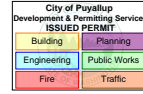


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April 3, 2024

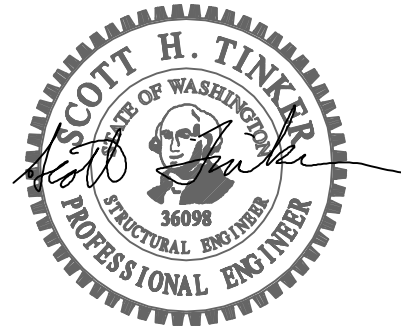
**STRUCTURAL CALCULATIONS**  
(Permit Submittal)

**CENTERIS DATA CENTER**  
**ELECTRICAL OPENINGS**  
1023 39<sup>th</sup> Avenue SE  
Puyallup, WA 98374

Quantum Job Number: 23444.01

*Prepared for:*  
CENTERIS DATA CENTERS  
18300 Cascade Avenue S  
Seattle, WA 98118

*Prepared by:*  
QUANTUM CONSULTING ENGINEERS  
1511 Third Avenue, Suite 323  
Seattle, WA 98101  
TEL 206.957.3900  
FAX 206.957.3901





QUANTUM | CONSULTING ENGINEERS

# STRUCTURAL DESIGN CRITERIA

CENTERIS – DATA CENTER  
1023 39<sup>TH</sup> AVENUE SE  
PUYALLUP, WA 98374

QUANTUM JOB NUMBER: 23444.01

CODE CRITERIA:

BUILDING CODE.....	2018 INTERNATIONAL BUILDING CODE
BUILDING DEPARTMENT.....	CITY OF PUYALLUP
SEISMIC ZONE.....	SDC = D
.....	SITE CLASS = D
.....	R 3.5
.....	$S_s = 1.26$ $S_1 = 0.43$
.....	$S_{DS} = 1.01$ $S_{D1} = 0.50$

MATERIALS CRITERIA:

CONCRETE (28 DAY STRENGTH):

FOUNDATION/S.O.G.....f'c=3,000 PSI

REINFORCING STEEL:

GRADE 60..... Fy=60,000 PSI

STRUCTURAL STEEL:

WIDE-FLANGE SECTIONS: A-992..... Fy=50,000 PSI

MISCELLANEOUS SECTIONS: A-36..... Fy=36,000 PSI

TUBE SECTIONS: A-500..... Fy=46,000 PSI

WELDING..... Fy=70,000 PSI

## Steel Beam

Lic. #: KW-06005835

File: Floor Openings.ec6  
 Software copyright ENERCALC, INC. 1983-2020, Build:12.20.5.31  
**QUANTUM CONSULTING ENGINEERS**

DESCRIPTION: Opening Jamb Beam

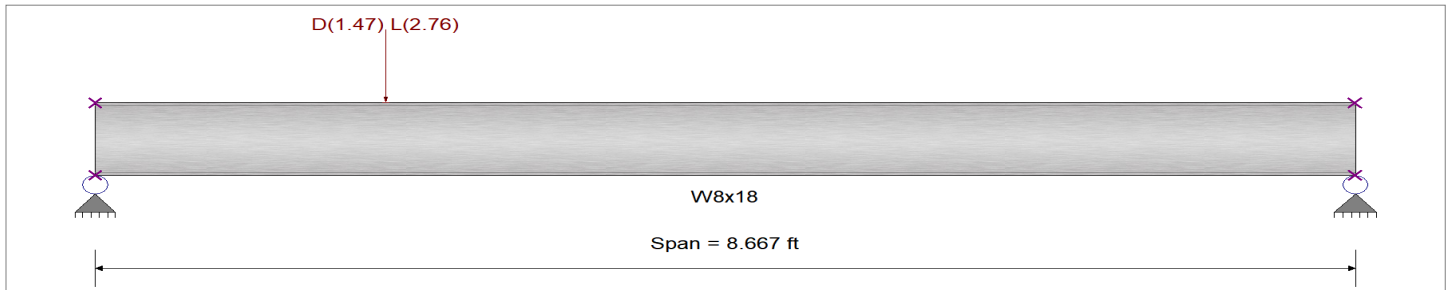
### CODE REFERENCES

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

### Material Properties

Analysis Method : Allowable Strength 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 NOT internally calculated and added  
 Load(s) for Span Number 1  
 Point Load : D = 1.470, L = 2.760 k @ 2.0 ft

