Structural Calculations

Project #240268

Ogden Community Services Bldg Remodel

1875 Monroe Blvd, Ogden UT 84401

Prepared For:

GSBS
375 West 200 South
Salt Lake City, UT 84101

REGISTERED PROFESSIONAL ENGINEER
JACOB D. DUNN
03/12/2025
12649738
STATE OF UTAH

DUNN ASSOCIATES, INC
Consulting Structural Engineers
Enabling Great Design™

380 West 800 South, Suite 100 | Salt Lake City, Utah 84101 | (801) 575-8877 | www.dunn-se.com

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DUNN ASSOCIATES, INC
Consulting Structural Engineers

Title
OGDEN COMMUNITY SERVICES BUILDING

Sheet Number:	G-1
Job Number:	240268
Date:	03/11/2025
By:	CF

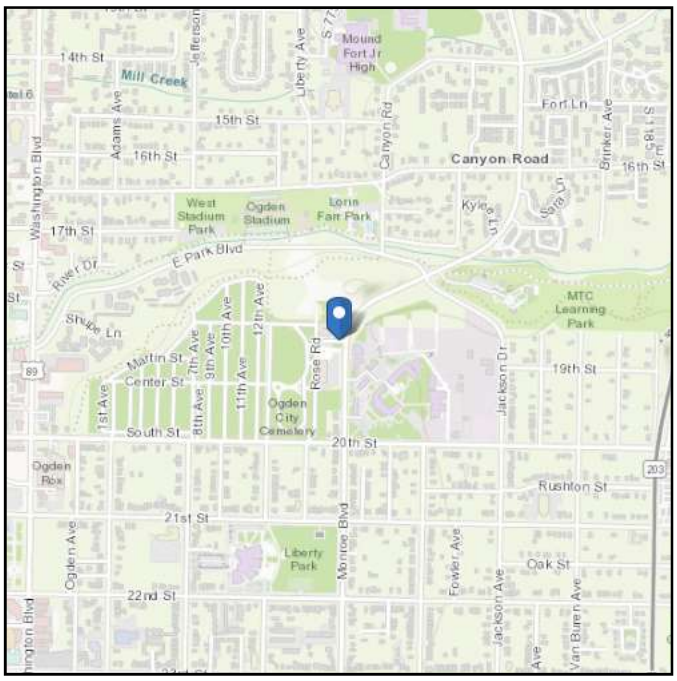
GENERAL DESIGN CRITERIA

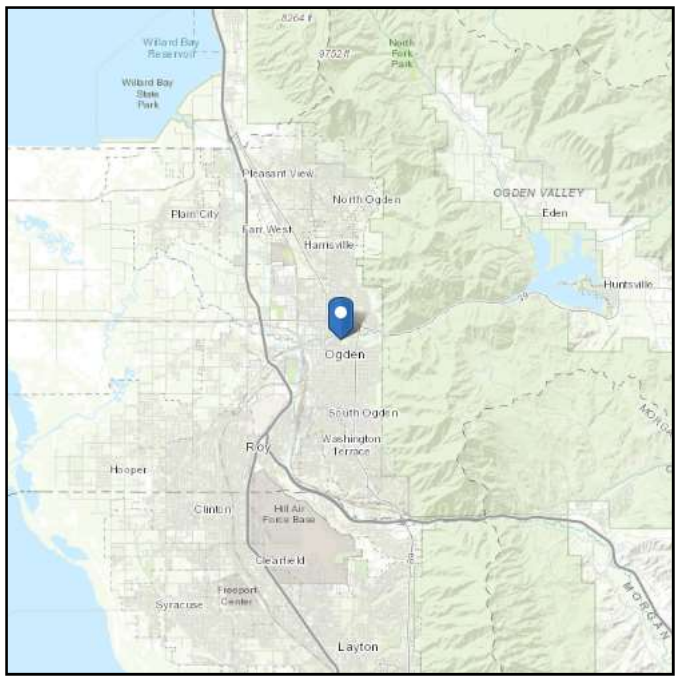
ASCE Hazards Report

Address:
1875 Monroe Blvd
Ogden, Utah
84401

Standard: ASCE/SEI 7-16
Risk Category: II
Soil Class: D - Default (see Section 11.4.3)

Latitude: 41.2337
Longitude: -111.959294
Elevation: 4388.367800831308 ft (NAVD 88)





Wind

Results:

Wind Speed	103 Vmph
10-year MRI	74 Vmph
25-year MRI	80 Vmph
50-year MRI	84 Vmph
100-year MRI	89 Vmph

Data Source: ASCE/SEI 7-16, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed: Fri Feb 14 2025

Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-16 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years).

Site is not in a hurricane-prone region as defined in ASCE/SEI 7-16 Section 26.2.

AMERICAN SOCIETY OF CIVIL ENGINEERS

Seismic

Site Soil Class: D - Default (see Section 11.4.3)

Results:

Sd1 = 0.602g

S_S :	1.366	S_{D1} :	N/A
S_1 :	0.502	T_L :	8
F_a :	1.2	PGA :	0.62
F_v :	N/A	PGA_M :	0.744
S_{MS} :	1.64	F_{PGA} :	1.2
S_{M1} :	N/A	I_e :	1
S_{DS} :	1.093	C_v :	1.373

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Fri Feb 14 2025

Date Source: USGS Seismic Design Maps

DESIGN CRITERIA
INTERMEDIATE MASONRY SHEAR WALLS

R = 3.5
Ω = 2.5
Cd = 2.25

Sd1 = 0.602g

Snow

Results:

Mapped Elevation:	4388.4 ft
Data Source:	ASCE/SEI 7-16, Table 7.2-8
Date Accessed:	Fri Feb 14 2025

In "Case Study" areas, site-specific case studies are required to establish ground snow loads. Extreme local variations in ground snow loads in these areas preclude mapping at this scale.

Ground snow load determination for such sites shall be based on an extreme value statistical analysis of data available in the vicinity of the site using a value with a 2 percent annual probability of being exceeded (50-year mean recurrence interval).

Values provided are ground snow loads. In areas designated "case study required," extreme local variations in ground snow loads preclude mapping at this scale. Site-specific case studies are required to establish ground snow loads at elevations not covered.

Snow load values are mapped to a 0.5 mile resolution. This resolution can create a mismatch between the mapped elevation and the site-specific elevation in topographically complex areas. Engineers should consult the local authority having jurisdiction in locations where the reported ‘elevation’ and ‘mapped elevation’ differ significantly from each other.

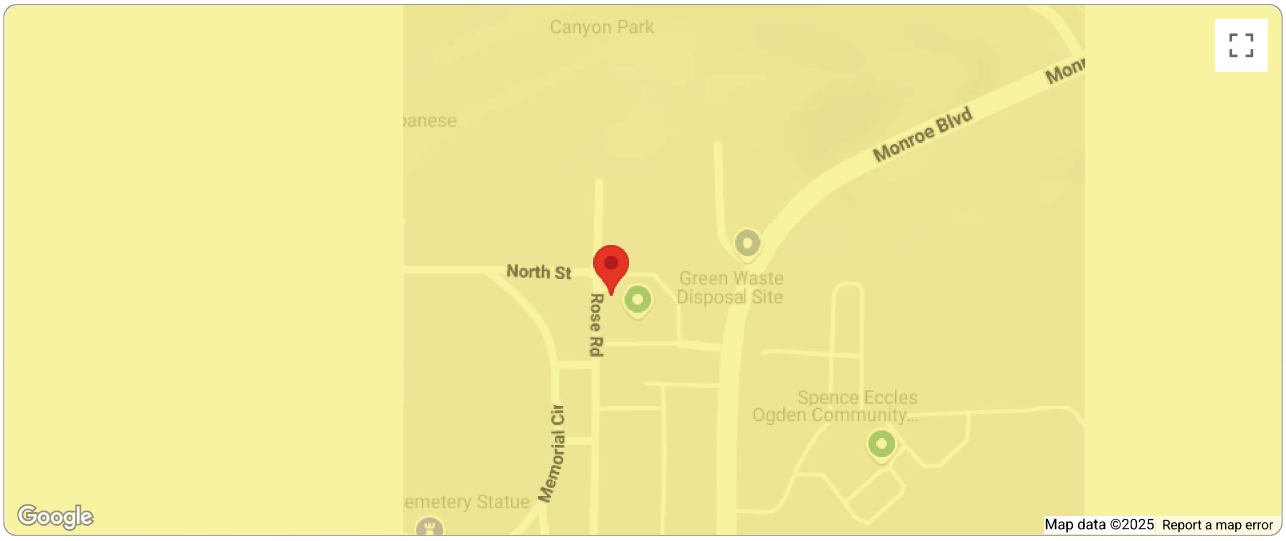
G-5

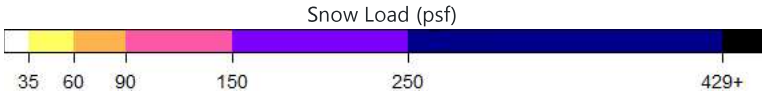
Utah Ground Snow Load Map

Latitude: 41.234
Longitude: -111.960
Elevation: 4,349 ft

Ground Snow Load:
38 psf / 1.82 kPa

*This document is not legally binding. The user is urged to verify ground snow load values with the local authority having jurisdiction.





These ground snow load values represent 50-year ground snow load estimated value at a 2% probability of exceedance for the location given. The grid used in the map is 3350ft by 3350ft. Elevations for these grid cells were estimated by aggregating data from 100ft by 100ft USGS digital elevation models and may not coincide with the actual site elevation. These predictions are calculated using the process outlined in The Utah Snow Load Study.[1]

Final predictions given are bounded at a lower limit for a minimum ground snow load of 21 psf to meet ASCE 7. Estimated values for snow loads at elevations significantly higher than all nearby stations lead to unreasonably high snow load estimates, therefore, the predictions in the map are not allowed to extend beyond the highest 50-year station ground snow load of 429 psf. Elevations over 9,000 ft are also considered less accurate due to the limited number of stations at these elevations. The results shown in this report have included a warning if the results have reached or exceeded the upper limit.

While great efforts have been made to ensure these predictions are as accurate as possible, designers must use expert judgement to ensure that such predictions are appropriate for their particular project. The SEAU and the authors cannot accept responsibility for prediction errors or any consequences resulting therefrom.

1 Bean, Brennan; Maguire, Marc; and Sun, Yan, "The Utah Snow Load Study" (2018). Civil and Environmental Engineering Faculty Publications. Paper 3589.

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Title
OGDEN COMMUNITY SERVICES BUILDING

Sheet Number:	R-1
Job Number:	240268
Date:	03/11/2025
By:	CF

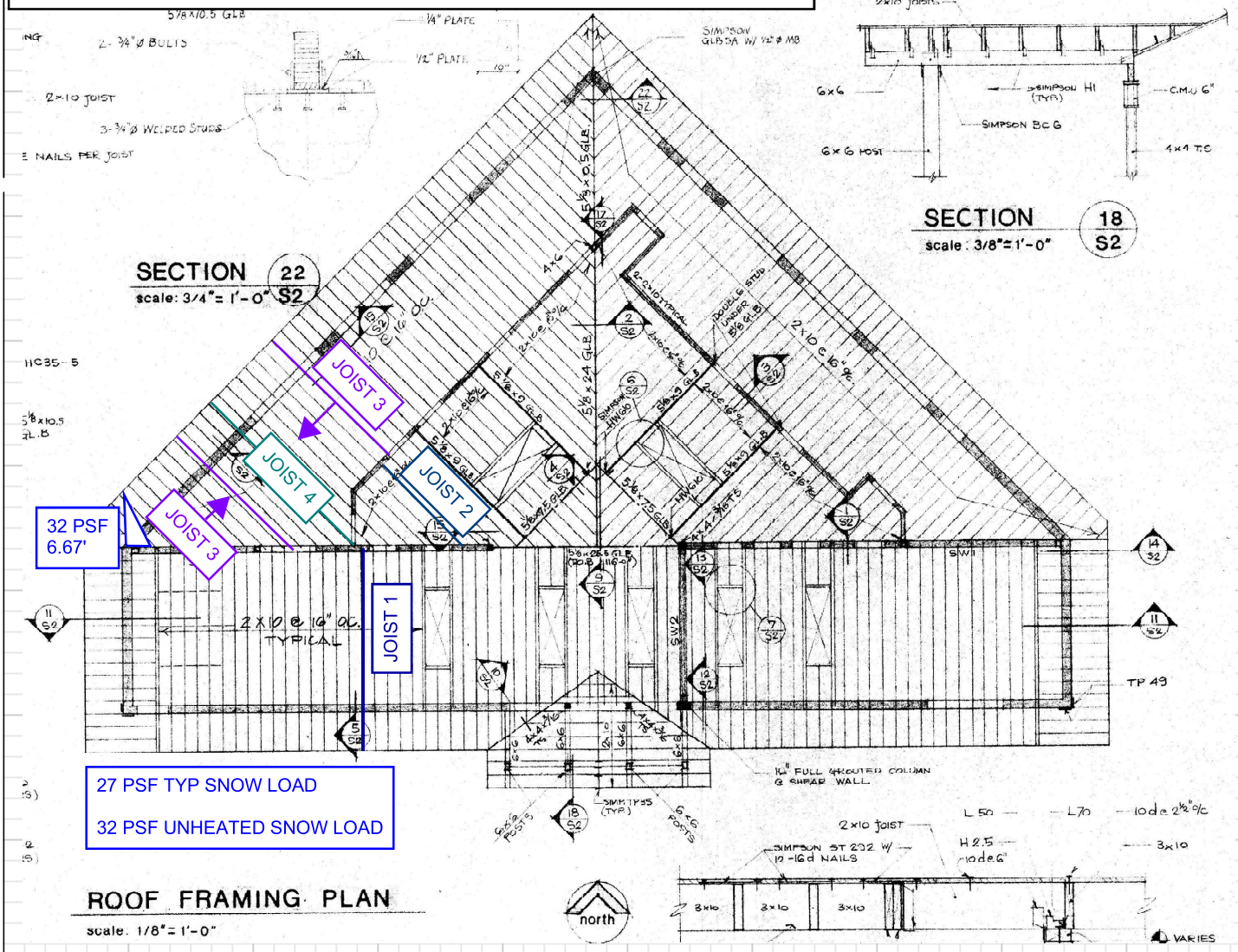
ROOF JOIST ANALYSIS FOR LOADING ON OPENINGS

DUNN ASSOCIATES, INC
Consulting Structural Engineers

Sheet Number:	R-2
Job Number:	240268
Date:	
By:	CF

Title
OGDEN COMMUNITY SERVICES BUILDING

JOIST ANALYSIS FOR DETERMINATION OF LOADS ON NEW OPENING HEADERS/BEAMS



JOIST 1	JOIST 2	JOIST 3		JOIST 4
For Backspan	For Backspan	For Backspan		For Backspan
DL = 20 psf	DL = 20 psf	DL = 20 psf		DL = 20 psf
LLr = 20 psf	LLr = 20 psf	LLr = 20 psf		LLr = 20 psf
SL = 27 psf	SL = 27 psf	SL = 27 psf		SL = 27 psf
For Cantilever	REACTIONS	For Cantilever		For Cantilever
DL = 20 psf	DL = 0.14 klf	DL = 20 psf		DL = 20 psf
LLr = 20 psf	LLr = 0.12 klf	LLr = 20 psf		LLr = 20 psf
SL = 32 psf	SL = 0.16 klf	SL = 32 psf		SL = 32 psf
REACTIONS BACK SPAN		REACTIONS BACK SPAN	REACTIONS WITH DRIFT BACK SPAN	REACTIONS BACK SPAN
DL = 0.18 klf		DL = 0.13 klf	DL = 0.13 klf	DL = 0.19 klf
LLr = 0.16 klf		LLr = 0.11 klf	LLr = 0.11 klf	LLr = 0.16 klf
SL = 0.21 klf		SL = 0.15 klf	SL = 0.24 klf	SL = 0.22 klf
CANTILEVER		CANTILEVER	CANTILEVER	CANTILEVER
DL = 0.32 klf		DL = 0.27 klf	DL = 0.27 klf	DL = 0.32 klf
LLr = 0.27 klf		LLr = 0.24 klf	LLr = 0.24 klf	LLr = 0.28 klf
SL = 0.40 klf		SL = 0.34 klf	SL = 0.36 klf	SL = 0.40 klf

Wood Beam

Project File: Ogden Community Services Building.ec6

LIC# : KW-06015170, Build:20.24.12.17 DUNN ASSOCIATES INC.

DESCRIPTION: Joist 1

CODE REFERENCES

Calculations per NDS 2018, IBC 2021, SDPWS 2021
Load Combination Set : IBC 2021

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : IBC 2021

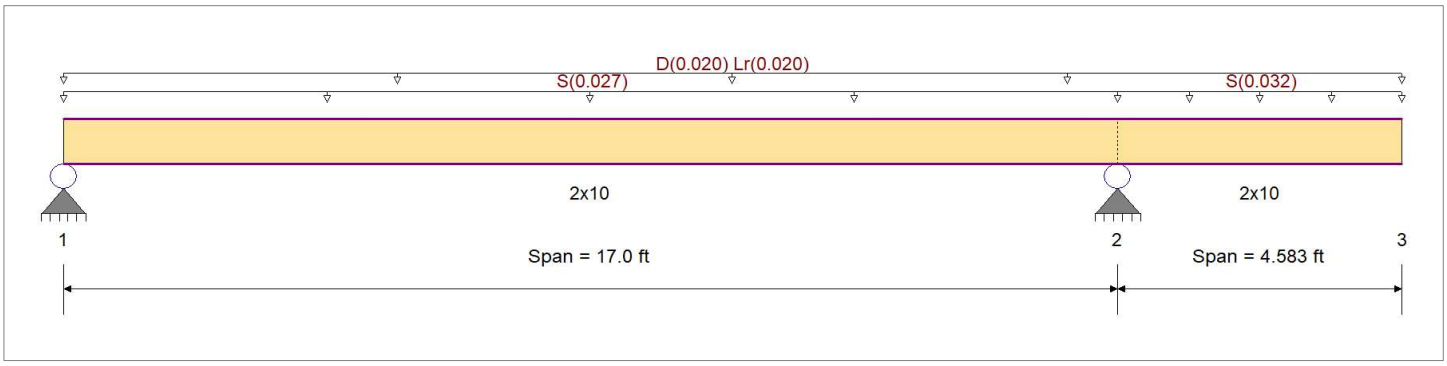
Wood Species : Douglas Fir-Larch
Wood Grade : No.2

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

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

E : Modulus of Elasticity

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



Applied Loads

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

Beam self weight calculated and added to loading
Loads on all spans...
Uniform Load on ALL spans : D = 0.020, Lr = 0.020 k/ft
Load for Span Number 1
Uniform Load : S = 0.0270 , Tributary Width = 1.0 ft
Load for Span Number 2
Uniform Load : S = 0.0320 , Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.753 : 1	Maximum Shear Stress Ratio	=	0.220 : 1
Section used for this span		2x10	Section used for this span		2x10
fb: Actual	=	857.84 psi	fv: Actual	=	45.52 psi
F'b	=	1,138.50 psi	F'v	=	207.00 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	7.788 ft	Location of maximum on span	=	16.240 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.257	in	Ratio =	793	>=360	Span: 1 : S Only
Max Upward Transient Deflection	-0.162	in	Ratio =	678	>=360	Span: 2 : S Only
Max Downward Total Deflection	0.485	in	Ratio =	420	>=240	Span: 1 : +D+S
Max Upward Total Deflection	-0.315	in	Ratio =	348	>=240	Span: 2 : +D+S

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_F	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 17.0 ft	1	0.450	0.128	0.90	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.71	400.9	891.0	0.19	20.8	162.0
Length = 4.583 ft	2	0.152	0.128	0.90	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.24	135.6	891.0	0.09	20.8	162.0
+D+Lr					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0

Wood Beam

Project File: Ogden Community Services Building.ec6

LIC# : KW-06015170, Build:20.24.12.17 DUNN ASSOCIATES INC.

DESCRIPTION: Joist 1

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_F	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
Length = 17.0 ft	1	0.606	0.173	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	1.34	749.5	1,237.5	0.36	38.9	225.0
Length = 4.583 ft	2	0.205	0.173	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.45	253.4	1,237.5	0.16	38.9	225.0
+D+S					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 17.0 ft	1	0.753	0.220	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	1.53	857.8	1,138.5	0.42	45.5	207.0
Length = 4.583 ft	2	0.285	0.220	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.58	324.1	1,138.5	0.21	45.5	207.0
+D+0.750Lr					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 17.0 ft	1	0.535	0.153	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	1.18	662.3	1,237.5	0.32	34.3	225.0
Length = 4.583 ft	2	0.181	0.153	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.40	224.0	1,237.5	0.15	34.3	225.0
+D+0.750S					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 17.0 ft	1	0.653	0.190	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	1.33	743.6	1,138.5	0.36	39.3	207.0
Length = 4.583 ft	2	0.243	0.190	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.49	277.0	1,138.5	0.18	39.3	207.0
+0.60D					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 17.0 ft	1	0.152	0.043	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.43	240.6	1,584.0	0.12	12.5	288.0
Length = 4.583 ft	2	0.051	0.043	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.14	81.3	1,584.0	0.05	12.5	288.0

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+S	0.4848	8.263		0.0000	0.000
2		0.0000	8.263	+D+S	-0.3154	4.583

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	0.391	0.711	
Max Upward from Load Combinations	0.391	0.711	
Max Upward from Load Cases	0.210	0.396	
D Only	0.181	0.315	
+D+Lr	0.339	0.589	
+D+S	0.391	0.711	
+D+0.750Lr	0.300	0.521	
+D+0.750S	0.339	0.612	
+0.60D	0.109	0.189	
Lr Only	0.158	0.274	
S Only	0.210	0.396	

Wood Beam

Project File: Ogden Community Services Building.ec6

LIC# : KW-06015170, Build:20.24.12.17 DUNN ASSOCIATES INC. (c) ENERCALC, LLC 1982-2025

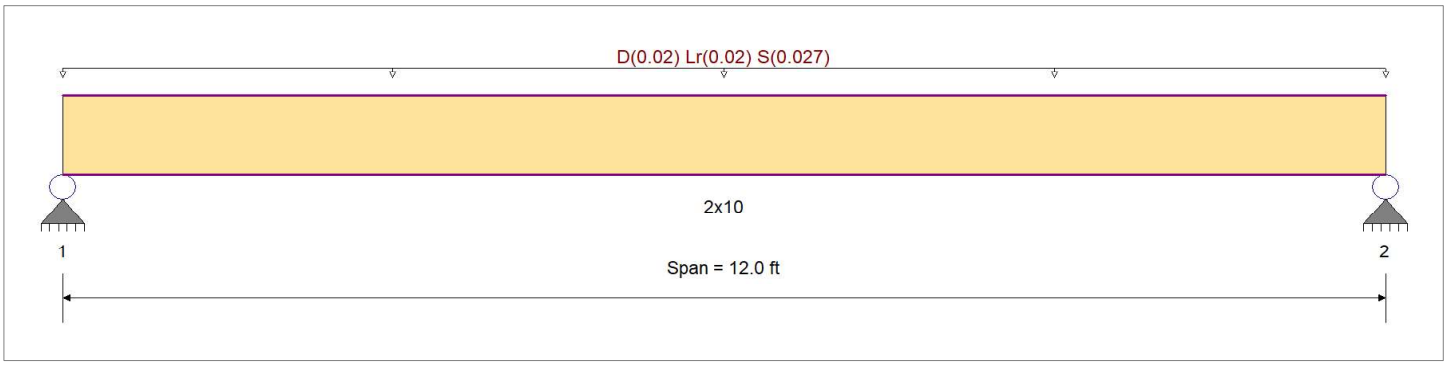
DESCRIPTION: Joist 2

CODE REFERENCES

Calculations per NDS 2018, IBC 2021, SDPWS 2021
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	900 psi	*E : Modulus of Elasticity*	
Load Combination :	IBC 2021	Fb -	900 psi	Ebend- xx	1600 ksi
		Fc - Prll	1350 psi	Eminbend - xx	580 ksi
Wood Species :	Douglas Fir-Larch	Fc - Perp	625 psi		
Wood Grade :	No.2	Fv	180 psi		
		Ft	575 psi	Density	31.21 pcf
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling				



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.020, Lr = 0.020, S = 0.0270 , Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.444 : 1	Maximum Shear Stress Ratio	=	0.137 : 1
Section used for this span		2x10	Section used for this span		2x10
fb: Actual	=	504.97 psi	fv: Actual	=	28.41 psi
F'b	=	1,138.50 psi	F'v	=	207.00 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	6.000 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	0.080 in	Ratio =	1798	>=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.148 in	Ratio =	971	>=180	Span: 1 : +D+S
Max Upward Total Deflection	0 in	Ratio =	0	<180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios										Moment Values			Shear Values		
Segment Length	Span #	M	V	CD	CM	C_t	CLx	C_F	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 12.0 ft	1	0.261	0.081	0.90	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.41	232.3	891.0	0.12	13.1	162.0
+D+Lr					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 12.0 ft	1	0.351	0.109	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.77	434.3	1,237.5	0.23	24.4	225.0
+D+S					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 12.0 ft	1	0.444	0.137	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.90	505.0	1,138.5	0.26	28.4	207.0
+D+0.750Lr					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 12.0 ft	1	0.310	0.096	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.68	383.8	1,237.5	0.20	21.6	225.0
+D+0.750S					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0

Wood Beam

Project File: Ogden Community Services Building.ec6

LIC# : KW-06015170, Build:20.24.12.17 DUNN ASSOCIATES INC.

DESCRIPTION: Joist 2

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_F	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
Length = 12.0 ft	1	0.384	0.119	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.78	436.8	1,138.5	0.23	24.6	207.0
+0.60D					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 12.0 ft	1	0.088	0.027	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.25	139.4	1,584.0	0.07	7.8	288.0

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+S	0.1483	6.044		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	0.300	0.300
Max Upward from Load Combinations	0.300	0.300
Max Upward from Load Cases	0.162	0.162
D Only	0.138	0.138
+D+Lr	0.258	0.258
+D+S	0.300	0.300
+D+0.750Lr	0.228	0.228
+D+0.750S	0.260	0.260
+0.60D	0.083	0.083
Lr Only	0.120	0.120
S Only	0.162	0.162

Wood Beam

Project File: Ogden Community Services Building.ec6

LIC# : KW-06015170, Build:20.24.12.17 DUNN ASSOCIATES INC.

