



MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

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CALCULATION PACKAGE

July 23, 2025

McCullough Architects

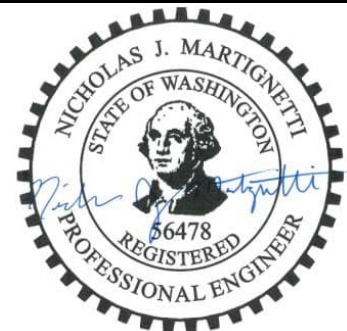
O'Brien Residence – 9412 SE 33rd St
Mercer Island,
Washington

MULHERN & KULP STRUCTURAL ENGINEERING, INC.

Prepared By:

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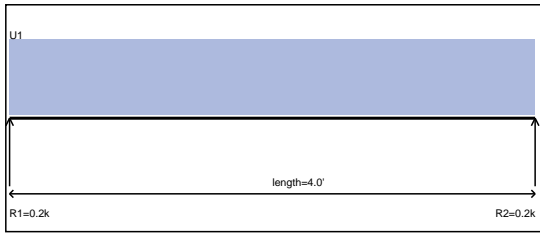


Signature, Seal & Date



BEAM & HEADER CALCULATIONS

Description - Roof Framing - H3-1 - Header



Uniform 1 = 0.07 klf (0.0'-4.0')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 0.14k	Vall = 2.66k	Ratio = 0.05
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M = 0.14k-ft	Mall = 1.98k-ft	Ratio = 0.07
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Deflection

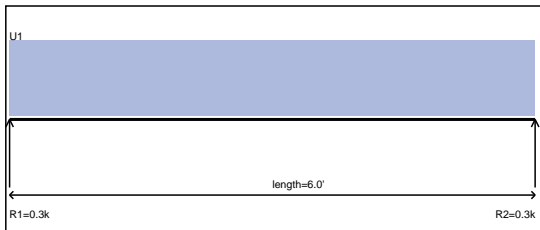
TL = 0.01" L/999+ > L/240 min

DL = 0.00"

L = 0.00" L/999+ > L/360 min

4x6 DF #2

Description - Roof Framing - H3-2 - Header



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

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 0.21k	Vall = 2.66k	Ratio = 0.08
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M = 0.31k-ft	Mall = 1.98k-ft	Ratio = 0.16
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Deflection

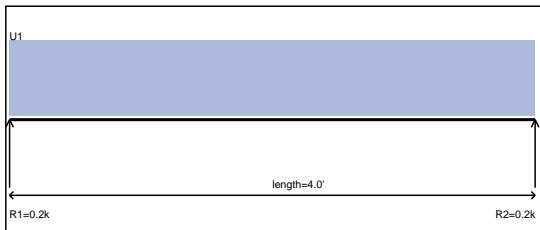
TL = 0.03" L/999+ > L/240 min

DL = 0.01"

L = 0.00" L/999+ > L/360 min

4x6 DF #2

Description - Roof Framing - H3-3 - Header



Uniform 1 = 0.07 klf (0.0'-4.0')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 0.14k	Vall = 2.66k	Ratio = 0.05
-----------	--------------	--------------

M = 0.14k-ft	Mall = 1.98k-ft	Ratio = 0.07
--------------	-----------------	--------------

Deflection

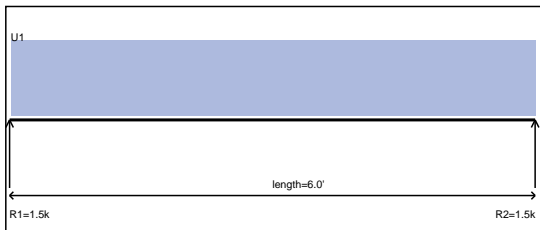
TL = 0.01" L/999+ > L/240 min

DL = 0.00"

L = 0.00" L/999+ > L/360 min

4x6 DF #2

Description - Roof Framing - H3-4 - Header



Uniform 1 = 0.48 klf (0.0'-6.0')

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd=1$

$M = (D + L) \quad Cd=1$

$\Delta = (D + L)$

V = 1.45k	Vall = 1.69k	Ratio = 0.86
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M = 2.18k-ft	Mall = 2.24k-ft	Ratio = 0.97
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Deflection

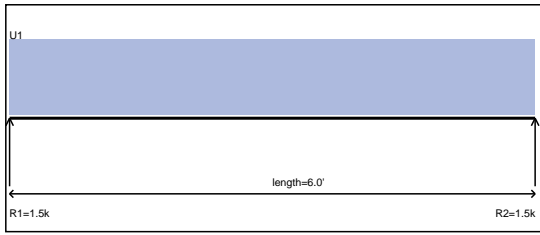
TL = 0.06" L/999+ > L/240 min

DL = 0.02"

L = 0.04" L/999+ > L/360 min

2x12 HF #2

Description - Roof Framing - H3-5 - Header



Uniform 1 = 0.48 klf (0.0'-6.0')

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd=1$

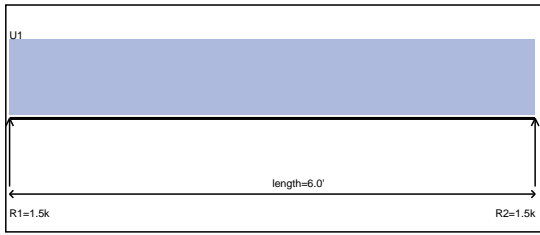
$M = (D + L) \quad Cd=1$

$\Delta = (D + L)$

V = 1.45k	Vall = 1.69k	Ratio = 0.86
M = 2.18k-ft	Mall = 2.24k-ft	Ratio = 0.97
Deflection		
TL = 0.06" L/999+ > L/240 min		
DL = 0.02"		
L = 0.04" L/999+ > L/360 min		

2x12 HF #2

Description - Roof Framing - H3-6 - Header



Uniform 1 = 0.48 klf (0.0'-6.0')

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd=1$

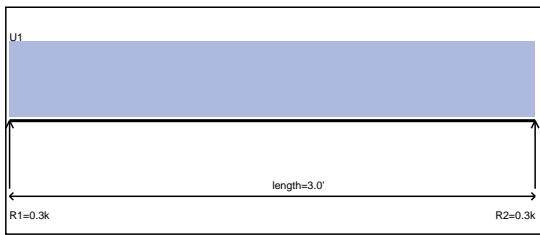
$M = (D + L) \quad Cd=1$

$\Delta = (D + L)$

V = 1.45k	Vall = 1.69k	Ratio = 0.86
M = 2.18k-ft	Mall = 2.24k-ft	Ratio = 0.97
Deflection		
TL = 0.06" L/999+ > L/240 min		
DL = 0.02"		
L = 0.04" L/999+ > L/360 min		

2x12 HF #2

Description - Roof Framing - H3-7 - Header



Uniform 1 = 0.18 klf (0.0'-3.0')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

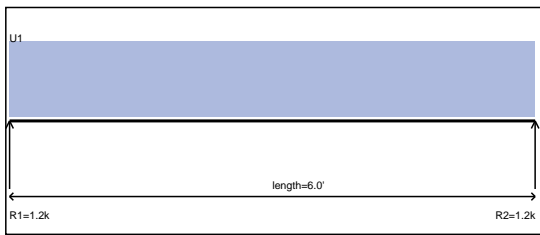
$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 0.27k	Vall = 2.66k	Ratio = 0.10
M = 0.20k-ft	Mall = 1.98k-ft	Ratio = 0.10
Deflection		
TL = 0.00" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

4x6 DF #2

Description - Roof Framing - H3-8 - Header



Uniform 1 = 0.38 klf (0.0'-6.0')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

$M = (D + S) \quad Cd=1.15$

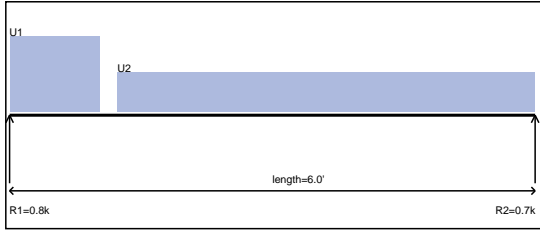
$\Delta = (D + S)$

V = 1.14k	Vall = 2.66k	Ratio = 0.43
M = 1.71k-ft	Mall = 1.98k-ft	Ratio = 0.86
Deflection		
TL = 0.14" L/506 > L/240 min		
DL = 0.04"		
L = 0.00" L/999+ > L/360 min		

4x6 DF #2



Description - Roof Framing - H3-9 - Header



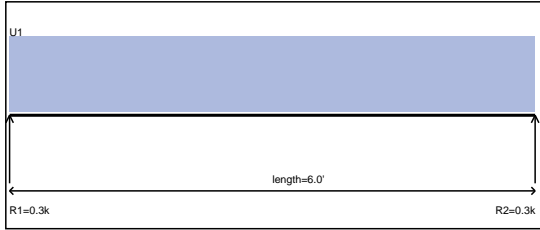
Uniform 1 = 0.38 klf (0.0'-1.0')
Uniform 2 = 0.20 klf (1.2'-6.0')

Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
 $\Delta = (D + S)$

V = 0.74k	Vall = 2.66k	Ratio = 0.28
M = 0.94k-ft	Mall = 1.98k-ft	Ratio = 0.47
Deflection		
TL = 0.08" L/922 > L/240 min		
DL = 0.02"		
L = 0.00" L/999+ > L/360 min		

4x6 DF #2

Description - Roof Framing - H3-10 - Header



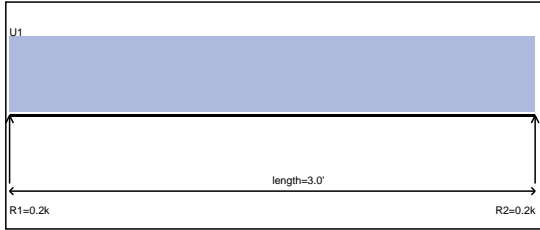
Uniform 1 = 0.07 klf (0.0'-6.0')

Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
 $\Delta = (D + S)$

V = 0.21k	Vall = 2.66k	Ratio = 0.08
M = 0.31k-ft	Mall = 1.98k-ft	Ratio = 0.16
Deflection		
TL = 0.03" L/999+ > L/240 min		
DL = 0.01"		
L = 0.00" L/999+ > L/360 min		

4x6 DF #2

Description - Roof Framing - H3-11 - Header



Uniform 1 = 0.07 klf (0.0'-3.0')

Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
 $\Delta = (D + S)$

V = 0.10k	Vall = 2.66k	Ratio = 0.04
M = 0.08k-ft	Mall = 1.98k-ft	Ratio = 0.04
Deflection		
TL = 0.00" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

4x6 DF #2

Description - Roof Framing - H3-12 - Header



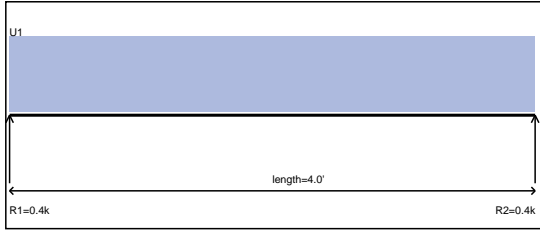
Uniform 1 = 0.18 klf (0.0'-4.0')

Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
 $\Delta = (D + S)$

V = 0.35k	Vall = 2.66k	Ratio = 0.13
M = 0.35k-ft	Mall = 1.98k-ft	Ratio = 0.18
Deflection		
TL = 0.01" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

4x6 DF #2

Description - Roof Framing - H3-13 - Header



Uniform 1 = 0.18 klf (0.0'-4.0')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

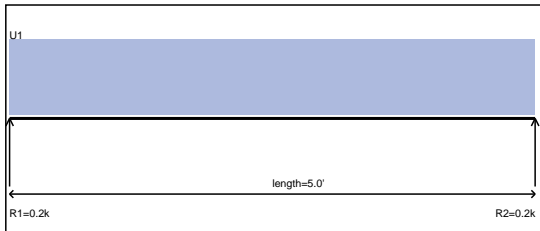
$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 0.35k	Vall = 2.66k	Ratio = 0.13
M = 0.35k-ft	Mall = 1.98k-ft	Ratio = 0.18
Deflection		
TL = 0.01" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

4x6 DF #2

Description - Roof Framing - H3-14 - Header



Uniform 1 = 0.07 klf (0.0'-5.0')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

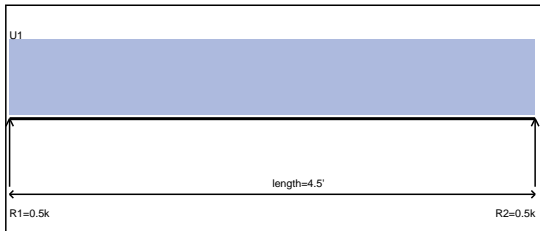
$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 0.18k	Vall = 2.66k	Ratio = 0.07
M = 0.22k-ft	Mall = 1.98k-ft	Ratio = 0.11
Deflection		
TL = 0.01" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

4x6 DF #2

Description - Roof Framing - H3-15 - Header



Uniform 1 = 0.19 klf (0.0'-4.5')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

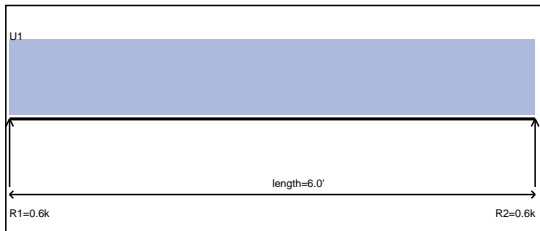
$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 0.42k	Vall = 2.66k	Ratio = 0.16
M = 0.47k-ft	Mall = 1.98k-ft	Ratio = 0.24
Deflection		
TL = 0.02" L/999+ > L/240 min		
DL = 0.01"		
L = 0.00" L/999+ > L/360 min		

4x6 DF #2

Description - Roof Framing - H3-16 - Header



Uniform 1 = 0.19 klf (0.0'-6.0')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

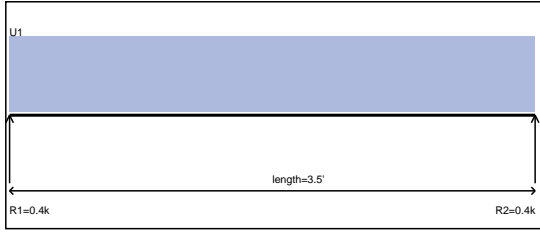
$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 0.56k	Vall = 2.66k	Ratio = 0.21
M = 0.84k-ft	Mall = 1.98k-ft	Ratio = 0.43
Deflection		
TL = 0.07" L/999+ > L/240 min		
DL = 0.02"		
L = 0.00" L/999+ > L/360 min		

4x6 DF #2

Description - Roof Framing - H3-17 - Header



Uniform 1 = 0.19 klf (0.0'-3.5')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

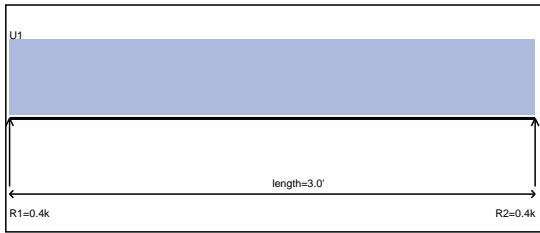
$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 0.33k	Vall = 2.66k	Ratio = 0.12
M = 0.29k-ft	Mall = 1.98k-ft	Ratio = 0.15
Deflection		
TL = 0.01" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

4x6 DF #2

Description - Roof Framing - H3-18 - Header



Uniform 1 = 0.27 klf (0.0'-3.0')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

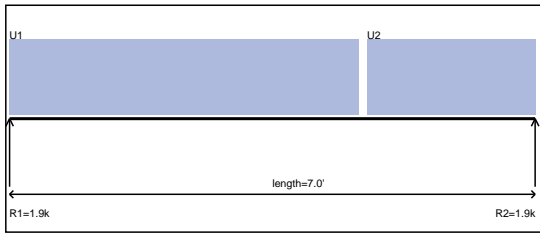
$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 0.40k	Vall = 2.66k	Ratio = 0.15
M = 0.30k-ft	Mall = 1.98k-ft	Ratio = 0.15
Deflection		
TL = 0.01" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

4x6 DF #2

Description - Roof Framing - H3-19 - Header



Uniform 1 = 0.54 klf (0.0'-4.7')

Uniform 2 = 0.54 klf (4.8'-7.0')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

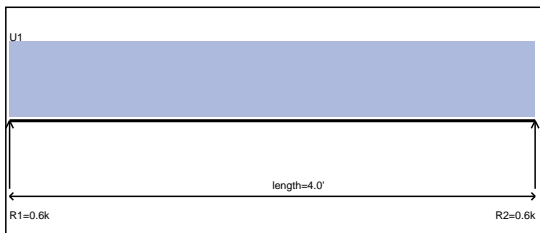
$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 1.87k	Vall = 4.27k	Ratio = 0.44
M = 3.24k-ft	Mall = 4.83k-ft	Ratio = 0.67
Deflection		
TL = 0.25" L/334 > L/240 min		
DL = 0.07"		
L = 0.00" L/999+ > L/360 min		

3-1/2x6 GLB

Description - Roof Framing - H3-20 - Header



Uniform 1 = 0.28 klf (0.0'-4.0')

Controlling Load Combination/ Cd

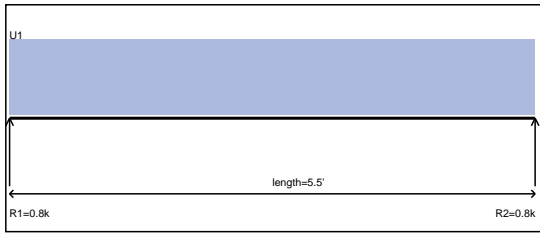
$V = (D + S) \quad Cd=1.15$

$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 0.56k	Vall = 2.66k	Ratio = 0.21
M = 0.56k-ft	Mall = 1.98k-ft	Ratio = 0.28
Deflection		
TL = 0.02" L/999+ > L/240 min		
DL = 0.01"		
L = 0.00" L/999+ > L/360 min		

4x6 DF #2

Description - Roof Framing - H3-21 - Header


Uniform 1 = 0.28 klf (0.0'-5.5')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 0.77k	Vall = 2.66k	Ratio = 0.29
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M = 1.05k-ft	Mall = 1.98k-ft	Ratio = 0.53
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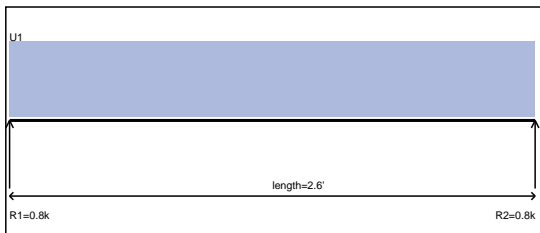
Deflection

$TL = 0.07" \quad L/894 > L/240 \text{ min}$

$DL = 0.02"$

$L = 0.00" \quad L/999+ > L/360 \text{ min}$

4x6 DF #2

Description - Roof Framing - H3-22 - Header


Uniform 1 = 0.56 klf (0.0'-2.6')

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd=1$

$M = (D + L) \quad Cd=1$

$\Delta = (D + L)$

V = 0.65k	Vall = 2.31k	Ratio = 0.28
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M = 0.42k-ft	Mall = 1.72k-ft	Ratio = 0.24
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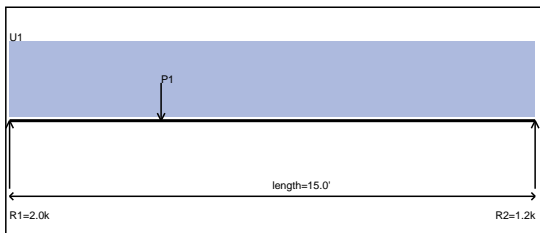
Deflection

$TL = 0.01" \quad L/999+ > L/240 \text{ min}$

$DL = 0.00"$

$L = 0.00" \quad L/999+ > L/360 \text{ min}$

4x6 DF #2

Description - Roof Framing - B3-1 - Flush


Uniform 1 = 0.07 klf (0.0'-14.9')

P1 = 2.07 K (4.3')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 2.00k	Vall = 9.08k	Ratio = 0.22
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M = 7.97k-ft	Mall = 20.50k-ft	Ratio = 0.39
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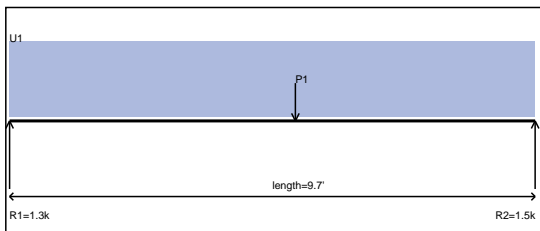
Deflection

$TL = 0.35" \quad L/520 > L/240 \text{ min}$

$DL = 0.10"$

$L = 0.00" \quad L/999+ > L/360 \text{ min}$

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

Description - Roof Framing - B3-2 - Flush


Uniform 1 = 0.07 klf (0.0'-9.7')

P1 = 2.07 K (5.3')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 1.47k	Vall = 4.54k	Ratio = 0.32
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M = 5.84k-ft	Mall = 10.25k-ft	Ratio = 0.57
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Deflection

$TL = 0.22" \quad L/544 > L/240 \text{ min}$

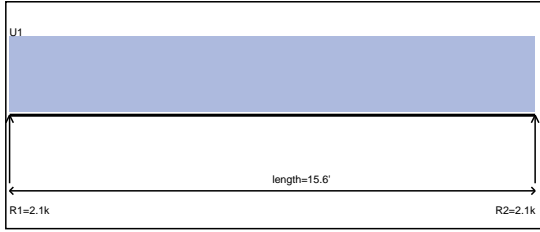
$DL = 0.06"$

$L = 0.00" \quad L/999+ > L/360 \text{ min}$

1-3/4x11-7/8 LVL



Description - Roof Framing - B3-3 - Flush



Uniform 1 = 0.27 klf (0.0'-15.6')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

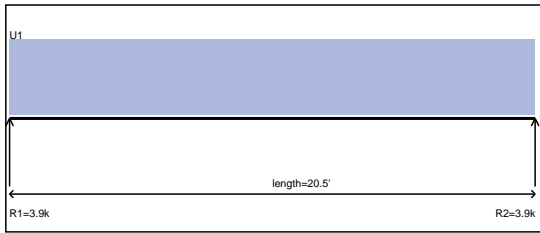
$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 2.07k	Vall = 9.08k	Ratio = 0.23
M = 8.07k-ft	Mall = 20.50k-ft	Ratio = 0.39
Deflection		
TL = 0.38" L/492 > L/240 min		
DL = 0.11"		
L = 0.00" L/999+ > L/360 min		

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

Description - Roof Framing - B3-4 - Refer to External Design



Uniform 1 = 0.38 klf (0.0'-20.5')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

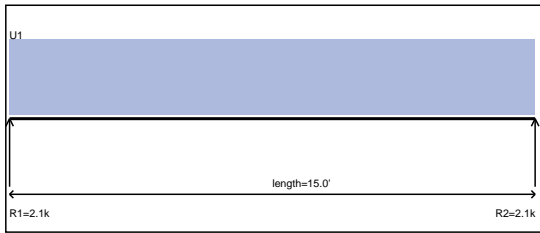
$M = (D + S) \quad Cd=1.15$

$\Delta = NA$

V = 3.89k	Vall = 0 k	Ratio = 0
M = 19.16k-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 - B3-5 - Flush



Uniform 1 = 0.28 klf (0.0'-15.0')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

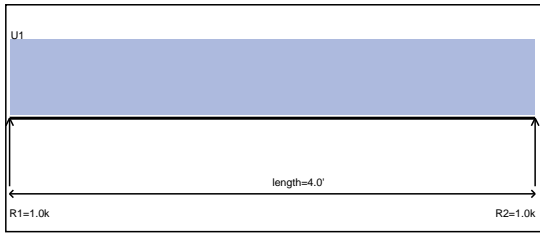
$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 2.08k	Vall = 9.08k	Ratio = 0.23
M = 7.78k-ft	Mall = 20.50k-ft	Ratio = 0.38
Deflection		
TL = 0.34" L/532 > L/240 min		
DL = 0.10"		
L = 0.00" L/999+ > L/360 min		

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

Description - Upper Floor Framing - H2-1 - Header



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

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd=1$

$M = (D + L) \quad Cd=1$

$\Delta = (D + L)$

V = 0.99k	Vall = 3.04k	Ratio = 0.32
M = 0.99k-ft	Mall = 2.99k-ft	Ratio = 0.33

Deflection

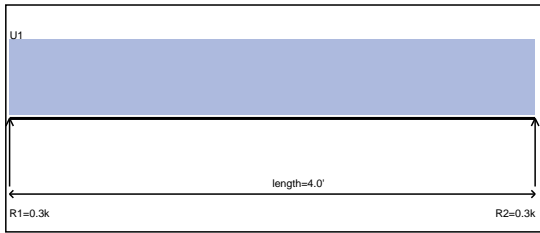
TL = 0.02" L/999+ > L/240 min

DL = 0.01"

L = 0.01" L/999+ > L/360 min

4x8 DF #2

Description - Upper Floor Framing - H2-2 - Header



Uniform 1 = 0.15 klf (0.0'-4.0')

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd=1$

$M = (D + L) \quad Cd=1$

$\Delta = (D + L)$

V = 0.30k	Vall = 3.04k	Ratio = 0.10
M = 0.30k-ft	Mall = 2.99k-ft	Ratio = 0.10

Deflection

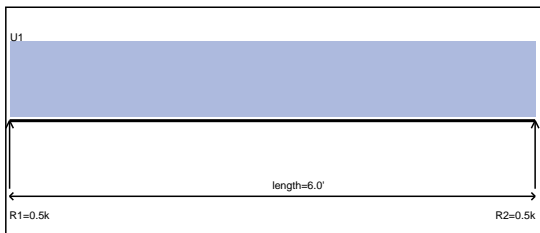
TL = 0.00" L/999+ > L/240 min

DL = 0.00"

L = 0.00" L/999+ > L/360 min

4x8 DF #2

Description - Upper Floor Framing - H2-3 - Header



Uniform 1 = 0.15 klf (0.0'-6.0')

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd=1$

$M = (D + L) \quad Cd=1$

$\Delta = (D + L)$

V = 0.45k	Vall = 3.04k	Ratio = 0.15
M = 0.67k-ft	Mall = 2.99k-ft	Ratio = 0.23

Deflection

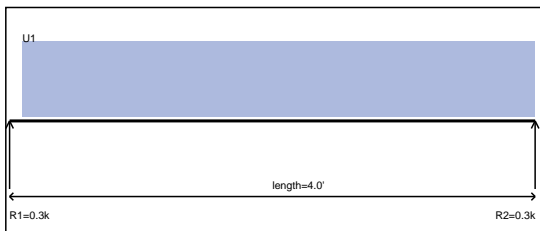
TL = 0.02" L/999+ > L/240 min

DL = 0.02"

L = 0.01" L/999+ > L/360 min

4x8 DF #2

Description - Upper Floor Framing - H2-4 - Header



Uniform 1 = 0.15 klf (0.1'-4.0')

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd=1$

$M = (D + L) \quad Cd=1$

$\Delta = (D + L)$

V = 0.30k	Vall = 3.04k	Ratio = 0.10
M = 0.30k-ft	Mall = 2.99k-ft	Ratio = 0.10

Deflection

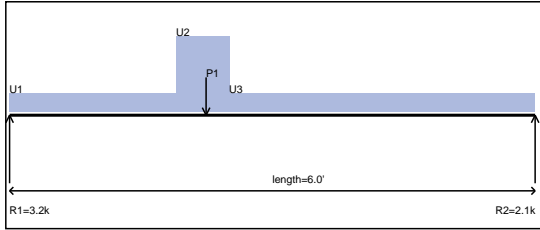
TL = 0.00" L/999+ > L/240 min

DL = 0.00"

L = 0.00" L/999+ > L/360 min

4x8 DF #2

Description - Upper Floor Framing - H2-5 - Header



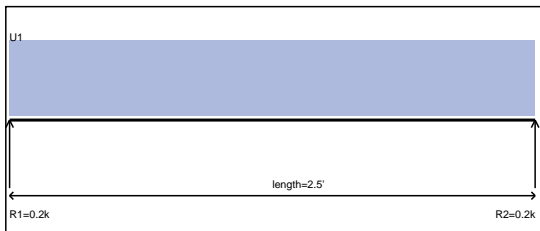
Uniform 1 = 0.15 klf (0.0'-1.9') P1 = 3.96 K (2.2')
 Uniform 2 = 0.63 klf (1.9'-2.5')
 Uniform 3 = 0.15 klf (2.5'-6.0')

Controlling Load Combination/ Cd
 $V = (D + L) \quad Cd=1$
 $M = (D + L) \quad Cd=1$
 $\Delta = (D + L)$

V = 3.12k	Vall = 7.17k	Ratio = 0.43
M = 6.59k-ft	Mall = 8.84k-ft	Ratio = 0.75
Deflection		
TL = 0.05"	L/999+ > L/240 min	
DL = 0.01"		
L = 0.03"	L/999+ > L/360 min	

6x12 DF #2

Description - Upper Floor Framing - H2-6 - Header



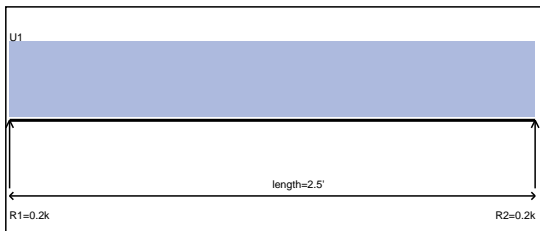
Uniform 1 = 0.15 klf (0.0'-2.5')

Controlling Load Combination/ Cd
 $V = (D + L) \quad Cd=1$
 $M = (D + L) \quad Cd=1$
 $\Delta = (D + L)$

