcs with overstrength.ec6

DESCRIPTION: H2-9 OS 309

CODE REFERENCES

Calculations per NDS 2018, IBC 2021, ASCE 7-16
Load Combination Set : ASCE 7-16

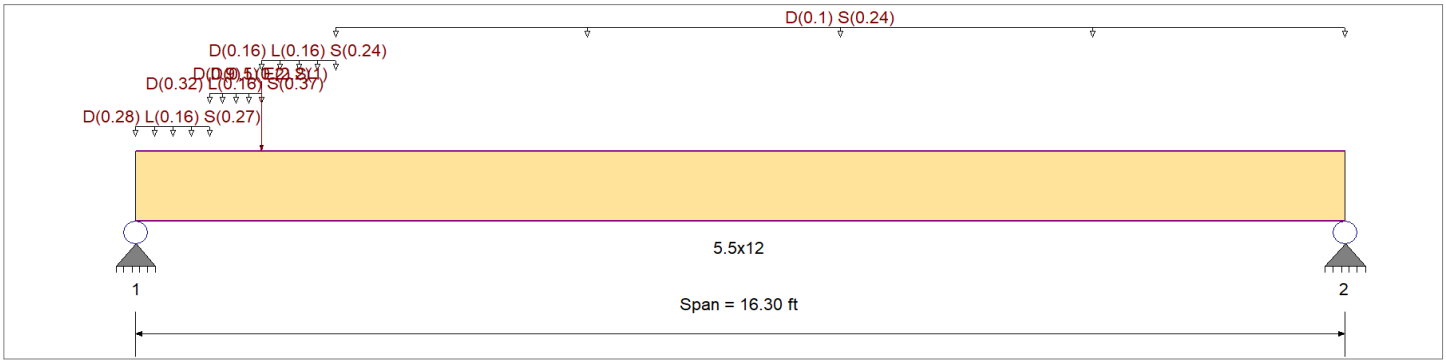
Material Properties

Analysis Method :	Allowable Stress Design
Load Combination :	ASCE 7-16
Wood Species :	24-V4 GLB OS
Wood Grade :	GLB - Western
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	318.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	ksi
Eminbend - yy	ksi
Density	35.0 pcf



Applied Loads

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

Beam self weight calculated and added to loading
Load for Span Number 1
Uniform Load : D = 0.280, L = 0.160, S = 0.270 k/ft, Extent = 0.0 -->> 1.0 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.320, L = 0.160, S = 0.370 k/ft, Extent = 1.0 -->> 1.70 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.160, L = 0.160, S = 0.240 k/ft, Extent = 1.70 -->> 2.70 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.10, S = 0.240 k/ft, Extent = 2.70 -->> 16.30 ft, Tributary Width = 1.0 ft
Point Load : D = 0.90, L = 0.20, S = 1.0 k @ 1.70 ft
Point Load : D = 0.50, E = 2.20 k @ 1.70 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.391 : 1	Maximum Shear Stress Ratio	=	0.310 : 1
Section used for this span		5.5x12	Section used for this span		5.5x12
fb: Actual	=	1,296.59 psi	fv: Actual	=	113.47 psi
F'b	=	3,312.00 psi	F'v	=	365.70 psi
Load Combination		+D+S+H	Load Combination		+D+S+H
Location of maximum on span	=	7.377 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	0.306 in	Ratio =	639 >=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.492 in	Ratio =	397 >=180	Span: 1 : +D+S+H
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+D+H														0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.189	0.181	0.90	1.00	1.00	1.00	1.000	1.00	1.00	1.00	5.39	489.7	2,592.0	2.29	51.9	286.2
+D+L+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.188	0.194	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	5.95	540.6	2,880.0	2.71	61.6	318.0

Wood Beam

Project File: beam calcs with overstrength.ec6

DESCRIPTION: H2-9 OS 309

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+D+Lr+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.136	0.131	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	5.39	489.7	3,600.0	2.29	51.9	397.5
+D+S+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.391	0.310	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	14.26	1,296.6	3,312.0	4.99	113.5	365.7
+D+0.750Lr+0.750L+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.147	0.149	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	5.80	527.6	3,600.0	2.60	59.2	397.5
+D+0.750L+0.750S+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.341	0.288	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.42	1,129.4	3,312.0	4.63	105.3	365.7
+D+0.60W+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.106	0.102	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	5.39	489.7	4,608.0	2.29	51.9	508.8
+D+0.750Lr+0.750L+0.450W+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.115	0.116	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	5.80	527.6	4,608.0	2.60	59.2	508.8
+D+0.750L+0.750S+0.450W+I					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.245	0.207	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.42	1,129.4	4,608.0	4.63	105.3	508.8
+0.60D+0.60W+0.60H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.064	0.061	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.23	293.8	4,608.0	1.37	31.2	508.8
+D+0.70E+0.60H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.139	0.164	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	7.05	640.5	4,608.0	3.66	83.3	508.8
+D-0.70E+0.60H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.078	0.040	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.95	359.1	4,608.0	0.91	20.6	508.8
+D+0.750L+0.750S+0.5250E+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.267	0.253	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	13.55	1,232.0	4,608.0	5.67	128.8	508.8
+D+0.750L+0.750S-0.5250E+I					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.224	0.161	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	11.34	1,031.3	4,608.0	3.60	81.8	508.8
+0.60D+0.70E+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.098	0.123	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.96	451.4	4,608.0	2.75	62.5	508.8
+0.60D-0.70E+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.037	0.024	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.87	170.0	4,608.0	0.54	12.3	508.8
+1.140D+0.70E					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.154	0.178	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	7.79	707.8	4,608.0	3.98	90.6	508.8
+1.140D-0.70E					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.093	0.055	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.69	426.4	4,608.0	1.23	27.9	508.8
+1.105D+0.750L+0.750S+0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.279	0.264	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	14.12	1,283.4	4,608.0	5.91	134.3	508.8
+1.105D+0.750L+0.750S-0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.235	0.171	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	11.91	1,082.3	4,608.0	3.84	87.2	508.8
+0.460D+0.70E					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.084	0.109	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.27	387.9	4,608.0	2.43	55.2	508.8
+0.460D-0.70E					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.30 ft	1	0.023	0.020	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.17	106.5	4,608.0	0.45	10.3	508.8

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	0.4924	7.972		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	6.257	3.187
Max Upward from Load Combinations	6.257	3.187

DESCRIPTION: H2-9 OS 309

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from Load Cases	2.964	2.069
Max Downward from all Load Conditio	-1.971	-0.229
Max Downward from Load Cases (Resis	-1.971	-0.229
+D+H	2.567	1.118
+D+L+H	3.143	1.175
+D+Lr+H	2.567	1.118
+D+S+H	5.532	3.187
+D+0.750Lr+0.750L+H	2.999	1.161
+D+0.750L+0.750S+H	5.222	2.712
+D+0.60W+H	2.567	1.118
+D+0.750Lr+0.750L+0.450W+H	2.999	1.161
+D+0.750L+0.750S+0.450W+H	5.222	2.712
+0.60D+0.60W+0.60H	1.540	0.671
+D+0.70E+0.60H	3.947	1.279
+D-0.70E+0.60H	1.188	0.958
+D+0.750L+0.750S+0.5250E+H	6.257	2.833
+D+0.750L+0.750S-0.5250E+H	4.188	2.592
+0.60D+0.70E+H	2.920	0.831
+0.60D-0.70E+H	0.161	0.510
D Only	2.567	1.118
L Only	0.575	0.057
S Only	2.964	2.069
E Only	1.971	0.229
E Only * -1.0	-1.971	-0.229
H Only		

Steel Beam

Project File: beam calcs with overstrength.ec6

DESCRIPTION: B2-18 OS 303

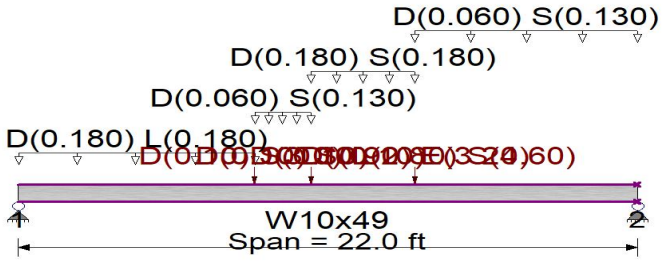
CODE REFERENCES

Calculations per AISC 360-16, IBC 2021, 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 calculated and added to loading
Load for Span Number 1
Uniform Load : D = 0.180, L = 0.180 k/ft, Extent = 0.0 -->> 8.40 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.060, S = 0.130 k/ft, Extent = 8.40 -->> 10.40 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.180, S = 0.180 k/ft, Extent = 10.40 -->> 14.10 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.060, S = 0.130 k/ft, Extent = 14.10 -->> 22.0 ft, Tributary Width = 1.0 ft
Point Load : D = 0.10, S = 0.10 k @ 8.40 ft
Point Load : D = 0.10, S = 0.10 k @ 10.40 ft
Point Load : D = 3.0, L = 2.80, S = 4.60 k @ 14.10 ft
Point Load : D = 0.90, E = 3.20 k @ 14.10 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.509 : 1	Maximum Shear Stress Ratio =	0.156 : 1
Section used for this span	W10x49	Section used for this span	W10x49
Ma : Applied	76.687 k-ft	Va : Applied	10.575 k
Mn / Omega : Allowable	150.699 k-ft	Vn/Omega : Allowable	68.0 k
Load Combination	+1.105D+0.750L+0.750S+0.5250E	Load Combination	+1.105D+0.750L+0.750S+0.5250E
		Location of maximum on span	22.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.279 in	Ratio =	944	>=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.703 in	Ratio =	376	>=180	Span: 1 : +D+0.750L+0.750S+0.5250E+H
Max Upward Total Deflection	0 in	Ratio =	0	<180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios 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+H													
Dsgn. L = 22.00 ft	1	0.199	0.062	29.95		29.95	251.67	150.70	1.00	1.00	4.22	102.00	68.00
+D+L+H													
Dsgn. L = 22.00 ft	1	0.308	0.093	46.40		46.40	251.67	150.70	1.00	1.00	6.31	102.00	68.00
+D+Lr+H													
Dsgn. L = 22.00 ft	1	0.199	0.062	29.95		29.95	251.67	150.70	1.00	1.00	4.22	102.00	68.00
+D+S+H													
Dsgn. L = 22.00 ft	1	0.400	0.126	60.30		60.30	251.67	150.70	1.00	1.00	8.58	102.00	68.00
+D+0.750Lr+0.750L+H													
Dsgn. L = 22.00 ft	1	0.281	0.085	42.29		42.29	251.67	150.70	1.00	1.00	5.79	102.00	68.00
+D+0.750L+0.750S+H													
Dsgn. L = 22.00 ft	1	0.432	0.133	65.05		65.05	251.67	150.70	1.00	1.00	9.05	102.00	68.00
+D+0.60W+H													
Dsgn. L = 22.00 ft	1	0.199	0.062	29.95		29.95	251.67	150.70	1.00	1.00	4.22	102.00	68.00
+D+0.750Lr+0.750L+0.450W+H													
Dsgn. L = 22.00 ft	1	0.281	0.085	42.29		42.29	251.67	150.70	1.00	1.00	5.79	102.00	68.00

DESCRIPTION: B2-18 OS 303

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+0.750L+0.750S+0.450W+H													
Dsgn. L = 22.00 ft	1	0.432	0.133	65.05		65.05	251.67	150.70	1.00	1.00	9.05	102.00	68.00
+0.60D+0.60W+0.60H													
Dsgn. L = 22.00 ft	1	0.119	0.037	17.97		17.97	251.67	150.70	1.00	1.00	2.53	102.00	68.00
+D+0.70E+0.60H													
Dsgn. L = 22.00 ft	1	0.274	0.083	41.28		41.28	251.67	150.70	1.00	1.00	5.66	102.00	68.00
+D-0.70E+0.60H													
Dsgn. L = 22.00 ft	1	0.125	0.043	18.78		18.78	251.67	150.70	1.00	1.00	2.92	102.00	68.00
+D+0.750L+0.750S+0.5250E+H													
Dsgn. L = 22.00 ft	1	0.488	0.149	73.54		73.54	251.67	150.70	1.00	1.00	10.13	102.00	68.00
+D+0.750L+0.750S-0.5250E+H													
Dsgn. L = 22.00 ft	1	0.375	0.117	56.55		56.55	251.67	150.70	1.00	1.00	7.98	102.00	68.00
+0.60D+0.70E+H													
Dsgn. L = 22.00 ft	1	0.194	0.058	29.30		29.30	251.67	150.70	1.00	1.00	3.97	102.00	68.00
+0.60D-0.70E+H													
Dsgn. L = 22.00 ft	1	0.050	0.021	7.48		7.48	251.67	150.70	1.00	1.00	1.43	102.00	68.00
+1.140D+0.70E													
Dsgn. L = 22.00 ft	1	0.302	0.092	45.47		45.47	251.67	150.70	1.00	1.00	6.25	102.00	68.00
+1.140D-0.70E													
Dsgn. L = 22.00 ft	1	0.152	0.051	22.89		22.89	251.67	150.70	1.00	1.00	3.44	102.00	68.00
+1.105D+0.750L+0.750S+0.5250E													
Dsgn. L = 22.00 ft	1	0.509	0.156	76.69		76.69	251.67	150.70	1.00	1.00	10.57	102.00	68.00
+1.105D+0.750L+0.750S-0.5250E													
Dsgn. L = 22.00 ft	1	0.396	0.124	59.70		59.70	251.67	150.70	1.00	1.00	8.42	102.00	68.00
+0.460D+0.70E													
Dsgn. L = 22.00 ft	1	0.167	0.050	25.10		25.10	251.67	150.70	1.00	1.00	3.38	102.00	68.00
+0.460D-0.70E													
Dsgn. L = 22.00 ft	1	0.026	0.013	3.93		3.93	251.67	150.70	1.00	1.00	0.91	102.00	68.00

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+H	1	0.7026	11.566		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	7.797	10.131
Max Upward from Load Combinations	7.797	10.131
Max Upward from Load Cases	3.726	4.358
Max Downward from all Load Conditions (Resisti	-1.149	-2.051
Max Downward from Load Cases (Resisting Upli	-1.149	-2.051
+D+H	3.726	4.224
+D+L+H	5.955	6.307
+D+Lr+H	3.726	4.224
+D+S+H	6.121	8.582
+D+0.750Lr+0.750L+H	5.398	5.786
+D+0.750L+0.750S+H	7.194	9.055
+D+0.60W+H	3.726	4.224
+D+0.750Lr+0.750L+0.450W+H	5.398	5.786
+D+0.750L+0.750S+0.450W+H	7.194	9.055
+0.60D+0.60W+0.60H	2.236	2.534
+D+0.70E+0.60H	4.531	5.659
+D-0.70E+0.60H	2.922	2.788
+D+0.750L+0.750S+0.5250E+H	7.797	10.131
+D+0.750L+0.750S-0.5250E+H	6.591	7.978
+0.60D+0.70E+H	3.040	3.970
+0.60D-0.70E+H	1.431	1.099
D Only	3.726	4.224
L Only	2.229	2.083
S Only	2.395	4.358
E Only	1.149	2.051
E Only * -1.0	-1.149	-2.051
H Only		

Steel Beam

Project File: beam calcs with overstrength.ec6

DESCRIPTION: B2-18 OS 311

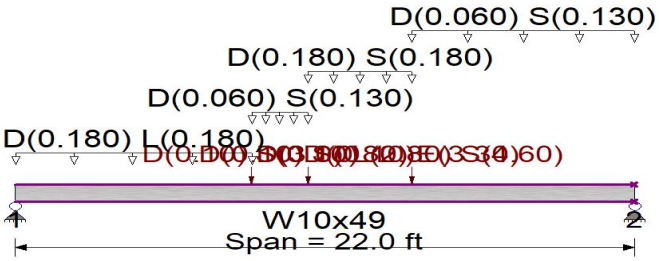
CODE REFERENCES

Calculations per AISC 360-16, IBC 2021, 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 calculated and added to loading
Load for Span Number 1
Uniform Load : D = 0.180, L = 0.180 k/ft, Extent = 0.0 -->> 8.40 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.060, S = 0.130 k/ft, Extent = 8.40 -->> 10.40 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.180, S = 0.180 k/ft, Extent = 10.40 -->> 14.10 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.060, S = 0.130 k/ft, Extent = 14.10 -->> 22.0 ft, Tributary Width = 1.0 ft
Point Load : D = 0.10, S = 0.10 k @ 8.40 ft
Point Load : D = 0.10, S = 0.10 k @ 10.40 ft
Point Load : D = 3.0, L = 2.80, S = 4.60 k @ 14.10 ft
Point Load : D = 0.80, E = 3.30 k @ 14.10 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.507 : 1	Maximum Shear Stress Ratio =	0.155 : 1
Section used for this span	W10x49	Section used for this span	W10x49
Ma : Applied	76.394 k-ft	Va : Applied	10.538 k
Mn / Omega : Allowable	150.699 k-ft	Vn/Omega : Allowable	68.0 k
Load Combination	+1.105D+0.750L+0.750S+0.5250E	Load Combination	+1.105D+0.750L+0.750S+0.5250E
		Location of maximum on span	22.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.279 in	Ratio =	944	>=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.700 in	Ratio =	377	>=180	Span: 1 : +D+0.750L+0.750S+0.5250E+H
Max Upward Total Deflection	0 in	Ratio =	0	<180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios 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+H													
Dsgn. L = 22.00 ft	1	0.195	0.061	29.45		29.45	251.67	150.70	1.00	1.00	4.16	102.00	68.00
+D+L+H													
Dsgn. L = 22.00 ft	1	0.305	0.092	45.89		45.89	251.67	150.70	1.00	1.00	6.24	102.00	68.00
+D+Lr+H													
Dsgn. L = 22.00 ft	1	0.195	0.061	29.45		29.45	251.67	150.70	1.00	1.00	4.16	102.00	68.00
+D+S+H													
Dsgn. L = 22.00 ft	1	0.397	0.125	59.80		59.80	251.67	150.70	1.00	1.00	8.52	102.00	68.00
+D+0.750Lr+0.750L+H													
Dsgn. L = 22.00 ft	1	0.277	0.084	41.78		41.78	251.67	150.70	1.00	1.00	5.72	102.00	68.00
+D+0.750L+0.750S+H													
Dsgn. L = 22.00 ft	1	0.428	0.132	64.54		64.54	251.67	150.70	1.00	1.00	8.99	102.00	68.00
+D+0.60W+H													
Dsgn. L = 22.00 ft	1	0.195	0.061	29.45		29.45	251.67	150.70	1.00	1.00	4.16	102.00	68.00
+D+0.750Lr+0.750L+0.450W+H													
Dsgn. L = 22.00 ft	1	0.277	0.084	41.78		41.78	251.67	150.70	1.00	1.00	5.72	102.00	68.00

DESCRIPTION: B2-18 OS 311

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+0.750L+0.750S+0.450W+H													
Dsgn. L = 22.00 ft	1	0.428	0.132	64.54		64.54	251.67	150.70	1.00	1.00	8.99	102.00	68.00
+0.60D+0.60W+0.60H													
Dsgn. L = 22.00 ft	1	0.117	0.037	17.67		17.67	251.67	150.70	1.00	1.00	2.50	102.00	68.00
+D+0.70E+0.60H													
Dsgn. L = 22.00 ft	1	0.273	0.083	41.13		41.13	251.67	150.70	1.00	1.00	5.64	102.00	68.00
+D-0.70E+0.60H													
Dsgn. L = 22.00 ft	1	0.119	0.042	18.00		18.00	251.67	150.70	1.00	1.00	2.86	102.00	68.00
+D+0.750L+0.750S+0.5250E+H													
Dsgn. L = 22.00 ft	1	0.486	0.149	73.30		73.30	251.67	150.70	1.00	1.00	10.10	102.00	68.00
+D+0.750L+0.750S-0.5250E+H													
Dsgn. L = 22.00 ft	1	0.370	0.116	55.78		55.78	251.67	150.70	1.00	1.00	7.88	102.00	68.00
+0.60D+0.70E+H													
Dsgn. L = 22.00 ft	1	0.195	0.058	29.35		29.35	251.67	150.70	1.00	1.00	3.98	102.00	68.00
+0.60D-0.70E+H													
Dsgn. L = 22.00 ft	1	0.046	0.020	6.99		6.99	251.67	150.70	1.00	1.00	1.38	102.00	68.00
+1.140D+0.70E													
Dsgn. L = 22.00 ft	1	0.300	0.092	45.25		45.25	251.67	150.70	1.00	1.00	6.22	102.00	68.00
+1.140D-0.70E													
Dsgn. L = 22.00 ft	1	0.146	0.050	22.01		22.01	251.67	150.70	1.00	1.00	3.38	102.00	68.00
+1.105D+0.750L+0.750S+0.5250E													
Dsgn. L = 22.00 ft	1	0.507	0.155	76.39		76.39	251.67	150.70	1.00	1.00	10.54	102.00	68.00
+1.105D+0.750L+0.750S-0.5250E													
Dsgn. L = 22.00 ft	1	0.391	0.122	58.87		58.87	251.67	150.70	1.00	1.00	8.32	102.00	68.00
+0.460D+0.70E													
Dsgn. L = 22.00 ft	1	0.167	0.050	25.23		25.23	251.67	150.70	1.00	1.00	3.39	102.00	68.00
+0.460D-0.70E													
Dsgn. L = 22.00 ft	1	0.024	0.013	3.58		3.58	251.67	150.70	1.00	1.00	0.87	102.00	68.00

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+H	1	0.7005	11.566		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	7.780	10.101
Max Upward from Load Combinations	7.780	10.101
Max Upward from Load Cases	3.690	4.358
Max Downward from all Load Conditions (Resisti	-1.185	-2.115
Max Downward from Load Cases (Resisting Upli	-1.185	-2.115
+D+H	3.690	4.160
+D+L+H	5.919	6.243
+D+Lr+H	3.690	4.160
+D+S+H	6.085	8.518
+D+0.750Lr+0.750L+H	5.362	5.722
+D+0.750L+0.750S+H	7.158	8.991
+D+0.60W+H	3.690	4.160
+D+0.750Lr+0.750L+0.450W+H	5.362	5.722
+D+0.750L+0.750S+0.450W+H	7.158	8.991
+0.60D+0.60W+0.60H	2.214	2.496
+D+0.70E+0.60H	4.520	5.640
+D-0.70E+0.60H	2.861	2.679
+D+0.750L+0.750S+0.5250E+H	7.780	10.101
+D+0.750L+0.750S-0.5250E+H	6.536	7.880
+0.60D+0.70E+H	3.044	3.976
+0.60D-0.70E+H	1.385	1.015
D Only	3.690	4.160
L Only	2.229	2.083
S Only	2.395	4.358
E Only	1.185	2.115
E Only * -1.0	-1.185	-2.115
H Only		

Wood Beam

Project File: beam calcs with overstrength.ec6

DESCRIPTION: B2-23 OS 310

CODE REFERENCES

Calculations per NDS 2018, IBC 2021, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

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

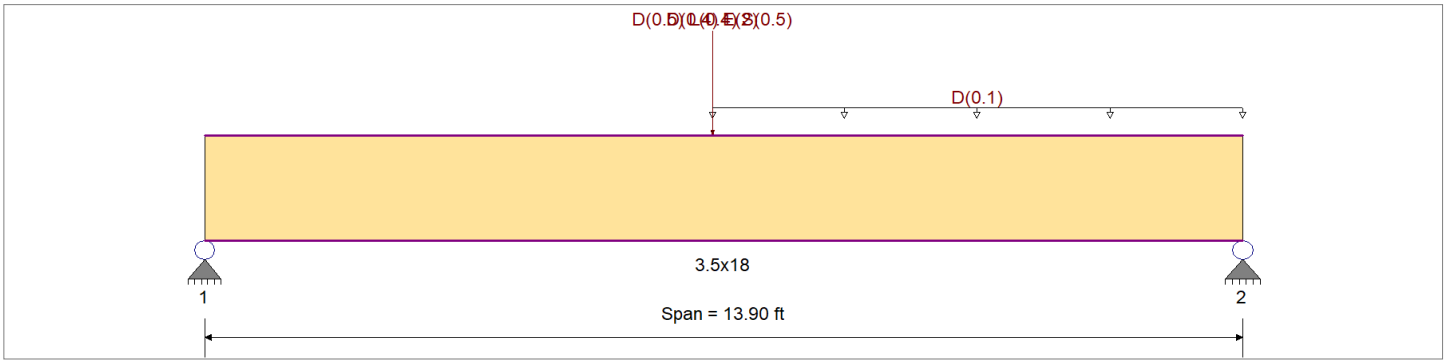
Wood Species : 24F-V4 GLB OS
Wood Grade : GLB - Western

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

Fb +	2880 psi
Fb -	2220 psi
Fc - Prll	1980 psi
Fc - Perp	780 psi
Fv	318 psi
Ft	318 psi

E : Modulus of Elasticity

Ebend- xx	1800 ksi
Eminbend - xx	950 ksi
Ebend- yy	ksi
Eminbend - yy	ksi
Density	35 pcf



Applied Loads

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

Beam self weight calculated and added to loading
Load for Span Number 1
Uniform Load : D = 0.10 k/ft, Extent = 6.80 -->> 13.90 ft, Tributary Width = 1.0 ft
Point Load : D = 0.50, L = 0.40, S = 0.50 k @ 6.80 ft
Point Load : D = 0.40, E = 2.0 k @ 6.80 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.155 : 1	Maximum Shear Stress Ratio	=	0.086 : 1
Section used for this span		3.5x18	Section used for this span		3.5x18
fb: Actual	=	711.96 psi	fv: Actual	=	43.92 psi
F'b	=	4,608.00 psi	F'v	=	508.80 psi
Load Combination		+1.105D+0.750L+0.750S+0.5250E	Load Combination		+1.105D+0.750L+0.750S+0.5250E
Location of maximum on span	=	6.798 ft	Location of maximum on span	=	12.429 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.063 in	Ratio =	2628 >=360	Span: 1 : E Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.102 in	Ratio =	1638 >=180	Span: 1 : +D+0.750L+0.750S+0.5250E+H
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+D+H														0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.116	0.075	0.90	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.73	300.1	2,592.0	0.91	21.6	286.2
+D+L+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.135	0.082	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	6.12	388.3	2,880.0	1.10	26.2	318.0
+D+Lr+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.083	0.054	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.73	300.1	3,600.0	0.91	21.6	397.5
+D+S+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0

DESCRIPTION: B2-23 OS 310

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
Length = 13.90 ft	1	0.124	0.075	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	6.46	410.4	3,312.0	1.15	27.4	365.7
+D+0.750Lr+0.750L+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.102	0.063	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	5.77	366.3	3,600.0	1.05	25.1	397.5
+D+0.750L+0.750S+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.136	0.080	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	7.07	449.0	3,312.0	1.24	29.4	365.7
+D+0.60W+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.065	0.042	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.73	300.1	4,608.0	0.91	21.6	508.8
+D+0.750Lr+0.750L+0.450W+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.079	0.049	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	5.77	366.3	4,608.0	1.05	25.1	508.8
+D+0.750L+0.750S+0.450W+I					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.097	0.058	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	7.07	449.0	4,608.0	1.24	29.4	508.8
+0.60D+0.60W+0.60H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.039	0.025	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.84	180.1	4,608.0	0.54	12.9	508.8
+D+0.70E+0.60H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.132	0.074	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	9.59	608.8	4,608.0	1.59	37.9	508.8
+D-0.70E+0.60H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.009	0.020	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.66	42.0	4,608.0	0.42	10.1	508.8
+D+0.750L+0.750S+0.5250E+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.148	0.082	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	10.72	680.4	4,608.0	1.75	41.7	508.8
+D+0.750L+0.750S-0.5250E+I					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.047	0.034	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.43	217.5	4,608.0	0.72	17.2	508.8
+0.60D+0.70E+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.106	0.057	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	7.70	488.7	4,608.0	1.23	29.2	508.8
+0.60D-0.70E+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.036	0.025	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.02	128.6	3,552.0	0.53	12.6	508.8
+1.140D+0.70E					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.141	0.080	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	10.25	650.8	4,608.0	1.72	40.9	508.8
+1.140D-0.70E					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.015	0.018	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.11	70.7	4,608.0	0.39	9.2	508.8
+1.105D+0.750L+0.750S+0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.155	0.086	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	11.21	712.0	4,608.0	1.84	43.9	508.8
+1.105D+0.750L+0.750S-0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.054	0.038	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.92	249.0	4,608.0	0.82	19.5	508.8
+0.460D+0.70E					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.097	0.052	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	7.04	446.7	4,608.0	1.10	26.2	508.8
+0.460D-0.70E					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.90 ft	1	0.048	0.026	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.69	170.6	3,552.0	0.56	13.4	508.8

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+H	1	0.1018	7.001		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.629	1.919
Max Upward from Load Combinations	1.629	1.919
Max Upward from Load Cases	1.022	1.075
Max Downward from all Load Conditio	-1.022	-0.978
Max Downward from Load Combinations	-0.267	-0.040
Max Downward from Load Cases (Resis	-1.022	-0.978

DESCRIPTION: B2-23 OS 310

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
+D+H	0.747	1.075
+D+L+H	0.952	1.271
+D+Lr+H	0.747	1.075
+D+S+H	1.003	1.320
+D+0.750Lr+0.750L+H	0.901	1.222
+D+0.750L+0.750S+H	1.092	1.406
+D+0.60W+H	0.747	1.075
+D+0.750Lr+0.750L+0.450W+H	0.901	1.222
+D+0.750L+0.750S+0.450W+H	1.092	1.406
+0.60D+0.60W+0.60H	0.448	0.645
+D+0.70E+0.60H	1.463	1.760
+D-0.70E+0.60H	0.032	0.390
+D+0.750L+0.750S+0.5250E+H	1.629	1.919
+D+0.750L+0.750S-0.5250E+H	0.556	0.892
+0.60D+0.70E+H	1.164	1.330
+0.60D-0.70E+H	-0.267	-0.040
D Only	0.747	1.075
L Only	0.204	0.196
S Only	0.255	0.245
E Only	1.022	0.978
E Only * -1.0	-1.022	-0.978
H Only		

Wood Beam

Project File: beam calcs with overstrength.ec6

DESCRIPTION: B2-24 OS 304

CODE REFERENCES

Calculations per NDS 2018, IBC 2021, ASCE 7-16
Load Combination Set : ASCE 7-16

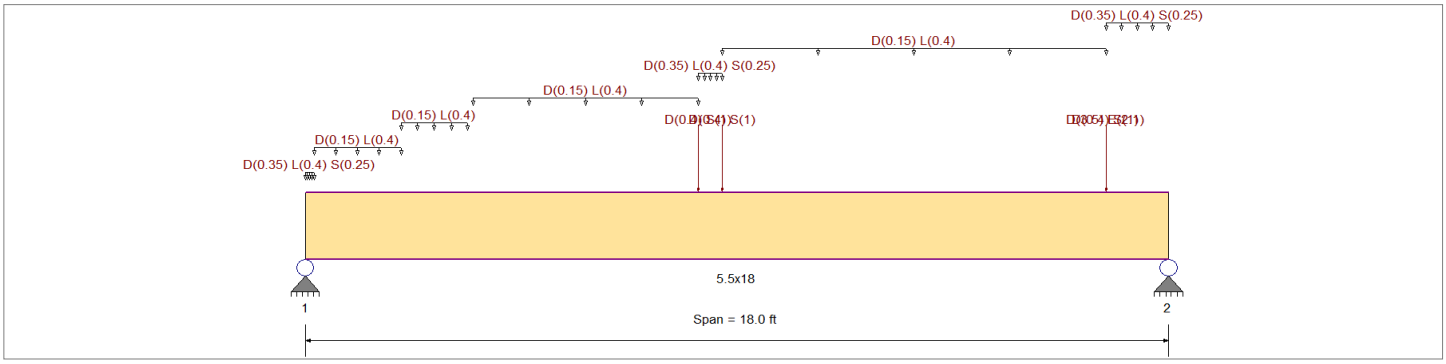
Material Properties

Analysis Method :	Allowable Stress Design
Load Combination :	ASCE 7-16
Wood Species :	24F-V4 GLB OS
Wood Grade :	GLB - Western
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	318.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	ksi
Eminbend - yy	ksi
Density	35.0 pcf