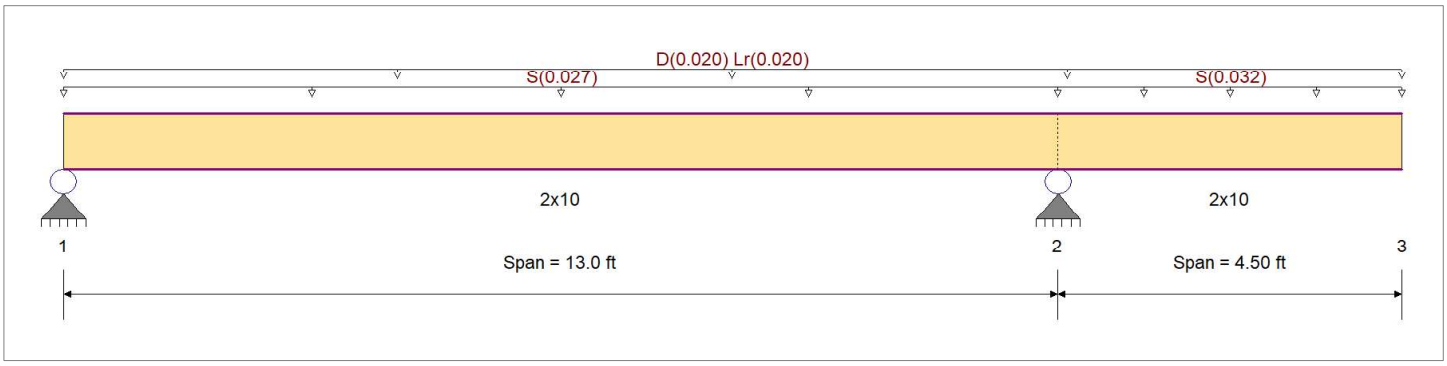
DESCRIPTION: Joist 3

CODE REFERENCES

Calculations per NDS 2018, IBC 2021, SDPWS 2021
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	900.0 psi	*E : Modulus of Elasticity*	
Load Combination :	IBC 2021	Fb -	900.0 psi	Ebend- xx	1,600.0 ksi
		Fc - Prll	1,350.0 psi	Eminbend - xx	580.0 ksi
Wood Species :	Douglas Fir-Larch	Fc - Perp	625.0 psi		
Wood Grade :	No.2	Fv	180.0 psi		
		Ft	575.0 psi	Density	31.210 pcf
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling				



Applied Loads

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

Beam self weight calculated and added to loading
Loads on all spans...
Uniform Load on ALL spans : D = 0.020, Lr = 0.020 k/ft
Load for Span Number 1
Uniform Load : S = 0.0270 , Tributary Width = 1.0 ft
Load for Span Number 2
Uniform Load : S = 0.0320 , Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.392 : 1	Maximum Shear Stress Ratio	=	0.173 : 1
Section used for this span		2x10	Section used for this span		2x10
fb: Actual	=	446.70 psi	fv: Actual	=	35.85 psi
F'b	=	1,138.50 psi	F'v	=	207.00 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	5.665 ft	Location of maximum on span	=	12.274 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.073 in	Ratio =	2126 >=360	Span: 1 : S Only
Max Upward Transient Deflection	-0.036 in	Ratio =	3026 >=360	Span: 2 : Lr Only
Max Downward Total Deflection	0.141 in	Ratio =	1108 >=240	Span: 1 : +D+S
Max Upward Total Deflection	-0.077 in	Ratio =	1406 >=240	Span: 2 : +D+Lr

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_F	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 13.0 ft	1	0.237	0.101	0.90	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.38	211.2	891.0	0.15	16.3	162.0
Length = 4.50 ft	2	0.147	0.101	0.90	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.23	130.7	891.0	0.09	16.3	162.0
+D+Lr					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0

Wood Beam

Project File: Ogden Community Services Building.ec6

LIC# : KW-06015170, Build:20.24.12.17 DUNN ASSOCIATES INC.

DESCRIPTION: Joist 3

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_F	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
Length = 13.0 ft	1	0.319	0.135	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.70	394.9	1,237.5	0.28	30.5	225.0
Length = 4.50 ft	2	0.197	0.135	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.44	244.3	1,237.5	0.16	30.5	225.0
+D+S					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.0 ft	1	0.392	0.173	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.80	446.7	1,138.5	0.33	35.8	207.0
Length = 4.50 ft	2	0.274	0.173	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.56	312.4	1,138.5	0.21	35.8	207.0
+D+0.750Lr					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.0 ft	1	0.282	0.120	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.62	348.9	1,237.5	0.25	26.9	225.0
Length = 4.50 ft	2	0.174	0.120	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.38	215.9	1,237.5	0.14	26.9	225.0
+D+0.750S					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.0 ft	1	0.341	0.150	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.69	387.8	1,138.5	0.29	31.0	207.0
Length = 4.50 ft	2	0.235	0.150	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.48	267.0	1,138.5	0.18	31.0	207.0
+0.60D					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.0 ft	1	0.080	0.034	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.23	126.7	1,584.0	0.09	9.8	288.0
Length = 4.50 ft	2	0.050	0.034	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.14	78.4	1,584.0	0.05	9.8	288.0

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+S	0.1408	6.173		0.0000	0.000
2		0.0000	6.173	+D+Lr	-0.0767	4.500

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	0.282	0.615	
Max Upward from Load Combinations	0.282	0.615	
Max Upward from Load Cases	0.151	0.344	
D Only	0.132	0.271	
+D+Lr	0.246	0.507	
+D+S	0.282	0.615	
+D+0.750Lr	0.217	0.448	
+D+0.750S	0.245	0.529	
+0.60D	0.079	0.163	
Lr Only	0.114	0.236	
S Only	0.151	0.344	

Wood Beam

Project File: Ogden Community Services Building.ec6

LIC# : KW-06015170, Build:20.24.12.17 DUNN ASSOCIATES INC. (c) ENERCALC, LLC 1982-2025

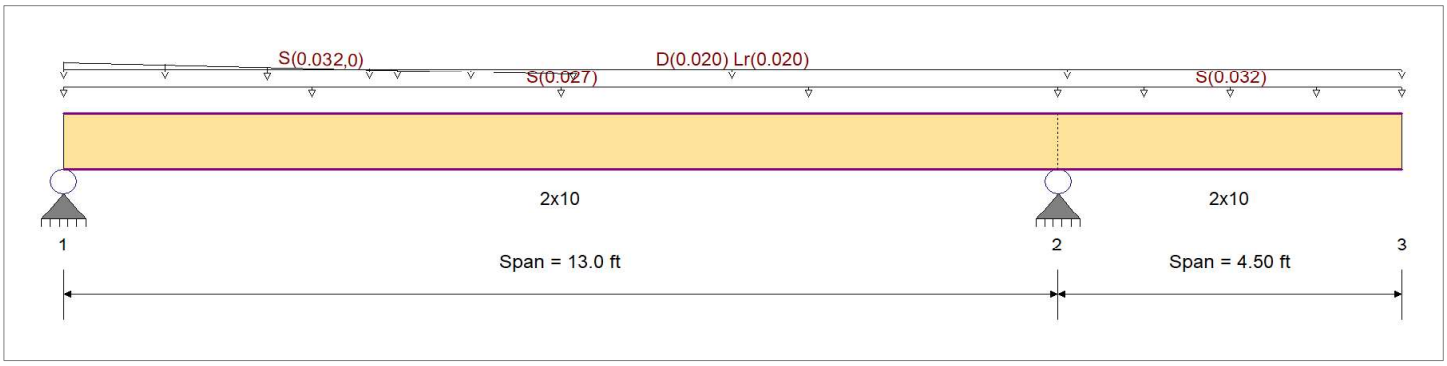
DESCRIPTION: Joist 3 - w/ Drift

CODE REFERENCES

Calculations per NDS 2018, IBC 2021, SDPWS 2021
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	900.0 psi	*E : Modulus of Elasticity*	
Load Combination :	IBC 2021	Fb -	900.0 psi	Ebend- xx	1,600.0 ksi
		Fc - Prll	1,350.0 psi	Eminbend - xx	580.0 ksi
Wood Species :	Douglas Fir-Larch	Fc - Perp	625.0 psi		
Wood Grade :	No.2	Fv	180.0 psi		
		Ft	575.0 psi	Density	31.210 pcf
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling				



Applied Loads

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

Beam self weight calculated and added to loading
Loads on all spans...
Uniform Load on ALL spans : D = 0.020, Lr = 0.020 k/ft
Load for Span Number 1
Uniform Load : S = 0.0270 , Tributary Width = 1.0 ft
Varying Uniform Load : S= 0.0320->0.0 k/ft, Extent = 0.0 -->> 6.667 ft, Trib Width = 1.0 ft

Load for Span Number 2
Uniform Load : S = 0.0320 , Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.459 : 1	Maximum Shear Stress Ratio	=	0.183 : 1
Section used for this span		2x10	Section used for this span		2x10
fb: Actual	=	522.73 psi	fv: Actual	=	37.82 psi
F'b	=	1,138.50 psi	F'v	=	207.00 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	5.374 ft	Location of maximum on span	=	12.274 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.098 in	Ratio =	1585	>=360	Span: 1 : S Only
Max Upward Transient Deflection	-0.058 in	Ratio =	1866	>=360	Span: 2 : S Only
Max Downward Total Deflection	0.166 in	Ratio =	940	>=240	Span: 1 : +D+S
Max Upward Total Deflection	-0.099 in	Ratio =	1092	>=240	Span: 2 : +D+S

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_F	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 13.0 ft	1	0.237	0.101	0.90	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.38	211.2	891.0	0.15	16.3	162.0
Length = 4.50 ft	2	0.147	0.101	0.90	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.23	130.7	891.0	0.09	16.3	162.0

Wood Beam

Project File: Ogden Community Services Building.ec6

LIC# : KW-06015170, Build:20.24.12.17 DUNN ASSOCIATES INC. (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Joist 3 - w/ Drift

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_F	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
+D+Lr					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.0 ft	1	0.319	0.135	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.70	394.9	1,237.5	0.28	30.5	225.0
Length = 4.50 ft	2	0.197	0.135	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.44	244.3	1,237.5	0.16	30.5	225.0
+D+S					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.0 ft	1	0.459	0.183	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.93	522.7	1,138.5	0.35	37.8	207.0
Length = 4.50 ft	2	0.274	0.183	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.56	312.4	1,138.5	0.21	37.8	207.0
+D+0.750Lr					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.0 ft	1	0.282	0.120	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.62	348.9	1,237.5	0.25	26.9	225.0
Length = 4.50 ft	2	0.174	0.120	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.38	215.9	1,237.5	0.14	26.9	225.0
+D+0.750S					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.0 ft	1	0.391	0.157	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.79	444.7	1,138.5	0.30	32.4	207.0
Length = 4.50 ft	2	0.235	0.157	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.48	267.0	1,138.5	0.18	32.4	207.0
+0.60D					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 13.0 ft	1	0.080	0.034	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.23	126.7	1,584.0	0.09	9.8	288.0
Length = 4.50 ft	2	0.050	0.034	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.14	78.4	1,584.0	0.05	9.8	288.0

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+S	0.1658	6.101		0.0000	0.000
2		0.0000	6.101	+D+S	-0.0989	4.500

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	0.371	0.634	
Max Upward from Load Combinations	0.371	0.634	
Max Upward from Load Cases	0.239	0.363	
D Only	0.132	0.271	
+D+Lr	0.246	0.507	
+D+S	0.371	0.634	
+D+0.750Lr	0.217	0.448	
+D+0.750S	0.311	0.543	
+0.60D	0.079	0.163	
Lr Only	0.114	0.236	
S Only	0.239	0.363	

Wood Beam

Project File: Ogden Community Services Building.ec6

LIC# : KW-06015170, Build:20.24.12.17 DUNN ASSOCIATES INC. (c) ENERCALC, LLC 1982-2025

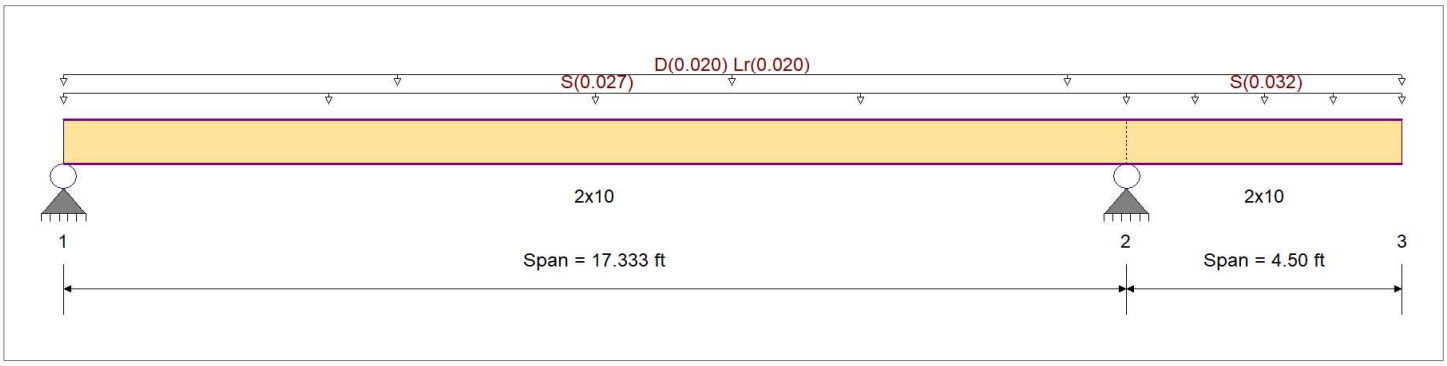
DESCRIPTION: Joist 4

CODE REFERENCES

Calculations per NDS 2018, IBC 2021, SDPWS 2021
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	900.0 psi	*E : Modulus of Elasticity*	
Load Combination :	IBC 2021	Fb -	900.0 psi	Ebend- xx	1,600.0 ksi
		Fc - Prll	1,350.0 psi	Eminbend - xx	580.0 ksi
Wood Species :	Douglas Fir-Larch	Fc - Perp	625.0 psi		
Wood Grade :	No.2	Fv	180.0 psi		
		Ft	575.0 psi	Density	31.210 pcf
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling				



Applied Loads

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

Beam self weight calculated and added to loading
Loads on all spans...
Uniform Load on ALL spans : D = 0.020, Lr = 0.020 k/ft
Load for Span Number 1
Uniform Load : S = 0.0270 , Tributary Width = 1.0 ft
Load for Span Number 2
Uniform Load : S = 0.0320 , Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.793** : 1	Maximum Shear Stress Ratio	=	**0.225** : 1
Section used for this span		**2x10**	Section used for this span		**2x10**
fb: Actual	=	903.14 psi	fv: Actual	=	46.66 psi
F'b	=	1,138.50 psi	F'v	=	207.00 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	8.037 ft	Location of maximum on span	=	16.655 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.283 in	Ratio =	735	>=360	Span: 1 : S Only
Max Upward Transient Deflection	-0.178 in	Ratio =	606	>=360	Span: 2 : S Only
Max Downward Total Deflection	0.533 in	Ratio =	390	>=240	Span: 1 : +D+S
Max Upward Total Deflection	-0.344 in	Ratio =	312	>=240	Span: 2 : +D+S

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_F	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 17.333 ft	1	0.473	0.132	0.90	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.75	421.6	891.0	0.20	21.3	162.0
Length = 4.50 ft	2	0.147	0.132	0.90	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.23	130.7	891.0	0.09	21.3	162.0
+D+Lr					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0

Wood Beam

Project File: Ogden Community Services Building.ec6

LIC# : KW-06015170, Build:20.24.12.17 DUNN ASSOCIATES INC.

DESCRIPTION: Joist 4

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_F	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
Length = 17.333 ft	1	0.637	0.177	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	1.40	788.0	1,237.5	0.37	39.9	225.0
Length = 4.50 ft	2	0.197	0.177	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.44	244.3	1,237.5	0.16	39.9	225.0
+D+S					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 17.333 ft	1	0.793	0.225	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	1.61	903.1	1,138.5	0.43	46.7	207.0
Length = 4.50 ft	2	0.274	0.225	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.56	312.4	1,138.5	0.21	46.7	207.0
+D+0.750Lr					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 17.333 ft	1	0.563	0.157	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	1.24	696.4	1,237.5	0.33	35.2	225.0
Length = 4.50 ft	2	0.174	0.157	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.38	215.9	1,237.5	0.14	35.2	225.0
+D+0.750S					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 17.333 ft	1	0.688	0.195	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	1.40	782.7	1,138.5	0.37	40.3	207.0
Length = 4.50 ft	2	0.235	0.195	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.48	267.0	1,138.5	0.18	40.3	207.0
+0.60D					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 17.333 ft	1	0.160	0.044	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.45	252.9	1,584.0	0.12	12.8	288.0
Length = 4.50 ft	2	0.050	0.044	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.14	78.4	1,584.0	0.05	12.8	288.0

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+S	0.5329	8.425		0.0000	0.000
2		0.0000	8.425	+D+S	-0.3443	4.500

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	0.401	0.713	
Max Upward from Load Combinations	0.401	0.713	
Max Upward from Load Cases	0.215	0.397	
D Only	0.186	0.316	
+D+Lr	0.348	0.591	
+D+S	0.401	0.713	
+D+0.750Lr	0.307	0.523	
+D+0.750S	0.347	0.614	
+0.60D	0.112	0.190	
Lr Only	0.162	0.275	
S Only	0.215	0.397	

DUNN ASSOCIATES, INC
Consulting Structural Engineers

Title
OGDEN COMMUNITY SERVICES BUILDING

Sheet Number:	O-1
Job Number:	240268
Date:	03/11/2025
By:	CF

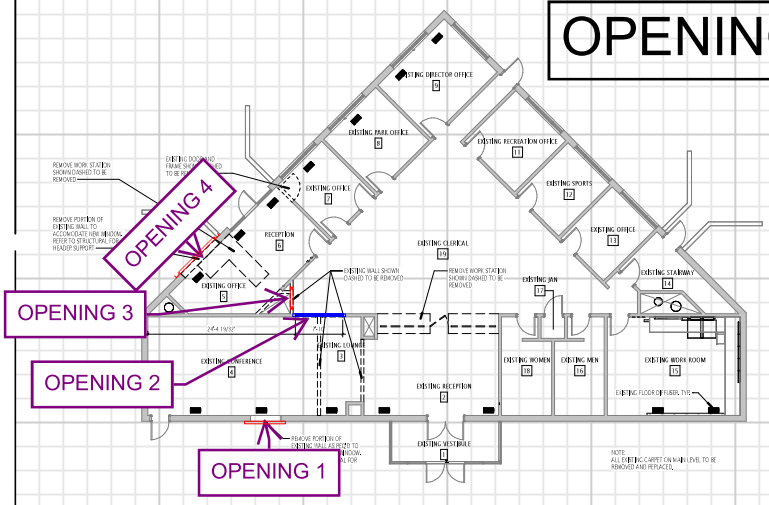
OPENING DESIGN

DUNN ASSOCIATES, INC
Consulting Structural Engineers

Sheet Number:	O-2
Job Number:	240268
Date:	
By:	CF

Title
OGDEN COMMUNITY SERVICES BUILDING

OPENINGS KEY PLAN

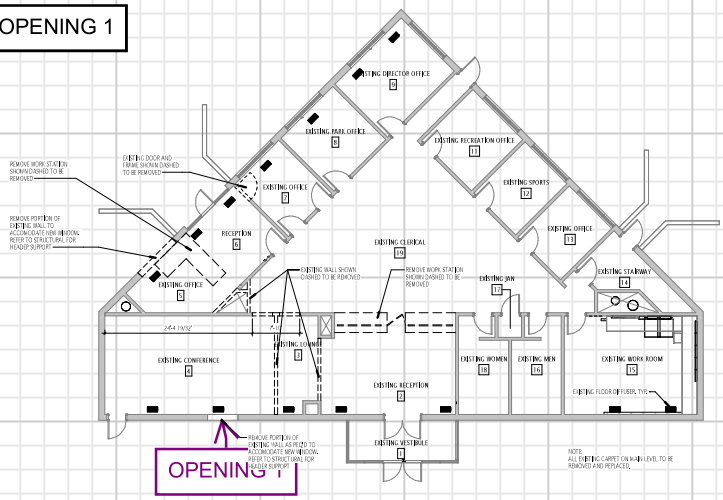


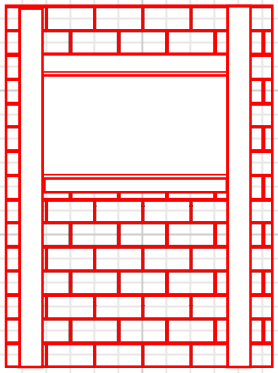
DUNN ASSOCIATES, INC
Consulting Structural Engineers

Sheet Number:	O-3
Job Number:	240268
Date:	
By:	CF

Title
OGDEN COMMUNITY SERVICES BUILDING

OPENING 1





OPENING 1

LOADS FROM JOIST 1
JOIST 1
DL = 0.32 klf
LLr = 0.27 klf
SL = 0.40 klf

SPAN = 5'-0" + 4' + 4' = 13' WORST CASE TO SPAN BETWEEN REINFORCEMENT

6" BLOCK, 135 pcf, (6" * 1' / 12" * 135 pcf * 4 ft height) = 270 plf additional DL

USE L8x6x1/2 ANGLE AS HEADER OVER OPENING.
USE HSS3.1/2x2.1/2x1/4 AS POSTS

OPENING #4 DESIGN CONTROLS AS IT IS THE LARGER OF THE OPENINGS IN THE MASONRY, PLEASE SEE CALCS FOR OPENING 4

SEISMIC LOADS
EQ = $0.4S_{DS}W_PI_E$
EQ = 0.4 * 1.093 * 36 PSF * 1.0 = 15.74 psf

EQ = 0.4 * 1.093 * 15 PSF * 1.0 = 6.56 psf

EQ JAMB
BARS AT 48" O.C., ADD'L TRIB TO JAMB = 2 ft
2 ft * 15.74 psf = 31.48 psf

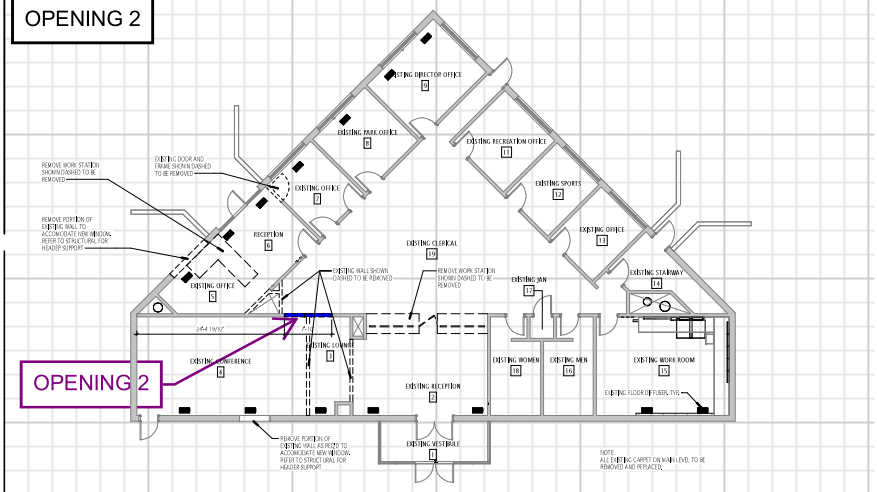
WL = 22.11 psf C&C
WL JAMB
2 ft * 22.11 psf = 44.22 psf

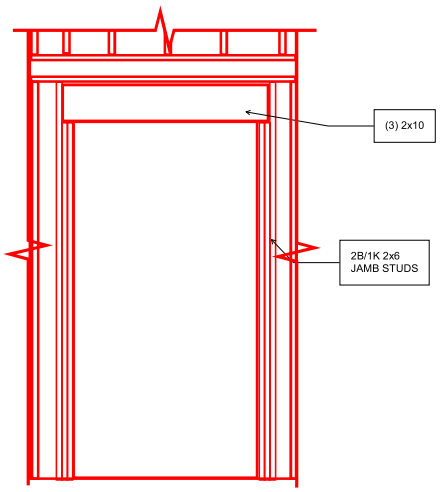
DUNN ASSOCIATES, INC
Consulting Structural Engineers

Sheet Number:	O-4
Job Number:	240268
Date:	
By:	CF

Title
OGDEN COMMUNITY SERVICES BUILDING

OPENING 2





OPENING 2

LOADS FROM JOIST 1 AND JOIST 2
JOIST 1
DL = 0.18 klf
LLr = 0.16 klf
SL = 0.21 klf

JOIST 2
DL = 0.14 klf
LLr = 0.12 klf
SL = 0.16 klf

SPAN = 7'-10"

USE (3) 2x10 DFL No. 2 FOR BEAM

INTERIOR 5 PSF PRESSURE
TRIB = 7.83' / 2 + 1' / 2 = 4.416'
5 psf * 4.416' = 22.083 plf

