OLSON KUNDIG
Fused Elements Residence
Mercer Island, WA

Structural Calculations

CALCULATIONS INCLUDED:

Pages A1 through E47

These Calculations cover the permit submittal for the single family residence, including gravity design, lateral design, foundation design, and miscellaneous design including canopy design, retaining wall design, and shoring design.

kpff

1601 5th Avenue, Suite 1600
Seattle, WA 98101 206.622.5822

KPFF Project No. 2200638

July 19, 2023

1601 5th Avenue, Suite 1600
Seattle, WA 98101 206.622.5822

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1601 5th Avenue, Suite 1600
Seattle, WA 98101 206 622-5822

Chapter A
Project Overview

Section 1
Design Criteria & Loads

Fused Elements Residence

Design Criteria and Loads

KPFF Project No. 2200638

June 23, 2023

1601 Fifth Avenue, Suite 1600
Seattle, WA 98101
(206) 622-5822

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STRUCTURAL DESIGN AND SYSTEMS SUMMARY

The Fused Elements Residence is a new three-story single family residence located in Mercer Island, WA. The primary structural system is concrete and wood shear walls and bearing walls, wood and steel framed floors, supported by a combination of steel and wood columns.

Gravity System

The gravity system consists of framed floors and roofs supported by wood beams, glulam beams, and steel beams, with engineered wood (TJI) infill. The wood and steel framing are supported by steel columns, wood columns, wood bearing walls and concrete bearing walls.

Lateral System

The primary lateral force resisting system supporting the upper level and upper roof levels consists of wood framed shear walls in the east and west and the north and south directions. The main level relies on the concrete basement walls for lateral resistance.

Foundations

Foundations consist of structural slabs-at-grade spanning between grade beams, spread footings below steel columns, and continuous footings below the concrete walls. All grade beams, spread footings, and continuous footings are supported by steel pipe piles that transfer the foundation loads to underlying suitable bearing soils, per recommendations in the geotechnical report. Foundations are designed to resist the overturning forces generated by gravity and seismic loading of the concrete and wood walls. At steel columns, footings have been designed to resist uplift generated by overturning forces from the wood frames. To resist sliding forces, helical piles will be bidder-designed and included in a deferred submittal.

CODES AND REFERENCES

- 2018 IBC with City of Mercer Island Amendments
- 2018 IBC Standards
- Design Loads
  - ASCE/SEI 7-16, Minimum Design Loads for Buildings and Other Structures
  - Snow Load Analysis for Washington, Second Edition (1995), by Structural Engineers Association of Washington.
  - WABO-SEAW White Paper – Snow Load Regulations and Engineering Practice, Washington State (2000)
  - WABO-SEAW White Paper #8 – Guidelines for Determining Snow Loads in Washington State (2010)
- Concrete Design
  - ACI 318-14 Building Code Requirements for Structural Concrete
  - CRSI Design Handbook (2008)
  - AWS D1.4-17 Structural Welding Code – Reinforcing Steel
- Structural Steel Design
  - AISC 360-16 Specification for Structural Steel Buildings
  - AISC 341-16 Seismic Provisions for Structural Steel Buildings
  - AWS D1.1-15 Structural welding Code - Steel
- Wood Design
  - ANSI/AWC NDS-2018 National Design Specification for Wood Construction with 2018 Supplement
  - ANSI/AWC SDPWS-2015 Special Design Provisions for Wind and Seismic

COMPUTER PROGRAMS USED

- General Analysis and Design
  - SAP2000
  - Enercalc
- Concrete Analysis and Design
  - QuickRWall
  - Hilti PROFIS Engineering 3.0.85
- Wood Analysis and Design
  - ForteWEB (software by Weyerhaeuser)

MATERIALS SPECIFICATIONS AND STRENGTHS

Concrete (normal weight)

Slab-at-Grade, Foundations, Concrete Walls, Grade Beams f'_c = 4,000 psi

Reinforcing Steel

Unless Noted Otherwise	ASTM A 615, Grade 60
Welded Rebar, Threaded Rebar	ASTM A 706, Grade 60
Headed Deformed Bars	ASTM A 970, Head Type HA
Adhesive Reinforcing Dowels (ARD)	ASTM A 615, Grade 60

Structural Steel

Wide Flange Shapes	ASTM A 992
Plates, Bars	ASTM A 36 or ASTM A 572 Grade 50
Angles, Channels	ASTM A 36
Structural Tubes (HSS)	ASTM A 500, Grade C
Steel Pipe	ASTM A 53, Grade B
Structural Bolts	ASTM A 325
Anchor Rods	ASTM F1554, Grade 36 (uno)
Threaded Rods	ASTM A 36 (uno)
Welding Electrodes	70 ksi, low hydrogen, typical
Headed Shear Studs	ASTM A 108
Deformed Bar Anchors	ASTM A 496

Wood

Sawn Lumber

Use	Grade	F_b psi (single use)
Wall Studs		
2” to 4” thick, 2” and wider	Hem-Fir Stud Grade	675
	Douglas Fir-Larch Stud Grade	700
	Douglas Fir-Larch No. 2	900
Planking & Plates		
2” to 4” thick, 2” and wider	Hem-Fir No. 2	850
	Douglas Fir-Larch No. 2	900
Joists & Rafters		
2” to 4” thick, 2” and wider	Hem-Fir No. 2	850
	Douglas Fir-Larch No. 2	900
Beams & Stringers		
5”x5” and larger	Douglas Fir-Larch No. 1	1,350
Posts		
5”x5” and larger	Douglas Fir-Larch No. 1	1,200
4”x4”	Douglas Fir-Larch No. 1	1,000
T & G Decking		
2x4 solid timber	Douglas Fir-Larch - Select	1,750
3x6 solid timber	Douglas Fir-Larch - Commercial	1,450

Glued Laminated Members

Use	Combination Symbol	Species
Beams <16" depth		
Simple Span	20F-V3	DF/DF
Continuous or Cantilever	20F-V7	DF/DF
Beams >16" depth		
Simple Span	24F-V4	DF/DF
Continuous or Cantilever	24F-V8	DF/DF
Columns	2-L2	DF

Engineered Composite Lumber

Type	Modulus of Elasticity (psi)	Allowable Flexural Stress (psi)
Parallel Strand Lumber (Column)	1,800,000	2,400
Parallel Strand Lumber (Beam)	2,000,000	2,900
Laminated Veneer Lumber	1,900,000	2,600
Laminated Strand Lumber	1,300,000	1,700
Laminated Strand Lumber	1,550,000	2,325

Foundations and Soils

Criteria per Geotechnical Investigation Report by Associated Earth Sciences, Inc. dated August 16, 2022.

	Allowable		Notes
Pipe Piles			
Compression Capacity			
- 6-inch diameter Sch. 40 Pipe	30	kips	
Uplift Capacity	0	kips	
Lateral Capacity (vertically installed)	0	kips	
Passive Pressure	300	pcf	(includes a factor of safety of 1.5)
Lateral Earth Pressures			
Restrained Wall	55	pcf	
Unrestrained Wall	35	pcf	
Seismic			
- Active Loading Condition	5 * h	psf, where h = wall height	
- At-Rest Loading Condition	10 * h	psf, where h = wall height	
Coefficient of Friction	0.30		(at spread footings only)

BEAM DEFLECTION AND CAMBER

Deflection Criteria

L/360	Live Load on Beams (uno)
L/240	Superimposed Dead + Live Load on Beams (uno)

Limit Precomposite DL deflection based on camber requirements:

L/600	Total Load on Beams Supporting Masonry or Concrete
L/600 (1/2-inch maximum)	Live Load on Beams Supporting Exterior Cladding

LIVE LOADS

Roof

20 psf For Wood Framed Residential Roof (reducible per IBC Section 1607.9)

25 psf Snow Load (nonreducible)

Drifted Snow per ASCE 7, Section 7 - Ground Snow Load = 20 psf, I_s = 1.0

Floors

40 psf Residential Spaces (reducible)

60 psf Exterior Residential Terrace (reducible)

60 psf Pool (reducible)

DEAD LOADS

Exterior Wall Dead Loads

		Comments
Framed Wall and Siding	10 psf	
Curtain Wall/Windows	10 psf	
Metal Panels/Louvers	10 psf	

Feature Stair Dead Loads

		Comments
Stair Treads (3” Wood on Steel Plate)	24 psf	
Double Plate Stringers	4 psf	
Total Stair DL per Square Foot of Horizontal Area	28 psf	

Typical Floor and Roof Dead Loads

Refer to the following pages for typical floor and roof dead loads.

LATERAL LOADS

Refer to the following pages for determination of seismic and wind lateral loading in accordance with provisions of ASCE 7-16.

Typical Roof Loads (1 of 2)

- Typical Roof Loads — Comments

3/4" Plywood	2.5	psf	
TJI Joists	4	psf	
Joist DL	7	psf	
Steel Framing	2	psf	
Steel Frame DL	9	psf	
Superimposed Loads			
a. PVC Roof and Membrane	2	psf	
b. Insulation	1.5	psf	
c. Lights, Ducts, Sprinklers, Misc	5	psf	
d. Wood Soffit	5	psf	
SDL	13.5	psf	
Total Framing DL + SDL	22	psf	
Partitions (seismic contribution)	5	psf	(10 psf/2 to roof)
Total Seismic DL	27	psf	

- Typical Roof Loads with Solar PV Array — Comments

3/4" Plywood	2.5	psf	
TJI Joists	4	psf	
Joist DL	7	psf	
Steel Framing	2	psf	
Steel Frame DL	9	psf	
Superimposed Loads			
a. PVC Roof and Membrane	2	psf	
b. Insulation	1.5	psf	
c. Lights, Ducts, Sprinklers, Misc	5	psf	
d. Wood Soffit	5	psf	
e. Solar PV Array	2.5	psf	41 lbs panels, 61"x41"
SDL	16	psf	
Total Framing DL + SDL	25	psf	
Partitions (seismic contribution)	5	psf	(10 psf/2 to roof)
Total Seismic DL	30	psf	

Typical Roof Loads (2 of 2)

- Green Roof Loads

				Comments
3/4" Plywood		2.5	psf	
TJI Joists		4	psf	
	Joist DL	7	psf	
Steel Framing		2	psf	
	Steel Frame DL	9	psf	
Superimposed Loads				
a. PVC Roof and Membrane		2	psf	
b. Insulation		1.5	psf	
c. Lights, Ducts, Sprinklers, Misc		5	psf	
d. Wood Soffit		5	psf	
e. Extensive Green Roof		30	psf	
	SDL	43.5	psf	
	Total Framing DL + SDL	52	psf	
Partitions (seismic contribution)		5	psf	(10 psf/2 to roof)
	Total Seismic DL	57	psf	

Typical Floor Loads

- Typical Wood Framed Floor — Comments

3/4" Plywood		2.5	psf
TJI Joists		4	psf
	Joist DL	6.5	psf
Superimposed Loads			
a. Wood Flooring		5	psf
b. Lights, Ducts, Insulation, Misc		5	psf
c. Gyp Soffit		2.5	psf
	SDL	12.5	psf
	Total Beam DL + SDL	19	psf
Partitions (seismic contribution)		10	psf
	Seismic DL	29	psf

- Wood Framed Floor with Tile — Comments

3/4" Plywood		2.5	psf
TJI Joists		4	psf
	Joist DL	6.5	psf
Superimposed Loads			
a. Stone Tile		10	psf
b. Thinset Mortar (1/2")		6	psf
c. Lights, Ducts, Sprinklers, Misc		5	psf
d. Gyp Soffit		2.5	psf
	SDL	23.5	psf
	Total Beam DL + SDL	30	psf
Partitions (seismic contribution)		10	psf
	Seismic DL	40	psf

- Wood Framed Planter Floor — Comments

3/4" Plywood		2.5	psf
TJI Joists		4	psf
	Joist DL	6.5	psf
Superimposed Loads			
a. Wood Flooring		5	psf
b. Lights, Ducts, Insulation, Misc		5	psf
c. Gyp Soffit		2.5	psf
d. Soil		120	psf
	SDL	133	psf
	Total Beam DL + SDL	139	psf
Partitions (seismic contribution)		10	psf
	Seismic DL	149	psf

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1601 5th Avenue, Suite 1600
Seattle, WA 98101 206 622-5822

project	Fused Elements Residence	by CBJ	sheet no.
location	Mercer Island, WA	date 9/2023	
client	Olson Kundig		job no.
	Seismic Base Shear Calculation		22-00638

Seismic Base Shear Calculation

2018 IBC (Ch. 16) & ASCE 7-16 (Ch. 11, 12, & 22), References per ASCE 7-16, UNO

Loading	X Direction	
Lateral System	A. BEARING WALL SYSTEMS	
[Tab. 12.2-1]	15. Light-framed (wood) walls sheathed with wood structural panels rated for shear resistance	
Risk Category	II	*[IBC Tab. 1604.5]*
Site Class	D	*[ASCE 7 Ch. 20]*
Design Category	D	*[IBC Sec. 1613.2.5; Tab. 1613.2.5(1) & (2)]*

S_s	1.435	*[IBC Fig. 1613.2.1(1) or USGS Seismic Hazard Data]*				
S_1	0.499	*[IBC Fig. 1613.2.1(2) or USGS Seismic Hazard Data]*				
F_a	1.00	*[IBC Tab. 1613.2.3(1)]*	C_t	0.02	*[Tab. 12.8-2]*	
F_v	1.80	*[IBC Tab. 1613.2.3(2)]*	x	0.75	*[Tab. 12.8-2]*	
S_{MS}	1.44	*[IBC Eqn. 16-36]*	h_n	35 ft	*[Sec. 12.8.2.1]*	
S_{M1}	1.35	*[IBC Eqn. 16-37]*	T_a	0.29 sec	*[Eqn. 12.8-7]*	
S_{DS}	0.96	*[IBC Eqn. 16-38]*	C_u	1.4	*[Tab. 12.8-1]*	
S_{D1}	0.90	*[IBC Eqn. 16-38]*	T_{MODAL}	0.30 sec	*[Sec. 12.8.2]*	
ρ	1.3	*[ASCE 7-16 12.3.4]*	T	0.30 sec	*[Sec. 12.8.2]*	
I	1.00	*[Tab. 1.5-2]*	T_L	6 sec	*[Fig. 22-14]*	
R	6.5	*[Tab. 12.2-1]*	T_S	0.94	*[Sec. 11.3]*	
Ω_0	3	*[Tab. 12.2-1]*				
C_d	4	*[Tab. 12.2-1]*	Building Height Limit (ft)	65	*[Tab. 12.2-1]*	

$S_{DS} / (R/I) = C_s$	0.147	*[Eqn. 12.8-2]*		
$S_{D1} / T (R/I) = C_{s,\ max}$	0.461	*[Eqn. 12.8-3]*		
$S_{D1} T_L / T^2 (R/I) = C_{s,\ max}$	N/A	*[Eqn. 12.8-4]*		
Ground motion hazard analysis perfomed?	No	*[Sec. 11.4.8]*	11.4.8 Factor	1.5
$0.044 S_{DS} I \geq 0.01 = C_{s,\ min}$	0.042	*[Eqn. 12.8-5]*		
$0.5 S_1 / (R/I) = C_{s,\ min}$	N/A	*[Eqn. 12.8-6]*		
C_s (design)	0.147	*Exception 2 (a*	MODAL	

Vertical Distribution of Forces
ASCE 7-16, Sec. 12.8.3

W	589 k	*[Sec. 12.8.1]*		
V	87 k	*[Eqn. 12.8-1]*		
$E_h = \rho V$	**113 k**	*[Eqn. 12.4-3]*		

exponent related to structural period
k 1.00 *[Sec. 12.8.3]*

Name	Weight, w_x	Height, h_x	Σw_x	$w_x h_x^k$	*[Eqn. 12.8-12]* C_{vx}	*[Eqn. 12.8-11]* ρ x F_x	*[Eqn. 12.8-13]* ρ x V_x	*[Eqn. 12.10-1]* F_{px}
Roof	59 k	33 ft	59 k	1908 k-ft	0.173	20 k	20 k	15.030 k
Upper Lvl	264 k	22 ft	323 k	5907 k-ft	0.537	60 k	80 k	50.589 k
Main Lvl	266 k	12 ft	589 k	3194 k-ft	0.290	33 k	113 k	50.933 k
-	0 k	0 ft	589 k	0 k-ft	0.000	0 k	113 k	0 k
Σ	589 k			11009 k-ft	1.000	113 k		

kpff
1601 5th Avenue, Suite 1600
Seattle, WA 98101 206 622-5822

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Seismic Base Shear Calculation

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F_a	1.00	[IBC Tab. 1613.2.3(1)]
F_v	1.80	[IBC Tab. 1613.2.3(2)]
S_{MS}	1.44	[IBC Eqn. 16-36]
S_{M1}	1.35	[IBC Eqn. 16-37]
S_{DS}	0.96	[IBC Eqn. 16-38]
S_{D1}	0.90	[IBC Eqn. 16-38]
ρ	1.3	[ASCE 7-16 12.3.4]
I	1.00	[Tab. 1.5-2]
R	6.5	[Tab. 12.2-1]
Ω_0	3	[Tab. 12.2-1]
C_d	4	[Tab. 12.2-1]

C_t	0.02	[Tab. 12.8-2]
x	0.75	[Tab. 12.8-2]
h_n	35 ft	[Sec. 12.8.2.1]
T_a	0.29 sec	[Eqn. 12.8-7]
C_u	1.4	[Tab. 12.8-1]
T_{MODAL}	2.00 sec	[Sec. 12.8.2]
T	0.40 sec	[Sec. 12.8.2]
T_L	5 sec	[Fig. 22-14]
T_S	0.94	[Sec. 11.3]

Building Height Limit (ft): 65 [Tab. 12.2-1]

S_{DS} / (R/I) = C_s	0.147	[Eqn. 12.8-2]	
S_{D1} / T (R/I) = $C_{s,\ max}$	0.343	[Eqn. 12.8-3]	
S_{D1} T_L / T^2 (R/I) = $C_{s,\ max}$	N/A	[Eqn. 12.8-4]	
Ground motion hazard analysis perfomed?	No	[Sec. 11.4.8]	11.4.8 Factor 1.5
$0.044S_{DS}$ I ≥ 0.01 = $C_{s,\ min}$	0.042	[Eqn. 12.8-5]	
$0.5S_1$ / (R/I) = $C_{s,\ min}$	N/A	[Eqn. 12.8-6]	
C_s (design)	**0.147**		

Vertical Distribution of Forces
ASCE 7-16, Sec. 12.8.3

exponent related to structural period
k 1.00 [Sec. 12.8.3]

W	589 k	[Sec. 12.8.1]
V	87 k	[Eqn. 12.8-1]
E_h = ρV	**113 k**	[Eqn. 12.4-3]

Name	Weight, w_x	Height, h_x	Σw_x	$w_x h_x^k$	[Eqn. 12.8-12] C_{vx}	[Eqn. 12.8-11] ρ x F_x	[Eqn. 12.8-13] ρ x V_x	[Eqn. 12.10-1] F_{px}
Roof	59 k	33 ft	59 k	1908 k-ft	0.173	20 k	20 k	15.030 k
Upper Lvl	264 k	22 ft	323 k	5907 k-ft	0.537	60 k	80 k	50.589 k
Main Lvl	266 k	12 ft	589 k	3194 k-ft	0.290	33 k	113 k	50.933 k
-	0 k	0 ft	589 k	0 k-ft	0.000	0 k	113 k	0 k
Σ	589 k			11009 k-ft	1.000	113 k		

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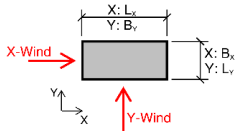
	location	date 4/21/23	
	client		job no.
	Components and Cladding Wind Loads		

Wind Load Calculations - MWFRS 1.0W LRFD

Calculations based on ASCE 7-16 Chapter 27 (Directional Procedure)

Wind Speed, V =	98 mph	*Fig. 26.5-1*	
Building Enclosure	Enclosed	*Sec. 26.12, Tab. 26.13-1*	
Mean Roof Height, h =	21 ft		
Risk Category	II	*Tab. 1.5-1*	
K_d =	0.85	*Tab. 26.6-1*	
R_i =	1.00	*Sec. 26.13.1*	
K_e =	1.00	*Sec. 26.9*	

	X	Y		
Width, B (⊥ to wind)	83	112	ft	
Length, L (∥ to wind)	112	83	ft	
Building Period, T =	5.00	6.24	sec	
Damping Ratio, β =	0.02	0.02		
Exposure Category	B	B		*Sec. 26.7.3*
Topo. Effects (K_{zt})	Constant			*Sec. 26.8*
K_1 =	0.75	0.75		*Fig 26.8-1*
K_2 =	1.00	1.00		*Fig 26.8-1*
γ =	2.50	2.50		*Fig 26.8-1*
L_h =	50	50	ft	
$K_{zt,roof}$ =	1.00	1.00		*Eq. 26.8-1.*
K_{zt} =	1.00	1.00		*Eq. 26.8-1.*



q_z =	20.9	*K_z*K_{zt} psf		*Eq. 26.10-1*
K_h =	0.62			*Tab. 26.10-1*

X-Direction

p=q*Gf*Cp - qi*(GCpi)				*Eq. 27.3-1*
Flexible Structure		f < 1 Hz		
C_p =	Windward	Leeward	Side	*Fig. 27.3-1*
	0.8	-0.43	-0.7	
Gf =	1.34			*Eq. 26.11-10*
GCpi (+/-)	0.18			*Tab. 26.13-1*
q_h =	13.0	psf		*Eq. 26.10-1*

Y-Direction

p=q*Gf*Cp - qi*(GCpi)				*Eq. 27.3-1*
Flexible Structure		f < 1 Hz		
C_p =	Windward	Leeward	Side	*Fig. 27.3-1*
	0.8	-0.50	-0.7	
Gf =	1.39			*Eq. 26.11-10*
GCpi (+/-)	0.18			*Tab. 26.13-1*
q_h =	13.0	psf		*Eq. 26.10-1*

Story Forces: X - Direction

Level	Elevation, z (ft)	Story Width (ft)	Trib. Story Height (ft)	Total Pressure (psf)	Story Force (k)
UR	20.50	83	5.08	21.5	9.1
UL	10.34	83	10.25	20.3	17.2
ML	0.00	-	-	-	-
Base Shear					**26 k**
Overturning Moment					**364 k-ft**

Story Forces: Y - Direction

Level	Elevation, z (ft)	Story Width (ft)	Trib. Story Height (ft)	Total Pressure (psf)	Story Force (k)
UR	20.50	112	5.08	23.5	13.4
UL	10.34	112	10.25	22.3	25.6
ML	0.00	-	-	-	-
Base Shear					**39 k**
Overturning Moment					**539 k-ft**

Level force is taken as the wind pressure at that level over half the story height above and half the story height below.

kpff	project	Fused Elements Residence	by	CBJ	sheet no.
1601 5th Avenue, Suite 1600 Seattle, WA 98101 206 622-5822	location		date	4/21/23	
	client				job no.
		Components and Cladding Wind Loads			

Wind Load Calculations - Components & Cladding (X-Direction) 1.0W LRFD

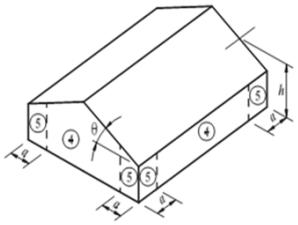
Calculations based on ASCE 7-16 Section 30.3 for low-rise buildings

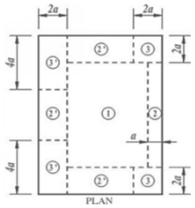
Wind Speed, V =	98	mph	*Fig. 26.5-1*	p=qh*[G*Cp - GCpi]			*Eq. 30.3-1*
Building Enclosure	Enclosed		*Sec. 26.12*	Gf =	1.34		*Eq. 26.11-10*
Building Height, h =	21	ft		GCpi (+/-)	0.18		*Tab. 26.13-1*
Risk Category	II		*Tab. 1.5-1*	q_z =	20.9	$*K_z*K_{zt}$ psf	*Eq. 26.10-1*
K_d =	0.85		*Tab. 26.6-1*	$K_{zt,roof}$ =	1.00		
R_i =	1.00		*Eq. 26.13-1*	K_h =	0.62		*Tab. 26.10-1*
Width (⊥ to wind)	83	ft		q_h =	13.0	psf	*Eq. 26.10-1*
Length (∥ to wind)	112	ft					
Building Period, T =	5.00	sec		Roof Type =	Monoslope (3° < Θ ≤ 10°) Fig. 30.3-5A		
Exposure Category	B		*Sec. 26.7.3*	Wall GC_p Factor =	0.9		

Walls

Fig. 30.3-1

	Factored Wind Pressures for Building Height and Area Ranges: X - Direction (psf)								
	≤ 10 sf Area			100 sf Area			> 500 sf Area		
	Windward	Leeward		Windward	Leeward		Windward	Leeward	
Height Range	GC_p Zone 4, 5 0.9	GC_p Zone 4 -1.0	GC_p Zone 5 -1.3	GC_p Zone 4, 5 0.74	GC_p Zone 4 -0.85	GC_p Zone 5 -0.95	GC_p Zone 4, 5 0.6	GC_p Zone 4 -0.7	GC_p Zone 5 -0.7
480-500	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
460-480	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
440-460	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
420-440	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
400-420	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
380-400	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
360-380	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
340-360	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
320-340	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
300-320	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
280-300	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
260-280	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
240-260	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
220-240	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
200-220	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
180-200	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
160-180	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
140-160	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
120-140	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
100-120	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
90-100	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
80-90	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
70-80	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
60-70	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
50-60	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
40-50	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
30-40	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
20-30	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
15-20	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
0-15	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7





Linear Interpolation is permitted for areas between 20 and 500 sf, 16 psf min, Kzt = 0.7 min. pressure per Sec 30.2.2

Roof

Fig. 30.3-5A

	Factored Wind Pressures for Building Height and ≤ 10 sf Area (psf)										
	Zone 1'	Zone 1	Zone 2'	Zone 2	Zone 2e	Zone 2n	Zone 2r	Zone 3'	Zone 3	Zone 3e	Zone 3r
	Interior				Edges				Corners		
GC_p	N/A	-1.1	-1.6	-1.3	N/A	N/A	N/A	-2.6	-1.8	N/A	N/A
Total Pressure	N/A	-16.7	-23.2	-19.3	N/A	N/A	N/A	-36.3	-25.8	N/A	N/A

	Factored Wind Pressures for Building Height and 100 sf Area (psf)										
	Zone 1'	Zone 1	Zone 2'	Zone 2	Zone 2e	Zone 2n	Zone 2r	Zone 3'	Zone 3	Zone 3e	Zone 3r
	Interior				Edges				Corners		
GC_p	N/A	-1.1	-1.5	-1.2	N/A	N/A	N/A	-1.6	-1.2	N/A	N/A
Total Pressure	N/A	-16.7	-21.9	-18.0	N/A	N/A	N/A	-23.2	-18.0	N/A	N/A

	Factored Wind Pressures for Building Height and > 500 sf Area (psf)										
	Zone 1'	Zone 1	Zone 2'	Zone 2	Zone 2e	Zone 2n	Zone 2r	Zone 3'	Zone 3	Zone 3e	Zone 3r
	Interior				Edges				Corners		
GC_p	N/A	-1.1	-1.5	-1.2	N/A	N/A	N/A	-1.6	-1.2	-1.2	N/A
Total Pressure	N/A	-16.7	-21.9	-18.0	N/A	N/A	N/A	-23.2	-18.0	-18.0	N/A

Notes

1. Linear Interpolation is permitted for areas between 10 and 100 sf
2. N/A
   N/A
3. qi = qh has been used for positive internal pressure calculations
4. Positive pressures on roofs and pressures on overhangs are not included in this spreadsheet.

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1601 5th Avenue, Suite 1600
Seattle, WA 98101 206 622-5822

project	Fused Elements Residence	by	CBJ	sheet no.
location		date	4/21/23	
client				job no.
	Components and Cladding Wind Loads			

Wind Load Calculations - Components & Cladding (Y-Direction) 1.0W LRFD

Calculations based on ASCE 7-16 Section 30.3 for low-rise buildings

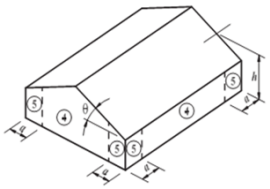
Wind Speed, V =	98	mph	*Fig. 26.5-1*	p=qh*[G*Cp - GCpi]			*Eq. 30.3-1*
Building Enclosure	Enclosed		*Sec. 26.12*	Gf =	1.39		*Eq. 26.11-10*
Building Height, h =	21	ft		GCpi (+/-)	0.18		*Tab. 26.13-1*
Risk Category	II		*Tab. 1.5-1*	q_z =	20.9	*K_z*K_{zt} psf	*Eq. 27.3-1*
K_d =	0.85		*Tab. 26.6-1*	$K_{zt,roof}$ =	1.00		
R_i =	1.00		*Eq. 26.13-1*	K_h =	0.62		*Tab. 26.10-1*
Width (⊥ to wind)	112	ft		q_h =	13.0	psf	*Eq. 27.3-1*
Length (∥ to wind)	83	ft					
Building Period, T =	6.24	sec		Roof Type =	Monoslope (3˚ < Θ ≤ 10˚) Fig. 30.3-5A		
Exposure Category	B		*Sec. 26.7.3*	Wall GC_p Factor =	0.9		

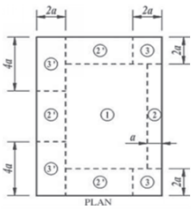
Walls

Fig. 30.3-1

Factored Wind Pressures for Building Height and Area Ranges: X - Direction (psf)

	≤ 10 sf Area			100 sf Area			> 500 sf Area		
	Windward	Leeward		Windward	Leeward		Windward	Leeward	
Height Range	GC_p Zone 4, 5 0.9	GC_p Zone 4 -1.0	GC_p Zone 5 -1.3	GC_p Zone 4, 5 0.74	GC_p Zone 4 -0.85	GC_p Zone 5 -0.95	GC_p Zone 4, 5 0.6	GC_p Zone 4 -0.7	GC_p Zone 5 -0.7
480-500	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
460-480	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
440-460	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
420-440	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
400-420	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
380-400	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
360-380	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
340-360	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
320-340	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
300-320	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
280-300	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
260-280	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
240-260	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
220-240	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
200-220	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
180-200	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
160-180	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
140-160	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
120-140	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
100-120	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
90-100	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
80-90	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
70-80	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
60-70	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
50-60	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
40-50	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
30-40	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
20-30	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
15-20	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7
0-15	14.1	-15.3	-18.8	12.0	-13.4	-14.7	10.6	-11.7	-11.7





Linear Interpolation is permitted for areas between 20 and 500 sf, 16 psf min, Kzt = 0.7 min. pressure per Sec 30.2.2

Roof

Fig. 30.3-5A

Factored Wind Pressures for Building Height and ≤ 10 sf Area (psf)

	Zone 1'	Zone 1	Zone 2'	Zone 2	Zone 2e	Zone 2n	Zone 2r	Zone 3'	Zone 3	Zone 3e	Zone 3r
	Interior				Edges				Corners		
GC_p	N/A	-1.1	-1.6	-1.3	N/A	N/A	N/A	-2.6	-1.8	N/A	N/A
Total Pressure	N/A	-16.7	-23.2	-19.3	N/A	N/A	N/A	-36.3	-25.8	N/A	N/A

Factored Wind Pressures for Building Height and 100 sf Area (psf)

	Zone 1'	Zone 1	Zone 2'	Zone 2	Zone 2e	Zone 2n	Zone 2r	Zone 3'	Zone 3	Zone 3e	Zone 3r
	Interior				Edges				Corners		
GC_p	N/A	-1.1	-1.5	-1.2	N/A	N/A	N/A	-1.6	-1.2	N/A	N/A
Total Pressure	N/A	-16.7	-21.9	-18.0	N/A	N/A	N/A	-23.2	-18.0	N/A	N/A

Factored Wind Pressures for Building Height and > 500 sf Area (psf)

	Zone 1'	Zone 1	Zone 2'	Zone 2	Zone 2e	Zone 2n	Zone 2r	Zone 3'	Zone 3	Zone 3e	Zone 3r
	Interior				Edges				Corners		
GC_p	N/A	-1.1	-1.5	-1.2	N/A	N/A	N/A	-1.6	-1.2	-1.2	N/A
Total Pressure	N/A	-16.7	-21.9	-18.0	N/A	N/A	N/A	-23.2	-18.0	-18.0	N/A

Notes

1. Linear Interpolation is permitted for areas between 10 and 100 sf
2. N/A
   N/A
3. qi = qh has been used for positive internal pressure calculations
4. Positive pressures on roofs and pressures on overhangs are not included in this spreadsheet.

A17

1601 5th Avenue, Suite 1600
Seattle, WA 98101 206 622-5822

Chapter B
Gravity Design

Section 1
Framing Design

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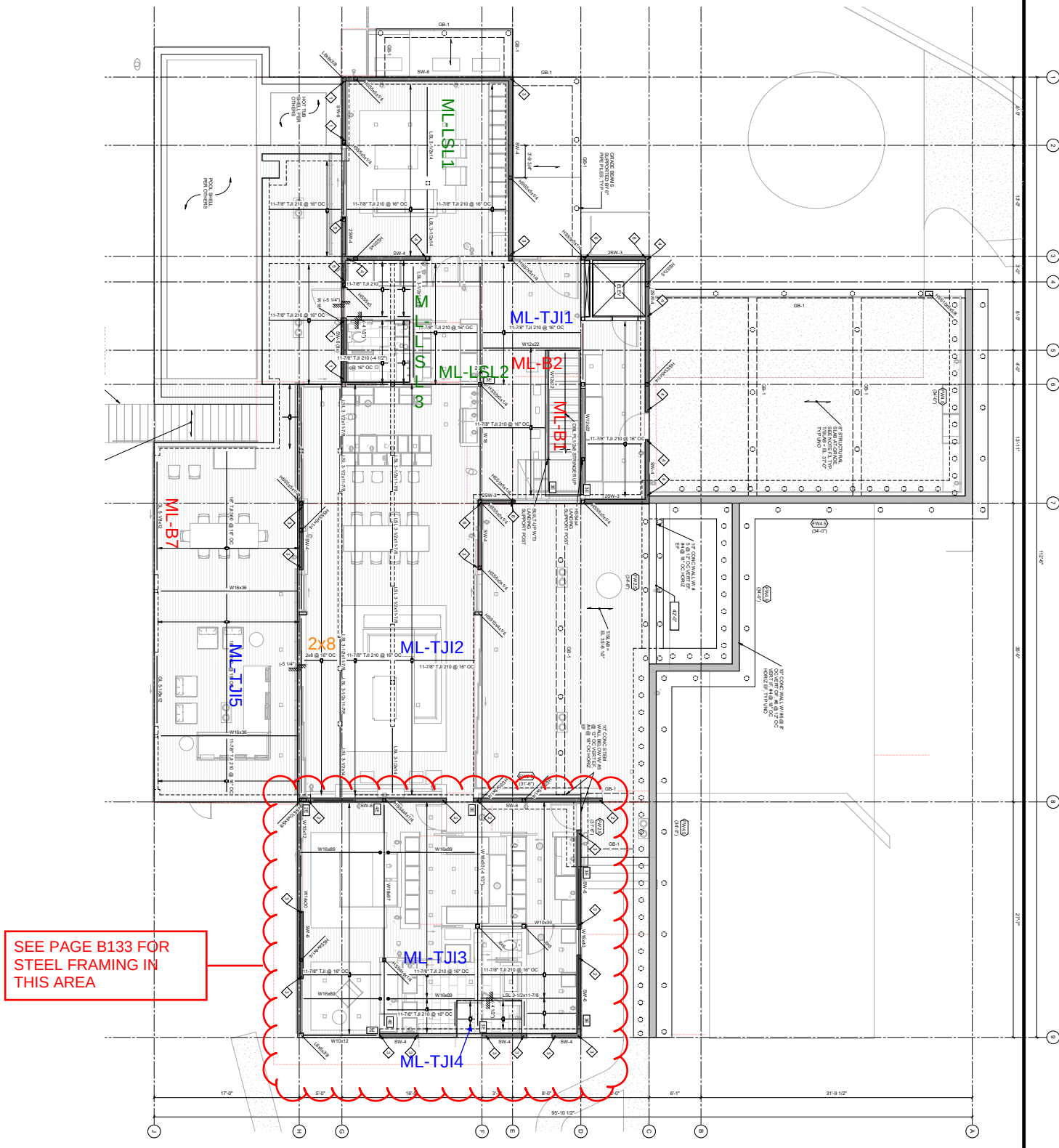
Seattle, WA 98101 206 622-5822

project	Fused Elements Residence	by CBJ	sheet no.
location	Mercer Island, WA	date 6-2023	
client	Olson Kundig		job no. 22-638
	Gravity Framing Design		

MAIN LEVEL FRAMING KEYPLAN



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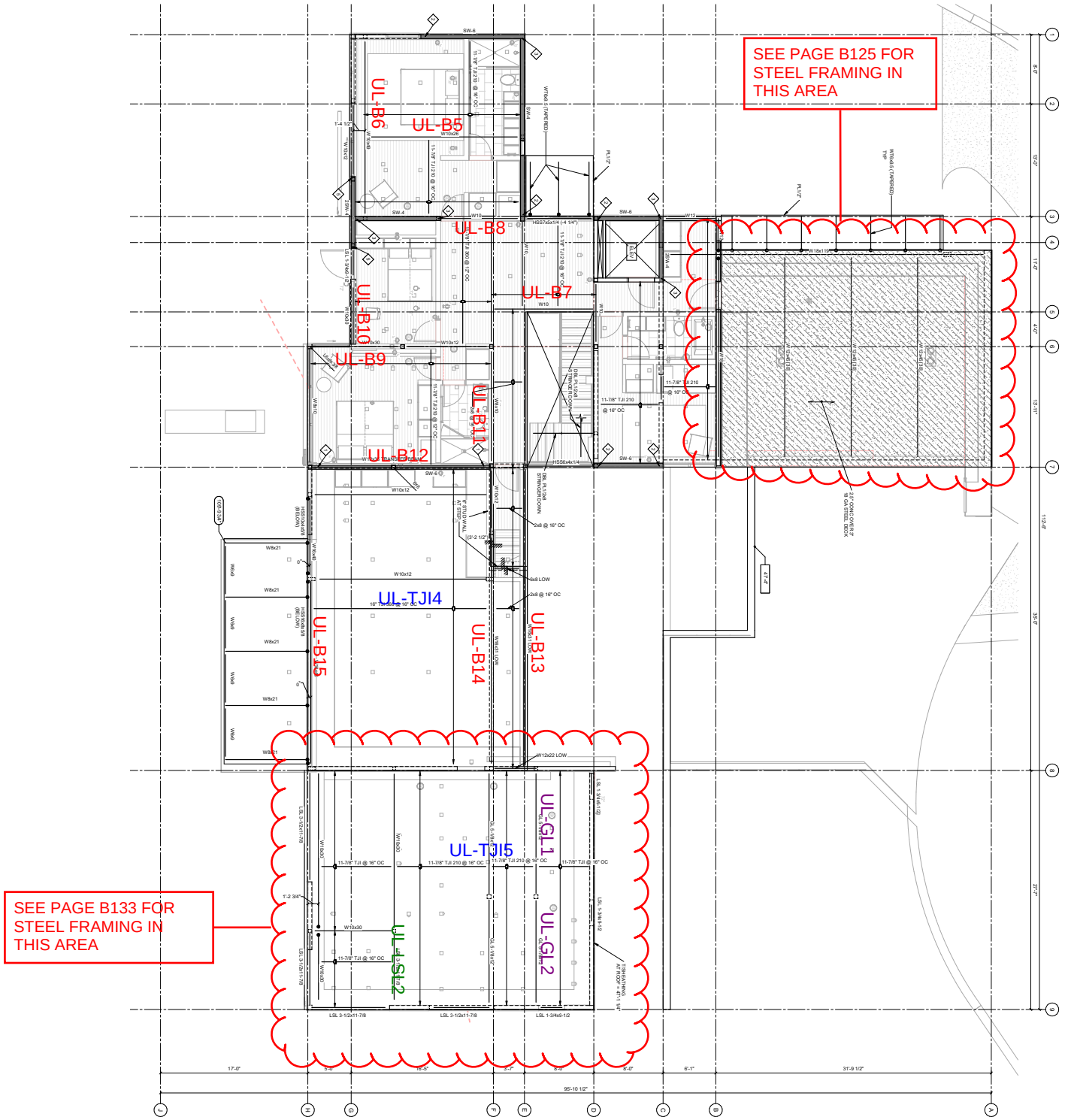
project	Fused Elements Residence	by CBJ	sheet no.
location	Mercer Island, WA	date 6-2023	
client	Olson Kundig		job no. 22-638
	Gravity Framing Design		

UPPER LEVEL FRAMING KEYPLAN



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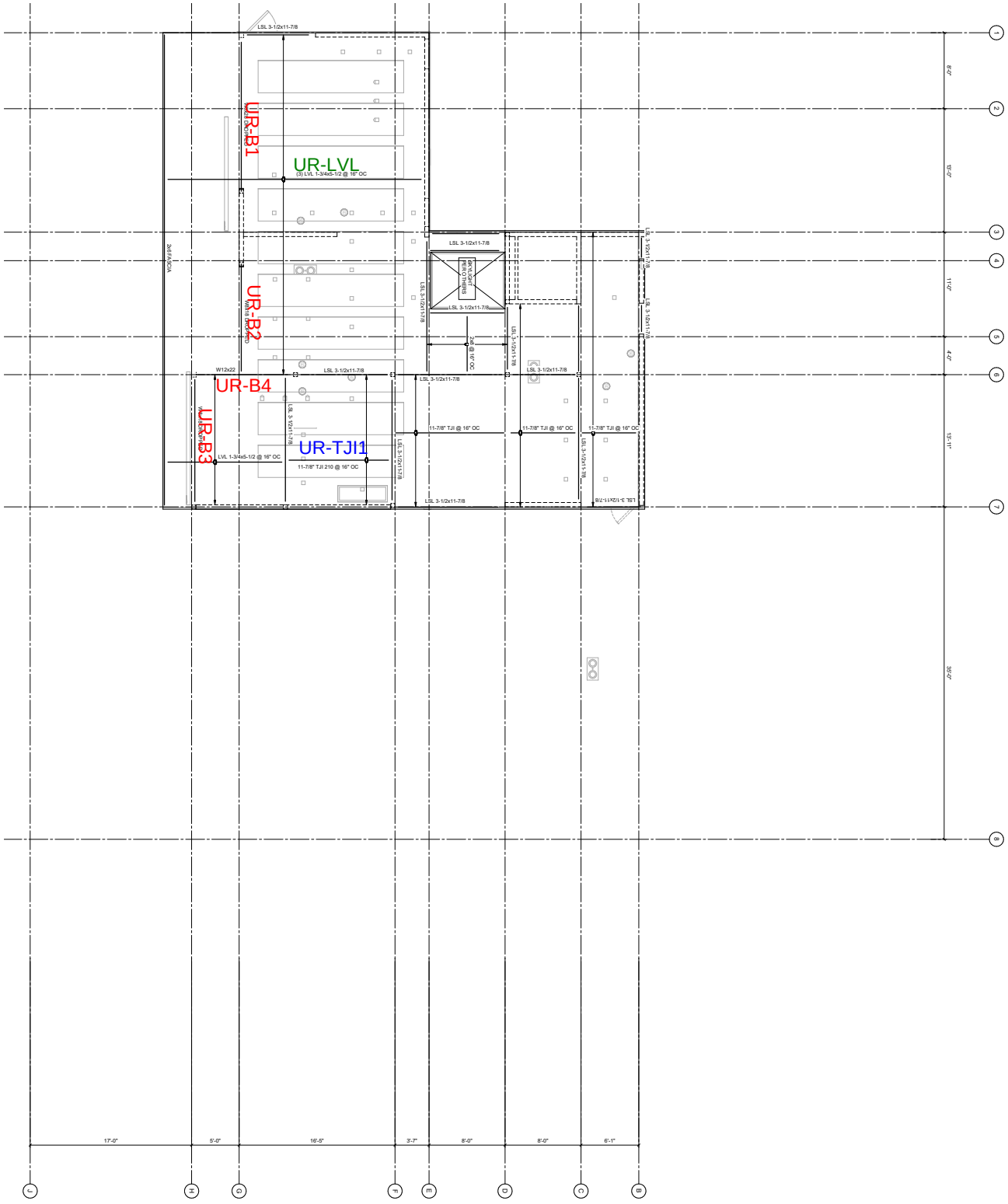
project	Fused Elements Residence	by CBJ	sheet no.
location	Mercer Island, WA	date 6-2023	
client	Olson Kundig		job no. 22-638
	Gravity Framing Design		

UPPER ROOF FRAMING KEYPLAN



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project Fused Elements Residence		by CBJ	sheet no.
location Mercer Island, WA		date 06/16/23	
client Olson Kundig			job no. 22-00638
Framing Design			

Steel Framing

ML-B1

Simply supported

L =	13.5	ft
TW =	1.34	ft
DL =	19	psf
LL =	40	psf (R)

Point Load from Stair Post

x_{POST} =	10.17	ft
P_{DL} =	0.248	k
P_{LL} =	1.276	k

→ W10x12 OK for bending, shear, and deflection. See Enercalc

ML-B2

Simply supported

L =	12.15	ft
TW =	12.75	ft
DL =	19	psf
LL =	40	psf (R)

Point Load from Stair Stringer

$x_{STRINGER}$ =	10.08	ft
P_{DL} =	0.077	k
P_{LL} =	0.393	k

Point Load from ML-B1

X_{ML-B1} =	8.08	ft
P_{DL} =	0.38	k
P_{LL} =	0.68	k

→ W12x22 OK for bending, shear, and deflection. See Enercalc

ML-B3 (TRANSFER BEAM)

Simply supported

L =	16.17	ft
TW =	12.34	ft
DL =	19	psf
LL =	40	psf (R)

Point Load from Column

x_{COLUMN} =	10.42	ft
Trib Area =	179.9	ft^2

	Area Load (psf)	Point Load (k)
DL	52	9.36
LR	20	3.60
SL	25	4.50

→ W12x26 OK for bending, shear, and deflection. See Enercalc

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Seattle, WA 98101 206 622-5822

project	Fused Elements Residence	by	CBJ	sheet no.
location	Mercer Island, WA	date	06/16/23	
client	Olson Kundig			job no. 22-00638
	Framing Design			

Steel Framing

ML-B4 (TRANSFER BEAM, EDGE BEAM WITH WINDOW WALL AND STUD WALL LOAD)

Backspan and cantilever

L =	18.75	ft
a =	2.75	ft
TW =	4.92	ft
DL =	19	psf
LL =	40	psf (R)

Point Load from UL-B18 @ 12.75'

P_{DL} =	5.49	k
P_{LR} =	1.86	k
P_{SL} =	2.33	k

Point Load from Column (@ End of Cantilever)

x_{COLUMN} =	2.75	ft
Trib Area =	21.5	ft^2

	Area Load (psf)	Point Load (k)
DL	52	1.12
LR	20	0.43
SL	25	0.54

Trib Height =	10.34	ft
w_{DL} =	0.103	klf

→ W12x35 OK for bending, shear, and deflection. See Enercalc

ML-B5

Backspan and cantilever

L =	22.58	ft
a =	9.83	ft
TW =	7.67	ft
DL =	19	psf
LL =	40	psf (R)

Point Load from ML-B4

x_{ML-B4} =	9.83	ft
P_{DL} =	3.72	k
P_{LR} =	0.60	k
P_{LL} =	1.85	k
P_{SL} =	0.67	k

→ W12x79 OK for bending, shear, and deflection. See Enercalc

ML-B6

Backspan and cantilever

L =	14.83	ft
TW_L =	2.25	ft
a =	9.83	ft
TW_a =	1.34	ft
DL =	19	psf
LL =	40	psf (R)

Point Load from ML-B4

x_{ML-B4} =	9.83	ft
P_{DL} =	4.14	k
P_{LR} =	0.49	k
P_{LL} =	2.43	k
P_{SL} =	0.62	k

→ W12x79 OK for bending, shear, and deflection. See Enercalc

Steel Framing

ML-B7

Simply supported

L =	30.58	ft
TW =	8.54	ft
DL =	19	psf
LL =	60	psf (R)
SL =	25	psf

→ W18x40 OK for bending, shear, and deflection. See Enercalc

UL-B1 (TRANSFER BEAM, EDGE BEAM WITH WINDOW WALL AND STUD WALL LOAD)

Backspan and cantilever

L =	23.83	ft
a =	1.17	ft
TW =	6.00	ft
DL =	19	psf
LL =	40	psf (R)
Trib Height =	10.17	ft
w_{DL} =	0.102	klf

Point Load from Column (@ End of Cantilever)

x_{COLUMN} = 1.17 ft

Trib Area = 16.5 ft^2

	Area Load (psf)	Point Load (k)
DL	14	0.23
LR	20	0.33
SL	25	0.41

→ W12x35 OK for bending, shear, and deflection. See Enercalc

UL-B2

Backspan and cantilever

L =	13.75	ft
a =	11.92	ft
TW =	1.92	ft
DL =	19	psf
LL =	40	psf (R)

Point Load from UL-B1

x_{UL-B1} =	12.0	ft
P_{DL} =	3.53	k
P_{LR} =	0.35	k
P_{LL} =	3.15	k
P_{SL} =	0.43	k

→ W12x79 OK for bending, shear, and deflection. See Enercalc
(deflection limited to 1")

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project Fused Elements Residence		by CBJ	sheet no.
location Mercer Island, WA		date 06/16/23	
client Olson Kundig			job no. 22-00638
Framing Design			

Steel Framing

UL-B3 (TRANSFER BEAM)

Simply supported

L =	25	ft
TW =	12.88	ft
DL =	19	psf
LL =	40	psf (R)

Point Load from Column

x_{COLUMN} =	10.00	ft
Trib Area =	161.5	ft^2

	Area Load (psf)	Point Load (k)
DL	14	2.26
LR	20	3.23
SL	25	4.04

→ W12x50 OK for bending, shear, and deflection. See Enercalc

UL-B4

Simply supported

L =	25	ft			
at L =	0 to 4.17	ft	at L =	4.17 to 25	ft
TW =	17.29	ft	TW =	17.29	ft
DL =	139	psf	DL =	19	psf
LL =	40	psf (R)	LL =	60	psf (R)
SL =	0	psf	SL =	25	psf

→ W16x50 OK for bending, shear, and deflection. See Enercalc

UL-B5

Simply supported

L =	18.34	ft
TW =	11.88	ft
DL =	19	psf
LL =	40	psf (R)

→ W10x26 OK for bending, shear, and deflection. See Enercalc

Steel Framing

UL-B6

Simply supported

L =	23.75	ft
TW =	1.26	ft
DL =	19	psf
LL =	40	psf (R)

Point Load from UL-B5

x_{UL-B5} =	12.0	ft
P_{DL} =	2.31	k
P_{LL} =	4.36	k

→ W10x49 OK for bending, shear, and deflection. See Enercalc

UL-B7 (Beam with Torsion, Supporting Entry Canopy, See Section E for Design)

UL-B8

Simply supported

L =	13.67	ft
TW =	11.88	ft
DL =	19	psf
LL =	40	psf (R)

→ W10x12 OK for bending, shear, and deflection. See Enercalc

UL-B9 (TRANSFER BEAM, EDGE BEAM WITH WINDOW WALL AND STUD WALL LOAD)

Backspan and cantilever

L =	6	ft
TW_L =	13.00	ft
a =	5	ft
TW_a =	7.00	ft
DL =	19	psf
LL =	40	psf (R)
Trib Height =	10.17	ft
w_{DL} =	0.102	klf

Point Load from Column

x_{COLUMN} =	5.00	ft
Trib Area =	183.0	ft^2

	Area Load (psf)	Point Load (k)	
DL	25	4.58	+ 0.712 (k)
LR	20	3.66	
SL	25	4.58	

→ W10x30 OK for bending, shear, and deflection. See Enercalc

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Seattle, WA 98101 206 622-5822

project	Fused Elements Residence	by	CBJ	sheet no.
location	Mercer Island, WA	date	06/16/23	
client	Olson Kundig			job no. 22-00638
	Framing Design			

Steel Framing

UL-B10

Backspan and cantilever

L =	5.75	ft
a =	1.04	ft
TW =	0.67	ft
DL =	19	psf
LL =	40	psf (R)

Point Load from UL-B9

x_{BM} =	1.04	ft
P_{DL} =	11.69	k
P_{LR} =	6.71	k
P_{LL} =	3.54	k
P_{SL} =	8.40	k

→ W10x30 OK for bending, shear, and deflection. See Enercalc

UL-B11

Simply supported

L =	13.75	ft
TW =	2.67	ft
DL =	19	psf
LL =	40	psf (R)

(Window or Wall Load also considered)

Trib Height =	10.34	ft
w_{DL} =	0.103	klf

→ W8x10 OK for bending, shear, and deflection. See Enercalc

UL-B12

Simply supported

L =	20.5	ft
TW =	8.34	ft
DL =	19	psf
LL =	40	psf (R)

Trib Height =	10.34	ft
w_{DL} =	0.103	klf

→ W12x35 OK for bending, shear, and deflection. See Enercalc

Steel Framing

UL-B13

Simply supported

L =	34	ft
TW =	2.13	ft
DL =	19	psf
LL =	60	psf (R)
SL =	25	psf

→ W12x35 OK for bending, shear, and deflection. See Enercalc

UL-B14

Simply supported

L =	25.83	ft
TW =	12.38	ft
DL =	19	psf
LL =	60	psf (R)
SL =	25	psf

→ W16x50 OK for bending, shear, and deflection. See Enercalc

UL-B15

Simply supported

L =	21.83	ft
TW =	10.25	ft
DL =	19	psf
LL =	60	psf (R)
SL =	25	psf

→ W16x40 OK for bending, shear, and deflection. See Enercalc

kpff
1601 5th Avenue, Suite 1600
Seattle, WA 98101 206 622-5822

project Fused Elements Residence		by CBJ	sheet no.
location Mercer Island, WA		date 06/16/23	
client Olson Kundig			job no. 22-00638
Framing Design			

Steel Framing

UL-B16

Simply supported

L =	18.67	ft
TW =	12.50	ft
DL =	52	psf
LR =	20	psf (R)
SL =	25	psf

→ W10x30 OK for bending, shear, and deflection. See Enercalc

UL-B17

Backspan and cantilever

L =	18.67	ft
a =	7.92	ft
TW =	5.21	ft
DL =	52	psf
LR =	20	psf (R)
SL =	25	psf

→ W10x30 OK for bending, shear, and deflection. See Enercalc

UL-B18

Simply supported

L =	9.67	ft
TW =	1.34	psf
DL =	52	psf (R)
LR =	20	psf
SL =	25	psf

Point Load from UL-B17

x_{UL-B17} =	1.17	ft
P_{DL} =	5.70	k
P_{LR} =	1.97	k
P_{SL} =	2.47	k

→ W10x30 OK for bending, shear, and deflection. See Enercalc

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project Fused Elements Residence		by CBJ	sheet no.
location Mercer Island, WA		date 06/16/23	
client Olson Kundig			job no. 22-00638
Framing Design			

Steel Framing

UR-B1

Simply supported

L =	20.25	ft
TW =	17.04	ft
DL =	16	psf
LR =	20	psf (R)
SL =	25	psf

→ W8x40 OK for bending, shear, and deflection. See Enercalc

UR-B2

Simply supported

L =	15	ft
TW =	17.04	ft
DL =	16	psf
LR =	20	psf (R)
SL =	25	psf

→ W8x21 OK for bending, shear, and deflection. See Enercalc

UR-B3

Simply supported

L =	14	ft
TW =	12.79	ft
DL =	16	psf
LR =	20	psf (R)
SL =	25	psf

→ W8x15 OK for bending, shear, and deflection. See Enercalc

kpff 1601 5th Avenue, Suite 1600 Seattle, WA 98101 206 622-5822	project Fused Elements Residence	by CBJ	sheet no.
	location Mercer Island, WA	date 06/16/23	
	client Olson Kundig		job no. 22-00638
	Framing Design		

Steel Framing

UR-B4

Simply supported

L =	10.83	ft
TW =	1.34	ft
DL =	16	psf
LR =	20	psf (R)
SL =	25	psf

Point Load from UR-B2

x_{UR-B2} =	4.83	ft
P_{DL} =	2.20	k
P_{LR} =	2.56	k
P_{SL} =	3.20	k

Point Load from LSL

x_{LSL} =	9.50	ft
P_{DL} =	1.16	k
P_{LR} =	1.45	k
P_{SL} =	1.82	k

→ W12x22 OK for bending, shear, and deflection. See Enercalc

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

LIC# : KW-06018139, Build:20.22.12.28 KPFF CONSULTING ENGINEERS SEA

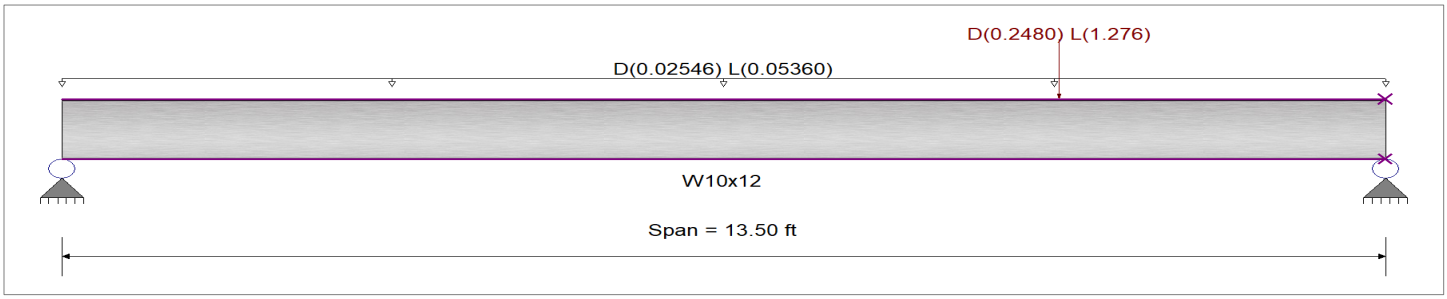
DESCRIPTION: ML-B1

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0190, L = 0.040 ksf, Tributary Width = 1.340 ft, (Floor Loads)

Point Load : D = 0.2480, L = 1.276 k @ 10.170 ft, (Stair Post)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.172 : 1	Maximum Shear Stress Ratio =	0.047 : 1
Section used for this span	W10x12	Section used for this span	W10x12
Mu : Applied	8.078 k-ft	Vu : Applied	2.645 k
Mn * Phi : Allowable	46.904 k-ft	Vn * Phi : Allowable	56.259 k
Load Combination	+1.20D+1.60L	Load Combination	+1.20D+1.60L
		Location of maximum on span	13.500 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.076 in	Ratio =	2,137	>=600.
Max Upward Transient Deflection	0.000 in	Ratio =	0	<600.0 Span: 1 : L Only
Max Downward Total Deflection	0.103 in	Ratio =	1566	>=360. Span: 1 : +D+L
Max Upward Total Deflection	0.000 in	Ratio =	0	<360.0

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D													
Dsgn. L = 13.50 ft	1	0.039	0.011	1.84		1.84	52.12	46.90	1.00	1.00	0.62	56.26	56.26
+1.20D+1.60L													
Dsgn. L = 13.50 ft	1	0.172	0.047	8.08		8.08	52.12	46.90	1.00	1.00	2.64	56.26	56.26
+1.20D+0.50L													
Dsgn. L = 13.50 ft	1	0.076	0.021	3.56		3.56	52.12	46.90	1.00	1.00	1.19	56.26	56.26
+1.20D													
Dsgn. L = 13.50 ft	1	0.034	0.009	1.58		1.58	52.12	46.90	1.00	1.00	0.53	56.26	56.26
+0.90D													
Dsgn. L = 13.50 ft	1	0.025	0.007	1.18		1.18	52.12	46.90	1.00	1.00	0.40	56.26	56.26

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.1034	7.213		0.0000	0.000

Vertical Reactions

Support notation : Far left is #' Values in KIPS

Load Combination	Support 1	Support 2	
Max Upward from all Load Conditions	0.991	1.763	
Max Upward from Load Combinations	0.991	1.763	B15
Max Upward from Load Cases	0.677	1.323	

Steel Beam

DESCRIPTION: ML-B1

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
D Only	0.314	0.440
+D+L	0.991	1.763
+D+0.750L	0.821	1.432
+0.60D	0.188	0.264
L Only	0.677	1.323

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

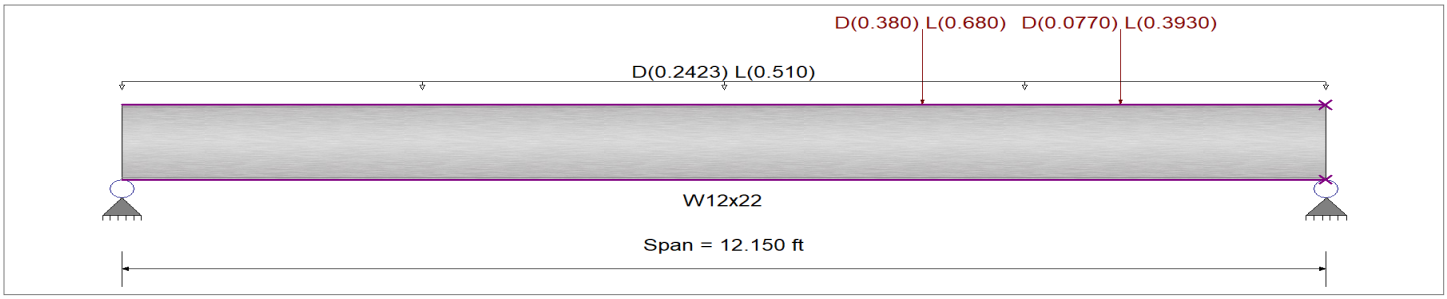
DESCRIPTION: ML-B2

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0190, L = 0.040 ksf, Tributary Width = 12.750 ft, (Floor Loads)

Point Load : D = 0.380, L = 0.680 k @ 8.080 ft, (ML-B1)

Point Load : D = 0.0770, L = 0.3930 k @ 10.080 ft, (Stringer)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.227 : 1	Maximum Shear Stress Ratio =	0.089 : 1
Section used for this span	W12x22	Section used for this span	W12x22
Mu : Applied	24.978 k-ft	Vu : Applied	8.509 k
Mn * Phi : Allowable	109.875 k-ft	Vn * Phi : Allowable	95.940 k
Load Combination	+1.20D+1.60L	Load Combination	+1.20D+1.60L
		Location of maximum on span	12.150 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.067 in	Ratio =	2,187	>=600.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<600.0	Span: 1 : L Only
Max Downward Total Deflection	0.101 in	Ratio =	1449	>=360.	Span: 1 : +D+L
Max Upward Total Deflection	0.000 in	Ratio =	0	<360.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D													
Dsgn. L = 12.15 ft	1	0.073	0.028	8.07		8.07	122.08	109.88	1.00	1.00	2.69	95.94	95.94
+1.20D+1.60L													
Dsgn. L = 12.15 ft	1	0.227	0.089	24.98		24.98	122.08	109.88	1.00	1.00	8.51	95.94	95.94
+1.20D+0.50L													
Dsgn. L = 12.15 ft	1	0.114	0.044	12.56		12.56	122.08	109.88	1.00	1.00	4.24	95.94	95.94
+1.20D													
Dsgn. L = 12.15 ft	1	0.063	0.024	6.92		6.92	122.08	109.88	1.00	1.00	2.31	95.94	95.94
+0.90D													
Dsgn. L = 12.15 ft	1	0.047	0.018	5.19		5.19	122.08	109.88	1.00	1.00	1.73	95.94	95.94

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.1006	6.179		0.0000	0.000

Steel Beam

DESCRIPTION: ML-B2

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	5.139	5.798
Max Upward from Load Combinations	5.139	5.798
Max Upward from Load Cases	3.393	3.877
D Only	1.746	1.922
+D+L	5.139	5.798
+D+0.750L	4.290	4.829
+0.60D	1.047	1.153
L Only	3.393	3.877

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

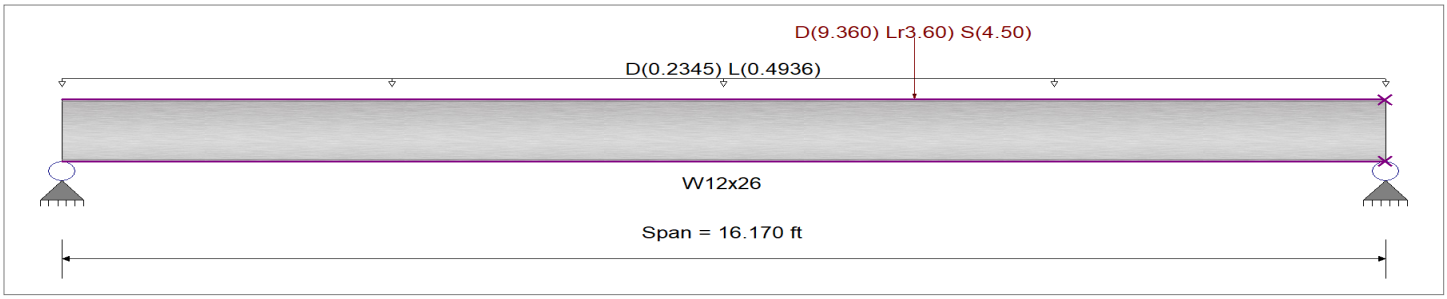
DESCRIPTION: ML-B3

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0190, L = 0.040 ksf, Tributary Width = 12.340 ft, (Floor Loads)

Point Load : D = 9.360, Lr = 3.60, S = 4.50 k @ 10.420 ft, (Column)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.609 : 1	Maximum Shear Stress Ratio =	0.209 : 1
Section used for this span	W12x26	Section used for this span	W12x26
Mu : Applied	84.922 k-ft	Vu : Applied	17.60 k
Mn * Phi : Allowable	139.500 k-ft	Vn * Phi : Allowable	84.180 k
Load Combination	+1.20D+0.50L+1.60S	Load Combination	+1.20D+1.60L+0.50S
		Location of maximum on span	16.170 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.129 in	Ratio =	1,505	>=600.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<600.0	Span: 1 : L Only
Max Downward Total Deflection	0.458 in	Ratio =	424	>=360.	Span: 1 : +D+0.750L+0.750S
Max Upward Total Deflection	0.000 in	Ratio =	0	<360.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D													
Dsgn. L = 16.17 ft	1	0.426	0.135	59.38		59.38	155.00	139.50	1.00	1.00	11.39	84.18	84.18
+1.20D+0.50Lr+1.60L													
Dsgn. L = 16.17 ft	1	0.582	0.206	81.26		81.26	155.00	139.50	1.00	1.00	17.31	84.18	84.18
+1.20D+1.60L+0.50S													
Dsgn. L = 16.17 ft	1	0.594	0.209	82.92		82.92	155.00	139.50	1.00	1.00	17.60	84.18	84.18
+1.20D+1.60Lr+0.50L													
Dsgn. L = 16.17 ft	1	0.571	0.184	79.60		79.60	155.00	139.50	1.00	1.00	15.47	84.18	84.18
+1.20D+1.60Lr													
Dsgn. L = 16.17 ft	1	0.517	0.160	72.19		72.19	155.00	139.50	1.00	1.00	13.48	84.18	84.18
+1.20D+0.50L+1.60S													
Dsgn. L = 16.17 ft	1	0.609	0.195	84.92		84.92	155.00	139.50	1.00	1.00	16.40	84.18	84.18
+1.20D+1.60S													
Dsgn. L = 16.17 ft	1	0.556	0.171	77.51		77.51	155.00	139.50	1.00	1.00	14.40	84.18	84.18
+1.20D+0.50Lr+0.50L													
Dsgn. L = 16.17 ft	1	0.466	0.153	64.96		64.96	155.00	139.50	1.00	1.00	12.92	84.18	84.18
+1.20D+0.50L+0.50S													
Dsgn. L = 16.17 ft	1	0.478	0.157	66.62		66.62	155.00	139.50	1.00	1.00	13.21	84.18	84.18
+1.20D+0.50L+0.70S													

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: ML-B3

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values						Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
Dsgn. L = 16.17 ft +0.90D	1	0.501	0.164	69.95		69.95	155.00	139.50	1.00	1.00	13.79	84.18	84.18
Dsgn. L = 16.17 ft	1	0.274	0.087	38.17		38.17	155.00	139.50	1.00	1.00	7.32	84.18	84.18

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750L+0.750S	1	0.4580	8.547		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	9.627	13.305
Max Upward from Load Combinations	9.627	13.305
Max Upward from Load Cases	5.434	8.137
D Only	5.434	8.137
+D+L	9.425	12.128
+D+Lr	6.714	10.457
+D+S	7.034	11.037
+D+0.750Lr+0.750L	9.387	12.870
+D+0.750L+0.750S	9.627	13.305
+0.60D	3.261	4.882
Lr Only	1.280	2.320
L Only	3.991	3.991
S Only	1.600	2.900

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

LIC# : KW-06018139, Build:20.22.12.28 KPFF CONSULTING ENGINEERS SEA (c) ENERCALC INC 1983-2022

DESCRIPTION: ML-B4

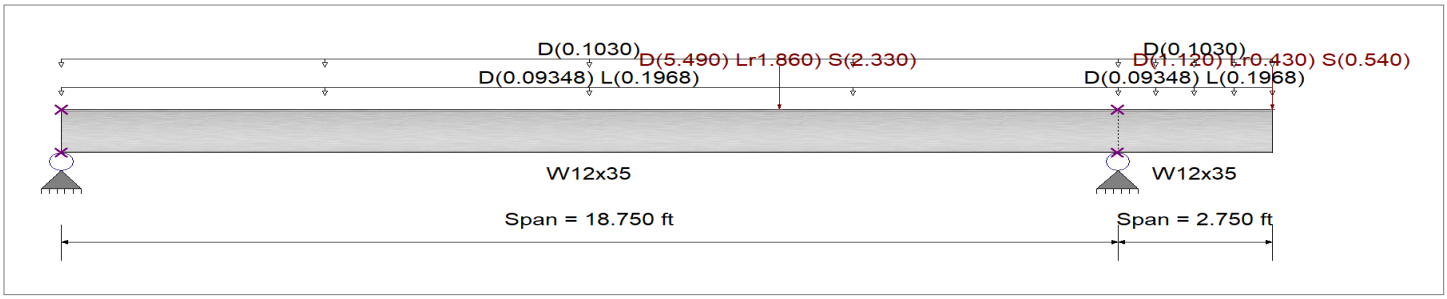
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method : Load Resistance Factor Design
Beam Bracing : Completely Unbraced
Bending Axis : Major Axis Bending

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



Applied Loads

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

Beam self weight calculated and added to loading
Load for Span Number 1
Uniform Load : D = 0.0190, L = 0.040 ksf, Tributary Width = 4.920 ft, (Floor Loads)

Uniform Load : D = 0.1030 k/ft, Tributary Width = 1.0 ft, (Window wall)

Point Load : D = 5.490, Lr = 1.860, S = 2.330 k @ 12.750 ft, (Stud)

Load for Span Number 2
Uniform Load : D = 0.0190, L = 0.040 ksf, Tributary Width = 4.920 ft, (Floor Loads)

Point Load : D = 1.120, Lr = 0.430, S = 0.540 k @ 2.750 ft, (Column)

Uniform Load : D = 0.1030 k/ft, Tributary Width = 1.0 ft, (Window wall)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.410 : 1	Maximum Shear Stress Ratio =	0.099 : 1
Section used for this span	W12x35	Section used for this span	W12x35
Mu : Applied	50.569 k-ft	Vu : Applied	11.184 k
Mn * Phi : Allowable	123.205 k-ft	Vn * Phi : Allowable	112.50 k
Load Combination	+1.20D+1.60L+0.50S+1.60H, LL Comb Run (L*)	Load Combination	+1.20D+1.60L+0.50S+1.60H, LL Comb Run (LL)
		Location of maximum on span	18.750 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.067 in	Ratio =	3,376	>=600.	Span: 2 : L Only, LL Comb Run (L*)
Max Upward Transient Deflection	-0.031 in	Ratio =	2,123	>=600.	Span: 2 : L Only, LL Comb Run (L*)
Max Downward Total Deflection	0.279 in	Ratio =	807	>=360.	Span: 2 : +D+0.750L+0.750S+H, LL Comb Run (L*)
Max Upward Total Deflection	-0.128 in	Ratio =	514	>=360.	Span: 2 : +D+0.750Lr+0.750L+H, LL Comb Run (L*)

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 18.75 ft	1	0.309	0.076	39.99	-5.54	39.99	143.78	129.40	1.27	1.00	8.56	112.50	112.50
Dsgn. L = 2.75 ft	2	0.029	0.022		-5.54	5.54	213.33	192.00	1.00	1.00	2.46	112.50	112.50
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 18.75 ft	1	0.256	0.066	33.06	-6.53	33.06	143.78	129.40	1.27	1.00	7.43	112.50	112.50
Dsgn. L = 2.75 ft	2	0.034	0.028		-6.53	6.53	213.33	192.00	1.00	1.00	3.19	112.50	112.50
+1.20D+0.50Lr+1.60L+1.60H, LL													

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: ML-B4

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
Dsgn. L = 18.75 ft	1	0.407	0.097	50.12	-4.75	50.12	136.67	123.00	1.21	1.00	10.92	112.50	112.50
Dsgn. L = 2.75 ft	2	0.025	0.019		-4.75	4.75	213.33	192.00	1.00	1.00	2.11	112.50	112.50
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 18.75 ft	1	0.398	0.098	48.90	-6.53	48.90	136.44	122.80	1.21	1.00	11.02	112.50	112.50
Dsgn. L = 2.75 ft	2	0.034	0.028		-6.53	6.53	213.33	192.00	1.00	1.00	3.19	112.50	112.50
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 18.75 ft	1	0.288	0.073	37.72	-6.68	37.72	145.58	131.03	1.29	1.00	8.23	112.50	112.50
Dsgn. L = 2.75 ft	2	0.035	0.029		-6.68	6.68	213.33	192.00	1.00	1.00	3.24	112.50	112.50
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 18.75 ft	1	0.410	0.099	50.57	-5.49	50.57	136.89	123.20	1.21	1.00	11.12	112.50	112.50
Dsgn. L = 2.75 ft	2	0.029	0.021		-5.49	5.49	213.33	192.00	1.00	1.00	2.38	112.50	112.50
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 18.75 ft	1	0.404	0.099	49.76	-6.68	49.76	136.89	123.20	1.21	1.00	11.18	112.50	112.50
Dsgn. L = 2.75 ft	2	0.035	0.029		-6.68	6.68	213.33	192.00	1.00	1.00	3.24	112.50	112.50
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 18.75 ft	1	0.253	0.066	32.74	-7.01	32.74	143.78	129.40	1.27	1.00	7.46	112.50	112.50
Dsgn. L = 2.75 ft	2	0.037	0.027		-7.01	7.01	213.33	192.00	1.00	1.00	3.07	112.50	112.50
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 18.75 ft	1	0.386	0.091	50.18	-4.75	50.18	144.46	130.01	1.28	1.00	10.28	112.50	112.50
Dsgn. L = 2.75 ft	2	0.025	0.019		-4.75	4.75	213.33	192.00	1.00	1.00	2.11	112.50	112.50
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 18.75 ft	1	0.374	0.092	48.64	-7.01	48.64	144.46	130.01	1.28	1.00	10.40	112.50	112.50
Dsgn. L = 2.75 ft	2	0.037	0.027		-7.01	7.01	213.33	192.00	1.00	1.00	3.07	112.50	112.50
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 18.75 ft	1	0.255	0.066	32.99	-6.64	32.99	143.78	129.40	1.27	1.00	7.44	112.50	112.50
Dsgn. L = 2.75 ft	2	0.035	0.025		-6.64	6.64	213.33	192.00	1.00	1.00	2.80	112.50	112.50
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 18.75 ft	1	0.350	0.083	46.42	-4.75	46.42	147.50	132.75	1.31	1.00	9.36	112.50	112.50
Dsgn. L = 2.75 ft	2	0.025	0.019		-4.75	4.75	213.33	192.00	1.00	1.00	2.11	112.50	112.50
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 18.75 ft	1	0.340	0.084	45.13	-6.64	45.13	147.62	132.85	1.31	1.00	9.46	112.50	112.50
Dsgn. L = 2.75 ft	2	0.035	0.025		-6.64	6.64	213.33	192.00	1.00	1.00	2.80	112.50	112.50
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 18.75 ft	1	0.357	0.089	47.62	-7.49	47.62	148.41	133.56	1.32	1.00	10.02	112.50	112.50
Dsgn. L = 2.75 ft	2	0.039	0.029		-7.49	7.49	213.33	192.00	1.00	1.00	3.24	112.50	112.50
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 18.75 ft	1	0.395	0.097	51.63	-7.12	51.63	145.36	130.82	1.29	1.00	10.92	112.50	112.50
Dsgn. L = 2.75 ft	2	0.037	0.026		-7.12	7.12	213.33	192.00	1.00	1.00	2.97	112.50	112.50
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 18.75 ft	1	0.393	0.097	51.38	-7.49	51.38	145.36	130.82	1.29	1.00	10.94	112.50	112.50
Dsgn. L = 2.75 ft	2	0.039	0.029		-7.49	7.49	213.33	192.00	1.00	1.00	3.24	112.50	112.50
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 18.75 ft	1	0.359	0.089	47.87	-7.12	47.87	148.29	133.46	1.31	1.00	10.00	112.50	112.50
Dsgn. L = 2.75 ft	2	0.037	0.026		-7.12	7.12	213.33	192.00	1.00	1.00	2.97	112.50	112.50
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 18.75 ft	1	0.260	0.066	33.62	-5.71	33.62	143.78	129.40	1.27	1.00	7.39	112.50	112.50
Dsgn. L = 2.75 ft	2	0.030	0.023		-5.71	5.71	213.33	192.00	1.00	1.00	2.59	112.50	112.50
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 18.75 ft	1	0.328	0.079	41.83	-4.75	41.83	141.86	127.67	1.26	1.00	8.89	112.50	112.50
Dsgn. L = 2.75 ft	2	0.025	0.019		-4.75	4.75	213.33	192.00	1.00	1.00	2.11	112.50	112.50
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 18.75 ft	1	0.323	0.079	41.18	-5.71	41.18	141.86	127.67	1.26	1.00	8.94	112.50	112.50
Dsgn. L = 2.75 ft	2	0.030	0.023		-5.71	5.71	213.33	192.00	1.00	1.00	2.59	112.50	112.50
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 18.75 ft	1	0.292	0.073	38.27	-5.86	38.27	145.47	130.92	1.29	1.00	8.19	112.50	112.50
Dsgn. L = 2.75 ft	2	0.031	0.024		-5.86	5.86	213.33	192.00	1.00	1.00	2.65	112.50	112.50
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 18.75 ft	1	0.330	0.081	42.29	-5.49	42.29	142.20	127.98	1.26	1.00	9.09	112.50	112.50
Dsgn. L = 2.75 ft	2	0.029	0.021		-5.49	5.49	213.33	192.00	1.00	1.00	2.38	112.50	112.50
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 18.75 ft	1	0.328	0.081	42.04	-5.86	42.04	142.20	127.98	1.26	1.00	9.11	112.50	112.50
Dsgn. L = 2.75 ft	2	0.031	0.024		-5.86	5.86	213.33	192.00	1.00	1.00	2.65	112.50	112.50
+1.20D+0.50L+0.70S+E+1.60H, L													

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: ML-B4

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
Dsgn. L = 18.75 ft	1	0.304	0.076	39.97	-6.16	39.97	146.15	131.53	1.30	1.00	8.52	112.50	112.50
Dsgn. L = 2.75 ft	2	0.032	0.025		-6.16	6.16	213.33	192.00	1.00	1.00	2.76	112.50	112.50
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 18.75 ft	1	0.342	0.084	43.99	-5.79	43.99	142.88	128.59	1.27	1.00	9.42	112.50	112.50
Dsgn. L = 2.75 ft	2	0.030	0.022		-5.79	5.79	213.33	192.00	1.00	1.00	2.49	112.50	112.50
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 18.75 ft	1	0.340	0.084	43.73	-6.16	43.73	142.88	128.59	1.27	1.00	9.44	112.50	112.50
Dsgn. L = 2.75 ft	2	0.032	0.025		-6.16	6.16	213.33	192.00	1.00	1.00	2.76	112.50	112.50
+0.90D+W+0.90H													
Dsgn. L = 18.75 ft	1	0.199	0.049	25.71	-3.56	25.71	143.78	129.40	1.27	1.00	5.50	112.50	112.50
Dsgn. L = 2.75 ft	2	0.019	0.014		-3.56	3.56	213.33	192.00	1.00	1.00	1.58	112.50	112.50
+0.90D+E+0.90H													
Dsgn. L = 18.75 ft	1	0.199	0.049	25.71	-3.56	25.71	143.78	129.40	1.27	1.00	5.50	112.50	112.50
Dsgn. L = 2.75 ft	2	0.019	0.014		-3.56	3.56	213.33	192.00	1.00	1.00	1.58	112.50	112.50

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	0.2789	9.825		0.0000	0.000
	2	0.0000	9.825	+D+0.750Lr+0.750L+0.450W+H	-0.1285	2.750

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	5.600	11.343	
Max Upward from Load Combinations	5.600	11.343	
Max Upward from Load Cases	3.716	7.871	
Max Downward from all Load Conditions (Resis	-0.063		
Max Downward from Load Cases (Resisting Up	-0.063		
+D+H	3.716	7.871	
+D+L+H, LL Comb Run (*L)	3.676	8.452	
+D+L+H, LL Comb Run (L*)	5.561	9.716	
+D+L+H, LL Comb Run (LL)	5.521	10.297	
+D+Lr+H, LL Comb Run (*L)	3.653	8.364	
+D+Lr+H, LL Comb Run (L*)	4.311	9.136	
+D+Lr+H, LL Comb Run (LL)	4.248	9.629	
+D+S+H	4.382	10.074	
+D+0.750Lr+0.750L+H, LL Comb Run (*L)	3.639	8.676	
+D+0.750Lr+0.750L+H, LL Comb Run (L*)	5.546	10.203	
+D+0.750Lr+0.750L+H, LL Comb Run (LL)	5.469	11.009	
+D+0.750L+0.750S+H, LL Comb Run (*L)	4.186	9.959	
+D+0.750L+0.750S+H, LL Comb Run (L*)	5.600	10.907	
+D+0.750L+0.750S+H, LL Comb Run (LL)	5.570	11.343	
+D+0.60W+H	3.716	7.871	
+D+0.70E+H	3.716	7.871	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	3.639	8.676	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	5.546	10.203	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	5.469	11.009	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	4.186	9.959	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	5.600	10.907	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	5.570	11.343	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	4.186	9.959	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	5.600	10.907	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	5.570	11.343	
+0.60D+0.60W+0.60H	2.230	4.723	
+0.60D+0.70E+0.60H	2.230	4.723	
D Only	3.716	7.871	
Lr Only, LL Comb Run (*L)	-0.063	0.493	
Lr Only, LL Comb Run (L*)	0.595	1.265	
Lr Only, LL Comb Run (LL)	0.532	1.758	
L Only, LL Comb Run (*L)	-0.040	0.581	
L Only, LL Comb Run (L*)	1.845	1.845	
L Only, LL Comb Run (LL)	1.805	2.426	
S Only	0.666	2.204	B23
H Only			

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

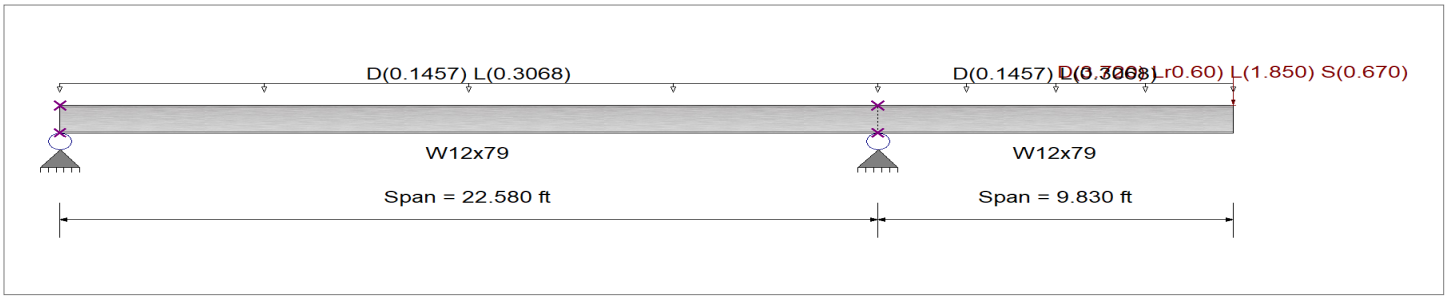
DESCRIPTION: ML-B5

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Completely Unbraced	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



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 = 0.0190, L = 0.040 ksf, Tributary Width = 7.670 ft, (Floor Loads)

Load for Span Number 2
Uniform Load : D = 0.0190, L = 0.040 ksf, Tributary Width = 7.670 ft, (Floor Loads)

Point Load : D = 3.720, Lr = 0.60, L = 1.850, S = 0.670 k @ 9.830 ft, (ML-B4)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.253 : 1	Maximum Shear Stress Ratio =	0.087 : 1
Section used for this span	W12x79	Section used for this span	W12x79
Mu : Applied	113.017 k-ft	Vu : Applied	15.235 k
Mn * Phi : Allowable	446.250 k-ft	Vn * Phi : Allowable	174.840 k
Load Combination	+1.20D+1.60L+0.50S+1.60H, LL Comb Run (LL)	Load Combination	+1.20D+1.60L+0.50S+1.60H, LL Comb Run (*L)
		Location of maximum on span	22.580 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.305 in	Ratio =	774	>=600.	Span: 2 : L Only, LL Comb Run (L*)
Max Upward Transient Deflection	-0.130 in	Ratio =	1,811	>=600.	Span: 2 : L Only, LL Comb Run (*L)
Max Downward Total Deflection	0.654 in	Ratio =	361	>=360.	Span: 2 : +D+L+H, LL Comb Run (*L)
Max Upward Total Deflection	-0.172 in	Ratio =	1576	>=360.	Span: 2 : +D+L+H, LL Comb Run (*L)

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 22.58 ft	1	0.149	0.047	0.59	-66.40	66.40	495.83	446.25	2.53	1.00	8.30	174.84	174.84
Dsgn. L = 9.83 ft	2	0.149	0.047		-66.40	66.40	495.83	446.25	1.00	1.00	8.30	174.84	174.84
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 22.58 ft	1	0.252	0.087		-112.67	112.67	495.83	446.25	2.01	1.00	15.20	174.84	174.84
Dsgn. L = 9.83 ft	2	0.252	0.087		-112.67	112.67	495.83	446.25	1.00	1.00	15.20	174.84	174.84
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 22.58 ft	1	0.128	0.064	24.19	-56.91	56.91	495.83	446.25	2.31	1.00	11.11	174.84	174.84
Dsgn. L = 9.83 ft	2	0.128	0.041		-56.91	56.91	495.83	446.25	1.00	1.00	7.11	174.84	174.84
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 22.58 ft	1	0.252	0.087	8.50	-112.67	112.67	495.83	446.25	2.91	1.00	15.20	174.84	174.84
Dsgn. L = 9.83 ft	2	0.252	0.087		-112.67	112.67	495.83	446.25	1.00	1.00	15.20	174.84	174.84
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 22.58 ft	1	0.253	0.087		-113.02	113.02	495.83	446.25	2.01	1.00	15.24	174.84	174.84
Dsgn. L = 9.83 ft	2	0.253	0.087		-113.02	113.02	495.83	446.25	1.00	1.00	15.24	174.84	174.84

