Construction Documents – 100% Submittal: Calculations

Reissued February 18th, 2025

Department of Veterans Health Administration

Electronic Health Record Modernization (EHRM) Infrastructure Upgrades – Togus, ME

Project No. 402-22-700

Contract No. 36C77623C0002

Togus VA Medical Center

1 VA Center,

Augusta, ME 04330

US Department of Veterans Affairs

Program Contracting Activity Central (PCAC)

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TABLE OF CONTENTS

Civil - MCR 6 in Sewer Lateral Pipe Size

Civil - MCR 8 in Sewer Main Pipe Size

Civil - MCR Domestic Water Pipe Sizing Calculations Fire -

MCR Fire Sprinkler Calculations

Mechanical - MCR CFD Analysis

Mechanical - MCR Fuel Tank Sizing

Mechanical - MCR Heat Load

Mechanical - MCR Roof Drain Sizing

Mechanical - Systems Design Report - All Other Buildings

Structural - MCR Structural Calculations

Blast Analysis Calculations

Civil - MCR 6 in Sewer Lateral Pipe Size

Partially Full Pipe Flow Calculations - U.S. Units

II. Calculation of Discharge, Q, and average velocity, V
for pipes more than half full

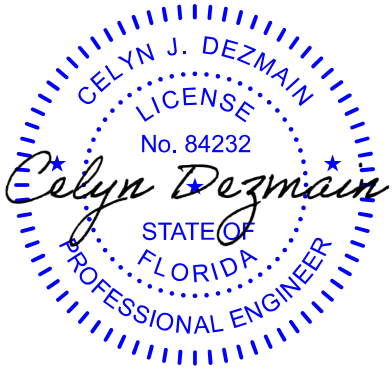
Instructions: *Enter values in blue boxes. Calculations in yellow*

Inputs

Pipe Diameter, **D** =	6	in
Depth of flow, **y** = (must have y ≥ D/2)	2.5	in
Full Pipe Manning roughness, $\mathbf{n_{full}}$ =	0.012	
Channel bottom slope, **S** =	0.01	ft/ft

Calculations

$\mathbf{n/n_{full}}$ =	1.2917	
Partially Full Manning roughness, **n** =	0.016	
Pipe Diameter, **D** =	0.5	ft
Pipe Radius, **r** =	0.25	ft
Circ. Segment Height, **h** =	0.292	ft
Central Angle, **q** =	3.48	radians
Cross-Sect. Area, **A** =	0.08	ft^2
Wetted Perimeter, **P** =	0.7	ft
Hydraulic Radius, **R** =	0.11	ft
Discharge, **Q** =	0.17	cfs
Ave. Velocity, **V** =	2.21	ft/sec
pipe % full [(A/A_{full})*100%] =	39.4%	



Civil - MCR 8 in Sewer Main Pipe Size

Partially Full Pipe Flow Calculations - U.S. Units

II. Calculation of Discharge, Q, and average velocity, V
for pipes more than half full

Instructions: *Enter values in blue boxes. Calculations in yellow*

Inputs

Pipe Diameter, **D** =	8	in
Depth of flow, **y** = (must have y ≥ D/2)	3.4	in
Full Pipe Manning roughness, $\mathbf{n_{full}}$ =	0.012	
Channel bottom slope, **S** =	0.005	ft/ft

Calculations

$\mathbf{n/n_{full}}$ =	1.2875	
Partially Full Manning roughness, **n** =	0.015	
Pipe Diameter, **D** =	0.66666666	ft
Pipe Radius, **r** =	0.33333333	ft
Circ. Segment Height, **h** =	0.383	ft
Central Angle, **q** =	3.44	radians
Cross-Sect. Area, **A** =	0.14	ft^2
Wetted Perimeter, **P** =	0.9	ft
Hydraulic Radius, **R** =	0.15	ft
Discharge, **Q** =	0.27	cfs
Ave. Velocity, **V** =	1.92	ft/sec
pipe % full [(A/A_{full})*100%] =	40.5%	

Civil - MCR Domestic Water Pipe Sizing Calculations

402-22-700 36C77623C0002 Togus VAMC
EHRM Infrastructure Upgrades

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Domestic and Fire Protection Water Distribution Pipe Sizing Calculations

Calculations below demonstrate the min pipe size requirement for the shared domestic and fire protection water service:

Known:

Domestic Water Demand Q_d	33 GPM
Fire Protection Water Demand Q_f	585.56 GPM @ 39.89PSI
Total Water Demand Q_t	**618 GPM ~ 1.37 cfs**
Pipe Material	PVC
Pipe Material C Value	150
Pipe Length (L)	210 LF
Pipe Size (D)	6 in
Residual Pressure at existing Main	58 PSI @ 1,113 GPM
Static Pressure at existing Main	65 PSI @ 0 GPM

Min Pipe Size Required:

Q=V*A

$Q=V*\pi r^2$

r=SQRT(Q/V π)

r=SQRT(1.37cfs/7.0fps*3.14)

r=0.25ft ~ 3”

Min Pipe Size 6” diameter

Pressure loss due to friction:

P_{loss} = $4.53*L*(Q/C)^{1.852} / D^{4.857}$

L_{eq} = 210 + (2-90 bend)*8.9 + (1 tee)*18 + (3-45 bends)*5.6
=210+17.8+18+16.8
= 262.6 ft
= $4.53*262.6*(655/150)^{1.852} / 6^{4.857}$

= **3.05 PSI**

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$H_{elevation}$ = 6” elevation change from water main connection to building connection is considered negligible.

Pressure in a 6” PVC Water Service line at the new standalone MCR connection 61.95PSI @ 618 GPM;

Therefore, a 6” PVC Water and Fire Service line will sufficiently serve the MCR water demand.

Fire - MCR Fire Sprinkler Calculations

Hydraulic Calculations Summary

for

Project Name: Togus EHRM Infrastructure Upgrades
Location: VA Togus Medical Center, Augusta, Maine,
Drawing Name: 22117_MCR_Fire_Protection_r25 Calculation Date:11/9/2025

Design

Remote Area Name:	MAIN COMPUTER ROOM
Occupancy Classification:	Ordinary Hazard Group 1
Density	0.15/Square feet
Area of Application:	1500.00 (Actual Area: 1501.17)
Coverage per Sprinkler:	91.41 (average)
Type of Sprinklers Calculated:	
No. of Sprinklers Calculated:	17

Type of System:	Fire Protection Wet	Volume of Dry or PreAction System:			0.0 gal
In-rack Demand:	N/A	at Node:	N/A		
Hose Streams:	250.00	at Node:	1	Type	Allowance at Source

Total Water Required (including Hose Streams where applicable)
FROM: Water Supply at Node 1: 585.58 @ 39.89
Safety Margin: 22.98

Applied Friction Loss Method:	Hazen-Williams
Darcy-Weisbach Suppression Agent:	None.

Contact Name Conrad Chandler, PE
Address: 1308 NE 134th Street, Suite A, Vancouver, WA 98685
Phone Number: 541-426-4723 Name of Designer:

Authority Having Jurisdiction: Department of Veterans Affairs

Notes: HYDRAULIC CALCULATIONS ARE PROVIDED TO VERIFY UNDERGROUND PIPE SIZE ONLY. CONTRACTORS FOR FIRE SUPPRESSION SYSTEMS ARE REQUIRED TO PROVIDE CALCULATIONS AND WORKING DRAWINGS FOR NEW OR MODIFIED SYSTEMS. NOTE: SPRINKLER HEADS WITHIN THE REMOTE AREA WERE CALCULATED AT ACTUAL COVERAGE AREA. FOR UNDERGROUND PIPING CALCULATION INCLUDES 262' EQUIVALENT LENGTH OF 6" DIP.

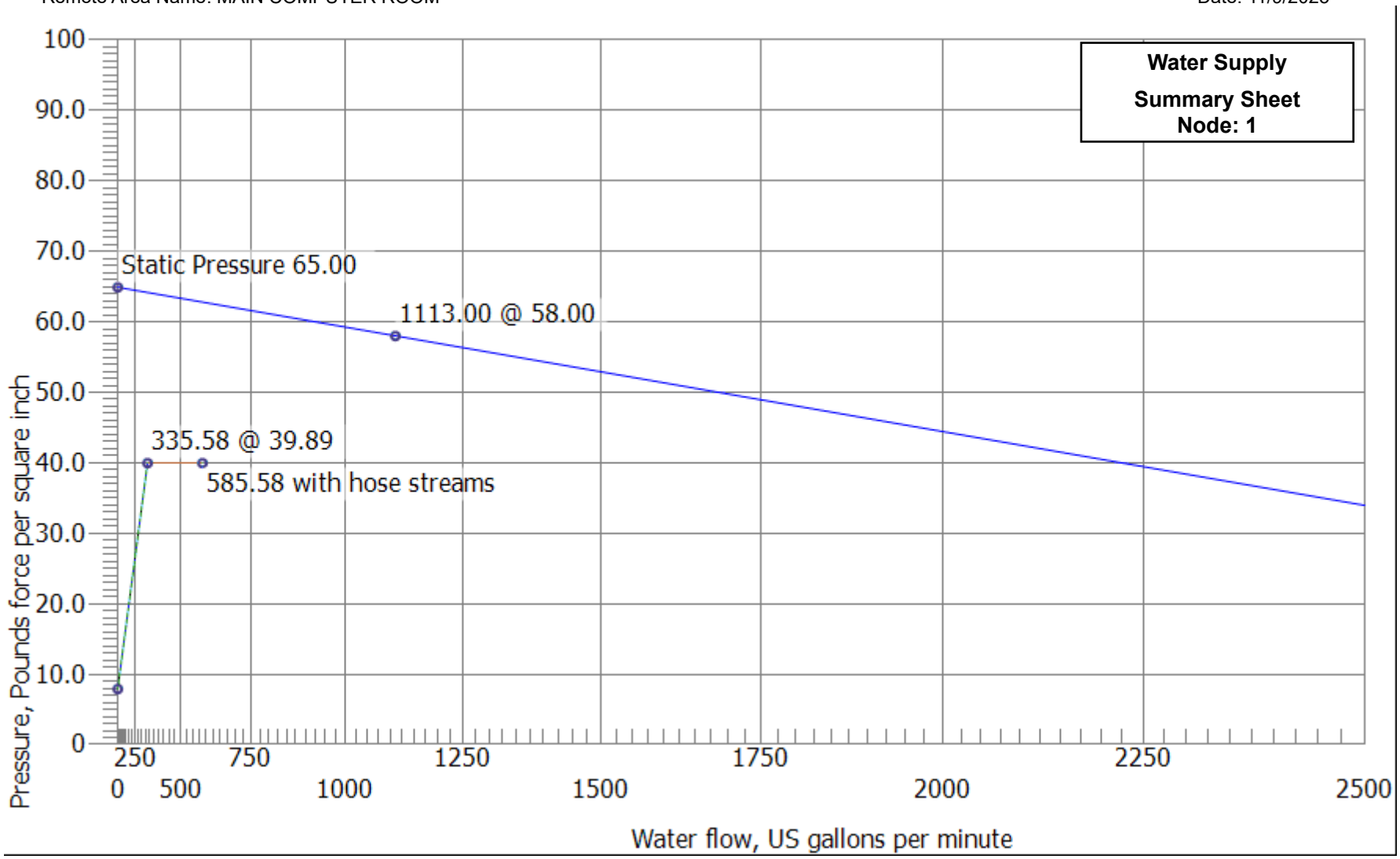
Hydraulic Graph

Job Name: Togus EHRM Infrastructure Upgrades

Remote Area Name: MAIN COMPUTER ROOM

$N^{1.85}$

Date: 11/9/2025



A negative result in Required Pressure indicates that the Pump is capable of furnishing all of the pressure required by the demand reported within this calculation.

No pressure is being required from the Source/Supply to meet the demand (by a margin of this negative value).

Outflowing Devices

Job Number: 402-22-700
Report Description: Ordinary Hazard Group 1

Device		Actual Flow (US gallons per minute)	Minimum Flow (US gallons per minute)	K-Factor (K)	Pressure ds force per square		
Sprinkler	101	19.12	14.82	5.6	11.65		
Sprinkler	102	18.95	14.82	5.6	11.45		
Sprinkler	103	20.09	14.82	5.6	12.87		
Sprinkler	**104**	**17.70**	**17.70**	**5.6**	**9.99**		
Sprinkler	105	18.65	17.70	5.6	11.09		
Sprinkler	117	20.65	15.00	5.6	13.60		
Sprinkler	112	20.19	15.00	5.6	13.00		
Sprinkler	107	19.99	15.00	5.6	12.74		
Sprinkler	116	19.92	15.00	5.6	12.66		
Sprinkler	111	19.72	15.00	5.6	12.40		
Sprinkler	115	19.44	15.00	5.6	12.06		
Sprinkler	110	19.25	15.00	5.6	11.82		
Sprinkler	114	19.75	15.00	5.6	12.43		
Sprinkler	109	19.55	15.00	5.6	12.19		
Sprinkler	113	21.54	15.00	5.6	14.80		
Sprinkler	108	21.07	15.00	5.6	14.16		
Sprinkler	106	19.99	15.00	5.6	12.75		

Most Demanding Sprinkler Data

Job Name: Togus EHRM Infrastructure Upgrades
Remote Area Name: MAIN COMPUTER ROOM

Date: 11/9/2025

Supply Analysis

Node	Name	Static (Pounds force per square in)	Residual (Pounds force per square in)	Flow @ (US gallons per minute)	Available (Pounds force per square in)	Total Demand @ (US gallons per minute)	Required Pressure (Pounds force per square in)
1	Water Supply	65.00	58.00	1113.00	62.87	585.58	39.89

Node Analysis

Node Number	Elevation (ft)	Node Type	Pressure at Node (Pounds force	Discharge at Node (US gallons per	Notes
1	100' - 0"	Supply	39.89	335.58	
101	111' - 1"	Sprinklers	11.65	19.12	
102	111' - 1"	Sprinklers	11.45	18.95	
103	111' - 1"	Sprinklers	12.87	20.09	
104	113' - 8"	Sprinklers	9.99	17.70	
105	113' - 8"	Sprinklers	11.09	18.65	
106	118' - 4"	Sprinklers	12.75	19.99	
107	118' - 4"	Sprinklers	12.74	19.99	
108	118' - 4"	Sprinklers	14.16	21.07	
109	118' - 4"	Sprinklers	12.19	19.55	
110	118' - 4"	Sprinklers	11.82	19.25	
111	118' - 4"	Sprinklers	12.40	19.72	
112	118' - 4"	Sprinklers	13.00	20.19	
113	118' - 4"	Sprinklers	14.80	21.54	
114	118' - 4"	Sprinklers	12.43	19.75	
115	118' - 4"	Sprinklers	12.06	19.44	
116	118' - 4"	Sprinklers	12.66	19.92	
117	118' - 4"	Sprinklers	13.60	20.65	
2	100' - 0"		38.86		

Node Number	Elevation (ft)	Node Type	Pressure at Node (Pounds force	Discharge at Node (US gallons per	Notes
3	102' - 11 1/4"		37.34		
4	102' - 11 1/4"		37.46		
5	102' - 11 1/4"		37.52		
6	108' - 0 1/4"		34.17		
7	108' - 0 1/4"		33.27		
8	111' - 0 3/8"		31.63		
10	113' - 6"		10.29		
11	113' - 6"		11.41		
12	117' - 4 5/8"		16.87		
13	117' - 4 5/8"		14.60		
14	117' - 4 5/8"		14.17		
15	117' - 4 5/8"		14.85		
16	117' - 4 5/8"		15.54		
17	117' - 4 5/8"		14.56		
18	117' - 4 5/8"		14.13		
19	117' - 4 5/8"		14.13		
20	117' - 4 5/8"		13.71		
21	117' - 4 5/8"		14.37		
22	117' - 4 5/8"		16.64		
23	117' - 4 5/8"		14.06		
24	117' - 4 5/8"		13.65		
25	117' - 4 5/8"		14.31		
26	117' - 4 5/8"		15.33		

Node Number	Elevation (ft)	Node Type	Pressure at Node (Pounds force	Discharge at Node (US gallons per	Notes
27	117' - 4 5/8"		17.67		
28	117' - 4 5/8"		16.95		
29	117' - 4 5/8"		16.53		
30	117' - 4 5/8"		16.35		
31	117' - 4 5/8"		16.28		
32	117' - 4 5/8"		16.27		
33	117' - 4 5/8"		15.93		
34	117' - 4 5/8"		14.40		
35	117' - 4 5/8"		14.40		
36	117' - 4 5/8"		15.48		
37	117' - 4 5/8"		13.66		

Job Name: Togus EHRM Infrastructure Upgrades
Remote Area Name: MAIN COMPUTER ROOM

Date: 11/9/2025

Pipe Information

Node 1 / Node 2	Elev 1 / Elev 2 ft	K-Factor / Velocity	Flow added this step / Total Flow Q	Nominal ID / Actual ID	Fittings & Devices / Equiv. Length ft	Length / Fitting / Total ft	C Factor or Roughness / Pf Friction Loss Per Unit ds force per square	Total(Pt) / Elev(Pe) / Friction(Pf)	Notes Fitting/Device (Equivalent Length) Fixed Pressure Losses, when applicable, are added directly to (Pf) and shown as a negative value.
104	113' - 8"	5.6	17.70	1"	(See Notes)	0' - 2"	120	9.99	• • • • • **Route 1** • • • • •
						2' - 0"	0.10	0.07	Sprinkler,
10	113' - 6"	6.57	17.70	1"		2' - 2"		0.22	E(2' - 0"), HW
10	113' - 6"			3/4"	(See Notes)	9' - 8 3/8"	120	10.29	
						8' - 0"	0.34	-1.68	
17	117' - 4 5/8"	10.65	17.70	7/8"		17' - 8 3/8"		5.95	2E(2' - 0"), PO(4' - 0"), HW
17	117' - 4 5/8"		38.86	1 1/2"	(See Notes)	0' - 4 3/8"	120	14.56	Flow (q) from Route 5
							0.11		
13	117' - 4 5/8"	8.91	56.56	1 5/8"		0' - 4 3/8"		0.04	Tr, HW
13	117' - 4 5/8"		19.55	1 1/2"	(See Notes)	4' - 3 1/4"	120	14.60	Flow (q) from Route 7
						8' - 0"	0.19	0.00	
28	117' - 4 5/8"	11.99	76.11	1 5/8"		12' - 3 1/4"		2.35	PO(8' - 0"), HW
28	117' - 4 5/8"		216.85	3"	(See Notes)	9' - 8"	120	16.95	Flow (q) from Route 2
							0.07		
27	117' - 4 5/8"	11.26	292.97	3 1/4"		9' - 8"		0.72	Tr, HW
27	117' - 4 5/8"		42.61	3"	(See Notes)	58' - 7 1/8"	120	17.67	Flow (q) from Route 16
						41' - 0"	0.10	2.76	
8	111' - 0 3/8"	12.90	335.58	3 1/4"		99' - 7 1/8"		11.21	5E(7' - 0"), 3red, E(6' - 0"), Tr, HW
8	111' - 0 3/8"			4"	(See Notes)	3' - 0 1/8"	120	31.63	
						10' - 0"	0.03	1.30	
7	108' - 0 1/4"	7.55	335.58	4 1/4"		13' - 0 1/8"		0.34	E(10' - 0"), HW
7	108' - 0 1/4"			4"	(See Notes)	2' - 2 3/8"	120	33.27	
						32' - 0"	0.03		
6	108' - 0 1/4"	7.55	335.58	4 1/4"		34' - 2 3/8"		0.89	BV(12' - 0"), PO(20' - 0"), HW
6	108' - 0 1/4"			4"	(See Notes)	5' - 1"	120	34.17	
						32' - 0"	0.03	2.20	
3	102' - 11 1/4"	7.55	335.58	4 1/4"		37' - 1"		0.97	CV(22' - 0"), E(10' - 0"), HW
3	102' - 11 1/4"			4"	(See Notes)	4' - 10 5/8"	120	37.34	
							0.03		
4	102' - 11 1/4"	7.55	335.58	4 1/4"		4' - 10 5/8"		0.13	BFP, red, HW
4	102' - 11 1/4"			6"	(See Notes)	1' - 1 3/8"	120	37.46	
						14' - 0"	0.00		
5	102' - 11 1/4"	3.39	335.58	6 3/8"		15' - 1 3/8"		0.06	E(14' - 0"), HW