FOR BEARING STUDS, USE (2) 2x6
USE (1) 2x6 KING STUD

Wood Beam

Project File: Ogden Community Services Building.ec6

LIC# : KW-06015170, Build:20.24.12.17 DUNN ASSOCIATES INC. (c) ENERCALC, LLC 1982-2025

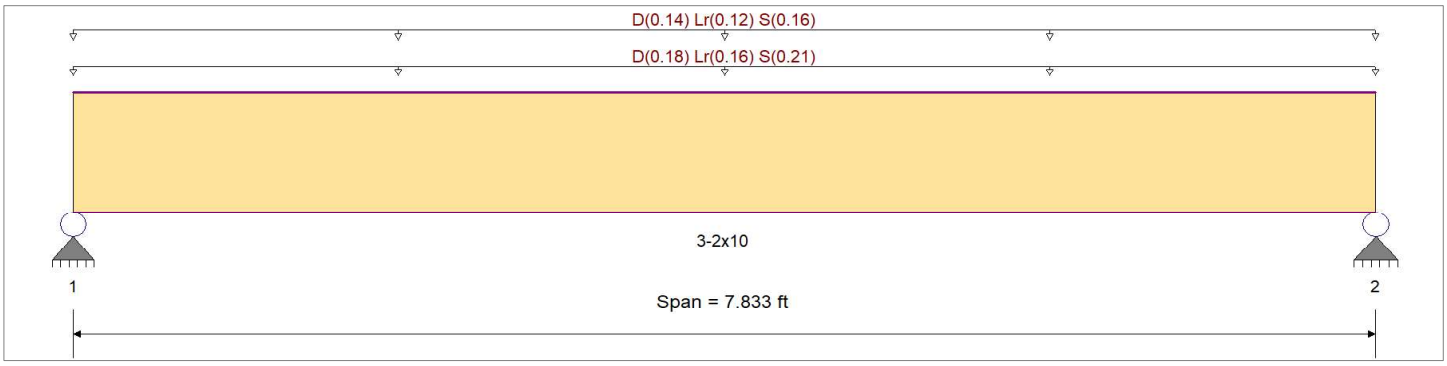
DESCRIPTION: Opening 2: Wood Beam

CODE REFERENCES

Calculations per NDS 2018, IBC 2021, SDPWS 2021
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	900.0 psi	*E : Modulus of Elasticity*	
Load Combination :	IBC 2021	Fb -	900.0 psi	Ebend- xx	1,600.0 ksi
		Fc - Prll	1,350.0 psi	Eminbend - xx	580.0 ksi
Wood Species :	Douglas Fir-Larch	Fc - Perp	625.0 psi		
Wood Grade :	No.2	Fv	180.0 psi		
		Ft	575.0 psi	Density	31.210 pcf
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling				



Applied Loads

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

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.180, Lr = 0.160, S = 0.210 , Tributary Width = 1.0 ft, (Joist 1 Loads)
Uniform Load : D = 0.140, Lr = 0.120, S = 0.160 , Tributary Width = 1.0 ft, (Joist 2 Loads)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.869 : 1	Maximum Shear Stress Ratio	=	0.381 : 1
Section used for this span		3-2x10	Section used for this span		3-2x10
fb: Actual	=	989.67 psi	fv: Actual	=	78.91 psi
F'b	=	1,138.50 psi	F'v	=	207.00 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	3.917 ft	Location of maximum on span	=	7.090 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.066 in	Ratio =	1415	>=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.124 in	Ratio =	759	>=240	Span: 1 : +D+S
Max Upward Total Deflection	0 in	Ratio =	0	<240	n/a

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_F	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 7.833 ft	1	0.515	0.226	0.90	1.00	1.00	1.00	1.100	1.00	1.00	1.00	2.45	459.0	891.0	1.02	36.6	162.0
+D+Lr					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 7.833 ft	1	0.695	0.305	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	4.60	860.6	1,237.5	1.90	68.6	225.0
+D+S					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 7.833 ft	1	0.869	0.381	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	5.29	989.7	1,138.5	2.19	78.9	207.0
+D+0.750Lr					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 7.833 ft	1	0.614	0.269	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	4.07	760.2	1,237.5	1.68	60.6	225.0

Wood Beam

Project File: Ogden Community Services Building.ec6

LIC# : KW-06015170, Build:20.24.12.17 DUNN ASSOCIATES INC. (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Opening 2: Wood Beam

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_F	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
+D+0.750S					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 7.833 ft	1	0.753	0.330	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	4.58	857.0	1,138.5	1.90	68.3	207.0
+1.153D					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 7.833 ft	1	0.334	0.147	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	2.83	529.2	1,584.0	1.17	42.2	288.0
+1.115D+0.750S					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 7.833 ft	1	0.574	0.252	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	4.86	909.7	1,584.0	2.01	72.5	288.0
+0.60D					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 7.833 ft	1	0.174	0.076	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	1.47	275.4	1,584.0	0.61	22.0	288.0
+0.4470D					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 7.833 ft	1	0.130	0.057	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	1.10	205.2	1,584.0	0.45	16.4	288.0

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+S	0.1238	3.945		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	2.703	2.703
Max Upward from Load Combinations	2.703	2.703
Max Upward from Load Cases	1.449	1.449
D Only	1.253	1.253
+D+Lr	2.350	2.350
+D+S	2.703	2.703
+D+0.750Lr	2.076	2.076
+D+0.750S	2.340	2.340
+0.60D	0.752	0.752
Lr Only	1.097	1.097
S Only	1.449	1.449

Wood Column

Project File: Ogden Community Services Building.ec6

LIC# : KW-06015170, Build:20.25.02.26 DUNN ASSOCIATES INC. (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Opening 2 Post

Code References

Calculations per NDS 2018, IBC 2021, SDPWS 2021
Load Combinations Used : IBC 2021

General Information

Analysis Method	Allowable Stress Design	Wood Section Name	**2-2x6**
End Fixities	Top & Bottom Pinned	Wood Grading/Manuf.	Graded Lumber
Overall Column Height	10 ft	Wood Member Type	Sawn
(Used for non-slender calculations)			
Wood Species	Douglas Fir-Larch	Exact Width	**3.0** in
Wood Grade	No.2	Exact Depth	**5.50** in
Fb +	900.0 psi	Fv	180.0 psi
Fb -	900.0 psi	Ft	575.0 psi
Fc - Prll	1,350.0 psi	Density	31.210 pcf
Fc - Perp	625.0 psi		

Area	16.50 in^2
Ix	41.594 in^4
Iy	12.375 in^4

Allow Stress Modification Factors

Cf or Cv for Bending	1.30
Cf or Cv for Compressio	1.10
Cf or Cv for Tension	1.30
Cm : Wet Use Factor	1.0
Ct : Temperature Fact	1.0
Cfu : Flat Use Factor	1.0
Kf : Built-up columns	1.0
Use Cr : Repetitive ?	No

E : Modulus of Elasticity . . .

	x-x Bending	y-y Bending	Axial
Basic	1,600.0	1,600.0	1,600.0 ksi
Minimum	580.0	580.0	

Column Buckling Condition:
ABOUT X-X Axis: Lux = 10 ft, Kx = 1.0
ABOUT Y-Y Axis: Luy = 10 ft, Ky = 1.0

Applied Loads

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

Column self weight included : 35.761 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 10.0 ft, Xecc = 1.0 in, D = 1.250, Lr = 1.10, S = 1.450 k
BENDING LOADS . . .
Lat. Uniform Load creating Mx-x, L = 0.02208 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.8798 : 1**

Load Combination	+D+S
Governing NDS Forumla	Comp + Myy, NDS Eq. 3.9-3
Location of max.above base	9.933 ft
At maximum location values are .	
Applied Axial	2.736 k
Applied Mx	0.0 k-ft
Applied My	-0.2235 k-ft
Fc : Allowable	286.430 psi

PASS Maximum Shear Stress Ratio = **0.05577 : 1**

Load Combination	+D+L
Location of max.above base	10.0 ft
Applied Design Shear	15.057 psi
Allowable Shear	180.0 psi

Maximum SERVICE Lateral Load Reactions . .

Top along Y-Y	0.1104 k	Bottom along Y-Y	0.1104 k
Top along X-X	0.02250 k	Bottom along X-X	0.02250 k

Maximum SERVICE Load Lateral Deflections . . .

Along Y-Y 0.07547 in at 5.034 ft above base
for load combination : +D+L

Along X-X -0.1271 in at 5.839 ft above base
for load combination : +D+S

Other Factors used to calculate allowable stresses . . .

	Bending	Compression	Tension

Load Combination Results

Load Combination	C_D	C_P	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Maximum Shear Ratios: Stress Ratio	Status	Location
D Only	0.900	0.212	0.2756	PASS	0.0 ft	0.005845	PASS	10.0 ft
+D+L	1.000	0.192	0.3782	PASS	6.040 ft	0.05577	PASS	10.0 ft
+D+Lr	1.250	0.155	0.6289	PASS	9.933 ft	0.007912	PASS	10.0 ft
+D+S	1.150	0.168	0.8798	PASS	9.933 ft	0.009881	PASS	10.0 ft
+D+0.750Lr+0.750L	1.250	0.155	0.5234	PASS	7.852 ft	0.03346	PASS	0.0 ft
+D+0.750L+0.750S	1.150	0.168	0.6723	PASS	8.523 ft	0.03637	PASS	0.0 ft
+0.60D	1.600	0.122	0.1613	PASS	0.0 ft	0.001973	PASS	10.0 ft

Wood Column

Project File: Ogden Community Services Building.ec6

LIC# : KW-06015170, Build:20.25.02.26 DUNN ASSOCIATES INC.

DESCRIPTION: Opening 2 Post

Maximum Reactions

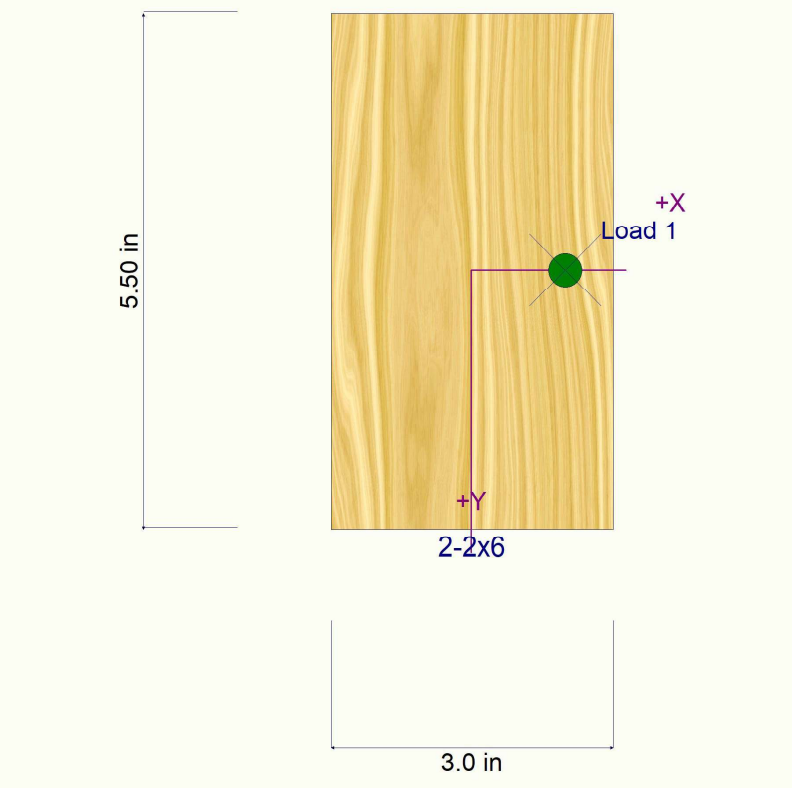
Note: Only non-zero reactions are listed.

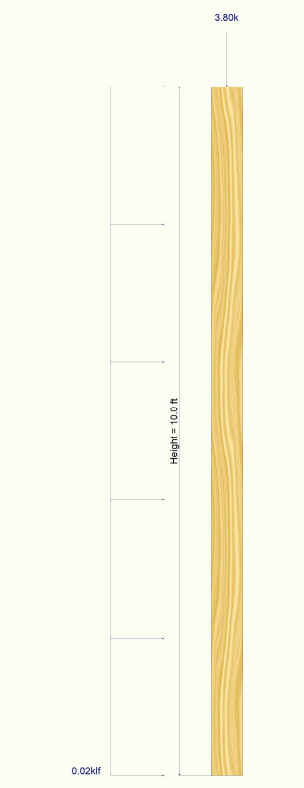
Load Combination	X-X Axis Reaction @ Base	@ Top	k Y-Y Axis Reaction @ Base	@ Top	Axial Reaction @ Base	My - End Moments @ Base	@ Top	k-ft Mx - End Moments @ Base	@ Top
D Only	-0.010	0.010			1.286				
+D+L	-0.010	0.010	0.110	0.110	1.286				
+D+Lr	-0.020	0.020			2.386				
+D+S	-0.023	0.023			2.736				
+D+0.750Lr+0.750L	-0.017	0.017	0.083	0.083	2.111				
+D+0.750L+0.750S	-0.019	0.019	0.083	0.083	2.373				
+0.60D	-0.006	0.006			0.771				
Lr Only	-0.009	0.009			1.100				
L Only			0.110	0.110					
S Only	-0.012	0.012			1.450				

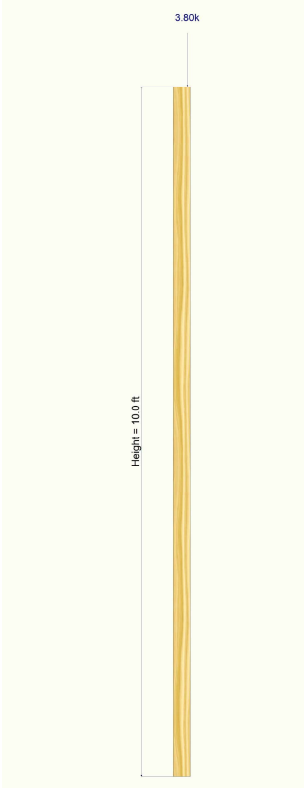
Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
D Only	-0.0588 in	5.839ft	0.000 in	0.000 ft
+D+L	-0.0588 in	5.839ft	0.075 in	5.034 ft
+D+Lr	-0.1106 in	5.839ft	0.000 in	0.000 ft
+D+S	-0.1271 in	5.839ft	0.000 in	0.000 ft
+D+0.750Lr+0.750L	-0.0976 in	5.839ft	0.057 in	5.034 ft
+D+0.750L+0.750S	-0.1100 in	5.839ft	0.057 in	5.034 ft
+0.60D	-0.0353 in	5.839ft	0.000 in	0.000 ft
Lr Only	-0.0518 in	5.839ft	0.000 in	0.000 ft
L Only	0.0000 in	0.000ft	0.075 in	5.034 ft
S Only	-0.0682 in	5.839ft	0.000 in	0.000 ft

Sketches





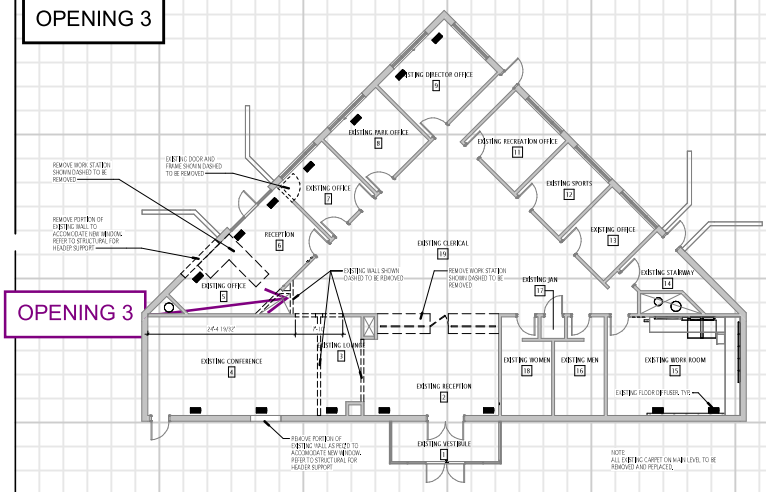


DUNN ASSOCIATES, INC
Consulting Structural Engineers

Sheet Number:	O-9
Job Number:	240268
Date:	
By:	CF

Title
OGDEN COMMUNITY SERVICES BUILDING

OPENING 3



OPENING 3

LOADS FROM JOIST 4 AND JOIST 2
JOIST 4
DL = 0.19 klf
LLr = 0.16 klf
SL = 0.22 klf

JOIST 2
DL = 0.14 klf
LLr = 0.12 klf
SL = 0.16 klf

SPAN = 6'-0"

USE (2) 2x10 AS BEAM
USE (2) 2x6 BEARING STUDS
USE (1) 2x6 KING STUD

Wood Beam

Project File: Ogden Community Services Building.ec6

LIC# : KW-06015170, Build:20.24.12.17 DUNN ASSOCIATES INC. (c) ENERCALC, LLC 1982-2025

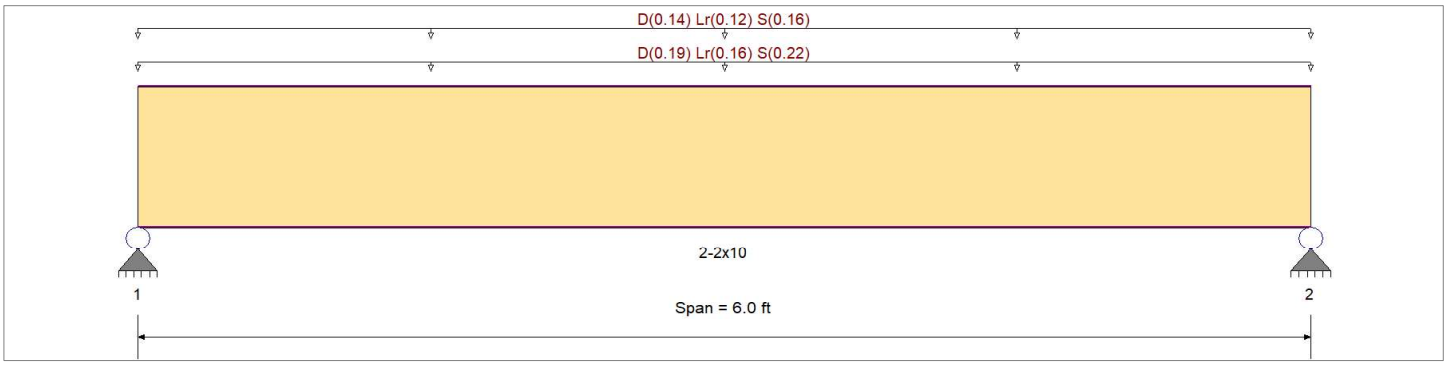
DESCRIPTION: Opening 3: Wood Beam

CODE REFERENCES

Calculations per NDS 2018, IBC 2021, SDPWS 2021
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	900.0 psi	*E : Modulus of Elasticity*	
Load Combination :	IBC 2021	Fb -	900.0 psi	Ebend- xx	1,600.0 ksi
		Fc - Prll	1,350.0 psi	Eminbend - xx	580.0 ksi
Wood Species :	Douglas Fir-Larch	Fc - Perp	625.0 psi		
Wood Grade :	No.2	Fv	180.0 psi		
		Ft	575.0 psi	Density	31.210 pcf
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling				



Applied Loads

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

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.190, Lr = 0.160, S = 0.220 , Tributary Width = 1.0 ft, (Joist 4 Loads)
Uniform Load : D = 0.140, Lr = 0.120, S = 0.160 , Tributary Width = 1.0 ft, (Joist 2 Loads)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.787**: 1	Maximum Shear Stress Ratio	=	**0.414** : 1
Section used for this span		**2-2x10**	Section used for this span		**2-2x10**
fb: Actual	=	896.19 psi	fv: Actual	=	85.72 psi
F'b	=	1,138.50 psi	F'v	=	207.00 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	3.000 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	0.035 in	Ratio =	2045 >=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.066 in	Ratio =	1094 >=240	Span: 1 : +D+S
Max Upward Total Deflection	0 in	Ratio =	0 <240	n/a

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_F	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 6.0 ft	1	0.467	0.246	0.90	1.00	1.00	1.00	1.100	1.00	1.00	1.00	1.49	416.5	891.0	0.74	39.8	162.0
+D+Lr					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 6.0 ft	1	0.622	0.327	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	2.75	770.0	1,237.5	1.36	73.6	225.0
+D+S					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 6.0 ft	1	0.787	0.414	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	3.20	896.2	1,138.5	1.59	85.7	207.0
+D+0.750Lr					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 6.0 ft	1	0.551	0.290	1.25	1.00	1.00	1.00	1.100	1.00	1.00	1.00	2.43	681.6	1,237.5	1.21	65.2	225.0

Wood Beam

Project File: Ogden Community Services Building.ec6

LIC# : KW-06015170, Build:20.24.12.17 DUNN ASSOCIATES INC.

DESCRIPTION: Opening 3: Wood Beam

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_F	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
+D+0.750S					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 6.0 ft	1	0.682	0.359	1.15	1.00	1.00	1.00	1.100	1.00	1.00	1.00	2.77	776.3	1,138.5	1.37	74.3	207.0
+1.153D					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 6.0 ft	1	0.303	0.160	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	1.71	480.3	1,584.0	0.85	45.9	288.0
+1.115D+0.750S					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 6.0 ft	1	0.520	0.274	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	2.94	824.1	1,584.0	1.46	78.8	288.0
+0.60D					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 6.0 ft	1	0.158	0.083	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.89	249.9	1,584.0	0.44	23.9	288.0
+0.4470D					1.00	1.00	1.00	1.100	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 6.0 ft	1	0.118	0.062	1.60	1.00	1.00	1.00	1.100	1.00	1.00	1.00	0.66	186.2	1,584.0	0.33	17.8	288.0

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+S	0.0658	3.022		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	2.130	2.130
Max Upward from Load Combinations	2.130	2.130
Max Upward from Load Cases	1.140	1.140
D Only	0.990	0.990
+D+Lr	1.830	1.830
+D+S	2.130	2.130
+D+0.750Lr	1.620	1.620
+D+0.750S	1.845	1.845
+0.60D	0.594	0.594
Lr Only	0.840	0.840
S Only	1.140	1.140

Wood Column

Project File: Ogden Community Services Building.ec6

LIC# : KW-06015170, Build:20.25.02.26 DUNN ASSOCIATES INC.

DESCRIPTION: Opening 3 Post

Code References

Calculations per NDS 2018, IBC 2021, SDPWS 2021
Load Combinations Used : IBC 2021

General Information

Analysis Method	Allowable Stress Design	Wood Section Name	**2-2x6**
End Fixities	Top & Bottom Pinned	Wood Grading/Manuf.	Graded Lumber
Overall Column Height	10 ft	Wood Member Type	Sawn
(Used for non-slender calculations)			
Wood Species	Douglas Fir-Larch	Exact Width	**3.0** in
Wood Grade	No.2	Exact Depth	**5.50** in
Fb +	900.0 psi	Area	16.50 in^2
Fb -	900.0 psi	Ix	41.594 in^4
Fc - Prll	1,350.0 psi	Iy	12.375 in^4
Fc - Perp	625.0 psi		
Fv	180.0 psi		
Ft	575.0 psi		
Density	31.210 pcf		

Allow Stress Modification Factors

Cf or Cv for Bending	1.30
Cf or Cv for Compressio	1.10
Cf or Cv for Tension	1.30
Cm : Wet Use Factor	1.0
Ct : Temperature Fact	1.0
Cfu : Flat Use Factor	1.0
Kf : Built-up columns	1.0
Use Cr : Repetitive ?	No

E : Modulus of Elasticity . . .

	x-x Bending	y-y Bending	Axial
Basic	1,600.0	1,600.0	1,600.0 ksi
Minimum	580.0	580.0	

Column Buckling Condition:
ABOUT X-X Axis: Lux = 10 ft, Kx = 1.0
ABOUT Y-Y Axis: Luy = 10 ft, Ky = 1.0

Applied Loads

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

Column self weight included : 35.761 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 10.0 ft, Xecc = 1.750 in, D = 1.0, Lr = 0.850, S = 1.150 k
BENDING LOADS . . .
Lat. Uniform Load creating Mx-x, L = 0.01750 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.8201 : 1**

Load Combination	+D+S
Governing NDS Forumla	Comp + Myy, NDS Eq. 3.9-3
Location of max.above base	9.933 ft
At maximum location values are .	
Applied Axial	2.186 k
Applied Mx	0.0 k-ft
Applied My	-0.3114 k-ft
Fc : Allowable	286.430 psi

PASS Maximum Shear Stress Ratio = **0.04419 : 1**

Load Combination	+D+L
Location of max.above base	0.0 ft
Applied Design Shear	11.932 psi
Allowable Shear	180.0 psi

Maximum SERVICE Lateral Load Reactions . .

Top along Y-Y	0.08750 k	Bottom along Y-Y	0.08750 k
Top along X-X	0.03135 k	Bottom along X-X	0.03135 k

Maximum SERVICE Load Lateral Deflections . . .

Along Y-Y 0.05980 in at 5.034 ft above base
for load combination : +D+L

Along X-X -0.1771 in at 5.839 ft above base
for load combination : +D+S

Other Factors used to calculate allowable stresses . . .

Bending	Compression	Tension

Load Combination Results

Load Combination	C_D	C_P	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Maximum Shear Ratios: Stress Ratio	Status	Location
D Only	0.900	0.212	0.3028	PASS	9.933 ft	0.008184	PASS	10.0 ft
+D+L	1.000	0.192	0.3448	PASS	6.779 ft	0.04419	PASS	0.0 ft
+D+Lr	1.250	0.155	0.5904	PASS	9.933 ft	0.01090	PASS	10.0 ft
+D+S	1.150	0.168	0.8201	PASS	9.933 ft	0.01377	PASS	10.0 ft
+D+0.750Lr+0.750L	1.250	0.155	0.4857	PASS	9.463 ft	0.02652	PASS	10.0 ft
+D+0.750L+0.750S	1.150	0.168	0.6394	PASS	9.933 ft	0.02882	PASS	10.0 ft
+0.60D	1.600	0.122	0.1299	PASS	0.0 ft	0.002762	PASS	10.0 ft

Wood Column

Project File: Ogden Community Services Building.ec6

LIC# : KW-06015170, Build:20.25.02.26 DUNN ASSOCIATES INC. (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Opening 3 Post

Maximum Reactions

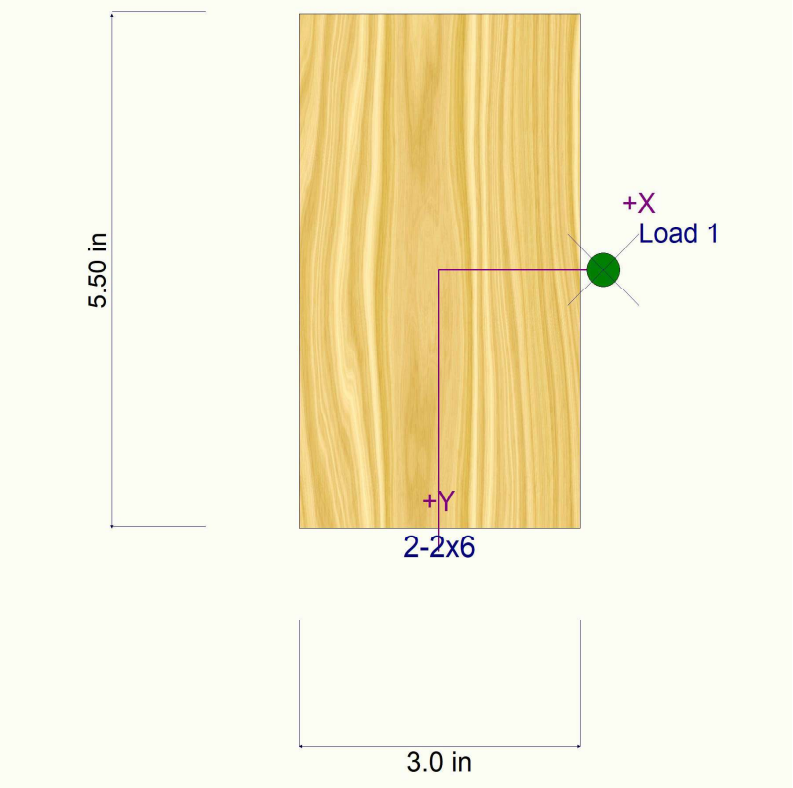
Note: Only non-zero reactions are listed.