Applied Loads

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

Beam self weight calculated and added to loading
Load for Span Number 1
Uniform Load : D = 0.350, L = 0.40, S = 0.250 k/ft, Extent = 0.0 -->> 0.20 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.150, L = 0.40 k/ft, Extent = 0.20 -->> 2.0 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.150, L = 0.40 k/ft, Extent = 2.0 -->> 3.40 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.150, L = 0.40 k/ft, Extent = 3.50 -->> 8.20 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.350, L = 0.40, S = 0.250 k/ft, Extent = 8.20 -->> 8.70 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.150, L = 0.40 k/ft, Extent = 8.70 -->> 16.70 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.350, L = 0.40, S = 0.250 k/ft, Extent = 16.70 -->> 18.0 ft, Tributary Width = 1.0 ft
Point Load : D = 0.40, S = 1.0 k @ 8.20 ft
Point Load : D = 0.40, S = 1.0 k @ 8.70 ft
Point Load : D = 0.40, S = 1.0 k @ 16.70 ft
Point Load : D = 3.50, E = 2.10 k @ 16.70 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.429 : 1	Maximum Shear Stress Ratio	=	0.241 : 1
Section used for this span		5.5x18	Section used for this span		5.5x18
fb: Actual	=	1,195.61 psi	fv: Actual	=	76.68 psi
F'b	=	2,788.76 psi	F'v	=	318.00 psi
Load Combination		+D+L+H	Load Combination		+D+L+H
Location of maximum on span	=	8.803 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	0.197 in	Ratio =	1098 >=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.399 in	Ratio =	542 >=180	Span: 1 : +D+0.750L+0.750S+0.5250E+H
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

DESCRIPTION: B2-24 OS 304

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios										Moment Values			Shear Values		
Segment Length	Span #	M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
+D+H														0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.217	0.110	0.90	1.00	1.00	1.00	0.968	1.00	1.00	1.00	13.48	544.5	2,509.9	2.07	31.4	286.2
+D+L+H					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.429	0.241	1.00	1.00	1.00	1.00	0.968	1.00	1.00	1.00	29.59	1,195.6	2,788.8	5.06	76.7	318.0
+D+Lr+H					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.156	0.079	1.25	1.00	1.00	1.00	0.968	1.00	1.00	1.00	13.48	544.5	3,486.0	2.07	31.4	397.5
+D+S+H					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.296	0.136	1.15	1.00	1.00	1.00	0.968	1.00	1.00	1.00	23.48	948.6	3,207.1	3.28	49.7	365.7
+D+0.750Lr+0.750L+H					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.296	0.164	1.25	1.00	1.00	1.00	0.968	1.00	1.00	1.00	25.56	1,032.8	3,486.0	4.31	65.4	397.5
+D+0.750L+0.750S+H					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.416	0.216	1.15	1.00	1.00	1.00	0.968	1.00	1.00	1.00	33.06	1,335.6	3,207.1	5.22	79.1	365.7
+D+0.60W+H					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.122	0.062	1.60	1.00	1.00	1.00	0.968	1.00	1.00	1.00	13.48	544.5	4,462.0	2.07	31.4	508.8
+D+0.750Lr+0.750L+0.450W+					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.231	0.128	1.60	1.00	1.00	1.00	0.968	1.00	1.00	1.00	25.56	1,032.8	4,462.0	4.31	65.4	508.8
+D+0.750L+0.750S+0.450W+I					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.299	0.155	1.60	1.00	1.00	1.00	0.968	1.00	1.00	1.00	33.06	1,335.6	4,462.0	5.22	79.1	508.8
+0.60D+0.60W+0.60H					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.073	0.037	1.60	1.00	1.00	1.00	0.968	1.00	1.00	1.00	8.09	326.7	4,462.0	1.24	18.8	508.8
+D+0.70E+0.60H					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.130	0.065	1.60	1.00	1.00	1.00	0.968	1.00	1.00	1.00	14.40	582.0	4,462.0	2.18	33.0	508.8
+D-0.70E+0.60H					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.114	0.059	1.60	1.00	1.00	1.00	0.968	1.00	1.00	1.00	12.55	507.0	4,462.0	1.97	29.8	508.8
+D+0.750L+0.750S+0.5250E+					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.306	0.158	1.60	1.00	1.00	1.00	0.968	1.00	1.00	1.00	33.75	1,363.5	4,462.0	5.30	80.3	508.8
+D+0.750L+0.750S-0.5250E+I					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.293	0.153	1.60	1.00	1.00	1.00	0.968	1.00	1.00	1.00	32.36	1,307.7	4,462.0	5.14	77.9	508.8
+0.60D+0.70E+H					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.082	0.040	1.60	1.00	1.00	1.00	0.968	1.00	1.00	1.00	9.03	364.8	4,462.0	1.35	20.4	508.8
+0.60D-0.70E+H					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.065	0.034	1.60	1.00	1.00	1.00	0.968	1.00	1.00	1.00	7.16	289.3	4,462.0	1.14	17.2	508.8
+1.140D+0.70E					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.148	0.073	1.60	1.00	1.00	1.00	0.968	1.00	1.00	1.00	16.29	658.2	4,462.0	2.47	37.4	508.8
+1.140D-0.70E					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.131	0.067	1.60	1.00	1.00	1.00	0.968	1.00	1.00	1.00	14.43	583.2	4,462.0	2.26	34.2	508.8
+1.105D+0.750L+0.750S+0.52					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.318	0.164	1.60	1.00	1.00	1.00	0.968	1.00	1.00	1.00	35.16	1,420.6	4,462.0	5.52	83.6	508.8
+1.105D+0.750L+0.750S-0.52					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.306	0.160	1.60	1.00	1.00	1.00	0.968	1.00	1.00	1.00	33.78	1,364.8	4,462.0	5.36	81.2	508.8
+0.460D+0.70E					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.065	0.032	1.60	1.00	1.00	1.00	0.968	1.00	1.00	1.00	7.16	289.1	4,462.0	1.06	16.0	508.8
+0.460D-0.70E					1.00	1.00	1.00	0.968	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.0 ft	1	0.048	0.025	1.60	1.00	1.00	1.00	0.968	1.00	1.00	1.00	5.28	213.1	4,462.0	0.85	12.8	508.8

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+H	1	0.3985	9.131		0.0000	0.000

DESCRIPTION: B2-24 OS 304

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	6.064	11.252
Max Upward from Load Combinations	6.064	11.252
Max Upward from Load Cases	3.568	5.855
Max Downward from all Load Conditio	-0.152	-1.948
Max Downward from Load Cases (Resis	-0.152	-1.948
+D+H	2.363	5.855
+D+L+H	5.930	9.448
+D+Lr+H	2.363	5.855
+D+S+H	3.624	8.094
+D+0.750Lr+0.750L+H	5.039	8.550
+D+0.750L+0.750S+H	5.984	10.229
+D+0.60W+H	2.363	5.855
+D+0.750Lr+0.750L+0.450W+H	5.039	8.550
+D+0.750L+0.750S+0.450W+H	5.984	10.229
+0.60D+0.60W+0.60H	1.418	3.513
+D+0.70E+0.60H	2.469	7.219
+D-0.70E+0.60H	2.257	4.492
+D+0.750L+0.750S+0.5250E+H	6.064	11.252
+D+0.750L+0.750S-0.5250E+H	5.905	9.206
+0.60D+0.70E+H	1.524	4.877
+0.60D-0.70E+H	1.311	2.149
D Only	2.363	5.855
L Only	3.568	3.592
S Only	1.261	2.239
E Only	0.152	1.948
E Only * -1.0	-0.152	-1.948
H Only		

Wood Beam

Project File: beam calcs with overstrength.ec6

DESCRIPTION: B2-15 OS 312

CODE REFERENCES

Calculations per NDS 2018, IBC 2021, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

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

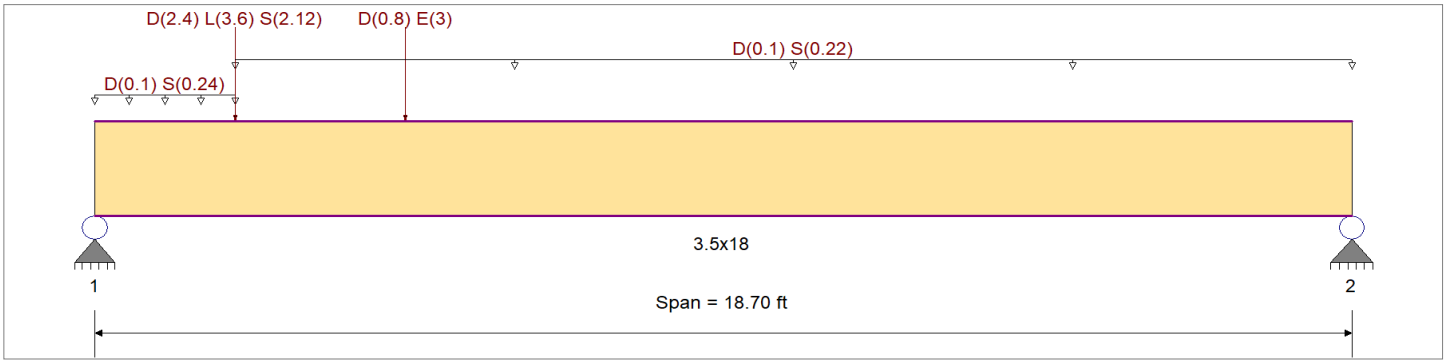
Wood Species : 24F-V4 GLB OS
Wood Grade : GLB - Western

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	318.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	ksi
Eminbend - yy	ksi
Density	35.0 pcf



Applied Loads

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

Beam self weight calculated and added to loading
Load for Span Number 1
Uniform Load : D = 0.10, S = 0.240 k/ft, Extent = 0.0 -->> 2.10 ft, Tributary Width = 1.0 ft
Uniform Load : D = 0.10, S = 0.220 k/ft, Extent = 2.10 -->> 18.70 ft, Tributary Width = 1.0 ft
Point Load : D = 2.40, L = 3.60, S = 2.120 k @ 2.10 ft
Point Load : D = 0.80, E = 3.0 k @ 4.630 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.436 : 1	Maximum Shear Stress Ratio	=	0.571 : 1
Section used for this span		3.5x18	Section used for this span		3.5x18
fb: Actual	=	1,445.04 psi	fv: Actual	=	208.76 psi
F'b	=	3,312.00 psi	F'v	=	365.70 psi
Load Combination		+D+0.750L+0.750S+H	Load Combination		+D+0.750L+0.750S+H
Location of maximum on span	=	5.938 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	0.254 in	Ratio =	883 >=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.554 in	Ratio =	404 >=180	Span: 1 : +D+0.750L+0.750S+0.5250E+H
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+D+H														0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.254	0.303	0.90	1.00	1.00	1.00	1.000	1.00	1.00	1.00	10.36	657.8	2,592.0	3.65	86.8	286.2
+D+L+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.353	0.512	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	16.02	1,017.1	2,880.0	6.84	162.9	318.0
+D+Lr+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.183	0.218	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	10.36	657.8	3,600.0	3.65	86.8	397.5

DESCRIPTION: B2-15 OS 312

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+D+S+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.422	0.474	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	22.02	1,398.4	3,312.0	7.28	173.3	365.7
+D+0.750Lr+0.750L+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.257	0.362	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	14.60	926.9	3,600.0	6.04	143.9	397.5
+D+0.750L+0.750S+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.436	0.571	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	22.76	1,445.0	3,312.0	8.77	208.8	365.7
+D+0.60W+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.143	0.171	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	10.36	657.8	4,608.0	3.65	86.8	508.8
+D+0.750Lr+0.750L+0.450W+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.201	0.283	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	14.60	926.9	4,608.0	6.04	143.9	508.8
+D+0.750L+0.750S+0.450W+I					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.314	0.410	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	22.76	1,445.0	4,608.0	8.77	208.8	508.8
+0.60D+0.60W+0.60H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.086	0.102	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	6.22	394.7	4,608.0	2.19	52.1	508.8
+D+0.70E+0.60H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.243	0.245	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	17.65	1,120.4	4,608.0	5.23	124.4	508.8
+D-0.70E+0.60H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.063	0.097	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.56	289.7	4,608.0	2.07	49.2	508.8
+D+0.750L+0.750S+0.5250E+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.386	0.466	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	28.00	1,777.7	4,608.0	9.95	237.0	508.8
+D+0.750L+0.750S-0.5250E+I					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.249	0.355	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	18.06	1,146.8	4,608.0	7.58	180.5	508.8
+0.60D+0.70E+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.186	0.176	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	13.51	857.9	4,608.0	3.77	89.7	508.8
+0.60D-0.70E+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.018	0.049	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.32	83.6	4,608.0	1.05	25.0	508.8
+1.140D+0.70E					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.263	0.268	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	19.09	1,212.2	4,608.0	5.74	136.6	508.8
+1.140D-0.70E					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.081	0.121	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	5.87	372.7	4,608.0	2.58	61.3	508.8
+1.105D+0.750L+0.750S+0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.401	0.484	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	29.08	1,846.6	4,608.0	10.34	246.1	508.8
+1.105D+0.750L+0.750S-0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.264	0.373	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	19.12	1,214.3	4,608.0	7.97	189.7	508.8
+0.460D+0.70E					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.166	0.152	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.06	766.0	4,608.0	3.26	77.5	508.8
+0.460D-0.70E					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 18.70 ft	1	0.046	0.055	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.56	162.3	3,552.0	1.17	27.9	508.8

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+H	1	0.5542	8.736		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	10.376	3.962
Max Upward from Load Combinations	10.376	3.962
Max Upward from Load Cases	3.979	2.297
Max Downward from all Load Conditio	-2.257	-0.743
Max Downward from Load Cases (Resis	-2.257	-0.743

DESCRIPTION: B2-15 OS 312

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
+D+H	3.811	1.546
+D+L+H	7.006	1.950
+D+Lr+H	3.811	1.546
+D+S+H	7.789	3.843
+D+0.750Lr+0.750L+H	6.207	1.849
+D+0.750L+0.750S+H	9.191	3.572
+D+0.60W+H	3.811	1.546
+D+0.750Lr+0.750L+0.450W+H	6.207	1.849
+D+0.750L+0.750S+0.450W+H	9.191	3.572
+0.60D+0.60W+0.60H	2.286	0.927
+D+0.70E+0.60H	5.391	2.066
+D-0.70E+0.60H	2.231	1.026
+D+0.750L+0.750S+0.5250E+H	10.376	3.962
+D+0.750L+0.750S-0.5250E+H	8.006	3.182
+0.60D+0.70E+H	3.866	1.447
+0.60D-0.70E+H	0.706	0.408
D Only	3.811	1.546
L Only	3.196	0.404
S Only	3.979	2.297
E Only	2.257	0.743
E Only * -1.0	-2.257	-0.743
H Only		

Wood Beam

Project File: beam calcs with overstrength.ec6

DESCRIPTION: B2-13 OS 313

CODE REFERENCES

Calculations per NDS 2018, IBC 2021, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

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

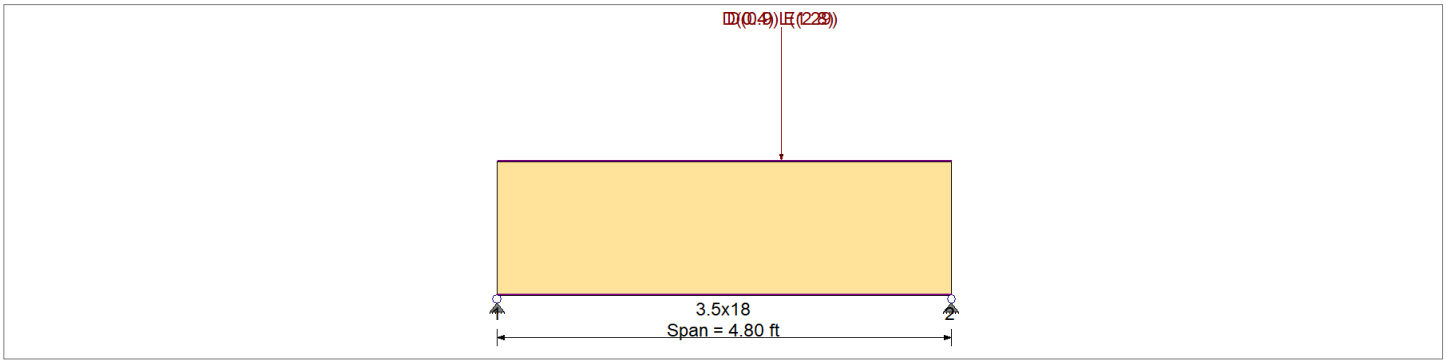
Wood Species : 24F-V4 GLB OS
Wood Grade : GLB - Western

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	318.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	ksi
Eminbend - yy	ksi
Density	35.0 pcf



Applied Loads

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

Beam self weight calculated and added to loading
Point Load : D = 0.40, L = 1.290 k @ 3.0 ft
Point Load : D = 0.90, E = 2.80 k @ 3.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.065 : 1	Maximum Shear Stress Ratio	=	0.122 : 1
Section used for this span		3.5x18	Section used for this span		3.5x18
fb: Actual	=	187.36 psi	fv: Actual	=	38.87 psi
F'b	=	2,880.00 psi	F'v	=	318.00 psi
Load Combination		+D+L+H	Load Combination		+D+L+H
Location of maximum on span	=	2.996 ft	Location of maximum on span	=	3.311 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.003 in	Ratio =	17110	>=360	Span: 1 : E Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.005 in	Ratio =	12650	>=180	Span: 1 : +D+0.750L+0.750S+0.5250E+H
Max Upward Total Deflection	0 in	Ratio =	0	<180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+D+H														0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.037	0.069	0.90	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.50	95.3	2,592.0	0.83	19.7	286.2
+D+L+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.065	0.122	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.95	187.4	2,880.0	1.63	38.9	318.0
+D+Lr+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.026	0.050	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.50	95.3	3,600.0	0.83	19.7	397.5
+D+S+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.029	0.054	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.50	95.3	3,312.0	0.83	19.7	365.7
+D+0.750Lr+0.750L+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0

Wood Beam

Project File: beam calcs with overstrength.ec6

DESCRIPTION: B2-13 OS 313

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
Length = 4.80 ft	1	0.046	0.086	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.59	164.4	3,600.0	1.43	34.1	397.5
+D+0.750L+0.750S+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.050	0.093	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.59	164.4	3,312.0	1.43	34.1	365.7
+D+0.60W+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.021	0.039	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.50	95.3	4,608.0	0.83	19.7	508.8
+D+0.750Lr+0.750L+0.450W+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.036	0.067	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.59	164.4	4,608.0	1.43	34.1	508.8
+D+0.750L+0.750S+0.450W+I					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.036	0.067	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.59	164.4	4,608.0	1.43	34.1	508.8
+0.60D+0.60W+0.60H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.012	0.023	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.90	57.2	4,608.0	0.50	11.8	508.8
+D+0.70E+0.60H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.051	0.096	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.70	235.1	4,608.0	2.05	48.8	508.8
+D-0.70E+0.60H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.013	0.019	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.70	44.4	3,552.0	0.40	9.6	508.8
+D+0.750L+0.750S+0.5250E+					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.058	0.110	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.24	269.2	4,608.0	2.35	55.9	508.8
+D+0.750L+0.750S-0.5250E+I					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.013	0.024	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.94	59.5	4,608.0	0.51	12.2	508.8
+0.60D+0.70E+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.043	0.081	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.10	197.0	4,608.0	1.72	41.0	508.8
+0.60D-0.70E+H					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.023	0.034	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.30	82.6	3,552.0	0.73	17.4	508.8
+1.140D+0.70E					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.054	0.101	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.91	248.5	4,608.0	2.17	51.6	508.8
+1.140D-0.70E					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.009	0.013	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.49	31.1	3,552.0	0.29	6.9	508.8
+1.105D+0.750L+0.750S+0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.061	0.114	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.40	279.2	4,608.0	2.44	58.0	508.8
+1.105D+0.750L+0.750S-0.52					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.015	0.028	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.09	69.5	4,608.0	0.60	14.3	508.8
+0.460D+0.70E					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.040	0.075	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.89	183.7	4,608.0	1.61	38.2	508.8
+0.460D-0.70E					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 4.80 ft	1	0.027	0.040	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.51	95.9	3,552.0	0.85	20.2	508.8

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+H	1	0.0046	2.575		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.438	2.373
Max Upward from Load Combinations	1.438	2.373
Max Upward from Load Cases	1.050	1.750
Max Downward from all Load Conditio	-1.050	-1.750
Max Downward from Load Combinations	-0.420	-0.715
Max Downward from Load Cases (Resis	-1.050	-1.750
+D+H	0.524	0.849
+D+L+H	1.008	1.656
+D+Lr+H	0.524	0.849

DESCRIPTION: B2-13 OS 313

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
+D+S+H	0.524	0.849
+D+0.750Lr+0.750L+H	0.887	1.454
+D+0.750L+0.750S+H	0.887	1.454
+D+0.60W+H	0.524	0.849
+D+0.750Lr+0.750L+0.450W+H	0.887	1.454
+D+0.750L+0.750S+0.450W+H	0.887	1.454
+0.60D+0.60W+0.60H	0.315	0.510
+D+0.70E+0.60H	1.259	2.074
+D-0.70E+0.60H	-0.211	-0.376
+D+0.750L+0.750S+0.5250E+H	1.438	2.373
+D+0.750L+0.750S-0.5250E+H	0.336	0.535
+0.60D+0.70E+H	1.050	1.735
+0.60D-0.70E+H	-0.420	-0.715
D Only	0.524	0.849
L Only	0.484	0.806
E Only	1.050	1.750
E Only * -1.0	-1.050	-1.750
H Only		

DESCRIPTION: B1-1

CODE REFERENCES

Calculations per AISC 360-16, IBC 2021, ASCE 7-16

Load Combination Set : ASCE 7-16

Material Properties

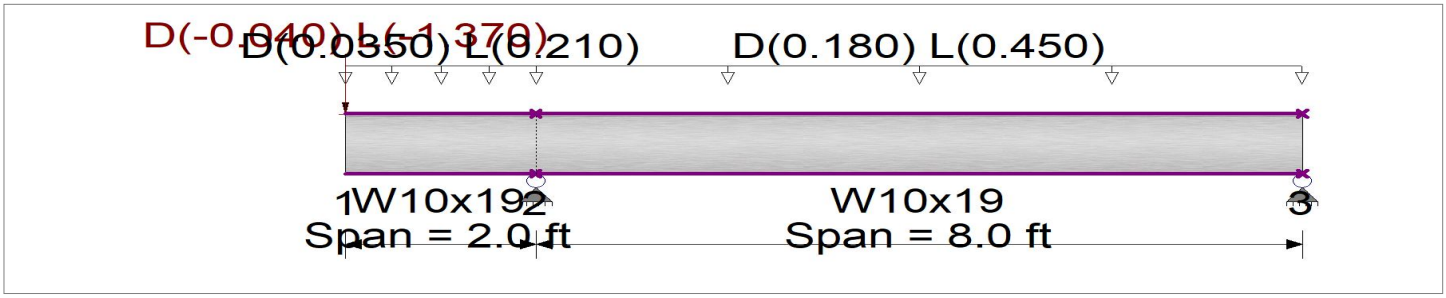
Analysis Method : Allowable Strength Design

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 calculated and added to loading

Load for Span Number 1

Uniform Load : D = 0.0350, L = 0.210 k/ft, Tributary Width = 1.0 ft

Point Load : D = -0.040, L = -1.370 k @ 0.0 ft

Load for Span Number 2

Uniform Load : D = 0.180, L = 0.450 k/ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.119 : 1	Maximum Shear Stress Ratio =	0.057 : 1
Section used for this span	W10x19	Section used for this span	W10x19
Ma : Applied	6.402 k-ft	Va : Applied	2.883 k
Mn / Omega : Allowable	53.892 k-ft	Vn/Omega : Allowable	51.0 k
Load Combination	+D+L+H, LL Comb Run (LL)	Load Combination	+D+L+H, LL Comb Run (LL)
		Location of maximum on span	8.000 ft
Span # where maximum occurs	Span # 2	Span # where maximum occurs	Span # 2

Maximum Deflection

Max Downward Transient Deflection	0.021 in	Ratio =	4,618	>=360	Span: 2 : L Only, LL Comb Run (LL)
Max Upward Transient Deflection	-0.022 in	Ratio =	2,228	>=360	Span: 2 : L Only, LL Comb Run (LL)
Max Downward Total Deflection	0.027 in	Ratio =	3514	>=180	Span: 2 : +D+L+H, LL Comb Run (LL)
Max Upward Total Deflection	-0.027 in	Ratio =	1797	>=180	Span: 2 : +D+L+H, LL Comb Run (LL)

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+H													
Dsgn. L = 2.00 ft	1	0.001	0.016	0.01	-0.03	0.03	90.00	53.89	1.00	1.00	0.80	76.50	51.00
Dsgn. L = 8.00 ft	2	0.029	0.016	1.58	-0.03	1.58	90.00	53.89	1.00	1.00	0.80	76.50	51.00
+D+L+H, LL Comb Run (*L)													
Dsgn. L = 2.00 ft	1	0.001	0.051	0.01	-0.03	0.03	90.00	53.89	1.00	1.00	2.60	76.50	51.00
Dsgn. L = 8.00 ft	2	0.096	0.051	5.18	-0.03	5.18	90.00	53.89	1.00	1.00	2.60	76.50	51.00
+D+L+H, LL Comb Run (L*)													
Dsgn. L = 2.00 ft	1	0.043	0.028	2.29		2.29	90.00	53.89	1.00	1.00	1.41	76.50	51.00
Dsgn. L = 8.00 ft	2	0.055	0.021	2.94		2.94	90.00	53.89	1.00	1.00	1.08	76.50	51.00
+D+L+H, LL Comb Run (LL)													
Dsgn. L = 2.00 ft	1	0.043	0.045	2.29		2.29	90.00	53.89	1.00	1.00	2.31	76.50	51.00
Dsgn. L = 8.00 ft	2	0.119	0.057	6.40		6.40	90.00	53.89	1.00	1.00	2.88	76.50	51.00
+D+Lr+H, LL Comb Run (*L)													
Dsgn. L = 2.00 ft	1	0.001	0.016	0.01	-0.03	0.03	90.00	53.89	1.00	1.00	0.80	76.50	51.00
Dsgn. L = 8.00 ft	2	0.029	0.016	1.58	-0.03	1.58	90.00	53.89	1.00	1.00	0.80	76.50	51.00
+D+Lr+H, LL Comb Run (L*)													
Dsgn. L = 2.00 ft	1	0.001	0.016	0.01	-0.03	0.03	90.00	53.89	1.00	1.00	0.80	76.50	51.00
Dsgn. L = 8.00 ft	2	0.029	0.016	1.58	-0.03	1.58	90.00	53.89	1.00	1.00	0.80	76.50	51.00
+D+Lr+H, LL Comb Run (LL)													
Dsgn. L = 2.00 ft	1	0.001	0.016	0.01	-0.03	0.03	90.00	53.89	1.00	1.00	0.80	76.50	51.00

DESCRIPTION: B1-1

Maximum Forces & Stresses for Load Combinations

Load Combination			Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length		Span #	M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
Dsgn. L =	8.00 ft	2	0.029	0.016	1.58	-0.03	1.58	90.00	53.89	1.00	1.00	0.80	76.50	51.00
+D+S+H														
Dsgn. L =	2.00 ft	1	0.001	0.016	0.01	-0.03	0.03	90.00	53.89	1.00	1.00	0.80	76.50	51.00
Dsgn. L =	8.00 ft	2	0.029	0.016	1.58	-0.03	1.58	90.00	53.89	1.00	1.00	0.80	76.50	51.00
+D+0.750Lr+0.750L+H, LL Comb F														
Dsgn. L =	2.00 ft	1	0.001	0.042	0.01	-0.03	0.03	90.00	53.89	1.00	1.00	2.15	76.50	51.00
Dsgn. L =	8.00 ft	2	0.079	0.042	4.28	-0.03	4.28	90.00	53.89	1.00	1.00	2.15	76.50	51.00
+D+0.750Lr+0.750L+H, LL Comb F														
Dsgn. L =	2.00 ft	1	0.032	0.021	1.71		1.71	90.00	53.89	1.00	1.00	1.07	76.50	51.00
Dsgn. L =	8.00 ft	2	0.048	0.020	2.56		2.56	90.00	53.89	1.00	1.00	1.01	76.50	51.00
+D+0.750Lr+0.750L+H, LL Comb F														
Dsgn. L =	2.00 ft	1	0.032	0.038	1.71		1.71	90.00	53.89	1.00	1.00	1.93	76.50	51.00
Dsgn. L =	8.00 ft	2	0.096	0.046	5.19		5.19	90.00	53.89	1.00	1.00	2.36	76.50	51.00
+D+0.750L+0.750S+H, LL Comb R														
Dsgn. L =	2.00 ft	1	0.001	0.042	0.01	-0.03	0.03	90.00	53.89	1.00	1.00	2.15	76.50	51.00
Dsgn. L =	8.00 ft	2	0.079	0.042	4.28	-0.03	4.28	90.00	53.89	1.00	1.00	2.15	76.50	51.00
+D+0.750L+0.750S+H, LL Comb R														
Dsgn. L =	2.00 ft	1	0.032	0.021	1.71		1.71	90.00	53.89	1.00	1.00	1.07	76.50	51.00
Dsgn. L =	8.00 ft	2	0.048	0.020	2.56		2.56	90.00	53.89	1.00	1.00	1.01	76.50	51.00
+D+0.750L+0.750S+H, LL Comb R														
Dsgn. L =	2.00 ft	1	0.032	0.038	1.71		1.71	90.00	53.89	1.00	1.00	1.93	76.50	51.00
Dsgn. L =	8.00 ft	2	0.096	0.046	5.19		5.19	90.00	53.89	1.00	1.00	2.36	76.50	51.00
+D+0.60W+H														
Dsgn. L =	2.00 ft	1	0.001	0.016	0.01	-0.03	0.03	90.00	53.89	1.00	1.00	0.80	76.50	51.00
Dsgn. L =	8.00 ft	2	0.029	0.016	1.58	-0.03	1.58	90.00	53.89	1.00	1.00	0.80	76.50	51.00
+D+0.750Lr+0.750L+0.450W+H, L														
Dsgn. L =	2.00 ft	1	0.001	0.042	0.01	-0.03	0.03	90.00	53.89	1.00	1.00	2.15	76.50	51.00
Dsgn. L =	8.00 ft	2	0.079	0.042	4.28	-0.03	4.28	90.00	53.89	1.00	1.00	2.15	76.50	51.00
+D+0.750Lr+0.750L+0.450W+H, L														
Dsgn. L =	2.00 ft	1	0.032	0.021	1.71		1.71	90.00	53.89	1.00	1.00	1.07	76.50	51.00
Dsgn. L =	8.00 ft	2	0.048	0.020	2.56		2.56	90.00	53.89	1.00	1.00	1.01	76.50	51.00
+D+0.750Lr+0.750L+0.450W+H, L														
Dsgn. L =	2.00 ft	1	0.032	0.038	1.71		1.71	90.00	53.89	1.00	1.00	1.93	76.50	51.00
Dsgn. L =	8.00 ft	2	0.096	0.046	5.19		5.19	90.00	53.89	1.00	1.00	2.36	76.50	51.00
+D+0.750L+0.750S+0.450W+H, LI														
Dsgn. L =	2.00 ft	1	0.001	0.042	0.01	-0.03	0.03	90.00	53.89	1.00	1.00	2.15	76.50	51.00
Dsgn. L =	8.00 ft	2	0.079	0.042	4.28	-0.03	4.28	90.00	53.89	1.00	1.00	2.15	76.50	51.00
+D+0.750L+0.750S+0.450W+H, LI														
Dsgn. L =	2.00 ft	1	0.032	0.021	1.71		1.71	90.00	53.89	1.00	1.00	1.07	76.50	51.00
Dsgn. L =	8.00 ft	2	0.048	0.020	2.56		2.56	90.00	53.89	1.00	1.00	1.01	76.50	51.00
+D+0.750L+0.750S+0.450W+H, LI														
Dsgn. L =	2.00 ft	1	0.032	0.038	1.71		1.71	90.00	53.89	1.00	1.00	1.93	76.50	51.00
Dsgn. L =	8.00 ft	2	0.096	0.046	5.19		5.19	90.00	53.89	1.00	1.00	2.36	76.50	51.00
+0.60D+0.60W+0.60H														
Dsgn. L =	2.00 ft	1	0.000	0.009	0.01	-0.02	0.02	90.00	53.89	1.00	1.00	0.48	76.50	51.00
Dsgn. L =	8.00 ft	2	0.018	0.009	0.95	-0.02	0.95	90.00	53.89	1.00	1.00	0.48	76.50	51.00
+D+0.70E+0.60H														
Dsgn. L =	2.00 ft	1	0.001	0.016	0.01	-0.03	0.03	90.00	53.89	1.00	1.00	0.80	76.50	51.00
Dsgn. L =	8.00 ft	2	0.029	0.016	1.58	-0.03	1.58	90.00	53.89	1.00	1.00	0.80	76.50	51.00
+D-0.70E+0.60H														
Dsgn. L =	2.00 ft	1	0.001	0.016	0.01	-0.03	0.03	90.00	53.89	1.00	1.00	0.80	76.50	51.00
Dsgn. L =	8.00 ft	2	0.029	0.016	1.58	-0.03	1.58	90.00	53.89	1.00	1.00	0.80	76.50	51.00
+D+0.750L+0.750S+0.5250E+H, L														
Dsgn. L =	2.00 ft	1	0.001	0.042	0.01	-0.03	0.03	90.00	53.89	1.00	1.00	2.15	76.50	51.00
Dsgn. L =	8.00 ft	2	0.079	0.042	4.28	-0.03	4.28	90.00	53.89	1.00	1.00	2.15	76.50	51.00
+D+0.750L+0.750S+0.5250E+H, L														
Dsgn. L =	2.00 ft	1	0.032	0.021	1.71		1.71	90.00	53.89	1.00	1.00	1.07	76.50	51.00
Dsgn. L =	8.00 ft	2	0.048	0.020	2.56		2.56	90.00	53.89	1.00	1.00	1.01	76.50	51.00
+D+0.750L+0.750S+0.5250E+H, L														
Dsgn. L =	2.00 ft	1	0.032	0.038	1.71		1.71	90.00	53.89	1.00	1.00	1.93	76.50	51.00
Dsgn. L =	8.00 ft	2	0.096	0.046	5.19		5.19	90.00	53.89	1.00	1.00	2.36	76.50	51.00
+D+0.750L+0.750S-0.5250E+H, LI														