Job Name: Togus EHRM Infrastructure Upgrades
Remote Area Name: MAIN COMPUTER ROOM

Date: 11/9/2025

Pipe Information

Node 1 / Node 2	Elev 1 / Elev 2 ft	K-Factor / Velocity	Flow added this step / Total Flow Q	Nominal ID / Actual ID	Fittings & Devices / Equiv. Length ft	Length / Fitting / Total ft	C Factor or Roughness / Pf Friction Loss Per Unit ds force per square	Total(Pt) / Elev(Pe) / Friction(Pf)	Notes (Fitting/Device (Equivalent Length); Fixed Pressure Losses, when applicable, are added directly to (Pf) and shown as a negative value.)
5	102' - 11 1/4"			6"	(See Notes)	2' - 11 1/4"	120	37.52	
2	100' - 0"	3.39	335.58	6 3/8"		14' - 0"	0.00	1.27	E(14' - 0"), HW
						16' - 11 1/4"		0.06	
2	100' - 0"			6"	(See Notes)	262' - 6 1/2"	120	38.86	
1	100' - 0"	3.47	335.58	6 1/4"			0.00		Water Supply, HW
						262' - 6 1/2"		1.03	
			250.00					39.89	Hose Allowance At Source
1			585.58						Total(Pt) Route 1
105	113' - 8"	5.6	18.65	1"	(See Notes)	0' - 2"	120	11.09	• • • • • **Route 2** • • • • • Sprinkler,
11	113' - 6"	6.92	18.65	1"		2' - 0"	0.11	0.07	E(2' - 0"), HW
						2' - 2"		0.25	
11	113' - 6"			3/4"	(See Notes)	5' - 10 5/8"	120	11.41	
18	117' - 4 5/8"	11.22	18.65	7/8"		6' - 0"	0.37	-1.68	E(2' - 0"), PO(4' - 0"), HW
						11' - 10 5/8"		4.40	
18	117' - 4 5/8"		38.39	1 1/2"	(See Notes)	0' - 4 3/8"	120	14.13	Flow (q) from Route 3
14	117' - 4 5/8"	8.99	57.05	1 5/8"			0.11		Tr, HW
						0' - 4 3/8"		0.04	
14	117' - 4 5/8"		19.25	1 1/2"	(See Notes)	4' - 3 1/4"	120	14.17	Flow (q) from Route 4
29	117' - 4 5/8"	12.02	76.30	1 5/8"		8' - 0"	0.19	0.00	PO(8' - 0"), HW
						12' - 3 1/4"		2.36	
29	117' - 4 5/8"		140.56	3"	(See Notes)	9' - 8"	120	16.53	Flow (q) from Route 8
28	117' - 4 5/8"	8.34	216.85	3 1/4"			0.04		Tr, HW
						9' - 8"		0.41	
								16.95	Total(Pt) Route 2
102	111' - 1"	5.6	18.95	3/4"	(See Notes)	7' - 1"	120	11.45	• • • • • **Route 3** • • • • • Sprinkler,
20	117' - 4 5/8"	11.40	18.95	7/8"		6' - 0"	0.38	-2.73	E(2' - 0"), PO(4' - 0"), HW
						13' - 1"		4.99	
20	117' - 4 5/8"		19.44	1 1/2"	(See Notes)	7' - 9 1/4"	120	13.71	Flow (q) from Route 6
18	117' - 4 5/8"	6.05	38.39	1 5/8"			0.05		Tr, HW
						7' - 9 1/4"		0.42	
								14.13	Total(Pt) Route 3

Job Name: Togus EHRM Infrastructure Upgrades
Remote Area Name: MAIN COMPUTER ROOM

Date: 11/9/2025

Pipe Information

Node 1 / Node 2	Elev 1 / Elev 2 ft	K-Factor / Velocity	Flow added this step / Total Flow Q	Nominal ID / Actual ID	Fittings & Devices / Equiv. Length ft	Length / Fitting / Total ft	C Factor or Roughness / Pf Friction Loss Per Unit ds force per square	Total(Pt) / Elev(Pe) / Friction(Pf)	Notes (Fitting/Device (Equivalent Length); Fixed Pressure Losses, when applicable, are added directly to (Pf) and shown as a negative value.)
110	118' - 4"	5.6	19.25	3/4"	(See Notes)	0' - 11 3/8"	120	11.82	• • • • • **Route 4** • • • • • Sprinkler, PO(4' - 0"), HW
14	117' - 4 5/8"	11.58	19.25	7/8"		4' - 0"	0.39	0.41	
						4' - 11 3/8"		1.94	
								14.17	Total(Pt) Route 4
101	111' - 1"	5.6	19.12	3/4"	(See Notes)	7' - 5"	120	11.65	• • • • • **Route 5** • • • • • Sprinkler, E(2' - 0"), PO(4' - 0"), HW
19	117' - 4 5/8"	11.50	19.12	7/8"		6' - 0"	0.39	-2.73	
						13' - 5"		5.21	
19	117' - 4 5/8"		19.75	1 1/2"	(See Notes)	7' - 9 1/4"	120	14.13	Flow (q) from Route 9 Tr, HW
17	117' - 4 5/8"	6.12	38.86	1 5/8"			0.06		
						7' - 9 1/4"		0.43	
								14.56	Total(Pt) Route 5
115	118' - 4"	5.6	19.44	3/4"	(See Notes)	0' - 11 3/8"	120	12.06	• • • • • **Route 6** • • • • • Sprinkler, E(2' - 0"), HW
24	117' - 4 5/8"	11.70	19.44	7/8"		2' - 0"	0.40	0.41	
						2' - 11 3/8"		1.18	
24	117' - 4 5/8"			1 1/2"	(See Notes)	4' - 3 1/2"	120	13.65	Tr, HW
20	117' - 4 5/8"	3.06	19.44	1 5/8"			0.02		
						4' - 3 1/2"		0.07	
								13.71	Total(Pt) Route 6
109	118' - 4"	5.6	19.55	3/4"	(See Notes)	0' - 11 3/8"	120	12.19	• • • • • **Route 7** • • • • • Sprinkler, PO(4' - 0"), HW
13	117' - 4 5/8"	11.76	19.55	7/8"		4' - 0"	0.40	0.41	
						4' - 11 3/8"		2.00	
								14.60	Total(Pt) Route 7
111	118' - 4"	5.6	19.72	3/4"	(See Notes)	0' - 11 3/8"	120	12.40	• • • • • **Route 8** • • • • • Sprinkler, PO(4' - 0"), HW
15	117' - 4 5/8"	11.87	19.72	7/8"		4' - 0"	0.41	0.41	
						4' - 11 3/8"		2.03	
15	117' - 4 5/8"		40.01	1 1/2"	(See Notes)	4' - 3 1/4"	120	14.85	Flow (q) from Route 10 PO(8' - 0"), HW
30	117' - 4 5/8"	9.41	59.73	1 5/8"		8' - 0"	0.12	0.00	
						12' - 3 1/4"		1.50	
30	117' - 4 5/8"		80.83	3"	(See Notes)	9' - 8"	120	16.35	Flow (q) from Route 11 Tr, HW
29	117' - 4 5/8"	5.40	140.56	3 1/4"			0.02		
						9' - 8"		0.19	

Pipe Information

Node 1 / Node 2	Elev 1 / Elev 2 ft	K-Factor / Velocity	Flow added this step / Total Flow Q	Nominal ID / Actual ID	Fittings & Devices / Equiv. Length ft	Length / Fitting / Total ft	C Factor or Roughness / Pf Friction Loss Per Unit ds force per square	Total(Pt) / Elev(Pe) / Friction(Pf)	Notes (Fitting/Device (Equivalent Length); Fixed Pressure Losses, when applicable, are added directly to (Pf) and shown as a negative value.)
								16.53	Total(Pt) Route 8
114	118' - 4"	5.6	19.75	3/4"	(See Notes)	0' - 11 3/8"	120	12.43	• • • • • **Route 9** • • • • • Sprinkler,
						2' - 0"	0.41	0.41	E(2' - 0"), HW
23	117' - 4 5/8"	11.88	19.75	7/8"		2' - 11 3/8"		1.21	
23	117' - 4 5/8"			1 1/2"	(See Notes)	4' - 3 1/2"	120	14.06	
							0.02		Tr, HW
19	117' - 4 5/8"	3.11	19.75	1 5/8"		4' - 3 1/2"		0.07	
								14.13	Total(Pt) Route 9
116	118' - 4"	5.6	19.92	3/4"	(See Notes)	0' - 11 3/8"	120	12.66	• • • • • **Route 10** • • • • • Sprinkler,
						2' - 0"	0.42	0.41	E(2' - 0"), HW
25	117' - 4 5/8"	11.99	19.92	7/8"		2' - 11 3/8"		1.24	
25	117' - 4 5/8"			1 1/2"	(See Notes)	4' - 3 1/2"	120	14.31	
							0.02		Tr, HW
21	117' - 4 5/8"	3.14	19.92	1 5/8"		4' - 3 1/2"		0.07	
21	117' - 4 5/8"		20.09	1 1/2"	(See Notes)	8' - 1 5/8"	120	14.37	Flow (q) from Route 14
							0.06		Tr, HW
15	117' - 4 5/8"	6.31	40.01	1 5/8"		8' - 1 5/8"		0.47	
								14.85	Total(Pt) Route 10
107	118' - 4"	5.6	19.99	3/4"	(See Notes)	0' - 11 3/8"	120	12.74	• • • • • **Route 11** • • • • • Sprinkler,
						2' - 0"	0.42	0.41	E(2' - 0"), HW
35	117' - 4 5/8"	12.03	19.99	7/8"		2' - 11 3/8"		1.24	
35	117' - 4 5/8"			1"	(See Notes)	3' - 4 1/8"	120	14.40	
						5' - 0"	0.13		PO(5' - 0"), HW
36	117' - 4 5/8"	7.42	19.99	1"		8' - 4 1/8"		1.09	
36	117' - 4 5/8"		19.99	1 1/4"	(See Notes)	0' - 7 7/8"	120	15.48	Flow (q) from Route 12
						3' - 0"	0.12		E(3' - 0"), HW
33	117' - 4 5/8"	8.58	39.98	1 3/8"		3' - 7 7/8"		0.45	
33	117' - 4 5/8"			2"	(See Notes)	9' - 8 3/4"	120	15.93	
						10' - 0"	0.02		2E(5' - 0"), HW
32	117' - 4 5/8"	3.82	39.98	2 1/8"		19' - 8 3/4"		0.34	

Job Name: Togus EHRM Infrastructure Upgrades
Remote Area Name: MAIN COMPUTER ROOM

Date: 11/9/2025

Pipe Information

Node 1 / Node 2	Elev 1 / Elev 2 ft	K-Factor / Velocity	Flow added this step / Total Flow Q	Nominal ID / Actual ID	Fittings & Devices / Equiv. Length ft	Length / Fitting / Total ft	C Factor or Roughness / Pf Friction Loss Per Unit ds force per square	Total(Pt) / Elev(Pe) / Friction(Pf)	Notes (Fitting/Device (Equivalent Length); Fixed Pressure Losses, when applicable, are added directly to (Pf) and shown as a negative value.)
32	117' - 4 5/8"			3"	(See Notes)	5' - 7 1/4"	120	16.27	
31	117' - 4 5/8"	1.54	39.98	3 1/4"		5' - 7 1/4"	0.00	0.01	Tr, HW
31	117' - 4 5/8"		40.84	3"	(See Notes)	9' - 8"	120	16.28	Flow (q) from Route 13
30	117' - 4 5/8"	3.11	80.83	3 1/4"		9' - 8"	0.01	0.07	Tr, HW
								16.35	Total(Pt) Route 11
106	118' - 4"	5.6	19.99	3/4"	(See Notes)	0' - 11 3/8"	120	12.75	• • • • • **Route 12** • • • • • Sprinkler,
34	117' - 4 5/8"	12.03	19.99	7/8"		2' - 0"	0.42	0.41	E(2' - 0"), HW
						2' - 11 3/8"		1.24	
34	117' - 4 5/8"			1"	(See Notes)	3' - 3 1/2"	120	14.40	
36	117' - 4 5/8"	7.42	19.99	1"		5' - 0"	0.13		PO(5' - 0"), HW
						8' - 3 1/2"		1.08	
								15.48	Total(Pt) Route 12
112	118' - 4"	5.6	20.19	3/4"	(See Notes)	0' - 11 3/8"	120	13.00	• • • • • **Route 13** • • • • • Sprinkler,
16	117' - 4 5/8"	12.15	20.19	7/8"		4' - 0"	0.43	0.41	PO(4' - 0"), HW
						4' - 11 3/8"		2.12	
16	117' - 4 5/8"		20.65	1 1/2"	(See Notes)	4' - 3 1/4"	120	15.54	Flow (q) from Route 15
31	117' - 4 5/8"	6.44	40.84	1 5/8"		8' - 0"	0.06	0.00	PO(8' - 0"), HW
						12' - 3 1/4"		0.74	
								16.28	Total(Pt) Route 13
103	111' - 1"	5.6	20.09	3/4"	(See Notes)	6' - 3 5/8"	120	12.87	• • • • • **Route 14** • • • • • Sprinkler,
37	117' - 4 5/8"	12.09	20.09	7/8"		2' - 0"	0.43	-2.73	E(2' - 0"), HW
						8' - 3 5/8"		3.53	
37	117' - 4 5/8"			1"	(See Notes)	0' - 4 7/8"	120	13.66	
21	117' - 4 5/8"	7.46	20.09	1"		5' - 0"	0.13	0.00	PO(5' - 0"), HW
						5' - 4 7/8"		0.71	
								14.37	Total(Pt) Route 14
117	118' - 4"	5.6	20.65	3/4"	(See Notes)	0' - 11 3/8"	120	13.60	• • • • • **Route 15** • • • • • Sprinkler,
26	117' - 4 5/8"	12.42	20.65	7/8"		2' - 0"	0.45	0.41	E(2' - 0"), HW
						2' - 11 3/8"		1.32	

Job Name: Togus EHRM Infrastructure Upgrades
Remote Area Name: MAIN COMPUTER ROOM

Date: 11/9/2025

Pipe Information

Node 1 / Node 2	Elev 1 / Elev 2 ft	K-Factor / Velocity	Flow added this step / Total Flow Q	Nominal ID / Actual ID	Fittings & Devices / Equiv. Length ft	Length ft / Fitting ft / Total ft	C Factor or Roughness / Pf Friction Loss Per Unit ds force per square	Total(Pt) / Elev(Pe) / Friction(Pf)	Notes Fitting/Device (Equivalent Length) Fixed Pressure Losses, when applicable, are added directly to (Pf) and shown as a negative value.
26	117' - 4 5/8"			1 1/2"	(See Notes)	12' - 5 1/8"	120	15.33	Tr, HW
16	117' - 4 5/8"	3.25	20.65	1 5/8"		12' - 5 1/8"	0.02	0.21	
								15.54	Total(Pt) Route 15
108	118' - 4"	5.6	21.07	3/4"	(See Notes)	0' - 11 3/8"	120	14.16	• • • • • **Route 16** • • • • • Sprinkler, PO(4' - 0"), HW
12	117' - 4 5/8"	12.68	21.07	7/8"		4' - 0"	0.46	0.41	
						4' - 11 3/8"		2.30	
12	117' - 4 5/8"		21.54	1 1/2"	(See Notes)	4' - 3 1/4"	120	16.87	Flow (q) from Route 17 PO(8' - 0"), HW
27	117' - 4 5/8"	6.72	42.61	1 5/8"		8' - 0"	0.07	0.00	
						12' - 3 1/4"		0.80	
								17.67	Total(Pt) Route 16
113	118' - 4"	5.6	21.54	3/4"	(See Notes)	0' - 11 3/8"	120	14.80	• • • • • **Route 17** • • • • • Sprinkler, E(2' - 0"), HW
22	117' - 4 5/8"	12.96	21.54	7/8"		2' - 0"	0.48	0.41	
						2' - 11 3/8"		1.43	
22	117' - 4 5/8"			1 1/2"	(See Notes)	12' - 5 1/8"	120	16.64	Tr, HW
12	117' - 4 5/8"	3.39	21.54	1 5/8"		12' - 5 1/8"	0.02	0.23	
								16.87	Total(Pt) Route 17

Job Name: Togus EHRM Infrastructure Upgrades
Remote Area Name: MAIN COMPUTER ROOM

Date: 11/9/2025

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

(Actual Inside Diameter / Schedule 40 Steel Pipe Inside Diameter) 4.87 = Factor

C Value Multiplier

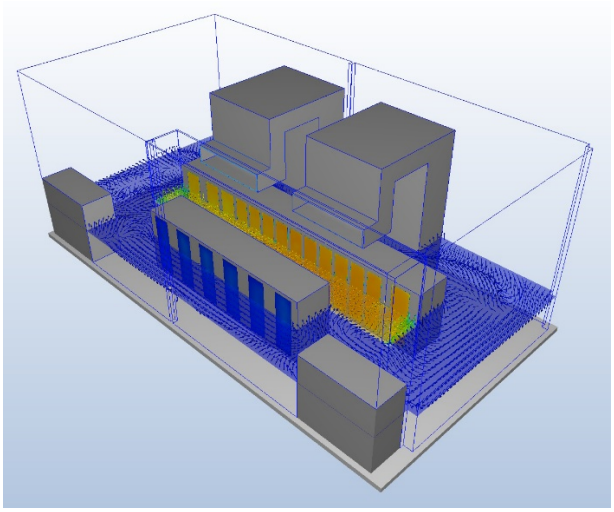
Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Notes Legend

BFP	Backflow Preventer	BV	Butterfly Valve	CV	Check Valve
E	90° Elbow	HW	Hazen-Williams	PO	Pipe Outlet
red	Reducer/Adapter	S	Supply	Spr	Sprinkler
Tr	Tee run				

Mechanical - MCR CFD Analysis

VA | U.S. Department of Veterans Affairs



EHRM Infrastructure Upgrades

Togus VA Medical Center
Togus, Maine
Project Number 402-22-700

November 10, 2025
100% Construction Documents

CFD Analysis

GDM ARCHITECTS • ENGINEERS

GDM AE, Inc.
1308 NE 134th Street, Suite A
Vancouver, WA 98685

SBA U.S. Small Business Administration SERVICE-DISABLED VETERAN-OWNED CERTIFIED

MECHANICAL DESIGN - MCR

The HVAC design for the MCR utilizes a pair of downflow CRAC units, connected to a hot aisle containment system by overhead return ductwork.