V = 0.19k	Vall = 3.04k	Ratio = 0.06
M = 0.12k-ft	Mall = 2.99k-ft	Ratio = 0.04
Deflection		
TL = 0.00"	L/999+ > L/240 min	
DL = 0.00"		
L = 0.00"	L/999+ > L/360 min	

4x8 DF #2

Description - Upper Floor Framing - H2-7 - Header



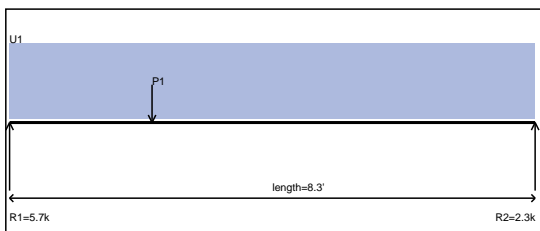
Uniform 1 = 0.09 klf (0.0'-2.5')

Controlling Load Combination/ Cd
 $V = (D + L) \quad Cd=1$
 $M = (D + L) \quad Cd=1$
 $\Delta = (D + L)$

V = 0.11k	Vall = 3.04k	Ratio = 0.03
M = 0.07k-ft	Mall = 2.99k-ft	Ratio = 0.02
Deflection		
TL = 0.00"	L/999+ > L/240 min	
DL = 0.00"		
L = 0.00"	L/999+ > L/360 min	

4x8 DF #2

Description - Upper Floor Framing - H2-8 - Header



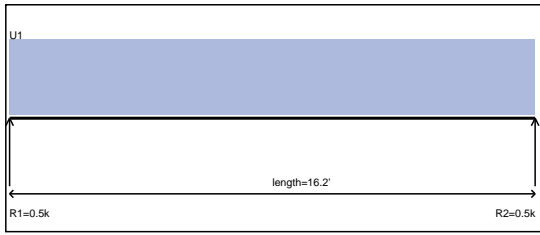
Uniform 1 = 0.05 klf (0.0'-8.3') P1 = 7.40 K (2.3')

Controlling Load Combination/ Cd
 $V = (D + S) \quad Cd=1.15$
 $M = (D + S) \quad Cd=1.15$
 $\Delta = (D + S)$

V = 5.24k	Vall = 8.53k	Ratio = 0.61
M = 11.81k-ft	Mall = 19.32k-ft	Ratio = 0.61
Deflection		
TL = 0.16"	L/615 > L/240 min	SEE ENERCALC OUTPUT
DL = 0.06"		
L = 0.01"	L/999+ > L/360 min	

3-1/2x12 GLB

Description - Upper Floor Framing - H2-9 - Header



Uniform 1 = 0.05 klf (0.0'-16.2')

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd=1$

$M = (D + L) \quad Cd=1$

$\Delta = (D + L)$

V = 0.40k	Vall = 4.72k	Ratio = 0.09
M = 1.63k-ft	Mall = 6.09k-ft	Ratio = 0.27
Deflection		
TL = 0.12" L/999+ > L/240 min		
DL = 0.02"		
L = 0.09" L/999+ > L/360 min		

4x12 DF #2

Description - Upper Floor Framing - H2-10 - Header



Uniform 1 = 0.20 klf (0.0'-4.0')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

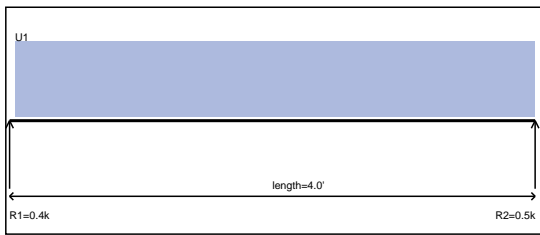
$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 0.41k	Vall = 3.50k	Ratio = 0.12
M = 0.41k-ft	Mall = 3.44k-ft	Ratio = 0.12
Deflection		
TL = 0.01" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

4x8 DF #2

Description - Upper Floor Framing - H2-11 - Header



Uniform 1 = 0.20 klf (0.0'-4.0')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

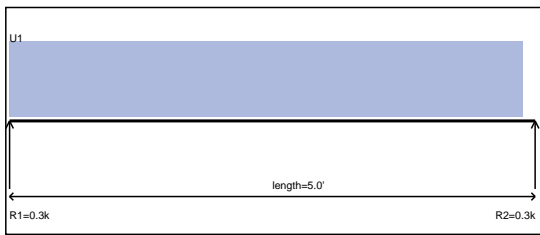
$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 0.41k	Vall = 3.50k	Ratio = 0.12
M = 0.41k-ft	Mall = 3.44k-ft	Ratio = 0.12
Deflection		
TL = 0.01" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

4x8 DF #2

Description - Upper Floor Framing - H2-12 - Header



Uniform 1 = 0.10 klf (0.0'-4.9')

Controlling Load Combination/ Cd

$V = D \quad Cd=0.9$

$M = D \quad Cd=0.9$

$\Delta = D$

V = 0.25k	Vall = 2.74k	Ratio = 0.09
M = 0.31k-ft	Mall = 2.69k-ft	Ratio = 0.12
Deflection		
TL = 0.01" L/999+ > L/240 min		
DL = 0.01"		
L = 0.00" L/999+ > L/360 min		

4x8 DF #2

Description - Upper Floor Framing - H2-13 - Header



Uniform 1 = 0.10 klf (0.0'-4.5')

Controlling Load Combination/ Cd

V = D Cd=0.9

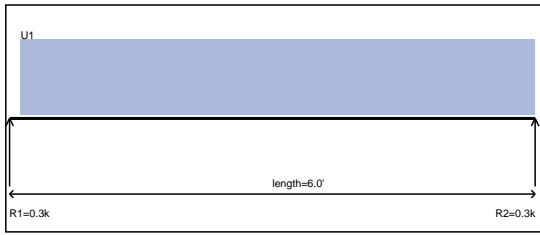
M = D Cd=0.9

$\Delta = D$

V = 0.22k	Vall = 2.74k	Ratio = 0.08
M = 0.25k-ft	Mall = 2.69k-ft	Ratio = 0.09
Deflection		
TL = 0.01" L/999+ > L/240 min		
DL = 0.01"		
L = 0.00" L/999+ > L/360 min		

4x8 DF #2

Description - Upper Floor Framing - H2-14 - Header



Uniform 1 = 0.10 klf (0.1'-6.0')

Controlling Load Combination/ Cd

V = D Cd=0.9

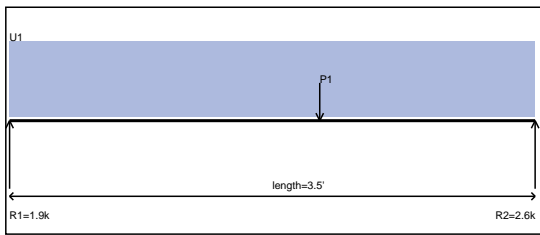
M = D Cd=0.9

$\Delta = (D + S)$

V = 0.30k	Vall = 2.74k	Ratio = 0.11
M = 0.45k-ft	Mall = 2.69k-ft	Ratio = 0.17
Deflection		
TL = 0.02" L/999+ > L/240 min		
DL = 0.02"		
L = 0.00" L/999+ > L/360 min		

4x8 DF #2

Description - Upper Floor Framing - H2-15 - Header



Uniform 1 = 0.15 klf (0.0'-3.5')

P1 = 3.92 K (2.1')

Controlling Load Combination/ Cd

V = (D + L) Cd=1

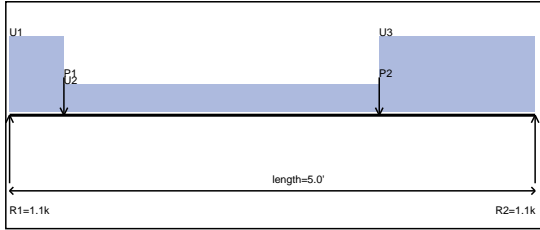
M = (D + L) Cd=1

$\Delta = (D + L)$

V = 2.58k	Vall = 5.92k	Ratio = 0.44
M = 3.54k-ft	Mall = 6.03k-ft	Ratio = 0.59
Deflection		
TL = 0.02" L/999+ > L/240 min		
DL = 0.00"		
L = 0.01" L/999+ > L/360 min		

6x10 DF #2

Description - Upper Floor Framing - H2-16 - Header



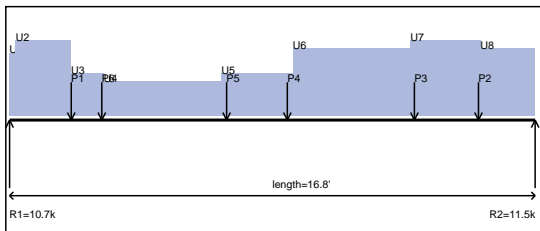
Uniform 1 = 0.42 klf (0.0'-0.5') P1 = 0.40 K (0.5')
 Uniform 2 = 0.15 klf (0.5'-3.5') P2 = 0.40 K (3.5')
 Uniform 3 = 0.42 klf (3.5'-5.0')

Controlling Load Combination/ Cd
 $V = (D + S) \quad Cd=1.15$
 $M = (D + S) \quad Cd=1.15$
 $\Delta = (D + S)$

V = 0.94k	Vall = 3.50k	Ratio = 0.27
M = 0.98k-ft	Mall = 3.44k-ft	Ratio = 0.29
Deflection		
TL = 0.02" L/999+ > L/240 min		
DL = 0.01"		
L = 0.00" L/999+ > L/360 min		

4x8 DF #2

Description - Upper Floor Framing - B2-1 - Refer to External Design



Uniform 1 = 1.03 klf (0.0'-0.2') P1 = 1.87 K (2.0')
 Uniform 2 = 1.24 klf (0.2'-2.0') P2 = 0.66 K (14.9')
 Uniform 3 = 0.70 klf (2.0'-3.0') P3 = 0.66 K (12.9')
 Uniform 4 = 0.57 klf (3.0'-6.8') P4 = 2.51 K (8.9')
 Uniform 5 = 0.70 klf (6.8'-9.0') P5 = 0.66 K (6.9')
 Uniform 6 = 1.11 klf (9.0'-12.8') P6 = 0.66 K (2.9')
 Uniform 7 = 1.24 klf (12.8'-15.0')
 Uniform 8 = 1.11 klf (15.0'-16.8')

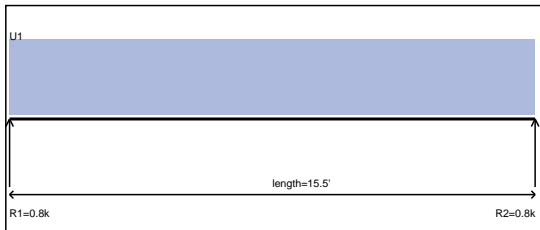
Controlling Load Combination/ Cd
 $V = (D + 0.75 * (L + S)) \quad Cd=1.15$
 $M = (D + 0.75 * (L + S)) \quad Cd=1.15$
 $\Delta = NA$

V = 9.51k	Vall = 0 k	Ratio = 0
M = 34.78k-ft	Mall = 0 k-ft	Ratio = 0
Deflection		
TL = NA L/NA > L/240 min		
DL = NA		
L = NA L/NA > L/360 min		

SEE
ENERCALC
OUTPUT

Refer to External Design

Description - Upper Floor Framing - B2-2 - Flush



Uniform 1 = 0.10 klf (0.0'-15.5')

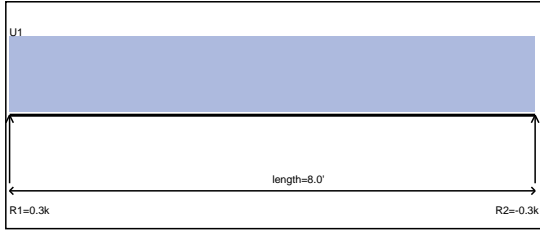
Controlling Load Combination/ Cd
 $V = D \quad Cd=0.9$
 $M = D \quad Cd=0.9$
 $\Delta = D$

V = 0.78k	Vall = 7.11k	Ratio = 0.11
M = 3.00k-ft	Mall = 16.04k-ft	Ratio = 0.19
Deflection		
TL = 0.14" L/999+ > L/240 min		
DL = 0.14"		
L = 0.00" L/999+ > L/360 min		

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



Description - Upper Floor Framing - B2-3 - Refer to External Design



Uniform 1 = 0.07 klf (0.0'-8.0')

Controlling Load Combination/ Cd

V = (D + S) Cd=1.15

M = (D + S) Cd=1.15

Δ = NA

V = 0.28k	Vall = 0 k	Ratio = 0
M = 0.56k-ft	Mall = 0 k-ft	Ratio = 0

Deflection

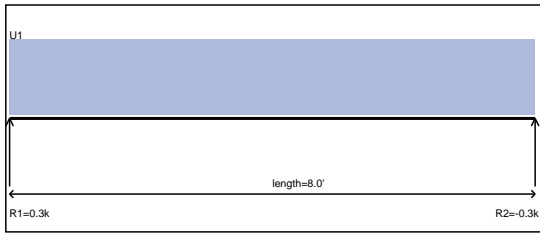
TL = NA L/ NA > L/240 min

DL = NA

L = NA L/ NA > L/360 min

Refer to External Design

Description - Upper Floor Framing - B2-4 - Refer to External Design



Uniform 1 = 0.07 klf (0.0'-8.0')

Controlling Load Combination/ Cd

V = (D + S) Cd=1.15

M = (D + S) Cd=1.15

Δ = NA

V = 0.28k	Vall = 0 k	Ratio = 0
M = 0.56k-ft	Mall = 0 k-ft	Ratio = 0

Deflection

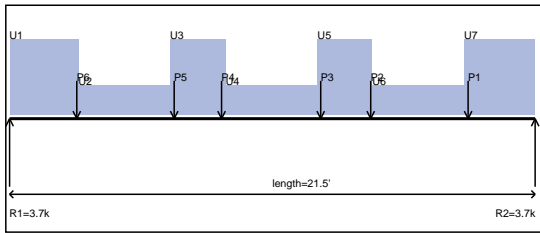
TL = NA L/ NA > L/240 min

DL = NA

L = NA L/ NA > L/360 min

Refer to External Design

Description - Upper Floor Framing - B2-5 - Flush Bottom



Uniform 1 = 0.23 klf (0.0'-2.8')

P1 = 0.67 K (18.7')

Uniform 2 = 0.09 klf (2.8'-6.6')

P2 = 0.67 K (14.8')

Uniform 3 = 0.23 klf (6.6'-8.8')

P3 = 0.67 K (12.7')

Uniform 4 = 0.09 klf (8.8'-12.6')

P4 = 0.67 K (8.7')

Uniform 5 = 0.23 klf (12.6'-14.8')

P5 = 0.67 K (6.7')

Uniform 6 = 0.09 klf (14.8'-18.6')

P6 = 0.67 K (2.7')

Uniform 7 = 0.23 klf (18.6'-21.5')

Controlling Load Combination/ Cd

V = (D + S) Cd= NA

M = (D + S) Cd= NA

Δ = (D + S)

V = 3.69k	Vall = 49.00k	Ratio = 0.08
M = 20.34k-ft	Mall = 64.90k-ft	Ratio = 0.31

Deflection

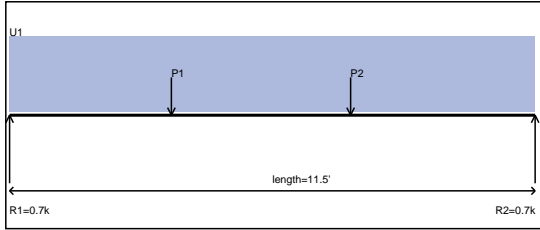
TL = 0.49" L/523 > L/240 min

DL = 0.16"

L = 0.00" L/999+ > L/360 min

W10x22 Steel

Description - Upper Floor Framing - B2-6 - Flush



Uniform 1 = 0.07 klf (0.0'-11.5') P1 = 0.25 K (3.6')
P2 = 0.27 K (7.5')

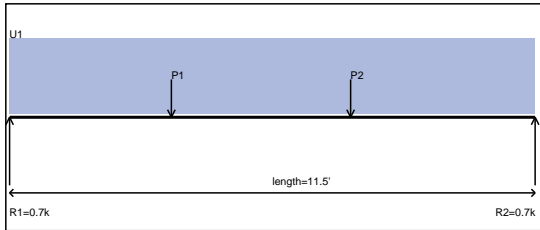
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
 $\Delta = (D + S)$

V = 0.67k	Vall = 1.94k	Ratio = 0.35
M = 2.17k-ft	Mall = 2.58k-ft	Ratio = 0.84

Deflection
TL = 0.22" L/617 > L/240 min
DL = 0.06"
L = 0.00" L/999+ > L/360 min

2x12 HF #2

Description - Upper Floor Framing - B2-7 - Flush



Uniform 1 = 0.07 klf (0.0'-11.5') P1 = 0.25 K (3.6')
P2 = 0.27 K (7.5')

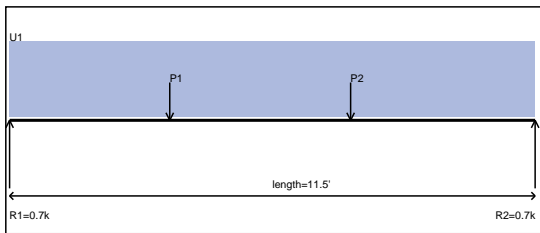
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
 $\Delta = (D + S)$

V = 0.67k	Vall = 1.94k	Ratio = 0.35
M = 2.17k-ft	Mall = 2.58k-ft	Ratio = 0.84

Deflection
TL = 0.22" L/617 > L/240 min
DL = 0.06"
L = 0.00" L/999+ > L/360 min

2x12 HF #2

Description - Upper Floor Framing - B2-8 - Flush



Uniform 1 = 0.07 klf (0.0'-11.5') P1 = 0.25 K (3.5')
P2 = 0.27 K (7.5')

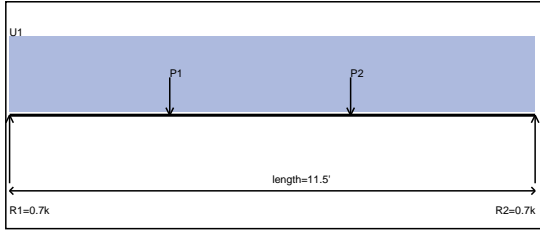
Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
 $\Delta = (D + S)$

V = 0.67k	Vall = 1.94k	Ratio = 0.35
M = 2.16k-ft	Mall = 2.58k-ft	Ratio = 0.84

Deflection
TL = 0.22" L/618 > L/240 min
DL = 0.06"
L = 0.00" L/999+ > L/360 min

2x12 HF #2

Description - Upper Floor Framing - B2-9 - Flush



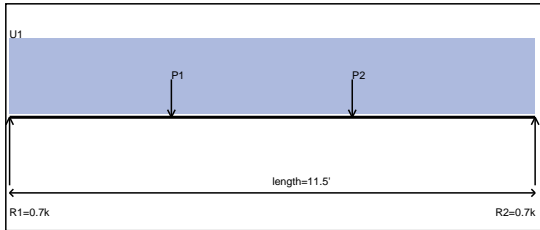
Uniform 1 = 0.07 klf (0.0'-11.5') P1 = 0.25 K (3.5')
P2 = 0.27 K (7.5')

Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
 $\Delta = (D + S)$

V = 0.67k	Vall = 1.94k	Ratio = 0.35
M = 2.16k-ft	Mall = 2.58k-ft	Ratio = 0.84
Deflection		
TL = 0.22" L/618 > L/240 min		
DL = 0.06"		
L = 0.00" L/999+ > L/360 min		

2x12 HF #2

Description - Upper Floor Framing - B2-10 - Flush



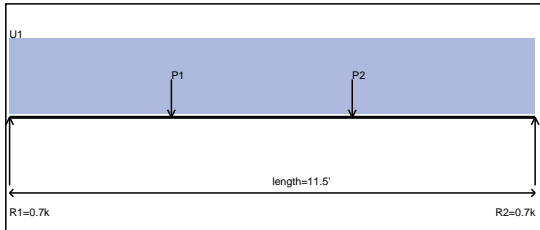
Uniform 1 = 0.07 klf (0.0'-11.5') P1 = 0.25 K (3.6')
P2 = 0.27 K (7.5')

Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
 $\Delta = (D + S)$

V = 0.67k	Vall = 1.94k	Ratio = 0.35
M = 2.16k-ft	Mall = 2.58k-ft	Ratio = 0.84
Deflection		
TL = 0.22" L/618 > L/240 min		
DL = 0.06"		
L = 0.00" L/999+ > L/360 min		

2x12 HF #2

Description - Upper Floor Framing - B2-11 - Flush



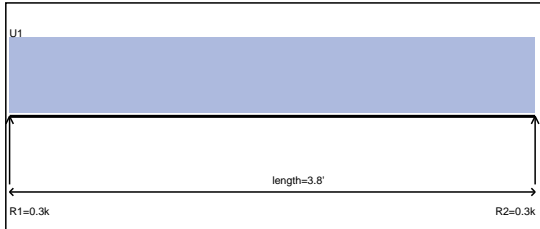
Uniform 1 = 0.07 klf (0.0'-11.5') P1 = 0.25 K (3.6')
P2 = 0.27 K (7.5')

Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
 $\Delta = (D + S)$

V = 0.67k	Vall = 1.94k	Ratio = 0.35
M = 2.16k-ft	Mall = 2.58k-ft	Ratio = 0.84
Deflection		
TL = 0.22" L/618 > L/240 min		
DL = 0.06"		
L = 0.00" L/999+ > L/360 min		

2x12 HF #2

Description - Upper Floor Framing - B2-12 - Flush



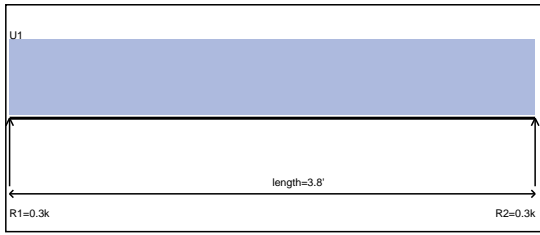
Uniform 1 = 0.13 klf (0.0'-3.8')

Controlling Load Combination/ Cd
V = (D + S) Cd=1.15
M = (D + S) Cd=1.15
 $\Delta = (D + S)$

V = 0.25k	Vall = 1.94k	Ratio = 0.13
M = 0.24k-ft	Mall = 2.58k-ft	Ratio = 0.09
Deflection		
TL = 0.00" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

2x12 HF #2

Description - Upper Floor Framing - B2-13 - Flush



Uniform 1 = 0.14 klf (0.0'-3.8')

Controlling Load Combination/ Cd

V = (D + S) Cd=1.15

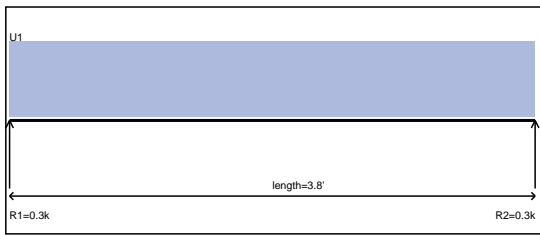
M = (D + S) Cd=1.15

Δ = (D + S)

V = 0.27k	Vall = 1.94k	Ratio = 0.14
M = 0.25k-ft	Mall = 2.58k-ft	Ratio = 0.10
Deflection		
TL = 0.00" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

2x12 HF #2

Description - Upper Floor Framing - B2-14 - Flush



Uniform 1 = 0.15 klf (0.0'-3.8')

Controlling Load Combination/ Cd

V = (D + S) Cd=1.15

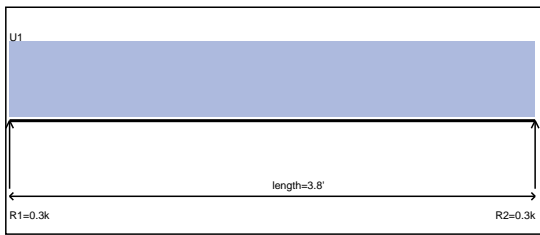
M = (D + S) Cd=1.15

Δ = (D + S)

V = 0.27k	Vall = 1.94k	Ratio = 0.14
M = 0.26k-ft	Mall = 2.58k-ft	Ratio = 0.10
Deflection		
TL = 0.00" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

2x12 HF #2

Description - Upper Floor Framing - B2-15 - Flush



Uniform 1 = 0.13 klf (0.0'-3.8')

Controlling Load Combination/ Cd

V = (D + S) Cd=1.15

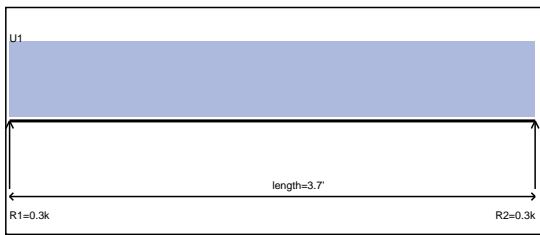
M = (D + S) Cd=1.15

Δ = (D + S)

V = 0.25k	Vall = 1.94k	Ratio = 0.13
M = 0.24k-ft	Mall = 2.58k-ft	Ratio = 0.09
Deflection		
TL = 0.00" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

2x12 HF #2

Description - Upper Floor Framing - B2-16 - Flush



Uniform 1 = 0.13 klf (0.0'-3.7')

Controlling Load Combination/ Cd

V = (D + S) Cd=1.15

M = (D + S) Cd=1.15

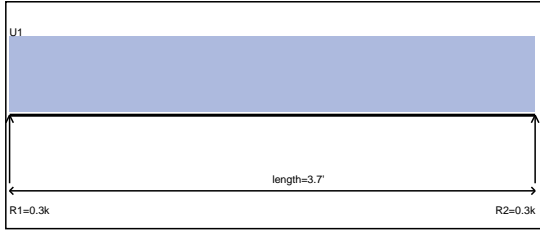
Δ = (D + S)

V = 0.25k	Vall = 1.94k	Ratio = 0.13
M = 0.24k-ft	Mall = 2.58k-ft	Ratio = 0.09
Deflection		
TL = 0.00" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

2x12 HF #2



Description - Upper Floor Framing - B2-17 - Flush



Uniform 1 = 0.14 klf (0.0'-3.7')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

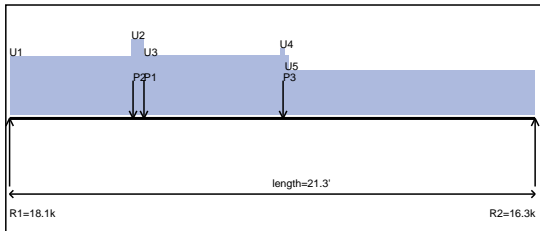
$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 0.27k	Vall = 1.94k	Ratio = 0.14
M = 0.25k-ft	Mall = 2.58k-ft	Ratio = 0.10
Deflection		
TL = 0.00" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

2x12 HF #2

Description - Upper Floor Framing - B2-18 - Dropped



Uniform 1 = 0.99 klf (0.0'-4.9')

P1 = 0.77 K (5.4')

Uniform 2 = 1.28 klf (4.9'-5.4')

P2 = 1.18 K (5.0')

Uniform 3 = 1.00 klf (5.4'-11.3')

P3 = 13.14 K (11.1')

Uniform 4 = 1.13 klf (10.9'-11.1')

Uniform 5 = 0.76 klf (11.1'-21.3')

Controlling Load Combination/ Cd

$V = (D + 0.75 * (L + S)) \quad Cd= NA$

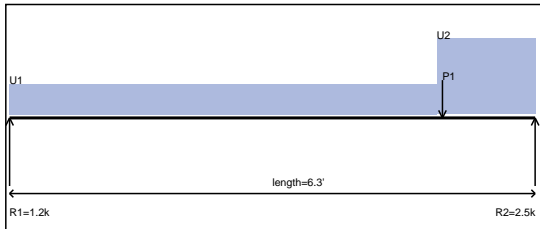
$M = (D + 0.75 * (L + S)) \quad Cd= NA$

$\Delta = (D + 0.75 * (L + S))$

V = 15.04k	Vall = 111.00k	Ratio = 0.14
M = 105.58k-ft	Mall = 205.00k-ft	Ratio = 0.52
Deflection		
TL = 0.51" L/505 > L/240 min		
DL = 0.20"		
L = 0.29" L/889 > L/360 min		

W16x45 Steel

Description - Upper Floor Framing - B2-19 - Flush



Uniform 1 = 0.26 klf (0.0'-5.1')

P1 = 1.44 K (5.2')

Uniform 2 = 0.65 klf (5.1'-6.3')

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd=1$

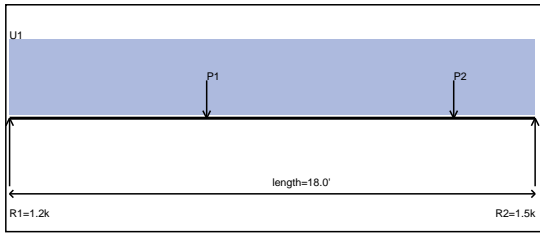
$M = (D + L) \quad Cd=1$

$\Delta = (D + L)$

V = 2.40k	Vall = 7.90k	Ratio = 0.30
M = 2.37k-ft	Mall = 17.82k-ft	Ratio = 0.13
Deflection		
TL = 0.02" L/999+ > L/240 min		
DL = 0.00"		
L = 0.01" L/999+ > L/360 min		

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

Description - Upper Floor Framing - B2-20 - Flush



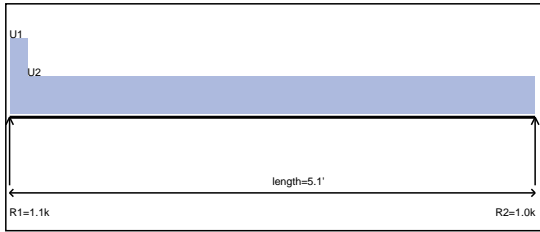
Uniform 1 = 0.05 klf (0.0'-18.0') P1 = 0.99 K (6.8')
P2 = 0.73 K (15.2')