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: ML-B5

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 22.58 ft	1	0.135	0.064	23.04	-60.20	60.20	495.83	446.25	2.39	1.00	11.25	174.84	174.84
Dsgn. L = 9.83 ft	2	0.135	0.043		-60.20	60.20	495.83	446.25	1.00	1.00	7.45	174.84	174.84
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 22.58 ft	1	0.253	0.087	8.43	-113.02	113.02	495.83	446.25	2.91	1.00	15.24	174.84	174.84
Dsgn. L = 9.83 ft	2	0.253	0.087		-113.02	113.02	495.83	446.25	1.00	1.00	15.24	174.84	174.84
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 22.58 ft	1	0.186	0.060		-82.85	82.85	495.83	446.25	2.18	1.00	10.51	174.84	174.84
Dsgn. L = 9.83 ft	2	0.186	0.060		-82.85	82.85	495.83	446.25	1.00	1.00	10.51	174.84	174.84
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 22.58 ft	1	0.128	0.042	6.02	-56.91	56.91	495.83	446.25	3.00	1.00	7.30	174.84	174.84
Dsgn. L = 9.83 ft	2	0.128	0.041		-56.91	56.91	495.83	446.25	1.00	1.00	7.11	174.84	174.84
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 22.58 ft	1	0.186	0.060	1.45	-82.85	82.85	495.83	446.25	2.64	1.00	10.51	174.84	174.84
Dsgn. L = 9.83 ft	2	0.186	0.060		-82.85	82.85	495.83	446.25	1.00	1.00	10.51	174.84	174.84
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 22.58 ft	1	0.149	0.046	0.02	-66.35	66.35	495.83	446.25	2.36	1.00	8.07	174.84	174.84
Dsgn. L = 9.83 ft	2	0.149	0.046		-66.35	66.35	495.83	446.25	1.00	1.00	8.07	174.84	174.84
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 22.58 ft	1	0.128	0.041	0.51	-56.91	56.91	495.83	446.25	2.53	1.00	7.11	174.84	174.84
Dsgn. L = 9.83 ft	2	0.128	0.041		-56.91	56.91	495.83	446.25	1.00	1.00	7.11	174.84	174.84
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 22.58 ft	1	0.149	0.046	0.02	-66.35	66.35	495.83	446.25	2.36	1.00	8.07	174.84	174.84
Dsgn. L = 9.83 ft	2	0.149	0.046		-66.35	66.35	495.83	446.25	1.00	1.00	8.07	174.84	174.84
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 22.58 ft	1	0.188	0.061		-83.95	83.95	495.83	446.25	2.17	1.00	10.62	174.84	174.84
Dsgn. L = 9.83 ft	2	0.188	0.061		-83.95	83.95	495.83	446.25	1.00	1.00	10.62	174.84	174.84
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 22.58 ft	1	0.151	0.047	3.78	-67.45	67.45	495.83	446.25	2.83	1.00	8.19	174.84	174.84
Dsgn. L = 9.83 ft	2	0.151	0.047		-67.45	67.45	495.83	446.25	1.00	1.00	8.19	174.84	174.84
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 22.58 ft	1	0.188	0.061	1.32	-83.95	83.95	495.83	446.25	2.62	1.00	10.62	174.84	174.84
Dsgn. L = 9.83 ft	2	0.188	0.061		-83.95	83.95	495.83	446.25	1.00	1.00	10.62	174.84	174.84
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 22.58 ft	1	0.151	0.047	0.01	-67.45	67.45	495.83	446.25	2.34	1.00	8.19	174.84	174.84
Dsgn. L = 9.83 ft	2	0.151	0.047		-67.45	67.45	495.83	446.25	1.00	1.00	8.19	174.84	174.84
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 22.58 ft	1	0.171	0.056		-76.36	76.36	495.83	446.25	2.24	1.00	9.85	174.84	174.84
Dsgn. L = 9.83 ft	2	0.171	0.056		-76.36	76.36	495.83	446.25	1.00	1.00	9.85	174.84	174.84
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 22.58 ft	1	0.128	0.042	6.02	-56.91	56.91	495.83	446.25	3.00	1.00	7.30	174.84	174.84
Dsgn. L = 9.83 ft	2	0.128	0.041		-56.91	56.91	495.83	446.25	1.00	1.00	7.11	174.84	174.84
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 22.58 ft	1	0.171	0.056	2.30	-76.36	76.36	495.83	446.25	2.72	1.00	9.85	174.84	174.84
Dsgn. L = 9.83 ft	2	0.171	0.056		-76.36	76.36	495.83	446.25	1.00	1.00	9.85	174.84	174.84
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 22.58 ft	1	0.172	0.057		-76.71	76.71	495.83	446.25	2.23	1.00	9.88	174.84	174.84
Dsgn. L = 9.83 ft	2	0.172	0.057		-76.71	76.71	495.83	446.25	1.00	1.00	9.88	174.84	174.84
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 22.58 ft	1	0.135	0.043	5.26	-60.20	60.20	495.83	446.25	2.96	1.00	7.45	174.84	174.84
Dsgn. L = 9.83 ft	2	0.135	0.043		-60.20	60.20	495.83	446.25	1.00	1.00	7.45	174.84	174.84
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 22.58 ft	1	0.172	0.057	2.25	-76.71	76.71	495.83	446.25	2.71	1.00	9.88	174.84	174.84
Dsgn. L = 9.83 ft	2	0.172	0.057		-76.71	76.71	495.83	446.25	1.00	1.00	9.88	174.84	174.84
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 22.58 ft	1	0.175	0.057		-78.02	78.02	495.83	446.25	2.22	1.00	10.02	174.84	174.84
Dsgn. L = 9.83 ft	2	0.175	0.057		-78.02	78.02	495.83	446.25	1.00	1.00	10.02	174.84	174.84
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 22.58 ft	1	0.138	0.043	4.98	-61.52	61.52	495.83	446.25	2.94	1.00	7.58	174.84	174.84
Dsgn. L = 9.83 ft	2	0.138	0.043		-61.52	61.52	495.83	446.25	1.00	1.00	7.58	174.84	174.84
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 22.58 ft	1	0.175	0.057	2.06	-78.02	78.02	495.83	446.25	2.70	1.00	10.02	174.84	174.84
Dsgn. L = 9.83 ft	2	0.175	0.057		-78.02	78.02	495.83	446.25	1.00	1.00	10.02	174.84	174.84

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: ML-B5

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+0.90D+W+0.90H													
Dsgn. L = 22.58 ft	1	0.096	0.031	0.38	-42.68	42.68	495.83	446.25	2.53	1.00	5.34	174.84	174.84
Dsgn. L = 9.83 ft	2	0.096	0.031		-42.68	42.68	495.83	446.25	1.00	1.00	5.34	174.84	174.84
+0.90D+E+0.90H													
Dsgn. L = 22.58 ft	1	0.096	0.031	0.38	-42.68	42.68	495.83	446.25	2.53	1.00	5.34	174.84	174.84
Dsgn. L = 9.83 ft	2	0.096	0.031		-42.68	42.68	495.83	446.25	1.00	1.00	5.34	174.84	174.84

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
	1	0.0000	0.000	+D+L+H	-0.1719	13.819
+D+L+H	2	0.6542	9.830		0.0000	13.819

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	3.901	20.358	
Max Upward from Load Combinations	3.901	20.358	
Max Upward from Load Cases	3.464	10.567	
Max Downward from all Load Conditions (Resis	-1.462		
Max Downward from Load Combinations (Resi	-1.025		
Max Downward from Load Cases (Resisting Up	-1.462		
+D+H	0.437	10.567	
+D+L+H, LL Comb Run (*L)	-1.025	16.894	
+D+L+H, LL Comb Run (L*)	3.901	14.030	
+D+L+H, LL Comb Run (LL)	2.439	20.358	
+D+Lr+H, LL Comb Run (*L)	0.176	11.428	
+D+Lr+H, LL Comb Run (L*)	0.437	10.567	
+D+Lr+H, LL Comb Run (LL)	0.176	11.428	
+D+S+H	0.145	11.528	
+D+0.750Lr+0.750L+H, LL Comb Run (*L)	-0.855	15.958	
+D+0.750Lr+0.750L+H, LL Comb Run (L*)	3.035	13.164	
+D+0.750Lr+0.750L+H, LL Comb Run (LL)	1.742	18.556	
+D+0.750L+0.750S+H, LL Comb Run (*L)	-0.878	16.034	
+D+0.750L+0.750S+H, LL Comb Run (L*)	2.816	13.886	
+D+0.750L+0.750S+H, LL Comb Run (LL)	1.720	18.631	
+D+0.60W+H	0.437	10.567	
+D+0.70E+H	0.437	10.567	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	-0.855	15.958	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	3.035	13.164	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	1.742	18.556	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	-0.878	16.034	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	2.816	13.886	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	1.720	18.631	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	-0.878	16.034	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	2.816	13.886	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	1.720	18.631	
+0.60D+0.60W+0.60H	0.262	6.340	
+0.60D+0.70E+0.60H	0.262	6.340	
D Only	0.437	10.567	
Lr Only, LL Comb Run (*L)	-0.261	0.861	
Lr Only, LL Comb Run (LL)	-0.261	0.861	
L Only, LL Comb Run (*L)	-1.462	6.328	
L Only, LL Comb Run (L*)	3.464	3.464	
L Only, LL Comb Run (LL)	2.002	9.791	
S Only	-0.292	0.962	
H Only			

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

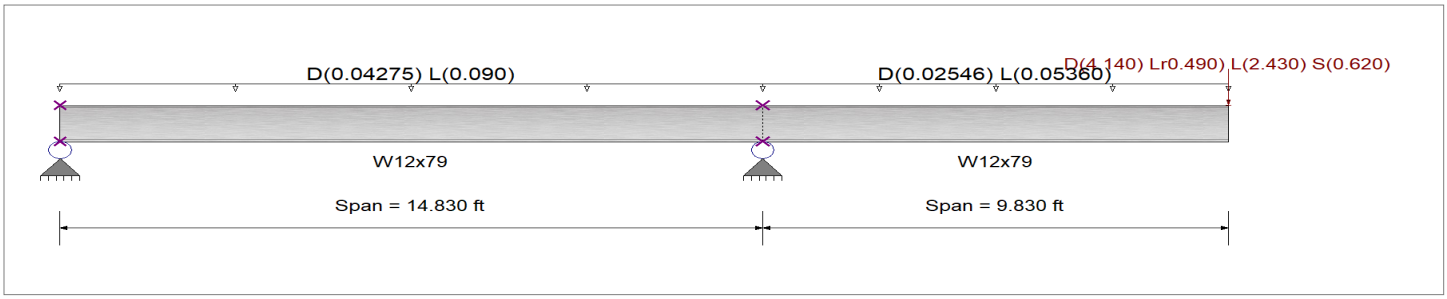
DESCRIPTION: ML-B6

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Completely Unbraced	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



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 = 0.0190, L = 0.040 ksf, Tributary Width = 2.250 ft, (Floor Loads)

Load for Span Number 2
Uniform Load : D = 0.0190, L = 0.040 ksf, Tributary Width = 1.340 ft, (Floor Loads)

Point Load : D = 4.140, Lr = 0.490, L = 2.430, S = 0.620 k @ 9.830 ft, (ML-B4)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.225 : 1	Maximum Shear Stress Ratio =	0.064 : 1
Section used for this span	W12x79	Section used for this span	W12x79
Mu : Applied	100.302 k-ft	Vu : Applied	11.241 k
Mn * Phi : Allowable	446.250 k-ft	Vn * Phi : Allowable	174.840 k
Load Combination	+1.20D+1.60L+0.50S+1.60H, LL Comb Run (*L)	Load Combination	+1.20D+1.60L+0.50S+1.60H, LL Comb Run (*L)
		Location of maximum on span	14.830 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.190 in	Ratio =	1,238	>=600.	Span: 2 : L Only, LL Comb Run (*L)
Max Upward Transient Deflection	-0.034 in	Ratio =	5,265	>=600.	Span: 2 : L Only, LL Comb Run (*L)
Max Downward Total Deflection	0.504 in	Ratio =	468	>=360.	Span: 2 : +D+L+H, LL Comb Run (*L)
Max Upward Total Deflection	-0.085 in	Ratio =	2082	>=360.	Span: 2 : +D+L+H, LL Comb Run (*L)

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 14.83 ft	1	0.144	0.041		-64.04	64.04	495.83	446.25	1.82	1.00	7.23	174.84	174.84
Dsgn. L = 9.83 ft	2	0.144	0.041		-64.04	64.04	495.83	446.25	1.00	1.00	7.23	174.84	174.84
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 14.83 ft	1	0.223	0.064		-99.66	99.66	495.83	446.25	1.75	1.00	11.18	174.84	174.84
Dsgn. L = 9.83 ft	2	0.223	0.064		-99.66	99.66	495.83	446.25	1.00	1.00	11.18	174.84	174.84
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 14.83 ft	1	0.123	0.035		-54.89	54.89	495.83	446.25	1.99	1.00	6.20	174.84	174.84
Dsgn. L = 9.83 ft	2	0.123	0.035		-54.89	54.89	495.83	446.25	1.00	1.00	6.20	174.84	174.84
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 14.83 ft	1	0.223	0.064		-99.66	99.66	495.83	446.25	1.83	1.00	11.18	174.84	174.84
Dsgn. L = 9.83 ft	2	0.223	0.064		-99.66	99.66	495.83	446.25	1.00	1.00	11.18	174.84	174.84
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 14.83 ft	1	0.225	0.064		-100.30	100.30	495.83	446.25	1.75	1.00	11.24	174.84	174.84
Dsgn. L = 9.83 ft	2	0.225	0.064		-100.30	100.30	495.83	446.25	1.00	1.00	11.24	174.84	174.84

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: ML-B6

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 14.83 ft	1	0.130	0.037		-57.94	57.94	495.83	446.25	1.97	1.00	6.51	174.84	174.84
Dsgn. L = 9.83 ft	2	0.130	0.037		-57.94	57.94	495.83	446.25	1.00	1.00	6.51	174.84	174.84
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 14.83 ft	1	0.225	0.064		-100.30	100.30	495.83	446.25	1.83	1.00	11.24	174.84	174.84
Dsgn. L = 9.83 ft	2	0.225	0.064		-100.30	100.30	495.83	446.25	1.00	1.00	11.24	174.84	174.84
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 14.83 ft	1	0.170	0.048		-75.84	75.84	495.83	446.25	1.77	1.00	8.46	174.84	174.84
Dsgn. L = 9.83 ft	2	0.170	0.048		-75.84	75.84	495.83	446.25	1.00	1.00	8.46	174.84	174.84
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 14.83 ft	1	0.123	0.035		-54.89	54.89	495.83	446.25	1.87	1.00	6.20	174.84	174.84
Dsgn. L = 9.83 ft	2	0.123	0.035		-54.89	54.89	495.83	446.25	1.00	1.00	6.20	174.84	174.84
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 14.83 ft	1	0.170	0.048		-75.84	75.84	495.83	446.25	1.81	1.00	8.46	174.84	174.84
Dsgn. L = 9.83 ft	2	0.170	0.048		-75.84	75.84	495.83	446.25	1.00	1.00	8.46	174.84	174.84
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 14.83 ft	1	0.140	0.040		-62.60	62.60	495.83	446.25	1.80	1.00	6.98	174.84	174.84
Dsgn. L = 9.83 ft	2	0.140	0.040		-62.60	62.60	495.83	446.25	1.00	1.00	6.98	174.84	174.84
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 14.83 ft	1	0.123	0.035		-54.89	54.89	495.83	446.25	1.82	1.00	6.20	174.84	174.84
Dsgn. L = 9.83 ft	2	0.123	0.035		-54.89	54.89	495.83	446.25	1.00	1.00	6.20	174.84	174.84
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 14.83 ft	1	0.140	0.040		-62.60	62.60	495.83	446.25	1.80	1.00	6.98	174.84	174.84
Dsgn. L = 9.83 ft	2	0.140	0.040		-62.60	62.60	495.83	446.25	1.00	1.00	6.98	174.84	174.84
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 14.83 ft	1	0.175	0.050		-77.88	77.88	495.83	446.25	1.77	1.00	8.67	174.84	174.84
Dsgn. L = 9.83 ft	2	0.175	0.050		-77.88	77.88	495.83	446.25	1.00	1.00	8.67	174.84	174.84
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 14.83 ft	1	0.145	0.041		-64.64	64.64	495.83	446.25	1.84	1.00	7.19	174.84	174.84
Dsgn. L = 9.83 ft	2	0.145	0.041		-64.64	64.64	495.83	446.25	1.00	1.00	7.19	174.84	174.84
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 14.83 ft	1	0.175	0.050		-77.88	77.88	495.83	446.25	1.80	1.00	8.67	174.84	174.84
Dsgn. L = 9.83 ft	2	0.175	0.050		-77.88	77.88	495.83	446.25	1.00	1.00	8.67	174.84	174.84
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 14.83 ft	1	0.145	0.041		-64.64	64.64	495.83	446.25	1.79	1.00	7.19	174.84	174.84
Dsgn. L = 9.83 ft	2	0.145	0.041		-64.64	64.64	495.83	446.25	1.00	1.00	7.19	174.84	174.84
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 14.83 ft	1	0.158	0.045		-70.54	70.54	495.83	446.25	1.78	1.00	7.92	174.84	174.84
Dsgn. L = 9.83 ft	2	0.158	0.045		-70.54	70.54	495.83	446.25	1.00	1.00	7.92	174.84	174.84
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 14.83 ft	1	0.123	0.035		-54.89	54.89	495.83	446.25	1.87	1.00	6.20	174.84	174.84
Dsgn. L = 9.83 ft	2	0.123	0.035		-54.89	54.89	495.83	446.25	1.00	1.00	6.20	174.84	174.84
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 14.83 ft	1	0.158	0.045		-70.54	70.54	495.83	446.25	1.82	1.00	7.92	174.84	174.84
Dsgn. L = 9.83 ft	2	0.158	0.045		-70.54	70.54	495.83	446.25	1.00	1.00	7.92	174.84	174.84
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 14.83 ft	1	0.160	0.046		-71.18	71.18	495.83	446.25	1.78	1.00	7.99	174.84	174.84
Dsgn. L = 9.83 ft	2	0.160	0.046		-71.18	71.18	495.83	446.25	1.00	1.00	7.99	174.84	174.84
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 14.83 ft	1	0.130	0.037		-57.94	57.94	495.83	446.25	1.86	1.00	6.51	174.84	174.84
Dsgn. L = 9.83 ft	2	0.130	0.037		-57.94	57.94	495.83	446.25	1.00	1.00	6.51	174.84	174.84
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 14.83 ft	1	0.160	0.046		-71.18	71.18	495.83	446.25	1.82	1.00	7.99	174.84	174.84
Dsgn. L = 9.83 ft	2	0.160	0.046		-71.18	71.18	495.83	446.25	1.00	1.00	7.99	174.84	174.84
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 14.83 ft	1	0.162	0.046		-72.40	72.40	495.83	446.25	1.78	1.00	8.11	174.84	174.84
Dsgn. L = 9.83 ft	2	0.162	0.046		-72.40	72.40	495.83	446.25	1.00	1.00	8.11	174.84	174.84
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 14.83 ft	1	0.133	0.038		-59.16	59.16	495.83	446.25	1.85	1.00	6.63	174.84	174.84
Dsgn. L = 9.83 ft	2	0.133	0.038		-59.16	59.16	495.83	446.25	1.00	1.00	6.63	174.84	174.84
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 14.83 ft	1	0.162	0.046		-72.40	72.40	495.83	446.25	1.82	1.00	8.11	174.84	174.84
Dsgn. L = 9.83 ft	2	0.162	0.046		-72.40	72.40	495.83	446.25	1.00	1.00	8.11	174.84	174.84

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: ML-B6

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+0.90D+W+0.90H													
Dsgn. L = 14.83 ft	1	0.092	0.027		-41.17	41.17	495.83	446.25	1.82	1.00	4.65	174.84	174.84
Dsgn. L = 9.83 ft	2	0.092	0.027		-41.17	41.17	495.83	446.25	1.00	1.00	4.65	174.84	174.84
+0.90D+E+0.90H													
Dsgn. L = 14.83 ft	1	0.092	0.027		-41.17	41.17	495.83	446.25	1.82	1.00	4.65	174.84	174.84
Dsgn. L = 9.83 ft	2	0.092	0.027		-41.17	41.17	495.83	446.25	1.00	1.00	4.65	174.84	174.84

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
	1	0.0000	0.000	+D+L+H	-0.0855	8.661
+D+L+H	2	0.5045	9.830		0.0000	8.661

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	0.667	14.564	
Max Upward from Load Combinations		14.564	
Max Upward from Load Cases	0.667	9.154	
Max Downward from all Load Conditions (Resis	-3.967		
Max Downward from Load Combinations (Resi	-3.967		
Max Downward from Load Cases (Resisting Up	-2.182		
+D+H	-2.182	9.154	
+D+L+H, LL Comb Run (*L)	-3.967	13.896	
+D+L+H, LL Comb Run (L*)	-1.514	9.821	
+D+L+H, LL Comb Run (LL)	-3.300	14.564	
+D+Lr+H, LL Comb Run (*L)	-2.507	9.969	
+D+Lr+H, LL Comb Run (L*)	-2.182	9.154	
+D+Lr+H, LL Comb Run (LL)	-2.507	9.969	
+D+S+H	-2.593	10.185	
+D+0.750Lr+0.750L+H, LL Comb Run (*L)	-3.764	13.322	
+D+0.750Lr+0.750L+H, LL Comb Run (L*)	-1.681	9.655	
+D+0.750Lr+0.750L+H, LL Comb Run (LL)	-3.264	13.822	
+D+0.750L+0.750S+H, LL Comb Run (*L)	-3.829	13.484	
+D+0.750L+0.750S+H, LL Comb Run (L*)	-1.989	10.428	
+D+0.750L+0.750S+H, LL Comb Run (LL)	-3.328	13.985	
+D+0.60W+H	-2.182	9.154	
+D+0.70E+H	-2.182	9.154	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	-3.764	13.322	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	-1.681	9.655	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	-3.264	13.822	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	-3.829	13.484	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	-1.989	10.428	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	-3.328	13.985	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	-3.829	13.484	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	-1.989	10.428	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	-3.328	13.985	
+0.60D+0.60W+0.60H	-1.309	5.492	
+0.60D+0.70E+0.60H	-1.309	5.492	
D Only	-2.182	9.154	
Lr Only, LL Comb Run (*L)	-0.325	0.815	
Lr Only, LL Comb Run (LL)	-0.325	0.815	
L Only, LL Comb Run (*L)	-1.785	4.742	
L Only, LL Comb Run (L*)	0.667	0.667	
L Only, LL Comb Run (LL)	-1.118	5.410	
S Only	-0.411	1.031	
H Only			

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

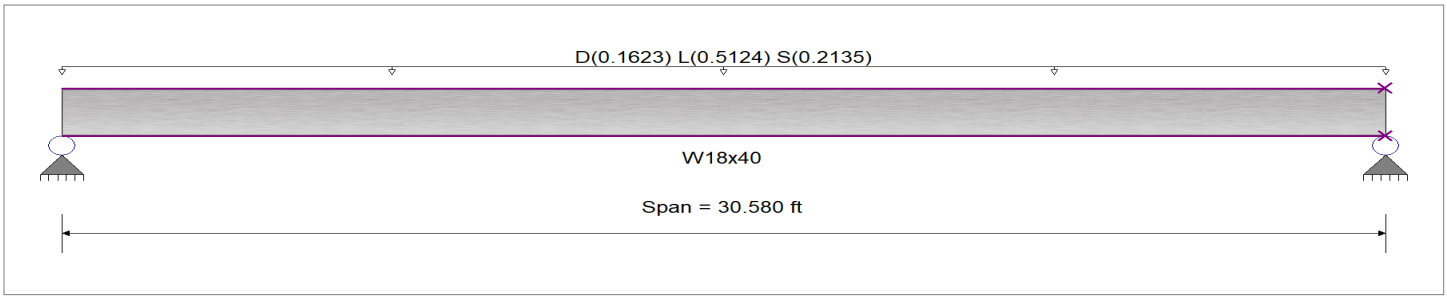
DESCRIPTION: ML-B7

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0190, L = 0.060, S = 0.0250 ksf, Tributary Width = 8.540 ft, (Floor Loads)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.465 : 1	Maximum Shear Stress Ratio =	0.106 : 1
Section used for this span	W18x40	Section used for this span	W18x40
Mu : Applied	136.682 k-ft	Vu : Applied	17.879 k
Mn * Phi : Allowable	294.000 k-ft	Vn * Phi : Allowable	169.155 k
Load Combination	+1.20D+1.60L+0.50S+1.60H	Load Combination	+1.20D+1.60L+0.50S+1.60H
		Location of maximum on span	30.580 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.570 in	Ratio =	643	>=600.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<600.0	Span: 1 : L Only
Max Downward Total Deflection	0.832 in	Ratio =	441	>=360.	Span: 1 : +D+0.750L+0.750S+H
Max Upward Total Deflection	0.000 in	Ratio =	0	<360.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 30.58 ft	1	0.113	0.026	33.10		33.10	326.67	294.00	1.00	1.00	4.33	169.16	169.16
+1.20D+0.50Lr+1.60L+1.60H													
Dsgn. L = 30.58 ft	1	0.422	0.096	124.20		124.20	326.67	294.00	1.00	1.00	16.25	169.16	169.16
+1.20D+1.60L+0.50S+1.60H													
Dsgn. L = 30.58 ft	1	0.465	0.106	136.68		136.68	326.67	294.00	1.00	1.00	17.88	169.16	169.16
+1.20D+1.60Lr+0.50L+1.60H													
Dsgn. L = 30.58 ft	1	0.198	0.045	58.32		58.32	326.67	294.00	1.00	1.00	7.63	169.16	169.16
+1.20D+1.60Lr+0.50W+1.60H													
Dsgn. L = 30.58 ft	1	0.097	0.022	28.37		28.37	326.67	294.00	1.00	1.00	3.71	169.16	169.16
+1.20D+0.50L+1.60S+1.60H													
Dsgn. L = 30.58 ft	1	0.334	0.076	98.25		98.25	326.67	294.00	1.00	1.00	12.85	169.16	169.16
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 30.58 ft	1	0.232	0.053	68.30		68.30	326.67	294.00	1.00	1.00	8.93	169.16	169.16
+1.20D+0.50Lr+0.50L+W+1.60H													
Dsgn. L = 30.58 ft	1	0.198	0.045	58.32		58.32	326.67	294.00	1.00	1.00	7.63	169.16	169.16
+1.20D+0.50L+0.50S+W+1.60H													
Dsgn. L = 30.58 ft	1	0.241	0.055	70.80		70.80	326.67	294.00	1.00	1.00	9.26	169.16	169.16
+1.20D+0.50L+0.70S+E+1.60H													
Dsgn. L = 30.58 ft	1	0.258	0.059	75.79		75.79	326.67	294.00	1.00	1.00	9.91	169.16	169.16
+0.90D+W+0.90H					B30								
Dsgn. L = 30.58 ft	1	0.072	0.016	21.28		21.28	326.67	294.00	1.00	1.00	2.78	169.16	169.16

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: ML-B7

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+0.90D+E+0.90H													
Dsgn. L = 30.58 ft	1	0.072	0.016	21.28		21.28	326.67	294.00	1.00	1.00	2.78	169.16	169.16

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	0.8316	15.377		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	11.417	11.417
Max Upward from Load Combinations	11.417	11.417
Max Upward from Load Cases	7.835	7.835
+D+H	3.093	3.093
+D+L+H	10.927	10.927
+D+Lr+H	3.093	3.093
+D+S+H	6.357	6.357
+D+0.750Lr+0.750L+H	8.969	8.969
+D+0.750L+0.750S+H	11.417	11.417
+D+0.60W+H	3.093	3.093
+D+0.70E+H	3.093	3.093
+D+0.750Lr+0.750L+0.450W+H	8.969	8.969
+D+0.750L+0.750S+0.450W+H	11.417	11.417
+D+0.750L+0.750S+0.5250E+H	11.417	11.417
+0.60D+0.60W+0.60H	1.856	1.856
+0.60D+0.70E+0.60H	1.856	1.856
D Only	3.093	3.093
L Only	7.835	7.835
S Only	3.264	3.264
H Only		

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

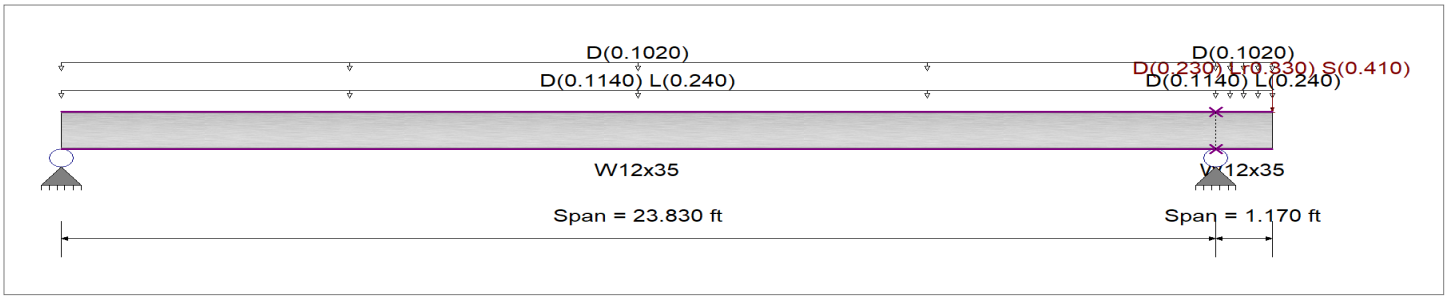
DESCRIPTION: UL-B1

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



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 = 0.0190, L = 0.040 ksf, Tributary Width = 6.0 ft, (Floor Loads)

Uniform Load : D = 0.1020 k/ft, Tributary Width = 1.0 ft, (Window wall)

Load for Span Number 2
Uniform Load : D = 0.0190, L = 0.040 ksf, Tributary Width = 6.0 ft, (Floor Loads)

Uniform Load : D = 0.1020 k/ft, Tributary Width = 1.0 ft, (Window wall)

Point Load : D = 0.230, Lr = 0.330, S = 0.410 k @ 1.170 ft, (Column)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.252** : 1	Maximum Shear Stress Ratio =	**0.073** : 1
Section used for this span	**W12x35**	Section used for this span	**W12x35**
Mu : Applied	48.373 k-ft	Vu : Applied	8.207 k
Mn * Phi : Allowable	192.000 k-ft	Vn * Phi : Allowable	112.50 k
Load Combination	+1.20D+0.50Lr+1.60L+1.60H, LL Comb Run (L*)	Load Combination	+1.20D+1.60L+0.50S+1.60H, LL Comb Run (LL)
		Location of maximum on span	23.830 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.212 in	Ratio =	1,348	>=600.	Span: 2 : L Only, LL Comb Run (L*)
Max Upward Transient Deflection	-0.033 in	Ratio =	848	>=600.	Span: 2 : L Only, LL Comb Run (L*)
Max Downward Total Deflection	0.431 in	Ratio =	664	>=360.	Span: 2 : +D+L+H, LL Comb Run (L*)
Max Upward Total Deflection	-0.067 in	Ratio =	420	>=360.	Span: 2 : +D+L+H, LL Comb Run (L*)

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 23.83 ft	1	0.128	0.037	24.64	-0.62	24.64	213.33	192.00	1.00	1.00	4.21	112.50	112.50
Dsgn. L = 1.17 ft	2	0.003	0.007		-0.62	0.62	213.33	192.00	1.00	1.00	0.73	112.50	112.50
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 23.83 ft	1	0.109	0.032	20.89	-0.98	20.89	213.33	192.00	1.00	1.00	3.63	112.50	112.50
Dsgn. L = 1.17 ft	2	0.005	0.011		-0.98	0.98	213.33	192.00	1.00	1.00	1.24	112.50	112.50
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 23.83 ft	1	0.252	0.073	48.37	-0.53	48.37	213.33	192.00	1.00	1.00	8.19	112.50	112.50
Dsgn. L = 1.17 ft	2	0.003	0.006		-0.53	0.53	213.33	192.00	1.00	1.00	0.63	112.50	112.50
+1.20D+0.50Lr+1.60L+1.60H, LL													

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B1

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
Dsgn. L = 23.83 ft	1	0.251	0.073	48.15	-0.98	48.15	213.33	192.00	1.00	1.00	8.21	112.50	112.50
Dsgn. L = 1.17 ft	2	0.005	0.011		-0.98	0.98	213.33	192.00	1.00	1.00	1.24	112.50	112.50
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 23.83 ft	1	0.109	0.032	20.87	-1.03	20.87	213.33	192.00	1.00	1.00	3.63	112.50	112.50
Dsgn. L = 1.17 ft	2	0.005	0.011		-1.03	1.03	213.33	192.00	1.00	1.00	1.28	112.50	112.50
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 23.83 ft	1	0.251	0.073	48.25	-0.77	48.25	213.33	192.00	1.00	1.00	8.20	112.50	112.50
Dsgn. L = 1.17 ft	2	0.004	0.007		-0.77	0.77	213.33	192.00	1.00	1.00	0.83	112.50	112.50
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 23.83 ft	1	0.251	0.073	48.12	-1.03	48.12	213.33	192.00	1.00	1.00	8.21	112.50	112.50
Dsgn. L = 1.17 ft	2	0.005	0.011		-1.03	1.03	213.33	192.00	1.00	1.00	1.28	112.50	112.50
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 23.83 ft	1	0.108	0.032	20.77	-1.23	20.77	213.33	192.00	1.00	1.00	3.64	112.50	112.50
Dsgn. L = 1.17 ft	2	0.006	0.012		-1.23	1.23	213.33	192.00	1.00	1.00	1.30	112.50	112.50
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 23.83 ft	1	0.154	0.045	29.63	-0.53	29.63	213.33	192.00	1.00	1.00	5.04	112.50	112.50
Dsgn. L = 1.17 ft	2	0.003	0.006		-0.53	0.53	213.33	192.00	1.00	1.00	0.63	112.50	112.50
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 23.83 ft	1	0.153	0.045	29.29	-1.23	29.29	213.33	192.00	1.00	1.00	5.07	112.50	112.50
Dsgn. L = 1.17 ft	2	0.006	0.012		-1.23	1.23	213.33	192.00	1.00	1.00	1.30	112.50	112.50
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 23.83 ft	1	0.108	0.032	20.81	-1.15	20.81	213.33	192.00	1.00	1.00	3.64	112.50	112.50
Dsgn. L = 1.17 ft	2	0.006	0.010		-1.15	1.15	213.33	192.00	1.00	1.00	1.16	112.50	112.50
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 23.83 ft	1	0.110	0.032	21.12	-0.53	21.12	213.33	192.00	1.00	1.00	3.61	112.50	112.50
Dsgn. L = 1.17 ft	2	0.003	0.006		-0.53	0.53	213.33	192.00	1.00	1.00	0.63	112.50	112.50
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 23.83 ft	1	0.108	0.032	20.81	-1.15	20.81	213.33	192.00	1.00	1.00	3.64	112.50	112.50
Dsgn. L = 1.17 ft	2	0.006	0.010		-1.15	1.15	213.33	192.00	1.00	1.00	1.16	112.50	112.50
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 23.83 ft	1	0.108	0.032	20.70	-1.38	20.70	213.33	192.00	1.00	1.00	3.65	112.50	112.50
Dsgn. L = 1.17 ft	2	0.007	0.013		-1.38	1.38	213.33	192.00	1.00	1.00	1.42	112.50	112.50
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 23.83 ft	1	0.152	0.045	29.25	-1.30	29.25	213.33	192.00	1.00	1.00	5.07	112.50	112.50
Dsgn. L = 1.17 ft	2	0.007	0.011		-1.30	1.30	213.33	192.00	1.00	1.00	1.28	112.50	112.50
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 23.83 ft	1	0.152	0.045	29.21	-1.38	29.21	213.33	192.00	1.00	1.00	5.08	112.50	112.50
Dsgn. L = 1.17 ft	2	0.007	0.013		-1.38	1.38	213.33	192.00	1.00	1.00	1.42	112.50	112.50
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 23.83 ft	1	0.108	0.032	20.74	-1.30	20.74	213.33	192.00	1.00	1.00	3.64	112.50	112.50
Dsgn. L = 1.17 ft	2	0.007	0.011		-1.30	1.30	213.33	192.00	1.00	1.00	1.28	112.50	112.50
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 23.83 ft	1	0.109	0.032	20.98	-0.80	20.98	213.33	192.00	1.00	1.00	3.62	112.50	112.50
Dsgn. L = 1.17 ft	2	0.004	0.008		-0.80	0.80	213.33	192.00	1.00	1.00	0.93	112.50	112.50
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 23.83 ft	1	0.154	0.045	29.63	-0.53	29.63	213.33	192.00	1.00	1.00	5.04	112.50	112.50
Dsgn. L = 1.17 ft	2	0.003	0.006		-0.53	0.53	213.33	192.00	1.00	1.00	0.63	112.50	112.50
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 23.83 ft	1	0.154	0.045	29.50	-0.80	29.50	213.33	192.00	1.00	1.00	5.05	112.50	112.50
Dsgn. L = 1.17 ft	2	0.004	0.008		-0.80	0.80	213.33	192.00	1.00	1.00	0.93	112.50	112.50
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 23.83 ft	1	0.109	0.032	20.96	-0.85	20.96	213.33	192.00	1.00	1.00	3.62	112.50	112.50
Dsgn. L = 1.17 ft	2	0.004	0.009		-0.85	0.85	213.33	192.00	1.00	1.00	0.97	112.50	112.50
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 23.83 ft	1	0.154	0.045	29.51	-0.77	29.51	213.33	192.00	1.00	1.00	5.05	112.50	112.50
Dsgn. L = 1.17 ft	2	0.004	0.007		-0.77	0.77	213.33	192.00	1.00	1.00	0.83	112.50	112.50
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 23.83 ft	1	0.154	0.045	29.47	-0.85	29.47	213.33	192.00	1.00	1.00	5.05	112.50	112.50
Dsgn. L = 1.17 ft	2	0.004	0.009		-0.85	0.85	213.33	192.00	1.00	1.00	0.97	112.50	112.50
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 23.83 ft	1	0.109	0.032	20.91	-0.95	20.91	213.33	192.00	1.00	1.00	3.63	112.50	112.50
Dsgn. L = 1.17 ft	2	0.005	0.009		-0.95	0.95	213.33	192.00	1.00	1.00	1.06	112.50	112.50
+1.20D+0.50L+0.70S+E+1.60H, L													

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

LIC# : KW-06018139, Build:20.22.12.28 KPFF CONSULTING ENGINEERS SEA (c) ENERCALC INC 1983-2022

DESCRIPTION: UL-B1

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
Dsgn. L = 23.83 ft	1	0.153	0.045	29.47	-0.86	29.47	213.33	192.00	1.00	1.00	5.05	112.50	112.50
Dsgn. L = 1.17 ft	2	0.005	0.008		-0.86	0.86	213.33	192.00	1.00	1.00	0.92	112.50	112.50
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 23.83 ft	1	0.153	0.045	29.43	-0.95	29.43	213.33	192.00	1.00	1.00	5.06	112.50	112.50
Dsgn. L = 1.17 ft	2	0.005	0.009		-0.95	0.95	213.33	192.00	1.00	1.00	1.06	112.50	112.50
+0.90D+W+0.90H													
Dsgn. L = 23.83 ft	1	0.082	0.024	15.84	-0.40	15.84	213.33	192.00	1.00	1.00	2.71	112.50	112.50
Dsgn. L = 1.17 ft	2	0.002	0.004		-0.40	0.40	213.33	192.00	1.00	1.00	0.47	112.50	112.50
+0.90D+E+0.90H													
Dsgn. L = 23.83 ft	1	0.082	0.024	15.84	-0.40	15.84	213.33	192.00	1.00	1.00	2.71	112.50	112.50
Dsgn. L = 1.17 ft	2	0.002	0.004		-0.40	0.40	213.33	192.00	1.00	1.00	0.47	112.50	112.50

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L+H	1	0.4305	11.915		0.0000	0.000
	2	0.0000	11.915	+D+L+H	-0.0668	1.170

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	5.832	6.680	
Max Upward from Load Combinations	5.832	6.680	
Max Upward from Load Cases	2.972	3.533	
Max Downward from all Load Conditions (Resis	-0.020		
Max Downward from Load Cases (Resisting Up	-0.020		
+D+H	2.972	3.533	
+D+L+H, LL Comb Run (*L)	2.965	3.821	
+D+L+H, LL Comb Run (L*)	5.832	6.392	
+D+L+H, LL Comb Run (LL)	5.825	6.680	
+D+Lr+H, LL Comb Run (*L)	2.956	3.879	
+D+Lr+H, LL Comb Run (L*)	2.972	3.533	
+D+Lr+H, LL Comb Run (LL)	2.956	3.879	
+D+S+H	2.952	3.963	
+D+0.750Lr+0.750L+H, LL Comb Run (*L)	2.955	4.008	
+D+0.750Lr+0.750L+H, LL Comb Run (L*)	5.117	5.678	
+D+0.750Lr+0.750L+H, LL Comb Run (LL)	5.100	6.153	
+D+0.750L+0.750S+H, LL Comb Run (*L)	2.952	4.071	
+D+0.750L+0.750S+H, LL Comb Run (L*)	5.102	6.000	
+D+0.750L+0.750S+H, LL Comb Run (LL)	5.097	6.216	
+D+0.60W+H	2.972	3.533	
+D+0.70E+H	2.972	3.533	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	2.955	4.008	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	5.117	5.678	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	5.100	6.153	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	2.952	4.071	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	5.102	6.000	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	5.097	6.216	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	2.952	4.071	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	5.102	6.000	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	5.097	6.216	
+0.60D+0.60W+0.60H	1.783	2.120	
+0.60D+0.70E+0.60H	1.783	2.120	
D Only	2.972	3.533	
Lr Only, LL Comb Run (*L)	-0.016	0.346	
Lr Only, LL Comb Run (LL)	-0.016	0.346	
L Only, LL Comb Run (*L)	-0.007	0.288	
L Only, LL Comb Run (L*)	2.860	2.860	
L Only, LL Comb Run (LL)	2.853	3.147	
S Only	-0.020	0.430	
H Only			

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B2

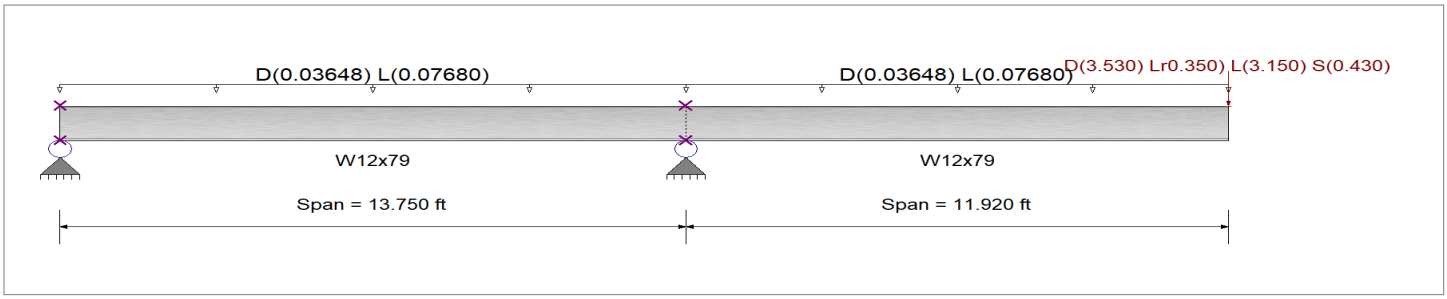
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method : Load Resistance Factor Design
Beam Bracing : Completely Unbraced
Bending Axis : Major Axis Bending

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



Applied Loads

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

Beam self weight calculated and added to loading
Load for Span Number 1
Uniform Load : D = 0.0190, L = 0.040 ksf, Tributary Width = 1.920 ft, (Floor Loads)

Load for Span Number 2
Uniform Load : D = 0.0190, L = 0.040 ksf, Tributary Width = 1.920 ft, (Floor Loads)

Point Load : D = 3.530, Lr = 0.350, L = 3.150, S = 0.430 k @ 11.920 ft, (UL-B1)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.300 : 1	Maximum Shear Stress Ratio =	0.072 : 1
Section used for this span	W12x79	Section used for this span	W12x79
Mu : Applied	131.707 k-ft	Vu : Applied	12.608 k
Mn * Phi : Allowable	439.741 k-ft	Vn * Phi : Allowable	174.840 k
Load Combination	+1.20D+1.60L+0.50S+1.60H, LL Comb Run (*L)	Load Combination	+1.20D+1.60L+0.50S+1.60H, LL Comb Run (*L)
		Location of maximum on span	13.750 ft
Span # where maximum occurs	Span # 2	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.388 in	Ratio =	736	>=600.	Span: 2 : L Only, LL Comb Run (*L)
Max Upward Transient Deflection	-0.047 in	Ratio =	3,496	>=600.	Span: 2 : L Only, LL Comb Run (*L)
Max Downward Total Deflection	0.827 in	Ratio =	346	>=240.	Span: 2 : +D+L+H, LL Comb Run (*L)
Max Upward Total Deflection	-0.098 in	Ratio =	1690	>=240.	Span: 2 : +D+L+H, LL Comb Run (*L)

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 13.75 ft	1	0.158	0.039		-70.39	70.39	495.83	446.25	1.78	1.00	6.87	174.84	174.84
Dsgn. L = 11.92 ft	2	0.160	0.039		-70.39	70.39	488.60	439.74	1.00	1.00	6.87	174.84	174.84
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 13.75 ft	1	0.294	0.072		-131.23	131.23	495.83	446.25	1.72	1.00	12.57	174.84	174.84
Dsgn. L = 11.92 ft	2	0.298	0.072		-131.23	131.23	488.60	439.74	1.00	1.00	12.57	174.84	174.84
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 13.75 ft	1	0.135	0.035		-60.34	60.34	495.83	446.25	1.89	1.00	6.19	174.84	174.84
Dsgn. L = 11.92 ft	2	0.137	0.034		-60.34	60.34	488.60	439.74	1.00	1.00	5.89	174.84	174.84
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 13.75 ft	1	0.294	0.072		-131.23	131.23	495.83	446.25	1.76	1.00	12.57	174.84	174.84
Dsgn. L = 11.92 ft	2	0.298	0.072		-131.23	131.23	488.60	439.74	1.00	1.00	12.57	174.84	174.84
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 13.75 ft	1	0.295	0.072		-131.35	131.71	495.83	446.25	1.72	1.00	12.61	174.84	174.84
Dsgn. L = 11.92 ft	2	0.300	0.072		-131.71	131.71	488.60	439.74	1.00	1.00	12.61	174.84	174.84

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B2

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 13.75 ft	1	0.141	0.036		-62.90	62.90	495.83	446.25	1.88	1.00	6.37	174.84	174.84
Dsgn. L = 11.92 ft	2	0.143	0.035		-62.90	62.90	488.60	439.74	1.00	1.00	6.10	174.84	174.84
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 13.75 ft	1	0.295	0.072		-131.71	131.71	495.83	446.25	1.76	1.00	12.61	174.84	174.84
Dsgn. L = 11.92 ft	2	0.300	0.072		-131.71	131.71	488.60	439.74	1.00	1.00	12.61	174.84	174.84
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 13.75 ft	1	0.198	0.049		-88.52	88.52	495.83	446.25	1.74	1.00	8.48	174.84	174.84
Dsgn. L = 11.92 ft	2	0.201	0.049		-88.52	88.52	488.60	439.74	1.00	1.00	8.48	174.84	174.84
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 13.75 ft	1	0.135	0.034		-60.34	60.34	495.83	446.25	1.81	1.00	5.89	174.84	174.84
Dsgn. L = 11.92 ft	2	0.137	0.034		-60.34	60.34	488.60	439.74	1.00	1.00	5.89	174.84	174.84
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 13.75 ft	1	0.198	0.049		-88.52	88.52	495.83	446.25	1.76	1.00	8.48	174.84	174.84
Dsgn. L = 11.92 ft	2	0.201	0.049		-88.52	88.52	488.60	439.74	1.00	1.00	8.48	174.84	174.84
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 13.75 ft	1	0.150	0.037		-67.01	67.01	495.83	446.25	1.76	1.00	6.45	174.84	174.84
Dsgn. L = 11.92 ft	2	0.152	0.037		-67.01	67.01	488.60	439.74	1.00	1.00	6.45	174.84	174.84
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 13.75 ft	1	0.135	0.034		-60.34	60.34	495.83	446.25	1.78	1.00	5.89	174.84	174.84
Dsgn. L = 11.92 ft	2	0.137	0.034		-60.34	60.34	488.60	439.74	1.00	1.00	5.89	174.84	174.84
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 13.75 ft	1	0.150	0.037		-67.01	67.01	495.83	446.25	1.76	1.00	6.45	174.84	174.84
Dsgn. L = 11.92 ft	2	0.152	0.037		-67.01	67.01	488.60	439.74	1.00	1.00	6.45	174.84	174.84
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 13.75 ft	1	0.202	0.049		-90.04	90.04	495.83	446.25	1.74	1.00	8.61	174.84	174.84
Dsgn. L = 11.92 ft	2	0.205	0.049		-90.04	90.04	488.60	439.74	1.00	1.00	8.61	174.84	174.84
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 13.75 ft	1	0.154	0.038		-68.54	68.54	495.83	446.25	1.79	1.00	6.58	174.84	174.84
Dsgn. L = 11.92 ft	2	0.156	0.038		-68.54	68.54	488.60	439.74	1.00	1.00	6.58	174.84	174.84
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 13.75 ft	1	0.202	0.049		-90.04	90.04	495.83	446.25	1.76	1.00	8.61	174.84	174.84
Dsgn. L = 11.92 ft	2	0.205	0.049		-90.04	90.04	488.60	439.74	1.00	1.00	8.61	174.84	174.84
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 13.75 ft	1	0.154	0.038		-68.54	68.54	495.83	446.25	1.76	1.00	6.58	174.84	174.84
Dsgn. L = 11.92 ft	2	0.156	0.038		-68.54	68.54	488.60	439.74	1.00	1.00	6.58	174.84	174.84
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 13.75 ft	1	0.188	0.046		-83.93	83.93	495.83	446.25	1.74	1.00	8.10	174.84	174.84
Dsgn. L = 11.92 ft	2	0.191	0.046		-83.93	83.93	488.60	439.74	1.00	1.00	8.10	174.84	174.84
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 13.75 ft	1	0.135	0.034		-60.34	60.34	495.83	446.25	1.81	1.00	5.89	174.84	174.84
Dsgn. L = 11.92 ft	2	0.137	0.034		-60.34	60.34	488.60	439.74	1.00	1.00	5.89	174.84	174.84
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 13.75 ft	1	0.188	0.046		-83.93	83.93	495.83	446.25	1.77	1.00	8.10	174.84	174.84
Dsgn. L = 11.92 ft	2	0.191	0.046		-83.93	83.93	488.60	439.74	1.00	1.00	8.10	174.84	174.84
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 13.75 ft	1	0.189	0.047		-84.40	84.40	495.83	446.25	1.74	1.00	8.14	174.84	174.84
Dsgn. L = 11.92 ft	2	0.192	0.047		-84.40	84.40	488.60	439.74	1.00	1.00	8.14	174.84	174.84
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 13.75 ft	1	0.141	0.035		-62.90	62.90	495.83	446.25	1.80	1.00	6.10	174.84	174.84
Dsgn. L = 11.92 ft	2	0.143	0.035		-62.90	62.90	488.60	439.74	1.00	1.00	6.10	174.84	174.84
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 13.75 ft	1	0.189	0.047		-84.40	84.40	495.83	446.25	1.77	1.00	8.14	174.84	174.84
Dsgn. L = 11.92 ft	2	0.192	0.047		-84.40	84.40	488.60	439.74	1.00	1.00	8.14	174.84	174.84
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 13.75 ft	1	0.191	0.047		-85.43	85.43	495.83	446.25	1.74	1.00	8.22	174.84	174.84
Dsgn. L = 11.92 ft	2	0.194	0.047		-85.43	85.43	488.60	439.74	1.00	1.00	8.22	174.84	174.84
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 13.75 ft	1	0.143	0.035		-63.93	63.93	495.83	446.25	1.80	1.00	6.19	174.84	174.84
Dsgn. L = 11.92 ft	2	0.145	0.035		-63.93	63.93	488.60	439.74	1.00	1.00	6.19	174.84	174.84
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 13.75 ft	1	0.191	0.047		-85.43	85.43	495.83	446.25	1.76	1.00	8.22	174.84	174.84
Dsgn. L = 11.92 ft	2	0.194	0.047		-85.43	85.43	488.60	439.74	1.00	1.00	8.22	174.84	174.84

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B2

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+0.90D+W+0.90H													
Dsgn. L = 13.75 ft	1	0.101	0.025		-45.25	45.25	495.83	446.25	1.78	1.00	4.42	174.84	174.84
Dsgn. L = 11.92 ft	2	0.103	0.025		-45.25	45.25	488.60	439.74	1.00	1.00	4.42	174.84	174.84
+0.90D+E+0.90H													
Dsgn. L = 13.75 ft	1	0.101	0.025		-45.25	45.25	495.83	446.25	1.78	1.00	4.42	174.84	174.84
Dsgn. L = 11.92 ft	2	0.103	0.025		-45.25	45.25	488.60	439.74	1.00	1.00	4.42	174.84	174.84

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
	1	0.0000	0.000	+D+L+H	-0.0976	8.030
+D+L+H	2	0.8273	11.920		0.0000	8.030

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	0.528	17.078	
Max Upward from Load Combinations		17.078	
Max Upward from Load Cases	0.528	9.357	
Max Downward from all Load Conditions (Resis	-5.990		
Max Downward from Load Combinations (Resi	-5.990		
Max Downward from Load Cases (Resisting Up	-3.128		
+D+H	-2.863	9.357	
+D+L+H, LL Comb Run (*L)	-5.990	16.550	
+D+L+H, LL Comb Run (L*)	-2.335	9.885	
+D+L+H, LL Comb Run (LL)	-5.462	17.078	
+D+Lr+H, LL Comb Run (*L)	-3.166	10.011	
+D+Lr+H, LL Comb Run (L*)	-2.863	9.357	
+D+Lr+H, LL Comb Run (LL)	-3.166	10.011	
+D+S+H	-3.236	10.160	
+D+0.750Lr+0.750L+H, LL Comb Run (*L)	-5.436	15.242	
+D+0.750Lr+0.750L+H, LL Comb Run (L*)	-2.467	9.753	
+D+0.750Lr+0.750L+H, LL Comb Run (LL)	-5.040	15.638	
+D+0.750L+0.750S+H, LL Comb Run (*L)	-5.488	15.354	
+D+0.750L+0.750S+H, LL Comb Run (L*)	-2.747	10.355	
+D+0.750L+0.750S+H, LL Comb Run (LL)	-5.092	15.750	
+D+0.60W+H	-2.863	9.357	
+D+0.70E+H	-2.863	9.357	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	-5.436	15.242	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	-2.467	9.753	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	-5.040	15.638	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	-5.488	15.354	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	-2.747	10.355	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	-5.092	15.750	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	-5.488	15.354	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	-2.747	10.355	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	-5.092	15.750	
+0.60D+0.60W+0.60H	-1.718	5.614	
+0.60D+0.70E+0.60H	-1.718	5.614	
D Only	-2.863	9.357	
Lr Only, LL Comb Run (*L)	-0.303	0.653	
Lr Only, LL Comb Run (LL)	-0.303	0.653	
L Only, LL Comb Run (*L)	-3.128	7.193	
L Only, LL Comb Run (L*)	0.528	0.528	
L Only, LL Comb Run (LL)	-2.600	7.721	
S Only	-0.373	0.803	
H Only			

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

LIC# : KW-06018139, Build:20.22.12.28 KPFF CONSULTING ENGINEERS SEA (c) ENERCALC INC 1983-2022

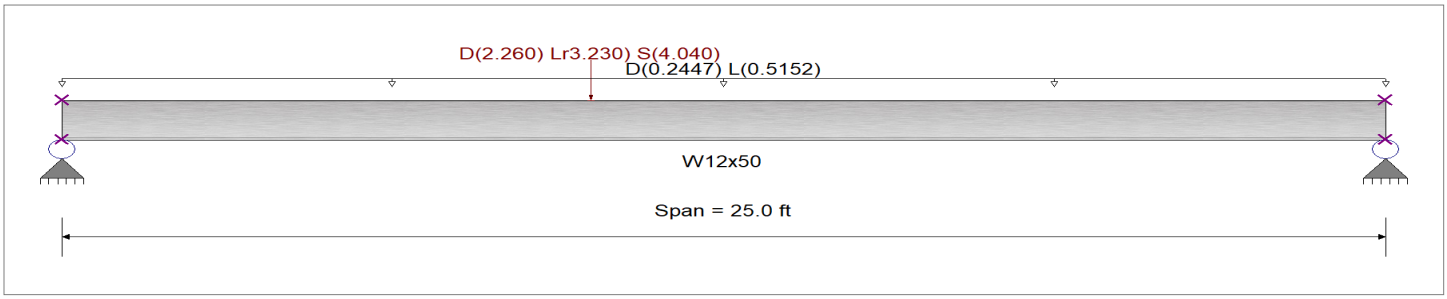
DESCRIPTION: UL-B3

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Completely Unbraced	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0190, L = 0.040 ksf, Tributary Width = 12.880 ft, (Floor Loads)

Point Load : D = 2.260, Lr = 3.230, S = 4.040 k @ 10.0 ft, (Column)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.634 : 1	Maximum Shear Stress Ratio =	0.130 : 1
Section used for this span	W12x50	Section used for this span	W12x50
Mu : Applied	117.210 k-ft	Vu : Applied	17.564 k
Mn * Phi : Allowable	184.929 k-ft	Vn * Phi : Allowable	135.420 k
Load Combination	+1.20D+1.60L+0.50S+1.60H	Load Combination	+1.20D+1.60L+0.50S+1.60H
		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	0.401 in	Ratio =	747	>=600.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<600.0	Span: 1 : L Only
Max Downward Total Deflection	0.780 in	Ratio =	385	>=360.	Span: 1 : +D+0.750L+0.750S+H
Max Upward Total Deflection	0.000 in	Ratio =	0	<360.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 25.00 ft	1	0.263	0.052	49.93		49.93	211.30	190.17	1.20	1.00	7.06	135.42	135.42
+1.20D+0.50Lr+1.60L+1.60H													
Dsgn. L = 25.00 ft	1	0.623	0.128	114.94		114.94	204.95	184.45	1.16	1.00	17.32	135.42	135.42
+1.20D+1.60L+0.50S+1.60H													
Dsgn. L = 25.00 ft	1	0.634	0.130	117.21		117.21	205.48	184.93	1.16	1.00	17.56	135.42	135.42
+1.20D+1.60Lr+0.50L+1.60H													
Dsgn. L = 25.00 ft	1	0.475	0.091	93.12		93.12	217.66	195.89	1.23	1.00	12.37	135.42	135.42
+1.20D+1.60Lr+0.50W+1.60H													
Dsgn. L = 25.00 ft	1	0.365	0.068	73.80		73.80	224.72	202.25	1.27	1.00	9.15	135.42	135.42
+1.20D+0.50L+1.60S+1.60H													
Dsgn. L = 25.00 ft	1	0.511	0.097	100.90		100.90	219.60	197.64	1.24	1.00	13.15	135.42	135.42
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 25.00 ft	1	0.400	0.073	81.58		81.58	226.66	203.99	1.28	1.00	9.93	135.42	135.42
+1.20D+0.50Lr+0.50L+W+1.60H													
Dsgn. L = 25.00 ft	1	0.379	0.076	71.81		71.81	210.42	189.38	1.19	1.00	10.24	135.42	135.42
+1.20D+0.50L+0.50S+W+1.60H													
Dsgn. L = 25.00 ft	1	0.390	0.077	74.24		74.24	211.48	190.33	1.20	1.00	10.48	135.42	135.42
+1.20D+0.50L+0.70S+E+1.60H													

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B3

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values						Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
Dsgn. L = 25.00 ft +0.90D+W+0.90H	1	0.412	0.081	79.08		79.08	213.24	191.92	1.21	1.00	10.96	135.42	135.42
Dsgn. L = 25.00 ft +0.90D+E+0.90H	1	0.169	0.033	32.10		32.10	211.30	190.17	1.20	1.00	4.54	135.42	135.42
Dsgn. L = 25.00 ft	1	0.169	0.033	32.10		32.10	211.30	190.17	1.20	1.00	4.54	135.42	135.42

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	0.7796	12.286		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	11.688	11.028
Max Upward from Load Combinations	11.688	11.028
Max Upward from Load Cases	6.440	6.440
+D+H	5.040	4.588
+D+L+H	11.480	11.028
+D+Lr+H	6.978	5.880
+D+S+H	7.464	6.204
+D+0.750Lr+0.750L+H	11.324	10.387
+D+0.750L+0.750S+H	11.688	10.630
+D+0.60W+H	5.040	4.588
+D+0.70E+H	5.040	4.588
+D+0.750Lr+0.750L+0.450W+H	11.324	10.387
+D+0.750L+0.750S+0.450W+H	11.688	10.630
+D+0.750L+0.750S+0.5250E+H	11.688	10.630
+0.60D+0.60W+0.60H	3.024	2.753
+0.60D+0.70E+0.60H	3.024	2.753
D Only	5.040	4.588
Lr Only	1.938	1.292
L Only	6.440	6.440
S Only	2.424	1.616
H Only		

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

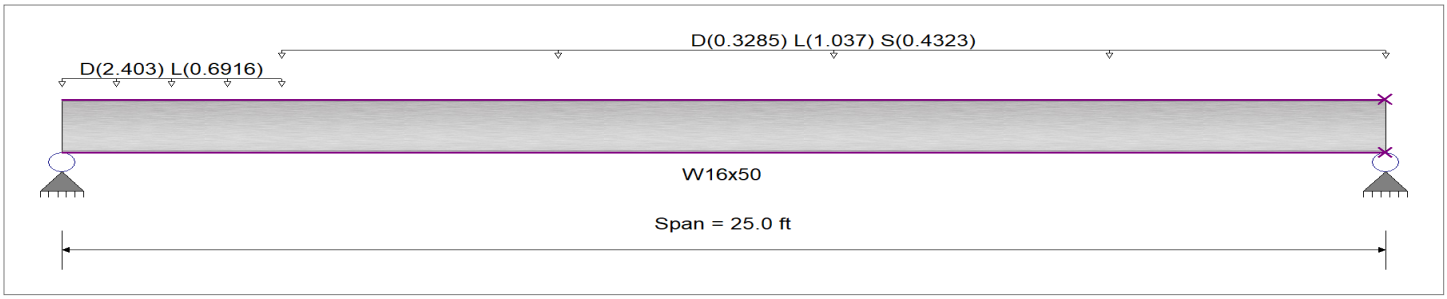
DESCRIPTION: UL-B4

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



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 = 0.1390, L = 0.040 ksf, Extent = 0.0 -->> 4.170 ft, Tributary Width = 17.290 ft, (Planter Loads)

Uniform Load : D = 0.0190, L = 0.060, S = 0.0250 ksf, Extent = 4.170 -->> 25.0 ft, Tributary Width = 17.290 ft, (Deck Loads)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.550** : 1	Maximum Shear Stress Ratio =	**0.192** : 1
Section used for this span	**W16x50**	Section used for this span	**W16x50**
Mu : Applied	189.600 k-ft	Vu : Applied	35.703 k
Mn * Phi : Allowable	345.000 k-ft	Vn * Phi : Allowable	185.820 k
Load Combination	+1.20D+1.60L+0.50S+1.60H	Load Combination	+1.20D+1.60L+0.50S+1.60H
		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	0.469 in	Ratio =	639	>=600.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<600.0	Span: 1 : L Only
Max Downward Total Deflection	0.729 in	Ratio =	411	>=360.	Span: 1 : +D+0.750L+0.750S+H
Max Upward Total Deflection	0.000 in	Ratio =	0	<360.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 25.00 ft	1	0.159	0.095	54.99		54.99	383.33	345.00	1.00	1.00	17.73	185.82	185.82
+1.20D+0.50Lr+1.60L+1.60H													
Dsgn. L = 25.00 ft	1	0.503	0.182	173.68		173.68	383.33	345.00	1.00	1.00	33.83	185.82	185.82
+1.20D+1.60L+0.50S+1.60H													
Dsgn. L = 25.00 ft	1	0.550	0.192	189.60		189.60	383.33	345.00	1.00	1.00	35.70	185.82	185.82
+1.20D+1.60Lr+0.50L+1.60H													
Dsgn. L = 25.00 ft	1	0.250	0.113	86.41		86.41	383.33	345.00	1.00	1.00	21.02	185.82	185.82
+1.20D+1.60Lr+0.50W+1.60H													
Dsgn. L = 25.00 ft	1	0.137	0.082	47.13		47.13	383.33	345.00	1.00	1.00	15.19	185.82	185.82
+1.20D+0.50L+1.60S+1.60H													
Dsgn. L = 25.00 ft	1	0.398	0.145	137.20		137.20	383.33	345.00	1.00	1.00	27.02	185.82	185.82
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 25.00 ft	1	0.283	0.114	97.50		97.50	383.33	345.00	1.00	1.00	21.20	185.82	185.82
+1.20D+0.50Lr+0.50L+W+1.60H													
Dsgn. L = 25.00 ft	1	0.250	0.113	86.41		86.41	383.33	345.00	1.00	1.00	21.02	185.82	185.82
+1.20D+0.50L+0.50S+W+1.60H													
Dsgn. L = 25.00 ft	1	0.296	0.123	102.25	B40	102.25	383.33	345.00	1.00	1.00	22.89	185.82	185.82

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B4

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values						Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+1.20D+0.50L+0.70S+E+1.60H													
Dsgn. L = 25.00 ft	1	0.315	0.127	108.60		108.60	383.33	345.00	1.00	1.00	23.64	185.82	185.82
+0.90D+W+0.90H													
Dsgn. L = 25.00 ft	1	0.102	0.061	35.35		35.35	383.33	345.00	1.00	1.00	11.40	185.82	185.82
+0.90D+E+0.90H													
Dsgn. L = 25.00 ft	1	0.102	0.061	35.35		35.35	383.33	345.00	1.00	1.00	11.40	185.82	185.82

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	0.7294	12.429		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	24.307	19.028
Max Upward from Load Combinations	24.307	19.028
Max Upward from Load Cases	12.662	12.847
+D+H	12.662	5.453
+D+L+H	24.307	18.300
+D+Lr+H	12.662	5.453
+D+S+H	16.413	10.706
+D+0.750Lr+0.750L+H	21.396	15.088
+D+0.750L+0.750S+H	24.209	19.028
+D+0.60W+H	12.662	5.453
+D+0.70E+H	12.662	5.453
+D+0.750Lr+0.750L+0.450W+H	21.396	15.088
+D+0.750L+0.750S+0.450W+H	24.209	19.028
+D+0.750L+0.750S+0.5250E+H	24.209	19.028
+0.60D+0.60W+0.60H	7.597	3.272
+0.60D+0.70E+0.60H	7.597	3.272
D Only	12.662	5.453
L Only	11.646	12.847
S Only	3.751	5.253
H Only		

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

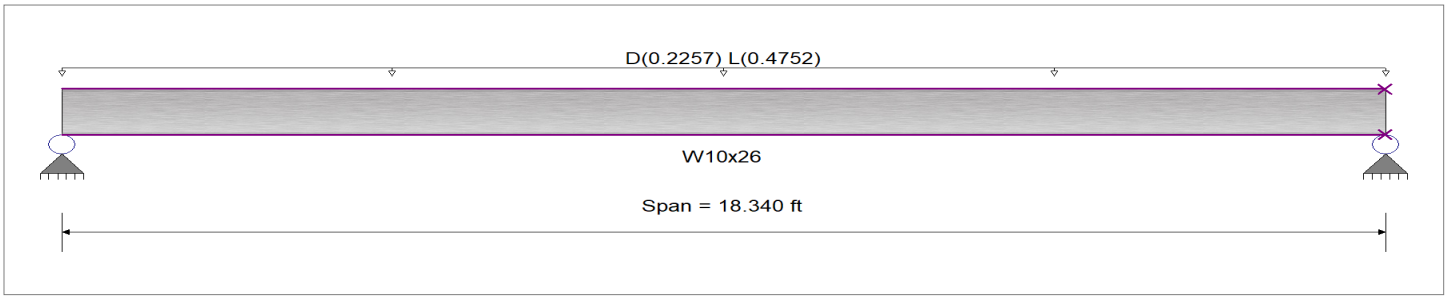
DESCRIPTION: UL-B5

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0190, L = 0.040 ksf, Tributary Width = 11.880 ft, (Floor Load)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.381 : 1	Maximum Shear Stress Ratio =	0.121 : 1
Section used for this span	W10x26	Section used for this span	W10x26
Mu : Applied	44.667 k-ft	Vu : Applied	9.742 k
Mn * Phi : Allowable	117.375 k-ft	Vn * Phi : Allowable	80.340 k
Load Combination	+1.20D+0.50Lr+1.60L+1.60H	Load Combination	+1.20D+0.50Lr+1.60L+1.60H
		Location of maximum on span	18.340 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.291 in	Ratio =	756	>=600.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<600.0	Span: 1 : L Only
Max Downward Total Deflection	0.445 in	Ratio =	494	>=360.	Span: 1 : +D+L+H
Max Upward Total Deflection	0.000 in	Ratio =	0	<360.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 18.34 ft	1	0.126	0.040	14.82		14.82	130.42	117.38	1.00	1.00	3.23	80.34	80.34
+1.20D+0.50Lr+1.60L+1.60H													
Dsgn. L = 18.34 ft	1	0.381	0.121	44.67		44.67	130.42	117.38	1.00	1.00	9.74	80.34	80.34
+1.20D+1.60L+0.50S+1.60H													
Dsgn. L = 18.34 ft	1	0.381	0.121	44.67		44.67	130.42	117.38	1.00	1.00	9.74	80.34	80.34
+1.20D+1.60Lr+0.50L+1.60H													
Dsgn. L = 18.34 ft	1	0.193	0.062	22.69		22.69	130.42	117.38	1.00	1.00	4.95	80.34	80.34
+1.20D+1.60Lr+0.50W+1.60H													
Dsgn. L = 18.34 ft	1	0.108	0.034	12.70		12.70	130.42	117.38	1.00	1.00	2.77	80.34	80.34
+1.20D+0.50L+1.60S+1.60H													
Dsgn. L = 18.34 ft	1	0.193	0.062	22.69		22.69	130.42	117.38	1.00	1.00	4.95	80.34	80.34
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 18.34 ft	1	0.108	0.034	12.70		12.70	130.42	117.38	1.00	1.00	2.77	80.34	80.34
+1.20D+0.50Lr+0.50L+W+1.60H													
Dsgn. L = 18.34 ft	1	0.193	0.062	22.69		22.69	130.42	117.38	1.00	1.00	4.95	80.34	80.34
+1.20D+0.50L+0.50S+W+1.60H													
Dsgn. L = 18.34 ft	1	0.193	0.062	22.69		22.69	130.42	117.38	1.00	1.00	4.95	80.34	80.34
+1.20D+0.50L+0.70S+E+1.60H													
Dsgn. L = 18.34 ft	1	0.193	0.062	22.69		22.69	130.42	117.38	1.00	1.00	4.95	80.34	80.34
+0.90D+W+0.90H					B42								
Dsgn. L = 18.34 ft	1	0.081	0.026	9.53		9.53	130.42	117.38	1.00	1.00	2.08	80.34	80.34

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B5

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+0.90D+E+0.90H													
Dsgn. L = 18.34 ft	1	0.081	0.026	9.53		9.53	130.42	117.38	1.00	1.00	2.08	80.34	80.34

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L+H	1	0.4451	9.222		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	6.666	6.666
Max Upward from Load Combinations	6.666	6.666
Max Upward from Load Cases	4.358	4.358
+D+H	2.308	2.308
+D+L+H	6.666	6.666
+D+Lr+H	2.308	2.308
+D+S+H	2.308	2.308
+D+0.750Lr+0.750L+H	5.576	5.576
+D+0.750L+0.750S+H	5.576	5.576
+D+0.60W+H	2.308	2.308
+D+0.70E+H	2.308	2.308
+D+0.750Lr+0.750L+0.450W+H	5.576	5.576
+D+0.750L+0.750S+0.450W+H	5.576	5.576
+D+0.750L+0.750S+0.5250E+H	5.576	5.576
+0.60D+0.60W+0.60H	1.385	1.385
+0.60D+0.70E+0.60H	1.385	1.385
D Only	2.308	2.308
L Only	4.358	4.358
H Only		

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

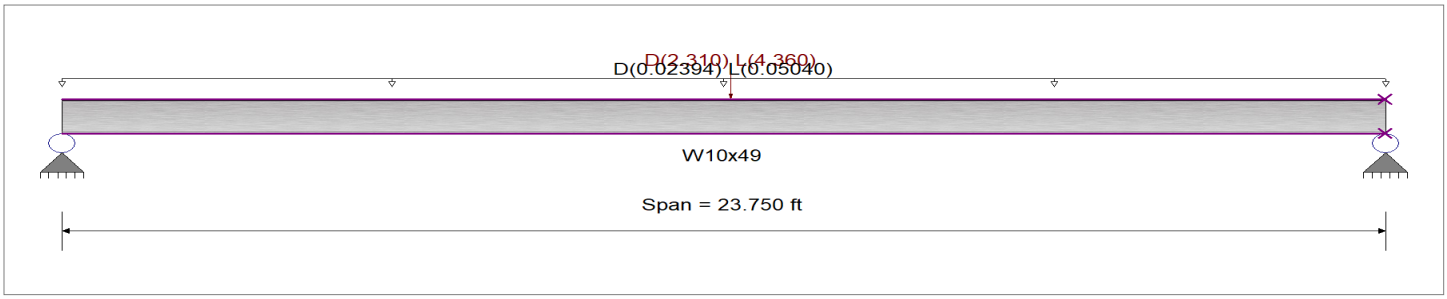
DESCRIPTION: UL-B6

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0190, L = 0.040 ksf, Tributary Width = 1.260 ft, (Floor Load)

Point Load : D = 2.310, L = 4.360 k @ 12.0 ft, (UL-B5)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.308 : 1	Maximum Shear Stress Ratio =	0.068 : 1
Section used for this span	W10x49	Section used for this span	W10x49
Mu : Applied	69.675 k-ft	Vu : Applied	6.922 k
Mn * Phi : Allowable	226.500 k-ft	Vn * Phi : Allowable	102.0 k
Load Combination	+1.20D+0.50Lr+1.60L+1.60H	Load Combination	+1.20D+0.50Lr+1.60L+1.60H
		Location of maximum on span	23.750 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.314 in	Ratio =	908	>=600.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<600.0	Span: 1 : L Only
Max Downward Total Deflection	0.522 in	Ratio =	546	>=360.	Span: 1 : +D+L+H
Max Upward Total Deflection	0.000 in	Ratio =	0	<360.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 23.75 ft	1	0.116	0.028	26.38		26.38	251.67	226.50	1.00	1.00	2.85	102.00	102.00
+1.20D+0.50Lr+1.60L+1.60H													
Dsgn. L = 23.75 ft	1	0.308	0.068	69.68		69.68	251.67	226.50	1.00	1.00	6.92	102.00	102.00
+1.20D+1.60L+0.50S+1.60H													
Dsgn. L = 23.75 ft	1	0.308	0.068	69.68		69.68	251.67	226.50	1.00	1.00	6.92	102.00	102.00
+1.20D+1.60Lr+0.50L+1.60H													
Dsgn. L = 23.75 ft	1	0.165	0.038	37.32		37.32	251.67	226.50	1.00	1.00	3.84	102.00	102.00
+1.20D+1.60Lr+0.50W+1.60H													
Dsgn. L = 23.75 ft	1	0.100	0.024	22.61		22.61	251.67	226.50	1.00	1.00	2.44	102.00	102.00
+1.20D+0.50L+1.60S+1.60H													
Dsgn. L = 23.75 ft	1	0.165	0.038	37.32		37.32	251.67	226.50	1.00	1.00	3.84	102.00	102.00
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 23.75 ft	1	0.100	0.024	22.61		22.61	251.67	226.50	1.00	1.00	2.44	102.00	102.00
+1.20D+0.50Lr+0.50L+W+1.60H													
Dsgn. L = 23.75 ft	1	0.165	0.038	37.32		37.32	251.67	226.50	1.00	1.00	3.84	102.00	102.00
+1.20D+0.50L+0.50S+W+1.60H													
Dsgn. L = 23.75 ft	1	0.165	0.038	37.32		37.32	251.67	226.50	1.00	1.00	3.84	102.00	102.00
+1.20D+0.50L+0.70S+E+1.60H													

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B6

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values						Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
Dsgn. L = 23.75 ft +0.90D+W+0.90H	1	0.165	0.038	37.32		37.32	251.67	226.50	1.00	1.00	3.84	102.00	102.00
Dsgn. L = 23.75 ft +0.90D+E+0.90H	1	0.075	0.018	16.96		16.96	251.67	226.50	1.00	1.00	1.83	102.00	102.00
Dsgn. L = 23.75 ft	1	0.075	0.018	16.96		16.96	251.67	226.50	1.00	1.00	1.83	102.00	102.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L+H	1	0.5219	11.943		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	4.765	4.835
Max Upward from Load Combinations	4.765	4.835
Max Upward from Load Cases	2.756	2.801
+D+H	2.009	2.033
+D+L+H	4.765	4.835
+D+Lr+H	2.009	2.033
+D+S+H	2.009	2.033
+D+0.750Lr+0.750L+H	4.076	4.134
+D+0.750L+0.750S+H	4.076	4.134
+D+0.60W+H	2.009	2.033
+D+0.70E+H	2.009	2.033
+D+0.750Lr+0.750L+0.450W+H	4.076	4.134
+D+0.750L+0.750S+0.450W+H	4.076	4.134
+D+0.750L+0.750S+0.5250E+H	4.076	4.134
+0.60D+0.60W+0.60H	1.205	1.220
+0.60D+0.70E+0.60H	1.205	1.220
D Only	2.009	2.033
L Only	2.756	2.801
H Only		

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

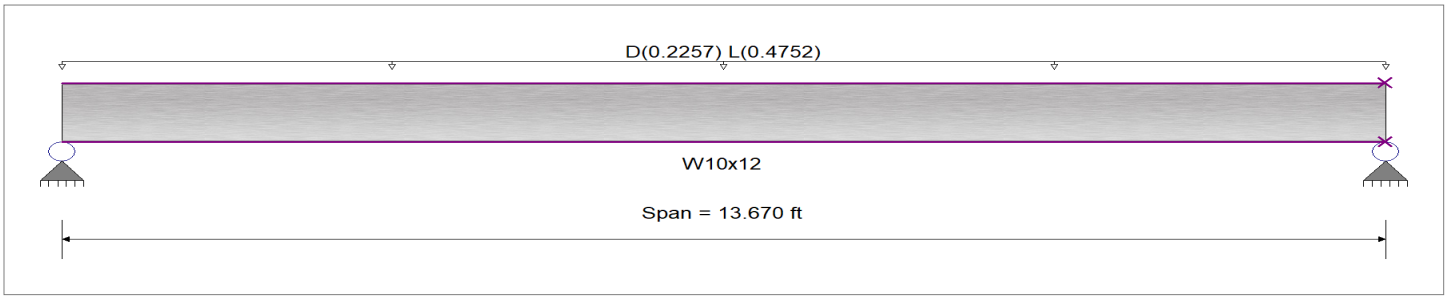
DESCRIPTION: UL-B8

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0190, L = 0.040 ksf, Tributary Width = 11.880 ft, (Floor Load)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.521 : 1	Maximum Shear Stress Ratio =	0.127 : 1
Section used for this span	W10x12	Section used for this span	W10x12
Mu : Applied	24.423 k-ft	Vu : Applied	7.147 k
Mn * Phi : Allowable	46.904 k-ft	Vn * Phi : Allowable	56.259 k
Load Combination	+1.20D+0.50Lr+1.60L+1.60H	Load Combination	+1.20D+0.50Lr+1.60L+1.60H
		Location of maximum on span	13.670 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.240 in	Ratio =	682	>=600.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<600.0	Span: 1 : L Only
Max Downward Total Deflection	0.361 in	Ratio =	455	>=360.	Span: 1 : +D+L+H
Max Upward Total Deflection	0.000 in	Ratio =	0	<360.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 13.67 ft	1	0.166	0.040	7.77		7.77	52.12	46.90	1.00	1.00	2.27	56.26	56.26
+1.20D+0.50Lr+1.60L+1.60H													
Dsgn. L = 13.67 ft	1	0.521	0.127	24.42		24.42	52.12	46.90	1.00	1.00	7.15	56.26	56.26
+1.20D+1.60L+0.50S+1.60H													
Dsgn. L = 13.67 ft	1	0.521	0.127	24.42		24.42	52.12	46.90	1.00	1.00	7.15	56.26	56.26
+1.20D+1.60Lr+0.50L+1.60H													
Dsgn. L = 13.67 ft	1	0.260	0.064	12.21		12.21	52.12	46.90	1.00	1.00	3.57	56.26	56.26
+1.20D+1.60Lr+0.50W+1.60H													
Dsgn. L = 13.67 ft	1	0.142	0.035	6.66		6.66	52.12	46.90	1.00	1.00	1.95	56.26	56.26
+1.20D+0.50L+1.60S+1.60H													
Dsgn. L = 13.67 ft	1	0.260	0.064	12.21		12.21	52.12	46.90	1.00	1.00	3.57	56.26	56.26
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 13.67 ft	1	0.142	0.035	6.66		6.66	52.12	46.90	1.00	1.00	1.95	56.26	56.26
+1.20D+0.50Lr+0.50L+W+1.60H													
Dsgn. L = 13.67 ft	1	0.260	0.064	12.21		12.21	52.12	46.90	1.00	1.00	3.57	56.26	56.26
+1.20D+0.50L+0.50S+W+1.60H													
Dsgn. L = 13.67 ft	1	0.260	0.064	12.21		12.21	52.12	46.90	1.00	1.00	3.57	56.26	56.26
+1.20D+0.50L+0.70S+E+1.60H													
Dsgn. L = 13.67 ft	1	0.260	0.064	12.21		12.21	52.12	46.90	1.00	1.00	3.57	56.26	56.26
+0.90D+W+0.90H					B46								
Dsgn. L = 13.67 ft	1	0.107	0.026	5.00		5.00	52.12	46.90	1.00	1.00	1.46	56.26	56.26

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B8

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+0.90D+E+0.90H													
Dsgn. L = 13.67 ft	1	0.107	0.026	5.00		5.00	52.12	46.90	1.00	1.00	1.46	56.26	56.26

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L+H	1	0.3607	6.874		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	4.873	4.873
Max Upward from Load Combinations	4.873	4.873
Max Upward from Load Cases	3.248	3.248
+D+H	1.625	1.625
+D+L+H	4.873	4.873
+D+Lr+H	1.625	1.625
+D+S+H	1.625	1.625
+D+0.750Lr+0.750L+H	4.061	4.061
+D+0.750L+0.750S+H	4.061	4.061
+D+0.60W+H	1.625	1.625
+D+0.70E+H	1.625	1.625
+D+0.750Lr+0.750L+0.450W+H	4.061	4.061
+D+0.750L+0.750S+0.450W+H	4.061	4.061
+D+0.750L+0.750S+0.5250E+H	4.061	4.061
+0.60D+0.60W+0.60H	0.975	0.975
+0.60D+0.70E+0.60H	0.975	0.975
D Only	1.625	1.625
L Only	3.248	3.248
H Only		

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B9

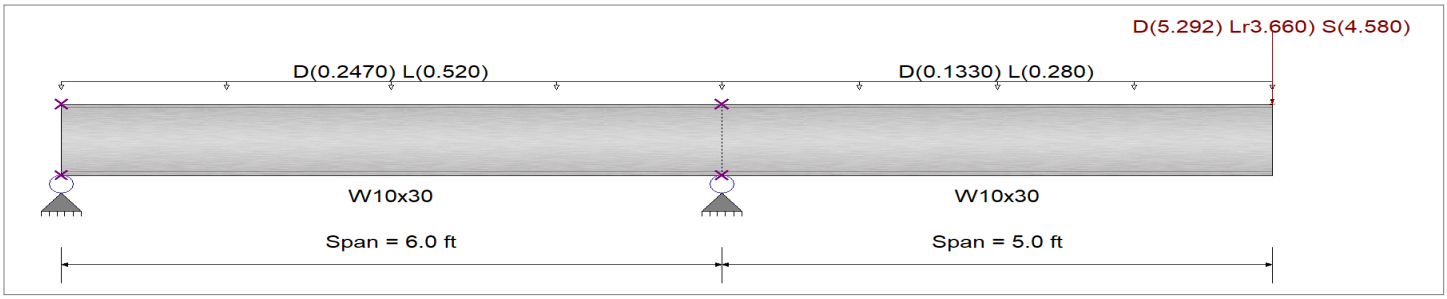
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method : Load Resistance Factor Design
Beam Bracing : Completely Unbraced
Bending Axis : Major Axis Bending

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



Applied Loads

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

Beam self weight calculated and added to loading
Load for Span Number 1
Uniform Load : D = 0.0190, L = 0.040 ksf, Tributary Width = 13.0 ft, (Floor Load)

Load for Span Number 2
Uniform Load : D = 0.0190, L = 0.040 ksf, Tributary Width = 7.0 ft, (Floor Load)

Point Load : D = 5.292, Lr = 3.660, S = 4.580 k @ 5.0 ft, (Column)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.532 : 1	Maximum Shear Stress Ratio =	0.163 : 1
Section used for this span	W10x30	Section used for this span	W10x30
Mu : Applied	72.587 k-ft	Vu : Applied	15.356 k
Mn * Phi : Allowable	136.513 k-ft	Vn * Phi : Allowable	94.50 k
Load Combination	+1.20D+0.50L+1.60S+1.60H, LL Comb Run (LL)	Load Combination	+1.20D+0.50L+1.60S+1.60H, LL Comb Run (*L)
		Location of maximum on span	6.000 ft
Span # where maximum occurs	Span # 2	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.147 in	Ratio =	816	>=600.	Span: 2 : S Only
Max Upward Transient Deflection	-0.019 in	Ratio =	3,864	>=600.	Span: 2 : S Only
Max Downward Total Deflection	0.324 in	Ratio =	370	>=360.	Span: 2 : +D+S+H
Max Upward Total Deflection	-0.040 in	Ratio =	1790	>=360.	Span: 2 : +D+S+H

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 6.00 ft	1	0.291	0.090		-39.90	39.90	152.50	137.25	1.75	1.00	8.55	94.50	94.50
Dsgn. L = 5.00 ft	2	0.292	0.090		-39.90	39.90	151.68	136.51	1.00	1.00	8.55	94.50	94.50
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 6.00 ft	1	0.357	0.121		-48.95	48.95	152.50	137.25	1.73	1.00	11.40	94.50	94.50
Dsgn. L = 5.00 ft	2	0.359	0.121		-48.95	48.95	151.68	136.51	1.00	1.00	11.40	94.50	94.50
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 6.00 ft	1	0.249	0.097		-34.20	34.20	152.50	137.25	2.02	1.00	9.19	94.50	94.50
Dsgn. L = 5.00 ft	2	0.251	0.078		-34.20	34.20	151.68	136.51	1.00	1.00	7.33	94.50	94.50
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 6.00 ft	1	0.357	0.123		-48.95	48.95	152.50	137.25	1.90	1.00	11.65	94.50	94.50
Dsgn. L = 5.00 ft	2	0.359	0.121		-48.95	48.95	151.68	136.51	1.00	1.00	11.40	94.50	94.50
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 6.00 ft	1	0.373	0.125		-51.25	51.25	152.50	137.25	1.72	1.00	11.86	94.50	94.50
Dsgn. L = 5.00 ft	2	0.375	0.125		-51.25	51.25	151.68	136.51	1.00	1.00	11.86	94.50	94.50

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B9

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 6.00 ft	1	0.333	0.117		-45.65	45.65	152.50	137.25	1.92	1.00	11.10	94.50	94.50
Dsgn. L = 5.00 ft	2	0.334	0.102		-45.65	45.65	151.68	136.51	1.00	1.00	9.62	94.50	94.50
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 6.00 ft	1	0.373	0.127		-51.25	51.25	152.50	137.25	1.88	1.00	12.03	94.50	94.50
Dsgn. L = 5.00 ft	2	0.375	0.125		-51.25	51.25	151.68	136.51	1.00	1.00	11.86	94.50	94.50
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 6.00 ft	1	0.475	0.147		-65.23	65.23	152.50	137.25	1.71	1.00	13.88	94.50	94.50
Dsgn. L = 5.00 ft	2	0.478	0.147		-65.23	65.23	151.68	136.51	1.00	1.00	13.88	94.50	94.50
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 6.00 ft	1	0.249	0.079		-34.20	34.20	152.50	137.25	1.83	1.00	7.48	94.50	94.50
Dsgn. L = 5.00 ft	2	0.251	0.078		-34.20	34.20	151.68	136.51	1.00	1.00	7.33	94.50	94.50
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 6.00 ft	1	0.475	0.147		-65.23	65.23	152.50	137.25	1.75	1.00	13.88	94.50	94.50
Dsgn. L = 5.00 ft	2	0.478	0.147		-65.23	65.23	151.68	136.51	1.00	1.00	13.88	94.50	94.50
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 6.00 ft	1	0.462	0.140		-63.48	63.48	152.50	137.25	1.71	1.00	13.18	94.50	94.50
Dsgn. L = 5.00 ft	2	0.465	0.140		-63.48	63.48	151.68	136.51	1.00	1.00	13.18	94.50	94.50
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 6.00 ft	1	0.249	0.078		-34.20	34.20	152.50	137.25	1.75	1.00	7.33	94.50	94.50
Dsgn. L = 5.00 ft	2	0.251	0.078		-34.20	34.20	151.68	136.51	1.00	1.00	7.33	94.50	94.50
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 6.00 ft	1	0.462	0.140		-63.48	63.48	152.50	137.25	1.71	1.00	13.18	94.50	94.50
Dsgn. L = 5.00 ft	2	0.465	0.140		-63.48	63.48	151.68	136.51	1.00	1.00	13.18	94.50	94.50
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 6.00 ft	1	0.529	0.163		-72.59	72.59	152.50	137.25	1.71	1.00	15.36	94.50	94.50
Dsgn. L = 5.00 ft	2	0.532	0.163		-72.59	72.59	151.68	136.51	1.00	1.00	15.36	94.50	94.50
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 6.00 ft	1	0.516	0.155		-70.84	70.84	152.50	137.25	1.74	1.00	14.66	94.50	94.50
Dsgn. L = 5.00 ft	2	0.519	0.155		-70.84	70.84	151.68	136.51	1.00	1.00	14.66	94.50	94.50
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 6.00 ft	1	0.529	0.163		-72.59	72.59	152.50	137.25	1.74	1.00	15.36	94.50	94.50
Dsgn. L = 5.00 ft	2	0.532	0.163		-72.59	72.59	151.68	136.51	1.00	1.00	15.36	94.50	94.50
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 6.00 ft	1	0.516	0.155		-70.84	70.84	152.50	137.25	1.71	1.00	14.66	94.50	94.50
Dsgn. L = 5.00 ft	2	0.519	0.155		-70.84	70.84	151.68	136.51	1.00	1.00	14.66	94.50	94.50
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 6.00 ft	1	0.329	0.104		-45.10	45.10	152.50	137.25	1.73	1.00	9.86	94.50	94.50
Dsgn. L = 5.00 ft	2	0.330	0.104		-45.10	45.10	151.68	136.51	1.00	1.00	9.86	94.50	94.50
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 6.00 ft	1	0.249	0.079		-34.20	34.20	152.50	137.25	1.83	1.00	7.48	94.50	94.50
Dsgn. L = 5.00 ft	2	0.251	0.078		-34.20	34.20	151.68	136.51	1.00	1.00	7.33	94.50	94.50
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 6.00 ft	1	0.329	0.104		-45.10	45.10	152.50	137.25	1.79	1.00	9.86	94.50	94.50
Dsgn. L = 5.00 ft	2	0.330	0.104		-45.10	45.10	151.68	136.51	1.00	1.00	9.86	94.50	94.50
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 6.00 ft	1	0.345	0.109		-47.40	47.40	152.50	137.25	1.73	1.00	10.32	94.50	94.50
Dsgn. L = 5.00 ft	2	0.347	0.109		-47.40	47.40	151.68	136.51	1.00	1.00	10.32	94.50	94.50
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 6.00 ft	1	0.333	0.102		-45.65	45.65	152.50	137.25	1.78	1.00	9.62	94.50	94.50
Dsgn. L = 5.00 ft	2	0.334	0.102		-45.65	45.65	151.68	136.51	1.00	1.00	9.62	94.50	94.50
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 6.00 ft	1	0.345	0.109		-47.40	47.40	152.50	137.25	1.78	1.00	10.32	94.50	94.50
Dsgn. L = 5.00 ft	2	0.347	0.109		-47.40	47.40	151.68	136.51	1.00	1.00	10.32	94.50	94.50
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 6.00 ft	1	0.379	0.119		-51.98	51.98	152.50	137.25	1.72	1.00	11.23	94.50	94.50
Dsgn. L = 5.00 ft	2	0.381	0.119		-51.98	51.98	151.68	136.51	1.00	1.00	11.23	94.50	94.50
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 6.00 ft	1	0.366	0.111		-50.23	50.23	152.50	137.25	1.77	1.00	10.53	94.50	94.50
Dsgn. L = 5.00 ft	2	0.368	0.111		-50.23	50.23	151.68	136.51	1.00	1.00	10.53	94.50	94.50
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 6.00 ft	1	0.379	0.119		-51.98	51.98	152.50	137.25	1.77	1.00	11.23	94.50	94.50
Dsgn. L = 5.00 ft	2	0.381	0.119		-51.98	51.98	151.68	136.51	1.00	1.00	11.23	94.50	94.50