### DESIGN SUMMARY

**Design OK**

Maximum Bending Stress Ratio =	<b>0.153</b> : 1	Maximum Shear Stress Ratio =	<b>0.087</b> : 1
Section used for this span	<b>W8x18</b>	Section used for this span	<b>W8x18</b>
Ma : Applied	6.502 k-ft	Va : Applied	3.254 k
Mn / Omega : Allowable	42.415 k-ft	Vn/Omega : Allowable	37.444 k
Load Combination	+D+L	Load Combination	+D+L
Location of maximum on span	2.006ft	Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
<b>Maximum Deflection</b>			
Max Downward Transient Deflection	0.024 in	Ratio =	4,385 >=360.
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360.0
Max Downward Total Deflection	0.036 in	Ratio =	2861 >=240.
Max Upward Total Deflection	0.000 in	Ratio =	0 <240.0

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios		Summary of Moment Values						Summary of Shear Values				
			M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega	
D Only															
Dsgn. L =	8.67 ft	1	0.053	0.030	2.26		2.26	70.83	42.42	1.39	1.00	1.13	56.17	37.44	
+D+L															
Dsgn. L =	8.67 ft	1	0.153	0.087	6.50		6.50	70.83	42.42	1.39	1.00	3.25	56.17	37.44	
+D+0.750L															
Dsgn. L =	8.67 ft	1	0.128	0.073	5.44		5.44	70.83	42.42	1.39	1.00	2.72	56.17	37.44	
+0.60D															
Dsgn. L =	8.67 ft	1	0.032	0.018	1.36		1.36	70.83	42.42	1.39	1.00	0.68	56.17	37.44	

### Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.0363	3.813		0.0000	0.000

### Vertical Reactions

Load Combination	Support 1	Support 2
Overall MAXimum	3.254	0.976
Overall MINimum	0.678	0.204
D Only	1.131	0.339
+D+L	3.254	0.976
+D+0.750L	2.723	0.817
+0.60D	0.678	0.204
L Only	2.123	0.637

Support notation : Far left is #1  
 Values in KIPS

Project Title: Centeris  
 Engineer:  
 Project ID:  
 Project Descr: Third Floor Opening

Printed: 3 APR 2024, 10:51AM

## Steel Beam

File: Floor Openings.ec6  
 Software copyright ENERCALC, INC. 1983-2020, Build:12.20.5.31

Lic. #: KW-06005835

QUANTUM CONSULTING ENGINEERS

DESCRIPTION: Opening Jamb Beam

### Steel Section Properties : W8x18

Depth	=	8.140 in	I xx	=	61.90 in <sup>4</sup>	J	=	0.172 in <sup>4</sup>
Web Thick	=	0.230 in	S xx	=	15.20 in <sup>3</sup>	Cw	=	122.00 in <sup>6</sup>
Flange Width	=	5.250 in	R xx	=	3.430 in			
Flange Thick	=	0.330 in	Zx	=	17.000 in <sup>3</sup>			
Area	=	5.260 in <sup>2</sup>	I yy	=	7.970 in <sup>4</sup>			
Weight	=	17.905 plf	S yy	=	3.040 in <sup>3</sup>	Who	=	10.300 in <sup>2</sup>
Kdesign	=	0.630 in	R yy	=	1.230 in	Sw	=	4.440 in <sup>4</sup>
K1	=	0.563 in	Zy	=	4.660 in <sup>3</sup>	Qf	=	3.230 in <sup>3</sup>
rts	=	1.430 in				Qw	=	8.370 in <sup>3</sup>
Ycg	=	4.070 in						