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

V = 1.44k	Vall = 7.90k	Ratio = 0.18
M = 6.86k-ft	Mall = 17.82k-ft	Ratio = 0.38
Deflection		
TL = 0.43" L/502 > L/240 min		
DL = 0.09"		
L = 0.34" L/627 > L/360 min		

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

Description - Upper Floor Framing - B2-21 - Flush



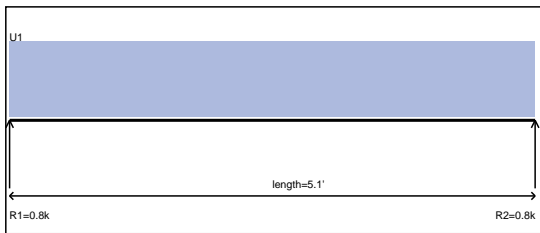
Uniform 1 = 0.78 klf (0.0'-0.2')
Uniform 2 = 0.39 klf (0.2'-5.1')

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

V = 1.06k	Vall = 3.95k	Ratio = 0.27
M = 1.27k-ft	Mall = 8.91k-ft	Ratio = 0.14
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 - Upper Floor Framing - B2-22 - Flush



Uniform 1 = 0.29 klf (0.0'-5.1')

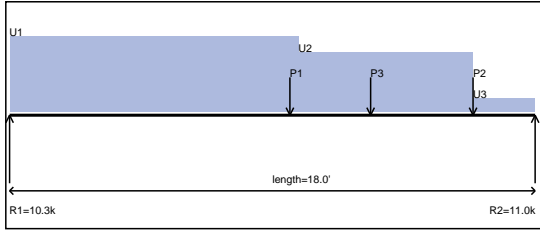
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
 Δ = (D + L)

V = 0.73k	Vall = 3.95k	Ratio = 0.18
M = 0.93k-ft	Mall = 8.91k-ft	Ratio = 0.10
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 - Upper Floor Framing - B2-23 - Flush Top



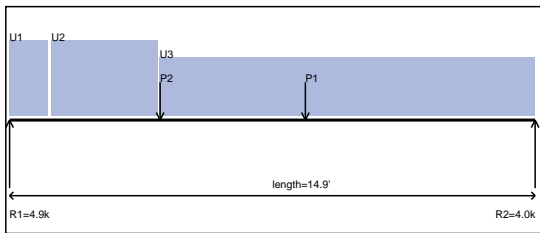
Uniform 1 = 0.91 klf (0.0'-9.9') P1 = 2.00 K (9.6')
 Uniform 2 = 0.72 klf (9.9'-15.9') P2 = 0.72 K (15.9')
 Uniform 3 = 0.16 klf (15.9'-18.0') P3 = 4.86 K (12.4')

Controlling Load Combination/ Cd
 $V = (D + L)$ Cd= NA
 $M = (D + 0.75 * (L + S))$ Cd= NA
 $\Delta = (D + 0.75 * (L + S))$

V = 9.33k	Vall = 89.30k	Ratio = 0.10
M = 47.93k-ft	Mall = 149.00k-ft	Ratio = 0.32
Deflection		
TL = 0.42" L/511 > L/240 min		
DL = 0.18"		
L = 0.23" L/948 > L/360 min		

W8x58 Steel

Description - Upper Floor Framing - B2-24 - Flush Top



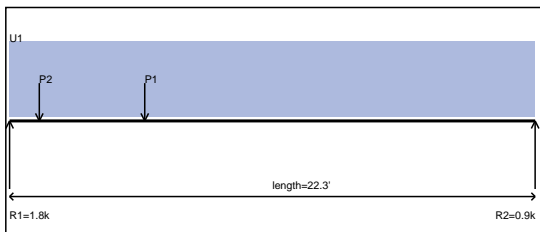
Uniform 1 = 0.49 klf (0.0'-1.1') P1 = 0.90 K (8.37')
 Uniform 2 = 0.49 klf (1.2'-4.2') P2 = 1.79 K (4.3')
 Uniform 3 = 0.38 klf (4.2'-14.9')

Controlling Load Combination/ Cd
 $V = (D + L)$ Cd= NA
 $M = (D + L)$ Cd= NA
 $\Delta = (D + L)$

V = 4.86k	Vall = 38.90k	Ratio = 0.12
M = 17.78k-ft	Mall = 57.60k-ft	Ratio = 0.31
Deflection		
TL = 0.30" L/605 > L/240 min		
DL = 0.09"		
L = 0.21" L/852 > L/360 min		

W8x24 Steel

Description - Upper Floor Framing - B2-25 - Flush

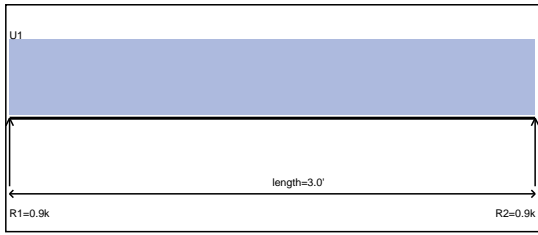


Uniform 1 = 0.05 klf (0.0'-22.3') P1 = 0.85 K (5.7')
 P2 = 0.64 K (1.3')

Controlling Load Combination/ Cd
 $V = (D + L)$ Cd=1
 $M = (D + L)$ Cd=1
 $\Delta = (D + L)$

V = 1.79k	Vall = 7.90k	Ratio = 0.23
M = 6.57k-ft	Mall = 17.82k-ft	Ratio = 0.37
Deflection		
TL = 0.63" L/423 > L/240 min		
DL = 0.13"		
L = 0.51" L/529 > L/360 min		

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

Description - Upper Floor Framing - B2-26 - Flush


Uniform 1 = 0.56 klf (0.0'-3.0')

Controlling Load Combination/ Cd

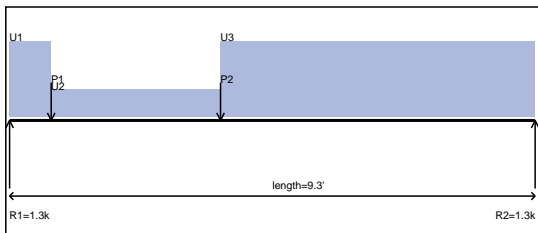
$V = (D + L) \quad Cd=1$

$M = (D + L) \quad Cd=1$

$\Delta = (D + L)$

V = 0.85k	Vall = 7.90k	Ratio = 0.11
M = 0.64k-ft	Mall = 17.82k-ft	Ratio = 0.04
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 - B2-27 - Flush


Uniform 1 = 0.28 klf (0.0'-0.7')

P1 = 0.27 K (0.7')

Uniform 2 = 0.10 klf (0.7'-3.7')

P2 = 0.27 K (3.7')

Uniform 3 = 0.28 klf (3.7'-9.3')

Controlling Load Combination/ Cd

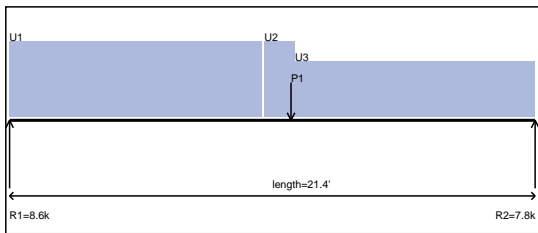
$V = (D + S) \quad Cd=1.15$

$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 1.29k	Vall = 9.08k	Ratio = 0.14
M = 3.00k-ft	Mall = 20.50k-ft	Ratio = 0.15
Deflection		
TL = 0.05"	L/999+ > L/240 min	
DL = 0.03"		
L = 0.00"	L/999+ > L/360 min	

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

Description - Upper Floor Framing - B2-28 - Dropped


Uniform 1 = 0.71 klf (0.0'-10.3')

P1 = 2.95 K (11.5')

Uniform 2 = 0.71 klf (10.4'-11.6')

Uniform 3 = 0.52 klf (11.6'-21.4')

Controlling Load Combination/ Cd

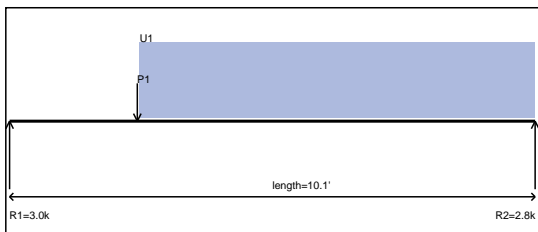
$V = (D + L) \quad Cd=1$

$M = (D + L) \quad Cd=1$

$\Delta = (D + L)$

V = 7.92k	Vall = 20.41k	Ratio = 0.39
M = 43.95k-ft	Mall = 75.76k-ft	Ratio = 0.58
Deflection		
TL = 0.48"	L/541 > L/240 min	
DL = 0.15"		
L = 0.33"	L/786 > L/360 min	

5-1/2x21 GLB

Description - Upper Floor Framing - B2-29 - Flush


Uniform 1 = 0.48 klf (2.5'-10.1')

P1 = 2.08 K (2.5')

Controlling Load Combination/ Cd

$V = (D + S) \quad Cd=1.15$

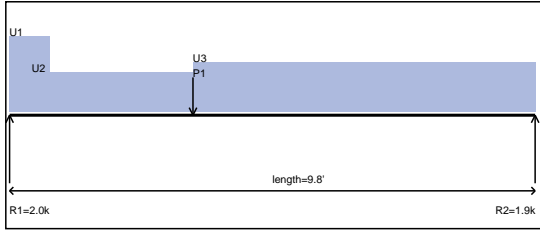
$M = (D + S) \quad Cd=1.15$

$\Delta = (D + S)$

V = 2.69k	Vall = 4.54k	Ratio = 0.59
M = 7.52k-ft	Mall = 10.25k-ft	Ratio = 0.73
Deflection		
TL = 0.30"	L/407 > L/240 min	
DL = 0.14"		
L = 0.03"	L/999+ > L/360 min	

1-3/4x11-7/8 LVL

Description - Upper Floor Framing - B2-30 - Flush



Uniform 1 = 0.57 klf (0.0'-0.8') P1 = 0.10 K (3.4')
 Uniform 2 = 0.30 klf (0.4'-3.4')
 Uniform 3 = 0.37 klf (3.4'-9.8')

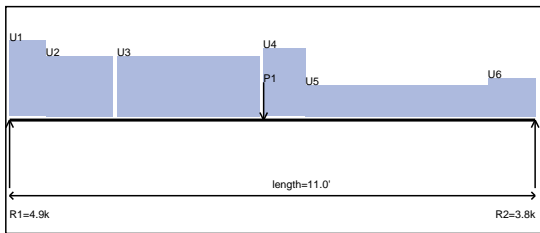
Controlling Load Combination/ Cd
 $V = (D + 0.75 * (L + S))$ Cd=1.15
 $M = (D + 0.75 * (L + S))$ Cd=1.15
 $\Delta = (D + 0.75 * (L + S))$

V = 1.71k	Vall = 9.08k	Ratio = 0.19
M = 3.89k-ft	Mall = 20.50k-ft	Ratio = 0.19
Deflection TL = 0.07" L/999+ > L/240 min DL = 0.04" L = 0.01" L/999+ > L/360 min		

SEE
ENERCALC
OUTPUT

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

Description - Upper Floor Framing - B2-32 - Refer to External Design



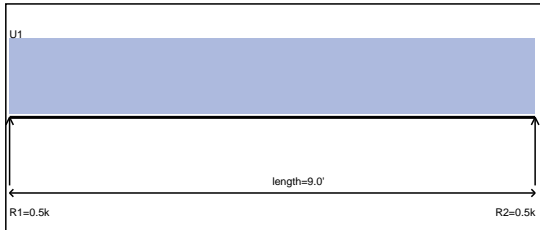
Uniform 1 = 1.09 klf (0.0'-0.8') P1 = 0.81 K (5.3')
 Uniform 2 = 0.87 klf (0.8'-2.2')
 Uniform 3 = 0.87 klf (2.3'-5.3')
 Uniform 4 = 0.98 klf (5.3'-6.2')
 Uniform 5 = 0.45 klf (6.2'-10.0')
 Uniform 6 = 0.55 klf (10.0'-11.0')

Controlling Load Combination/ Cd
 $V = (D + L)$ Cd=1
 $M = (D + L)$ Cd=1
 $\Delta = NA$

V = 4.86k	Vall = 0 k	Ratio = 0
M = 12.91k-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 - B2-33 - Flush



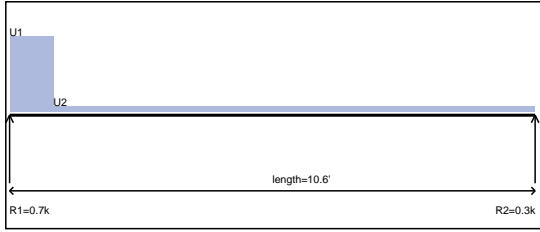
Uniform 1 = 0.10 klf (0.0'-9.0')

Controlling Load Combination/ Cd
 $V = (D + S)$ Cd=1.15
 $M = (D + S)$ Cd=1.15
 $\Delta = (D + S)$

V = 0.47k	Vall = 4.54k	Ratio = 0.10
M = 1.06k-ft	Mall = 10.25k-ft	Ratio = 0.10
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 - Upper Floor Framing - B2-34 - Flush



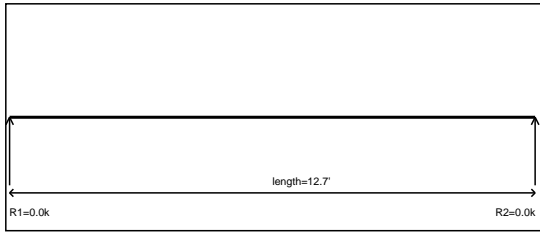
Uniform 1 = 0.56 klf (0.0'-0.9')
Uniform 2 = 0.04 klf (0.9'-10.6')

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

V = 0.64k	Vall = 7.90k	Ratio = 0.08
M = 0.61k-ft	Mall = 17.82k-ft	Ratio = 0.03
Deflection		
TL = 0.01" L/999+ > L/240 min		
DL = 0.00"		
L = 0.01" L/999+ > L/360 min		

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

Description - Upper Floor Framing - B2-35 - Refer to External Design



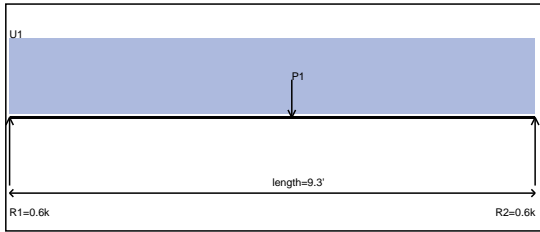
Controlling Load Combination/ Cd
V = NA Cd=1
M = NA Cd=1
 Δ = NA

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		

SEE ENERCALC OUTPUT

Refer to External Design

Description - Upper Floor Framing - B2-36 - Flush



Uniform 1 = 0.11 klf (0.0'-9.3') P1 = 0.00 K (5')

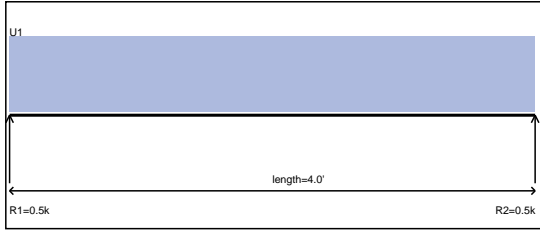
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
 Δ = (D + L)

V = 0.53k	Vall = 9.64k	Ratio = 0.05
M = 1.23k-ft	Mall = 13.29k-ft	Ratio = 0.09
Deflection		
TL = 0.05" L/999+ > L/240 min		
DL = 0.01"		
L = 0.03" L/999+ > L/360 min		

(4)1-3/4x7-1/4 LVL



Description - Main Floor Framing - H1-1 - Header



Uniform 1 = 0.21 klf (0.0'-4.0')

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd=1$

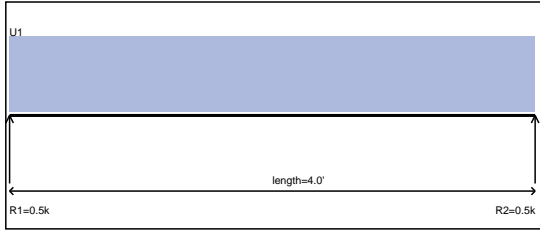
$M = (D + L) \quad Cd=1$

$\Delta = (D + L)$

V = 0.42k	Vall = 3.04k	Ratio = 0.14
M = 0.42k-ft	Mall = 2.99k-ft	Ratio = 0.14
Deflection		
TL = 0.01" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

4x8 DF #2

Description - Main Floor Framing - H1-2 - Header



Uniform 1 = 0.21 klf (0.0'-4.0')

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd=1$

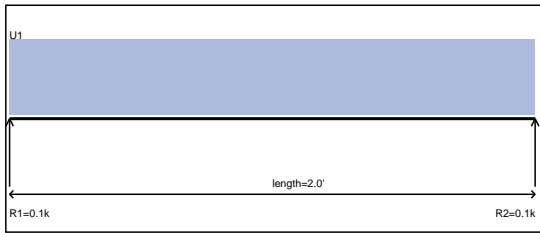
$M = (D + L) \quad Cd=1$

$\Delta = (D + L)$

V = 0.42k	Vall = 3.04k	Ratio = 0.14
M = 0.42k-ft	Mall = 2.99k-ft	Ratio = 0.14
Deflection		
TL = 0.01" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

4x8 DF #2

Description - Main Floor Framing - H1-3 - Header



Uniform 1 = 0.10 klf (0.0'-2.0')

Controlling Load Combination/ Cd

$V = D \quad Cd=0.9$

$M = D \quad Cd=0.9$

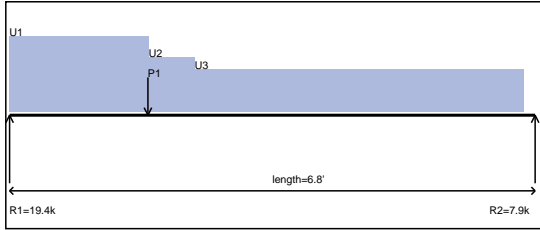
$\Delta = D$

V = 0.10k	Vall = 2.74k	Ratio = 0.04
M = 0.05k-ft	Mall = 2.69k-ft	Ratio = 0.02
Deflection		
TL = 0.00" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

4x8 DF #2



Description - Main Floor Framing - H1-4 - Header



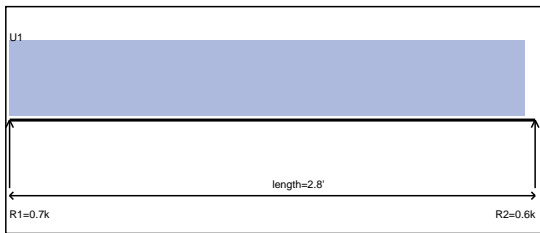
Uniform 1 = 0.91 klf (0.0'-1.8') P1 = 22.98 K (1.8')
 Uniform 2 = 0.65 klf (1.8'-2.4')
 Uniform 3 = 0.51 klf (2.4'-6.7')

Controlling Load Combination/ Cd
 $V = (D + 0.75 * (L + S))$ Cd= NA
 $M = (D + 0.75 * (L + S))$ Cd= NA
 $\Delta = (D + 0.75 * (L + S))$

V = 16.23k	Vall = 56.40k	Ratio = 0.29
M = 27.98k-ft	Mall = 96.80k-ft	Ratio = 0.29
Deflection		
TL = 0.05" L/999+ > L/240 min		
DL = 0.02"		
L = 0.02" L/999+ > L/360 min		

W10x33 Steel

Description - Main Floor Framing - H1-5 - Header



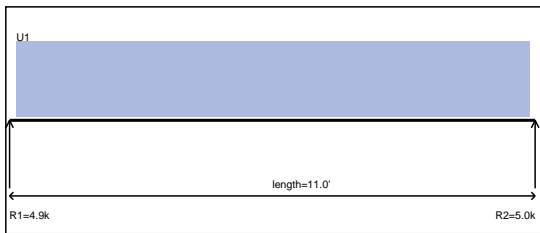
Uniform 1 = 0.44 klf (0.0'-2.7')

Controlling Load Combination/ Cd
 $V = (D + L)$ Cd=1
 $M = (D + L)$ Cd=1
 $\Delta = (D + L)$

V = 0.61k	Vall = 3.04k	Ratio = 0.20
M = 0.42k-ft	Mall = 2.99k-ft	Ratio = 0.14
Deflection		
TL = 0.00" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

4x8 DF #2

Description - Main Floor Framing - H1-6 - Header



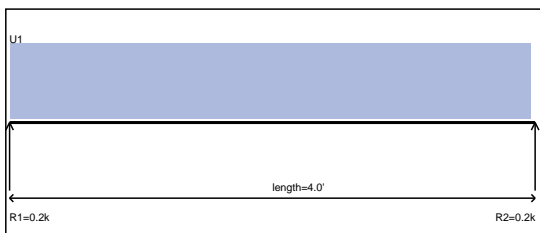
Uniform 1 = 0.91 klf (0.1'-10.9')

Controlling Load Combination/ Cd
 $V = (D + L)$ Cd=1
 $M = (D + L)$ Cd=1
 $\Delta = (D + L)$

V = 4.90k	Vall = 10.64k	Ratio = 0.46
M = 13.73k-ft	Mall = 31.44k-ft	Ratio = 0.44
Deflection		
TL = 0.13" L/999+ > L/240 min		
DL = 0.03"		
L = 0.10" L/999+ > L/360 min		

(2)1-3/4x16 LVL

Description - Main Floor Framing - H1-7 - Header



Uniform 1 = 0.10 klf (0.0'-4.0')

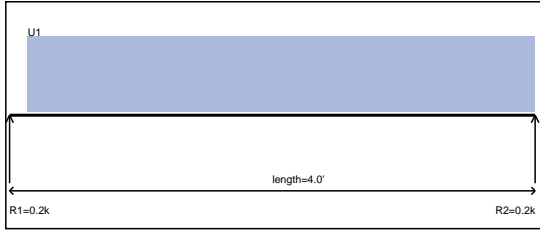
Controlling Load Combination/ Cd
 $V = D$ Cd=0.9
 $M = D$ Cd=0.9
 $\Delta = D$

V = 0.20k	Vall = 2.74k	Ratio = 0.07
M = 0.20k-ft	Mall = 2.69k-ft	Ratio = 0.07
Deflection		
TL = 0.00" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

4x8 DF #2



Description - Main Floor Framing - H1-8 - Header



Uniform 1 = 0.10 klf (0.1'-4.0')

Controlling Load Combination/ Cd

V = D Cd=0.9

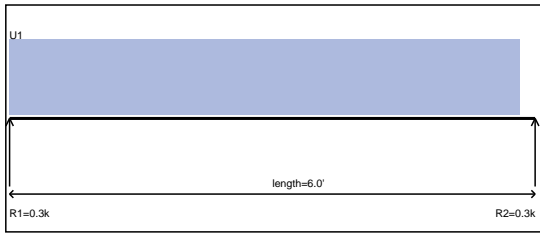
M = D Cd=0.9

Δ = D

V = 0.20k	Vall = 2.74k	Ratio = 0.07
M = 0.20k-ft	Mall = 2.69k-ft	Ratio = 0.07
Deflection		
TL = 0.00" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

4x8 DF #2

Description - Main Floor Framing - H1-9 - Header



Uniform 1 = 0.10 klf (0.0'-5.8')

Controlling Load Combination/ Cd

V = D Cd=0.9

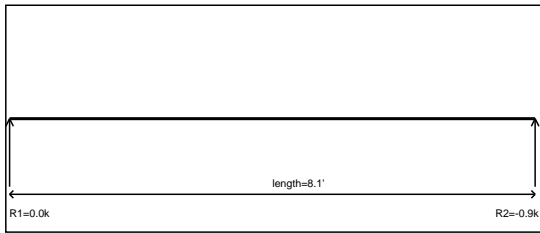
M = D Cd=0.9

Δ = D

V = 0.30k	Vall = 2.74k	Ratio = 0.11
M = 0.45k-ft	Mall = 2.69k-ft	Ratio = 0.17
Deflection		
TL = 0.02" L/999+ > L/240 min		
DL = 0.02"		
L = 0.00" L/999+ > L/360 min		

4x8 DF #2

Description - Main Floor Framing - B1-1 - Flush



Controlling Load Combination/ Cd

V = NA Cd=1

M = NA Cd=1

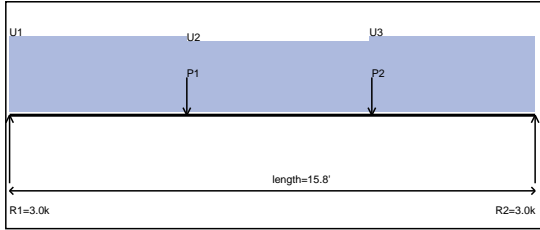
Δ = NA

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 - Main Floor Framing - B1-2 - Flush



Uniform 1 = 0.31 klf (0.0'-5.3') P1 = 0.56 K (5.3')
 Uniform 2 = 0.29 klf (5.3'-10.8') P2 = 0.55 K (10.9')
 Uniform 3 = 0.31 klf (10.8'-15.8')

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd=1$

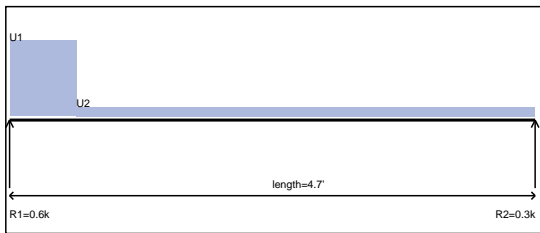
$M = (D + L) \quad Cd=1$

$\Delta = (D + L)$

V = 2.95k	Vall = 10.64k	Ratio = 0.28
M = 12.12k-ft	Mall = 31.44k-ft	Ratio = 0.39
Deflection		
TL = 0.24" L/791 > L/240 min		
DL = 0.11"		
L = 0.13" L/999+ > L/360 min		

(2)1-3/4x16 LVL

Description - Main Floor Framing - B1-3 - Flush



Uniform 1 = 0.73 klf (0.0'-0.6')
 Uniform 2 = 0.09 klf (0.6'-4.7')

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd=1$

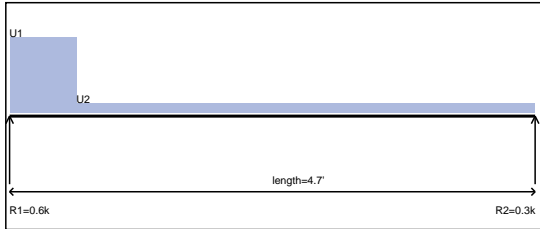
$M = (D + L) \quad Cd=1$

$\Delta = (D + L)$

V = 0.56k	Vall = 3.38k	Ratio = 0.17
M = 0.30k-ft	Mall = 4.48k-ft	Ratio = 0.07
Deflection		
TL = 0.00" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

(2)2x12 HF #2

Description - Main Floor Framing - B1-4 - Flush



Uniform 1 = 0.71 klf (0.0'-0.6')
 Uniform 2 = 0.09 klf (0.6'-4.7')

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd=1$

$M = (D + L) \quad Cd=1$

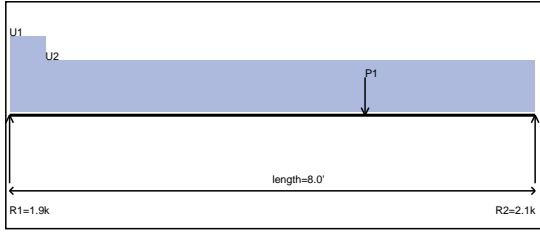
$\Delta = (D + L)$

V = 0.55k	Vall = 3.38k	Ratio = 0.16
M = 0.29k-ft	Mall = 4.48k-ft	Ratio = 0.07
Deflection		
TL = 0.00" L/999+ > L/240 min		
DL = 0.00"		
L = 0.00" L/999+ > L/360 min		

(2)2x12 HF #2



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



Uniform 1 = 0.54 klf (0.0'-0.5') P1 = 0.90 K (5.38')
Uniform 2 = 0.37 klf (0.5'-8.0')

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd = NA$

$M = (D + L) \quad Cd = NA$

$\Delta = (D + L)$

V = 2.07k	Vall = 49.00k	Ratio = 0.04
M = 4.18k-ft	Mall = 64.90k-ft	Ratio = 0.06

Deflection

TL = 0.01" L/999+ > L/240 min

DL = 0.00"

L = 0.01" L/999+ > L/360 min

W10x22 Steel

Description - Main Floor Framing - B1-6 - Flush



P1 = 1.51 K (0.5')

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd = 1$

$M = (D + L) \quad Cd = 1$

$\Delta = (D + L)$

V = 1.41k	Vall = 3.95k	Ratio = 0.36
M = 0.73k-ft	Mall = 8.91k-ft	Ratio = 0.08

Deflection

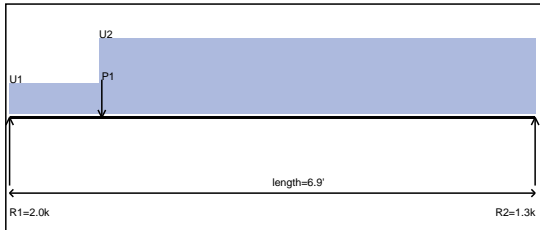
TL = 0.02" L/999+ > L/240 min

DL = 0.00"

L = 0.01" L/999+ > L/360 min

1-3/4x11-7/8 LVL

Description - Main Floor Framing - B1-7 - Flush



Uniform 1 = 0.12 klf (0.0'-1.2') P1 = 1.41 K (1.2')
Uniform 2 = 0.30 klf (1.2'-6.9')

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd = 1$

$M = (D + L) \quad Cd = 1$

$\Delta = (D + L)$

V = 1.99k	Vall = 7.90k	Ratio = 0.25
M = 2.63k-ft	Mall = 17.82k-ft	Ratio = 0.15

Deflection

TL = 0.02" L/999+ > L/240 min

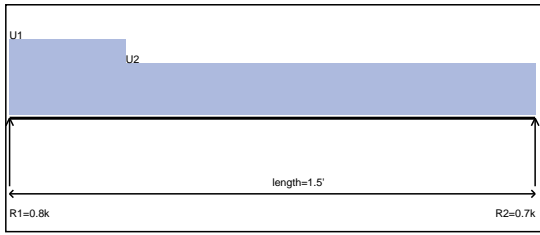
DL = 0.01"