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B9

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+0.90D+W+0.90H													
Dsgn. L = 6.00 ft	1	0.187	0.058		-25.65	25.65	152.50	137.25	1.75	1.00	5.50	94.50	94.50
Dsgn. L = 5.00 ft	2	0.188	0.058		-25.65	25.65	151.68	136.51	1.00	1.00	5.50	94.50	94.50
+0.90D+E+0.90H													
Dsgn. L = 6.00 ft	1	0.187	0.058		-25.65	25.65	152.50	137.25	1.75	1.00	5.50	94.50	94.50
Dsgn. L = 5.00 ft	2	0.188	0.058		-25.65	25.65	151.68	136.51	1.00	1.00	5.50	94.50	94.50

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
	1	0.0000	0.000	+D+S+H	-0.0402	3.504
+D+S+H	2	0.3240	5.000		0.0000	3.504

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	1.560	20.643	
Max Upward from Load Combinations		20.643	
Max Upward from Load Cases	1.560	11.688	
Max Downward from all Load Conditions (Resis	-7.735		
Max Downward from Load Combinations (Resi	-7.735		
Max Downward from Load Cases (Resisting Up	-3.919		
+D+H	-3.919	11.688	
+D+L+H, LL Comb Run (*L)	-4.502	13.671	
+D+L+H, LL Comb Run (L*)	-2.359	13.248	
+D+L+H, LL Comb Run (LL)	-2.942	15.231	
+D+Lr+H, LL Comb Run (*L)	-6.969	18.398	
+D+Lr+H, LL Comb Run (L*)	-3.919	11.688	
+D+Lr+H, LL Comb Run (LL)	-6.969	18.398	
+D+S+H	-7.735	20.084	
+D+0.750Lr+0.750L+H, LL Comb Run (*L)	-6.644	18.208	
+D+0.750Lr+0.750L+H, LL Comb Run (L*)	-2.749	12.858	
+D+0.750Lr+0.750L+H, LL Comb Run (LL)	-5.474	19.378	
+D+0.750L+0.750S+H, LL Comb Run (*L)	-7.219	19.473	
+D+0.750L+0.750S+H, LL Comb Run (L*)	-5.611	19.155	
+D+0.750L+0.750S+H, LL Comb Run (LL)	-6.049	20.643	
+D+0.60W+H	-3.919	11.688	
+D+0.70E+H	-3.919	11.688	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	-6.644	18.208	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	-2.749	12.858	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	-5.474	19.378	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	-7.219	19.473	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	-5.611	19.155	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	-6.049	20.643	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	-7.219	19.473	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	-5.611	19.155	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	-6.049	20.643	
+0.60D+0.60W+0.60H	-2.351	7.013	
+0.60D+0.70E+0.60H	-2.351	7.013	
D Only	-3.919	11.688	
Lr Only, LL Comb Run (*L)	-3.050	6.710	
Lr Only, LL Comb Run (LL)	-3.050	6.710	
L Only, LL Comb Run (*L)	-0.583	1.983	
L Only, LL Comb Run (L*)	1.560	1.560	
L Only, LL Comb Run (LL)	0.977	3.543	
S Only	-3.817	8.397	
H Only			

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

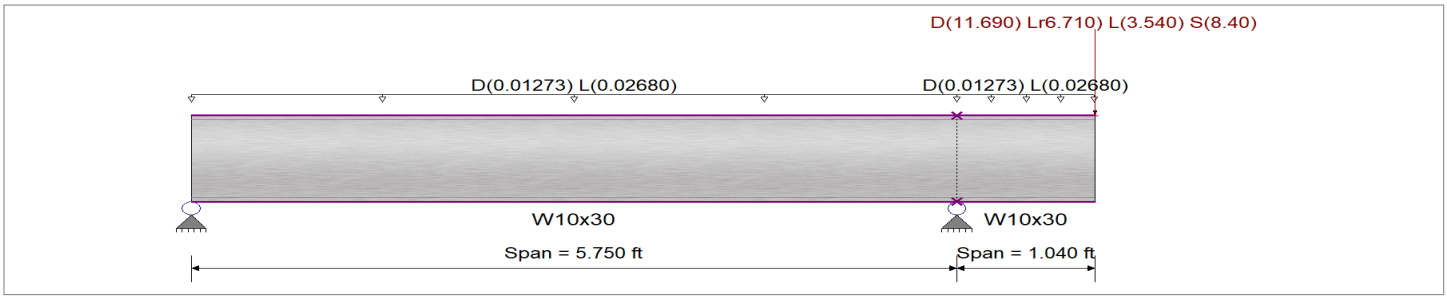
DESCRIPTION: UL-B10

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



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 = 0.0190, L = 0.040 ksf, Tributary Width = 0.670 ft, (Floor Load)

Load for Span Number 2
Uniform Load : D = 0.0190, L = 0.040 ksf, Tributary Width = 0.670 ft, (Floor Load)

Point Load : D = 11.690, Lr = 6.710, L = 3.540, S = 8.40 k @ 1.040 ft, (UL-B9)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.222 : 1	Maximum Shear Stress Ratio =	0.310 : 1
Section used for this span	W10x30	Section used for this span	W10x30
Mu : Applied	30.442 k-ft	Vu : Applied	29.305 k
Mn * Phi : Allowable	137.250 k-ft	Vn * Phi : Allowable	94.50 k
Load Combination	+1.20D+0.50L+1.60S+1.60H, LL Comb Run (*L)	Load Combination	+1.20D+0.50L+1.60S+1.60H, LL Comb Run (LL)
		Location of maximum on span	5.750 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.007 in	Ratio =	3,464	>=600.	Span: 2 : S Only
Max Upward Transient Deflection	-0.007 in	Ratio =	10,569	>=600.	Span: 2 : S Only
Max Downward Total Deflection	0.018 in	Ratio =	1417	>=360.	Span: 2 : +D+0.750L+0.750S+H, LL Comb Run (*L)
Max Upward Total Deflection	-0.016 in	Ratio =	4350	>=360.	Span: 2 : +D+0.750L+0.750S+H, LL Comb Run (*L)

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 5.75 ft	1	0.124	0.174		-17.05	17.05	152.50	137.25	1.00	1.00	16.43	94.50	94.50
Dsgn. L = 1.04 ft	2	0.124	0.174		-17.05	17.05	152.50	137.25	1.00	1.00	16.43	94.50	94.50
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 5.75 ft	1	0.175	0.245		-24.02	24.02	152.50	137.25	1.00	1.00	23.14	94.50	94.50
Dsgn. L = 1.04 ft	2	0.175	0.245		-24.02	24.02	152.50	137.25	1.00	1.00	23.14	94.50	94.50
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 5.75 ft	1	0.106	0.149		-14.62	14.62	152.50	137.25	1.00	1.00	14.08	94.50	94.50
Dsgn. L = 1.04 ft	2	0.106	0.149		-14.62	14.62	152.50	137.25	1.00	1.00	14.08	94.50	94.50
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 5.75 ft	1	0.175	0.245		-24.02	24.02	152.50	137.25	1.00	1.00	23.14	94.50	94.50
Dsgn. L = 1.04 ft	2	0.175	0.245		-24.02	24.02	152.50	137.25	1.00	1.00	23.14	94.50	94.50
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 5.75 ft	1	0.181	0.254		-24.90	24.90	152.50	137.25	1.00	1.00	23.99	94.50	94.50
Dsgn. L = 1.04 ft	2	0.181	0.254		-24.90	24.90	152.50	137.25	1.00	1.00	23.99	94.50	94.50

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B10

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 5.75 ft	1	0.138	0.193		-18.98	18.98	152.50	137.25	1.00	1.00	18.28	94.50	94.50
Dsgn. L = 1.04 ft	2	0.138	0.193		-18.98	18.98	152.50	137.25	1.00	1.00	18.28	94.50	94.50
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 5.75 ft	1	0.181	0.254		-24.90	24.90	152.50	137.25	1.00	1.00	23.99	94.50	94.50
Dsgn. L = 1.04 ft	2	0.181	0.254		-24.90	24.90	152.50	137.25	1.00	1.00	23.99	94.50	94.50
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 5.75 ft	1	0.201	0.281		-27.63	27.63	152.50	137.25	1.00	1.00	26.60	94.50	94.50
Dsgn. L = 1.04 ft	2	0.201	0.281		-27.63	27.63	152.50	137.25	1.00	1.00	26.60	94.50	94.50
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 5.75 ft	1	0.106	0.149		-14.62	14.62	152.50	137.25	1.00	1.00	14.08	94.50	94.50
Dsgn. L = 1.04 ft	2	0.106	0.149		-14.62	14.62	152.50	137.25	1.00	1.00	14.08	94.50	94.50
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 5.75 ft	1	0.201	0.281		-27.63	27.63	152.50	137.25	1.00	1.00	26.60	94.50	94.50
Dsgn. L = 1.04 ft	2	0.201	0.281		-27.63	27.63	152.50	137.25	1.00	1.00	26.60	94.50	94.50
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 5.75 ft	1	0.188	0.263		-25.78	25.78	152.50	137.25	1.00	1.00	24.82	94.50	94.50
Dsgn. L = 1.04 ft	2	0.188	0.263		-25.78	25.78	152.50	137.25	1.00	1.00	24.82	94.50	94.50
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 5.75 ft	1	0.106	0.149		-14.62	14.62	152.50	137.25	1.00	1.00	14.08	94.50	94.50
Dsgn. L = 1.04 ft	2	0.106	0.149		-14.62	14.62	152.50	137.25	1.00	1.00	14.08	94.50	94.50
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 5.75 ft	1	0.188	0.263		-25.78	25.78	152.50	137.25	1.00	1.00	24.82	94.50	94.50
Dsgn. L = 1.04 ft	2	0.188	0.263		-25.78	25.78	152.50	137.25	1.00	1.00	24.82	94.50	94.50
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 5.75 ft	1	0.222	0.310		-30.44	30.44	152.50	137.25	1.00	1.00	29.31	94.50	94.50
Dsgn. L = 1.04 ft	2	0.222	0.310		-30.44	30.44	152.50	137.25	1.00	1.00	29.31	94.50	94.50
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 5.75 ft	1	0.208	0.291		-28.59	28.59	152.50	137.25	1.00	1.00	27.52	94.50	94.50
Dsgn. L = 1.04 ft	2	0.208	0.291		-28.59	28.59	152.50	137.25	1.00	1.00	27.52	94.50	94.50
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 5.75 ft	1	0.222	0.310		-30.44	30.44	152.50	137.25	1.00	1.00	29.31	94.50	94.50
Dsgn. L = 1.04 ft	2	0.222	0.310		-30.44	30.44	152.50	137.25	1.00	1.00	29.31	94.50	94.50
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 5.75 ft	1	0.208	0.291		-28.59	28.59	152.50	137.25	1.00	1.00	27.52	94.50	94.50
Dsgn. L = 1.04 ft	2	0.208	0.291		-28.59	28.59	152.50	137.25	1.00	1.00	27.52	94.50	94.50
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 5.75 ft	1	0.145	0.203		-19.95	19.95	152.50	137.25	1.00	1.00	19.22	94.50	94.50
Dsgn. L = 1.04 ft	2	0.145	0.203		-19.95	19.95	152.50	137.25	1.00	1.00	19.22	94.50	94.50
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 5.75 ft	1	0.106	0.149		-14.62	14.62	152.50	137.25	1.00	1.00	14.08	94.50	94.50
Dsgn. L = 1.04 ft	2	0.106	0.149		-14.62	14.62	152.50	137.25	1.00	1.00	14.08	94.50	94.50
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 5.75 ft	1	0.145	0.203		-19.95	19.95	152.50	137.25	1.00	1.00	19.22	94.50	94.50
Dsgn. L = 1.04 ft	2	0.145	0.203		-19.95	19.95	152.50	137.25	1.00	1.00	19.22	94.50	94.50
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 5.75 ft	1	0.152	0.212		-20.83	20.83	152.50	137.25	1.00	1.00	20.07	94.50	94.50
Dsgn. L = 1.04 ft	2	0.152	0.212		-20.83	20.83	152.50	137.25	1.00	1.00	20.07	94.50	94.50
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 5.75 ft	1	0.138	0.193		-18.98	18.98	152.50	137.25	1.00	1.00	18.28	94.50	94.50
Dsgn. L = 1.04 ft	2	0.138	0.193		-18.98	18.98	152.50	137.25	1.00	1.00	18.28	94.50	94.50
+1.20D+0.50L+0.50S+W+1.60H,													
Dsgn. L = 5.75 ft	1	0.152	0.212		-20.83	20.83	152.50	137.25	1.00	1.00	20.07	94.50	94.50
Dsgn. L = 1.04 ft	2	0.152	0.212		-20.83	20.83	152.50	137.25	1.00	1.00	20.07	94.50	94.50
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 5.75 ft	1	0.165	0.230		-22.58	22.58	152.50	137.25	1.00	1.00	21.75	94.50	94.50
Dsgn. L = 1.04 ft	2	0.165	0.230		-22.58	22.58	152.50	137.25	1.00	1.00	21.75	94.50	94.50
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 5.75 ft	1	0.151	0.211		-20.73	20.73	152.50	137.25	1.00	1.00	19.96	94.50	94.50
Dsgn. L = 1.04 ft	2	0.151	0.211		-20.73	20.73	152.50	137.25	1.00	1.00	19.96	94.50	94.50
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 5.75 ft	1	0.165	0.230		-22.58	22.58	152.50	137.25	1.00	1.00	21.75	94.50	94.50
Dsgn. L = 1.04 ft	2	0.165	0.230		-22.58	22.58	152.50	137.25	1.00	1.00	21.75	94.50	94.50

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B10

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+0.90D+W+0.90H													
Dsgn. L = 5.75 ft	1	0.080	0.112		-10.96	10.96	152.50	137.25	1.00	1.00	10.56	94.50	94.50
Dsgn. L = 1.04 ft	2	0.080	0.112		-10.96	10.96	152.50	137.25	1.00	1.00	10.56	94.50	94.50
+0.90D+E+0.90H													
Dsgn. L = 5.75 ft	1	0.080	0.112		-10.96	10.96	152.50	137.25	1.00	1.00	10.56	94.50	94.50
Dsgn. L = 1.04 ft	2	0.080	0.112		-10.96	10.96	152.50	137.25	1.00	1.00	10.56	94.50	94.50

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	-0.0159	3.335
+D+0.750L+0.750S+0.5250E+H	2	0.0176	1.040		0.0000	3.335

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	0.077	24.631	
Max Upward from Load Combinations		24.631	
Max Upward from Load Cases	0.077	13.976	
Max Downward from all Load Conditions (Resis	-3.617		
Max Downward from Load Combinations (Resi	-3.617		
Max Downward from Load Cases (Resisting Up	-1.996		
+D+H	-1.996	13.976	
+D+L+H, LL Comb Run (*L)	-2.638	18.186	
+D+L+H, LL Comb Run (L*)	-1.918	14.053	
+D+L+H, LL Comb Run (LL)	-2.561	18.263	
+D+Lr+H, LL Comb Run (*L)	-3.209	21.899	
+D+Lr+H, LL Comb Run (L*)	-1.996	13.976	
+D+Lr+H, LL Comb Run (LL)	-3.209	21.899	
+D+S+H	-3.515	23.895	
+D+0.750Lr+0.750L+H, LL Comb Run (*L)	-3.388	23.076	
+D+0.750Lr+0.750L+H, LL Comb Run (L*)	-1.938	14.033	
+D+0.750Lr+0.750L+H, LL Comb Run (LL)	-3.330	23.134	
+D+0.750L+0.750S+H, LL Comb Run (*L)	-3.617	24.573	
+D+0.750L+0.750S+H, LL Comb Run (L*)	-3.077	21.473	
+D+0.750L+0.750S+H, LL Comb Run (LL)	-3.559	24.631	
+D+0.60W+H	-1.996	13.976	
+D+0.70E+H	-1.996	13.976	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	-3.388	23.076	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	-1.938	14.033	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	-3.330	23.134	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	-3.617	24.573	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	-3.077	21.473	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	-3.559	24.631	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	-3.617	24.573	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	-3.077	21.473	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	-3.559	24.631	
+0.60D+0.60W+0.60H	-1.197	8.385	
+0.60D+0.70E+0.60H	-1.197	8.385	
D Only	-1.996	13.976	
Lr Only, LL Comb Run (*L)	-1.214	7.924	
Lr Only, LL Comb Run (LL)	-1.214	7.924	
L Only, LL Comb Run (*L)	-0.643	4.211	
L Only, LL Comb Run (L*)	0.077	0.077	
L Only, LL Comb Run (LL)	-0.566	4.288	
S Only	-1.519	9.919	
H Only			

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B11

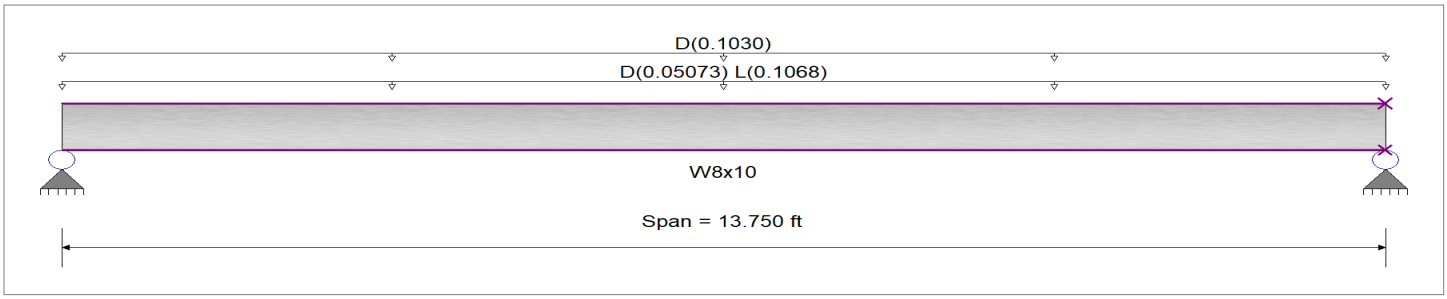
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method : Load Resistance Factor Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending

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



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0190, L = 0.040 ksf, Tributary Width = 2.670 ft, (Floor Load)

Uniform Load : D = 0.1030 k/ft, Tributary Width = 1.0 ft, (Wall Load)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.264 : 1	Maximum Shear Stress Ratio =	0.063 : 1
Section used for this span	W8x10	Section used for this span	W8x10
Mu : Applied	8.682 k-ft	Vu : Applied	2.526 k
Mn * Phi : Allowable	32.871 k-ft	Vn * Phi : Allowable	40.239 k
Load Combination	+1.20D+0.50Lr+1.60L+1.60H	Load Combination	+1.20D+0.50Lr+1.60L+1.60H
		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	0.097 in	Ratio =	1,707	>=600.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<600.0	Span: 1 : L Only
Max Downward Total Deflection	0.245 in	Ratio =	674	>=360.	Span: 1 : +D+L+H
Max Upward Total Deflection	0.000 in	Ratio =	0	<360.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 13.75 ft	1	0.165	0.039	5.42		5.42	36.52	32.87	1.00	1.00	1.58	40.24	40.24
+1.20D+0.50Lr+1.60L+1.60H													
Dsgn. L = 13.75 ft	1	0.264	0.063	8.68		8.68	36.52	32.87	1.00	1.00	2.53	40.24	40.24
+1.20D+1.60L+0.50S+1.60H													
Dsgn. L = 13.75 ft	1	0.264	0.063	8.68		8.68	36.52	32.87	1.00	1.00	2.53	40.24	40.24
+1.20D+1.60Lr+0.50L+1.60H													
Dsgn. L = 13.75 ft	1	0.180	0.043	5.91		5.91	36.52	32.87	1.00	1.00	1.72	40.24	40.24
+1.20D+1.60Lr+0.50W+1.60H													
Dsgn. L = 13.75 ft	1	0.141	0.034	4.64		4.64	36.52	32.87	1.00	1.00	1.35	40.24	40.24
+1.20D+0.50L+1.60S+1.60H													
Dsgn. L = 13.75 ft	1	0.180	0.043	5.91		5.91	36.52	32.87	1.00	1.00	1.72	40.24	40.24
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 13.75 ft	1	0.141	0.034	4.64		4.64	36.52	32.87	1.00	1.00	1.35	40.24	40.24
+1.20D+0.50Lr+0.50L+W+1.60H													
Dsgn. L = 13.75 ft	1	0.180	0.043	5.91		5.91	36.52	32.87	1.00	1.00	1.72	40.24	40.24
+1.20D+0.50L+0.50S+W+1.60H													
Dsgn. L = 13.75 ft	1	0.180	0.043	5.91		5.91	36.52	32.87	1.00	1.00	1.72	40.24	40.24
+1.20D+0.50L+0.70S+E+1.60H													

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B11

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values						Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
Dsgn. L = 13.75 ft +0.90D+W+0.90H	1	0.180	0.043	5.91		5.91	36.52	32.87	1.00	1.00	1.72	40.24	40.24
Dsgn. L = 13.75 ft +0.90D+E+0.90H	1	0.106	0.025	3.48		3.48	36.52	32.87	1.00	1.00	1.01	40.24	40.24
Dsgn. L = 13.75 ft	1	0.106	0.025	3.48		3.48	36.52	32.87	1.00	1.00	1.01	40.24	40.24

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L+H	1	0.2447	6.914		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	1.860	1.860
Max Upward from Load Combinations	1.860	1.860
Max Upward from Load Cases	1.126	1.126
+D+H	1.126	1.126
+D+L+H	1.860	1.860
+D+Lr+H	1.126	1.126
+D+S+H	1.126	1.126
+D+0.750Lr+0.750L+H	1.676	1.676
+D+0.750L+0.750S+H	1.676	1.676
+D+0.60W+H	1.126	1.126
+D+0.70E+H	1.126	1.126
+D+0.750Lr+0.750L+0.450W+H	1.676	1.676
+D+0.750L+0.750S+0.450W+H	1.676	1.676
+D+0.750L+0.750S+0.5250E+H	1.676	1.676
+0.60D+0.60W+0.60H	0.675	0.675
+0.60D+0.70E+0.60H	0.675	0.675
D Only	1.126	1.126
L Only	0.734	0.734
H Only		

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B12

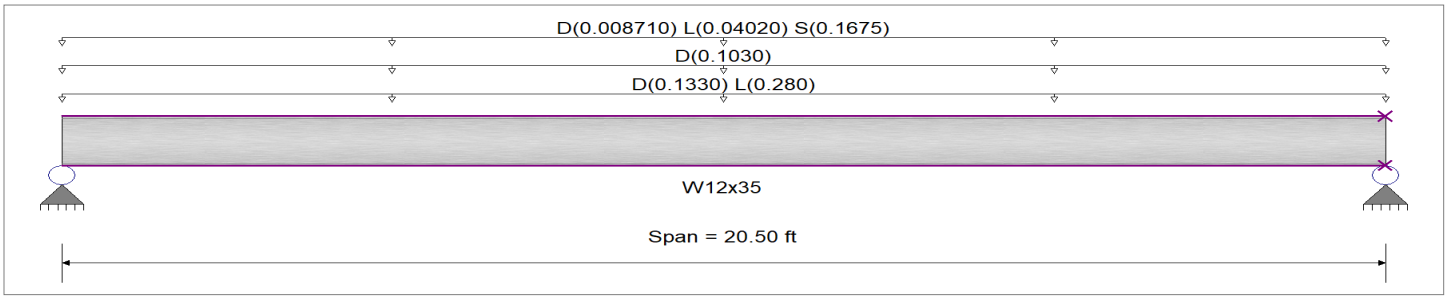
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method : Load Resistance Factor Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending

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



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0190, L = 0.040 ksf, Tributary Width = 7.0 ft, (Floor Load)

Uniform Load : D = 0.1030 k/ft, Tributary Width = 1.0 ft, (Wall Load)

Uniform Load : D = 0.0130, L = 0.060, S = 0.250 ksf, Tributary Width = 0.670 ft, (Floor Load)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.255 : 1	Maximum Shear Stress Ratio =	0.085 : 1
Section used for this span	W12x35	Section used for this span	W12x35
Mu : Applied	48.945 k-ft	Vu : Applied	9.550 k
Mn * Phi : Allowable	192.000 k-ft	Vn * Phi : Allowable	112.50 k
Load Combination	+1.20D+1.60L+0.50S+1.60H	Load Combination	+1.20D+1.60L+0.50S+1.60H
		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	0.155 in	Ratio =	1,590	>=600.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<600.0	Span: 1 : L Only
Max Downward Total Deflection	0.312 in	Ratio =	789	>=360.	Span: 1 : +D+0.750L+0.750S+H
Max Upward Total Deflection	0.000 in	Ratio =	0	<360.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 20.50 ft	1	0.107	0.036	20.57		20.57	213.33	192.00	1.00	1.00	4.01	112.50	112.50
+1.20D+0.50Lr+1.60L+1.60H													
Dsgn. L = 20.50 ft	1	0.232	0.077	44.55		44.55	213.33	192.00	1.00	1.00	8.69	112.50	112.50
+1.20D+1.60L+0.50S+1.60H													
Dsgn. L = 20.50 ft	1	0.255	0.085	48.94		48.94	213.33	192.00	1.00	1.00	9.55	112.50	112.50
+1.20D+1.60Lr+0.50L+1.60H													
Dsgn. L = 20.50 ft	1	0.136	0.045	26.04		26.04	213.33	192.00	1.00	1.00	5.08	112.50	112.50
+1.20D+1.60Lr+0.50W+1.60H													
Dsgn. L = 20.50 ft	1	0.092	0.031	17.63		17.63	213.33	192.00	1.00	1.00	3.44	112.50	112.50
+1.20D+0.50L+1.60S+1.60H													
Dsgn. L = 20.50 ft	1	0.209	0.070	40.12		40.12	213.33	192.00	1.00	1.00	7.83	112.50	112.50
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 20.50 ft	1	0.165	0.055	31.71		31.71	213.33	192.00	1.00	1.00	6.19	112.50	112.50
+1.20D+0.50Lr+0.50L+W+1.60H													
Dsgn. L = 20.50 ft	1	0.136	0.045	26.04	B56	26.04	213.33	192.00	1.00	1.00	5.08	112.50	112.50
+1.20D+0.50L+0.50S+W+1.60H													

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B12

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values						Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
Dsgn. L = 20.50 ft	1	0.159	0.053	30.44		30.44	213.33	192.00	1.00	1.00	5.94	112.50	112.50
+1.20D+0.50L+0.70S+E+1.60H													
Dsgn. L = 20.50 ft	1	0.168	0.056	32.20		32.20	213.33	192.00	1.00	1.00	6.28	112.50	112.50
+0.90D+W+0.90H													
Dsgn. L = 20.50 ft	1	0.069	0.023	13.22		13.22	213.33	192.00	1.00	1.00	2.58	112.50	112.50
+0.90D+E+0.90H													
Dsgn. L = 20.50 ft	1	0.069	0.023	13.22		13.22	213.33	192.00	1.00	1.00	2.58	112.50	112.50

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	0.3118	10.309		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	6.616	6.616
Max Upward from Load Combinations	6.616	6.616
Max Upward from Load Cases	3.282	3.282
+D+H	2.867	2.867
+D+L+H	6.149	6.149
+D+Lr+H	2.867	2.867
+D+S+H	4.584	4.584
+D+0.750Lr+0.750L+H	5.329	5.329
+D+0.750L+0.750S+H	6.616	6.616
+D+0.60W+H	2.867	2.867
+D+0.70E+H	2.867	2.867
+D+0.750Lr+0.750L+0.450W+H	5.329	5.329
+D+0.750L+0.750S+0.450W+H	6.616	6.616
+D+0.750L+0.750S+0.5250E+H	6.616	6.616
+0.60D+0.60W+0.60H	1.720	1.720
+0.60D+0.70E+0.60H	1.720	1.720
D Only	2.867	2.867
L Only	3.282	3.282
S Only	1.717	1.717
H Only		

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B13

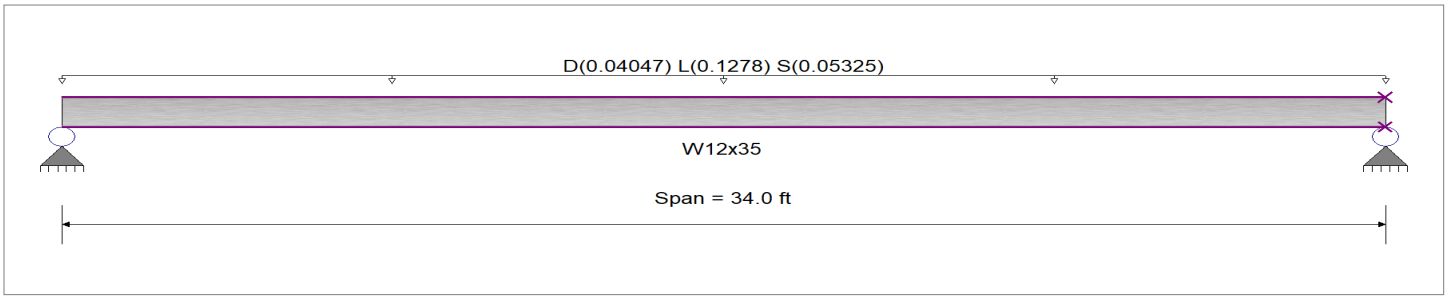
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method : Load Resistance Factor Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending

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



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0190, L = 0.060, S = 0.0250 ksf, Tributary Width = 2.130 ft, (Floor Load)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.242 : 1	Maximum Shear Stress Ratio =	0.049 : 1
Section used for this span	W12x35	Section used for this span	W12x35
Mu : Applied	46.481 k-ft	Vu : Applied	5.468 k
Mn * Phi : Allowable	192.000 k-ft	Vn * Phi : Allowable	112.50 k
Load Combination	+1.20D+1.60L+0.50S+1.60H	Load Combination	+1.20D+1.60L+0.50S+1.60H
		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	0.467 in	Ratio =	873	>=600.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<600.0	Span: 1 : L Only
Max Downward Total Deflection	0.772 in	Ratio =	528	>=360.	Span: 1 : +D+0.750L+0.750S+H
Max Upward Total Deflection	0.000 in	Ratio =	0	<360.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 34.00 ft	1	0.080	0.016	15.27		15.27	213.33	192.00	1.00	1.00	1.80	112.50	112.50
+1.20D+0.50Lr+1.60L+1.60H													
Dsgn. L = 34.00 ft	1	0.222	0.045	42.63		42.63	213.33	192.00	1.00	1.00	5.02	112.50	112.50
+1.20D+1.60L+0.50S+1.60H													
Dsgn. L = 34.00 ft	1	0.242	0.049	46.48		46.48	213.33	192.00	1.00	1.00	5.47	112.50	112.50
+1.20D+1.60Lr+0.50L+1.60H													
Dsgn. L = 34.00 ft	1	0.116	0.023	22.32		22.32	213.33	192.00	1.00	1.00	2.63	112.50	112.50
+1.20D+1.60Lr+0.50W+1.60H													
Dsgn. L = 34.00 ft	1	0.068	0.014	13.09		13.09	213.33	192.00	1.00	1.00	1.54	112.50	112.50
+1.20D+0.50L+1.60S+1.60H													
Dsgn. L = 34.00 ft	1	0.180	0.036	34.63		34.63	213.33	192.00	1.00	1.00	4.07	112.50	112.50
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 34.00 ft	1	0.132	0.027	25.40		25.40	213.33	192.00	1.00	1.00	2.99	112.50	112.50
+1.20D+0.50Lr+0.50L+W+1.60H													
Dsgn. L = 34.00 ft	1	0.116	0.023	22.32		22.32	213.33	192.00	1.00	1.00	2.63	112.50	112.50
+1.20D+0.50L+0.50S+W+1.60H													
Dsgn. L = 34.00 ft	1	0.136	0.027	26.17		26.17	213.33	192.00	1.00	1.00	3.08	112.50	112.50
+1.20D+0.50L+0.70S+E+1.60H													
Dsgn. L = 34.00 ft	1	0.144	0.029	27.71		27.71	213.33	192.00	1.00	1.00	3.26	112.50	112.50
+0.90D+W+0.90H					B58								
Dsgn. L = 34.00 ft	1	0.051	0.010	9.81		9.81	213.33	192.00	1.00	1.00	1.15	112.50	112.50

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B13

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+0.90D+E+0.90H													
Dsgn. L = 34.00 ft	1	0.051	0.010	9.81		9.81	213.33	192.00	1.00	1.00	1.15	112.50	112.50

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	0.7721	17.097		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	3.591	3.591
Max Upward from Load Combinations	3.591	3.591
Max Upward from Load Cases	2.173	2.173
+D+H	1.283	1.283
+D+L+H	3.456	3.456
+D+Lr+H	1.283	1.283
+D+S+H	2.188	2.188
+D+0.750Lr+0.750L+H	2.912	2.912
+D+0.750L+0.750S+H	3.591	3.591
+D+0.60W+H	1.283	1.283
+D+0.70E+H	1.283	1.283
+D+0.750Lr+0.750L+0.450W+H	2.912	2.912
+D+0.750L+0.750S+0.450W+H	3.591	3.591
+D+0.750L+0.750S+0.5250E+H	3.591	3.591
+0.60D+0.60W+0.60H	0.770	0.770
+0.60D+0.70E+0.60H	0.770	0.770
D Only	1.283	1.283
L Only	2.173	2.173
S Only	0.905	0.905
H Only		

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B14

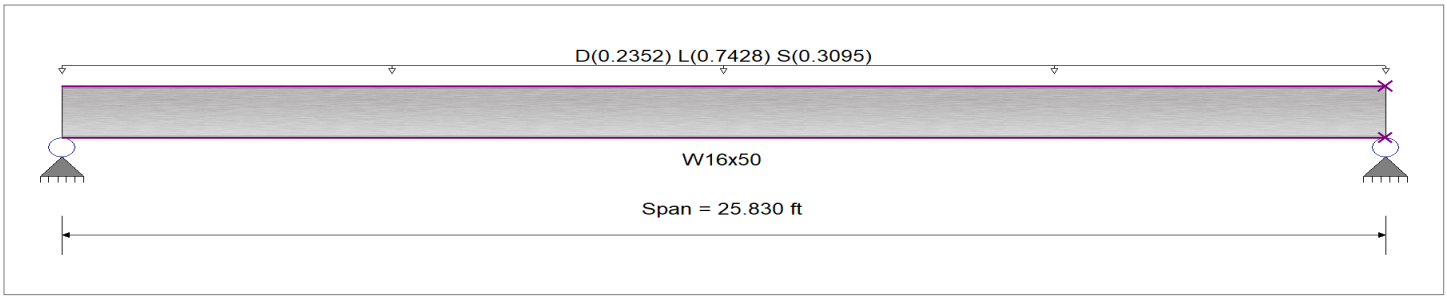
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method : Load Resistance Factor Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending

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



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0190, L = 0.060, S = 0.0250 ksf, Tributary Width = 12.380 ft, (Floor Load)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.407 : 1	Maximum Shear Stress Ratio =	0.117 : 1
Section used for this span	W16x50	Section used for this span	W16x50
Mu : Applied	140.568 k-ft	Vu : Applied	21.768 k
Mn * Phi : Allowable	345.000 k-ft	Vn * Phi : Allowable	185.820 k
Load Combination	+1.20D+1.60L+0.50S+1.60H	Load Combination	+1.20D+1.60L+0.50S+1.60H
		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	0.391 in	Ratio =	792	>=600.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<600.0	Span: 1 : L Only
Max Downward Total Deflection	0.566 in	Ratio =	548	>=360.	Span: 1 : +D+0.750L+0.750S+H
Max Upward Total Deflection	0.000 in	Ratio =	0	<360.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 25.83 ft	1	0.097	0.028	33.30		33.30	383.33	345.00	1.00	1.00	5.16	185.82	185.82
+1.20D+0.50Lr+1.60L+1.60H													
Dsgn. L = 25.83 ft	1	0.370	0.106	127.66		127.66	383.33	345.00	1.00	1.00	19.77	185.82	185.82
+1.20D+1.60L+0.50S+1.60H													
Dsgn. L = 25.83 ft	1	0.407	0.117	140.57		140.57	383.33	345.00	1.00	1.00	21.77	185.82	185.82
+1.20D+1.60Lr+0.50L+1.60H													
Dsgn. L = 25.83 ft	1	0.173	0.050	59.52		59.52	383.33	345.00	1.00	1.00	9.22	185.82	185.82
+1.20D+1.60Lr+0.50W+1.60H													
Dsgn. L = 25.83 ft	1	0.083	0.024	28.54		28.54	383.33	345.00	1.00	1.00	4.42	185.82	185.82
+1.20D+0.50L+1.60S+1.60H													
Dsgn. L = 25.83 ft	1	0.292	0.084	100.82		100.82	383.33	345.00	1.00	1.00	15.61	185.82	185.82
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 25.83 ft	1	0.202	0.058	69.84		69.84	383.33	345.00	1.00	1.00	10.82	185.82	185.82
+1.20D+0.50Lr+0.50L+W+1.60H													
Dsgn. L = 25.83 ft	1	0.173	0.050	59.52		59.52	383.33	345.00	1.00	1.00	9.22	185.82	185.82
+1.20D+0.50L+0.50S+W+1.60H													
Dsgn. L = 25.83 ft	1	0.210	0.060	72.42		72.42	383.33	345.00	1.00	1.00	11.22	185.82	185.82
+1.20D+0.50L+0.70S+E+1.60H													
Dsgn. L = 25.83 ft	1	0.225	0.065	77.59		77.59	383.33	345.00	1.00	1.00	12.02	185.82	185.82
+0.90D+W+0.90H					B60								
Dsgn. L = 25.83 ft	1	0.062	0.018	21.41		21.41	383.33	345.00	1.00	1.00	3.32	185.82	185.82

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B14

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+0.90D+E+0.90H													
Dsgn. L = 25.83 ft	1	0.062	0.018	21.41		21.41	383.33	345.00	1.00	1.00	3.32	185.82	185.82

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	0.5657	12.989		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	13.876	13.876
Max Upward from Load Combinations	13.876	13.876
Max Upward from Load Cases	9.593	9.593
+D+H	3.684	3.684
+D+L+H	13.277	13.277
+D+Lr+H	3.684	3.684
+D+S+H	7.681	7.681
+D+0.750Lr+0.750L+H	10.879	10.879
+D+0.750L+0.750S+H	13.876	13.876
+D+0.60W+H	3.684	3.684
+D+0.70E+H	3.684	3.684
+D+0.750Lr+0.750L+0.450W+H	10.879	10.879
+D+0.750L+0.750S+0.450W+H	13.876	13.876
+D+0.750L+0.750S+0.5250E+H	13.876	13.876
+0.60D+0.60W+0.60H	2.210	2.210
+0.60D+0.70E+0.60H	2.210	2.210
D Only	3.684	3.684
L Only	9.593	9.593
S Only	3.997	3.997
H Only		

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

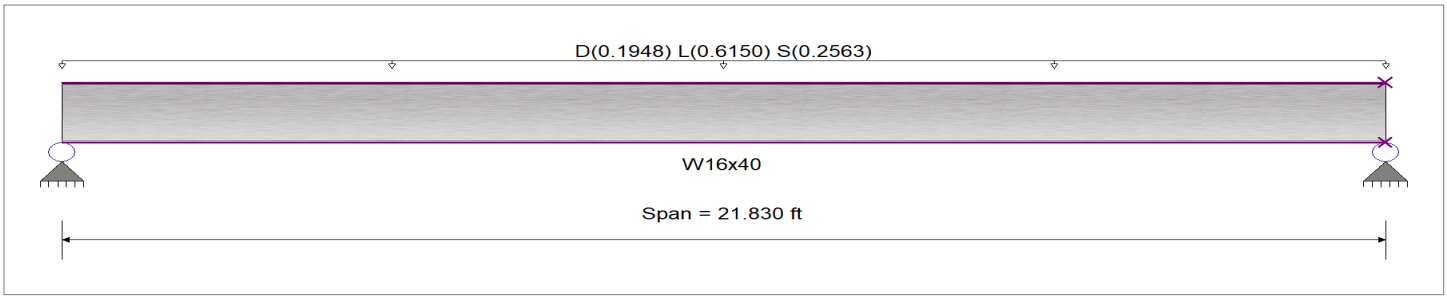
DESCRIPTION: UL-B15

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0190, L = 0.060, S = 0.0250 ksf, Tributary Width = 10.250 ft, (Floor Load)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.303 : 1	Maximum Shear Stress Ratio =	0.104 : 1
Section used for this span	W16x40	Section used for this span	W16x40
Mu : Applied	83.028 k-ft	Vu : Applied	15.214 k
Mn * Phi : Allowable	273.750 k-ft	Vn * Phi : Allowable	146.40 k
Load Combination	+1.20D+1.60L+0.50S+1.60H	Load Combination	+1.20D+1.60L+0.50S+1.60H
		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	0.210 in	Ratio =	1,246	>=600.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<600.0	Span: 1 : L Only
Max Downward Total Deflection	0.303 in	Ratio =	863	>=360.	Span: 1 : +D+0.750L+0.750S+H
Max Upward Total Deflection	0.000 in	Ratio =	0	<360.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 21.83 ft	1	0.072	0.025	19.58		19.58	304.17	273.75	1.00	1.00	3.59	146.40	146.40
+1.20D+0.50Lr+1.60L+1.60H													
Dsgn. L = 21.83 ft	1	0.275	0.094	75.40		75.40	304.17	273.75	1.00	1.00	13.82	146.40	146.40
+1.20D+1.60L+0.50S+1.60H													
Dsgn. L = 21.83 ft	1	0.303	0.104	83.03		83.03	304.17	273.75	1.00	1.00	15.21	146.40	146.40
+1.20D+1.60Lr+0.50L+1.60H													
Dsgn. L = 21.83 ft	1	0.128	0.044	35.10		35.10	304.17	273.75	1.00	1.00	6.43	146.40	146.40
+1.20D+1.60Lr+0.50W+1.60H													
Dsgn. L = 21.83 ft	1	0.061	0.021	16.78		16.78	304.17	273.75	1.00	1.00	3.07	146.40	146.40
+1.20D+0.50L+1.60S+1.60H													
Dsgn. L = 21.83 ft	1	0.217	0.074	59.52		59.52	304.17	273.75	1.00	1.00	10.91	146.40	146.40
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 21.83 ft	1	0.151	0.052	41.20		41.20	304.17	273.75	1.00	1.00	7.55	146.40	146.40
+1.20D+0.50Lr+0.50L+W+1.60H													
Dsgn. L = 21.83 ft	1	0.128	0.044	35.10		35.10	304.17	273.75	1.00	1.00	6.43	146.40	146.40
+1.20D+0.50L+0.50S+W+1.60H													
Dsgn. L = 21.83 ft	1	0.156	0.053	42.73		42.73	304.17	273.75	1.00	1.00	7.83	146.40	146.40
+1.20D+0.50L+0.70S+E+1.60H													
Dsgn. L = 21.83 ft	1	0.167	0.057	45.78		45.78	304.17	273.75	1.00	1.00	8.39	146.40	146.40
+0.90D+W+0.90H					B62								
Dsgn. L = 21.83 ft	1	0.046	0.016	12.59		12.59	304.17	273.75	1.00	1.00	2.31	146.40	146.40

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B15

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+0.90D+E+0.90H													
Dsgn. L = 21.83 ft	1	0.046	0.016	12.59		12.59	304.17	273.75	1.00	1.00	2.31	146.40	146.40

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	0.3035	10.977		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	9.695	9.695
Max Upward from Load Combinations	9.695	9.695
Max Upward from Load Cases	6.713	6.713
+D+H	2.562	2.562
+D+L+H	9.275	9.275
+D+Lr+H	2.562	2.562
+D+S+H	5.359	5.359
+D+0.750Lr+0.750L+H	7.597	7.597
+D+0.750L+0.750S+H	9.695	9.695
+D+0.60W+H	2.562	2.562
+D+0.70E+H	2.562	2.562
+D+0.750Lr+0.750L+0.450W+H	7.597	7.597
+D+0.750L+0.750S+0.450W+H	9.695	9.695
+D+0.750L+0.750S+0.5250E+H	9.695	9.695
+0.60D+0.60W+0.60H	1.537	1.537
+0.60D+0.70E+0.60H	1.537	1.537
D Only	2.562	2.562
L Only	6.713	6.713
S Only	2.797	2.797
H Only		

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

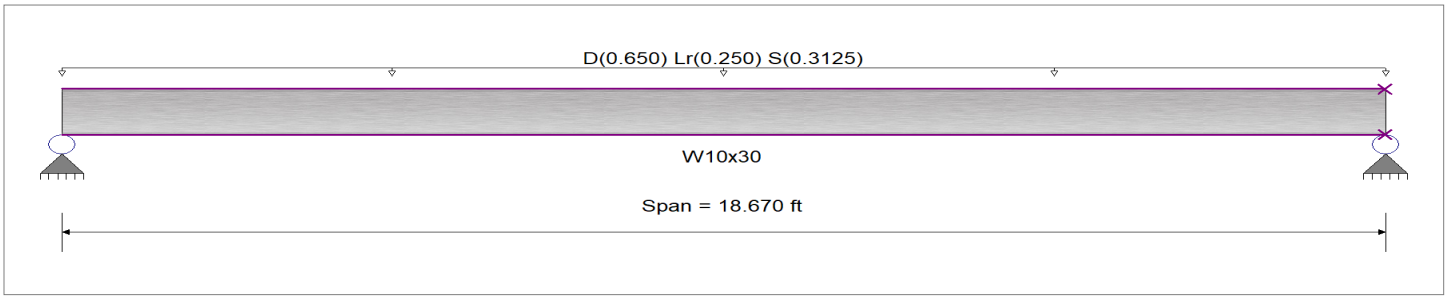
DESCRIPTION: UL-B16

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0520, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 12.50 ft, (Floor Load)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.418 : 1	Maximum Shear Stress Ratio =	0.130 : 1
Section used for this span	W10x30	Section used for this span	W10x30
Mu : Applied	57.340 k-ft	Vu : Applied	12.285 k
Mn * Phi : Allowable	137.250 k-ft	Vn * Phi : Allowable	94.50 k
Load Combination	+1.20D+0.50L+1.60S+1.60H	Load Combination	+1.20D+0.50L+1.60S+1.60H
		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	0.174 in	Ratio =	1,287	>=600.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<600.0	Span: 1 : S Only
Max Downward Total Deflection	0.553 in	Ratio =	405	>=360.	Span: 1 : +D+S+H
Max Upward Total Deflection	0.000 in	Ratio =	0	<360.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 18.67 ft	1	0.302	0.094	41.48		41.48	152.50	137.25	1.00	1.00	8.89	94.50	94.50
+1.20D+0.50Lr+1.60L+1.60H													
Dsgn. L = 18.67 ft	1	0.299	0.093	41.00		41.00	152.50	137.25	1.00	1.00	8.78	94.50	94.50
+1.20D+1.60L+0.50S+1.60H													
Dsgn. L = 18.67 ft	1	0.309	0.096	42.36		42.36	152.50	137.25	1.00	1.00	9.08	94.50	94.50
+1.20D+1.60Lr+0.50L+1.60H													
Dsgn. L = 18.67 ft	1	0.386	0.120	52.98		52.98	152.50	137.25	1.00	1.00	11.35	94.50	94.50
+1.20D+1.60Lr+0.50W+1.60H													
Dsgn. L = 18.67 ft	1	0.386	0.120	52.98		52.98	152.50	137.25	1.00	1.00	11.35	94.50	94.50
+1.20D+0.50L+1.60S+1.60H													
Dsgn. L = 18.67 ft	1	0.418	0.130	57.34		57.34	152.50	137.25	1.00	1.00	12.28	94.50	94.50
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 18.67 ft	1	0.418	0.130	57.34		57.34	152.50	137.25	1.00	1.00	12.28	94.50	94.50
+1.20D+0.50Lr+0.50L+W+1.60H													
Dsgn. L = 18.67 ft	1	0.299	0.093	41.00		41.00	152.50	137.25	1.00	1.00	8.78	94.50	94.50
+1.20D+0.50L+0.50S+W+1.60H													
Dsgn. L = 18.67 ft	1	0.309	0.096	42.36		42.36	152.50	137.25	1.00	1.00	9.08	94.50	94.50
+1.20D+0.50L+0.70S+E+1.60H													
Dsgn. L = 18.67 ft	1	0.328	0.102	45.09		45.09	152.50	137.25	1.00	1.00	9.66	94.50	94.50
+0.90D+W+0.90H					B64								
Dsgn. L = 18.67 ft	1	0.194	0.060	26.67		26.67	152.50	137.25	1.00	1.00	5.71	94.50	94.50

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B16

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+0.90D+E+0.90H													
Dsgn. L = 18.67 ft	1	0.194	0.060	26.67		26.67	152.50	137.25	1.00	1.00	5.71	94.50	94.50

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	0.5529	9.388		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	9.265	9.265
Max Upward from Load Combinations	9.265	9.265
Max Upward from Load Cases	6.348	6.348
+D+H	6.348	6.348
+D+L+H	6.348	6.348
+D+Lr+H	8.682	8.682
+D+S+H	9.265	9.265
+D+0.750Lr+0.750L+H	8.098	8.098
+D+0.750L+0.750S+H	8.536	8.536
+D+0.60W+H	6.348	6.348
+D+0.70E+H	6.348	6.348
+D+0.750Lr+0.750L+0.450W+H	8.098	8.098
+D+0.750L+0.750S+0.450W+H	8.536	8.536
+D+0.750L+0.750S+0.5250E+H	8.536	8.536
+0.60D+0.60W+0.60H	3.809	3.809
+0.60D+0.70E+0.60H	3.809	3.809
D Only	6.348	6.348
Lr Only	2.334	2.334
S Only	2.917	2.917
H Only		

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

LIC# : KW-06018139, Build:20.22.12.28 KPFF CONSULTING ENGINEERS SEA (c) ENERCALC INC 1983-2022

DESCRIPTION: UL-B17

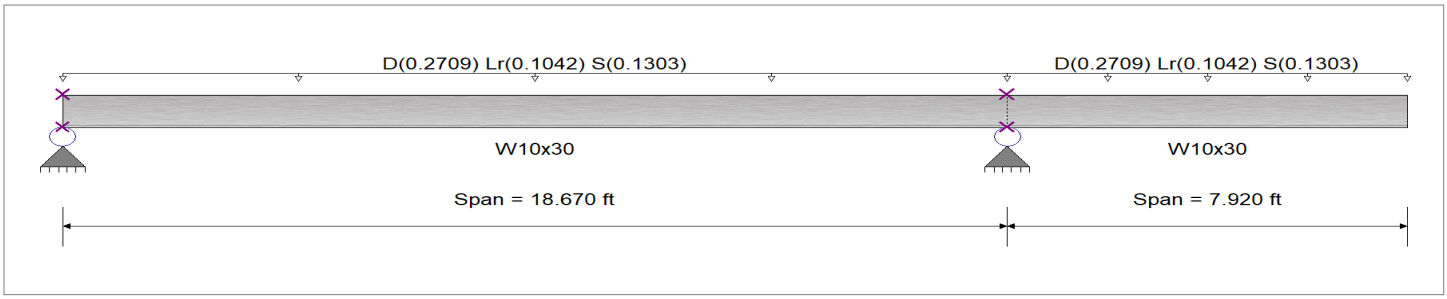
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method : Load Resistance Factor Design
Beam Bracing : Completely Unbraced
Bending Axis : Major Axis Bending

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



Applied Loads

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

Beam self weight calculated and added to loading
Load for Span Number 1
Uniform Load : D = 0.0520, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 5.210 ft, (Floor Load)

Load for Span Number 2
Uniform Load : D = 0.0520, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 5.210 ft, (Floor Load)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.207 : 1	Maximum Shear Stress Ratio =	0.066 : 1
Section used for this span	W10x30	Section used for this span	W10x30
Mu : Applied	17.684 k-ft	Vu : Applied	6.273 k
Mn * Phi : Allowable	85.388 k-ft	Vn * Phi : Allowable	94.50 k
Load Combination	+1.20D+1.60Lr+0.50L+1.60H, LL Comb Run (L*)	Load Combination	+1.20D+0.50L+1.60S+1.60H, LL Comb Run (*L)
		Location of maximum on span	18.670 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.074 in	Ratio =	2,555	>=600.	Span: 2 : Lr Only, LL Comb Run (L*)
Max Upward Transient Deflection	-0.078 in	Ratio =	2,423	>=600.	Span: 2 : Lr Only, LL Comb Run (*L)
Max Downward Total Deflection	0.154 in	Ratio =	1451	>=360.	Span: 2 : +D+Lr+H, LL Comb Run (L*)
Max Upward Total Deflection	-0.090 in	Ratio =	2108	>=360.	Span: 2 : +D+Lr+H, LL Comb Run (L*)

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 18.67 ft	1	0.139	0.049	12.34	-13.21	13.21	105.61	95.05	1.35	1.00	4.64	94.50	94.50
Dsgn. L = 7.92 ft	2	0.107	0.035		-13.21	13.21	136.83	123.14	1.00	1.00	3.34	94.50	94.50
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 18.67 ft	1	0.115	0.043	9.92	-12.96	12.96	125.74	113.17	1.61	1.00	4.07	94.50	94.50
Dsgn. L = 7.92 ft	2	0.105	0.035		-12.96	12.96	136.83	123.14	1.00	1.00	3.27	94.50	94.50
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 18.67 ft	1	0.145	0.047	12.79	-11.33	12.79	97.85	88.07	1.25	1.00	4.46	94.50	94.50
Dsgn. L = 7.92 ft	2	0.092	0.030		-11.33	11.33	136.83	123.14	1.00	1.00	2.86	94.50	94.50
+1.20D+0.50Lr+1.60L+1.60H, LL													
Dsgn. L = 18.67 ft	1	0.136	0.048	12.11	-12.96	12.96	105.61	95.05	1.35	1.00	4.55	94.50	94.50
Dsgn. L = 7.92 ft	2	0.105	0.035		-12.96	12.96	136.83	123.14	1.00	1.00	3.27	94.50	94.50
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 18.67 ft	1	0.141	0.050	12.49	-13.37	13.37	105.61	95.05	1.35	1.00	4.69	94.50	94.50
Dsgn. L = 7.92 ft	2	0.109	0.036		-13.37	13.37	136.83	123.14	1.00	1.00	3.38	94.50	94.50
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 18.67 ft	1	0.141	0.050	12.49	-13.37	13.37	105.61	95.05	1.35	1.00	4.69	94.50	94.50

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B17

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
Dsgn. L = 7.92 ft	2	0.109	0.036		-13.37	13.37	136.83	123.14	1.00	1.00	3.38	94.50	94.50
+1.20D+1.60L+0.50S+1.60H, LL (													
Dsgn. L = 18.67 ft	1	0.141	0.050	12.49	-13.37	13.37	105.61	95.05	1.35	1.00	4.69	94.50	94.50
Dsgn. L = 7.92 ft	2	0.109	0.036		-13.37	13.37	136.83	123.14	1.00	1.00	3.38	94.50	94.50
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 18.67 ft	1	0.121	0.045	8.55	-16.55	16.55	152.50	137.25	2.15	1.00	4.26	94.50	94.50
Dsgn. L = 7.92 ft	2	0.134	0.044		-16.55	16.55	136.83	123.14	1.00	1.00	4.18	94.50	94.50
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 18.67 ft	1	0.207	0.059	17.68	-11.33	17.68	94.88	85.39	1.21	1.00	5.53	94.50	94.50
Dsgn. L = 7.92 ft	2	0.092	0.030		-11.33	11.33	136.83	123.14	1.00	1.00	2.86	94.50	94.50
+1.20D+1.60Lr+0.50L+1.60H, LL													
Dsgn. L = 18.67 ft	1	0.174	0.062	15.47	-16.55	16.55	105.61	95.05	1.35	1.00	5.81	94.50	94.50
Dsgn. L = 7.92 ft	2	0.134	0.044		-16.55	16.55	136.83	123.14	1.00	1.00	4.18	94.50	94.50
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 18.67 ft	1	0.121	0.045	8.55	-16.55	16.55	152.50	137.25	2.15	1.00	4.26	94.50	94.50
Dsgn. L = 7.92 ft	2	0.134	0.044		-16.55	16.55	136.83	123.14	1.00	1.00	4.18	94.50	94.50
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 18.67 ft	1	0.207	0.059	17.68	-11.33	17.68	94.88	85.39	1.21	1.00	5.53	94.50	94.50
Dsgn. L = 7.92 ft	2	0.092	0.030		-11.33	11.33	136.83	123.14	1.00	1.00	2.86	94.50	94.50
+1.20D+1.60Lr+0.50W+1.60H, LL													
Dsgn. L = 18.67 ft	1	0.174	0.062	15.47	-16.55	16.55	105.61	95.05	1.35	1.00	5.81	94.50	94.50
Dsgn. L = 7.92 ft	2	0.134	0.044		-16.55	16.55	136.83	123.14	1.00	1.00	4.18	94.50	94.50
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 18.67 ft	1	0.188	0.066	16.69	-17.86	17.86	105.61	95.05	1.35	1.00	6.27	94.50	94.50
Dsgn. L = 7.92 ft	2	0.145	0.048		-17.86	17.86	136.83	123.14	1.00	1.00	4.51	94.50	94.50
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 18.67 ft	1	0.188	0.066	16.69	-17.86	17.86	105.61	95.05	1.35	1.00	6.27	94.50	94.50
Dsgn. L = 7.92 ft	2	0.145	0.048		-17.86	17.86	136.83	123.14	1.00	1.00	4.51	94.50	94.50
+1.20D+0.50L+1.60S+1.60H, LL (													
Dsgn. L = 18.67 ft	1	0.188	0.066	16.69	-17.86	17.86	105.61	95.05	1.35	1.00	6.27	94.50	94.50
Dsgn. L = 7.92 ft	2	0.145	0.048		-17.86	17.86	136.83	123.14	1.00	1.00	4.51	94.50	94.50
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 18.67 ft	1	0.188	0.066	16.69	-17.86	17.86	105.61	95.05	1.35	1.00	6.27	94.50	94.50
Dsgn. L = 7.92 ft	2	0.145	0.048		-17.86	17.86	136.83	123.14	1.00	1.00	4.51	94.50	94.50
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 18.67 ft	1	0.115	0.043	9.92	-12.96	12.96	125.74	113.17	1.61	1.00	4.07	94.50	94.50
Dsgn. L = 7.92 ft	2	0.105	0.035		-12.96	12.96	136.83	123.14	1.00	1.00	3.27	94.50	94.50
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 18.67 ft	1	0.145	0.047	12.79	-11.33	12.79	97.85	88.07	1.25	1.00	4.46	94.50	94.50
Dsgn. L = 7.92 ft	2	0.092	0.030		-11.33	11.33	136.83	123.14	1.00	1.00	2.86	94.50	94.50
+1.20D+0.50Lr+0.50L+W+1.60H,													
Dsgn. L = 18.67 ft	1	0.136	0.048	12.11	-12.96	12.96	105.61	95.05	1.35	1.00	4.55	94.50	94.50
Dsgn. L = 7.92 ft	2	0.105	0.035		-12.96	12.96	136.83	123.14	1.00	1.00	3.27	94.50	94.50
+1.20D+0.50L+0.50S+W+1.60H, I													
Dsgn. L = 18.67 ft	1	0.141	0.050	12.49	-13.37	13.37	105.61	95.05	1.35	1.00	4.69	94.50	94.50
Dsgn. L = 7.92 ft	2	0.109	0.036		-13.37	13.37	136.83	123.14	1.00	1.00	3.38	94.50	94.50
+1.20D+0.50L+0.50S+W+1.60H, I													
Dsgn. L = 18.67 ft	1	0.141	0.050	12.49	-13.37	13.37	105.61	95.05	1.35	1.00	4.69	94.50	94.50
Dsgn. L = 7.92 ft	2	0.109	0.036		-13.37	13.37	136.83	123.14	1.00	1.00	3.38	94.50	94.50
+1.20D+0.50L+0.50S+W+1.60H, I													
Dsgn. L = 18.67 ft	1	0.141	0.050	12.49	-13.37	13.37	105.61	95.05	1.35	1.00	4.69	94.50	94.50
Dsgn. L = 7.92 ft	2	0.109	0.036		-13.37	13.37	136.83	123.14	1.00	1.00	3.38	94.50	94.50
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 18.67 ft	1	0.149	0.053	13.25	-14.18	14.18	105.61	95.05	1.35	1.00	4.98	94.50	94.50
Dsgn. L = 7.92 ft	2	0.115	0.038		-14.18	14.18	136.83	123.14	1.00	1.00	3.58	94.50	94.50
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 18.67 ft	1	0.149	0.053	13.25	-14.18	14.18	105.61	95.05	1.35	1.00	4.98	94.50	94.50
Dsgn. L = 7.92 ft	2	0.115	0.038		-14.18	14.18	136.83	123.14	1.00	1.00	3.58	94.50	94.50
+1.20D+0.50L+0.70S+E+1.60H, L													
Dsgn. L = 18.67 ft	1	0.149	0.053	13.25	-14.18	14.18	105.61	95.05	1.35	1.00	4.98	94.50	94.50
Dsgn. L = 7.92 ft	2	0.115	0.038		-14.18	14.18	136.83	123.14	1.00	1.00	3.58	94.50	94.50
+0.90D+W+0.90H													
Dsgn. L = 18.67 ft	1	0.089	0.032	7.94	-8.49	8.49	105.61	95.05	1.35	1.00	2.98	94.50	94.50

B67

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B17

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
Dsgn. L = 7.92 ft +0.90D+E+0.90H	2	0.069	0.023		-8.49	8.49	136.83	123.14	1.00	1.00	2.14	94.50	94.50
Dsgn. L = 18.67 ft	1	0.089	0.032	7.94	-8.49	8.49	105.61	95.05	1.35	1.00	2.98	94.50	94.50
Dsgn. L = 7.92 ft	2	0.069	0.023		-8.49	8.49	136.83	123.14	1.00	1.00	2.14	94.50	94.50

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+Lr+H	1	0.1544	8.812		0.0000	0.000
	2	0.0000	8.812	+D+Lr+H	-0.0902	7.920

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	3.301	8.164	
Max Upward from Load Combinations	3.301	8.164	
Max Upward from Load Cases	2.304	5.698	
Max Downward from all Load Conditions (Resis	-0.175		
Max Downward from Load Cases (Resisting Up	-0.175		
+D+H	2.304	5.698	
+D+L+H, LL Comb Run (*L)	2.304	5.698	
+D+L+H, LL Comb Run (L*)	2.304	5.698	
+D+L+H, LL Comb Run (LL)	2.304	5.698	
+D+Lr+H, LL Comb Run (*L)	2.129	6.698	
+D+Lr+H, LL Comb Run (L*)	3.276	6.671	
+D+Lr+H, LL Comb Run (LL)	3.101	7.671	
+D+S+H	3.301	8.164	
+D+0.750Lr+0.750L+H, LL Comb Run (*L)	2.172	6.448	
+D+0.750Lr+0.750L+H, LL Comb Run (L*)	3.033	6.427	
+D+0.750Lr+0.750L+H, LL Comb Run (LL)	2.902	7.178	
+D+0.750L+0.750S+H, LL Comb Run (*L)	3.051	7.548	
+D+0.750L+0.750S+H, LL Comb Run (L*)	3.051	7.548	
+D+0.750L+0.750S+H, LL Comb Run (LL)	3.051	7.548	
+D+0.60W+H	2.304	5.698	
+D+0.70E+H	2.304	5.698	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	2.172	6.448	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	3.033	6.427	
+D+0.750Lr+0.750L+0.450W+H, LL Comb Rur	2.902	7.178	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	3.051	7.548	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	3.051	7.548	
+D+0.750L+0.750S+0.450W+H, LL Comb Run	3.051	7.548	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	3.051	7.548	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	3.051	7.548	
+D+0.750L+0.750S+0.5250E+H, LL Comb Rur	3.051	7.548	
+0.60D+0.60W+0.60H	1.382	3.419	
+0.60D+0.70E+0.60H	1.382	3.419	
D Only	2.304	5.698	
Lr Only, LL Comb Run (*L)	-0.175	1.000	
Lr Only, LL Comb Run (L*)	0.973	0.973	
Lr Only, LL Comb Run (LL)	0.798	1.973	
S Only	0.997	2.466	
H Only			

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B18

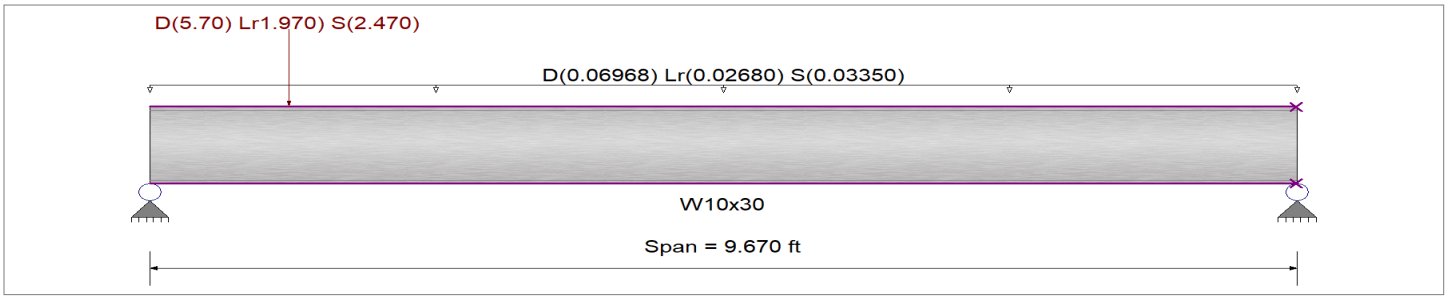
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method : Load Resistance Factor Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending

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



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0520, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 1.340 ft, (Floor Load)

Point Load : D = 5.70, Lr = 1.970, S = 2.470 k @ 1.170 ft, (UL-B17)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.087 : 1	Maximum Shear Stress Ratio =	0.109 : 1
Section used for this span	W10x30	Section used for this span	W10x30
Mu : Applied	11.948 k-ft	Vu : Applied	10.324 k
Mn * Phi : Allowable	137.250 k-ft	Vn * Phi : Allowable	94.50 k
Load Combination	+1.20D+0.50L+1.60S+1.60H	Load Combination	+1.20D+0.50L+1.60S+1.60H
		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	0.007 in	Ratio =	15,904	>=600.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<600.0	Span: 1 : S Only
Max Downward Total Deflection	0.025 in	Ratio =	4639	>=360.	Span: 1 : +D+S+H
Max Upward Total Deflection	0.000 in	Ratio =	0	<360.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 9.67 ft	1	0.065	0.081	8.89		8.89	152.50	137.25	1.00	1.00	7.69	94.50	94.50
+1.20D+0.50Lr+1.60L+1.60H													
Dsgn. L = 9.67 ft	1	0.063	0.080	8.70		8.70	152.50	137.25	1.00	1.00	7.52	94.50	94.50
+1.20D+1.60L+0.50S+1.60H													
Dsgn. L = 9.67 ft	1	0.065	0.082	8.97		8.97	152.50	137.25	1.00	1.00	7.76	94.50	94.50
+1.20D+1.60Lr+0.50L+1.60H													
Dsgn. L = 9.67 ft	1	0.081	0.101	11.07		11.07	152.50	137.25	1.00	1.00	9.57	94.50	94.50
+1.20D+1.60Lr+0.50W+1.60H													
Dsgn. L = 9.67 ft	1	0.081	0.101	11.07		11.07	152.50	137.25	1.00	1.00	9.57	94.50	94.50
+1.20D+0.50L+1.60S+1.60H													
Dsgn. L = 9.67 ft	1	0.087	0.109	11.95		11.95	152.50	137.25	1.00	1.00	10.32	94.50	94.50
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 9.67 ft	1	0.087	0.109	11.95		11.95	152.50	137.25	1.00	1.00	10.32	94.50	94.50
+1.20D+0.50Lr+0.50L+W+1.60H													
Dsgn. L = 9.67 ft	1	0.063	0.080	8.70		8.70	152.50	137.25	1.00	1.00	7.52	94.50	94.50
+1.20D+0.50L+0.50S+W+1.60H													
Dsgn. L = 9.67 ft	1	0.065	0.082	8.97		8.97	152.50	137.25	1.00	1.00	7.76	94.50	94.50
+1.20D+0.50L+0.70S+E+1.60H													

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-B18

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values						Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
Dsgn. L = 9.67 ft +0.90D+W+0.90H	1	0.069	0.087	9.51		9.51	152.50	137.25	1.00	1.00	8.22	94.50	94.50
Dsgn. L = 9.67 ft +0.90D+E+0.90H	1	0.042	0.052	5.72		5.72	152.50	137.25	1.00	1.00	4.94	94.50	94.50
Dsgn. L = 9.67 ft	1	0.042	0.052	5.72		5.72	152.50	137.25	1.00	1.00	4.94	94.50	94.50

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	0.0250	4.310		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	7.825	1.632
Max Upward from Load Combinations	7.825	1.632
Max Upward from Load Cases	5.492	1.172
+D+H	5.492	1.172
+D+L+H	5.492	1.172
+D+Lr+H	7.354	1.540
+D+S+H	7.825	1.632
+D+0.750Lr+0.750L+H	6.888	1.448
+D+0.750L+0.750S+H	7.242	1.517
+D+0.60W+H	5.492	1.172
+D+0.70E+H	5.492	1.172
+D+0.750Lr+0.750L+0.450W+H	6.888	1.448
+D+0.750L+0.750S+0.450W+H	7.242	1.517
+D+0.750L+0.750S+0.5250E+H	7.242	1.517
+0.60D+0.60W+0.60H	3.295	0.703
+0.60D+0.70E+0.60H	3.295	0.703
D Only	5.492	1.172
Lr Only	1.861	0.368
S Only	2.333	0.461
H Only		

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UR-B1

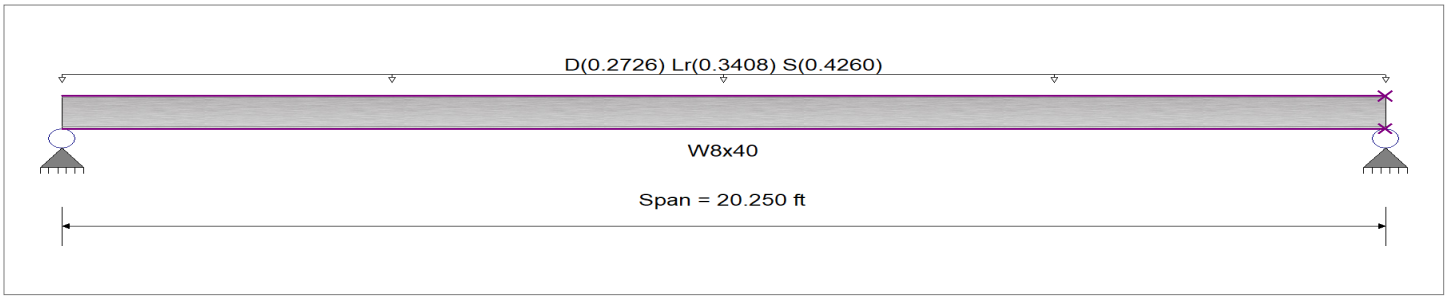
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method : Load Resistance Factor Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending

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



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0160, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 17.040 ft, (Floor Load)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.363 : 1	Maximum Shear Stress Ratio =	0.120 : 1
Section used for this span	W8x40	Section used for this span	W8x40
Mu : Applied	54.168 k-ft	Vu : Applied	10.70 k
Mn * Phi : Allowable	149.250 k-ft	Vn * Phi : Allowable	89.10 k
Load Combination	+1.20D+0.50L+1.60S+1.60H	Load Combination	+1.20D+0.50L+1.60S+1.60H
		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	0.382 in	Ratio =	635	>=600.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<600.0	Span: 1 : S Only
Max Downward Total Deflection	0.663 in	Ratio =	366	>=360.	Span: 1 : +D+S+H
Max Upward Total Deflection	0.000 in	Ratio =	0	<360.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 20.25 ft	1	0.150	0.050	22.44		22.44	165.83	149.25	1.00	1.00	4.43	89.10	89.10
+1.20D+0.50Lr+1.60L+1.60H													
Dsgn. L = 20.25 ft	1	0.187	0.062	27.96		27.96	165.83	149.25	1.00	1.00	5.52	89.10	89.10
+1.20D+1.60L+0.50S+1.60H													
Dsgn. L = 20.25 ft	1	0.202	0.067	30.15		30.15	165.83	149.25	1.00	1.00	5.96	89.10	89.10
+1.20D+1.60Lr+0.50L+1.60H													
Dsgn. L = 20.25 ft	1	0.316	0.105	47.18		47.18	165.83	149.25	1.00	1.00	9.32	89.10	89.10
+1.20D+1.60Lr+0.50W+1.60H													
Dsgn. L = 20.25 ft	1	0.316	0.105	47.18		47.18	165.83	149.25	1.00	1.00	9.32	89.10	89.10
+1.20D+0.50L+1.60S+1.60H													
Dsgn. L = 20.25 ft	1	0.363	0.120	54.17		54.17	165.83	149.25	1.00	1.00	10.70	89.10	89.10
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 20.25 ft	1	0.363	0.120	54.17		54.17	165.83	149.25	1.00	1.00	10.70	89.10	89.10
+1.20D+0.50Lr+0.50L+W+1.60H													
Dsgn. L = 20.25 ft	1	0.187	0.062	27.96		27.96	165.83	149.25	1.00	1.00	5.52	89.10	89.10
+1.20D+0.50L+0.50S+W+1.60H													
Dsgn. L = 20.25 ft	1	0.202	0.067	30.15		30.15	165.83	149.25	1.00	1.00	5.96	89.10	89.10
+1.20D+0.50L+0.70S+E+1.60H													
Dsgn. L = 20.25 ft	1	0.231	0.077	34.52		34.52	165.83	149.25	1.00	1.00	6.82	89.10	89.10
+0.90D+W+0.90H					B71								
Dsgn. L = 20.25 ft	1	0.097	0.032	14.42		14.42	165.83	149.25	1.00	1.00	2.85	89.10	89.10

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UR-B1

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+0.90D+E+0.90H													
Dsgn. L = 20.25 ft	1	0.097	0.032	14.42		14.42	165.83	149.25	1.00	1.00	2.85	89.10	89.10

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	0.6630	10.183		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	7.479	7.479
Max Upward from Load Combinations	7.479	7.479
Max Upward from Load Cases	4.313	4.313
+D+H	3.165	3.165
+D+L+H	3.165	3.165
+D+Lr+H	6.616	6.616
+D+S+H	7.479	7.479
+D+0.750Lr+0.750L+H	5.753	5.753
+D+0.750L+0.750S+H	6.400	6.400
+D+0.60W+H	3.165	3.165
+D+0.70E+H	3.165	3.165
+D+0.750Lr+0.750L+0.450W+H	5.753	5.753
+D+0.750L+0.750S+0.450W+H	6.400	6.400
+D+0.750L+0.750S+0.5250E+H	6.400	6.400
+0.60D+0.60W+0.60H	1.899	1.899
+0.60D+0.70E+0.60H	1.899	1.899
D Only	3.165	3.165
Lr Only	3.451	3.451
S Only	4.313	4.313
H Only		

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

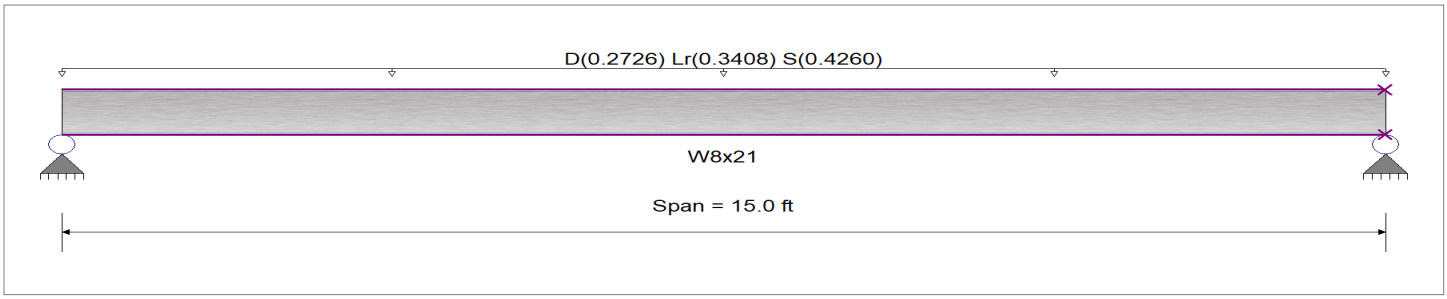
DESCRIPTION: UR-B2

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0160, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 17.040 ft, (Floor Load)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.380 : 1	Maximum Shear Stress Ratio =	0.125 : 1
Section used for this span	W8x21	Section used for this span	W8x21
Mu : Applied	29.080 k-ft	Vu : Applied	7.755 k
Mn * Phi : Allowable	76.500 k-ft	Vn * Phi : Allowable	62.10 k
Load Combination	+1.20D+0.50L+1.60S+1.60H	Load Combination	+1.20D+0.50L+1.60S+1.60H
		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	0.223 in	Ratio =	806	>=600.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<600.0	Span: 1 : S Only
Max Downward Total Deflection	0.377 in	Ratio =	477	>=360.	Span: 1 : +D+S+H
Max Upward Total Deflection	0.000 in	Ratio =	0	<360.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 15.00 ft	1	0.151	0.050	11.56		11.56	85.00	76.50	1.00	1.00	3.08	62.10	62.10
+1.20D+0.50Lr+1.60L+1.60H													
Dsgn. L = 15.00 ft	1	0.192	0.063	14.70		14.70	85.00	76.50	1.00	1.00	3.92	62.10	62.10
+1.20D+1.60L+0.50S+1.60H													
Dsgn. L = 15.00 ft	1	0.208	0.068	15.90		15.90	85.00	76.50	1.00	1.00	4.24	62.10	62.10
+1.20D+1.60Lr+0.50L+1.60H													
Dsgn. L = 15.00 ft	1	0.330	0.108	25.25		25.25	85.00	76.50	1.00	1.00	6.73	62.10	62.10
+1.20D+1.60Lr+0.50W+1.60H													
Dsgn. L = 15.00 ft	1	0.330	0.108	25.25		25.25	85.00	76.50	1.00	1.00	6.73	62.10	62.10
+1.20D+0.50L+1.60S+1.60H													
Dsgn. L = 15.00 ft	1	0.380	0.125	29.08		29.08	85.00	76.50	1.00	1.00	7.75	62.10	62.10
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 15.00 ft	1	0.380	0.125	29.08		29.08	85.00	76.50	1.00	1.00	7.75	62.10	62.10
+1.20D+0.50Lr+0.50L+W+1.60H													
Dsgn. L = 15.00 ft	1	0.192	0.063	14.70		14.70	85.00	76.50	1.00	1.00	3.92	62.10	62.10
+1.20D+0.50L+0.50S+W+1.60H													
Dsgn. L = 15.00 ft	1	0.208	0.068	15.90		15.90	85.00	76.50	1.00	1.00	4.24	62.10	62.10
+1.20D+0.50L+0.70S+E+1.60H													
Dsgn. L = 15.00 ft	1	0.239	0.079	18.30		18.30	85.00	76.50	1.00	1.00	4.88	62.10	62.10
+0.90D+W+0.90H					B73								
Dsgn. L = 15.00 ft	1	0.097	0.032	7.43		7.43	85.00	76.50	1.00	1.00	1.98	62.10	62.10

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UR-B2

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+0.90D+E+0.90H													
Dsgn. L = 15.00 ft	1	0.097	0.032	7.43		7.43	85.00	76.50	1.00	1.00	1.98	62.10	62.10

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	0.3771	7.543		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	5.397	5.397
Max Upward from Load Combinations	5.397	5.397
Max Upward from Load Cases	3.195	3.195
+D+H	2.202	2.202
+D+L+H	2.202	2.202
+D+Lr+H	4.758	4.758
+D+S+H	5.397	5.397
+D+0.750Lr+0.750L+H	4.119	4.119
+D+0.750L+0.750S+H	4.599	4.599
+D+0.60W+H	2.202	2.202
+D+0.70E+H	2.202	2.202
+D+0.750Lr+0.750L+0.450W+H	4.119	4.119
+D+0.750L+0.750S+0.450W+H	4.599	4.599
+D+0.750L+0.750S+0.5250E+H	4.599	4.599
+0.60D+0.60W+0.60H	1.321	1.321
+0.60D+0.70E+0.60H	1.321	1.321
D Only	2.202	2.202
Lr Only	2.556	2.556
S Only	3.195	3.195
H Only		

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

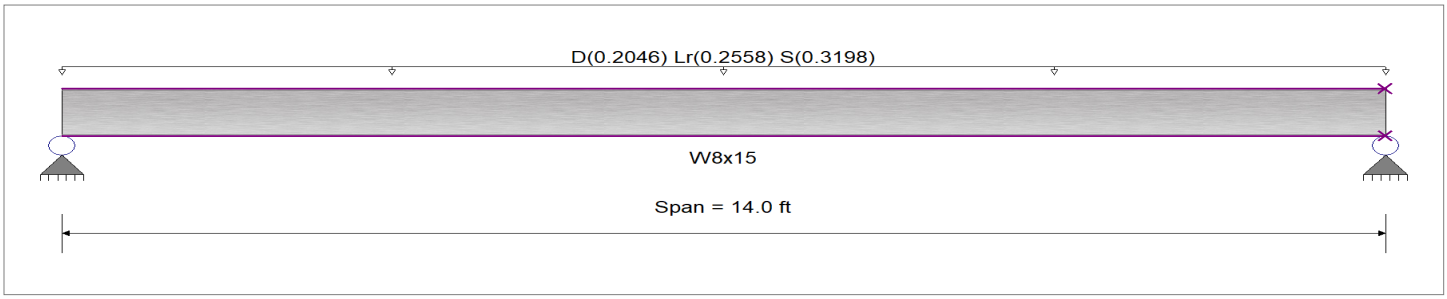
DESCRIPTION: UR-B3

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0160, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 12.790 ft, (Floor Load)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.372 : 1	Maximum Shear Stress Ratio =	0.091 : 1
Section used for this span	W8x15	Section used for this span	W8x15
Mu : Applied	18.992 k-ft	Vu : Applied	5.426 k
Mn * Phi : Allowable	51.000 k-ft	Vn * Phi : Allowable	59.609 k
Load Combination	+1.20D+0.50L+1.60S+1.60H	Load Combination	+1.20D+0.50L+1.60S+1.60H
		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	0.199 in	Ratio =	842	>=600.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<600.0	Span: 1 : S Only
Max Downward Total Deflection	0.336 in	Ratio =	499	>=360.	Span: 1 : +D+S+H
Max Upward Total Deflection	0.000 in	Ratio =	0	<360.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 14.00 ft	1	0.148	0.036	7.53		7.53	56.67	51.00	1.00	1.00	2.15	59.61	59.61
+1.20D+0.50Lr+1.60L+1.60H													
Dsgn. L = 14.00 ft	1	0.188	0.046	9.59		9.59	56.67	51.00	1.00	1.00	2.74	59.61	59.61
+1.20D+1.60L+0.50S+1.60H													
Dsgn. L = 14.00 ft	1	0.203	0.050	10.37		10.37	56.67	51.00	1.00	1.00	2.96	59.61	59.61
+1.20D+1.60Lr+0.50L+1.60H													
Dsgn. L = 14.00 ft	1	0.323	0.079	16.48		16.48	56.67	51.00	1.00	1.00	4.71	59.61	59.61
+1.20D+1.60Lr+0.50W+1.60H													
Dsgn. L = 14.00 ft	1	0.323	0.079	16.48		16.48	56.67	51.00	1.00	1.00	4.71	59.61	59.61
+1.20D+0.50L+1.60S+1.60H													
Dsgn. L = 14.00 ft	1	0.372	0.091	18.99		18.99	56.67	51.00	1.00	1.00	5.43	59.61	59.61
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 14.00 ft	1	0.372	0.091	18.99		18.99	56.67	51.00	1.00	1.00	5.43	59.61	59.61
+1.20D+0.50Lr+0.50L+W+1.60H													
Dsgn. L = 14.00 ft	1	0.188	0.046	9.59		9.59	56.67	51.00	1.00	1.00	2.74	59.61	59.61
+1.20D+0.50L+0.50S+W+1.60H													
Dsgn. L = 14.00 ft	1	0.203	0.050	10.37		10.37	56.67	51.00	1.00	1.00	2.96	59.61	59.61
+1.20D+0.50L+0.70S+E+1.60H													
Dsgn. L = 14.00 ft	1	0.234	0.057	11.94		11.94	56.67	51.00	1.00	1.00	3.41	59.61	59.61
+0.90D+W+0.90H					B75								
Dsgn. L = 14.00 ft	1	0.095	0.023	4.84		4.84	56.67	51.00	1.00	1.00	1.38	59.61	59.61

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UR-B3

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+0.90D+E+0.90H													
Dsgn. L = 14.00 ft	1	0.095	0.023	4.84		4.84	56.67	51.00	1.00	1.00	1.38	59.61	59.61

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	0.3365	7.040		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	3.776	3.776
Max Upward from Load Combinations	3.776	3.776
Max Upward from Load Cases	2.238	2.238
+D+H	1.537	1.537
+D+L+H	1.537	1.537
+D+Lr+H	3.328	3.328
+D+S+H	3.776	3.776
+D+0.750Lr+0.750L+H	2.880	2.880
+D+0.750L+0.750S+H	3.216	3.216
+D+0.60W+H	1.537	1.537
+D+0.70E+H	1.537	1.537
+D+0.750Lr+0.750L+0.450W+H	2.880	2.880
+D+0.750L+0.750S+0.450W+H	3.216	3.216
+D+0.750L+0.750S+0.5250E+H	3.216	3.216
+0.60D+0.60W+0.60H	0.922	0.922
+0.60D+0.70E+0.60H	0.922	0.922
D Only	1.537	1.537
Lr Only	1.791	1.791
S Only	2.238	2.238
H Only		

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UR-B4

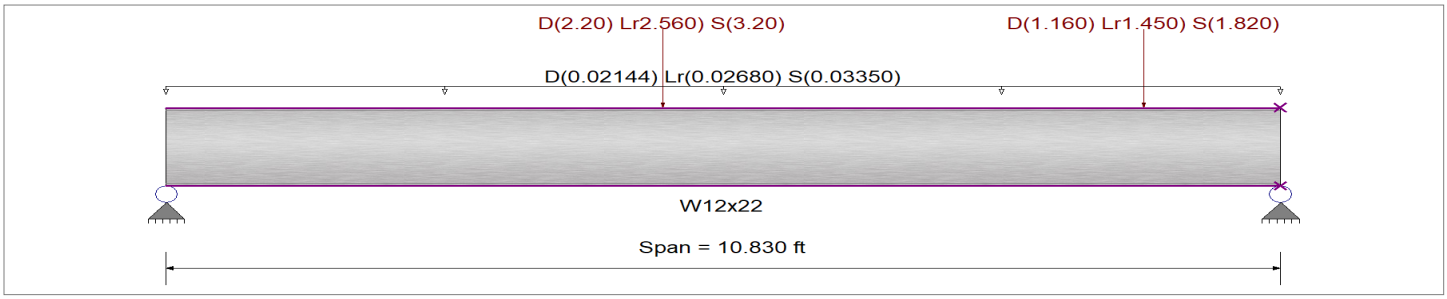
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method : Load Resistance Factor Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending

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



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0160, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 1.340 ft, (Floor Load)

Point Load : D = 2.20, Lr = 2.560, S = 3.20 k @ 4.830 ft, (UR-B2)

Point Load : D = 1.160, Lr = 1.450, S = 1.820 k @ 9.50 ft, (LSL)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.226 : 1	Maximum Shear Stress Ratio =	0.081 : 1
Section used for this span	W12x22	Section used for this span	W12x22
Mu : Applied	24.836 k-ft	Vu : Applied	7.809 k
Mn * Phi : Allowable	109.875 k-ft	Vn * Phi : Allowable	95.940 k
Load Combination	+1.20D+0.50L+1.60S+1.60H	Load Combination	+1.20D+0.50L+1.60S+1.60H
		Location of maximum on span	10.830 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.041 in	Ratio =	3,176	>=600.	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<600.0	Span: 1 : S Only
Max Downward Total Deflection	0.070 in	Ratio =	1854	>=360.	Span: 1 : +D+S+H
Max Upward Total Deflection	0.000 in	Ratio =	0	<360.0	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D+1.60H													
Dsgn. L = 10.83 ft	1	0.092	0.033	10.08		10.08	122.08	109.88	1.00	1.00	3.13	95.94	95.94
+1.20D+0.50Lr+1.60L+1.60H													
Dsgn. L = 10.83 ft	1	0.115	0.041	12.69		12.69	122.08	109.88	1.00	1.00	3.96	95.94	95.94
+1.20D+1.60L+0.50S+1.60H													
Dsgn. L = 10.83 ft	1	0.125	0.045	13.70		13.70	122.08	109.88	1.00	1.00	4.28	95.94	95.94
+1.20D+1.60Lr+0.50L+1.60H													
Dsgn. L = 10.83 ft	1	0.197	0.071	21.59		21.59	122.08	109.88	1.00	1.00	6.77	95.94	95.94
+1.20D+1.60Lr+0.50W+1.60H													
Dsgn. L = 10.83 ft	1	0.197	0.071	21.59		21.59	122.08	109.88	1.00	1.00	6.77	95.94	95.94
+1.20D+0.50L+1.60S+1.60H													
Dsgn. L = 10.83 ft	1	0.226	0.081	24.84		24.84	122.08	109.88	1.00	1.00	7.81	95.94	95.94
+1.20D+1.60S+0.50W+1.60H													
Dsgn. L = 10.83 ft	1	0.226	0.081	24.84		24.84	122.08	109.88	1.00	1.00	7.81	95.94	95.94
+1.20D+0.50Lr+0.50L+W+1.60H													
Dsgn. L = 10.83 ft	1	0.115	0.041	12.69	B77	12.69	122.08	109.88	1.00	1.00	3.96	95.94	95.94
+1.20D+0.50L+0.50S+W+1.60H													