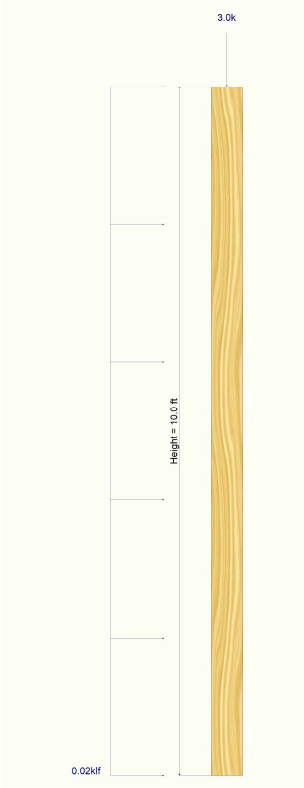
Load Combination	X-X Axis Reaction @ Base	@ Top	k Y-Y Axis Reaction @ Base	@ Top	Axial Reaction @ Base	My - End Moments @ Base	k-ft @ Top	Mx - End Moments @ Base	@ Top
D Only	-0.015	0.015			1.036				
+D+L	-0.015	0.015	0.088	0.088	1.036				
+D+Lr	-0.027	0.027			1.886				
+D+S	-0.031	0.031			2.186				
+D+0.750Lr+0.750L	-0.024	0.024	0.066	0.066	1.673				
+D+0.750L+0.750S	-0.027	0.027	0.066	0.066	1.898				
+0.60D	-0.009	0.009			0.621				
Lr Only	-0.012	0.012			0.850				
L Only			0.088	0.088					
S Only	-0.017	0.017			1.150				

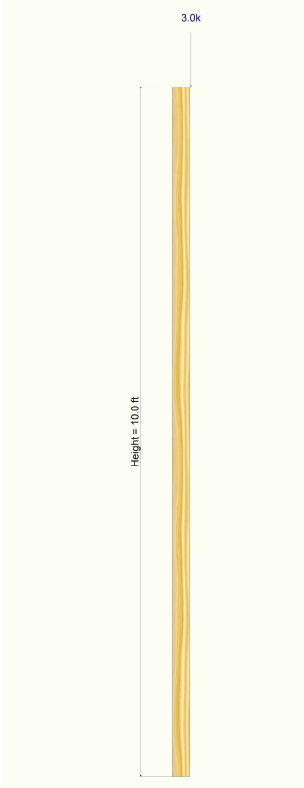
Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
D Only	-0.0824 in	5.839ft	0.000 in	0.000 ft
+D+L	-0.0824 in	5.839ft	0.060 in	5.034 ft
+D+Lr	-0.1524 in	5.839ft	0.000 in	0.000 ft
+D+S	-0.1771 in	5.839ft	0.000 in	0.000 ft
+D+0.750Lr+0.750L	-0.1349 in	5.839ft	0.045 in	5.034 ft
+D+0.750L+0.750S	-0.1534 in	5.839ft	0.045 in	5.034 ft
+0.60D	-0.0494 in	5.839ft	0.000 in	0.000 ft
Lr Only	-0.0700 in	5.839ft	0.000 in	0.000 ft
L Only	0.0000 in	0.000ft	0.060 in	5.034 ft
S Only	-0.0947 in	5.839ft	0.000 in	0.000 ft

Sketches





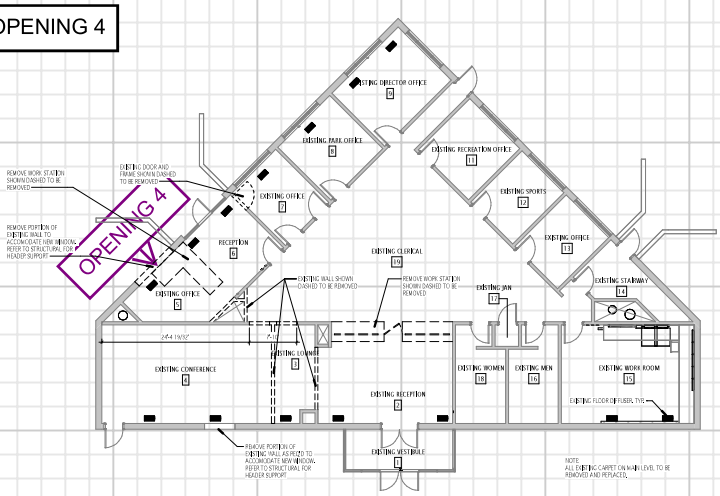


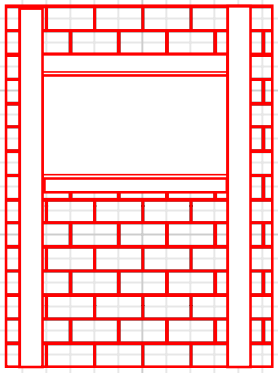
DUNN ASSOCIATES, INC
Consulting Structural Engineers

Sheet Number:	O-14
Job Number:	240268
Date:	
By:	CF

Title
OGDEN COMMUNITY SERVICES BUILDING

OPENING 4





OPENING 4

LOADS FROM JOIST 4
JOIST 4
DL = 0.32 klf
LLr = 0.28 klf
SL = 0.40 klf

6" BLOCK, 135 pcf, (6" * 1' / 12" * 135 pcf * 4 ft height) = 270 plf additional DL

SPAN = 9'-4"

FOR BEAM, USE L8x6x1/2

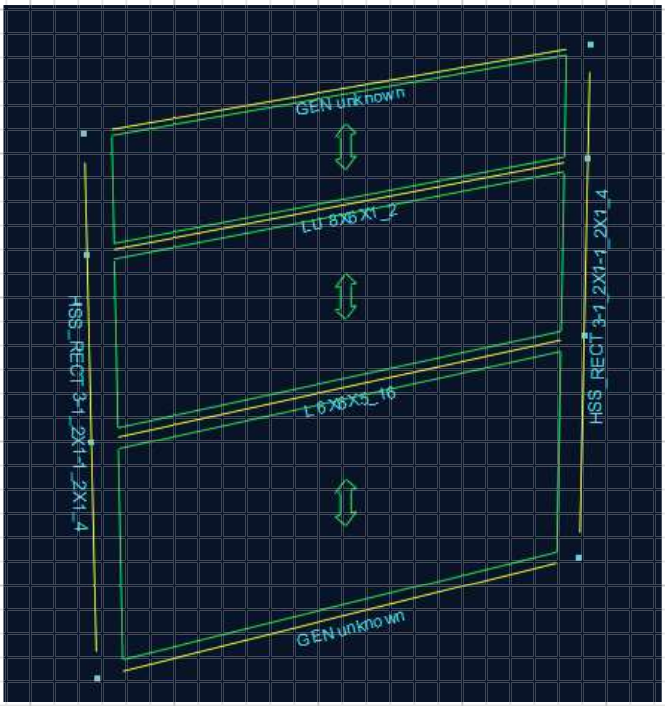
FOR POSTS, USE HSS3.1/2x2.1/2x1/4

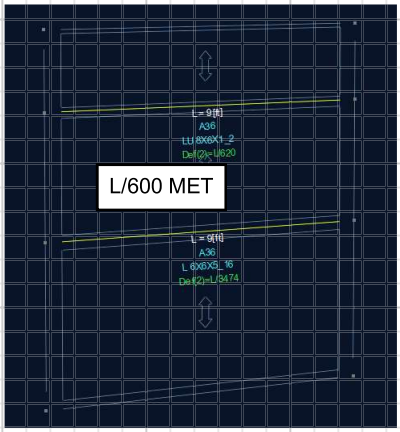
SEISMIC LOADS
EQ = $0.4S_{DS}W_P I_E$
EQ = 0.4 * 1.093 * 36 PSF * 1.0 = 15.74 psf

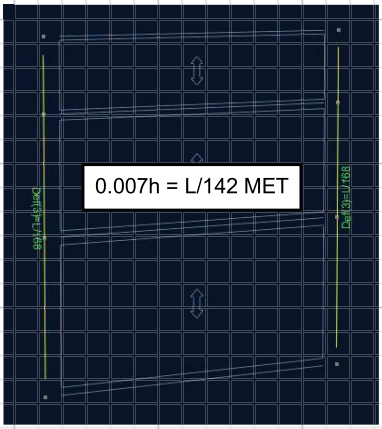
EQ = 0.4 * 1.093 * 15 PSF * 1.0 = 6.56 psf

EQ JAMB
BARS AT 48" O.C., ADD'L TRIB TO JAMB = 2 ft
2 ft * 15.74 psf = 31.48 psf

WL = 22.41 psf C&C
WL JAMB
2 ft * 22.11 psf = 44.82 psf







RAM Elements

Current Date: 3/11/2025 11:56 AM
Units system: English
File name: K:\2024\240268\Ram Elements\Tube Steel Analysis for opening 4.retx

Load data

Load Conditions

Condition	Description	Comb.	Category
D1	1.4DL	Yes	
D2	1.2DL+0.5Lr_or_S	Yes	
D3	1.2DL+1.6Lr_or_S	Yes	
D4	1.2DL+0.5W_OOP	Yes	
D5	1.2DL+1.6Lr_or_S+0.5W_OOP	Yes	
D6	1.2DL+W_OOP	Yes	
D7	1.2DL+0.5Lr_or_S+W_OOP	Yes	
D8	0.9DL+W_OOP	Yes	
D9	1.2DL+0.2Lr_or_S	Yes	
D10	1.4186DL+EQ_OOP	Yes	
D11	1.4186DL+0.2Lr_or_S+EQ_OOP	Yes	
D12	0.7DL+EQ_OOP	Yes	
S1	DL	Yes	
S2	DL+Lr_or_S	Yes	
S3	DL+0.75Lr_or_S	Yes	
S4	DL+0.6W_OOP	Yes	
S6	DL+0.75Lr_or_S+0.45W_OOP	Yes	
S7	0.6DL+0.6W_OOP	Yes	
S8	1.15302DL+0.7EQ_OOP	Yes	
S9	1.115DL+0.525EQ_OOP	Yes	
S10	DL+0.75Lr_or_S	Yes	
S11	1.115DL+0.75Lr_or_S+0.525EQ_OOP	Yes	
S12	0.44698DL+0.7EQ_OOP	Yes	

Glossary

Comb : Indicates if load condition is a load combination

RAM Elements

Current Date: 3/11/2025 11:58 AM
Units system: English
File name: K:\2024\240268\Ram Elements\Tube Steel Analysis for opening 4.retx

Load data

Load Conditions

Condition	Description	Comb.	Category
DL	Dead Load. Assumed SDS=1.093 in LCs with EQ	No	DL
Lr_or_S	Roof Live Load or Snow Load	No	SNOW
EQ_OOP	Out of Plane Earthquake Positive/Negative	No	EQ
W_OOP	Out of Plane Wind Positive/Negative	No	WIND

Distributed force on members

Condition	Member	Dir1	Val1 [Kip/ft]	Val2 [Kip/ft]	Dist1 [ft]	%	Dist2 [ft]	%
DL	9	Y	-0.32	-0.32	0.00	Yes	100.00	Yes
		Y	-0.27	-0.27	0.00	Yes	100.00	Yes
Lr_or_S	9	Y	-0.40	-0.40	0.00	Yes	100.00	Yes
EQ_OOP	7	Z	-0.0315	-0.0315	0.00	No	9.00	No
	8	Z	-0.0315	-0.0315	0.00	No	9.00	No
	9	Z	-0.0252	-0.0252	0.00	No	9.00	No
	10	Z	-0.0151	-0.0151	0.00	Yes	100.00	Yes
	11	Z	-0.0315	-0.0315	0.00	Yes	100.00	Yes
	12	Z	-0.0416	-0.0416	0.00	No	9.00	No
W_OOP	7	Z	-0.0448	-0.0448	0.00	No	9.00	No
	8	Z	-0.0448	-0.0448	0.00	No	9.00	No
	9	Z	-0.056	-0.056	0.00	No	9.00	No
	10	Z	-0.0215	-0.0215	0.00	Yes	100.00	Yes
	11	Z	-0.0448	-0.0448	0.00	Yes	100.00	Yes
	12	Z	-0.0794	-0.0794	0.00	No	9.00	No

Self weight multipliers for load conditions

Condition	Description	Self weight multiplier			
		Comb.	MultX	MultY	MultZ
DL	Dead Load. Assumed SDS=1.093 in LCs with EQ	No	0.00	-1.00	0.00
Lr_or_S	Roof Live Load or Snow Load	No	0.00	0.00	0.00
EQ_OOP	Out of Plane Earthquake Positive/Negative	No	0.00	0.00	0.00
W_OOP	Out of Plane Wind Positive/Negative	No	0.00	0.00	0.00

Glossary

Comb : Indicates if load condition is a load combination

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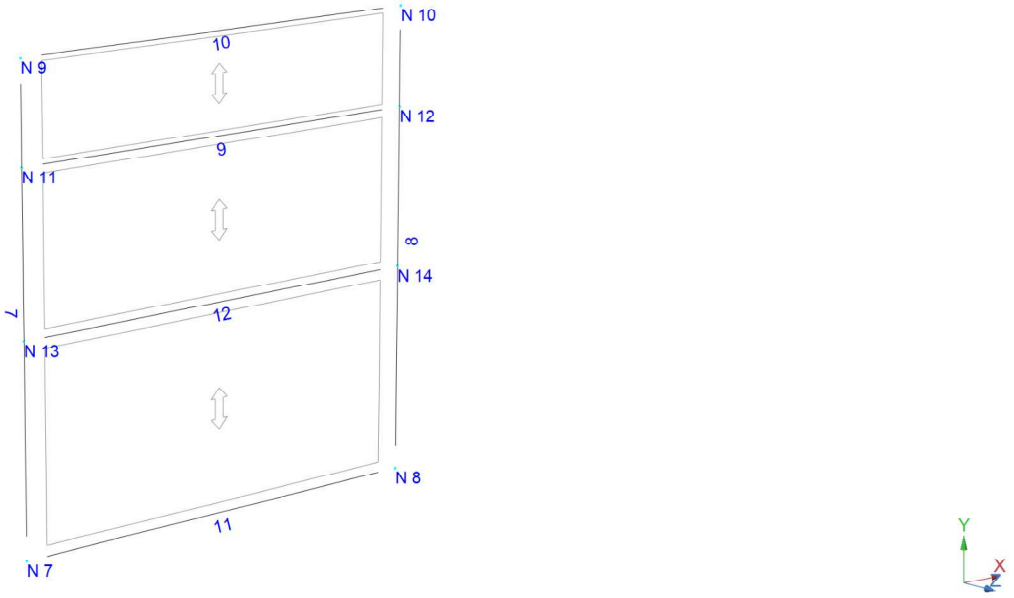

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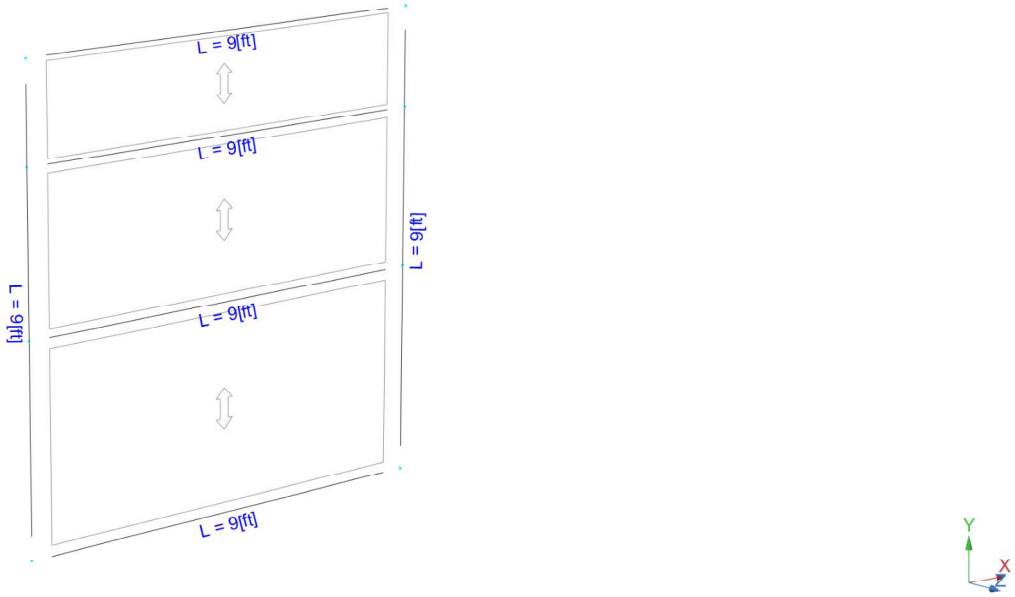

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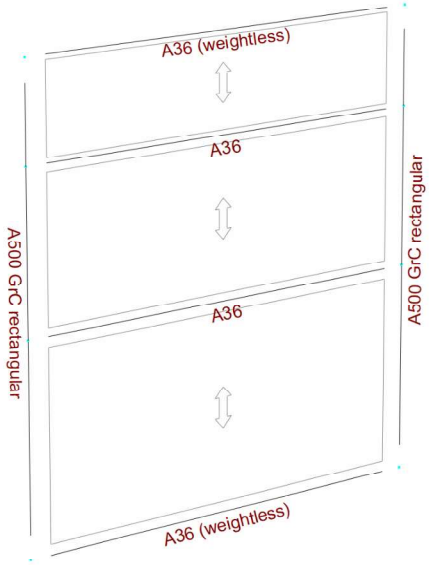

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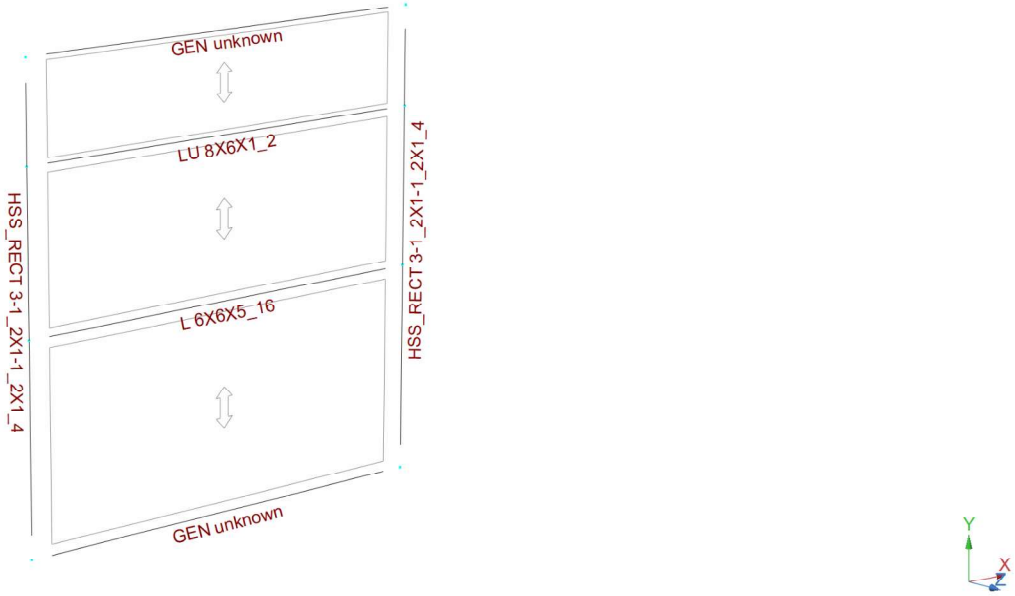
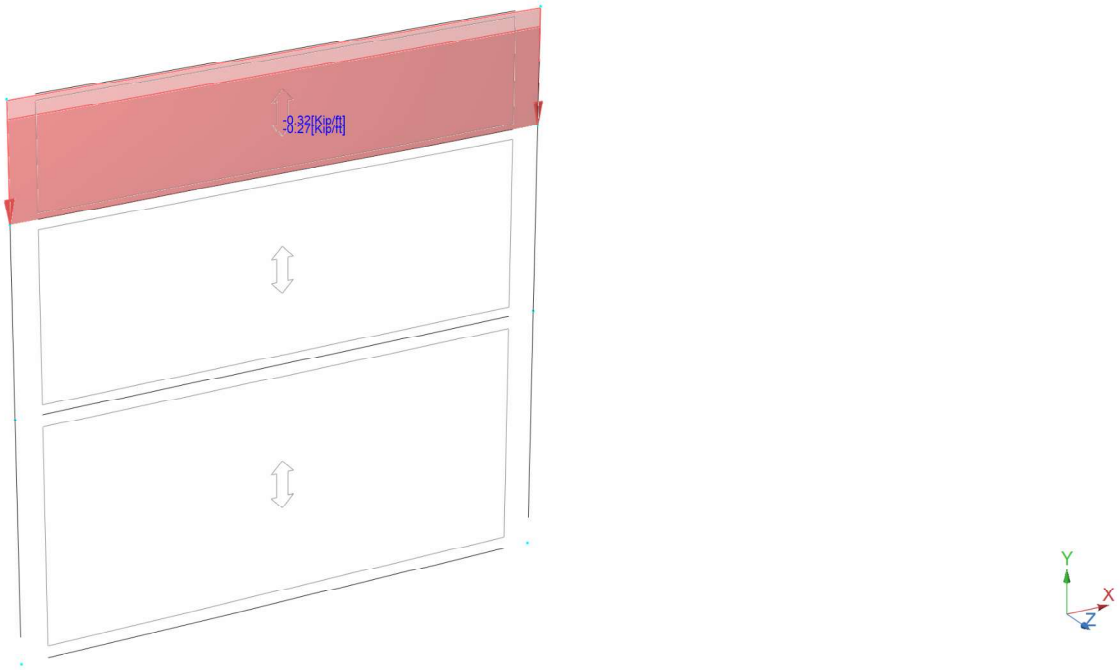


Current Date: 3/11/2025 12:04 PM
Units system: English
File name: K:\2024\240268\Ram Elements\Tube Steel Analysis for opening 4.retx
Load condition: DL=Dead Load. Assumed SDS=1.093 in LCs with EQ

Loads

Distributed user loads - Members



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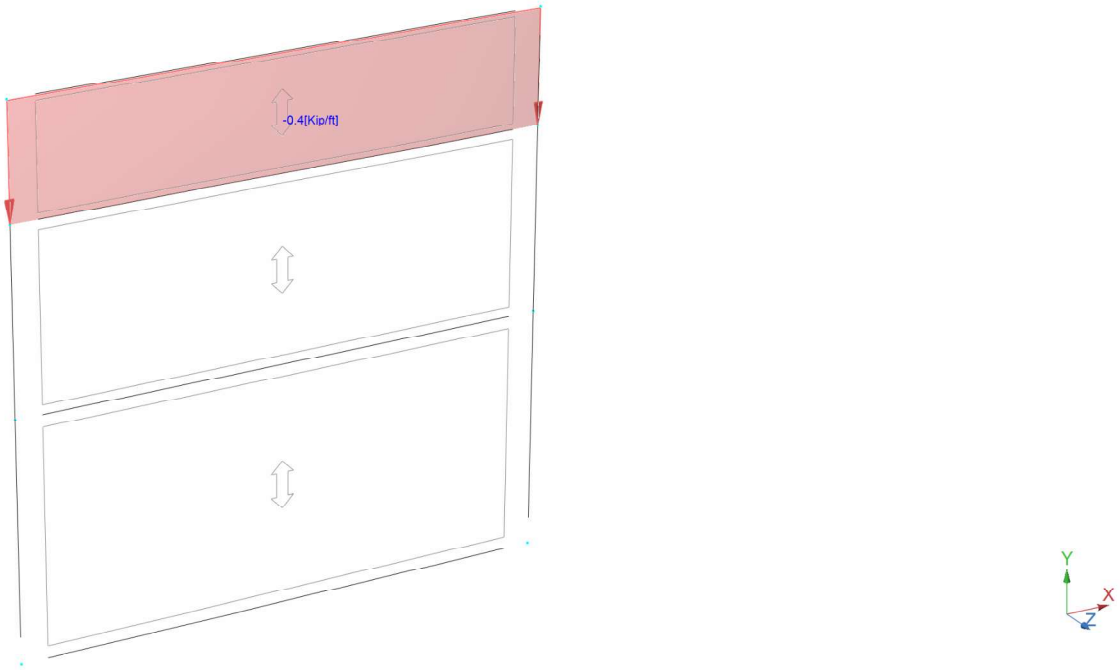
Units system: English
File name: K:\2024\240268\Ram Elements\Tube Steel Analysis for opening 4.retx
Load condition: Lr_or_S=Roof Live Load or Snow Load