The CRAC unit configuration included in the current design and calculations meet the N+1 minimum redundancy required by DCIE/OIT. Each unit is capable of handling the required cooling load on its own, with the other unit in standby or shut down.

The CRAC units can operate concurrently at reduced airflow and compressor settings for optimized energy efficiency, or can operate with fewer units at higher loading to meet the required capacity.

Staging and fail-over functionality is handled by the CRAC system integrated controls. Both CRAC units are networked together to enable this control functionality.

The CRAC units included in the design are Liebert DSE125 indoor units with nominal sensible cooling capacity of 125kW each. Heat rejection from the CRAC units is accomplished using dedicated outdoor condensing units. These systems will also include a refrigerant-side economizer for increased efficiency.

Arranged in a hot-aisle configuration, the CRAC units draw hot supply air from the containment area and flood the MCR with cooled supply air. This configuration is proposed for this project as it offers greater occupant comfort compared to a cold-aisle containment system which results in elevated temperatures throughout the rest of the room, and also may mitigate potential hot-spots that could otherwise occur due to the nature of the in-row CRAC units.

ANALYSIS CONDITIONS

CFD analysis performed using Autodesk CFD 2019 software.

The following design conditions are utilized in the CFD model for this facility:

- Exact loads for each data cabinet, and the distribution of loads within each cabinet, are unknown and may change over time. The CFD analysis utilizes the following heat loads (as specified in the VA CFD Guidelines and ISTS v3.1) for each cabinet/equipment type:
    - SD cabinets: 5.0kW each
    - HD cabinets: 10.0kW each
    - HDA cabinets: 2.8kW each
    - MDA cabinets: 3.5kW each
    - UPS units: 5kw per active section (10.0kw total)
- Based on the telecommunications documents, the total loads included in the CFD model for the MCR include 86.6kW in data cabinets (SD, HDA, & MDA types) as well as 10kW estimated load for the UPS units for a total design heat load of 96.6kW. The actual installed kW load following

this project will be less than the calculated load in the CFD model. The ultimate data cabinet load in the MCR per the DCIE standard small data center layout is 79.6kW.

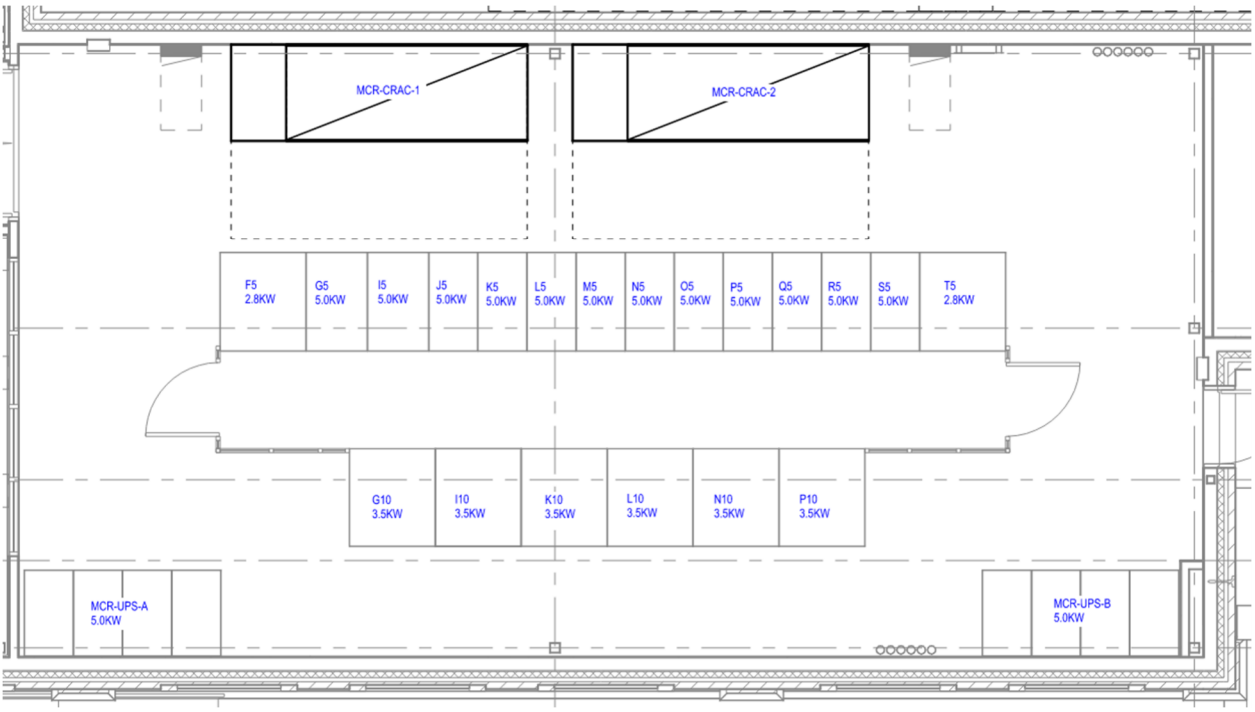
- Airflows for each cabinet/equipment type utilized are modeled as follows:
    - SD cabinets: 1040 cfm each
    - HDA cabinets: 585 cfm each
    - MDA cabinets: 725 cfm each
- (2) CRAC units provide data center conditioning for the main data cabinet set in the MCR. The CFD model reflects (1) CRAC units operating at 100% airflow (18,000 cfm), with the other unit being inactive (redundant/standby or failed).
- The UPS units are nominally 100kW rated each, with a nominal maximum heat output of 10kW. Sample manufacturer's data indicates that actual heat output from the UPS units will be much lower (example - 3.1kW for Schneider Galaxy VS 100kW).

DESIGN GOALS

The objectives for the MCR cooling system are to achieve the following conditions:

- Supply air temperature setpoints between 64-81°F.
- Inlet temperatures at data equipment between 72-80.6°F.
- Rack/cabinet exhaust temperatures below 106°F (with up to 108°F acceptable at 1-2 racks).
- Minimize cold and hot spots near data equipment.
- Maintain room ambient conditions below 85°F for human comfort. Note that required rack inlet temperatures are lower than this temperature (supply air temperatures between 64-81°F).
- Maintain suitable temperatures for UPS unit operation, within manufacturer typical ambient temperature range of 41-104°F.

MCR LAYOUT

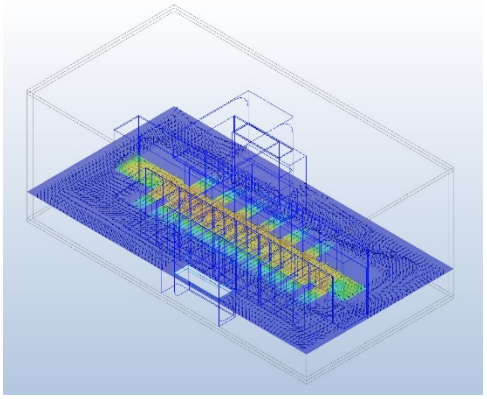


MCR DATA CABINET INFORMATION

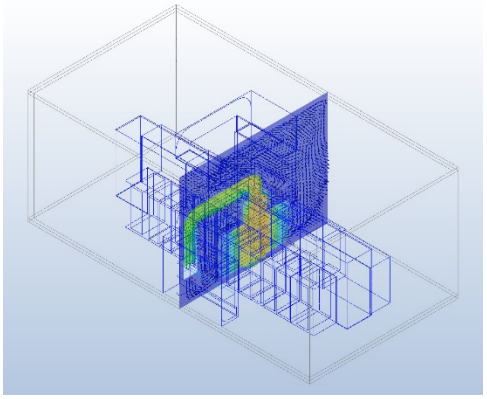
Label	Type	Modeled KW Heat Load
F5	HDA	2.8
G5	SD (Oracle FDS)	5.0
I5	SD (Oracle FDS)	5.0
J5	SD	5.0
K5	SD	5.0
L5	SD	5.0
M5	SD	5.0
N5	SD	5.0
O5	SD	5.0
P5	SD	5.0
Q5	SD	5.0
R5	SD	5.0
S5	SD	5.0
T5	HDA	2.8
G10	MDA	3.5
I10	MDA	3.5
K10	MDA	3.5
L10	MDA	3.5
N10	MDA	3.5
P10	MDA	3.5
MCR-UPS-A	UPS	5.0
MCR-UPS-B	UPS	5.0
Total Load		**96.6**

VIEW LEGENDS - MCR

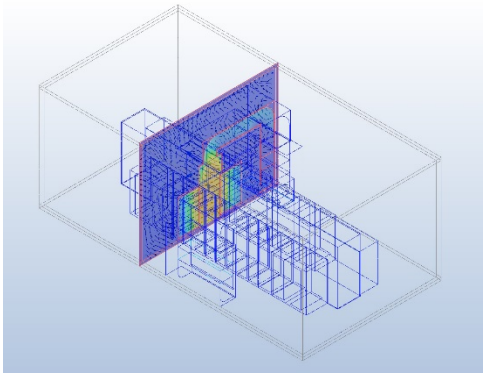
The views shown for each scenario are cut at the following locations.



Plane 1 – Horizontal orientation, approximately 48" above raised floor



Plane 2 – Vertical (north-south) orientation, through MCR-CRAC-1



Plane 3 – Vertical (north-south) orientation, through MCR-CRAC-2

MCR - SCENARIO 1A

Scenario conditions: 65°F supply air, CRAC unit MCR-CRAC-1 on, MCR-CRAC-2 off.

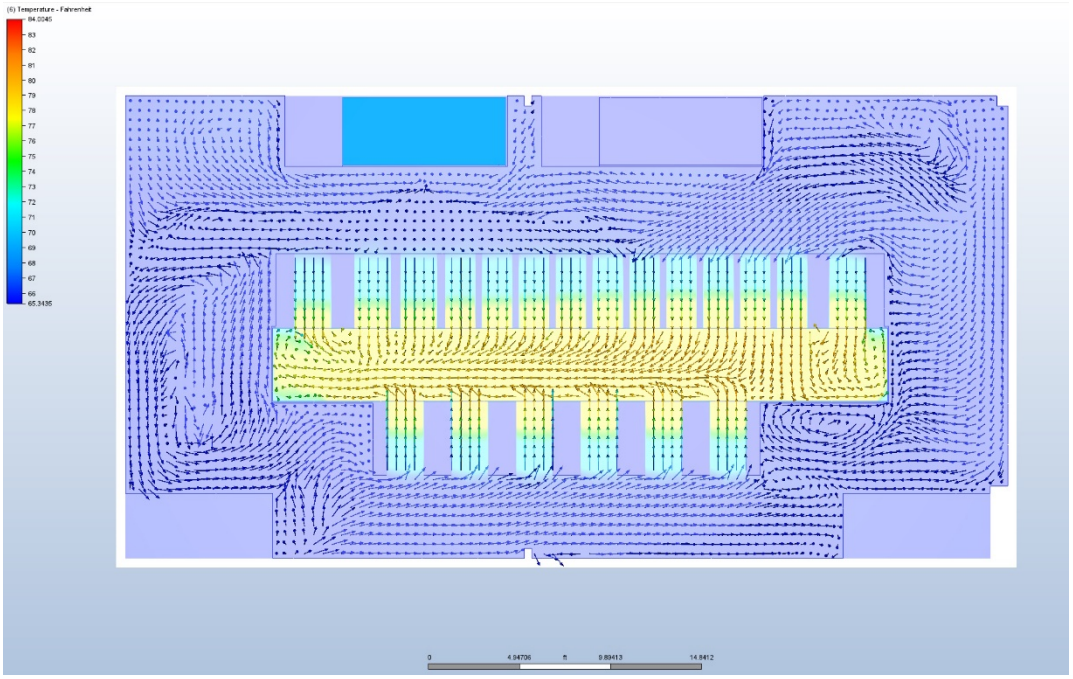


Figure 1a.1 – Plane 1

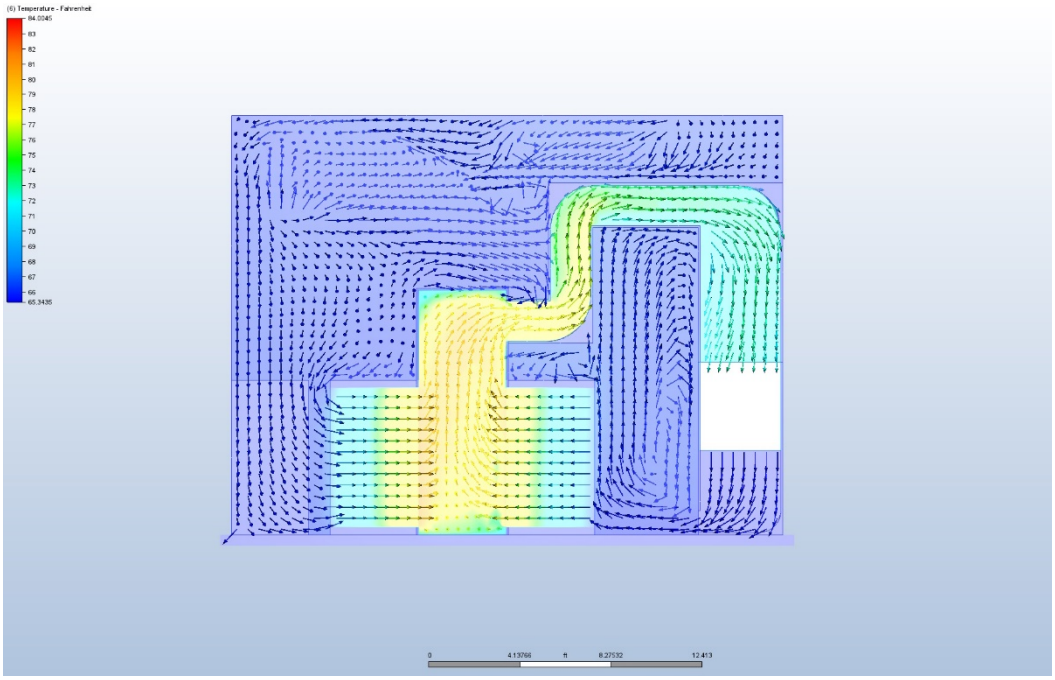


Figure 1a.2 – Plane 2

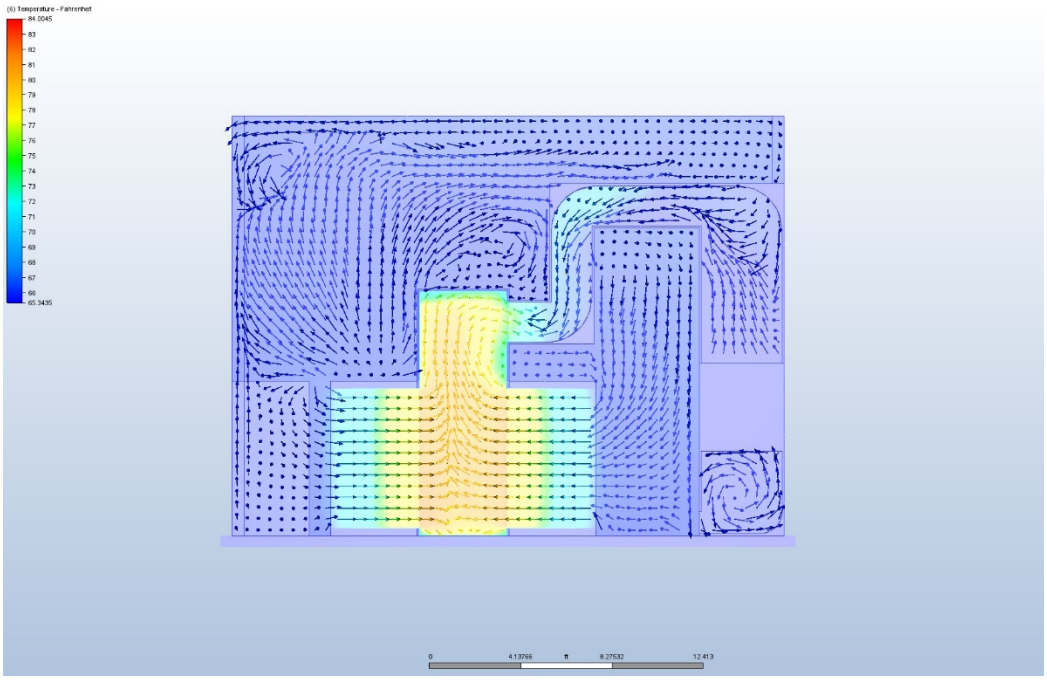


Figure 1a.3 – Plane 3

MCR - SCENARIO 1B

Scenario conditions: 65°F supply air, CRAC unit MCR-CRAC-2 on, MCR-CRAC-1 off.