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UR-B4

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values						Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
Dsgn. L = 10.83 ft	1	0.125	0.045	13.70		13.70	122.08	109.88	1.00	1.00	4.28	95.94	95.94
+1.20D+0.50L+0.70S+E+1.60H													
Dsgn. L = 10.83 ft	1	0.143	0.051	15.73		15.73	122.08	109.88	1.00	1.00	4.92	95.94	95.94
+0.90D+W+0.90H													
Dsgn. L = 10.83 ft	1	0.059	0.021	6.48		6.48	122.08	109.88	1.00	1.00	2.01	95.94	95.94
+0.90D+E+0.90H													
Dsgn. L = 10.83 ft	1	0.059	0.021	6.48		6.48	122.08	109.88	1.00	1.00	2.01	95.94	95.94

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	0.0701	5.384		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	3.774	5.439
Max Upward from Load Combinations	3.774	5.439
Max Upward from Load Cases	2.178	3.205
+D+H	1.597	2.234
+D+L+H	1.597	2.234
+D+Lr+H	3.338	4.793
+D+S+H	3.774	5.439
+D+0.750Lr+0.750L+H	2.903	4.153
+D+0.750L+0.750S+H	3.230	4.638
+D+0.60W+H	1.597	2.234
+D+0.70E+H	1.597	2.234
+D+0.750Lr+0.750L+0.450W+H	2.903	4.153
+D+0.750L+0.750S+0.450W+H	3.230	4.638
+D+0.750L+0.750S+0.5250E+H	3.230	4.638
+0.60D+0.60W+0.60H	0.958	1.340
+0.60D+0.70E+0.60H	0.958	1.340
D Only	1.597	2.234
Lr Only	1.741	2.559
S Only	2.178	3.205
H Only		

kpff
1601 5th Avenue, Suite 1600
Seattle, WA 98101 206 622-5822

project Fused Elements Residence		by CBJ	sheet no.
location Mercer Island, WA		date 06/16/23	
client Olson Kundig			job no. 22-00638
Framing Design			

Wood TJI Framing

ML-TJI1 (11-7/8" @ 16" OC)

Simply supported

L =	12	ft
DL =	13	psf
LL =	40	psf (R)

→ 11-7/8" TJI 210 @ 16" OC OK, See ForteWeb

ML-TJI2 (16" @ 16" OC)

Simply supported

L =	17.5	ft
DL =	13	psf
LL =	40	psf (R)

→ 16" TJI 360 @ 16" OC OK, See ForteWeb

ML-TJI3 (14" @ 16" OC)

Simply supported

L =	14.75	ft
DL =	13	psf
LL =	40	psf (R)

→ 14" TJI 360 @ 16" OC OK, See ForteWeb

ML-TJI4 (9-1/2" @ 16" OC)

Simply supported

L =	14.75	ft
DL =	24	psf
LL =	40	psf (R)

→ 9-1/2" TJI 210 @ 16" OC OK, See ForteWeb

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project Fused Elements Residence		by CBJ	sheet no.
location Mercer Island, WA		date 06/16/23	
client Olson Kundig			job no. 22-00638
Framing Design			

Wood TJI Framing

ML-TJI5 (18" @ 16" OC)

Simply supported

L =	17.08	ft
DL =	13	psf
LL =	60	psf (R)
SL =	25	psf

→ 18" TJI 360 @ 16" OC OK, See ForteWeb

UL-TJI1 (11-7/8" @ 12" OC)

Simply supported

L =	14	ft
DL =	13	psf
LL =	40	psf (R)

→ 11-7/8" TJI 210 @ 12" OC OK, See ForteWeb

UL-TJI2 (16" @ 16" OC)

Simply supported

L =	17.25	ft
DL =	13	psf
LL =	60	psf (R)
SL =	25	psf

→ 16" TJI 360 @ 16" OC OK, See ForteWeb

UL-TJI3 (16" @ 12" OC)

Simply supported

L =	17.25	ft
DL =	133	psf
LL =	40	psf (R)

→ 16" TJI 360 @ 12" OC OK, See ForteWeb

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location Mercer Island, WA		date 06/16/23	
client Olson Kundig			job no. 22-00638
Framing Design			

Wood TJI Framing

UL-TJI4 (16" @ 12" OC)

Simply supported

L =	20.5	ft
DL =	13	psf
LL =	60	psf (R)
SL =	25	psf

→ 16" TJI 360 @ 12" OC OK, See ForteWeb

UL-TJI5 (11-7/8" @ 16" OC)

Simply supported

L =	16.34	ft
DL =	44	psf
LR =	20	psf (R)
SL =	25	psf

→ 2-Ply 11-7/8" TJI 360 @ 16" OC OK, See ForteWeb

UR-TJI1 (11-7/8" @ 16" OC)

Simply supported

L =	15	ft
DL =	13	psf
LR =	20	psf (R)
SL =	25	psf

→ 11-7/8" TJI 360 @ 16" OC OK, See ForteWeb

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project Fused Elements Residence		by CBJ	sheet no.
location Mercer Island, WA		date 06/16/23	
client Olson Kundig			job no. 22-00638
Framing Design			

Wood LSL Framing

ML-LSL1

Simply supported

L =	12.17	ft	DL =	13	psf
TW =	9.59	ft	LL =	40	psf (R)

→ LSL 3-1/2x14 OK, See ForteWeb

ML-LSL2

Simply supported

L =	13.5	ft
TW =	6	ft
DL =	13	psf
LL =	40	psf (R)

Point Load from ML-B1

$X_{ML\text{-}LSL1}$ =	3.92	ft
P_{DL} =	758	lb
P_{LL} =	2333	lb

→ LSL 3-1/2x14 OK, See ForteWeb

ML-LSL3

Simply supported

L =	11.17	ft
TW =	1.34	ft
DL =	13	psf
LL =	40	psf (R)

Point Load from Beam

X_{BM} =	4.08	ft
P_{DL} =	519	lb
P_{LL} =	866	lb

→ LSL 3-1/2x11-7/8 OK, See ForteWeb

ML-LSL4

Simply supported

L =	5.75	ft	DL =	13	psf
TW =	11.88	ft	LL =	40	psf (R)

→ LSL 3-1/2x11-7/8 OK, See ForteWeb

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project Fused Elements Residence		by CBJ	sheet no.
location Mercer Island, WA		date 06/16/23	
client Olson Kundig			job no. 22-00638
Framing Design			

Wood LSL Framing

UL-LSL1

Simply supported

L =	7.5	ft	DL =	13	psf
TW =	2.80	ft	LL =	40	psf (R)

→ LSL 1-3/4x9-1/2 OK, See ForteWeb

UL-LSL2

Simply supported

L =	8.83	ft	DL =	44	psf
TW =	12.5	ft	LL =	20	psf (R)
			SL =	25	psf

→ LSL 3-1/2x11-7/8 OK, See ForteWeb

Wood 2x Framing

2x8

Simply supported

L =	5.08	ft
DL =	13	psf
LL =	60	psf (R)
SL =	25	psf

→ 2x8 @ 16" OC OK, See ForteWeb

2x4

Simply supported

L =	4.75	ft
DL =	16	psf
LL =	20	psf (R)
SL =	25	psf

→ 2x4 @ 16" OC OK, See ForteWeb

kpff 1601 5th Avenue, Suite 1600 Seattle, WA 98101 206 622-5822	project Fused Elements Residence	by CBJ	sheet no.
	location Mercer Island, WA	date 06/16/23	
	client Olson Kundig		job no. 22-00638
	Framing Design		

Wood Glulam Framing

ML-GL1

Simply supported

L =	20.5	ft
TW =	17.13	ft
DL =	13	psf
LL =	40	psf (R)

→ GL 8-3/4x18 OK for bending, shear, and deflection. See Enercalc

→ W12x35 OK for bending, shear, and deflection. See Enercalc

ML-GL2

Simply supported

L =	7.75	ft
TW =	1.34	ft
DL =	13	psf
LL =	40	psf (R)

Point Load from Wood Column

x_{COL} =	1.58	ft
P_{DL} =	7.14	k
P_{LL} =	3.24	k
P_{LL} =	4.06	k

→ GL 5-1/8x12 OK for bending, shear, and deflection. See Enercalc

UL-GL1

Simply supported

L =	16.17	ft
TW =	11.42	ft
DL =	44	psf
LL =	20	psf (R)
SL =	25	psf

→ GL 6-3/4x12 OK for bending, shear, and deflection. See Enercalc

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project Fused Elements Residence		by CBJ	sheet no.
location Mercer Island, WA		date 06/16/23	
client Olson Kundig			job no. 22-00638
Framing Design			

Wood Glulam Framing

UL-GL2

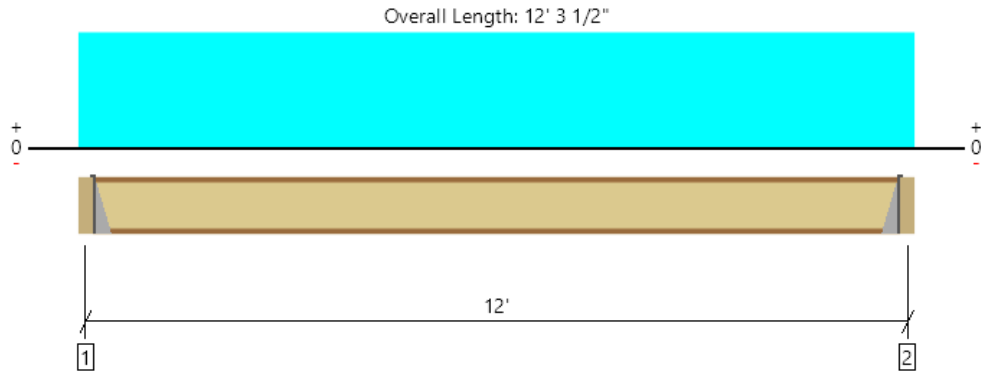
Simply supported

L =	12.34	ft
TW =	11.42	ft
DL =	44	psf
LL =	20	psf (R)
SL =	25	psf

→ GL 5-1/8x12 OK for bending, shear, and deflection. See Enercalc

Permit Calcs, ML-TJI1

1 piece(s) 11 7/8" TJI® 210 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	414 @ 3 1/2"	1005 (1.75")	Passed (41%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	414 @ 3 1/2"	1655	Passed (25%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1211 @ 6' 1 3/4"	3795	Passed (32%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.075 @ 6' 1 3/4"	0.234	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.099 @ 6' 1 3/4"	0.390	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	56	55	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/600) and TL (L/360).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 11 7/8" DF beam	3.50"	Hanger[1]	1.75" / - [2]	107	328	434	See note [1]
2 - Hanger on 11 7/8" DF beam	3.50"	Hanger[1]	1.75" / - [2]	107	328	434	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 9" o/c	
Bottom Edge (Lu)	11' 9" o/c	

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

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Top Mount Hanger	ITS2.06/11.88	2.00"	4-10dx1.5	2-10dx1.5	2-Strong-Grip	
2 - Top Mount Hanger	ITS2.06/11.88	2.00"	4-10dx1.5	2-10dx1.5	2-Strong-Grip	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 12' 3 1/2"	16"	13.0	40.0	Default Load

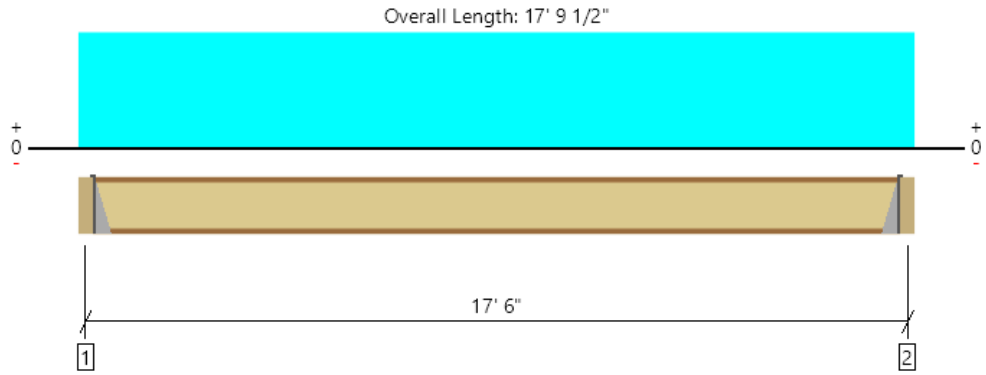
Member Notes
Floor joist, interior loads

ForteWEB Software Operator	Job Notes
Tina Johnsen KPFF (206) 926-0524 christina.johnsen@kpff.com	B86

Weyerhaeuser

Permit Calcs, ML-TJI2

1 piece(s) 16" TJI® 360 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	608 @ 3 1/2"	1080 (1.75")	Passed (56%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	608 @ 3 1/2"	2190	Passed (28%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2616 @ 8' 10 3/4"	8405	Passed (31%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.135 @ 8' 10 3/4"	0.344	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.179 @ 8' 10 3/4"	0.574	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	54	54	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/600) and TL (L/360).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 16" DF beam	3.50"	Hanger[1]	1.75" / - [2]	154	474	629	See note [1]
2 - Hanger on 16" DF beam	3.50"	Hanger[1]	1.75" / - [2]	154	474	629	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 11" o/c	
Bottom Edge (Lu)	17' 3" o/c	

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

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Top Mount Hanger	ITS2.37/16	2.00"	4-10dx1.5	2-10dx1.5	2-Strong-Grip	
2 - Top Mount Hanger	ITS2.37/16	2.00"	4-10dx1.5	2-10dx1.5	2-Strong-Grip	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 17' 9 1/2"	16"	13.0	40.0	Default Load

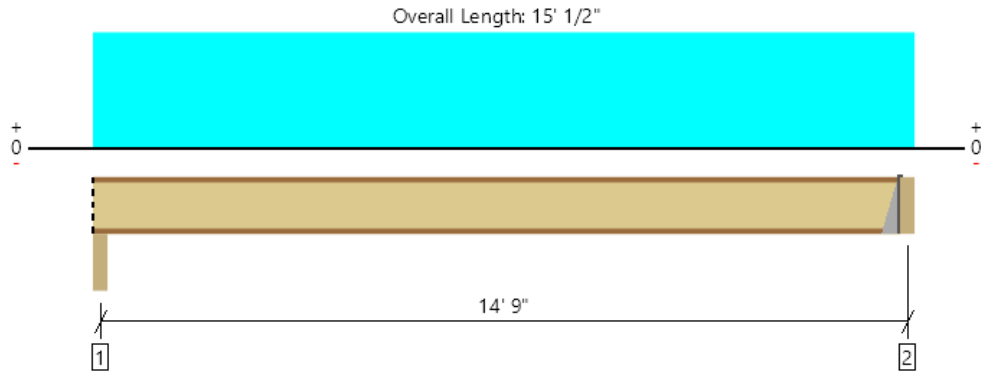
Member Notes
Floor joist, interior loads

ForteWEB Software Operator	Job Notes
Tina Johnsen KPFF (206) 926-0524 christina.johnsen@kpff.com	B87

Weyerhaeuser

Permit Calcs, ML-TJI3

1 piece(s) 14" TJI® 360 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	514 @ 14' 9"	1080 (1.75")	Passed (48%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	514 @ 14' 9"	1955	Passed (26%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1868 @ 7' 5 3/4"	7335	Passed (25%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.096 @ 7' 5 3/4"	0.291	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.127 @ 7' 5 3/4"	0.485	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	55	55	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/600) and TL (L/360).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Beam - DF	3.50"	3.50"	1.75"	130	399	529	Blocking
2 - Hanger on 14" DF beam	3.50"	Hanger[1]	1.75" / - [2]	131	403	534	See note [1]

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 8" o/c	
Bottom Edge (Lu)	14' 9" o/c	

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

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Top Mount Hanger	ITS2.37/14	2.00"	4-10dx1.5	2-10dx1.5	2-Strong-Grip	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 15' 1/2"	16"	13.0	40.0	Default Load

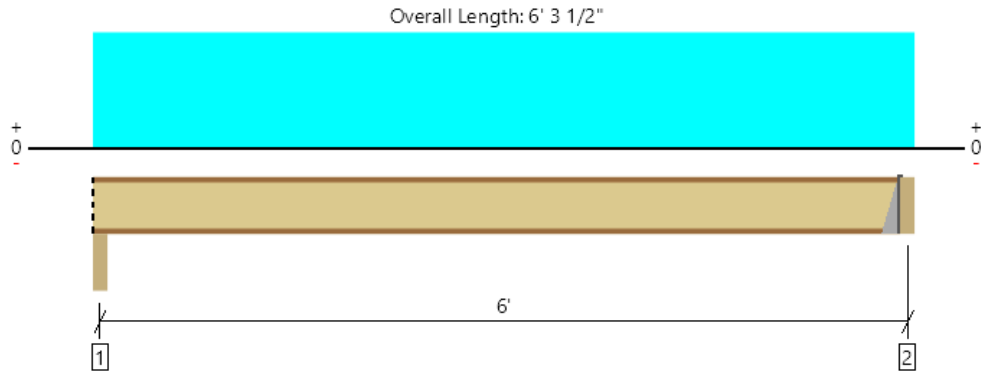
Member Notes
Floor joist, interior loads

ForteWEB Software Operator	Job Notes
Tina Johnsen KPFF (206) 926-0524 christina.johnsen@kpff.com	B88

Weyerhaeuser

Permit Calcs, ML-TJI4

1 piece(s) 9 1/2" TJI® 210 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	247 @ 6'	1005 (1.75")	Passed (25%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	247 @ 6'	1330	Passed (19%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	358 @ 3' 1 1/4"	3000	Passed (12%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.011 @ 3' 1 1/4"	0.116	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.017 @ 3' 1 1/4"	0.193	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	67	55	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/600) and TL (L/360).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Beam - DF	3.50"	3.50"	1.75"	99	166	265	Blocking
2 - Hanger on 9 1/2" DF beam	3.50"	Hanger[1]	1.75" / - [2]	102	170	272	See note [1]

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' o/c	
Bottom Edge (Lu)	6' o/c	

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

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Top Mount Hanger	ITS2.06/9.5	2.00"	4-10dx1.5	2-10dx1.5	2-Strong-Grip	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 6' 3 1/2"	16"	24.0	40.0	Default Load

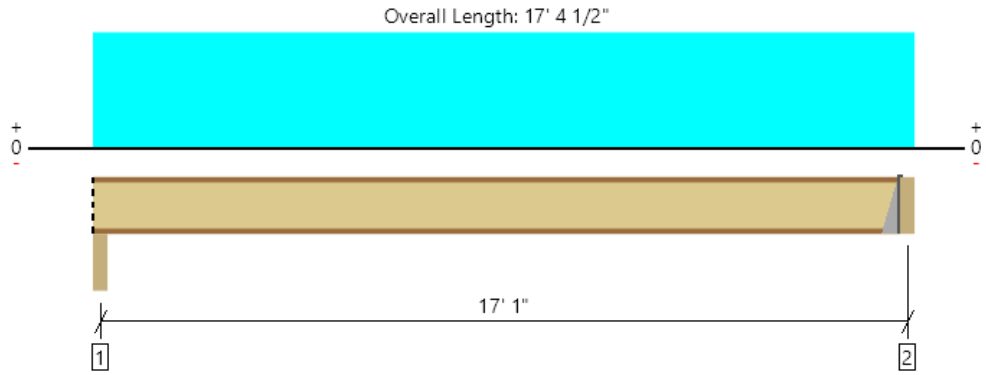
Member Notes
Floor joist, interior loads with tile

ForteWEB Software Operator	Job Notes
Tina Johnsen KPFF (206) 926-0524 christina.johnsen@kpff.com	B89

Weyerhaeuser

Permit Calcs, ML-TJI5

1 piece(s) 18" TJI® 360 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	821 @ 17' 1"	1080 (1.75")	Passed (76%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	821 @ 17' 1"	2425	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3465 @ 8' 7 3/4"	9465	Passed (37%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.159 @ 8' 7 3/4"	0.338	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.191 @ 8' 7 3/4"	0.563	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
TJ-Pro™ Rating	58	55	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/600) and TL (L/360).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Beam - DF	3.50"	3.50"	1.75"	150	692	288	885	Blocking
2 - Hanger on 18" DF beam	3.50"	Hanger[1]	1.75" / - [2]	151	698	291	893	See note [1]

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 3" o/c	
Bottom Edge (Lu)	17' 1" o/c	

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

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Top Mount Hanger	MIT3518	2.50"	4-10dx1.5	4-10dx1.5	2-10dx1.5	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 17' 4 1/2"	16"	13.0	60.0	25.0	Default Load

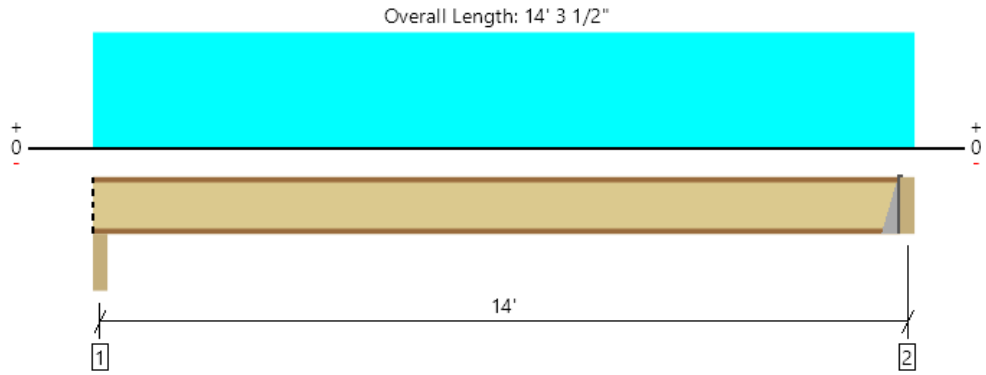
Member Notes
Floor joist, exterior loads

ForteWEB Software Operator	Job Notes
Tina Johnsen KPFF (206) 926-0524 christina.johnsen@kpff.com	B90

Weyerhaeuser

Permit Calcs, UL-TJI1

1 piece(s) 11 7/8" TJI® 210 @ 12" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	365 @ 14'	1005 (1.75")	Passed (36%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	365 @ 14'	1655	Passed (22%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1260 @ 7' 1 1/4"	3795	Passed (33%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.104 @ 7' 1 1/4"	0.276	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.138 @ 7' 1 1/4"	0.460	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	55	55	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/600) and TL (L/360).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Beam - DF	3.50"	3.50"	1.75"	92	284	377	Blocking
2 - Hanger on 11 7/8" DF beam	3.50"	Hanger[1]	1.75" / - [2]	93	288	381	See note [1]

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 7" o/c	
Bottom Edge (Lu)	14' o/c	

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

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Top Mount Hanger	ITS2.06/11.88	2.00"	4-10dx1.5	2-10dx1.5	2-Strong-Grip	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 14' 3 1/2"	12"	13.0	40.0	Default Load

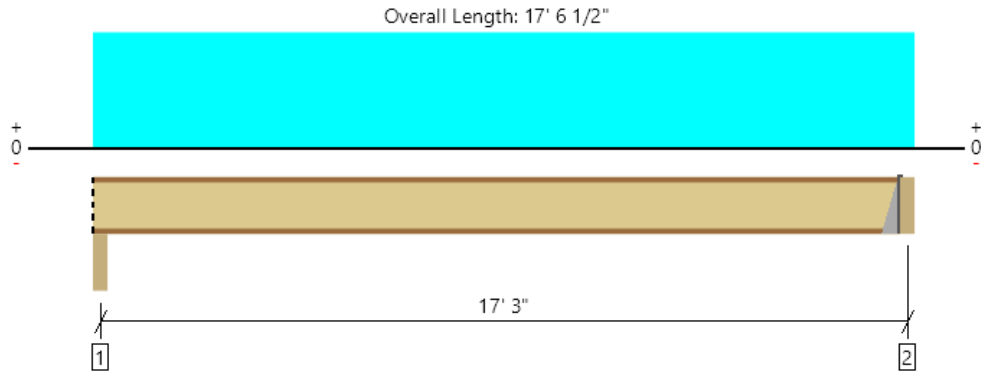
Member Notes
Floor joist, interior loads

ForteWEB Software Operator	Job Notes
Tina Johnsen KPFF (206) 926-0524 christina.johnsen@kpff.com	B91

Weyerhaeuser

Permit Calcs, UL-TJI2

1 piece(s) 16" TJI® 360 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	829 @ 17' 3"	1080 (1.75")	Passed (77%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	829 @ 17' 3"	2190	Passed (38%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3533 @ 8' 8 3/4"	8405	Passed (42%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.208 @ 8' 8 3/4"	0.341	Passed (L/985)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.250 @ 8' 8 3/4"	0.568	Passed (L/819)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
TJ-Pro™ Rating	54	54	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/600) and TL (L/360).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Beam - DF	3.50"	3.50"	1.75"	151	698	291	893	Blocking
2 - Hanger on 16" DF beam	3.50"	Hanger[1]	1.75" / - [2]	153	705	294	902	See note [1]

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 10" o/c	
Bottom Edge (Lu)	17' 3" o/c	

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

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Top Mount Hanger	ITS2.37/16	2.00"	4-10dx1.5	2-10dx1.5	2-Strong-Grip	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 17' 6 1/2"	16"	13.0	60.0	25.0	Default Load

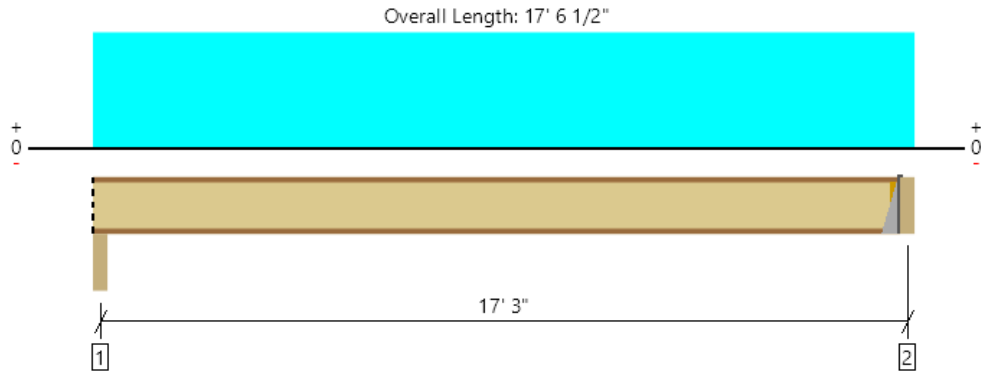
Member Notes
Floor joist, exterior loads

ForteWEB Software Operator	Job Notes
Tina Johnsen KPFF (206) 926-0524 christina.johnsen@kpff.com	B92

Weyerhaeuser

Permit Calcs, UL-TJI3

1 piece(s) 16" TJI® 360 @ 12" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1510 @ 2 1/2"	1505 (3.50")	Passed (100%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1474 @ 17' 3"	2190	Passed (67%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	6280 @ 8' 8 3/4"	8405	Passed (75%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.100 @ 8' 8 3/4"	0.341	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.432 @ 8' 8 3/4"	0.568	Passed (L/473)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	59	55	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/600) and TL (L/360).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Beam - DF	3.50"	3.50"	3.50"	1161	349	1510	Blocking
2 - Hanger on 16" DF beam	3.50"	Hanger[1]	3.37" / - [2]	1172	353	1525	See note [1]

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 3" o/c	
Bottom Edge (Lu)	17' 3" o/c	

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

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Top Mount Hanger	HB2.31X H=15.938	4.00"	6-16d	16-16d	10-10dx1.5	Web Stiffeners

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 17' 6 1/2"	12"	133.0	40.0	Default Load

Member Notes
Floor joist, exterior loads

ForteWEB Software Operator	Job Notes
Tina Johnsen KPFF (206) 926-0524 christina.johnsen@kpff.com	B93

Weyerhaeuser

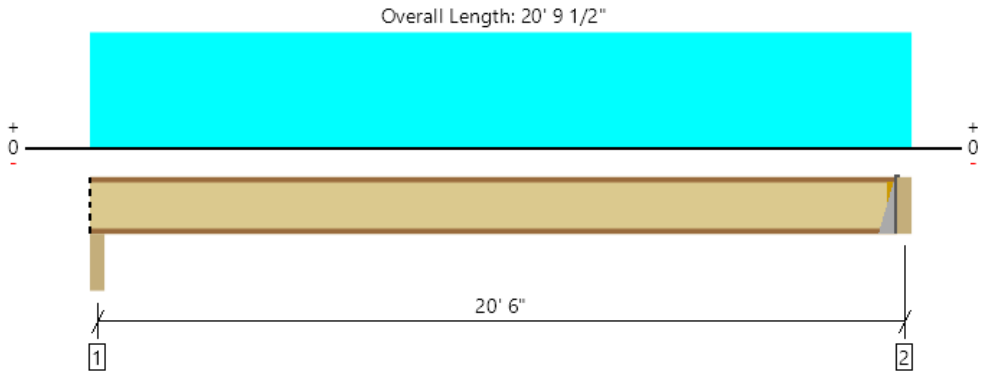
FORTEWEB

MEMBER REPORT

PASSED

Permit Calcs, UL-TJI4

1 piece(s) 16" TJI® 360 @ 12" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	741 @ 20' 6"	1080 (1.75")	Passed (69%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	741 @ 20' 6"	2190	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3757 @ 10' 4 1/4"	8405	Passed (45%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.302 @ 10' 4 1/4"	0.406	Passed (L/806)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.363 @ 10' 4 1/4"	0.676	Passed (L/670)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
TJ-Pro™ Rating	53	53	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/600) and TL (L/360).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Beam - DF	3.50"	3.50"	1.75"	135	621	259	795	Blocking
2 - Hanger on 16" DF beam	3.50"	Hanger[1]	1.75" / - [2]	136	626	261	801	See note [1]

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 7" o/c	
Bottom Edge (Lu)	20' 6" o/c	

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

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Top Mount Hanger	HB2.31X H=15.938	4.00"	6-16d	16-16d	10-10dx1.5	Web Stiffeners

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 20' 9 1/2"	12"	13.0	60.0	25.0	Default Load

Member Notes
Floor joist, exterior loads

ForteWEB Software Operator	Job Notes
Tina Johnsen KPFF (206) 926-0524 christina.johnsen@kpff.com	B94

Weyerhaeuser

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ForteWEB v3.5, Engine: V8.2.5.1, Data: V8.1.3.6
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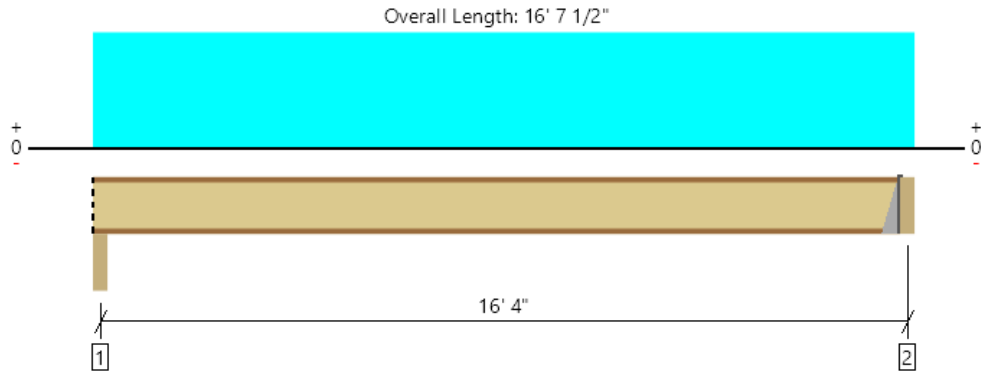
Permit Calcs, UL-TJI5

2 piece(s) 11 7/8" TJI® 360 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	742 @ 16' 4"	2484 (1.75")	Passed (30%)	1.15	1.0 D + 1.0 S (All Spans)
Shear (lbs)	742 @ 16' 4"	3922	Passed (19%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	2990 @ 8' 3 1/4"	14214	Passed (21%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.064 @ 8' 3 1/4"	0.322	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.178 @ 8' 3 1/4"	0.538	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
TJ-Pro™ Rating	57	55	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/600) and TL (L/360).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Roof Live	Snow	Factored	
1 - Beam - DF	3.50"	3.50"	1.75"	485	221	276	761	Blocking
2 - Hanger on 11 7/8" DF beam	3.50"	Hanger[1]	1.75" / - [2]	490	223	278	769	See note [1]

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 10" o/c	
Bottom Edge (Lu)	16' 4" o/c	

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

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Top Mount Hanger	MIT3511.88-2	2.50"	4-10dx1.5	4-10dx1.5	2-10dx1.5	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location	Spacing	Dead (0.90)	Roof Live (non-snow: 1.25)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 16' 7 1/2"	16"	44.0	20.0	25.0	Default Load

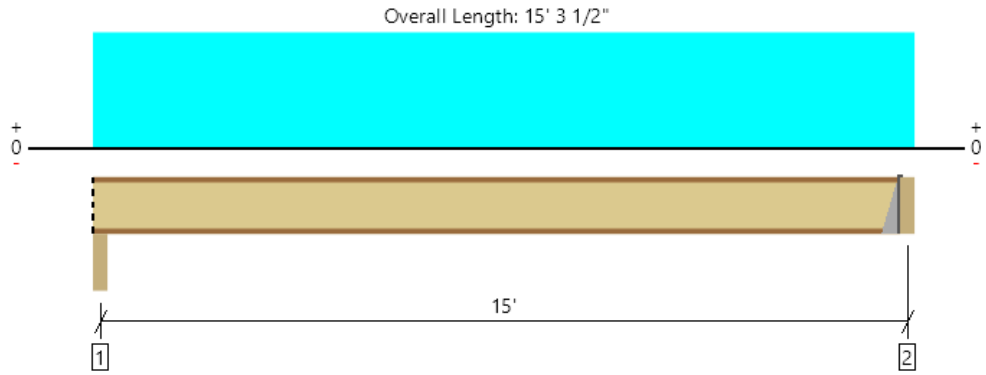
Member Notes
Roof joist, green roof loads

ForteWEB Software Operator	Job Notes
Tina Johnsen KPFF (206) 926-0524 christina.johnsen@kpff.com	B95

Weyerhaeuser

Permit Calcs, UR-TJI1

1 piece(s) 11 7/8" TJI® 360 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	375 @ 15'	1242 (1.75")	Passed (30%)	1.15	1.0 D + 1.0 S (All Spans)
Shear (lbs)	375 @ 15'	1961	Passed (19%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1386 @ 7' 7 1/4"	7107	Passed (19%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.089 @ 7' 7 1/4"	0.296	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.135 @ 7' 7 1/4"	0.493	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
TJ-Pro™ Rating	49	49	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/600) and TL (L/360).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Roof Live	Snow	Factored	
1 - Beam - DF	3.50"	3.50"	1.75"	132	203	253	385	Blocking
2 - Hanger on 11 7/8" DF beam	3.50"	Hanger[1]	1.75" / - [2]	133	205	256	389	See note [1]

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 2" o/c	
Bottom Edge (Lu)	15' o/c	

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

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Top Mount Hanger	ITS2.37/11.88	2.00"	4-10dx1.5	2-10dx1.5	2-Strong-Grip	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location	Spacing	Dead (0.90)	Roof Live (non-snow: 1.25)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 15' 3 1/2"	16"	13.0	20.0	25.0	Default Load

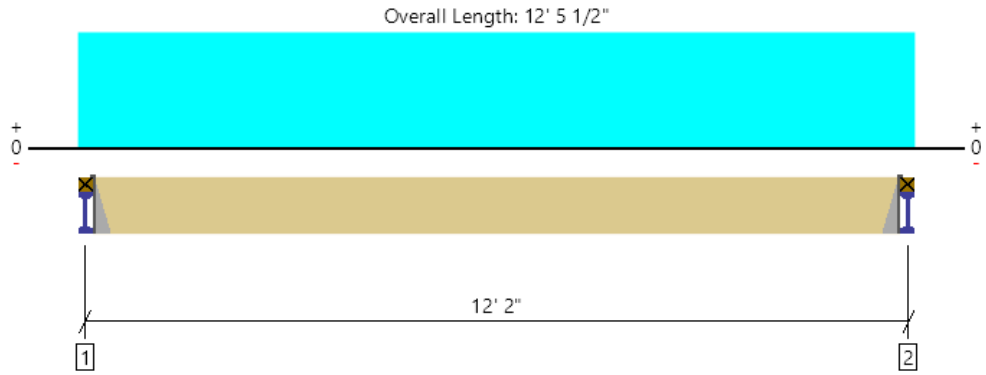
Member Notes
Roof joist, roof loads

ForteWEB Software Operator	Job Notes
Tina Johnsen KPFF (206) 926-0524 christina.johnsen@kpff.com	B96

Weyerhaeuser

Permit Calcs, ML-LSL1

1 piece(s) 3 1/2" x 14" 1.55E TimberStrand® LSL @ 12" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3022 @ 3 1/2"	4725 (1.50")	Passed (64%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2428 @ 1' 5 1/2"	10127	Passed (24%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	8972 @ 6' 2 3/4"	22714	Passed (40%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.148 @ 6' 2 3/4"	0.237	Passed (L/961)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.197 @ 6' 2 3/4"	0.396	Passed (L/725)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	70	55	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/600) and TL (L/360).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 4% increase in the moment capacity has been added to account for repetitive member usage.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on Single 2X DF plate	3.50"	Hanger[1]	1.50"	779	2392	3171	See note [1]
2 - Hanger on Single 2X DF plate	3.50"	Hanger[1]	1.50"	779	2392	3171	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	11' 11" o/c	
Bottom Edge (Lu)	11' 11" o/c	

- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Top Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	
2 - Top Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PLF)	0 to 12' 5 1/2"	N/A	125.0	384.0	Default Load

Member Notes
Floor beam, interior loads

ForteWEB Software Operator	Job Notes
Tina Johnsen KPFF (206) 926-0524 christina.johnsen@kpff.com	B97

Weyerhaeuser

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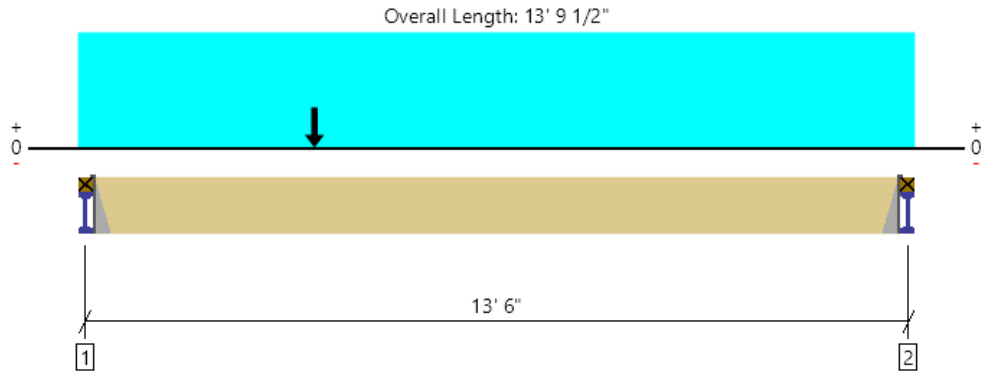
MEMBER REPORT

PASSED

Permit Calcs, ML-LSL2

1 piece(s) 3 1/2" x 14" 1.55E TimberStrand® LSL @ 12" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	4343 @ 3 1/2"	4725 (1.50")	Passed (92%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	3972 @ 1' 5 1/2"	10127	Passed (39%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	13669 @ 4' 2 3/4"	22714	Passed (60%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.259 @ 6' 6 7/8"	0.264	Passed (L/612)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.343 @ 6' 6 7/8"	0.440	Passed (L/462)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	69	55	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/600) and TL (L/360).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 4% increase in the moment capacity has been added to account for repetitive member usage.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on Single 2X DF plate	3.50"	Hanger[1]	1.50"	1088	3348	4436	See note [1]
2 - Hanger on Single 2X DF plate	3.50"	Hanger[1]	1.50"	746	2295	3041	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	13' 3" o/c	
Bottom Edge (Lu)	13' 3" o/c	

- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Top Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	
2 - Top Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Loads	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PLF)	0 to 13' 9 1/2"	N/A	78.0	240.0	Default Load
2 - Point (lb)	3' 11"	N/A	758	2333	

Member Notes
Floor beam, interior loads

ForteWEB Software Operator	Job Notes
Tina Johnsen KPFF (206) 926-0524 christina.johnsen@kpff.com	B98

Weyerhaeuser

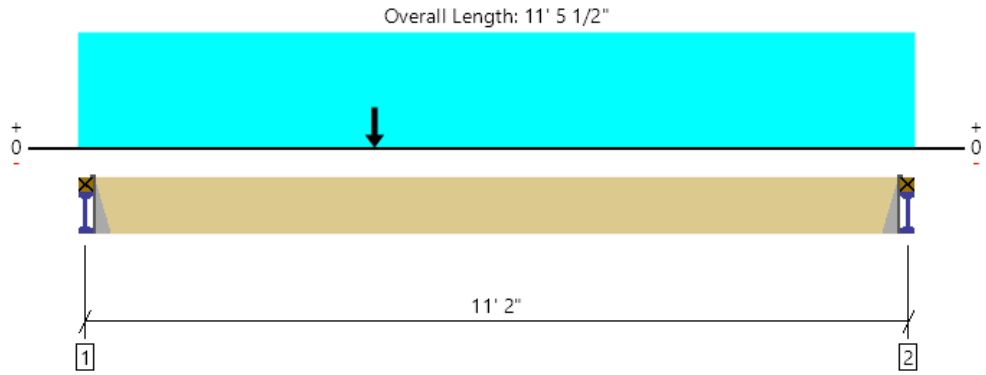
6/17/2023 11:23:51 PM UTC

ForteWEB v3.5, Engine: V8.2.5.1, Data: V8.1.3.6

File Name: Fused Elements Residence

Permit Calcs, ML-LSL3

1 piece(s) 3 1/2" x 11 7/8" 1.55E TimberStrand® LSL @ 12" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1294 @ 3 1/2"	4725 (1.50")	Passed (27%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1222 @ 1' 3 3/8"	8590	Passed (14%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4387 @ 4' 1"	16591	Passed (26%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.072 @ 5' 5 1/8"	0.218	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.109 @ 5' 4 15/16"	0.363	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	69	55	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/600) and TL (L/360).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 4% increase in the moment capacity has been added to account for repetitive member usage.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on Single 2X DF plate	3.50"	Hanger[1]	1.50"	441	873	1315	See note [1]
2 - Hanger on Single 2X DF plate	3.50"	Hanger[1]	1.50"	284	611	895	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	10' 11" o/c	
Bottom Edge (Lu)	10' 11" o/c	

- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Top Mount Hanger	THA422	1.75"	4-10dx1.5	2-10dx1.5	6-10dx1.5	
2 - Top Mount Hanger	ITS3.56/11.88	2.00"	4-10dx1.5	2-10dx1.5	2-10dx1.5	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Loads	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PLF)	0 to 11' 5 1/2"	N/A	18.0	54.0	Default Load
2 - Point (lb)	4' 1"	N/A	519	866	

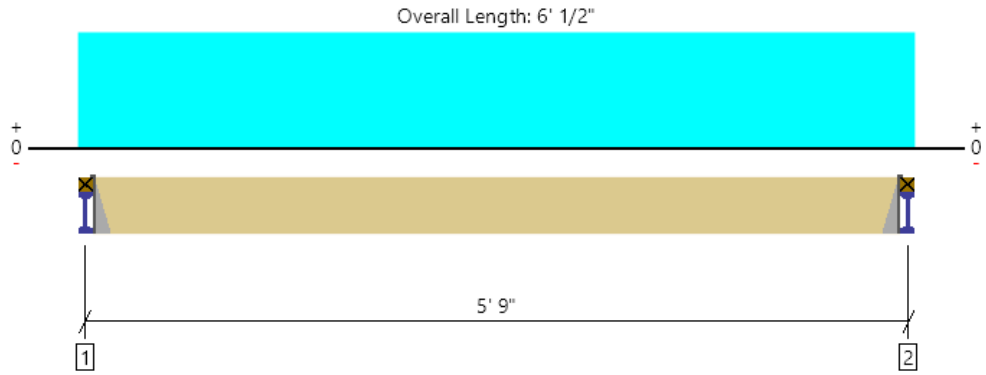
Member Notes
Floor beam, interior loads

ForteWEB Software Operator	Job Notes
Tina Johnsen KPFF (206) 926-0524 christina.johnsen@kpff.com	B99

Weyerhaeuser

Permit Calcs, ML-LSL4

1 piece(s) 3 1/2" x 11 7/8" 1.55E TimberStrand® LSL @ 12" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1719 @ 3 1/2"	4725 (1.50")	Passed (36%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1096 @ 1' 3 3/8"	8590	Passed (13%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2346 @ 3' 1/4"	16591	Passed (14%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.018 @ 3' 1/4"	0.109	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.024 @ 3' 1/4"	0.182	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	74	55	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/600) and TL (L/360).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 4% increase in the moment capacity has been added to account for repetitive member usage.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on Single 2X DF plate	3.50"	Hanger[1]	1.50"	468	1435	1903	See note [1]
2 - Hanger on Single 2X DF plate	3.50"	Hanger[1]	1.50"	468	1435	1903	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 6" o/c	
Bottom Edge (Lu)	5' 6" o/c	

- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Top Mount Hanger	THA426	1.75"	4-10dx1.5	2-10dx1.5	6-10dx1.5	
2 - Top Mount Hanger	THA426	1.75"	4-10dx1.5	2-10dx1.5	6-10dx1.5	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

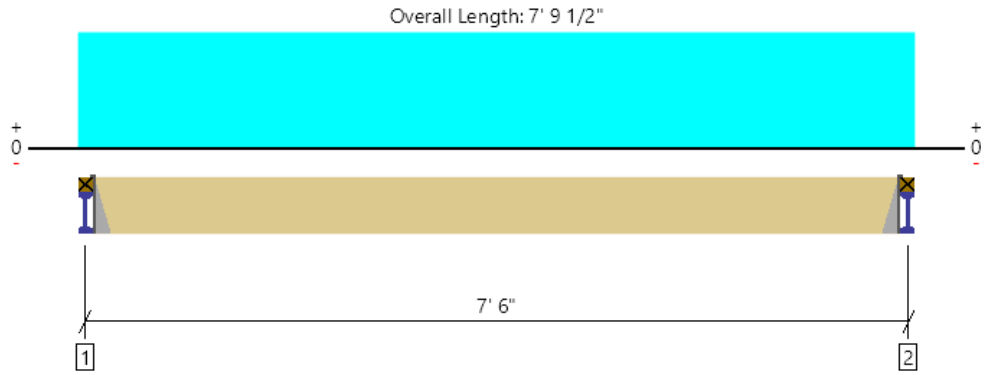
Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PLF)	0 to 6' 1/2"	N/A	155.0	475.0	Default Load

Member Notes
Floor beam, interior loads

ForteWEB Software Operator	Job Notes
Tina Johnsen KPFF (206) 926-0524 christina.johnsen@kpff.com	

Permit Calcs, UL-LSL1

1 piece(s) 1 3/4" x 9 1/2" 1.55E TimberStrand® LSL @ 12" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	537 @ 3 1/2"	2363 (1.50")	Passed (23%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	419 @ 1' 1"	3436	Passed (12%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	968 @ 3' 10 3/4"	5419	Passed (18%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.035 @ 3' 10 3/4"	0.144	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.047 @ 3' 10 3/4"	0.240	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	69	55	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/600) and TL (L/360).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 4% increase in the moment capacity has been added to account for repetitive member usage.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on Single 2X DF plate	3.50"	Hanger[1]	1.50"	144	436	580	See note [1]
2 - Hanger on Single 2X DF plate	3.50"	Hanger[1]	1.50"	144	436	580	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 3" o/c	
Bottom Edge (Lu)	7' 3" o/c	

- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Top Mount Hanger	ITS1.81/9.5	2.00"	4-10dx1.5	2-10dx1.5	2-10dx1.5	
2 - Top Mount Hanger	ITS1.81/9.5	2.00"	4-10dx1.5	2-10dx1.5	2-10dx1.5	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PLF)	0 to 7' 9 1/2"	N/A	37.0	112.0	Default Load

Member Notes
Floor beam, interior loads

ForteWEB Software Operator	Job Notes
Tina Johnsen KPFF (206) 926-0524 christina.johnsen@kpff.com	B101

Weyerhaeuser

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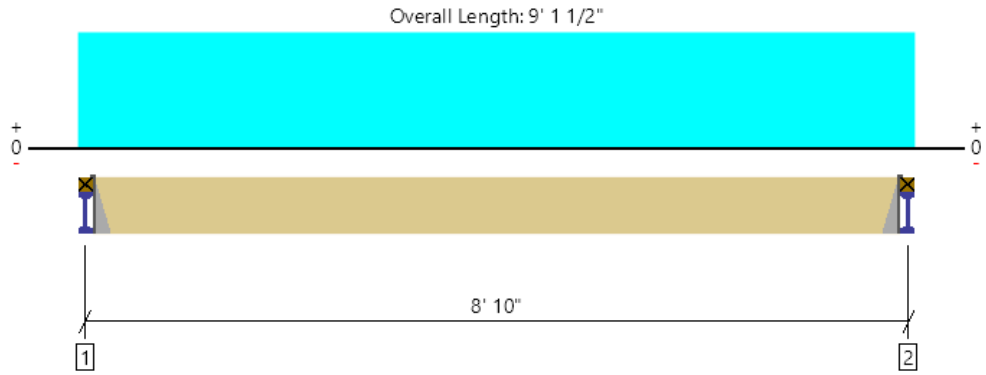
MEMBER REPORT

PASSED

Permit Calcs, UL-LSL2

1 piece(s) 3 1/2" x 11 7/8" 1.55E TimberStrand® LSL @ 12" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	3686 @ 3 1/2"	4725 (1.50")	Passed (78%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2832 @ 1' 3 3/8"	9878	Passed (29%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	7871 @ 4' 6 3/4"	19080	Passed (41%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.055 @ 4' 6 3/4"	0.171	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.152 @ 4' 6 3/4"	0.285	Passed (L/673)	--	1.0 D + 1.0 S (All Spans)
TJ-Pro™ Rating	72	55	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/600) and TL (L/360).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 4% increase in the moment capacity has been added to account for repetitive member usage.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Roof Live	Snow	Factored	
1 - Hanger on Single 2X DF plate	3.50"	Hanger[1]	1.50"	2509	1141	1428	3937	See note [1]
2 - Hanger on Single 2X DF plate	3.50"	Hanger[1]	1.50"	2509	1141	1428	3937	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 7" o/c	
Bottom Edge (Lu)	8' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Top Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	
2 - Top Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Roof Live (non-snow: 1.25)	Snow (1.15)	Comments
1 - Uniform (PLF)	0 to 9' 1 1/2"	N/A	550.0	250.0	313.0	Default Load

Member Notes
Floor beam, green roof loads

ForteWEB Software Operator	Job Notes
Tina Johnsen KPFF (206) 926-0524 christina.johnsen@kpff.com	

B102

Weyerhaeuser

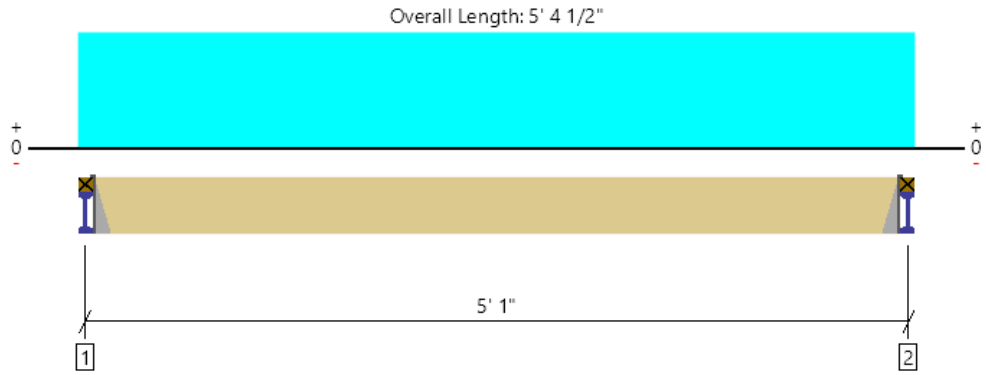
FORTEWEB

MEMBER REPORT

PASSED

Permit Calcs, 2X8

1 piece(s) 2 x 8 DF No.2 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	184 @ 3 1/2"	1406 (1.50")	Passed (13%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	131 @ 10 3/4"	1305	Passed (10%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	210 @ 2' 8 1/4"	1360	Passed (15%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.010 @ 2' 8 1/4"	0.096	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.012 @ 2' 8 1/4"	0.160	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/600) and TL (L/360).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Factored	
1 - Hanger on Single 2X DF plate	3.50"	Hanger[1]	1.50"	35	161	67	206	See note [1]
2 - Hanger on Single 2X DF plate	3.50"	Hanger[1]	1.50"	35	161	67	206	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 10" o/c	
Bottom Edge (Lu)	4' 10" o/c	

•Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Top Mount Hanger	LB28	1.50"	2-10dx1.5	2-10dx1.5	2-10dx1.5	
2 - Top Mount Hanger	LB28	1.50"	2-10dx1.5	2-10dx1.5	2-10dx1.5	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
1 - Uniform (PLF)	0 to 5' 4 1/2"	N/A	13.0	60.0	25.0	Default Load

Member Notes
Floor beam, green roof loads

ForteWEB Software Operator	Job Notes
Tina Johnsen KPFF (206) 926-0524 christina.johnsen@kpff.com	

B103

Weyerhaeuser

6/18/2023 12:03:40 AM UTC

ForteWEB v3.5, Engine: V8.2.5.1, Data: V8.1.3.6

File Name: Fused Elements Residence

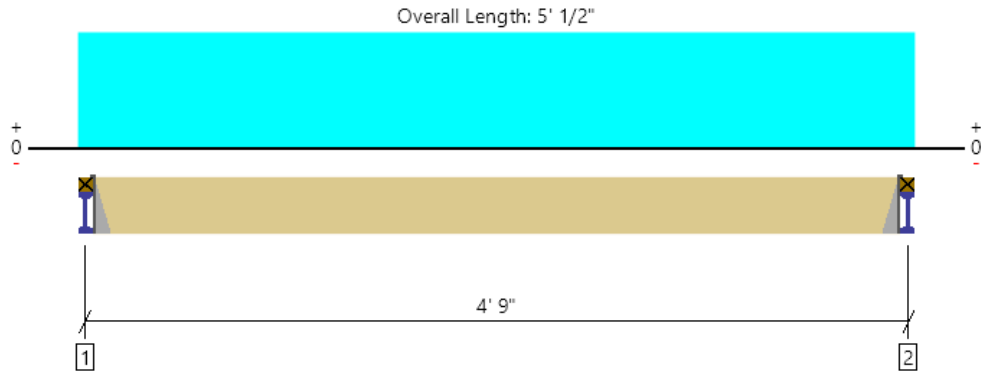
FORTEWEB

MEMBER REPORT

PASSED

Permit Calcs, 2X4

1 piece(s) 2 x 4 DF No.2 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	91 @ 3 1/2"	1406 (1.50")	Passed (6%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	79 @ 7"	725	Passed (11%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	102 @ 2' 6 1/4"	456	Passed (22%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.026 @ 2' 6 1/4"	0.089	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.043 @ 2' 6 1/4"	0.149	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/600) and TL (L/360).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Roof Live	Snow	Factored	
1 - Hanger on Single 2X DF plate	3.50"	Hanger[1]	1.50"	40	50	63	103	See note [1]
2 - Hanger on Single 2X DF plate	3.50"	Hanger[1]	1.50"	40	50	63	103	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 6" o/c	
Bottom Edge (Lu)	4' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Top Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	
2 - Top Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Roof Live (non-snow: 1.25)	Snow (1.15)	Comments
1 - Uniform (PLF)	0 to 5' 1/2"	N/A	16.0	20.0	25.0	Default Load

Member Notes
Floor beam, green roof loads

ForteWEB Software Operator	Job Notes
Tina Johnsen KPFF (206) 926-0524 christina.johnsen@kpff.com	

B104

Weyerhaeuser

Project Title:
Engineer:
Project ID:
Project Descr:

Wood Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: ML-GL1

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

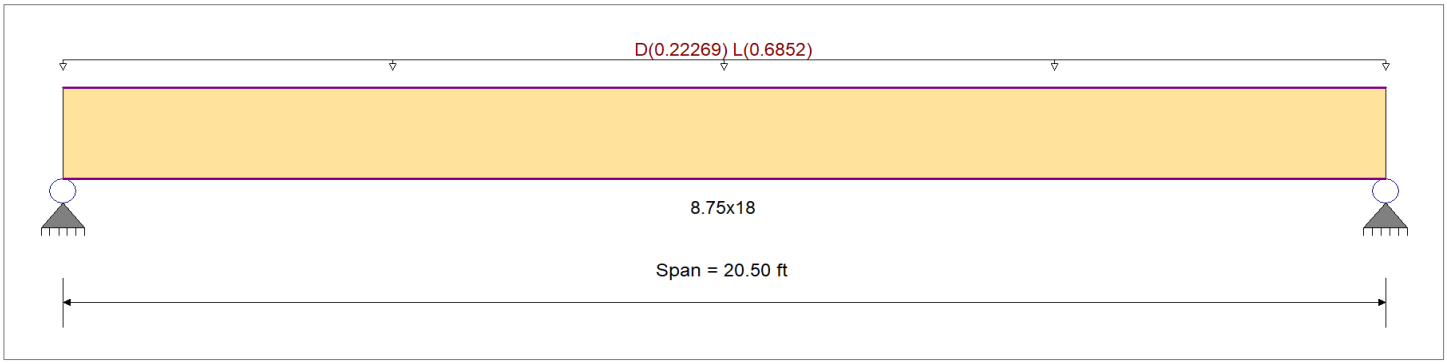
Material Properties

Analysis Method :	Allowable Stress Design
Load Combination :	IBC 2021
Wood Species :	DF/DF
Wood Grade :	24F-V4
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling

Fb +	2400 psi
Fb -	1850 psi
Fc - Prll	1650 psi
Fc - Perp	650 psi
Fv	265 psi
Ft	1100 psi

E : Modulus of Elasticity

Ebend- xx	1800 ksi
Eminbend - xx	950 ksi
Ebend- yy	1600 ksi
Eminbend - yy	850 ksi
Density	31.21 pcf



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0130, L = 0.040 ksf, Tributary Width = 17.130 ft, (Floor Loads)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.574 : 1	Maximum Shear Stress Ratio	=	0.296 : 1
Section used for this span		8.75x18	Section used for this span		8.75x18
fb: Actual	=	1,256.78 psi	fv: Actual	=	78.53 psi
F'b	=	2,189.86 psi	F'v	=	265.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	10.250 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.358 in	Ratio =	687 >=600	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0 <600	n/a
Max Downward Total Deflection	0.492 in	Ratio =	500 >=360	Span: 1 : +D+L
Max Upward Total Deflection	0 in	Ratio =	0 <360	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 20.50 ft	1	0.174	0.090	0.90	1.00	1.00	1.00	0.912	1.00	1.00	1.00	13.49	342.6	1,970.9	2.25	21.4	238.5
+D+L					1.00	1.00	1.00	0.912	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 20.50 ft	1	0.574	0.296	1.00	1.00	1.00	1.00	0.912	1.00	1.00	1.00	49.49	1,256.8	2,189.9	8.25	78.5	265.0
+D+0.750L					1.00	1.00	1.00	0.912	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 20.50 ft	1	0.376	0.194	1.25	1.00	1.00	1.00	0.912	1.00	1.00	1.00	40.49	1,028.2	2,737.3	6.75	64.3	331.3
+0.60D					1.00	1.00	1.00	0.912	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 20.50 ft	1	0.059	0.030	1.60	1.00	1.00	1.00	0.912	1.00	1.00	1.00	8.09	205.6	3,503.8	1.35	12.8	424.0

Project Title:
Engineer:
Project ID:
Project Descr:

Wood Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: ML-GL1

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.4919	10.325		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	9.656	9.656
Max Upward from Load Combinations	9.656	9.656
Max Upward from Load Cases	7.023	7.023
D Only	2.632	2.632
+D+L	9.656	9.656
+D+0.750L	7.900	7.900
+0.60D	1.579	1.579
L Only	7.023	7.023

Project Title:
Engineer:
Project ID:
Project Descr:

Wood Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: ML-GL2

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : IBC 2021

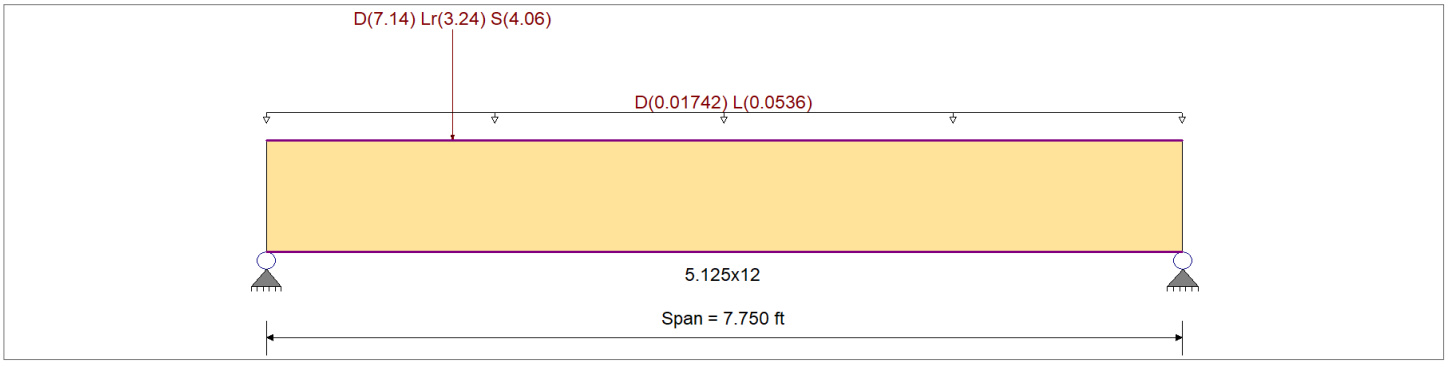
Wood Species : DF/DF
Wood Grade : 20F-V3

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

Fb +	2000 psi
Fb -	1450 psi
Fc - Prll	1550 psi
Fc - Perp	560 psi
Fv	265 psi
Ft	1000 psi

E : Modulus of Elasticity

Ebend- xx	1600 ksi
Eminbend - xx	850 ksi
Ebend- yy	1500 ksi
Eminbend - yy	790 ksi
Density	31.21 pcf



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0130, L = 0.040 ksf, Tributary Width = 1.340 ft, (Floor Loads)
Point Load : D = 7.140, Lr = 3.240, S = 4.060 k @ 1.580 ft, (Column)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.604 : 1	Maximum Shear Stress Ratio	=	0.721 : 1
Section used for this span		5.125x12	Section used for this span		5.125x12
fb: Actual	=	1,388.24 psi	fv: Actual	=	219.64 psi
F'b	=	2,300.00 psi	F'v	=	304.75 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	1.584 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.034 in	Ratio =	2720 >=600	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0 <600	n/a
Max Downward Total Deflection	0.096 in	Ratio =	964 >=360	Span: 1 : +D+S
Max Upward Total Deflection	0 in	Ratio =	0 <360	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 7.750 ft	1	0.495	0.590	0.90	1.00	1.00	1.00	1.000	1.00	1.00	1.00	9.13	890.3	1,800.0	5.77	140.8	238.5
+D+L					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 7.750 ft	1	0.458	0.546	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	9.39	915.8	2,000.0	5.93	144.6	265.0
+D+Lr					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 7.750 ft	1	0.515	0.615	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	13.20	1,287.7	2,500.0	8.35	203.7	331.3
+D+S					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 7.750 ft	1	0.604	0.721	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	14.23	1,388.2	2,300.0	9.01	219.6	304.8
+D+0.750Lr+0.750L					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0

Project Title:
Engineer:
Project ID:
Project Descr:

Wood Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: ML-GL2

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios										Moment Values			Shear Values		
Segment Length	Span #	M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
Length = 7.750 ft	1	0.483	0.576	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	12.38	1,207.5	2,500.0	7.82	190.8	331.3
+D+0.750L+0.750S					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 7.750 ft	1	0.558	0.665	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	13.15	1,282.9	2,300.0	8.31	202.8	304.8
+0.60D					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 7.750 ft	1	0.167	0.199	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	5.48	534.2	3,200.0	3.46	84.5	424.0

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.0964	3.394		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	9.036	2.403
Max Upward from Load Combinations	9.036	2.403
Max Upward from Load Cases	5.804	1.575
D Only	5.804	1.575
+D+L	6.011	1.782
+D+Lr	8.383	2.235
+D+S	9.036	2.403
+D+0.750Lr+0.750L	7.894	2.226
+D+0.750L+0.750S	8.384	2.351
+0.60D	3.482	0.945
Lr Only	2.579	0.661
L Only	0.208	0.208
S Only	3.232	0.828

Project Title:
Engineer:
Project ID:
Project Descr:

Wood Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-GL1

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : IBC 2021

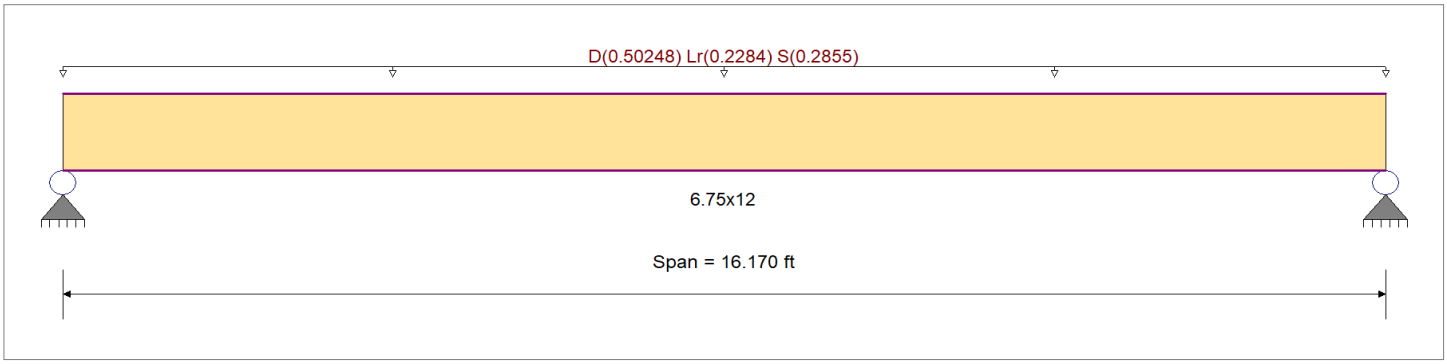
Wood Species : DF/DF
Wood Grade : 20F-V3

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

Fb +	2,000.0 psi
Fb -	1,450.0 psi
Fc - Prll	1,550.0 psi
Fc - Perp	560.0 psi
Fv	265.0 psi
Ft	1,000.0 psi

E : Modulus of Elasticity

Ebend- xx	1,600.0 ksi
Eminbend - xx	850.0 ksi
Ebend- yy	1,500.0 ksi
Eminbend - yy	790.0 ksi
Density	31.210 pcf



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0440, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 11.420 ft, (Floor Loads)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.849 : 1	Maximum Shear Stress Ratio	=	0.350 : 1
Section used for this span		6.75x12	Section used for this span		6.75x12
fb: Actual	=	1,950.21 psi	fv: Actual	=	106.52 psi
F'b	=	2,296.77 psi	F'v	=	304.75 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	8.085 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.284 in	Ratio =	683 >=600	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0 <600	n/a
Max Downward Total Deflection	0.801 in	Ratio =	242 >=240	Span: 1 : +D+S
Max Upward Total Deflection	0 in	Ratio =	0 <240	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 16.170 ft	1	0.700	0.288	0.90	1.00	1.00	1.00	0.999	1.00	1.00	1.00	17.00	1,259.0	1,797.5	3.71	68.8	238.5
+D+Lr					1.00	1.00	1.00	0.999	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.170 ft	1	0.726	0.299	1.25	1.00	1.00	1.00	0.999	1.00	1.00	1.00	24.46	1,812.0	2,496.5	5.34	99.0	331.3
+D+S					1.00	1.00	1.00	0.999	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.170 ft	1	0.849	0.350	1.15	1.00	1.00	1.00	0.999	1.00	1.00	1.00	26.33	1,950.2	2,296.8	5.75	106.5	304.8
+D+0.750Lr					1.00	1.00	1.00	0.999	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.170 ft	1	0.670	0.276	1.25	1.00	1.00	1.00	0.999	1.00	1.00	1.00	22.60	1,673.7	2,496.5	4.94	91.4	331.3
+D+0.750S					1.00	1.00	1.00	0.999	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.170 ft	1	0.774	0.319	1.15	1.00	1.00	1.00	0.999	1.00	1.00	1.00	24.00	1,777.4	2,296.8	5.24	97.1	304.8

Project Title:
Engineer:
Project ID:
Project Descr:

Wood Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-GL1

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+0.60D					1.00	1.00	1.00	0.999	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 16.170 ft	**1**	0.236	0.097	1.60	1.00	1.00	1.00	0.999	1.00	1.00	1.00	10.20	755.4	3,195.5	2.23	41.3	424.0

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.8014	8.144		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	6.513	6.513
Max Upward from Load Combinations	6.513	6.513
Max Upward from Load Cases	4.204	4.204
D Only	4.204	4.204
+D+Lr	6.051	6.051
+D+S	6.513	6.513
+D+0.750Lr	5.589	5.589
+D+0.750S	5.936	5.936
+0.60D	2.523	2.523
Lr Only	1.847	1.847
S Only	2.308	2.308

Project Title:
Engineer:
Project ID:
Project Descr:

Wood Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-GL2

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : IBC 2021

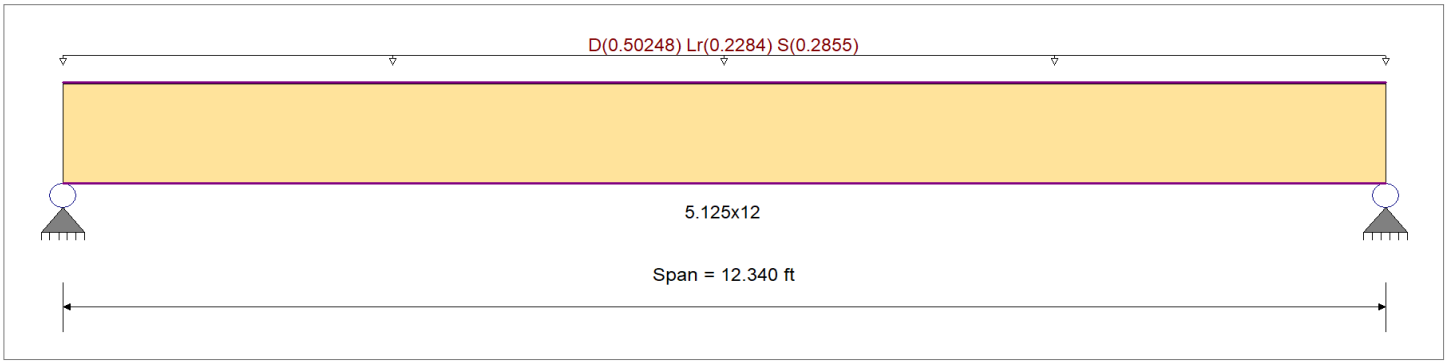
Wood Species : DF/DF
Wood Grade : 20F-V3

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

Fb +	2,000.0 psi
Fb -	1,450.0 psi
Fc - Prll	1,550.0 psi
Fc - Perp	560.0 psi
Fv	265.0 psi
Ft	1,000.0 psi

E : Modulus of Elasticity

Ebend- xx	1,600.0 ksi
Eminbend - xx	850.0 ksi
Ebend- yy	1,500.0 ksi
Eminbend - yy	790.0 ksi
Density	31.210 pcf



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0440, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 11.420 ft, (Floor Loads)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.647 : 1	Maximum Shear Stress Ratio	=	0.332 : 1
Section used for this span		5.125x12	Section used for this span		5.125x12
fb: Actual	=	1,488.05 psi	fv: Actual	=	101.22 psi
F'b	=	2,300.00 psi	F'v	=	304.75 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	6.170 ft	Location of maximum on span	=	11.349 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.127 in	Ratio =	1167 >=600	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0 <600	n/a
Max Downward Total Deflection	0.356 in	Ratio =	415 >=240	Span: 1 : +D+S
Max Upward Total Deflection	0 in	Ratio =	0 <240	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 12.340 ft	1	0.532	0.273	0.90	1.00	1.00	1.00	1.000	1.00	1.00	1.00	9.82	957.9	1,800.0	2.67	65.2	238.5
+D+Lr					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 12.340 ft	1	0.553	0.284	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	14.17	1,382.0	2,500.0	3.85	94.0	331.3
+D+S					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 12.340 ft	1	0.647	0.332	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	15.25	1,488.0	2,300.0	4.15	101.2	304.8
+D+0.750Lr					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 12.340 ft	1	0.510	0.262	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	13.08	1,276.0	2,500.0	3.56	86.8	331.3
+D+0.750S					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 12.340 ft	1	0.589	0.303	1.15	1.00	1.00	1.00	1.000	1.00	1.00	1.00	13.89	1,355.5	2,300.0	3.78	92.2	304.8

Project Title:
Engineer:
Project ID:
Project Descr:

Wood Beam

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: UL-GL2

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios										Moment Values			Shear Values		
Segment Length	Span #	M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
+0.60D					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 12.340 ft	**1**	0.180	0.092	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	5.89	574.7	3,200.0	1.60	39.1	424.0

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.3561	6.215		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	4.944	4.944
Max Upward from Load Combinations	4.944	4.944
Max Upward from Load Cases	3.183	3.183
D Only	3.183	3.183
+D+Lr	4.592	4.592
+D+S	4.944	4.944
+D+0.750Lr	4.239	4.239
+D+0.750S	4.504	4.504
+0.60D	1.910	1.910
Lr Only	1.409	1.409
S Only	1.762	1.762

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	location Mercer Island, WA	date 06/23/23	
	client Olson Kundig		22-00638
	Foundation Design and Loading		

Calculation Objective:

1. Design retaining wall footing widths and pile spacing for worst case overturning loads.
2. Calculate worst case loading for typical one-way slab-at-grade (SAG) and grade beam (GB) design inputs. (Design loads used in respective design calculations for SAG and GB.)

References:

1. Geotechnical Engineering Report, Associated Earth Sciences, Inc., August 16, 2022
2. IBC 2018 and ASCE 7-16 [Load Combinations]

Retaining Wall Loads - Same for Each Wall

Active Pressure	35	pcf	
At-Rest Pressure	55	pcf	
Seismic Surcharge	5	*H psf	[Active Condition]
	10	*H psf	[At-Rest Condition]
Hydrostatic Pressure	0	pcf	[Drains]
Vertical Surharge	60	psf	
Fill Density	110	pcf	
K Value	0.32		

Resisting Loads

Passive Presure	300	pcf	[Equivalent Fluid]
	0	pcf	[Pile Pipe Supported]
Sliding Friction	0.35		

Allowable Bearing

Soil Bearing Pressure	2500	psf	
Concrete Density	145	pcf	

Piles, Axial Capacity:

Pile Diam.	3"	4"	6"
Capacity (k)	12	17	30

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Wall Design

Walls Retaining 12'-0" Soil

Height (T.O.Ftg to T.O.Fill) 13 ft
Depth (Ftg) 24 in

Axial Loads (Wall on Grid F, 6-7):

Level	DL (psf)	LL (psf)	TW (ft)	DL (klf)	LL (klf)
Wall & Ftg SW	-	-	-	3.190	-
Main Level	13	40	10.71	0.139	0.428
Upper Level	13	60	12.5	0.163	0.750
			Total	3.492	1.178

P_{wall} = 1.75 k/ft [Wall axial loads on pile, per linear foot]
w_{heel} = 1.75 ft [Width of heel]
t_{wall} = 12 in [Width of concrete wall]
d_{pile} = 1.750 ft [Distance from pile to center of wall]

Overturning Moments:

	Force (k/ft)	Distance (ft)	Moment (k-ft/ft)	
Active Backfill Pressure	3.938	5.00	19.69	(H)
Surcharge Pressure	0.248	8.50	2.11	(LL)
Lateral Pressure	1.125	7.50	8.44	(E)
		1.0H	19.69	
		1.0H + 0.7E	25.59	
		1.0L + 1.0 H	21.80	

Resisting Moments:

	Force (k/ft)	Distance (ft)	Moment (k-ft/ft)	
Soil Self Weight	2.503	1.38	3.44	(D)
Concrete Ftg Self Weight	0.508	1.38	0.70	(D)
		1.0D	4.14	

s_{pile} = 2 ft [Pile spacing]
P_{pile} = 13.25 k/ft [Resisting force in pile, per linear foot]
M_{OT} = 25.59 k-ft/ft [Overturning moment, per linear foot]
M_R = **27.33** k-ft/ft [Resisting moment, per linear foot]
$P_{R,pile}$ = 4.76 k/ft [Force in pile under retained soil, per linear foot]
$s_{R,pile}$ = 6 ft [Pile spacing, under retained soil]

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Foundation Design and Loading			

Wall Design (Cont'd)

Walls Retaining 8'-0" Soil

Height (T.O.Ftg to T.O.Fill) 8 ft

Depth (Ftg) 24 in

Axial Loads (Wall on Grid E, 1-3):

Level	DL (psf)	LL (psf)	TW (ft)	DL (klf)	LL (klf)
Wall & Ftg SW	-	-	-	1.249	-
Main Level	13	40	5	0.065	0.200
Upper Level	13	40	10	0.130	0.400
Upper Roof	20	16	9.6	0.192	0.154
			Total	1.636	0.754

P_{wall} = 0.82 k/ft [Wall axial loads on pile, per linear foot]

w_{heel} = 0.83 ft [Width of heel]

t_{wall} = 10 in [Width of concrete wall]

d = 0.83 ft [Distance from pile to center of wall]

Overturning Moments:

	Force (k/ft)	Distance (ft)	Moment (k-ft/ft)	
Active Backfill Pressure	1.750	3.33	5.83	(H)
Surcharge Pressure	0.153	6.00	0.92	(LL)
Lateral Pressure	0.500	5.00	2.50	(E)
		1.0 H	5.83	
		1.0 H + 0.7 E	7.58	
		1.0 L + 1.0 H	6.75	

Resisting Moments:

	Force (k/ft)	Distance (ft)	Moment (k-ft/ft)	
Soil Self Weight	2.191	0.83	1.82	(D)
Concrete Ftg Self Weight	0.241	0.83	0.20	(D)
		1.0 D	2.02	

s_{pile} = 4 ft [Pile spacing]

P_{pile} = 6.68 k/ft [Resisting force in pile, per linear foot]

M_{OT} = 7.58 k-ft/ft [Overturning moment, per linear foot]

M_R = **7.59** k-ft/ft [Resisting moment, per linear foot]

$P_{R,pile}$ = 3.25 k/ft [Force in pile under retained soil, per linear foot]

$s_{R,pile}$ = 9 ft [Pile spacing, under retained soil]

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	Foundation Design and Loading		

Grade Beam Loads

Slab at Grade Loading

Slab at Grade Loading Criteria:

TW_{max} =	13.58	ft	
p_{DL} =	5	psf	
p_{LL} =	60	psf	
V_{max} =	1.39	k/ft	[Max shear force per foot width of SAG span]

Max Pile Spacing:

Pile Diam.	3"	4"	6"
$s_{pile,max}$ (ft)	8.66	12.27	21.66

Grade Beam Loading

Grade Beam Dimensions:

b =	12	
h =	18	
w_{GB} =	225	plf

Slab at Grade Dimensions:

h =	8	in
p_{SAG} =	100	psf

Grade Beam Applied Loads:

w_{sw} =	1.583	klf	
w_{DL} =	0.068	klf	
w_{LL} =	0.815	klf	
w_{ult}	3.285	klf	
w_a	2.466	klf	

Grade Beam Forces for Design Spreadsheet:

L =	8	ft	
M_{ult} =	26.3	k-ft	[Considering single-span]
V_{ult} =	26.3	k	[Considering multi-span]
M_a =	19.7	k-ft	[Service moment, considering single span]

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Foundation Design and Loading			

Design and Loading Summary:

Footing Design

WF-3 For walls retaining 13 ft of soil, a footing with a width of 1'-9'' and depth of 24'' is required, supported by pile pipes spaced at 1'-0'' O.C.

WF-2 For walls retaining 8 ft of soil, a footing with a width of 0'-9.96'' and depth of 24'' is required, supported by [Pile spacing, under retained soil] pile pipes spaced at 1'-0''

Typical Slab At Grade Design

For one-way slab-at-grade design, an ultimate moment of 2.35 kip-ft and an ultimate shear of 0.69 kips should be used.
A maximum service moment of 1.5 kip-ft should also be checked.

Grade Beam Design

GB-1 For grade beam design, an ultimate moment of 26.28 kip-ft and an ultimate shear of 26.28 kips should be used.
A maximum service moment of 19.73 kip-ft should also be checked.

Pool Slab At Grade Design

For one-way slab-at-grade design, an ultimate moment of 5.46 kip-ft and an ultimate shear of 2.08 kips should be used.
A maximum service moment of 4.27 kip-ft should also be checked.

Pool Slab at Grade Loading

Pool Slab at Grade Loading Criteria:

TW_{max} =	10.5	ft	
p_{DL} =	250	psf	
p_{LL} =	60	psf	
V_{max} =	4.16	k/ft	[Max shear force per foot width of SAG span]

Max Pile Spacing:

Pile Diam.	3"	4"	6"
$s_{pile,max}$ (ft)	2.89	4.09	7.22

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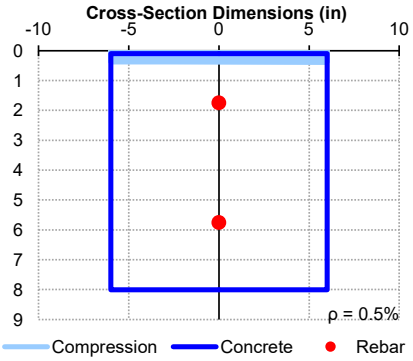
	client	Olson Kundig			job no. 22-00638
		Slab-at-Grade Design			

ONE-WAY SLAB DESIGN



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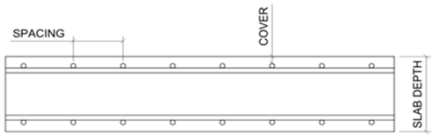
INPUT PARAMETERS:

CROSS-SECTION DIMENSIONS



Section Shape? Slab Type 1

Slab Width	b =	12.0 in	
Slab Depth	h =	8.0 in	
Exposure	Top	Exposed	20.6.1.3.1
	Bottom	Not Exposed	20.6.1.3.1

COVER PARAMETERS

Top Cover	CLR =	1.5	in
Bottom Cover	CLR =	2	in

As Overwrite? NO

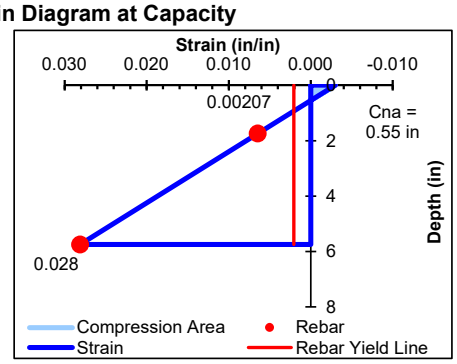
FLEXURAL REBAR DIMENSIONS

Layer	Bar # (U.S.)	d_{layer} (in)	on center sp. (in)
Top	#4	1.750	10.00
Bot	#4	5.750	10.00

TEMPERATURE AND SHRINKAGE REINFORCING

Top	#4	2.250	18.00	OK
Bot	#4	5.250	18.00	OK

Strain Diagram at Capacity



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MATERIAL PROPERTIES

Concrete 28 Day Compressive Strength	f'_{c28} =	3.0	ksi
Concrete Type	Type =	Normal weight	
Concrete Weight	γ_c =	150	pcf
Flexural Reinforcement Yield Strength	f_y =	60	ksi

ANALYSIS OUTPUT: (Referenced to ACI 318-14 Requirements)

STATUS: GOOD - PASSES ACI 318

FLEXURAL STRENGTH

				Reference
Nominal Moment Strength Capacity	M_n =	6.6	kip-ft	
Reduction Factor, ϕ	ϕ =	0.90		21.2.2
Design Positive Moment Capacity	**ϕM_n =**	**6.0**	**kip-ft**	
Factored Positive Moment Demand	**M_u =**	**2.35**	**kip-ft**	

GOOD - ϕMn > Mu

SHEAR STRENGTH

Nominal Shear Strength Capacity	V_n =	7.6	kips	22.5.5.1
Reduction Factor, ϕ	ϕ =	0.75		21.2.1
Design Shear Strength Capacity	**ϕV_n =**	**5.7**	**kips**	22.5.5.1
Factored Shear Demand	**V_u =**	**0.69**	**kips**	

GOOD - ϕVn > Vu

SERVICABILITY

Concrete 28 Day Modulus of Elasticity	E_{c28} =	3122	ksi	19.2.2
Gross Moment of Inertia	I_g =	523	in^4	24.1.2.5
Cracked Moment of Inertia	I_{cr} =	54	in^4	24.2.3.5
Cracking Moment	**M_{cr} =**	**4.9**	**kip-ft**	24.2.3.5b
Moment for Deflection *(Service Demand)*	**M_a =**	**1.5**	**kip-ft**	
Effective Moment of Inertia	I_e = B118	523	in^4	24.2.3.5a

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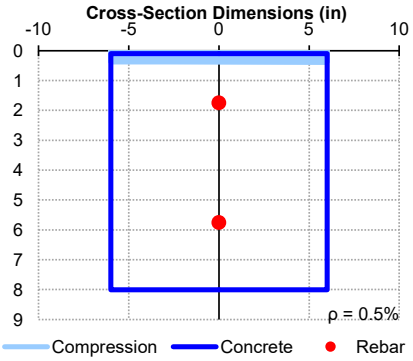
location	Mercer Island, WA	date	3/29/2023
client	Olson Kundig		
	Slab-at-Grade Design		

sheet no.

job no. 22-00638

ONE-WAY SLAB DESIGN



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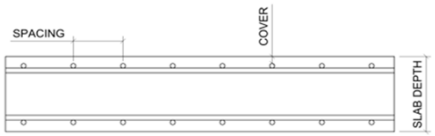


Section Shape? Slab Type 1

Slab Width	b =	12.0 in	
Slab Depth	h =	8.0 in	
Exposure	Top	Exposed	20.6.1.3.1
	Bottom	Not Exposed	20.6.1.3.1

COVER PARAMETERS

Top Cover	CLR =	1.5	in
Bottom Cover	CLR =	2	in

As Overwrite? NO

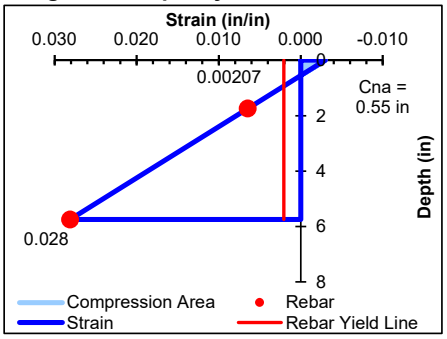
FLEXURAL REBAR DIMENSIONS

Layer	Bar # (U.S.)	d_{layer} (in)	on center sp. (in)
Top	#4	1.750	10.00
Bot	#4	5.750	10.00

TEMPERATURE AND SHRINKAGE REINFORCING

Top	#4	2.250	18.00	OK
Bot	#4	5.250	18.00	OK

Strain Diagram at Capacity



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MATERIAL PROPERTIES

Concrete 28 Day Compressive Strength	f'_{c28} =	3.0	ksi
Concrete Type	Type =	Normal weight	
Concrete Weight	γ_c =	150	pcf
Flexural Reinforcement Yield Strength	f_y =	60	ksi

ANALYSIS OUTPUT: (Referenced to ACI 318-14 Requirements)

Reference | **STATUS:**

FLEXURAL STRENGTH

				Reference	
Nominal Moment Strength Capacity	M_n =	6.6	kip-ft		
Reduction Factor, ϕ	ϕ =	0.90		21.2.2	
Design Positive Moment Capacity	**ϕM_n =**	**6.0**	**kip-ft**		
Factored Positive Moment Demand	**M_u =**	**5.46**	**kip-ft**		GOOD - ϕMn > Mu

SHEAR STRENGTH

				Reference	
Nominal Shear Strength Capacity	V_n =	7.6	kips	22.5.5.1	
Reduction Factor, ϕ	ϕ =	0.75		21.2.1	
Design Shear Strength Capacity	**ϕV_n =**	**5.7**	**kips**	22.5.5.1	
Factored Shear Demand	**V_u =**	**2.08**	**kips**		GOOD - ϕVn > Vu

SERVICABILITY

				Reference
Concrete 28 Day Modulus of Elasticity	E_{c28} =	3122	ksi	19.2.2
Gross Moment of Inertia	I_g =	523	in⁴	24.1.2.5
Cracked Moment of Inertia	I_{cr} =	54	in⁴	24.2.3.5
Cracking Moment	**M_{cr} =**	**4.9**	**kip-ft**	24.2.3.5b
Moment for Deflection *(Service Demand)*	**M_a =**	**4.27**	**kip-ft**	
Effective Moment of Inertia	I_e = B119	523	in⁴	24.2.3.5a

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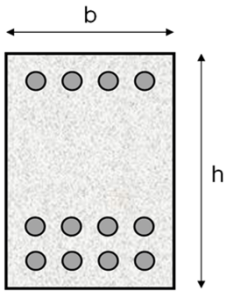
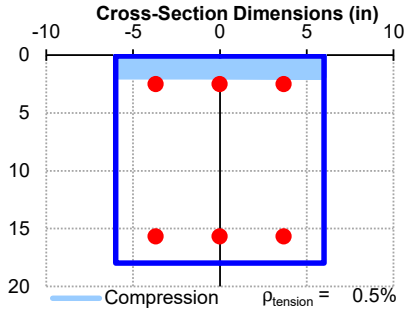
client	Olson Kundig		job no. 22-00638
	Grade Beam Design		

CONCRETE BEAM DESIGN





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INPUT PARAMETERS:

CROSS-SECTION DIMENSIONS

Section Shape? Rectangular

Beam Width b = 12.0 in

Beam Height h = 18.0 in

FLEXURAL REBAR DIMENSIONS

Layer	# of Bars	Bar # (U.S.)	d_{layer} (in)	clear sp. (in)	Bar purpose
1	3	#5	15.688	3.06	Tension Bars
2	3	#5	2.500	3.06	Comp. Bars
3	0	N/A	0.000	N/A	N/A
4	0	N/A	0.000	N/A	N/A
5	0	N/A	0.000	N/A	N/A

Strain Diagram at Capacity

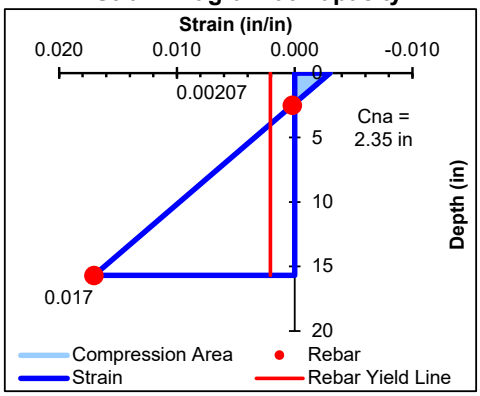


Image for reference only and is not to scale.
Items shown may not be accurate.