Loads

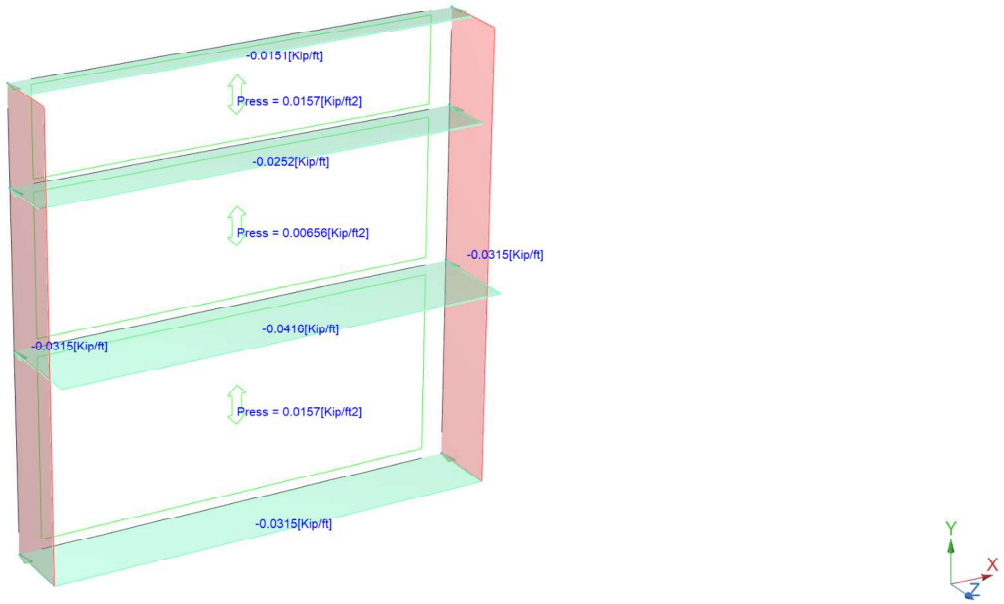
Distributed user loads - Members



Current Date: 3/11/2025 12:05 PM
Units system: English
File name: K:\2024\240268\Ram Elements\Tube Steel Analysis for opening 4.retx
Load condition: EQ_OOP=Out of Plane Earthquake Positive/Negative

Loads

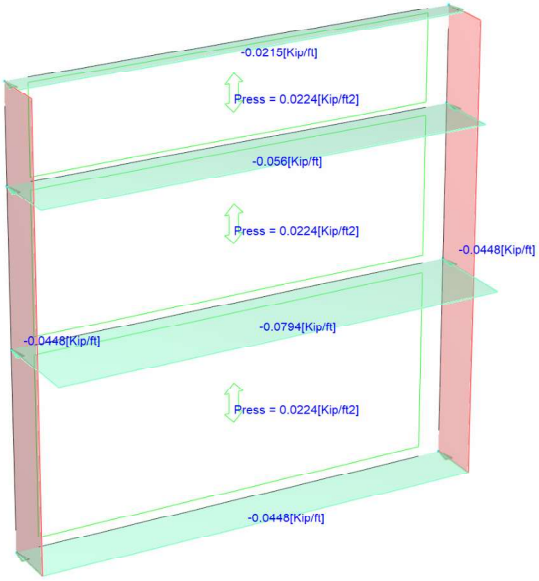
- Distributed user loads - Members
- Distributed area loads - Members



Current Date: 3/11/2025 12:05 PM
Units system: English
File name: K:\2024\240268\Ram Elements\Tube Steel Analysis for opening 4.retx
Load condition: W_OOP=Out of Plane Wind Positive/Negative

Loads

- Distributed user loads - Members
- Distributed area loads - Members



RAM Elements

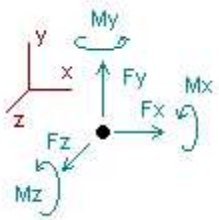
Current Date: 3/11/2025 12:06 PM
Units system: English
File name: K:\2024\240268\Ram Elements\Tube Steel Analysis for opening 4.retx

Analysis result

Nodes

Envelope for nodal reactions

Note.- **Ic** is the controlling load condition



Direction of positive forces and moments

Envelope of nodal reactions for :
S1=DL
S2=DL+Lr_or_S
S3=DL+0.75Lr_or_S
S4=DL+0.6W_OOP
S6=DL+0.75Lr_or_S+0.45W_OOP
S7=0.6DL+0.6W_OOP
S8=1.15302DL+0.7EQ_OOP
S9=1.115DL+0.525EQ_OOP
S10=DL+0.75Lr_or_S
S11=1.115DL+0.75Lr_or_S+0.525EQ_OOP
S12=0.44698DL+0.7EQ_OOP

		Forces						Moments					
Node		**Fx** [Kip]	**Ic**	**Fy** [Kip]	**Ic**	**Fz** [Kip]	**Ic**	**Mx** [Kip*ft]	**Ic**	**My** [Kip*ft]	**Ic**	**Mz** [Kip*ft]	**Ic**
7	Max	-0.013	S1	4.676	S2	0.393	S4	0.00000	S1	0.00000	S1	0.00000	S1
	Min	-0.028	S11	1.285	S12	0.000	S1	0.00000	S1	0.00000	S1	0.00000	S1
8	Max	0.028	S11	4.676	S2	0.393	S4	0.00000	S1	0.00000	S1	0.00000	S1
	Min	0.013	S1	1.285	S12	0.000	S1	0.00000	S1	0.00000	S1	0.00000	S1
9	Max	-0.001	S12	0.000	S1	0.393	S4	0.00000	S1	0.00000	S1	0.00000	S1
	Min	-0.053	S2	0.000	S1	0.000	S2	0.00000	S1	0.00000	S1	0.00000	S1
10	Max	0.053	S2	0.000	S1	0.393	S4	0.00000	S1	0.00000	S1	0.00000	S1
	Min	0.001	S12	0.000	S1	0.000	S2	0.00000	S1	0.00000	S1	0.00000	S1

RAM Elements

Current Date: 3/11/2025 12:07 PM
Units system: English
File name: K:\2024\240268\Ram Elements\Tube Steel Analysis for opening 4.retx

Steel Code Check
Summary - Group by member

Load conditions to be included in design :

D1=1.4DL
D2=1.2DL+0.5Lr_or_S
D3=1.2DL+1.6Lr_or_S
D4=1.2DL+0.5W_OOP
D5=1.2DL+1.6Lr_or_S+0.5W_OOP
D6=1.2DL+W_OOP
D7=1.2DL+0.5Lr_or_S+W_OOP
D8=0.9DL+W_OOP
D9=1.2DL+0.2Lr_or_S
D10=1.4186DL+EQ_OOP
D11=1.4186DL+0.2Lr_or_S+EQ_OOP
D12=0.7DL+EQ_OOP

Description	Section	Member	Ctrl Eq.	Ratio	Status	Reference
Bottom Angle	***L 6X6X5_16***	**12**	D7 at 50.00%	**0.16**	**OK**	
Columns	***HSS_RECT 3-1_2X1-1_2X1_4***	**7**	D7 at 44.44%	**0.70**	**OK**	
		8	D7 at 44.44%	0.70	OK	
Top Angle	***LU 8X6X1_2***	**9**	D5 at 50.00%	**0.80**	**OK**	

DUNN ASSOCIATES, INC
Consulting Structural Engineers

Title
OGDEN COMMUNITY SERVICES BUILDING

Sheet Number:	O-28
Job Number:	240268
Date:	
By:	CF

OPENING 4 DESIGN NARRATIVE

OPENING IN MASONRY WALL: OPENING 4

ALTERATION LEVEL 2

PER IEBC 2021

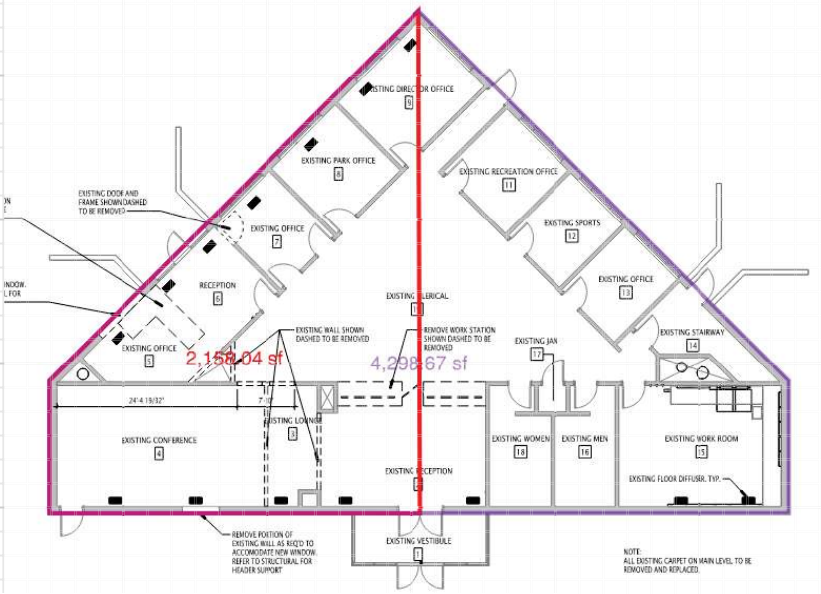
SECTION 603
ALTERATION—LEVEL 2

603.1 Scope. INSIGHTS

Level 2 *alterations* include the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment, and shall apply where the *work area* is equal to or less than 50 percent of the building area.

Exception: The movement or addition of nonfixed and movable fixtures, cases, racks, counters and partitions not over 5 feet 9 inches (1753 mm) in height shall not be considered a Level 2 *alteration*.

ADDITIONS OF WINDOWS AND DOORS, WORK AREA IS LESS THAN 50% OF BUILDING AREA



BASEMENT FLOOR: 4299 sq ft

MAIN FLOOR: 4299 sq ft

WORK AREA: 2158 sq ft

TOTAL AREA = 8598 sq ft

2158 / 8598 = 25% OF BUILDING AREA IS WORK AREA

FOR LEVEL 2 ALTERNATIONS

[BS] 805.3 Existing structural elements resisting lateral loads. INSIGHTS

Except as *permitted* by Section 805.4, where the *alteration* increases design lateral loads, or where the alteration results in prohibited structural irregularity as defined in ASCE 7, or where the *alteration* decreases the capacity of any existing lateral load-carrying structural element, the structure of the altered building or structure shall meet the requirements of Sections 1609 and 1613 of the *International Building Code*. Reduced seismic forces shall be permitted.

Exception: Any existing lateral load-carrying structural element whose demand-capacity ratio with the *alteration* considered is not more than 10 percent greater than its demand-capacity ratio with the *alteration* ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces in accordance with Sections 1609 and 1613 of the *International Building Code*. Reduced seismic forces shall be permitted. For purposes of this exception, comparisons of demand-capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of *additions* and *alterations* since original construction.

DUNN ASSOCIATES, INC
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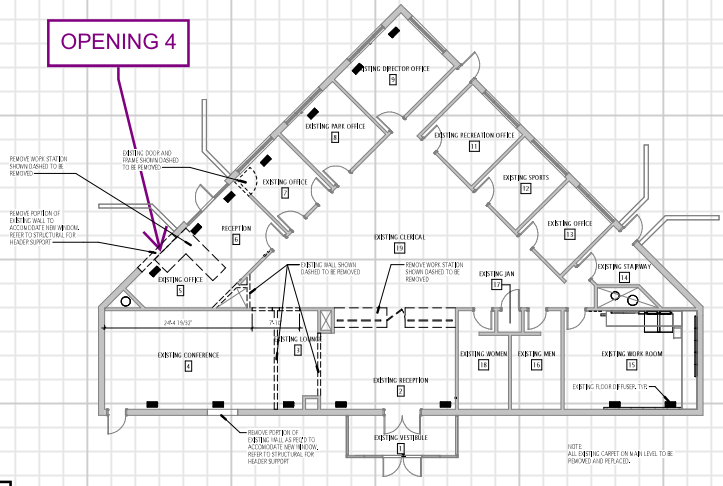
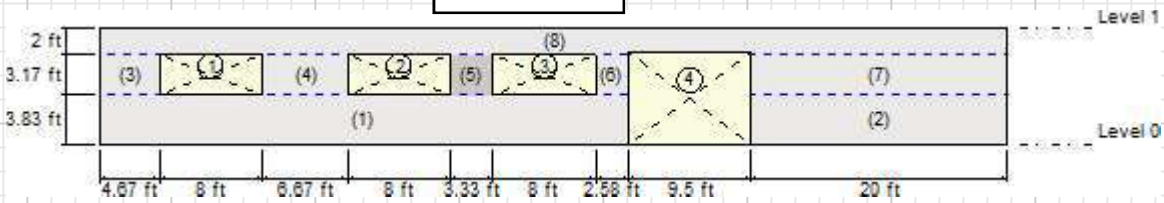
OPENING 4 DESIGN NARRATIVE



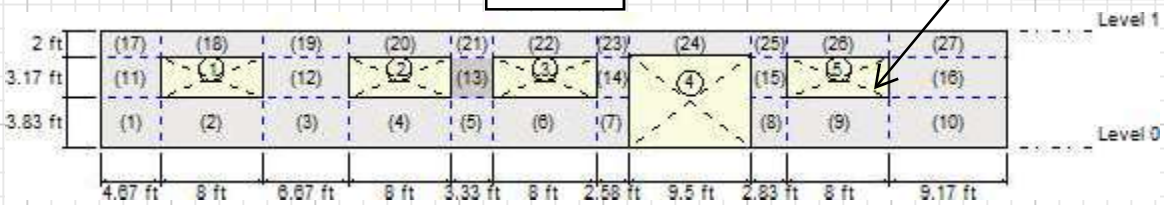
OPENING 4: CREATING NEW WINDOW IN MASONRY WALL

ORIGINAL WALL



NEW WALL

NEW OPENING



OPENING 4 DESIGN NARRATIVE

[BS] 304.3.2 Compliance with reduced seismic forces.

Where seismic evaluation and design is permitted to use reduced seismic forces, the criteria used shall be in accordance with one of the following:

1. The *International Building Code* using 75 percent of the prescribed forces. Values of R, Ω_0 and C_d used for analysis shall be as specified in Section 304.3.1 of this code.
2. Structures or portions of structures that comply with the requirements of the applicable chapter in Appendix A as specified in Items 2.1 through 2.4 and subject to the limitations of the respective Appendix A chapters shall be deemed to comply with this section.
   - 2.1. The seismic evaluation and design of unreinforced masonry bearing wall buildings in *Risk Category* I or II are permitted to be based on the procedures specified in Appendix Chapter A1.
   - 2.2. Seismic evaluation and design of the wall anchorage system in reinforced concrete and reinforced masonry wall buildings with flexible diaphragms in *Risk Category* I or II are permitted to be based on the procedures specified in Chapter A2.
   - 2.3. Seismic evaluation and design of cripple walls and sill plate anchorage in residential buildings of light-frame wood construction in *Risk Category* I or II are permitted to be based on the procedures specified in Chapter A3.
   - 2.4. Seismic evaluation and design of soft, weak or open-front wall conditions in multiple-unit residential buildings of wood construction in *Risk Category* I or II are permitted to be based on the procedures specified in Chapter A4.
3. ASCE 41, using the performance objective in Table 304.3.2 for the applicable *risk category*.

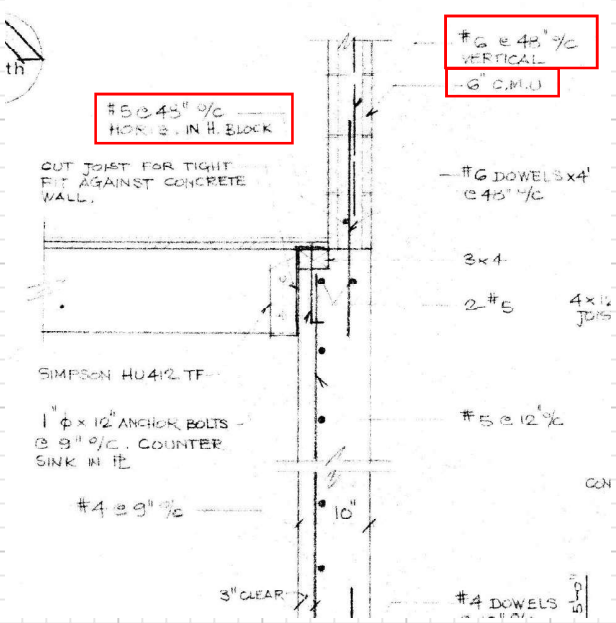
[BS] 304.3.1 Compliance with full seismic forces.

Where compliance requires the use of full seismic forces, the criteria shall be in accordance with one of the following:

1. One-hundred percent of the values in the *International Building Code*. Where the existing seismic force-resisting system is a type that can be designated as "Ordinary," values of R, Ω_0 and C_d used for analysis in accordance with Chapter 16 of the *International Building Code* shall be those specified for structural systems classified as "Ordinary" in accordance with Table 12.2-1 of ASCE 7, unless it can be demonstrated that the structural system will provide performance equivalent to that of a "Detailed," "Intermediate" or "Special" system.

DEFINED AS INTERMEDIATE WALL

PER TMS 7.3.2.5: Intermediate reinforced shear walls shall comply with the requirements of section 8.3. Reinforcement detailing shall also comply with the requirements of section 7.3.2.3.1, except that the spacing of vertical reinforcement shall not exceed 48 in.



6" CMU BLOCK
#6 AT 48" O.C. VERT
#5 AT 48" O.C. HORIZ

PER 7.3.2.5, VERTICAL REINFORCEMENT DOES NOT EXCEED 48" O.C.

PER 7.3.2.3.1,VERT REINF. MUST MEET 0.2 in^2 in area not spaced more than 120 in.
0.44 in^2 AT 48" O.C. meets this.

PER 7.3.2.3.1, HORIZ REINF. MUST MEET 0.2 in^2 in area not spaced more than 120 in.
0.31 in^2 AT 48" O.C. meets this.

MASONRY

1. ALL MASONRY SHALL BE REINFORCED WITH BOTH HORIZONTAL AND VERTICAL REINFORCEMENT. ALL BLOCK CELLS OR BRICK CAVITIES WITH REINFORCEMENT SHALL BE GROUTED FULL USING CONCRETE GROUT: 2000 PSI. CELLS SHALL BE ALIGNED TO PRESERVE UNOBSTRUCTED VERTICAL CAVITIES OF 2" X 3" MINIMUM.
2. ADDITIONAL VERTICAL BARS OF MATCHING WALL REINFORCING SHALL BE PLACED AT CORNERS AND JAMBS OF ALL OPENINGS.
3. HORIZONTAL BARS SHALL BE PLACED IN BOND BEAMS FILLED WITH GROUT AT THE TOP OF ALL WALLS AND AT 48" O.C. MAXIMUM BETWEEN TOP OF WALL AND FOUNDATION. BOND BEAM UNITS SHALL CONTINUE UNINTERRUPTED AROUND ALL CORNERS AND WALL INTERSECTIONS. WHERE STRUCTURAL STEEL COLUMNS OR BEAMS INTERRUPT THE CONTINUITY OF A BOND BEAM DOWELS MATCHING BOND BEAM REINFORCEMENT SHALL BE WELDED TO THE STRUCTURAL STEEL TO PROVIDE CONTINUITY. PLACE 9 GAUGE DURO-WALL (OR EQUAL) AT 16" O.C. AS SHOWN ON DRAWINGS. REFER TO TYPICAL DETAILS FOR CORNER BARS.

MASONRY GSN ON DRAWINGS LISTS THAT ADD'L VERT BARS REQ NEXT TO OPENINGS AND CORNERS

DUNN ASSOCIATES, INC
Consulting Structural Engineers

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OPENING 4 DESIGN NARRATIVE

WALL ANALYZED AS INTERMEDIATE WALL WITH 75% OF SEISMIC FORCES

178 PLF, CALCULATION BELOW FOR MASS TRIBUTARY TO SHEAR WALL

Table 3—6-in. (152-mm) Single Wythe Wall Weights

Units	Vertical grout spacing, in.(mm)	Mortar bedding	Wall weight, lb/ft^2 (kg/m^2) for concrete densities, lb/ft^3 (kg/m^3) of: 85 (1,362)	95 (1,522)	105 (1,682)	115 (1,842)	125 (2,003)	135 (2,163)
Hollow	No grout	Face shell	20 (98)	22 (108)	24 (117)	26 (127)	28 (137)	30 (147)
Hollow	No grout	Full	20 (98)	22 (108)	24 (117)	26 (127)	28 (137)	31 (151)
Solid	No grout	Full	42 (205)	46 (225)	50 (244)	55 (269)	59 (288)	63 (308)
Hollow	8 (203)	Full	53 (259)	56 (274)	58 (283)	60 (293)	62 (303)	64 (313)
Hollow	16 (406)	Face shell	37 (181)	39 (191)	41 (200)	43 (210)	45 (220)	47 (230)
Hollow	24 (610)	Face shell	31 (151)	33 (161)	35 (171)	37 (181)	39 (191)	41 (200)
Hollow	32 (812)	Face shell	28 (137)	30 (147)	32 (156)	34 (166)	37 (181)	39 (191)
Hollow	40 (1,016)	Face shell	26 (127)	29 (142)	31 (151)	33 (161)	35 (171)	37 (181)
Hollow	48 (1,219)	Face shell	25 (122)	27 (132)	30 (147)	32 (156)	34 (166)	36 (176)

Seismic Analysis

Sds =	1.093	g
R =	3.5	For Intermediate Masonry Shear Walls
Cs =	0.312	

Roof Area	2110	ft^2
DL_{ROOF} =	20	psf

Roof Weight

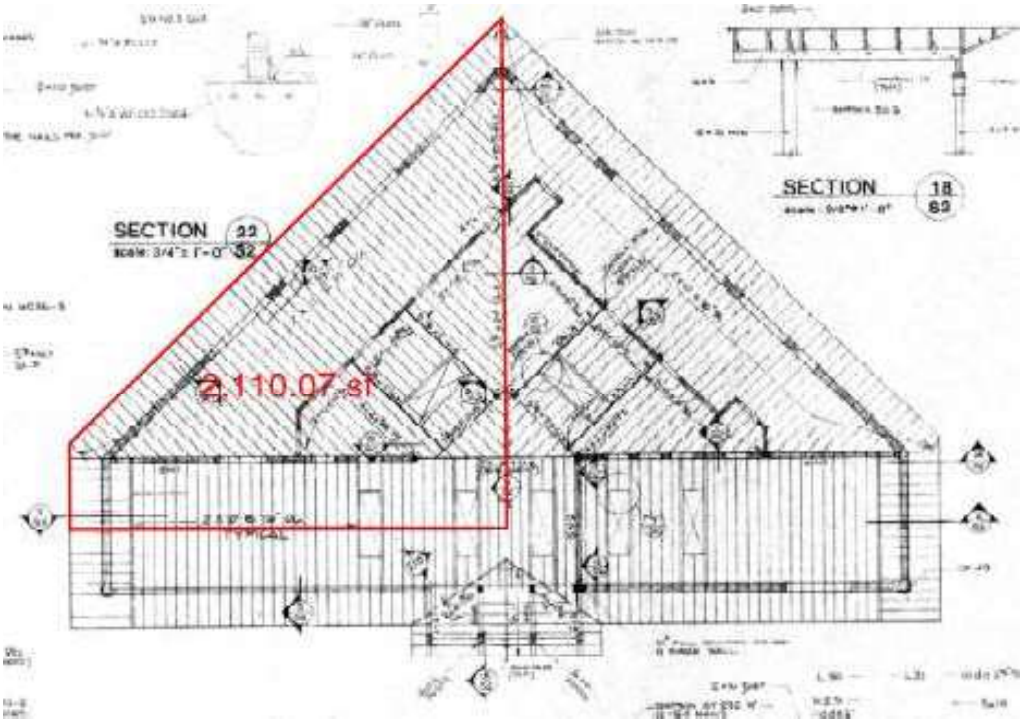
42200	lb

DL_{WALL} =	36	psf
Wall Height =	9	ft
Wall Length	70.75	ft
Trib Height =	4.5	ft^2

Wall Weight

11462	lb
53662	lb Total

V =	758	plf over 70.75 ft Wall length
$0.75*C_s*V$ =	178	plf over 70.75 ft Wall length



RAM Elements

Current Date: 2/21/2025 10:16 AM
Units system: English
File name: K:\2024\240268\Ram Elements\Masonry Opening 4 - Full Wall Design - Pre Opening.msw

Design Results
Masonry wall

MASONRY SHEAR WALL (INTERMEDIATE) DESIGN ANALYSIS - EXISTING CONDITION

General Information

Global status : Warnings in design

Design code	:	TMS 402-16 ASD

Materials:

Material	:	CMU 2.0-60
Mortar type	:	Port/Mort - M/S
Grouting type	:	Partial grouting
Mortar bed type	:	Full bed
Masonry compression strength (F`m)	:	2 [Kip/in2]
Steel tension strength (fy)	:	60 [Kip/in2]
Steel allowable tension strength (Fs)	:	32 [Kip/in2]
Steel elasticity modulus (Es)	:	29000 [Kip/in2]
Masonry elasticity modulus (Em)	:	1800 [Kip/in2]
Masonry unit weight	:	0.135 [Kip/ft3]

Seismic data:

Seismic design category	:	SDC D
Response modification factor	:	1.00
Shear wall type	:	Intermediate

Geometry

Total height	:	9.00 [ft]
Total length	:	70.75 [ft]
Foundation type	:	Continuous
Wall bottom restraint	:	Pinned
Column bottom restraint	:	Fixed
Rigidity elements	:	None

Number of stories: 1

Story	Story height [ft]	Wall thickness [in]	Effective unit weight [Kip/ft3]
1	9.00	5.63	0.08

Openings:

Reference	X Coordinate [ft]	Y Coordinate [ft]	Width [ft]	Height [ft]
Lower left	4.67	3.83	8.00	3.17
Lower left	19.33	3.83	8.00	3.17
Lower left	30.67	3.83	8.00	3.17
Lower left	41.25	0.00	9.50	7.17