DESCRIPTION: B1-1

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 = 2.00 ft	1	0.001	0.042	0.01	-0.03	0.03	90.00	53.89	1.00	1.00	2.15	76.50	51.00
Dsgn. L = 8.00 ft	2	0.079	0.042	4.28	-0.03	4.28	90.00	53.89	1.00	1.00	2.15	76.50	51.00
+D+0.750L+0.750S-0.5250E+H, LI													
Dsgn. L = 2.00 ft	1	0.032	0.021	1.71		1.71	90.00	53.89	1.00	1.00	1.07	76.50	51.00
Dsgn. L = 8.00 ft	2	0.048	0.020	2.56		2.56	90.00	53.89	1.00	1.00	1.01	76.50	51.00
+D+0.750L+0.750S-0.5250E+H, LI													
Dsgn. L = 2.00 ft	1	0.032	0.038	1.71		1.71	90.00	53.89	1.00	1.00	1.93	76.50	51.00
Dsgn. L = 8.00 ft	2	0.096	0.046	5.19		5.19	90.00	53.89	1.00	1.00	2.36	76.50	51.00
+0.60D+0.70E+H													
Dsgn. L = 2.00 ft	1	0.000	0.009	0.01	-0.02	0.02	90.00	53.89	1.00	1.00	0.48	76.50	51.00
Dsgn. L = 8.00 ft	2	0.018	0.009	0.95	-0.02	0.95	90.00	53.89	1.00	1.00	0.48	76.50	51.00
+0.60D-0.70E+H													
Dsgn. L = 2.00 ft	1	0.000	0.009	0.01	-0.02	0.02	90.00	53.89	1.00	1.00	0.48	76.50	51.00
Dsgn. L = 8.00 ft	2	0.018	0.009	0.95	-0.02	0.95	90.00	53.89	1.00	1.00	0.48	76.50	51.00
+1.140D+0.70E													
Dsgn. L = 2.00 ft	1	0.001	0.018	0.02	-0.03	0.03	90.00	53.89	1.00	1.00	0.91	76.50	51.00
Dsgn. L = 8.00 ft	2	0.033	0.018	1.80	-0.03	1.80	90.00	53.89	1.00	1.00	0.91	76.50	51.00
+1.140D-0.70E													
Dsgn. L = 2.00 ft	1	0.001	0.018	0.02	-0.03	0.03	90.00	53.89	1.00	1.00	0.91	76.50	51.00
Dsgn. L = 8.00 ft	2	0.033	0.018	1.80	-0.03	1.80	90.00	53.89	1.00	1.00	0.91	76.50	51.00
+1.105D+0.750L+0.750S+0.5250E													
Dsgn. L = 2.00 ft	1	0.001	0.044	0.02	-0.03	0.03	90.00	53.89	1.00	1.00	2.23	76.50	51.00
Dsgn. L = 8.00 ft	2	0.082	0.044	4.44	-0.03	4.44	90.00	53.89	1.00	1.00	2.23	76.50	51.00
+1.105D+0.750L+0.750S+0.5250E													
Dsgn. L = 2.00 ft	1	0.032	0.021	1.71		1.71	90.00	53.89	1.00	1.00	1.07	76.50	51.00
Dsgn. L = 8.00 ft	2	0.050	0.021	2.72		2.72	90.00	53.89	1.00	1.00	1.09	76.50	51.00
+1.105D+0.750L+0.750S+0.5250E													
Dsgn. L = 2.00 ft	1	0.032	0.040	1.71		1.71	90.00	53.89	1.00	1.00	2.02	76.50	51.00
Dsgn. L = 8.00 ft	2	0.099	0.048	5.36		5.36	90.00	53.89	1.00	1.00	2.44	76.50	51.00
+1.105D+0.750L+0.750S-0.5250E,													
Dsgn. L = 2.00 ft	1	0.001	0.044	0.02	-0.03	0.03	90.00	53.89	1.00	1.00	2.23	76.50	51.00
Dsgn. L = 8.00 ft	2	0.082	0.044	4.44	-0.03	4.44	90.00	53.89	1.00	1.00	2.23	76.50	51.00
+1.105D+0.750L+0.750S-0.5250E,													
Dsgn. L = 2.00 ft	1	0.032	0.021	1.71		1.71	90.00	53.89	1.00	1.00	1.07	76.50	51.00
Dsgn. L = 8.00 ft	2	0.050	0.021	2.72		2.72	90.00	53.89	1.00	1.00	1.09	76.50	51.00
+1.105D+0.750L+0.750S-0.5250E,													
Dsgn. L = 2.00 ft	1	0.032	0.040	1.71		1.71	90.00	53.89	1.00	1.00	2.02	76.50	51.00
Dsgn. L = 8.00 ft	2	0.099	0.048	5.36		5.36	90.00	53.89	1.00	1.00	2.44	76.50	51.00
+0.460D+0.70E													
Dsgn. L = 2.00 ft	1	0.000	0.007	0.01	-0.01	0.01	90.00	53.89	1.00	1.00	0.37	76.50	51.00
Dsgn. L = 8.00 ft	2	0.013	0.007	0.73	-0.01	0.73	90.00	53.89	1.00	1.00	0.37	76.50	51.00
+0.460D-0.70E													
Dsgn. L = 2.00 ft	1	0.000	0.007	0.01	-0.01	0.01	90.00	53.89	1.00	1.00	0.37	76.50	51.00
Dsgn. L = 8.00 ft	2	0.013	0.007	0.73	-0.01	0.73	90.00	53.89	1.00	1.00	0.37	76.50	51.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
	1	0.0000	0.000	+D+L+H	-0.0267	0.000
+D+L+H	2	0.0273	3.904		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Max Upward from all Load Conditions		2.668	2.883
Max Upward from Load Combinations		2.668	2.883
Max Upward from Load Cases		1.800	2.090
Max Downward from all Load Conditions (Resisti		-1.240	
Max Downward from Load Combinations (Resisti		-0.372	
Max Downward from Load Cases (Resisting Upli		-1.240	
+D+H		0.868	0.793
+D+L+H, LL Comb Run (*L)		2.668	2.593
+D+L+H, LL Comb Run (L*)		-0.372	1.083
+D+L+H, LL Comb Run (LL)		1.428	2.883

DESCRIPTION: B1-1

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
+D+Lr+H, LL Comb Run (*L)		0.868	0.793
+D+Lr+H, LL Comb Run (L*)		0.868	0.793
+D+Lr+H, LL Comb Run (LL)		0.868	0.793
+D+S+H		0.868	0.793
+D+0.750Lr+0.750L+H, LL Comb Run (*L)		2.218	2.143
+D+0.750Lr+0.750L+H, LL Comb Run (L*)		-0.062	1.010
+D+0.750Lr+0.750L+H, LL Comb Run (LL)		1.288	2.360
+D+0.750L+0.750S+H, LL Comb Run (*L)		2.218	2.143
+D+0.750L+0.750S+H, LL Comb Run (L*)		-0.062	1.010
+D+0.750L+0.750S+H, LL Comb Run (LL)		1.288	2.360
+D+0.60W+H		0.868	0.793
+D+0.750Lr+0.750L+0.450W+H, LL Comb Run		2.218	2.143
+D+0.750Lr+0.750L+0.450W+H, LL Comb Run		-0.062	1.010
+D+0.750Lr+0.750L+0.450W+H, LL Comb Run		1.288	2.360
+D+0.750L+0.750S+0.450W+H, LL Comb Run (		2.218	2.143
+D+0.750L+0.750S+0.450W+H, LL Comb Run (		-0.062	1.010
+D+0.750L+0.750S+0.450W+H, LL Comb Run (		1.288	2.360
+0.60D+0.60W+0.60H		0.521	0.476
+D+0.70E+0.60H		0.868	0.793
+D-0.70E+0.60H		0.868	0.793
+D+0.750L+0.750S+0.5250E+H, LL Comb Run		2.218	2.143
+D+0.750L+0.750S+0.5250E+H, LL Comb Run		-0.062	1.010
+D+0.750L+0.750S+0.5250E+H, LL Comb Run		1.288	2.360
+D+0.750L+0.750S-0.5250E+H, LL Comb Run (		2.218	2.143
+D+0.750L+0.750S-0.5250E+H, LL Comb Run (		-0.062	1.010
+D+0.750L+0.750S-0.5250E+H, LL Comb Run (		1.288	2.360
+0.60D+0.70E+H		0.521	0.476
+0.60D-0.70E+H		0.521	0.476
D Only		0.868	0.793
L Only, LL Comb Run (*L)		1.800	1.800
L Only, LL Comb Run (L*)		-1.240	0.290
L Only, LL Comb Run (LL)		0.560	2.090
H Only			

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Shear Wall Calculations Wind

Design Built Homes

86th Ave SE - Lot 2

Mercer Island

Parameters:

Single Family Home

Design Wind Speed: 100 MPH

Wind Exposure Category: B

Seismic Design Category: D1

Code & Design Standard: 2021 IBC Ch. 1609, ASCE 7-16 Ch. 26-30

MULHERN & KULP STRUCTURAL ENGINEERING, INC.

Nicholas Martignetti, P.E., Project Manager

Ryan Chan, Staff Engineer

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

WIND DESIGN SUMMARY PER ASCE 7-16

M+K PROJECT #: 244-24010
ENGINEER: RSC

PARAMETERS:

WIND SPEED	100
EXPOSURE CATEGORY	B
RISK CATEGORY	II
WIND DIRECTIONALITY FACTOR, K_D	0.85
TOPOGRAPHIC FACTOR, K_{zt}	1.60
GUST FACTOR, G	0.85
GROUND ELEV. ABOVE SEA LEVEL [FT]	0
DESIGN TYPE	ASD

0.60

ROOF GEOMETRY:

TRANS. ROOF PITCH	0.0	:12
LONG. ROOF PITCH	0.0	:12
MEAN ROOF HEIGHT, H	33.87	FT

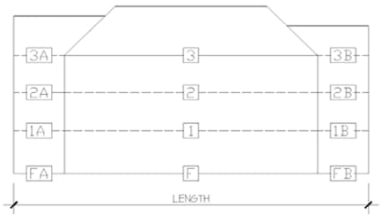
BUILDING GEOMETRY:

LENGTH	80	FT
WIDTH	44	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	9.08 FT	ROOF SURFACE	0	0	0	SQ FT
		WALL SURFACE	0	485	0	SQ FT
2	11.65 FT	ROOF SURFACE	0	0	0	SQ FT
		WALL SURFACE	0	816	0	SQ FT
1	10.64 FT	ROOF SURFACE	0	0	0	SQ FT
		WALL SURFACE	0	0	0	SQ FT
FND		ROOF SURFACE	0	0	0	SQ FT
		WALL SURFACE	0	0	0	SQ FT



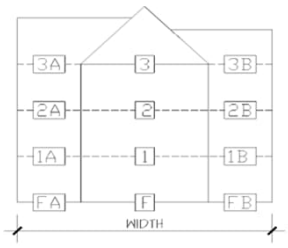
TRIBUTARY DESIGN LOADS: (0.6W)

	SECTION A	SECTION O	SECTION B	
STORY SHEAR	0.00	8.01	0.00	KIPS
TOTAL SHEAR	0.00	8.01	0.00	KIPS
		8.01		KIPS
STORY SHEAR	0.00	12.71	0.00	KIPS
TOTAL SHEAR	0.00	20.73	0.00	KIPS
		20.73		KIPS
STORY SHEAR	0.00	0.00	0.00	KIPS
TOTAL SHEAR	0.00	20.73	0.00	KIPS
		20.73		KIPS
STORY SHEAR	0.00	0.00	0.00	KIPS
TOTAL SHEAR	0.00	20.73	0.00	KIPS
		20.73		KIPS

LONGITUDINAL DIRECTION (PARALLEL TO MAIN RIDGE LINE)

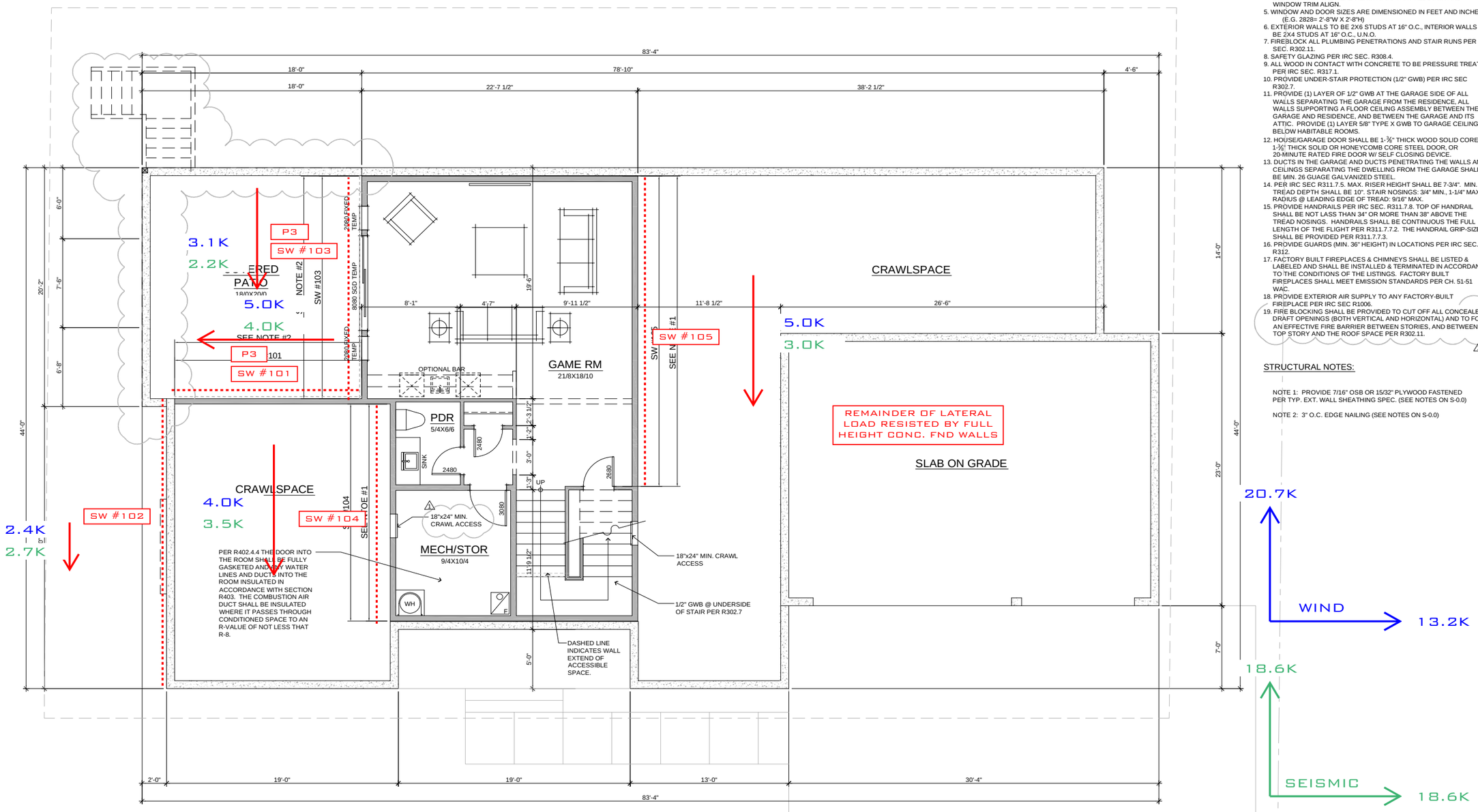
TRIBUTARY DESIGN AREAS:

DIAPHRAGM LEVEL	FLOOR-TO-FLOOR HEIGHT		SECTION A	SECTION O	SECTION B	
3	9.08 FT	ROOF SURFACE	0	0	0	SQ FT
		WALL SURFACE	0	298	0	SQ FT
2	11.65 FT	ROOF SURFACE	0	0	0	SQ FT
		WALL SURFACE	0	456	0	SQ FT
1	10.64 FT	ROOF SURFACE	0	0	0	SQ FT
		WALL SURFACE	0	220	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	4.29	0.00	KIPS
TOTAL SHEAR	0.00	4.29	0.00	KIPS
		4.29		KIPS
STORY SHEAR	0.00	6.14	0.00	KIPS
TOTAL SHEAR	0.00	10.44	0.00	KIPS
		10.44		KIPS
STORY SHEAR	0.00	2.75	0.00	KIPS
TOTAL SHEAR	0.00	13.19	0.00	KIPS
		13.19		KIPS
STORY SHEAR	0.00	0.00	0.00	KIPS
TOTAL SHEAR	0.00	13.19	0.00	KIPS
		13.19		KIPS



BASEMENT FLOOR PLAN

700 SF

GENERAL NOTES:

1. PLATE HEIGHT @ UPPER FLOOR IS 9'-1", U.N.O.
   PLATE HEIGHT @ MAIN FLOOR IS 10'-1", U.N.O.
   PLATE HEIGHT @ LOWER FLOOR IS 9'-1" U.N.P.
2. DIMENSION LINES ARE TO FACE OF STUD U.N.O.
3. WINDOW SIZES & ROUGH OPENINGS TO BE VERIFIED BY CONTRACTOR.
4. WINDOW HEAD HEIGHT AT MAIN FLOOR IS 8'-0" ABOVE SUBFLOOR, U.N.O. IF NOMINAL DOOR AND WINDOW HEIGHTS ARE SIMILAR, COORDINATE WITH DOOR AND WINDOW SPEC'S TO LOCATE FINAL ELEVATION OF THE HEAD HEIGHTS SO THAT ALL DOOR AND WINDOW TRIM ALIGN.
5. WINDOW AND DOOR SIZES ARE DIMENSIONED IN FEET AND INCHES (E.G. 2828= 2'-8"W X 2'-8"H)
6. EXTERIOR WALLS TO BE 2X6 STUDS AT 16" O.C., INTERIOR WALLS TO BE 2X4 STUDS AT 16" O.C., U.N.O.
7. FIREBLOCK ALL PLUMBING PENETRATIONS AND STAIR RUNS PER IRC SEC. R302.11.
8. SAFETY GLAZING PER IRC SEC. R308.4.
9. ALL WOOD IN CONTACT WITH CONCRETE TO BE PRESSURE TREATED PER IRC SEC. R317.1.
10. PROVIDE UNDER-STAIR PROTECTION (1/2" GWB) PER IRC SEC R302.7.
11. PROVIDE (1) LAYER OF 1/2" GWB AT THE GARAGE SIDE OF ALL WALLS SEPARATING THE GARAGE FROM THE RESIDENCE, ALL WALLS SUPPORTING A FLOOR CEILING ASSEMBLY BETWEEN THE GARAGE AND RESIDENCE, AND BETWEEN THE GARAGE AND ITS ATTIC. PROVIDE (1) LAYER 5/8" TYPE X GWB TO GARAGE CEILING IF BELOW HABITABLE ROOMS.
12. HOUSE/GARAGE DOOR SHALL BE 1-⅜" THICK WOOD SOLID CORE, OR 1-⅜' THICK SOLID OR HONEYCOMB CORE STEEL DOOR, OR 20-MINUTE RATED FIRE DOOR W/ SELF CLOSING DEVICE.
13. DUCTS IN THE GARAGE AND DUCTS PENETRATING THE WALLS AND CEILINGS SEPARATING THE DWELLING FROM THE GARAGE SHALL BE MIN. 26 GUAGE GALVANIZED STEEL.
14. PER IRC SEC R311.7.5. MAX. RISER HEIGHT SHALL BE 7-3/4". MIN. TREAD DEPTH SHALL BE 10". STAIR NOSINGS: 3/4" MIN., 1-1/4" MAX. RADIUS @ LEADING EDGE OF TREAD: 9/16" MAX.
15. PROVIDE HANDRAILS PER IRC SEC. R311.7.8. TOP OF HANDRAIL SHALL BE NOT LASS THAN 34" OR MORE THAN 38" ABOVE THE TREAD NOSINGS. HANDRAILS SHALL BE CONTINUOUS THE FULL LENGTH OF THE FLIGHT PER R311.7.7.2. THE HANDRAIL GRIP-SIZE SHALL BE PROVIDED PER R311.7.7.3.
16. PROVIDE GUARDS (MIN. 36" HEIGHT) IN LOCATIONS PER IRC SEC. R312.
17. FACTORY BUILT FIREPLACES & CHIMNEYS SHALL BE LISTED & LABELED AND SHALL BE INSTALLED & TERMINATED IN ACCORDANCE TO THE CONDITIONS OF THE LISTINGS. FACTORY BUILT FIREPLACES SHALL MEET EMISSION STANDARDS PER CH. 51-51 WAC.
18. PROVIDE EXTERIOR AIR SUPPLY TO ANY FACTORY-BUILT FIREPLACE PER IRC SEC R1006.
19. FIRE BLOCKING SHALL BE PROVIDED TO CUT OFF ALL CONCEALED DRAFT OPENINGS (BOTH VERTICAL AND HORIZONTAL) AND TO FORM AN EFFECTIVE FIRE BARRIER BETWEEN STORIES, AND BETWEEN A TOP STORY AND THE ROOF SPACE PER R302.11.

STRUCTURAL NOTES:

NOTE 1: PROVIDE 7/16" OSB OR 15/32" PLYWOOD FASTENED PER TYP. EXT. WALL SHEATHING SPEC. (SEE NOTES ON S-0.0)

NOTE 2: 3" O.C. EDGE NAILING (SEE NOTES ON S-0.0)

MCCULLOUGH ARCHITECTS
5601 6th Ave South
Suite 371
Seattle, WA. 98108
206.443.1181
mccullougharchitects.com

Revisions
05.11.2025 1 Comment

Date: 04.09.2025
Job No: xx-xxx
Project No: 00000
Drawn: BAK
Approved: APM

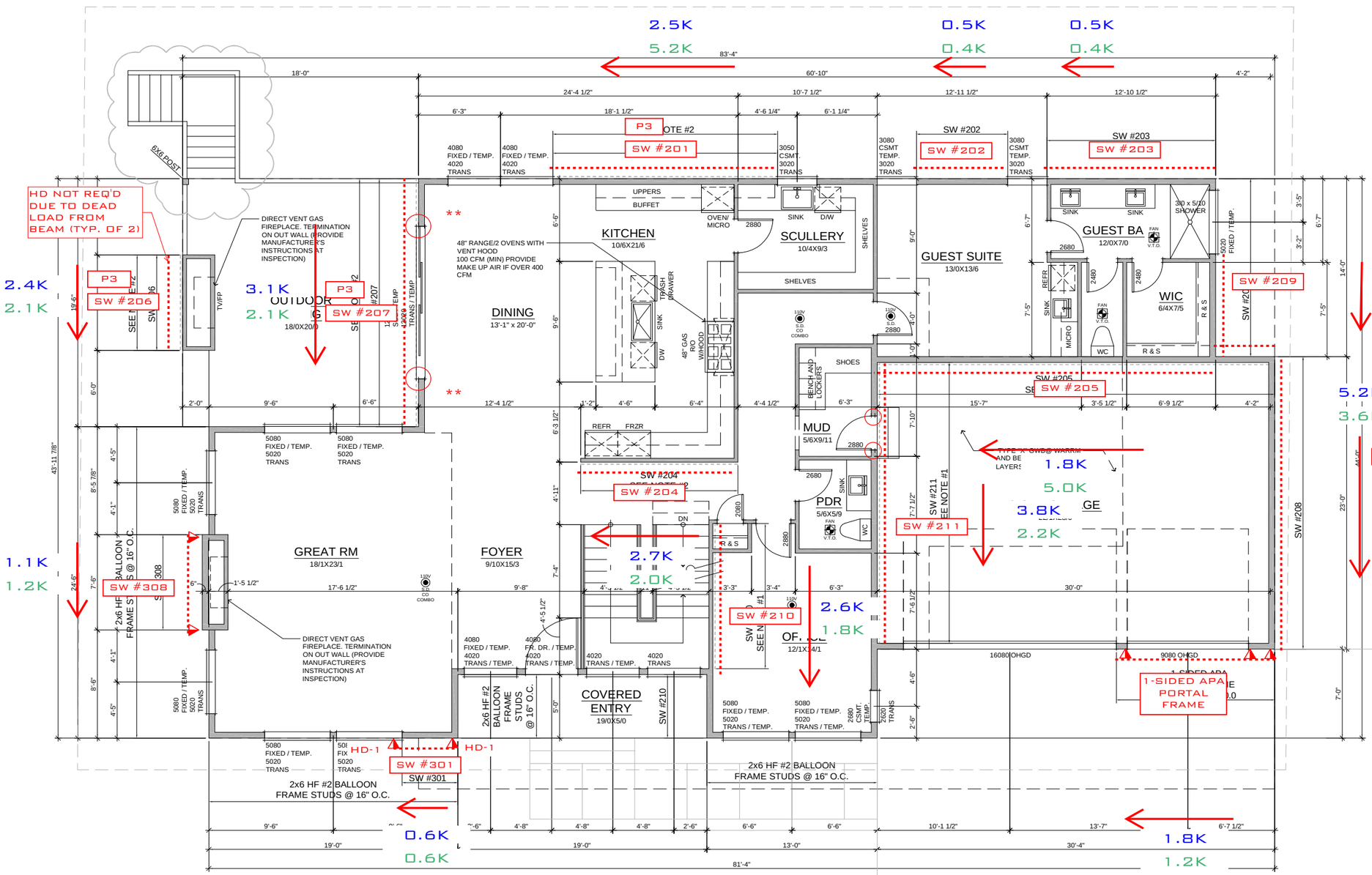
Owner
Design Built Homes

REGISTERED ARCHITECT
7806
PHILIP MCCULLOUGH
STATE OF WASHINGTON

4715 86th Ave SE
Mercer Island, Washington

Lower Floor Plan

A4



GENERAL NOTES:

1. PLATE HEIGHT @ UPPER FLOOR IS 9'-1", U.N.O.
   PLATE HEIGHT @ MAIN FLOOR IS 10'-1", U.N.O.
   PLATE HEIGHT @ LOWER FLOOR IS 9'-1" U.N.P.
2. DIMENSION LINES ARE TO FACE OF STUD U.N.O.
3. WINDOW SIZES & ROUGH OPENINGS TO BE VERIFIED BY CONTRACTOR.
4. WINDOW HEAD HEIGHT AT MAIN FLOOR IS 8'-0" ABOVE SUBFLOOR, U.N.O. IF NOMINAL DOOR AND WINDOW HEIGHTS ARE SIMILAR, COORDINATE WITH DOOR AND WINDOW SPEC'S TO LOCATE FINAL ELEVATION OF THE HEAD HEIGHTS SO THAT ALL DOOR AND WINDOW TRIM ALIGN.
5. WINDOW AND DOOR SIZES ARE DIMENSIONED IN FEET AND INCHES (E.G. 2828= 2'-8"W X 2'-8"H)
6. EXTERIOR WALLS TO BE 2X6 STUDS AT 16" O.C., INTERIOR WALLS TO BE 2X4 STUDS AT 16" O.C., U.N.O.
7. FIREBLOCK ALL PLUMBING PENETRATIONS AND STAIR RUNS PER IRC SEC. R302.11.
8. SAFETY GLAZING PER IRC SEC. R308.4.
9. ALL WOOD IN CONTACT WITH CONCRETE TO BE PRESSURE TREATED PER IRC SEC. R317.1.
10. PROVIDE UNDER-STAIR PROTECTION (1/2" GWB) PER IRC SEC R302.7.
11. PROVIDE (1) LAYER OF 1/2" GWB AT THE GARAGE SIDE OF ALL WALLS SEPARATING THE GARAGE FROM THE RESIDENCE, ALL WALLS SUPPORTING A FLOOR CEILING ASSEMBLY BETWEEN THE GARAGE AND RESIDENCE, AND BETWEEN THE GARAGE AND ITS ATTIC. PROVIDE (1) LAYER 5/8" TYPE X GWB TO GARAGE CEILING IF BELOW HABITABLE ROOMS.
12. HOUSE/GARAGE DOOR SHALL BE 1-⅜" THICK WOOD SOLID CORE, OR 1-¾" THICK SOLID OR HONEYCOMB CORE STEEL DOOR, OR 20-MINUTE RATED FIRE DOOR W/ SELF CLOSING DEVICE.
13. DUCTS IN THE GARAGE AND DUCTS PENETRATING THE WALLS AND CEILINGS SEPARATING THE DWELLING FROM THE GARAGE SHALL BE MIN. 26 GUAGE GALVANIZED STEEL.
14. PER IRC SEC R311.7.5. MAX. RISER HEIGHT SHALL BE 7-3/4". MIN. TREAD DEPTH SHALL BE 10". STAIR NOSINGS: 3/4" MIN., 1-1/4" MAX. RADIUS @ LEADING EDGE OF TREAD: 9/16" MAX.
15. PROVIDE HANDRAILS PER IRC SEC. R311.7.8. TOP OF HANDRAIL SHALL BE NOT LASS THAN 34" OR MORE THAN 38" ABOVE THE TREAD NOSINGS. HANDRAILS SHALL BE CONTINUOUS THE FULL ...IGHT PER R311.7.7.2. THE HANDRAIL GRIP-SIZE ...D PER R311.7.7.3.
16. PROVIDE GUARDS (MIN. 36" HEIGHT) IN LOCATIONS PER IRC SEC. 2.5K
17. 1.8K REPLACES & CHIMNEYS SHALL BE LISTED & LABELED AND SHALL BE INSTALLED & TERMINATED IN ACCORDANCE TO THE CONDITIONS OF THE LISTINGS. FACTORY BUILT FIREPLACES SHALL MEET EMISSION STANDARDS PER CH. 51-51 WAC.
18. PROVIDE EXTERIOR AIR SUPPLY TO ANY FACTORY-BUILT FIREPLACE PER IRC SEC R1006.
19. FIRE BLOCKING SHALL BE PROVIDED TO CUT OFF ALL CONCEALED DRAFT OPENINGS (BOTH VERTICAL AND HORIZONTAL) AND TO FORM AN EFFECTIVE FIRE BARRIER BETWEEN STORIES, AND BETWEEN A TOP STORY AND THE ROOF SPACE PER R302.11.