STIRRUP DIMENSIONS

Number of Shear Legs	# of legs =	2
Bar # (U.S.)	Bar # =	#4
Shear Stirrup Spacing	s =	6 in
Minimum Clear Cover to Stirrup	CLR_{MIN} =	1.5 in

MATERIAL PROPERTIES

Concrete 28 Day Compressive Strength	f'_{c28} =	3.0 ksi
Concrete Type	Type =	Normalweight
Concrete Weight	γ_c =	150 pcf
Flexural Reinforcement Yield Strength	f_y =	60 ksi
Stirrup Yield Strength	f_{yt} =	60 ksi

ANALYSIS OUTPUT: (Referenced to ACI 318-14 Requirements)

			Reference	STATUS:
FLEXURAL STRENGTH				GOOD - PASSES ACI 318
Nominal Moment Strength Capacity	M_n =	69.0 kip-ft		
Reduction Factor, ϕ	ϕ =	0.90	21.2.2	
Design Moment Strength Capacity	**ϕM_n =**	**62.1 kip-ft**		
Design Axial Strength Capacity	**ϕP_{n_comp} =**	**342.0 kip**	22.4.2.2	
	ϕP_{n_t} =	**-100.4 kip**	22.4.3.1	
Factored Moment and Axial Demand	**M_u =**	**26.278 kip-ft**		GOOD - ϕMn > Mu
	P_u =	**0 kip**		
SHEAR STRENGTH				
Nominal Shear Strength Capacity	V_n =	83.4 kips	9.5.1.1(b)	
Reduction Factor, ϕ	ϕ =	0.75	21.2.1	Vn = 1.0Vc + 1.0Vs
Design Shear Strength Capacity	**ϕV_n =**	**62.5 kips**	9.5.1.1(b)	
Factored Shear Demand	**V_u =**	**26.278 kips**		GOOD - ϕVn > Vu
SERVICABILITY				
Concrete 28 Day Modulus of Elasticity	E_{c28} =	3122 ksi	19.2.2	
Gross Moment of Inertia	I_g =	5832 in⁴	24.1.2.5	
Cracked Moment of Inertia	I_{cr} =	1436 in⁴	24.2.3.5	
Cracking Moment	**M_{cr} =**	**22.2 kip-ft**	24.2.3.5b	
Moment for Deflection *(Service Demand)*	**M_a =**	**19.726 kip-ft**		
Effective Moment of Inertia	I_e = B120	5832 in⁴	24.2.3.5a	

kpff 1601 5th Avenue, Suite 1600 Seattle, WA 98101 206.622.5822	project: Fused Elements Residence	by: CBJ	sheet no.
	location: Mercer Island, WA	date: 6/23/2023	
	client: Olson Kundig		job no. 22-00638
	Pile Cap Design		

PILE CAP DESIGN - 4 PILES

Calculations based on ACI 318-14 and 2015 CRSI Design Guide

INPUT PARAMETERS

Seismic Design Condition: Non-Seismic — *Ref ACI 318 21.2.4*

PILE AND COLUMN DIMENSIONS

Pile Type & Capacity	Steel	15	tons/pile
Pile Shape & Size	Round	6	in dia
Pile Horizontal Mislocation	Δ_h =	3	in
Pile Vertical Mislocation	Δ_v =	2	in
Column Shape & Size	Rectangle	12	in wide
		12	in deep

MATERIAL PROPERTIES

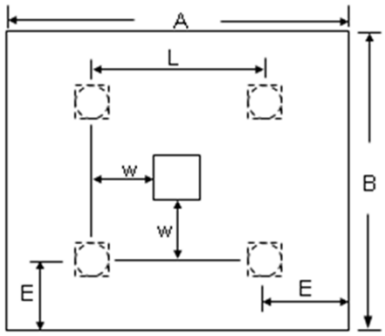
Concrete Compressive Strength	f'_c =	4,000	psi
Reinforcement Yield Strength	f_y =	60,000	psi
Concrete Type		Normalweight	
Reinforced Concrete Weight	γ_c =	150	pcf

PILE CAP DIMENSIONS

Pile Spacing	L =	12	in
Pile Edge Distance	E =	12	in
Pile Cap Thickness	t_{cap} =	21	in
Pile Cap Cover (all faces)	Cover =	3	in
Pile Embed	Embed =	6	in
Pile Offset, Direction A	w_A =	0.0	in
Pile Offset, Direction B	w_B =	0.0	in

Pile Cap Size (A x B x t_{cap}): **3.00 ft x 3.00 ft x 21 in**

PILE CAP LAYOUT



FLEXURAL REINFORCEMENT

Minimum Reinforcement Ratio: ρ_{min} = 0.0018 — *Ref ACI 318 24.4.3.2*

Longitudinal Reinforcement:	**(5)**	**#5**		**Bars w/hook**
Total Reinforcement Area	A_s =	1.55	in^2	
Required Reinforcement Area	$A_{s,req}$ =	1.36	in^2	*Governed by flexural minimum*
Spacing	s =	7.5	in OC	
Transverse Reinforcement:	**(5)**	**#5**		**Bars w/hook**
Total Reinforcement Area	A_s =	1.55	in^2	
Required Reinforcement Area	$A_{s,req}$ =	1.36	in^2	*Governed by flexural minimum*
Spacing	s =	7.5	in OC	

ANALYSIS SUMMARY

Load Factor: U = 1.5

SHEAR STRENGTH

Reduction Factor: ϕ_v = 0.75 — *Ref ACI 318 21.2.1*

Governing Ratio: $V_u/\phi V_n$ = 0.64 — **OK** — *Governed by 45-degree failure*

FLEXURAL STRENGTH

Reduction Factor: ϕ_b = 0.90 — *Ref ACI 318 21.2.1*

Governing Ratio: $M_u/\phi M_n$ = 0.19 — **OK** — *Governed by flexural minimum*

BEARING STRENGTH

Reduction Factor: $\phi_{bearing}$ = 0.65 — *Ref ACI 318 21.2.1*

Governing Ratio: $\sigma_u/\phi\sigma_n$ = 0.28 — **OK**

NET DESIGN CAPACITY OF PILE CAP

Ultimate Capacity	$P_{u,net}$ =	**177**	**kip**	*Max factored load at column base (Ref CRSI pg. 8-2)*
Service Capacity	P_{net} =	**118**	**kip**	*Max service load at column base (Ref CRSI pg. 8-2)*

kpff 1601 5th Avenue, Suite 1600 Seattle, WA 98101 206.622.5822	project	Fused Elements Residence	by CBJ	sheet no.
	location	Mercer Island, WA	date 6/23/2023	
	client	Olson Kundig		job no. 22-00638
		Pile Cap Design		

PILE CAP DESIGN - 4 PILES

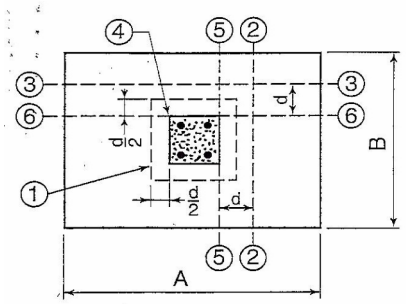
Calculations based on ACI 318-14 and 2015 CRSI Design Guide

DESIGN CALCULATIONS

SHEAR

(Ref CRSI pg. 5-2 - 5-4 / ACI 318 Ch.22.5,22.6)

Effective Shear Depth	d_v =	13.0	in



Nomenclature
Critical Shear Sections

1. 2-way at d/2 from face of column
2. 1-way at d from face of column in direction of short width "B"
3. 1-way at d from face of column in direction of long width "A"
4. 2-way at face of column
5. 1-way at face of column in direction of short width "B"
6. 1-way at face of column in direction of long width "A"

Case 1: Two-Way Shear at Column		**N/A**	*d/2 > w for all piles*	
Section Perimeter	b_o =	100.0	in	
Shear Demand	V_u =	0	kips	
Shear Capacity	ϕV_c =	--	kips	
Case 2: One-Way Shear at Column		**N/A**	*d > w*	
Effective Width	b =	36.0	in	
Shear Demand	V_u =	0	kips	
Shear Capacity	ϕV_c =	--	kips	
Case 3: One-Way Shear at Column		**N/A**	*d > w*	
Effective Width	b =	36.0	in	
Shear Demand	V_u =	0	kips	
Shear Capacity	ϕV_c =	--	kips	
Case 4: Two-Way Shear at Column Face		**OK**		
Effective Perimeter	b =	48.0	in	
Shear Demand	V_u =	177	kips	
Shear Capacity	ϕV_c =	534	kips	
Case 5: One-Way Shear at Column Face		**OK**		
Shear Demand	V_u =	89	kips	
Moment Demand	M_u =	264	k-in	
Ratio	$V_u d/M_u$ =	4.380		
Shear Capacity	ϕV_c =	222	kips	

Case 6: One-Way Shear at Column Face		**OK**	
Shear Demand	V_u =	89	kips
Moment Demand	M_u =	264	k-in
Ratio	$V_u d/M_u$ =	4.380	
Shear Capacity	ϕV_c =	222	kips
Case P3: Two-Way Shear at Corner		**OK**	
Effective Width	b =	34.7	in
Shear Demand	V_u =	45	kips
Shear Capacity	ϕV_c =	86	kips
Case P4: One-Way Shear at Corner		**OK**	
Effective Width	b =	57.5	in
Shear Demand	V_u =	45	kips
Shear Capacity	ϕV_c =	71	kips

FLEXURE

(Ref ACI 318 Ch. 22.3)

Longitudinal			OK	
Moment Demand	M_u =	264	k-in	
Depth of Reinforcement	d_s =	17.38	in	
Area of Steel Demand	$A_{s,demand}$ =	0.31	in^2	
Required Area of Steel	$A_{s,req}$ =	1.36	in^2	
Longitudinal Reinforcement:	(5)	#5		
Longitudinal Spacing	s =	7.5	in OC	
Total Reinforcement Area	A_s =	1.55	in^2	
Moment Capacity	ϕM_n =	1,422	k-in	
TENSION CONTROL?		**OK**		
Development Length, w/o hook	L_d =	17.8	in	
Development Length w/hook	L_{dh} =	8.4	in	
Development Length Available	Embed =	9.00	in	
DEVELOPMENT CHECK		**OK w/ Hook**		

Transverse			OK	
Moment Demand	M_u =	264	k-in	
Depth of Reinforcement	d_s =	17.38	in	
Area of Steel Demand	$A_{s,demand}$ =	0.31	in^2	
Required Area of Steel	$A_{s,req}$ =	1.36	in^2	
Transverse Reinforcement:	(5)	#5		
Transverse Spacing	s =	7.5	in OC	
Total Reinforcement Area	A_s =	1.55	in^2	
Moment Capacity	ϕM_n =	1,422	k-in	
TENSION CONTROL?		**OK**		
Development Length, w/o hook	L_d =	17.8	in	
Development Length w/hook	L_{dh} =	8.4	in	
Development Length Available	Embed =	9.00	in	
DEVELOPMENT CHECK		**OK w/ Hook**		

COLUMN BEARING

(Ref CRSI pg. 8-2/ ACI 318-22.8)

Factored Self Wt. of Concrete	W_c =	3.3	kips
Net Design Capacity	$P_{u,net}$ =	177	kips
Bearing Demand	σ_u =	1227	psi
Loaded Area	A_1 =	144	in^2
Projected Area	A_2 =	1296	in^2
Increase Factor	$\sqrt{(A_2/A_1)}$ =	2.00	
Bearing Strength	$\phi\sigma_n$ =	4420	psi
BEARING CHECK		**OK**	

Project Title:
Engineer:
Project ID:
Project Descr:

"UR-LSL" ON KEY PLAN

Wood Beam

Project File: Fe Designs.ec6

LIC# : KW-06018139, Build:20.22.6.4 KPFF CONSULTING ENGINEERS SEA (c) ENERCALC INC 1983-2022

DESCRIPTION: Guest Bed Roof Cant beam

CODE REFERENCES

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

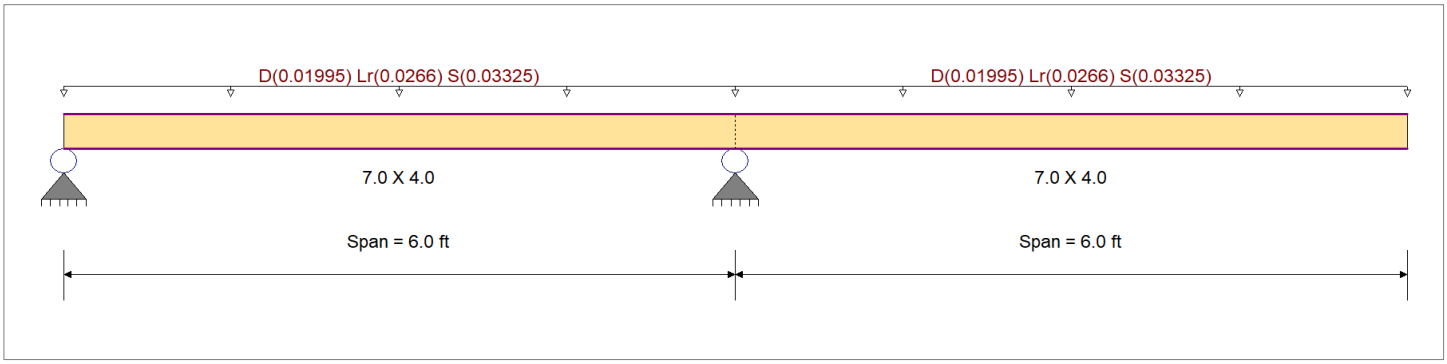
Material Properties

Analysis Method :	Allowable Stress Design
Load Combination :	ASCE 7-16
Wood Species :	iLevel Truss Joist
Wood Grade :	TimberStrand LSL 1.55E
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling

Fb +	2,325.0 psi
Fb -	2,325.0 psi
Fc - Prll	2,050.0 psi
Fc - Perp	800.0 psi
Fv	310.0 psi
Ft	1,070.0 psi

E : Modulus of Elasticity

Ebend- xx	1,550.0 ksi
Eminbend - xx	787.82 ksi
Density	45.010 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Load for Span Number 1
Uniform Load : D = 0.0150, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 1.330 ft
Load for Span Number 2
Uniform Load : D = 0.0150, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 1.330 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.230 : 1	Maximum Shear Stress Ratio	=	0.046 : 1
Section used for this span		7.0 X 4.0	Section used for this span		7.0 X 4.0
fb: Actual	=	615.60 psi	fv: Actual	=	16.24 psi
Fb: Allowable	=	2,673.75 psi	Fv: Allowable	=	356.50 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	6.000 ft	Location of maximum on span	=	5.698 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.321 in	Ratio =	448	>=360	Span: 2 : S Only
Max Upward Transient Deflection	-0.025 in	Ratio =	2825	>=360	Span: 1 : S Only
Max Downward Total Deflection	0.514 in	Ratio =	280	>=240	Span: 2 : +D+S
Max Upward Total Deflection	-0.041 in	Ratio =	1765	>=240	Span: 1 : +D+S

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios									Moment Values			Shear Values		
Segment Length	Span #	M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	M	fb	F'b	V	fv	F'v
D Only													0.00	0.00	0.00	0.00
Length = 6.0 ft	1	0.110	0.022	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.36	230.85	2092.50	0.11	6.09	279.00
Length = 6.0 ft	2	0.110	0.022	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.36	230.85	2092.50	0.11	6.09	279.00
+D+Lr					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.0 ft	1	0.185	0.037	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.84	538.65	2906.25	0.27	14.21	387.50
Length = 6.0 ft	2	0.185	0.037	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.84	538.65	2906.25	0.27	14.21	387.50
+D+S					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.0 ft	1	0.230	0.046	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.96	615.60	2673.75	0.30	16.24	356.50
Length = 6.0 ft	2	0.230	0.046	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.96	615.60	2673.75	0.30	16.24	356.50
+D+0.750Lr					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00

Project Title:
Engineer:
Project ID:
Project Descr:

Wood Beam

Project File: Fe Designs.ec6

LIC# : KW-06018139, Build:20.22.6.4 KPFF CONSULTING ENGINEERS SEA (c) ENERCALC INC 1983-2022

DESCRIPTION: Guest Bed Roof Cant beam

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios									Moment Values			Shear Values		
Segment Length	Span #	M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	M	fb	F'b	V	fv	F'v
Length = 6.0 ft	**1**	0.159	0.031	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.72	461.70	2906.25	0.23	12.18	387.50
Length = 6.0 ft	**2**	0.159	0.031	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.72	461.70	2906.25	0.23	12.18	387.50
+D+0.750S					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.0 ft	**1**	0.194	0.038	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.81	519.41	2673.75	0.26	13.70	356.50
Length = 6.0 ft	**2**	0.194	0.038	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.81	519.41	2673.75	0.26	13.70	356.50
+0.60D					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 6.0 ft	**1**	0.037	0.007	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.22	138.51	3720.00	0.07	3.65	496.00
Length = 6.0 ft	**2**	0.037	0.007	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.22	138.51	3720.00	0.07	3.65	496.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
	1	0.0000	0.000	+D+S	-0.0408	3.788
+D+S	2	0.5138	6.000		0.0000	3.788

Maximum Deflections for Load Combinations

Load Combination	Span	Max. Downward Defl		Location in Span	Max. Upward Defl		Location in Span	
D Only	2	0.1927	in	6.000 ft	0.0000	in	0.000	ft
+D+Lr	2	0.4495	in	6.000 ft	0.0000	in	0.000	ft
+D+S	2	0.5138	in	6.000 ft	0.0000	in	0.000	ft
+D+0.750Lr	2	0.3853	in	6.000 ft	0.0000	in	0.000	ft
+D+0.750S	2	0.4335	in	6.000 ft	0.0000	in	0.000	ft
+0.60D	2	0.1156	in	6.000 ft	0.0000	in	0.000	ft
Lr Only	2	0.2569	in	6.000 ft	0.0000	in	0.000	ft
S Only	2	0.3211	in	6.000 ft	0.0000	in	0.000	ft

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	0.000	0.638	
Overall MINimum	0.000	0.399	
D Only	0.000	0.239	
+D+Lr	0.000	0.559	
+D+S	0.000	0.638	
+D+0.750Lr	0.000	0.479	
+D+0.750S	0.000	0.539	
+0.60D	0.000	0.144	
Lr Only	0.000	0.319	
S Only	0.000	0.399	

Project Title:
Engineer:
Project ID:
Project Descr:

Composite Steel Beam

Project File: Fused Elements Calcs.ec6

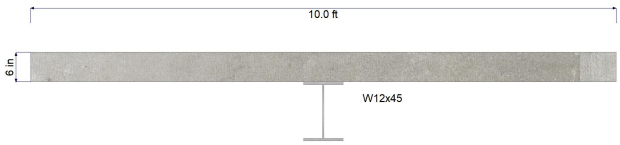
DESCRIPTION: Typical Garage Composite Beam

CODE REFERENCES

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

Material Properties

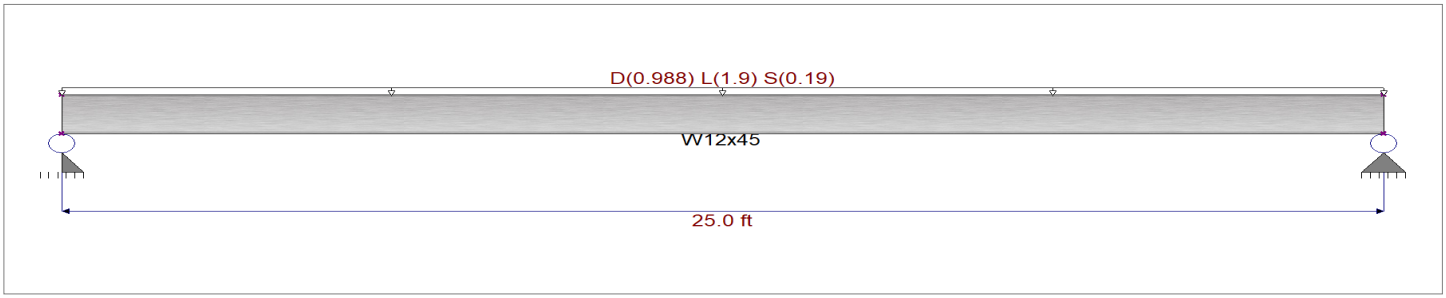
Analysis Method : Load Resistance Factor Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buc
Load Combination ASCE 7-16
Fy : Steel Yield : 50.0 ksi E: Modulus : 29,000.0 ksi



Composite Beam Section Data

Beam is UNSHORED for Concrete Placement

Total Slab Thickness	6.0 in	Concrete f'c	3.0 ksi	Stud Diameter	3/4" in
Effective Width	10.0 ft	Concrete Density	145.0 pcf	Qn : Stud Capacity	11.0 k



Applied Loads

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

Load for Span Number 1
Uniform Load : D = 0.130, L = 0.250, S = 0.0250 ksf, Tributary Width = 7.60 ft, Post Composite Only

DESIGN SUMMARY

Design OK

MAX Bending Ratio = **0.958** : 1
Steel section **W12x45**

Composite

% Composite Action **25** %
Mu : Applied 337.547 k-ft
Mn * Phi : Allow 352.356 k-ft
Location of maximum 12.50 ft
Load Combination
+1.20D+1.60L+0.50S+1.60H

Pre-Composite

Mu : Applied 0.0 k-ft
Mn * Phi : Allowable 240.750 k-ft

MAX Shear Ratio = **0.444** : 1
Vu : Applied 54.008 k
Vn * Phi : Allow 121.605 k
Location of maximum 0.0 ft
Load Combination
+1.20D+1.60L+0.50S+1.60H

DEFLECTIONS

FINAL Composite
Max Downward 1.243 in
Max Upward 0.000 in
Defl Ratio 241
+D+L+H

Transient Composite
Max Downward 0.818 in
Max Upward 0.000 in
Defl Ratio 366
L Only

NonComposite
Max Downward 0.000 in
Max Upward 0.000 in
Defl Ratio N/A
PreCompDL+PreCompLL

Shear Stud Requirements

From Support 1 to 12.50 ft use 15 studs.
From 12.50 ft to Support 2 use 15 studs.

Maximum Forces & Stresses for Load Combir

Load Comb & Design Length	Span #	Max Stress Ratios M	V	Bending Summary Mu-Applied	MnTr * Phi		Shear Summary Va	Vn * Phi
Pre Composite : D + Const L								
Span L = 25 ft	1							
Final Composite : +1.40D+1.60H								
Span L = 25 ft	1	0.307	0.142	B125	108.06	352.36	17.29	121.61
Final Composite : +1.20D+0.50Lı								

Project Title:
Engineer:
Project ID:
Project Descr:

Composite Steel Beam

Project File: Fused Elements Calcs.ec6

DESCRIPTION: Typical Garage Composite Beam

Load Comb & Design Length	Span #	Max Stress Ratios M	V	Bending Summary Mu-Applied	MnTr * Phi	Shear Summary Va	Vn * Phi
Span L = 25 ft	1	0.937	0.434	330.13	352.36	52.82	121.61
Final Composite : +1.20D+1.60L-							
Span L = 25 ft	1	0.958	0.444	337.55	352.36	54.01	121.61
Final Composite : +1.20D+1.60Lı							
Span L = 25 ft	1	0.684	0.317	241.06	352.36	38.57	121.61
Final Composite : +1.20D+1.60Lı							
Span L = 25 ft	1	0.263	0.122	92.63	352.36	14.82	121.61
Final Composite : +1.20D+L+1.6(							
Span L = 25 ft	1	0.752	0.348	264.81	352.36	42.37	121.61
Final Composite : +1.20D+1.60S							
Span L = 25 ft	1	0.330	0.153	116.38	352.36	18.62	121.61
Final Composite : +1.20D+0.50Lı							
Span L = 25 ft	1	0.684	0.317	241.06	352.36	38.57	121.61
Final Composite : +1.20D+L+0.5(							
Span L = 25 ft	1	0.705	0.327	248.48	352.36	39.76	121.61
Final Composite : +0.90D+W+1.(							
Span L = 25 ft	1	0.197	0.091	69.47	352.36	11.12	121.61
Final Composite : +1.20D+L+0.2(							
Span L = 25 ft	1	0.693	0.321	244.03	352.36	39.05	121.61
Final Composite : +0.90D+E+0.9							
Span L = 25 ft	1	0.197	0.091	69.47	352.36	11.12	121.61

Maximum Deflections for Load Combinations - Unfactored Loads

Load Combination		Location in Span (ft)	FINAL	DEFLECTIONS (in) Pre-Composite	onComposite Remove	Added Post Composite	Ixx - Used in^4
Precomposite	Downward	25.000	**0.000**				348.00
Precomposite	Upward	25.000	**0.000**				348.00
NonComposite Removed	Downward	25.000	**0.000**				0.00
NonComposite Removed	Upward	25.000	**0.000**				0.00
Final Composite : +D+H	Downward	12.667	**0.425**				711.72
Final Composite : +D+H	Upward	0.000	**0.000**				711.72
Final Composite : +D+L+H	Downward	12.667	**1.243**				711.72
Final Composite : +D+L+H	Upward	0.000	**0.000**				711.72
Final Composite : +D+Lr+H	Downward	12.667	**0.425**				711.72
Final Composite : +D+Lr+H	Upward	0.000	**0.000**				711.72
Final Composite : +D+S+H	Downward	12.667	**0.507**				711.72
Final Composite : +D+S+H	Upward	0.000	**0.000**				711.72
Final Composite : +D+0.750Lr+0.7	Downward	12.667	**1.038**				711.72
Final Composite : +D+0.750Lr+0.7	Upward	0.000	**0.000**				711.72
Final Composite : +D+0.750L+0.7	Downward	12.667	**1.100**				711.72
Final Composite : +D+0.750L+0.7	Upward	0.000	**0.000**				711.72
Final Composite : +D+0.60W+H	Downward	12.667	**0.425**				711.72
Final Composite : +D+0.60W+H	Upward	0.000	**0.000**				711.72
Final Composite : +D+0.750Lr+0.7	Downward	12.667	**1.038**				711.72
Final Composite : +D+0.750Lr+0.7	Upward	0.000	**0.000**				711.72
Final Composite : +D+0.750L+0.7	Downward	12.667	**1.100**				711.72
Final Composite : +D+0.750L+0.7	Upward	0.000	**0.000**				711.72
Final Composite : +0.60D+0.60W+	Downward	12.667	**0.255**				711.72
Final Composite : +0.60D+0.60W+	Upward	0.000	**0.000**				711.72
Final Composite : +D+0.70E+0.60	Downward	12.667	**0.425**				711.72
Final Composite : +D+0.70E+0.60	Upward	0.000	**0.000**				711.72
Final Composite : +D+0.750L+0.7	Downward	12.667	**1.100**				711.72
Final Composite : +D+0.750L+0.7	Upward	0.000	**0.000**				711.72
Final Composite : +0.60D+0.70E+	Downward	12.667	**0.255**				711.72
Final Composite : +0.60D+0.70E+	Upward	0.000	**0.000**				711.72
Final Composite : D Only	Downward	12.667	**0.425**				711.72
Final Composite : D Only	Upward	0.000	**0.000**				711.72
Final Composite : Lr Only	Downward	25.000	**0.000**				711.72
Final Composite : Lr Only	Upward	25.000	**0.000**				711.72
Final Composite : L Only	Downward	12.667	**0.818**				711.72
Final Composite : L Only	Upward	0.000	**0.000**				711.72
Final Composite : S Only	Downward	12.667	**0.082**				711.72
Final Composite : S Only	Upward	0.000	**0.000**				711.72
Final Composite : W Only	Downward	25.000	**0.000**				711.72
Final Composite : W Only	Upward	25.000	**0.000**				711.72
Final Composite : E Only	Downward	25.000	**0.000**				711.72
Final Composite : E Only	Upward	25.000	**0.000**				711.72
Final Composite : H Only	Downward	25.000	**0.000**				711.72
Final Composite : H Only	Upward	25.000	**0.000**				711.72

Project Title:
Engineer:
Project ID:
Project Descr:

Composite Steel Beam

Project File: Fused Elements Calcs.ec6

DESCRIPTION: Typical Garage Composite Beam

Maximum Vertical Reactions - Unfactored

Support notation : Far left is #:

Load Combination	Support 1	Support 2
Overall MAXimum333	36.100	36.100
Precomposite Loads		
NonComposite Removed		
Final Composite : +D+H	12.350	12.350
Final Composite : +D+L+H	36.100	36.100
Final Composite : +D+Lr+H	12.350	12.350
Final Composite : +D+S+H	14.725	14.725
Final Composite : +D+0.750Lr+0.	30.163	30.163
Final Composite : +D+0.750L+0.7	31.944	31.944
Final Composite : +D+0.60W+H	12.350	12.350
Final Composite : +D+0.750Lr+0.	30.163	30.163
Final Composite : +D+0.750L+0.7	31.944	31.944
Final Composite : +0.60D+0.60W	7.410	7.410
Final Composite : +D+0.70E+0.6	12.350	12.350
Final Composite : +D+0.750L+0.7	31.944	31.944
Final Composite : +0.60D+0.70E	7.410	7.410
Final Composite : D Only	12.350	12.350
Final Composite : Lr Only		
Final Composite : L Only	23.750	23.750
Final Composite : S Only	2.375	2.375
Final Composite : W Only		
Final Composite : E Only		
Final Composite : H Only		

Steel Section Properties W12x45

Depth	=	12.100	in	I xx	=	348.00	in^4	I yy	=	50.000	in^4
Web Thick	=	0.335	in	S xx	=	57.70	in^3	S yy	=	12.400	in^3
Flange Width	=	8.050	in	R xx	=	5.150	in	R yy	=	1.950	in
Flange Thick	=	0.575	in	Zx	=	64.200	in^3	Zy	=	19.000	in^3
Area	=	13.100	in^2					J	=	1.260	in^4
Weight	=	45.000	plf								

Composite Section Properties

Span Number / Plastic N. A. Location	Analysis Type	% Shear Connection	Plastic N.A. from Bottom	Sum Qn Shear (k)	# Studs per 1/2 Span	Mn - Capacity k-ft	Moment of Inertia I-Steel	I-Trans	I-Lwr Bound
PNA in Slab		100.0	12.100	655.000	60	599.31	348.0	1,502.3	1,137.6
PNA in Flange		95.0	12.059	622.250	57	599.31	348.0	1,502.3	1,124.9
PNA in Flange		90.0	12.019	589.500	54	599.31	348.0	1,502.3	1,110.7
PNA in Flange		85.0	11.978	556.750	51	595.59	348.0	1,502.3	1,095.0
PNA in Flange		80.0	11.937	524.000	48	579.71	348.0	1,502.3	1,077.5
PNA in Flange		75.0	11.897	491.250	45	563.73	348.0	1,502.3	1,058.2
PNA in Flange		70.0	11.856	458.500	42	547.65	348.0	1,502.3	1,036.9
PNA in Flange		65.0	11.815	425.750	39	531.46	348.0	1,502.3	1,013.3
PNA in Flange		60.0	11.775	393.000	36	515.17	348.0	1,502.3	987.3
PNA in Flange		55.0	11.734	360.250	33	498.78	348.0	1,502.3	958.6
PNA in Flange		50.0	11.693	327.500	30	482.29	348.0	1,502.3	927.0
PNA in Flange		45.0	11.652	294.750	27	465.71	348.0	1,502.3	892.1
PNA in Flange		40.0	11.612	262.000	24	449.02	348.0	1,502.3	853.5
PNA in Flange		35.0	11.571	229.250	21	432.23	348.0	1,502.3	811.0
PNA in Flange		30.0	11.530	196.500	18	415.35	348.0	1,502.3	763.9
PNA in Web		25.0	10.678	163.750	15	391.51	348.0	1,502.3	711.7
Span 1									

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements Calcs.ec6

DESCRIPTION: Garage Beam Girder

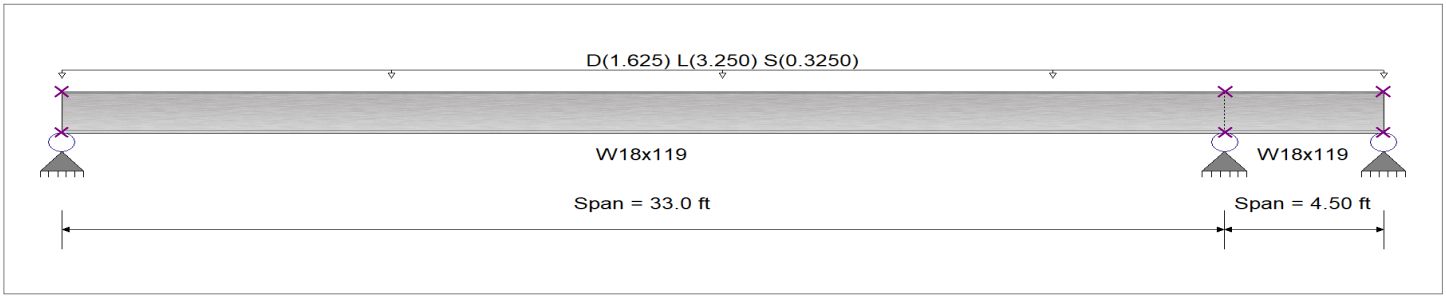
CODE REFERENCES

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

Material Properties

Analysis Method : Load Resistance Factor Design
Beam Bracing : Completely Unbraced
Bending Axis : Major Axis Bending

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



Applied Loads

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

Beam self weight calculated and added to loading
Loads on all spans...
Uniform Load on ALL spans : D = 0.1250, L = 0.250, S = 0.0250 ksf, Tributary Width = 13.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.911** : 1	Maximum Shear Stress Ratio =	**0.578** : 1
Section used for this span	**W18x119**	Section used for this span	**W18x119**
Mu : Applied	895.335 k-ft	Vu : Applied	215.738 k
Mn * Phi : Allowable	982.500 k-ft	Vn * Phi : Allowable	373.350 k
Load Combination	+1.20D+1.60L+0.50S	Load Combination	+1.20D+1.60L+0.50S
		Location of maximum on span	33.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.663 in	Ratio =	597	>=360	Span: 2 : L Only
Max Upward Transient Deflection	-0.013 in	Ratio =	4,006	>=360	Span: 2 : L Only
Max Downward Total Deflection	1.019 in	Ratio =	389	>=240.	Span: 2 : +D+L
Max Upward Total Deflection	-0.021 in	Ratio =	2607	>=240.	Span: 2 : +D+L

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	Summary of Shear Values VuMax	Vnx	Phi*Vnx
+1.40D													
Dsgn. L = 33.00 ft	1	0.298	0.189	201.92	-293.22	293.22	1,091.67	982.50	1.76	1.00	70.65	373.35	373.35
Dsgn. L = 4.50 ft	2	0.298	0.189		-293.22	293.22	1,091.67	982.50	1.71	1.00	70.65	373.35	373.35
+1.20D+1.60L													
Dsgn. L = 33.00 ft	1	0.891	0.565	603.10	-875.82	875.82	1,091.67	982.50	1.76	1.00	211.04	373.35	373.35
Dsgn. L = 4.50 ft	2	0.891	0.565		-875.82	875.82	1,091.67	982.50	1.71	1.00	211.04	373.35	373.35
+1.20D+1.60L+0.50S													
Dsgn. L = 33.00 ft	1	0.911	0.578	616.54	-895.33	895.33	1,091.67	982.50	1.76	1.00	215.74	373.35	373.35
Dsgn. L = 4.50 ft	2	0.911	0.578		-895.33	895.33	1,091.67	982.50	1.71	1.00	215.74	373.35	373.35
+1.20D+L													
Dsgn. L = 33.00 ft	1	0.653	0.414	441.84	-641.64	641.64	1,091.67	982.50	1.76	1.00	154.61	373.35	373.35
Dsgn. L = 4.50 ft	2	0.653	0.414		-641.64	641.64	1,091.67	982.50	1.71	1.00	154.61	373.35	373.35
+1.20D													
Dsgn. L = 33.00 ft	1	0.256	0.162	173.07	-251.33	251.33	1,091.67	982.50	1.76	1.00	60.56	373.35	373.35
Dsgn. L = 4.50 ft	2	0.256	0.162		-251.33	251.33	1,091.67	982.50	1.71	1.00	60.56	373.35	373.35
+1.20D+L+1.60S													
Dsgn. L = 33.00 ft	1	0.717	0.454	484.84	-704.09	704.09	1,091.67	982.50	1.76	1.00	169.65	373.35	373.35
Dsgn. L = 4.50 ft	2	0.717	0.454		-704.09	704.09	1,091.67	982.50	1.71	1.00	169.65	373.35	373.35
+1.20D+1.60S													
Dsgn. L = 33.00 ft	1	0.319	0.203	216.07	-313.78	313.78	1,091.67	982.50	1.76	1.00	75.61	373.35	373.35
Dsgn. L = 4.50 ft	2	0.319	0.203		-313.78	313.78	1,091.67	982.50	1.71	1.00	75.61	373.35	373.35

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements Calcs.ec6

DESCRIPTION: Garage Beam Girder

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+1.20D+L+0.50S													
Dsgn. L = 33.00 ft	1	0.673	0.427	455.28	-661.15	661.15	1,091.67	982.50	1.76	1.00	159.31	373.35	373.35
Dsgn. L = 4.50 ft	2	0.673	0.427		-661.15	661.15	1,091.67	982.50	1.71	1.00	159.31	373.35	373.35
+0.90D													
Dsgn. L = 33.00 ft	1	0.192	0.122	129.80	-188.50	188.50	1,091.67	982.50	1.76	1.00	45.42	373.35	373.35
Dsgn. L = 4.50 ft	2	0.192	0.122		-188.50	188.50	1,091.67	982.50	1.71	1.00	45.42	373.35	373.35
+1.20D+L+0.20S													
Dsgn. L = 33.00 ft	1	0.661	0.419	447.22	-649.44	649.44	1,091.67	982.50	1.76	1.00	156.49	373.35	373.35
Dsgn. L = 4.50 ft	2	0.661	0.419		-649.44	649.44	1,091.67	982.50	1.71	1.00	156.49	373.35	373.35

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	1.0187	14.520		0.0000	0.000
	2	0.0000	14.520	+D+L	-0.0207	1.890

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	64.227	245.089	-122.041
Overall MINimum	4.180	15.950	-7.942
D Only	22.429	85.590	-42.619
+D+L	64.227	245.089	-122.041
+D+S	26.609	101.540	-50.561
+D+0.750L	53.777	205.214	-102.185
+D+0.750L+0.750S	56.912	217.177	-108.142
+0.60D	13.458	51.354	-25.571
L Only	41.798	159.499	-79.422
S Only	4.180	15.950	-7.942

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Column

Project File: Fused Elements Calcs.ec6

DESCRIPTION: Garage Post

Code References

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Steel Section Name : **HSS10x6x5/8**

Analysis Method :	Load Resistance Factor
Steel Stress Grade	
Fy : Steel Yield	36.0 ksi
E : Elastic Bending Modulus	29,000.0 ksi

Overall Column Height	10.0 ft
Top & Bottom Fixity	Top & Bottom Pinned

Brace condition for deflection (buckling) along columns :
X-X (width) axis :
Unbraced Length for buckling ABOUT Y-Y Axis = 10.0 ft, K = 1.0
Y-Y (depth) axis :
Unbraced Length for buckling ABOUT X-X Axis = 10.0 ft, K = 1.0

Applied Loads

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

Column self weight included : 593.20 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 10.0 ft, D = 86.0, L = 160.0, S = 16.0 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.7952** : 1

Load Combination	+1.20D+1.60L+0.50S	
Location of max.above base	0.0	ft
At maximum location values are . . .		
Pu	367.912	k
0.9 * Pn	462.660	k
Mu-x	0.0	k-ft
0.9 * Mn-x :	138.510	k-ft
Mu-y	0.0	k-ft
0.9 * Mn-y :	96.660	k-ft

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

Load Combination	0.0	
Location of max.above base	0.0	ft
At maximum location values are . . .		
Vu : Applied	0.0	k
Vn * Phi : Allowable	0.0	k

Maximum Load Reactions . .

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

Maximum Load Deflections . . .

Along Y-Y 0.0 in at 0.0 ft above base
for load combination :

Along X-X 0.0 in at 0.0 ft above base
for load combination :

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Cbx	Cby	KxLx/Ry	KyLy/Rx	Maximum Shear Ratios: Stress Ratio	Status	Location
+1.40D	0.262	PASS	0.00 ft	1.00	1.00	51.28	34.29	0.000	PASS	0.00 ft
+1.20D+1.60L	0.778	PASS	0.00 ft	1.00	1.00	51.28	34.29	0.000	PASS	0.00 ft
+1.20D+1.60L+0.50S	0.795	PASS	0.00 ft	1.00	1.00	51.28	34.29	0.000	PASS	0.00 ft
+1.20D+L	0.570	PASS	0.00 ft	1.00	1.00	51.28	34.29	0.000	PASS	0.00 ft
+1.20D	0.225	PASS	0.00 ft	1.00	1.00	51.28	34.29	0.000	PASS	0.00 ft
+1.20D+L+1.60S	0.626	PASS	0.00 ft	1.00	1.00	51.28	34.29	0.000	PASS	0.00 ft
+1.20D+1.60S	0.280	PASS	0.00 ft	1.00	1.00	51.28	34.29	0.000	PASS	0.00 ft
+1.20D+L+0.50S	0.588	PASS	0.00 ft	1.00	1.00	51.28	34.29	0.000	PASS	0.00 ft
+0.90D	0.168	PASS	0.00 ft	1.00	1.00	51.28	34.29	0.000	PASS	0.00 ft
+1.20D+L+0.20S	0.577	PASS	0.00 ft	1.00	1.00	51.28	34.29	0.000	PASS	0.00 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction @ Base	@ Top	k	Y-Y Axis Reaction @ Base	@ Top	Mx - End Moments k-ft @ Base	@ Top	My - End Moments @ Base	@ Top
D Only	86.593									
+D+L	246.593									
+D+S	102.593									
+D+0.750L	206.593									
+D+0.750L+0.750S	218.593									

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Column

Project File: Fused Elements Calcs.ec6

DESCRIPTION: Garage Post

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction @ Base	@ Top	k	Y-Y Axis Reaction @ Base	@ Top	Mx - End Moments k-ft @ Base	@ Top	My - End Moments @ Base	@ Top
+0.60D	51.956									
L Only	160.000									
S Only	16.000									

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction @ Base	@ Top	k	Y-Y Axis Reaction @ Base	@ Top	Mx - End Moments k-ft @ Base	@ Top	My - End Moments @ Base	@ Top
Axial @ Base	Maximum	246.593									
"	Minimum	16.000									
Reaction, X-X Axis Base	Maximum	86.593									
"	Minimum	86.593									
Reaction, Y-Y Axis Base	Maximum	86.593									
"	Minimum	86.593									
Reaction, X-X Axis Top	Maximum	86.593									
"	Minimum	86.593									
Reaction, Y-Y Axis Top	Maximum	86.593									
"	Minimum	86.593									
Moment, X-X Axis Base	Maximum	86.593									
"	Minimum	86.593									
Moment, Y-Y Axis Base	Maximum	86.593									
"	Minimum	86.593									
Moment, X-X Axis Top	Maximum	86.593									
"	Minimum	86.593									
Moment, Y-Y Axis Top	Maximum	86.593									
"	Minimum	86.593									

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
D Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
+D+L	0.0000 in	0.000 ft	0.000 in	0.000 ft
+D+S	0.0000 in	0.000 ft	0.000 in	0.000 ft
+D+0.750L	0.0000 in	0.000 ft	0.000 in	0.000 ft
+D+0.750L+0.750S	0.0000 in	0.000 ft	0.000 in	0.000 ft
+0.60D	0.0000 in	0.000 ft	0.000 in	0.000 ft
L Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
S Only	0.0000 in	0.000 ft	0.000 in	0.000 ft

Steel Section Properties : HSS10x6x5/8

Depth	=	10.000	in	I xx	=	201.00	in^4	J	=	209.000	in^4
Design Thick	=	0.581	in	S xx	=	40.20	in^3	Cw	=	58.60	in^6
Width	=	6.000	in	R xx	=	3.500	in				
Wall Thick	=	0.624	in	Zx	=	51.300	in^3				
Area	=	16.400	in^2	I yy	=	89.400	in^4	C	=	58.600	in^3
Weight	=	59.320	plf	S yy	=	29.800	in^3				
				R yy	=	2.340	in				
				Zy	=	35.800	in^3				
Ycg	=	0.000	in								

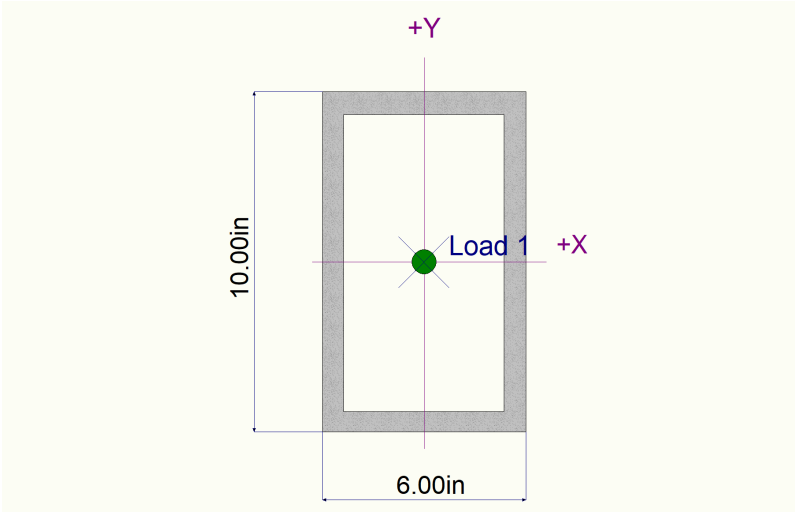
Project Title:
Engineer:
Project ID:
Project Descr:

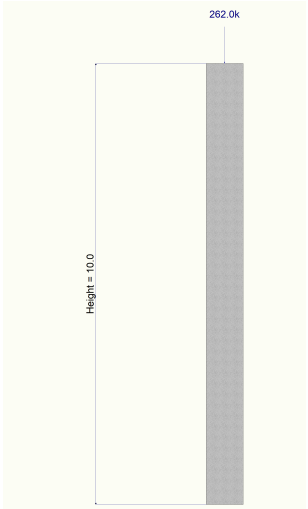
Steel Column

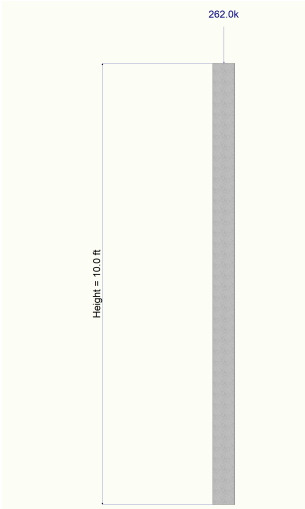
Project File: Fused Elements Calcs.ec6

DESCRIPTION: Garage Post

Sketches







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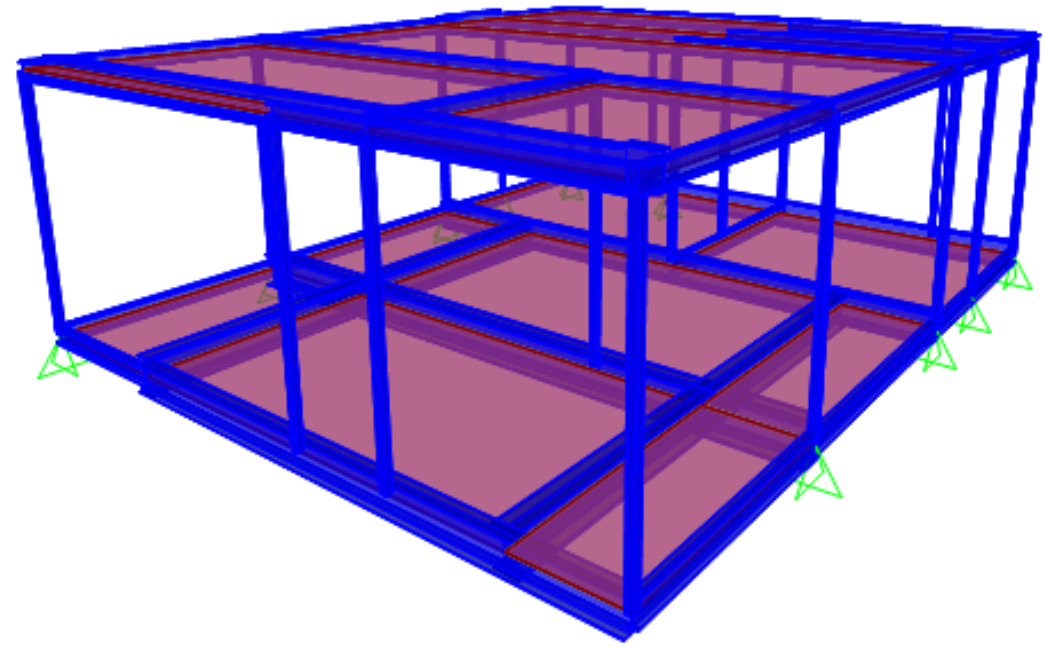
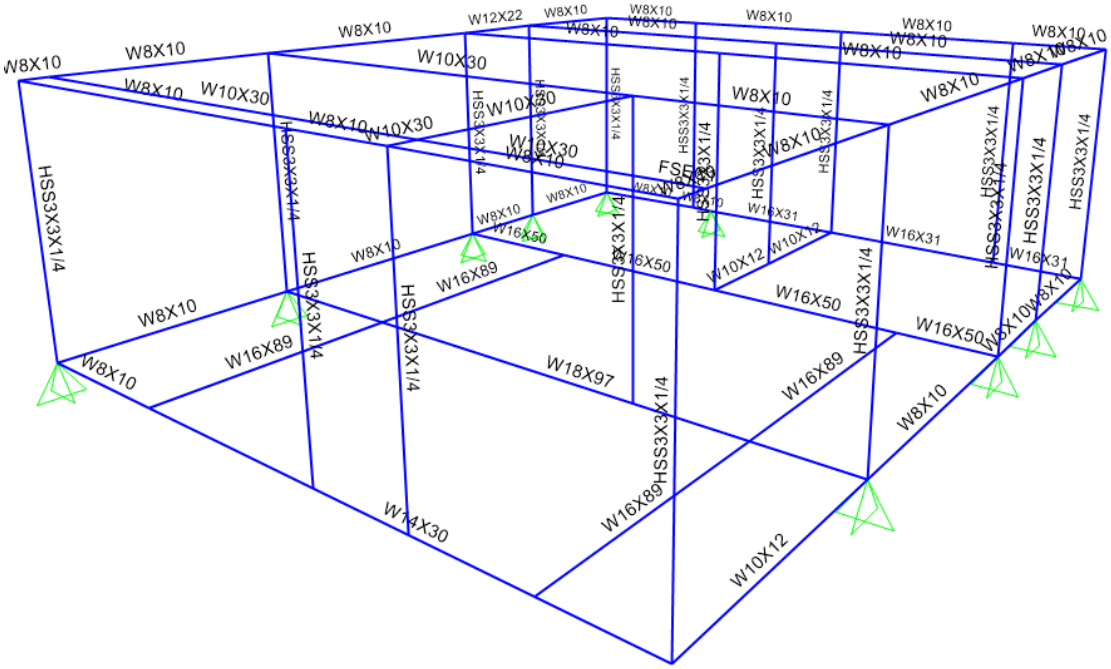
Seattle, WA 98101 206 622-5822

project	Fused Elements Residence	by JRS	sheet no.
location	Mercer Island, WA	date 9/8/2023	
client	Olson Kundig		job no. 2200638
	Primary Bedroom Framing Design		

PRIMARY BEDROOM FRAMING DESIGN





Analysis sections in SAP 2000

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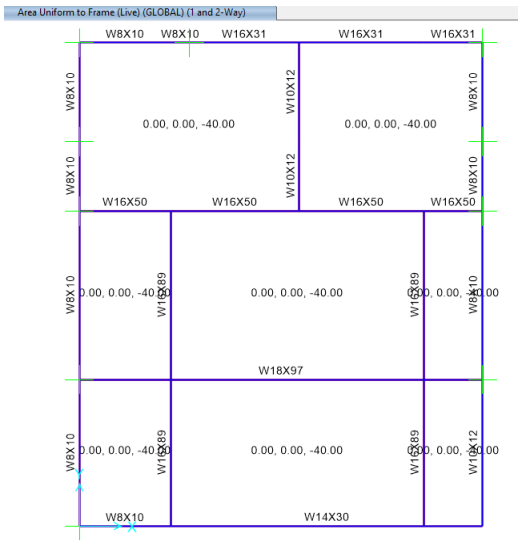
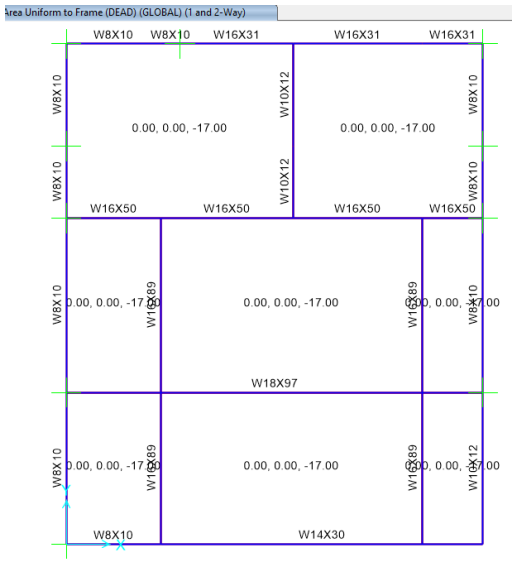
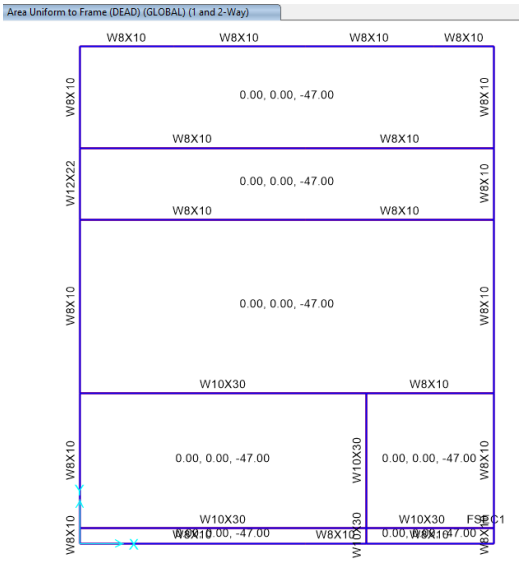
project	Fused Elements Residence	by JRS	sheet no.
location	Mercer Island, WA	date 9/8/2023	
client	Olson Kundig		job no. 2200638
	Primary Bedroom Framing Design		



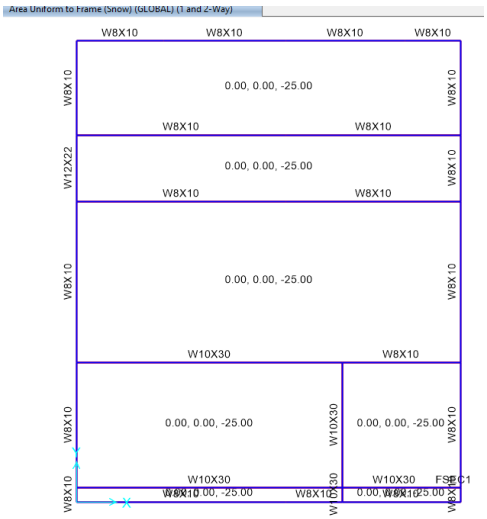
Floor Live Loads (psf)



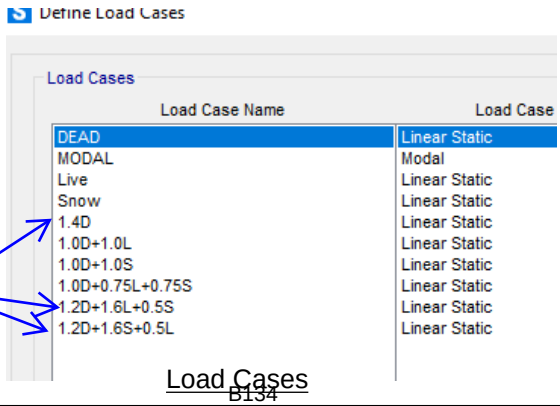
Floor Dead Loads (psf)



Roof Dead Loads (psf)



Roof Snow Loads (psf)



Load combination used for LRFD steel frame design

Load Cases

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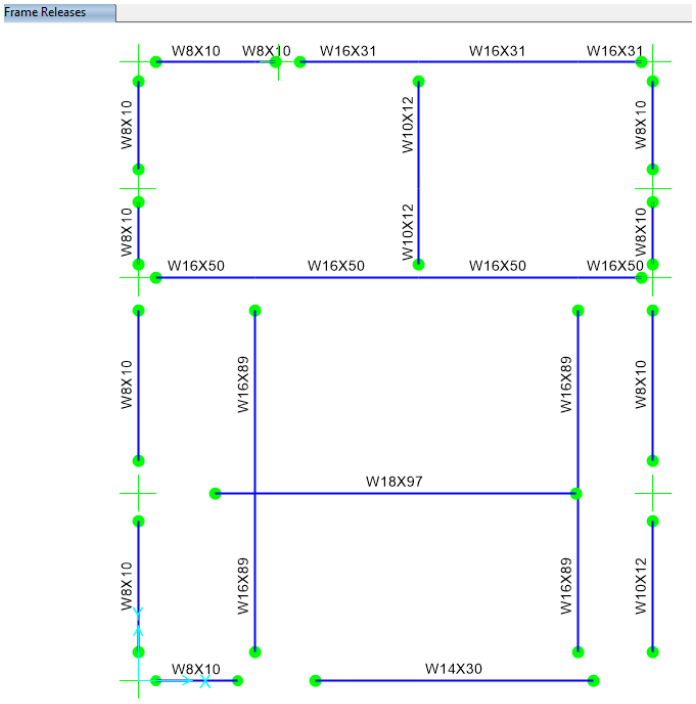
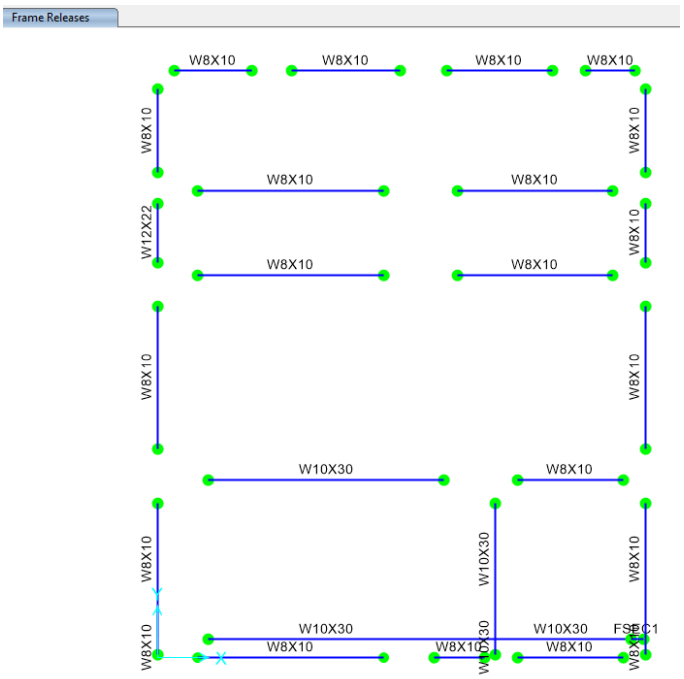
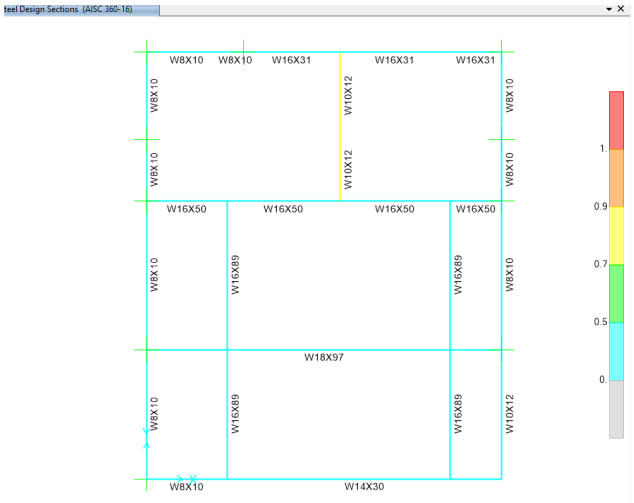
project	Fused Elements Residence	by JRS	sheet no.
location	Mercer Island, WA	date 9/8/2023	
client	Olson Kundig		job no. 2200638
	Primary Bedroom Framing Design		



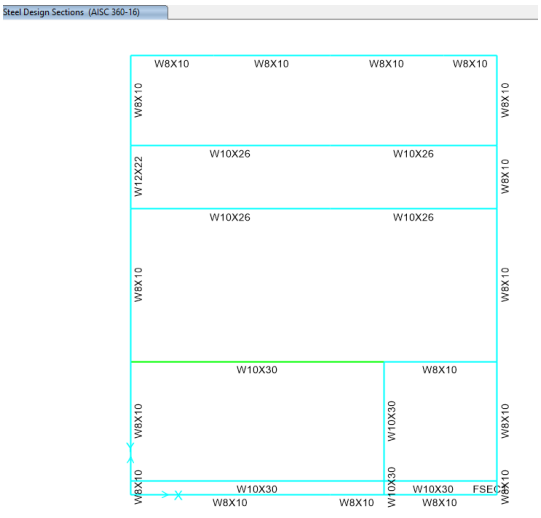
Floor Frame Releases



Roof Frame Releases



Floor LRFD Steel Demand Capacity Ratios (DCRs)



Roof LRFD Steel Demand Capacity Ratios (DCRs)

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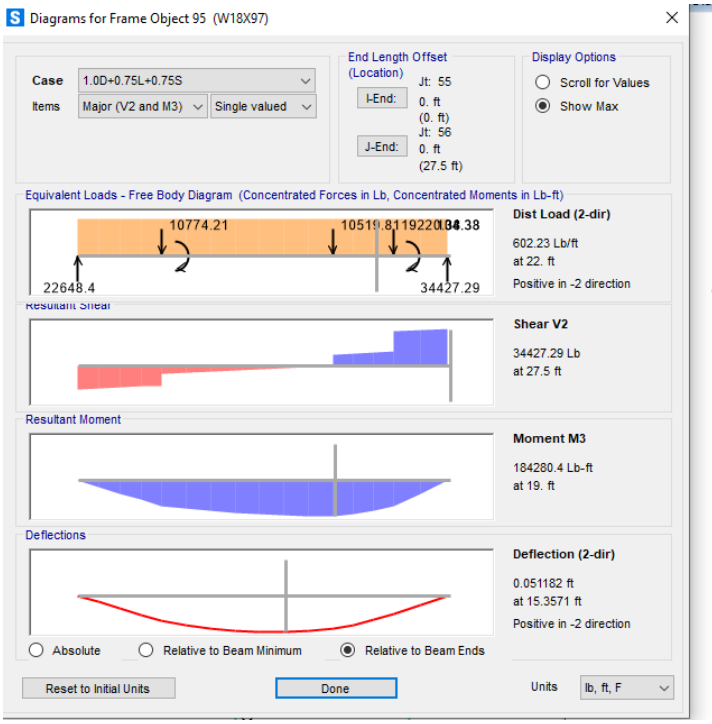
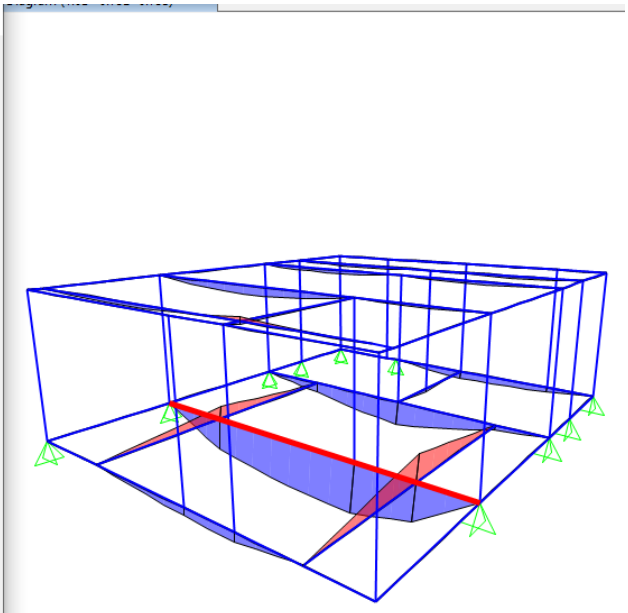
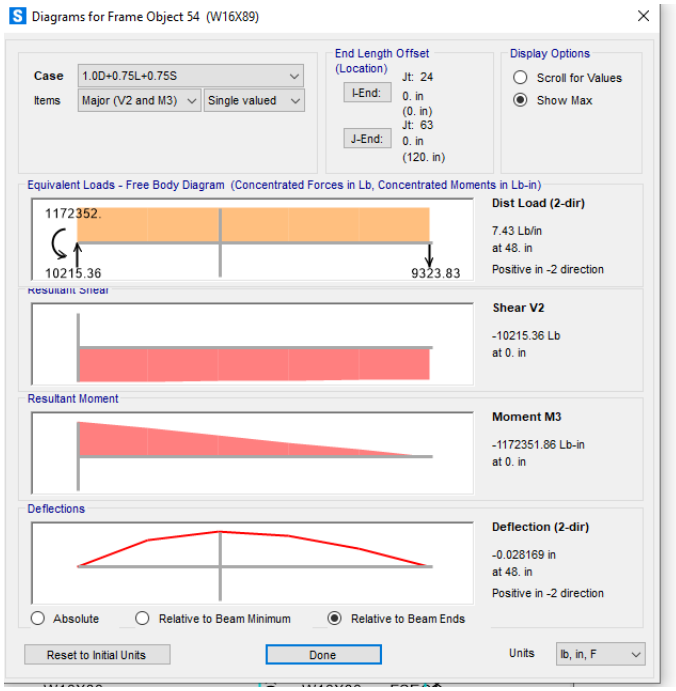
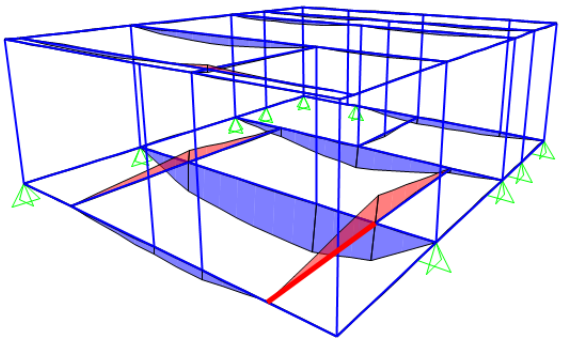
project	Fused Elements Residence	by JRS	sheet no.
location	Mercer Island, WA	date 9/8/2023	
client	Olson Kundig		job no. 2200638
	Primary Bedroom Framing Design		





Worst Case Girder Loads





Worst Case Beam Loads

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Chapter B
Gravity Design

Section 2
Column Design

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project Fused Elements Residence		by CBJ	sheet no.
location Mercer Island, WA		date 06/23/23	
client Olson Kundig			job no. 22-00638
Column Design			

Column Loading

5/G - Max HSS 5x5 Load

Loads at Upper Level (H = 10'-4"):

Point Load from UL-B10:

P_{DL} =	13.98	k
P_{LR} =	7.92	k
P_{LL} =	4.29	k
P_{SL} =	9.92	k
P_{ULT} =	36.9	k

→ HSS 5x5x1/4 OK. See P-M Interaction Calc

5/H - Max L 6x6 Load

Loads at Upper Roof (H = 10'-2"):

Point Load from UL-B10:

P_{DL} =	4.58	k
P_{LR} =	3.66	k
P_{SL} =	4.58	k
P_{ULT} =	13.6	k

Capacity pe AISC Table 4-11:

K =	1.0	
KL =	10.17	ft
ϕP_n =	72	k

DCR = 0.19

→ L 6x6x3/8 OK

7.5/E - Max Wood Column Load

Loads at Upper Level (H = 10'-4"):

Point Load from UL-B10:

P_{DL} =	7.14	k
P_{LR} =	3.24	k
P_{SL} =	9.92	k
P_{ULT} =	24.4	k

→ DFL No.1 6x6 Post OK. See Enercalc

kpff 1601 5th Avenue, Suite 1600 Seattle, WA 98101 206 622-5822	project: Fused Elements Residence	by: CBJ	sheet no.
	location: Mercer Island, WA	date: 4/4/2023	
	client: Olson Kundig		job no. 22-00638
	Steel Gravity Column Design - Max Loads on HSS 5x5		

P-M INTERACTION CALCULATIONS - HSS & PIPE SECTIONS

Member Data

Shape	HSS5X5X1/4	Rect. HSS
F_y	50	ksi
E	29000	ksi

Loads

P_u	36.9	k
M_{ux}	0	k-ft
M_{uy}	0	k-ft

Loads from 1st Order Analysis

Resistance Factors

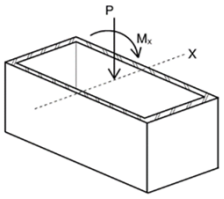
Φ_c	0.9
Φ_b	0.9

Geometry

K_x	1.0	
K_y	1.0	
L_{bx} (Axial)	10.34	ft
L_{by} (Axial)	10.34	ft
L_{bx} (Flexure)	10.34	ft

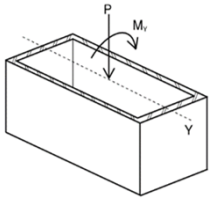
Strong Axis Properties

I_x	16.0	in^4
S_x	6.4	in^3
r_x	1.93	in
Z_x	7.6	in^3



Weak Axis Properties

I_y	16.0	in^4
S_y	6.4	in^3
r_y	1.93	in
Z_y	7.6	in^3



Axial Capacity

Strong Axis

L_c/r_x	64	.....	*(E3)*
F_{cr}	37.0	ksi.....	*(E3-2)*
P_n	158.9	k.....	*(E3-1)*
ΦP_n	143.0	k.....	

Weak Axis

L_c/r_y	64	.....	*(E3)*
F_{cr}	37.0	ksi.....	*(E3-2)*
P_n	158.9	k.....	*(E3-1)*
ΦP_n	143.0	k.....	

Moment Capacity

Strong Axis

M_p	31.7	k-ft.....	*(F7-1)*
M_n	31.7	k-ft.....	*(F7-1)*
ΦM_n	28.5	k-ft.....	

Weak Axis

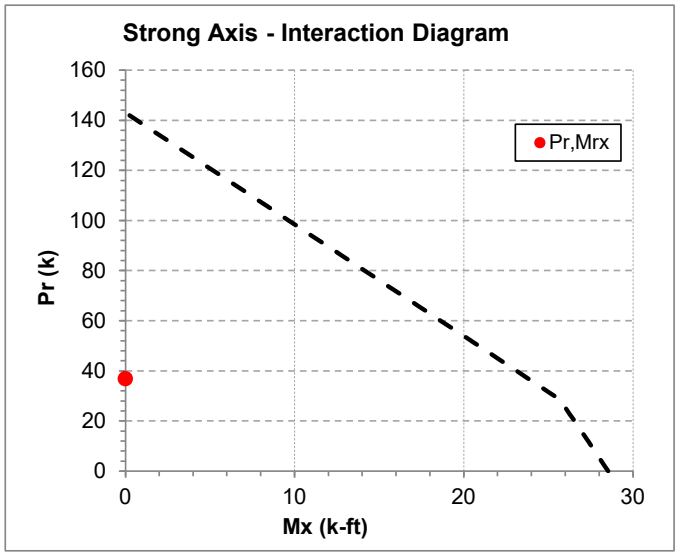
M_p	31.7	k-ft.....	*(F7-1)*
M_n	31.7	k-ft.....	*(F7-1)*
ΦM_n	28.5	k-ft.....	

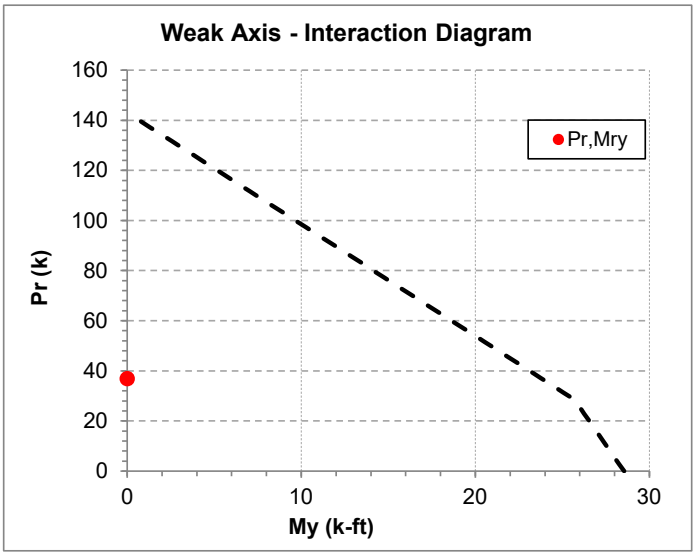
Interaction (AISC Steel Construction Manual, 15th Edition, Section H1)

P_r	36.9	k	P_c	143.0	k
M_{rx}	0.0	k-ft	M_{cx}	28.5	k-ft
M_{ry}	0.0	k-ft	M_{cy}	28.5	k-ft

Interaction Eqn: (Pr/Pc)+(8/9)*((Mrx/Mcx)+(Mry/Mcy))

Interaction DCR 0.26 OK ..... *(H1-1a)*





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	location: Mercer Island, WA	date: 4/4/2023	
	client: Olson Kundig		job no. 22-00638
	Steel Gravity Column Design - Max Loads on HSS 5x5		

P-M INTERACTION: DETAILED CALCULATIONS - HSS & PIPE SECTIONS

Member Properties

							Computed:		
Area	4.30	in^2	**t**	0.233	in		**($\sqrt{E/F_y}$)**	24.1	
b	4.31	in	**λb,b/t**	18.5			**Axial λ_r**	33.7	*(Tab B4.1a)*
h	4.31	in	**λh,h/t**	18.5			**Flexure λpf**	27.0	*(Tab B4.1b)*
H	5.0	in	**J**	25.8	in4		**Flexure λrf**	33.7	*(Tab B4.1b)*
B	5.0	in					**Flexure λpw**	58.3	*(Tab B4.1b)*
							Flexure λrw	137.3	*(Tab B4.1b)*

Axial Capacity (AISC Steel Construction Manual, 15th Edition, Section E3/E7)

***L_c=KL_b**

Strong Axis				Weak Axis		
4.71($\sqrt{E/F_y}$)	113.4	..... *(E3)*		**4.71($\sqrt{E/F_y}$)**	113.4	..... *(E3)*
L_c/r_x	64.3	..... *(E3)*		**L_c/r_y**	64.3	..... *(E3)*
L_c/r_x	**<**	**4.71($\sqrt{E/F_y}$)**		**L_c/r_y**	**<**	**4.71($\sqrt{E/F_y}$)**
F_e	69.2	ksi..... *(E3-4)*		**F_e**	69.2	ksi..... *(E3-4)*
F_{cr}	37.0	ksi..... *(E3-2)*		**F_{cr}**	37.0	ksi..... *(E3-2)*
		Controlling F_{cr}	37.0 ksi.....			
Non-Slender				Non-Slender		
P_n	158.9	k..... *(E3-1)*		**P_n**	158.9	k..... *(E3-1)*
ΦP$_n$	143.0	k.....		**ΦP$_n$**	143.0	k.....

Wall Comp. Buckling (Section E7)

Ae = Ag

A_e 4.30 in^2 .....

λr √Fy/Fcr	-	..... *(E7)*	**λr √Fy/Fcr**	-	..... *(E7)*
λ	-	**λr√Fy/Fcr**	**λ**	-	**λr√Fy/Fcr**
c1	-	..... *(Table E7.1)*	**c1**	-	..... *(Table E7.1)*
c2	-	..... *(Table E7.1)*	**c2**	-	..... *(Table E7.1)*
Fel	-	ksi..... *(E7-5)*	**Fel**	-	ksi..... *(E7-5)*
be,y	-	in.....	**he,y**	-	in.....

Approx. 2nd-Order (App. 8)

Second order effects accounted for with calculations below

P_{ns}	215.0	..... *(C2-2)*	**P_{ns}**	215.0	..... *(C2-2)*
α	1.0	..... *(C2-2)*	**α**	1.0	..... *(C2-2)*
τ_b	1.00	..... *(C2-2)*	**τ_b**	1.00	..... *(C2-2)*
Trans. Loads	No	..... *(App-8-4)*	**Trans. Loads**	No	..... *(App-8-4)*
M_1	0	k-ft..... *(App-8-4)*	**M_1**	0	k-ft..... *(App-8-4)*
M_2	0	k-ft..... *(App-8-4)*	**M_2**	0	k-ft..... *(App-8-4)*
C_m	1.00	..... *(App-8-4)*	**C_m**	1.00	..... *(App-8-4)*
P_{e1}	297	..... *(App-8-5)*	**P_{e1}**	297	..... *(App-8-5)*
B_1	1.14	..... *(App-8-3)*	**B_1**	1.14	..... *(App-8-3)*
M_r	0.0	k-ft..... *(App-8-1)*	**M_r**	0.0	k-ft..... *(App-8-1)*

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project	Fused Elements Residence	by CBJ	sheet no.
location	Mercer Island, WA	date 4/4/2023	
client	Olson Kundig		job no. 22-00638
	Steel Gravity Column Design - Max Loads on HSS 5x5		

Moment Capacity (AISC Steel Construction Manual, 15th Edition, Section F7/F8)

Strong Axis

M_p	31.7	k-ft.....	*(F7-1)*
Governing M_n	31.7	k-ft.....	*(F7-1)*
ΦM_n	28.5	k-ft.....	

Weak Axis

M_p	31.7	k-ft.....	*(F7-1)*
Governing M_n	31.7	k-ft.....	*(F7-1)*
ΦM_n	28.5	k-ft.....	

Wall Local Buckling (Section F7.2-4)

Strong Axis: Compact Flange	Strong Axis: Compact Web	Weak Axis: Compact Flange	Weak Axis: Compact Web

Flange Local Buckling (F7-2)

Mn	-	k-ft.....	

Mn	-	k-ft.....	

Web Local Buckling (F7-3)

Mn	-	k-ft.....	

Mn	-	k-ft.....	

Lateral Torsional Buckling (F7-4)

LTB Modification Factor: **Off** **When off, C_b is conservatively assumed as 1.00*

M_{max}	0	(k-ft)		M_b	0	(k-ft)	**C_b** 1.00
M_a	0	(k-ft)		M_c	0	(k-ft)	
Lp	16.78	ft.....	*(F7-12)*	**Lp**	16.78	ft.....	*(F7-12)*
Lr	437.95	ft.....	*(F7-13)*	**Lr**	437.95	ft.....	*(F7-13)*
Lb < Lp				**Lb < Lp**			
LTB does not apply				LTB does not apply			
Mn	-	k-ft.....	*(F7-10)*	**Mn**	-	k-ft.....	*(F7-10)*

Project Title: Fused Elements Residence
Engineer: CBJ
Project ID: 22-00638
Project Descr: Single-Family Residence in Mercer Island, WA

Wood Column

Project File: Fused Elements SD_CBJ.ec6

LIC# : KW-06018139, Build:20.22.12.28 KPFF CONSULTING ENGINEERS SEA (c) ENERCALC INC 1983-2022

DESCRIPTION: Wood Post - Max Gravity Loads (7.5/E)

Code References

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : IBC 2021

General Information

Analysis Method	Load Resistance Factor Design	Wood Section Name	**6x6**
End Fixities	Top & Bottom Pinned	Wood Grading/Manuf.	Graded Lumber
Overall Column Height	10.34 ft	Wood Member Type	Sawn
(Used for non-slender calculations)		Exact Width	**5.50** in
Wood Species	Douglas Fir-Larch	Exact Depth	**5.50** in
Wood Grade	No.1	Area	30.250 in^2
Fb +	1200 psi	Fv	170 psi
Fb -	1200 psi	Ft	825 psi
Fc - Prll	1000 psi	Density	31.21 pcf
Fc - Perp	625 psi	Ix	76.255 in^4
		Iy	76.255 in^4

E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
Basic	1600	1600	1600 ksi
Minimum	580	580	

Allow Stress Modification Factors

Cf or Cv for Bending	1.0
Cf or Cv for Compressio	1.0
Cf or Cv for Tension	1.0
Cm : Wet Use Factor	1.0
Ct : Temperature Fact	1.0
Cfu : Flat Use Factor	1.0
Kf : Built-up columns	1.0 *NDS 15.3.2*
Use Cr : Repetitive ?	No

Brace condition for deflection (buckling) along columns :
X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 10.34 f
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 10.34 f

Applied Loads

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

Column self weight included : 67.792 lbs * Dead Load Factor
AXIAL LOADS . . .
Green Roof Load: Axial Load at 10.340 ft, D = 7.140, Lr = 3.240, S = 9.920 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.7073 : 1**

Load Combination	+1.20D+1.60S
Governing NDS Forumla	Comp Only, fc/Fc'
Location of max.above base	0.0 ft
At maximum location values are .	
Applied Axial	24.521 k
Applied Mx	0.0 k-ft
Applied My	0.0 k-ft
Fc : Allowable	1,146.05 psi

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

Load Combination	+0.90D
Location of max.above base	0.0 ft
Applied Design Shear	0.0 psi
Allowable Shear	0.0 psi

Maximum SERVICE Lateral Load Reactions . .

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

Maximum SERVICE Load Lateral Deflections . . .

Along Y-Y 0.0 in at 0.0 ft above base
for load combination : n/a
Along X-X 0.0 in at 0.0 ft above base
for load combination : n/a

Other Factors used to calculate allowable stresses . . .

	Bending	Compression	Tension
LRFD - Format Conversion factor	2.541	2.400	2.700
LRFD - Resistance factor	0.850	0.900	0.800

Load Combination Results

Load Combination	Lambda	C_P	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Maximum Shear Ratios: Stress Ratio	Status	Location
+1.40D	0.000	0.531	0.2911	PASS	0.0 ft	0.0	PASS	0.0 ft
+1.20D+0.50Lr	0.000	0.531	0.2962	PASS	0.0 ft	0.0	PASS	0.0 ft
+1.20D+0.50S	0.000	0.531	0.3926	PASS	0.0 ft	0.0	PASS	0.0 ft
+1.20D+1.60Lr	0.000	0.531	0.3990	PASS	0.0 ft	0.0	PASS	0.0 ft
+1.20D+1.60S	0.000	0.531	0.7073	PASS	0.0 ft	0.0	PASS	0.0 ft
+1.20D+0.70S	0.000	0.531	0.4498	PASS	0.0 ft	0.0	PASS	0.0 ft
+0.90D	0.000	0.531	0.1871	PASS	0.0 ft	0.0	PASS	0.0 ft

Wood Column

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: Wood Post - Max Gravity Loads (7.5/E)

Maximum Reactions

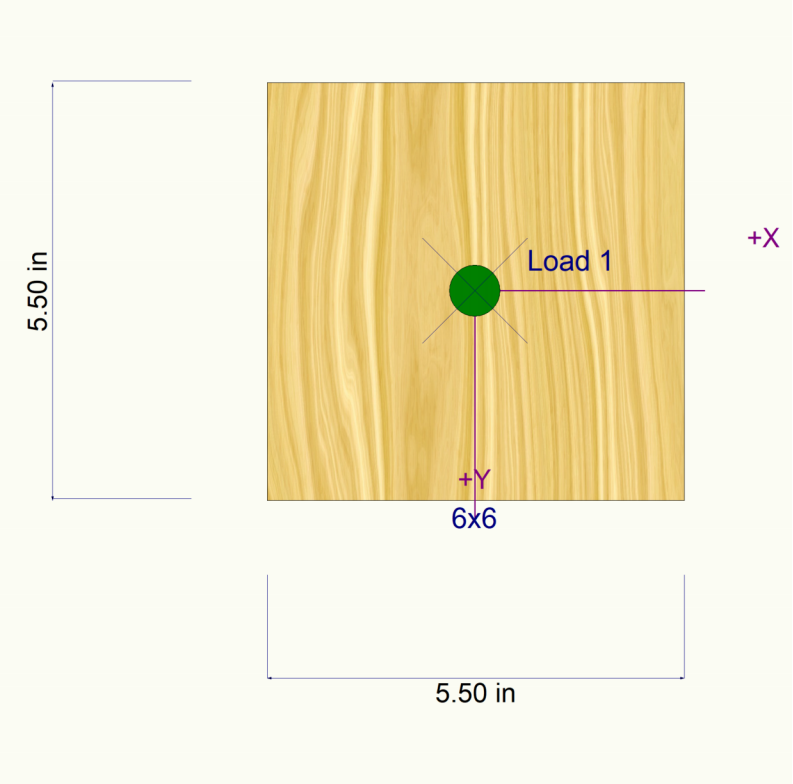
Note: Only non-zero reactions are listed.