Load Conditions

ID	Comb.	Category	Description
DL	No	DL	Dead Load
LLr	No	LLR	Live Load Roof
SL	No	SNOW	Snow Load
EQpos	No	EQ	Seismic In Plane Pos
EQneg	No	EQ	Sesimic In Plane Neg
H	No	EARTH	Soil pressures
D1	Yes		1.4DL
D2	Yes		1.2DL+0.5LLr
D3	Yes		1.2DL+0.5SL
D4	Yes		1.2DL+1.6LLr
D5	Yes		1.2DL+1.6SL
D6	Yes		1.2DL+0.2SL
D7	Yes		1.4186DL+EQpos
D8	Yes		1.4186DL+EQneg
D9	Yes		1.4186DL+0.2SL+EQpos
D10	Yes		1.4186DL+0.2SL+EQneg
D11	Yes		1.1186DL+EQpos
D12	Yes		1.1186DL+EQneg
S1	Yes		DL
S2	Yes		DL+LLr
S3	Yes		DL+SL
S4	Yes		DL+0.75LLr
S5	Yes		DL+0.75SL
S6	Yes		1.15302DL+0.7EQpos
S7	Yes		1.15302DL+0.7EQneg
S8	Yes		1.114765DL+0.525EQpos
S9	Yes		1.11477DL+0.525EQneg
S10	Yes		DL+0.75SL
S11	Yes		1.11477DL+0.75SL+0.525EQpos
S12	Yes		1.11477DL+0.75SL+0.525EQneg
S13	Yes		0.44698DL+0.7EQpos
S14	Yes		0.44698DL+0.7EQneg
D13	Yes		1.4186DL+EQpos
D14	Yes		1.4186DL+EQneg
D15	Yes		1.4186DL+0.2SL+EQpos
D16	Yes		1.4186DL+0.2SL+EQneg
D17	Yes		1.1186DL+EQpos
D18	Yes		1.1186DL+EQneg
D19	Yes		1.1186DL+EQpos+1.6H
D20	Yes		1.1186DL+EQneg+1.6H
D21	Yes		1.1186DL+EQpos+0.9H
D22	Yes		1.1186DL+EQneg+0.9H
S15	Yes		DL
S16	Yes		DL+LLr
S17	Yes		DL+SL
S18	Yes		DL+0.75LLr
S19	Yes		DL+0.75SL
S20	Yes		1.15302DL+0.7EQpos
S21	Yes		1.15302DL+0.7EQneg
S22	Yes		1.15302DL+0.7EQpos+H
S23	Yes		1.15302DL+0.7EQneg+H
S24	Yes		1.15302DL+0.7EQpos+0.6H
S25	Yes		1.15302DL+0.7EQneg+0.6H
S26	Yes		1.11477DL+0.525EQpos
S27	Yes		1.11477DL+0.525EQneg
S28	Yes		DL+0.75SL
S29	Yes		1.11477DL+0.75SL+0.525EQpos
S30	Yes		1.11477DL+0.75SL+0.525EQneg
S31	Yes		0.44698DL+0.7EQpos
S32	Yes		0.44698DL+0.7EQneg

S33	Yes	0.44698DL+0.7EQpos+H
S34	Yes	0.44698DL+0.7EQneg+H
S35	Yes	0.44698DL+0.7EQpos+0.6H
S36	Yes	0.44698DL+0.7EQneg+0.6H

Loads

Distributed loads:

Consider self weight : DL

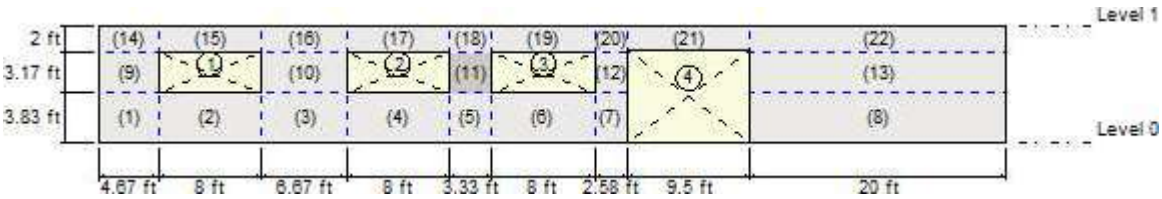
Story	Condition	Direction	Magnitude [Kip/ft]	Eccentricity [ft]
1	DL	Vertical	0.19	0.00
1	LLr	Vertical	0.16	0.00
1	SL	Vertical	0.22	0.00
1	EQpos	Horizontal	0.18	0.00
1	EQneg	Horizontal	-0.18	0.00

Out-of-plane loads:

Story	Condition	Magnitude [Kip/ft2]
1	H	0.02
Parapet	H	0.02

Bearing Wall Design

Status : OK



Geometry

Level	Segment	X Coordinate [ft]	Y Coordinate [ft]	Width [ft]	Height [ft]
0	1	0.00	0.00	4.67	3.83
	2	4.67	0.00	8.00	3.83
	3	12.67	0.00	6.67	3.83
	4	19.33	0.00	8.00	3.83
	5	27.33	0.00	3.33	3.83
	6	30.67	0.00	8.00	3.83
	7	38.67	0.00	2.58	3.83
	8	50.75	0.00	20.00	3.83
	9	0.00	3.83	4.67	3.17
	10	12.67	3.83	6.67	3.17
	11	27.33	3.83	3.33	3.17
	12	38.67	3.83	2.58	3.17
	13	50.75	3.83	20.00	3.17
	14	0.00	7.00	4.67	2.00
	15	4.67	7.00	8.00	2.00

16	12.67	7.00	6.67	2.00
17	19.33	7.00	8.00	2.00
18	27.33	7.00	3.33	2.00
19	30.67	7.00	8.00	2.00
20	38.67	7.00	2.58	2.00
21	41.25	7.00	9.50	2.00
22	50.75	7.00	20.00	2.00

Vertical reinforcement

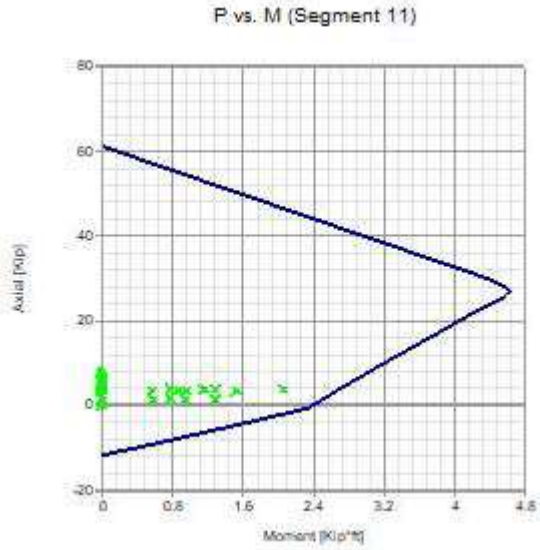
Segment	Bars	Spacing [in]	Ld [in]
1	2-#6	48.00	63.77
2	2-#6	48.00	63.77
3	2-#6	48.00	63.77
4	2-#6	48.00	63.77
5	1-#6	48.00	63.77
6	2-#6	48.00	63.77
7	1-#6	48.00	63.77
8	5-#6	48.00	63.77
9	2-#6	48.00	63.77
10	2-#6	48.00	63.77
11	1-#6	48.00	63.77
12	1-#6	48.00	63.77
13	5-#6	48.00	63.77
14	2-#6	48.00	63.77
15	2-#6	48.00	63.77
16	2-#6	48.00	63.77
17	2-#6	48.00	63.77
18	1-#6	48.00	63.77
19	2-#6	48.00	63.77
20	1-#6	48.00	63.77
21	3-#6	48.00	63.77
22	5-#6	48.00	63.77

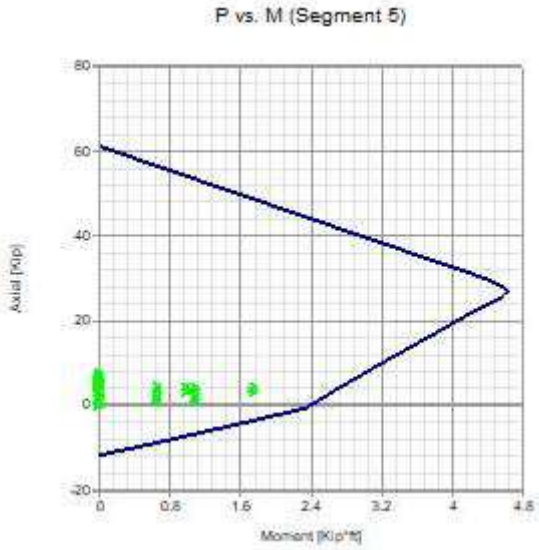
Combined axial flexure

Segment	Condition	P [Kip]	M [Kip*ft]	Ma [Kip*ft]	Ratio
1	D19(Max)	1.91	-1.56	3.49	0.45
2	D19(Top)	2.65	-1.53	5.93	0.26
3	D19(Top)	4.01	-2.66	5.09	0.52
4	D20(Top)	2.23	-1.87	5.90	0.32
5	D19(Top)	3.14	-1.75	2.63	0.66
6	D20(Max)	2.91	-1.47	5.95	0.25
7	D20(Top)	3.99	-1.34	2.17	0.62
8	D20(Top)	9.88	-5.45	15.09	0.36
9	D19(Bottom)	2.64	-1.95	3.55	0.55
10	D20(Max)	5.15	-3.12	5.18	0.60
11	D20(Max)	3.77	-2.05	2.68	0.76
12	D20(Bottom)	3.61	-1.36	2.13	0.64
13	D20(Max)	8.93	-5.98	15.02	0.40
14	D19(Max)	2.00	-1.17	3.50	0.33
15	D19(Max)	2.59	-0.73	5.93	0.12
16	D20(Bottom)	4.17	-1.99	5.10	0.39
17	D20(Max)	2.90	-1.20	5.95	0.20
18	D20(Bottom)	3.28	-1.22	2.64	0.46
19	D19(Max)	2.18	-0.79	5.90	0.13

20	D19(Max)	3.51	-1.02	2.13	0.48
21	D19(Max)	2.86	-0.57	7.02	0.08
22	D20(Bottom)	6.79	-4.28	14.85	0.29

Interaction diagrams, P vs. M





Axial compression

Segment	Condition	P [Kip]	Pa [Kip]	Ratio
1	D5(Bottom)	6.96	74.94	0.09
2	D5(Bottom)	6.51	128.47	0.05
3	D5(Bottom)	11.11	107.06	0.10
4	D5(Bottom)	8.26	128.47	0.06
5	D5(Top)	7.77	40.82	0.19
6	D5(Bottom)	14.73	128.47	0.11
7	D5(Top)	8.69	31.64	0.27
8	D5(Bottom)	22.37	321.18	0.07
9	D5(Bottom)	6.38	74.94	0.09
10	D5(Bottom)	10.71	107.06	0.10
11	D5(Bottom)	8.09	40.82	0.20
12	D5(Bottom)	8.05	31.64	0.25
13	D5(Bottom)	19.04	321.18	0.06
14	D5(Bottom)	5.02	74.94	0.07
15	D5(Bottom)	6.44	128.47	0.05
16	D5(Bottom)	9.83	107.06	0.09
17	D5(Bottom)	7.00	128.47	0.05
18	D5(Bottom)	7.76	40.82	0.19
19	D5(Top)	9.78	128.47	0.08
20	D5(Bottom)	8.04	31.64	0.25
21	D5(Top)	8.89	152.56	0.06
22	D5(Bottom)	16.28	321.18	0.05

Axial tension

Segment	Condition	ft [Kip/in2]	Fs [Kip/in2]	Ratio
1	D1(Top)	0.00	32.00	0.00
2	D1(Top)	0.00	32.00	0.00
3	D1(Top)	0.00	32.00	0.00
4	D1(Top)	0.00	32.00	0.00
5	D1(Top)	0.00	32.00	0.00
6	D1(Top)	0.00	32.00	0.00
7	D1(Top)	0.00	32.00	0.00
8	D1(Top)	0.00	32.00	0.00
9	D1(Top)	0.00	32.00	0.00
10	D1(Top)	0.00	32.00	0.00
11	D1(Top)	0.00	32.00	0.00
12	D1(Top)	0.00	32.00	0.00
13	D1(Top)	0.00	32.00	0.00
14	D1(Top)	0.00	32.00	0.00
15	D1(Top)	0.00	32.00	0.00
16	D1(Top)	0.00	32.00	0.00
17	D1(Top)	0.00	32.00	0.00
18	D1(Top)	0.00	32.00	0.00
19	D1(Top)	0.00	32.00	0.00
20	D1(Top)	0.00	32.00	0.00
21	D1(Top)	0.00	32.00	0.00
22	D1(Top)	0.00	32.00	0.00

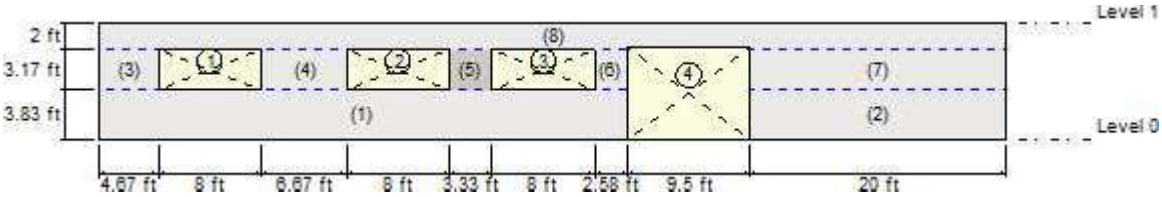
Shear

Segment	Condition	fv [Kip/in2]	Fv [Kip/in2]	Ratio
1	D19(Bottom)	0.005	0.093	0.05
2	D19(Bottom)	0.004	0.092	0.04
3	D19(Bottom)	0.006	0.095	0.06
4	D20(Bottom)	0.004	0.092	0.04
5	D19(Bottom)	0.006	0.095	0.07
6	D20(Bottom)	0.005	0.090	0.05
7	D20(Bottom)	0.006	0.091	0.06
8	D20(Bottom)	0.004	0.094	0.04
9	D19(Top)	0.002	0.054	0.04
10	D20(Top)	0.002	0.055	0.04
11	D20(Top)	0.003	0.058	0.05
12	D20(Top)	0.002	0.060	0.04
13	D20(Top)	0.002	0.053	0.03
14	D19(Top)	0.005	0.061	0.08
15	D19(Top)	0.002	0.065	0.03
16	D19(Top)	0.005	0.060	0.08
17	D19(Top)	0.003	0.066	0.05
18	D19(Top)	0.006	0.060	0.10
19	D19(Max)	0.004	0.052	0.07
20	D19(Bottom)	0.002	0.060	0.04
21	D20(Top)	0.003	0.062	0.05
22	D20(Top)	0.004	0.060	0.06

Shear Wall Design

PER TMS 2016 AND IEBC 2021, EXISTING WALL REINFORCEMENT PROVDIES PERFORMANCE OF INTERMEDIATE WALL

Status : Warnings in design
- Invalid wall type for the seismic design category, TMS 402-16 ASD, 7.3.2, 7.4.1 (Segment 1)



Geometry

Level	Segment	X Coordinate [ft]	Y Coordinate [ft]	Width [ft]	Height [ft]
0	1	0.00	0.00	41.25	3.83
	2	50.75	0.00	20.00	3.83
	3	0.00	3.83	4.67	3.17
	4	12.67	3.83	6.67	3.17
	5	27.33	3.83	3.33	3.17
	6	38.67	3.83	2.58	3.17
	7	50.75	3.83	20.00	3.17
	8	0.00	7.00	70.75	2.00

Reinforcement

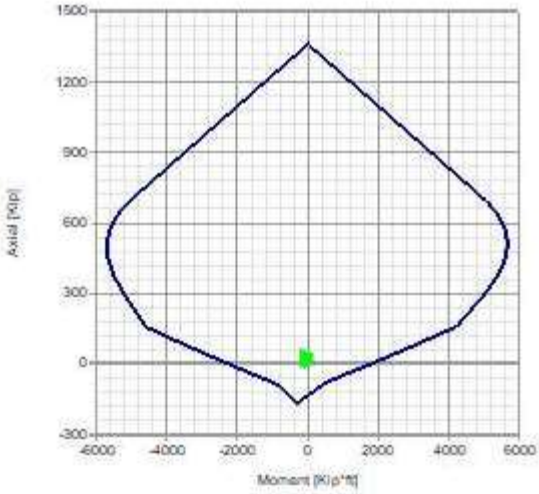
	Vertical reinforcement			Horizontal reinforcement		
Segment	Bars	Spacing [in]	Ld [in]	Bars	Spacing [in]	Ld [in]
1	2-#6	48.00	63.77	1-#6	48.00	63.77
	2-#6	48.00	63.77	1-#6	48.00	63.77
	2-#6	48.00	63.77	1-#6	48.00	63.77
	2-#6	48.00	63.77	1-#6	48.00	63.77
	1-#6	48.00	63.77	1-#6	48.00	63.77
	2-#6	48.00	63.77	1-#6	48.00	63.77
	1-#6	48.00	63.77	1-#6	48.00	63.77
2	5-#6	48.00	63.77	1-#6	48.00	63.77
3	2-#6	48.00	63.77	1-#6	48.00	63.77
4	2-#6	48.00	63.77	1-#6	48.00	63.77
5	1-#6	48.00	63.77	1-#6	48.00	63.77
6	1-#6	48.00	63.77	1-#6	48.00	63.77
7	5-#6	48.00	63.77	1-#6	48.00	63.77
8	2-#6	48.00	63.77	1-#6	48.00	63.77
	2-#6	48.00	63.77	1-#6	48.00	63.77
	2-#6	48.00	63.77	1-#6	48.00	63.77
	2-#6	48.00	63.77	1-#6	48.00	63.77
	1-#6	48.00	63.77	1-#6	48.00	63.77
	2-#6	48.00	63.77	1-#6	48.00	63.77
	1-#6	48.00	63.77	1-#6	48.00	63.77
	3-#6	48.00	63.77	1-#6	48.00	63.77
	5-#6	48.00	63.77	1-#6	48.00	63.77

Combined axial flexure

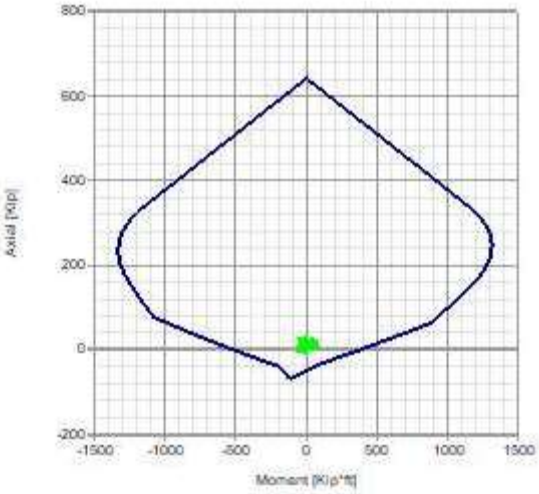
Segment	Condition	P [Kip]	M [Kip*ft]	Ma [Kip*ft]	Ratio
1	D9(Bottom)	29.82	-88.68	2721.19	0.03
2	D22(Bottom)	12.47	49.21	481.33	0.10
3	D9(Bottom)	3.86	-6.63	64.55	0.10
4	D22(Bottom)	5.15	9.23	72.16	0.13
5	S36(Bottom)	1.50	2.50	3.63	0.69
6	S36(Bottom)	1.41	1.70	2.95	0.58
7	D10(Bottom)	13.05	36.72	485.98	0.08
8	D22(Bottom)	20.71	25.87	5727.37	0.00

Interaction diagrams, P vs. M

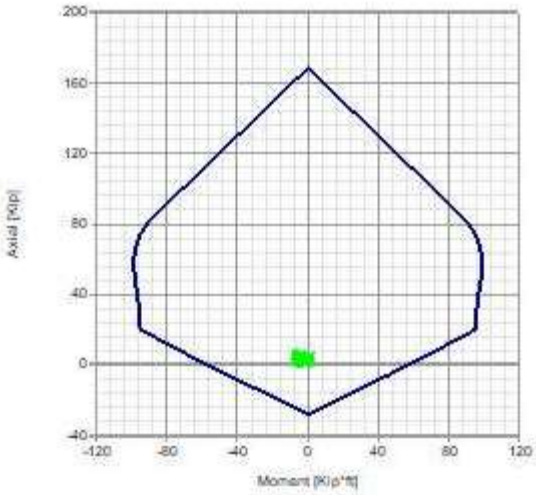
P vs. M (Segment 1)



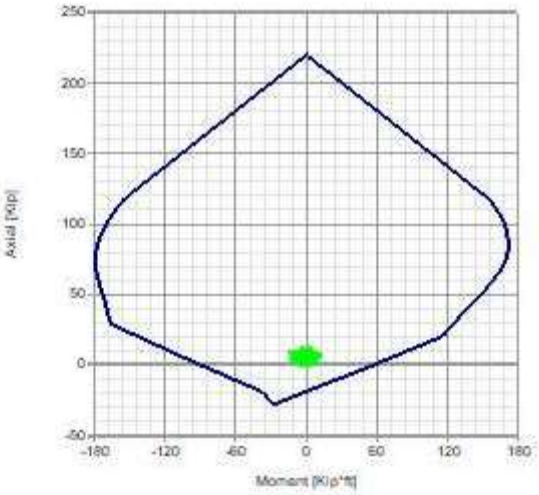
P vs. M (Segment 2)



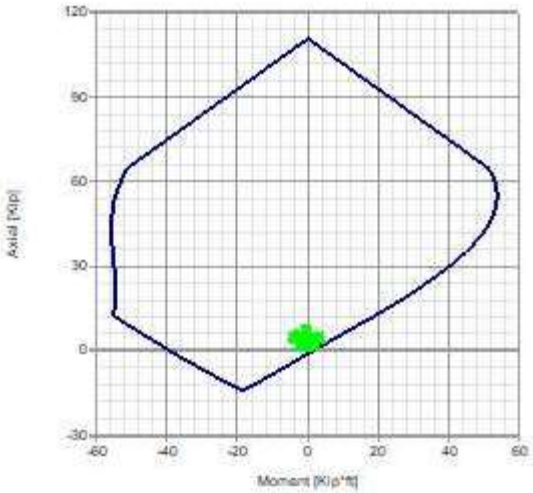
P vs. M (Segment 3)



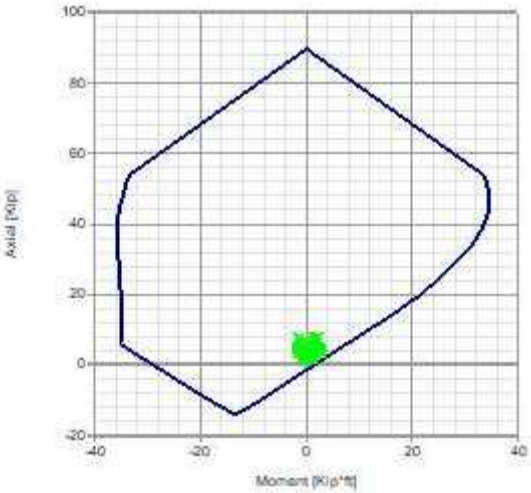
P vs. M (Segment 4)

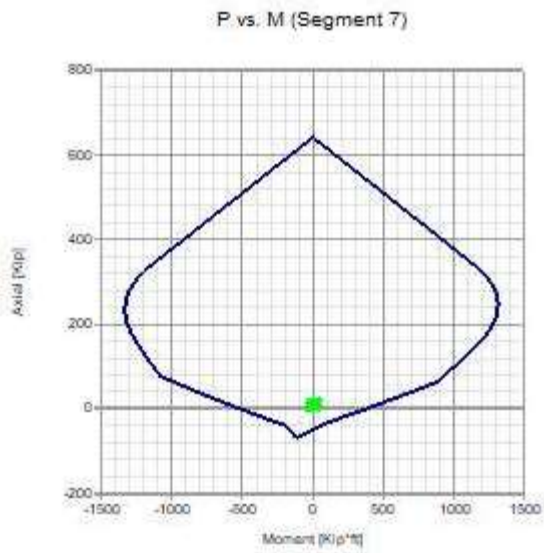


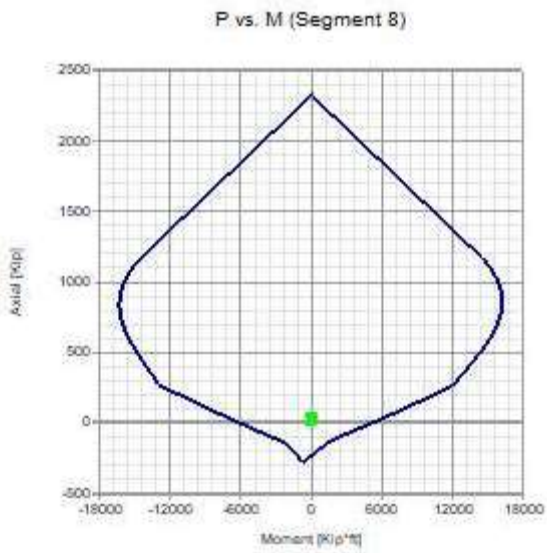
P vs. M (Segment 5)



P vs. M (Segment 6)







Axial compression

Segment	Condition	P [Kip]	Pa [Kip]	Ratio
1	D5(Bottom)	40.09	641.93	0.06
2	D5(Bottom)	22.37	303.92	0.07
3	D5(Bottom)	6.38	78.54	0.08
4	D5(Bottom)	10.71	103.71	0.10
5	D5(Bottom)	8.09	52.19	0.15
6	D5(Bottom)	8.05	42.01	0.19
7	D5(Bottom)	19.04	303.92	0.06
8	D5(Bottom)	47.12	1097.01	0.04

Axial tension

Segment	Condition	ft [Kip/in2]	Fs [Kip/in2]	Ratio
1	D1(Top)	0.00	32.00	0.00
2	D1(Top)	0.00	32.00	0.00
3	D1(Top)	0.00	32.00	0.00
4	D1(Top)	0.00	32.00	0.00
5	D1(Top)	0.00	32.00	0.00
6	D1(Top)	0.00	32.00	0.00
7	D1(Top)	0.00	32.00	0.00
8	D1(Top)	0.00	32.00	0.00