...UCTURAL NOTES:

NOTE 1: PROVIDE 7/16" OSB OR 15/32" PLYWOOD FASTENED ...ED TYP. EXT. WALL SHEATHING SPEC. (SEE NOTES ON S-0.0)
NOTE 2: ...O.C. EDGE NAILING (SEE NOTES ON S-0.0)

NOTE 3 @ STEEL BEAMS: PROVIDE SOLID 2x/LVL WEB PACKOUT FASTENED TO WEB w/ 1/2" DIA THRU BOLTS @ 24" O.C. STAGGERED. PROVIDE 2x TOP PLATE FASTENED TO TOP FLANGE OF STEEL BEAMS W/ P.A.F.S. (HILTI X-U PINS OR EQUAL (0.157" DIA. X 2" LONG MIN.)) @ 16" O.C. STAGGERED OR 1/2" DIA. ...RED)

MAIN FLOOR PLAN

2,183 SF

TOTAL = 4,827 SF

MCCULLOUGH ARCHITECTS
5601 6th Ave South
Suite 371
Seattle, WA. 98108
206.443.1181
mccullougharchitects.com

Revisions
1 Comment
05.11.2025

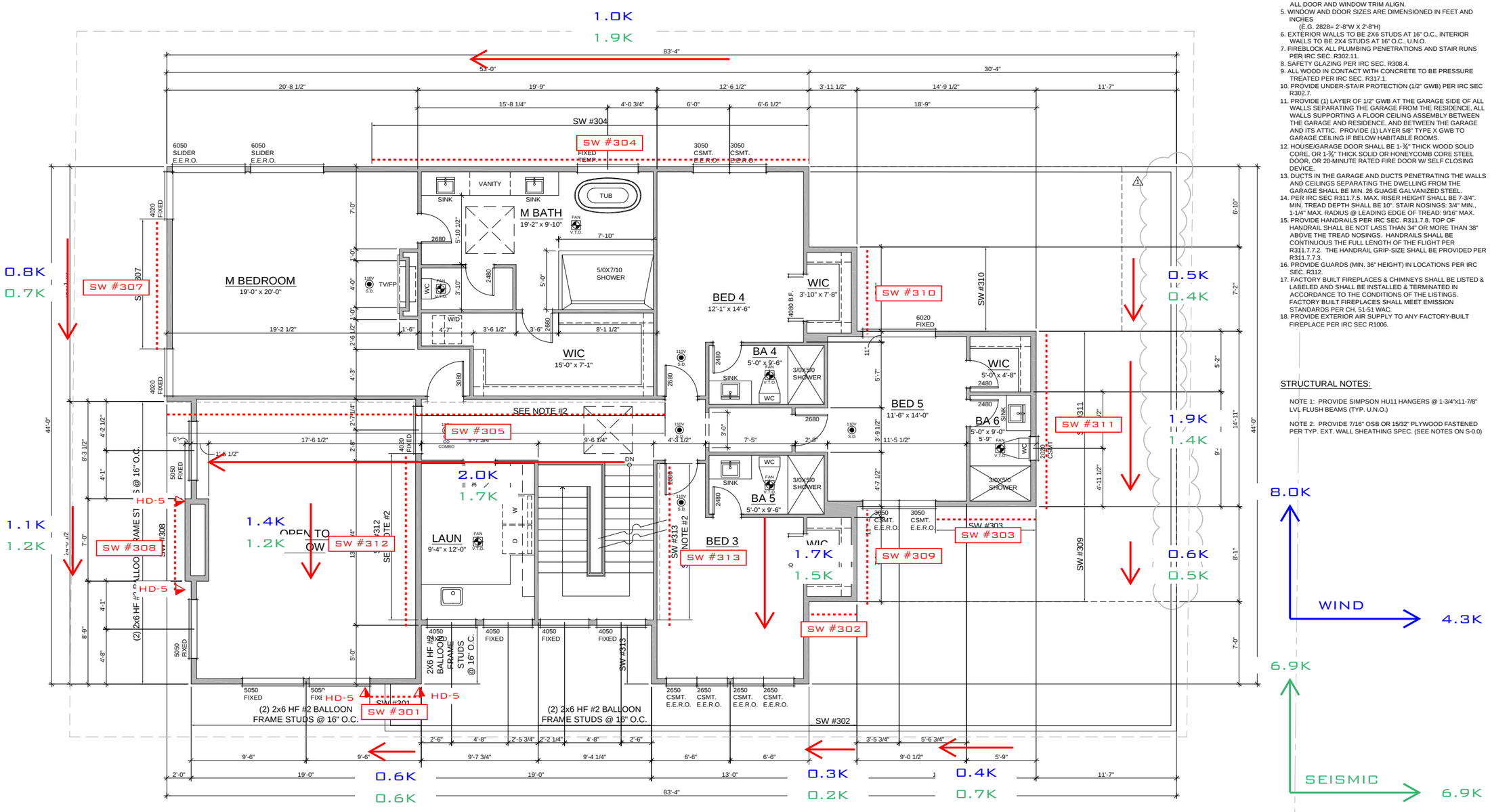
Date: 04.09.2025
Job No: xx-xxx
Project No: 00000
Drawn: BAK
Approved: APM

Owner
Design Built Homes

REGISTERED ARCHITECT
7806
PHILIP MCCULLOUGH
STATE OF WASHINGTON

4715 86th Ave SE
Mercer Island, Washington

Main Floor Plan
A6



UPPER FLOOR PLAN

1,933 SF

GENERAL NOTES:

1. PLATE HEIGHT @ UPPER FLOOR IS 9'-1", U.N.O.
   PLATE HEIGHT @ MAIN FLOOR IS 10'-1", U.N.O.
   PLATE HEIGHT @ LOWER FLOOR IS 9'-1" U.N.P.
2. DIMENSION LINES ARE TO FACE OF STUD U.N.O.
3. WINDOW SIZES & ROUGH OPENINGS TO BE VERIFIED BY CONTRACTOR.
4. WINDOW HEAD HEIGHT AT MAIN FLOOR IS 8'-0" ABOVE SUBFLOOR, U.N.O. IF NOMINAL DOOR AND WINDOW HEIGHTS ARE SIMILAR, COORDINATE WITH DOOR AND WINDOW SPEC'S TO LOCATE FINAL ELEVATION OF THE HEAD HEIGHTS SO THAT ALL DOOR AND WINDOW TRIM ALIGN.
5. WINDOW AND DOOR SIZES ARE DIMENSIONED IN FEET AND INCHES
   (E.G. 2828= 2'-8"W X 2'-8"H)
6. EXTERIOR WALLS TO BE 2X6 STUDS AT 16" O.C., INTERIOR WALLS TO BE 2X4 STUDS AT 16" O.C., U.N.O.
7. FIREBLOCK ALL PLUMBING PENETRATIONS AND STAIR RUNS PER IRC SEC. R302.11.
8. SAFETY GLAZING PER IRC SEC. R308.4.
9. ALL WOOD IN CONTACT WITH CONCRETE TO BE PRESSURE TREATED PER IRC SEC. R317.1.
10. PROVIDE UNDER-STAIR PROTECTION (1/2" GWB) PER IRC SEC R302.7.
11. PROVIDE (1) LAYER OF 1/2" GWB AT THE GARAGE SIDE OF ALL WALLS SEPARATING THE GARAGE FROM THE RESIDENCE, ALL WALLS SUPPORTING A FLOOR CEILING ASSEMBLY BETWEEN THE GARAGE AND RESIDENCE, AND BETWEEN THE GARAGE AND ITS ATTIC. PROVIDE (1) LAYER 5/8" TYPE X GWB TO GARAGE CEILING IF BELOW HABITABLE ROOMS.
12. HOUSE/GARAGE DOOR SHALL BE 1-⅜" THICK WOOD SOLID CORE, OR 1-⅜" THICK SOLID OR HONEYCOMB CORE STEEL DOOR, OR 20-MINUTE RATED FIRE DOOR W/ SELF CLOSING DEVICE.
13. DUCTS IN THE GARAGE AND DUCTS PENETRATING THE WALLS AND CEILINGS SEPARATING THE DWELLING FROM THE GARAGE SHALL BE MIN. 26 GUAGE GALVANIZED STEEL.
14. PER IRC SEC R311.7.5. MAX. RISER HEIGHT SHALL BE 7-3/4". MIN. TREAD DEPTH SHALL BE 10". STAIR NOSINGS: 3/4" MIN., 1-1/4" MAX. RADIUS @ LEADING EDGE OF TREAD: 9/16" MAX.
15. PROVIDE HANDRAILS PER IRC SEC. R311.7.8. TOP OF HANDRAIL SHALL BE NOT LASS THAN 34" OR MORE THAN 38" ABOVE THE TREAD NOSINGS. HANDRAILS SHALL BE CONTINUOUS THE FULL LENGTH OF THE FLIGHT PER R311.7.7.2. THE HANDRAIL GRIP-SIZE SHALL BE PROVIDED PER R311.7.7.3.
16. PROVIDE GUARDS (MIN. 36" HEIGHT) IN LOCATIONS PER IRC SEC. R312.
17. FACTORY BUILT FIREPLACES & CHIMNEYS SHALL BE LISTED & LABELED AND SHALL BE INSTALLED & TERMINATED IN ACCORDANCE TO THE CONDITIONS OF THE LISTINGS. FACTORY BUILT FIREPLACES SHALL MEET EMISSION STANDARDS PER CH. 51-51 WAC.
18. PROVIDE EXTERIOR AIR SUPPLY TO ANY FACTORY-BUILT FIREPLACE PER IRC SEC R1006.

STRUCTURAL NOTES:

NOTE 1: PROVIDE SIMPSON HU11 HANGERS @ 1-3/4"x11-7/8" LVL FLUSH BEAMS (TYP. U.N.O.)

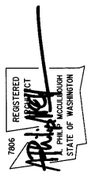
NOTE 2: PROVIDE 7/16" OSB OR 15/32" PLYWOOD FASTENED PER TYP. EXT. WALL SHEATHING SPEC. (SEE NOTES ON S-0.0)

MCCULLOUGH ARCHITECTS
5601 6th Ave South
Suite 371
Seattle, WA. 98108
206.443.1181
mccullougharchitects.com

Revisions Comment
05.11.2025 1

Date: 04.09.2025
Job No: xx-xxx
Project No: 00000
Drawn: BAK
Approved: APM

Owner
Design Built Homes



4715 86th Ave SE

Mercer Island, Washington

Upper Floor Plan

A8

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Shearwall Design Summary

M+K Project #: 244-24010
Engineer: RSC

Shearwall 301: 3rd - Front B.F. Wall @ Great Rm

Shearwall Properties:

Wall height, H	16.0	ft.	Max wall opening ht, H_o	0.0	ft.		
Wall Length, L	4.8	ft.	Qualifying Wall Length, L	4.8	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
600 lbs	<	1322 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	213	plf	Overturning Moment	9.6	k-ft	Hold Down Design Load	1296	lbs
DL at ends of wall	300	lbs	Resistive Moment	3.4	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

Shearwall 302: 3rd - Front Ext. Wall @ W.I.C.

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	4.0	ft.	Qualifying Wall Length, L	4.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
300 lbs	<	1281 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	251	plf	Overturning Moment	2.7	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	400	lbs	Resistive Moment	3.2	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Shearwall Design Summary

M+K Project #: 244-24010
Engineer: RSC

Shearwall 303: 3rd - Front Ext. Wall @ BA 6

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	8.3	ft.	Qualifying Wall Length, L	8.3	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
400 lbs	<	2790 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	214	plf	Overturning Moment	3.6	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	400	lbs	Resistive Moment	9.6	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall 304: 3rd - Rear Ext. Wall @ M Bed - Bed 4

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, Hc	5.0	ft.		
Wall Length, L	36.1	ft.	Qualifying Wall Length, L	25.1	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1000 lbs	<	8422 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	194	plf	Overturning Moment	9.1	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	400	lbs	Resistive Moment	126.6	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Shearwall Design Summary

M+K Project #: 244-24010
Engineer: RSC

Shearwall 305: 3rd - Front Int. Wall @ M Bed

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, H_c	8.0	ft.		
Wall Length, L	41.1	ft.	Qualifying Wall Length, L	38.1	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
2000 lbs	<	12801 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	206	plf	Overturning Moment	18.2	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	200	lbs	Resistive Moment	164.0	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall : Basement - 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

Shearwall Design Summary

M+K Project #: 244-24010
Engineer: RSC

Shearwall 307: 3rd - Side Ext. Wall @ M Bed

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	11.1	ft.	Qualifying Wall Length, L	11.1	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
800 lbs	<	3724 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	113	plf	Overturning Moment	7.3	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	300	lbs	Resistive Moment	9.2	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall 308: 3rd - Side Ext. B.F. Wall @ Great Rm

Shearwall Properties:

Wall height, H	16.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	8.0	ft.	Qualifying Wall Length, L	8.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1100 lbs	<	2686 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	279	plf	Overturning Moment	17.6	k-ft	Hold Down Design Load	791	lbs
DL at ends of wall	450	lbs	Resistive Moment	11.3	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

SHEARWALL DESIGN SUMMARY

M+K PROJECT #: 244-24010
ENGINEER: RSC

SHEARWALL 309: 3RD - SIDE EXT. WALL @ W.I.C.

SHEARWALL PROPERTIES:

WALL HEIGHT, H	9.1	FT.	MAX WALL OPENING HT, H_c	0.0	FT.		
WALL LENGTH, L	8.1	FT.	QUALIFYING WALL LENGTH, L	8.1	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
600 LBS	<	2713 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	113	PLF	OVERTURNING MOMENT	5.4	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	450	LBS	RESISTIVE MOMENT	6.6	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

SHEARWALL 310: 3RD - SIDE EXT. WALL @ W.I.C.

SHEARWALL PROPERTIES:

WALL HEIGHT, H	9.1	FT.	MAX WALL OPENING HT, Hc	0.0	FT.		
WALL LENGTH, L	7.2	FT.	QUALIFYING WALL LENGTH, L	7.2	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
500 LBS	<	2404 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	113	PLF	OVERTURNING MOMENT	4.5	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	450	LBS	RESISTIVE MOMENT	5.5	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

SHEARWALL DESIGN SUMMARY

M+K PROJECT #: 244-24010
ENGINEER: RSC

SHEARWALL 311: 3RD - SIDE EXT. WALL @ W.I.C. - BA 6

SHEARWALL PROPERTIES:

WALL HEIGHT, H	9.1	FT.	MAX WALL OPENING HT, H_c	2.0	FT.		
WALL LENGTH, L	14.9	FT.	QUALIFYING WALL LENGTH, L	14.9	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
1900 LBS	<	5010 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	113	PLF	OVERTURNING MOMENT	17.3	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	450	LBS	RESISTIVE MOMENT	17.4	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

SHEARWALL 312: 3RD - SIDE INT. WALL @ LAUN.

SHEARWALL PROPERTIES:

WALL HEIGHT, H	9.1	FT.	MAX WALL OPENING HT, Hc	0.0	FT.		
WALL LENGTH, L	14.6	FT.	QUALIFYING WALL LENGTH, L	14.6	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
1400 LBS	<	4903 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	113	PLF	OVERTURNING MOMENT	12.7	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	400	LBS	RESISTIVE MOMENT	16.1	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Shearwall Design Summary

M+K Project #: 244-24010
Engineer: RSC

Shearwall 313: 3rd - Side Int. Wall @ Bed 3

Shearwall Properties:

Wall height, H	9.1	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	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1700 lbs	<	6296 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	100	plf	Overturning Moment	15.4	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	200	lbs	Resistive Moment	19.2	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall : Basement - 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

SHEARWALL DESIGN SUMMARY

M+K PROJECT #: 244-24010
ENGINEER: RSC

SHEARWALL 201: 2ND - REAR EXT. WALL @ KITCHEN

SHEARWALL PROPERTIES:

WALL HEIGHT, H	10.0	FT.	MAX WALL OPENING HT, H_c	0.0	FT.		
WALL LENGTH, L	17.2	FT.	QUALIFYING WALL LENGTH, L	17.2	FT.	SHEARWALL ASSEMBLY	P3

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
2500 LBS	<	10808 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	444	PLF	OVERTURNING MOMENT	25.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	800	LBS	RESISTIVE MOMENT	71.1	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

SHEARWALL 202: 2ND - REAR EXT. WALL @ GUEST SUITE

SHEARWALL PROPERTIES:

WALL HEIGHT, H	10.0	FT.	MAX WALL OPENING HT, Hc	0.0	FT.		
WALL LENGTH, L	7.0	FT.	QUALIFYING WALL LENGTH, L	7.0	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
500 LBS	<	2337 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	208	PLF	OVERTURNING MOMENT	5.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	200	LBS	RESISTIVE MOMENT	5.8	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

SHEARWALL DESIGN SUMMARY

M+K PROJECT #: 244-24010
ENGINEER: RSC

SHEARWALL 203: 2ND - REAR EXT. WALL @ GUEST BA

SHEARWALL PROPERTIES:

WALL HEIGHT, H	10.0	FT.	MAX WALL OPENING HT, H_c	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
500 LBS	<	2294 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	208	PLF	OVERTURNING MOMENT	5.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	200	LBS	RESISTIVE MOMENT	5.6	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

SHEARWALL 204: 2ND - REAR INT. WALL @ HALL

SHEARWALL PROPERTIES:

WALL HEIGHT, H	10.0	FT.	MAX WALL OPENING HT, Hc	0.0	FT.		
WALL LENGTH, L	12.0	FT.	QUALIFYING WALL LENGTH, L	12.0	FT.	SHEARWALL ASSEMBLY	P3

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
2700 LBS	<	7562 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	289	PLF	OVERTURNING MOMENT	27.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	800	LBS	RESISTIVE MOMENT	27.4	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

SHEARWALL DESIGN SUMMARY

M+K PROJECT #: 244-24010
ENGINEER: RSC

SHEARWALL 205: 2ND - REAR INT. WALL @ GARAGE

SHEARWALL PROPERTIES:

WALL HEIGHT, H	10.0	FT.	MAX WALL OPENING HT, H_c	0.0	FT.		
WALL LENGTH, L	29.0	FT.	QUALIFYING WALL LENGTH, L	29.0	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
1800 LBS	<	9738 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	338	PLF	OVERTURNING MOMENT	18.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	400	LBS	RESISTIVE MOMENT	138.4	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

SHEARWALL 206: 2ND - SIDE EXT. WALL @ OUTDOOR LIVING

SHEARWALL PROPERTIES:

WALL HEIGHT, H	10.0	FT.	MAX WALL OPENING HT, Hc	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
2400 LBS	<	3781 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	243	PLF	OVERTURNING MOMENT	24.0	K-FT	HOLD DOWN DESIGN LOAD	2984	LBS
DL AT ENDS OF WALL	400	LBS	RESISTIVE MOMENT	6.1	K-FT	HOLDOWN CAPACITY	5505	LBS

HOLD-DOWN SPECIFICATION

SIMPSON MSTC66 STRAP TIE (24" END LENGTH)

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

SHEARWALL DESIGN SUMMARY

M+K PROJECT #: 244-24010
ENGINEER: RSC

SHEARWALL 207: 2ND - SIDE EXT. WALL @ OUTDOOR LIVING

SHEARWALL PROPERTIES:

WALL HEIGHT, H	10.0	FT.	MAX WALL OPENING HT, H_c	8.0	FT.		
WALL LENGTH, L	19.5	FT.	QUALIFYING WALL LENGTH, L	7.5	FT.	SHEARWALL ASSEMBLY	P3

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
3100 LBS	<	4654 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	130	PLF	OVERTURNING MOMENT	31.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	1200	LBS	RESISTIVE MOMENT	43.3	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

SHEARWALL 208: 2ND - SIDE EXT. WALL @ GARAGE

SHEARWALL PROPERTIES:

WALL HEIGHT, H	10.0	FT.	MAX WALL OPENING HT, Hc	0.0	FT.		
WALL LENGTH, L	23.0	FT.	QUALIFYING WALL LENGTH, L	23.0	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
5200 LBS	<	7723 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	151	PLF	OVERTURNING MOMENT	52.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	800	LBS	RESISTIVE MOMENT	52.5	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

SHEARWALL DESIGN SUMMARY

M+K PROJECT #: 244-24010
ENGINEER: RSC

SHEARWALL 209: 2ND - SIDE EXT. WALL @ GUEST BA - W.I.C.

SHEARWALL PROPERTIES:

WALL HEIGHT, H	10.0	FT.	MAX WALL OPENING HT, H_c	0.0	FT.		
WALL LENGTH, L	14.0	FT.	QUALIFYING WALL LENGTH, L	14.0	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
2500 LBS	<	4701 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	113	PLF	OVERTURNING MOMENT	25.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	1200	LBS	RESISTIVE MOMENT	25.1	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

SHEARWALL 210: 2ND - SIDE INT. WALL @ OFFICE

SHEARWALL PROPERTIES:

WALL HEIGHT, H	10.0	FT.	MAX WALL OPENING HT, Hc	0.0	FT.		
WALL LENGTH, L	16.9	FT.	QUALIFYING WALL LENGTH, L	16.9	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
2600 LBS	<	5668 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	230	PLF	OVERTURNING MOMENT	39.9	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	800	LBS	RESISTIVE MOMENT	41.6	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Shearwall Design Summary

M+K Project #: 244-24010
Engineer: RSC

Shearwall 211: 2nd - Side Int. Wall @ Garage

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	8.0	ft.		
Wall Length, L	22.1	ft.	Qualifying Wall Length, L	19.4	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
3800 lbs	<	6525 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	100	plf	Overturning Moment	38.0	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	810	lbs	Resistive Moment	38.1	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall : Basement - 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

SHEARWALL DESIGN SUMMARY

M+K PROJECT #: 244-24010
ENGINEER: RSC

SHEARWALL 101: 1ST - FRONT EXT. WALL @ COVERED PATIO

SHEARWALL PROPERTIES:

WALL HEIGHT, H	9.1	FT.	MAX WALL OPENING HT, H_c	0.0	FT.		
WALL LENGTH, L	15.3	FT.	QUALIFYING WALL LENGTH, L	15.3	FT.	SHEARWALL ASSEMBLY	P3

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
5000 LBS	<	9661 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	312	PLF	OVERTURNING MOMENT	45.4	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	1200	LBS	RESISTIVE MOMENT	49.6	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

SHEARWALL 102: 1ST - SIDE EXT. WALL @ COVERED PATIO

SHEARWALL PROPERTIES:

WALL HEIGHT, H	5.0	FT.	MAX WALL OPENING HT, Hc	0.0	FT.		
WALL LENGTH, L	24.0	FT.	QUALIFYING WALL LENGTH, L	24.0	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
2400 LBS	<	8059 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	300	PLF	OVERTURNING MOMENT	12.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	1200	LBS	RESISTIVE MOMENT	103.7	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

SHEARWALL DESIGN SUMMARY

M+K PROJECT #: 244-24010
ENGINEER: RSC

SHEARWALL 103: 1ST - SIDE EXT. WALL @ COVERED PATIO

SHEARWALL PROPERTIES:

WALL HEIGHT, H	9.1	FT.	MAX WALL OPENING HT, H_c	8.0	FT.		
WALL LENGTH, L	18.8	FT.	QUALIFYING WALL LENGTH, L	5.8	FT.	SHEARWALL ASSEMBLY	P3

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
3100 LBS	<	3136 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	247	PLF	OVERTURNING MOMENT	58.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	1200	LBS	RESISTIVE MOMENT	59.6	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

SHEARWALL 104: 1ST - SIDE EXT. WALL @ PDR - MECH

SHEARWALL PROPERTIES:

WALL HEIGHT, H	4.0	FT.	MAX WALL OPENING HT, Hc	0.0	FT.		
WALL LENGTH, L	18.3	FT.	QUALIFYING WALL LENGTH, L	18.3	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
4000 LBS	<	6155 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	117	PLF	OVERTURNING MOMENT	16.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	1200	LBS	RESISTIVE MOMENT	37.5	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

SHEARWALL DESIGN SUMMARY

M+K PROJECT #: 244-24010
ENGINEER: RSC

SHEARWALL 105: 1ST - SIDE EXT. WALL @ GAME RM

SHEARWALL PROPERTIES:

WALL HEIGHT, H	4.0	FT.	MAX WALL OPENING HT, H_c	0.0	FT.		
WALL LENGTH, L	26.3	FT.	QUALIFYING WALL LENGTH, L	26.3	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
5000 LBS	<	8815 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	117	PLF	OVERTURNING MOMENT	20.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	1200	LBS	RESISTIVE MOMENT	64.6	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

SHEARWALL : BASEMENT - 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

Shear Wall Calculations Seismic

Design Built Homes

86th Ave SE - Lot 2

Mercer Island

Parameters:

Single Family Home

Design Wind Speed: 100 MPH

Wind Exposure Category: B

Seismic Design Category: D1

Code & Design Standard: 2021 IBC Ch. 1609, ASCE 7-16 Ch. 26-30

MULHERN & KULP STRUCTURAL ENGINEERING, INC.

Nicholas Martignetti, P.E., Project Manager

Ryan Chan, Staff Engineer

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

SEISMIC CALCULATION - ASCE 7-16

M+K PROJECT #: 244-24010
ENGINEER: RSC

SEISMIC DESIGN CATEGORY:

USER INPUTS:

SITE CLASS	D
SPECTRAL RESPONSE ACCELERATION 0.2 SEC, S_S	1.405
SPECTRAL RESPONSE ACCELERATION 1.0 SEC, S_1	0.489
OCCUPANCY CATEGORY	II

VARIABLES:

SITE COEFFICIENT, FA	1.20
SITE COEFFICIENT, FV	1.81

CALCULATED VALUES:

MAXIMUM SPECTRAL RESPONSE ACCELERATION, S_{MS}	1.686
MAXIMUM SPECTRAL RESPONSE ACCELERATION, S_{M1}	0.886
DESIGN SPECTRAL RESPONSE ACCELERATION, S_{DS}	1.124
DESIGN SPECTRAL RESPONSE ACCELERATION, S_{D1}	0.590
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	31

CALCULATED VALUES:

APPROXIMATE FUNDAMENTAL PERIOD, T_A	0.265
T_O	0.105
T_S	0.525
SPECTRAL RESPONSE ACC., S_A (G)	1.124

SITE CLASS ASSUMPTION

YES — 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	10.6	2330	15	24.4	59 K
2	11.7	2835	15	15.9	58 K
3	9.1	2955	10	6.5	36 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

TOTAL DEAD LOAD OF STRUCTURE 154 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	0.173	0.173

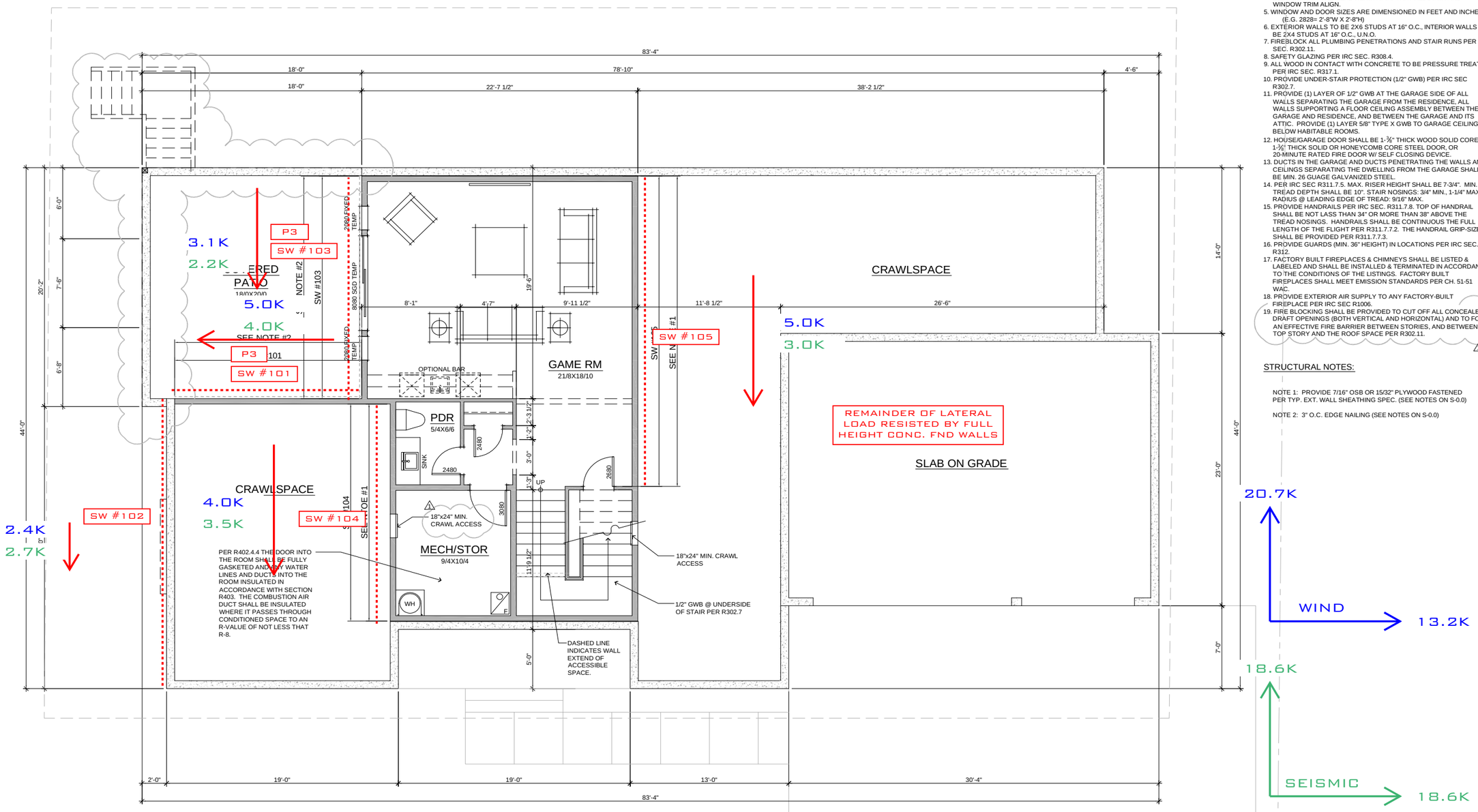
BASE SHEARS:

ULTIMATE LOADS				x 0.7 =	ALLOWABLE LOADS			
TRANSVERSE		LONGITUDINAL			TRANSVERSE		LONGITUDINAL	
27	K	27	K		18.6	K	18.6	K

STORY SHEAR CALCULATION:

DISTRIBUTION EXPONENT, k: 1.00

		ULTIMATE LOADS				x 0.7 =	ALLOWABLE LOADS					
		TRANSVERSE		LONGITUDINAL			TRANSVERSE			LONGITUDINAL		
LEVEL	VERT. DIST. FACTOR, C_{VX}	STORY SHEAR, F_x		STORY SHEAR, F_x			STORY SHEAR, F_x	Σ STORY SHEAR		STORY SHEAR, F_x	Σ STORY SHEAR	
1	0.206	5.5	K	5.5	K		3.8 K	18.6	K	3.8 K	18.6	K
2	0.425	11.3	K	11.3	K		7.9 K	14.8	K	7.9 K	14.8	K
3	0.369	9.8	K	9.8	K		6.9 K	6.9	K	6.9 K	6.9	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



BASEMENT FLOOR PLAN

700 SF

GENERAL NOTES:

1. PLATE HEIGHT @ UPPER FLOOR IS 9'-1", U.N.O.
   PLATE HEIGHT @ MAIN FLOOR IS 10'-1", U.N.O.
   PLATE HEIGHT @ LOWER FLOOR IS 9'-1" U.N.P.
2. DIMENSION LINES ARE TO FACE OF STUD U.N.O.
3. WINDOW SIZES & ROUGH OPENINGS TO BE VERIFIED BY CONTRACTOR.
4. WINDOW HEAD HEIGHT AT MAIN FLOOR IS 8'-0" ABOVE SUBFLOOR, U.N.O. IF NOMINAL DOOR AND WINDOW HEIGHTS ARE SIMILAR, COORDINATE WITH DOOR AND WINDOW SPEC'S TO LOCATE FINAL ELEVATION OF THE HEAD HEIGHTS SO THAT ALL DOOR AND WINDOW TRIM ALIGN.
5. WINDOW AND DOOR SIZES ARE DIMENSIONED IN FEET AND INCHES (E.G. 2828= 2'-8"W X 2'-8"H)
6. EXTERIOR WALLS TO BE 2X6 STUDS AT 16" O.C., INTERIOR WALLS TO BE 2X4 STUDS AT 16" O.C., U.N.O.
7. FIREBLOCK ALL PLUMBING PENETRATIONS AND STAIR RUNS PER IRC SEC. R302.11.
8. SAFETY GLAZING PER IRC SEC. R308.4.
9. ALL WOOD IN CONTACT WITH CONCRETE TO BE PRESSURE TREATED PER IRC SEC. R317.1.
10. PROVIDE UNDER-STAIR PROTECTION (1/2" GWB) PER IRC SEC R302.7.
11. PROVIDE (1) LAYER OF 1/2" GWB AT THE GARAGE SIDE OF ALL WALLS SEPARATING THE GARAGE FROM THE RESIDENCE, ALL WALLS SUPPORTING A FLOOR CEILING ASSEMBLY BETWEEN THE GARAGE AND RESIDENCE, AND BETWEEN THE GARAGE AND ITS ATTIC. PROVIDE (1) LAYER 5/8" TYPE X GWB TO GARAGE CEILING IF BELOW HABITABLE ROOMS.
12. HOUSE/GARAGE DOOR SHALL BE 1-⅜" THICK WOOD SOLID CORE, OR 1-⅜' THICK SOLID OR HONEYCOMB CORE STEEL DOOR, OR 20-MINUTE RATED FIRE DOOR W/ SELF CLOSING DEVICE.
13. DUCTS IN THE GARAGE AND DUCTS PENETRATING THE WALLS AND CEILINGS SEPARATING THE DWELLING FROM THE GARAGE SHALL BE MIN. 26 GUAGE GALVANIZED STEEL.
14. PER IRC SEC R311.7.5. MAX. RISER HEIGHT SHALL BE 7-3/4". MIN. TREAD DEPTH SHALL BE 10". STAIR NOSINGS: 3/4" MIN., 1-1/4" MAX. RADIUS @ LEADING EDGE OF TREAD: 9/16" MAX.
15. PROVIDE HANDRAILS PER IRC SEC. R311.7.8. TOP OF HANDRAIL SHALL BE NOT LASS THAN 34" OR MORE THAN 38" ABOVE THE TREAD NOSINGS. HANDRAILS SHALL BE CONTINUOUS THE FULL LENGTH OF THE FLIGHT PER R311.7.7.2. THE HANDRAIL GRIP-SIZE SHALL BE PROVIDED PER R311.7.7.3.
16. PROVIDE GUARDS (MIN. 36" HEIGHT) IN LOCATIONS PER IRC SEC. R312.
17. FACTORY BUILT FIREPLACES & CHIMNEYS SHALL BE LISTED & LABELED AND SHALL BE INSTALLED & TERMINATED IN ACCORDANCE TO THE CONDITIONS OF THE LISTINGS. FACTORY BUILT FIREPLACES SHALL MEET EMISSION STANDARDS PER CH. 51-51 WAC.
18. PROVIDE EXTERIOR AIR SUPPLY TO ANY FACTORY-BUILT FIREPLACE PER IRC SEC R1006.
19. FIRE BLOCKING SHALL BE PROVIDED TO CUT OFF ALL CONCEALED DRAFT OPENINGS (BOTH VERTICAL AND HORIZONTAL) AND TO FORM AN EFFECTIVE FIRE BARRIER BETWEEN STORIES, AND BETWEEN A TOP STORY AND THE ROOF SPACE PER R302.11.

STRUCTURAL NOTES:

NOTE 1: PROVIDE 7/16" OSB OR 15/32" PLYWOOD FASTENED PER TYP. EXT. WALL SHEATHING SPEC. (SEE NOTES ON S-0.0)

NOTE 2: 3" O.C. EDGE NAILING (SEE NOTES ON S-0.0)

MCCULLOUGH ARCHITECTS
5601 6th Ave South
Suite 371
Seattle, WA. 98108
206.443.1181
mccullougharchitects.com

Revisions
05.11.2025 1 Comment

Date: 04.09.2025
Job No: xx-xxx
Project No: 00000
Drawn: BAK
Approved: APM

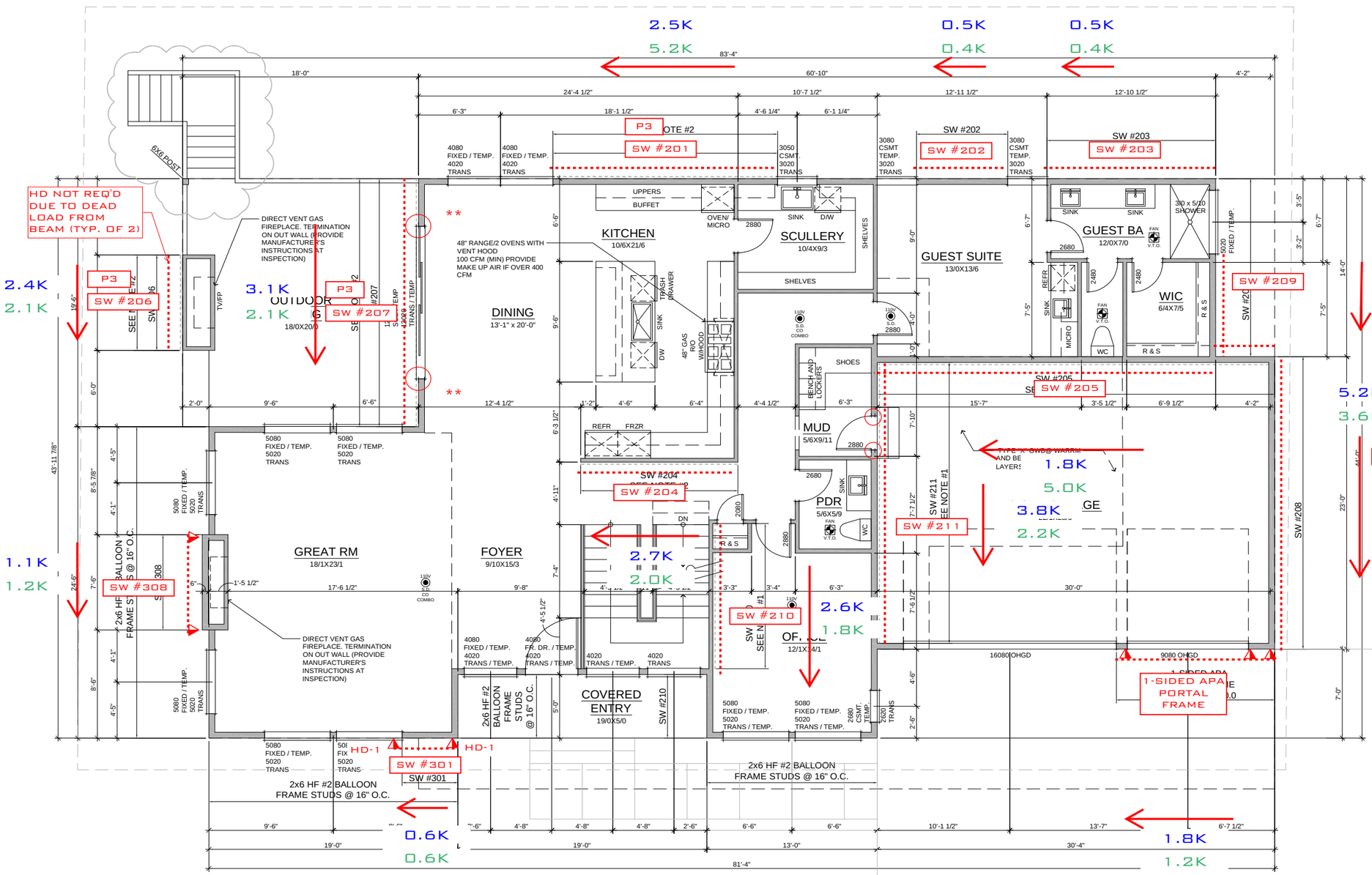
Owner
Design Built Homes

REGISTERED ARCHITECT
7806
PHILIP MCCULLOUGH
STATE OF WASHINGTON

4715 86th Ave SE
Mercer Island, Washington

Lower Floor Plan

A4



GENERAL NOTES:

1. PLATE HEIGHT @ UPPER FLOOR IS 9'-1", U.N.O.
   PLATE HEIGHT @ MAIN FLOOR IS 10'-1", U.N.O.
   PLATE HEIGHT @ LOWER FLOOR IS 9'-1" U.N.P.
2. DIMENSION LINES ARE TO FACE OF STUD U.N.O.
3. WINDOW SIZES & ROUGH OPENINGS TO BE VERIFIED BY CONTRACTOR.
4. WINDOW HEAD HEIGHT AT MAIN FLOOR IS 8'-0" ABOVE SUBFLOOR, U.N.O. IF NOMINAL DOOR AND WINDOW HEIGHTS ARE SIMILAR, COORDINATE WITH DOOR AND WINDOW SPEC'S TO LOCATE FINAL ELEVATION OF THE HEAD HEIGHTS SO THAT ALL DOOR AND WINDOW TRIM ALIGN.
5. WINDOW AND DOOR SIZES ARE DIMENSIONED IN FEET AND INCHES (E.G. 2828= 2'-8"W X 2'-8"H)
6. EXTERIOR WALLS TO BE 2X6 STUDS AT 16" O.C., INTERIOR WALLS TO BE 2X4 STUDS AT 16" O.C., U.N.O.
7. FIREBLOCK ALL PLUMBING PENETRATIONS AND STAIR RUNS PER IRC SEC. R302.11.
8. SAFETY GLAZING PER IRC SEC. R308.4.
9. ALL WOOD IN CONTACT WITH CONCRETE TO BE PRESSURE TREATED PER IRC SEC. R317.1.
10. PROVIDE UNDER-STAIR PROTECTION (1/2" GWB) PER IRC SEC R302.7.
11. PROVIDE (1) LAYER OF 1/2" GWB AT THE GARAGE SIDE OF ALL WALLS SEPARATING THE GARAGE FROM THE RESIDENCE, ALL WALLS SUPPORTING A FLOOR CEILING ASSEMBLY BETWEEN THE GARAGE AND RESIDENCE, AND BETWEEN THE GARAGE AND ITS ATTIC. PROVIDE (1) LAYER 5/8" TYPE X GWB TO GARAGE CEILING IF BELOW HABITABLE ROOMS.
12. HOUSE/GARAGE DOOR SHALL BE 1-⅜" THICK WOOD SOLID CORE, OR 1-¾" THICK SOLID OR HONEYCOMB CORE STEEL DOOR, OR 20-MINUTE RATED FIRE DOOR W/ SELF CLOSING DEVICE.
13. DUCTS IN THE GARAGE AND DUCTS PENETRATING THE WALLS AND CEILINGS SEPARATING THE DWELLING FROM THE GARAGE SHALL BE MIN. 26 GUAGE GALVANIZED STEEL.
14. PER IRC SEC R311.7.5. MAX. RISER HEIGHT SHALL BE 7-3/4". MIN. TREAD DEPTH SHALL BE 10". STAIR NOSINGS: 3/4" MIN., 1-1/4" MAX. RADIUS @ LEADING EDGE OF TREAD: 9/16" MAX.
15. PROVIDE HANDRAILS PER IRC SEC. R311.7.8. TOP OF HANDRAIL SHALL BE NOT LASS THAN 34" OR MORE THAN 38" ABOVE THE TREAD NOSINGS. HANDRAILS SHALL BE CONTINUOUS THE FULL ...IGHT PER R311.7.7.2. THE HANDRAIL GRIP-SIZE ...D PER R311.7.7.3.
16. PROVIDE GUARDS (MIN. 36" HEIGHT) IN LOCATIONS PER IRC SEC. 2.5K
17. 1.8K REPLACES & CHIMNEYS SHALL BE LISTED & LABELED AND SHALL BE INSTALLED & TERMINATED IN ACCORDANCE TO THE CONDITIONS OF THE LISTINGS. FACTORY BUILT FIREPLACES SHALL MEET EMISSION STANDARDS PER CH. 51-51 WAC.
18. PROVIDE EXTERIOR AIR SUPPLY TO ANY FACTORY-BUILT FIREPLACE PER IRC SEC R1006.
19. FIRE BLOCKING SHALL BE PROVIDED TO CUT OFF ALL CONCEALED DRAFT OPENINGS (BOTH VERTICAL AND HORIZONTAL) AND TO FORM AN EFFECTIVE FIRE BARRIER BETWEEN STORIES, AND BETWEEN A TOP STORY AND THE ROOF SPACE PER R302.11.

...UCTURAL NOTES:

NOTE 1: PROVIDE 7/16" OSB OR 15/32" PLYWOOD FASTENED ...ED TYP. EXT. WALL SHEATHING SPEC. (SEE NOTES ON S-0.0)
NOTE 2: ...O.C. EDGE NAILING (SEE NOTES ON S-0.0)

NOTE 3 @ STEEL BEAMS: PROVIDE SOLID 2x/LVL WEB PACKOUT FASTENED TO WEB w/ 1/2" DIA THRU BOLTS @ 24" O.C. STAGGERED. PROVIDE 2x TOP PLATE FASTENED TO TOP FLANGE OF STEEL BEAMS W/ P.A.F.S. (HILTI X-U PINS OR EQUAL (0.157" DIA. X 2" LONG MIN.)) @ 16" O.C. STAGGERED OR 1/2" DIA. ...RED)

MAIN FLOOR PLAN

2,183 SF

TOTAL = 4,827 SF

MCCULLOUGH ARCHITECTS
5601 6th Ave South
Suite 371
Seattle, WA. 98108
206.443.1181
mccullougharchitects.com

Revisions
1 Comment
05.11.2025

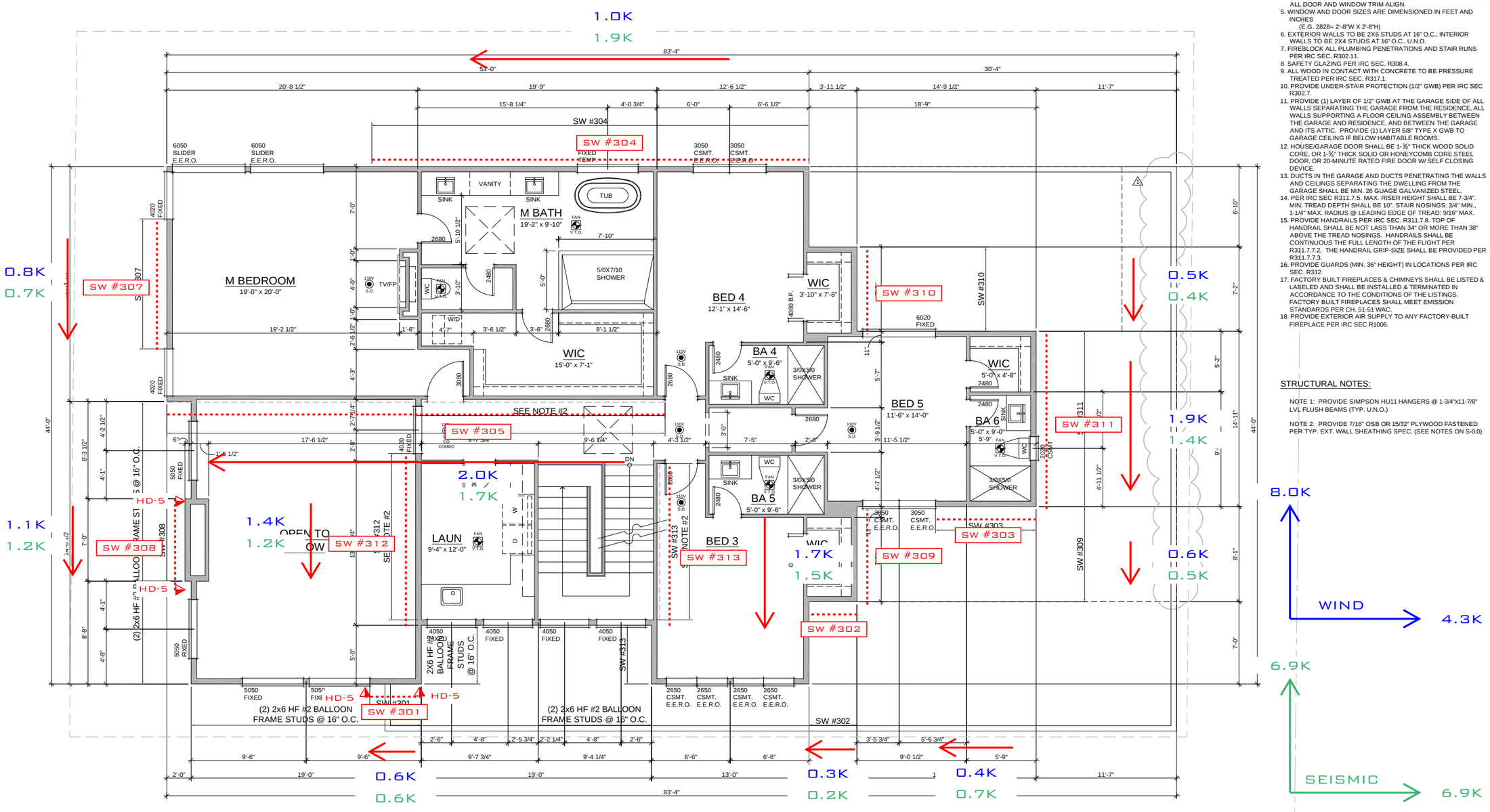
Date: 04.09.2025
Job No: xx-xxx
Project No: 00000
Drawn: BAK
Approved: APM

Owner
Design Built Homes

REGISTERED ARCHITECT
7806
PHILIP MCCULLOUGH
STATE OF WASHINGTON

4715 86th Ave SE
Mercer Island, Washington

Main Floor Plan
A6



UPPER FLOOR PLAN

1,933 SF

GENERAL NOTES:

1. PLATE HEIGHT @ UPPER FLOOR IS 9'-1", U.N.O.
   PLATE HEIGHT @ MAIN FLOOR IS 10'-1", U.N.O.
   PLATE HEIGHT @ LOWER FLOOR IS 9'-1" U.N.P.
2. DIMENSION LINES ARE TO FACE OF STUD U.N.O.
3. WINDOW SIZES & ROUGH OPENINGS TO BE VERIFIED BY CONTRACTOR.
4. WINDOW HEAD HEIGHT AT MAIN FLOOR IS 8'-0" ABOVE SUBFLOOR, U.N.O. IF NOMINAL DOOR AND WINDOW HEIGHTS ARE SIMILAR, COORDINATE WITH DOOR AND WINDOW SPEC'S TO LOCATE FINAL ELEVATION OF THE HEAD HEIGHTS SO THAT ALL DOOR AND WINDOW TRIM ALIGN.
5. WINDOW AND DOOR SIZES ARE DIMENSIONED IN FEET AND INCHES
   (E.G. 2828= 2'-8"W X 2'-8"H)
6. EXTERIOR WALLS TO BE 2X6 STUDS AT 16" O.C., INTERIOR WALLS TO BE 2X4 STUDS AT 16" O.C., U.N.O.
7. FIREBLOCK ALL PLUMBING PENETRATIONS AND STAIR RUNS PER IRC SEC. R302.11.
8. SAFETY GLAZING PER IRC SEC. R308.4.
9. ALL WOOD IN CONTACT WITH CONCRETE TO BE PRESSURE TREATED PER IRC SEC. R317.1.
10. PROVIDE UNDER-STAIR PROTECTION (1/2" GWB) PER IRC SEC R302.7.
11. PROVIDE (1) LAYER OF 1/2" GWB AT THE GARAGE SIDE OF ALL WALLS SEPARATING THE GARAGE FROM THE RESIDENCE, ALL WALLS SUPPORTING A FLOOR CEILING ASSEMBLY BETWEEN THE GARAGE AND RESIDENCE, AND BETWEEN THE GARAGE AND ITS ATTIC. PROVIDE (1) LAYER 5/8" TYPE X GWB TO GARAGE CEILING IF BELOW HABITABLE ROOMS.
12. HOUSE/GARAGE DOOR SHALL BE 1-⅜" THICK WOOD SOLID CORE, OR 1-⅜" THICK SOLID OR HONEYCOMB CORE STEEL DOOR, OR 20-MINUTE RATED FIRE DOOR W/ SELF CLOSING DEVICE.
13. DUCTS IN THE GARAGE AND DUCTS PENETRATING THE WALLS AND CEILINGS SEPARATING THE DWELLING FROM THE GARAGE SHALL BE MIN. 26 GUAGE GALVANIZED STEEL.
14. PER IRC SEC R311.7.5. MAX. RISER HEIGHT SHALL BE 7-3/4". MIN. TREAD DEPTH SHALL BE 10". STAIR NOSINGS: 3/4" MIN., 1-1/4" MAX. RADIUS @ LEADING EDGE OF TREAD: 9/16" MAX.
15. PROVIDE HANDRAILS PER IRC SEC. R311.7.8. TOP OF HANDRAIL SHALL BE NOT LASS THAN 34" OR MORE THAN 38" ABOVE THE TREAD NOSINGS. HANDRAILS SHALL BE CONTINUOUS THE FULL LENGTH OF THE FLIGHT PER R311.7.7.2. THE HANDRAIL GRIP-SIZE SHALL BE PROVIDED PER R311.7.7.3.
16. PROVIDE GUARDS (MIN. 36" HEIGHT) IN LOCATIONS PER IRC SEC. R312.
17. FACTORY BUILT FIREPLACES & CHIMNEYS SHALL BE LISTED & LABELED AND SHALL BE INSTALLED & TERMINATED IN ACCORDANCE TO THE CONDITIONS OF THE LISTINGS. FACTORY BUILT FIREPLACES SHALL MEET EMISSION STANDARDS PER CH. 51-51 WAC.
18. PROVIDE EXTERIOR AIR SUPPLY TO ANY FACTORY-BUILT FIREPLACE PER IRC SEC R1006.

STRUCTURAL NOTES:

NOTE 1: PROVIDE SIMPSON HU11 HANGERS @ 1-3/4"x11-7/8" LVL FLUSH BEAMS (TYP. U.N.O.)

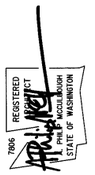
NOTE 2: PROVIDE 7/16" OSB OR 15/32" PLYWOOD FASTENED PER TYP. EXT. WALL SHEATHING SPEC. (SEE NOTES ON S-0.0)

MCCULLOUGH ARCHITECTS
5601 6th Ave South
Suite 371
Seattle, WA. 98108
206.443.1181
mccullougharchitects.com

Revisions Comment
05.11.2025 1

Date: 04.09.2025
Job No: xx-xxx
Project No: 00000
Drawn: BAK
Approved: APM

Owner
Design Built Homes



4715 86th Ave SE

Mercer Island, Washington

Upper Floor Plan

A8

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Shearwall Design Summary

M+K Project #: 244-24010
Engineer: RSC

Shearwall 301: 3rd - Front B.F. Wall @ Great Rm

Shearwall Properties:

Wall height, H	16.0	ft.	Max wall opening ht, H_o	0.0	ft.		
Wall Length, L	4.8	ft.	Qualifying Wall Length, L	4.8	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
600 lbs	<	944 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	213	plf	Overturning Moment	9.6	k-ft	Hold Down Design Load	1486	lbs
DL at ends of wall	300	lbs	Resistive Moment	2.5	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

Shearwall 302: 3rd - Front Ext. Wall @ W.I.C.

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	4.0	ft.	Qualifying Wall Length, L	4.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
200 lbs	<	915 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	251	plf	Overturning Moment	1.8	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	400	lbs	Resistive Moment	2.4	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Shearwall Design Summary

M+K Project #: 244-24010
Engineer: RSC

Shearwall 303: 3rd - Front Ext. Wall @ BA 6

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	8.3	ft.	Qualifying Wall Length, L	8.3	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
700 lbs	<	1993 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	214	plf	Overturning Moment	6.4	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	400	lbs	Resistive Moment	7.1	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall 304: 3rd - Rear Ext. Wall @ M Bed - Bed 4

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, Hc	5.0	ft.		
Wall Length, L	36.1	ft.	Qualifying Wall Length, L	25.1	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1900 lbs	<	6016 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	194	plf	Overturning Moment	17.3	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	400	lbs	Resistive Moment	93.4	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Shearwall Design Summary

M+K Project #: 244-24010
Engineer: RSC

Shearwall 305: 3rd - Front Int. Wall @ M Bed

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, H_c	8.0	ft.		
Wall Length, L	41.1	ft.	Qualifying Wall Length, L	38.1	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
3500 lbs	<	9143 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	206	plf	Overturning Moment	31.8	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	200	lbs	Resistive Moment	121.0	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall : Basement - 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

SHEARWALL DESIGN SUMMARY

M+K PROJECT #: 244-24010
ENGINEER: RSC

SHEARWALL 307: 3RD - SIDE EXT. WALL @ M BED

SHEARWALL PROPERTIES:

WALL HEIGHT, H	9.1	FT.	MAX WALL OPENING HT, H_c	0.0	FT.		
WALL LENGTH, L	11.1	FT.	QUALIFYING WALL LENGTH, L	11.1	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
700 LBS	<	2660 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	113	PLF	OVERTURNING MOMENT	6.4	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	300	LBS	RESISTIVE MOMENT	6.8	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

SHEARWALL 308: 3RD - SIDE EXT. B.F. WALL @ GREAT RM

SHEARWALL PROPERTIES:

WALL HEIGHT, H	16.0	FT.	MAX WALL OPENING HT, Hc	0.0	FT.		
WALL LENGTH, L	8.0	FT.	QUALIFYING WALL LENGTH, L	8.0	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
1200 LBS	<	1919 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	279	PLF	OVERTURNING MOMENT	19.2	K-FT	HOLD DOWN DESIGN LOAD	1360	LBS
DL AT ENDS OF WALL	450	LBS	RESISTIVE MOMENT	8.3	K-FT	HOLDOWN CAPACITY	1705	LBS

HOLD-DOWN SPECIFICATION

SIMPSON CS16 STRAP TIE (14" END LENGTH)

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

SHEARWALL DESIGN SUMMARY

M+K PROJECT #: 244-24010
ENGINEER: RSC

SHEARWALL 309: 3RD - SIDE EXT. WALL @ W.I.C.

SHEARWALL PROPERTIES:

WALL HEIGHT, H	9.1	FT.	MAX WALL OPENING HT, H_c	0.0	FT.		
WALL LENGTH, L	8.1	FT.	QUALIFYING WALL LENGTH, L	8.1	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
500 LBS	<	1938 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	113	PLF	OVERTURNING MOMENT	4.5	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	450	LBS	RESISTIVE MOMENT	4.9	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

SHEARWALL 310: 3RD - SIDE EXT. WALL @ W.I.C.

SHEARWALL PROPERTIES:

WALL HEIGHT, H	9.1	FT.	MAX WALL OPENING HT, Hc	0.0	FT.		
WALL LENGTH, L	7.2	FT.	QUALIFYING WALL LENGTH, L	7.2	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
400 LBS	<	1717 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	113	PLF	OVERTURNING MOMENT	3.6	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	450	LBS	RESISTIVE MOMENT	4.1	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

SHEARWALL DESIGN SUMMARY

M+K PROJECT #: 244-24010
ENGINEER: RSC

SHEARWALL 311: 3RD - SIDE EXT. WALL @ W.I.C. - BA 6

SHEARWALL PROPERTIES:

WALL HEIGHT, H	9.1	FT.	MAX WALL OPENING HT, H_c	2.0	FT.		
WALL LENGTH, L	14.9	FT.	QUALIFYING WALL LENGTH, L	14.9	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
1400 LBS	<	3579 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	113	PLF	OVERTURNING MOMENT	12.7	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	450	LBS	RESISTIVE MOMENT	12.8	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

SHEARWALL 312: 3RD - SIDE INT. WALL @ LAUN.