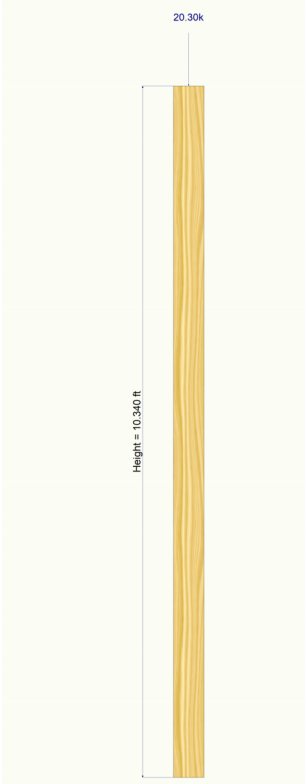
Load Combination	X-X Axis Reaction @ Base	@ Top	k	Y-Y Axis Reaction @ Base	@ Top	Axial Reaction @ Base	My - End Moments @ Base	@ Top	k-ft	Mx - End Moments @ Base	@ Top
D Only						7.208					
+D+Lr						10.448					
+D+S						17.128					
+D+0.750Lr						9.638					
+D+0.750S						14.648					
+0.60D						4.325					
Lr Only						3.240					
S Only						9.920					

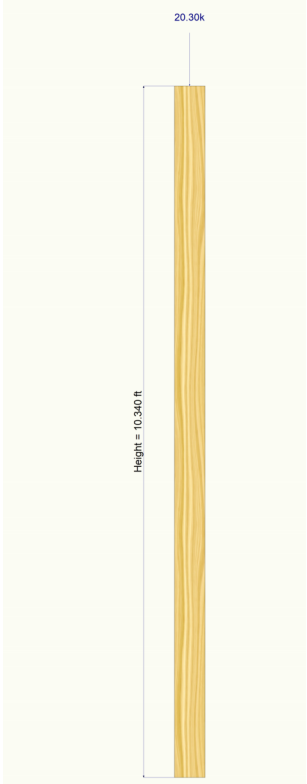
Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
D Only	0.0000 in	0.000ft	0.000 in	0.000 ft
+D+Lr	0.0000 in	0.000ft	0.000 in	0.000 ft
+D+S	0.0000 in	0.000ft	0.000 in	0.000 ft
+D+0.750Lr	0.0000 in	0.000ft	0.000 in	0.000 ft
+D+0.750S	0.0000 in	0.000ft	0.000 in	0.000 ft
+0.60D	0.0000 in	0.000ft	0.000 in	0.000 ft
Lr Only	0.0000 in	0.000ft	0.000 in	0.000 ft
S Only	0.0000 in	0.000ft	0.000 in	0.000 ft

Sketches







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Chapter B
Gravity Design

Section 3
Bearing Wall Design

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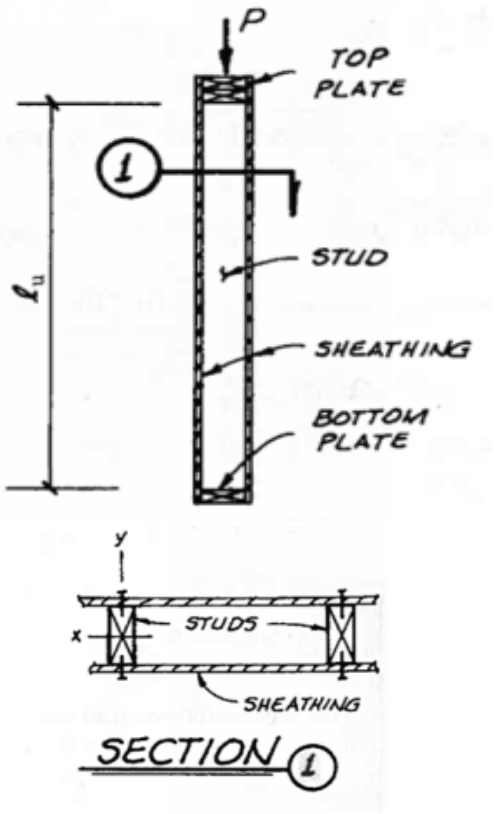
	location Mercer Island, WA	date 6/23/2023	
	client Olson Kundig		job no. 22-638
	(1) 2x6 Capacity		

WOOD STUDS - AXIAL LOADS ONLY (NDS)

STUD PROPERTIES

Lumber Type		Visually Graded Sawn Lumber	
Wood Species	Species =	Douglas Fir-Larch	
Wood Grade	Grade =	No. 2	
Stud Size	Size =	2x6	
Number of Studs	n =	1	
Unbraced Length - X	ℓ_{ux} =	12	ft
Unbraced Length - Y	ℓ_{uy} =	1	ft
Buckling Length Coefficient	K_e =	1	
Slenderness Ratio - X	ℓ_e/d_x =	26.2	
Slenderness Ratio - Y	ℓ_e/d_y =	8.0	



BOTTOM PLATE PROPERTIES

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

SECTION REDUCTION

Rows of bolts	n =	0	
Bolt Diameter	D =	0.75	in

NDS REFERENCE DESIGN VALUES *(NDS Supplement Table 4A)*

Allowable Compressive Stress	F_c =	1,350	psi
Modulus of Elasticity	E =	1,600,000	psi
Minimum Modulus of Elasticity	E_{min} =	580,000	psi
Perpendicular Load Capacity	$F_{c,perp}$ =	625	psi

NDS ADJUSTMENT FACTORS

Adjustment Factor		F_c	$F_{c,perp}$	E	*Code Reference*
Load Duration Factor	C_D =	1.00	-	-	*NDS Table 2.3.2*
Wet Service Factor	C_M =	1.00	1.00	1.00	*NDS Supplement Table 4A*
Temperature Factor	C_t =	1.00	1.00	1.00	*NDS Appendix C*
Incising Factor	C_i =	1.00	1.00	1.00	*NDS Table 4.3.8*
Size Factor	C_F =	1.10	-	-	*NDS Supplement Table 4A*
Column Stability Factor	C_b =	0.41	-	-	*NDS Eq. 3.7-1*
Bearing Area Factor	C_b =	-	1.25	-	*NDS Sec. 3.10.4*
Fire-Treatment Factor	C_{FT} =	1.00	1.00	1.00	

ADJUSTED DESIGN VALUES

Compression Design Value	F_c' =	610	psi
Stiffness Design Value	E_{min}' =	580,000	psi
Perpendicular Design Value	$F_{c,perp}'$ =	781	psi

RESULTS

Buckling Capacity	5,035	lbs
Net Section Capacity	12,251	lbs
Sill Plate Capacity	6,445	lbs

Allowable Axial Capacity **5,035 lbs**

Stud Wall Axial Capacities	
Stud Spacing	Capacity
12 in oc	5,035 lbs/ft
16 in oc	3,776 lbs/ft
24 in oc	2,518 lbs/ft

MAX TRIB WIDTHS FOR LOADING:
TERRACE = 83 PSF MAX -> 3776 PLF / 83 PSF = 45' MAX TRIB WIDTH OK
INTERIOR = 59 PSF MAX -> 3776 PLF / 59 PSF = 64' MAX TRIB WIDTH OK
GREEN ROOF = 86 PSF MAX -> 3776 PLF / 86 PSF = 44' MAX TRIB WIDTH OK

NO TRIB BEARING WIDTHS EXCEED THESE ALLOWABLE WIDTHS

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client: Olson Kundig			job no. 22-638
(2) 2x6 Capacity			

WOOD STUDS - AXIAL LOADS ONLY (NDS)

STUD PROPERTIES

Lumber Type		Visually Graded Sawn Lumber	
Wood Species	Species =	Douglas Fir-Larch	
Wood Grade	Grade =	No. 2	
Stud Size	Size =	2x6	
Number of Studs	n =	2	
Unbraced Length - X	ℓ_{ux} =	12	ft
Unbraced Length - Y	ℓ_{uy} =	1	ft
Buckling Length Coefficient	K_e =	1	
Slenderness Ratio - X	ℓ_e/d_x =	26.2	
Slenderness Ratio - Y	ℓ_e/d_y =	8.0	

BOTTOM PLATE PROPERTIES

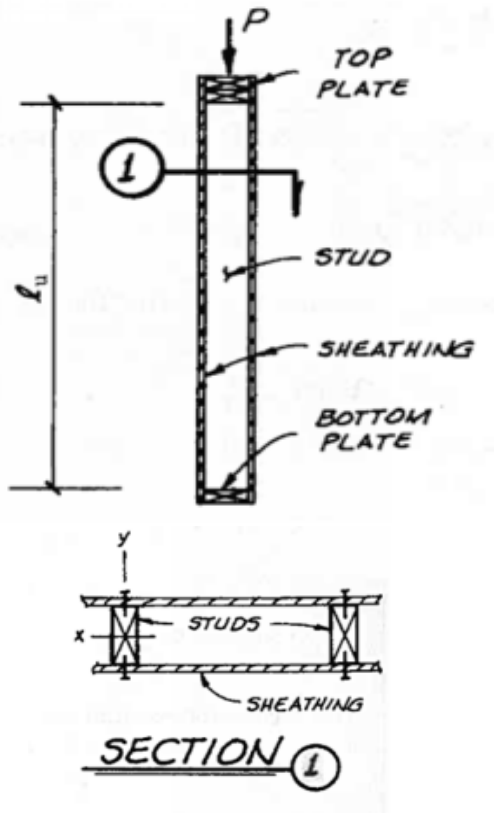
Wood Species	Species =	Douglas Fir-Larch
Wood Grade	Grade =	No. 2

SECTION REDUCTION

Rows of bolts	n =	0	
Bolt Diameter	D =	0.75	in

NDS REFERENCE DESIGN VALUES *(NDS Supplement Table 4A)*

Allowable Compressive Stress	F_c =	1,350	psi
Modulus of Elasticity	E =	1,600,000	psi
Minimum Modulus of Elasticity	E_{min} =	580,000	psi
Perpendicular Load Capacity	$F_{c,perp}$ =	625	psi



NDS ADJUSTMENT FACTORS

Adjustment Factor		F_c	$F_{c,perp}$	E	*Code Reference*
Load Duration Factor	C_D =	1.00	-	-	*NDS Table 2.3.2*
Wet Service Factor	C_M =	1.00	1.00	1.00	*NDS Supplement Table 4A*
Temperature Factor	C_t =	1.00	1.00	1.00	*NDS Appendix C*
Incising Factor	C_i =	1.00	1.00	1.00	*NDS Table 4.3.8*
Size Factor	C_F =	1.10	-	-	*NDS Supplement Table 4A*
Column Stability Factor	C_b =	0.41	-	-	*NDS Eq. 3.7-1*
Bearing Area Factor	C_b =	-	1.13	-	*NDS Sec. 3.10.4*
Fire-Treatment Factor	C_{FT} =	1.00	1.00	1.00	

ADJUSTED DESIGN VALUES

Compression Design Value	F_c' =	610	psi
Stiffness Design Value	E_{min}' =	580,000	psi
Perpendicular Design Value	$F_{c,perp}'$ =	703	psi

RESULTS

Buckling Capacity	10,070	lbs
Net Section Capacity	49,005	lbs
Sill Plate Capacity	11,602	lbs
Allowable Axial Capacity	**10,070**	**lbs**

Stud Wall Axial Capacities	
Stud Spacing	Capacity
12 in oc	10,070 lbs/ft
16 in oc	7,553 lbs/ft
24 in oc	5,035 lbs/ft

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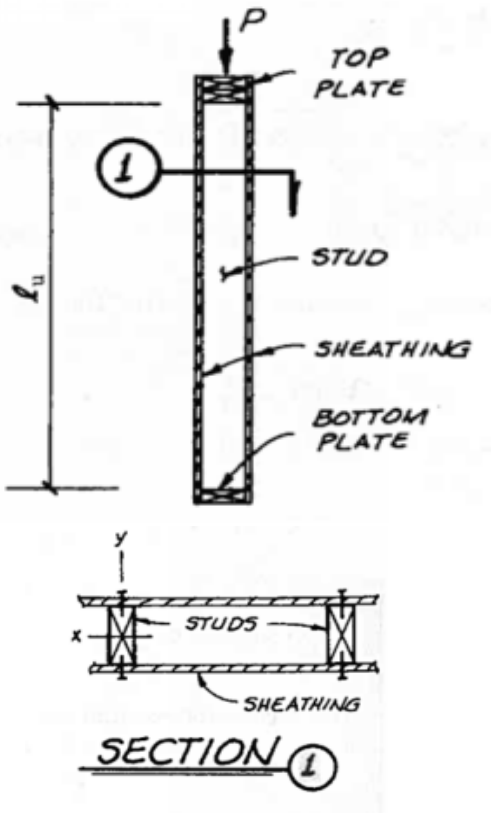
project: Fused Elements Residence		by: CBJ	sheet no.
location: Mercer Island, WA		date: 6/23/2023	
client: Olson Kundig			job no. 22-638
(3) 2x6 Capacity			

WOOD STUDS - AXIAL LOADS ONLY (NDS)

STUD PROPERTIES

Lumber Type		Visually Graded Sawn Lumber	
Wood Species	Species =	Douglas Fir-Larch	
Wood Grade	Grade =	No. 2	
Stud Size	Size =	2x6	
Number of Studs	n =	3	
Unbraced Length - X	ℓ_{ux} =	12	ft
Unbraced Length - Y	ℓ_{uy} =	1	ft
Buckling Length Coefficient	K_e =	1	
Slenderness Ratio - X	ℓ_e/d_x =	26.2	
Slenderness Ratio - Y	ℓ_e/d_y =	8.0	



BOTTOM PLATE PROPERTIES

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

SECTION REDUCTION

Rows of bolts	n =	0	
Bolt Diameter	D =	0.75	in

NDS REFERENCE DESIGN VALUES *(NDS Supplement Table 4A)*

Allowable Compressive Stress	F_c =	1,350	psi
Modulus of Elasticity	E =	1,600,000	psi
Minimum Modulus of Elasticity	E_{min} =	580,000	psi
Perpendicular Load Capacity	$F_{c,perp}$ =	625	psi

NDS ADJUSTMENT FACTORS

Adjustment Factor		F_c	$F_{c,perp}$	E	*Code Reference*
Load Duration Factor	C_D =	1.00	-	-	*NDS Table 2.3.2*
Wet Service Factor	C_M =	1.00	1.00	1.00	*NDS Supplement Table 4A*
Temperature Factor	C_t =	1.00	1.00	1.00	*NDS Appendix C*
Incising Factor	C_i =	1.00	1.00	1.00	*NDS Table 4.3.8*
Size Factor	C_F =	1.10	-	-	*NDS Supplement Table 4A*
Column Stability Factor	C_b =	0.41	-	-	*NDS Eq. 3.7-1*
Bearing Area Factor	C_b =	-	1.08	-	*NDS Sec. 3.10.4*
Fire-Treatment Factor	C_{FT} =	1.00	1.00	1.00	

ADJUSTED DESIGN VALUES

Compression Design Value	F_c' =	610	psi
Stiffness Design Value	E_{min}' =	580,000	psi
Perpendicular Design Value	$F_{c,perp}'$ =	677	psi

RESULTS

Buckling Capacity	15,106	lbs
Net Section Capacity	110,261	lbs
Sill Plate Capacity	16,758	lbs
Allowable Axial Capacity	**15,106**	**lbs**

Stud Wall Axial Capacities	
Stud Spacing	Capacity
12 in oc	15,106 lbs/ft
16 in oc	11,329 lbs/ft
24 in oc	7,553 lbs/ft

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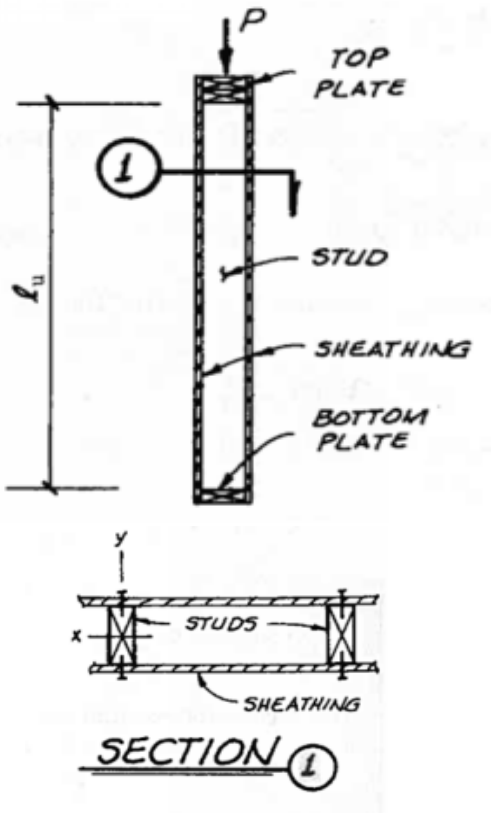
location: Mercer Island, WA		date: 6/23/2023	
client: Olson Kundig			job no. 22-638
(4) 2x6 Capacity			

WOOD STUDS - AXIAL LOADS ONLY (NDS)

STUD PROPERTIES

Lumber Type		Visually Graded Sawn Lumber	
Wood Species	Species =	Douglas Fir-Larch	
Wood Grade	Grade =	No. 2	
Stud Size	Size =	2x6	
Number of Studs	n =	4	
Unbraced Length - X	ℓ_{ux} =	12	ft
Unbraced Length - Y	ℓ_{uy} =	1	ft
Buckling Length Coefficient	K_e =	1	
Slenderness Ratio - X	ℓ_e/d_x =	26.2	
Slenderness Ratio - Y	ℓ_e/d_y =	8.0	



BOTTOM PLATE PROPERTIES

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

SECTION REDUCTION

Rows of bolts	n =	0	
Bolt Diameter	D =	0.75	in

NDS REFERENCE DESIGN VALUES *(NDS Supplement Table 4A)*

Allowable Compressive Stress	F_c =	1,350	psi
Modulus of Elasticity	E =	1,600,000	psi
Minimum Modulus of Elasticity	E_{min} =	580,000	psi
Perpendicular Load Capacity	$F_{c,perp}$ =	625	psi

NDS ADJUSTMENT FACTORS

Adjustment Factor		F_c	$F_{c,perp}$	E	*Code Reference*
Load Duration Factor	C_D =	1.00	-	-	*NDS Table 2.3.2*
Wet Service Factor	C_M =	1.00	1.00	1.00	*NDS Supplement Table 4A*
Temperature Factor	C_t =	1.00	1.00	1.00	*NDS Appendix C*
Incising Factor	C_i =	1.00	1.00	1.00	*NDS Table 4.3.8*
Size Factor	C_F =	1.10	-	-	*NDS Supplement Table 4A*
Column Stability Factor	C_b =	0.41	-	-	*NDS Eq. 3.7-1*
Bearing Area Factor	C_b =	-	1.00	-	*NDS Sec. 3.10.4*
Fire-Treatment Factor	C_{FT} =	1.00	1.00	1.00	

ADJUSTED DESIGN VALUES

Compression Design Value	F_c' =	610	psi
Stiffness Design Value	E_{min}' =	580,000	psi
Perpendicular Design Value	$F_{c,perp}'$ =	625	psi

RESULTS

Buckling Capacity	20,141	lbs
Net Section Capacity	196,020	lbs
Sill Plate Capacity	20,625	lbs

Allowable Axial Capacity **20,141 lbs**

Stud Wall Axial Capacities	
Stud Spacing	Capacity
12 in oc	20,141 lbs/ft
16 in oc	15,106 lbs/ft
24 in oc	10,070 lbs/ft

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Chapter C
Lateral Design

Section 1
Shear Wall Design

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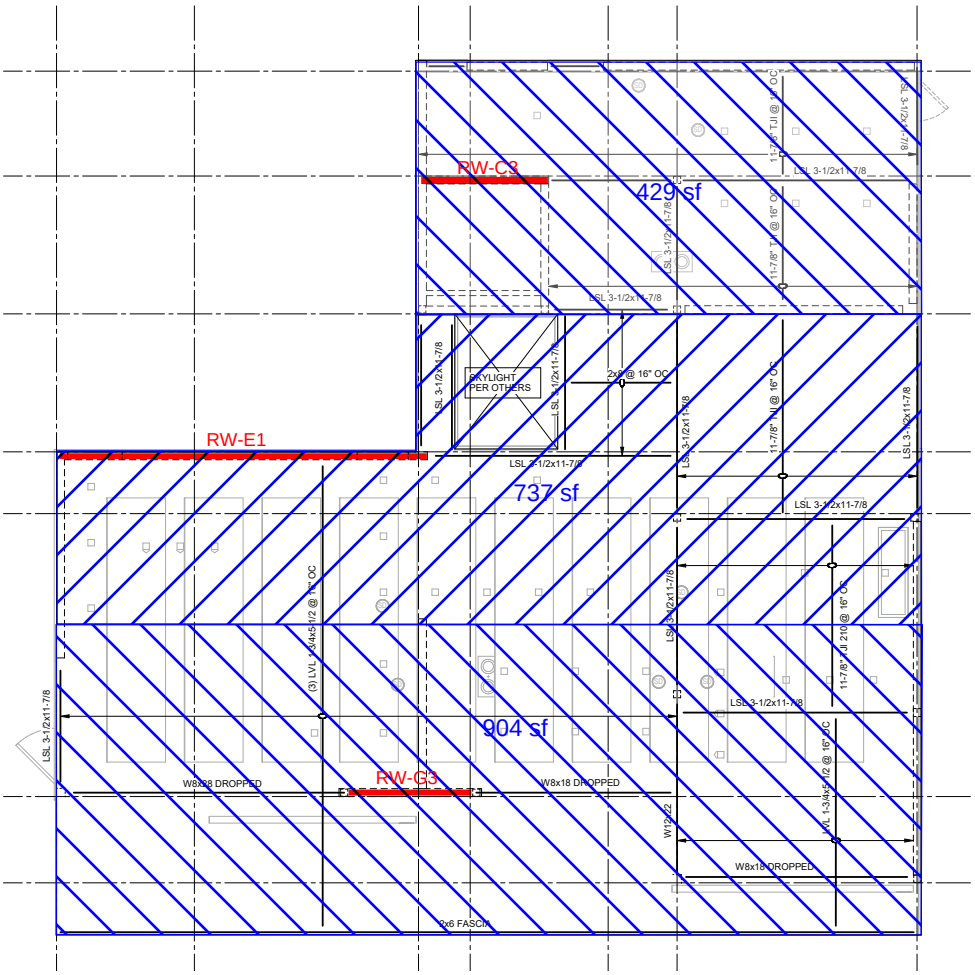
project	Fused Elements Residence	by CBJ	sheet no.
location	Mercer Island, WA	date 9-2023	
client	Olson Kundig		job no. 22-638
	Gravity Framing Design		

UPPER ROOF LATERAL LOAD DISTRIBUTION - NORTH/SOUTH DIRECTION



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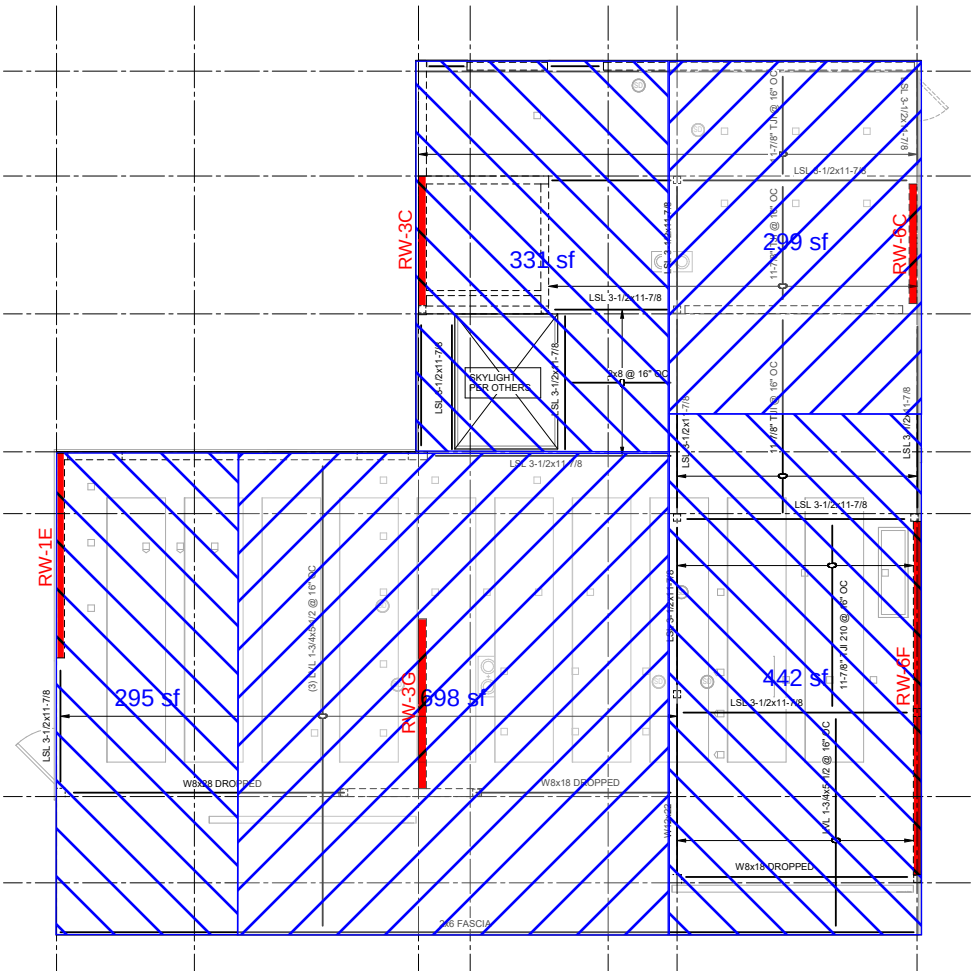
project	Fused Elements Residence	by CBJ	sheet no.
location	Mercer Island, WA	date 9-2023	
client	Olson Kundig		job no. 22-638
	Gravity Framing Design		

UPPER ROOF LATERAL LOAD DISTRIBUTION - EAST/WEST DIRECTION



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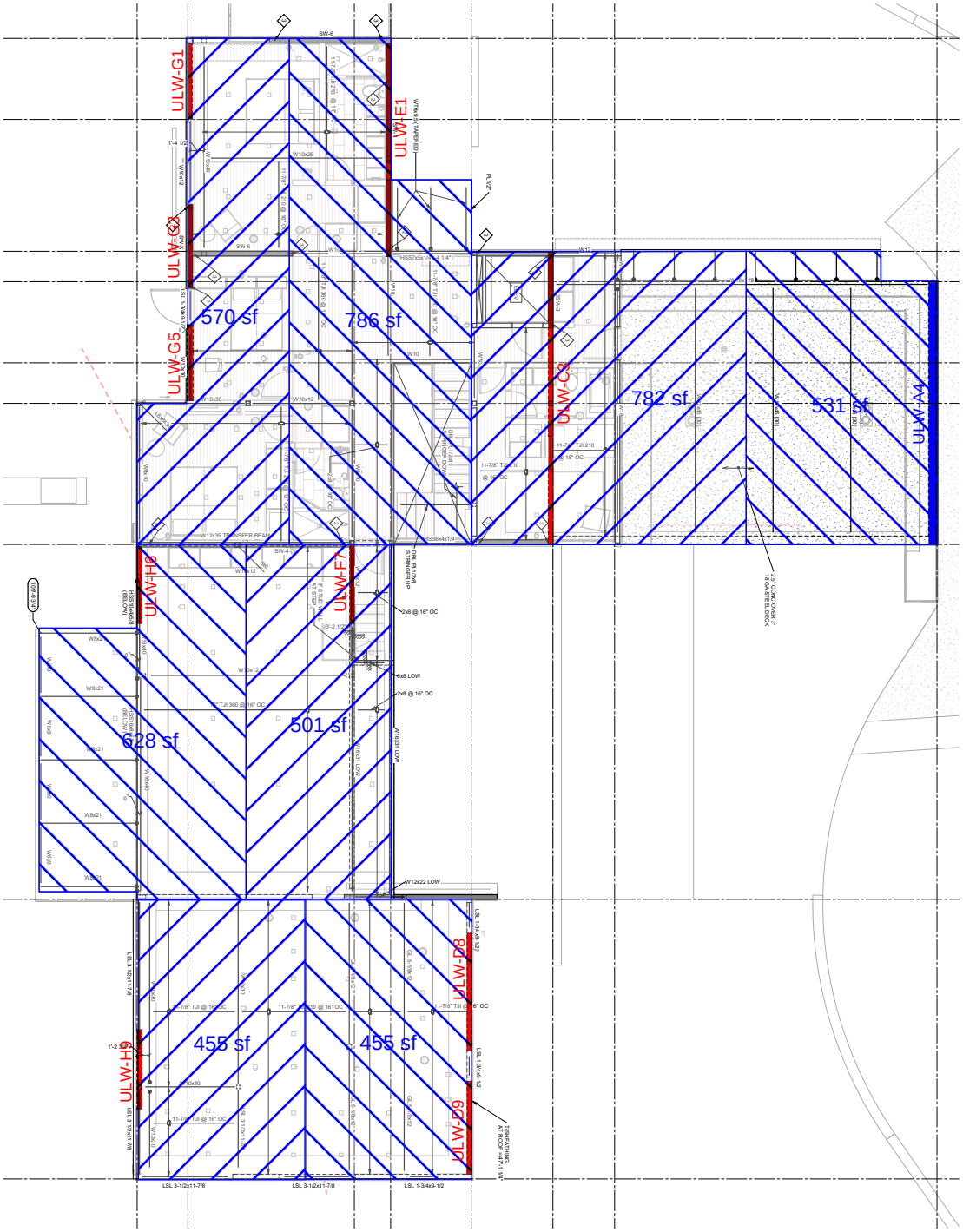
project	Fused Elements Residence	by CBJ	sheet no.
location	Mercer Island, WA	date 9-2023	
client	Olson Kundig		job no. 22-638
	Gravity Framing Design		

UPPER LEVEL LATERAL LOAD DISTRIBUTION - NORTH/SOUTH DIRECTION



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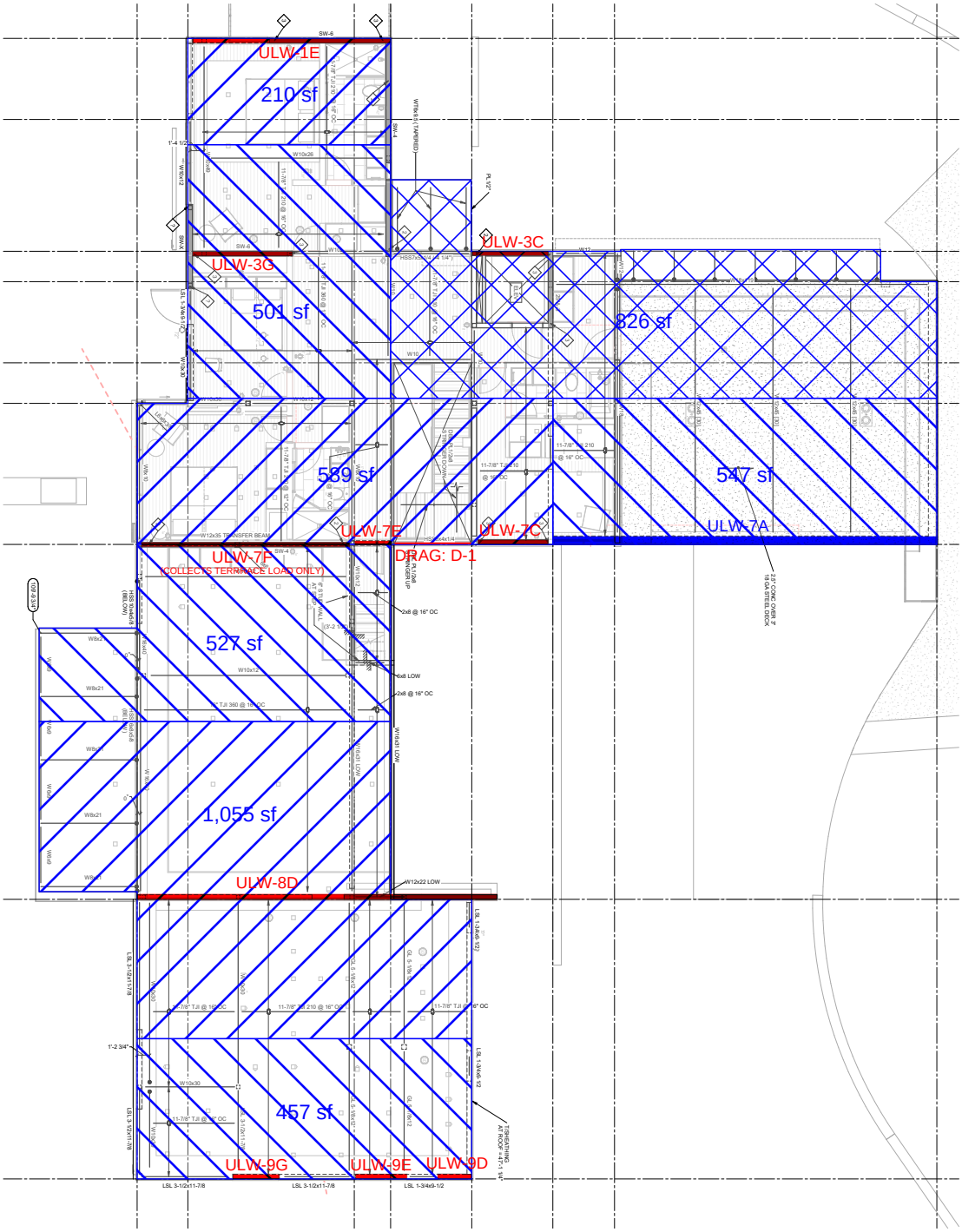
project	Fused Elements Residence	by CBJ	sheet no.
location	Mercer Island, WA	date 9-2023	
client	Olson Kundig		job no. 22-638
	Gravity Framing Design		

UPPER LEVEL LATERAL LOAD DISTRIBUTION - EAST/WEST DIRECTION



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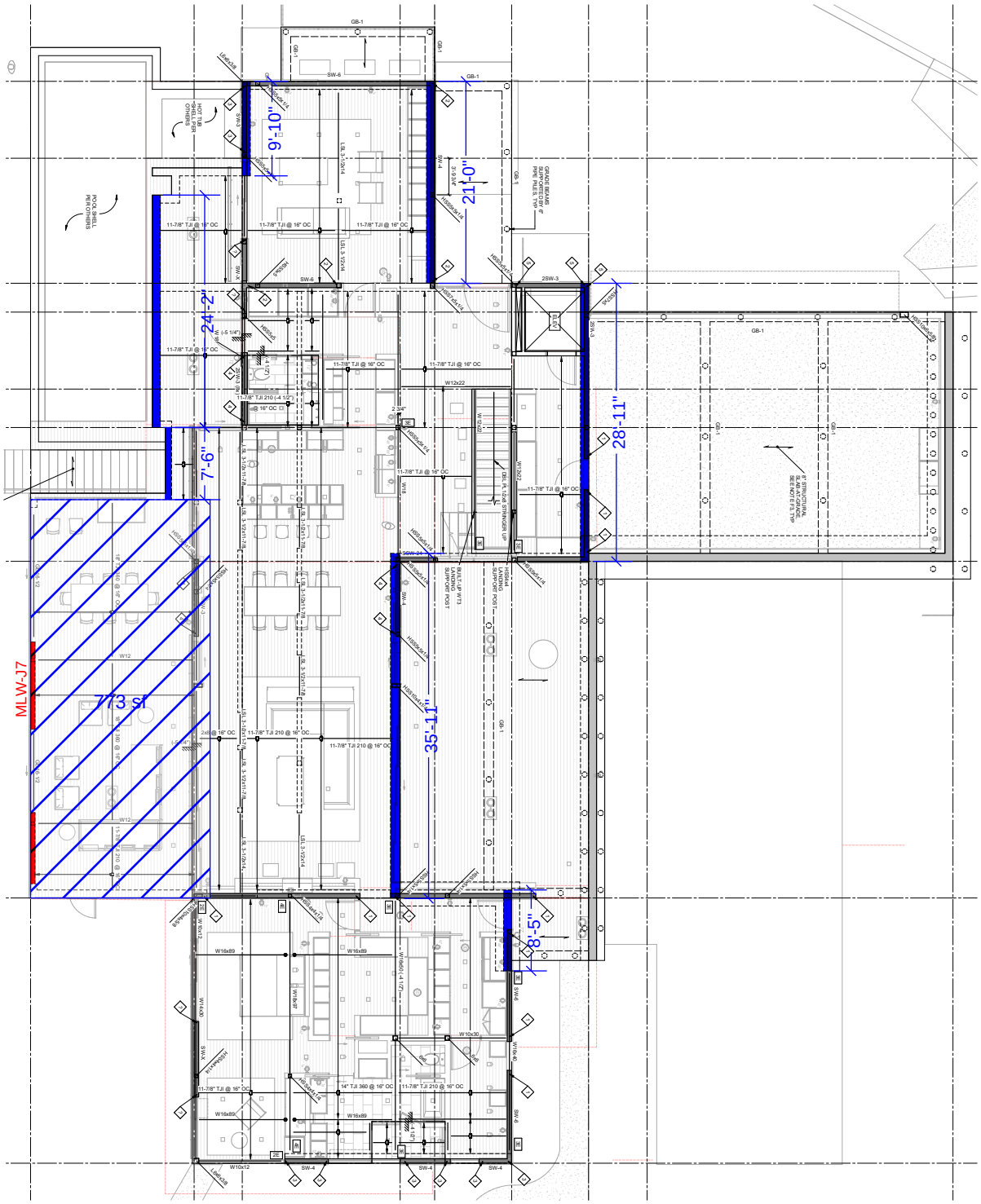
project	Fused Elements Residence	by CBJ	sheet no.
location	Mercer Island, WA	date 9-2023	
client	Olson Kundig		job no. 22-638
	Gravity Framing Design		

MAIN LEVEL LATERAL LOAD DISTRIBUTION - NORTH/SOUTH DIRECTION



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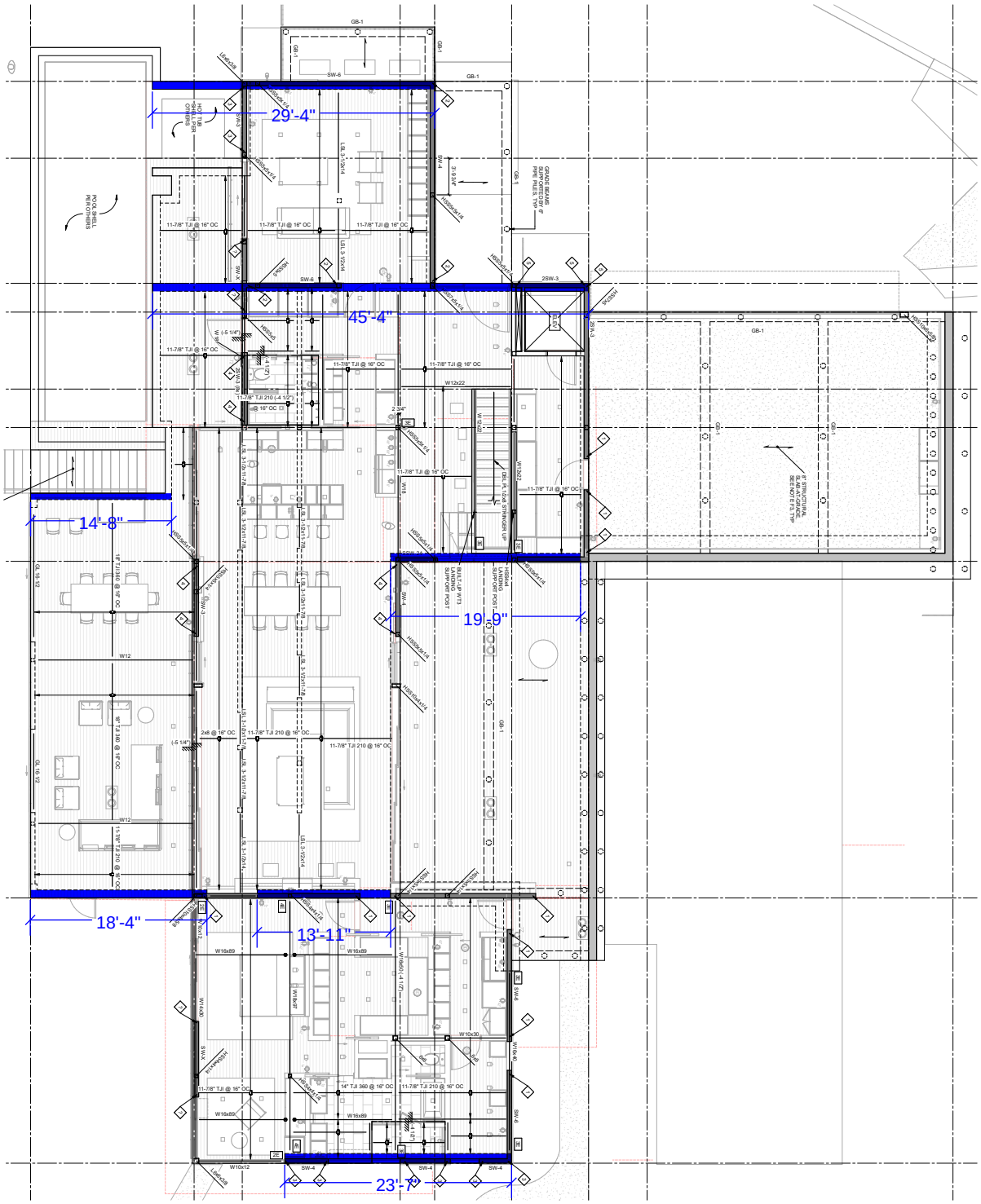
project	Fused Elements Residence	by CBJ	sheet no.
location	Mercer Island, WA	date 9-2023	
client	Olson Kundig		job no. 22-638
	Gravity Framing Design		

MAIN LEVEL LATERAL LOAD DISTRIBUTION - EAST/WEST DIRECTION



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project: Fused Elements Residence		by: CBJ	sheet no.
location: Mercer Island, WA		date: 09/2023	
client: Olson Kundig			job no. 22-00638
Lateral Load Distribution			

Typical Roof Lateral Loads

Seismic DL: 27 psf
LL: 20 psf

Green Roof Lateral Loads

Seismic DL: 57 psf
LL: 20 psf

Solar PV Roof Lateral Loads

Seismic DL: 30 psf
LL: 20 psf

Interior Lateral Loads

Seismic DL: 29 psf
LL: 40 psf

Terrace Lateral Loads

Seismic DL: 29 psf
LL: 60 psf

Garage Roof Lateral Loads

Seismic DL: 100 psf
LL: 250 psf

Seismic Weight Calculation:

Roof Section	Load Type	Trib Area ft^2	Load psf	Weight lb	Comments
Typical	DL	1060	27.0	28620	
Solar PV	DL	1004	30.0	30120	
Whole	LL	2064	20.0	41280	
Total Seismic Weight				58740	

Upper Lvl Section	Load Type	Trib Area ft^2	Load psf	Weight lb	Comments
Interior	DL	1734	29.0	50286	
Interior	LL	1734	40.0	69360	
Terrace	DL	887	29.0	25723	
Terrace	LL	887	60.0	53220	
Green Roof	DL	922	57.0	52554	
Green Roof	LL	922	20.0	18440	
Roof	DL	392	27.0	10584	
Roof	LL	392	20.0	7840	
Garage Roof	DL	814	100.0	81400	
Garage Roof	LL	814	250.0	203500	
10" Wall	DL	351	125.0	43875	62 LF x 5'-6" Trib Ht
Total Seismic Weight				264422	220547 43875

Main Lvl Section	Load Type	Trib Area ft^2	Load psf	Weight lb	Comments
Interior	DL	3213	29.0	93177	
Interior	LL	3213	40.0	128520	
Terrace	DL	1000	29.0	29000	
Terrace	LL	1000	60.0	60000	
10" Wall	DL	580	125.0	72500	49 LF x 4'-0" Trib Ht, 64 LF x 6'-0" Trib Ht
12" Wall	DL	960	150.0	144000	160 LF x 6'-0" Trib Ht
Total Seismic Weight				266177	

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	location	Mercer Island, WA	date	09/2023	
	client	Olson Kundig			job no. 22-00638
		Lateral Load Distribution			

Typical Roof (TR) Lateral Loads
Seismic DL: 27 psf

Green Roof (GR) Lateral Loads
Seismic DL: 57 psf

Seismic Values
C_S: 0.147

Interior (Int) Lateral Loads
Seismic DL: 29 psf

Terrace (Terr) Lateral Loads
Seismic DL: 29 psf

R_{LFSW}: 6.5
R_{ORCSW}: 4

Garage Roof (GaR) Lateral Loads
Seismic DL: 100 psf

Solar PV Roof (PV) Lateral Loads
Seismic DL: 30 psf

$R_{LFSW/ORCSW}$: 1.625

	Roof	Upper Lvl	Main Lvl
Area (ft^2)	1060.0	3935	4213
W_x (k)	59	264	266
F_x (k)	15.4	46.2	25.4

Lateral Load Distribution: East - West Loading

Roof	Trib Area	Trib Area	Trib Area	Trib Area	Trib Area	Trib Area	Trib L	Trib H	E_{Frame}
	TR	GR	Int	Terr	GaR	PV	10" Thick Conc Wall		Total
ID	ft^2	ft^2	ft^2	ft^2	ft^2	ft^2	ft	ft	lb
RW-1E	85	0	0	0	0	210	0	0	2251
RW-3C	330	0	0	0	0	0	0	0	2334
RW-3G	200	0	0	0	0	500	0	0	5343
RW-7C	300	0	0	0	0	0	0	0	2121
RW-7F	155	0	0	0	0	295	0	0	3414

Upper Lvl	Trib Area	Trib Area	Trib Area	Trib Area	Trib Area	Trib Area	Trib L	Trib H	E_{Frame}
	TR	GR	Int	Terr	GaR	PV	10" Thick Conc Wall		Total
ID	ft^2	ft^2	ft^2	ft^2	ft^2	ft^2	ft	ft	lb
ULW-1E	0	0	214	0	0	0	0	0	1083
ULW-3C	130	0	330	0	363	0	0	0	8619
ULW-3G	0	0	508	0	0	0	0	0	2571
ULW-7A	93	0	689	438	452	0	15	5	34543
ULW-7C	93	0	590	438	0	0	0	0	5642
ULW-7F	93	0	0	438	0	0	0	0	2655
ULW-8D	168	460	0	438	0	0	0	0	7585
ULW-9D	0	460	0	0	0	0	0	0	4577
									26220

Main Lvl	Total Length	E_{Wall}	Notes
ID	ft	lb/ft	
Basement Walls	155	267	Uniform shear load in basement walls based on Fx and length of concrete walls in East-West direction. Fx is increased by R ratio for ORCSW.

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project	Fused Elements Residence	by CBJ	sheet no.
location	Mercer Island, WA	date 09/2023	
client	Olson Kundig		job no. 22-00638
	Lateral Load Distribution		

Lateral Load Distribution: North-South Loading

Roof	Trib Area	Trib Area	Trib Area	Trib Area	Trib Area	Trib Area	Trib L	Trib H	E_{Frame}
	TR	GR	Int	Terr	GaR	PV	10" Thick Conc Wall		Total
ID	ft^2	ft^2	ft^2	ft^2	ft^2	ft^2	ft	ft	lb
RW-C3	430	0	0	0	0	0	0	0	3041
RW-E1	232	0	0	0	0	504	0	0	5601
RW-G3	402	0	0	0	0	504	0	0	6803

Upper Lvl	Trib Area	Trib Area	Trib Area	Trib Area	Trib Area	Trib Area	Trib L	Trib H	E_{Frame}
	TR	GR	Int	Terr	GaR	PV	10" Thick Conc Wall		Total
ID	ft^2	ft^2	ft^2	ft^2	ft^2	ft^2	ft	ft	lb
ULW-A4	40	0	0	0	497	0	0	0	14403
ULW-C3	37	0	426	0	318	0	0	0	7881
ULW-D8/9	0	460	0	0	0	0	0	0	4577
ULW-E1	55	0	725	0	0	0	0	0	3929
ULW-F7	0	0	0	513	0	0	0	0	2597
ULW-G1	0	0	125	0	0	0	0	0	633
ULW-G3	0	0	143	0	0	0	0	0	724
ULW-G5	0	0	311	0	0	0	0	0	1574
ULW-H7	260	0	0	375	0	0	0	0	3124
ULW-H9	0	460	0	0	0	0	0	0	4577

Main Lvl	Total Length	E_{Wall}	Notes
ID	ft	lb/ft	
Basement Walls	130	317	Uniform shear load in basement walls based on Fx and length of concrete walls in North-South direction. Fx is increased by R ratio for ORCSW.

	TR	GR	Int	Terr	GaR	PV	10" Thick Conc Wall		Total
ID	ft^2	ft^2	ft^2	ft^2	ft^2	ft^2	ft	ft	lb
MLW-J7	0	0	73	710	0	0	0	0	2166

Wood Shear Wall Design:

rho: 1.3

	East-West:	Wall Geometry:							O.T.
Level	Wall ID:	Length (ft)	Height (ft)	F_{PE} (k)	ρV_E (plf)	Wall Type	ϕV_n (plf)	Shear DCR	$\rho T/C_E$ (k)
Roof	RW-1E	11.5	10.17	2.25	254.5	SW-6	496.0	0.51	2.8
	RW-3C	7.5	10.17	2.33	404.6	SW-6	496.0	0.82	4.7
	RW-3G	9.75	10.17	5.34	712.4	SW-4	736.0	0.97	8.1
	RW-7C	7	10.17	2.12	393.9	SW-6	496.0	0.79	4.7
	RW-7F	20	10.17	3.41	221.9	SW-6	496.0	0.45	2.4
Upper Level	ULW-1E, UL	19.5	10.34	1.08	-	-	-	-	0.8
	ULW-1E, UL+R	19.5	10.34	3.33	222.3	SW-6	496.0	0.45	3.6
	ULW-3C, UL	7.5	10.34	8.62	-	-	-	-	17.8
	ULW-3C, UL+R	7.5	10.34	10.95	1898.5	2SW-3	1920.0	0.99	22.6
	ULW-3G	9.75	10.34	2.57	-	-	-	-	3.9
	ULW-3G, UL+R	9.75	10.34	7.91	1055.2	2SW-4	1472.0	0.72	12.0
	ULW-7C,E, UL	11.34	10.34	11.71	-	-	-	-	-
	ULW-7C UL	7.34	10.34	7.58	-	-	-	-	16.1
	ULW-7C, UL+R	7.34	10.34	9.70	1718.2	2SW-3	1920.0	0.89	20.7
	ULW-7E, UL+R	4	10.34	4.13	1342.5	2SW-3	1485.5	0.90	18.5
	ULW-7F, UL	20	3.75	2.66	-	-	-	-	0.7
	ULW-7F, UL+R	20	3.75	6.07	394.5	SW-6	496.0	0.80	1.6
	ULW-8D	32	10.34	7.59	308.1	SW-6	496.0	0.62	3.3
	ULW-9D,E,G	13	10.34	4.58	457.7	SW-4	736.0	0.62	-
	ULW-9D	3.33	10.34	1.17	-	-	-	-	6.8
	ULW-9E	5.17	10.34	1.82	-	-	-	-	5.9
	ULW-9G	4.5	10.34	1.58	-	-	-	-	6.1

	North-South:	Wall Geometry:							O.T.
Level	Wall ID:	Length (ft)	Height (ft)	F_{PE} (k)	ρV_E (plf)	Wall Type	ϕV_n (plf)	Shear DCR	$\rho T/C_E$ (k)
Roof	RW-C3	7	10.17	3.04	564.8	SW-4	736.0	0.77	6.7
	RW-E1	13.58	10.17	5.60	536.2	SW-4	736.0	0.73	5.9
	RW-G3	7.25	10.17	6.80	1219.8	2SW-4	1472.0	0.83	14.4
Upper Level	ULW-C3, UL	23.75	10.34	7.88	-	-	-	-	4.7
	ULW-C3, UL+R	23.75	10.34	10.92	597.8	SW-4	736.0	0.81	11.4
	ULW-D8,9	20.75	10.34	4.58	-	-	-	-	3.1
	ULW-D8	11.58	10.34	2.55	286.8	SW-6	496.0	0.58	3.2
	ULW-D9	9.17	10.34	2.02	286.8	SW-6	496.0	0.58	3.3
	ULW-E1, UL	20.5	10.34	3.93	-	-	-	-	2.7
	ULW-E1, UL+R	20.5	10.34	9.53	604.3	SW-4	736.0	0.82	8.6
	ULW-F7	7.25	14.08	2.60	465.7	SW-4	736.0	0.63	7.6
	ULW-G1,3,5, UL	21.75	10.34	2.93	175.2	SW-6	496.0	0.35	-
	ULW-G1, UL	7	10.34	0.94	-	-	-	-	2.1
	ULW-G3, UL	7.25	10.34	0.98	-	-	-	-	2.1
	ULW-G3, UL+R	7.25	10.34	7.78	1395.0	2SW-4	1472.0	0.95	16.5
	ULW-G5, UL	7.5	10.34	1.01	-	-	-	-	2.1
	ULW-H7	7.5	14.08	3.12	541.5	SW-4	736.0	0.74	8.8
	ULW-H9	7.75	10.34	4.58	767.8	SW-3	960.0	0.80	9.1
Main Level	MLW-J7	16.5	11.5	2.17	170.7	SW-6	496.0	0.34	2.1

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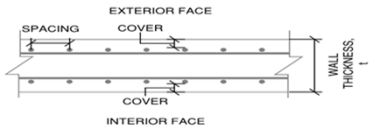
project	Fused Elements Resdience	by CBJ	sheet no.
location	Mercer Island, WA	date 9/2023	
client	Olson Kundig		job no. 22-638
	Typical Basement Shear Wall		

CONCRETE BASEMENT WALL DESIGN



INPUT PARAMETERS:

CROSS-SECTION DIMENSIONS

Section Shape		Wall Type 1	
Wall Width	b =	12.0 in	
Wall Thickness	t =	10.0 in	
Compression Face		Interior Face	
Height of Wall	h_w =	144.0 in	11.6.2a
Length of Wall	l_w =	40.0 in	11.6.2a

COVER PARAMETERS

				Minimum Required Cover	
Wall Face Exposure	Interior Face:	Not Exposed	→	0.75 in	20.6.1.3.1
	Exterior Face:	Exposed	→	2.00 in	20.6.1.3.1
Clear Cover Used	Interior Face	0.75 in			
	Exterior Face	2.00 in			

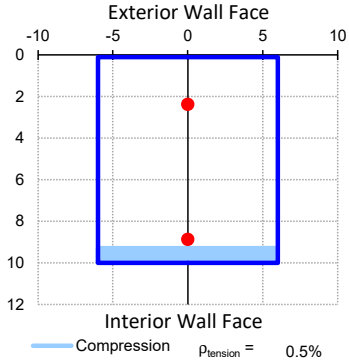


Image for reference only and is not to scale. Items shown may not be accurate. Reinforcing is represented as a single top & single bot. bar

VERTICAL REINFORCING LAYOUT

Layer	On-Center Spacing (in)	Bar # (U.S.)	d_{layer} (in)
Interior Face	12	#6	1.125
Exterior Face	12	#6	7.625

HORIZONTAL REINFORCING LAYOUT

Layer	On-Center Spacing (in)	Bar # (U.S.)
Interior Face	18	#4
Exterior Face	18	#4

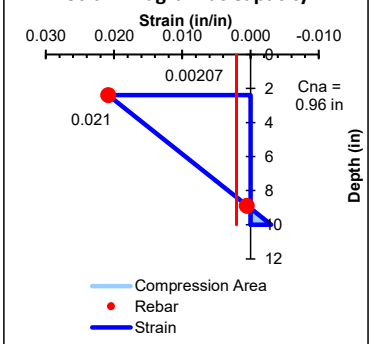


Image for reference only and is not to scale. Items shown may not be accurate.

MATERIAL PROPERTIES

Concrete 28 Day Compressive Strength	f'_{c28} =	4.0 ksi
Concrete Type	Type =	Normalweight
Concrete Weight	γ_c =	145 pcf
Flexural Reinforcement Yield Strength	f_y =	60 ksi

ANALYSIS OUTPUT: (Referenced to ACI 318-14 Requirements)

			Reference	STATUS:
FLEXURAL STRENGTH				GOOD - PASSES ACI 318
Nominal Moment Strength Capacity	M_n =	18.5 kip-ft		
Reduction Factor, ϕ	ϕ =	0.90	21.2.2	
Design Moment Strength Capacity at P_u	**ϕM_n =**	**16.6 kip-ft/ft**		
Axial Strength Capacity	**$\phi P_{n\_comp,max}$ =**	**210.6 kip**	22.4.2.2	
	$\phi P_{n\_tens,min}$ =	**-47.5 kip**	22.4.3.1	
Factored Moment Demand (matching compression face)	**M_u =**	**1.7 kip-ft/ft**		GOOD - ϕMn > Mu
Factored Axial Demand (compression positive)	**P_u =**	**6.1 kip**		
OUT-OF-PLANE SHEAR STRENGTH				
Nominal Shear Strength Capacity	$V_{n,out-of-plane}$ =	11.9 kips	11.5.5.1	
Reduction Factor, ϕ	**ϕ =**	0.75	21.2.4.1	
Design Shear Strength Capacity	**$\phi V_{n,out-of-plane}$ =**	**8.9 kips/ft**	11.5.1.1c	
Factored Shear Demand	**$V_{u,out-of-plane}$ =**	**1.7 kips/ft**		GOOD - ϕVn > Vu
IN-PLANE SHEAR STRENGTH				
Nominal Shear Strength Capacity	$V_{n,in-plane}$ =	83.1 kips	11.5.4.4	
Reduction Factor, ϕ	ϕ =	0.6	21.2.1	
Design Shear Strength Capacity	**$\phi V_{n,in-plane}$ =**	**15.0 kips/ft**	11.5.1.1c	
Factored Shear Demand	**$V_{u,in-plane}$ =**	**1.7 kips/ft**		GOOD - ϕVn > Vu
SERVICABILITY				
Cracking Moment	**M_{cr} =**	**8.8 kip-ft**	24.2.3.5b	

1601 5th Avenue, Suite 1600
Seattle, WA 98101 206 622-5822

Chapter C
Lateral Design

Section 2
Shear Wall Anchorage

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1601 5th Avenue, Suite 1600
Seattle, WA 98101 206 622-5822

project	Fused Elements	by	CBJ
location	Mercer Island, WA	date	9/2023
client	Olson Kundig		
	Wood Shear Wall Design		

sheet no.

job no. 2200638

Wall Boundary Studs / Anchor Design:

P_{max} (k): $(1.0 + 0.14S_{DS})D + H + F + 0.7\rho Q_E$ Or $(1.0 + 0.10S_{DS})D + H + F + 0.525\rho Q_E + 0.75L$ Or $1.0D + 1.0L$

P_{min} (k): $(0.6 - 0.14S_{DS})D + H - 0.7\rho Q_E$ *[0.14 = 0.7*0.2]*

S_{DS}: 0.96

Wall ID:	O.T.	End 1: (N or E)		(Compression)	(Tension)	End 2: (S or W)		(Compression)	(Tension)	
East-West:	$\rho T/C_E$ (k)	P_D (k)	$P_{L/S}$ (k)	P_{max} (k)	P_{min} (k)	P_D (k)	$P_{L/S}$ (k)	P_{max} (k)	P_{min} (k)	
RW-1E	2.83			1.98	-1.98			1.98	-1.98	(2) 2x6 /HDU2
RW-3C	4.75			3.32	-3.32			3.32	-3.32	(2) 2x6 /HDU4
RW-3G	8.07			5.65	-5.65			5.65	-5.65	(2) 2x6 /HDU8
RW-7C	4.67	0.82	1.20	4.25	-2.89			3.27	-3.27	(2) 2x6 /HDU4
RW-7F	2.38	1.37	2.01	4.26	-1.03	1.06	1.56	3.58	-1.17	(2) 2x6 /DTT2Z
ULW-1E, UL+R	3.62			2.53	-2.53			2.53	-2.53	(2) 2x6 /HDU2
ULW-3C, UL+R	22.57			15.80	-15.80			19.12	-19.12	(4) 2X6/(2) HDU14
ULW-3G, UL+R	12.02	0.95	2.24	9.49	-7.97			8.42	-8.42	(2) 2x6 /HDU11
ULW-7C, UL+R	20.74	0.82	1.20	15.45	-14.14			14.52	-14.52	(4) 2X6/(2) HDU14
ULW-7E, UL+R	18.51	0.90	2.90	13.98	-12.54	2.06	4.47	15.33	-12.00	(4) 2X6/HDU14
ULW-7F, UL+R	1.56	2.06	4.47	6.53	-0.13	1.75	4.02	5.75	-0.28	(2) 2x6 /DTT2Z
ULW-8D	3.29			2.30	-2.30			2.30	-2.30	(2) 2x6 /HDU2
ULW-9D	6.76			4.73	-4.73			4.73	-4.73	(2) 2x6 /HDU5
ULW-9E	5.87	1.73	0.90	6.07	-3.30	2.50	1.30	6.94	-2.95	(2) 2x6 /HDU4
ULW-9G	6.08			4.26	-4.26	2.02	1.05	6.55	-3.32	(2) 2x6 /HDU5
North-South:	$\rho T/C_E$ (k)	P_D (k)	$P_{L/S}$ (k)	P_{max} (k)	P_{min} (k)	P_D (k)	$P_{L/S}$ (k)	P_{max} (k)	P_{min} (k)	
RW-C3	6.70			4.69	-4.69	0.45	0.66	5.20	-4.48	(2) 2x6 /HDU5
RW-E1	5.89			4.12	-4.12			4.12	-4.12	(2) 2x6 /HDU5
RW-G3	14.39	2.98	3.93	13.77	-8.52	2.13	2.80	12.49	-9.08	(3) 2x6 /HDU14
ULW-C3, UL+R	11.36			7.95	-7.95			7.95	-7.95	(2) 2x6 /HDU11
ULW-D8	3.25	0.24	0.13	6.66	-6.27	0.24	0.13	6.66	-6.28	(2) 2x6 /HDU8
ULW-D9	3.33	0.24	0.13	2.60	-2.20			2.33	-2.33	(2) 2x6 /HDU2
ULW-E1, UL+R	8.59			6.02	-6.02	1.46	3.44	8.70	-5.34	(2) 2x6 /HDU8
ULW-F7	7.61	2.06	4.47	9.60	-4.25	2.87	10.14	14.74	-3.99	(3) 2x6 /HDU5
ULW-G1, UL	2.11			1.48	-1.48			1.48	-1.48	(2) 2x6 /DTT2Z
ULW-G3, UL+R	16.49	2.98	3.93	14.92	-9.99	2.13	2.80	13.96	-10.55	(3) 2x6 /HDU14
ULW-G5, UL	2.09			1.46	-1.46			1.46	-1.46	(2) 2x6 /DTT2Z
ULW-H7	8.80	1.75	4.02	9.55	-5.24	0.65	2.28	7.04	-5.86	(2) 2x6 /HDU8
ULW-H9	9.11			6.38	-6.38			6.38	-6.38	(2) 2x6 /HDU8
MLW-J7	2.09			1.46	-1.46			1.46	-1.46	(2) 2x6 /DTT2Z

Compression Studs:		$0.9*P_{max}$ (k)	P_{max} (k)
(2) 2x6	DFL No. 2	9.063	10.07
(3) 2x6	DFL No. 2	13.59	15.1
(4) 2X6	DFL No. 2	18.09	20.1
Steel	See drawings		

Holdowns:	$0.9*T_{max}$ (k)	T_{max} (k)
DTT2Z	1.93	2.145
HDU2	2.77	3.075
HDU4	4.11	4.565
HDU5	5.08	5.645
HDU8	7.08	7.87
HDU11	8.58	9.535
HDU14	13.00	14.445

HDU/DTT

Holdowns

This product is preferable to similar connectors because of (a) easier installation, (b) higher loads, (c) lower installed cost, or a combination of these features.

HDU holdowns are pre-deflected during the manufacturing process, virtually eliminating deflection under load due to material stretch. They use Strong-Drive® SDS Heavy-Duty Connector screws which install easily, reduce fastener slip and provide a greater net section when compared to bolts.

The DTT tension ties are designed for lighter-duty holdown applications on single 2x posts. The DTT1Z is installed with nails or Strong-Drive SD Connector screws and the DTT2 installs easily with the Strong-Drive SDS Heavy-Duty Connector screws (included). The DTT1Z holdowns have been tested for use in designed shearwalls and prescriptive braced wall panels as well as prescriptive wood-deck applications (see p. 295 for deck applications).

For more information on holdown options, contact Simpson Strong-Tie.

HDU Features:

- Uses Strong-Drive SDS Heavy-Duty Connector screws which install easily, reduce fastener slip and provide a greater net section area of the post compared to bolts
- Strong-Drive SDS Heavy-Duty Connector screws are supplied with the holdowns to ensure proper fasteners are used
- No stud bolts to countersink at openings

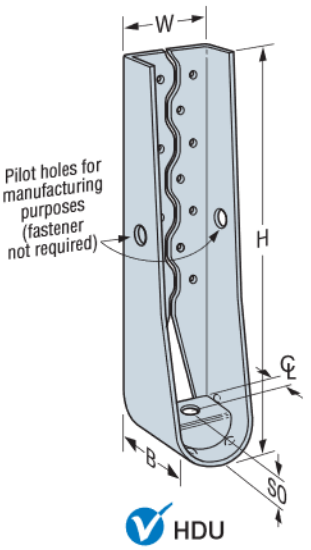
Material: See table

Finish: HDU — galvanized; DTT1Z and DTT2Z — ZMAX® coating; DTT2SS — stainless steel

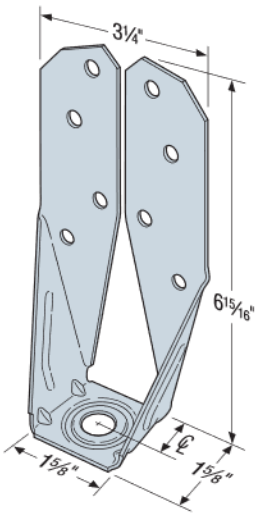
Installation:

- See Holdown and Tension Tie General Notes on pp. 49–50.
- The HDU requires no additional washer; the DTT requires a standard-cut washer (included) be installed between the nut and the seat.
- Strong-Drive SDS Heavy-Duty Connector screws install best with a low-speed high-torque drill with a ⅜" hex-head driver.
- Fasteners and crescent washer are included with the holdowns. For replacements, order part no. SDS25212-HDU__. (Fill in the size needed, e.g., HDU2.)

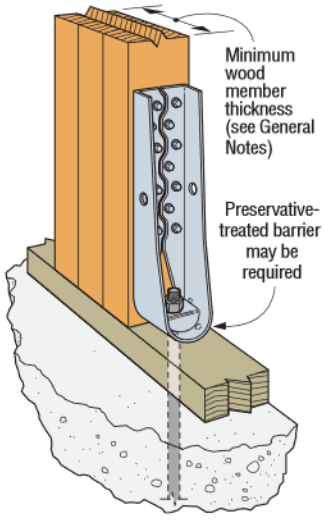
Codes: See p. 11 for Code Reference Key Chart



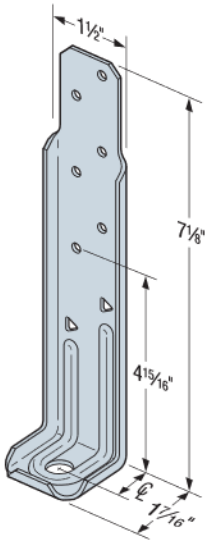
HDU



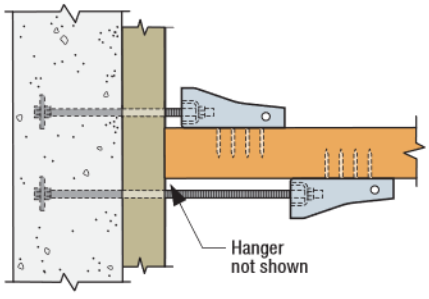
DTT2Z
US Patent
8,555,580



Vertical HDU Installation



DTT1Z
US Patent
10,865,558



Horizontal HDU Offset Installation
(plan view)
See Holdown and Tension Tie General Notes.

HDU/DTT

Holdowns (cont.)

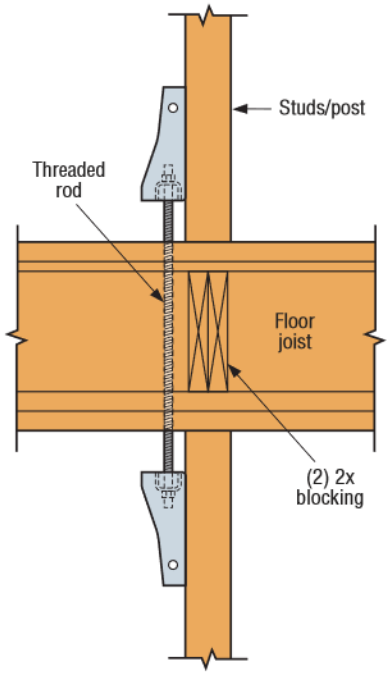
These products are available with additional corrosion protection. For more information, see p. 14.

SS For stainless-steel fasteners, see p. 21.

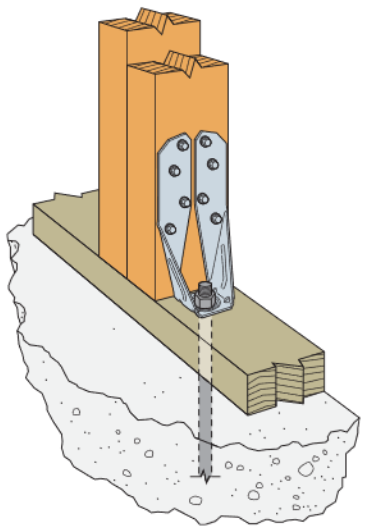
SD Many of these products are approved for installation with Strong-Drive® SD Connector screws. See pp. 348–352 for more information.

Model No.	Ga.	Dimensions (in.)					Fasteners (in.)		Minimum Wood Member Size (in.)	Allowable Tension Loads (160)			Code Ref.
		W	H	B	CL	SO	Anchor Bolt Dia. (in.)	Wood Fasteners		DF/SP	SPF/HF	Deflection at Allowable Load (in.)	
DTT1Z	14	1½	7⅛	1⅞	¾	⅜	⅜	(6) #9 x 1½" SD	1½ x 5½	840	840	0.17	IBC, FL, LA
								(6) 0.148 x 1½		910	640	0.167	
								(8) 0.148 x 1½		910	850	0.167	
SS DTT2Z	14	3¼	6⁵⁄₁₆	1⅝	¹³⁄₁₆	⅜	½	(8) ¼ x 1½ SDS	1½ x 3½	1,825	1,800	0.105	
								(8) ¼ x 1½ SDS	3 x 3½	2,145	1,835	0.128	
SS DTT2Z-SDS2.5								(8) ¼ x 2½ SDS	3 x 3½	2,145	2,105	0.128	
HDU2-SDS2.5	14	3	8¹⁄₁₆	3¼	1⁵⁄₁₆	1⅜	⅝	(6) ¼ x 2½ SDS	3 x 3½	3,075	2,215	0.088	
HDU4-SDS2.5	14	3	10¹⁵⁄₁₆	3¼	1⁵⁄₁₆	1⅜	⅝	(10) ¼ x 2½ SDS	3 x 3½	4,565	3,285	0.114	
HDU5-SDS2.5	14	3	13³⁄₁₆	3¼	1⁵⁄₁₆	1⅜	⅝	(14) ¼ x 2½ SDS	3 x 3½	5,645	4,340	0.115	
HDU8-SDS2.5	10	3	16⅝	3½	1⅜	1½	⅞	(20) ¼ x 2½ SDS	3 x 3½	6,765	5,820	0.11	
									3½ x 3½	6,970	5,995	0.116	
									3½ x 4½	7,870	6,580	0.113	
HDU11-SDS2.5	10	3	22¼	3½	1⅜	1½	1	(30) ¼ x 2½ SDS	3½ x 5½	9,535	8,030	0.137	
									3½ x 7¼	11,175	9,610	0.137	
HDU14-SDS2.5	7	3	25¹¹⁄₁₆	3½	1⁹⁄₁₆	1⁹⁄₁₆	1	(36) ¼ x 2½ SDS	3½ x 5½	10,770	9,260	0.122	—
									3½ x 7¼	14,390	12,375	0.177	IBC, FL, LA
									5½ x 5½	14,445	12,425	0.172	

1. HDU14 requires heavy-hex anchor nut to achieve tabulated loads (supplied with holdown).
2. HDU14 loads on 4x6 post are applicable to installation on either the narrow or the wide face of the post.
3. **Fasteners:** Nail dimensions are listed diameter by length. SD and SDS screws are Simpson Strong-Tie® Strong-Drive SD Connector and SDS Heavy-Duty Connector screws. See pp. 21–22 for fastener information.



Typical HDU Tie Between Floors



Typical DTT2Z Installation

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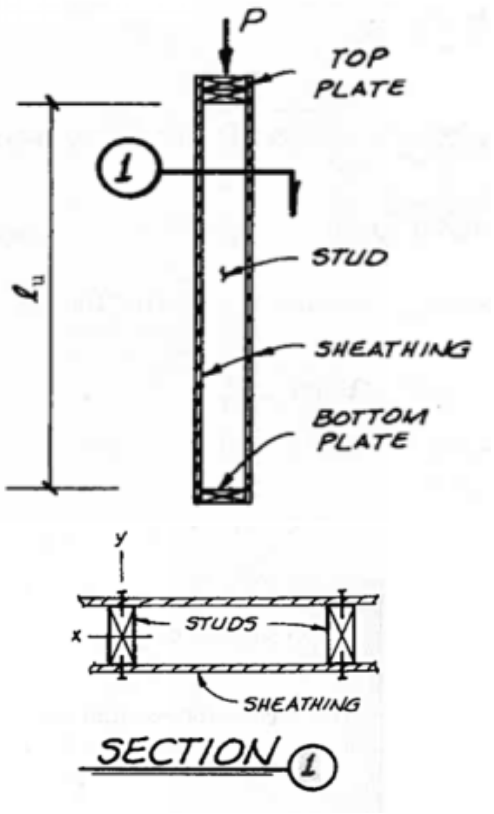
project: Fused Elements Residence		by: CBJ	sheet no.
location: Mercer Island, WA		date: 6/23/2023	
client: Olson Kundig			job no. 22-638
(2) 2x6 Capacity			

WOOD STUDS - AXIAL LOADS ONLY (NDS)

STUD PROPERTIES

Lumber Type		Visually Graded Sawn Lumber	
Wood Species	Species =	Douglas Fir-Larch	
Wood Grade	Grade =	No. 2	
Stud Size	Size =	2x6	
Number of Studs	n =	2	
Unbraced Length - X	ℓ_{ux} =	12	ft
Unbraced Length - Y	ℓ_{uy} =	1	ft
Buckling Length Coefficient	K_e =	1	
Slenderness Ratio - X	ℓ_e/d_x =	26.2	
Slenderness Ratio - Y	ℓ_e/d_y =	8.0	



BOTTOM PLATE PROPERTIES

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

SECTION REDUCTION

Rows of bolts	n =	0	
Bolt Diameter	D =	0.75	in

NDS REFERENCE DESIGN VALUES *(NDS Supplement Table 4A)*

Allowable Compressive Stress	F_c =	1,350	psi
Modulus of Elasticity	E =	1,600,000	psi
Minimum Modulus of Elasticity	E_{min} =	580,000	psi
Perpendicular Load Capacity	$F_{c,perp}$ =	625	psi

NDS ADJUSTMENT FACTORS

Adjustment Factor		**F_c**	**$F_{c,perp}$**	**E**	***Code Reference***
Load Duration Factor	C_D =	1.00	-	-	*NDS Table 2.3.2*
Wet Service Factor	C_M =	1.00	1.00	1.00	*NDS Supplement Table 4A*
Temperature Factor	C_t =	1.00	1.00	1.00	*NDS Appendix C*
Incising Factor	C_i =	1.00	1.00	1.00	*NDS Table 4.3.8*
Size Factor	C_F =	1.10	-	-	*NDS Supplement Table 4A*
Column Stability Factor	C_b =	0.41	-	-	*NDS Eq. 3.7-1*
Bearing Area Factor	C_b =	-	1.13	-	*NDS Sec. 3.10.4*
Fire-Treatment Factor	C_{FT} =	1.00	1.00	1.00	

ADJUSTED DESIGN VALUES

Compression Design Value	F_c' =	610	psi
Stiffness Design Value	E_{min}' =	580,000	psi
Perpendicular Design Value	$F_{c,perp}'$ =	703	psi

RESULTS

Buckling Capacity	10,070	lbs
Net Section Capacity	49,005	lbs
Sill Plate Capacity	11,602	lbs
Allowable Axial Capacity	**10,070**	**lbs**

Stud Wall Axial Capacities	
Stud Spacing	Capacity
12 in oc	10,070 lbs/ft
16 in oc	7,553 lbs/ft
24 in oc	5,035 lbs/ft

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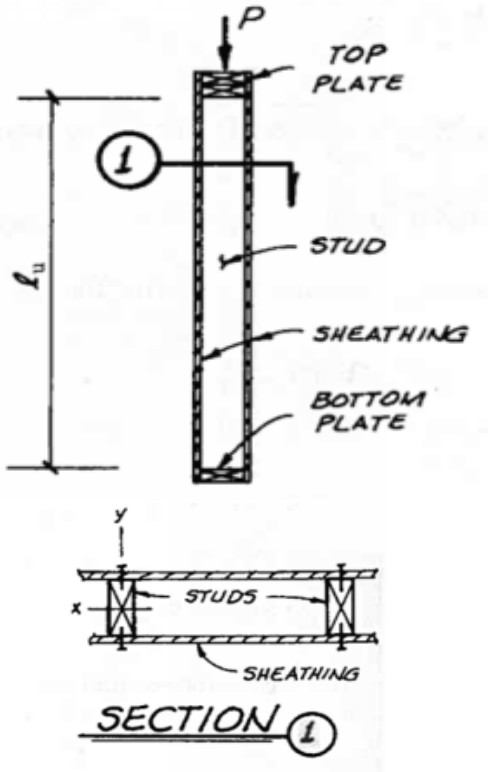
location: Mercer Island, WA	date: 6/23/2023		
client: Olson Kundig		job no. 22-638	
(3) 2x6 Capacity			

WOOD STUDS - AXIAL LOADS ONLY (NDS)



STUD PROPERTIES

Lumber Type		Visually Graded Sawn Lumber	
Wood Species	Species =	Douglas Fir-Larch	
Wood Grade	Grade =	No. 2	
Stud Size	Size =	2x6	
Number of Studs	n =	3	
Unbraced Length - X	ℓ_{ux} =	12	ft
Unbraced Length - Y	ℓ_{uy} =	1	ft
Buckling Length Coefficient	K_e =	1	
Slenderness Ratio - X	ℓ_e/d_x =	26.2	
Slenderness Ratio - Y	ℓ_e/d_y =	8.0	

BOTTOM PLATE PROPERTIES

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

SECTION REDUCTION

Rows of bolts	n =	0	
Bolt Diameter	D =	0.75	in

NDS REFERENCE DESIGN VALUES *(NDS Supplement Table 4A)*

Allowable Compressive Stress	F_c =	1,350	psi
Modulus of Elasticity	E =	1,600,000	psi
Minimum Modulus of Elasticity	E_{min} =	580,000	psi
Perpendicular Load Capacity	$F_{c,perp}$ =	625	psi

NDS ADJUSTMENT FACTORS

Adjustment Factor		F_c	$F_{c,perp}$	E	*Code Reference*
Load Duration Factor	C_D =	1.00	-	-	*NDS Table 2.3.2*
Wet Service Factor	C_M =	1.00	1.00	1.00	*NDS Supplement Table 4A*
Temperature Factor	C_t =	1.00	1.00	1.00	*NDS Appendix C*
Incising Factor	C_i =	1.00	1.00	1.00	*NDS Table 4.3.8*
Size Factor	C_F =	1.10	-	-	*NDS Supplement Table 4A*
Column Stability Factor	C_b =	0.41	-	-	*NDS Eq. 3.7-1*
Bearing Area Factor	C_b =	-	1.08	-	*NDS Sec. 3.10.4*
Fire-Treatment Factor	C_{FT} =	1.00	1.00	1.00	

ADJUSTED DESIGN VALUES

Compression Design Value	F_c' =	610	psi
Stiffness Design Value	E_{min}' =	580,000	psi
Perpendicular Design Value	$F_{c,perp}'$ =	677	psi

RESULTS

Buckling Capacity	15,106	lbs
Net Section Capacity	110,261	lbs
Sill Plate Capacity	16,758	lbs
Allowable Axial Capacity	**15,106**	**lbs**

Stud Wall Axial Capacities	
Stud Spacing	Capacity
12 in oc	15,106 lbs/ft
16 in oc	11,329 lbs/ft
24 in oc	7,553 lbs/ft

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Seattle, WA 98101 206 622-5822

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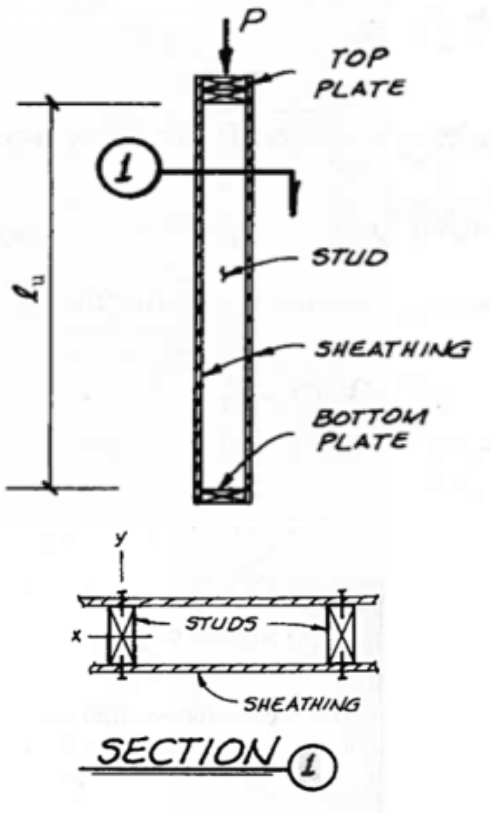
location: Mercer Island, WA		date: 6/23/2023	
client: Olson Kundig			job no. 22-638
(4) 2x6 Capacity			

WOOD STUDS - AXIAL LOADS ONLY (NDS)

STUD PROPERTIES

Lumber Type		Visually Graded Sawn Lumber	
Wood Species	Species =	Douglas Fir-Larch	
Wood Grade	Grade =	No. 2	
Stud Size	Size =	2x6	
Number of Studs	n =	4	
Unbraced Length - X	ℓ_{ux} =	12	ft
Unbraced Length - Y	ℓ_{uy} =	1	ft
Buckling Length Coefficient	K_e =	1	
Slenderness Ratio - X	ℓ_e/d_x =	26.2	
Slenderness Ratio - Y	ℓ_e/d_y =	8.0	



BOTTOM PLATE PROPERTIES

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

SECTION REDUCTION

Rows of bolts	n =	0	
Bolt Diameter	D =	0.75	in

NDS REFERENCE DESIGN VALUES *(NDS Supplement Table 4A)*

Allowable Compressive Stress	F_c =	1,350	psi
Modulus of Elasticity	E =	1,600,000	psi
Minimum Modulus of Elasticity	E_{min} =	580,000	psi
Perpendicular Load Capacity	$F_{c,perp}$ =	625	psi

NDS ADJUSTMENT FACTORS

Adjustment Factor		**F_c**	**$F_{c,perp}$**	**E**	***Code Reference***
Load Duration Factor	C_D =	1.00	-	-	*NDS Table 2.3.2*
Wet Service Factor	C_M =	1.00	1.00	1.00	*NDS Supplement Table 4A*
Temperature Factor	C_t =	1.00	1.00	1.00	*NDS Appendix C*
Incising Factor	C_i =	1.00	1.00	1.00	*NDS Table 4.3.8*
Size Factor	C_F =	1.10	-	-	*NDS Supplement Table 4A*
Column Stability Factor	C_b =	0.41	-	-	*NDS Eq. 3.7-1*
Bearing Area Factor	C_b =	-	1.00	-	*NDS Sec. 3.10.4*
Fire-Treatment Factor	C_{FT} =	1.00	1.00	1.00	

ADJUSTED DESIGN VALUES

Compression Design Value	F_c' =	610	psi
Stiffness Design Value	E_{min}' =	580,000	psi
Perpendicular Design Value	$F_{c,perp}'$ =	625	psi

RESULTS

Buckling Capacity	20,141	lbs
Net Section Capacity	196,020	lbs
Sill Plate Capacity	20,625	lbs
Allowable Axial Capacity	**20,141**	**lbs**

Stud Wall Axial Capacities	
Stud Spacing	Capacity
12 in oc	20,141 lbs/ft
16 in oc	15,106 lbs/ft
24 in oc	10,070 lbs/ft

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Chapter C
Lateral Design

Section 3
Drag Member Design

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	location: Mercer Island, WA	date: 4/21/2023	
	client: Olson Kundig		job no. 2200638
	Lateral System - Drag Member Design		

P-M INTERACTION CALCULATIONS - HSS & PIPE SECTIONS

Member Data

Shape	HSS6X4X1/4	Rect. HSS
F_y	50	ksi
E	29000	ksi

Loads

P_u	27.1	k
M_{ux}	1	k-ft
M_{uy}	1	k-ft

Loads from 1st Order Analysis

Resistance Factors

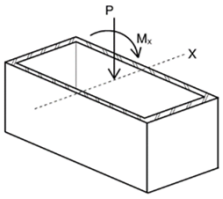
Φ_c	0.9
Φ_b	0.9

Geometry

K_x	1.0	
K_y	1.0	
L_{bx} (Axial)	8	ft
L_{by} (Axial)	8	ft
L_{bx} (Flexure)	8	ft

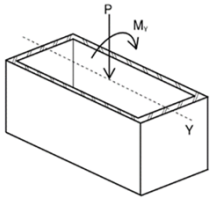
Strong Axis Properties

I_x	20.9	in^4
S_x	7.0	in^3
r_x	2.20	in
Z_x	8.5	in^3



Weak Axis Properties

I_y	11.1	in^4
S_y	5.6	in^3
r_y	1.61	in
Z_y	6.5	in^3



Axial Capacity

Strong Axis

L_c/r_x	44	.....	*(E3)*
F_{cr}	43.5	ksi.....	*(E3-2)*
P_n	187.1	k.....	*(E3-1)*
ΦP_n	168.4	k.....	

Weak Axis

L_c/r_y	60	.....	*(E3)*
F_{cr}	38.6	ksi.....	*(E3-2)*
P_n	165.8	k.....	*(E3-1)*
ΦP_n	149.2	k.....	

Moment Capacity

Strong Axis

M_p	35.5	k-ft.....	*(F7-1)*
M_n	35.5	k-ft.....	*(F7-1)*
ΦM_n	32.0	k-ft.....	

Weak Axis

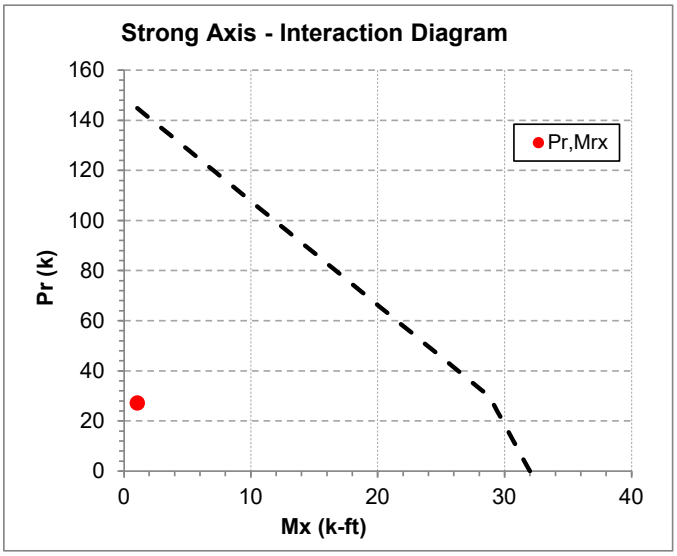
M_p	26.9	k-ft.....	*(F7-1)*
M_n	26.9	k-ft.....	*(F7-1)*
ΦM_n	24.2	k-ft.....	

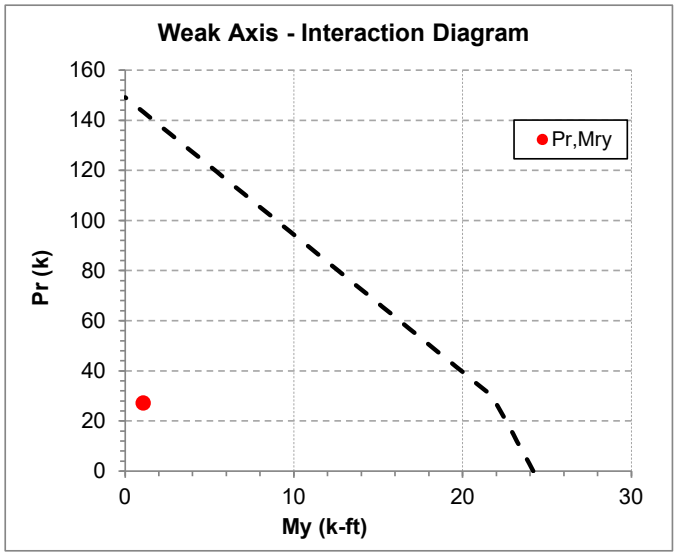
Interaction (AISC Steel Construction Manual, 15th Edition, Section H1)

P_r	27.1	k	P_c	149.2	k
M_{rx}	1.0	k-ft	M_{cx}	32.0	k-ft
M_{ry}	1.1	k-ft	M_{cy}	24.2	k-ft

Interaction Eqn: (Pr/Pc/2)+((Mrx/Mcx)+(Mry/Mcy))

Interaction DCR 0.17 OK ..... *(H1-1b)*





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	location	Mercer Island, WA	date	4/21/2023	
	client	Olson Kundig			job no. 2200638
		Lateral System - Drag Member Design			

P-M INTERACTION: DETAILED CALCULATIONS - HSS & PIPE SECTIONS

Member Properties

							Computed:		
Area	4.30	in^2	**t**	0.233	in		**($\sqrt{E/F_y}$)**	24.1	
b	3.31	in	**λb,b/t**	14.2			**Axial λ_r**	33.7	*(Tab B4.1a)*
h	5.31	in	**λh,h/t**	22.8			**Flexure λpf**	27.0	*(Tab B4.1b)*
H	6.0	in	**J**	23.6	in4		**Flexure λrf**	33.7	*(Tab B4.1b)*
B	4.0	in					**Flexure λpw**	58.3	*(Tab B4.1b)*
							Flexure λrw	137.3	*(Tab B4.1b)*

Axial Capacity (AISC Steel Construction Manual, 15th Edition, Section E3/E7)

***L_c=KL_b**

Strong Axis				**Weak Axis**		
4.71($\sqrt{E/F_y}$)	113.4	..... *(E3)*		**4.71($\sqrt{E/F_y}$)**	113.4	..... *(E3)*
L_c/r_x	43.6	..... *(E3)*		**L_c/r_y**	59.6	..... *(E3)*
L_c/r_x	**<**	**4.71($\sqrt{E/F_y}$)**		**L_c/r_y**	**<**	**4.71($\sqrt{E/F_y}$)**
F_e	150.3	ksi..... *(E3-4)*		**F_e**	80.5	ksi..... *(E3-4)*
F_{cr}	43.5	ksi..... *(E3-2)*		**F_{cr}**	38.6	ksi..... *(E3-2)*
		Controlling F_{cr}	38.6	ksi.....		
Non-Slender				Non-Slender		
P_n	187.1	k..... *(E3-1)*		**P_n**	165.8	k..... *(E3-1)*
ΦP$_n$	168.4	k.....		**ΦP$_n$**	149.2	k.....

Wall Comp. Buckling (Section E7)

Ae = Ag

A_e 4.30 in^2 .....

λr √Fy/Fcr	-	..... *(E7)*		**λr √Fy/Fcr**	-	..... *(E7)*
λ	-	**λr√Fy/Fcr**		**λ**	-	**λr√Fy/Fcr**
c1	-	..... *(Table E7.1)*		**c1**	-	..... *(Table E7.1)*
c2	-	..... *(Table E7.1)*		**c2**	-	..... *(Table E7.1)*
Fel	-	ksi..... *(E7-5)*		**Fel**	-	ksi..... *(E7-5)*
be,y	-	in.....		**he,y**	-	in.....