Shear

SHEAR WALL DESIGN - EXISTING CONDITION

Segment	Condition	fv [Kip/in2]	Fv [Kip/in2]	Ratio
1	D16(Bottom)	0.006	0.105	0.05
2	D15(Bottom)	0.009	0.103	0.09
3	D10(Top)	0.012	0.100	0.12
4	D11(Bottom)	0.015	0.096	0.15
5	D21(Bottom)	0.016	0.094	0.17

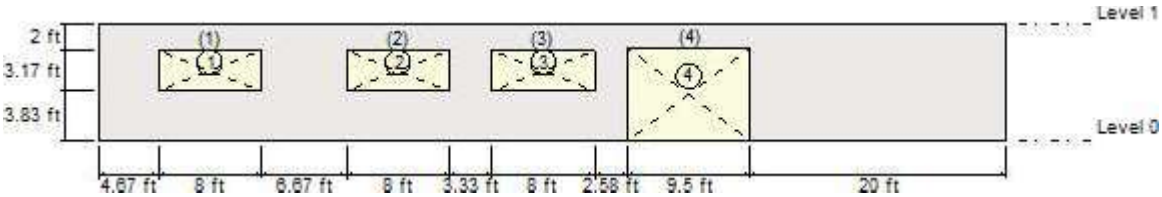
6	D16(Bottom)	0.022	0.097	0.23
7	D15(Top)	0.009	0.105	0.09
8	D22(Bottom)	0.005	0.104	0.05

Shear friction

Segment	Condition	ff [Kip/in2]	Ff [Kip/in2]	Ratio
1	D16(Top)	0.006	0.127	0.04
2	D15(Top)	0.009	0.118	0.08

Lintel Design

Status : OK



Geometry

Lintel	X Coordinate [ft]	Y Coordinate [ft]	Length [ft]	Depth [in]
1	4.67	3.83	8.00	24.00
2	19.33	3.83	8.00	24.00
3	30.67	3.83	8.00	24.00
4	41.25	0.00	9.50	22.00

Reinforcement

	Top long. reinforcement		Bottom long. reinforcement		Transverse reinforcement		
Lintel	Bars	Extent [in]	Bars	Extent [in]	Bars	Spacing [in]	Ld [in]
1	1-#5	0.00	1-#5	6.00	--	0.00	0.00
2	1-#5	0.00	1-#5	5.50	--	0.00	0.00
3	1-#5	0.00	1-#5	6.50	--	0.00	0.00
4	1-#5	0.00	1-#5	12.50	--	0.00	0.00

Bending

Lintel	Condition	M [Kip*ft]	Ma [Kip*ft]	Ratio
1	D5(Bottom)	-3.46	16.45	0.21
2	D5(Bottom)	-2.96	16.45	0.18
3	D5(Bottom)	-3.27	16.45	0.20
4	D5(Top)	5.35	14.87	0.36

Shear

Lintel	Condition	fv [Kip/in2]	Fv [Kip/in2]	Ratio
1	D5(Top)	0.021	0.050	0.41
2	D5(Top)	0.025	0.050	0.50
3	D5(Bottom)	0.028	0.050	0.56
4	D5(Bottom)	0.037	0.050	0.73

Deflection

Lintel	Condition	δs [in]	δmax [in]	Ratio
1		0.00	0.00	0.00
2		0.00	0.00	0.00
3		0.00	0.00	0.00
4		0.00	0.00	0.00

Notes

* P = Axial load
* Pa = Allowable compressive force due to axial load.
* M = Moment at the section under consideration.
* Ma = Wall allowable moment due to axial force or lintel pure flexure allowable moment
* fa = Calculated compressive stress due to axial load only
* fb = Calculated compressive stress due to axial flexure only
* ft = Calculated axial tension
* Fa = Allowable compressive stress due to axial load only
* Fb = Allowable compressive stress due to axial flexure only
* fv = Calculated shear stress
* Fs = Allowable tensile or compressive stress
* Fv = Allowable shear stress
* ld = Embedment length
* As = Effective cross sectional area of reinforcement
* δs = Calculated deflection
* δmax = Maximum allowable deflection

RAM Elements

Current Date: 2/21/2025 10:15 AM
Units system: English
File name: K:\2024\240268\Ram Elements\Masonry Opening 4 - Full Wall Design.msw

Design Results
Masonry wall

MASONRY SHEAR WALL (INTERMEDIATE) DESIGN ANALYSIS - POST OPENING INSTALLATION

General Information

Global status : Warnings in design

Design code	:	TMS 402-16 ASD

Materials:

Material	:	CMU 2.0-60
Mortar type	:	Port/Mort - M/S
Grouting type	:	Partial grouting
Mortar bed type	:	Full bed
Masonry compression strength (F`m)	:	2 [Kip/in2]
Steel tension strength (fy)	:	60 [Kip/in2]
Steel allowable tension strength (Fs)	:	32 [Kip/in2]
Steel elasticity modulus (Es)	:	29000 [Kip/in2]
Masonry elasticity modulus (Em)	:	1800 [Kip/in2]
Masonry unit weight	:	0.135 [Kip/ft3]

Seismic data:

Seismic design category	:	SDC D
Response modification factor	:	1.00
Shear wall type	:	Intermediate

Geometry

Total height	:	9.00 [ft]
Total length	:	70.75 [ft]
Foundation type	:	Continuous
Wall bottom restraint	:	Pinned
Column bottom restraint	:	Fixed
Rigidity elements	:	None

Number of stories: 1

Story	Story height [ft]	Wall thickness [in]	Effective unit weight [Kip/ft3]
1	9.00	5.63	0.08

Openings:

Reference	X Coordinate [ft]	Y Coordinate [ft]	Width [ft]	Height [ft]
Lower left	4.67	3.83	8.00	3.17
Lower left	19.33	3.83	8.00	3.17
Lower left	30.67	3.83	8.00	3.17
Lower left	41.25	0.00	9.50	7.17
Lower left	53.58	3.83	8.00	3.17

Load Conditions

ID	Comb.	Category	Description
DL	No	DL	Dead Load
LLr	No	LLR	Live Load Roof
SL	No	SNOW	Snow Load
EQpos	No	EQ	Seismic In Plane Pos
EQneg	No	EQ	Sesimic In Plane Neg
H	No	EARTH	Soil pressures
D1	Yes		1.4DL
D2	Yes		1.2DL+0.5LLr
D3	Yes		1.2DL+0.5SL
D4	Yes		1.2DL+1.6LLr
D5	Yes		1.2DL+1.6SL
D6	Yes		1.2DL+0.2SL
D7	Yes		1.4186DL+EQpos
D8	Yes		1.4186DL+EQneg
D9	Yes		1.4186DL+0.2SL+EQpos
D10	Yes		1.4186DL+0.2SL+EQneg
D11	Yes		1.1186DL+EQpos
D12	Yes		1.1186DL+EQneg
S1	Yes		DL
S2	Yes		DL+LLr
S3	Yes		DL+SL
S4	Yes		DL+0.75LLr
S5	Yes		DL+0.75SL
S6	Yes		1.15302DL+0.7EQpos
S7	Yes		1.15302DL+0.7EQneg
S8	Yes		1.114765DL+0.525EQpos
S9	Yes		1.11477DL+0.525EQneg
S10	Yes		DL+0.75SL
S11	Yes		1.11477DL+0.75SL+0.525EQpos
S12	Yes		1.11477DL+0.75SL+0.525EQneg
S13	Yes		0.44698DL+0.7EQpos
S14	Yes		0.44698DL+0.7EQneg
D13	Yes		1.4186DL+EQpos
D14	Yes		1.4186DL+EQneg
D15	Yes		1.4186DL+0.2SL+EQpos
D16	Yes		1.4186DL+0.2SL+EQneg
D17	Yes		1.1186DL+EQpos
D18	Yes		1.1186DL+EQneg
D19	Yes		1.1186DL+EQpos+1.6H
D20	Yes		1.1186DL+EQneg+1.6H
D21	Yes		1.1186DL+EQpos+0.9H
D22	Yes		1.1186DL+EQneg+0.9H
S15	Yes		DL
S16	Yes		DL+LLr
S17	Yes		DL+SL
S18	Yes		DL+0.75LLr
S19	Yes		DL+0.75SL
S20	Yes		1.15302DL+0.7EQpos
S21	Yes		1.15302DL+0.7EQneg
S22	Yes		1.15302DL+0.7EQpos+H
S23	Yes		1.15302DL+0.7EQneg+H
S24	Yes		1.15302DL+0.7EQpos+0.6H
S25	Yes		1.15302DL+0.7EQneg+0.6H
S26	Yes		1.11477DL+0.525EQpos
S27	Yes		1.11477DL+0.525EQneg
S28	Yes		DL+0.75SL
S29	Yes		1.11477DL+0.75SL+0.525EQpos
S30	Yes		1.11477DL+0.75SL+0.525EQneg
S31	Yes		0.44698DL+0.7EQpos

S32	Yes	0.44698DL+0.7EQneg
S33	Yes	0.44698DL+0.7EQpos+H
S34	Yes	0.44698DL+0.7EQneg+H
S35	Yes	0.44698DL+0.7EQpos+0.6H
S36	Yes	0.44698DL+0.7EQneg+0.6H

Loads

Distributed loads:

Consider self weight : DL

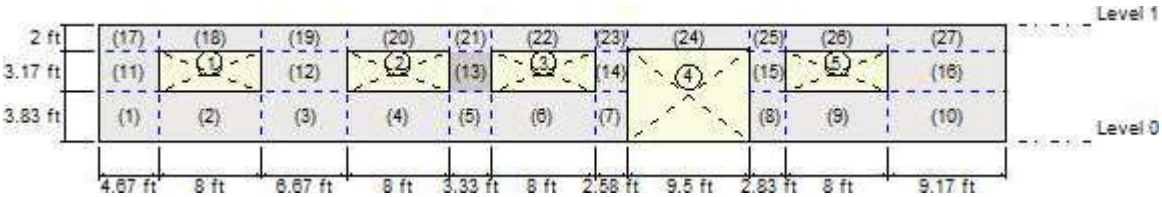
Story	Condition	Direction	Magnitude [Kip/ft]	Eccentricity [ft]
1	DL	Vertical	0.19	0.00
1	LLr	Vertical	0.16	0.00
1	SL	Vertical	0.22	0.00
1	EQpos	Horizontal	0.18	0.00
1	EQneg	Horizontal	-0.18	0.00

Out-of-plane loads:

Story	Condition	Magnitude [Kip/ft2]
1	H	0.02
Parapet	H	0.02

Bearing Wall Design

Status : OK



Geometry

Level	Segment	X Coordinate [ft]	Y Coordinate [ft]	Width [ft]	Height [ft]
0	1	0.00	0.00	4.67	3.83
	2	4.67	0.00	8.00	3.83
	3	12.67	0.00	6.67	3.83
	4	19.33	0.00	8.00	3.83
	5	27.33	0.00	3.33	3.83
	6	30.67	0.00	8.00	3.83
	7	38.67	0.00	2.58	3.83
	8	50.75	0.00	2.83	3.83
	9	53.58	0.00	8.00	3.83
	10	61.58	0.00	9.17	3.83
	11	0.00	3.83	4.67	3.17
	12	12.67	3.83	6.67	3.17
	13	27.33	3.83	3.33	3.17
	14	38.67	3.83	2.58	3.17

15	50.75	3.83	2.83	3.17
16	61.58	3.83	9.17	3.17
17	0.00	7.00	4.67	2.00
18	4.67	7.00	8.00	2.00
19	12.67	7.00	6.67	2.00
20	19.33	7.00	8.00	2.00
21	27.33	7.00	3.33	2.00
22	30.67	7.00	8.00	2.00
23	38.67	7.00	2.58	2.00
24	41.25	7.00	9.50	2.00
25	50.75	7.00	2.83	2.00
26	53.58	7.00	8.00	2.00
27	61.58	7.00	9.17	2.00

Vertical reinforcement

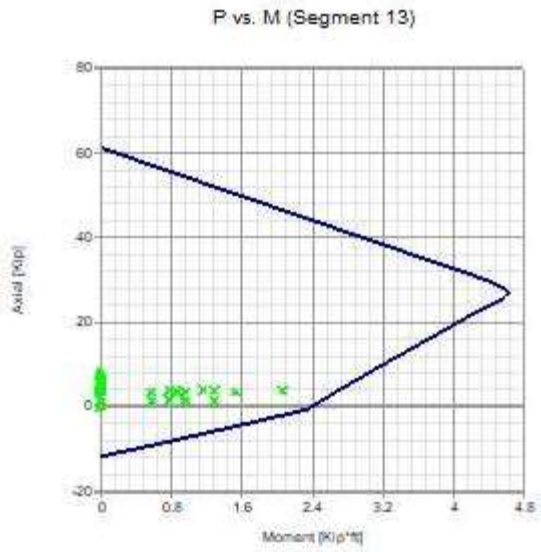
Segment	Bars	Spacing [in]	Ld [in]
1	2-#6	48.00	63.77
2	2-#6	48.00	63.77
3	2-#6	48.00	63.77
4	2-#6	48.00	63.77
5	1-#6	48.00	63.77
6	2-#6	48.00	63.77
7	1-#6	48.00	63.77
8	1-#6	48.00	63.77
9	2-#6	48.00	63.77
10	3-#6	48.00	63.77
11	2-#6	48.00	63.77
12	2-#6	48.00	63.77
13	1-#6	48.00	63.77
14	1-#6	48.00	63.77
15	1-#6	48.00	63.77
16	3-#6	48.00	63.77
17	2-#6	48.00	63.77
18	2-#6	48.00	63.77
19	2-#6	48.00	63.77
20	2-#6	48.00	63.77
21	1-#6	48.00	63.77
22	2-#6	48.00	63.77
23	1-#6	48.00	63.77
24	3-#6	48.00	63.77
25	1-#6	48.00	63.77
26	2-#6	48.00	63.77
27	3-#6	48.00	63.77

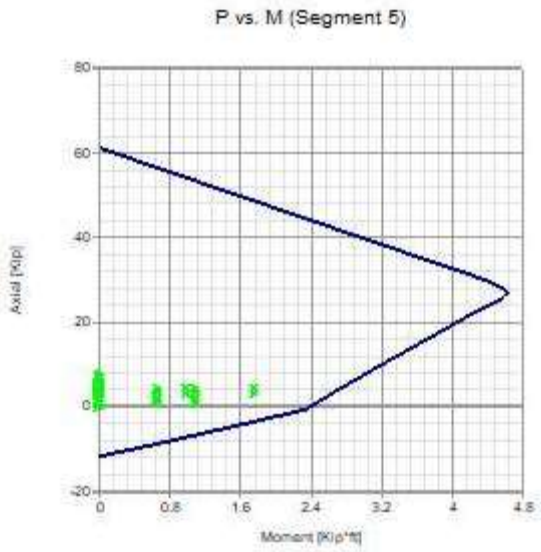
Combined axial flexure

Segment	Condition	P [Kip]	M [Kip*ft]	Ma [Kip*ft]	Ratio
1	D19(Max)	1.89	-1.56	3.49	0.45
2	D19(Top)	2.62	-1.53	5.93	0.26
3	D19(Max)	3.96	-2.66	5.08	0.52
4	D20(Max)	2.26	-1.87	5.90	0.32
5	D19(Max)	3.03	-1.75	2.62	0.67
6	D20(Top)	2.91	-1.48	5.95	0.25
7	D20(Top)	3.94	-1.36	2.16	0.63
8	D19(Top)	4.11	-1.38	2.35	0.59
9	D19(Top)	2.48	-1.33	5.92	0.22

10	D20(Top)	4.19	-2.85	6.89	0.41
11	D19(Bottom)	2.63	-1.95	3.55	0.55
12	D20(Max)	5.17	-3.12	5.18	0.60
13	D19(Bottom)	3.76	-2.06	2.68	0.77
14	D20(Bottom)	3.54	-1.39	2.13	0.65
15	D19(Max)	3.63	-1.42	2.31	0.61
16	D20(Max)	4.32	-3.30	6.90	0.48
17	D19(Bottom)	2.00	-1.17	3.50	0.33
18	D19(Max)	2.39	-0.72	5.91	0.12
19	D20(Max)	4.23	-1.99	5.10	0.39
20	D19(Max)	2.91	-1.17	5.95	0.20
21	D19(Bottom)	3.23	-1.23	2.64	0.47
22	D19(Max)	1.75	-0.74	5.86	0.13
23	D19(Max)	3.33	-1.08	2.11	0.51
24	D19(Max)	3.18	-0.81	7.05	0.12
25	D20(Max)	3.08	-0.96	2.27	0.42
26	D19(Max)	1.90	-0.57	5.88	0.10
27	D20(Bottom)	3.69	-2.28	6.85	0.33

Interaction diagrams, P vs. M





Axial compression

Segment	Condition	P [Kip]	Pa [Kip]	Ratio
1	D5(Bottom)	6.96	74.94	0.09
2	D5(Bottom)	6.51	128.47	0.05
3	D5(Bottom)	11.13	107.06	0.10
4	D5(Bottom)	8.27	128.47	0.06
5	D5(Top)	7.75	40.82	0.19
6	D5(Bottom)	14.56	128.47	0.11
7	D5(Top)	8.57	31.64	0.27
8	D5(Top)	8.82	34.70	0.25
9	D5(Bottom)	12.81	128.47	0.10
10	D5(Bottom)	10.41	147.21	0.07
11	D5(Bottom)	6.37	74.94	0.09
12	D5(Bottom)	10.72	107.06	0.10
13	D5(Bottom)	8.08	40.82	0.20

14	D5(Bottom)	7.93	31.64	0.25
15	D5(Bottom)	8.15	34.70	0.24
16	D5(Bottom)	9.90	147.21	0.07
17	D5(Bottom)	5.04	74.94	0.07
18	D5(Bottom)	6.37	128.47	0.05
19	D5(Bottom)	9.84	107.06	0.09
20	D5(Bottom)	6.64	128.47	0.05
21	D5(Bottom)	7.65	40.82	0.19
22	D5(Top)	9.01	128.47	0.07
23	D5(Bottom)	7.90	31.64	0.25
24	D5(Top)	8.91	152.56	0.06
25	D5(Bottom)	7.26	34.70	0.21
26	D5(Top)	6.58	128.47	0.05
27	D5(Bottom)	9.32	147.21	0.06

Axial tension

Segment	Condition	ft [Kip/in2]	Fs [Kip/in2]	Ratio
1	D1(Top)	0.00	32.00	0.00
2	D1(Top)	0.00	32.00	0.00
3	D1(Top)	0.00	32.00	0.00
4	D1(Top)	0.00	32.00	0.00
5	D1(Top)	0.00	32.00	0.00
6	D1(Top)	0.00	32.00	0.00
7	D1(Top)	0.00	32.00	0.00
8	D1(Top)	0.00	32.00	0.00
9	D1(Top)	0.00	32.00	0.00
10	D1(Top)	0.00	32.00	0.00
11	D1(Top)	0.00	32.00	0.00
12	D1(Top)	0.00	32.00	0.00
13	D1(Top)	0.00	32.00	0.00
14	D1(Top)	0.00	32.00	0.00
15	D1(Top)	0.00	32.00	0.00
16	D1(Top)	0.00	32.00	0.00
17	D1(Top)	0.00	32.00	0.00
18	D1(Top)	0.00	32.00	0.00
19	D1(Top)	0.00	32.00	0.00
20	D1(Top)	0.00	32.00	0.00
21	D1(Top)	0.00	32.00	0.00
22	D1(Top)	0.00	32.00	0.00
23	D1(Top)	0.00	32.00	0.00
24	D1(Top)	0.00	32.00	0.00
25	D1(Top)	0.00	32.00	0.00
26	D1(Top)	0.00	32.00	0.00
27	D1(Top)	0.00	32.00	0.00

Shear

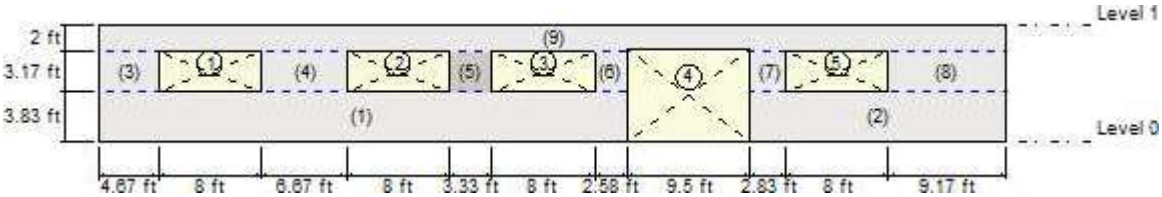
Segment	Condition	fv [Kip/in2]	Fv [Kip/in2]	Ratio
1	D19(Bottom)	0.005	0.093	0.05
2	D19(Bottom)	0.004	0.092	0.04
3	D19(Bottom)	0.006	0.095	0.06
4	D20(Bottom)	0.004	0.092	0.04
5	D19(Bottom)	0.006	0.095	0.07
6	D20(Bottom)	0.005	0.090	0.05

7	D20(Bottom)	0.006	0.091	0.07
8	D19(Bottom)	0.006	0.091	0.06
9	D19(Max)	0.004	0.053	0.07
10	D20(Bottom)	0.004	0.091	0.04
11	D19(Top)	0.002	0.054	0.04
12	D20(Top)	0.002	0.055	0.04
13	D19(Top)	0.003	0.058	0.05
14	D20(Top)	0.002	0.060	0.04
15	D19(Top)	0.002	0.059	0.03
16	D20(Top)	0.002	0.053	0.04
17	D19(Top)	0.005	0.061	0.08
18	D19(Max)	0.002	0.053	0.04
19	D19(Top)	0.005	0.060	0.09
20	D20(Top)	0.003	0.066	0.05
21	D19(Top)	0.006	0.061	0.09
22	D19(Max)	0.003	0.052	0.07
23	D19(Bottom)	0.002	0.060	0.04
24	D20(Top)	0.003	0.056	0.05
25	D19(Top)	0.005	0.056	0.10
26	D19(Max)	0.002	0.052	0.04
27	D19(Top)	0.004	0.059	0.07

Shear Wall Design

PER TMS 2016 AND IEBC 2021, EXISTING WALL REINFORCEMENT PROVDIES PERFORMANCE OF INTERMEDIATE WALL

Status : Warnings in design
- Invalid wall type for the seismic design category, TMS 402-16 ASD, 7.3.2, 7.4.1 (Segment 1)



Geometry

Level	Segment	X Coordinate [ft]	Y Coordinate [ft]	Width [ft]	Height [ft]
0	1	0.00	0.00	41.25	3.83
	2	50.75	0.00	20.00	3.83
	3	0.00	3.83	4.67	3.17
	4	12.67	3.83	6.67	3.17
	5	27.33	3.83	3.33	3.17
	6	38.67	3.83	2.58	3.17
	7	50.75	3.83	2.83	3.17
	8	61.58	3.83	9.17	3.17
	9	0.00	7.00	70.75	2.00

Reinforcement

	Vertical reinforcement			Horizontal reinforcement		
Segment	Bars	Spacing [in]	Ld [in]	Bars	Spacing [in]	Ld [in]
1	2-#6	48.00	63.77	1-#6	48.00	63.77
	2-#6	48.00	63.77	1-#6	48.00	63.77
	2-#6	48.00	63.77	1-#6	48.00	63.77
	2-#6	48.00	63.77	1-#6	48.00	63.77

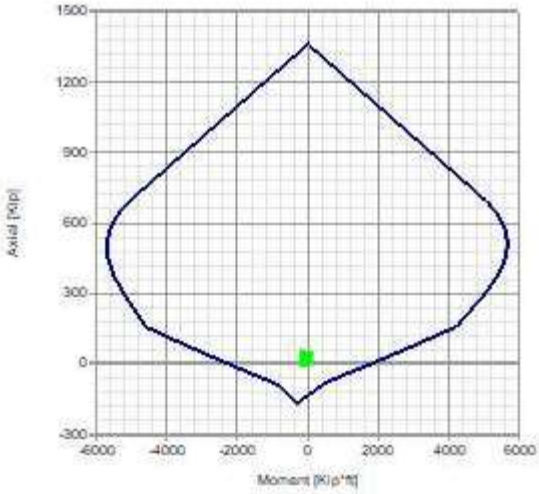
	1-#6	48.00	63.77	1-#6	48.00	63.77
	2-#6	48.00	63.77	1-#6	48.00	63.77
	1-#6	48.00	63.77	1-#6	48.00	63.77
2	1-#6	48.00	63.77	1-#6	48.00	63.77
	2-#6	48.00	63.77	1-#6	48.00	63.77
	3-#6	48.00	63.77	1-#6	48.00	63.77
3	2-#6	48.00	63.77	1-#6	48.00	63.77
4	2-#6	48.00	63.77	1-#6	48.00	63.77
5	1-#6	48.00	63.77	1-#6	48.00	63.77
6	1-#6	48.00	63.77	1-#6	48.00	63.77
7	1-#6	48.00	63.77	1-#6	48.00	63.77
8	3-#6	48.00	63.77	1-#6	48.00	63.77
9	2-#6	48.00	63.77	1-#6	48.00	63.77
	2-#6	48.00	63.77	1-#6	48.00	63.77
	2-#6	48.00	63.77	1-#6	48.00	63.77
	2-#6	48.00	63.77	1-#6	48.00	63.77
	1-#6	48.00	63.77	1-#6	48.00	63.77
	2-#6	48.00	63.77	1-#6	48.00	63.77
	1-#6	48.00	63.77	1-#6	48.00	63.77
	3-#6	48.00	63.77	1-#6	48.00	63.77
	1-#6	48.00	63.77	1-#6	48.00	63.77
	2-#6	48.00	63.77	1-#6	48.00	63.77
	3-#6	48.00	63.77	1-#6	48.00	63.77