SHEARWALL PROPERTIES:

WALL HEIGHT, H	9.1	FT.	MAX WALL OPENING HT, Hc	0.0	FT.		
WALL LENGTH, L	14.6	FT.	QUALIFYING WALL LENGTH, L	14.6	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
1200 LBS	<	3502 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	113	PLF	OVERTURNING MOMENT	10.9	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	400	LBS	RESISTIVE MOMENT	11.9	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Shearwall Design Summary

M+K Project #: 244-24010
Engineer: RSC

Shearwall 313: 3rd - Side Int. Wall @ Bed 3

Shearwall Properties:

Wall height, H	9.1	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	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1500 lbs	<	4497 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	100	plf	Overturning Moment	13.6	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	200	lbs	Resistive Moment	14.2	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall : Basement - 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

SHEARWALL DESIGN SUMMARY

M+K PROJECT #: 244-24010
ENGINEER: RSC

SHEARWALL 201: 2ND - REAR EXT. WALL @ KITCHEN

SHEARWALL PROPERTIES:

WALL HEIGHT, H	10.0	FT.	MAX WALL OPENING HT, H_c	0.0	FT.		
WALL LENGTH, L	17.2	FT.	QUALIFYING WALL LENGTH, L	17.2	FT.	SHEARWALL ASSEMBLY	P3

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
5200 LBS	<	7720 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	444	PLF	OVERTURNING MOMENT	52.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	800	LBS	RESISTIVE MOMENT	52.5	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

SHEARWALL 202: 2ND - REAR EXT. WALL @ GUEST SUITE

SHEARWALL PROPERTIES:

WALL HEIGHT, H	10.0	FT.	MAX WALL OPENING HT, Hc	0.0	FT.		
WALL LENGTH, L	7.0	FT.	QUALIFYING WALL LENGTH, L	7.0	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
400 LBS	<	1669 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	208	PLF	OVERTURNING MOMENT	4.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	200	LBS	RESISTIVE MOMENT	4.3	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

SHEARWALL DESIGN SUMMARY

M+K PROJECT #: 244-24010
ENGINEER: RSC

SHEARWALL 203: 2ND - REAR EXT. WALL @ GUEST BA

SHEARWALL PROPERTIES:

WALL HEIGHT, H	10.0	FT.	MAX WALL OPENING HT, H_c	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
400 LBS	<	1638 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	208	PLF	OVERTURNING MOMENT	4.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	200	LBS	RESISTIVE MOMENT	4.1	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

SHEARWALL 204: 2ND - REAR INT. WALL @ HALL

SHEARWALL PROPERTIES:

WALL HEIGHT, H	10.0	FT.	MAX WALL OPENING HT, Hc	0.0	FT.		
WALL LENGTH, L	12.0	FT.	QUALIFYING WALL LENGTH, L	12.0	FT.	SHEARWALL ASSEMBLY	P3

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
2000 LBS	<	5402 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	289	PLF	OVERTURNING MOMENT	20.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	800	LBS	RESISTIVE MOMENT	20.2	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

SHEARWALL DESIGN SUMMARY

M+K PROJECT #: 244-24010
ENGINEER: RSC

SHEARWALL 205: 2ND - REAR INT. WALL @ GARAGE

SHEARWALL PROPERTIES:

WALL HEIGHT, H	10.0	FT.	MAX WALL OPENING HT, H_c	0.0	FT.		
WALL LENGTH, L	29.0	FT.	QUALIFYING WALL LENGTH, L	29.0	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
5000 LBS	<	6956 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	338	PLF	OVERTURNING MOMENT	50.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	400	LBS	RESISTIVE MOMENT	102.1	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

SHEARWALL 206: 2ND - SIDE EXT. WALL @ OUTDOOR LIVING

SHEARWALL PROPERTIES:

WALL HEIGHT, H	10.0	FT.	MAX WALL OPENING HT, Hc	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
2100 LBS	<	2701 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	243	PLF	OVERTURNING MOMENT	21.0	K-FT	HOLD DOWN DESIGN LOAD	2750	LBS
DL AT ENDS OF WALL	400	LBS	RESISTIVE MOMENT	4.5	K-FT	HOLDOWN CAPACITY	5505	LBS

HOLD-DOWN SPECIFICATION

SIMPSON MSTC66 STRAP TIE (24" END LENGTH)

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

SHEARWALL DESIGN SUMMARY

M+K PROJECT #: 244-24010
ENGINEER: RSC

SHEARWALL 207: 2ND - SIDE EXT. WALL @ OUTDOOR LIVING

SHEARWALL PROPERTIES:

WALL HEIGHT, H	10.0	FT.	MAX WALL OPENING HT, H_c	8.0	FT.		
WALL LENGTH, L	19.5	FT.	QUALIFYING WALL LENGTH, L	7.5	FT.	SHEARWALL ASSEMBLY	P3

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
2100 LBS	<	3324 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	130	PLF	OVERTURNING MOMENT	21.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	1200	LBS	RESISTIVE MOMENT	32.0	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

SHEARWALL 208: 2ND - SIDE EXT. WALL @ GARAGE

SHEARWALL PROPERTIES:

WALL HEIGHT, H	10.0	FT.	MAX WALL OPENING HT, Hc	0.0	FT.		
WALL LENGTH, L	23.0	FT.	QUALIFYING WALL LENGTH, L	23.0	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
3600 LBS	<	5517 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	151	PLF	OVERTURNING MOMENT	36.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	800	LBS	RESISTIVE MOMENT	38.7	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

SHEARWALL DESIGN SUMMARY

M+K PROJECT #: 244-24010
ENGINEER: RSC

SHEARWALL 209: 2ND - SIDE EXT. WALL @ GUEST BA - W.I.C.

SHEARWALL PROPERTIES:

WALL HEIGHT, H	10.0	FT.	MAX WALL OPENING HT, H_c	0.0	FT.		
WALL LENGTH, L	14.0	FT.	QUALIFYING WALL LENGTH, L	14.0	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
1800 LBS	<	3358 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	113	PLF	OVERTURNING MOMENT	18.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	1200	LBS	RESISTIVE MOMENT	18.5	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

SHEARWALL 210: 2ND - SIDE INT. WALL @ OFFICE

SHEARWALL PROPERTIES:

WALL HEIGHT, H	10.0	FT.	MAX WALL OPENING HT, Hc	0.0	FT.		
WALL LENGTH, L	16.9	FT.	QUALIFYING WALL LENGTH, L	16.9	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
1800 LBS	<	4049 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	230	PLF	OVERTURNING MOMENT	30.3	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	800	LBS	RESISTIVE MOMENT	30.7	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Shearwall Design Summary

M+K Project #: 244-24010
Engineer: RSC

Shearwall 211: 2nd - Side Int. Wall @ Garage

Shearwall Properties:

Wall height, H	10.0	ft.	Max wall opening ht, H_c	8.0	ft.		
Wall Length, L	22.1	ft.	Qualifying Wall Length, L	19.4	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
2200 lbs	<	4660 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	100	plf	Overturning Moment	22.0	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	810	lbs	Resistive Moment	28.1	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall : Basement - 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

Shearwall Design Summary

M+K Project #: 244-24010
Engineer: RSC

Shearwall 101: 1st - Front Ext. Wall @ Covered Patio

Shearwall Properties:

Wall height, H	9.1	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	15.3	ft.	Qualifying Wall Length, L	15.3	ft.	Shearwall Assembly	P3

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
4000 lbs	<	6901 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	312	plf	Overturning Moment	36.3	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	1200	lbs	Resistive Moment	36.6	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall 102: 1st - Side Ext. Wall @ Crawlspace

Shearwall Properties:

Wall height, H	5.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	24.0	ft.	Qualifying Wall Length, L	24.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
2700 lbs	<	5757 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	300	plf	Overturning Moment	13.5	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	1200	lbs	Resistive Moment	76.5	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

SHEARWALL DESIGN SUMMARY

M+K PROJECT #: 244-24010
ENGINEER: RSC

SHEARWALL 103: 1ST - SIDE EXT. WALL @ COVERED PATIO

SHEARWALL PROPERTIES:

WALL HEIGHT, H	9.1	FT.	MAX WALL OPENING HT, H_c	8.0	FT.		
WALL LENGTH, L	18.8	FT.	QUALIFYING WALL LENGTH, L	5.8	FT.	SHEARWALL ASSEMBLY	P3

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
2200 LBS	<	2240 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	247	PLF	OVERTURNING MOMENT	40.2	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	1200	LBS	RESISTIVE MOMENT	44.0	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

SHEARWALL 104: 1ST - SIDE EXT. WALL @ PDR - MECH

SHEARWALL PROPERTIES:

WALL HEIGHT, H	4.0	FT.	MAX WALL OPENING HT, Hc	0.0	FT.		
WALL LENGTH, L	18.3	FT.	QUALIFYING WALL LENGTH, L	18.3	FT.	SHEARWALL ASSEMBLY	P1

CAPACITY EVALUATION:

TOTAL SHEAR LOAD ON WALL		ALLOWABLE SHEARWALL CAPACITY
3500 LBS	<	4397 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	117	PLF	OVERTURNING MOMENT	14.0	K-FT	HOLD DOWN DESIGN LOAD	0	LBS
DL AT ENDS OF WALL	1200	LBS	RESISTIVE MOMENT	27.7	K-FT	HOLDOWN CAPACITY	0	LBS

HOLD-DOWN SPECIFICATION

NO HOLDOWN REQUIRED

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Shearwall Design Summary

M+K Project #: 244-24010
Engineer: RSC

Shearwall 105: 1st - Side Ext. Wall @ Game Rm

Shearwall Properties:

Wall height, H	4.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	26.3	ft.	Qualifying Wall Length, L	26.3	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
3000 lbs	<	6296 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	117	plf	Overturning Moment	12.0	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	1200	lbs	Resistive Moment	47.7	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall : Basement - 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

Cantilevered Retaining Wall

Project File: Foundation Retaining.ec6

DESCRIPTION: 8'-9" Basement Wall w/o surcharge

Code Reference

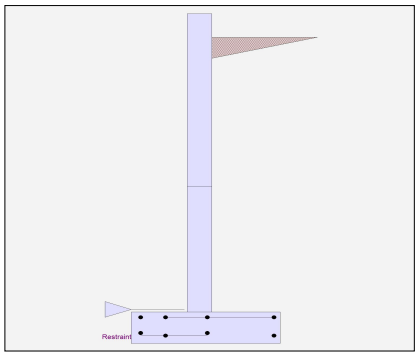
Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	8.75 ft
Wall height above soil	=	0.75 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,500.0 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	=	110.00 pcf
Footing||Soil Friction	=	0.400
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 (Strength 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		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Cantilevered Retaining Wall

Project File: Foundation Retaining.ec6

DESCRIPTION: 8'-9" Basement Wall w/o surcharge

Design Summary

Wall Stability Ratios

Overturning	=	2.09	OK
Slab Resists All Sliding !			
Global Stability	=	1.48	

Total Bearing Load	=	4,049	lbs
...resultant ecc.	=	6.47	in
Eccentricity within middle third			
Soil Pressure @ Toe	=	1,831	psf OK
Soil Pressure @ Heel	=	193	psf OK
Allowable	=	2,500	psf
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,099	psf
ACI Factored @ Heel	=	221	psf
Footing Shear @ Toe	=	13.5	psi OK
Footing Shear @ Heel	=	21.3	psi OK
Allowable	=	75.0	psi

Sliding Calcs

Lateral Sliding Force	=	1,663.6	lbs

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

Load Factors

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

Stem Construction

		2nd	Bottom		
		Stem OK	Stem OK		
Design Height Above Ftg	ft =	4.00	0.00		
Wall Material Above "Ht"	=	Concrete	Concrete		
Design Method	=	SD	SD	SD	SD
Thickness	=	8.00	8.00		
Rebar Size	=	# 5	# 5		
Rebar Spacing	=	16.00	8.00		
Rebar Placed at	=	6.5 in	6.5 in		
Design Data					
fb/FB + fa/Fa	=	**0.153**	**0.502**		
Total Force @ Section					
Service Level	lbs =				
Strength Level	lbs =	631.8	2,143.8		
Moment....Actual					
Service Level	ft-# =				
Strength Level	ft-# =	1,000.3	6,252.6		
Moment.....Allowable	ft-# =	6,513.6	12,453.1		
Shear.....Actual					
Service Level	psi =				
Strength Level	psi =	8.1	27.5		
Shear.....Allowable	psi =	43.2	54.4		
Anet (Masonry)	in2 =				
Wall Weight	psf =	100.0	100.0		
Rebar Depth 'd'	in =	6.50	6.50		

Masonry Data

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

Concrete Data

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

DESCRIPTION: 8'-9" Basement Wall w/o surcharge

Concrete Stem Rebar Area Details

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.036 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@ 13.89 in	#4@ 27.78 in
Provided Area :	0.2325 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	0.8805 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2248 in2/ft		
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.2248 in2/ft	#4@ 13.89 in	#4@ 27.78 in
Provided Area :	0.465 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	0.8805 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Footing Data

Toe Width	=	1.50 ft
Heel Width	=	2.50
Total Footing Width	=	4.00
Footing Thickness	=	12.00 in

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	=	2,099	221	psf
Mu' : Upward	=	2,097	854	ft-#
Mu' : Downward	=	203	4,398	ft-#
Mu: Design	=	1,895	3,544	ft-#
φ Mn	=	17,034	13,005	ft-#
Actual 1-Way Shear	=	13.45	21.30	psi
Allow 1-Way Shear	=	49.38	41.60	psi

Toe Reinforcing = # 5 @ 8.00 in
Heel Reinforcing = # 5 @ 12.00 in
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

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

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

Key: No key defined

Min footing T&S reinf Area 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

DESCRIPTION: 8'-9" Basement Wall w/o surcharge

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)		1,663.6	3.25	5,406.7	Soil Over HL (ab. water tbl)	1,764.6	3.08	5,440.8
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		3.08	5,440.8
Hydrostatic Force					Water 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	=		
	=				Surcharge Over Toe	=		
					Stem Weight(s)	=	950.0	1.83	1,741.7
					Earth @ Stem Transitions	=		
Total	=	1,663.6	**O.T.M.** =	5,406.7	Footing Weight	=	600.0	2.00	1,200.0
					Key Weight	=			
					Vert. Component	=	734.3	4.00	2,937.4
					Total =		4,048.9 lbs	**R.M.=**	11,319.8

Resisting/Overturning Ratio = **2.09**

Vertical Loads used for Soil Pressure = 4,048.9 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

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

Vertical component of active lateral soil pressure IS 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)	0.121	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.

DESCRIPTION: 8'-9" Basement Wall w/o surcharge

Rebar Lap & Embedment Lengths Information

Stem Design Segment: 2nd
Stem Design Height: 4.00 ft above top of footing

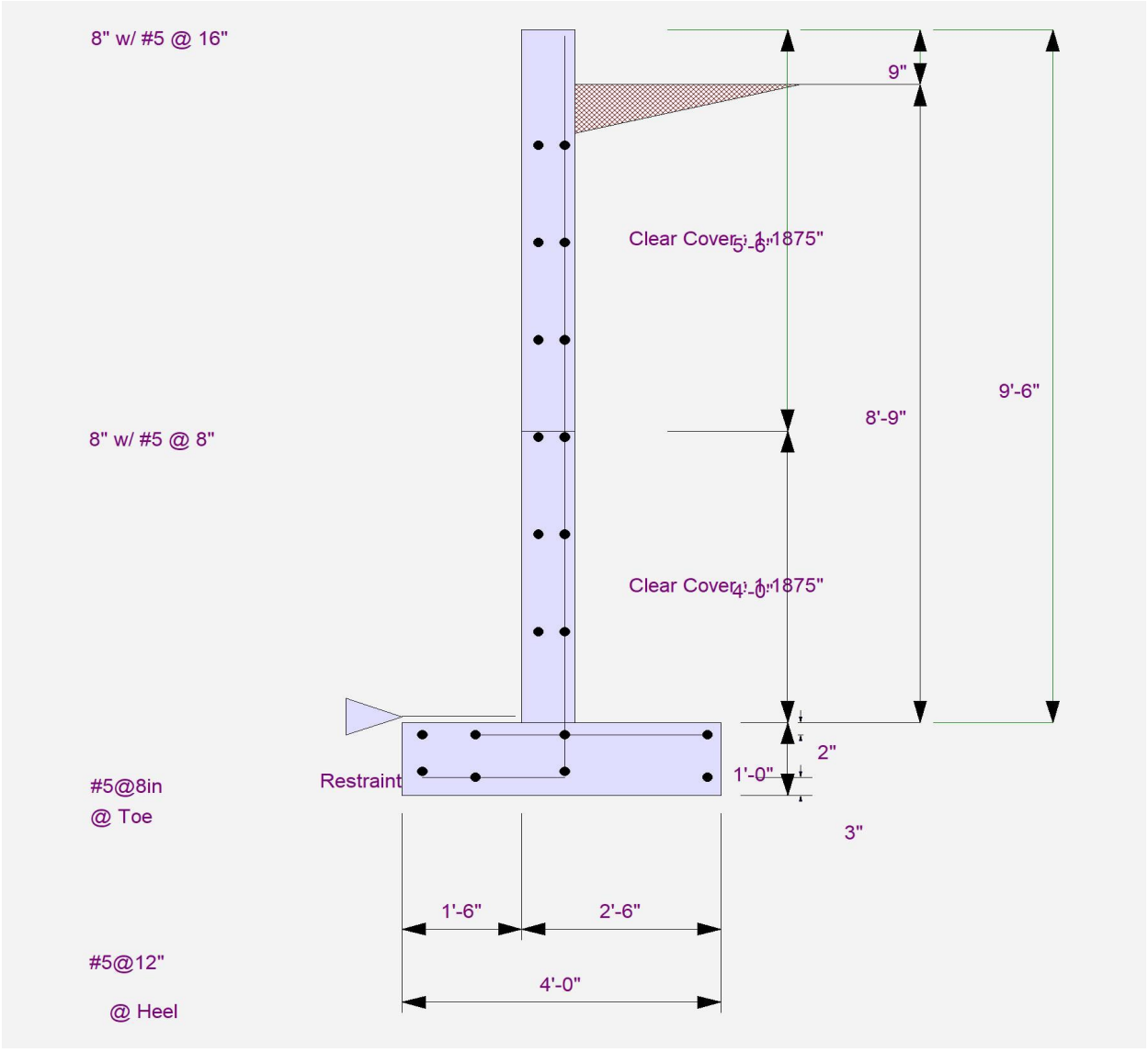
Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in

---

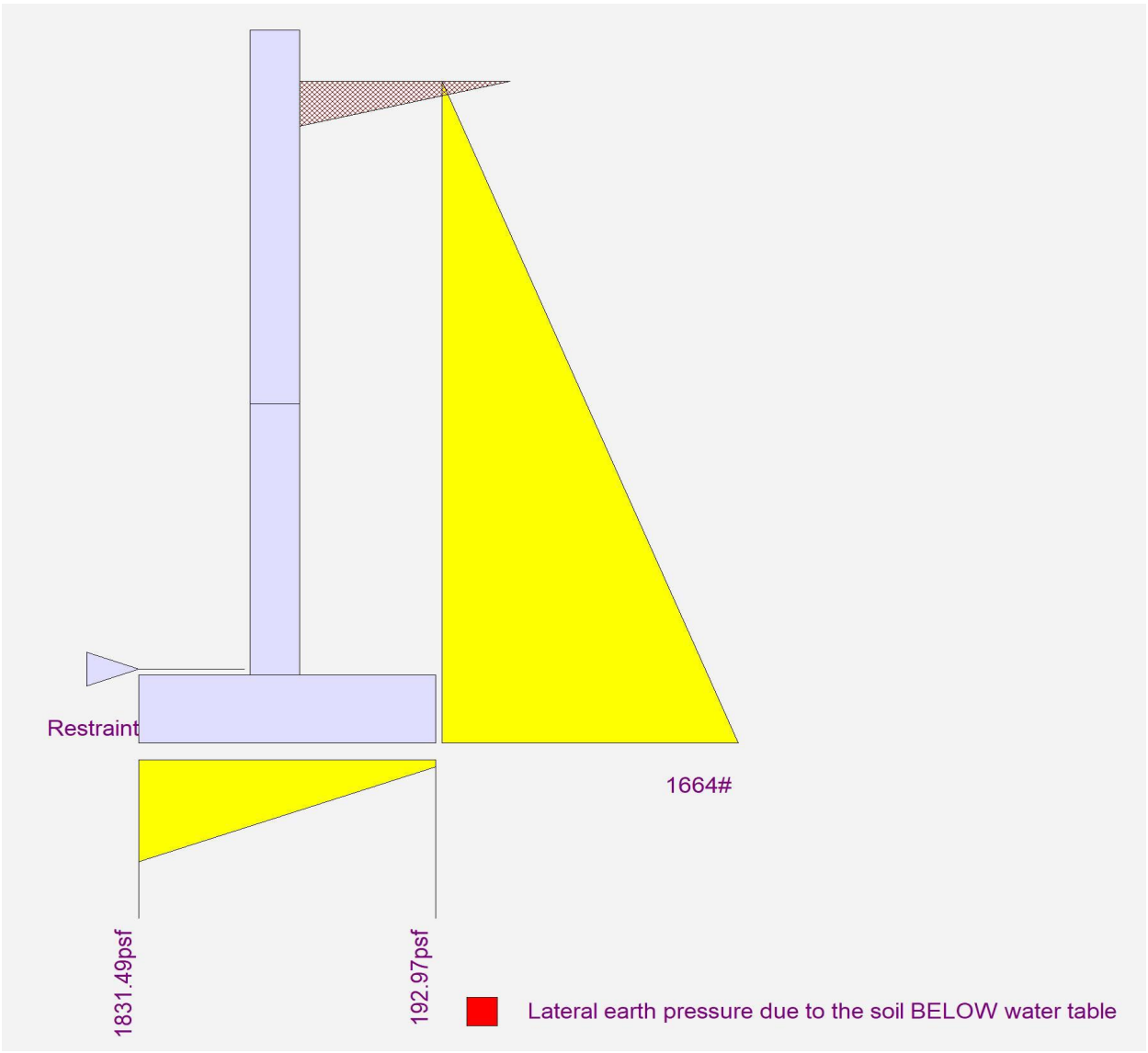
Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	6.00 in
As Provided =	0.4650 in2/ft
As Required =	0.2600 in2/ft

DESCRIPTION: 8'-9" Basement Wall w/o surcharge



DESCRIPTION: 8'-9" Basement Wall w/o surcharge



Cantilevered Retaining Wall

Project File: Foundation Retaining.ec6

DESCRIPTION: 8'-9" Basement Wall w/ surcharge

Code Reference

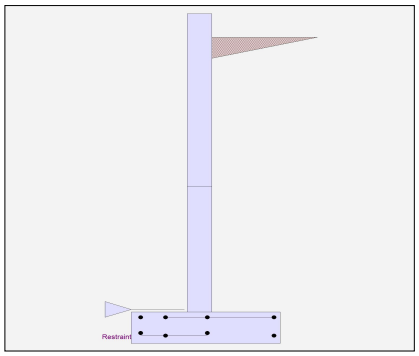
Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	8.75 ft
Wall height above soil	=	0.75 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	3,333.0 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	=	110.00 pcf
Footing||Soil Friction	=	0.400
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

Earth Pressure Seismic Load

Method : Uniform		
Multiplier Used (Multiplier used on soil density)	=	8.000

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 (Strength Level)	=	0.0 psf
Uniform Seismic Force	=	78.000
Total Seismic Force	=	760.500

Adjacent Footing Load

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

Cantilevered Retaining Wall

Project File: Foundation Retaining.ec6

DESCRIPTION: 8'-9" Basement Wall w/ surcharge

Design Summary

Wall Stability Ratios

Overturning	=	1.41	Ratio < 1.5!
Slab Resists All Sliding !			
Global Stability	=	1.48	

Total Bearing Load	=	4,049	lbs
...resultant ecc.	=	14.17	in
Eccentricity outside middle third			
Soil Pressure @ Toe	=	3,294	psf OK
Soil Pressure @ Heel	=	0	psf OK
Allowable	=	3,333	psf
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	3,775	psf
ACI Factored @ Heel	=	0	psf
Footing Shear @ Toe	=	23.2	psi OK
Footing Shear @ Heel	=	31.2	psi OK
Allowable	=	75.0	psi

Sliding Calcs

Lateral Sliding Force	=	2,195.9	lbs

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

Load Factors

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

Stem Construction

		2nd	Bottom		
		Stem OK	Stem OK		
Design Height Above Ftg	ft =	4.00	0.00		
Wall Material Above "Ht"	=	Concrete	Concrete		
Design Method	=	SD	SD	SD	SD
Thickness	=	8.00	8.00		
Rebar Size	=	# 5	# 5		
Rebar Spacing	=	16.00	8.00		
Rebar Placed at	=	6.5 in	6.5 in		
Design Data					
fb/FB + fa/Fa	=	**0.288**	**0.741**		
Total Force @ Section					
Service Level	lbs =				
Strength Level	lbs =	1,002.3	2,826.3		
Moment....Actual					
Service Level	ft-# =				
Strength Level	ft-# =	1,880.2	9,238.5		
Moment.....Allowable	ft-# =	6,513.6	12,453.1		
Shear.....Actual					
Service Level	psi =				
Strength Level	psi =	12.8	36.2		
Shear.....Allowable	psi =	43.2	54.4		
Anet (Masonry)	in2 =				
Wall Weight	psf =	100.0	100.0		
Rebar Depth 'd'	in =	6.50	6.50		

Masonry Data

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

Concrete Data

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

DESCRIPTION: 8'-9" Basement Wall w/ surcharge

Concrete Stem Rebar Area Details

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0676 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@ 13.89 in	#4@ 27.78 in
Provided Area :	0.2325 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	0.8805 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.3321 in2/ft		
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.3321 in2/ft	#4@ 13.89 in	#4@ 27.78 in
Provided Area :	0.465 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	0.8805 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Footing Data

Toe Width	=	1.50 ft
Heel Width	=	2.50
Total Footing Width	=	4.00
Footing Thickness	=	12.00 in

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	=	3,775	0	psf
Mu' : Upward	=	3,383	6	ft-#
Mu' : Downward	=	203	4,398	ft-#
Mu: Design	=	3,181	4,391	ft-#
φ Mn	=	17,034	13,005	ft-#
Actual 1-Way Shear	=	23.19	31.20	psi
Allow 1-Way Shear	=	49.38	41.60	psi

Toe Reinforcing = # 5 @ 8.00 in
Heel Reinforcing = # 5 @ 12.00 in
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

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

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

Key: No key defined

Min footing T&S reinf Area 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

DESCRIPTION: 8'-9" Basement Wall w/ surcharge

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)		1,663.6	3.25	5,406.7	Soil Over HL (ab. water tbl)	1,764.6	3.08	5,440.8
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		3.08	5,440.8
Hydrostatic Force					Water 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	=	532.4	4.88	2,595.2	Surcharge Over Toe	=		
	=				Stem Weight(s)	=	950.0	1.83	1,741.7
					Earth @ Stem Transitions	=			
Total	=	2,195.9	**O.T.M.** =	8,001.9	Footing Weight	=	600.0	2.00	1,200.0
					Key Weight	=			
					Vert. Component	=	734.3	4.00	2,937.4
					Total =		4,048.9 lbs	**R.M.=**	11,319.8

Resisting/Overturning Ratio = **1.41**

Vertical Loads used for Soil Pressure = 4,048.9 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)	0.217	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.

DESCRIPTION: 8'-9" Basement Wall w/ surcharge

Rebar Lap & Embedment Lengths Information

Stem Design Segment: 2nd
Stem Design Height: 4.00 ft above top of footing

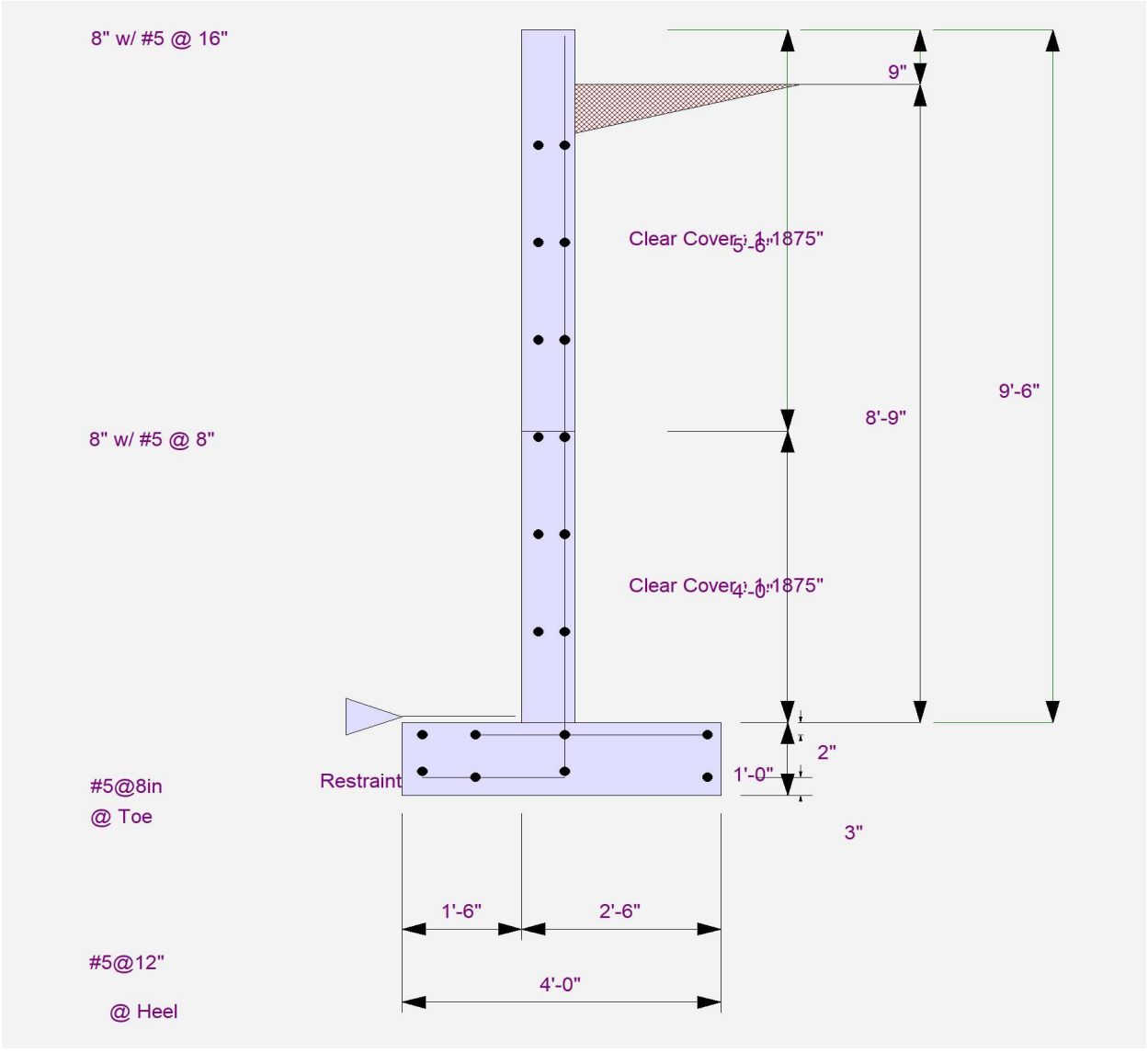
Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in

---

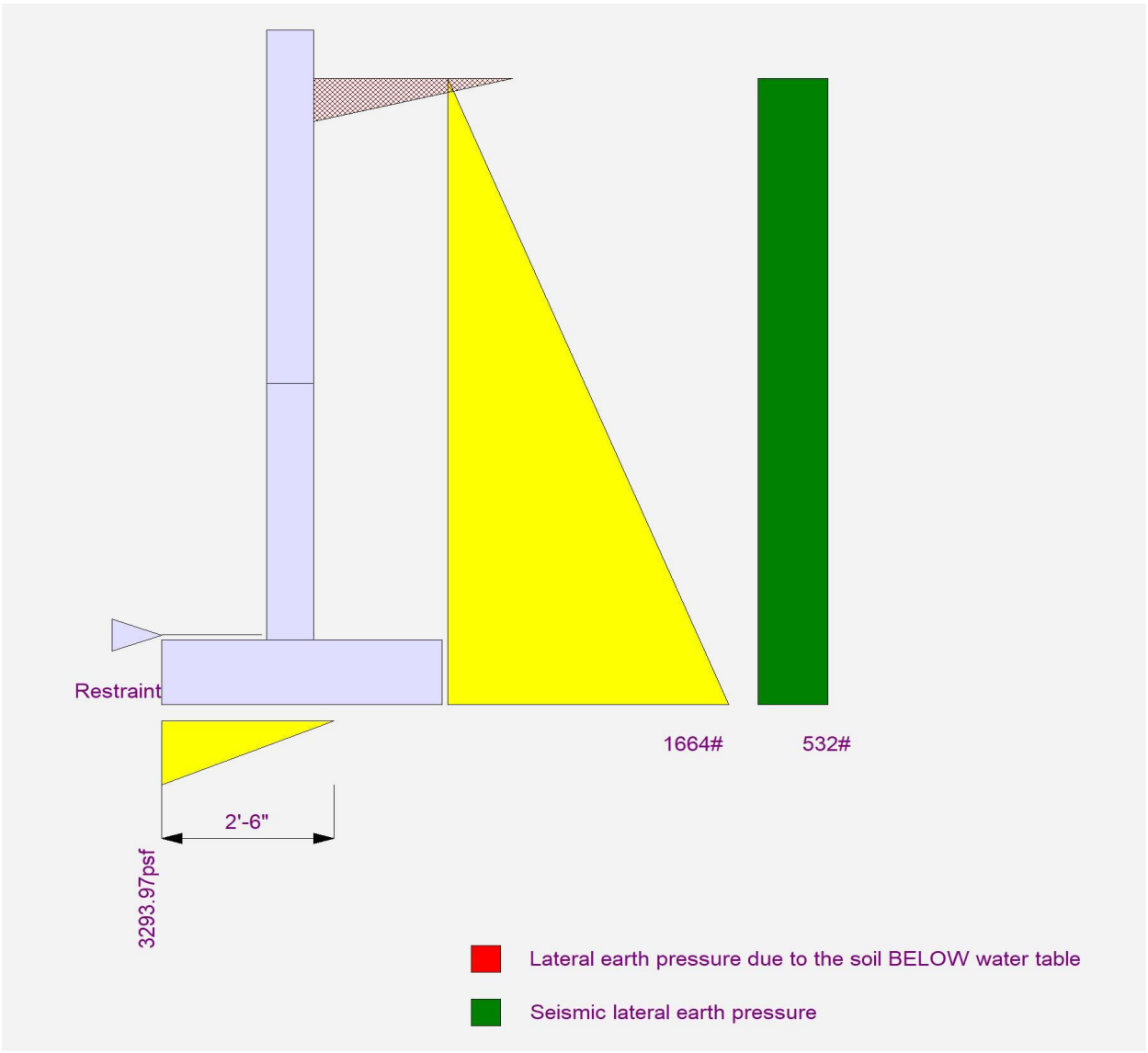
Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	6.00 in
As Provided =	0.4650 in2/ft
As Required =	0.3321 in2/ft