L = 0.02" L/999+ > L/360 min

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



Description - Main Floor Framing - B1-8 - Flush



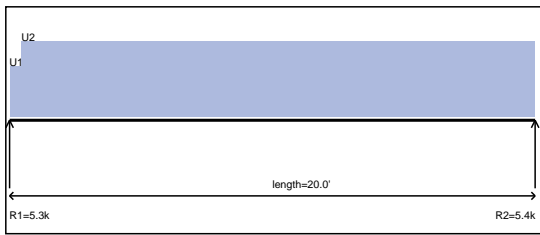
Uniform 1 = 1.28 klf (0.0'-0.3')
Uniform 2 = 0.87 klf (0.3'-1.5')

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

V = 0.77k	Vall = 3.95k	Ratio = 0.20
M = 0.26k-ft	Mall = 8.91k-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 - Main Floor Framing - B1-9 - Flush



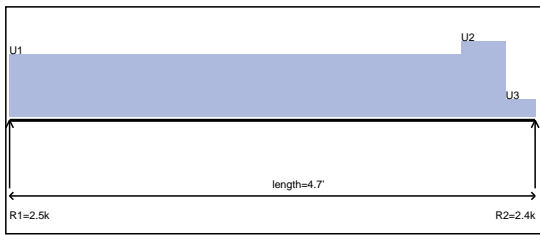
Uniform 1 = 0.36 klf (0.0'-0.5')
Uniform 2 = 0.54 klf (0.5'-20.0')

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

V = 5.38k	Vall = 53.60k	Ratio = 0.10
M = 26.85k-ft	Mall = 78.10k-ft	Ratio = 0.34
Deflection		
TL = 0.46" L/520 > L/240 min		
DL = 0.15"		
L = 0.31" L/774 > L/360 min		

W10x26 Steel

Description - Main Floor Framing - B1-10 - Dropped



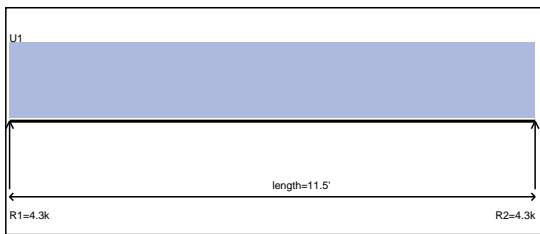
Uniform 1 = 1.05 klf (0.0'-4.0')
Uniform 2 = 1.28 klf (4.0'-4.4')
Uniform 3 = 0.30 klf (4.4'-4.7')

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

V = 2.45k	Vall = 3.88k	Ratio = 0.63
M = 2.88k-ft	Mall = 4.49k-ft	Ratio = 0.64
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 - B1-11 - Flush Top



Uniform 1 = 0.74 klf (0.0'-11.5')

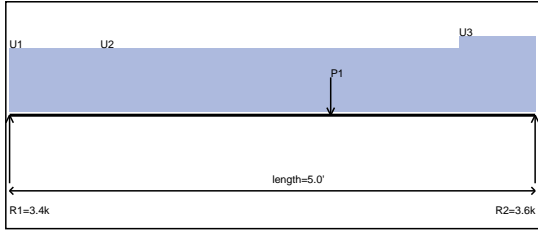
Controlling Load Combination/ Cd
V = (D + L) Cd=1
M = (D + L) Cd=1
 Δ = (D + L)

V = 4.26k	Vall = 10.64k	Ratio = 0.40
M = 12.25k-ft	Mall = 31.44k-ft	Ratio = 0.39
Deflection		
TL = 0.13" L/999+ > L/240 min		
DL = 0.03"		
L = 0.10" L/999+ > L/360 min		

(2)1-3/4x16 LVL



Description - Main Floor Framing - B1-12 - Dropped



Uniform 1 = 1.20 klf (0.0'-1.0') P1 = 0.53 K (3.1')
 Uniform 2 = 1.20 klf (0.9'-4.3')
 Uniform 3 = 1.44 klf (4.3'-5.0')

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd=1$

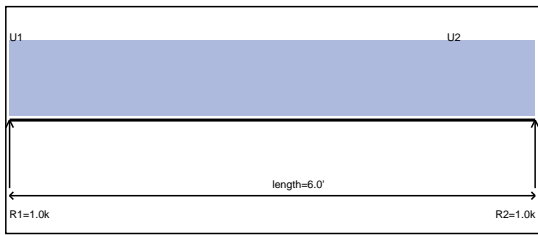
$M = (D + L) \quad Cd=1$

$\Delta = (D + L)$

V = 3.52k	Vall = 3.88k	Ratio = 0.91
M = 4.40k-ft	Mall = 4.49k-ft	Ratio = 0.98
Deflection		
TL = 0.05" L/999+ > L/240 min		
DL = 0.02"		
L = 0.03" L/999+ > L/360 min		

4x10 DF #2

Description - Main Floor Framing - B1-13 - Dropped



Uniform 1 = 0.30 klf (0.0'-5.0')
 Uniform 2 = 0.30 klf (5.0'-6.0')

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd=1$

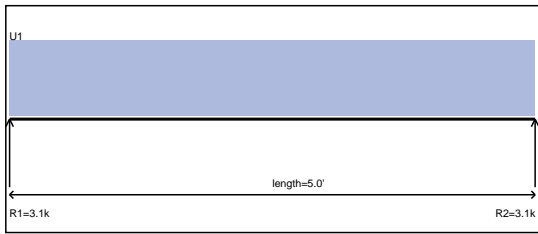
$M = (D + L) \quad Cd=1$

$\Delta = (D + L)$

V = 0.90k	Vall = 3.88k	Ratio = 0.23
M = 1.36k-ft	Mall = 4.49k-ft	Ratio = 0.30
Deflection		
TL = 0.02" L/999+ > L/240 min		
DL = 0.00"		
L = 0.02" L/999+ > L/360 min		

4x10 DF #2

Description - Main Floor Framing - B1-14 - Dropped



Uniform 1 = 1.20 klf (0.0'-5.0')

Controlling Load Combination/ Cd

$V = (D + L) \quad Cd=1$

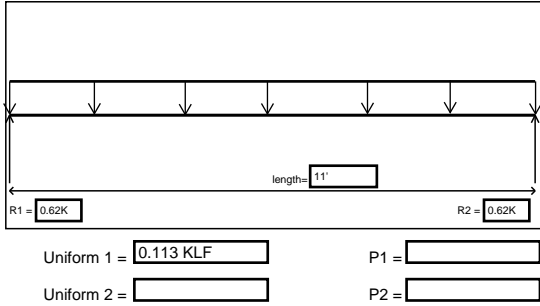
$M = (D + L) \quad Cd=1$

$\Delta = (D + L)$

V = 3.02k	Vall = 3.88k	Ratio = 0.78
M = 3.78k-ft	Mall = 4.49k-ft	Ratio = 0.84
Deflection		
TL = 0.05" L/999+ > L/240 min		
DL = 0.02"		
L = 0.03" L/999+ > L/360 min		

4x10 DF #2

Description - TYP. DECK JOIST - ROOF FRMG. [B3-6]

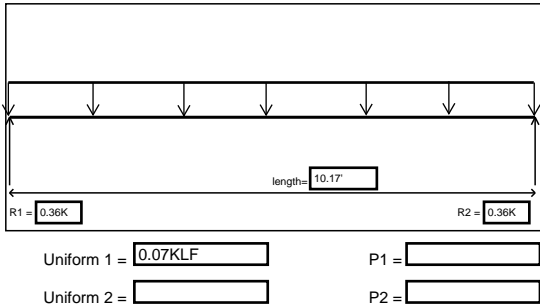


Controlling Load Combination/ Cd
V = Cd =
M = Cd =
Δ =

V = Vall = Ratio =
M = Mall = Ratio =
Deflection
TL = L/820 > L/240 min.
DL =
L = L/999+ > L/360 min.

2x12 HF#2 @ 16" O.C.

Description - TYP. R.R. @ STAIRS - ROOF FRMG. [B3-7]

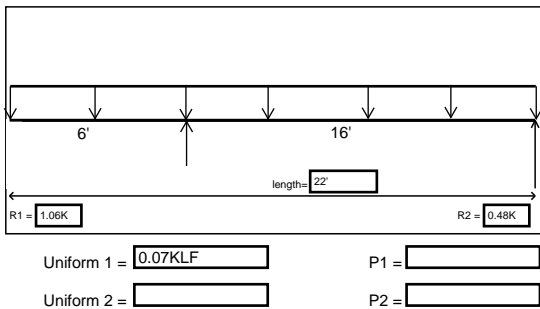


Controlling Load Combination/ Cd
V = Cd =
M = Cd =
Δ =

V = Vall = Ratio =
M = Mall = Ratio =
Deflection
TL = L/999+ > L/240 min.
DL =
L =

2x12 HF#2 @ 24" O.C.

Description - TYP. CANT'D LVL R.R. - ROOF FRMG. [B3-8]

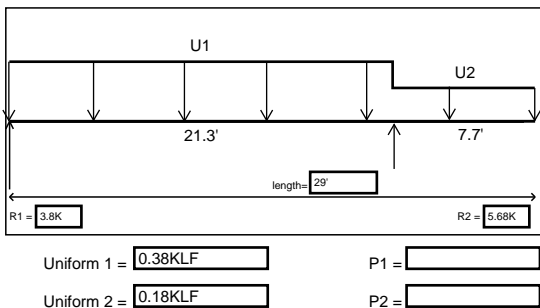


Controlling Load Combination/ Cd
V = Cd =
M = Cd =
Δ =

V = Vall = Ratio =
M = Mall = Ratio =
Deflection
TL = L/999+ > L/240 min.
DL =
L =

1 3/4" x 11 7/8" LVL's @ 24" O.C.

Description - [B3-4] CANT'D FLUSH BM. @ BA2 - ROOF FRMG.

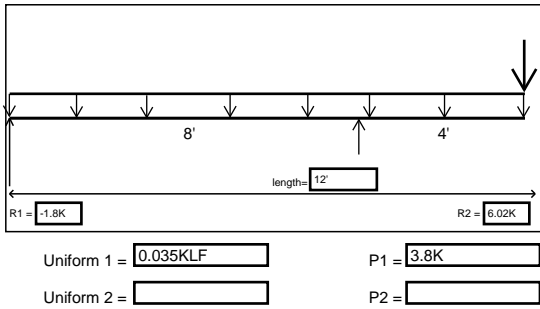


Controlling Load Combination/ Cd
V = Cd =
M = Cd =
Δ =

V = Vall = Ratio =
M = Mall = Ratio =
Deflection
TL = 2L/999+ > 2L/240 min.
DL =
L =

3 1/2" x 11 7/8" LVL

Description - [B2-3]/[B2-4] - CANT'D FLUSH BM. - UPPER FLR FRM



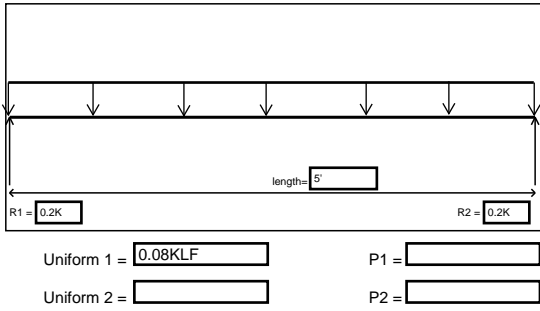
Controlling Load Combination/ Cd
V = D+S Cd = 1.15
M = D+S Cd = 1.15
Δ = D+S

V = 3.94K Vall = 12.9K Ratio = 0.31
M = 15.5K-FT Mall = 27.6K-FT Ratio = 0.56

Deflection
TL = 0.357" 2L/269 > 2L/240 min.
DL = 0.122"
L =

5 1/4"x11 1/4" LVL

Description - TYP. FLOOR JOIST @ FLUSH SHOWER - UPPER FLR FRM



[B2-36]

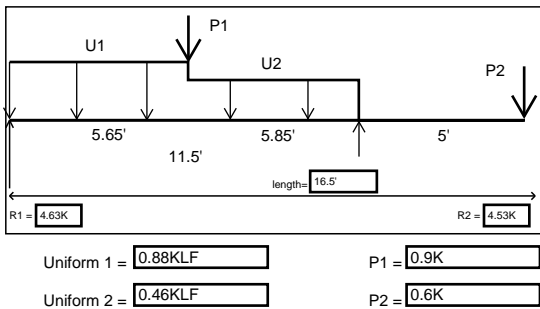
Controlling Load Combination/ Cd
V = D+L Cd = 1.0
M = D+L Cd = 1.0
Δ = D+L

V = 0.2K Vall = 1.09K Ratio = 0.18
M = 0.25K-FT Mall = 1.28K-FT Ratio = 0.20

Deflection
TL = 0.018" L/999+ > L/240 min.
DL = 0.006"
L = 0.012" L/999+ > L/360 min.

2x8 HF#2 @ 16" O.C.

Description - [B2-32] CANT'D FLUSH BEAM - UPPER FLR FRMG



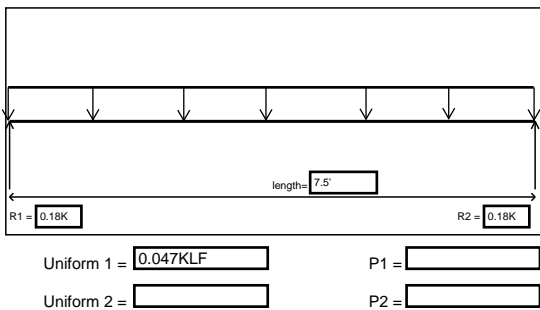
Controlling Load Combination/ Cd
V = D+L Cd = 1.0
M = D+L Cd = 1.0
Δ = D+L

V = 4.63K Vall = 7.90K Ratio = 0.59
M = 15.2K-FT Mall = 17.8K-FT Ratio = 0.85

Deflection
TL = 0.253" L/545 > L/240 min.
DL = 0.050"
L = 0.203" L/680 > L/360 min.

3 1/2" x 11 7/8" LVL

Description - TYP. R.R. @ GARAGE LOW ROOF - UPPER FLR FRM



[B2-37]

Controlling Load Combination/ Cd
V = D+S Cd = 1.15
M = D+S Cd = 1.15
Δ = D+S

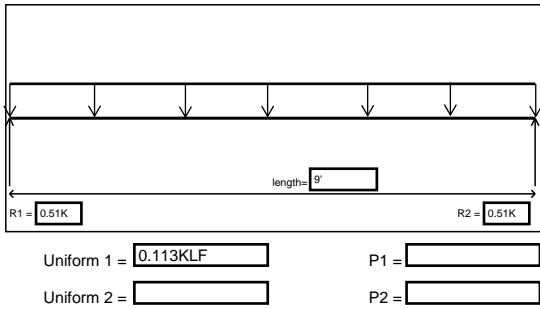
V = 0.18K Vall = 1.25K Ratio = 0.14
M = 0.33K-FT Mall = 1.47K-FT Ratio = 0.22

Deflection
TL = 0.054" L/999+ > L/240 min.
DL = 0.015"
L =

2x8 HF#2 @ 16" O.C.

Description - **TYP. DECK JOIST @ STAIR LANDING - UPPER FLR**

[B2-38]



Controlling Load Combination/ Cd

V = D+L Cd = 1.0
M = D+L Cd = 1.0
Δ = D+L

V = 0.51K Vall = 1.09 Ratio = 0.47
M = 1.15K-FT Mall = 1.28K-FT Ratio = 0.90

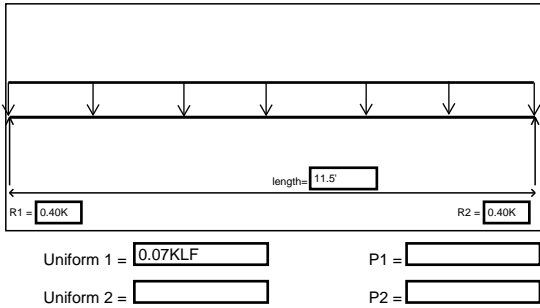
Deflection

TL = 0.271" L/399 > L/240 min.
DL = 0.080"
L = 0.191" L/565 > L/360 min.

2x8 HF#2 @ 16" O.C.

Description - **TYP. R.R.'s @ DECK - UPPER FLR FRMG.**

[B2-39]



Controlling Load Combination/ Cd

V = D+S Cd = 1.15
M = D+S Cd = 1.15
Δ = D+S

V = 0.40K Vall = 1.94K Ratio = 0.21
M = 1.16K-FT Mall = 2.97K-FT Ratio = 0.39

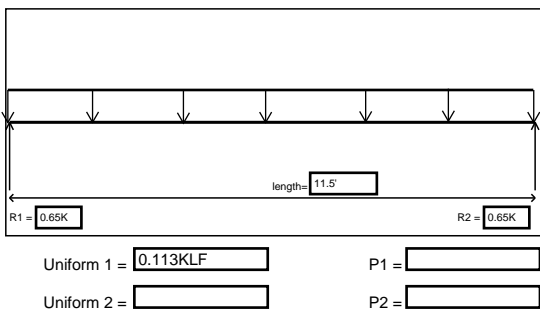
Deflection

TL = 0.119" L/999+ > L/240 min.
DL = 0.034"
L =

2x12 HF#2 @ 24" O.C.

Description - **TYP. DECK JOISTS - MAIN FLR FRMG. [B1-15]**

[B1-15]



Controlling Load Combination/ Cd

V = D+L Cd = 1.0
M = D+L Cd = 1.0
Δ = D+L

V = 0.65K Vall = 1.65K Ratio = 0.39
M = 1.87K-FT Mall = 2.06K-FT Ratio = 0.91

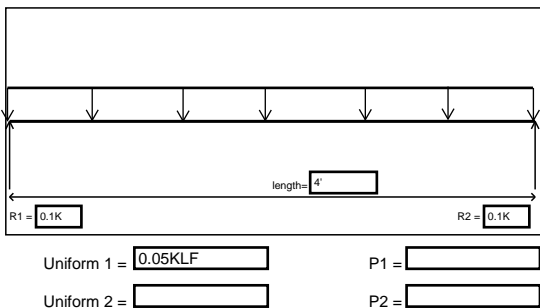
Deflection

TL = 0.202" L/683 > L/240 min.
DL = 0.059"
L = 0.143" L/965 > L/360 min.

P.T. 2x12 HF#2 @ 16" O.C.

Description - **TYP. LANDING JOIST - MAIN FLR FRMG. [B1-16]**

[B1-16]



Controlling Load Combination/ Cd

V = D+L Cd = 1.0
M = D+L Cd = 1.0
Δ = D+L

V = 0.1K Vall = 1.09K Ratio = 0.09
M = 0.1K-FT Mall = 1.28K-FT Ratio = 0.08

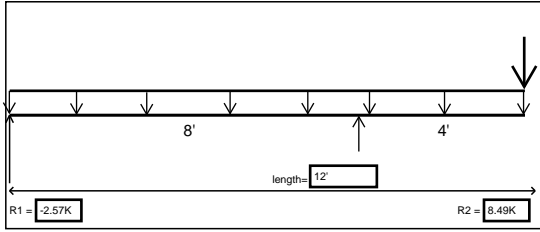
Deflection

TL = 0.005" L/999+ > L/240 min.
DL = 0.001"
L = 0.004" L/999+ > L/360 min.

2x8 HF#2 @ 12" O.C.



Description - [B1-1] - CANT'D FLUSH BM. - MAIN FLR FRMG



Uniform 1 = 0.043KLF P1 = 5.4K
Uniform 2 = P2 =

Controlling Load Combination/ Cd

V = D+L Cd = 1.0
M = D+L Cd = 1.0
Δ = D+L

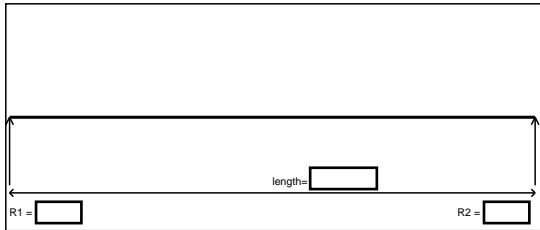
V = 5.33K Vall = 16.0K Ratio = 0.33
M = 22.9K-FT Mall = 48.5K-FT Ratio = 0.47

Deflection

TL = 0.176" 2L/545 > 2L/240 min.
DL = 0.052"
L = 0.124" 2L/774 > 2L/360 min.

5 1/4"x16" LVL

Description -



Uniform 1 = P1 =
Uniform 2 = P2 =

Controlling Load Combination/ Cd

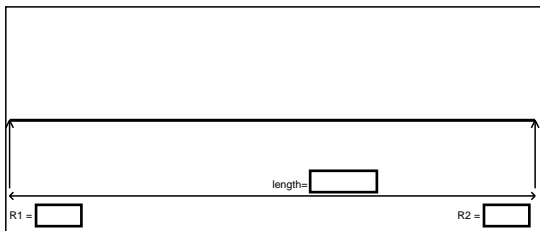
V = Cd =
M = Cd =
Δ =

V = Vall = Ratio =
M = Mall = Ratio =

Deflection

TL =
DL =
L =

Description -



Uniform 1 = P1 =
Uniform 2 = P2 =

Controlling Load Combination/ Cd

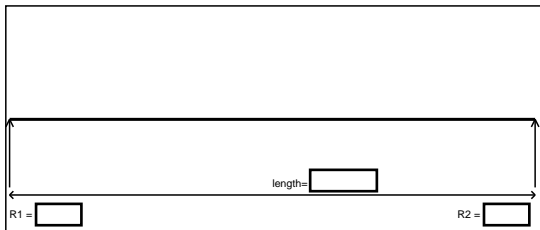
V = Cd =
M = Cd =
Δ =

V = Vall = Ratio =
M = Mall = Ratio =

Deflection

TL =
DL =
L =

Description -



Uniform 1 = P1 =
Uniform 2 = P2 =

Controlling Load Combination/ Cd

V = Cd =
M = Cd =
Δ =

V = Vall = Ratio =
M = Mall = Ratio =

Deflection

TL =
DL =
L =



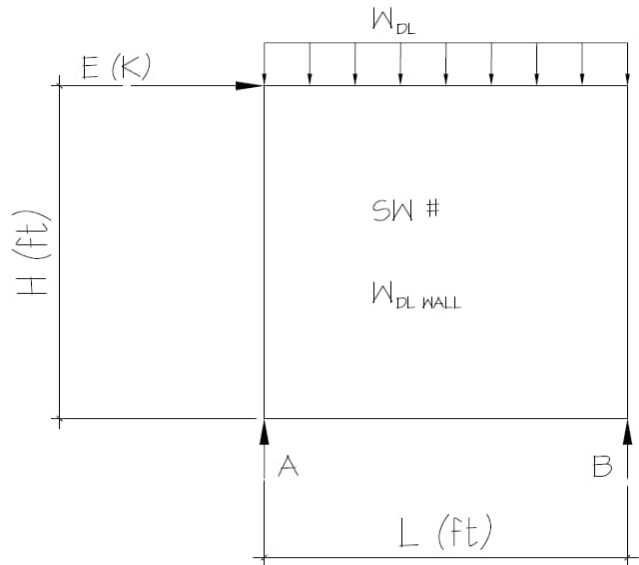
Overstrength Calculations

Wall Description/SW #:

203

Parameters:

- L = 26.5 ft
- H = 8.8 ft
- E = 1.20 k
- W_{DLWall} = 0.10 kl f
- W_{DL} = 0.038 kl f
- Ω_0 = 2.5 (ASCE TABLE 12.2.1 FOOTNOTE)
- SDS = 0.929



analysis:

E (unfactored) = 1.71

$E_{mh} = \Omega_0 * E = 4.29$ K $E_v = 0.2 * SDS * DL = 0.679$ K

$E_m = E_{mh} + E_v = 4.965$ K

$E_m = E_{mh} - E_v = 3.606$ K

E_m (max) = $\sum M_A = 0 = 4.97(8.8) - R_b(26.5)$ $R_b = 1.6E$
 $R_a = -1.6E$

E_m (min) = $\sum M_A = 0 = 3.61(8.8) - R_b(26.5)$ $R_b = 1.2E$
 $R_a = -1.2E$

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

allowable stress permitted to be increased by 1.2

see following beam
calcs for load
application



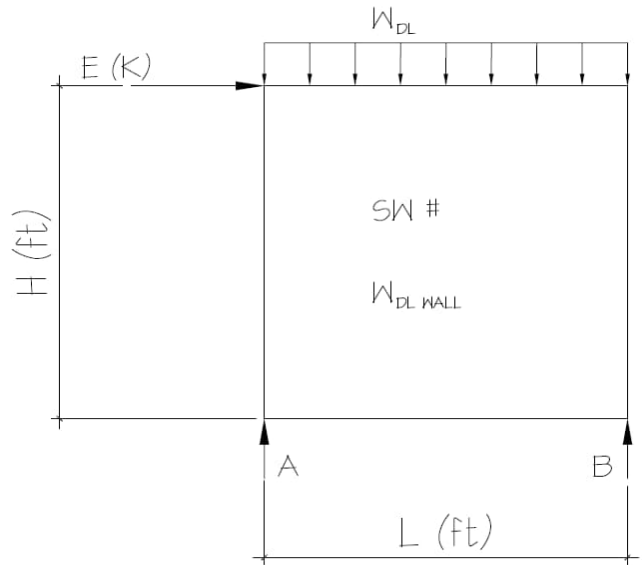
Overstrength Calculations

Wall Description/SW #:

204

Parameters:

- L = 21.3 ft
- H = 8.8 ft
- E = 1.20 k
- W_{DLWall} = 0.10 kl f
- W_{DL} = 0.110 kl f
- Ω_0 = 2.5 (ASCE TABLE 12.2.1 FOOTNOTE)
- SDS = 0.929



analysis:

E (unfactored) = 1.71

$E_{mh} = \Omega_0 * E = 4.29$ K $E_v = 0.2 * SDS * DL = 0.831$ K

$E_m = E_{mh} + E_v = 5.117$ K

$E_m = E_{mh} - E_v = 3.455$ K

E_m (max) = $\sum M_A = 0 = 5.12(8.8) - R_b(21.3)$ $R_b = 2.1E$
 $R_a = -2.1E$

E_m (min) = $\sum M_A = 0 = 3.45(8.8) - R_b(21.3)$ $R_b = 1.4E$
 $R_a = -1.4E$

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

allowable stress permitted to be increased by 1.2

see following beam
calcs for load
application



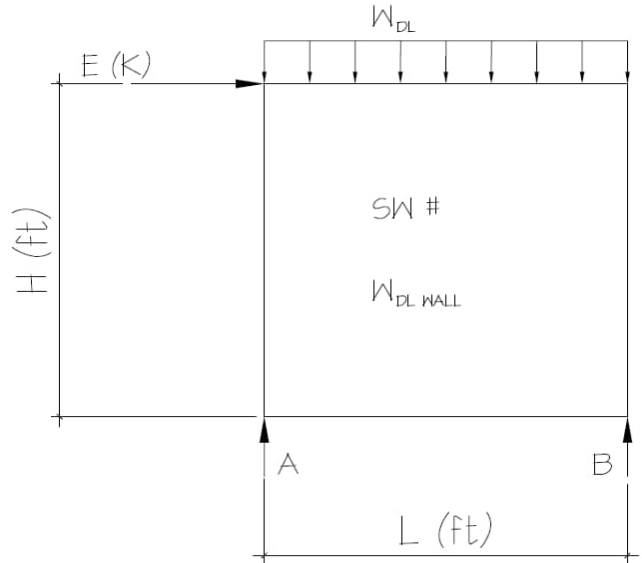
Overstrength Calculations

Wall Description/SW #:

205

Parameters:

- L = 22.0 ft
- H = 8.8 ft
- E = 0.70 k
- W_{DLWall} = 0.10 kl f
- W_{DL} = 0.080 kl f
- Ω_0 = 2.5 (ASCE TABLE 12.2.1 FOOTNOTE)
- SDS = 0.929



analysis:

E (unfactored) = 1.00

$E_{mh} = \Omega_0 * E = 2.50$ K $E_v = 0.2 * SDS * DL = 0.736$ K

$E_m = E_{mh} + E_v = 3.236$ K

$E_m = E_{mh} - E_v = 1.764$ K

$E_m (max) = \sum M_A = 0 = 3.24(8.8) - R_b(22)$ $R_b = 1.3E$
 $R_a = -1.3E$

$E_m (min) = \sum M_A = 0 = 1.76(8.8) - R_b(22)$ $R_b = 0.7E$
 $R_a = -0.7E$

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

allowable stress permitted to be increased by 1.2

see following beam
calcs for load
application



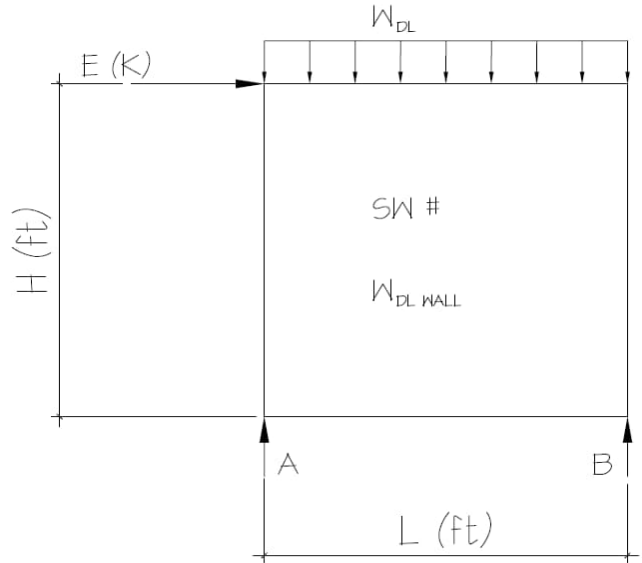
Overstrength Calculations

Wall Description/SW #:

206

Parameters:

- L = 10.6 ft
- H = 8.8 ft
- E = 1.10 k
- W_{DLWall} = 0.10 kl f
- W_{DL} = 0.020 kl f
- Ω_0 = 2.5 (ASCE TABLE 12.2.1 FOOTNOTE)
- SDS = 0.929



analysis:

E (unfactored) = 1.57

$E_{mh} = \Omega_0 * E = 3.93$ K $E_v = 0.2 * SDS * DL = 0.236$ K

$E_m = E_{mh} + E_v = 4.165$ K

$E_m = E_{mh} - E_v = 3.692$ K

E_m (max) = $\sum M_A = 0 = 4.16(8.8) - R_b(10.6)$ $R_B = 3.4E$
 $R_a = -3.4E$

E_m (min) = $\sum M_A = 0 = 3.69(8.8) - R_b(10.6)$ $R_B = 3.0E$
 $R_a = -3.0E$

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

allowable stress permitted to be increased by 1.2

see following beam calcs for load application



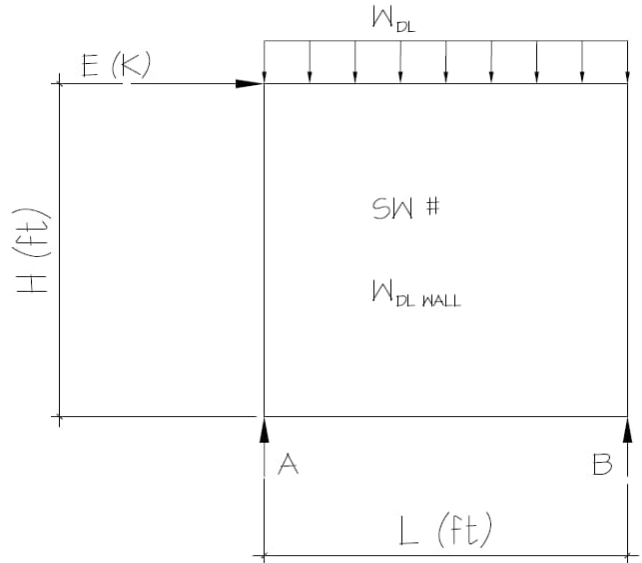
Overstrength Calculations

Wall Description/SW #:

209

Parameters:

- L = 6.6 ft
- H = 8.8 ft
- E = 0.30 k
- W_{DLWall} = 0.10 kl f
- W_{DL} = 0.020 kl f
- Ω_0 = 2.5 (ASCE TABLE 12.2.1 FOOTNOTE)
- SDS = 0.929



analysis:

E (unfactored) = 0.43

$E_{mh} = \Omega_0 * E = 1.07$ K $E_v = 0.2 * SDS * DL = 0.147$ K

$E_m = E_{mh} + E_v = 1.219$ K

$E_m = E_{mh} - E_v = 0.924$ K

E_m (max) = $\sum M_A = 0 = 1.22(8.8) - R_b(6.6)$ $R_b = 1.6E$

$R_a = -1.6E$

E_m (min) = $\sum M_A = 0 = 0.92(8.8) - R_b(6.6)$ $R_b = 1.2E$

$R_a = -1.2E$

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

allowable stress permitted to be increased by 1.2

see following beam
calcs for load
application

Wood Beam

Project File: Retaining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

(c) ENERCALC INC 1983-2023

DESCRIPTION: [H2-8] (SW#204)

CODE REFERENCES

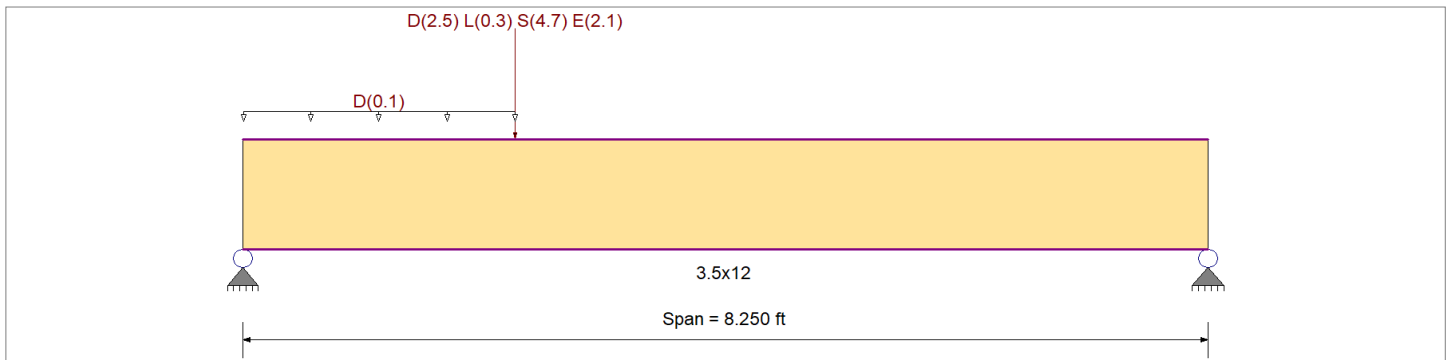
Calculations per NDS 2018, IBC 2021, ASCE 7-16

Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,880.0 psi	<i>E : Modulus of Elasticity</i>
Load Combination : ASCE 7-16	Fb -	2,220.0 psi	Ebend- xx
	Fc - Prll	1,980.0 psi	Eminbend - xx
Wood Species : DF/DF	Fc - Perp	780.0 psi	Ebend- yy
Wood Grade : 24F - V4	Fv	318.0 psi	Eminbend - yy
	Ft	1,320.0 psi	Density
			31.210 pcf

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



Applied Loads

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

Beam self weight calculated and added to loading

Point Load : D = 2.50, L = 0.30, S = 4.70, E = 2.10 k @ 2.330 ft

Uniform Load : D = 0.10 k/ft, Extent = 0.0 --> 2.330 ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.529 : 1	Maximum Shear Stress Ratio	=	0.517 : 1
Section used for this span		3.5x12	Section used for this span		3.5x12
fb: Actual	=	1,751.09psi	fv: Actual	=	189.14 psi
F'b	=	3,312.00psi	F'v	=	365.70 psi
Load Combination		+D+S+H	Load Combination		+D+S+H
Location of maximum on span	=	2.349ft	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		0.081 in	Ratio =	1223	>=360
Max Upward Transient Deflection		0 in	Ratio =	0	<360
Max Downward Total Deflection		0.130 in	Ratio =	762	>=300
Max Upward Total Deflection		0 in	Ratio =	0	<300
				Span: 1 : S Only	
				n/a	
				Span: 1 : +D+0.750L+0.750S+0.5250E+H	
				n/a	

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios										Moment Values			Shear Values			
			M	V	CD	CM	C _t	CLx	C _v	C _{fu}	C _i	C _r	M	fb	F'b	V	fv	F'v	
+D+H	Length = 8.250 ft	1	0.244	0.240	0.90	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.42	632.0	2,592.0	0.0	0.00	0.0	0.0
+D+L+H	Length = 8.250 ft	1	0.244	0.240	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.92	703.4	2,880.0	0.0	0.00	0.0	0.0
+D+Lr+H	Length = 8.250 ft	1	0.176	0.173	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.42	632.0	3,600.0	0.0	0.00	0.0	0.0
+D+S+H	Length = 8.250 ft	1	0.529	0.517	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.26	1,751.1	3,312.0	0.0	0.00	0.0	0.0
+D+0.750Lr+0.750L+H						1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.0	0.0	0.0	0.0

Wood Beam

Project File: Retaining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

(c) ENERCALC INC 1983-2023

DESCRIPTION: [H2-8] (SW#204)

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values			
			M	V	CD	CM	C _t	CLx	C _v	C _{fu}	C _i	C _r	M	fb	F'b	V	fv	F'v
Length = 8.250 ft	1		0.190	0.187	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.80	685.6	3,600.0	2.08	74.5	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 = 8.250 ft	1		0.460	0.451	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	10.67	1,524.9	3,312.0	4.61	164.8	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 = 8.250 ft	1		0.137	0.135	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.42	632.0	4,608.0	1.92	68.7	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 = 8.250 ft	1		0.149	0.146	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.80	685.6	4,608.0	2.08	74.5	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 = 8.250 ft	1		0.331	0.324	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	10.67	1,524.9	4,608.0	4.61	164.8	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 = 8.250 ft	1		0.082	0.081	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.65	379.2	4,608.0	1.15	41.2	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 = 8.250 ft	1		0.213	0.209	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	6.87	982.0	4,608.0	2.98	106.4	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 = 8.250 ft	1		0.061	0.061	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.97	282.0	4,608.0	0.87	31.0	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 = 8.250 ft	1		0.388	0.379	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.51	1,787.4	4,608.0	5.41	193.0	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 = 8.250 ft	1		0.274	0.268	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	8.84	1,262.4	4,608.0	3.82	136.5	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	0.1298	3.703		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	5.514	2.147
Max Upward from Load Combinations	5.514	2.147
Max Upward from Load Cases	3.373	1.327
+D+H	2.032	0.777
+D+L+H	2.247	0.861
+D+Lr+H	2.032	0.777
+D+S+H	5.404	2.104
+D+0.750Lr+0.750L+H	2.193	0.840
+D+0.750L+0.750S+H	4.722	1.836
+D+0.60W+H	2.032	0.777
+D+0.750Lr+0.750L+0.450W+H	2.193	0.840
+D+0.750L+0.750S+0.450W+H	4.722	1.836
+0.60D+0.60W+0.60H	1.219	0.466
+D+0.70E+0.60H	3.086	1.192
+D+0.750L+0.750S+0.5250E+H	5.514	2.147
+0.60D+0.70E+H	2.274	0.881
D Only	2.032	0.777
L Only	0.215	0.085
S Only	3.373	1.327
E Only	1.507	0.593
H Only		

Wood Beam

Project File: Retaining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

(c) ENERCALC INC 1983-2023

DESCRIPTION: [B2-1] (SW#203)

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values			
			M	V	CD	CM	C _t	CLx	C _v	C _{fu}	C _i	C _r	M	fb	F _b	V	fv	F _v
+D+0.750L+0.750S+0.450W+I						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.170	0.272	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.56	603.9	3,552.0	8.37	138.4	508.8
Length = 17.0 ft	2		0.345	0.272	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	32.44	1,559.8	4,526.8	8.37	138.4	508.8
+D+0.750L+0.750S+0.450W+I						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.211	0.222	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	15.56	748.1	3,552.0	6.83	112.9	508.8
Length = 17.0 ft	2		0.239	0.222	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	22.52	1,082.8	4,526.8	6.83	112.9	508.8
+D+0.750L+0.750S+0.450W+I						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.211	0.278	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	15.56	748.1	3,552.0	8.55	141.3	508.8
Length = 17.0 ft	2		0.330	0.278	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	31.07	1,494.2	4,526.8	8.55	141.3	508.8
+0.60D+0.60W+0.60H						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.055	0.066	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.05	194.6	3,552.0	2.04	33.8	508.8
Length = 17.0 ft	2		0.076	0.066	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	7.18	345.5	4,526.8	2.04	33.8	508.8
+D+0.70E+0.60H						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.167	0.121	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.35	593.6	3,552.0	3.74	61.7	508.8
Length = 17.0 ft	2		0.170	0.121	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	12.35	593.6	3,489.4	3.74	61.7	508.8
+D-0.70E+0.60H						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.016	0.100	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	1.15	55.1	3,552.0	3.08	50.9	508.8
Length = 17.0 ft	2		0.155	0.100	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	14.59	701.7	4,526.8	3.08	50.9	508.8
+D+0.750L+0.750S+0.5250E+						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.227	0.280	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	16.76	805.8	3,552.0	8.62	142.5	508.8
Length = 17.0 ft	2		0.324	0.280	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	30.54	1,468.4	4,526.8	8.62	142.5	508.8
+D+0.750L+0.750S+0.5250E+						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.267	0.230	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	19.76	950.1	3,552.0	7.08	116.9	508.8
Length = 17.0 ft	2		0.220	0.230	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	20.73	996.8	4,526.8	7.08	116.9	508.8
+D+0.750L+0.750S+0.5250E+						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.267	0.286	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	19.76	950.1	3,552.0	8.80	145.4	508.8
Length = 17.0 ft	2		0.310	0.286	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	29.22	1,404.8	4,526.8	8.80	145.4	508.8
+D+0.750L+0.750S-0.5250E+I						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.113	0.264	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	8.36	401.9	3,552.0	8.13	134.3	508.8
Length = 17.0 ft	2		0.365	0.264	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	34.39	1,653.8	4,526.8	8.13	134.3	508.8
+D+0.750L+0.750S-0.5250E+I						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.154	0.214	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	11.36	546.2	3,552.0	6.58	108.8	508.8
Length = 17.0 ft	2		0.259	0.214	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	24.38	1,172.4	4,526.8	6.58	108.8	508.8
+D+0.750L+0.750S-0.5250E+I						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.154	0.270	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	11.36	546.2	3,552.0	8.30	137.2	508.8
Length = 17.0 ft	2		0.350	0.270	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	32.99	1,586.4	4,526.8	8.30	137.2	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	-0.3033	0.000
+D+0.750L+0.750S+0.450W+H, LI	2	0.4379	8.832		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		16.825	8.311
Max Upward from Load Combinations		16.825	8.311
Max Upward from Load Cases		7.946	4.134
Max Downward from all Load Conditions			-0.471
Max Downward from Load Cases (Resis)			-0.471
+D+H		6.362	3.170

Wood Beam

Project File: Retaining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

(c) ENERCALC INC 1983-2023

DESCRIPTION: [B2-1] (No Overstrength)

CODE REFERENCES

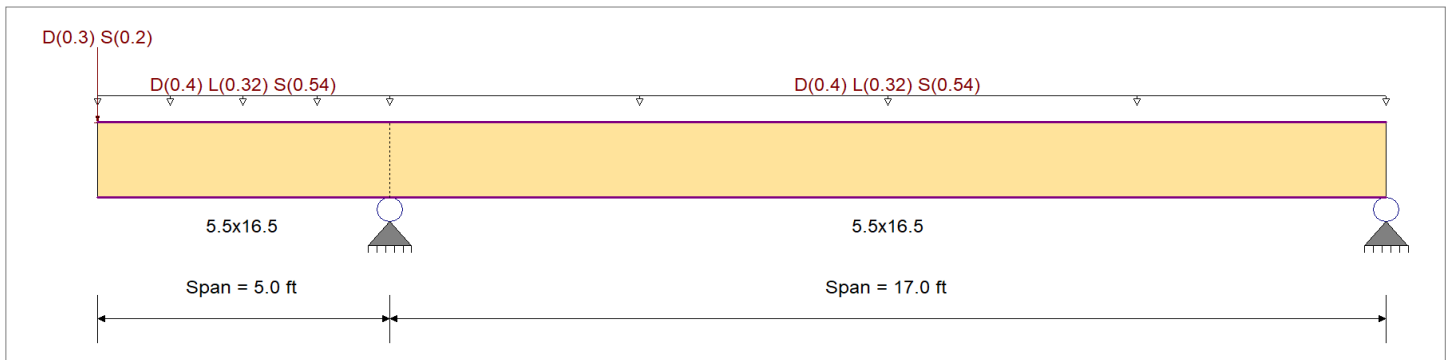
Calculations per NDS 2018, IBC 2021, ASCE 7-16

Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design	Fb +	2,880.0 psi	<i>E : Modulus of Elasticity</i>
Load Combination : ASCE 7-16	Fb -	2,220.0 psi	Ebend- xx
	Fc - Prll	1,980.0 psi	Eminbend - xx
Wood Species : DF/DF	Fc - Perp	780.0 psi	Ebend- yy
Wood Grade : 24F - V4	Fv	318.0 psi	Eminbend - yy
	Ft	1,320.0 psi	Density
			31.210pcf

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



Applied Loads

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

Beam self weight calculated and added to loading

Load for Span Number 1

Uniform Load : D = 0.40, L = 0.320, S = 0.540, Tributary Width = 1.0 ft

Point Load : D = 0.30, S = 0.20 k @ 0.0 ft

Load for Span Number 2

Uniform Load : D = 0.40, L = 0.320, S = 0.540, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.479 : 1	Maximum Shear Stress Ratio	=	0.386 : 1
Section used for this span		5.5x16.5	Section used for this span		5.5x16.5
fb: Actual	=	1,559.76psi	fv: Actual	=	141.31 psi
F'b	=	3,253.65psi	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 (LL)		
Location of maximum on span	=	9.212ft	Location of maximum on span	=	5.000ft
Span # where maximum occurs	=	Span # 2	Span # where maximum occurs	=	Span # 1
Maximum Deflection					
Max Downward Transient Deflection		0.210 in Ratio =	969 >=360	Span: 2 : S Only	
Max Upward Transient Deflection		-0.153 in Ratio =	784 >=360	Span: 2 : L Only, LL Comb Run (L*)	
Max Downward Total Deflection		0.438 in Ratio =	465 >=300	Span: 2 : +D+0.750L+0.750S+H, LL Comb Run (*L)	
Max Upward Total Deflection		-0.303 in Ratio =	394 >=300	Span: 1 : +D+0.750L+0.750S+H, LL Comb Run (*L)	

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values				
			M	V	CD	CM	C _t	CLx	C _v	C _{fu}	C _i	C _r	M	fb	F'b	V	fv	F'v	
+D+H																			
	Length = 5.0 ft	1	0.162	0.197	0.90	1.00	1.00	1.00	1.00	1.00	1.00	6.75	324.4	1,998.0	0.0	0.00	0.0	0.0	286.2
	Length = 17.0 ft	2	0.226	0.197	0.90	1.00	1.00	1.00	0.982	1.00	1.00	11.97	575.8	2,546.3	3.41	56.3	286.2		
+D+L+H, LL Comb Run (*L)																			
	Length = 5.0 ft	1	0.146	0.296	1.00	1.00	1.00	1.00	1.00	1.00	1.00	6.75	324.4	2,220.0	5.70	94.2	318.0		
	Length = 17.0 ft	2	0.399	0.296	1.00	1.00	1.00	1.00	0.982	1.00	1.00	23.45	1,127.8	2,829.3	5.70	94.2	318.0		
+D+L+H, LL Comb Run (L*)																			
															0.0	0.00	0.0	0.0	

Wood Beam

Project File: Retaining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

(c) ENERCALC INC 1983-2023

DESCRIPTION: [B2-1] (No Overstrength)

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values			
			M	V	CD	CM	C _t	CLx	C _v	C _{fu}	C _i	C _r	M	fb	F _b	V	fv	F _v
+D+0.750L+0.750S+0.450W+I						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.170	0.272	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.56	603.9	3,552.0	8.37	138.4	508.8
Length = 17.0 ft	2		0.345	0.272	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	32.44	1,559.8	4,526.8	8.37	138.4	508.8
+D+0.750L+0.750S+0.450W+I						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.211	0.222	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	15.56	748.1	3,552.0	6.83	112.9	508.8
Length = 17.0 ft	2		0.239	0.222	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	22.52	1,082.8	4,526.8	6.83	112.9	508.8
+D+0.750L+0.750S+0.450W+I						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.211	0.278	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	15.56	748.1	3,552.0	8.55	141.3	508.8
Length = 17.0 ft	2		0.330	0.278	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	31.07	1,494.2	4,526.8	8.55	141.3	508.8
+0.60D+0.60W+0.60H						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.055	0.066	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.05	194.6	3,552.0	2.04	33.8	508.8
Length = 17.0 ft	2		0.076	0.066	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	7.18	345.5	4,526.8	2.04	33.8	508.8
+D+0.70E+0.60H						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.091	0.111	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	6.75	324.4	3,552.0	3.41	56.3	508.8
Length = 17.0 ft	2		0.127	0.111	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	11.97	575.8	4,526.8	3.41	56.3	508.8
+D-0.70E+0.60H						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.091	0.111	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	6.75	324.4	3,552.0	3.41	56.3	508.8
Length = 17.0 ft	2		0.127	0.111	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	11.97	575.8	4,526.8	3.41	56.3	508.8
+D+0.750L+0.750S+0.5250E+						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.170	0.272	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.56	603.9	3,552.0	8.37	138.4	508.8
Length = 17.0 ft	2		0.345	0.272	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	32.44	1,559.8	4,526.8	8.37	138.4	508.8
+D+0.750L+0.750S+0.5250E+						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.211	0.222	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	15.56	748.1	3,552.0	6.83	112.9	508.8
Length = 17.0 ft	2		0.239	0.222	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	22.52	1,082.8	4,526.8	6.83	112.9	508.8
+D+0.750L+0.750S+0.5250E+						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.211	0.278	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	15.56	748.1	3,552.0	8.55	141.3	508.8
Length = 17.0 ft	2		0.330	0.278	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	31.07	1,494.2	4,526.8	8.55	141.3	508.8
+D+0.750L+0.750S-0.5250E+I						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.170	0.272	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.56	603.9	3,552.0	8.37	138.4	508.8
Length = 17.0 ft	2		0.345	0.272	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	32.44	1,559.8	4,526.8	8.37	138.4	508.8
+D+0.750L+0.750S-0.5250E+I						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.211	0.222	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	15.56	748.1	3,552.0	6.83	112.9	508.8
Length = 17.0 ft	2		0.239	0.222	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	22.52	1,082.8	4,526.8	6.83	112.9	508.8
+D+0.750L+0.750S-0.5250E+I						1.00	1.00	1.00	0.982	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1		0.211	0.278	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	15.56	748.1	3,552.0	8.55	141.3	508.8
Length = 17.0 ft	2		0.330	0.278	1.60	1.00	1.00	1.00	0.982	1.00	1.00	1.00	31.07	1,494.2	4,526.8	8.55	141.3	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+0.5250E+H, L	-0.3033	0.000
+D+0.750L+0.750S+0.5250E+H, L	2	0.4379	8.832		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		15.738	8.311
Max Upward from Load Combinations		15.738	8.311
Max Upward from Load Cases		7.946	4.134
Max Downward from all Load Conditions			-0.235
Max Downward from Load Cases (Resis)			-0.235
+D+H	6.362	3.170	

Wood Beam

Project File: Retaining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

(c) ENERCALC INC 1983-2023

DESCRIPTION: [B2-30] (SW #209)

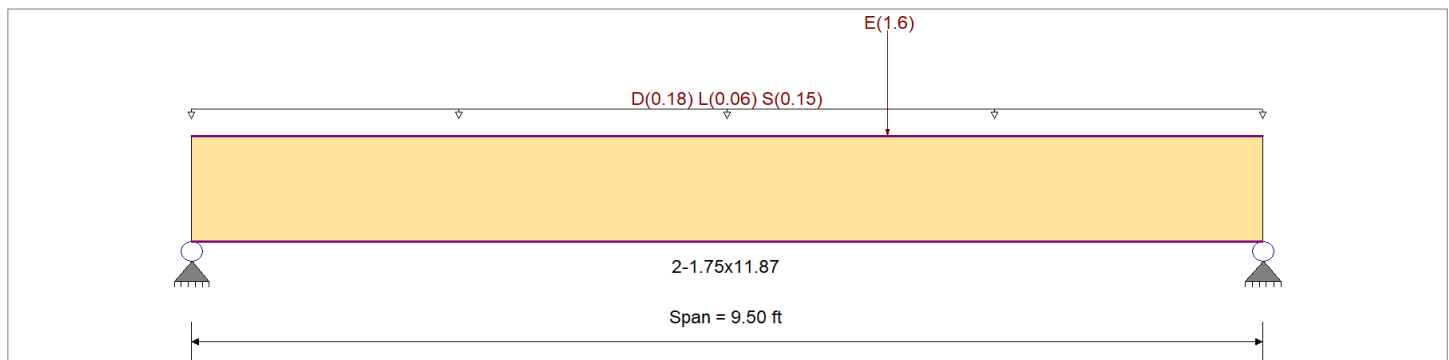
CODE REFERENCES

Calculations per NDS 2018, IBC 2021, ASCE 7-16

Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design	Fb +	3,120.0 psi	E : Modulus of Elasticity	
Load Combination : ASCE 7-16	Fb -	3,120.0 psi	Ebend- xx	2,000.0 ksi
	Fc - Prll	3,012.0 psi	Eminbend - xx	1,016.54 ksi
Wood Species : Trus Joist	Fc - Perp	900.0 psi		
Wood Grade : MicroLam LVL 2.0 E	Fv	342.0 psi		
	Ft	1,866.0 psi	Density	42.010 pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



Applied Loads

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

Beam self weight calculated and added to loading

Point Load : E = 1.60 k @ 6.170 ft

Uniform Load : D = 0.180, L = 0.060, S = 0.150, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.166 : 1	Maximum Shear Stress Ratio	=	0.128 : 1
Section used for this span		2-1.75x11.87	Section used for this span		2-1.75x11.87
fb: Actual	=	829.71 psi	fv: Actual	=	70.13 psi
F'b	=	4,999.11 psi	F'v	=	547.20 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	=	5.547ft	Location of maximum on span	=	8.529 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
Maximum Deflection					
Max Downward Transient Deflection		0.045 in Ratio = 2530 >=360	Span: 1 : E Only		
Max Upward Transient Deflection		0 in Ratio = 0 <360	n/a		
Max Downward Total Deflection		0.089 in Ratio = 1273 >=300	Span: 1 : +D+0.750L+0.750S+0.5250E+H		
Max Upward Total Deflection		0 in Ratio = 0 <300	n/a		

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios										Moment Values			Shear Values				
			M	V	CD	CM	C _t	CLx	C _F	C _{fu}	C _i	C _r	M	fb	F'b	V	fv	F'v		
+D+H	Length = 9.50 ft	1	0.112	0.085	0.90	1.00	1.00	1.00	1.001	1.00	1.00	1.00	2.17	316.2	2,812.0	0.00	0.00	0.0	0.0	307.8
+D+L+H	Length = 9.50 ft	1	0.133	0.101	1.00	1.00	1.00	1.00	1.001	1.00	1.00	1.00	2.84	414.9	3,124.4	0.00	0.00	0.0	0.0	342.0
+D+Lr+H	Length = 9.50 ft	1	0.081	0.061	1.25	1.00	1.00	1.00	1.001	1.00	1.00	1.00	2.17	316.2	3,905.6	0.00	0.00	0.0	0.0	427.5
+D+S+H	Length = 9.50 ft	1	0.157	0.119	1.15	1.00	1.00	1.00	1.001	1.00	1.00	1.00	3.86	563.0	3,593.1	0.00	0.00	0.0	0.0	393.3
+D+0.750Lr+0.750L+H						1.00	1.00	1.00	1.001	1.00	1.00	1.00			0.0	0.00	0.00	0.0	0.0	0.0

Wood Beam

Project File: Retaining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

(c) ENERCALC INC 1983-2023

DESCRIPTION: [B2-30] (SW #209)

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values		
			M	V	CD	CM	C _t	CLx	C _F	C _{fu}	C _i	C _r	M	fb	F ^b	V	fv
Length = 9.50 ft	1	0.100	0.076	1.25	1.00	1.00	1.00	1.001	1.00	1.00	1.00	2.68	390.2	3,905.6	0.90	32.3	427.5
+D+0.750L+0.750S+H														0.0	0.00	0.0	0.0
Length = 9.50 ft	1	0.160	0.121	1.15	1.00	1.00	1.00	1.001	1.00	1.00	1.00	3.94	575.4	3,593.1	1.32	47.7	393.3
+D+0.60W+H														0.0	0.00	0.0	0.0
Length = 9.50 ft	1	0.063	0.048	1.60	1.00	1.00	1.00	1.001	1.00	1.00	1.00	2.17	316.2	4,999.1	0.73	26.2	547.2
+D+0.750Lr+0.750L+0.450W+														0.0	0.00	0.0	0.0
Length = 9.50 ft	1	0.078	0.059	1.60	1.00	1.00	1.00	1.001	1.00	1.00	1.00	2.68	390.2	4,999.1	0.90	32.3	547.2
+D+0.750L+0.750S+0.450W+i														0.0	0.00	0.0	0.0
Length = 9.50 ft	1	0.115	0.087	1.60	1.00	1.00	1.00	1.001	1.00	1.00	1.00	3.94	575.4	4,999.1	1.32	47.7	547.2
+0.60D+0.60W+0.60H														0.0	0.00	0.0	0.0
Length = 9.50 ft	1	0.038	0.029	1.60	1.00	1.00	1.00	1.001	1.00	1.00	1.00	1.30	189.7	4,999.1	0.44	15.7	547.2
+D+0.70E+0.60H														0.0	0.00	0.0	0.0
Length = 9.50 ft	1	0.128	0.096	1.60	1.00	1.00	1.00	1.001	1.00	1.00	1.00	4.39	641.1	4,999.1	1.45	52.5	547.2
+D-0.70E+0.60H														0.0	0.00	0.0	0.0
Length = 9.50 ft	1	0.021	0.043	1.60	1.00	1.00	1.00	1.001	1.00	1.00	1.00	0.70	102.7	4,999.1	0.66	23.8	547.2
+D+0.750L+0.750S+0.5250E+														0.0	0.00	0.0	0.0
Length = 9.50 ft	1	0.160	0.123	1.60	1.00	1.00	1.00	1.001	1.00	1.00	1.00	5.47	797.5	4,999.1	1.87	67.4	547.2
+D+0.750L+0.750S-0.5250E+i														0.0	0.00	0.0	0.0
Length = 9.50 ft	1	0.078	0.068	1.60	1.00	1.00	1.00	1.001	1.00	1.00	1.00	2.67	389.4	4,999.1	1.03	37.1	547.2
+0.60D+0.70E+H														0.0	0.00	0.0	0.0
Length = 9.50 ft	1	0.105	0.077	1.60	1.00	1.00	1.00	1.001	1.00	1.00	1.00	3.61	525.9	4,999.1	1.16	42.0	547.2
+0.60D-0.70E+H														0.0	0.00	0.0	0.0
Length = 9.50 ft	1	0.036	0.037	1.60	1.00	1.00	1.00	1.001	1.00	1.00	1.00	1.24	180.5	4,999.1	0.56	20.3	547.2
+1.140D+0.70E														0.0	0.00	0.0	0.0
Length = 9.50 ft	1	0.136	0.103	1.60	1.00	1.00	1.00	1.001	1.00	1.00	1.00	4.67	681.4	4,999.1	1.56	56.1	547.2
+1.140D-0.70E														0.0	0.00	0.0	0.0
Length = 9.50 ft	1	0.028	0.046	1.60	1.00	1.00	1.00	1.001	1.00	1.00	1.00	0.96	139.7	4,999.1	0.70	25.1	547.2
+1.105D+0.750L+0.750S+0.52														0.0	0.00	0.0	0.0
Length = 9.50 ft	1	0.166	0.128	1.60	1.00	1.00	1.00	1.001	1.00	1.00	1.00	5.69	829.7	4,999.1	1.94	70.1	547.2
+1.105D+0.750L+0.750S-0.52														0.0	0.00	0.0	0.0
Length = 9.50 ft	1	0.084	0.073	1.60	1.00	1.00	1.00	1.001	1.00	1.00	1.00	2.89	421.7	4,999.1	1.10	39.8	547.2
+0.460D+0.70E														0.0	0.00	0.0	0.0
Length = 9.50 ft	1	0.097	0.070	1.60	1.00	1.00	1.00	1.001	1.00	1.00	1.00	3.33	485.6	4,999.1	1.06	38.3	547.2
+0.460D-0.70E														0.0	0.00	0.0	0.0
Length = 9.50 ft	1	0.044	0.040	1.60	1.00	1.00	1.00	1.001	1.00	1.00	1.00	1.51	220.8	4,999.1	0.60	21.7	547.2