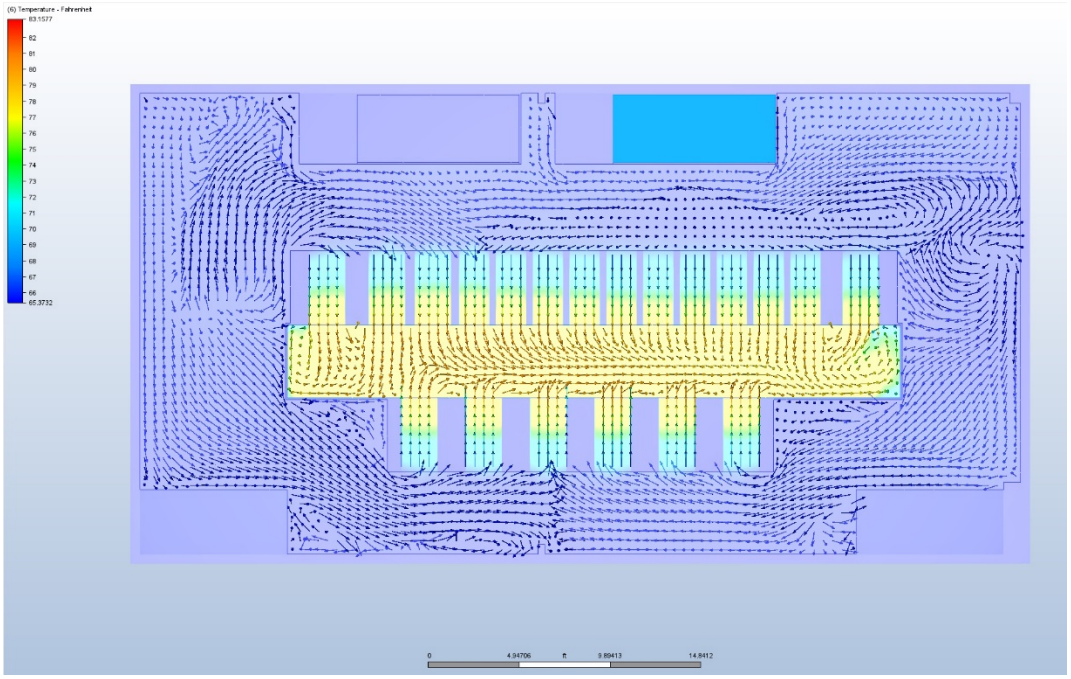


Figure 1b.1 – Plane 1

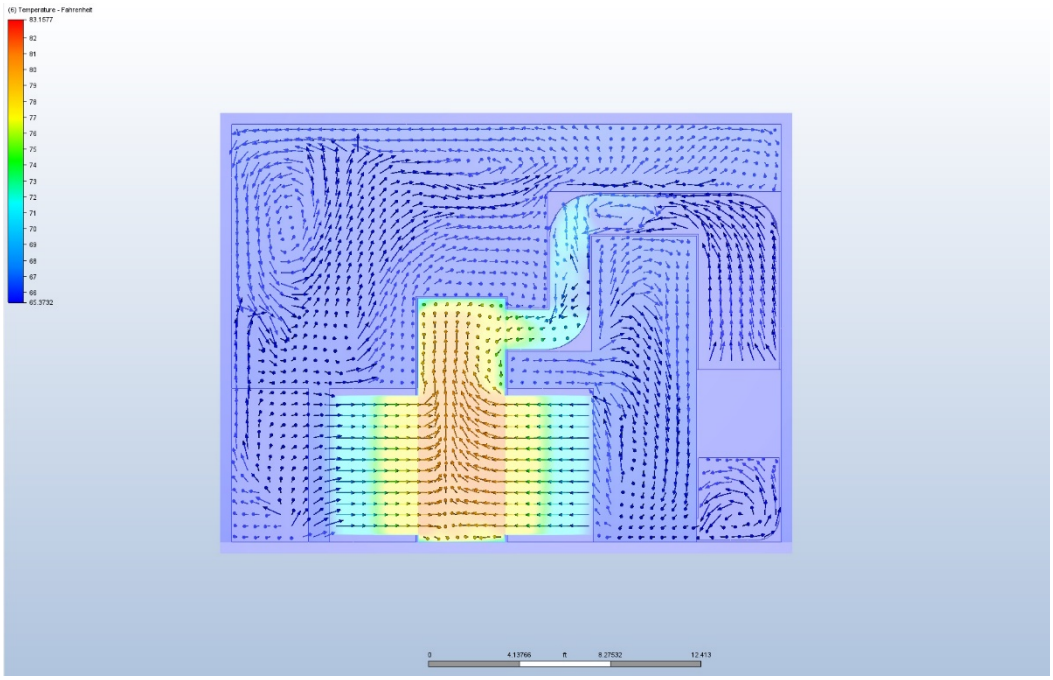


Figure 1b.2 – Plane 2

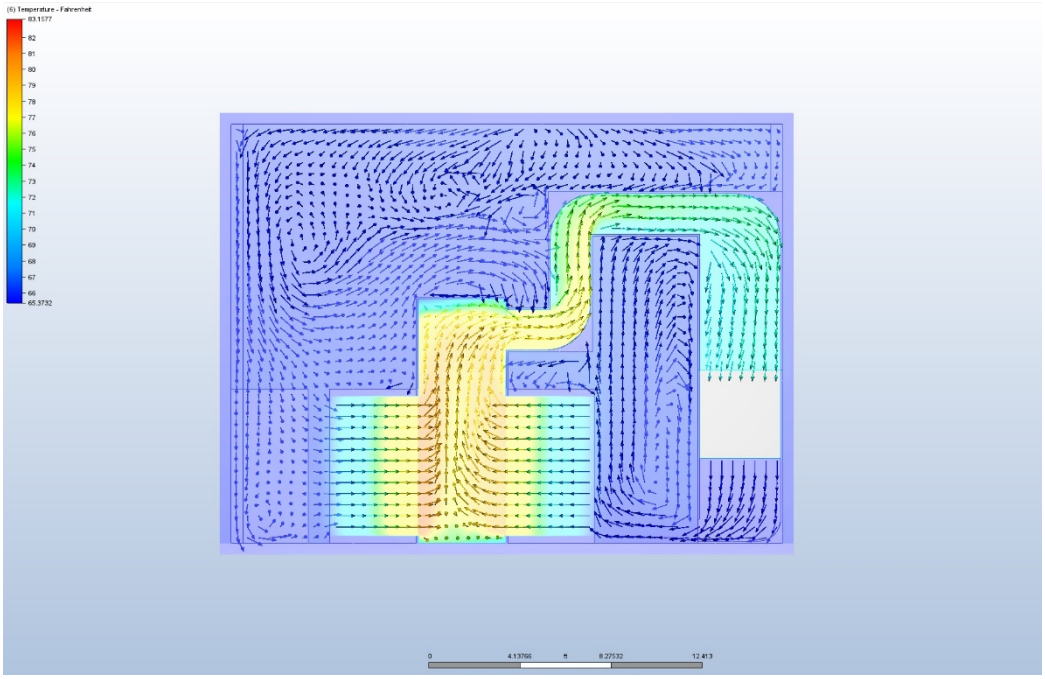


Figure 1b.3 – Plane 3

MCR - SCENARIO 2A

Scenario conditions: 70°F supply air, CRAC unit MCR-CRAC-1 on, MCR-CRAC-2 off.

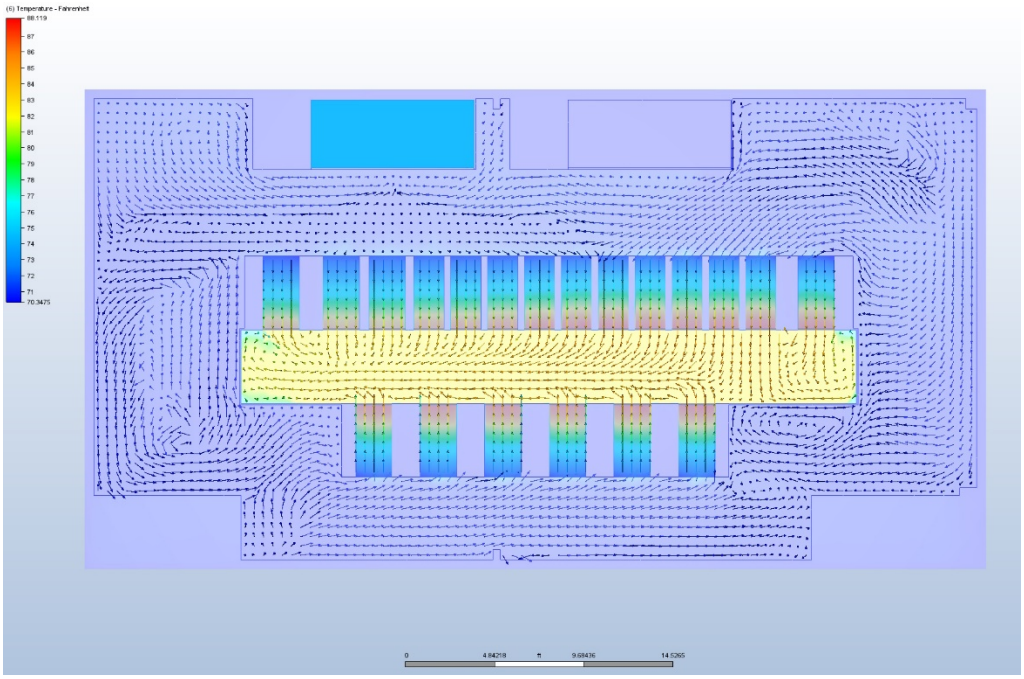


Figure 2a.1 – Plane 1

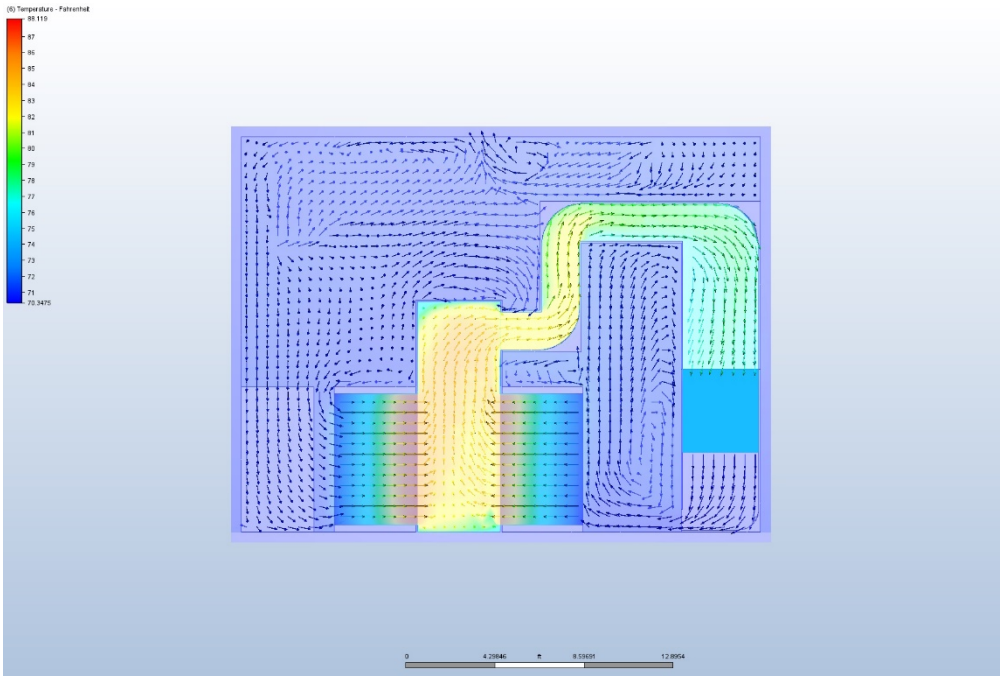


Figure 2a.2 – Plane 2

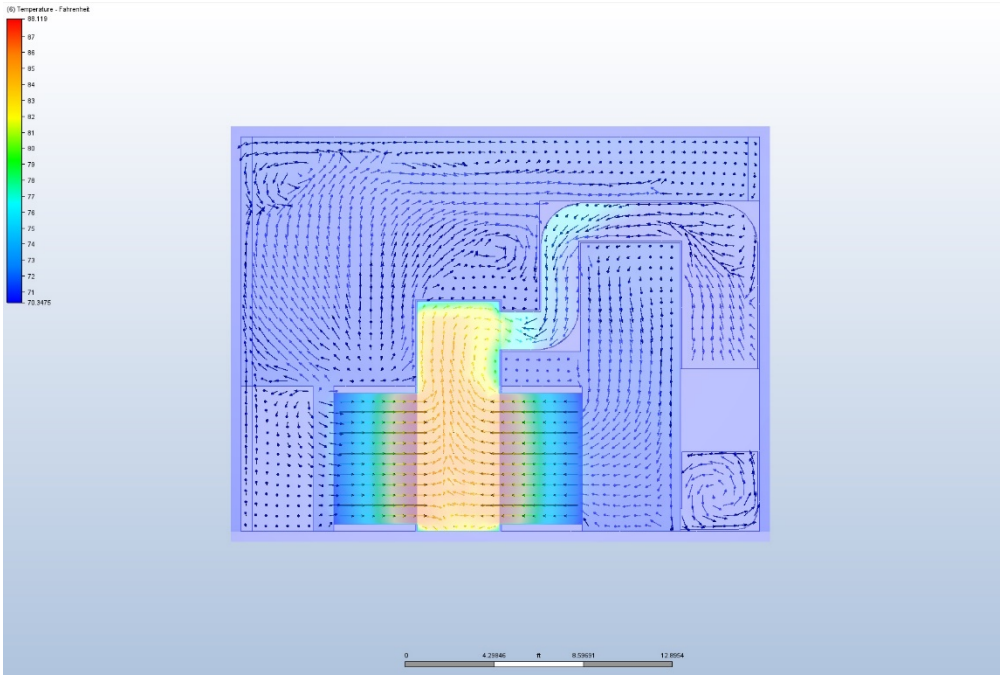


Figure 2a.3 – Plane 3

MCR - SCENARIO 2B

Scenario conditions: 70°F supply air, CRAC unit MCR-CRAC-2 on, MCR-CRAC-1 off.

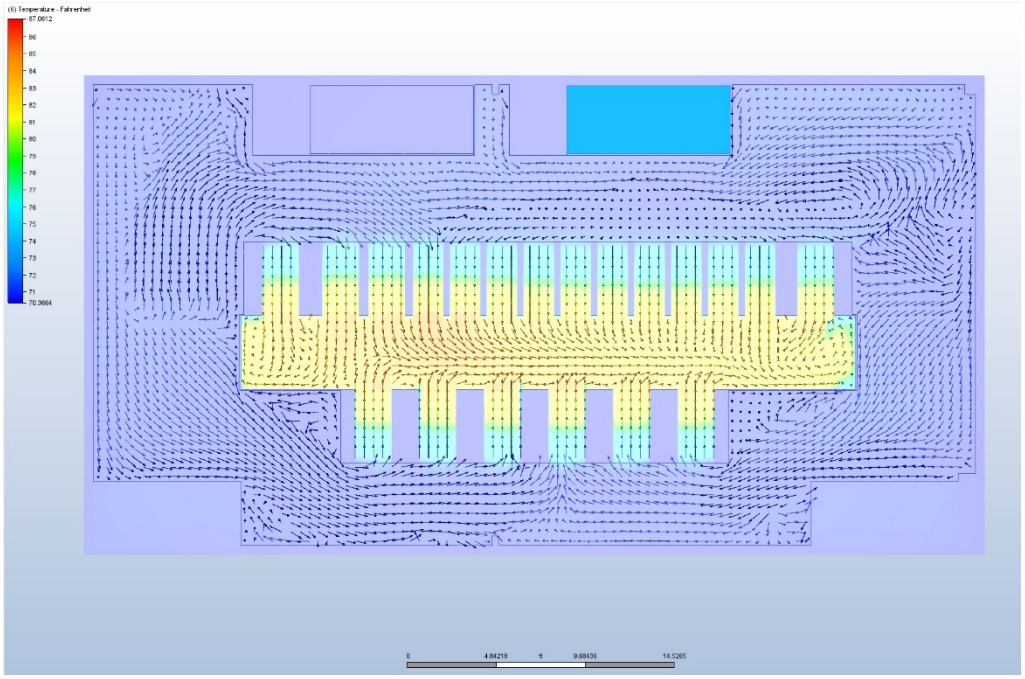


Figure 2b.1 – Plane 1

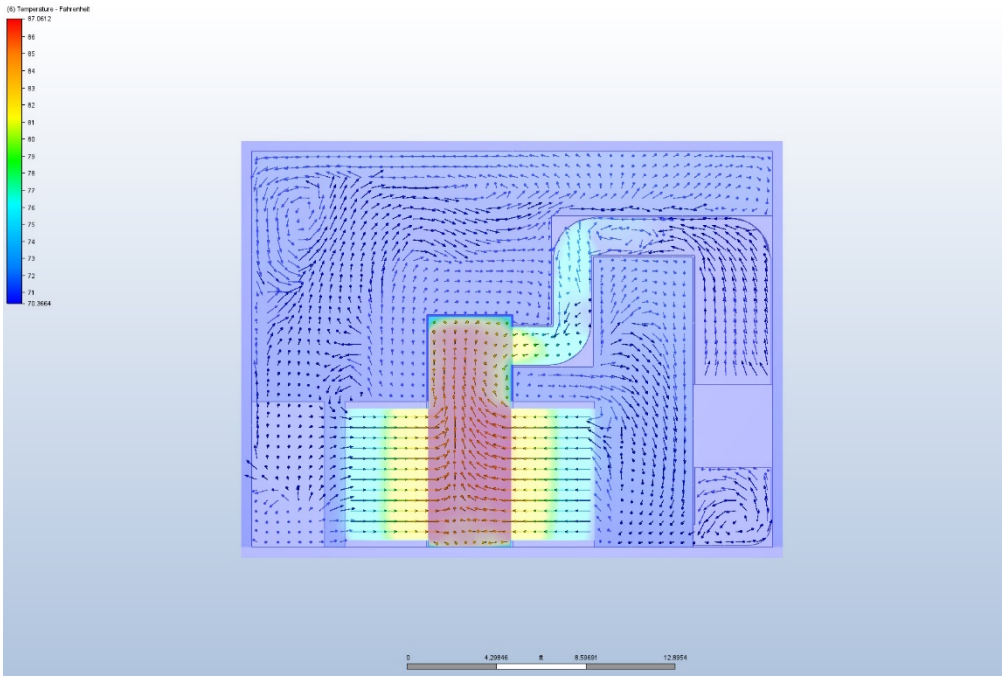


Figure 2b.2 – Plane 2

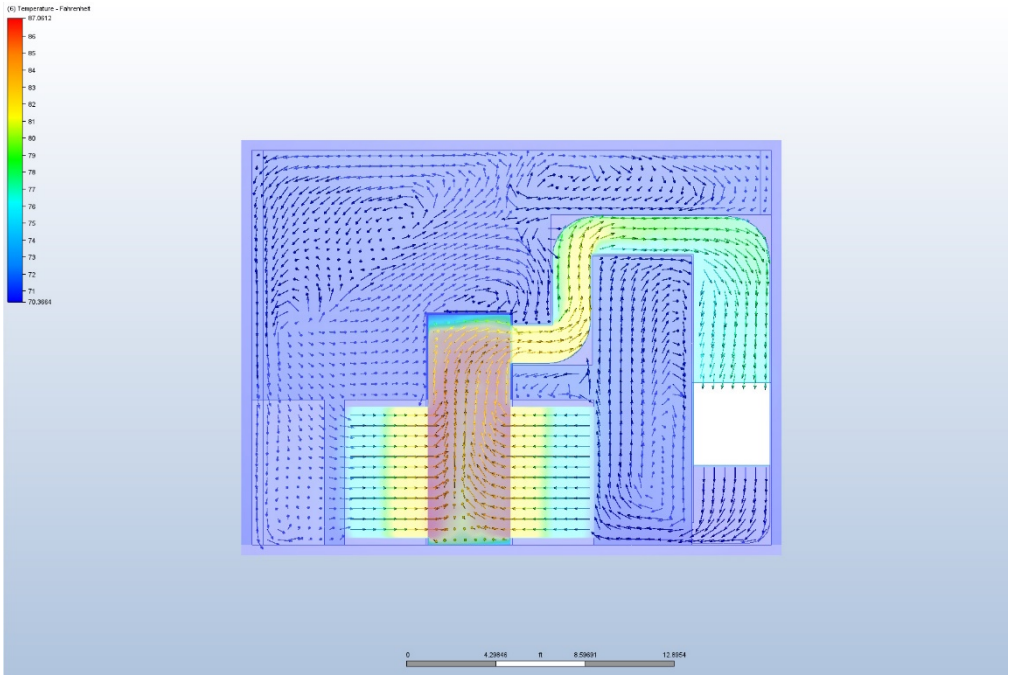


Figure 2b.3 – Plane 3

MCR - SCENARIO 3A

Scenario conditions: 75°F supply air, CRAC unit MCR-CRAC-1 on, MCR-CRAC-2 off.