DESCRIPTION: 8'-9" Basement Wall w/ surcharge



DESCRIPTION: 8'-9" Basement Wall w/ surcharge



Concrete Beam

Project File: Foundation Retaining.ec6

DESCRIPTION: Beam Spanning Wall

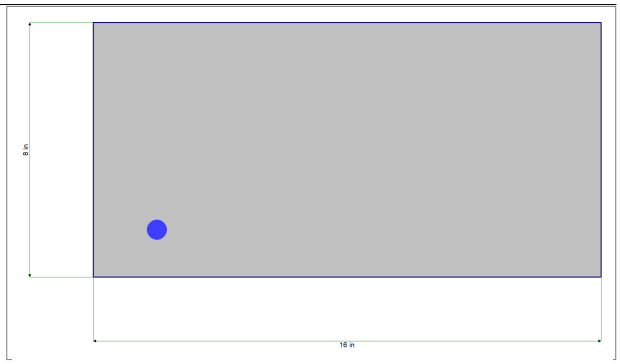
CODE REFERENCES

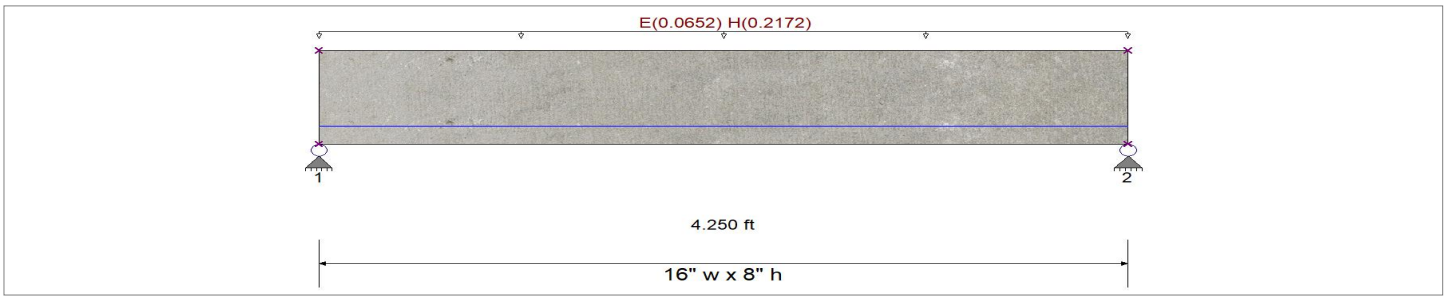
Calculations per ACI 318-19, IBC 2021, ASCE 7-16
Load Combination Set : ASCE 7-22 / IBC 2024 (L<=100psf)

General Information

f'c	= 3.0 ksi	ϕ Phi Values	Flexure :	0.90
fr = f'c$^{1/2}$ *7.50	= 410.792 psi		Shear :	0.750
ψ Density	= 145.0 pcf	β_1	=	0.850
λ LtWt Factor	= 1.0			
Elastic Modulus	= 3,122.0 ksi	Fy - Stirrups		40.0 ksi
fy - Main Rebar	= 60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	= 29,000.0 ksi	Stirrup Bar Size #		3
		Number of Resisting Legs Per Stirrup	=	2

Seismic Design Category = A





Cross Section & Reinforcing Details

Rectangular Section, Width = 16.0 in, Height = 8.0 in
Span #1 Reinforcing....
1-#5 at 1.50 in from Bottom, from 0.0 to 4.250 ft in this span

Load for Span Number 1
Uniform Load : E = 0.06520, H = 0.2172 k/ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.107** : 1	
Section used for this span	**Typical Section**	
Mu : Applied	0.9318	k-ft
Mn * Phi : Allowable	8.750	k-ft
Location of maximum on span	2.121	ft
Span # where maximum occurs	Span # 1	

Maximum Deflection

Max Downward Transient Deflection	0.000 in	Ratio =	0 <360.0	E Only
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360.0	E Only
Max Downward Total Deflection	0.000 in	Ratio =	0 <180.0	Span: 1 : +0.70E+H
Max Upward Total Deflection	0.000 in	Ratio =	0 <180.0	Span: 1 : +0.70E+H

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	0.559	0.559
Max Upward from Load Combinations	0.559	0.559
Max Upward from Load Cases	0.462	0.462
H Only	0.462	0.462
+0.60H	0.277	0.277
+0.70E+H	0.559	0.559
+0.5250E+H	0.534	0.534
+0.70E+0.60H	0.374	0.374

DESCRIPTION: Beam Spanning Wall

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
E Only	0.139	0.139

Shear Stirrup Requirements

Between 0.00 to 4.24 ft, Ties Not Req'd, Stirrups are not required.

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	Φ Vc (k)	Φ Vs (k)	Φ Vn (k)	Vu / Φ Vn	Vc Eqn (T22.5.5.1)	Spacing Provision
+E+1.60H	1	0.00	6.50	0.88	No	N/A	4.92	0.00	4.92	0.178	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.05	6.50	0.86	No	N/A	4.92	0.00	4.92	0.174	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.09	6.50	0.84	No	N/A	4.92	0.00	4.92	0.171	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.14	6.50	0.82	No	N/A	4.92	0.00	4.92	0.167	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.19	6.50	0.80	No	N/A	4.92	0.00	4.92	0.163	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.23	6.50	0.78	No	N/A	4.92	0.00	4.92	0.159	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.28	6.50	0.76	No	N/A	4.92	0.00	4.92	0.155	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.33	6.50	0.74	No	N/A	4.92	0.00	4.92	0.151	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.37	6.50	0.72	No	N/A	4.92	0.00	4.92	0.147	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.42	6.50	0.70	No	N/A	4.92	0.00	4.92	0.143	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.46	6.50	0.69	No	N/A	4.92	0.00	4.92	0.139	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.51	6.50	0.67	No	N/A	4.92	0.00	4.92	0.135	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.56	6.50	0.65	No	N/A	4.92	0.00	4.92	0.132	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.60	6.50	0.63	No	N/A	4.92	0.00	4.92	0.128	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.65	6.50	0.61	No	N/A	4.92	0.00	4.92	0.124	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.70	6.50	0.59	No	N/A	4.92	0.00	4.92	0.120	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.74	6.50	0.57	No	N/A	4.92	0.00	4.92	0.116	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.79	6.50	0.55	No	N/A	4.92	0.00	4.92	0.112	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.84	6.50	0.53	No	N/A	4.92	0.00	4.92	0.108	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.88	6.50	0.51	No	N/A	4.92	0.00	4.92	0.104	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.93	6.50	0.49	No	N/A	4.92	0.00	4.92	0.100	Eqn (b)	Ties Not Req'd
+E+1.60H	1	0.98	6.50	0.47	No	N/A	4.92	0.00	4.92	0.096	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.02	6.50	0.46	No	N/A	4.92	0.00	4.92	0.093	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.07	6.50	0.44	No	N/A	4.92	0.00	4.92	0.089	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.11	6.50	0.42	No	N/A	4.92	0.00	4.92	0.085	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.16	6.50	0.40	No	N/A	4.92	0.00	4.92	0.081	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.21	6.50	0.38	No	N/A	4.92	0.00	4.92	0.077	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.25	6.50	0.36	No	N/A	4.92	0.00	4.92	0.073	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.30	6.50	0.34	No	N/A	4.92	0.00	4.92	0.069	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.35	6.50	0.32	No	N/A	4.92	0.00	4.92	0.065	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.39	6.50	0.30	No	N/A	4.92	0.00	4.92	0.061	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.44	6.50	0.28	No	N/A	4.92	0.00	4.92	0.057	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.49	6.50	0.26	No	N/A	4.92	0.00	4.92	0.054	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.53	6.50	0.24	No	N/A	4.92	0.00	4.92	0.050	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.58	6.50	0.23	No	N/A	4.92	0.00	4.92	0.046	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.63	6.50	0.21	No	N/A	4.92	0.00	4.92	0.042	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.67	6.50	0.19	No	N/A	4.92	0.00	4.92	0.038	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.72	6.50	0.17	No	N/A	4.92	0.00	4.92	0.034	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.77	6.50	0.15	No	N/A	4.92	0.00	4.92	0.030	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.81	6.50	0.13	No	N/A	4.92	0.00	4.92	0.026	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.86	6.50	0.11	No	N/A	4.92	0.00	4.92	0.022	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.90	6.50	0.09	No	N/A	4.92	0.00	4.92	0.019	Eqn (b)	Ties Not Req'd
+E+1.60H	1	1.95	6.50	0.07	No	N/A	4.92	0.00	4.92	0.015	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.00	6.50	0.05	No	N/A	4.92	0.00	4.92	0.011	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.04	6.50	0.03	No	N/A	4.92	0.00	4.92	0.007	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.09	6.50	0.01	No	N/A	4.92	0.00	4.92	0.003	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.14	6.50	-0.00	No	N/A	4.92	0.00	4.92	0.001	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.18	6.50	-0.02	No	N/A	4.92	0.00	4.92	0.005	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.23	6.50	-0.04	No	N/A	4.92	0.00	4.92	0.009	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.28	6.50	-0.06	No	N/A	4.92	0.00	4.92	0.013	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.32	6.50	-0.08	No	N/A	4.92	0.00	4.92	0.017	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.37	6.50	-0.10	No	N/A	4.92	0.00	4.92	0.020	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.42	6.50	-0.12	No	N/A	4.92	0.00	4.92	0.024	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.46	6.50	-0.14	No	N/A	4.92	0.00	4.92	0.028	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.51	6.50	-0.16	No	N/A	4.92	0.00	4.92	0.032	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.55	6.50	-0.18	No	N/A	4.92	0.00	4.92	0.036	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.60	6.50	-0.20	No	N/A	4.92	0.00	4.92	0.040	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.65	6.50	-0.22	No	N/A	4.92	0.00	4.92	0.044	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.69	6.50	-0.23	No	N/A	4.92	0.00	4.92	0.048	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.74	6.50	-0.25	No	N/A	4.92	0.00	4.92	0.052	Eqn (b)	Ties Not Req'd

DESCRIPTION: Beam Spanning Wall

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	Φ Vc (k)	Φ Vs (k)	Φ Vn (k)	Vu / Φ Vn	Vc Eqn (T22.5.5.1)	Spacing Provision
+E+1.60H	1	2.79	6.50	-0.27	No	N/A	4.92	0.00	4.92	0.056	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.83	6.50	-0.29	No	N/A	4.92	0.00	4.92	0.059	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.88	6.50	-0.31	No	N/A	4.92	0.00	4.92	0.063	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.93	6.50	-0.33	No	N/A	4.92	0.00	4.92	0.067	Eqn (b)	Ties Not Req'd
+E+1.60H	1	2.97	6.50	-0.35	No	N/A	4.92	0.00	4.92	0.071	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.02	6.50	-0.37	No	N/A	4.92	0.00	4.92	0.075	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.07	6.50	-0.39	No	N/A	4.92	0.00	4.92	0.079	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.11	6.50	-0.41	No	N/A	4.92	0.00	4.92	0.083	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.16	6.50	-0.43	No	N/A	4.92	0.00	4.92	0.087	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.20	6.50	-0.45	No	N/A	4.92	0.00	4.92	0.091	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.25	6.50	-0.46	No	N/A	4.92	0.00	4.92	0.095	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.30	6.50	-0.48	No	N/A	4.92	0.00	4.92	0.098	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.34	6.50	-0.50	No	N/A	4.92	0.00	4.92	0.102	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.39	6.50	-0.52	No	N/A	4.92	0.00	4.92	0.106	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.44	6.50	-0.54	No	N/A	4.92	0.00	4.92	0.110	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.48	6.50	-0.56	No	N/A	4.92	0.00	4.92	0.114	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.53	6.50	-0.58	No	N/A	4.92	0.00	4.92	0.118	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.58	6.50	-0.60	No	N/A	4.92	0.00	4.92	0.122	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.62	6.50	-0.62	No	N/A	4.92	0.00	4.92	0.126	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.67	6.50	-0.64	No	N/A	4.92	0.00	4.92	0.130	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.72	6.50	-0.66	No	N/A	4.92	0.00	4.92	0.133	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.76	6.50	-0.68	No	N/A	4.92	0.00	4.92	0.137	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.81	6.50	-0.69	No	N/A	4.92	0.00	4.92	0.141	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.86	6.50	-0.71	No	N/A	4.92	0.00	4.92	0.145	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.90	6.50	-0.73	No	N/A	4.92	0.00	4.92	0.149	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.95	6.50	-0.75	No	N/A	4.92	0.00	4.92	0.153	Eqn (b)	Ties Not Req'd
+E+1.60H	1	3.99	6.50	-0.77	No	N/A	4.92	0.00	4.92	0.157	Eqn (b)	Ties Not Req'd
+E+1.60H	1	4.04	6.50	-0.79	No	N/A	4.92	0.00	4.92	0.161	Eqn (b)	Ties Not Req'd
+E+1.60H	1	4.09	6.50	-0.81	No	N/A	4.92	0.00	4.92	0.165	Eqn (b)	Ties Not Req'd
+E+1.60H	1	4.13	6.50	-0.83	No	N/A	4.92	0.00	4.92	0.169	Eqn (b)	Ties Not Req'd
+E+1.60H	1	4.18	6.50	-0.85	No	N/A	4.92	0.00	4.92	0.172	Eqn (b)	Ties Not Req'd
+E+1.60H	1	4.23	6.50	-0.87	No	N/A	4.92	0.00	4.92	0.176	Eqn (b)	Ties Not Req'd

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft) Mu : Max	Phi*Mnx	Stress Ratio
MAXimum BENDING Envelope					
Span # 1	1	4.250	0.93	8.75	0.11
+1.60H					
Span # 1	1	4.250	0.78	8.75	0.09
+0.90H					
Span # 1	1	4.250	0.44	8.75	0.05
+E+1.60H					
Span # 1	1	4.250	0.93	8.75	0.11
+E+0.90H					
Span # 1	1	4.250	0.59	8.75	0.07

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl (in)	Location in Span (ft)	Load Combination	Max. "+" Defl (in)	Location in Span (ft)
+0.70E+H	1	0.0009	2.125		0.0000	0.000

Cantilevered Retaining Wall

Project File: Foundation Retaining.ec6

DESCRIPTION: 5'-9" Crawlspace Wall w/o Surchage

Code Reference

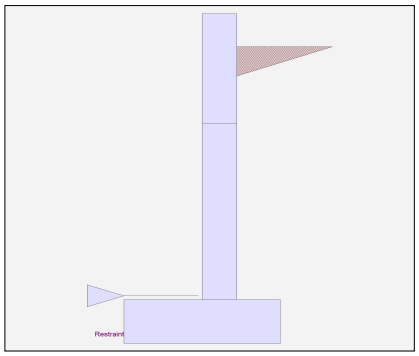
Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	5.75 ft
Wall height above soil	=	0.75 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,500.0 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	=	110.00 pcf
Footing||Soil Friction	=	0.400
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 (Strength 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		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Cantilevered Retaining Wall

Project File: Foundation Retaining.ec6

DESCRIPTION: 5'-9" Crawlspace Wall w/o Surchage

Design Summary

Wall Stability Ratios

Overturning	=	2.39	OK
Slab Resists All Sliding !			
Global Stability	=	1.65	

Total Bearing Load	=	1,979	lbs
...resultant ecc.	=	2.90	in
Eccentricity within middle third			
Soil Pressure @ Toe	=	979	psf OK
Soil Pressure @ Heel	=	341	psf OK
Allowable	=	2,500	psf
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,126	psf
ACI Factored @ Heel	=	392	psf
Footing Shear @ Toe	=	5.6	psi OK
Footing Shear @ Heel	=	7.8	psi OK
Allowable	=	75.0	psi

Sliding Calcs

Lateral Sliding Force	=	797.3	lbs

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

Load Factors

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

Stem Construction

		2nd	Bottom		
		Stem OK	Stem OK		
Design Height Above Ftg	ft =	4.00	0.00		
Wall Material Above "Ht"	=	Concrete	Concrete		
Design Method	=	SD	SD	SD	SD
Thickness	=	8.00	8.00		
Rebar Size	=	# 5	# 5		
Rebar Spacing	=	16.00	16.00		
Rebar Placed at	=	6.5 in	6.5 in		
Design Data					
fb/FB + fa/Fa	=	**0.007**	**0.272**		
Total Force @ Section					
Service Level	lbs =				
Strength Level	lbs =	85.8	925.8		
Moment....Actual					
Service Level	ft-# =				
Strength Level	ft-# =	50.0	1,774.4		
Moment.....Allowable	ft-# =	6,513.6	6,513.6		
Shear.....Actual					
Service Level	psi =				
Strength Level	psi =	1.1	11.9		
Shear.....Allowable	psi =	43.2	43.2		
Anet (Masonry)	in2 =				
Wall Weight	psf =	100.0	100.0		
Rebar Depth 'd'	in =	6.50	6.50		

Masonry Data

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

Concrete Data

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

DESCRIPTION: 5'-9" Crawlspace Wall w/o Surchage

Concrete Stem Rebar Area Details

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0018 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@ 13.89 in	#4@ 27.78 in
Provided Area :	0.2325 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	0.8805 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0638 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@ 13.89 in	#4@ 27.78 in
Provided Area :	0.2325 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	0.8805 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Footing Data

Toe Width	=	1.50 ft
Heel Width	=	1.50
Total Footing Width	=	3.00
Footing Thickness	=	12.00 in

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	=	1,126	392	psf
Mu' : Upward	=	1,130	160	ft-#
Mu' : Downward	=	203	795	ft-#
Mu: Design	=	927	636	ft-#
φ Mn	=	2,500	2,500	ft-#
Actual 1-Way Shear	=	5.60	7.78	psi
Allow 1-Way Shear	=	40.00	40.00	psi

Toe Reinforcing = None Spec'd
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: phiMn = phi*5*lambda*sqrt(fc)*Sm

Heel: phiMn = phi*5*lambda*sqrt(fc)*Sm

Key: No key defined

Min footing T&S reinf Area 0.78 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

DESCRIPTION: 5'-9" Crawlspace Wall w/o Surchage

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)	797.3	2.25	1,794.0			
HL Act Pres (be water tbl)						
Hydrostatic Force						
Buoyant Force =						
Surcharge over Heel =						
Surcharge Over Toe =						
Adjacent Footing Load =						
Added Lateral Load =						
Load @ Stem Above Soil =						
=						
Soil Over HL (ab. water tbl)				527.1	2.58	1,361.6
Soil Over HL (bel. water tbl)					2.58	1,361.6
Water Table						
Sloped Soil Over Heel =						
Surcharge Over Heel =						
Adjacent Footing Load =						
Axial Dead Load on Stem =						
* Axial Live Load on Stem =						
Soil Over Toe =						
Surcharge Over Toe =						
Stem Weight(s) =				650.0	1.83	1,191.7
Earth @ Stem Transitions =						
Footing Weight =				450.0	1.50	675.0
Key Weight =						
Vert. Component =				352.0	3.00	1,055.9
Total =	797.3	**O.T.M.** =	1,794.0	**Total =** 1,979.0 lbs	**R.M.=**	4,284.2

Resisting/Overturning Ratio = **2.39**

Vertical Loads used for Soil Pressure = 1,979.0 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

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

Vertical component of active lateral soil pressure IS 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)	0.059	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.

DESCRIPTION: 5'-9" Crawlspace Wall w/o Surchage

Rebar Lap & Embedment Lengths Information

Stem Design Segment: 2nd
Stem Design Height: 4.00 ft above top of footing

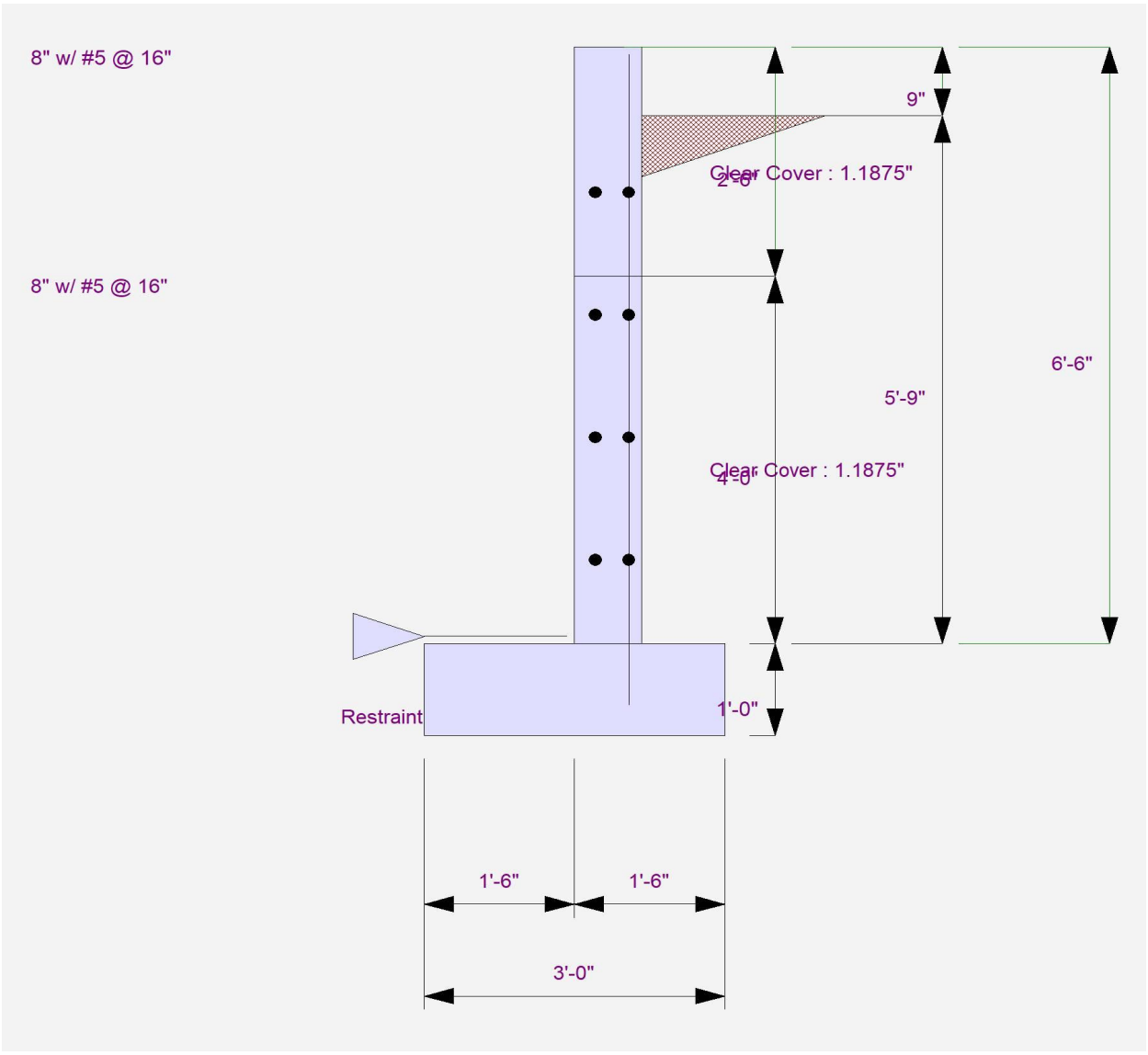
Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in

---

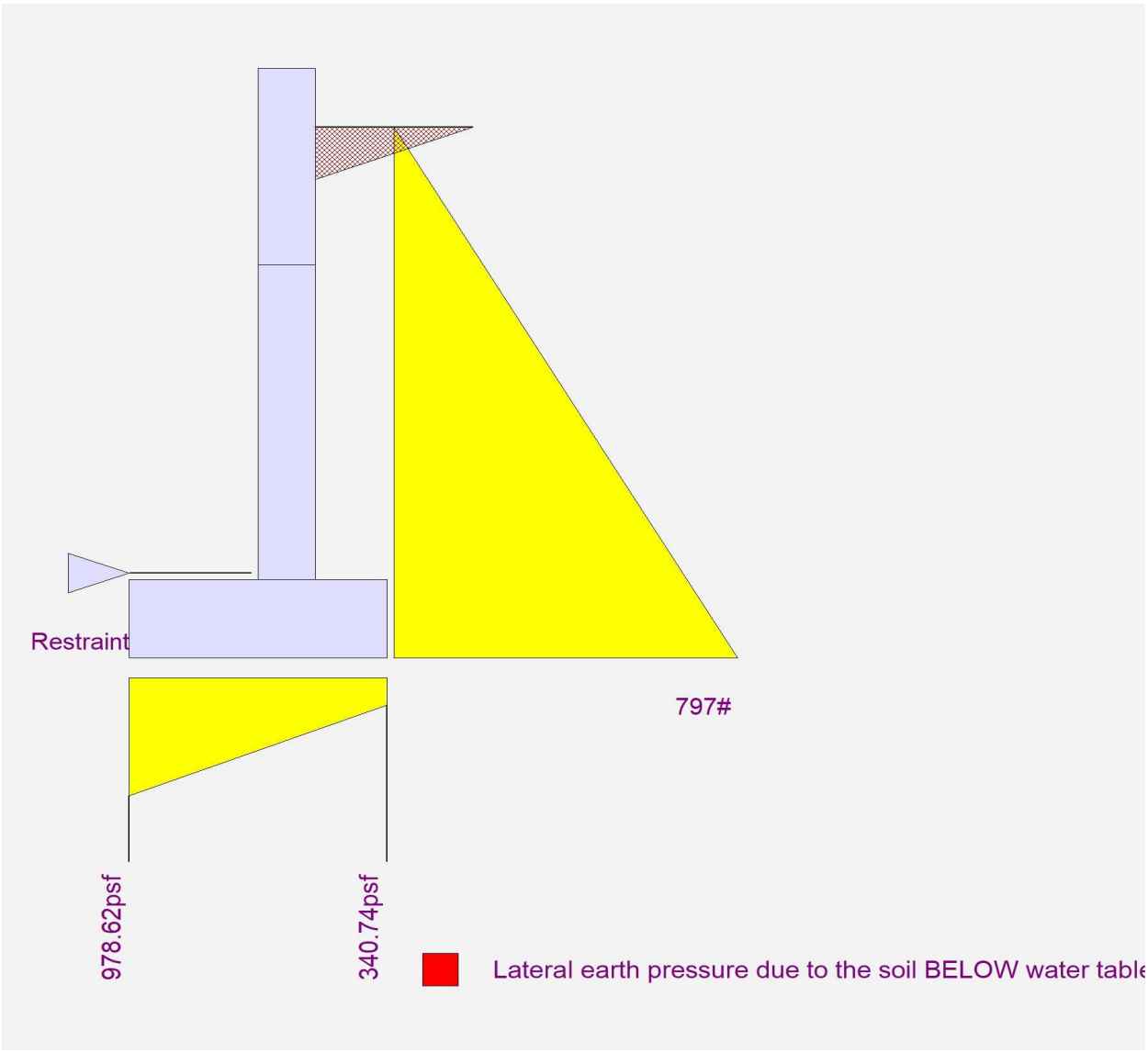
Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	6.00 in
As Provided =	0.2325 in2/ft
As Required =	0.1728 in2/ft

DESCRIPTION: 5'-9" Crawlspace Wall w/o Surchage



DESCRIPTION: 5'-9" Crawlspace Wall w/o Surchage



Cantilevered Retaining Wall

Project File: Foundation Retaining.ec6

DESCRIPTION: 5'-9" Crawlspace Wall w/ Surchage

Code Reference

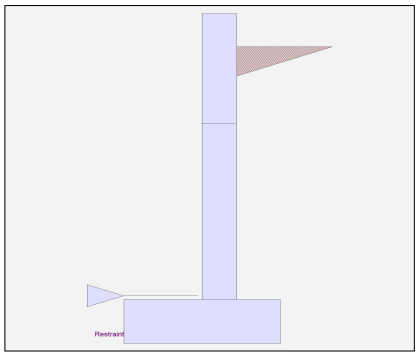
Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	5.75 ft
Wall height above soil	=	0.75 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	3,333.0 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	=	110.00 pcf
Footing||Soil Friction	=	0.400
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 (Strength 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		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Earth Pressure Seismic Load

Method : Uniform		
Multiplier Used	=	8.000
(Multiplier used on soil density)		
Uniform Seismic Force	=	54.000
Total Seismic Force	=	364.500

Cantilevered Retaining Wall

Project File: Foundation Retaining.ec6

DESCRIPTION: 5'-9" Crawlspace Wall w/ Surchage

Design Summary

Wall Stability Ratios

Overturning	=	1.61	OK
Slab Resists All Sliding !			
Global Stability	=	1.65	

Total Bearing Load	=	1,979	lbs
...resultant ecc.	=	8.12	in
Eccentricity outside middle third			
Soil Pressure @ Toe	=	1,603	psf OK
Soil Pressure @ Heel	=	0	psf OK
Allowable	=	3,333	psf
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,845	psf
ACI Factored @ Heel	=	0	psf
Footing Shear @ Toe	=	9.0	psi OK
Footing Shear @ Heel	=	10.9	psi OK
Allowable	=	75.0	psi

Sliding Calcs

Lateral Sliding Force	=	1,052.5	lbs

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

Load Factors

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

Stem Construction

		2nd	Bottom		
		Stem OK	Stem OK		
Design Height Above Ftg	ft =	4.00	0.00		
Wall Material Above "Ht"	=	Concrete	Concrete		
Design Method	=	SD	SD	SD	SD
Thickness	=	8.00	8.00		
Rebar Size	=	# 5	# 5		
Rebar Spacing	=	16.00	16.00		
Rebar Placed at	=	6.5 in	6.5 in		
Design Data					
fb/FB + fa/Fa	=	**0.020**	**0.409**		
Total Force @ Section					
Service Level	lbs =				
Strength Level	lbs =	180.3	1,236.3		
Moment....Actual					
Service Level	ft-# =				
Strength Level	ft-# =	132.7	2,667.0		
Moment.....Allowable	ft-# =	6,513.6	6,513.6		
Shear.....Actual					
Service Level	psi =				
Strength Level	psi =	2.3	15.8		
Shear.....Allowable	psi =	43.2	43.2		
Anet (Masonry)	in2 =				
Wall Weight	psf =	100.0	100.0		
Rebar Depth 'd'	in =	6.50	6.50		

Masonry Data

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

Concrete Data

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

DESCRIPTION: 5'-9" Crawlspace Wall w/ Surchage

Concrete Stem Rebar Area Details

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0048 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@ 13.89 in	#4@ 27.78 in
Provided Area :	0.2325 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	0.8805 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0959 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@ 13.89 in	#4@ 27.78 in
Provided Area :	0.2325 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	0.8805 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Footing Data

Toe Width	=	1.50 ft
Heel Width	=	1.50
Total Footing Width	=	3.00
Footing Thickness	=	12.00 in

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	=	1,845	0	psf
Mu' : Upward	=	1,655	3	ft-#
Mu' : Downward	=	203	795	ft-#
Mu: Design	=	1,453	792	ft-#
φ Mn	=	2,500	2,500	ft-#
Actual 1-Way Shear	=	9.03	10.93	psi
Allow 1-Way Shear	=	40.00	40.00	psi

Toe Reinforcing = None Spec'd
Heel Reinforcing = None Spec'd
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: phiMn = phi*5*lambda*sqrt(fc)*Sm

Heel: phiMn = phi*5*lambda*sqrt(fc)*Sm

Key: No key defined

Min footing T&S reinf Area 0.78 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

DESCRIPTION: 5'-9" Crawlspace Wall w/ Surchage

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)		797.3	2.25	1,794.0	Soil Over HL (ab. water tbl)	527.1	2.58	1,361.6
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		2.58	1,361.6
Hydrostatic Force					Water 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	=	255.2	3.38	861.1	Surcharge Over Toe	=		
	=				Stem Weight(s)	=	650.0	1.83	1,191.7
					Earth @ Stem Transitions	=			
Total	=	1,052.5	**O.T.M.** =	2,655.2	Footing Weight	=	450.0	1.50	675.0
					Key Weight	=			
					Vert. Component	=	352.0	3.00	1,055.9
					Total =		1,979.0 lbs	**R.M.=**	4,284.2

Resisting/Overturning Ratio = **1.61**

Vertical Loads used for Soil Pressure = 1,979.0 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.