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	0.0895	4.889		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	1.955	2.206
Max Upward from Load Combinations	1.955	2.206
Max Upward from Load Cases	0.913	1.039
Max Downward from all Load Conditions	-0.561	-1.039
Max Downward from Load Combinations		-0.180
Max Downward from Load Cases (Resis	-0.561	-1.039
+D+H	0.913	0.913
+D+L+H	1.198	1.198
+D+Lr+H	0.913	0.913

Wood Beam

Project File: Retaining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

(c) ENERCALC INC 1983-2023

DESCRIPTION: [B2-35] (SW #206)

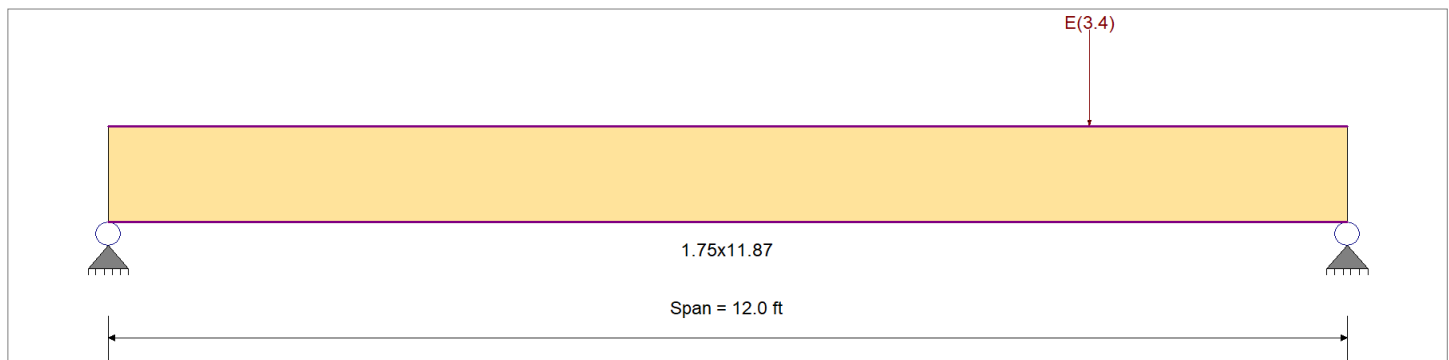
CODE REFERENCES

Calculations per NDS 2018, IBC 2021, ASCE 7-16

Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design	Fb +	3,120.0 psi	E : Modulus of Elasticity	
Load Combination : ASCE 7-16	Fb -	3,120.0 psi	Ebend- xx	2,000.0ksi
	Fc - Prll	3,012.0 psi	Eminbend - xx	1,016.54ksi
Wood Species : Trus Joist	Fc - Perp	900.0 psi		
Wood Grade : MicroLam LVL 2.0 E	Fv	342.0 psi		
	Ft	1,866.0 psi	Density	42.010pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



Applied Loads

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

Beam self weight calculated and added to loading

Point Load : E = 3.40 k @ 9.50 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio = 0.280 : 1	Maximum Shear Stress Ratio = 0.253 : 1
Section used for this span = 1.75x11.87	Section used for this span = 1.75x11.87
fb: Actual = 1,396.23psi	fv: Actual = 138.51 psi
F'b = 4,992.00psi	F'v = 547.20 psi
Load Combination = +1.140D+0.70E	Load Combination = +1.140D+0.70E
Location of maximum on span = 9.504ft	Location of maximum on span = 11.036 ft
Span # where maximum occurs = Span # 1	Span # where maximum occurs = Span # 1
Maximum Deflection	
Max Downward Transient Deflection = 0.261 in Ratio = 551 >=360	Span: 1 : E Only
Max Upward Transient Deflection = 0 in Ratio = 0 <360	n/a
Max Downward Total Deflection = 0.189 in Ratio = 763 >=300	Span: 1 : +D+0.70E+0.60H
Max Upward Total Deflection = 0 in Ratio = 0 <300	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios										Moment Values			Shear Values				
			M	V	CD	CM	C _t	CLx	C _F	C _{fu}	C _i	C _r	M	fb	F'b	V	fv	F'v		
+D+H	Length = 12.0 ft	1	0.011	0.007	0.90	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.11	31.8	2,808.0	0.0	0.00	0.0	0.0	307.8
+D+L+H	Length = 12.0 ft	1	0.010	0.006	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.11	31.8	3,120.0	0.0	0.00	0.0	0.0	342.0
+D+Lr+H	Length = 12.0 ft	1	0.008	0.005	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.11	31.8	3,900.0	0.0	0.00	0.0	0.0	427.5
+D+S+H	Length = 12.0 ft	1	0.009	0.006	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.11	31.8	3,588.0	0.0	0.00	0.0	0.0	393.3
+D+0.750Lr+0.750L+H	Length = 12.0 ft	1	0.008	0.005	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.11	31.8	3,900.0	0.0	0.00	0.0	0.0	427.5

Wood Beam

Project File: Retaining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

(c) ENERCALC INC 1983-2023

DESCRIPTION: [B2-35] (SW #206)

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values			
			M	V	CD	CM	C _t	CLx	C _F	C _{fu}	C _i	C _r	M	fb	F ^b	V	fv	F ^v
+D+0.750L+0.750S+H	Length = 12.0 ft	1	0.009	0.006	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.11	31.8	3,588.0	0.03	2.2	393.3
+D+0.60W+H	Length = 12.0 ft	1	0.006	0.004	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.11	31.8	4,992.0	0.03	2.2	547.2
+D+0.750Lr+0.750L+0.450W+	Length = 12.0 ft	1	0.006	0.004	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.11	31.8	4,992.0	0.03	2.2	547.2
+D+0.750L+0.750S+0.450W+i	Length = 12.0 ft	1	0.006	0.004	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.11	31.8	4,992.0	0.03	2.2	547.2
+0.60D+0.60W+0.60H	Length = 12.0 ft	1	0.004	0.002	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.07	19.1	4,992.0	0.02	1.3	547.2
+D+0.70E+0.60H	Length = 12.0 ft	1	0.279	0.253	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.78	1,393.3	4,992.0	1.91	138.2	547.2
+D-0.70E+0.60H	Length = 12.0 ft	1	0.271	0.246	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.63	1,351.3	4,992.0	1.86	134.5	547.2
+D+0.750L+0.750S+0.5250E+	Length = 12.0 ft	1	0.210	0.190	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.60	1,050.2	4,992.0	1.44	104.2	547.2
+D+0.750L+0.750S-0.5250E+i	Length = 12.0 ft	1	0.202	0.184	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.46	1,008.2	4,992.0	1.39	100.5	547.2
+0.60D+0.70E+H	Length = 12.0 ft	1	0.277	0.251	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.75	1,384.9	4,992.0	1.90	137.3	547.2
+0.60D-0.70E+H	Length = 12.0 ft	1	0.272	0.247	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.66	1,359.7	4,992.0	1.87	135.1	547.2
+1.140D+0.70E	Length = 12.0 ft	1	0.280	0.253	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.79	1,396.2	4,992.0	1.92	138.5	547.2
+1.140D-0.70E	Length = 12.0 ft	1	0.270	0.245	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.62	1,348.4	4,992.0	1.86	134.3	547.2
+1.105D+0.750L+0.750S+0.52	Length = 12.0 ft	1	0.211	0.191	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.61	1,052.4	4,992.0	1.45	104.4	547.2
+1.105D+0.750L+0.750S-0.52i	Length = 12.0 ft	1	0.202	0.183	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.45	1,006.0	4,992.0	1.39	100.3	547.2
+0.460D+0.70E	Length = 12.0 ft	1	0.277	0.250	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.74	1,382.0	4,992.0	1.90	137.0	547.2
+0.460D-0.70E	Length = 12.0 ft	1	0.273	0.247	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.67	1,362.7	4,992.0	1.87	135.3	547.2

Overall Maximum Deflections

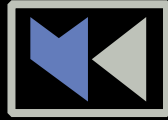
Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
E Only	1	0.2612	6.788		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	0.708	2.692
Max Upward from Load Combinations	0.532	1.921
Max Upward from Load Cases	0.708	2.692
Max Downward from all Load Conditio	-0.708	-2.692
Max Downward from Load Combinations	-0.474	-1.862
Max Downward from Load Cases (Resis	-0.708	-2.692
+D+H	0.036	0.036
+D+L+H	0.036	0.036
+D+Lr+H	0.036	0.036
+D+S+H	0.036	0.036



MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Seismic Shear Wall Calculations

McCullough Architects

O'Brien Residence

Mercer Island, WA

Parameters:

Single Family Home

Design Wind Speed: 100 MPH

Wind Exposure Category: C

Seismic Design Category: D

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

MULHERN & KULP STRUCTURAL ENGINEERING, INC.

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

Adam J. Cervantes, E.I.T. Staff Engineer II



SEISMIC CALCULATION - ASCE 7-16

M+K Project #: 244-25006
Engineer: AJC

Seismic Design Category:

User Inputs:

Site Class	D
Spectral Response Acceleration 0.2 sec, S_s	1.393
Spectral Response Acceleration 1.0 sec, S₁	0.485
Occupancy Category	II

Variables:

Site coefficient, F_a	1.00
Site coefficient, F_v	1.82

Calculated Values:

Maximum spectral response acceleration, S_{ms}	1.393
Maximum spectral response acceleration, S_{m1}	0.880
Design spectral response acceleration, S_{ds}	0.929
Design spectral response acceleration, S_{d1}	0.587
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)	8
Ht. abv base to highest level, h_n	30

Calculated Values:

Approximate Fundamental Period, T_a	0.257
T₀	0.126
T_s	0.632
Spectral Response Acc., S_s (g)	0.929

Site Class Assumption

No	Per ASCE 7-16 Section 11.4.3 the Site Class may be assumed to be D
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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	10.2	2505	10	13.1	38 k
2	11.2	2239	10	16.0	38 k
3	8.8	2404	10	8.0	32 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 = 109 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	0.143	0.143

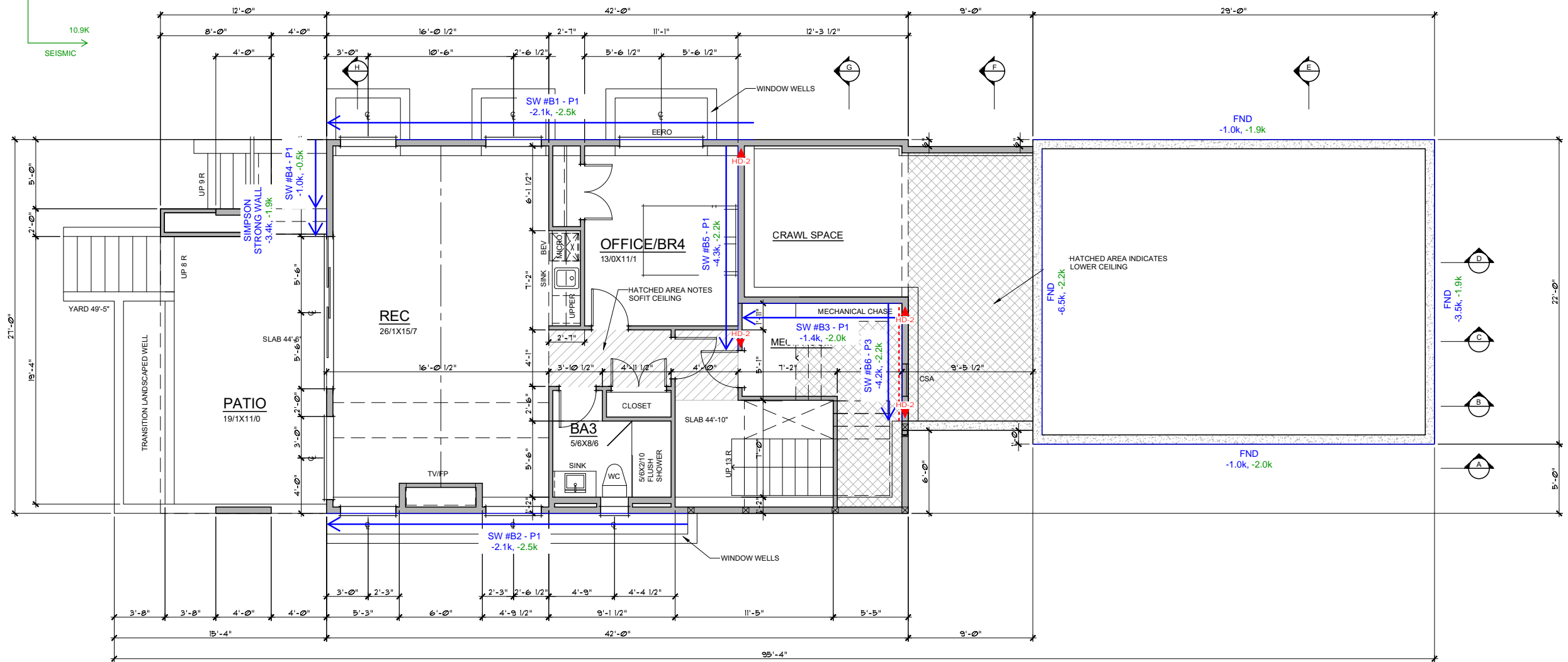
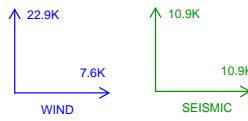
Base Shears:

	Ultimate Loads		x 0.7 =	Allowable Loads	
	Transverse	Longitudinal		Transverse	Longitudinal
	16 k	16 k		10.9 k	10.9 k

Story Shear Calculation:

Distribution exponent, **n** = 1.00

Level	Vert. Dist. Factor, C_{vt}	Ultimate Loads		x 0.7 =	Allowable Loads			
		Transverse Story Shear, F_x	Longitudinal Story Shear, F_y		Transverse Story Shear, F_x	Longitudinal Story Shear, F_y	Transverse Story Shear, F_x	Longitudinal Story Shear, F_y
1	0.179	2.8 k	2.8 k		1.9 k	10.9 k	1.9 k	10.9 k
2	0.377	5.9 k	5.9 k		4.1 k	8.9 k	4.1 k	8.9 k
3	0.444	6.9 k	6.9 k		4.8 k	4.8 k	4.8 k	4.8 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



9412 BASEMENT PLAN



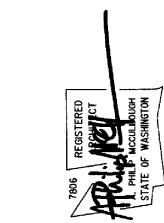
GENERAL NOTES:

- DIMENSION LINES ARE TO FACE OF STUD U.N.O.
- WINDOW SIZES & ROUGH OPENINGS TO BE VERIFIED BY CONTRACTOR.
- 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.
- WINDOW AND DOOR SIZES ARE DIMENSIONED IN FEET AND INCHES (E.G. 2828= 2'-8" W X 2'-8" H)
- EXTERIOR WALLS TO BE 2X6 STUDS PER STRUCTURAL. INTERIOR WALLS TO BE 2X4 STUDS PER STRUCTURAL.
- FIREBLOCK ALL PLUMBING PENETRATIONS AND STAIR RUNS PER IRC SEC. R302.11.
- ALL WOOD IN CONTACT WITH CONCRETE TO BE PRESSURE TREATED PER IRC SEC. R317.1.
- PROVIDE UNDER-STAIR PROTECTION (1/2" GWB) PER IRC SEC R302.7.
- 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.
- HOUSE/GARAGE DOOR SHALL BE 1-3/4" THICK WOOD SOLID CORE, OR 1-3/4" THICK SOLID OR HONEYCOMB CORE STEEL DOOR, OR 20-MINUTE RATED FIRE DOOR. PROVIDE SELF-CLOSING DEVICE.
- DUCTS IN THE GARAGE AND DUCTS PENETRATING THE WALLS AND CEILINGS SEPARATING THE DWELLING FROM THE GARAGE SHALL BE MIN. 26 GAUGE GALVANIZED STEEL.
- 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.
- PROVIDE HANDRAILS PER IRC SEC. R311.7.8. TOP OF HANDRAIL SHALL BE NOT LESS THAN 34" OR MORE THAN 38" ABOVE THE TREAD NOSING. HANDRAILS SHALL BE CONTINUOUS THE FULL LENGTH OF THE FLIGHT PER R311.7.8.2. THE HANDRAIL GRIP-SIZE SHALL BE PROVIDED PER R311.7.8.3.
- PROVIDE GUARDS (MIN. 36" HEIGHT) IN LOCATIONS PER IRC SEC. R312.
- 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 R1004.1.1.
- PROVIDE EXTERIOR AIR SUPPLY TO ANY FACTORY-BUILT FIREPLACE PER IRC SEC R1006.
- WATER HEATERS SHALL COMPLY WITH THE REQUIREMENTS OF THE IRC CH. 20 AND 28.
- INSTALL PER MANUFACTURERS SPECIFICATIONS, PROVIDING ALL SPECIFIED CLEARANCES & VENTILATION.
- WATER HEATERS SHALL BE ANCHORED OR STRAPPED IN THE UPPER ONE-THIRD AND IN THE LOWER ONE-THIRD OF THE APPLIANCE.
- ALL SHOWER AND TUB FIXTURES TO HAVE THERMOSTATIC CONTROL W/ 120" F. MAX. SETTING FOR THERMAL PROTECTION PER UPC 408.3 & 409.4.
- ALL KITCHEN, BATHROOM AND LAUNDRY EXHAUST TERMINATIONS TO EXIT THE STRUCTURE NOT LESS THAN 3 FEET FROM PROPERTY LINES & FROM OPERABLE OPENINGS INTO THE BUILDING AND NOT LESS THAN 10 FEET FROM MECHANICAL AIR INTAKES PER SRC M1504.3

PLAN KEY:

- INDICATES 110V SMOKE DET. PER I.R.C. 314.3 INTERCONNECTED W/ EMERGENCY BATTERY BACKUP } MAY BE COMBINED
- INDICATES CARBON MONOXIDE ALARM PER I.R.C. R315.1
- INDICATES HEAT ALARM PER I.R.C. R314.2.3
- INDICATES EXHAUST VENTILATION FAN. SEE "LOCAL EXHAUST" ON COVER SHEET FOR ADDITIONAL INFORMATION.
- INDICATES SHEAR WALL PER STRUCTURAL. SEE "TYPICAL EXTERIOR WALL SHEATHING SPECIFICATIONS" ON SHEET S-0.0.
- INDICATES HOLD DOWN PER STRUCTURAL NOTES, S-0.0
- SAFETY GLASS REQUIRED PER IRC R308

Date: 2025.03.18
Job No: 23-031
Drawn: NMIR
Approved: APM
Owner: Sean O'Brien



O'Brien Residence

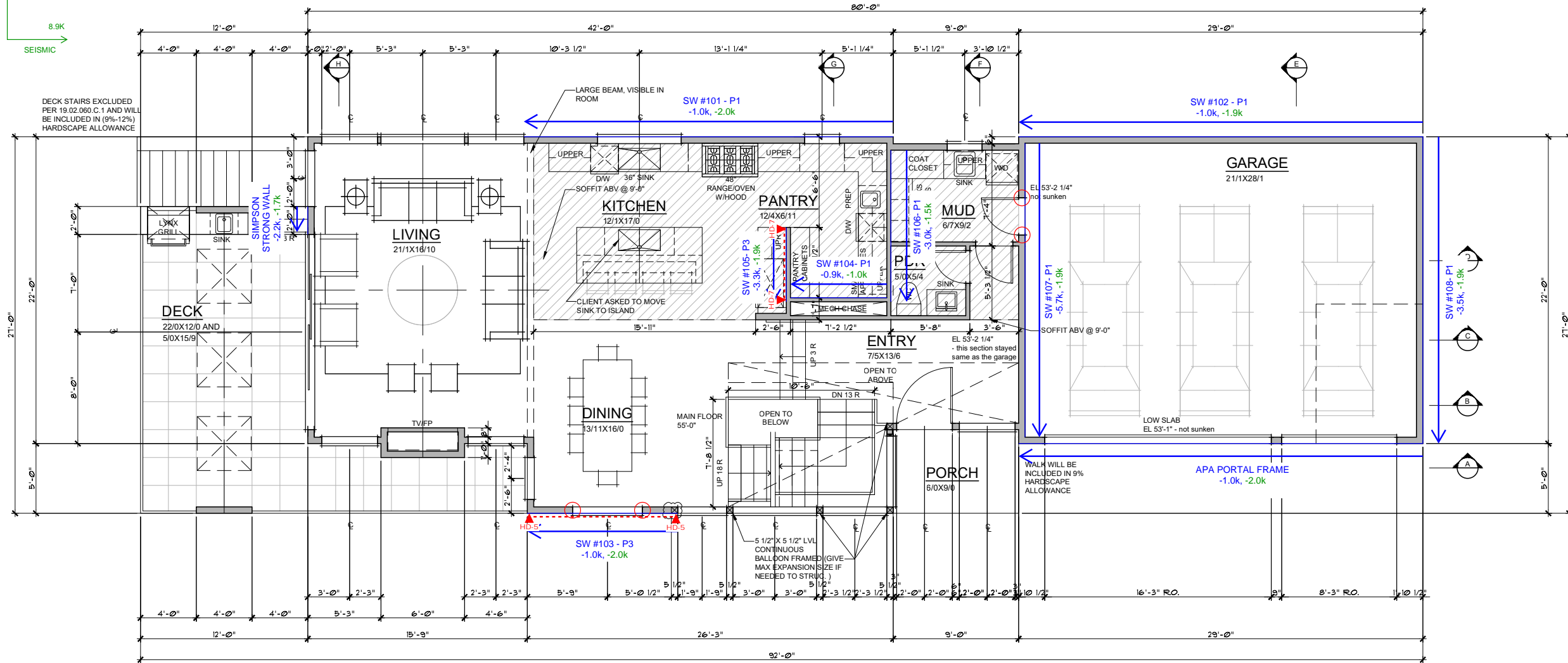
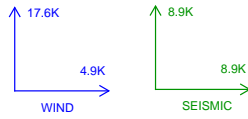
9412 SE 33rd st
Mercer Island, WA 98040

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Lower Floor Plan

A3



9412 MAIN FLOOR PLAN



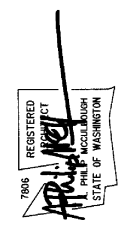
GENERAL NOTES:

- PLATE HEIGHT @ MAIN FLOOR IS 9'-1", U.N.O.
- DIMENSION LINES ARE TO FACE OF STUD U.N.O.
- WINDOW SIZES & ROUGH OPENINGS TO BE VERIFIED BY CONTRACTOR.
- 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 SPECS TO LOCATE FINAL ELEVATION OF THE HEAD HEIGHTS SO THAT ALL DOOR AND WINDOW TRIM ALIGN.
- WINDOW AND DOOR SIZES ARE DIMENSIONED IN FEET AND INCHES (E.G. 2828= 2'-8" W X 2'-8" H)
- EXTERIOR WALLS TO BE 2X6 STUDS AT 16" O.C., INTERIOR WALLS TO BE 2X4 STUDS AT 16" O.C., U.N.O.
- FIREBLOCK ALL PLUMBING PENETRATIONS AND STAIR RUNS PER IRC SEC. R302.11.
- SAFETY GLAZING PER IRC SEC. R308.4.
- ALL WOOD IN CONTACT WITH CONCRETE TO BE PRESSURE TREATED PER IRC SEC. R317.1.
- PROVIDE UNDER-STAIR PROTECTION (1/2" GWB) PER IRC SEC R302.7.
- 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.
- HOUSE/GARAGE DOOR SHALL BE 1-3/4" THICK WOOD SOLID CORE, OR 1-3/8" THICK SOLID OR HONEYCOMB CORE STEEL DOOR, OR 20-MINUTE RATED FIRE DOOR, PROVIDE SELF-CLOSING DEVICE.
- DUCTS IN THE GARAGE AND DUCTS PENETRATING THE WALLS AND CEILINGS SEPARATING THE DWELLING FROM THE GARAGE SHALL BE MIN. 26 GAUGE GALVANIZED STEEL.
- 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.
- PROVIDE HANDRAILS PER IRC SEC. R311.7.8. TOP OF HANDRAIL SHALL BE NOT LESS THAN 34" OR MORE THAN 38" ABOVE THE TREAD NOSINGS. HANDRAILS SHALL BE CONTINUOUS THE FULL LENGTH OF THE FLIGHT PER R311.7.8.2. THE HANDRAIL GRIP-SIZE SHALL BE PROVIDED PER R311.7.8.3.
- PROVIDE GUARDS (MIN. 36" HEIGHT) IN LOCATIONS PER IRC SEC. R312.
- 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 R1004.1.1.
- PROVIDE EXTERIOR AIR SUPPLY TO ANY FACTORY-BUILT FIREPLACE PER IRC SEC R1006.
- GAS FIRED WATER HEATERS SHALL COMPLY WITH THE REQUIREMENTS OF THE IRC CH. 20, 24, AND 28.
- INSTALL PER MANUFACTURERS SPECIFICATIONS, PROVIDING ALL SPECIFIED CLEARANCES.
- WATER HEATERS SHALL BE ANCHORED OR STRAPPED IN THE UPPER ONE-THIRD AND IN THE LOWER ONE-THIRD OF THE APPLIANCE.
- VENT TO OUTSIDE PER IRC CH. 18.
- ELEVATE IGNITION SOURCE 18" MIN.