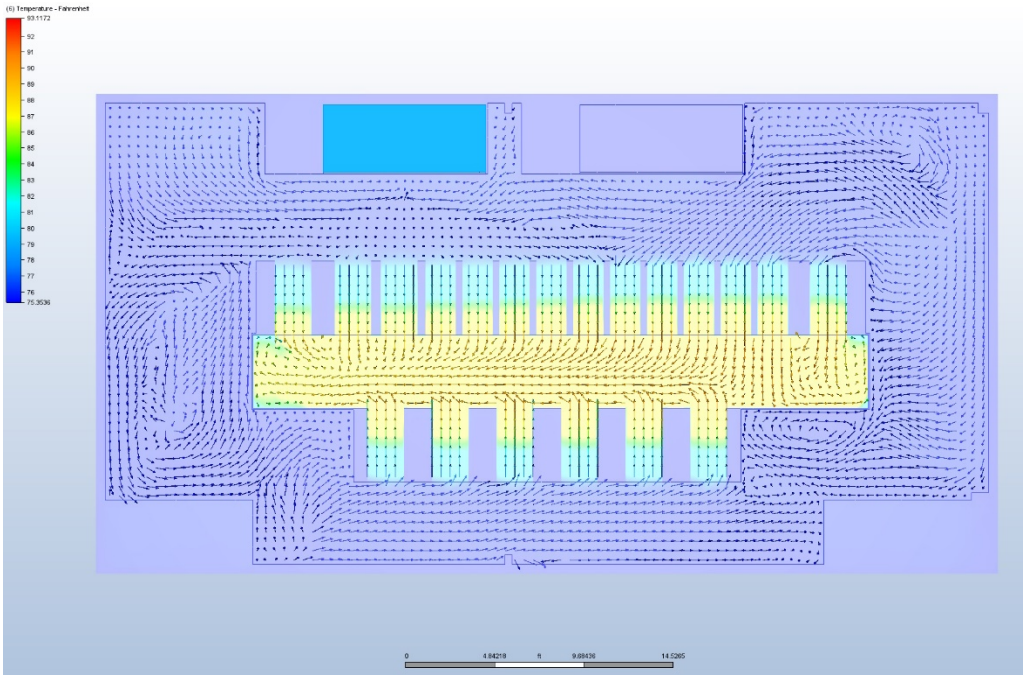


Figure 3a.1 – Plane 1

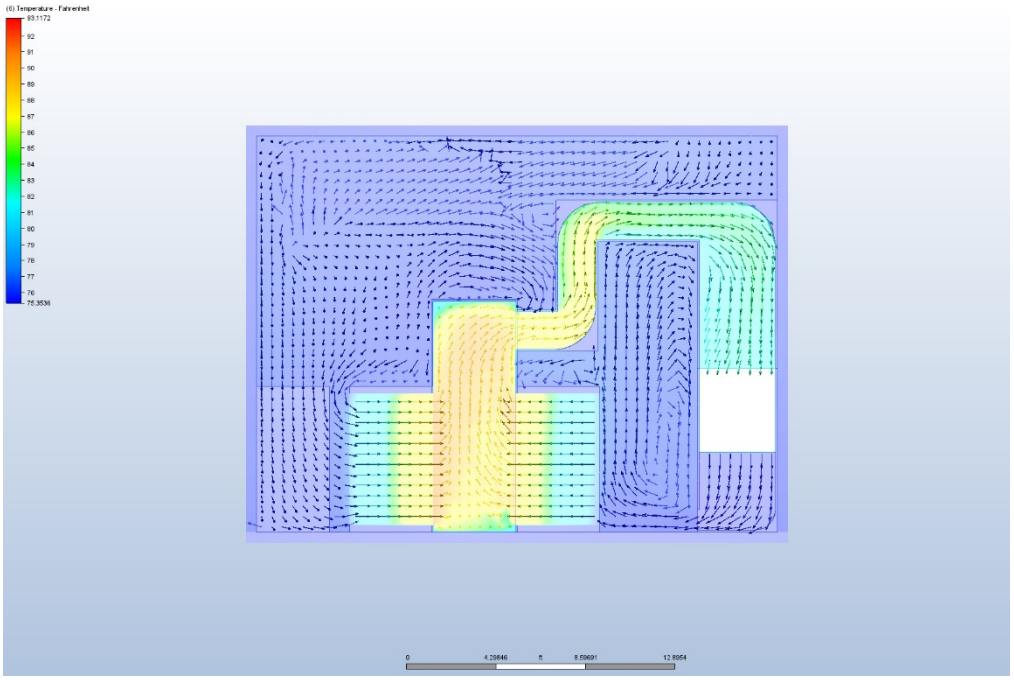


Figure 3a.2 – Plane 2

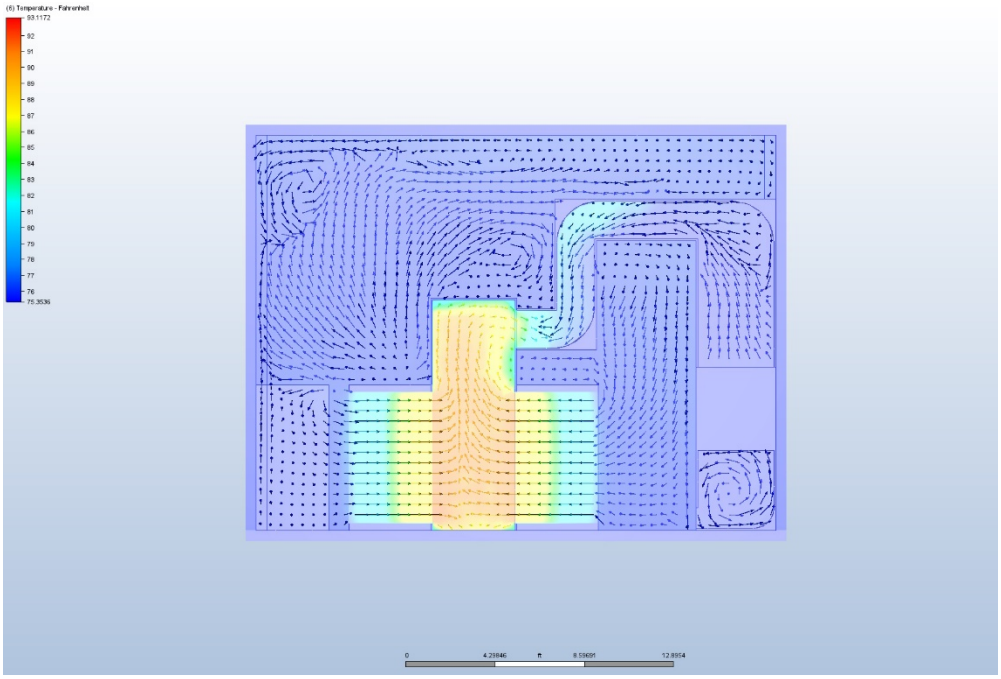


Figure 3a.3 – Plane 3

MCR - SCENARIO 3B

Scenario conditions: 75°F supply air, CRAC unit MCR-CRAC-2 on, MCR-CRAC-1 off.

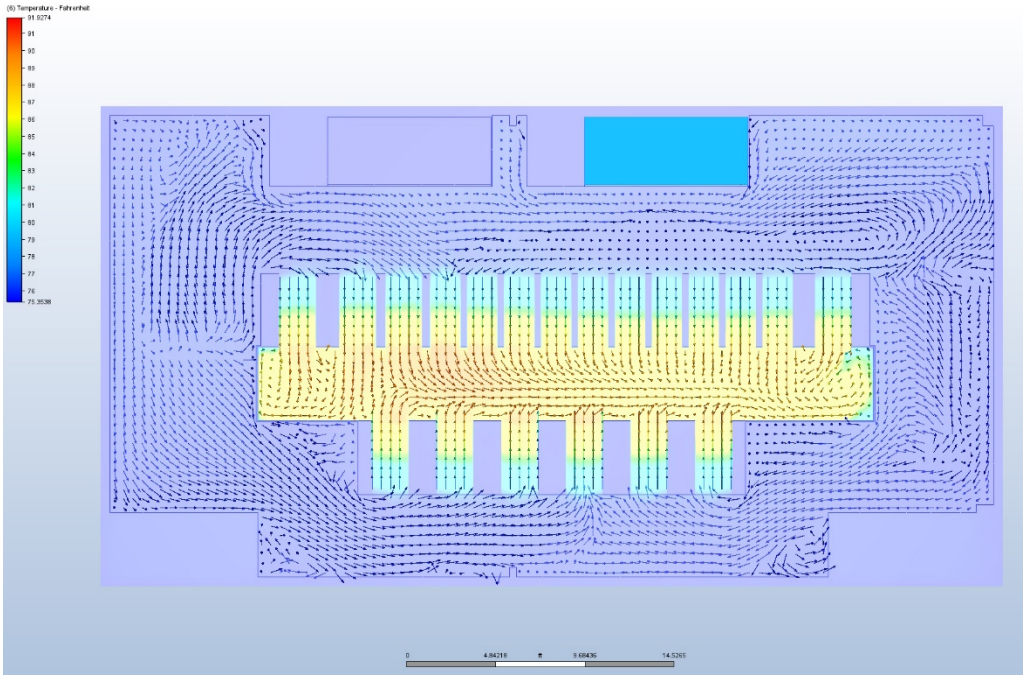


Figure 3b.1 – Plane 1

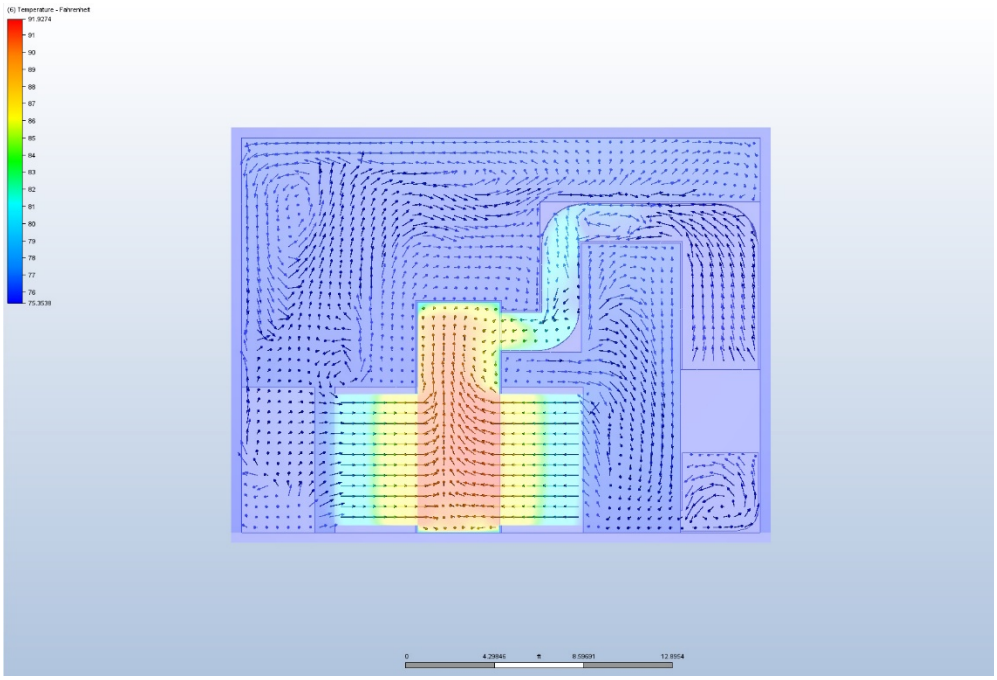


Figure 3b.2 – Plane 2

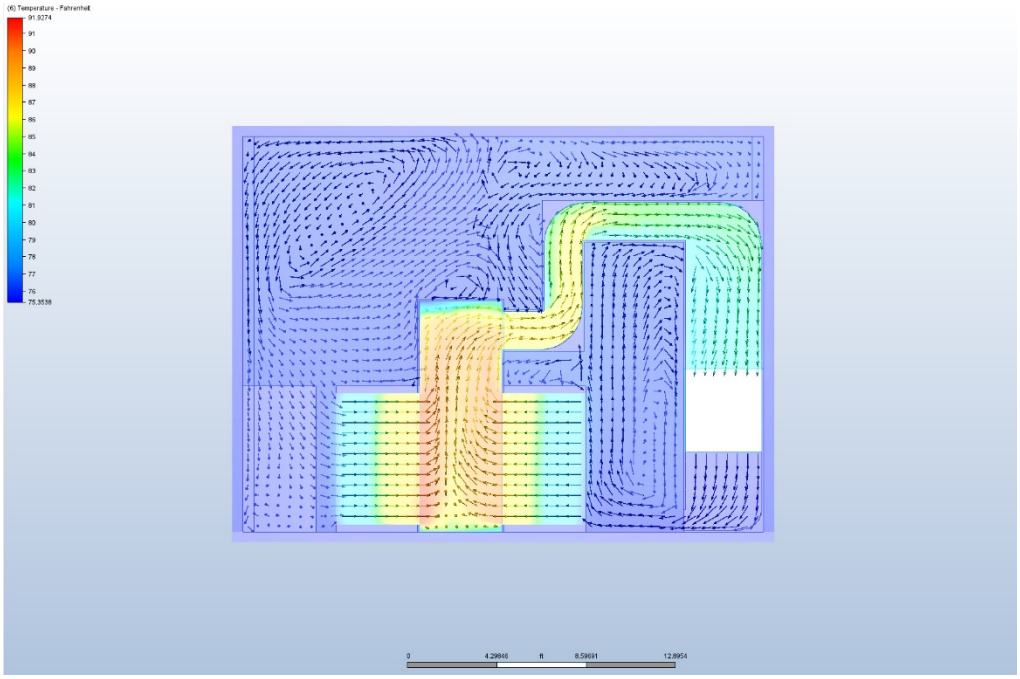


Figure 3b.3 – Plane 3

MCR - SCENARIO 4A

Scenario conditions: 80°F supply air, CRAC unit MCR-CRAC-1 on, MCR-CRAC-2 off.

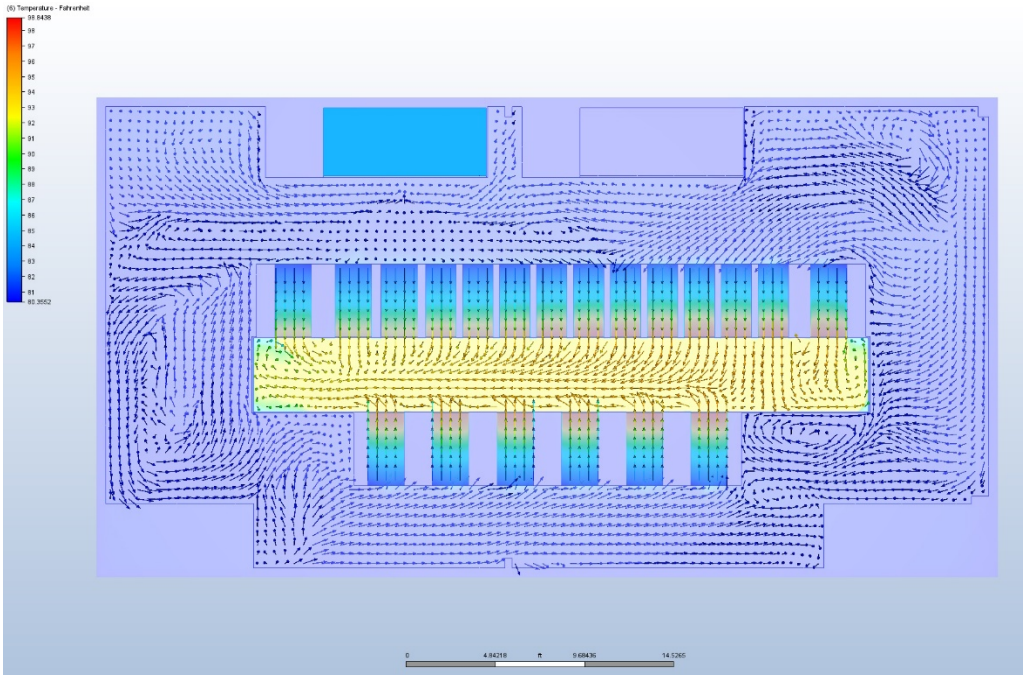


Figure 4a.1 – Plane 1

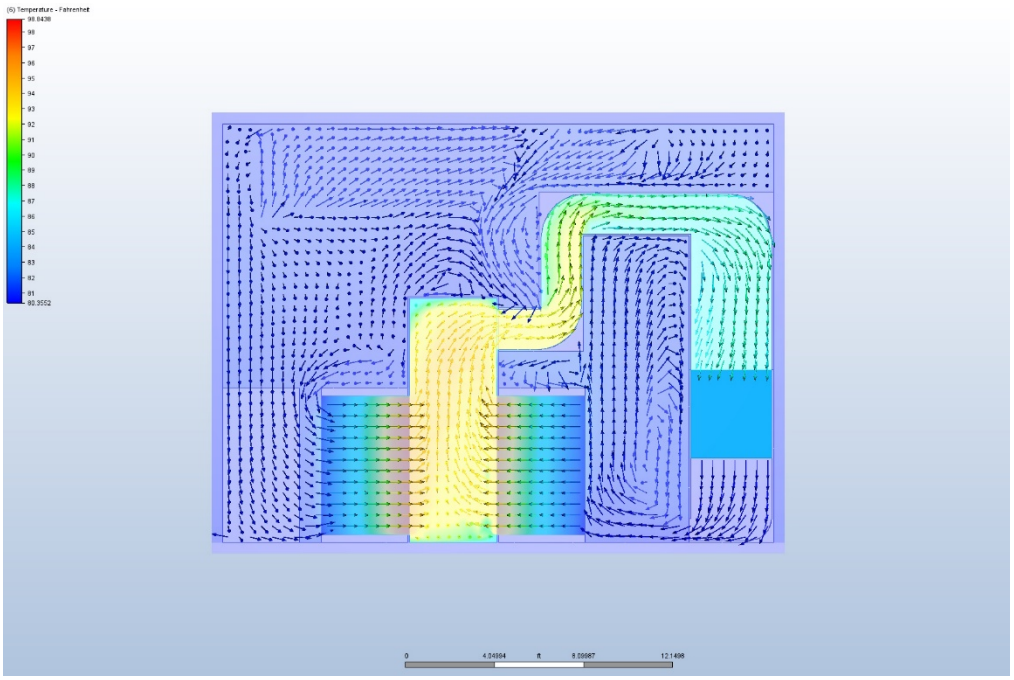


Figure 4a.2 – Plane 2

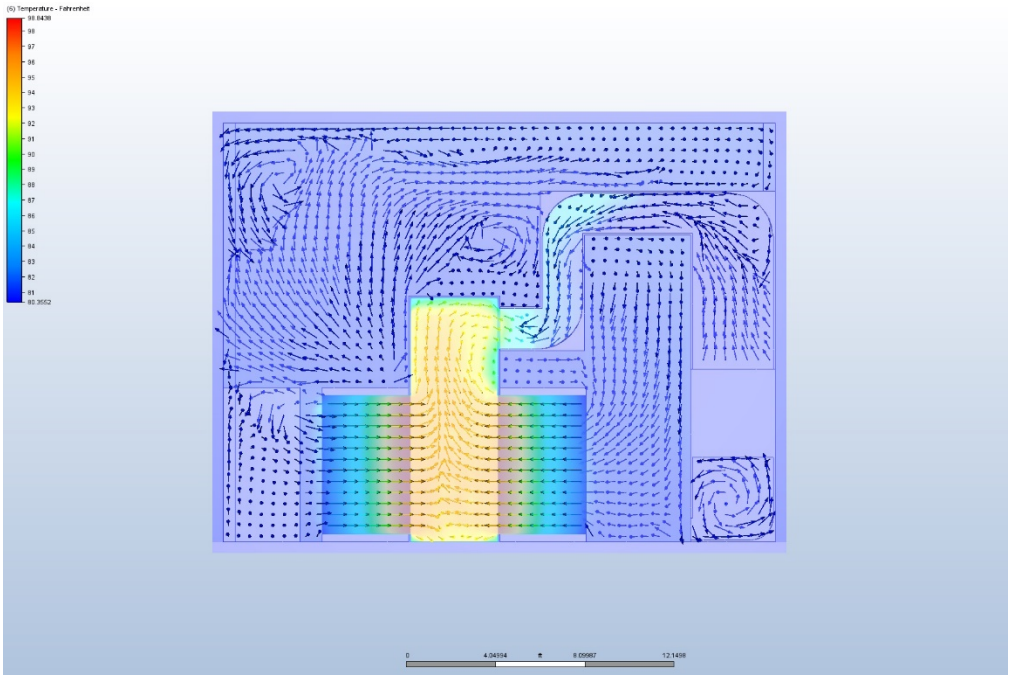


Figure 4a.3 – Plane 3

MCR - SCENARIO 4B

Scenario conditions: 80°F supply air, CRAC unit MCR-CRAC-2 on, MCR-CRAC-1 off.