DESCRIPTION: 5'-9" Crawlspace Wall w/ Surchage

Rebar Lap & Embedment Lengths Information

Stem Design Segment: 2nd
Stem Design Height: 4.00 ft above top of footing

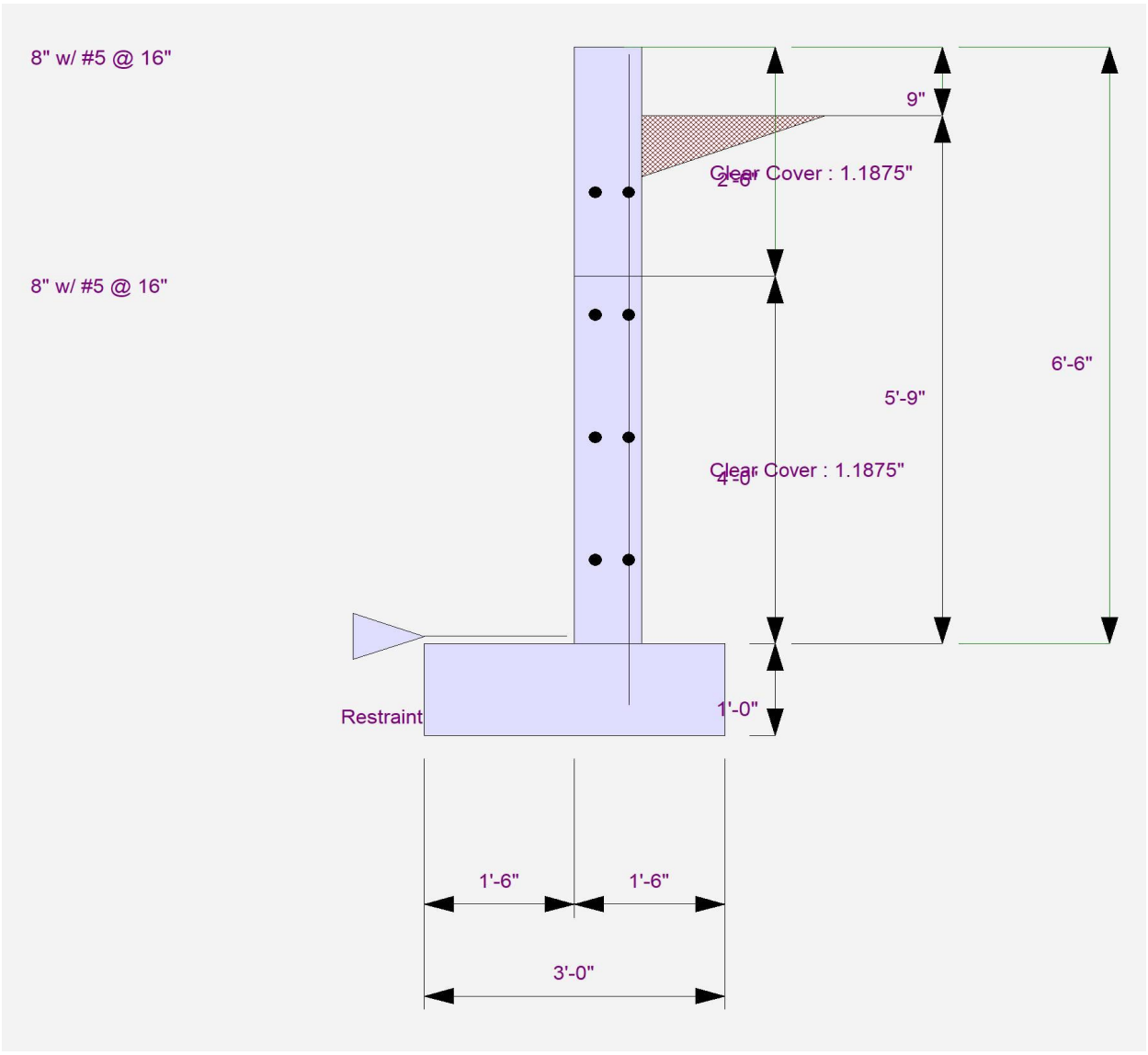
Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in

---

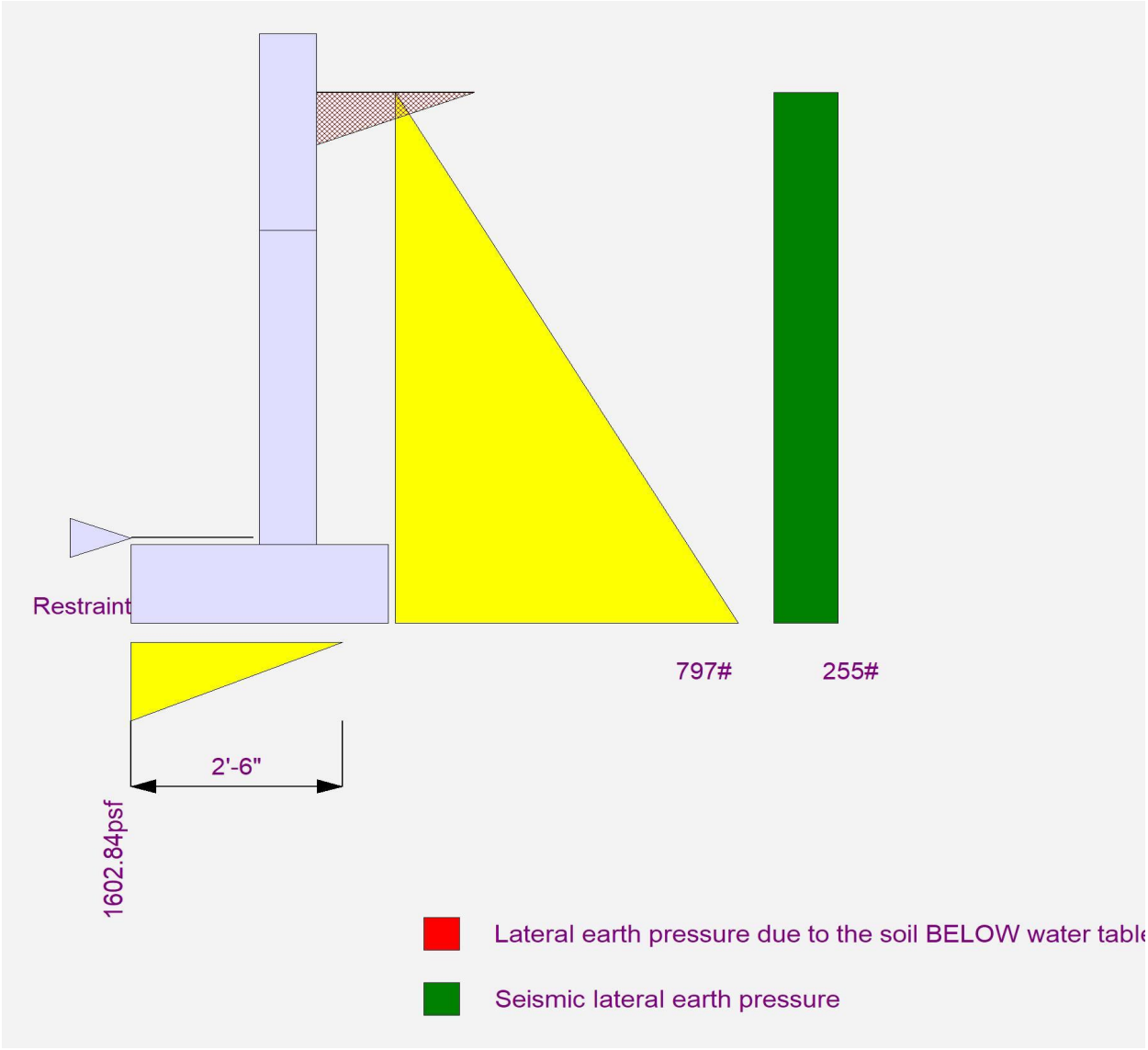
Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	6.00 in
As Provided =	0.2325 in2/ft
As Required =	0.1728 in2/ft

DESCRIPTION: 5'-9" Crawlspace Wall w/ Surchage



DESCRIPTION: 5'-9" Crawlspace Wall w/ Surchage



Cantilevered Retaining Wall

Project File: Foundation Retaining.ec6

DESCRIPTION: 9'-9" Basement Wall w/o surcharge

Code References

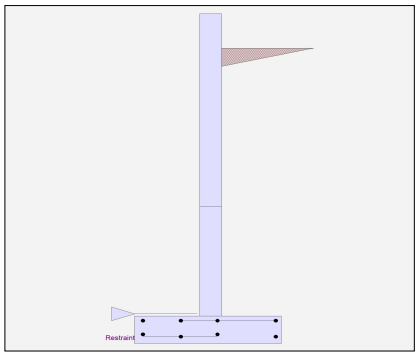
Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	9.75 ft
Wall height above soil	=	1.25 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,500.0 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	=	110.00 pcf
Footing||Soil Friction	=	0.400
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 (Strength 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		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Cantilevered Retaining Wall

Project File: Foundation Retaining.ec6

DESCRIPTION: 9'-9" Basement Wall w/o surcharge

Design Summary

Wall Stability Ratios

Overturning	=	2.09	OK
Slab Resists All Sliding !			
Global Stability	=	1.38	

Total Bearing Load	=	4,634	lbs
...resultant ecc.	=	6.54	in
Eccentricity within middle third			
Soil Pressure @ Toe	=	1,778	psf OK
Soil Pressure @ Heel	=	282	psf OK
Allowable	=	2,500	psf
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,010	psf
ACI Factored @ Heel	=	318	psf
Footing Shear @ Toe	=	20.1	psi OK
Footing Shear @ Heel	=	25.5	psi OK
Allowable	=	75.0	psi

Sliding Calcs

Lateral Sliding Force	=	2,022.3	lbs

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

Load Factors

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

Stem Construction

		2nd	Bottom		
		Stem OK	Stem OK		
Design Height Above Ftg	ft =	4.00	0.00		
Wall Material Above "Ht"	=	Concrete	Concrete		
Design Method	=	SD	SD	SD	SD
Thickness	=	8.00	8.00		
Rebar Size	=	# 5	# 5		
Rebar Spacing	=	16.00	8.00		
Rebar Placed at	=	6.5 in	6.5 in		
Design Data					
fb/FB + fa/Fa	=	**0.272**	**0.694**		
Total Force @ Section					
Service Level	lbs =				
Strength Level	lbs =	925.8	2,661.8		
Moment....Actual					
Service Level	ft-# =				
Strength Level	ft-# =	1,774.4	8,650.7		
Moment.....Allowable	ft-# =	6,513.6	12,453.1		
Shear.....Actual					
Service Level	psi =				
Strength Level	psi =	11.9	34.1		
Shear.....Allowable	psi =	43.2	54.4		
Anet (Masonry)	in2 =				
Wall Weight	psf =	100.0	100.0		
Rebar Depth 'd'	in =	6.50	6.50		

Masonry Data

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

Concrete Data

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

DESCRIPTION: 9'-9" Basement Wall w/o surcharge

Concrete Stem Rebar Area Details

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0638 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@ 13.89 in	#4@ 27.78 in
Provided Area :	0.2325 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	0.8805 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.311 in2/ft		
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.311 in2/ft	#4@ 13.89 in	#4@ 27.78 in
Provided Area :	0.465 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	0.8805 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Footing Data

Toe Width	=	2.00 ft
Heel Width	=	2.50
Total Footing Width	=	4.50
Footing Thickness	=	12.00 in

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	=	2,010	318	psf
Mu' : Upward	=	3,518	921	ft-#
Mu' : Downward	=	360	5,084	ft-#
Mu: Design	=	3,158	4,163	ft-#
φ Mn	=	17,034	13,005	ft-#
Actual 1-Way Shear	=	20.09	25.46	psi
Allow 1-Way Shear	=	49.38	41.60	psi

Toe Reinforcing = # 5 @ 8.00 in
Heel Reinforcing = # 5 @ 12.00 in
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

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

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

Key: No key defined

Min footing T&S reinf Area 1.17 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

DESCRIPTION: 9'-9" Basement Wall w/o surcharge

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)		2,022.3	3.58	7,246.7	Soil Over HL (ab. water tbl)	1,966.3	3.58	7,045.7
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		3.58	7,045.7
Hydrostatic Force					Water 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	=		
	=				Surcharge Over Toe	=		
					Stem Weight(s)	=	1,100.0	2.33	2,566.7
					Earth @ Stem Transitions	=		
Total	=	2,022.3	**O.T.M.** =	7,246.7	Footing Weight	=	675.0	2.25	1,518.8
					Key Weight	=			
					Vert. Component	=	892.7	4.50	4,017.2
					Total =		4,634.0 lbs	**R.M.=**	15,148.3

Resisting/Overturning Ratio = **2.09**

Vertical Loads used for Soil Pressure = 4,634.0 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

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

Vertical component of active lateral soil pressure IS 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)	0.121	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.

DESCRIPTION: 9'-9" Basement Wall w/o surcharge

Rebar Lap & Embedment Lengths Information

Stem Design Segment: 2nd
Stem Design Height: 4.00 ft above top of footing

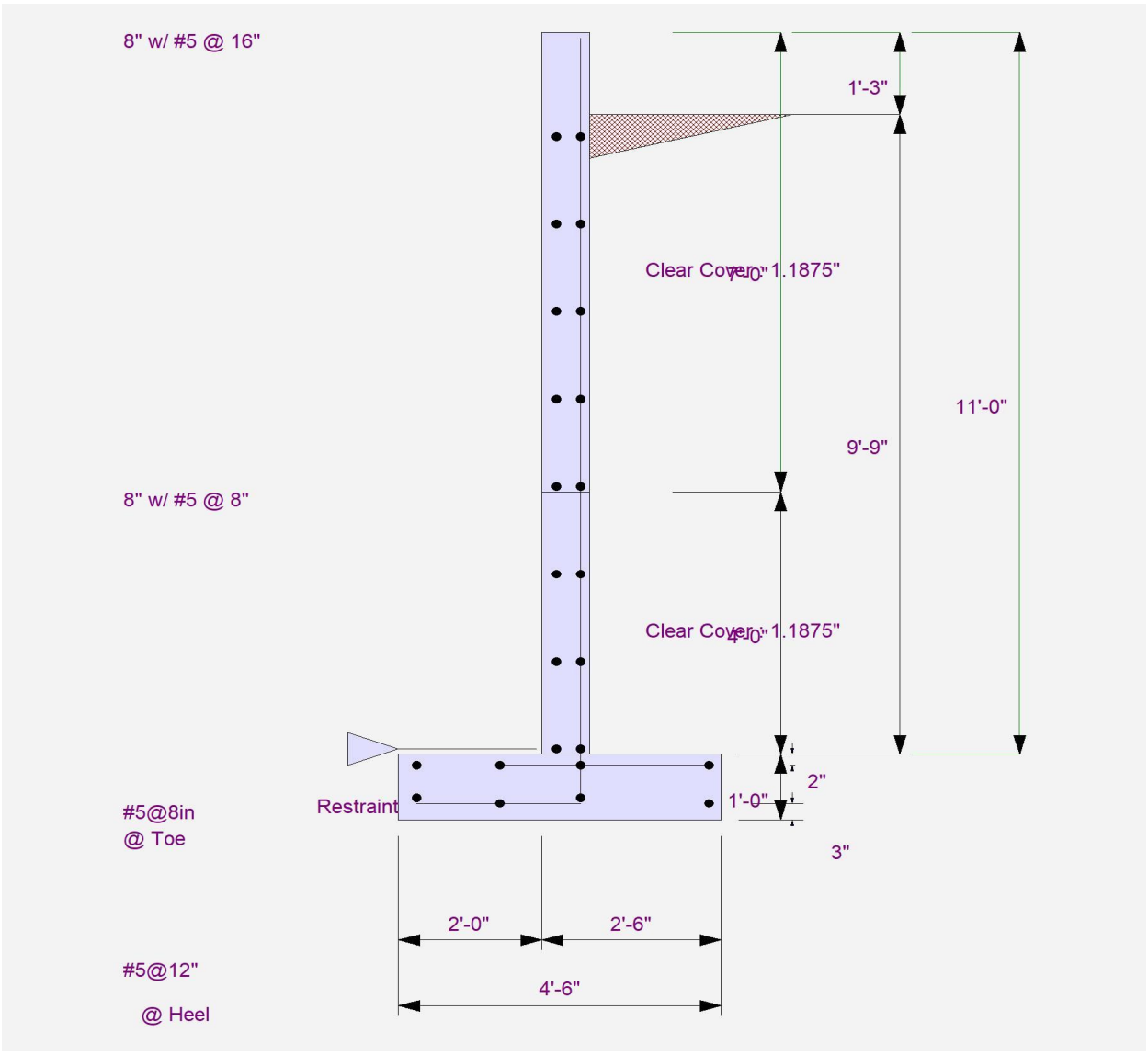
Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in

---

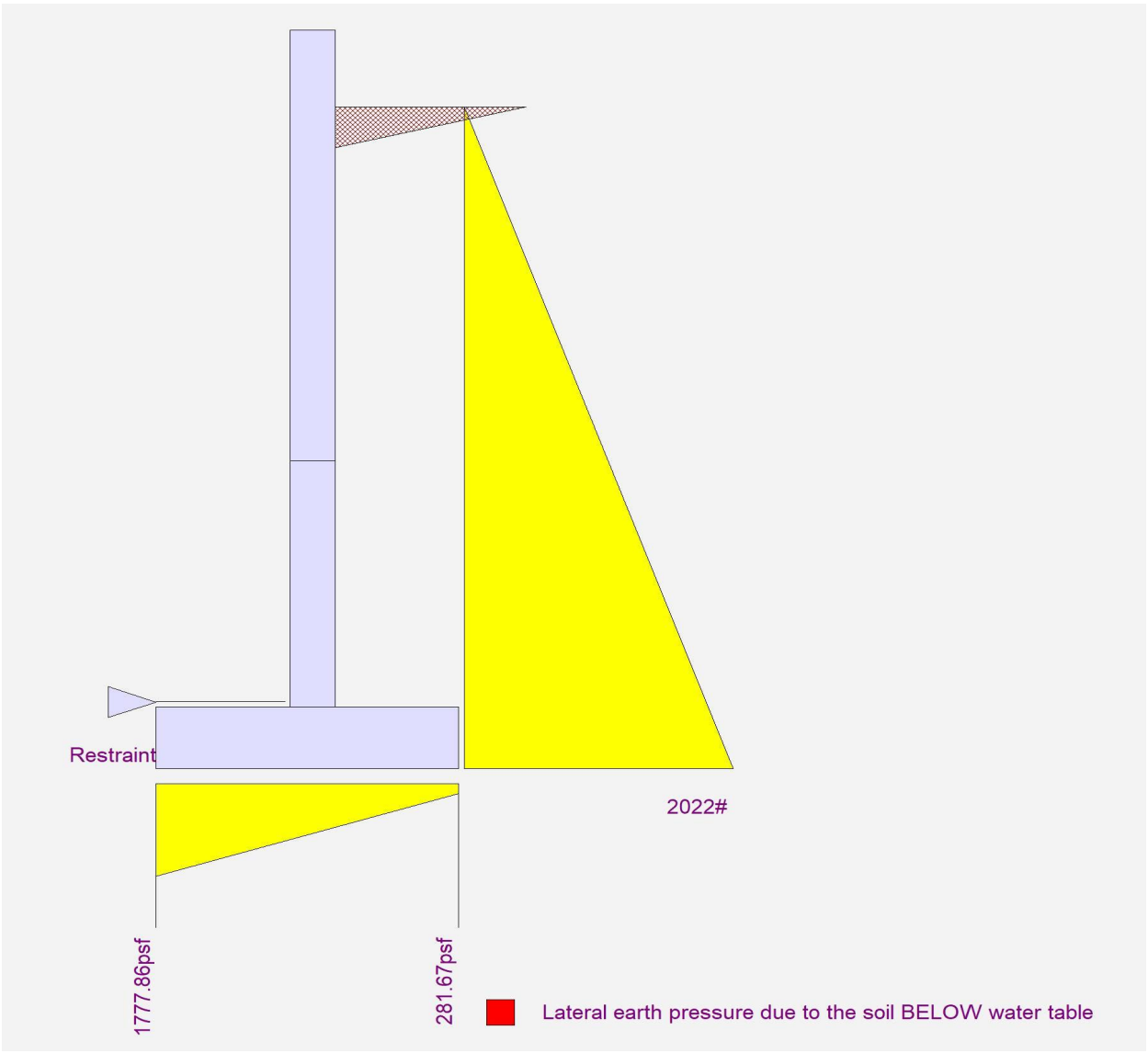
Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	6.00 in
As Provided =	0.4650 in2/ft
As Required =	0.3110 in2/ft

DESCRIPTION: 9'-9" Basement Wall w/o surcharge



DESCRIPTION: 9'-9" Basement Wall w/o surcharge



Cantilevered Retaining Wall

Project File: Foundation Retaining.ec6

DESCRIPTION: 9'-9" Basement Wall w/ surcharge

Code References

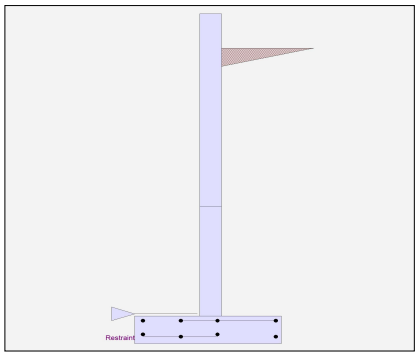
Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	9.75 ft
Wall height above soil	=	1.25 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	3,333.0 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	=	110.00 pcf
Footing||Soil Friction	=	0.400
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

Earth Pressure Seismic Load

Method : Uniform

Multiplier Used (Multiplier used on soil density)	=	8.000

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 (Strength Level)	=	0.0 psf

Uniform Seismic Force	=	86.000
Total Seismic Force	=	924.500

Adjacent Footing Load

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

Cantilevered Retaining Wall

Project File: Foundation Retaining.ec6

DESCRIPTION: 9'-9" Basement Wall w/ surcharge

Design Summary

Wall Stability Ratios

Overturning	=	1.41	Ratio < 1.5!
Slab Resists All Sliding !			
Global Stability	=	1.38	

Total Bearing Load	=	4,634 lbs	
...resultant ecc.	=	15.55 in	
Eccentricity outside middle third			
Soil Pressure @ Toe	=	3,237 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	3,333 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	3,658 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	33.6 psi	OK
Footing Shear @ Heel	=	35.9 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	2,669.5 lbs

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

Load Factors

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

Stem Construction

		2nd	Bottom		
		Stem OK	Ratio > 1.0		
Design Height Above Ftg	ft =	4.00	0.00		
Wall Material Above "Ht"	=	Concrete	Concrete		
Design Method	=	SD	SD	SD	SD
Thickness	=	8.00	8.00		
Rebar Size	=	# 5	# 5		
Rebar Spacing	=	16.00	8.00		
Rebar Placed at	=	6.5 in	6.5 in		
Design Data					
fb/FB + fa/Fa	=	**0.490**	**1.022**		
Total Force @ Section					
Service Level	lbs =				
Strength Level	lbs =	1,420.3	3,500.3		
Moment....Actual					
Service Level	ft-# =				
Strength Level	ft-# =	3,196.0	12,738.4		
Moment.....Allowable	ft-# =	6,513.6	12,453.1		
Shear.....Actual					
Service Level	psi =				
Strength Level	psi =	18.2	44.9		
Shear.....Allowable	psi =	43.2	54.4		
Anet (Masonry)	in2 =				
Wall Weight	psf =	100.0	100.0		
Rebar Depth 'd'	in =	6.50	6.50		

Masonry Data

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

Concrete Data

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

DESCRIPTION: 9'-9" Basement Wall w/ surcharge

Concrete Stem Rebar Area Details

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1149 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@ 13.89 in	#4@ 27.78 in
Provided Area :	0.2325 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	0.8805 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.458 in2/ft		
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.458 in2/ft	#4@ 13.89 in	#4@ 27.78 in
Provided Area :	0.465 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	0.8805 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Footing Data

Toe Width	=	2.00 ft
Heel Width	=	2.50
Total Footing Width	=	4.50
Footing Thickness	=	12.00 in

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	=	3,658	0	psf
Mu' : Upward	=	5,613	2	ft-#
Mu' : Downward	=	360	5,084	ft-#
Mu: Design	=	5,253	5,082	ft-#
φ Mn	=	17,034	13,005	ft-#
Actual 1-Way Shear	=	33.60	35.90	psi
Allow 1-Way Shear	=	49.38	41.60	psi

Toe Reinforcing = # 5 @ 8.00 in
Heel Reinforcing = # 5 @ 12.00 in
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

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

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

Key: No key defined

Min footing T&S reinf Area 1.17 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

DESCRIPTION: 9'-9" Basement Wall w/ surcharge

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)		2,022.3	3.58	7,246.7	Soil Over HL (ab. water tbl)	1,966.3	3.58	7,045.7
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		3.58	7,045.7
Hydrostatic Force					Water 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	=	647.2	5.38	3,478.4	Surcharge Over Toe	=		
	=				Stem Weight(s)	=	1,100.0	2.33	2,566.7
					Earth @ Stem Transitions	=			
Total	=	2,669.5	**O.T.M.** =	10,725.2	Footing Weight	=	675.0	2.25	1,518.8
					Key Weight	=			
					Vert. Component	=	892.7	4.50	4,017.2
					Total =		4,634.0 lbs	**R.M.=**	15,148.3

Resisting/Overturning Ratio = **1.41**

Vertical Loads used for Soil Pressure = 4,634.0 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)	0.220	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.

DESCRIPTION: 9'-9" Basement Wall w/ surcharge

Rebar Lap & Embedment Lengths Information

Stem Design Segment: 2nd
Stem Design Height: 4.00 ft above top of footing

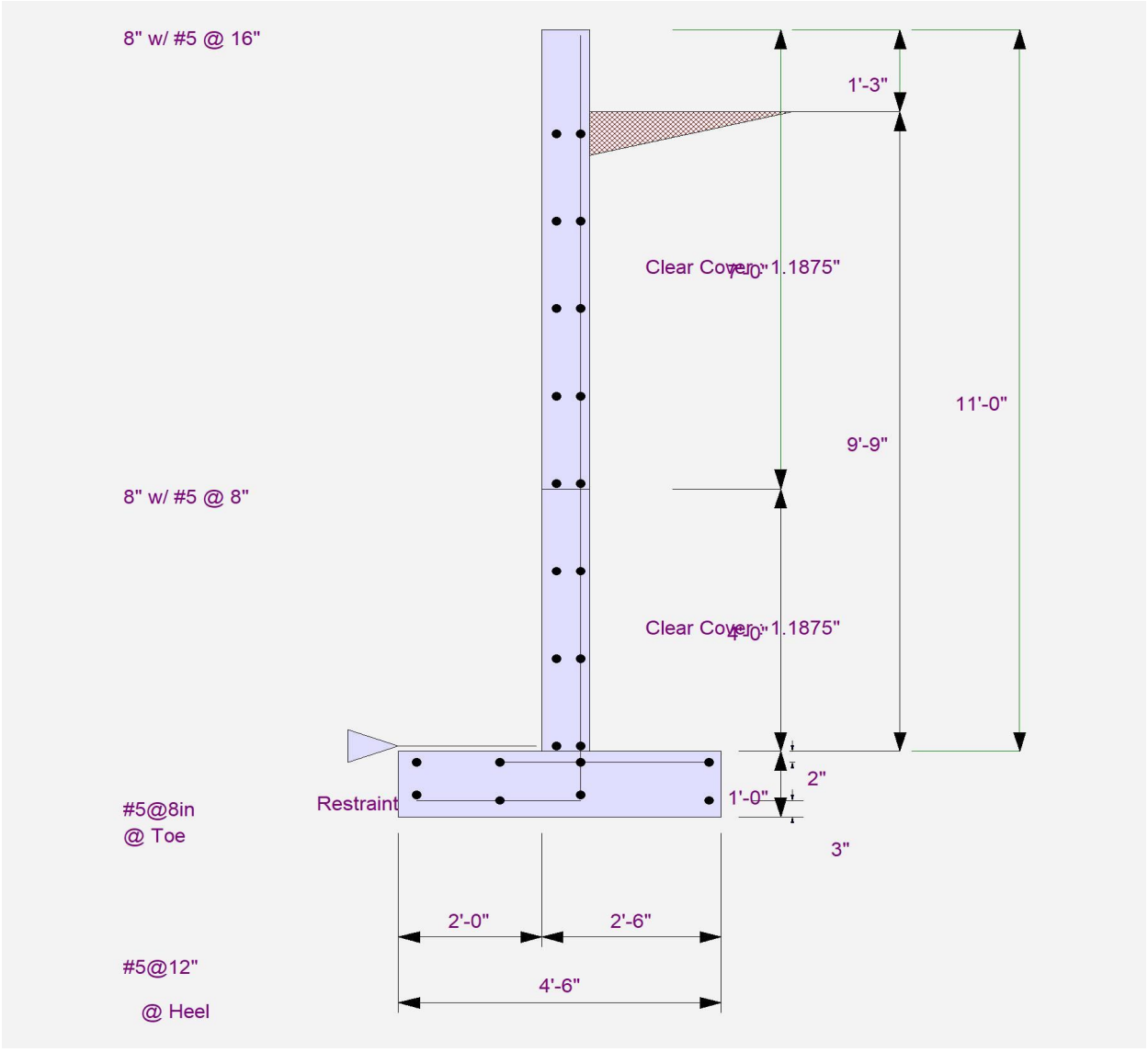
Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in

---

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	6.00 in
As Provided =	0.4650 in2/ft
As Required =	0.4580 in2/ft

DESCRIPTION: 9'-9" Basement Wall w/ surcharge



DESCRIPTION: 9'-9" Basement Wall w/ surcharge