PLAN KEY:

- INDICATES 110V SMOKE DET. PER I.R.C. 313.4 INTERCONNECTED W/ EMERGENCY BATTERY BACKUP
- INDICATES CARBON MONOXIDE ALARM PER I.R.C. R315.1
- INDICATES EXHAUST VENTILATION FAN PER COVER SHEET.
- INDICATES SAFETY GLAZING REQUIRED PER IRC SEC. R308.4
- INDICATES SHEAR WALL PER SCHEDULE, 14/S1.1
- INDICATES SHEAR WALL W/ FORCE TRANSFER PER 8/S1.2

Date:	2025.03.18
Job No:	23-031
Drawn:	NMR
Approved:	APM
Owner:	Sean O'Brien



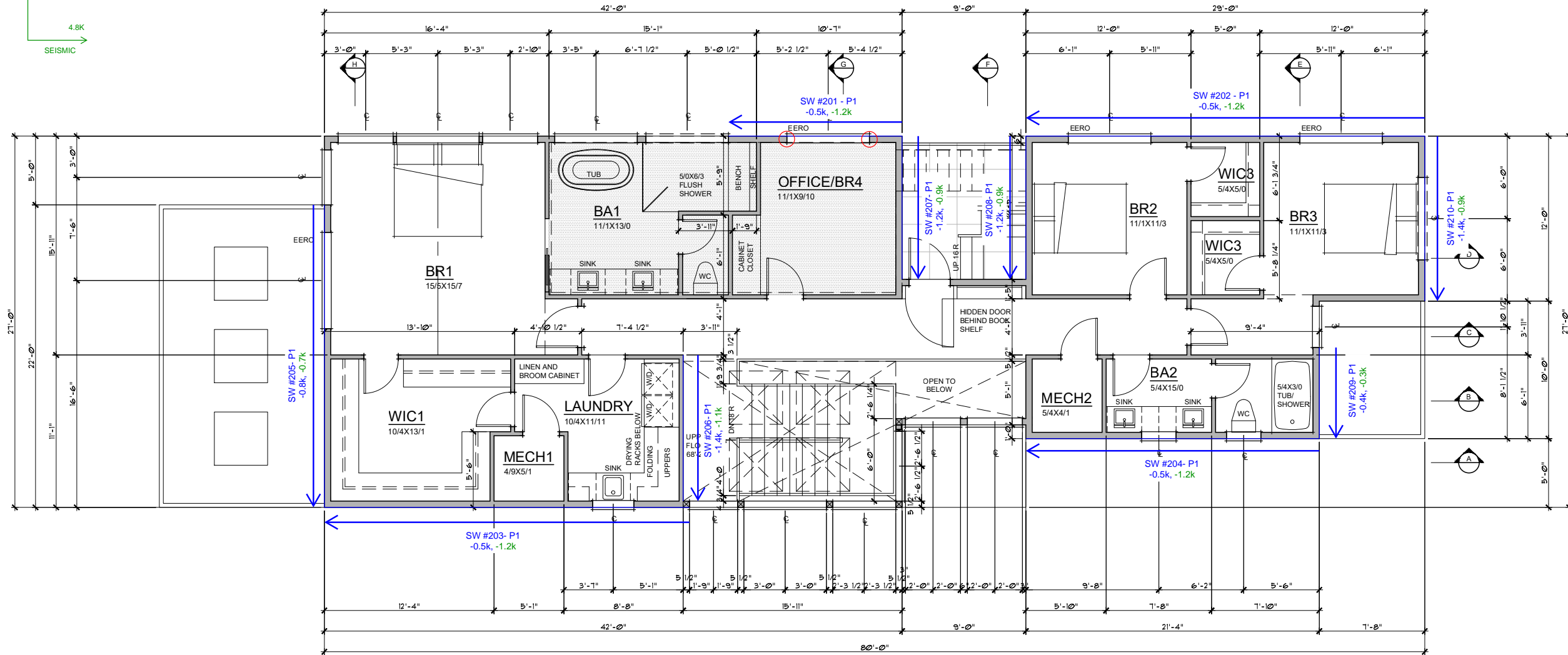
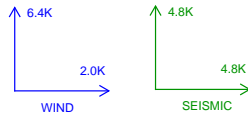
O'Brien Residence
 9412 SE 33rd st
 Mercer Island, WA 98040

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Main Floor Plan

A5



9412 UPPER FLOOR PLAN



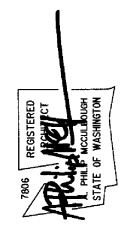
GENERAL NOTES:

- PLATE HEIGHT @ UPPER FLOOR IS 8'-1", U.N.O.
- DIMENSION LINES ARE TO FACE OF STUD U.N.O.
- WINDOW SIZES & ROUGH OPENINGS TO BE VERIFIED BY CONTRACTOR.
- WINDOW HEAD HEIGHT AT UPPER FLOOR IS 6'-8" ABOVE SUBFLOOR, U.N.O. IF NOMINAL DOOR AND WINDOW HEIGHTS ARE SIMILAR, COORDINATE WITH DOOR AND WINDOW SPECS TO LOCATE FINAL ELEVATION OF THE HEAD HEIGHTS SO THAT ALL DOOR AND WINDOW TRIM ALIGN.
- WINDOW AND DOOR SIZES ARE DIMENSIONED IN FEET AND INCHES (E.G. 2828= 2'-8" W X 2'-8" H)
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- SAFETY GLAZING PER IRC SEC. R308.4.
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- PROVIDE UNDER-STAIR PROTECTION (1/2" GWB) PER IRC SEC R302.7.
- 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.
- HOUSE/GARAGE DOOR SHALL BE 1-3/4" THICK WOOD SOLID CORE, OR 1-3/8" THICK SOLID OR HONEYCOMB CORE STEEL DOOR, OR 20-MINUTE RATED FIRE DOOR, PROVIDE SELF-CLOSING DEVICE.
- DUCTS IN THE GARAGE AND DUCTS PENETRATING THE WALLS AND CEILINGS SEPARATING THE DWELLING FROM THE GARAGE SHALL BE MIN. 26 GAUGE GALVANIZED STEEL.
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- ELEVATE IGNITION SOURCE 18" MIN.

PLAN KEY:

- INDICATES 110V SMOKE DET. PER I.R.C. 313.4 INTERCONNECTED W/ EMERGENCY BATTERY BACKUP
- INDICATES CARBON MONOXIDE ALARM PER I.R.C. R315.1
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- INDICATES SHEAR WALL PER SCHEDULE, 14/S1.1
- INDICATES SHEAR WALL W/ FORCE TRANSFER PER 8/S1.2

Date:	2025.03.18
Job No:	23-031
Drawn:	NMR
Approved:	APM
Revisions	
Comment	
Date:	2025.03.18
Job No:	23-031
Drawn:	NMR
Approved:	APM
Owner	Sean O'Brien



O'Brien Residence
 9412 SE 33rd st
 Mercer Island, WA 98040

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Upper Floor Plan
A7



Shearwall Design Summary

M+K Project #: 244-25006

Engineer: AJC

Shearwall 201: 2nd - Rear Ext. Wall @ Office/BR4

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 plf Overturning Moment k-ft Hold Down Design Load lbs
 DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required

Shearwall 202: 2nd - Rear Ext. Wall @ BR2/BR3

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 plf Overturning Moment k-ft Hold Down Design Load lbs
 DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall 203: 2nd - Front Ext. Wall @ WIC1/Laundry

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required

Shearwall 204: 2nd - Front Ext. Wall @ Mech/BA2

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall Design Summary

M+K Project #: 244-25006
Engineer: AJC

Shearwall 205: 2nd - Side Ext. Wall @ BR1

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required

Shearwall 206: 2nd - Side Int. Wall @ Laundry/Stairs

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity lbs

Shearwall Assembly Specification

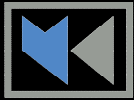
P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall Design Summary

M+K Project #: 244-25006
Engineer: AJC

Shearwall 207: 2nd - Side Ext. Wall @ Office/Roof Deck Stairs

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required

Shearwall 208: 2nd - Side Ext. Wall @ BR2/Roof Deck Stairs

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall Design Summary

M+K Project #: 244-25006
Engineer: AJC

Shearwall 209: 2nd - Side Ext. Wall @ BA2

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 plf Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required

Shearwall 210: 2nd - Side Ext. Wall @ BR3

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 plf Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall Design Summary

M+K Project #: 244-25006
Engineer: AJC

Shearwall 101: 1st - Rear Ext. Wall @ Kitchen

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required

Shearwall 102: 1st - Rear Ext. Wall @ Garage

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall Design Summary

M+K Project #: 244-25006
Engineer: AJC

Shearwall 103: 1st - Front Ext. Wall @ Dining

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 plf Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

Shearwall 104: 1st - Rear Int. Wall @ Entry/Powder

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 plf Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall Design Summary

M+K Project #: 244-25006
Engineer: AJC

Shearwall 105: 1st - Side Int. Wall @ Kitchen Fridge

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

SIMPSON MSTC66 STRAP TIE (24" END LENGTH)

Shearwall 106: 1st - Side Int. Wall @ Mud/Powder

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall Design Summary

M+K Project #: 244-25006
Engineer: AJC

Shearwall 107: 1st - Side Int. Wall @ Garage

Shearwall Properties:

Wall height, H	<input type="text" value="11.9"/> ft.	Max wall opening ht, H _c	<input type="text" value="8.0"/> ft.	Shearwall Assembly	<input type="text" value="P1"/>
Wall Length, L	<input type="text" value="21.1"/> ft.	Qualifying Wall Length, L	<input type="text" value="18.4"/> ft.		

Capacity Evaluation:

Total Shear Load on Wall	<input type="text" value="1900"/> lbs	<	Allowable Shearwall Capacity	<input type="text" value="4413"/> lbs
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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	<input type="text" value="323"/> plf	Overturning Moment	<input type="text" value="22.6"/> k-ft	Hold Down Design Load	<input type="text" value="0"/> lbs
DL at ends of wall	<input type="text" value="1200"/> lbs	Resistive Moment	<input type="text" value="68.4"/> k-ft	Hold down Capacity	<input type="text" value="0"/> lbs

Hold-down Specification

No Hold down Required

Shearwall 108: 1st - Side Ext. Wall @ Garage

Shearwall Properties:

Wall height, H	<input type="text" value="11.9"/> ft.	Max wall opening ht, H _c	<input type="text" value="0.0"/> ft.	Shearwall Assembly	<input type="text" value="P1"/>
Wall Length, L	<input type="text" value="22.0"/> ft.	Qualifying Wall Length, L	<input type="text" value="22.0"/> ft.		

Capacity Evaluation:

Total Shear Load on Wall	<input type="text" value="1900"/> lbs	<	Allowable Shearwall Capacity	<input type="text" value="5277"/> lbs
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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	<input type="text" value="200"/> plf	Overturning Moment	<input type="text" value="37.0"/> k-ft	Hold Down Design Load	<input type="text" value="0"/> lbs
DL at ends of wall	<input type="text" value="1040"/> lbs	Resistive Moment	<input type="text" value="50.2"/> k-ft	Hold down Capacity	<input type="text" value="0"/> lbs

Hold-down Specification

No Hold down Required



Shearwall Design Summary

M+K Project #: 244-25006
Engineer: AJC

Shearwall B1: - Rear Ext. Wall @ Rec/BR4

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required

Shearwall B2: - Front Ext. Wall @ Rec/BA3

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall Design Summary

M+K Project #: 244-25006
Engineer: AJC

Shearwall B3: - Rear Int. Wall @ Mech/Crawl

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required

Shearwall B4: - Side Ext. Wall @ Rec

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall Design Summary

M+K Project #: 244-25006
Engineer: AJC

Shearwall B5: - Side Int. Wall @ Office/Crawl

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

SIMPSON HDU4-SDS2.5 HOLDOWN

Shearwall B6: - Side Ext. Wall @ Mech/Crawl

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity lbs

Shearwall Assembly Specification

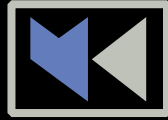
P3 - 1-side 7/16" OSB
fastened w/ 8d nails at 3"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

SIMPSON HDU4-SDS2.5 HOLDOWN



MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Wind Shear Wall Calculations

McCullough Architects

O'Brien Residence

Mercer Island, WA

Parameters:

Single Family Home

Design Wind Speed: 100 MPH

Wind Exposure Category: C

Seismic Design Category: D

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

MULHERN & KULP STRUCTURAL ENGINEERING, INC.

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

Adam J. Cervantes, E.I.T. Staff Engineer II



WIND DESIGN SUMMARY PER ASCE 7-16

M+K Project #: 244-25006
Engineer: AJC

Parameters:

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

0.60

Roof Geometry:

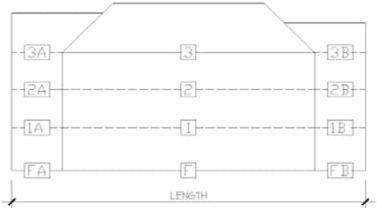
Trans. Roof Pitch	0.0	:12
Long. Roof Pitch	0.0	:12
Mean Roof Height, H	25.25	ft

Building Geometry:

length	80	ft
width	27	ft
Number of stories	2	

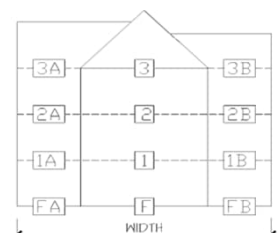
Transverse Direction (Perpendicular to Main Ridge Line)

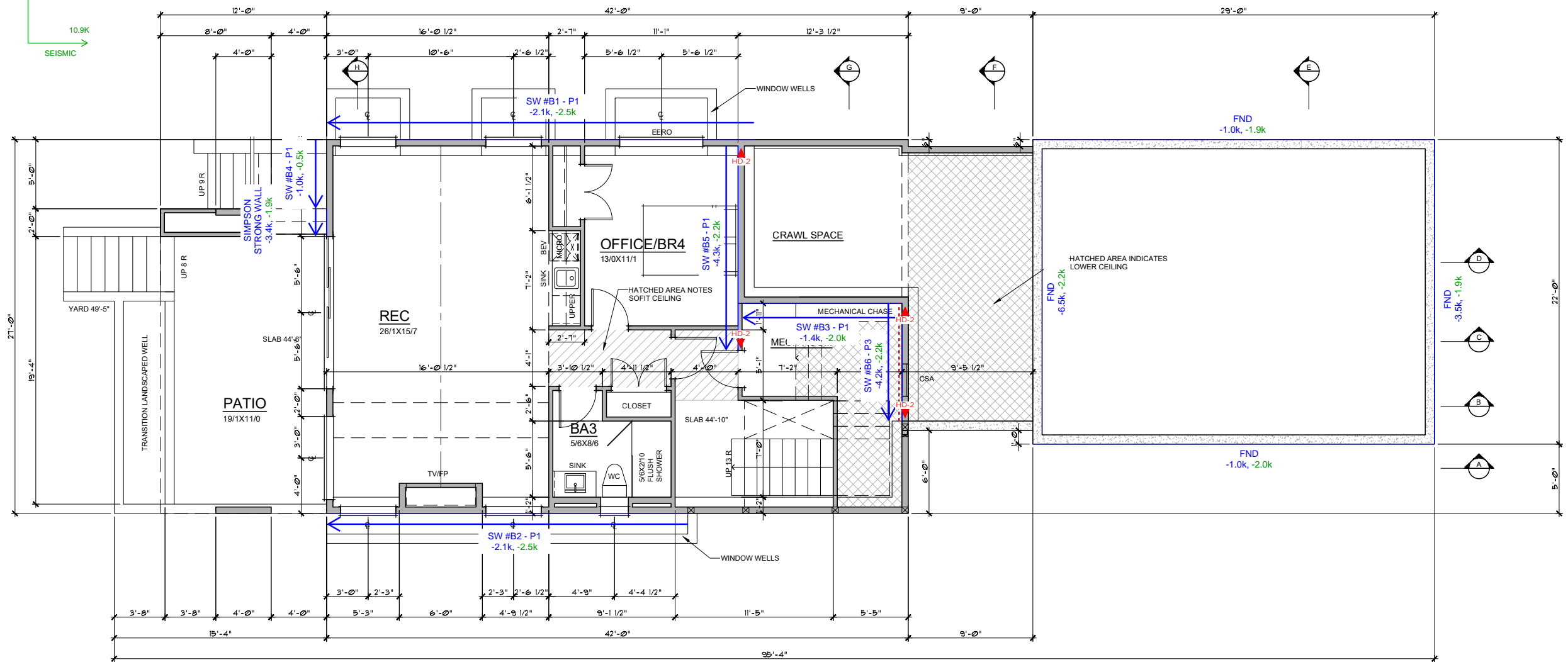
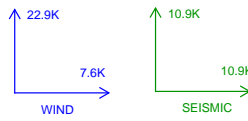
Diaphragm Level	Floor-to-Floor Height	Roof Surface	Tributary Design Areas:			sq ft	Tributary Design Loads: (0.6W)			kips	
			Section A	O	B		Section A	O	B		
2	10.1 ft	Roof Surface	0	0	0	sq ft	Story Shear	0.00	6.43	0.00	kips
		Wall surface	0	488	0	sq ft	Total Shear	0.00	6.43	0.00	kips
1	9 ft	Roof Surface	0	0	0	sq ft	Story Shear	0.00	11.21	0.00	kips
		Wall surface	0	876	0	sq ft	Total Shear	0.00	17.64	0.00	kips
FND		Roof Surface	0	0	0	sq ft	Story Shear	0.00	5.24	0.00	kips
		Wall surface	0	410	0	sq ft	Total Shear	0.00	22.89	0.00	kips



Longitudinal Direction (Parallel to Main Ridge Line)

Diaphragm Level	Floor-to-Floor Height	Roof Surface	Tributary Design Areas:			sq ft	Tributary Design Loads: (0.6W)			kips	
			Section A	O	B		Section A	O	B		
2	10.1 ft	Roof Surface	0	0	0	sq ft	Story Shear	0.00	2.03	0.00	kips
		Wall surface	0	192	0	sq ft	Total Shear	0.00	2.03	0.00	kips
1	9 ft	Roof Surface	0	0	0	sq ft	Story Shear	0.00	2.88	0.00	kips
		Wall surface	0	283	0	sq ft	Total Shear	0.00	4.91	0.00	kips
FND		Roof Surface	0	0	0	sq ft	Story Shear	0.00	2.67	0.00	kips
		Wall surface	0	262	0	sq ft	Total Shear	0.00	7.58	0.00	kips





9412 BASEMENT PLAN



GENERAL NOTES:

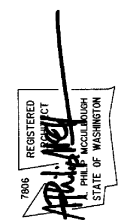
- DIMENSION LINES ARE TO FACE OF STUD U.N.O.
- WINDOW SIZES & ROUGH OPENINGS TO BE VERIFIED BY CONTRACTOR.
- IF NOMINAL DOOR AND WINDOW HEIGHTS ARE SIMILAR, COORDINATE WITH DOOR AND WINDOW SPEC'S TO LOCATE FINAL ELEVATION OF THE HEAD HEIGHTS SO THAT ALL DOOR AND WINDOW TRIM ALIGN.
- WINDOW AND DOOR SIZES ARE DIMENSIONED IN FEET AND INCHES (E.G. 2828= 2'-8" W X 2'-8" H)
- EXTERIOR WALLS TO BE 2X6 STUDS PER STRUCTURAL. INTERIOR WALLS TO BE 2X4 STUDS PER STRUCTURAL.
- FIREBLOCK ALL PLUMBING PENETRATIONS AND STAIR RUNS PER IRC SEC. R302.11.
- ALL WOOD IN CONTACT WITH CONCRETE TO BE PRESSURE TREATED PER IRC SEC. R317.1.
- PROVIDE UNDER-STAIR PROTECTION (1/2" GWB) PER IRC SEC R302.7.
- 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.
- HOUSE/GARAGE DOOR SHALL BE 1-3/4" THICK WOOD SOLID CORE, OR 1-3/4" THICK SOLID OR HONEYCOMB CORE STEEL DOOR, OR 20-MINUTE RATED FIRE DOOR. PROVIDE SELF-CLOSING DEVICE.
- DUCTS IN THE GARAGE AND DUCTS PENETRATING THE WALLS AND CEILINGS SEPARATING THE DWELLING FROM THE GARAGE SHALL BE MIN. 26 GAUGE GALVANIZED STEEL.
- 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.
- PROVIDE HANDRAILS PER IRC SEC. R311.7.8. TOP OF HANDRAIL SHALL BE NOT LESS THAN 34" OR MORE THAN 38" ABOVE THE TREAD NOSING. HANDRAILS SHALL BE CONTINUOUS THE FULL LENGTH OF THE FLIGHT PER R311.7.8.2. THE HANDRAIL GRIP-SIZE SHALL BE PROVIDED PER R311.7.8.3.
- PROVIDE GUARDS (MIN. 36" HEIGHT) IN LOCATIONS PER IRC SEC. R312.
- 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 R1004.1.1.
- PROVIDE EXTERIOR AIR SUPPLY TO ANY FACTORY-BUILT FIREPLACE PER IRC SEC R1006.
- WATER HEATERS SHALL COMPLY WITH THE REQUIREMENTS OF THE IRC CH. 20 AND 28.
- INSTALL PER MANUFACTURERS SPECIFICATIONS, PROVIDING ALL SPECIFIED CLEARANCES & VENTILATION.
- WATER HEATERS SHALL BE ANCHORED OR STRAPPED IN THE UPPER ONE-THIRD AND IN THE LOWER ONE-THIRD OF THE APPLIANCE.
- ALL SHOWER AND TUB FIXTURES TO HAVE THERMOSTATIC CONTROL W/ 120" F. MAX. SETTING FOR THERMAL PROTECTION PER UPC 408.3 & 409.4.
- ALL KITCHEN, BATHROOM AND LAUNDRY EXHAUST TERMINATIONS TO EXIT THE STRUCTURE NOT LESS THAN 3 FEET FROM PROPERTY LINES & FROM OPERABLE OPENINGS INTO THE BUILDING AND NOT LESS THAN 10 FEET FROM MECHANICAL AIR INTAKES PER SRC M1504.3

PLAN KEY:

- INDICATES 110V SMOKE DET. PER I.R.C. 314.3 INTERCONNECTED W/ EMERGENCY BATTERY BACKUP
- INDICATES CARBON MONOXIDE ALARM PER I.R.C. R315.1
- INDICATES HEAT ALARM PER I.R.C. R314.2.3
- INDICATES EXHAUST VENTILATION FAN. SEE "LOCAL EXHAUST" ON COVER SHEET FOR ADDITIONAL INFORMATION.
- INDICATES SHEAR WALL PER STRUCTURAL. SEE "TYPICAL EXTERIOR WALL SHEATHING SPECIFICATIONS" ON SHEET S-0.0.
- INDICATES HOLD DOWN PER STRUCTURAL NOTES, S-0.0
- SAFETY GLASS REQUIRED PER IRC R308

Date: 2025.03.18
Job No: 23-031
Drawn: NMR
Approved: APM

Owner
Sean O'Brien



O'Brien Residence

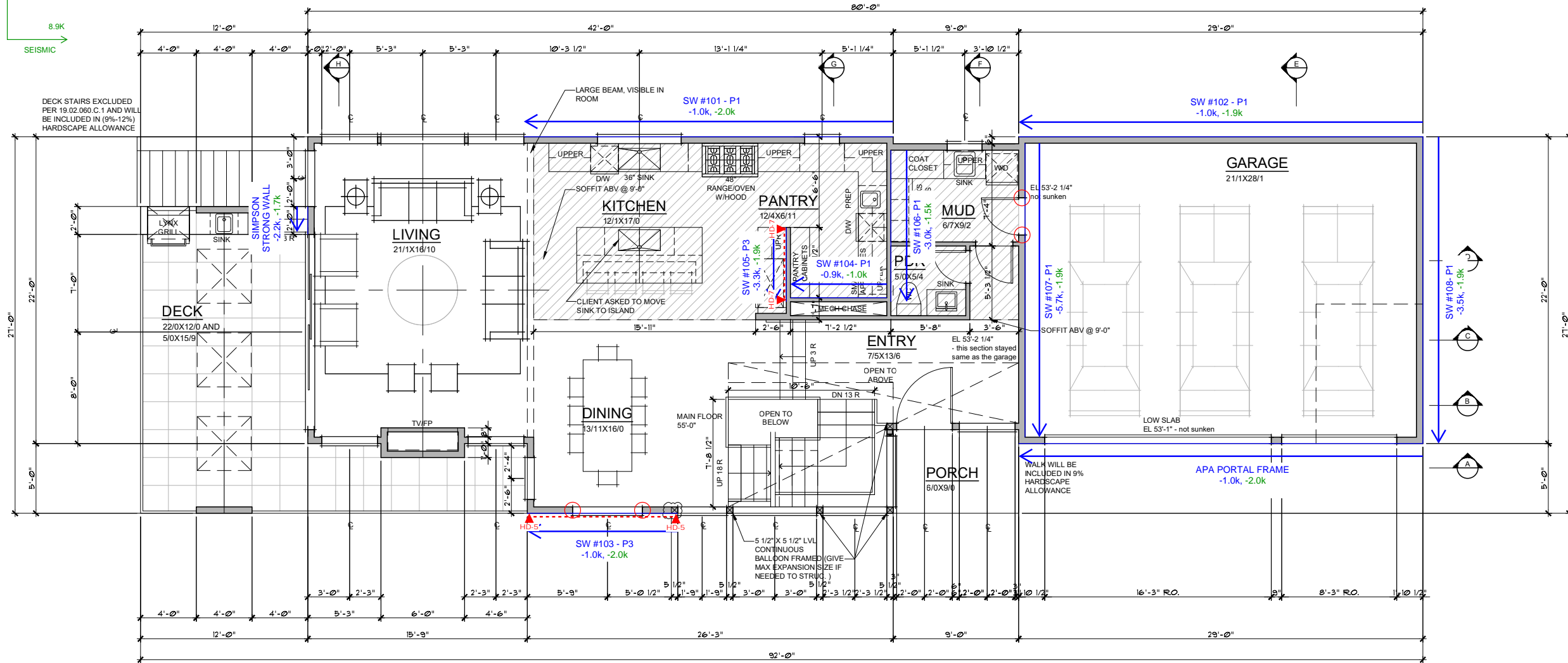
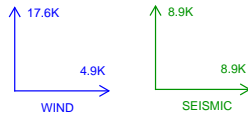
9412 SE 33rd st
Mercer Island, WA 98040

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OR SUBMITTAL

approval stamp

Lower Floor
Plan

A3



9412 MAIN FLOOR PLAN



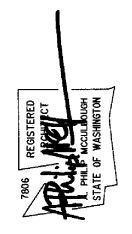
GENERAL NOTES:

- PLATE HEIGHT @ MAIN FLOOR IS 9'-1", U.N.O.
- DIMENSION LINES ARE TO FACE OF STUD U.N.O.
- WINDOW SIZES & ROUGH OPENINGS TO BE VERIFIED BY CONTRACTOR.
- 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 SPECS TO LOCATE FINAL ELEVATION OF THE HEAD HEIGHTS SO THAT ALL DOOR AND WINDOW TRIM ALIGN.
- WINDOW AND DOOR SIZES ARE DIMENSIONED IN FEET AND INCHES (E.G. 2828= 2'-8" W X 2'-8" H)
- EXTERIOR WALLS TO BE 2X6 STUDS AT 16" O.C., INTERIOR WALLS TO BE 2X4 STUDS AT 16" O.C., U.N.O.
- FIREBLOCK ALL PLUMBING PENETRATIONS AND STAIR RUNS PER IRC SEC. R302.11.
- SAFETY GLAZING PER IRC SEC. R308.4.
- ALL WOOD IN CONTACT WITH CONCRETE TO BE PRESSURE TREATED PER IRC SEC. R317.1.
- PROVIDE UNDER-STAIR PROTECTION (1/2" GWB) PER IRC SEC R302.7.
- 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.
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- DUCTS IN THE GARAGE AND DUCTS PENETRATING THE WALLS AND CEILINGS SEPARATING THE DWELLING FROM THE GARAGE SHALL BE MIN. 26 GAUGE GALVANIZED STEEL.
- 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.
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- PROVIDE EXTERIOR AIR SUPPLY TO ANY FACTORY-BUILT FIREPLACE PER IRC SEC R1006.
- GAS FIRED WATER HEATERS SHALL COMPLY WITH THE REQUIREMENTS OF THE IRC CH. 20, 24, AND 28.
- INSTALL PER MANUFACTURERS SPECIFICATIONS, PROVIDING ALL SPECIFIED CLEARANCES.
- WATER HEATERS SHALL BE ANCHORED OR STRAPPED IN THE UPPER ONE-THIRD AND IN THE LOWER ONE-THIRD OF THE APPLIANCE.
- VENT TO OUTSIDE PER IRC CH. 18.
- ELEVATE IGNITION SOURCE 18" MIN.

PLAN KEY:

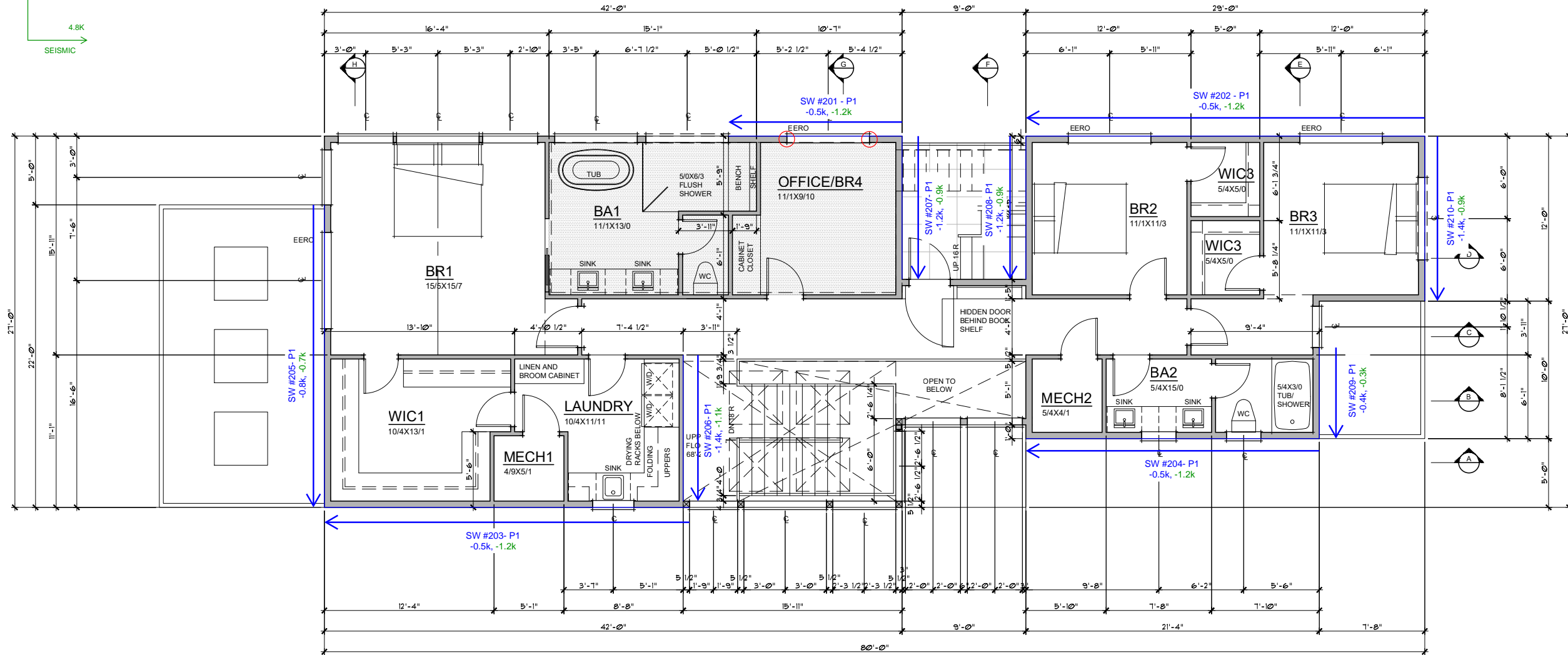
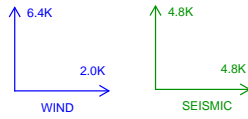
- INDICATES 110V SMOKE DET. PER I.R.C. 313.4 INTERCONNECTED W/ EMERGENCY BATTERY BACKUP
- INDICATES CARBON MONOXIDE ALARM PER I.R.C. R315.1
- INDICATES EXHAUST VENTILATION FAN PER COVER SHEET.
- INDICATES SAFETY GLAZING REQUIRED PER IRC SEC. R308.4
- INDICATES SHEAR WALL PER SCHEDULE, 14/S1.1
- INDICATES SHEAR WALL W/ FORCE TRANSFER PER 8/S1.2

Date:	2025.03.18
Job No:	23-031
Drawn:	NMR
Approved:	APM
Owner:	Sean O'Brien



O'Brien Residence
 9412 SE 33rd st
 Mercer Island, WA 98040

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 OR SUBMITTAL



9412 UPPER FLOOR PLAN



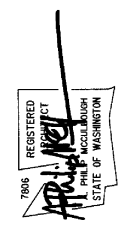
GENERAL NOTES:

- PLATE HEIGHT @ UPPER FLOOR IS 8'-1", U.N.O.
- DIMENSION LINES ARE TO FACE OF STUD U.N.O.
- WINDOW SIZES & ROUGH OPENINGS TO BE VERIFIED BY CONTRACTOR.
- WINDOW HEAD HEIGHT AT UPPER FLOOR IS 6'-8" ABOVE SUBFLOOR, U.N.O. IF NOMINAL DOOR AND WINDOW HEIGHTS ARE SIMILAR, COORDINATE WITH DOOR AND WINDOW SPECS TO LOCATE FINAL ELEVATION OF THE HEAD HEIGHTS SO THAT ALL DOOR AND WINDOW TRIM ALIGN.
- WINDOW AND DOOR SIZES ARE DIMENSIONED IN FEET AND INCHES (E.G. 2828= 2'-8"W X 2'-8"H)
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- PROVIDE UNDER-STAIR PROTECTION (1/2" GWB) PER IRC SEC R302.7.
- 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.
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- PROVIDE EXTERIOR AIR SUPPLY TO ANY FACTORY-BUILT FIREPLACE PER IRC SEC R1006.
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- WATER HEATERS SHALL BE ANCHORED OR STRAPPED IN THE UPPER ONE-THIRD AND IN THE LOWER ONE-THIRD OF THE APPLIANCE.
- VENT TO OUTSIDE PER IRC CH. 18.
- ELEVATE IGNITION SOURCE 18" MIN.