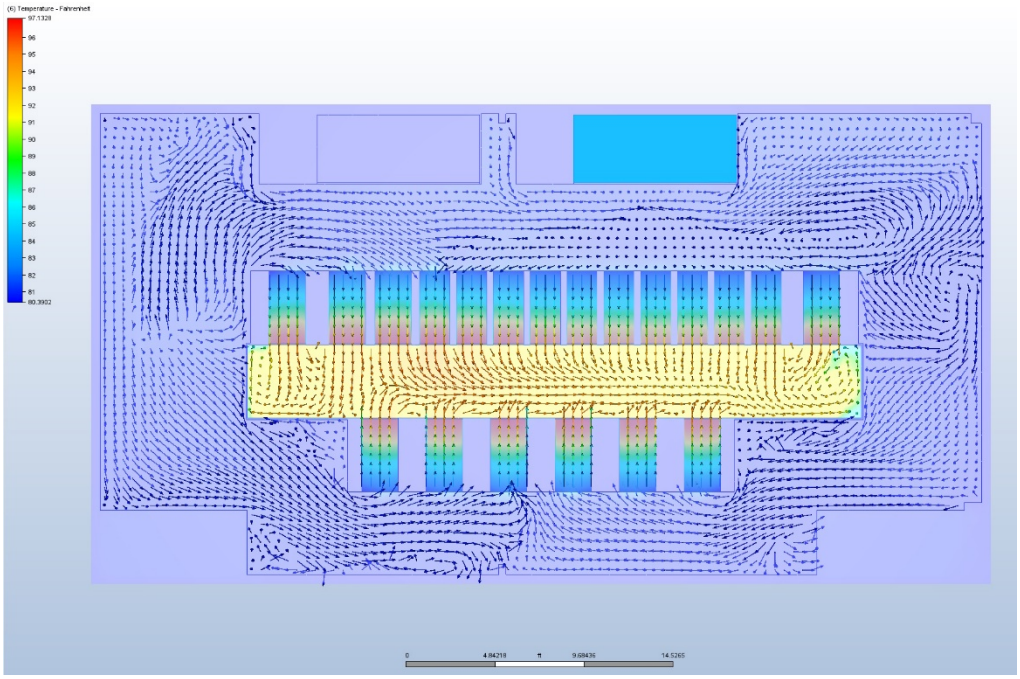


Figure 4b.1 – Plane 1

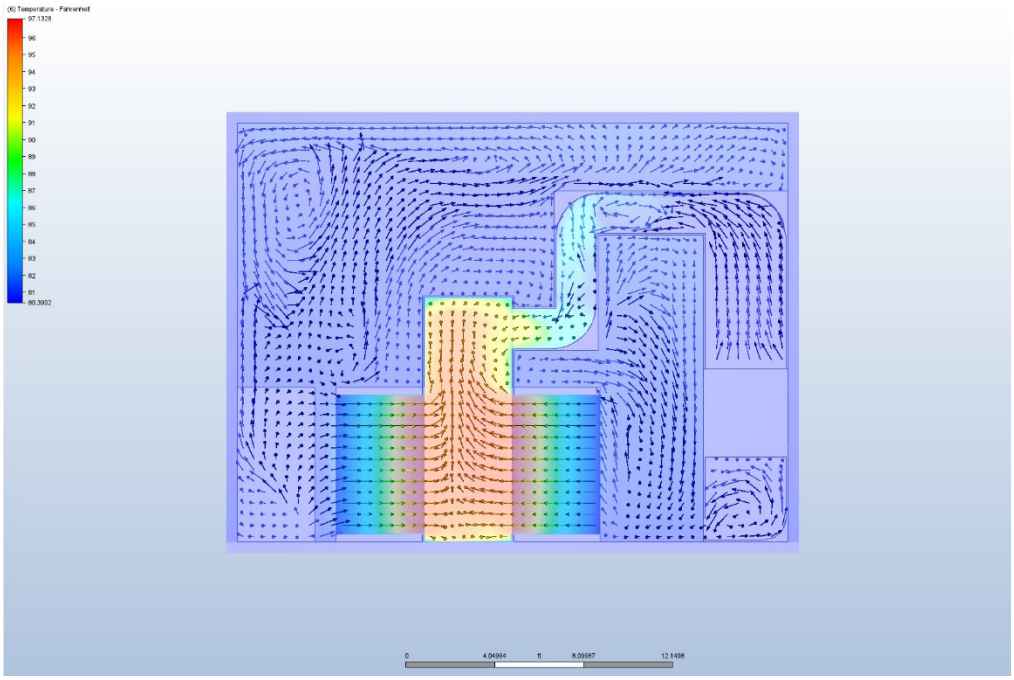


Figure 4b.2 – Plane 2

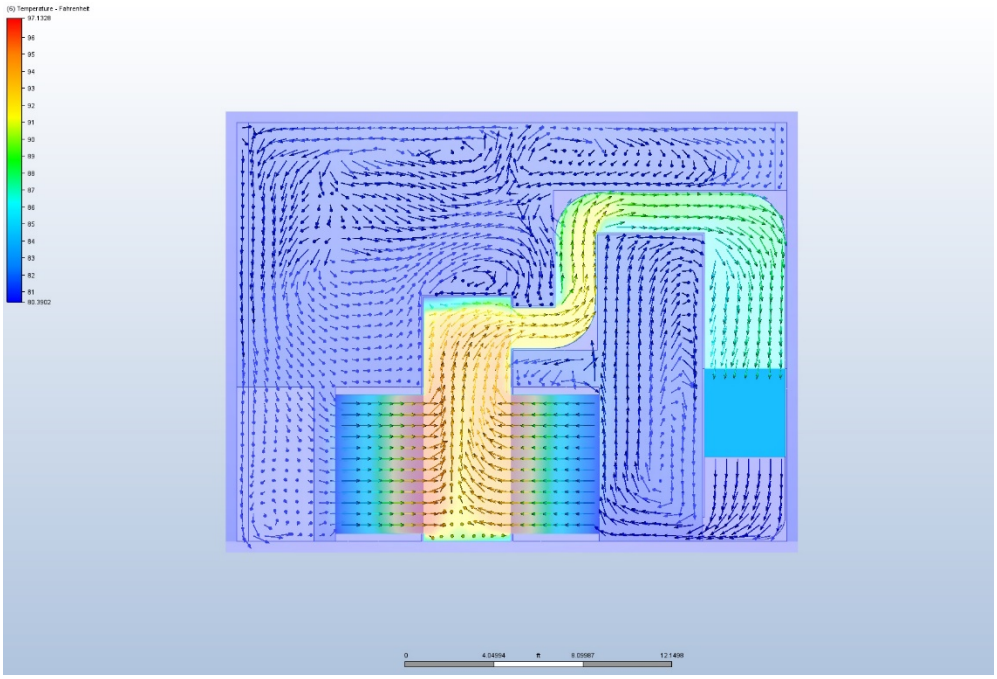


Figure 4b.3 – Plane 3

MCR - TEMPERATURE DATA

Temperature data for each modeled scenario is provided on the following pages.

Inlet temperature points are located at the inlet side of the data cabinet, centered on the face of the cabinet, at approximately 48” above floor level.

Outlet temperature points are located at the outlet side of the data cabinet, centered on the face of the cabinet, at approximately 48” above floor level.

POINT TEMPERATURE DATA

Point Location	Point Type	Scenario 1a 65°f	Scenario 1b 65°f	Scenario 2a 70°f	Scenario 2b 70°f
F5 Inlet	Inlet	65.8278	65.9831	70.8284	71.0193
G5 Inlet	Inlet	66.3709	66.5551	71.3780	71.5656
I5 Inlet	Inlet	66.2745	66.4524	71.2883	71.4902
J5 Inlet	Inlet	66.2599	66.6200	71.2830	71.5866
K5 Inlet	Inlet	66.1128	66.0623	71.1376	71.1470
L5 Inlet	Inlet	66.0570	66.1194	71.0858	71.1746
M5 Inlet	Inlet	66.0472	66.1126	71.0812	71.1328
N5 Inlet	Inlet	66.1023	66.1839	71.1466	71.1966
O5 Inlet	Inlet	65.9891	66.1514	71.0859	71.1616
P5 Inlet	Inlet	66.2169	66.1625	71.2707	71.1792
Q5 Inlet	Inlet	66.3531	66.2191	71.3889	71.2363
R5 Inlet	Inlet	66.2355	66.1257	71.2529	71.1582
S5 Inlet	Inlet	66.3685	66.1738	71.3716	71.2124
T5 Inlet	Inlet	66.1176	66.2178	71.0961	71.2276
G10 Inlet	Inlet	65.8294	65.7682	70.8190	70.7753
I10 Inlet	Inlet	66.0777	66.0194	71.0293	71.0610
K10 Inlet	Inlet	66.1795	66.2085	71.1232	71.2714
L10 Inlet	Inlet	66.0809	66.1490	71.0493	71.2450
N10 Inlet	Inlet	66.0708	66.1067	71.0740	71.0860
P10 Inlet	Inlet	66.3138	66.0941	71.3224	71.1204
F5 Outlet	Outlet	78.3458	80.0736	83.3935	85.0930
G5 Outlet	Outlet	78.2237	80.0947	83.2330	85.1074
I5 Outlet	Outlet	78.1697	80.1986	83.1683	85.2276
J5 Outlet	Outlet	78.8330	80.4804	83.8141	85.4873
K5 Outlet	Outlet	79.0558	80.2875	84.0328	85.3304
L5 Outlet	Outlet	79.4426	80.0781	84.4321	85.0446
M5 Outlet	Outlet	79.8997	79.4708	84.9136	84.5023
N5 Outlet	Outlet	80.1245	78.9243	85.1506	83.9288
O5 Outlet	Outlet	80.2844	78.7391	85.3100	83.7477
P5 Outlet	Outlet	80.3834	78.8652	85.3959	83.8590
Q5 Outlet	Outlet	80.2425	78.7802	85.2666	83.7621
R5 Outlet	Outlet	80.3866	79.1101	85.3943	84.0766
S5 Outlet	Outlet	80.3746	79.5028	85.3743	84.4539
T5 Outlet	Outlet	80.1243	79.6001	85.1613	84.5517
G10 Outlet	Outlet	79.7396	80.0674	84.7262	85.0781
I10 Outlet	Outlet	79.8650	80.1456	84.8228	85.0893
K10 Outlet	Outlet	79.9690	80.1676	84.9545	85.1894
L10 Outlet	Outlet	79.9523	80.1465	84.9366	85.1842
N10 Outlet	Outlet	79.7798	79.7291	84.7455	84.7137
P10 Outlet	Outlet	80.2207	79.7124	85.2324	84.7183
UPS-A Mid-Front	Area	65.6096	65.6808	70.6016	70.6935
UPS-A Mid-Side	Area	65.6118	65.6268	70.6001	70.6274
UPS-A Top	Area	65.6593	65.6866	70.6309	70.6781
UPS-B Mid-Front	Area	65.6642	65.7340	70.6550	70.6289
UPS-B Mid-Side	Area	65.6568	65.6804	70.6461	70.6754
UPS-B Top	Area	65.6701	65.6910	70.6689	70.6172
Rack Inlets Below 72°F		20	20	20	20
Rack Inlets Above 80.6°F		0	0	0	0
Rack Exhausts Above 106°F		0	0	0	0
RESULT		**FAIL**	**FAIL**	**FAIL**	**FAIL**

POINT TEMPERATURE DATA

Point Location	Point Type	Scenario 3a 75°f	Scenario 3b 75°f	Scenario 4a 80°f	Scenario 4b 80°f
F5 Inlet	Inlet	75.8269	76.0212	80.8582	81.0255
G5 Inlet	Inlet	76.3628	76.5755	81.3916	81.6172
I5 Inlet	Inlet	76.2751	76.4842	81.2939	81.4940
J5 Inlet	Inlet	76.2810	76.6361	81.2864	81.6724
K5 Inlet	Inlet	76.1324	76.1410	81.1313	81.0837
L5 Inlet	Inlet	76.0747	76.1658	81.0789	81.1334
M5 Inlet	Inlet	76.0689	76.1404	81.0738	81.1335
N5 Inlet	Inlet	76.1300	76.2049	81.1433	81.2070
O5 Inlet	Inlet	76.0104	76.1677	81.0170	81.1733
P5 Inlet	Inlet	76.1929	76.1840	81.2255	81.1898
Q5 Inlet	Inlet	76.3392	76.2320	81.3640	81.2413
R5 Inlet	Inlet	76.2148	76.1294	81.2423	81.1542
S5 Inlet	Inlet	76.3581	76.1694	81.3740	81.2021
T5 Inlet	Inlet	76.0948	76.2023	81.1079	81.2274
G10 Inlet	Inlet	75.8254	75.7741	80.8420	80.7850
I10 Inlet	Inlet	76.0690	76.0693	81.0831	81.0343
K10 Inlet	Inlet	76.1592	76.1961	81.1868	81.2469
L10 Inlet	Inlet	76.0641	76.2486	81.1080	81.1751
N10 Inlet	Inlet	76.0861	76.0604	81.1347	81.0594
P10 Inlet	Inlet	76.3109	76.1373	81.3837	81.0538
F5 Outlet	Outlet	88.3985	90.0891	93.2625	95.0582
G5 Outlet	Outlet	88.2786	90.1124	93.2173	95.1269
I5 Outlet	Outlet	88.2280	90.2422	93.1959	95.2475
J5 Outlet	Outlet	88.8429	90.5152	93.8653	95.5102
K5 Outlet	Outlet	89.0480	90.3199	94.0675	95.3035
L5 Outlet	Outlet	89.4465	90.0796	94.4547	95.1218
M5 Outlet	Outlet	89.8947	89.5152	94.9234	94.5419
N5 Outlet	Outlet	90.1178	88.9316	95.1323	93.9431
O5 Outlet	Outlet	90.2998	88.7598	95.2915	93.7590
P5 Outlet	Outlet	90.3867	88.8802	95.3964	93.8716
Q5 Outlet	Outlet	90.2240	88.8062	95.2585	93.7783
R5 Outlet	Outlet	90.3892	89.1405	95.4016	94.1178
S5 Outlet	Outlet	90.3723	89.5264	95.3814	94.5011
T5 Outlet	Outlet	90.1487	89.6783	95.1614	94.6742
G10 Outlet	Outlet	89.6899	90.0802	94.7369	95.0755
I10 Outlet	Outlet	89.8452	90.0500	94.8757	95.1485
K10 Outlet	Outlet	89.9658	90.1399	94.9846	95.1887
L10 Outlet	Outlet	89.9367	90.1782	94.9696	95.1454
N10 Outlet	Outlet	89.7420	89.6222	94.8194	94.6756
P10 Outlet	Outlet	90.2182	89.7150	95.3122	94.6807
UPS-A Mid-Front	Area	75.6000	75.6944	80.6043	80.7054
UPS-A Mid-Side	Area	75.6184	75.6369	80.6294	80.6399
UPS-A Top	Area	75.6372	75.6939	80.6619	80.7002
UPS-B Mid-Front	Area	75.6588	75.6319	80.6696	80.6142
UPS-B Mid-Side	Area	75.6420	75.6473	80.6841	80.6449
UPS-B Top	Area	75.6783	75.6069	80.6895	80.6486
Rack Inlets Below 72°F		0	0	0	0
Rack Inlets Above 80.6°F		0	0	20	20
Rack Exhausts Above 106°F		0	0	0	0
RESULT		**PASS**	**PASS**	**FAIL**	**FAIL**

CONCLUSIONS - MCR

1. The model demonstrates that a hot aisle configuration with CRAC units located as shown is suitable for meeting the requirements for VA data center conditioning.
2. Based on temperature data from the modeled scenarios at the maximum design cabinet loading, the ideal supply air temperature setpoint for the MCR CRAC systems is 72-78°F as demonstrated in Scenario 3.
3. As demonstrated in Scenarios 1 & 2, a setpoint below approximately 72°F will likely result in data cabinet inlet air temperatures below 72°F.
4. As demonstrated in Scenario 4, a setpoint above approximately 78°F will likely result in data cabinet inlet air temperatures above 80.6°F.
5. As demonstrated in all included scenarios, none of the modeled setpoints result in cabinet outlet air temperatures above 106°F.
6. As demonstrated in all included scenarios, none of the modeled setpoints result in ambient temperatures at the UPS unit locations outside of manufacturer's typical temperature recommendations (41-104°F).
7. At the design data equipment load of 96.6kW (including data cabinets and UPS units), the proposed arrangement of (2) 125kW nominal capacity CRAC units appear to be capable of maintaining space conditions within VA OIT standards while meeting N+1 redundancy. Note that this calculation includes data cabinet loads per the VA CFD Manual which is higher than the VA small data center template ultimate load of 79.6kW.
8. Future data equipment changes will need to be modeled to verify load distribution and any system adjustments or upgrades that might be required.