Combined axial flexure

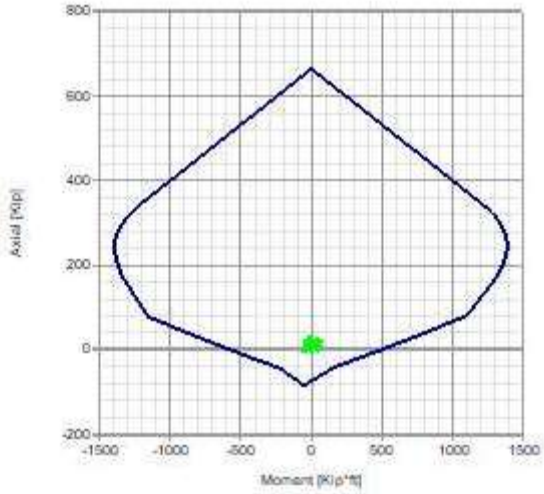
Segment	Condition	P [Kip]	M [Kip*ft]	Ma [Kip*ft]	Ratio
1	D15(Bottom)	29.70	-91.54	2719.37	0.03
2	D16(Bottom)	15.72	45.05	616.43	0.07
3	D15(Bottom)	3.85	-6.70	64.53	0.10
4	D22(Bottom)	5.17	9.65	72.22	0.13
5	S36(Bottom)	1.53	2.81	3.66	0.77
6	S32(Bottom)	1.39	2.01	2.92	0.69
7	S36(Bottom)	1.55	1.28	3.28	0.39
8	D16(Bottom)	6.42	18.80	157.75	0.12
9	D12(Bottom)	20.71	25.87	6214.26	0.00

Interaction diagrams, P vs. M

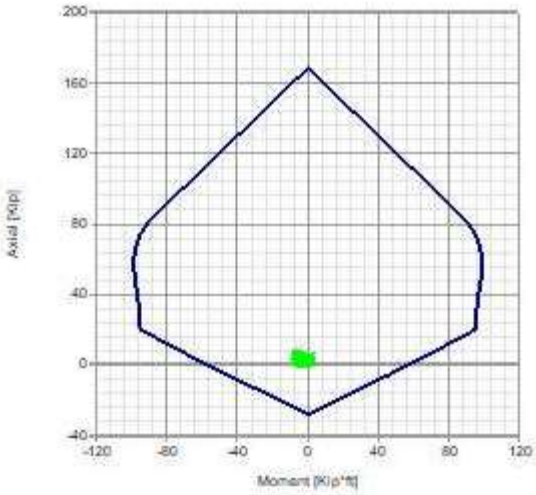
P vs. M (Segment 1)



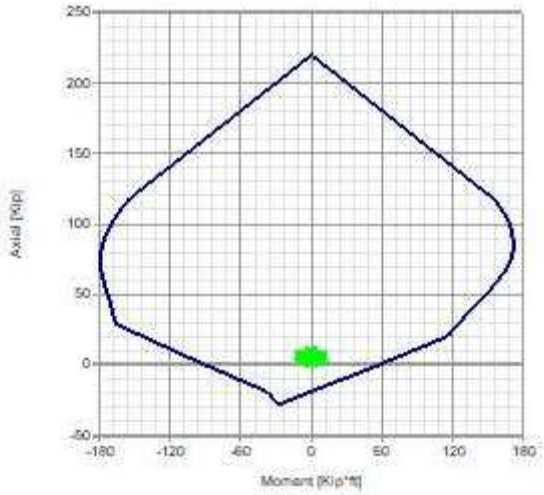
P vs. M (Segment 2)



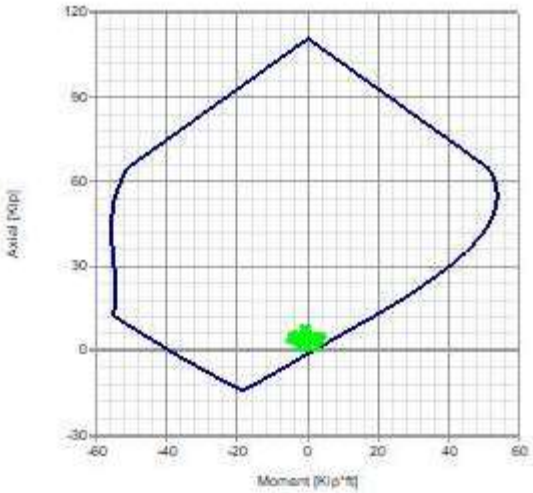
P vs. M (Segment 3)



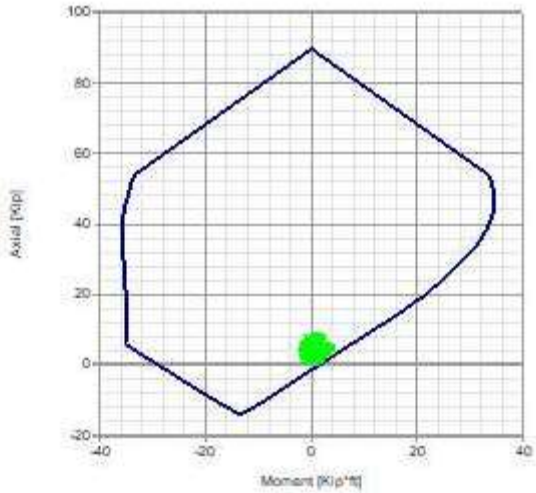
P vs. M (Segment 4)

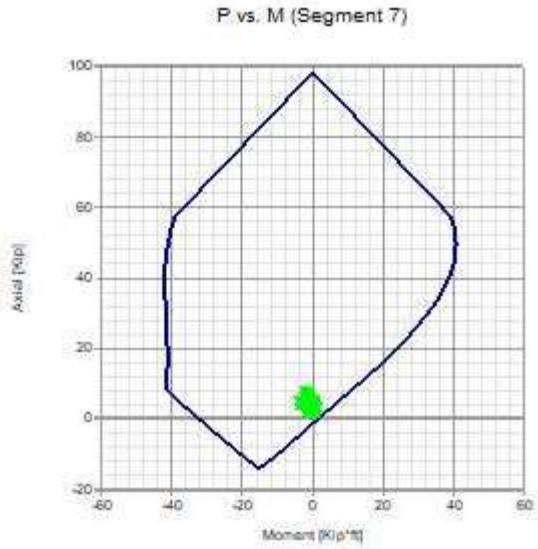


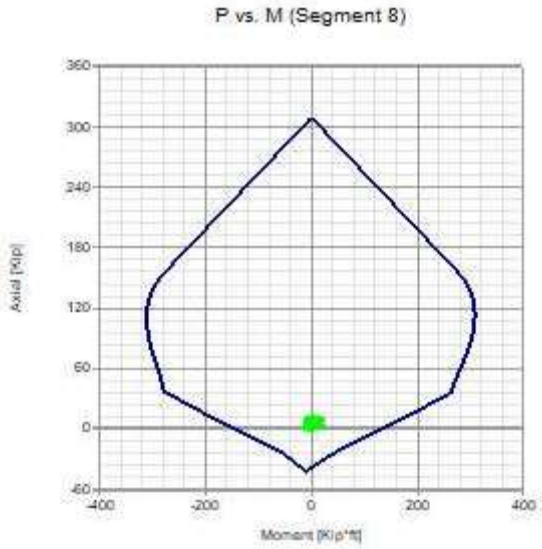
P vs. M (Segment 5)

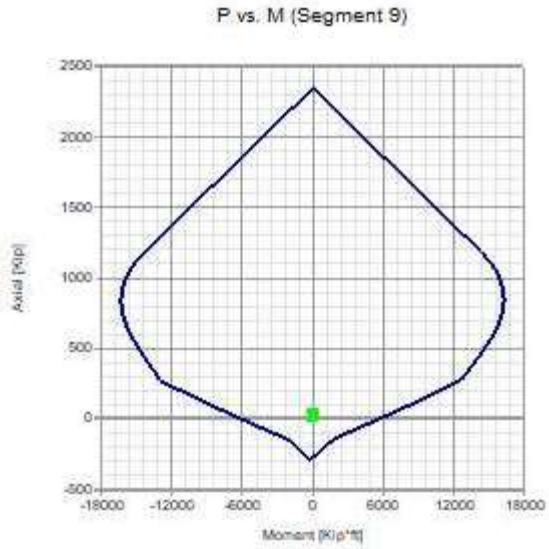


P vs. M (Segment 6)









Axial compression

Segment	Condition	P [Kip]	Pa [Kip]	Ratio
1	D5(Bottom)	39.98	641.93	0.06
2	D5(Bottom)	21.39	313.16	0.07
3	D5(Bottom)	6.37	78.54	0.08
4	D5(Bottom)	10.72	103.71	0.10
5	D5(Bottom)	8.08	52.19	0.15
6	D5(Bottom)	7.93	42.01	0.19
7	D5(Bottom)	8.15	46.07	0.18
8	D5(Bottom)	9.90	145.49	0.07
9	D5(Bottom)	47.12	1106.23	0.04

Axial tension

Segment	Condition	ft [Kip/in2]	Fs [Kip/in2]	Ratio
1	D1(Top)	0.00	32.00	0.00
2	D1(Top)	0.00	32.00	0.00
3	D1(Top)	0.00	32.00	0.00
4	D1(Top)	0.00	32.00	0.00
5	D1(Top)	0.00	32.00	0.00
6	D1(Top)	0.00	32.00	0.00
7	D1(Top)	0.00	32.00	0.00
8	D1(Top)	0.00	32.00	0.00
9	D1(Top)	0.00	32.00	0.00

Shear

SHEAR WALL DESIGN - POST OPENING INSTALLATION

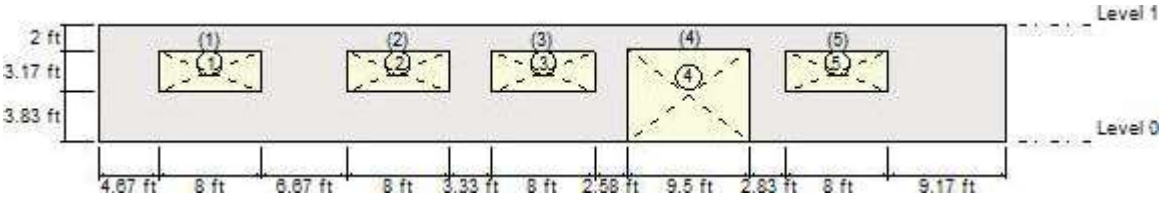
Segment	Condition	fv [Kip/in2]	Fv [Kip/in2]	Ratio
1	D10(Bottom)	0.006	0.105	0.06
2	D15(Bottom)	0.008	0.101	0.08
3	D16(Top)	0.012	0.101	0.12
4	D21(Bottom)	0.016	0.096	0.16
5	D21(Bottom)	0.018	0.094	0.19
6	D16(Bottom)	0.023	0.096	0.24
7	D9(Bottom)	0.020	0.095	0.21
8	D15(Bottom)	0.011	0.104	0.11
9	D22(Bottom)	0.005	0.104	0.05

Shear friction

Segment	Condition	ff [Kip/in2]	Ff [Kip/in2]	Ratio
1	D12(Top)	0.006	0.123	0.05
2	D15(Top)	0.008	0.132	0.06

Lintel Design

Status : OK



Geometry

Lintel	X Coordinate [ft]	Y Coordinate [ft]	Length [ft]	Depth [in]
1	4.67	3.83	8.00	24.00
2	19.33	3.83	8.00	24.00
3	30.67	3.83	8.00	24.00
4	41.25	0.00	9.50	22.00
5	53.58	3.83	8.00	24.00

Reinforcement

Lintel	Top long. reinforcement Bars	Top long. reinforcement Extent [in]	Bottom long. reinforcement Bars	Bottom long. reinforcement Extent [in]	Transverse reinforcement Bars	Transverse reinforcement Spacing [in]	Ld [in]
1	1-#5	0.00	1-#5	6.00	--	0.00	0.00
2	1-#5	0.00	1-#5	5.50	--	0.00	0.00
3	1-#5	0.00	1-#5	6.50	--	0.00	0.00
4	1-#5	0.00	1-#5	10.50	--	0.00	0.00
5	1-#5	0.00	1-#5	5.00	--	0.00	0.00

Bending

Lintel	Condition	M [Kip*ft]	Ma [Kip*ft]	Ratio
1	D5(Bottom)	-3.46	16.45	0.21
2	D5(Bottom)	-2.98	16.45	0.18
3	D5(Bottom)	-3.23	16.45	0.20
4	D5(Top)	4.52	14.87	0.30
5	D5(Bottom)	-3.00	16.45	0.18

Shear

Lintel	Condition	fv [Kip/in2]	Fv [Kip/in2]	Ratio
1	D5(Bottom)	0.021	0.050	0.41
2	D5(Bottom)	0.025	0.050	0.50
3	D5(Bottom)	0.028	0.050	0.56
4	D5(Bottom)	0.036	0.050	0.72
5	D5(Bottom)	0.021	0.050	0.42

Deflection

Lintel	Condition	δs [in]	δmax [in]	Ratio
1		0.00	0.00	0.00
2		0.00	0.00	0.00
3		0.00	0.00	0.00
4		0.00	0.00	0.00
5		0.00	0.00	0.00

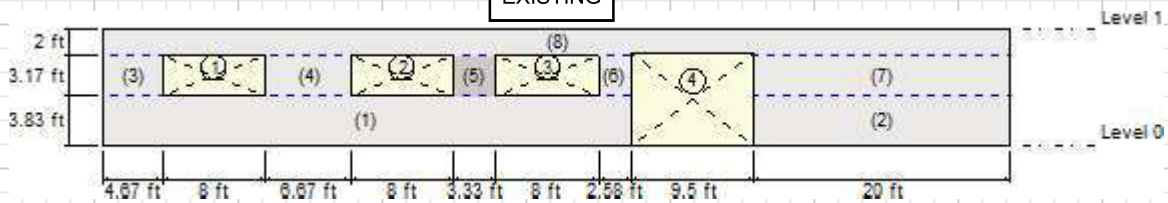
Notes

* P = Axial load
* Pa = Allowable compressive force due to axial load.
* M = Moment at the section under consideration.
* Ma = Wall allowable moment due to axial force or lintel pure flexure allowable moment
* fa = Calculated compressive stress due to axial load only
* fb = Calculated compressive stress due to axial flexure only
* ft = Calculated axial tension
* Fa = Allowable compressive stress due to axial load only
* Fb = Allowable compressive stress due to axial flexure only
* fv = Calculated shear stress
* Fs = Allowable tensile or compressive stress
* Fv = Allowable shear stress
* ld = Embedment length
* As = Effective cross sectional area of reinforcement
* δs = Calculated deflection
* δmax = Maximum allowable deflection

OPENING 4 DESIGN NARRATIVE

S.R. COMPARISON

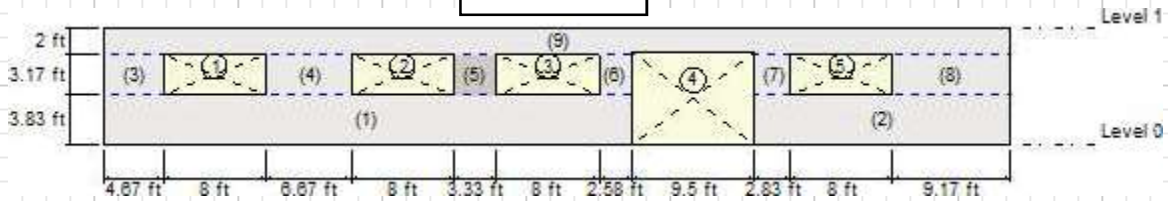
EXISTING



Shear

Segment	Condition	fv [Kip/in2]	Fv [Kip/in2]	Ratio
1	D16(Bottom)	0.006	0.105	0.05
2	D15(Bottom)	0.009	0.103	0.09
3	D10(Top)	0.012	0.100	0.12
4	D11(Bottom)	0.015	0.096	0.15
5	D21(Bottom)	0.016	0.094	0.17
6	D16(Bottom)	0.022	0.097	0.23
7	D15(Top)	0.009	0.105	0.09
8	D22(Bottom)	0.005	0.104	0.05

POST OPENING



Shear

Segment	Condition	fv [Kip/in2]	Fv [Kip/in2]	Ratio
1	D10(Bottom)	0.006	0.105	0.06
2	D15(Bottom)	0.008	0.101	0.08
3	D16(Top)	0.012	0.101	0.12
4	D21(Bottom)	0.016	0.096	0.16
5	D21(Bottom)	0.018	0.094	0.19
6	D16(Bottom)	0.023	0.096	0.24
7	D9(Bottom)	0.020	0.095	0.21
8	D15(Bottom)	0.011	0.104	0.11
9	D22(Bottom)	0.005	0.104	0.05

EXSITING	S.R.	POST OPENING	S.R.
	0.05		0.06
	0.09		0.08
	0.12		0.12
	0.15		0.16
	0.17		0.19
	0.23		0.24
	0.09		0.21
	0.05		0.11
			0.05
Average S.R.	**0.119**	**Average S.R.**	**0.1356**

Difference in Stress Ratios = 1.14

14% INCREASE

14% INCREASE > 10%, EXCEPTION NOT TAKEN

[BS] 304.3.2 Compliance with reduced seismic forces.

Where seismic evaluation and design is permitted to use reduced seismic forces, the criteria used shall be in accordance with one of the following:

1. The *International Building Code* using 75 percent of the prescribed forces. Values of R, Ω_0 and C_d used for analysis shall be as specified in Section 304.3.1 of this code.
2. Structures or portions of structures that comply with the requirements of the applicable chapter in Appendix A as specified in Items 2.1 through 2.4 and subject to the limitations of the respective Appendix A chapters shall be deemed to comply with this section.
   - 2.1. The seismic evaluation and design of unreinforced masonry bearing wall buildings in *Risk Category* I or II are permitted to be based on the procedures specified in Appendix Chapter A1.
   - 2.2. Seismic evaluation and design of the wall anchorage system in reinforced concrete and reinforced masonry wall buildings with flexible diaphragms in *Risk Category* I or II are permitted to be based on the procedures specified in Chapter A2.
   - 2.3. Seismic evaluation and design of cripple walls and sill plate anchorage in residential buildings of light-frame wood construction in *Risk Category* I or II are permitted to be based on the procedures specified in Chapter A3.
   - 2.4. Seismic evaluation and design of soft, weak or open-front wall conditions in multiple-unit residential buildings of wood construction in *Risk Category* I or II are permitted to be based on the procedures specified in Chapter A4.
3. ASCE 41, using the performance objective in Table 304.3.2 for the applicable *risk category*.

WALL ANALYZED TO PROVE IT WORKS WITH NEW OPENING AND PER IEBC 304.3.2 THE WALL IS ACCEPTABLE WITH 75% OF IBC FORCES FOR INTERMEDIATE MASONRY SHEAR WALL SEISMIC RESPONSE

DESIGN INFORMATION IN MASONRY

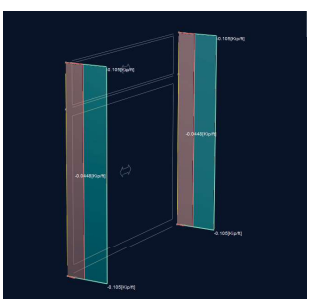
Table 13 — Allowable tension loads for Hilti KWIK HUS installed in grout-filled masonry walls (lb)[1,2,3,4,5]

Nominal anchor diameter	Nominal embedment[3] in.	Loads at c_{cr} and s_{cr}	Spacing			Edge distance		
			Critical - s_{cr}[6] in.	Minimum - s_{min}[6] in.	Load reduction factor at s_{min}[6]	Critical - c_{cr}[7] in.	Minimum c_{min}[8] in.	Load reduction factor[7]
3/8	1-5/8	535	4	2	0.70	4	4	1.00
	2-1/2	895	6	4	0.80			
	3-1/4	1,210						
1/2	2-1/4	710	4	2	0.60	4	4	1.00
	3	1,110	8	4				
	4-1/4	1,515						
5/8	3-1/4	1,155	10	4	0.60	10	4	1.00
	5	1,735						
3/4	4	1,680	12	4	0.60	12	4	1.00
	6-1/4	2,035						

Table 14 — Allowable shear loads for Hilti KWIK HUS installed in grout-filled masonry walls (lb)[1,2,3,4,5]

Nominal anchor diameter	Nominal embedment[3] in.	Loads at c_{cr} and s_{cr}	Spacing			Edge distance			
								Load reduction factor at c_{min}	
			Critical - s_{cr}[6] in.	Minimum - s_{min}[6] in.	Load reduction factor at s_{min}[7]	Critical - c_{cr}[8] in.	Minimum c_{min}[8] in.	Load direction perpendicular to edge	Load direction parallel to edge
3/8	1-5/8	1,140	6	4	0.94	6	4	0.61	1.00
	2-1/2	1,165						0.70	1.00
	3-1/4	1,190						0.70	1.00
1/2	2-1/4	1,845	8	4	0.88	8	4	0.50	1.00
	3	2,055						0.45	0.94
	4-1/4	2,745						0.40	0.89
5/8	3-1/4	3,040	10	4	0.36	10	4	0.36	0.82
	5	3,485						0.34	0.92
3/4	4	3,040	10	4	0.36	12	4	0.36	0.82
	6-1/4	3,485						0.34	0.92

WORST CASE OUT OF PLANE LOAD



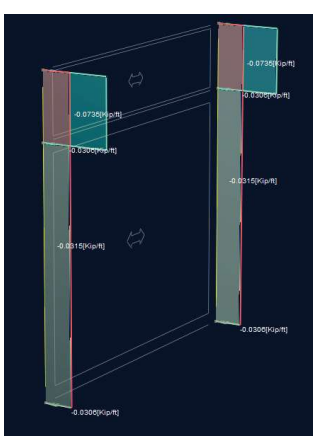
44.82 plf + 105 plf = 150 plf OOP WL

ANCHORS SPACED AT 48" O.C.
150 PLF * 48" * 1'/12" = 600 lb

600 lb * 0.6 = 360 lb (ASD)

ALLOWABLE CAPACITY = 535 lb

360 lb < 535 lb, O.K.



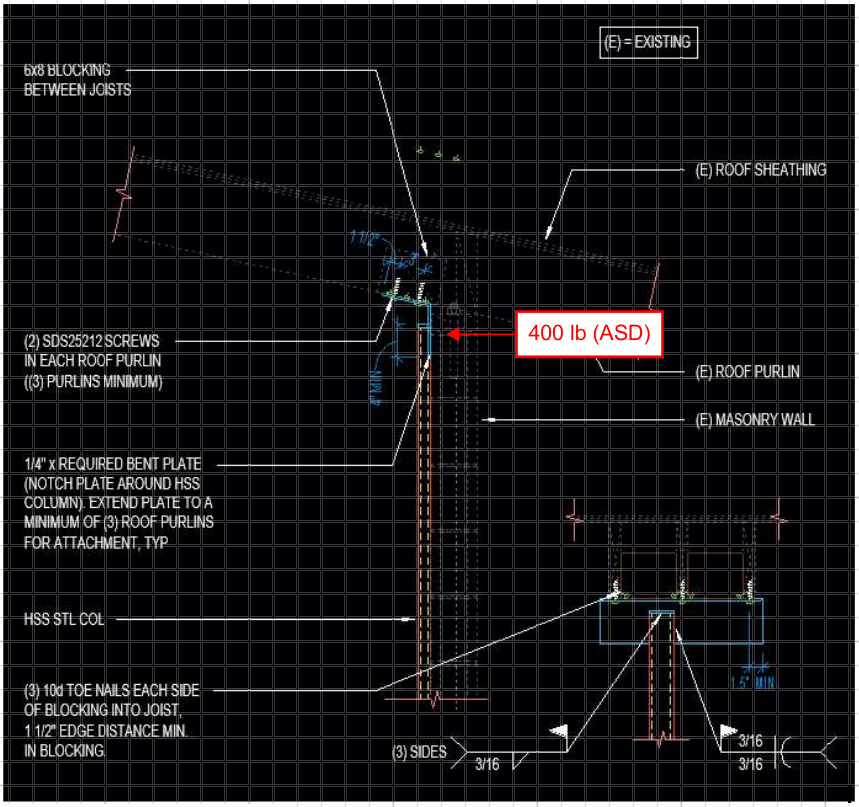
30.6 plf + 73.5 plf = 105 plf OOP EQ

ANCHORS SPACED AT 48" O.C.
150 PLF * 48" * 1'/12" = 420 lb

420 lb * 0.7 = 294 lb (ASD)

590 plf + 400 plf = 990 plf
990 plf * 1 ft = 990
lb shear per anchor

OGDEN COMMUNITY BUILDING



REACTION AT COLUMN
TOP = 400 lb (ASD)

MINIMUM (3) JOISTS ATTACHED,
(2) SDS SCREWS PER JOIST,
(6) SDS SCREWS TOTAL
SDS SHEAR CAPACITY = 165 lb

165 * 6 = 990 lb > 400 lb (ASD)

1½" – 8"

SDS Heavy-Duty Connector Screw — Allowable Shear Loads — Douglas Fir–Larch and Southern Pine Lumber

Fastener Length (in.)	Model No.	Reference DFL/SP Allowable Shear Loads (lb.) — Wood Side Plate Thickness (in.)												
		½	⅝	¾	1	1⅛	1¼	1½	1¾	2½	3	3½	4	4½
2	SDS25200	145	—	—	—	—	—	—	—	—	—	—	—	—
2½	SDS25212	165	165	170	165	—	—	190[1]	—	—	—	—	—	—

400 lb * 5" = 2000 lb-in

2000 lb-in / 3" = 667 lb
Tension/Compression

6 Screws Total,
3 of them in Tension

3 * 255 lb = 765 lb
Capacity

765 lb > 667 lb, O.K.

SDS Heavy-Duty Connector Screw — Reference Allowable Withdrawal Loads — Douglas Fir–Larch, Southern Pine, Spruce-Pine-Fir and Hem-Fir Lumber

Model No.	Fastener Length (in.)	Thread Length (in.)	Reference Allowable Withdrawal Loads, W (lb./in.)		Max. Reference Allowable Withdrawal Loads, W_{max} (lb.)	
			DFL and SP Main Member	HF and SPF Main Member	DFL and SP Main Member	HF and SPF Main Member
SDS25112	1.5	1	172	121	170	120
SDS25200	2	1.25	172	121	215	150
SDS25212	2.5	1.5	172	121	255	180

Toe Nails: (3) 10d nails per side, (9) MIN,

10d Capacity = 118 lb
Toe Nail Factor = 0.83
118 * 0.83 = 97 lb, 97lb * 9 nails = 873 lb > 400 lb