## Steel Beam

Lic. #: KW-06005835

DESCRIPTION: Drilled Holes Header Beam

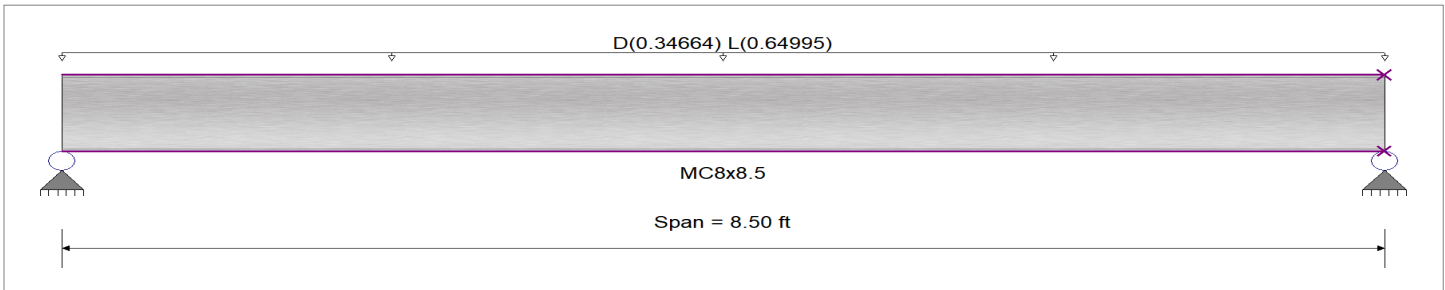
### CODE REFERENCES

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

### Material Properties

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

Fy : Steel Yield : 36.0 ksi  
 E: Modulus : 29,000.0 ksi



### Applied Loads

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

Beam self weight NOT internally calculated and added  
 Uniform Load : D = 0.080, L = 0.150 ksf, Tributary Width = 4.333 ft

### DESIGN SUMMARY

**Design OK**

Maximum Bending Stress Ratio =	<b>0.721 : 1</b>	Maximum Shear Stress Ratio =	<b>0.229 : 1</b>
Section used for this span	<b>MC8x8.5</b>	Section used for this span	<b>MC8x8.5</b>
Ma : Applied	9.000 k-ft	Va : Applied	4.236 k
Mn / Omega : Allowable	12.485 k-ft	Vn/Omega : Allowable	18.522 k
Load Combination	+D+L	Load Combination	+D+L
Location of maximum on span	4.250ft	Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
<b>Maximum Deflection</b>			
Max Downward Transient Deflection	0.113 in	Ratio =	898 >=480.
Max Upward Transient Deflection	0.000 in	Ratio =	0 <480.0
Max Downward Total Deflection	0.174 in	Ratio =	586 >=240.
Max Upward Total Deflection	0.000 in	Ratio =	0 <240.0

### Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios		Summary of Moment Values						Summary of Shear Values			
			M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
D Only	Dsgn. L = 8.50 ft	1	0.251	0.080	3.13		3.13	20.85	12.49	1.00	1.00	1.47	30.93	18.52
+D+L	Dsgn. L = 8.50 ft	1	0.721	0.229	9.00		9.00	20.85	12.49	1.00	1.00	4.24	30.93	18.52
+D+0.750L	Dsgn. L = 8.50 ft	1	0.603	0.191	7.53		7.53	20.85	12.49	1.00	1.00	3.54	30.93	18.52
+0.60D	Dsgn. L = 8.50 ft	1	0.150	0.048	1.88		1.88	20.85	12.49	1.00	1.00	0.88	30.93	18.52

### Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.1740	4.274		0.0000	0.000

### Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	4.236	4.236
Overall MINimum	0.884	0.884
D Only	1.473	1.473
+D+L	4.236	4.236
+D+0.750L	3.545	3.545
+0.60D	0.884	0.884
L Only	2.762	2.762

**Steel Beam**

Lic. # : KW-06005835

DESCRIPTION: Drilled Holes Header Beam

**Steel Section Properties : MC8x8.5**

Depth	=	8.000 in	I xx	=	23.30 in <sup>4</sup>	J	=	0.059 in <sup>4</sup>
Web Thick	=	0.179 in	S xx	=	5.82 in <sup>3</sup>	Cw	=	8.21 in <sup>6</sup>
Flange Width	=	1.870 in	R xx	=	3.050 in	Ro	=	3.240 in
Flange Thick	=	0.311 in	Zx	=	6.950 in <sup>3</sup>	H	=	0.910 in
Area	=	2.500 in <sup>2</sup>	I yy	=	0.624 in <sup>4</sup>	Who	=	0.000 in <sup>2</sup>
Weight	=	8.500 plf	S yy	=	0.431 in <sup>3</sup>	Sw	=	0.000 in <sup>4</sup>
Kdesign	=	0.813 in	R yy	=	0.500 in	Qf	=	0.000 in <sup>3</sup>
			Zy	=	0.875 in <sup>3</sup>	Qw	=	0.000 in <sup>3</sup>
rts	=	0.624 in				Wn2	=	2.428
Ycg	=	4.000 in				Sw2	=	0.551
Xcg	=	0.428 in				Sw3	=	0.000
Xp	=	0.156 in						
Eo	=	0.542 in						