Mechanical - MCR Fuel Tank Sizing

GDM ARCHITECTS • ENGINEERS

Job# 22-055	Job Name TOGUS EHRM		
Subject FUEL TANK CALCULATIONS		Date 11/10/2025	
By ADR	Chkd.	Sheet 1	of 1

SIZE OF ABOVE GROUND FUEL TANK

A	100% Load Fuel Consumption	105.8 L/hr
		27.9 gal/hr
B	Integrated Fuel Tank - Useable Capacity	2,553.0 L
		674.4 gal
C	Hours required per RFI #13 response	96 hr
D	Useable Gallons Required in System	2,683.1 gal
	(C * D)	
E	Gallons Required in Tank	2,008.7 gal
	(D - B)	
F	Safety Factor	33%
G	Gallons for Stand-by Tank Sizing	**2,671.6 gal**
	(E * F)	
H	Gallons from Ullage assumed: 90%	267.2 gal
	SPACE ABOVE MAX FILL	
I	Gallons from Drop Tube assumed: 10%	267.2 gal
	SPACE BELOW SUCTION TUBE	
J	Gallons for Generator Testing assumed: 10%	267.2 gal
	VOLUME USED FOR TESTING NOT TO IMPACT VOLUME FOR TANK CAPACITY	
K	NOMINAL CAPACITY FOR TANK	3,473.1 gal

Mechanical - MCR Heat Load

Dedicated Outdoor Air System (DOAS) Sizing Summary for MCR - OFFICE

Project Name: 22-055 TOGUS 95% 08/01/2023
Prepared by: GDM-AE 10:36AM

Air System Information

Air System Name	**MCR - OFFICE**		Number of zones	**6**	
Equipment Class	**TERM**		Floor Area	**2795.0**	ft²
Air System Type	**VRF**		Location	**Portland, Maine**	

Sizing Calculation Information

Calculation Months	**Jan to Dec**		Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**		Space CFM Sizing	**Individual peak space loads**

Cooling Coil Sizing Data

Total coil load	**0.8**	Tons	Load occurs at	**Jul 1500**	
Total coil load	**9.5**	MBH	OA DB / WB	**86.0 / 71.0**	°F
Total coil load	**344.6**	CFM/Ton	Entering DB / WB	**86.0 / 71.0**	°F
Sensible coil load	**7.3**	MBH	Leaving DB / WB	**61.2 / 60.6**	°F
Coil CFM at Jul 1500	**274**	CFM	Bypass Factor	**0.100**	
Max coil CFM	**274**	CFM			
Sensible heat ratio	**0.766**				
Water flow @ 10.0 °F rise	**N/A**				

Heating Coil Sizing Data

Max coil load	**21.5**	MBH	Load occurs at	**Des Htg**	
Coil CFM at Des Htg	**274**	CFM	Ent. DB / Lvg DB	**-3.0 / 70.0**	°F
Max coil CFM	**274**	CFM			
Water flow @ 20.0 °F drop	**N/A**				

Humidifier Sizing Data

Max steam flow at Des Htg	**5.29**	lb/hr	Air mass flow	**1228.25**	lb/hr
Airflow Rate	**274**	CFM	Moisture gain	**.00431**	lb/lb

Ventilation Fan Sizing Data

Actual max CFM	**274**	CFM	Fan motor BHP	**0.00**	BHP
Standard CFM	**273**	CFM	Fan motor kW	**0.00**	kW
Actual max CFM/ft²	**0.10**	CFM/ft²	Fan static	**0.00**	in wg

Outdoor Ventilation Air Data

Design airflow CFM	**274**	CFM	CFM/person	**54.71**	CFM/person
CFM/ft²	**0.10**	CFM/ft²			

Zone Sizing Summary for MCR - OFFICE

Project Name: 22-055 TOGUS 95% 08/01/2023
Prepared by: GDM-AE 10:36AM

Air System Information

Air System Name ..... **MCR - OFFICE**
Equipment Class ..... **TERM**
Air System Type ..... **VRF**

Number of zones **6**
Floor Area ..... **2795.0** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Ship / Recieve	3.5	3.3	74.8 / 65.1	61.1 / 60.2	-	Aug 1400	0.61
Support	5.9	5.7	75.1 / 65.2	61.1 / 60.2	-	Jul 1700	0.54
Working	4.5	4.3	75.3 / 64.5	59.8 / 58.8	-	Jul 1600	1.26
MCR	355.2	353.7	76.0 / 63.9	59.0 / 57.8	-	Jul 1600	16.08
Entrance B	31.0	30.8	75.9 / 63.9	58.9 / 57.8	-	Jul 1600	10.54
Entrance A	31.0	30.8	75.8 / 63.9	58.9 / 57.7	-	Aug 1500	10.02

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Ship / Recieve	4.4	69.1 / 87.1	-	225	0.000	0.000	45
Support	6.6	69.4 / 85.5	-	377	0.000	0.000	72
Working	4.1	69.2 / 83.9	-	256	0.000	0.000	30
MCR	16.1	69.7 / 70.5	-	19301	0.000	0.000	103
Entrance B	5.8	70.4 / 73.6	-	1687	0.000	0.000	12
Entrance A	4.1	69.9 / 72.1	-	1683	0.000	0.000	13

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	430.8	35.9	41.0
Estimated Piping / Line Losses	0.0	0.0	0.0
Total Required ODU Capacity	430.8	35.9	41.0

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Ship / Recieve	3.8	Jul 1400	4.5	372.0
Support	6.6	Jul 1700	6.5	692.0
Working	4.6	Aug 1600	4.1	203.0
MCR	353.6	Jul 1700	16.0	1200.0
Entrance B	30.9	Jul 1700	5.7	160.0
Entrance A	30.8	Aug 1500	4.1	168.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Ship / Recieve							
MCR - RECEIVING - 101	1	0.8	Jul 1500	59	1.6	87.0	0.68
MCR - UNBOX - 102	1	1.1	Jul 1500	60	0.7	143.0	0.42
MCR - SUPPLIES - 103	1	0.7	Aug 1500	41	0.7	89.0	0.46
MCR - VESTIBULE - 113	1	1.2	Jul 0900	66	1.5	53.0	1.24
Support							
MCR - HAC - 106	1	0.3	Jul 1400	14	0.1	36.0	0.40
MCR - MECH - 104	1	1.1	Aug 1700	72	1.9	105.0	0.69
MCR - ELEC - 105	1	2.7	Jul 1800	147	3.1	203.0	0.72
MCR - CLEAN AGENT - 107	1	0.9	Jul 1600	48	0.8	78.0	0.61
MCR - TOILET - 112	1	0.5	Jul 1400	26	0.1	46.0	0.58
MCR - CORRIDOR	1	1.3	Jul 1400	69	0.5	224.0	0.31
Working							
MCR - WORK STATION - 110	1	2.7	Jul 1500	149	1.2	134.0	1.11
MCR - STORAGE - 109	1	1.9	Aug 1600	108	2.9	69.0	1.56
MCR							
MCR - DATA CENTER - 111	1	353.6	Jul 1700	19301	16.0	1200.0	16.08
Entrance B							
MCR - ENTRANCE B - 112	1	30.9	Jul 1700	1687	5.7	160.0	10.54
Entrance A							
MCR - ENTRANCE A - 100	1	30.8	Aug 1500	1683	4.1	168.0	10.02

Ventilation Sizing Summary for MCR - OFFICE

Project Name: 22-055 TOGUS 95% 08/01/2023
Prepared by: GDM-AE 10:36AM

1. Summary

Ventilation Sizing Method ..... **ASHRAE Std 62.1-2013**
Design Condition ..... **Heating operation**

Zone Name	Zone Outdoor Airflow (CFM)	Uncorrected Outdoor Air Intake (CFM)	Ventilation Efficiency	Outdoor Air Intake (CFM)
	(Voz)	(Vou)	(Ev)	(Vot)
Ship / Recieve		36	0.802	45
Support		54	0.752	72
Working		27	0.912	30
MCR	103		1.000	103
Entrance B	12		1.000	12
Entrance A	13		1.000	13
System Total				**274**

Note: For terminal systems, Standard 62.1 considers each terminal unit to be a "ventilation system". Standard 62.1 calculations are performed separately for each terminal unit zone. Outdoor air intake flow rates for all terminal zones are summed to determine the total system outdoor air flow rate.

2. Space Ventilation Analysis

2.1 Zone: Ship / Recieve

Zone Name / Space Name	Mult.	Supply Air (CFM) (Vpz)	Space Floor Area (ft²) (Az)	Area Outdoor Air Rate (CFM/ft²) (Ra)	Time Averaged Occupancy (Occupants) (Pz)	People Outdoor Air Rate (CFM/person) (Rp)	Air Distribution Effectiveness (Ez)	Space Outdoor Air (CFM) (Voz)	Breathing Zone Outdoor Air (CFM) (Vbz)	Space Ventilation Efficiency (Evz)
Ship / Recieve										
MCR - RECEIVING - 101	1	59	87.0	0.12	0.0	10.00	0.8	**13**	*10*	0.939
MCR - UNBOX - 102	1	60	143.0	0.12	0.0	7.50	0.8	**21**	*17*	0.802
MCR - SUPPLIES - 103	1	41	89.0	0.06	0.0	5.00	0.8	**7**	*5*	0.997
MCR - VESTIBULE - 113	1	66	53.0	0.06	0.0	5.00	0.8	**4**	*3*	1.100
Totals (incl. Space Multipliers)		**225**							**36**	**0.802**

2.2 Zone: Support

Zone Name / Space Name	Mult.	Supply Air (CFM) (Vpz)	Space Floor Area (ft²) (Az)	Area Outdoor Air Rate (CFM/ft²) (Ra)	Time Averaged Occupancy (Occupants) (Pz)	People Outdoor Air Rate (CFM/person) (Rp)	Air Distribution Effectiveness (Ez)	Space Outdoor Air (CFM) (Voz)	Breathing Zone Outdoor Air (CFM) (Vbz)	Space Ventilation Efficiency (Evz)
Support										
MCR - HAC - 106	1	14	36.0	0.12	0.0	5.00	0.8	**5**	*4*	0.766
MCR - MECH - 104	1	72	105.0	0.06	0.0	5.00	0.8	**8**	*6*	1.034
MCR - ELEC - 105	1	147	203.0	0.06	0.0	5.00	0.8	**15**	*12*	1.039
MCR - CLEAN AGENT - 107	1	48	78.0	0.12	0.0	5.00	0.8	**12**	*9*	0.898
MCR - TOILET - 112	1	26	46.0	0.18	0.0	10.00	0.8	**10**	*8*	0.752
MCR - CORRIDOR	1	69	224.0	0.06	0.0	0.00	0.8	**17**	*13*	0.900
Totals (incl. Space Multipliers)		**377**							**54**	**0.752**

2.3 Zone: Working

Zone Name / Space Name	Mult.	Supply Air (CFM) (Vpz)	Space Floor Area (ft²) (Az)	Area Outdoor Air Rate (CFM/ft²) (Ra)	Time Averaged Occupancy (Occupants) (Pz)	People Outdoor Air Rate (CFM/person) (Rp)	Air Distribution Effectiveness (Ez)	Space Outdoor Air (CFM) (Voz)	Breathing Zone Outdoor Air (CFM) (Vbz)	Space Ventilation Efficiency (Evz)
Working										
MCR - WORK STATION - 110	1	149	134.0	0.06	3.0	5.00	0.8	**29**	*23*	0.912
MCR - STORAGE - 109	1	108	69.0	0.06	0.0	5.00	0.8	**5**	*4*	1.058
Totals (incl. Space Multipliers)		**256**							**27**	**0.912**

2.4 Zone: MCR

Zone Name / Space Name	Mult.	Supply Air (CFM) (Vpz)	Space Floor Area (ft²) (Az)	Area Outdoor Air Rate (CFM/ft²) (Ra)	Time Averaged Occupancy (Occupants) (Pz)	People Outdoor Air Rate (CFM/person) (Rp)	Air Distribution Effectiveness (Ez)	Space Outdoor Air (CFM) (Voz)	Breathing Zone Outdoor Air (CFM) (Vbz)	Space Ventilation Efficiency (Evz)
MCR										
MCR - DATA CENTER - 111	1	19301	1200.0	0.06	2.0	5.00	0.8	**103**	*82*	1.000
Totals (incl. Space Multipliers)		**19301**							**82**	**1.000**

2.5 Zone: Entrance B

Zone Name / Space Name	Mult.	Supply Air (CFM) (Vpz)	Space Floor Area (ft²) (Az)	Area Outdoor Air Rate (CFM/ft²) (Ra)	Time Averaged Occupancy (Occupants) (Pz)	People Outdoor Air Rate (CFM/person) (Rp)	Air Distribution Effectiveness (Ez)	Space Outdoor Air (CFM) (Voz)	Breathing Zone Outdoor Air (CFM) (Vbz)	Space Ventilation Efficiency (Evz)
Entrance B										
MCR - ENTRANCE B - 112	1	1687	160.0	0.06	0.0	5.00	0.8	**12**	*10*	1.000
Totals (incl. Space Multipliers)		**1687**							**10**	**1.000**

2.6 Zone: Entrance A

Zone Name / Space Name	Mult.	Supply Air (CFM) (Vpz)	Space Floor Area (ft²) (Az)	Area Outdoor Air Rate (CFM/ft²) (Ra)	Time Averaged Occupancy (Occupants) (Pz)	People Outdoor Air Rate (CFM/person) (Rp)	Air Distribution Effectiveness (Ez)	Space Outdoor Air (CFM) (Voz)	Breathing Zone Outdoor Air (CFM) (Vbz)	Space Ventilation Efficiency (Evz)
Entrance A										
MCR - ENTRANCE A - 100	1	1683	168.0	0.06	0.0	5.00	0.8	**13**	*10*	1.000
Totals (incl. Space Multipliers)		**1683**							**10**	**1.000**

Air System Design Load Summary for MCR - OFFICE

Project Name: 22-055 TOGUS 95% 08/01/2023
Prepared by: GDM-AE 10:36AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1600 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	4 ft²	103	-	4 ft²	-	-
Wall Transmission	4745 ft²	4854	-	4745 ft²	27713	-
Roof Transmission	2858 ft²	2187	-	2858 ft²	6676	-
Window Transmission	4 ft²	13	-	4 ft²	123	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	195 ft²	3482	-	195 ft²	6506	-
Floor Transmission	2693 ft²	0	-	2693 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	3395 W	10607	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	19950 W	67851	-	0	0	-
People	5	1043	1025	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	339849	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**429990**	**1025**	**-**	**41019**	**0**
Zone Conditioning	-	430194	1025	-	41119	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	274 CFM	0	-	274 CFM	0	-
Ventilation Load	274 CFM	2759	3041	274 CFM	21361	5584
Ventilation Fan Load	274 CFM	0	-	274 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**432952**	**4066**	**-**	**62481**	**5584**
Cooling Coil	-	7134	2227	-	0	0
Heating Coil	-	-2583	-	-	21519	-
Terminal Unit Cooling	-	428401	2362	-	0	0
Terminal Unit Heating	-	0	-	-	40953	-
Humidification Load	-	-	0	-	-	5584
>> Total Conditioning	**-**	**432952**	**4589**	**-**	**62472**	**5584**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for MCR - OFFICE

Project Name: 22-055 TOGUS 95% 08/01/2023
Prepared by: GDM-AE 10:36AM

Ship / Recieve	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	315 ft²	293	-	315 ft²	1840	-
Roof Transmission	376 ft²	351	-	376 ft²	878	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	111 ft²	774	-	111 ft²	1785	-
Floor Transmission	364 ft²	0	-	364 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	372 W	1147	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	372 W	1222	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**3788**	**0**	**-**	**4503**	**0**

Support	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1700 COOLING OA DB / WB 84.1 °F / 70.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	822 ft²	968	-	822 ft²	4800	-
Roof Transmission	744 ft²	451	-	744 ft²	1738	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	602 ft²	0	-	602 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	692 W	2175	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	907 W	2986	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**6580**	**0**	**-**	**6538**	**0**

Zone Design Load Summary for MCR - OFFICE

Project Name: 22-055 TOGUS 95% 08/01/2023
Prepared by: GDM-AE 10:36AM

Working	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1600 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	4 ft²	93	-	4 ft²	-	-
Wall Transmission	403 ft²	453	-	403 ft²	2356	-
Roof Transmission	210 ft²	140	-	210 ft²	491	-
Window Transmission	4 ft²	13	-	4 ft²	123	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	21 ft²	1077	-	21 ft²	1180	-
Floor Transmission	199 ft²	0	-	199 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	203 W	634	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	471 W	1547	-	0	0	-
People	3	626	615	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**4582**	**615**	**-**	**4149**	**0**

MCR	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1700 COOLING OA DB / WB 84.1 °F / 70.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	2064 ft²	2443	-	2064 ft²	12054	-
Roof Transmission	1200 ft²	728	-	1200 ft²	2803	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	21 ft²	381	-	21 ft²	1180	-
Floor Transmission	1200 ft²	0	-	1200 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	1800 W	5658	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	1200 W	4094	-	0	0	-
People	2	422	410	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	339849	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**353575**	**410**	**-**	**16037**	**0**

Entrance B	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1700 COOLING OA DB / WB 84.1 °F / 70.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	715 ft²	738	-	715 ft²	4176	-
Roof Transmission	160 ft²	97	-	160 ft²	374	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	21 ft²	557	-	21 ft²	1180	-
Floor Transmission	160 ft²	0	-	160 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	160 W	503	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	8500 W	29002	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**30898**	**0**	**-**	**5730**	**0**

Entrance A	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1500 COOLING OA DB / WB 86.0 °F / 71.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	426 ft²	463	-	426 ft²	2488	-
Roof Transmission	168 ft²	132	-	168 ft²	392	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	21 ft²	707	-	21 ft²	1180	-
Floor Transmission	168 ft²	0	-	168 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	168 W	522	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	8500 W	29002	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**30825**	**0**	**-**	**4061**	**0**

TABLE 1.1.A. Component Loads For Space "MCR - RECEIVING - 101" In Zone "Ship / Recieve"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 86.0 °F / 71.0 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	132 ft²	125	-	132 ft²	771	-
Roof Transmission	91 ft²	80	-	91 ft²	213	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	90 ft²	63	-	90 ft²	604	-
Floor Transmission	87 ft²	0	-	87 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	87 W	270	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	87 W	285	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**823**	**0**	**-**	**1588**	**0**

TABLE 1.1.B. Envelope Loads For Space "MCR - RECEIVING - 101" In Zone "Ship / Recieve"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
ENE EXPOSURE						
WALL	60	0.080	-	50	-	350
DOOR	90	0.092	-	63	-	604
SSE EXPOSURE						
WALL	72	0.080	-	74	-	420
H EXPOSURE						
ROOF	91	0.032	-	80	-	213