PLAN KEY:

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- INDICATES SHEAR WALL W/ FORCE TRANSFER PER 8/S1.2

Date:	2025.03.18
Job No:	23-031
Drawn:	NMR
Approved:	APM
Owner:	Sean O'Brien



O'Brien Residence
 9412 SE 33rd st
 Mercer Island, WA 98040

PRELIMINARY NOT FOR CONSTRUCTION OR SUBMITTAL

approval stamp

Upper Floor Plan
A7



Shearwall Design Summary

M+K Project #: 244-25006

Engineer: AJC

Shearwall 201: 2nd - Rear Ext. Wall @ Office/BR4

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 plf Overturning Moment k-ft Hold Down Design Load lbs
 DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required

Shearwall 202: 2nd - Rear Ext. Wall @ BR2/BR3

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 plf Overturning Moment k-ft Hold Down Design Load lbs
 DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall Design Summary

M+K Project #: 244-25006
Engineer: AJC

Shearwall 203: 2nd - Front Ext. Wall @ WIC1/Laundry

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required

Shearwall 204: 2nd - Front Ext. Wall @ Mech/BA2

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall Design Summary

M+K Project #: 244-25006
Engineer: AJC

Shearwall 205: 2nd - Side Ext. Wall @ BR1

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required

Shearwall 206: 2nd - Side Int. Wall @ Laundry/Stairs

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity lbs

Shearwall Assembly Specification

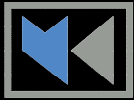
P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall Design Summary

M+K Project #: 244-25006
Engineer: AJC

Shearwall 207: 2nd - Side Ext. Wall @ Office/Roof Deck Stairs

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required

Shearwall 208: 2nd - Side Ext. Wall @ BR2/Roof Deck Stairs

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall Design Summary

M+K Project #: 244-25006
Engineer: AJC

Shearwall 209: 2nd - Side Ext. Wall @ BA2

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 plf Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required

Shearwall 210: 2nd - Side Ext. Wall @ BR3

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 plf Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall Design Summary

M+K Project #: 244-25006
Engineer: AJC

Shearwall 101: 1st - Rear Ext. Wall @ Kitchen

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required

Shearwall 102: 1st - Rear Ext. Wall @ Garage

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall Design Summary

M+K Project #: 244-25006
Engineer: AJC

Shearwall 103: 1st - Front Ext. Wall @ Dining

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 plf Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required

Shearwall 104: 1st - Rear Int. Wall @ Entry/Powder

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 plf Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall Design Summary

M+K Project #: 244-25006
Engineer: AJC

Shearwall 105: 1st - Side Int. Wall @ Kitchen Fridge

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

SIMPSON MSTC66 STRAP TIE (24" END LENGTH)

Shearwall 106: 1st - Side Int. Wall @ Mud/Powder

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall Design Summary

M+K Project #: 244-25006
Engineer: AJC

Shearwall 107: 1st - Side Int. Wall @ Garage

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required

Shearwall 108: 1st - Side Ext. Wall @ Garage

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall Design Summary

M+K Project #: 244-25006
Engineer: AJC

Shearwall B1: - Rear Ext. Wall @ Rec/BR4

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required

Shearwall B2: - Front Ext. Wall @ Rec/BA3

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall B3: - Rear Int. Wall @ Mech/Crawl

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required

Shearwall B4: - Side Ext. Wall @ Rec

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

No Hold down Required



Shearwall Design Summary

M+K Project #: 244-25006
Engineer: AJC

Shearwall B5: - Side Int. Wall @ Office/Crawl

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

SIMPSON HDU4-SDS2.5 HOLDOWN

Shearwall B6: - Side Ext. Wall @ Mech/Crawl

Shearwall Properties:

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

Capacity Evaluation:

Total Shear Load on Wall lbs < Allowable Shearwall Capacity 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 pl f Overturning Moment k-ft Hold Down Design Load lbs
DL at ends of wall lbs Resistive Moment k-ft Hold down Capacity lbs

Hold-down Specification

SIMPSON HDU4-SDS2.5 HOLDOWN

Cantilevered Retaining Wall

Project File: Reataining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

(c) ENERCALC INC 1983-2023

DESCRIPTION: 7'-0" Unbalanced Fill

Code Reference

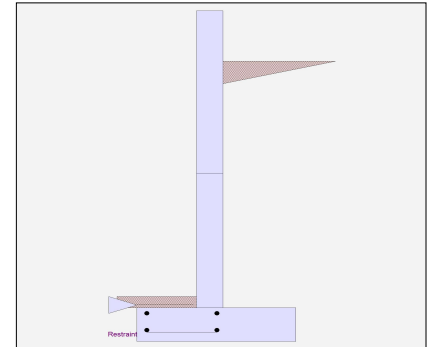
Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	7.33 ft
Wall height above soil	=	1.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	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	=	7.000
(Multiplier used on soil density)		

Lateral Load Applied to Stem

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

Uniform Seismic Force	=	58.310
Total Seismic Force	=	485.722

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

1/3 SOIL BEARING INCREASE ALLOWED WHEN RESISTING SEISMIC LOADING. <2667PSF OK

Cantilevered Retaining Wall

Project File: Reataining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

(c) ENERCALC INC 1983-2023

DESCRIPTION: 7'-0" Unbalanced Fill

Design Summary

Wall Stability Ratios

Overturning	=	1.55	OK
Slab Resists All Sliding !			
Global Stability	=	1.80	
Total Bearing Load	=	3,552 lbs	
...resultant ecc.	=	13.54 in	
Eccentricity outside middle third			
Soil Pressure @ Toe	=	2,306 psf	NG
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Exceeds Allowable!			
ACI Factored @ Toe	=	3,228 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	19.4 psi	OK
Footing Shear @ Heel	=	16.5 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,554.3 lbs
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Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing pressures.

Load Factors

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

Stem Construction

Design Height Above Ftg

Wall Material Above "Ht"	=	Concrete
Design Method	=	SD
Thickness	=	8.00
Rebar Size	=	# 5
Rebar Spacing	=	16.00
Rebar Placed at	=	Edge

Design Data

fb/FB + fa/Fa	=	0.107	0.444
Total Force @ Section			
Service Level	lbs =		
Strength Level	lbs =	504.7	1,931.8
Moment....Actual			
Service Level	ft-# =		
Strength Level	ft-# =	667.9	5,242.2
Moment.....Allowable	ft-# =	6,186.6	11,799.2
Shear.....Actual			
Service Level	psi =		
Strength Level	psi =	6.8	26.0
Shear.....Allowable	psi =	43.9	55.3
Anet (Masonry)	in2 =		
Wall Weight	psf =	100.0	100.0
Rebar Depth 'd'	in =	6.19	6.19

Masonry Data

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

Concrete Data

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

2nd	Bottom		
Stem OK	Stem OK		
4.00	0.00		
Concrete	Concrete		
SD	SD	SD	SD

Cantilevered Retaining Wall

Project File: Reataining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

(c) ENERCALC INC 1983-2023

DESCRIPTION: 7'-0" Unbalanced Fill

Concrete Stem Rebar Area Details

	<u>Vertical Reinforcing</u>	<u>Horizontal Reinforcing</u>
2nd Stem		
As (based on applied moment) :	0.0253 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	
	=====	
Required Area :	0.1728 in2/ft	Horizontal Reinforcing Options :
Provided Area :	0.2325 in2/ft	<u>One layer of :</u> <u>Two layers of :</u>
Maximum Area :	0.8382 in2/ft	#4@ 13.89 in #4@ 27.78 in
		#5@ 21.53 in #5@ 43.06 in
		#6@ 30.56 in #6@ 61.11 in

	<u>Vertical Reinforcing</u>	<u>Horizontal Reinforcing</u>
Bottom Stem		
As (based on applied moment) :	0.1985 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	
	=====	
Required Area :	0.1985 in2/ft	Horizontal Reinforcing Options :
Provided Area :	0.465 in2/ft	<u>One layer of :</u> <u>Two layers of :</u>
Maximum Area :	0.8382 in2/ft	#4@ 13.89 in #4@ 27.78 in
		#5@ 21.53 in #5@ 43.06 in
		#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
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f'c =	2,500 psi	Fy = 60,000 psi
Footing Concrete Density	=	150.00 pcf
Min. As %	=	0.0018
Cover @ Top	2.00	@ Btm.= 3.00 in

Footing Design Results

	<u>Toe</u>	<u>Heel</u>
Factored Pressure	= 3,228	0 psf
Mu' : Upward	= 2,938	19 ft-#
Mu' : Downward	= 252	1,929 ft-#
Mu: Design	= 2,686 OK	1,910 ft-#
phiMn	= 17,034	2,500 ft-#
Actual 1-Way Shear	= 19.41	16.49 psi
Allow 1-Way Shear	= 49.38	40.00 psi
Toe Reinforcing	= # 5 @ 8.00 in	
Heel Reinforcing	= None Spec'd	
Key Reinforcing	= None Spec'd	
Footing Torsion, Tu	=	0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

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

Heel: $\phi M_n = \phi * 5 * \lambda * \sqrt{f_c} * S_m$

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
<u>If one layer of horizontal bars:</u>		<u>If two layers of horizontal bars:</u>
#4@ 9.26 in		#4@ 18.52 in
#5@ 14.35 in		#5@ 28.70 in
#6@ 20.37 in		#6@ 40.74 in

Cantilevered Retaining Wall

Project File: Retaining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

(c) ENERCALC INC 1983-2023

DESCRIPTION: 7'-0" Unbalanced Fill

Summary of Overturning & Resisting Forces & Moments

ItemOVERTURNING.....			RESISTING.....		
	Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	1,214.3	2.78	3,371.7	Soil Over HL (ab. water tbl)	1,478.2	3.08	4,557.8
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		3.08	4,557.8
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 =	55.0	0.75	41.3
Seismic Earth Load =	340.0	4.17	1,416.1	Surcharge Over Toe =			
=				Stem Weight(s) =	883.0	1.83	1,618.8
				Earth @ Stem Transitions =			
Total	= 1,554.3	O.T.M. =	4,787.8	Footing Weight =	600.0	2.00	1,200.0
				Key Weight =			
				Vert. Component =			
Resisting/Overturning Ratio		= 1.55		Total =	3,016.2 lbs	R.M.=	7,417.9
Vertical Loads used for Soil Pressure =		3,552.2 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 NOT considered in the calculation of Sliding Resistance.

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci
 Horizontal Defl @ Top of Wall (approximate only) 0.141 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.

Cantilevered Retaining Wall

Project File: Reataining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

(c) ENERCALC INC 1983-2023

DESCRIPTION: 7'-0" Unbalanced Fill

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 = 8.27 in
As Provided = 0.4650 in²/ft
As Required = 0.2475 in²/ft

Cantilevered Retaining Wall

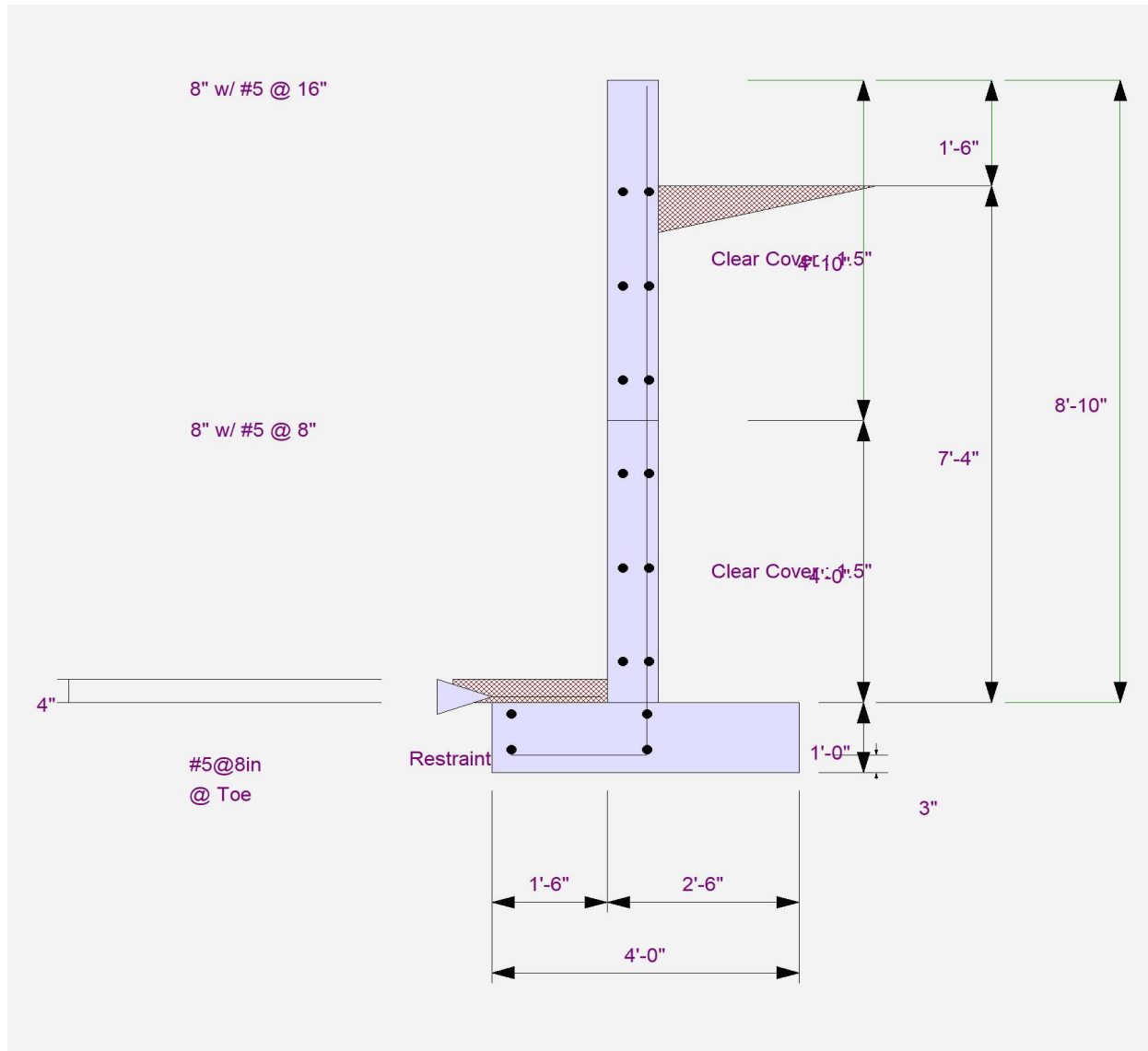
Project File: Retaining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

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DESCRIPTION: 7'-0" Unbalanced Fill



Cantilevered Retaining Wall

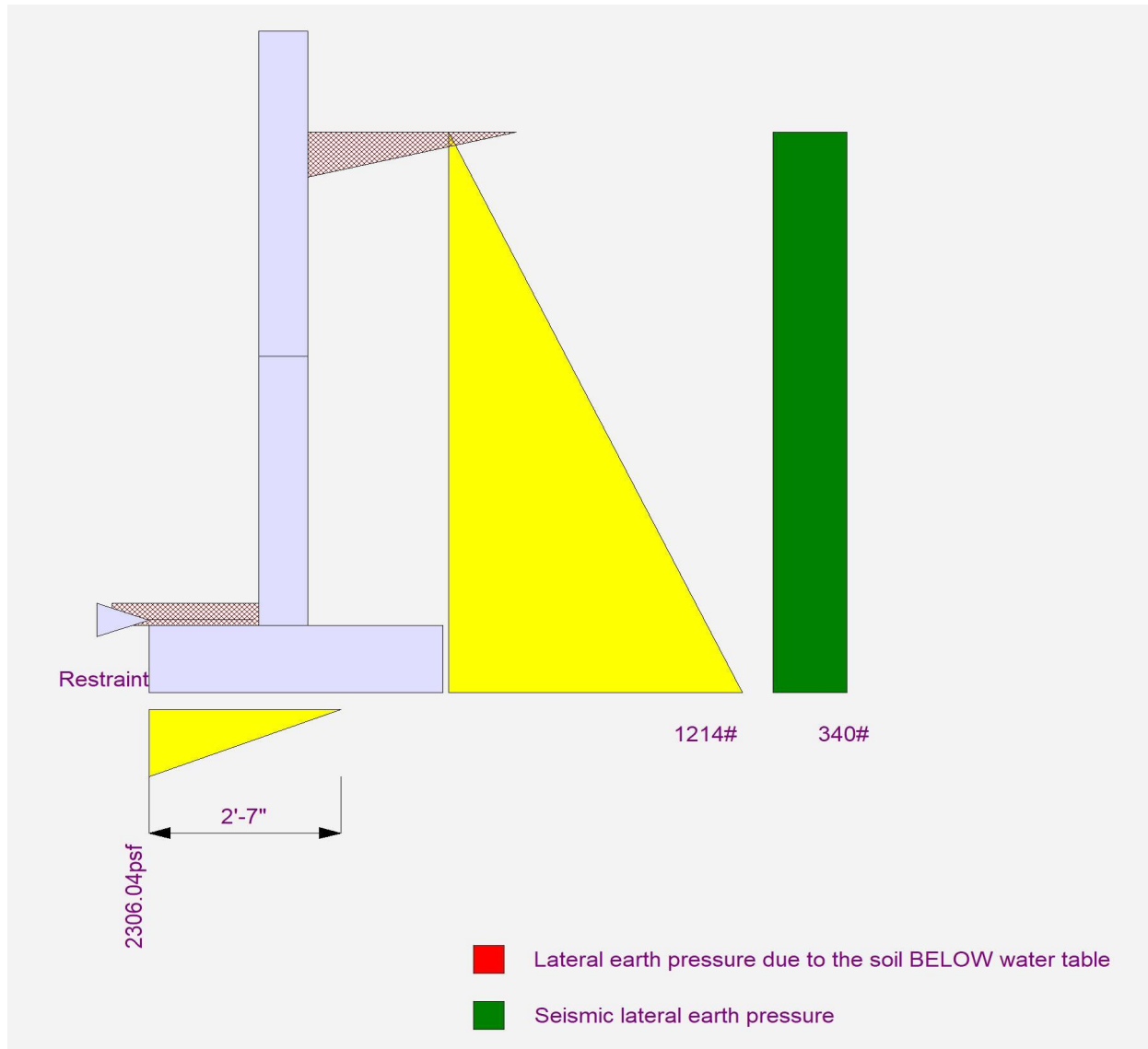
Project File: Reataining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

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DESCRIPTION: 7'-0" Unbalanced Fill



Cantilevered Retaining Wall

Project File: Reataining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

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DESCRIPTION: 5'-5" Unbalanced Fill

Code Reference

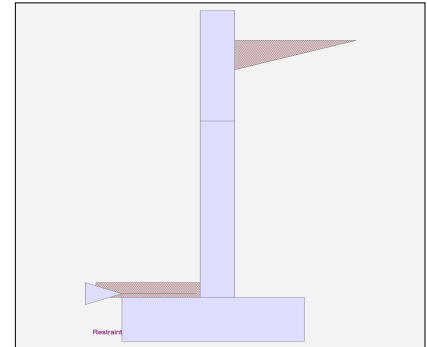
Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	5.83 ft
Wall height above soil	=	0.67 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	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	=	7.000
(Multiplier used on soil density)		

Lateral Load Applied to Stem

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

Uniform Seismic Force	=	47.831
Total Seismic Force	=	326.829

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: Reataining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

(c) ENERCALC INC 1983-2023

DESCRIPTION: 5'-5" Unbalanced Fill

Design Summary

Wall Stability Ratios			
Overturning	=	1.73	OK
Slab Resists All Sliding !			
Global Stability	=	1.96	
Total Bearing Load	=	2,446 lbs	
...resultant ecc.	=	9.88 in	
Eccentricity outside middle third			
Soil Pressure @ Toe	=	1,500 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,100 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	10.3 psi	OK
Footing Shear @ Heel	=	9.4 psi	OK
Allowable	=	75.0 psi	
Sliding Calcs			
Lateral Sliding Force	=	1,045.9 lbs	

Vertical component of active lateral soil pressure IS NOT 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		
Design Height Above Ftg	ft =	Stem OK 4.00	Stem OK 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	=	Edge	Edge		
Design Data					
fb/FB + fa/Fa	=	0.022	0.430		
Total Force @ Section					
Service Level	lbs =				
Strength Level	lbs =	181.8	1,231.7		
Moment....Actual					
Service Level	ft-# =				
Strength Level	ft-# =	137.8	2,666.0		
Moment.....Allowable	ft-# =	6,186.6	6,186.6		
Shear.....Actual					
Service Level	psi =				
Strength Level	psi =	2.4	16.6		
Shear.....Allowable	psi =	43.9	43.9		
Anet (Masonry)	in2 =				
Wall Weight	psf =	100.0	100.0		
Rebar Depth 'd'	in =	6.19	6.19		

Masonry Data

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

Concrete Data

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

Cantilevered Retaining Wall

Project File: Retaining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

(c) ENERCALC INC 1983-2023

DESCRIPTION: 5'-5" Unbalanced Fill

Concrete Stem Rebar Area Details

2nd Stem	<u>Vertical Reinforcing</u>	<u>Horizontal Reinforcing</u>	
As (based on applied moment) :	0.0052 in2/ft		
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	=====	<u>One layer of :</u> <u>Two layers of :</u>	
Required Area :	0.1728 in2/ft	#4@ 13.89 in	#4@ 27.78 in
Provided Area :	0.2325 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	0.8382 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Bottom Stem	<u>Vertical Reinforcing</u>	<u>Horizontal Reinforcing</u>	
As (based on applied moment) :	0.1009 in2/ft		
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	=====	<u>One layer of :</u> <u>Two layers of :</u>	
Required Area :	0.1728 in2/ft	#4@ 13.89 in	#4@ 27.78 in
Provided Area :	0.2325 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	0.8382 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Footing Data

Toe Width	=	1.50 ft
Heel Width	=	2.00
Total Footing Width	=	3.50
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f'c =	2,500 psi	Fy = 60,000 psi
Footing Concrete Density	=	150.00 pcf
Min. As %	=	0.0018
Cover @ Top	2.00	@ Btm.= 3.00 in

Footing Design Results

		<u>Toe</u>	<u>Heel</u>	
Factored Pressure	=	2,100	0 psf	
Mu' : Upward	=	1,938	29 ft-#	
Mu' : Downward	=	252	844 ft-#	
Mu: Design	=	1,686 OK	815 ft-#	OK
phiMn	=	2,500	2,500 ft-#	
Actual 1-Way Shear	=	10.31	9.37 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, phi Tu	=		0.00 ft-lbs	

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

Other Acceptable Sizes & Spacings

Toe: $\phi Mn = \phi * 5 * \lambda * \sqrt{fc} * Sm$

Heel: $\phi Mn = \phi * 5 * \lambda * \sqrt{fc} * Sm$

Key: No key defined

Min footing T&S reinf Area	0.91	in2
Min footing T&S reinf Area per foot	0.26	in2 /ft

If one layer 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

If two layers of horizontal bars:

Cantilevered Retaining Wall

Project File: Reataining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

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DESCRIPTION: 5'-5" Unbalanced Fill

Summary of Overturning & Resisting Forces & Moments

ItemOVERTURNING.....		RESISTING.....			
	Force lbs	Distance ft	Moment ft-#	Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	817.1	2.28	1,861.0	Soil Over HL (ab. water tbl)	855.5	2.83	2,423.9
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		2.83	2,423.9
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 =	55.0	0.75	41.3
Seismic Earth Load =	228.8	3.42	781.6	Surcharge Over Toe =			
				Stem Weight(s) =	650.0	1.83	1,191.7
				Earth @ Stem Transitions =			
Total	= 1,045.9	O.T.M. =	2,642.6	Footing Weight =	525.0	1.75	918.8
				Key Weight =			
				Vert. Component =			
Resisting/Overturning Ratio		= 1.73		Total =	2,085.5 lbs	R.M.=	4,575.6
Vertical Loads used for Soil Pressure =		2,446.2 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 NOT considered in the calculation of Sliding Resistance.

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci
 Horizontal Defl @ Top of Wall (approximate only) 0.077 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.

Cantilevered Retaining Wall

Project File: Reataining Wall Calcs.ec6

LIC# : KW-06017913, Build:20.24.02.03

MULHERN & KULP STRUCTURAL ENGINEERING INC

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DESCRIPTION: 5'-5" Unbalanced Fill

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 = 8.27 in
As Provided = 0.2325 in²/ft
As Required = 0.1728 in²/ft

Cantilevered Retaining Wall

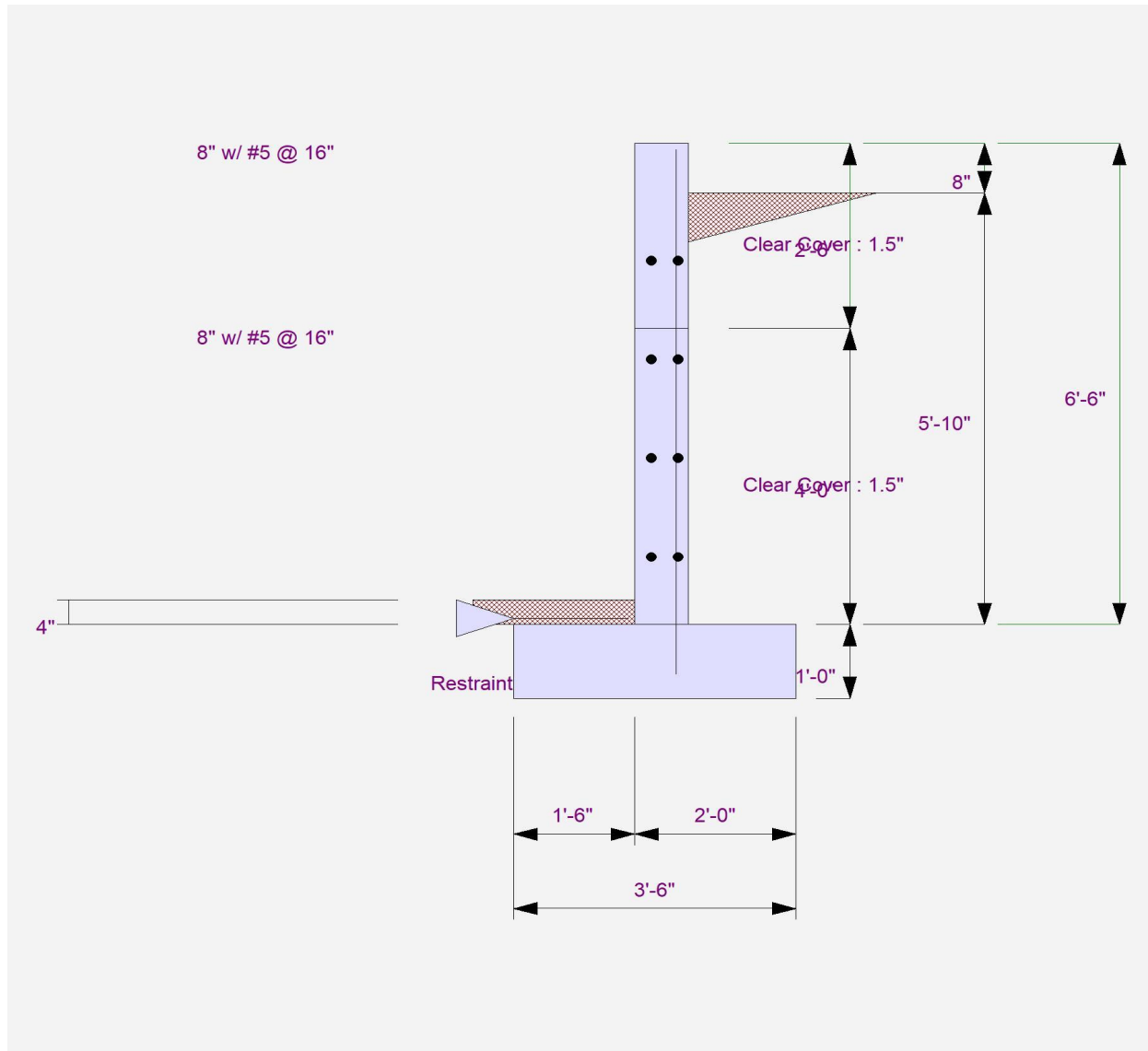
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Cantilevered Retaining Wall

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