Approx. 2nd-Order (App. 8)

Second order effects accounted for with calculations below

P_{ns}	215.0	..... *(C2-2)*		**P_{ns}**	215.0	..... *(C2-2)*
α	1.0	..... *(C2-2)*		**α**	1.0	..... *(C2-2)*
τ_b	1.00	..... *(C2-2)*		**τ_b**	1.00	..... *(C2-2)*
Trans. Loads	No	..... *(App-8-4)*		**Trans. Loads**	No	..... *(App-8-4)*
M_1	0	k-ft..... *(App-8-4)*		**M_1**	0	k-ft..... *(App-8-4)*
M_2	0	k-ft..... *(App-8-4)*		**M_2**	0	k-ft..... *(App-8-4)*
C_m	1.00	..... *(App-8-4)*		**C_m**	1.00	..... *(App-8-4)*
P_{e1}	649	..... *(App-8-5)*		**P_{e1}**	345	..... *(App-8-5)*
B_1	1.04	..... *(App-8-3)*		**B_1**	1.09	..... *(App-8-3)*
M_r	1.0	k-ft..... *(App-8-1)*		**M_r**	1.1	k-ft..... *(App-8-1)*

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project	Fused Elements Residence	by CBJ	sheet no.
location	Mercer Island, WA	date 4/21/2023	
client	Olson Kundig		job no. 2200638
	Lateral System - Drag Member Design		

Moment Capacity (AISC Steel Construction Manual, 15th Edition, Section F7/F8)

Strong Axis				Weak Axis			
M_p	35.5	k-ft	*(F7-1)*	M_p	26.9	k-ft	*(F7-1)*
Governing M_n	35.5	k-ft	*(F7-1)*	Governing M_n	26.9	k-ft	*(F7-1)*
ΦM_n	32.0	k-ft		ΦM_n	24.2	k-ft	

Wall Local Buckling (Section F7.2-4)

Strong Axis: Compact Flange	Strong Axis: Compact Web	Weak Axis: Compact Flange	Weak Axis: Compact Web

Flange Local Buckling (F7-2)

Mn	-	k-ft		Mn	-	k-ft	

Web Local Buckling (F7-3)

Mn	-	k-ft		Mn	-	k-ft	

Lateral Torsional Buckling (F7-4)

LTB Modification Factor: **Off** **When off, C_b is conservatively assumed as 1.00*

								C_b	1.00
M_{max}	0	(k-ft)			M_b	0	(k-ft)		
M_a	0	(k-ft)			M_c	0	(k-ft)		
Lp	11.95	ft	*(F7-12)*		Lp	15.8	ft	*(F7-12)*	
Lr	321.8	ft	*(F7-13)*		Lr	321.8	ft	*(F7-13)*	
Lb < Lp					**Lb < Lp**				
LTB does not apply					LTB does not apply				
Mn	-	k-ft	*(F7-10)*		Mn	-	k-ft	*(F7-10)*	

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Chapter D
Foundation Design

Section 1
Pipe Pile Spacing Design

kpff 1601 5th Avenue, Suite 1600 Seattle, WA 98101 206 622-5822	project Fused Elements Residence	by CBJ	sheet no.
	location Mercer Island, WA	date 06/23/23	
	client Olson Kundig		22-00638
	Foundation Design and Loading		

Calculation Objective:

1. Design retaining wall footing widths and pile spacing for worst case overturning loads.
2. Calculate worst case loading for typical one-way slab-at-grade (SAG) and grade beam (GB) design inputs. (Design loads used in respective design calculations for SAG and GB.)

References:

1. Geotechnical Engineering Report, Associated Earth Sciences, Inc., August 16, 2022
2. IBC 2018 and ASCE 7-16 [Load Combinations]

Retaining Wall Loads - Same for Each Wall

Active Pressure	35	pcf	
At-Rest Pressure	55	pcf	
Seismic Surcharge	5	*H psf	[Active Condition]
	10	*H psf	[At-Rest Condition]
Hydrostatic Pressure	0	pcf	[Drains]
Vertical Surharge	60	psf	
Fill Density	110	pcf	
K Value	0.32		

Resisting Loads

Passive Presure	300	pcf	[Equivalent Fluid]
	0	pcf	[Pile Pipe Supported]
Sliding Friction	0.35		

Allowable Bearing

Soil Bearing Pressure	2500	psf	
Concrete Density	145	pcf	

Piles, Axial Capacity:

Pile Diam.	3"	4"	6"
Capacity (k)	12	17	30

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project	Fused Elements Residence	by CBJ	sheet no.
location	Mercer Island, WA	date 06/23/23	
client	Olson Kundig		22-00638
	Foundation Design and Loading		

Wall Design

Walls Retaining 12'-0" Soil

Height (T.O.Ftg to T.O.Fill) 13 ft
Depth (Ftg) 24 in

Axial Loads (Wall on Grid F, 6-7):

Level	DL (psf)	LL (psf)	TW (ft)	DL (klf)	LL (klf)
Wall & Ftg SW	-	-	-	3.190	-
Main Level	13	40	10.71	0.139	0.428
Upper Level	13	60	12.5	0.163	0.750
			Total	3.492	1.178

P_{wall} = 1.75 k/ft [Wall axial loads on pile, per linear foot]
w_{heel} = 1.75 ft [Width of heel]
t_{wall} = 12 in [Width of concrete wall]
d_{pile} = 1.750 ft [Distance from pile to center of wall]

Overturning Moments:

	Force (k/ft)	Distance (ft)	Moment (k-ft/ft)	
Active Backfill Pressure	3.938	5.00	19.69	(H)
Surcharge Pressure	0.248	8.50	2.11	(LL)
Lateral Pressure	1.125	7.50	8.44	(E)
		1.0H	19.69	
		1.0H + 0.7E	25.59	
		1.0L + 1.0 H	21.80	

Resisting Moments:

	Force (k/ft)	Distance (ft)	Moment (k-ft/ft)	
Soil Self Weight	2.503	1.38	3.44	(D)
Concrete Ftg Self Weight	0.508	1.38	0.70	(D)
		1.0D	4.14	

s_{pile} = 2 ft [Pile spacing]
P_{pile} = 13.25 k/ft [Resisting force in pile, per linear foot]
M_{OT} = 25.59 k-ft/ft [Overturning moment, per linear foot]
M_R = **27.33** k-ft/ft [Resisting moment, per linear foot]
$P_{R,pile}$ = 4.76 k/ft [Force in pile under retained soil, per linear foot]
$s_{R,pile}$ = 6 ft [Pile spacing, under retained soil]

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	Foundation Design and Loading		

Wall Design (Cont'd)

Walls Retaining 8'-0" Soil

Height (T.O.Ftg to T.O.Fill) 8 ft

Depth (Ftg) 24 in

Axial Loads (Wall on Grid E, 1-3):

Level	DL (psf)	LL (psf)	TW (ft)	DL (klf)	LL (klf)
Wall & Ftg SW	-	-	-	1.249	-
Main Level	13	40	5	0.065	0.200
Upper Level	13	40	10	0.130	0.400
Upper Roof	20	16	9.6	0.192	0.154
			Total	1.636	0.754

P_{wall} = 0.82 k/ft [Wall axial loads on pile, per linear foot]

w_{heel} = 0.83 ft [Width of heel]

t_{wall} = 10 in [Width of concrete wall]

d = 0.83 ft [Distance from pile to center of wall]

Overturning Moments:

	Force (k/ft)	Distance (ft)	Moment (k-ft/ft)	
Active Backfill Pressure	1.750	3.33	5.83	(H)
Surcharge Pressure	0.153	6.00	0.92	(LL)
Lateral Pressure	0.500	5.00	2.50	(E)
		1.0 H	5.83	
		1.0 H + 0.7 E	7.58	
		1.0 L + 1.0 H	6.75	

Resisting Moments:

	Force (k/ft)	Distance (ft)	Moment (k-ft/ft)	
Soil Self Weight	2.191	0.83	1.82	(D)
Concrete Ftg Self Weight	0.241	0.83	0.20	(D)
		1.0 D	2.02	

s_{pile} = 4 ft [Pile spacing]

P_{pile} = 6.68 k/ft [Resisting force in pile, per linear foot]

M_{OT} = 7.58 k-ft/ft [Overturning moment, per linear foot]

M_R = **7.59** k-ft/ft [Resisting moment, per linear foot]

$P_{R,pile}$ = 3.25 k/ft [Force in pile under retained soil, per linear foot]

$s_{R,pile}$ = 9 ft [Pile spacing, under retained soil]

Grade Beam Loads

Slab at Grade Loading

Slab at Grade Loading Criteria:

TW_{max} =	13.58	ft	
p_{DL} =	5	psf	
p_{LL} =	60	psf	
V_{max} =	1.39	k/ft	[Max shear force per foot width of SAG span]

Max Pile Spacing:

Pile Diam.	3"	4"	6"
$s_{pile,max}$ (ft)	8.66	12.27	21.66

Grade Beam Loading

Grade Beam Dimensions:

b =	12	
h =	18	
w_{GB} =	225	plf

Slab at Grade Dimensions:

h =	8	in
p_{SAG} =	100	psf

Grade Beam Applied Loads:

w_{sw} =	1.583	klf	
w_{DL} =	0.068	klf	
w_{LL} =	0.815	klf	
w_{ult}	3.285	klf	
w_a	2.466	klf	

Grade Beam Forces for Design Spreadsheet:

L =	8	ft	
M_{ult} =	26.3	k-ft	[Considering single-span]
V_{ult} =	26.3	k	[Considering multi-span]
M_a =	19.7	k-ft	[Service moment, considering single span]

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client Olson Kundig			22-00638
Foundation Design and Loading			

Design and Loading Summary:

Footing Design

WF-3 For walls retaining 13 ft of soil, a footing with a width of 1'-9'' and depth of 24'' is required, supported by pile pipes spaced at 1'-0'' O.C.

WF-2 For walls retaining 8 ft of soil, a footing with a width of 0'-9.96'' and depth of 24'' is required, supported by [Pile spacing, under retained soil] pile pipes spaced at 1'-0''

Typical Slab At Grade Design

For one-way slab-at-grade design, an ultimate moment of 2.35 kip-ft and an ultimate shear of 0.69 kips should be used.
A maximum service moment of 1.5 kip-ft should also be checked.

Grade Beam Design

GB-1 For grade beam design, an ultimate moment of 26.28 kip-ft and an ultimate shear of 26.28 kips should be used.
A maximum service moment of 19.73 kip-ft should also be checked.

Pool Slab At Grade Design

For one-way slab-at-grade design, an ultimate moment of 5.46 kip-ft and an ultimate shear of 2.08 kips should be used.
A maximum service moment of 4.27 kip-ft should also be checked.

Pool Slab at Grade Loading

Pool Slab at Grade Loading Criteria:

TW_{max} =	10.5	ft	
p_{DL} =	250	psf	
p_{LL} =	60	psf	
V_{max} =	4.16	k/ft	[Max shear force per foot width of SAG span]

Max Pile Spacing:

Pile Diam.	3"	4"	6"
$s_{pile,max}$ (ft)	2.89	4.09	7.22

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Chapter D
Foundation Design

Section 2
Slab at Grade Design

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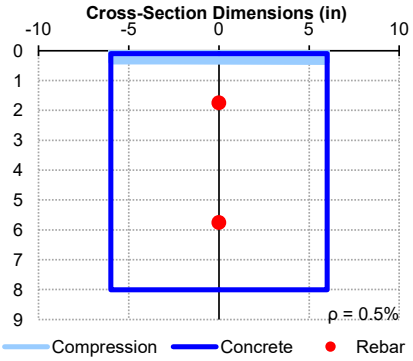
project	Fused Elements Residence	by	CBJ
location	Mercer Island, WA	date	6/23/2023
client	Olson Kundig		
	Slab-at-Grade Design (Typical)		

sheet no.

job no. 22-00638

ONE-WAY SLAB DESIGN



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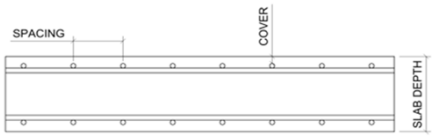
INPUT PARAMETERS:

CROSS-SECTION DIMENSIONS



Section Shape? Slab Type 1

Slab Width	b =	12.0 in	
Slab Depth	h =	8.0 in	
Exposure	Top	Exposed	20.6.1.3.1
	Bottom	Not Exposed	20.6.1.3.1

COVER PARAMETERS

Top Cover	CLR =	1.5 in
Bottom Cover	CLR =	2 in

As Overwrite? NO

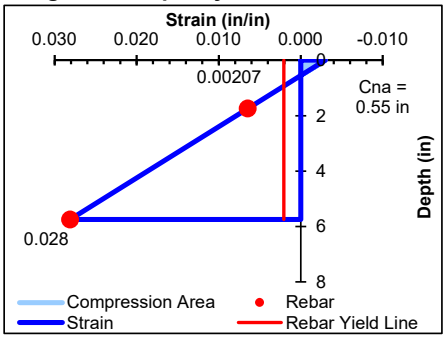
FLEXURAL REBAR DIMENSIONS

Layer	Bar # (U.S.)	d_{layer} (in)	on center sp. (in)
Top	#4	1.750	10.00
Bot	#4	5.750	10.00

TEMPERATURE AND SHRINKAGE REINFORCING

Top	#4	2.250	18.00	OK
Bot	#4	5.250	18.00	OK

Strain Diagram at Capacity



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MATERIAL PROPERTIES

Concrete 28 Day Compressive Strength	f'_{c28} =	3.0	ksi
Concrete Type	Type =	Normal weight	
Concrete Weight	γ_c =	150	pcf
Flexural Reinforcement Yield Strength	f_y =	60	ksi

ANALYSIS OUTPUT: (Referenced to ACI 318-14 Requirements)

Reference | **STATUS:**

FLEXURAL STRENGTH

				Reference	STATUS
Nominal Moment Strength Capacity	M_n =	6.6	kip-ft		
Reduction Factor, ϕ	ϕ =	0.90		21.2.2	
Design Positive Moment Capacity	**ϕM_n =**	**6.0**	**kip-ft**		
Factored Positive Moment Demand	**M_u =**	**2.35**	**kip-ft**		GOOD - ϕMn > Mu

SHEAR STRENGTH

Nominal Shear Strength Capacity	V_n =	7.6	kips	22.5.5.1	
Reduction Factor, ϕ	ϕ =	0.75		21.2.1	
Design Shear Strength Capacity	**ϕV_n =**	**5.7**	**kips**	22.5.5.1	
Factored Shear Demand	**V_u =**	**0.69**	**kips**		GOOD - ϕVn > Vu

SERVICABILITY

Concrete 28 Day Modulus of Elasticity	E_{c28} =	3122	ksi	19.2.2	
Gross Moment of Inertia	I_g =	523	in⁴	24.1.2.5	
Cracked Moment of Inertia	I_{cr} =	54	in⁴	24.2.3.5	
Cracking Moment	**M_{cr} =**	**4.9**	**kip-ft**	24.2.3.5b	
Moment for Deflection *(Service Demand)*	**M_a =**	**1.5**	**kip-ft**		
Effective Moment of Inertia	I_e = D8	523	in⁴	24.2.3.5a	

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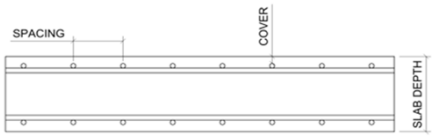
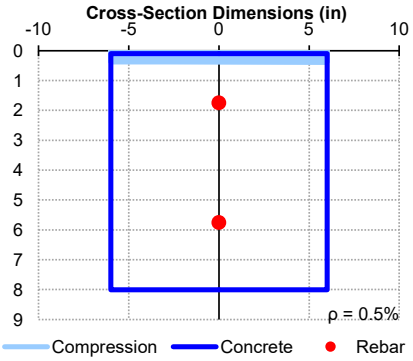
location	Mercer Island, WA	date	3/29/2023
client	Olson Kundig		
	Slab-at-Grade Design (Pool)		

sheet no.

job no. 22-00638

ONE-WAY SLAB DESIGN





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Items shown may not be accurate. Reinforcing is represented as a single top & single bot. bar

INPUT PARAMETERS:

CROSS-SECTION DIMENSIONS

Section Shape? Slab Type 1

Slab Width	b =	12.0 in
Slab Depth	h =	8.0 in

Exposure	Top	Exposed	20.6.1.3.1
	Bottom	Not Exposed	20.6.1.3.1

COVER PARAMETERS

Top Cover	CLR =	1.5 in
Bottom Cover	CLR =	2 in

As Overwrite? NO

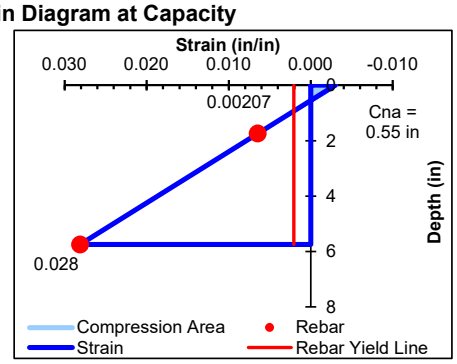
FLEXURAL REBAR DIMENSIONS

Layer	Bar # (U.S.)	d_{layer} (in)	on center sp. (in)
Top	#4	1.750	10.00
Bot	#4	5.750	10.00

TEMPERATURE AND SHRINKAGE REINFORCING

Top	#4	2.250	18.00	OK
Bot	#4	5.250	18.00	OK

Strain Diagram at Capacity



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MATERIAL PROPERTIES

Concrete 28 Day Compressive Strength	f'_{c28} =	3.0	ksi
Concrete Type	Type =	Normal weight	
Concrete Weight	γ_c =	150	pcf
Flexural Reinforcement Yield Strength	f_y =	60	ksi

ANALYSIS OUTPUT: (Referenced to ACI 318-14 Requirements)

Reference | **STATUS:**

FLEXURAL STRENGTH

				Reference	STATUS
Nominal Moment Strength Capacity	M_n =	6.6	kip-ft		
Reduction Factor, ϕ	ϕ =	0.90		21.2.2	
Design Positive Moment Capacity	**ϕM_n =**	**6.0**	**kip-ft**		
Factored Positive Moment Demand	**M_u =**	**5.46**	**kip-ft**		GOOD - ϕMn > Mu

GOOD - PASSES ACI 318

SHEAR STRENGTH

Nominal Shear Strength Capacity	V_n =	7.6	kips	22.5.5.1
Reduction Factor, ϕ	ϕ =	0.75		21.2.1
Design Shear Strength Capacity	**ϕV_n =**	**5.7**	**kips**	22.5.5.1
Factored Shear Demand	**V_u =**	**2.08**	**kips**	GOOD - ϕVn > Vu

SERVICABILITY

Concrete 28 Day Modulus of Elasticity	E_{c28} =	3122	ksi	19.2.2
Gross Moment of Inertia	I_g =	523	in^4	24.1.2.5
Cracked Moment of Inertia	I_{cr} =	54	in^4	24.2.3.5
Cracking Moment	**M_{cr} =**	**4.9**	**kip-ft**	24.2.3.5b
Moment for Deflection *(Service Demand)*	**M_a =**	**4.27**	**kip-ft**	
Effective Moment of Inertia	I_e = D9	523	in^4	24.2.3.5a

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Chapter D
Foundation Design

Section 3
Grade Beam Design

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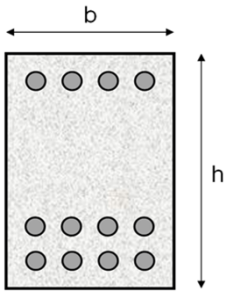
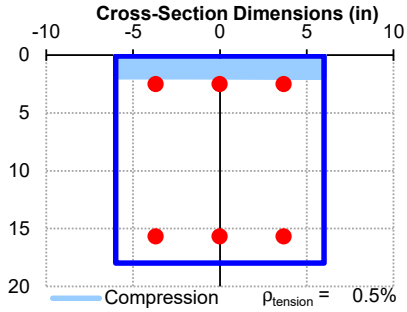
project	Fused Elements Residence	by CBJ	sheet no.
location	Mercer Island, WA	date 6/23/2023	
client	Olson Kundig		job no. 22-00638
	Grade Beam Design		

CONCRETE BEAM DESIGN





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INPUT PARAMETERS:

CROSS-SECTION DIMENSIONS

Section Shape? Rectangular

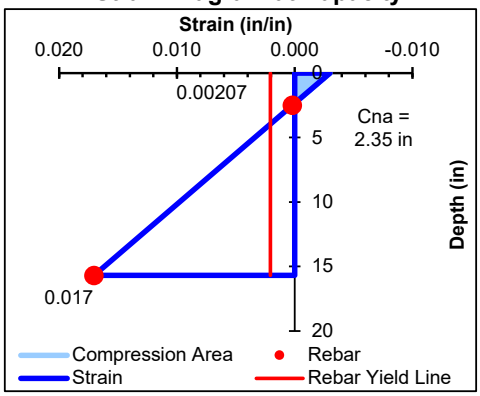
Beam Width b = 12.0 in

Beam Height h = 18.0 in

FLEXURAL REBAR DIMENSIONS

Layer	# of Bars	Bar # (U.S.)	d_{layer} (in)	clear sp. (in)	Bar purpose
1	3	#5	15.688	3.06	Tension Bars
2	3	#5	2.500	3.06	Comp. Bars
3	0	N/A	0.000	N/A	N/A
4	0	N/A	0.000	N/A	N/A
5	0	N/A	0.000	N/A	N/A

Strain Diagram at Capacity



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STIRRUP DIMENSIONS

Number of Shear Legs	# of legs =	2	
Bar # (U.S.)	Bar # =	#4	
Shear Stirrup Spacing	s =	6	in
Minimum Clear Cover to Stirrup	CLR_{MIN} =	1.5	in

MATERIAL PROPERTIES

Concrete 28 Day Compressive Strength	f'_{c28} =	3.0	ksi
Concrete Type	Type =	Normalweight	
Concrete Weight	γ_c =	150	pcf
Flexural Reinforcement Yield Strength	f_y =	60	ksi
Stirrup Yield Strength	f_{yt} =	60	ksi

ANALYSIS OUTPUT: (Referenced to ACI 318-14 Requirements)

				Reference	STATUS:
FLEXURAL STRENGTH					GOOD - PASSES ACI 318
Nominal Moment Strength Capacity	M_n =	69.0	kip-ft		
Reduction Factor, ϕ	ϕ =	0.90	.....	21.2.2	
Design Moment Strength Capacity	**ϕM_n =**	**62.1**	**kip-ft**		
Design Axial Strength Capacity	**ϕP_{n_comp} =**	**342.0**	**kip**.....	22.4.2.2	
	ϕP_{n_t} =	**-100.4**	**kip**.....	22.4.3.1	
Factored Moment and Axial Demand	**M_u =**	**26.278**	**kip-ft**		GOOD - ϕMn > Mu
	P_u =	**0**	**kip**		
SHEAR STRENGTH					
Nominal Shear Strength Capacity	V_n =	83.4	kips.....	9.5.1.1(b)	
Reduction Factor, ϕ	ϕ =	0.75	.....	21.2.1	Vn = 1.0Vc + 1.0Vs
Design Shear Strength Capacity	**ϕV_n =**	**62.5**	**kips**.....	9.5.1.1(b)	
Factored Shear Demand	**V_u =**	**26.278**	**kips**		GOOD - ϕVn > Vu
SERVICABILITY					
Concrete 28 Day Modulus of Elasticity	E_{c28} =	3122	ksi.....	19.2.2	
Gross Moment of Inertia	I_g =	5832	in⁴.....	24.1.2.5	
Cracked Moment of Inertia	I_{cr} =	1436	in⁴.....	24.2.3.5	
Cracking Moment	**M_{cr} =**	**22.2**	**kip-ft**.....	24.2.3.5b	
Moment for Deflection *(Service Demand)*	**M_a =**	**19.726**	**kip-ft**		
Effective Moment of Inertia	I_e = D11	5832	in⁴.....	24.2.3.5a	

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Chapter D
Foundation Design

Section 4
Pile Cap Design

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	location: Mercer Island, WA	date: 6/23/2023	
	client: Olson Kundig		job no. 22-00638
	Pile Cap Design		

PILE CAP DESIGN - 4 PILES

Calculations based on ACI 318-14 and 2015 CRSI Design Guide

INPUT PARAMETERS

Seismic Design Condition: Non-Seismic — *Ref ACI 318 21.2.4*

PILE AND COLUMN DIMENSIONS

Pile Type & Capacity	Steel	15	tons/pile
Pile Shape & Size	Round	6	in dia
Pile Horizontal Mislocation	Δ_h =	3	in
Pile Vertical Mislocation	Δ_v =	2	in
Column Shape & Size	Rectangle	12	in wide
		12	in deep

MATERIAL PROPERTIES

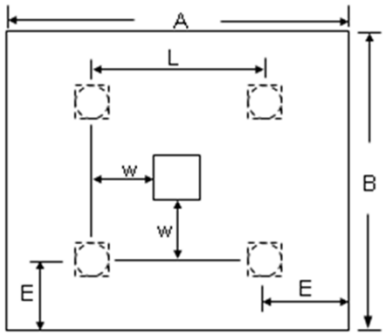
Concrete Compressive Strength	f'_c =	4,000	psi
Reinforcement Yield Strength	f_y =	60,000	psi
Concrete Type		Normalweight	
Reinforced Concrete Weight	γ_c =	150	pcf

PILE CAP DIMENSIONS

Pile Spacing	L =	12	in
Pile Edge Distance	E =	12	in
Pile Cap Thickness	t_{cap} =	21	in
Pile Cap Cover (all faces)	Cover =	3	in
Pile Embed	Embed =	6	in
Pile Offset, Direction A	w_A =	0.0	in
Pile Offset, Direction B	w_B =	0.0	in

Pile Cap Size (A x B x t_{cap}): **3.00 ft x 3.00 ft x 21 in**

PILE CAP LAYOUT



FLEXURAL REINFORCEMENT

Minimum Reinforcement Ratio: ρ_{min} = 0.0018 — *Ref ACI 318 24.4.3.2*

Longitudinal Reinforcement:	**(5)**	**#5**		**Bars w/hook**
Total Reinforcement Area	A_s =	1.55	in^2	
Required Reinforcement Area	$A_{s,req}$ =	1.36	in^2	*Governed by flexural minimum*
Spacing	s =	7.5	in OC	
Transverse Reinforcement:	**(5)**	**#5**		**Bars w/hook**
Total Reinforcement Area	A_s =	1.55	in^2	
Required Reinforcement Area	$A_{s,req}$ =	1.36	in^2	*Governed by flexural minimum*
Spacing	s =	7.5	in OC	

ANALYSIS SUMMARY

Load Factor: U = 1.5

SHEAR STRENGTH

Reduction Factor	ϕ_v =	0.75	*Ref ACI 318 21.2.1*	
Governing Ratio	$V_u/\phi V_n$ =	0.64	**OK**	*Governed by 45-degree failure*

FLEXURAL STRENGTH

Reduction Factor	ϕ_b =	0.90	*Ref ACI 318 21.2.1*	
Governing Ratio	$M_u/\phi M_n$ =	0.19	**OK**	*Governed by flexural minimum*

BEARING STRENGTH

Reduction Factor	$\phi_{bearing}$ =	0.65	*Ref ACI 318 21.2.1*	
Governing Ratio	$\sigma_u/\phi\sigma_n$ =	0.28	**OK**	

NET DESIGN CAPACITY OF PILE CAP

Ultimate Capacity	$P_{u,net}$ =	**177**	**kip**	*Max factored load at column base (Ref CRSI pg. 8-2)*
Service Capacity	P_{net} =	**118**	**kip**	*Max service load at column base (Ref CRSI pg. 8-2)*

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	location: Mercer Island, WA	date: 6/23/2023	
	client: Olson Kundig		job no. 22-00638
	Pile Cap Design		

PILE CAP DESIGN - 4 PILES

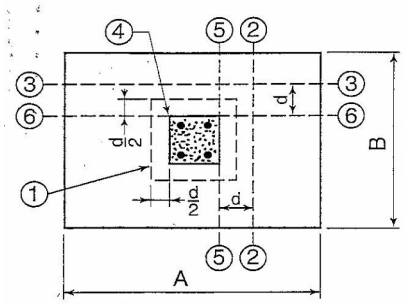
Calculations based on ACI 318-14 and 2015 CRSI Design Guide

DESIGN CALCULATIONS

SHEAR

(Ref CRSI pg. 5-2 - 5-4 / ACI 318 Ch.22.5,22.6)

Effective Shear Depth	d_v =	13.0	in



Nomenclature
Critical Shear Sections

1. 2-way at d/2 from face of column
2. 1-way at d from face of column in direction of short width "B"
3. 1-way at d from face of column in direction of long width "A"
4. 2-way at face of column
5. 1-way at face of column in direction of short width "B"
6. 1-way at face of column in direction of long width "A"

Case 1: Two-Way Shear at Column		**N/A**	*d/2 > w for all piles*	
Section Perimeter	b_o =	100.0	in	
Shear Demand	V_u =	0	kips	
Shear Capacity	ϕV_c =	--	kips	
Case 2: One-Way Shear at Column		**N/A**	*d > w*	
Effective Width	b =	36.0	in	
Shear Demand	V_u =	0	kips	
Shear Capacity	ϕV_c =	--	kips	
Case 3: One-Way Shear at Column		**N/A**	*d > w*	
Effective Width	b =	36.0	in	
Shear Demand	V_u =	0	kips	
Shear Capacity	ϕV_c =	--	kips	
Case 4: Two-Way Shear at Column Face		**OK**		
Effective Perimeter	b =	48.0	in	
Shear Demand	V_u =	177	kips	
Shear Capacity	ϕV_c =	534	kips	
Case 5: One-Way Shear at Column Face		**OK**		
Shear Demand	V_u =	89	kips	
Moment Demand	M_u =	264	k-in	
Ratio	$V_u d/M_u$ =	4.380		
Shear Capacity	ϕV_c =	222	kips	

Case 6: One-Way Shear at Column Face		**OK**	
Shear Demand	V_u =	89	kips
Moment Demand	M_u =	264	k-in
Ratio	$V_u d/M_u$ =	4.380	
Shear Capacity	ϕV_c =	222	kips
Case P3: Two-Way Shear at Corner		**OK**	
Effective Width	b =	34.7	in
Shear Demand	V_u =	45	kips
Shear Capacity	ϕV_c =	86	kips
Case P4: One-Way Shear at Corner		**OK**	
Effective Width	b =	57.5	in
Shear Demand	V_u =	45	kips
Shear Capacity	ϕV_c =	71	kips

FLEXURE

(Ref ACI 318 Ch. 22.3)

Longitudinal			OK	
Moment Demand	M_u =	264	k-in	
Depth of Reinforcement	d_s =	17.38	in	
Area of Steel Demand	$A_{s,demand}$ =	0.31	in^2	
Required Area of Steel	$A_{s,req}$ =	1.36	in^2	
Longitudinal Reinforcement:	(5)	#5		
Longitudinal Spacing	s =	7.5	in OC	
Total Reinforcement Area	A_s =	1.55	in^2	
Moment Capacity	ϕM_n =	1,422	k-in	
TENSION CONTROL?		**OK**		
Development Length, w/o hook	L_d =	17.8	in	
Development Length w/hook	L_{dh} =	8.4	in	
Development Length Available	Embed =	9.00	in	
DEVELOPMENT CHECK		**OK w/ Hook**		

Transverse			OK	
Moment Demand	M_u =	264	k-in	
Depth of Reinforcement	d_s =	17.38	in	
Area of Steel Demand	$A_{s,demand}$ =	0.31	in^2	
Required Area of Steel	$A_{s,req}$ =	1.36	in^2	
Transverse Reinforcement:	(5)	#5		
Transverse Spacing	s =	7.5	in OC	
Total Reinforcement Area	A_s =	1.55	in^2	
Moment Capacity	ϕM_n =	1,422	k-in	
TENSION CONTROL?		**OK**		
Development Length, w/o hook	L_d =	17.8	in	
Development Length w/hook	L_{dh} =	8.4	in	
Development Length Available	Embed =	9.00	in	
DEVELOPMENT CHECK		**OK w/ Hook**		

COLUMN BEARING

(Ref CRSI pg. 8-2/ ACI 318-22.8)

Factored Self Wt. of Concrete	W_c =	3.3	kips
Net Design Capacity	$P_{u,net}$ =	177	kips
Bearing Demand	σ_u =	1227	psi
Loaded Area	A_1 =	144	in^2
Projected Area	A_2 =	1296	in^2
Increase Factor	$\sqrt{(A_2/A_1)}$ =	2.00	
Bearing Strength	$\phi\sigma_n$ =	4420	psi
BEARING CHECK		**OK**	

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Chapter E
Miscellaneous Design

Section 1
Canopy Design

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DESIGN SUMMARY

Date: *6/23/2023*
By: *CBJ*

Design: *Deck Canopy*

The deck canopy is cantilevered from the residence, 10'-0" over the back deck. A SAP study was performed to check deflections due to gravity loading and torsional deformations in the supporting members of the cantilevered canopy beams. Member design was also checked in SAP.

Separate checks of the long HSS 16x8 beam that experiences torsional loading and rotation and the HSS 10x4 column that has induced moments from the torsional loading of the canopy roof are included in the pages after the SAP model input and overall results.

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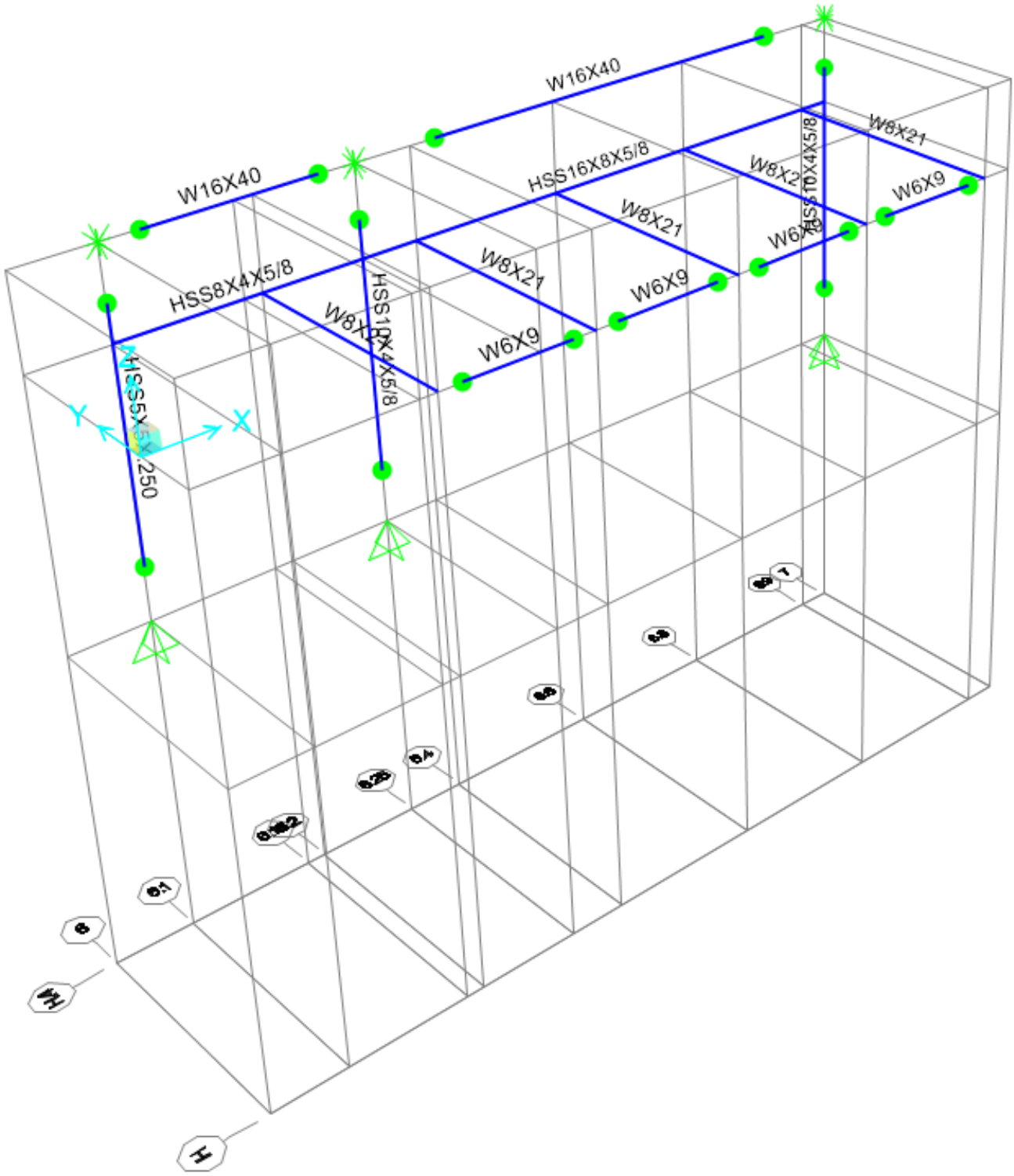
Seattle, WA 98101 206 622-5822

project	Fused Elements Residence	by CBJ	sheet no.
location	Mercer Island, WA	date 6/23/2023	
client	Olson Kundig		job no. 22-638
	Deck Canopy SAP Model Inputs		

SAP Model Section Members and Layout:



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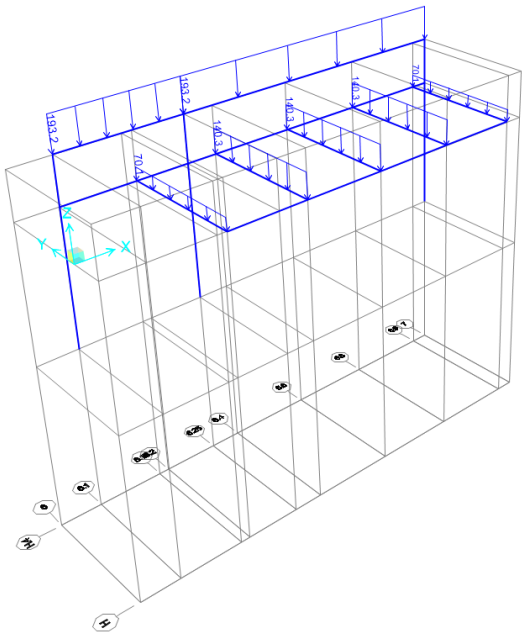
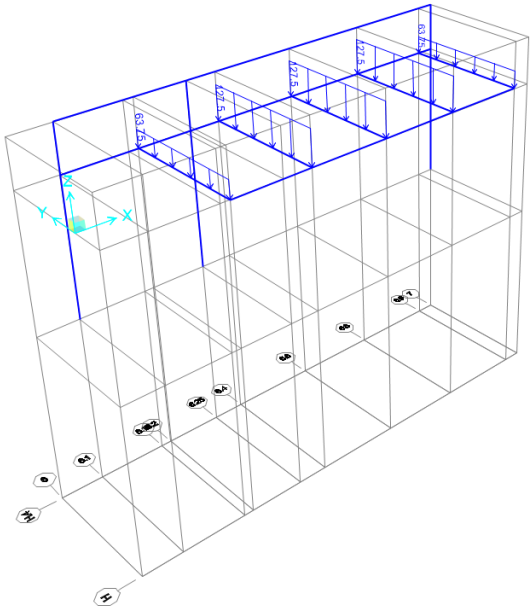
project	Fused Elements Residence	by CBJ	sheet no.
location	Mercer Island, WA	date 6/23/2023	
client	Olson Kundig		job no. 22-638
	Deck Canopy SAP Model Inputs		

SAP Model Loading Input (in plf):

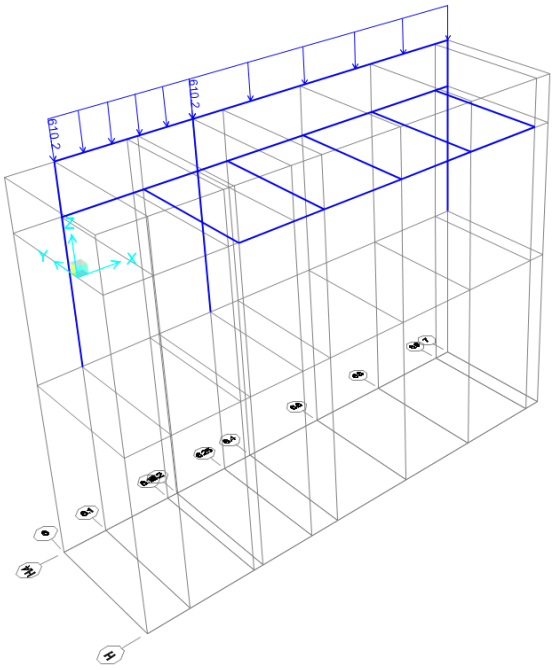
Dead Loads



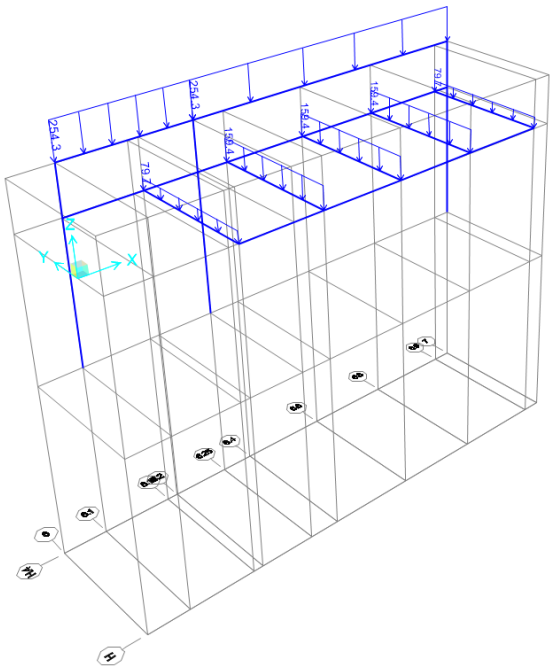
Roof Live Loads



Live Loads



Snow Loads



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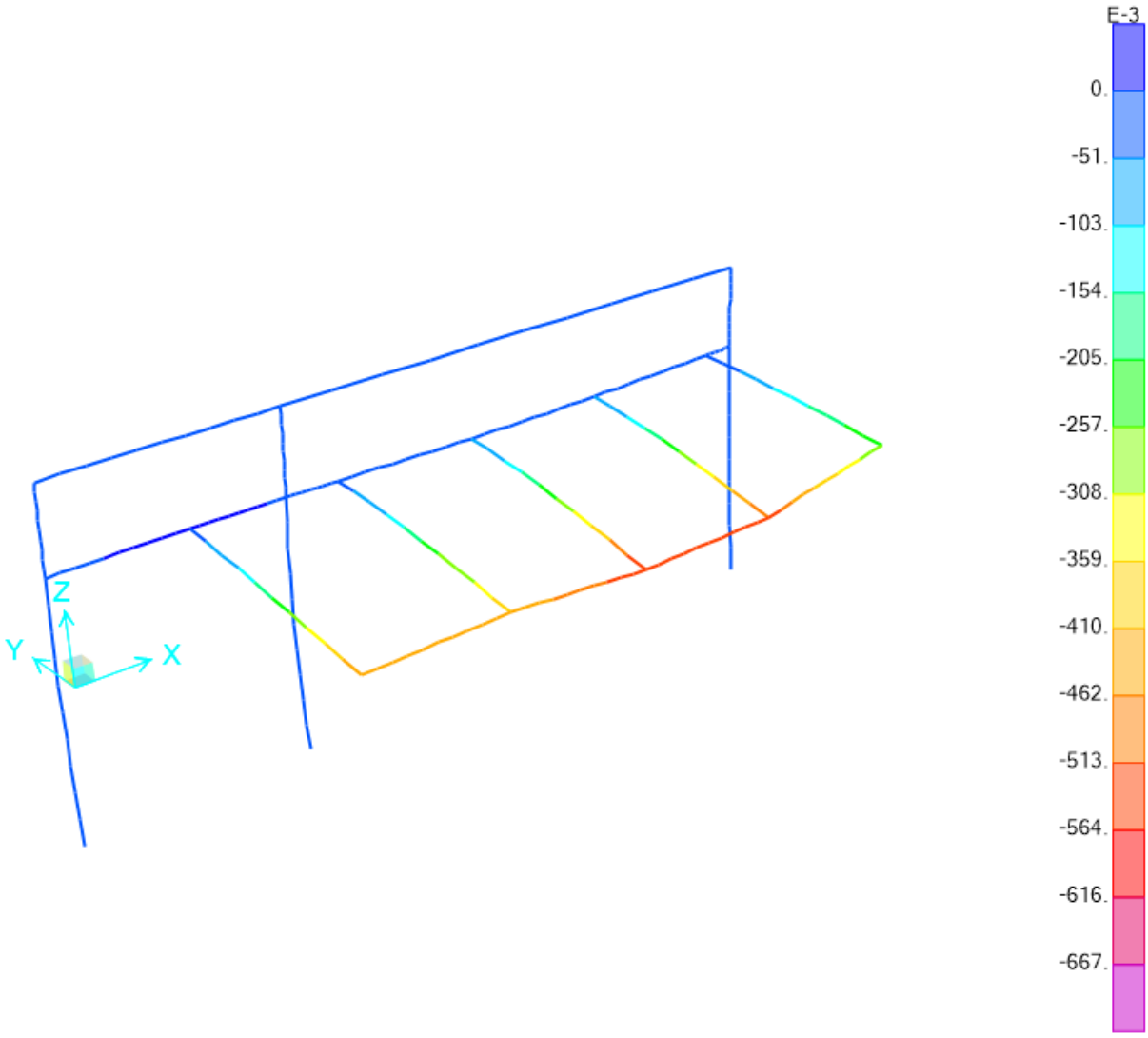
project	Fused Elements Residence	by CBJ	sheet no.
location	Mercer Island, WA	date 6/23/2023	
client	Olson Kundig		job no. 22-638
	Deck Canopy SAP Model Outputs		

SAP Model Defelction (in inches):

Maximum Transient Load Deflection, Snow:



Max Transient Deflection = 0.5508"
Max Transient Deflection Ratio = 2L/435

→ Deflection OK for flexible canopy roof

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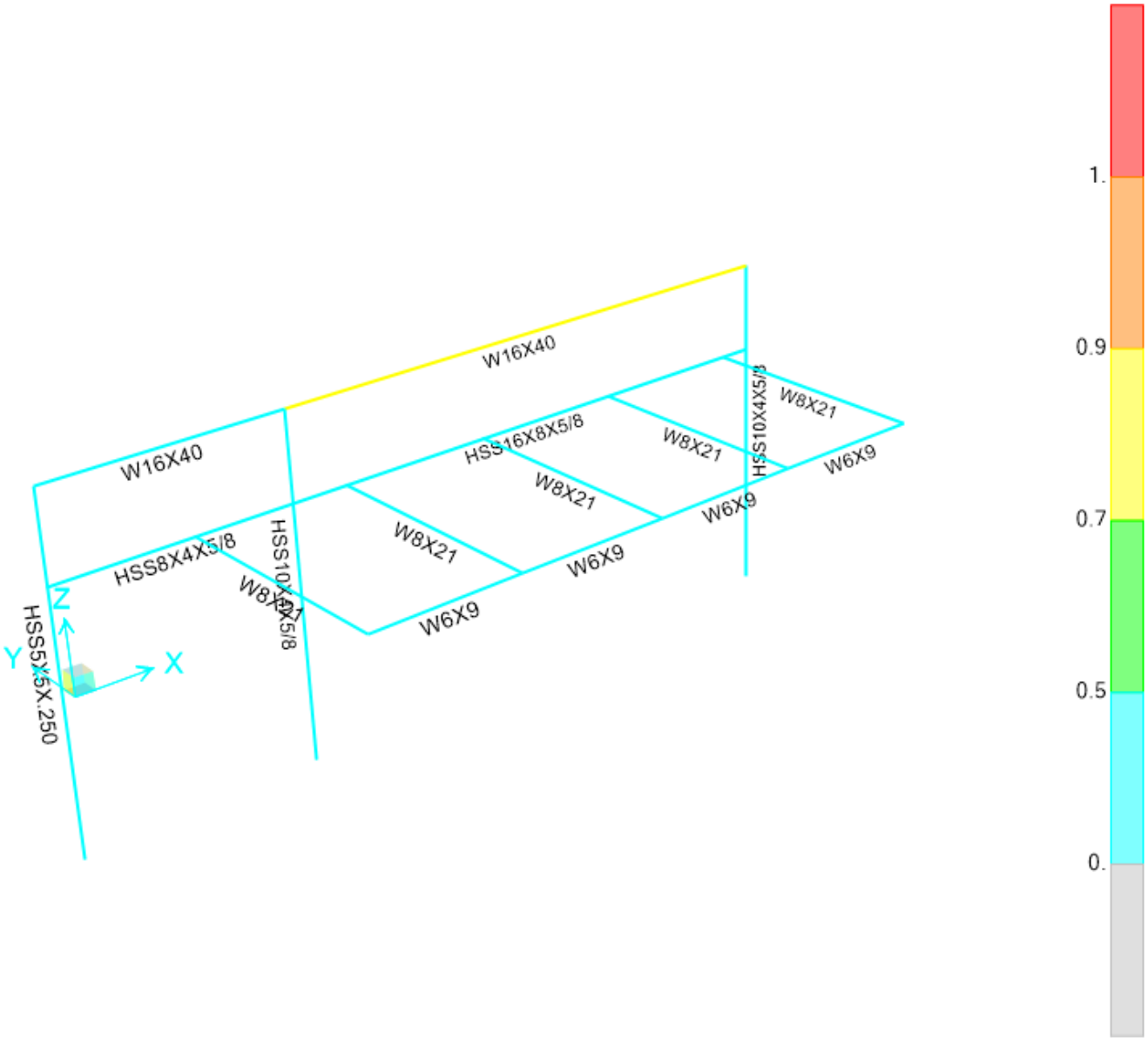
project	Fused Elements Residence	by CBJ	sheet no.
location	Mercer Island, WA	date 6/23/2023	
client	Olson Kundig		job no. 22-638
	Deck Canopy SAP Model Outputs		

SAP Model Steel Design Sections (AISC 360-16):



See Section B1, Framing Design, for design check on W16x40. See following pages for design check of HSS 16x8x5/8 and HSS 10x4x5/8.

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam with Torsional Loads

Project File: Fused Elements SD_CBJ.ec6

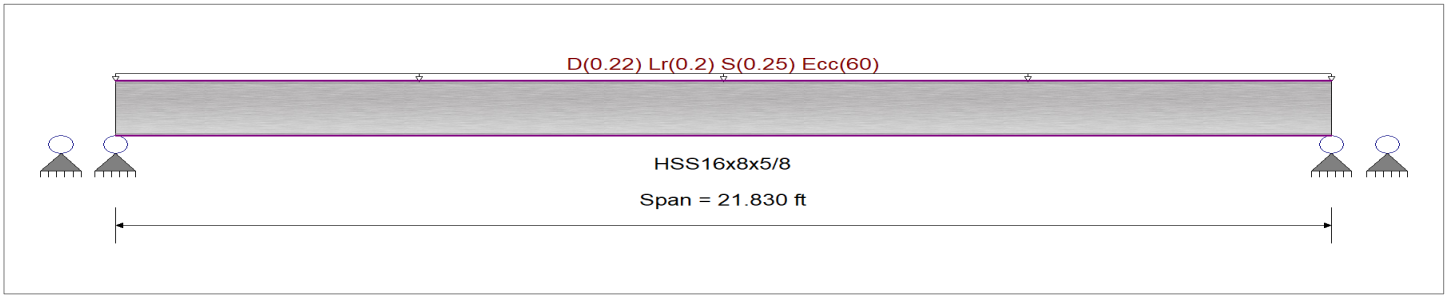
DESCRIPTION: Deck Canopy - HSS 16x8

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2021

Analysis Settings

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	46.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		
Load Combination	IBC 2021		



Applied Loads

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

Beam self weight calculated and added to loads
Load for Span Number 0
Uniform Load : D = 0.0220, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 10.0 ft, Tors Ecc. = 60.0 in, (Deck Roof)

DESIGN SUMMARY

Design OK

Max. Flange Normal Stress Ratio =	**0.113** : 1	Maximum Shear Stress Ratio =	**0.141** : 1
Flange Normal Stress	3.95 ksi	Flange Shear Stress	2.33 ksi
Phi vn : Flange Normal Stress *(Phi Mn/Sxx)*	34.84 ksi	Web Shear Stress	2.66 ksi
		Vn/Omega : Allowable	16.53 ksi
Max Mu : Applied	33.56 k-ft		
Section used for this span	**HSS16x8x5/8**	Section used for this span	**HSS16x8x5/8**
Load Combination	+D+S	Load Combination	+D+S

Maximum Rotation = 0.1514 deg at 10.92 ft

Maximum Deflection

Max Download Transient Load Deflection	0.054 in	Max Downward Total Deflection	0.123 in
Ratio =	4815	Ratio =	2137
Max Upward Transient Load Deflection	0.000 in	Max Upward Total Deflection	0.000 in
Ratio =	0 <360	Ratio =	0 <180

Maximum Forces & Stresses for Load Combinations

Load Combination	Max Stress	Bending Max		Flange Normal (ksi)			Flange Shear (ksi)			Web Shear (ksi)		
	Ratio	Mu (kft)	Vu (k)	Total	Allow	Ratio	Total	Allow	Ratio	Total	Allow	Ratio
D Only	0.077	18.67	3.42	2.196	34.836	0.063	1.090	16.527	0.066	1.274	16.527	0.077
+D+Lr	0.144	30.58	5.60	3.598	34.836	0.103	2.081	16.527	0.126	2.383	16.527	0.144
+D+S	0.161	33.56	6.15	3.948	34.836	0.113	2.329	16.527	0.141	2.660	16.527	0.161
+D+0.750Lr	0.127	27.60	5.06	3.247	34.836	0.093	1.833	16.527	0.111	2.105	16.527	0.127
+D+0.750S	0.140	29.83	5.47	3.510	34.836	0.101	2.019	16.527	0.122	2.313	16.527	0.140
+0.60D	0.046	11.20	2.05	1.318	34.836	0.038	0.654	16.527	0.040	0.764	16.527	0.046

Maximum Upward Deflections - Unfactored Loads

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
span_1	1	0.1226	11.002		0.0000	0.000

Vertical Reactions - Unfactored

Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditi	6.149	6.149
Max Upward from Load Combinat	6.149	6.149
Max Upward from Load Cases	3.420	3.420
D Only	3.420	3.420

Steel Beam with Torsional Loads

DESCRIPTION: Deck Canopy - HSS 16x8

Vertical Reactions - Unfactored

Values in KIPS

Load Combination	Support 1	Support 2
+D+Lr	5.603	5.603
+D+S	6.149	6.149
+D+0.750Lr	5.057	5.057
+D+0.750S	5.467	5.467
+0.60D	2.052	2.052
Lr Only	2.183	2.183
S Only	2.729	2.729

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Column

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: Deck Canopy - HSS 10x4

Code References

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : IBC 2021

General Information

Steel Section Name : **HSS10x4x5/8**

Analysis Method :	Allowable Strength
Steel Stress Grade	
Fy : Steel Yield	46.0 ksi
E : Elastic Bending Modulus	29,000.0 ksi

Overall Column Height	14.08 ft
Top & Bottom Fixity	Top & Bottom Pinned

Brace condition for deflection (buckling) along columns :
X-X (width) axis :
Unbraced Length for buckling ABOUT Y-Y Axis = 14.08 ft, K = 1.0
Y-Y (depth) axis :
Unbraced Length for buckling ABOUT X-X Axis = 14.08 ft, K = 1.0

Applied Loads

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

Column self weight included : 715.40 lbs * Dead Load Factor
AXIAL LOADS . . .
Deck Canopy: Axial Load at 10.340 ft, D = 3.388, LR = 3.080, S = 3.850 k
Terrace: Axial Load at 14.080 ft, D = 2.679, L = 8.460, S = 3.525 k
BENDING LOADS . . .
Deck Canopy: Moment acting about X-X axis at 10.340 ft, D = 16.940, LR = 15.40, S = 19.250 k-ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.3274** : 1

Load Combination	+D+S
Location of max.above base	10.30 ft
At maximum location values are . . .	
Pa : Axial	14.157 k
Pn / Omega : Allowable	171.598 k
Ma-x : Applied	26.475 k-ft
Mn-x / Omega : Allowable	92.505 k-ft
Ma-y : Applied	0.0 k-ft
Mn-y / Omega : Allowable	47.285 k-ft

PASS Maximum Shear Stress Ratio **0.01621** : 1

Load Combination	+D+S
Location of max.above base	0.0 ft
At maximum location values are . . .	
Va : Applied	2.570 k
Vn / Omega : Allowable	158.570 k

Maximum Load Reactions . .

Top along X-X	0.0 k
Bottom along X-X	0.0 k
Top along Y-Y	2.570 k
Bottom along Y-Y	2.570 k

Maximum Load Deflections . . .

Along Y-Y 0.1301 in at 7.276 ft above base
for load combination : +D+S

Along X-X 0.0 in at 0.0 ft above base
for load combination :

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Cbx	Cby	KxLx/Ry	KyLy/Rx	Maximum Shear Ratios: Stress Ratio	Status	Location
D Only	0.154	PASS	10.30 ft	1.72	1.00	109.71	51.83	0.008	PASS	0.00 ft
+D+L	0.178	PASS	10.30 ft	1.72	1.00	109.71	51.83	0.008	PASS	0.00 ft
+D+Lr	0.284	PASS	10.30 ft	1.72	1.00	109.71	51.83	0.014	PASS	0.00 ft
+D+S	0.327	PASS	10.30 ft	1.72	1.00	109.71	51.83	0.016	PASS	0.00 ft
+D+0.750Lr+0.750L	0.270	PASS	10.30 ft	1.72	1.00	109.71	51.83	0.013	PASS	0.00 ft
+D+0.750L+0.750S	0.303	PASS	10.30 ft	1.72	1.00	109.71	51.83	0.014	PASS	0.00 ft
+0.60D	0.092	PASS	10.30 ft	1.72	1.00	109.71	51.83	0.005	PASS	0.00 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction @ Base	@ Top	k	Y-Y Axis Reaction @ Base	@ Top	Mx - End Moments k-ft @ Base	@ Top	My - End Moments @ Base	@ Top
D Only	6.782				1.203	-1.203				
+D+L	15.242				1.203	-1.203				
+D+Lr	9.862				2.297	-2.297				
+D+S	14.157				2.570	-2.570				
+D+0.750Lr+0.750L	15.437				2.023	-2.023				

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Column

Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: Deck Canopy - HSS 10x4

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction @ Base	@ Top	k	Y-Y Axis Reaction @ Base	@ Top	Mx - End Moments k-ft @ Base	@ Top	My - End Moments @ Base	@ Top
+D+0.750L+0.750S	18.659				2.229	-2.229				
+0.60D	4.069				0.722	-0.722				
Lr Only	3.080				1.094	-1.094				
L Only	8.460									
S Only	7.375				1.367	-1.367				

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction @ Base	@ Top	k	Y-Y Axis Reaction @ Base	@ Top	Mx - End Moments k-ft @ Base	@ Top	My - End Moments @ Base	@ Top
Axial @ Base	Maximum	18.659				2.229	-2.229				
"	Minimum	3.080				1.094	-1.094				
Reaction, X-X Axis Base	Maximum	6.782				1.203	-1.203				
"	Minimum	6.782				1.203	-1.203				
Reaction, Y-Y Axis Base	Maximum	14.157				2.570	-2.570				
"	Minimum	8.460									
Reaction, X-X Axis Top	Maximum	6.782				1.203	-1.203				
"	Minimum	6.782				1.203	-1.203				
Reaction, Y-Y Axis Top	Maximum	8.460									
"	Minimum	6.782				1.203	-1.203				
Moment, X-X Axis Base	Maximum	6.782				1.203	-1.203				
"	Minimum	6.782				1.203	-1.203				
Moment, Y-Y Axis Base	Maximum	6.782				1.203	-1.203				
"	Minimum	6.782				1.203	-1.203				
Moment, X-X Axis Top	Maximum	6.782				1.203	-1.203				
"	Minimum	6.782				1.203	-1.203				
Moment, Y-Y Axis Top	Maximum	6.782				1.203	-1.203				
"	Minimum	6.782				1.203	-1.203				

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
D Only	0.0000 in	0.000 ft	0.061 in	7.276 ft
+D+L	0.0000 in	0.000 ft	0.061 in	7.276 ft
+D+Lr	0.0000 in	0.000 ft	0.116 in	7.276 ft
+D+S	0.0000 in	0.000 ft	0.130 in	7.276 ft
+D+0.750Lr+0.750L	0.0000 in	0.000 ft	0.102 in	7.276 ft
+D+0.750L+0.750S	0.0000 in	0.000 ft	0.113 in	7.276 ft
+0.60D	0.0000 in	0.000 ft	0.037 in	7.276 ft
Lr Only	0.0000 in	0.000 ft	0.055 in	7.276 ft
L Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
S Only	0.0000 in	0.000 ft	0.069 in	7.276 ft

Steel Section Properties : HSS10x4x5/8

Depth	=	10.000 in	I xx	=	149.00 in^4	J	=	95.700 in^4
Design Thick	=	0.581 in	S xx	=	29.90 in^3	Cw	=	36.70 in^6
Width	=	4.000 in	R xx	=	3.260 in			
Wall Thick	=	0.624 in	Zx	=	40.300 in^3			
Area	=	14.000 in^2	I yy	=	33.500 in^4	C	=	36.700 in^3
Weight	=	50.810 plf	S yy	=	16.800 in^3			
			R yy	=	1.540 in			
			Zy	=	20.600 in^3			
Ycg	=	0.000 in						

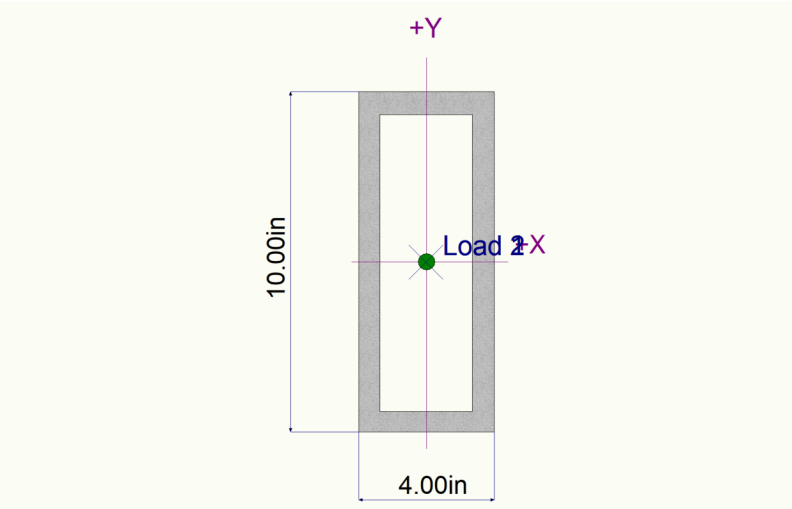
Project Title:
Engineer:
Project ID:
Project Descr:

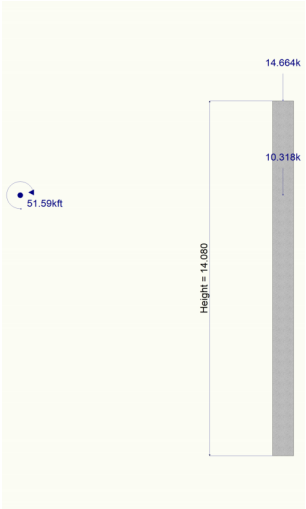
Steel Column

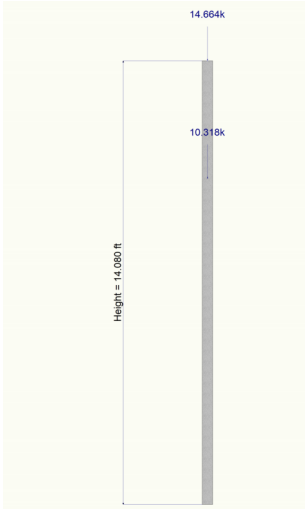
Project File: Fused Elements SD_CBJ.ec6

DESCRIPTION: Deck Canopy - HSS 10x4

Sketches







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Chapter E
Miscellaneous Design

Section 2
Feature Stair Design

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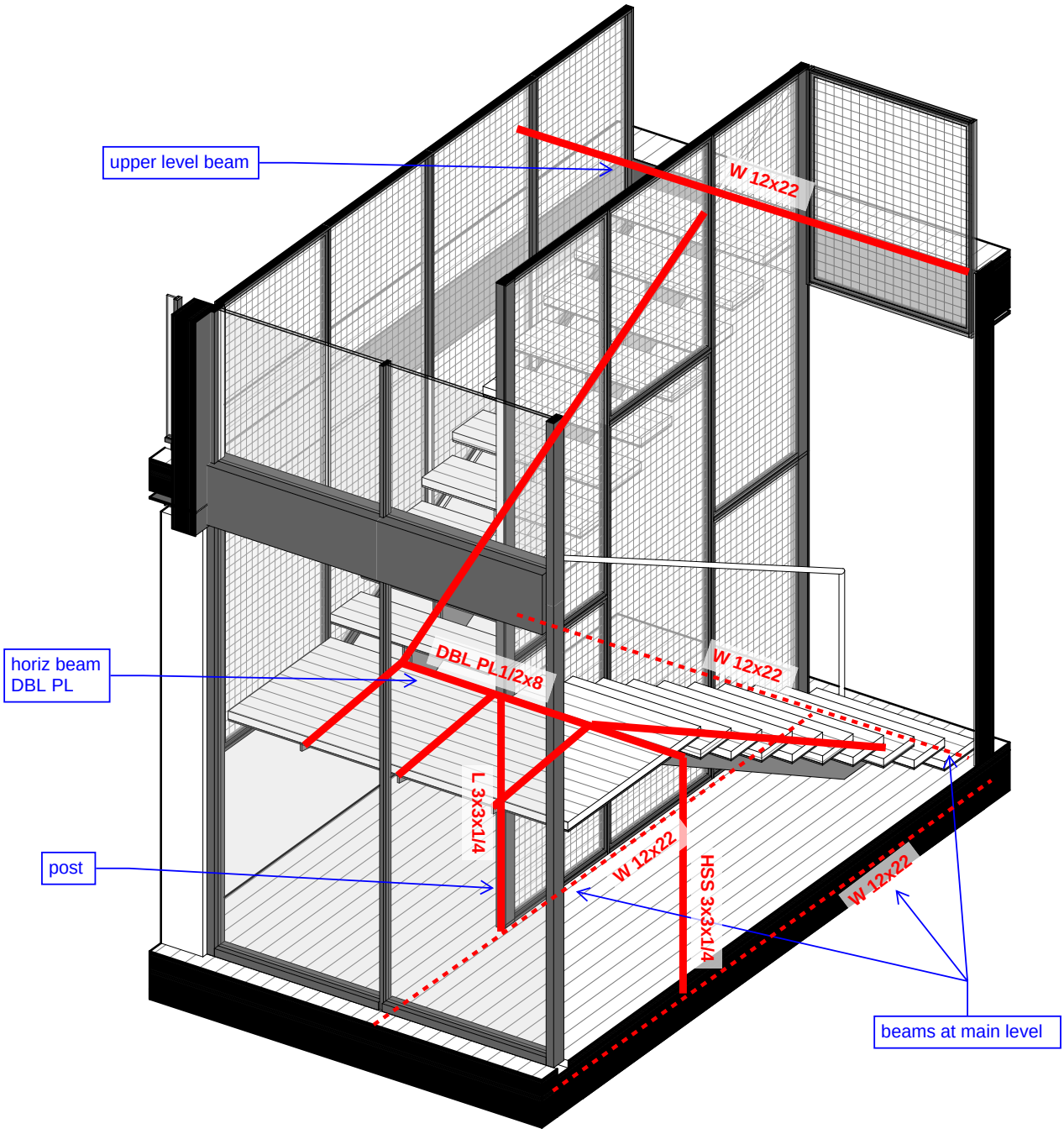
Seattle, WA 98101 206 622-5822

project	Fused Elements Residence	by CBJ	sheet no.
location	Mercer Island, WA	date 6/23/2023	
client	Olson Kundig		job no. 22-638
	Feature Stair Design Layout		

Stair Axon:



6 STAIR AXON
SCALE:

kpff 1601 5th Avenue, Suite 1600 Seattle, WA 98101 206 622-5822	project Fused Elements Residence	by CBJ	sheet no.
	location Mercer Island, WA	date 04/12/23	
	client Olson Kundig		job no. 22-00638
	Stair Design		

Stair Tread Design

Guardrail loads not supported by treads and stringers

Material Properties

F_y =	36	ksi
F_u =	58	ksi
E =	29000	ksi
γ_{steel} =	490	pcf
$\gamma_{DF,wood}$ =	32.7	pcf
t_{wood} =	3.0	in

Section Properties

b =	12	in
t_{steel} =	0.375	in
A_g =	4.5	in^2
y =	0.188	in
I =	0.053	in^4
S =	0.281	in^3
Z =	0.422	in^3

Loading Criteria

Support Cond'n: Cantilevered

L_{tread} =	3.5	ft
$s_{stringer}$ =	2	in
$L_{cantilever}$ =	1.67	ft
w_{DL} =	23.5	plf/ft
w_{LL} =	40	plf/ft
P_{LL} =	300	lb/ft

Loading & Forces

	Forces in Tread PL	
Load Cond'n	M (lb-ft)	V (lb)
DL	32.6	39.1
Dist LL	55.6	66.7
Concen LL @ End	500.0	300.0
1.2DL+1.6LL	839.1	527.0
DL+LL	532.6	

Capacity of a Single Stringer Plate

$\phi_{flexure}$ = 0.9 *yielding*

$M_n = \phi * F_y * Z$

M_n = 13.7 k-in = 1.14 k-ft

ϕ_{shear} = 1.0 *yielding*

$V_n = \phi * 0.6 * F_y * A_g$

V_n = 97.2 k

Ultimate Demands on Plate Stringer

M_u =	839.1	lb-ft
	0.839	k-ft
V_u =	527.0	lb
	0.527	k

M_u Util =	0.74	OK
V_u Util =	0.01	OK
M_u+V_u Util =	0.74	OK

Deflection Check

L/ 600 *Max Deflection Ratio*

w_{DL} =	23.5	plf
P_{LL} =	300.0	lb
Δ_{limit} =	0.067	in
Δ_{max} =	0.062	in

OK

kpff 1601 5th Avenue, Suite 1600 Seattle, WA 98101 206 622-5822	project Fused Elements Residence	by CBJ	sheet no.
	location Mercer Island, WA	date 04/12/23	
	client Olson Kundig		job no. 22-00638
	Stair Design		

Stair Stringer Design (Main Span)

Guardrail loads not supported by treads and stringers

Material Properties

F_y =	36	ksi
F_u =	58	ksi
E =	29000	ksi
γ_{steel} =	490	pcf

Section Properties

t_{steel} =	0.5	in
h_{steel} =	8.0	in
A_g =	4.0	in^2
y =	4.0	in
I =	21.3	in^4
S =	5.3	in^3
Z =	8.0	in^3

Loading Criteria

Backspan

$L_{stringer}$ =	10.00	ft
L_{tread} =	3.5	ft
	42	in
DL_{treads} =	23.5	psf
w_{DL} =	13.6	plf
w_{LL} =	70	plf
P_{LL} =	300	lb

Loading & Forces (for a Single Stringer Plate)

Load Cond'n	Forces in Stringer M (lb-ft)	V (lb)
DL	131.0	76.4
Dist LL	673.8	392.9
Concen LL @ Midspan	750.0	150.0
1.2DL+1.6LL	1837.2	720.3
DL+LL	1181.0	469.3

Capacity of a Single Stringer Plate

$\phi_{flexure}$ = 0.9 *yielding*

$M_n = \phi * F_y * Z$

M_n = 259.2 k-in

21.60 k-ft

ϕ_{shear} = 1.0 *yielding*

$V_n = \phi * 0.6 * F_y * A_g$

V_n = 86.4 k

Ultimate Demands on Plate Stringer

M_u =	1837.2	lb-ft
	1.837	k-ft
V_u =	720.3	lb
	0.720	k

M_u Util =	0.09	OK
V_u Util =	0.01	OK
M_u+V_u Util =	0.09	OK

Deflection Check

L/ 600 *Max Deflection Ratio*

w_{DL} =	13.6	plf
w_{LL} =	70.0	plf
w_{DL+LL} =	83.6	plf
P_{LL} =	300.0	lb

Δ_{limit} = 0.20 in

Δ_{max} = 0.021 in OK

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	location Mercer Island, WA	date 06/02/23	
	client Olson Kundig		job no. 22-00638
	Stair Design		

Stair Stringer Design (Cantilever Span)

Guardrail loads not supported by treads and stringers

Material Properties

F_y =	36	ksi
F_u =	58	ksi
E =	29000	ksi
γ_{steel} =	490	pcf

Section Properties

t_{steel} =	0.5	in
h_{steel} =	8.0	in
A_g =	4.0	in^2
y =	4.0	in
I =	21.3	in^4
S =	5.3	in^3
Z =	8.0	in^3

Loading Criteria

Cantilever

$L_{stringer}$ =	3.50	ft
L_{tread} =	3.5	ft
	42	in
DL_{treads} =	23.5	psf
w_{DL} =	54.7	plf
w_{LL} =	70	plf
P_{LL} =	300	lb

Loading & Forces (for a Single Stringer Plate)

Load Cond'n	Forces in Stringer M (lb-ft)	V (lb)
DL	335.1	191.5
Dist LL	428.8	245.0
Concen LL @ End	1050.0	300.0
1.2DL+1.6LL	2082.1	709.8
DL+LL	1385.1	491.5

Capacity of a Single Stringer Plate

$\phi_{flexure}$ =	0.9	*yielding*
$\phi M_n = \phi * F_y * Z$		
ϕM_n =	259.2	k-in
	21.60	k-ft

ϕ_{shear} =	1.0	*yielding*
$\phi V_n = \phi * 0.6 * F_y * A_g$		
ϕV_n =	86.4	k

Ultimate Demands on Plate Stringer

M_u =	2082.1	lb-ft
	2.082	k-ft
V_u =	709.8	lb
	0.710	k

M_u Util =	0.10	OK
V_u Util =	0.01	OK
M_u+V_u Util =	0.11	OK

Deflection Check

L/	600	*Max Deflection Ratio*
w_{DL} =	54.7	plf
w_{LL} =	70.0	plf
w_{DL+LL} =	124.7	plf
P_{LL} =	300.0	lb

Δ_{limit} =	0.14	in	
Δ_{max} =	0.046	in	OK

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	location Mercer Island, WA	date 06/02/23	
	client Olson Kundig		job no. 22-00638
	Stair Design		

Stair Stringer Design (Cantilever Span, Reduced Section Properties at Midspan)

Material Properties

F_y =	36	ksi
F_u =	58	ksi
E =	29000	ksi
γ_{steel} =	490	pcf

Assuming 8" deep stringer tapers to 2" at end of landing

Reduced Section Properties

t_{steel} =	0.5	in
h_{steel} =	5.0	in
A_g =	2.5	in^2
y =	2.5	in
I =	5.2	in^4
S =	2.1	in^3
Z =	3.1	in^3

Loading Criteria

Cantilever

$L_{stringer}$ =	3.50	ft
L_{tread} =	3.5	ft
	42	in
DL_{treads} =	23.5	psf
w_{DL} =	54.7	plf
w_{LL} =	70	plf
P_{LL} =	300	lb

Loading & Forces (for a Single Stringer Plate)

	Forces in Stringer	
Load Cond'n	M (lb-ft)	V (lb)
DL	83.8	95.7
Dist LL	107.2	122.5
Concen LL @ End	525.0	300.0
1.2DL+1.6LL	940.5	594.9
DL+LL	608.8	

Capacity of a Single Stringer Plate

$\phi_{flexure}$ = 0.9 *yielding*

$\phi M_n = \phi * F_y * Z$

ϕM_n = 101.3 k-in

8.44 k-ft

ϕ_{shear} = 1.0 *yielding*

$\phi V_n = \phi * 0.6 * F_y * A_g$

ϕV_n = 54.0 k

Ultimate Demands on Plate Stringer

M_u =	940.5	lb-ft
	0.941	k-ft
V_u =	594.9	lb
	0.595	k

M_u Util =	0.11	OK
V_u Util =	0.01	OK
M_u+V_u Util =	0.13	OK

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	location Mercer Island, WA	date 06/11/23	
	client Olson Kundig		job no. 22-00638
	Stair Design		

Stair Horiz Beam Design (Main Span, Post to Wall)

Material Properties

F_y =	36	ksi
F_u =	58	ksi
E =	29000	ksi
γ_{steel} =	490	pcf

Section Properties

t_{steel} =	0.5	in
h_{steel} =	8.0	in
A_g =	4.0	in^2
y =	4.0	in
I =	21.3	in^4
S =	5.3	in^3
Z =	8.0	in^3

Loading Criteria

Backspan

$L_{stringer}$ = 4.17 ft

P_{DL} =	124.0	lb
P_{LL} =	637.9	lb

Loading & Forces (from both Stringers)

Load Cond'n	Forces in Stringer M (lb-ft)	V (lb)
Concen DL @ Midspan	129.3	123.9
Concen LL @ Midspan	665.0	637.1
1.2DL+1.6LL	1219.1	1168.0
DL+LL	794.3	761.0

Capacity of a Single Stringer Plate

$\phi_{flexure}$ = 0.9 *yielding*

$M_n = \phi * F_y * Z$

M_n = 259.2 k-in

21.60 k-ft

ϕ_{shear} = 1.0 *yielding*

$V_n = \phi * 0.6 * F_y * A_g$

V_n = 86.4 k

Ultimate Demands on Plate Stringer

M_u =	1219.1	lb-ft
	1.219	k-ft
V_u =	1168.0	lb
	1.168	k

M_u Util =	0.06	OK
V_u Util =	0.01	OK
M_u+V_u Util =	0.07	OK

Deflection Check

L/ 600 *Max Deflection Ratio*

P_{DL} =	124.0	lb
P_{LL} =	637.9	lb
P_{DL+LL} =	761.9	lb

Δ_{limit} = 0.08 in

Δ_{max} = 0.003 in OK

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	location Mercer Island, WA	date 06/11/23	
	client Olson Kundig		job no. 22-00638
	Stair Design		

Stair Horiz Beam Design (Cantilever Span, Edge to Post)

Material Properties

F_y =	36	ksi
F_u =	58	ksi
E =	29000	ksi
γ_{steel} =	490	pcf

Section Properties

t_{steel} =	0.5	in
h_{steel} =	8.0	in
A_g =	4.0	in^2
y =	4.0	in
I =	21.3	in^4
S =	5.3	in^3
Z =	8.0	in^3

Loading Criteria

Cantilever

$L_{stringer}$ = 2.08 ft

P_{DL} =	124.0	lb
P_{LL} =	637.9	lb

Loading & Forces (from both Stringers)

	Forces in Stringer	
Load Cond'n	M (lb-ft)	V (lb)
Concen DL @ End	258.0	124.0
Concen LL @ End	1326.8	637.9
1.2DL+1.6LL	2432.4	347.3
DL+LL	1584.8	761.9

Capacity of a Single Stringer Plate

$\phi_{flexure}$ = 0.9 *yielding*

$\phi M_n = \phi * F_y * Z$

ϕM_n = 259.2 k-in

21.60 k-ft

ϕ_{shear} = 1.0 *yielding*

$\phi V_n = \phi * 0.6 * F_y * A_g$

ϕV_n = 86.4 k

Ultimate Demands on Plate Stringer

M_u =	2432.4	lb-ft
	2.432	k-ft
V_u =	347.3	lb
	0.347	k

M_u Util =	0.11	OK
V_u Util =	0.00	OK
M_u+V_u Util =	0.12	OK

Deflection Check

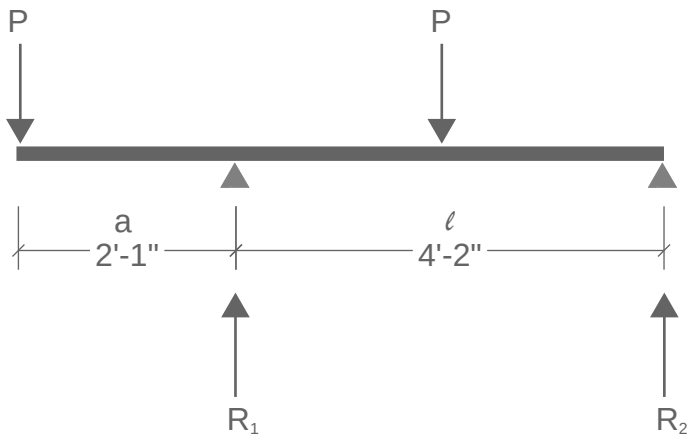
L/ 600 *Max Deflection Ratio*

P_{DL} =	124.0	lb
P_{LL} =	637.9	lb
P_{DL+LL} =	761.9	lb

Δ_{limit} = 0.08 in

Δ_{max} = 0.019 in OK

Load Calculation:



P_{DL} = 124 #
P_{LL} = 638 #

$R_1 = P/\ell * (\ell + a) + P/2 =$ 248 # (DL)
1275 # (LL)

R_{MAX} = 2338 # = 2.34 k

L3x3x1/4 Compression Capacity:

KL = 2.1 * 4'-3" = 8.93'

P_n = 6.35 k (per AISC Table 4-11)

→ L3x3x1/4 OK for stair post

kpff 1601 5th Avenue, Suite 1600 Seattle, WA 98101 206 622-5822	project Fused Elements Residence	by CBJ	sheet no.
	location Mercer Island, WA	date 06/15/23	
	client Olson Kundig		job no. 22-00638
	Stair Design		

Main Level and Upper Level Support Beams are Checked in Framing Design, Section B1 of this Package

Stair Loads on Landing Beams

Guardrail loads not supported by treads and stringers

Main Level Beams Length and Loading Points

$L_{GRID\ 5}$ =	12.15	ft			
x_{BM} =	8.08	ft	P_{DL} =	61.2	lb
			P_{LL} =	314.7	lb
$x_{STRINGER}$ =	10.08	ft	P_{DL} =	76.4	lb
			P_{LL} =	392.9	lb
$L_{GRID\ D.5}$ =	13.50	ft			
x_{POST} =	10.17	ft	P_{DL} =	248.1	lb
			P_{LL} =	1275.8	lb

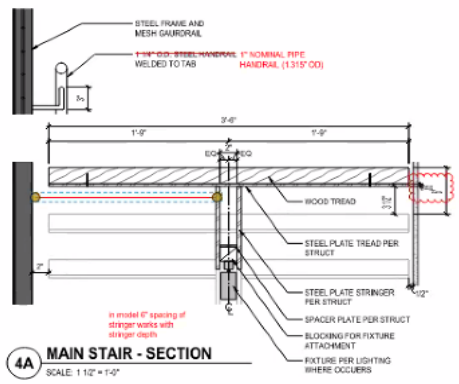
Landing Level Beam Length and Loading Points

$L_{cantilever}$ =	2.08	ft	$L_{backspan}$ =	4.17	ft
x =	0.08	ft	x =	2.08	ft
P_{DL} =	124.0	lb	P_{DL} =	124.0	lb
P_{LL} =	637.9	lb	P_{LL} =	637.9	lb

Upper Level Landing Beam Length and Loading Points

L =	12.15	ft			
x =	6.08	ft	P_{DL} =	76.4	lb
			P_{LL} =	392.9	lb

Draft Architectural Tread Detail (5/10/23):



Chapter E
Miscellaneous Design

Section 3
Retaining Wall Design

1601 5th Avenue, Suite 1600
Seattle, WA 98101 206 622-5822

DESIGN SUMMARY

Date: *6/23/2023*
By: *CBJ*

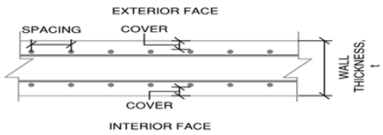
Design: *Retaining Wall Design*

Two typical basement wall heights retaining soil are designed in this section, a wall retaining 8 ft of soil, and a wall retaining 13 ft of soil. Retaining walls are designed using the KPFF standard basement wall design spreadhseet to resist active soil pressure, live surcharge, and seismic loading per recommendations of the geotechnical report. The demands for the walls were calculated in Section D of these calculations.

kpff
1601 5th Avenue, Suite 1600
Seattle, WA 98101 206 622-5822

project	Fused Elements Residence	by	CBJ
location	Mercer Island, WA	date	4/7/2023
client	Olson Kundig		
	13'-0" Retaining Basement Wall		job no. 22-00638

CONCRETE BASEMENT WALL DESIGN



INPUT PARAMETERS:

CROSS-SECTION DIMENSIONS

Section Shape		Wall Type 1	
Wall Width	b =	12.0 in	
Wall Thickness	t =	12.0 in	
Compression Face		Interior Face	
Height of Wall	h_w =	156.0 in	11.6.2a
Length of Wall	l_w =	348.0 in	11.6.2a

COVER PARAMETERS

Wall Face Exposure	Interior Face:	Not Exposed	→	Minimum Required Cover 0.75 in	20.6.1.3.1
	Exterior Face:	Exposed	→	2.00 in	20.6.1.3.1
Clear Cover Used	Interior Face	0.75 in			
	Exterior Face	2.00 in			

VERTICAL REINFORCING LAYOUT

Layer	On-Center Spacing (in)	Bar # (U.S.)	d_{layer} (in)
Interior Face	12	#7	1.188
Exterior Face	9	#7	9.563

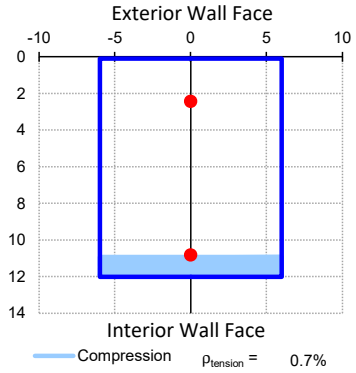
HORIZONTAL REINFORCING LAYOUT

Layer	On-Center Spacing (in)	Bar # (U.S.)
Interior Face	16	#4
Exterior Face	16	#4

MATERIAL PROPERTIES

Concrete 28 Day Compressive Strength	f'_{c28} =	4.0 ksi
Concrete Type	Type =	Normalweight
Concrete Weight	γ_c =	145 pcf
Flexural Reinforcement Yield Strength	f_y =	60 ksi

Cross-Section Dimensions (in)



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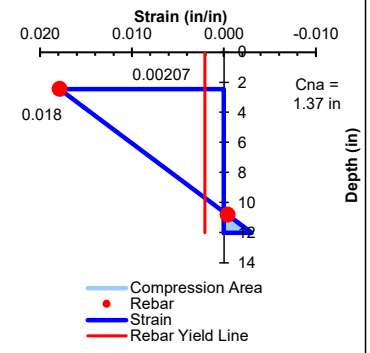
Strain Diagram at Capacity



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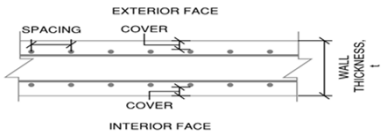
ANALYSIS OUTPUT: (Referenced to ACI 318-14 Requirements)

			Reference	STATUS:
FLEXURAL STRENGTH				GOOD - PASSES ACI 318
Nominal Moment Strength Capacity	M_n =	38.6 kip-ft		
Reduction Factor, ϕ	ϕ =	0.90	21.2.2	
Design Moment Strength Capacity at P_u	**ϕM_n =**	**34.8 kip-ft/ft**		
Axial Strength Capacity	**$\phi P_{n\_comp,max}$ =**	**252.1 kip**	22.4.2.2	
	$\phi P_{n\_tens,min}$ =	**-75.6 kip**	22.4.3.1	
Factored Moment Demand (matching compression face)	**M_u =**	**27.6 kip-ft/ft**		GOOD - ϕMn > Mu
Factored Axial Demand (compression positive)	**P_u =**	**6.1 kip**		
OUT-OF-PLANE SHEAR STRENGTH				
Nominal Shear Strength Capacity	$V_{n,out-of-plane}$ =	14.8 kips	11.5.5.1	
Reduction Factor, ϕ	**ϕ =**	0.75	21.2.4.1	
Design Shear Strength Capacity	**$\phi V_{n,out-of-plane}$ =**	**11.1 kips/ft**	11.5.1.1c	
Factored Shear Demand	**$V_{u,out-of-plane}$ =**	**5.8 kips/ft**		GOOD - ϕVn > Vu
IN-PLANE SHEAR STRENGTH				
Nominal Shear Strength Capacity	$V_{n,in-plane}$ =	840.2 kips	11.5.4.4	
Reduction Factor, ϕ	ϕ =	0.6	21.2.1	
Design Shear Strength Capacity	**$\phi V_{n,in-plane}$ =**	**17.4 kips/ft**	11.5.1.1c	
Factored Shear Demand	**$V_{u,in-plane}$ =**	**0.8 kips/ft**		GOOD - ϕVn > Vu
SERVICABILITY				
Cracking Moment	**M_{cr} =**	**12.4 kip-ft**	24.2.3.5b	Mu > Mcr. Use the cracked section properties in analysis.

kpff
1601 5th Avenue, Suite 1600
Seattle, WA 98101 206 622-5822

project	Fused Elements Residence	by	CBJ
location	Mercer Island, WA	date	4/7/2023
client	Olson Kundig		job no. 22-00638
	8'-0" Retaining Basement Wall		

CONCRETE BASEMENT WALL DESIGN



INPUT PARAMETERS:

CROSS-SECTION DIMENSIONS

Section Shape		Wall Type 1	
Wall Width	b =	12.0 in	
Wall Thickness	t =	10.0 in	
Compression Face		Interior Face	
Height of Wall	h_w =	96.0 in	11.6.2a
Length of Wall	l_w =	40.0 in	11.6.2a

COVER PARAMETERS

				Minimum Required Cover	
Wall Face Exposure	Interior Face:	Not Exposed	→	0.75 in	20.6.1.3.1
	Exterior Face:	Exposed	→	2.00 in	20.6.1.3.1
Clear Cover Used	Interior Face	0.75 in			
	Exterior Face	2.00 in			

VERTICAL REINFORCING LAYOUT

Layer	On-Center Spacing (in)	Bar # (U.S.)	d_{layer} (in)
Interior Face	12	#6	1.125
Exterior Face	12	#6	7.625

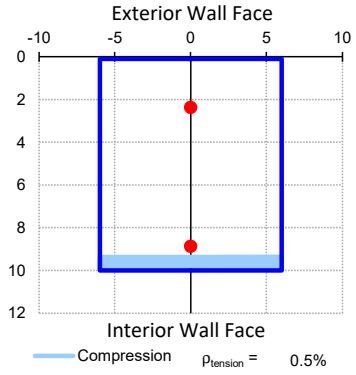
HORIZONTAL REINFORCING LAYOUT

Layer	On-Center Spacing (in)	Bar # (U.S.)
Interior Face	18	#4
Exterior Face	18	#4

MATERIAL PROPERTIES

Concrete 28 Day Compressive Strength	f'_{c28} =	4.0 ksi
Concrete Type	Type =	Normalweight
Concrete Weight	γ_c =	145 pcf
Flexural Reinforcement Yield Strength	f_y =	60 ksi

Cross-Section Dimensions (in)



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Strain Diagram at Capacity

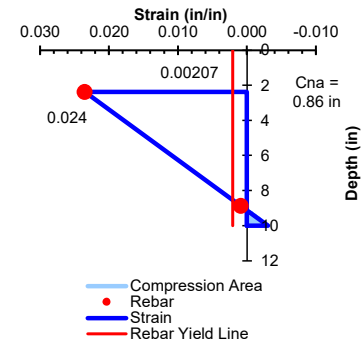

Image for reference only and is not to scale. Items shown may not be accurate.

ANALYSIS OUTPUT: (Referenced to ACI 318-14 Requirements)

			Reference	STATUS:
FLEXURAL STRENGTH				GOOD - PASSES ACI 318
Nominal Moment Strength Capacity	M_n =	17.3 kip-ft		
Reduction Factor, ϕ	ϕ =	0.90	21.2.2	
Design Moment Strength Capacity at P_u	**ϕM_n =**	**15.6 kip-ft/ft**		
Axial Strength Capacity	**$\phi P_{n\_comp,max}$ =**	**210.6 kip**	22.4.2.2	
	$\phi P_{n\_tens,min}$ =	**-47.5 kip**	22.4.3.1	
Factored Moment Demand (matching compression face)	**M_u =**	**6.7 kip-ft/ft**		GOOD - ϕMn > Mu
Factored Axial Demand (compression positive)	**P_u =**	**3.2 kip**		
OUT-OF-PLANE SHEAR STRENGTH				
Nominal Shear Strength Capacity	$V_{n,out-of-plane}$ =	11.7 kips	11.5.5.1	
Reduction Factor, ϕ	**ϕ =**	0.75	21.2.4.1	
Design Shear Strength Capacity	**$\phi V_{n,out-of-plane}$ =**	**8.8 kips/ft**	11.5.1.1c	
Factored Shear Demand	**$V_{u,out-of-plane}$ =**	**2.3 kips/ft**		GOOD - ϕVn > Vu
IN-PLANE SHEAR STRENGTH				
Nominal Shear Strength Capacity	$V_{n,in-plane}$ =	83.1 kips	11.5.4.4	
Reduction Factor, ϕ	ϕ =	0.6	21.2.1	
Design Shear Strength Capacity	**$\phi V_{n,in-plane}$ =**	**15.0 kips/ft**	11.5.1.1c	
Factored Shear Demand	**$V_{u,in-plane}$ =**	**0.8 kips/ft**		GOOD - ϕVn > Vu
SERVICABILITY				
Cracking Moment	**M_{cr} =**	**8.3 kip-ft**	24.2.3.5b	

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Chapter E
Miscellaneous Design

Section 4
Shoring Design

Codes and References

2015 IBC Standards, as amended by the City of Mercer Island
ACI 318-14
AISC Steel Construction Manual, 15th ED.
ASCE 7-10, Minimum Design Loads for Building and Other Structures
ASCE 37/14, Design Loads on Structures during Construction
AWS D1.1-2015
Recommendation for Prestressed Rock and Soil Anchors, by Post-Tensioning Institute, latest edition
Geotechnical Engineering Services Final Report, 401 Queen Anne Avenue North, for Martin Selig Real Estate, November 13, 2020

Computer Programs Used

CT Shoring Suite V8
Excel
Enercalc

Material Specifications and Strength

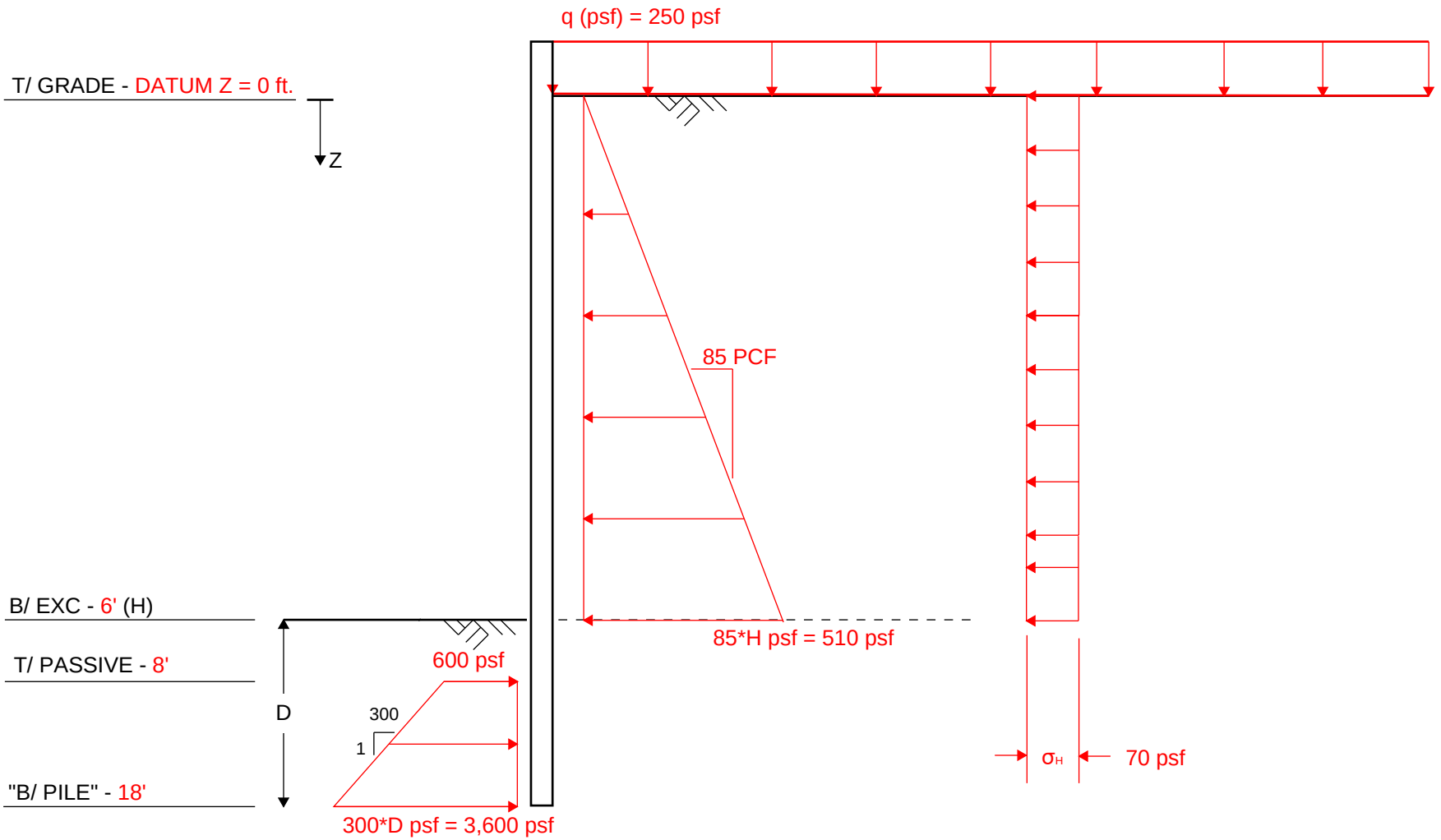
Pile Structural Concrete		f'_c= 3000 psi
Tieback Grout		f'_c= 3000 psi
Structural Steel		ASTM A 992
Connection Material, Angles, Plates and Misc. Steel		ASTM A 36 UNO
Welding Electrodes		ASTM E70XX UNO
Welded Headed Studs		ASTM A 108
Timber Lagging	Douglas Fit-Larch No. 2	F_b = 900 psi
	Hem-Fir No. 1	F_b = 975 psi

Lagging Board Recommendation

Depth (feet)	Recommended Lagging Thickness (roughcut) for clear spans of					
	5 feet	6 feet	7 feet	8 feet	9 feet	10 feet
0 to 25	2 inches	3 inches	3 inches	3 inches	4 inches	4 inches

DESIGN SECTION 6' Tall Cantilevered Wall

NOTES:
1. Piles @ 8'-0" OC
2. Shaft Ø = 2 ft
3. Passive over 2.5 x pile Ø
4. 2H:1V backslope pressures



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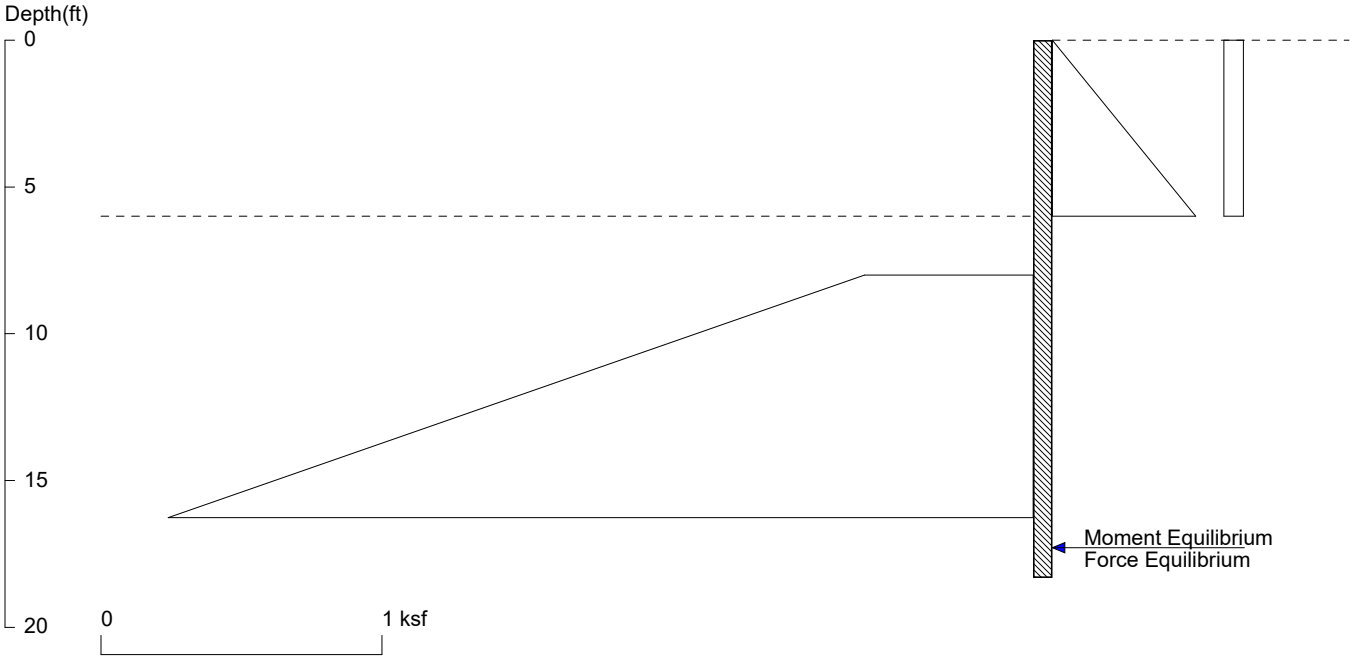
Seattle, WA 98101 206 622-5822

project: Fused Elements Shoring
location: Mercer Island, WA
client: Olson Kundig
Shoring Design Pressures
date: 6/20/2023
by: JRS
job no.: 2200638
sheet no.:

Fused Elements Permanent Shoring

6' cantilever



Licensed to 4324324234 3424343 Date: 6/20/2023

File: C:\Users\johns\Desktop\FE - 6 ft cantilevered wall.sh8

Wall Height=6.0 Pile Diameter=2.0 Pile Spacing=8.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=12.31 Min. Pile Length=18.31
MOMENT IN PILE: Max. Moment=97.09 per Pile Spacing=8.0 at Depth=11.47

VERTICAL BEARING CAPACITY: Vertical Loading=0.0, Resistance=128.7, Vertical Factor of Safety=999.00

PILE SELECTION:
Request Min. Section Modulus = 35.3 in3/pile=578.53 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
W12X30 has Section Modulus = 38.6 in3/pile=632.54 cm3/pile. It is greater than Min. Requirements!
Top Deflection = 0.54(in) based on E (ksi)=29000.00 and I (in4)/pile=238.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	0	6	0.510	0.085
0	0.07	6	0.070	0.000000

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
8	0.6	999	297.900	0.3

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	8.00
2	6.00	2.00

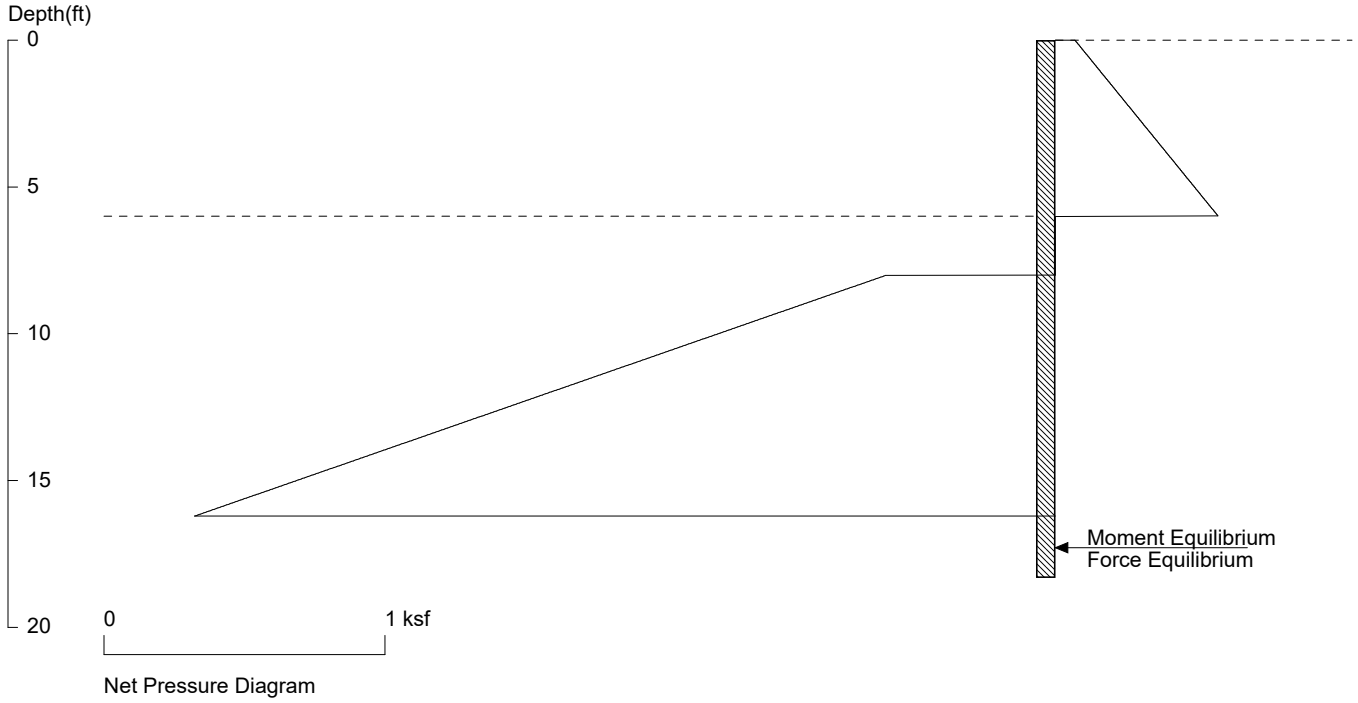
PASSIVE SPACING:

No.	Z depth	Spacing
1	6.00	4.00

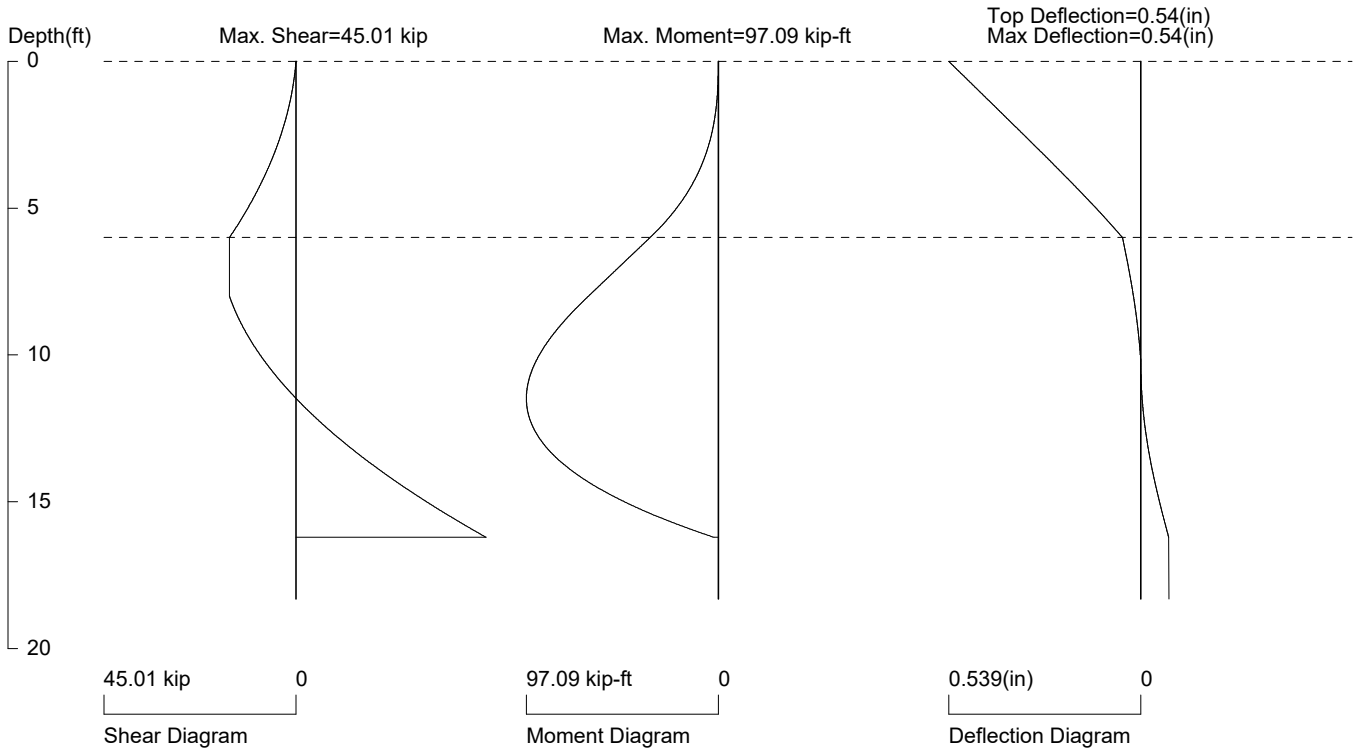
UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

Fused Elements Permanent Shoring

6' cantilever



Net Pressure Diagram



Shear Diagram | Moment Diagram | Deflection Diagram

PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

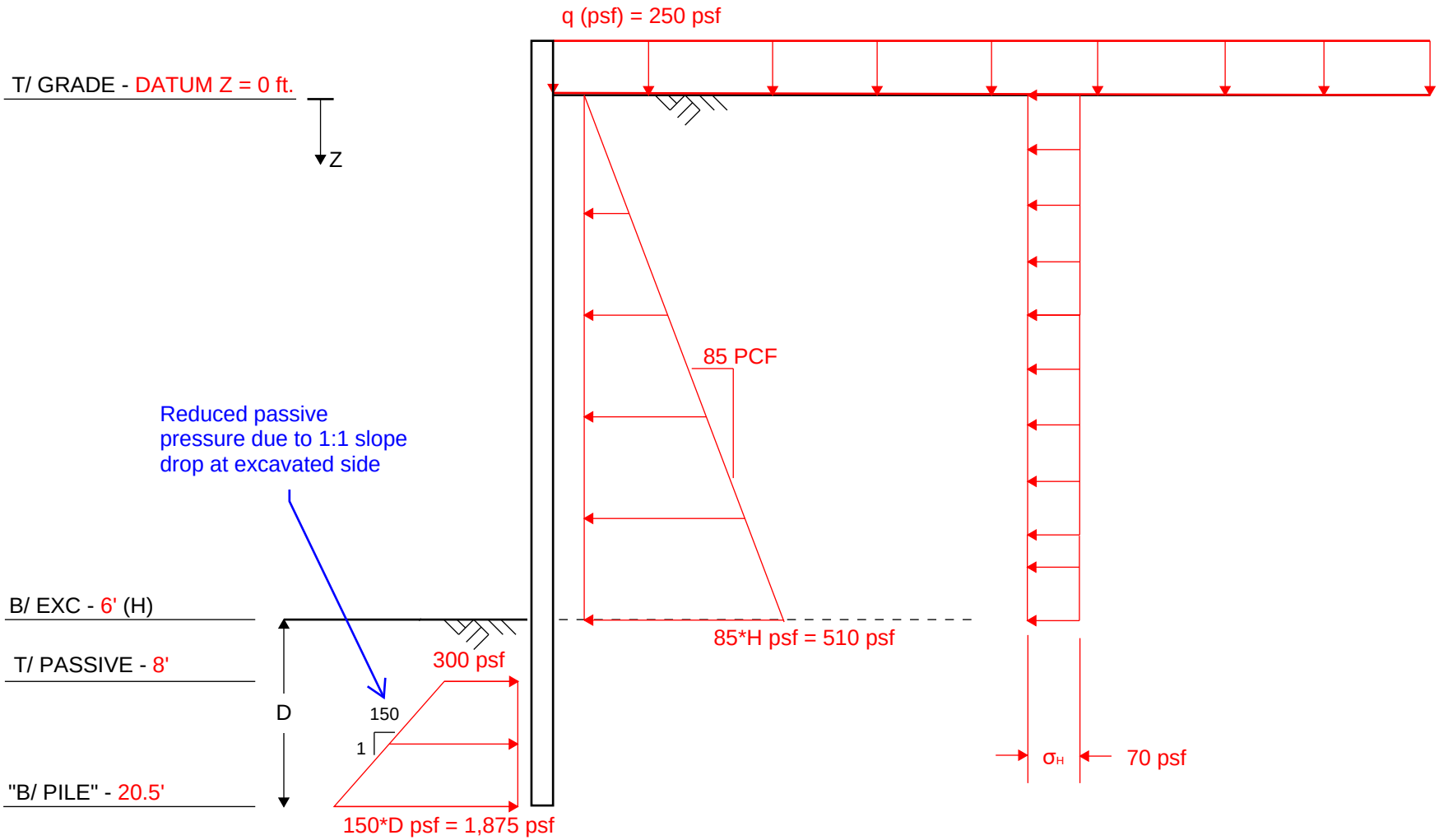
Based on pile spacing: 8.0 foot or meter

User Input Pile, W12X30: E (ksi)=29000.0, I (in4)/pile=238.0

File: C:\Users\johns\Desktop\FE - 6 ft cantilevered wall.sh8

DESIGN SECTION 6' Tall Cantilevered Wall - South Corner

NOTES:
1. Piles @ 8'-0" OC
2. Shaft Ø = 2 ft
3. Passive over 2.5 x pile Ø
4. 2H:1V backslope pressures



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1601 5th Avenue, Suite 1600
Seattle, WA 98101 206 622-5822

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Shoring Design Pressures
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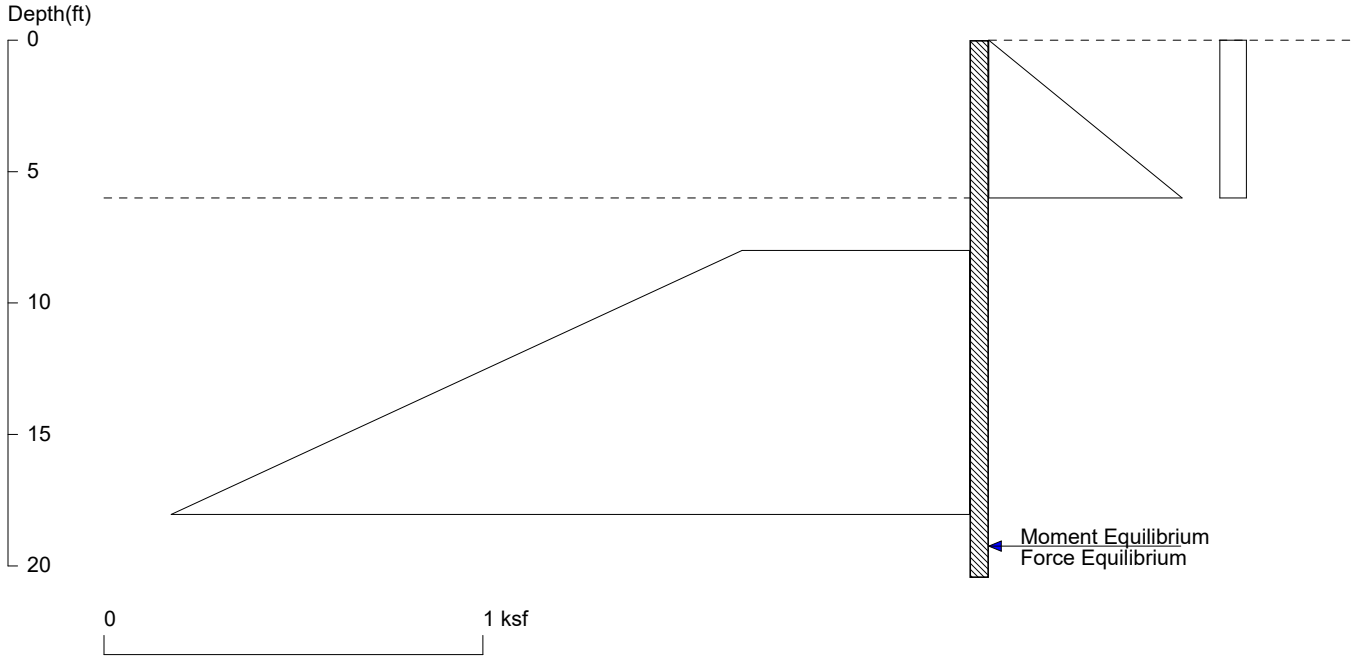
by: JRS
job no.: 2200638
sheet no.:

Fused Elements Permanent Shoring

6' cantilever - South Corner



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File: C:\Users\johns\Desktop\FE - 6 ft cantilevered wall.sh8

Wall Height=6.0 Pile Diameter=2.0 Pile Spacing=8.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=14.45 Min. Pile Length=20.45
MOMENT IN PILE: Max. Moment=102.71 per Pile Spacing=8.0 at Depth=12.25

VERTICAL BEARING CAPACITY: Vertical Loading=0.0, Resistance=138.8, Vertical Factor of Safety=999.00

PILE SELECTION:
Request Min. Section Modulus = 37.3 in3/pile=612.03 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
W12X30 has Section Modulus = 38.6 in3/pile=632.54 cm3/pile. It is greater than Min. Requirements!
Top Deflection = 0.67(in) based on E (ksi)=29000.00 and I (in4)/pile=238.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	0	6	0.510	0.085
0	0.07	6	0.070	0.000000

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
8	0.6	999	149.250	0.15

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	8.00
2	6.00	2.00

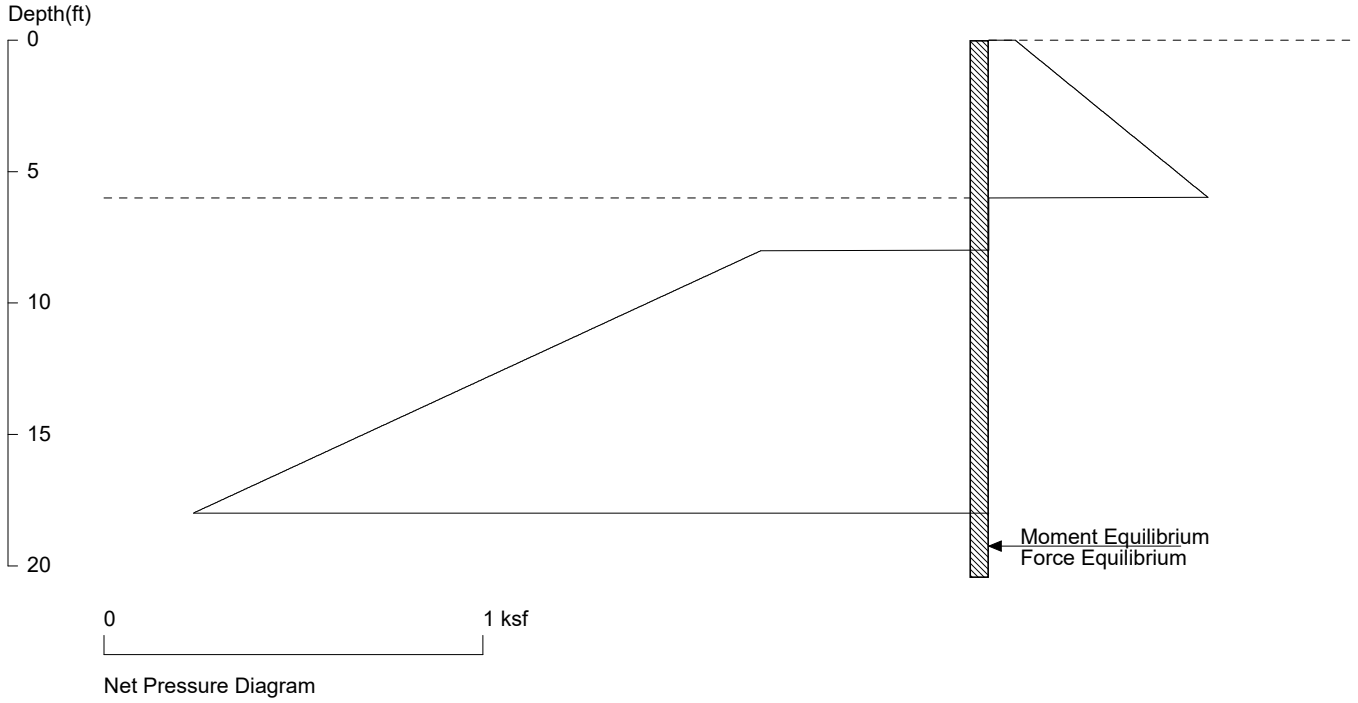
PASSIVE SPACING:

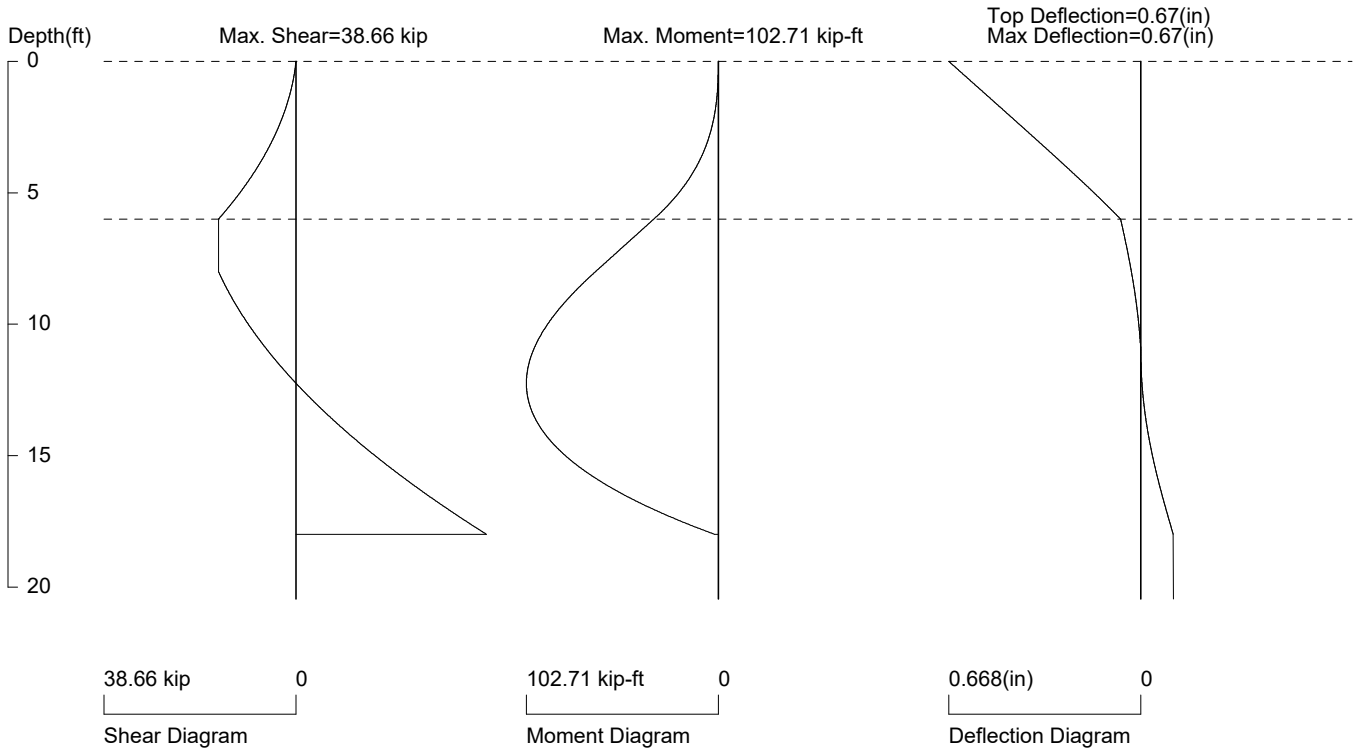
No.	Z depth	Spacing
1	6.00	4.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

Fused Elements Permanent Shoring

6' cantilever - South Corner





PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

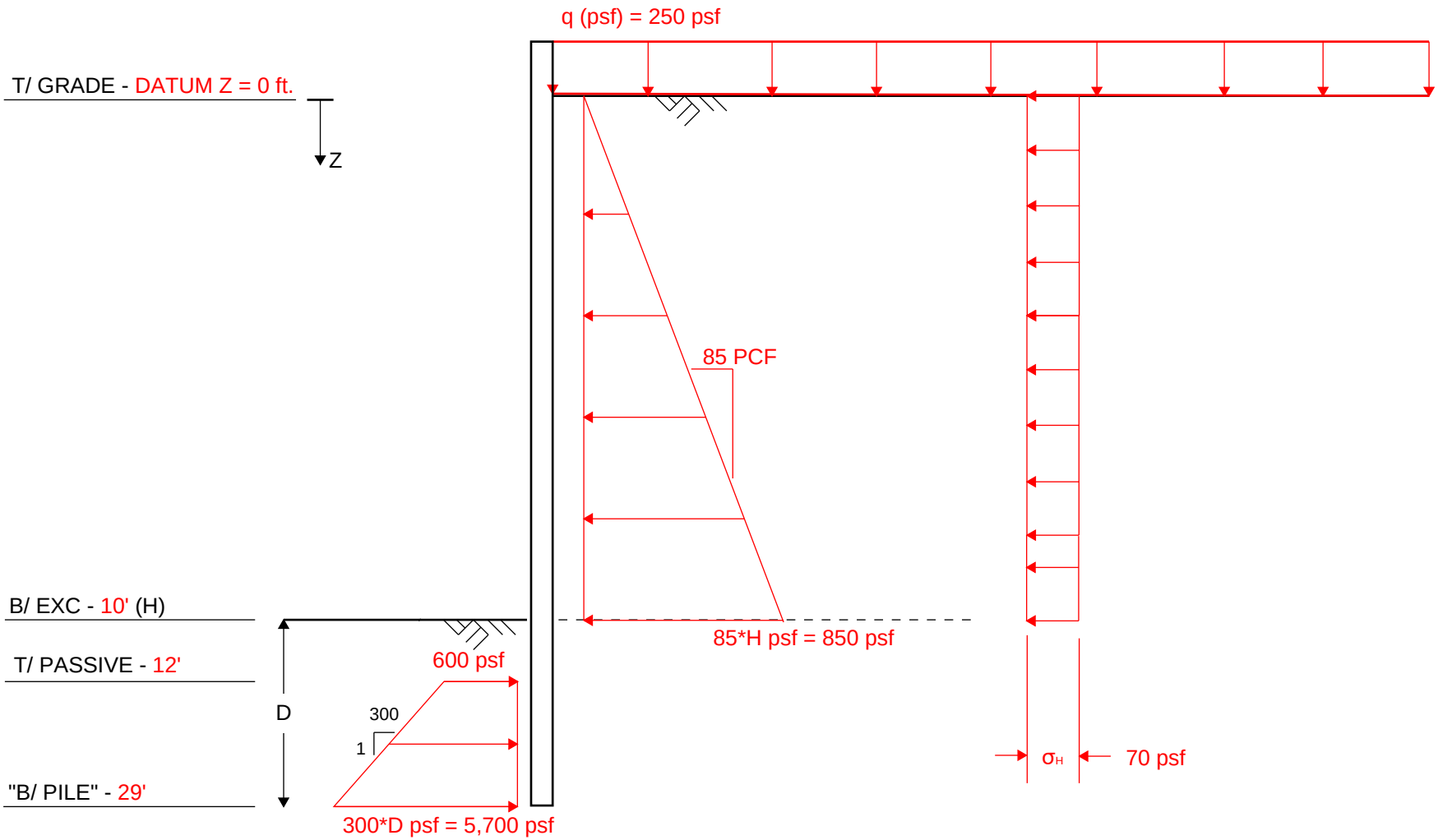
Based on pile spacing: 8.0 foot or meter

User Input Pile, W12X30: E (ksi)=29000.0, I (in4)/pile=238.0

File: C:\Users\johns\Desktop\FE - 6 ft cantilevered wall.sh8

DESIGN SECTION 10' Tall Cantilevered Wall

NOTES:
1. Piles @ 8'-0" OC
2. Shaft Ø = 2 ft
3. Passive over 2.5 x pile Ø
4. 2H:1V backslope pressures



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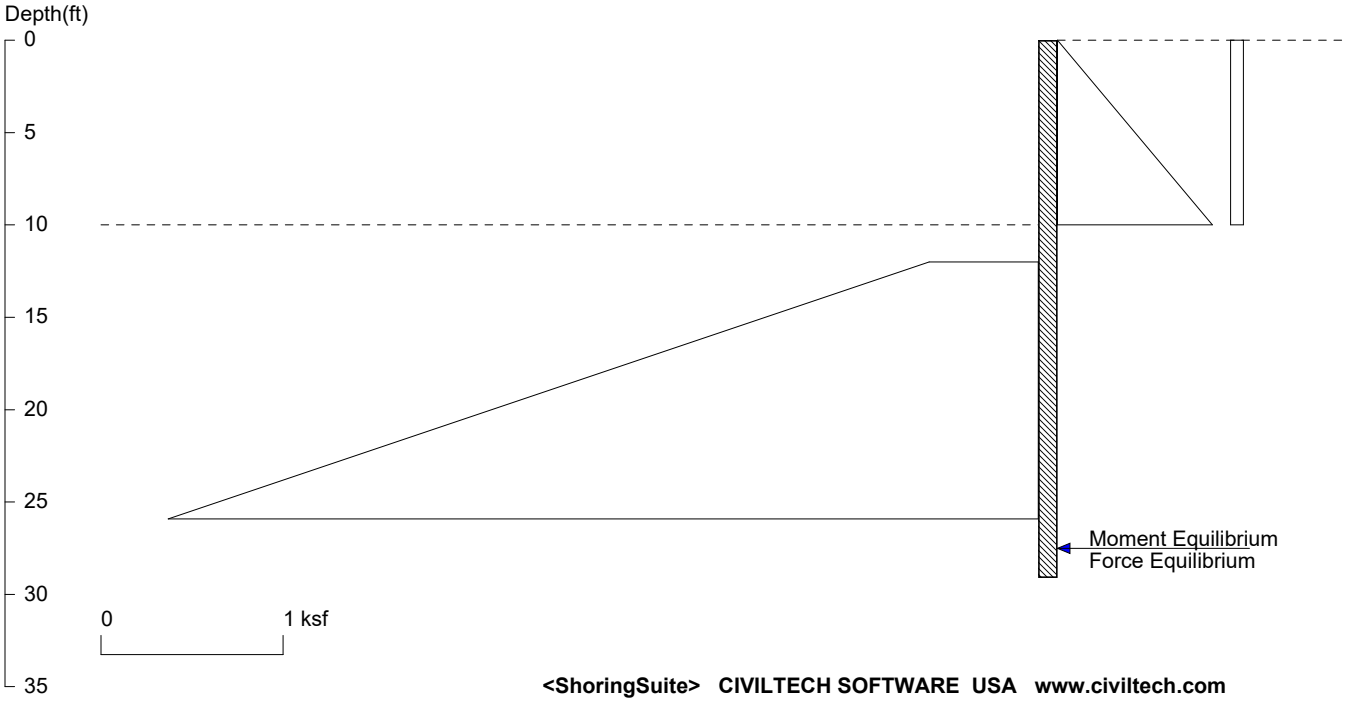
Seattle, WA 98101 206 622-5822

project: Fused Elements Shoring
location: Mercer Island, WA
client: Olson Kundig
Shoring Design Pressures
date: 6/20/2023
by: JRS
job no.: 2200638
sheet no.:

Fused Elements Permanent Shoring

10' cantilever



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File: C:\Users\johns\Desktop\FE - 10 ft cantilevered wall.sh8

Wall Height=10.0 Pile Diameter=2.0 Pile Spacing=8.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=19.10 Min. Pile Length=29.10
MOMENT IN PILE: Max. Moment=372.40 per Pile Spacing=8.0 at Depth=18.37

VERTICAL BEARING CAPACITY: Vertical Loading=0.0, Resistance=170.1, Vertical Factor of Safety=999.00

PILE SELECTION:
Request Min. Section Modulus = 135.4 in3/pile=2219.09 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
W12X106 has Section Modulus = 145.0 in3/pile=2376.12 cm3/pile. It is greater than Min. Requirements!
Top Deflection = 1.36(in) based on E (ksi)=29000.00 and I (in4)/pile=933.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	0	10	0.850	0.085
0	0.07	10	0.070	0.000000

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
12	0.6	999	296.700	0.3

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	8.00
2	10.00	2.00

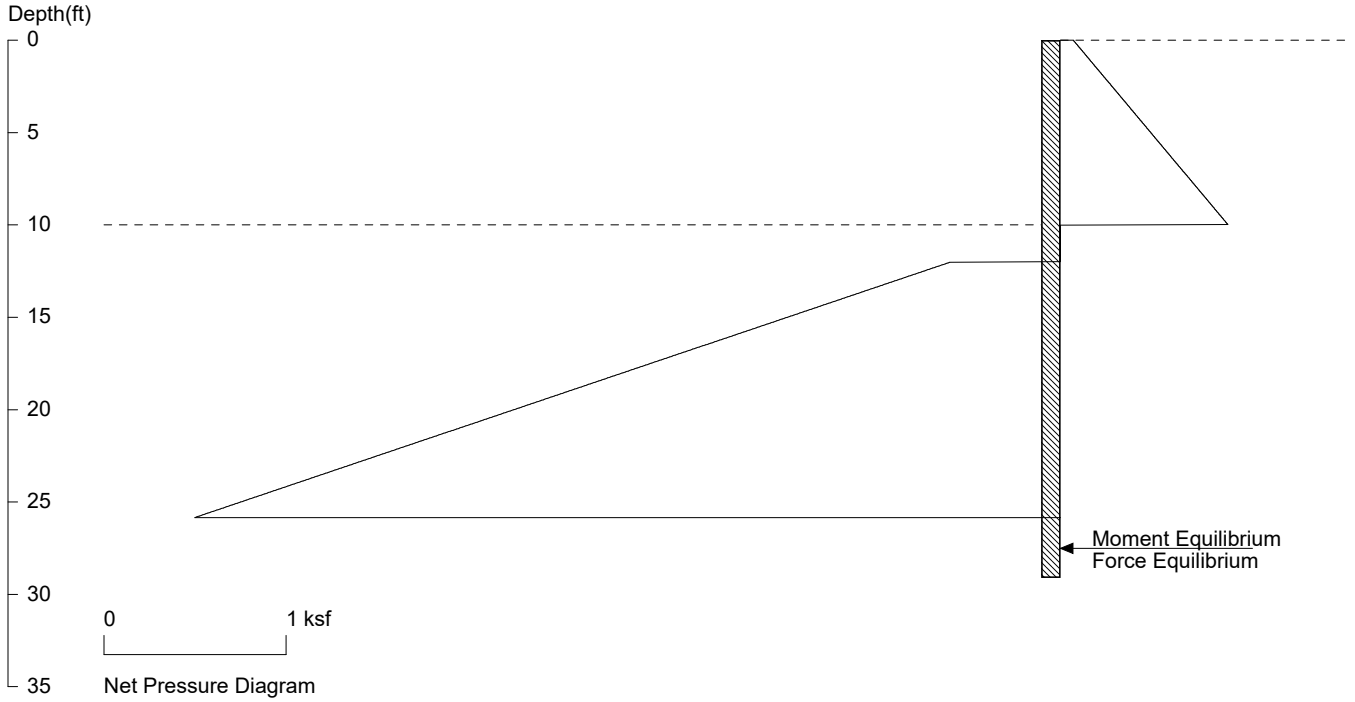
PASSIVE SPACING:

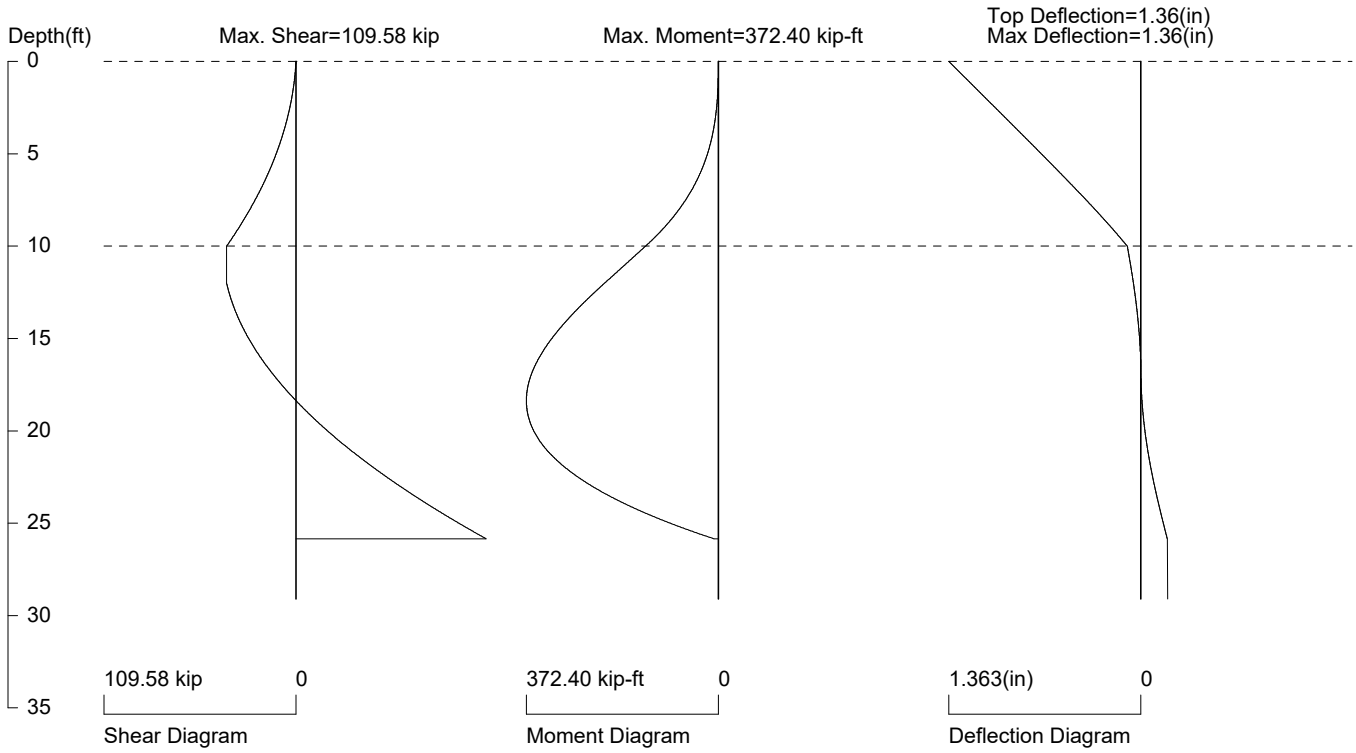
No.	Z depth	Spacing
1	10.00	4.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

Fused Elements Permanent Shoring

10' cantilever





PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

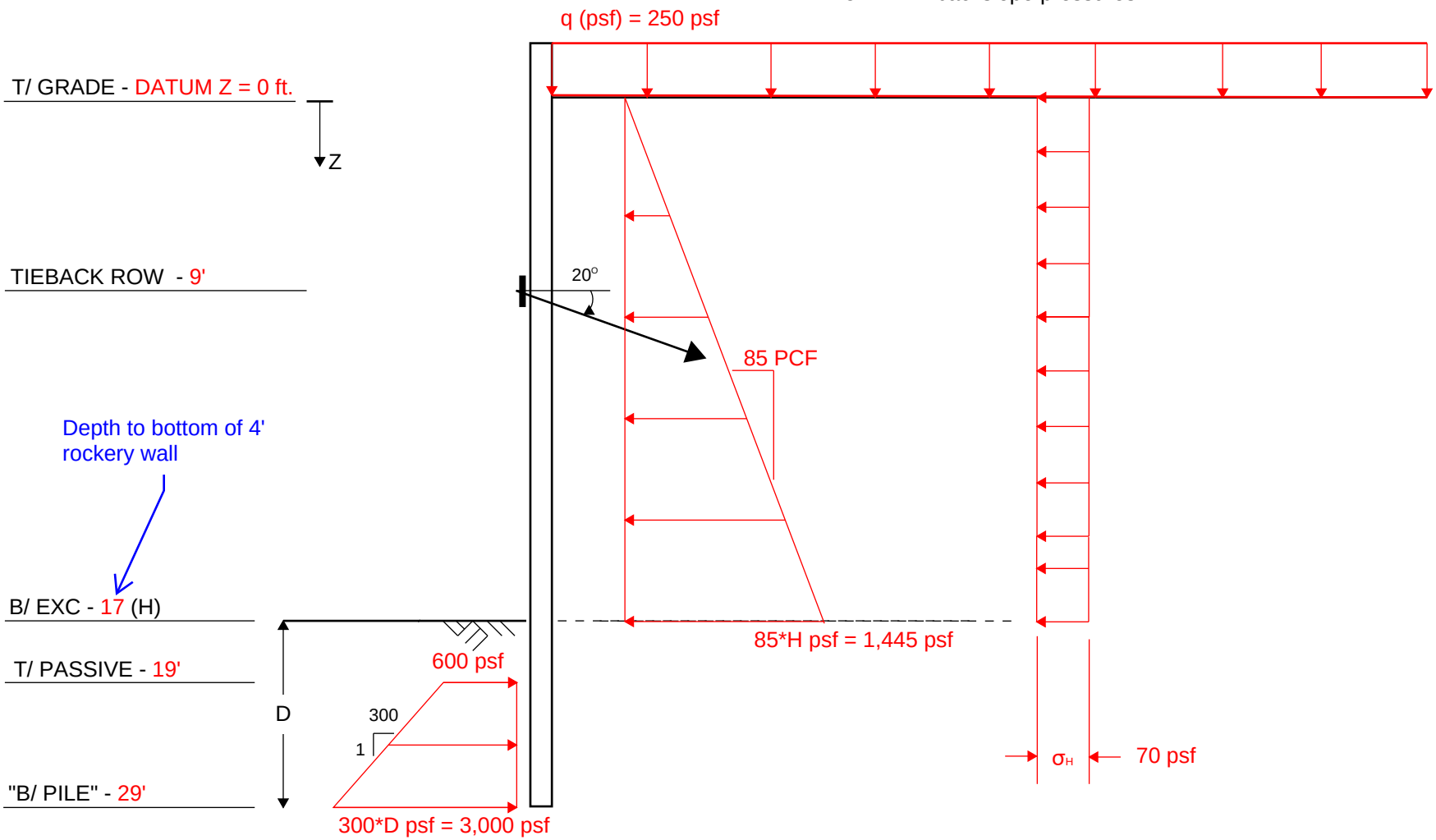
Based on pile spacing: 8.0 foot or meter

User Input Pile, W12X106: E (ksi)=29000.0, I (in4)/pile=933.0

File: C:\Users\johns\Desktop\FE - 10 ft cantilevered wall.sh8

DESIGN SECTION 17' Tall Wall With Tiebacks

NOTES:
1. Piles @ 8'-0" OC
2. Shaft Ø = 2 ft
3. Passive over 2.5 x pile Ø
4. μ = 2 ksf; EB = 18 ksf
5. 2H:1V backslope pressures



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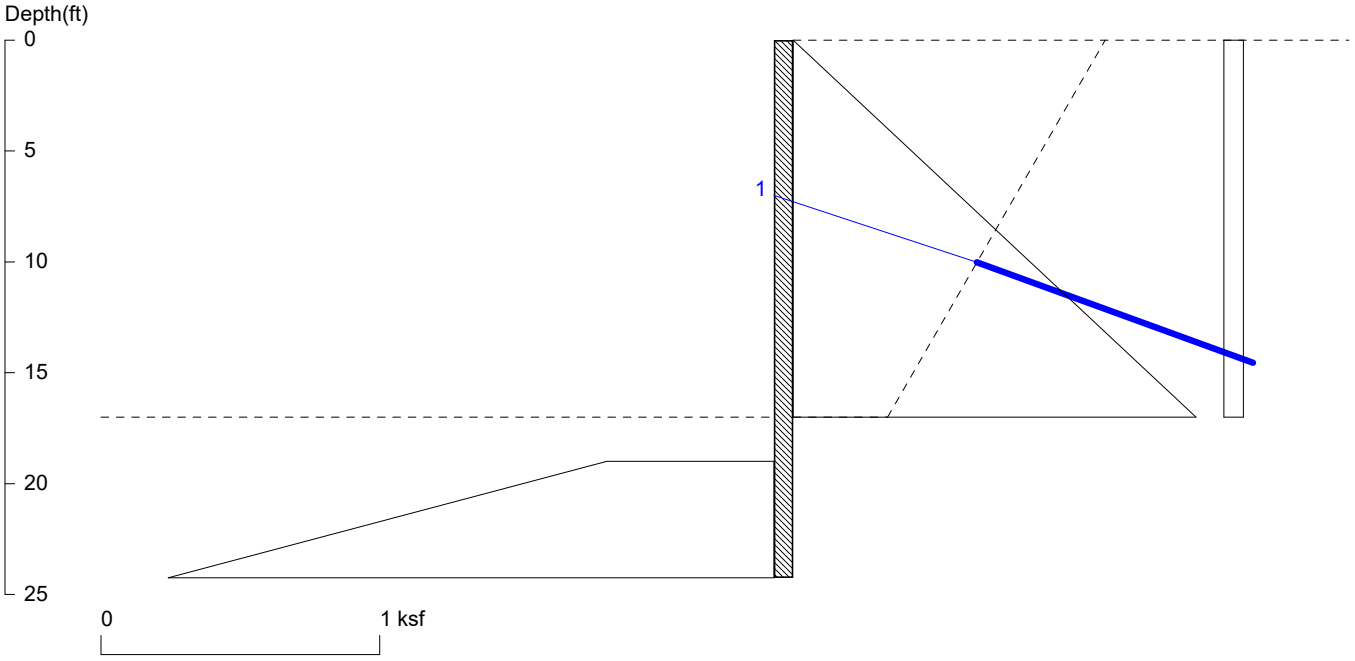
1601 5th Avenue, Suite 1600
Seattle, WA 98101 206 622-5822

project: Fused Elements Shoring
location: Mercer Island, WA
client: Olson Kundig
Shoring Design Pressures
date: 6/20/2023
by: JRS
job no.: 2200638
sheet no.:

Fused Elements Permanent Shoring

17' wall w/ tiebacks



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File: C:\Users\johns\Desktop\FE - 17 ft wall, tiebacks.sh8

Wall Height=17.0 Pile Diameter=2.0 Pile Spacing=8.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=7.25 Min. Pile Length=24.25
MOMENT IN PILE: Max. Moment=185.71 per Pile Spacing=8.0 at Depth=14.41

VERTICAL BEARING CAPACITY: Vertical Loading=28.6, Resistance=130.8, Vertical Factor of Safety=4.57

PILE SELECTION:
Request Min. Section Modulus = 67.5 in3/pile=1106.64 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
W12X53 has Section Modulus = 70.6 in3/pile=1156.92 cm3/pile. It is greater than Min. Requirements!
Top Deflection = -0.73(in) based on E (ksi)=29000.00 and I (in4)/pile=425.0

BRACE FORCE: Strut, Tieback, Plate Anchor, Deadman, Sheet Pile as Anchor

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	L_free	Fixed Length
1. Tieback	7.0	20.0	8.0	83.7	78.7	28.6	8.8	26.6

UNITS: Width,Diameter,Spacing,Length,Depth,and Height - ft; Force - kip; Bond Strength and Pressure - ksf

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	0	17	1.445	0.085
0	0.07	17	0.070	0.000000

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
19	0.6	999	294.600	0.3

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	8.00
2	17.00	2.00

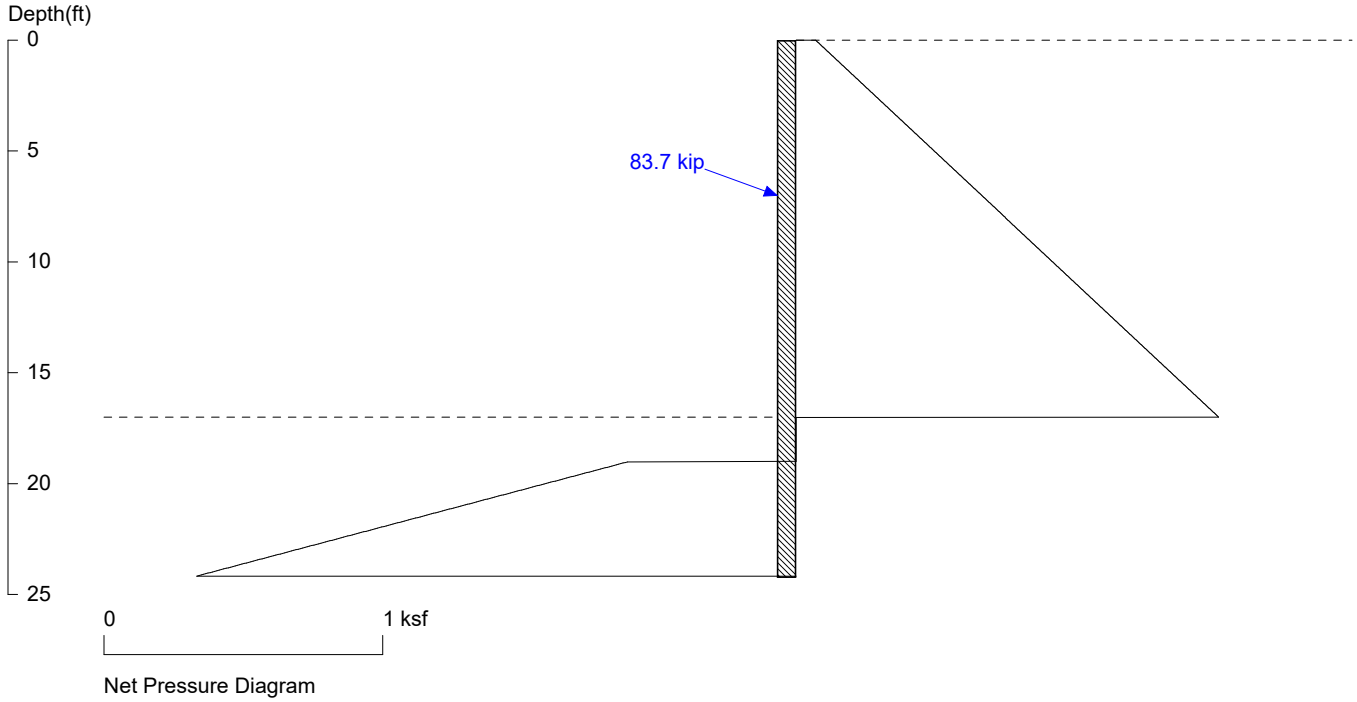
PASSIVE SPACING:

No.	Z depth	Spacing
1	17.00	4.00

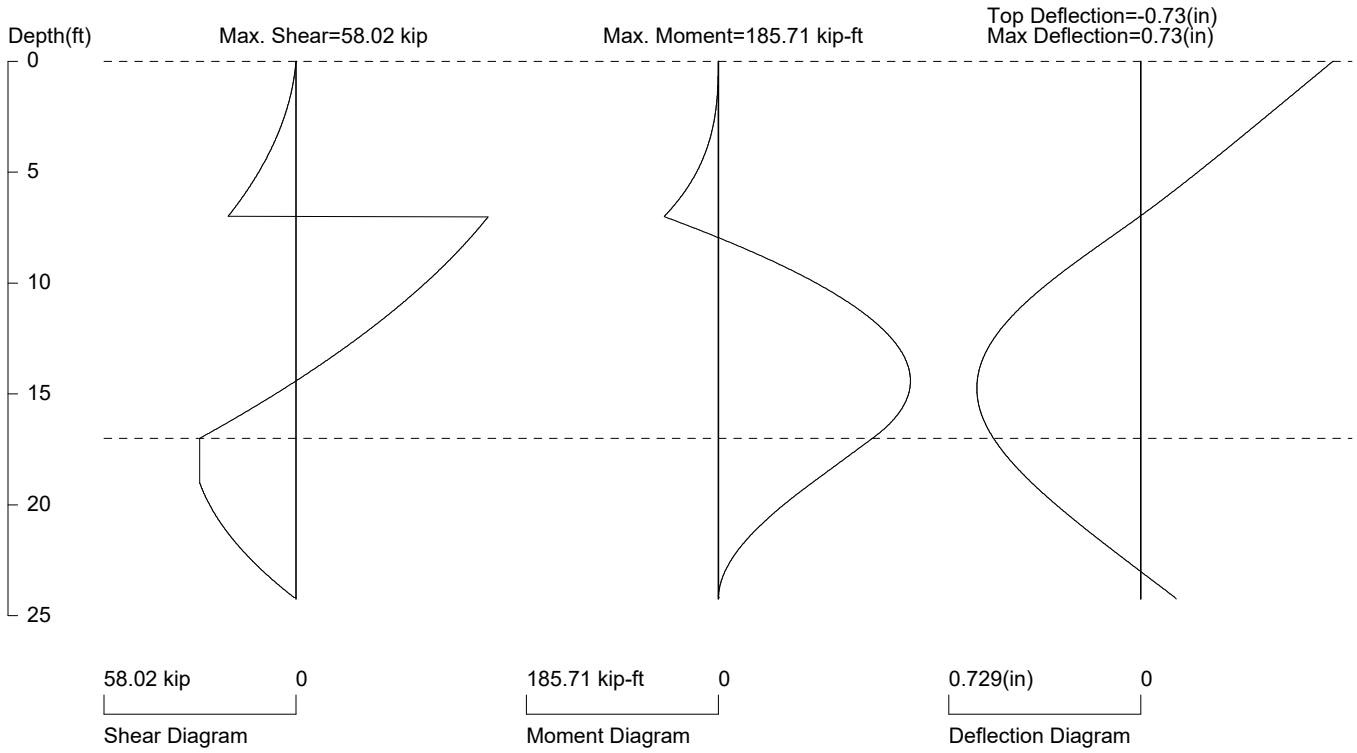
UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

Fused Elements Permanent Shoring

17' wall w/ tiebacks



Net Pressure Diagram



Shear Diagram | Moment Diagram | Deflection Diagram

PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

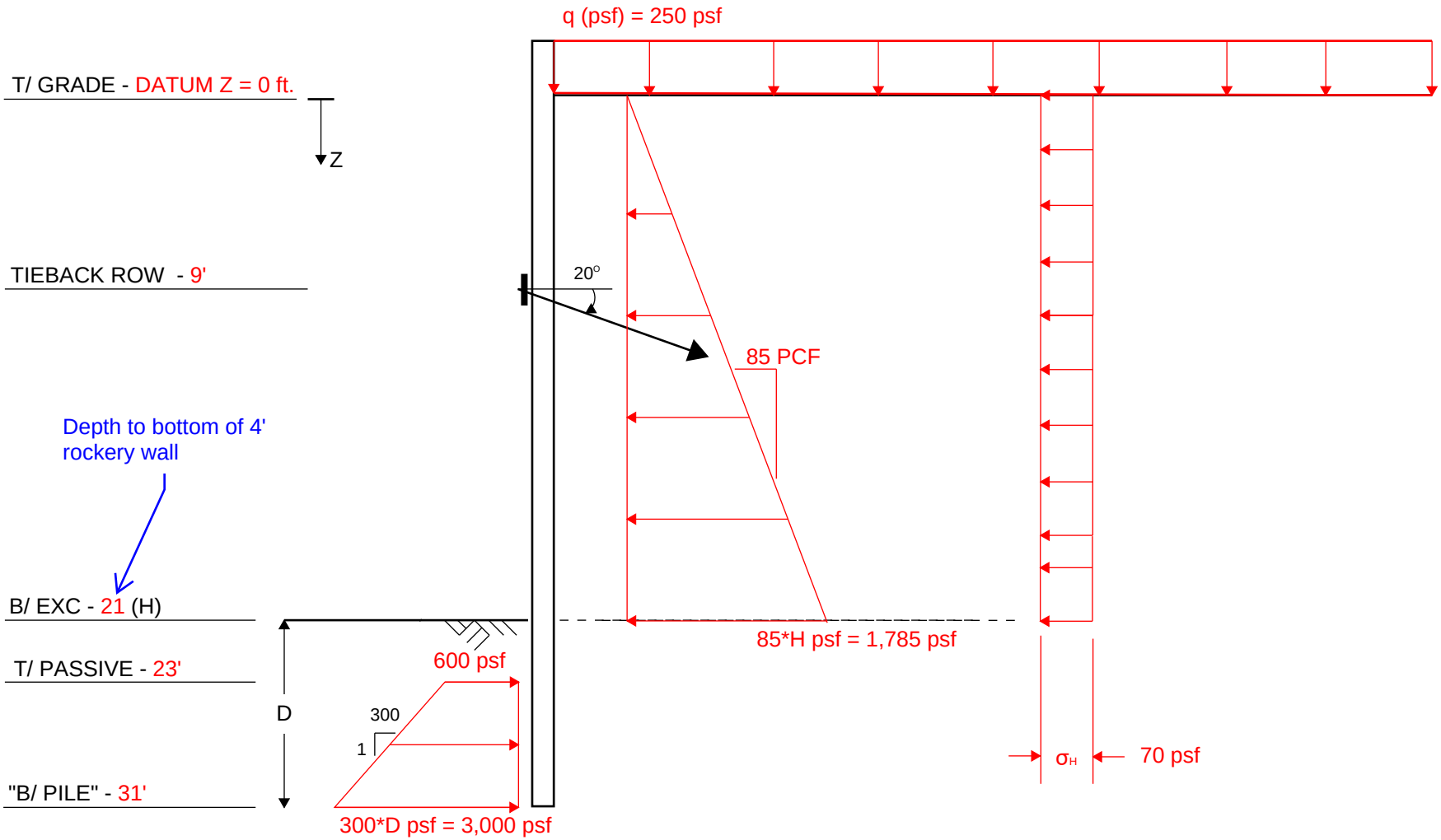
Based on pile spacing: 8.0 foot or meter

User Input Pile, W12X53: E (ksi)=29000.0, I (in4)/pile=425.0

File: C:\Users\johns\Desktop\FE - 17 ft wall, tiebacks.sh8

DESIGN SECTION 21' Tall Wall With Tiebacks

NOTES:
1. Piles @ 8'-0" OC
2. Shaft Ø = 2 ft
3. Passive over 2.5 x pile Ø
4. μ = 2 ksf; EB = 18 ksf
5. 2H:1V backslope pressures



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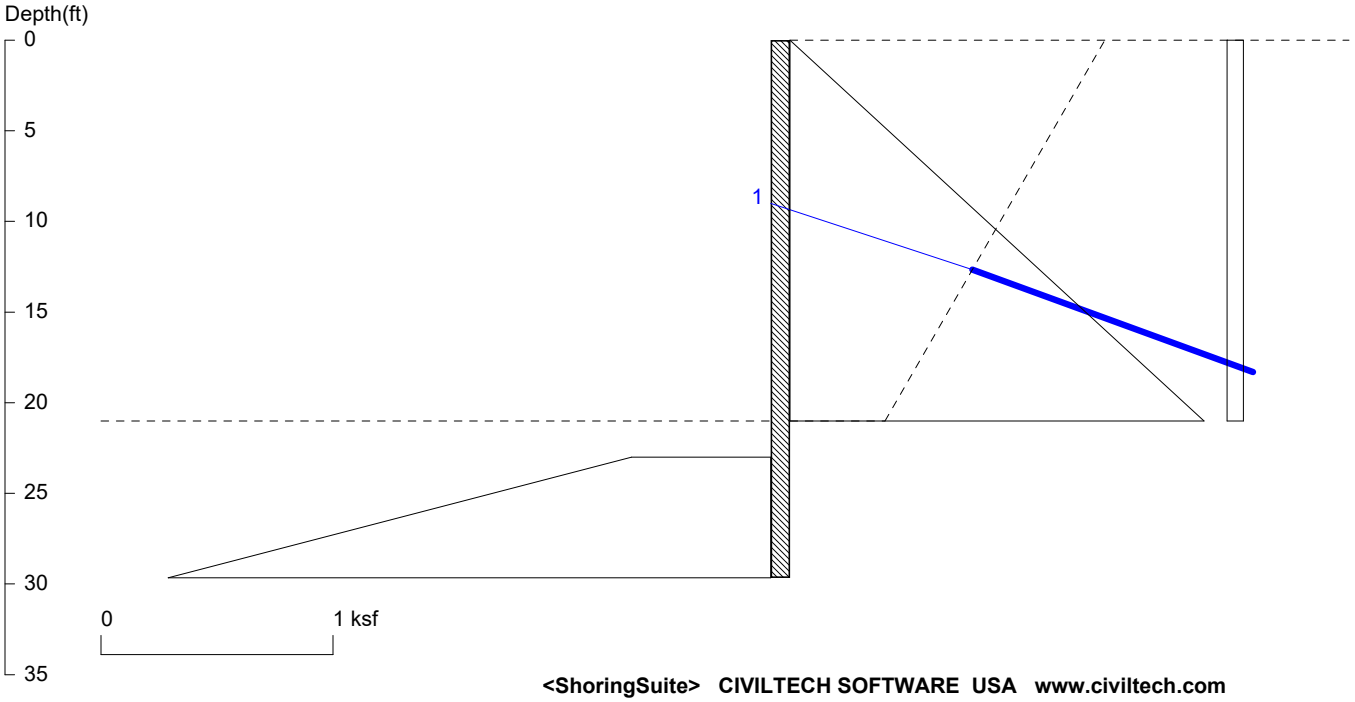
Seattle, WA 98101 206 622-5822

project: Fused Elements Shoring
location: Mercer Island, WA
client: Olson Kundig
Shoring Design Pressures
date: 6/20/2023
by: JRS
job no.: 2200638
sheet no.:

FE - 21' w/ tiebacks



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

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File: C:\Users\johns\Desktop\FE - 21 ft wall, tiebacks.sh8

Wall Height=21.0 Pile Diameter=2.0 Pile Spacing=8.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=8.66 Min. Pile Length=29.66
MOMENT IN PILE: Max. Moment=320.47 per Pile Spacing=8.0 at Depth=17.92

VERTICAL BEARING CAPACITY: Vertical Loading=43.4, Resistance=146.8, Vertical Factor of Safety=3.39

PILE SELECTION:
Request Min. Section Modulus = 116.5 in3/pile=1909.68 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
W12X87 has Section Modulus = 118.0 in3/pile=1933.67 cm3/pile. It is greater than Min. Requirements!
Top Deflection = -1.06(in) based on E (ksi)=29000.00 and I (in4)/pile=740.0

BRACE FORCE: Strut, Tieback, Plate Anchor, Deadman, Sheet Pile as Anchor

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	L_free	Fixed Length
1. Tieback	9.0	20.0	8.0	126.8	119.1	43.4	10.7	40.4

UNITS: Width,Diameter,Spacing,Length,Depth,and Height - ft; Force - kip; Bond Strength and Pressure - ksf

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	0	21	1.785	0.085
0	0.07	21	0.070	0.000000

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
23	0.6	999	293.4	0.3

ACTIVE SPACING:

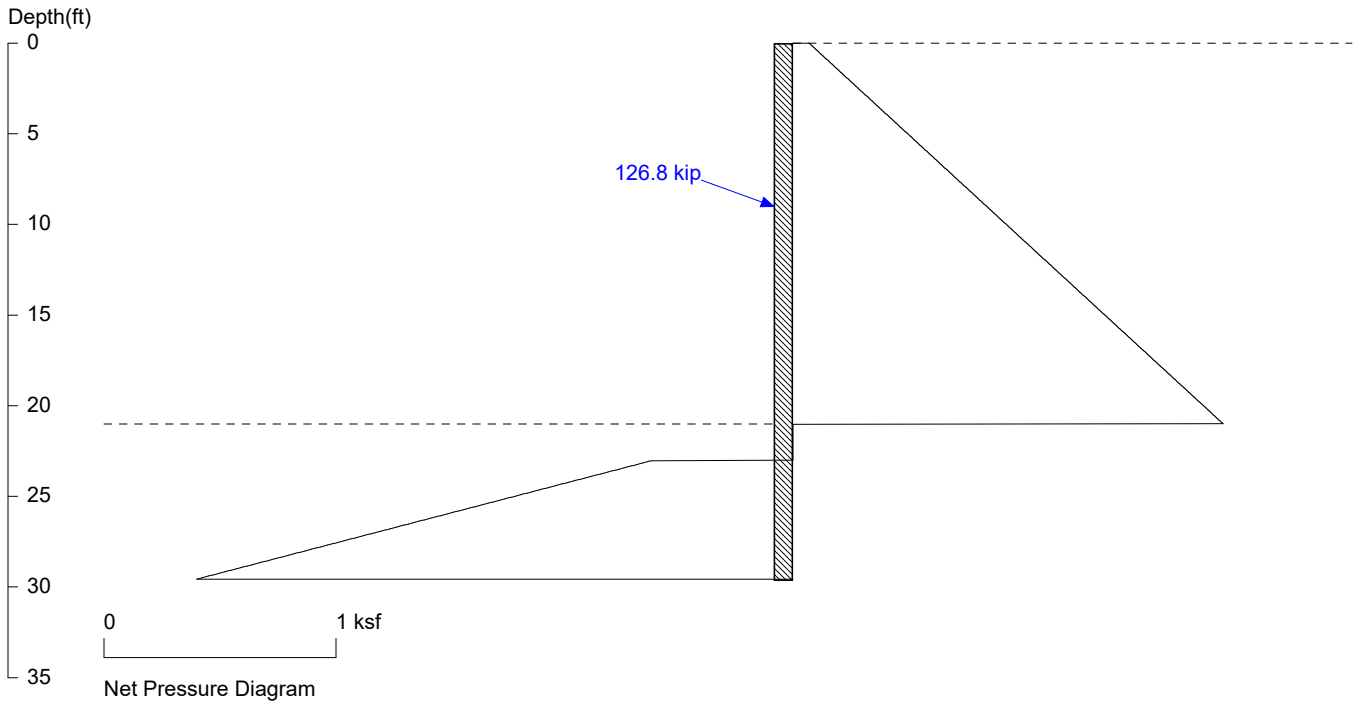
No.	Z depth	Spacing
1	0.00	8.00
2	21.00	2.00

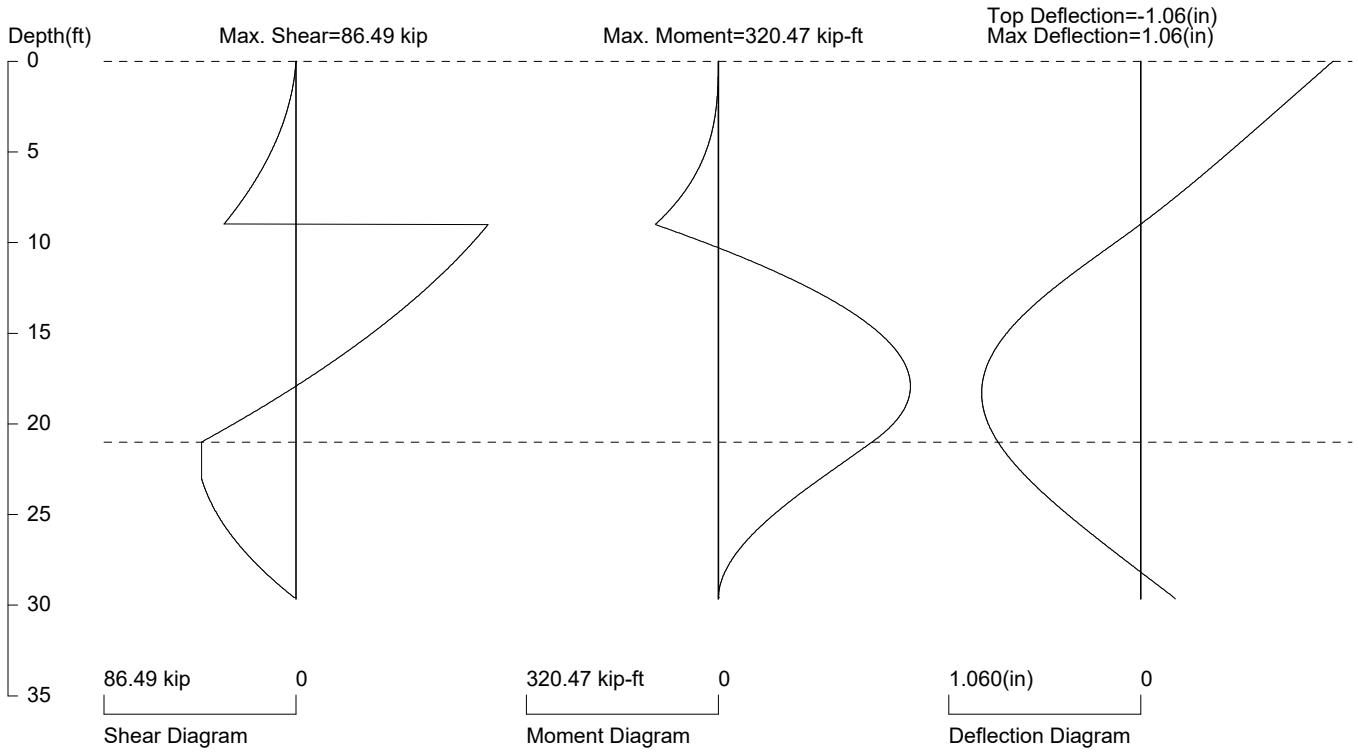
PASSIVE SPACING:

No.	Z depth	Spacing
1	21.00	4.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

FE - 21' w/ tiebacks





PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 8.0 foot or meter

User Input Pile, W12X87: E (ksi)=29000.0, I (in4)/pile=740.0

File: C:\Users\johns\Desktop\FE - 21 ft wall, tiebacks.sh8

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Seattle, WA 98101 206 622-5822

project: Fused Elements Shoring		by: JRS	sheet no.
location: Mercer Island, WA		date: 6/20/2023	
client: Olson Kundig			job no. 2200638
Tieback Strand Count Verification			

Example Design Section → 21' Tall Wall

Demand = P_a = 126.8 k (design load)

For proof test, $P_p = 1.3\ P_a$ = 164.8 k

For verification test, $P_v = 2.0\ P_a$ = 253.6 k

References
- PTI DC35.1-14
- ASTM A416-02a

Required Strength

$P_p = 0.8\ F_{pu}$

$P_v = 0.8\ F_{pu}$ (per PTI requirements during testing)

$P_a = 0.6\ F_{pu}$ (per PTI for design loads)

Check capacity and determine # strands

- For 0.6"ϕ ASTM A416 Grade 270 strand: F_{pu} = 58.6 k/strand

Proof test check:

$$\#\ \text{strands required} = \frac{164.8}{0.8 \times 58.6\ \text{k/strand}} = 3.5 \rightarrow \underline{4\ \text{strands}}$$

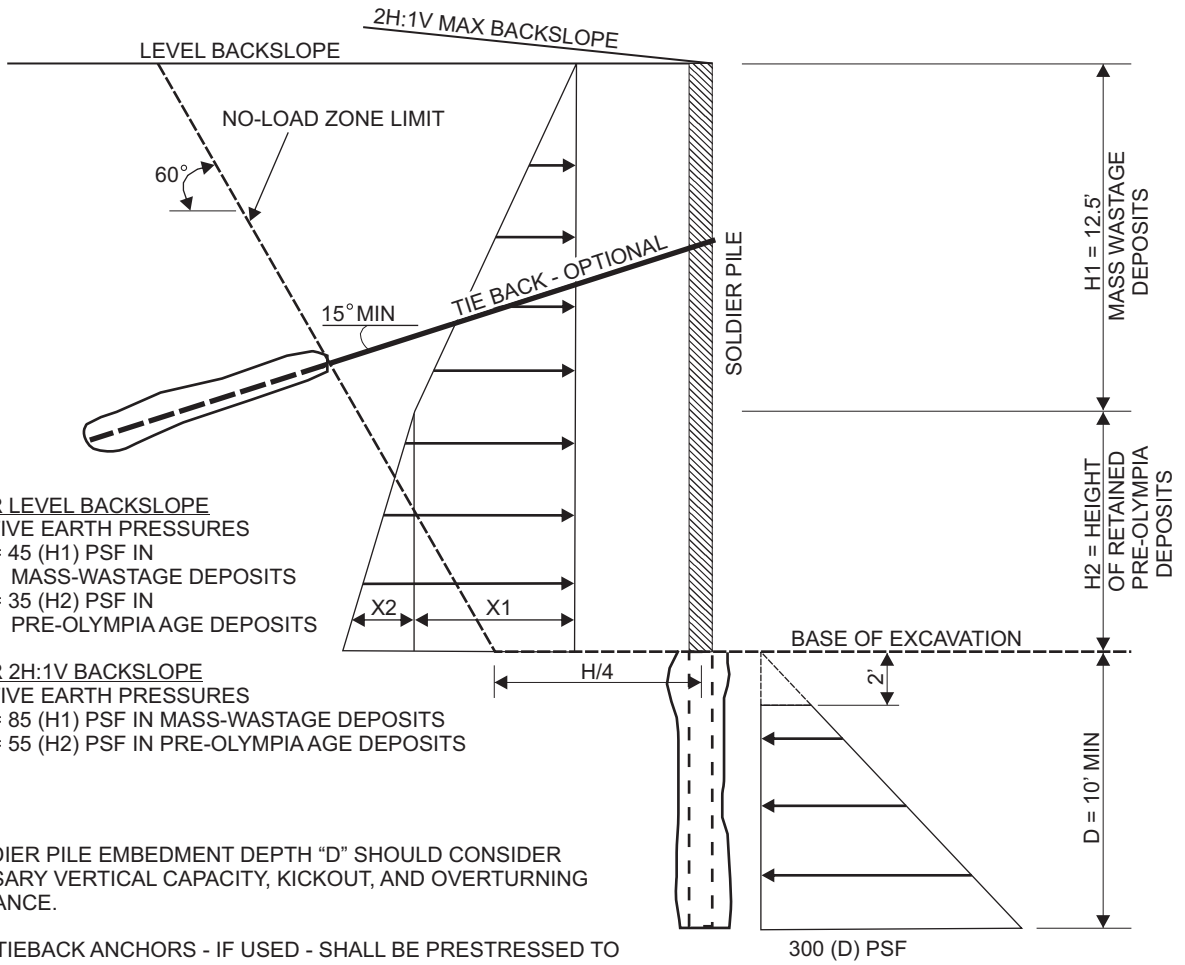
Design load check:

$$\#\ \text{strands required} = \frac{126.8}{0.6 \times 58.6\ \text{k/strand}} = 3.6 \rightarrow \underline{4\ \text{strands}}$$

Verification test load check:

$$\#\ \text{strands required} = \frac{253.6\ \text{k}}{0.8 \times 58.6\ \text{k/strand}} = 5.4 \rightarrow \underline{6\ \text{strands}}$$

→ **1.5 x** more strands required for verification tested piles



FOR LEVEL BACKSLOPE
ACTIVE EARTH PRESSURES
X1 = 45 (H1) PSF IN
MASS-WASTAGE DEPOSITS
X2 = 35 (H2) PSF IN
PRE-OLYMPIA AGE DEPOSITS

FOR 2H:1V BACKSLOPE
ACTIVE EARTH PRESSURES
X1 = 85 (H1) PSF IN MASS-WASTAGE DEPOSITS
X2 = 55 (H2) PSF IN PRE-OLYMPIA AGE DEPOSITS

PASSIVE PRESSURE ACTS
OVER TWICE PILE DIAMETER

PASSIVE PRESSURE TRUNCATED
2 FEET BELOW BASE OF EXCAVATION

NOTES:

1. SOLDIER PILE EMBEDMENT DEPTH "D" SHOULD CONSIDER NECESSARY VERTICAL CAPACITY, KICKOUT, AND OVERTURNING RESISTANCE.

2. ALL TIEBACK ANCHORS - IF USED - SHALL BE PRESTRESSED TO 130 PERCENT OF DESIGN LOAD AND LOCKED OFF AT 100 PERCENT OF DESIGN LOAD. AT LEAST TWO ANCHORS ON EACH SIDE OF THE EXCAVATION SHALL BE PRESTRESSED TO 200 PERCENT AND MONITORED FOR CREEP. TIE-BACK ANCHOR ZONE IS TO BE LOCATED BEHIND THE NO-LOAD ZONE AND FULLY EMBEDDED IN PRE-OLYMPIA DEPOSITS.

3. ALLOWABLE TIEBACK - SOIL ADHESION = SEE REPORT TEXT.

4. PASSIVE PRESSURES INCLUDE A FACTOR OF SAFETY OF 1.5.

5. ALLOWABLE SKIN FRICTION OF SOLDIER PILE - 750 PSF OVER DEPTH "D-2". ALLOWABLE END BEARING = 18 KSF.

6. DIAGRAM DOES NOT INCLUDE HYDROSTATIC PRESSURES OR SURCHARGES AND ASSUMES WALLS ARE SUITABLY DRAINED TO PREVENT BUILDUP OF HYDROSTATIC PRESSURE.

7. DIAGRAM IS ILLUSTRATIVE AND NOT REFERENCED TO A PARTICULAR LOCATION.

8. DIAGRAM DOES NOT INCLUDE PRESSURES DUE TO SURFACE SURCHARGES FROM ANY ADJACENT STRUCTURES, SLOPES, STOCKPILED MATERIALS, OR CONSTRUCTION EQUIPMENT. THESE PRESSURES MUST BE PROVIDED BY THE STRUCTURAL ENGINEER.

9. BASE OF EXCAVATION SHALL BE DEFINED AS THE FOUNDATION SUBGRADE ELEVATION.

associated
earth sciences
incorporated

TEMPORARY SOLDIER PILE
RETAINING WALL DESIGN CRITERIA
CHASE RESIDENCE
MERCER ISLAND, WASHINGTON

PROJ NO.	DATE:	FIGURE:
20220141E001	8/22	4

kpff 1601 5th Avenue, Suite 1600 Seattle, WA 98101 206 622-5822	project: Fused Elements	by: JRS	sheet no.: 1/1
	location: Mercer Island, WA	date: 7/19/23	
	client: Olson Kundig		job no.: 2200638
	Worst Case Shotcrete Wall Design		

ONE-WAY SLAB DESIGN

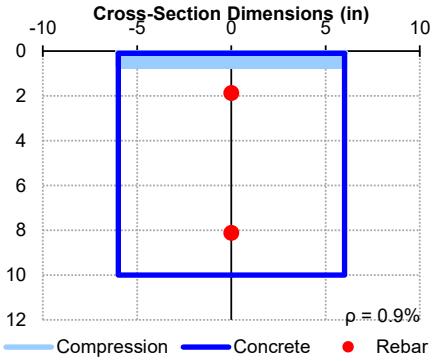
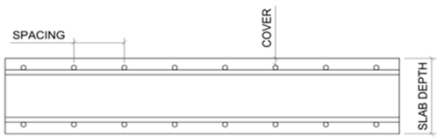


Image for reference only and is not to scale. Items shown may not be accurate. Reinforcing is represented as a single top & single bot. bar

INPUT PARAMETERS:

CROSS-SECTION DIMENSIONS



Section Shape? Slab Type 1

Slab Width	b =	12.0	in
Slab Depth	h =	10.0	in

Exposure	Top	Exposed	20.6.1.3.1
	Bottom	Exposed	20.6.1.3.1

COVER PARAMETERS

Top Cover	CLR =	1.5	in
Bottom Cover	CLR =	1.5	in

As Overwrite? NO

FLEXURAL REBAR DIMENSIONS

Layer	Bar # (U.S.)	d_{layer} (in)	on center sp. (in)
Top	#6	1.875	10.00
Bot	#6	8.125	10.00

TEMPERATURE AND SHRINKAGE REINFORCING

Top	#4	2.500	18.00	OK
Bot	#4	7.500	18.00	OK

Strain Diagram at Capacity

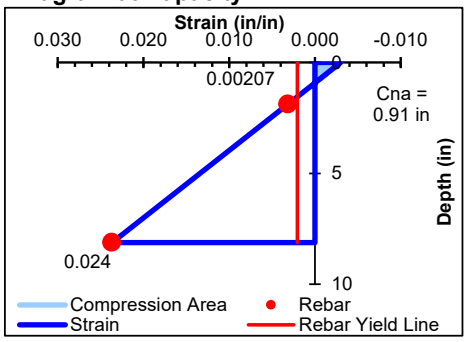


Image for reference only and is not to scale. Items shown may not be accurate.

MATERIAL PROPERTIES

Concrete 28 Day Compressive Strength	f'_{c28} =	4.0	ksi
Concrete Type	Type =	Normal weight	
Concrete Weight	γ_c =	150	pcf
Flexural Reinforcement Yield Strength	f_y =	60	ksi

ANALYSIS OUTPUT: (Referenced to ACI 318-14 Requirements)

				Reference	STATUS:
FLEXURAL STRENGTH					GOOD - PASSES ACI 318
Nominal Moment Strength Capacity	M_n =	20.4	kip-ft		
Reduction Factor, ϕ	ϕ =	0.90		21.2.2	
Design Positive Moment Capacity	**ϕM_n =**	**18.4**	**kip-ft**		
Factored Positive Moment Demand	**M_u =**	**12**	**kip-ft**		GOOD - ϕMn > Mu
SHEAR STRENGTH					
Nominal Shear Strength Capacity	V_n =	8.7	kips	22.5.5.1	
Reduction Factor, ϕ	ϕ =	0.75		21.2.1	
Design Shear Strength Capacity	**ϕV_n =**	**6.5**	**kips**	22.5.5.1	
Factored Shear Demand	**V_u =**	**5.5**	**kips**		GOOD - ϕVn > Vu
SERVICABILITY					
Concrete 28 Day Modulus of Elasticity	E_{c28} =	3605	ksi	19.2.2	
Gross Moment of Inertia	I_g =	1021	in⁴	24.1.2.5	
Cracked Moment of Inertia	I_{cr} =	194	in⁴	24.2.3.5	
Cracking Moment	**M_{cr} =**	**8.8**	**kip-ft**	24.2.3.5b	
Moment for Deflection *(Service Demand)*	**M_a =**	**4**	**kip-ft**		
Effective Moment of Inertia	I_e = E47	1021	in⁴	24.2.3.5a	