TABLE 1.2.A. Component Loads For Space "MCR - UNBOX - 102" In Zone "Ship / Recieve"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 86.0 °F / 71.0 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	58 ft²	60	-	58 ft²	339	-
Roof Transmission	143 ft²	125	-	143 ft²	334	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	135 ft²	0	-	135 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	143 W	444	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	143 W	468	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**1097**	**0**	**-**	**673**	**0**

TABLE 1.2.B. Envelope Loads For Space "MCR - UNBOX - 102" In Zone "Ship / Recieve"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
SSE EXPOSURE						
WALL	58	0.080	-	60	-	339
H EXPOSURE						
ROOF	143	0.032	-	125	-	334

TABLE 1.3.A. Component Loads For Space "MCR - SUPPLIES - 103" In Zone "Ship / Recieve"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1500 COOLING OA DB / WB 86.0 °F / 71.0 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	92 ft²	112	-	92 ft²	537	-
Roof Transmission	89 ft²	70	-	89 ft²	208	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	89 ft²	0	-	89 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	89 W	276	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	89 W	291	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**750**	**0**	**-**	**745**	**0**

TABLE 1.3.B. Envelope Loads For Space "MCR - SUPPLIES - 103" In Zone "Ship / Recieve"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
SSE EXPOSURE						
WALL	92	0.080	-	112	-	537
H EXPOSURE						
ROOF	89	0.032	-	70	-	208

TABLE 1.4.A. Component Loads For Space "MCR - VESTIBULE - 113" In Zone "Ship / Recieve"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 0900 COOLING OA DB / WB 72.7 °F / 67.0 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	33 ft²	19	-	33 ft²	193	-
Roof Transmission	53 ft²	25	-	53 ft²	124	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	21 ft²	820	-	21 ft²	1180	-
Floor Transmission	53 ft²	0	-	53 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	53 W	156	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	53 W	181	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**1201**	**0**	**-**	**1497**	**0**

TABLE 1.4.B. Envelope Loads For Space "MCR - VESTIBULE - 113" In Zone "Ship / Recieve"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
E EXPOSURE						
WALL	33	0.080	-	19	-	193
DOOR GLASS	21	0.770	0.460	-35	855	1180
H EXPOSURE						
ROOF	53	0.032	-	25	-	124

TABLE 2.1.A. Component Loads For Space "MCR - HAC - 106" In Zone "Support"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 85.4 °F / 70.8 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	36 ft²	34	-	36 ft²	84	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	36 ft²	0	-	36 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	36 W	111	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	36 W	118	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**262**	**0**	**-**	**84**	**0**

TABLE 2.1.B. Envelope Loads For Space "MCR - HAC - 106" In Zone "Support"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
H EXPOSURE						
ROOF	36	0.032	-	34	-	84

TABLE 2.2.A. Component Loads For Space "MCR - MECH - 104" In Zone "Support"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1700 COOLING OA DB / WB 84.1 °F / 70.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	270 ft²	363	-	270 ft²	1577	-
Roof Transmission	157 ft²	78	-	157 ft²	367	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	100 ft²	0	-	100 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	105 W	330	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	105 W	346	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**1117**	**0**	**-**	**1944**	**0**

TABLE 2.2.B. Envelope Loads For Space "MCR - MECH - 104" In Zone "Support"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
WSW EXPOSURE						
WALL	132	0.080	-	198	-	771
SSE EXPOSURE						
WALL	138	0.080	-	165	-	806
H EXPOSURE						
ROOF	157	0.032	-	78	-	367

TABLE 2.3.A. Component Loads For Space "MCR - ELEC - 105" In Zone "Support"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1800 COOLING OA DB / WB 82.1 °F / 69.8 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	454 ft²	628	-	454 ft²	2651	-
Roof Transmission	203 ft²	85	-	203 ft²	474	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	118 ft²	0	-	118 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	203 W	642	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	406 W	1340	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**2694**	**0**	**-**	**3126**	**0**

TABLE 2.3.B. Envelope Loads For Space "MCR - ELEC - 105" In Zone "Support"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
NNE EXPOSURE						
WALL	124	0.080	-	91	-	724
WSW EXPOSURE						
WALL	330	0.080	-	536	-	1927
H EXPOSURE						
ROOF	203	0.032	-	85	-	474

TABLE 2.4.A. Component Loads For Space "MCR - CLEAN AGENT - 107" In Zone "Support"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1600 COOLING OA DB / WB 85.4 °F / 70.8 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	98 ft²	61	-	98 ft²	572	-
Roof Transmission	78 ft²	60	-	78 ft²	182	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	78 ft²	0	-	78 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	78 W	244	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	156 W	512	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**876**	**0**	**-**	**755**	**0**

TABLE 2.4.B. Envelope Loads For Space "MCR - CLEAN AGENT - 107" In Zone "Support"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
NNE EXPOSURE						
WALL	98	0.080	-	61	-	572
H EXPOSURE						
ROOF	78	0.032	-	60	-	182

TABLE 2.5.A. Component Loads For Space "MCR - TOILET - 112" In Zone "Support"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 85.4 °F / 70.8 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	46 ft²	43	-	46 ft²	107	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	46 ft²	0	-	46 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	46 W	142	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	92 W	300	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**485**	**0**	**-**	**107**	**0**

TABLE 2.5.B. Envelope Loads For Space "MCR - TOILET - 112" In Zone "Support"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
H EXPOSURE						
ROOF	46	0.032	-	43	-	107

TABLE 2.6.A. Component Loads For Space "MCR - CORRIDOR" In Zone "Support"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 85.4 °F / 70.8 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	224 ft²	209	-	224 ft²	523	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	224 ft²	0	-	224 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	224 W	690	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	112 W	366	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**1266**	**0**	**-**	**523**	**0**

TABLE 2.6.B. Envelope Loads For Space "MCR - CORRIDOR" In Zone "Support"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
H EXPOSURE						
ROOF	224	0.032	-	209	-	523

TABLE 3.1.A. Component Loads For Space "MCR - WORK STATION - 110" In Zone "Working"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 86.0 °F / 71.0 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	4 ft²	109	-	4 ft²	-	-
Wall Transmission	140 ft²	135	-	140 ft²	818	-
Roof Transmission	130 ft²	114	-	130 ft²	304	-
Window Transmission	4 ft²	13	-	4 ft²	123	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	130 ft²	0	-	130 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	134 W	416	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	402 W	1316	-	0	0	-
People	3	618	615	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**2722**	**615**	**-**	**1244**	**0**

TABLE 3.1.B. Envelope Loads For Space "MCR - WORK STATION - 110" In Zone "Working"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
E EXPOSURE						
WALL	140	0.080	-	135	-	818
WINDOW 1	4	0.420	0.460	13	109	123
H EXPOSURE						
ROOF	130	0.032	-	114	-	304

TABLE 3.2.A. Component Loads For Space "MCR - STORAGE - 109" In Zone "Working"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1600 COOLING OA DB / WB 85.4 °F / 70.8 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	263 ft²	323	-	263 ft²	1538	-
Roof Transmission	80 ft²	53	-	80 ft²	187	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	21 ft²	1077	-	21 ft²	1180	-
Floor Transmission	69 ft²	0	-	69 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	69 W	216	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	69 W	227	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**1895**	**0**	**-**	**2906**	**0**

TABLE 3.2.B. Envelope Loads For Space "MCR - STORAGE - 109" In Zone "Working"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
WSW EXPOSURE						
WALL	127	0.080	-	156	-	742
DOOR GLASS	21	0.770	0.460	121	956	1180
SSE EXPOSURE						
WALL	136	0.080	-	167	-	797
H EXPOSURE						
ROOF	80	0.032	-	53	-	187

TABLE 4.1.A. Component Loads For Space "MCR - DATA CENTER - 111" In Zone "MCR"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1700 COOLING OA DB / WB 84.1 °F / 70.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	2064 ft²	2443	-	2064 ft²	12054	-
Roof Transmission	1200 ft²	728	-	1200 ft²	2803	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	21 ft²	381	-	21 ft²	1180	-
Floor Transmission	1200 ft²	0	-	1200 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	1800 W	5658	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	1200 W	4094	-	0	0	-
People	2	422	410	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	339849	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**353575**	**410**	**-**	**16037**	**0**

TABLE 4.1.B. Envelope Loads For Space "MCR - DATA CENTER - 111" In Zone "MCR"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
WSW EXPOSURE						
WALL	918	0.080	-	1328	-	5361
NNE EXPOSURE						
WALL	228	0.080	-	158	-	1332
DOOR GLASS	21	0.770	0.460	110	271	1180
ESE EXPOSURE						
WALL	918	0.080	-	958	-	5361
H EXPOSURE						
ROOF	1200	0.032	-	728	-	2803

TABLE 5.1.A. Component Loads For Space "MCR - ENTRANCE B - 112" In Zone "Entrance B"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1700 COOLING OA DB / WB 84.1 °F / 70.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	715 ft²	738	-	715 ft²	4176	-
Roof Transmission	160 ft²	97	-	160 ft²	374	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	21 ft²	557	-	21 ft²	1180	-
Floor Transmission	160 ft²	0	-	160 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	160 W	503	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	8500 W	29002	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**30898**	**0**	**-**	**5730**	**0**

TABLE 5.1.B. Envelope Loads For Space "MCR - ENTRANCE B - 112" In Zone "Entrance B"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
NNE EXPOSURE						
WALL	228	0.080	-	158	-	1332
ENE EXPOSURE						
WALL	233	0.080	-	213	-	1361
DOOR GLASS	21	0.770	0.460	110	448	1180
WSW EXPOSURE						
WALL	254	0.080	-	367	-	1483
H EXPOSURE						
ROOF	160	0.032	-	97	-	374

TABLE 6.1.A. Component Loads For Space "MCR - ENTRANCE A - 100" In Zone "Entrance A"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1500 COOLING OA DB / WB 86.0 °F / 71.0 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	426 ft²	463	-	426 ft²	2488	-
Roof Transmission	168 ft²	132	-	168 ft²	392	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	21 ft²	707	-	21 ft²	1180	-
Floor Transmission	168 ft²	0	-	168 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	168 W	522	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	8500 W	29002	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**30825**	**0**	**-**	**4061**	**0**

TABLE 6.1.B. Envelope Loads For Space "MCR - ENTRANCE A - 100" In Zone "Entrance A"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
ESE EXPOSURE						
WALL	129	0.080	-	133	-	753
DOOR GLASS	21	0.770	0.460	124	583	1180
SSE EXPOSURE						
WALL	195	0.080	-	237	-	1139
WSW EXPOSURE						
WALL	102	0.080	-	93	-	596
H EXPOSURE						
ROOF	168	0.032	-	132	-	392

Mechanical - MCR Roof Drain Sizing

GDM ARCHITECTS • ENGINEERS	Job# 22-055	Job Name TOGUS - EHRM	
	Subject STORM DRAINAGE - IPC		Date 9/26/2025
	By SB	Chkd.	Sheet 1 of 1

2018 IPC STORM DRAINAGE SECTION 1105

ROOF SQUARE FOOTAGE 1141.7 SQ FT

Size of Drain Leader or Pipe	CAPACITY (GPM)				
	VERTICAL	SLOPE OF HORIZONTAL			
inches		1/16	1/8	1/4	1/2
2	34	15	22	31	44
3	87	39	55	79	111
4	180	81	115	163	231
5	311	117	165	234	331
6	538	243	344	487	689
8	1,117	505	714	1,010	1,429
10	2,050	927	1,311	1,855	2,623
12	3,272	1,480	2,093	2,960	4,187
15	5,543	2,503	3,546	5,016	7,093

RAINFALL ZONE: IPC 2018 1106

BANGOR MAINE 2.2 IN/HR

0.02288 GPM / SQ FT

GPM RAINFALL ON ROOF 26.1221 GPM

MINIMUM ROOF DRAIN SIZE 3 IN

DRAIN SIZING SELECTED 4 IN

GDM ARCHITECTS • ENGINEERS	Job# 22-055	Job Name TOGUS EHRM	
	Subject STORM DRAINAGE - IPC		Date 9/26/2025
	By SB	Chkd.	Sheet 1 of 1

2018 IPC STORM DRAINAGE SECTION 1105

ROOF SQUARE FOOTAGE 1141.7 SQ FT

Size of Drain Leader or Pipe	CAPACITY (GPM)				
	VERTICAL	SLOPE OF HORIZONTAL			
inches		1/16	1/8	1/4	1/2
2	34	15	22	31	44
3	87	39	55	79	111
4	180	81	115	163	231
5	311	117	165	234	331
6	538	243	344	487	689
8	1,117	505	714	1,010	1,429
10	2,050	927	1,311	1,855	2,623
12	3,272	1,480	2,093	2,960	4,187
15	5,543	2,503	3,546	5,016	7,093

RAINFALL ZONE: IPC 2018 1106

BANGOR MAINE 2.2 IN/HR

0.02288 GPM / SQ FT

GPM RAINFALL ON ROOF 26.1221 GPM

MINIMUM ROOF DRAIN SIZE 3 IN

DRAIN SIZING SELECTED 4 IN

GDM ARCHITECTS • ENGINEERS	Job# 22-055	Job Name TOGUS EHRM	
	Subject STORM DRAINAGE - IPC		Date 9/26/2025
	By SB	Chkd.	Sheet 1 of 1

2018 IPC STORM DRAINAGE SECTION 1105

ROOF SQUARE FOOTAGE 1141.7 SQ FT

Size of Drain Leader or Pipe	CAPACITY (GPM)				
	VERTICAL	SLOPE OF HORIZONTAL			
inches		1/16	1/8	1/4	1/2
2	34	15	22	31	44
3	87	39	55	79	111
4	180	81	115	163	231
5	311	117	165	234	331
6	538	243	344	487	689
8	1,117	505	714	1,010	1,429
10	2,050	927	1,311	1,855	2,623
12	3,272	1,480	2,093	2,960	4,187
15	5,543	2,503	3,546	5,016	7,093

RAINFALL ZONE: IPC 2018 1106

BANGOR MAINE 2.2 IN/HR

0.02288 GPM / SQ FT

GPM RAINFALL ON ROOF 26.1221 GPM

MINIMUM ROOF DRAIN SIZE 3 IN

DRAIN SIZING SELECTED 4 IN

Mechanical - Systems Design Report - All Other Buildings

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.200_G 009A TR#7A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.200_G 009A TR#7A**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**129.6** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.200_G 009A TR#7A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.200_G 009A TR#7A**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **129.6** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	17.8	17.6	78.5 / 66.1	61.4 / 60.2	-	Aug 1800	7.40

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	2.0	69.6 / 71.5	-	959	0.000	0.000	8

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	17.6	Jul 1800	1.3	129.6

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.200_G C009A TR#7A	1	17.6	Jul 1800	959	1.3	129.6	7.40

Air System Design Load Summary for Bldg.200_G 009A TR#7A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1800 COOLING OA DB / WB 84.1 °F / 70.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	60 ft²	67	-	60 ft²	350	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	130 ft²	0	-	130 ft²	186	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	106 W	342	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	96	90	-	765	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17565**	**90**	**-**	**1301**	**0**
Zone Conditioning	-	17601	90	-	1397	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	8 CFM	48	72	8 CFM	613	0
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**17649**	**162**	**-**	**2011**	**0**
Terminal Unit Cooling	-	17649	169	-	0	0
Terminal Unit Heating	-	0	-	-	2011	-
>> Total Conditioning	**-**	**17649**	**169**	**-**	**2011**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.200_G 009A TR#7A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1800 COOLING OA DB / WB 84.1 °F / 70.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	60 ft²	71	-	60 ft²	350	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	130 ft²	0	-	130 ft²	186	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	106 W	342	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	96	80	-	765	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17570**	**80**	**-**	**1301**	**0**

Space Design Load Summary for Bldg.200_G 009A TR#7A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.200_G C009A TR#7A" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1800 COOLING OA DB / WB 84.1 °F / 70.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	60 ft²	71	-	60 ft²	350	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	130 ft²	0	-	130 ft²	186	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	106 W	342	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	96	80	-	765	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17570**	**80**	**-**	**1301**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.200_G C009A TR#7A" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
WNW EXPOSURE						
WALL	60	0.080	-	71	-	350

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.200_L1 196A TR#8A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.200_L1 196A TR#8A**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**122.3** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.200_L1 196A TR#8A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.200_L1 196A TR#8A**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **122.3** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	24.3	24.2	78.4 / 66.0	61.4 / 60.2	-	Aug 0900	10.81

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	0.6	69.6 / 70.0	-	1322	0.000	0.000	7

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	24.2	Jan 2200	0.0	122.3

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.200_L1 196A TR#8A	1	24.2	Jan 2200	1322	0.0	122.3	10.81

Air System Design Load Summary for Bldg.200_L1 196A TR#8A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 0900 COOLING OA DB / WB 70.3 °F / 66.2 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	100 W	307	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24191**	**0**	**-**	**0**	**0**
Zone Conditioning	-	24246	0	-	0	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	7 CFM	-64	69	7 CFM	577	2
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**24182**	**69**	**-**	**577**	**2**
Terminal Unit Cooling	-	24182	77	-	0	0
Terminal Unit Heating	-	0	-	-	577	-
>> Total Conditioning	**-**	**24182**	**77**	**-**	**577**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.200_L1 196A TR#8A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	100 W	328	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24212**	**0**	**-**	**0**	**0**

Space Design Load Summary for Bldg.200_L1 196A TR#8A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.200_L1 196A TR#8A" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	100 W	328	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24212**	**0**	**-**	**0**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.200_L1 196A TR#8A" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.200_L2 210 TR#9A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.200_L2 210 TR#9A**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**152.3** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.200_L2 210 TR#9A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.200_L2 210 TR#9A**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **152.3** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	24.7	24.6	78.3 / 65.9	61.2 / 60.0	-	Jul 2000	8.81

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	1.3	69.1 / 70.0	-	1342	0.000	0.000	9

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	24.6	Jul 1800	0.7	152.3

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.200_L2 210 TR#9A	1	24.6	Jul 1800	1342	0.7	152.3	8.81

Air System Design Load Summary for Bldg.200_L2 210 TR#9A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 2000 COOLING OA DB / WB 79.6 °F / 69.1 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	4 ft²	105	-	4 ft²	-	-
Wall Transmission	104 ft²	159	-	104 ft²	607	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	4 ft²	5	-	4 ft²	93	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	125 W	405	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24559**	**0**	**-**	**701**	**0**
Zone Conditioning	-	24622	0	-	621	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	9 CFM	14	89	9 CFM	715	2
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**24635**	**89**	**-**	**1335**	**2**
Terminal Unit Cooling	-	24635	103	-	0	0
Terminal Unit Heating	-	0	-	-	1335	-
>> Total Conditioning	**-**	**24635**	**103**	**-**	**1335**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.200_L2 210 TR#9A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1800 COOLING OA DB / WB 84.1 °F / 70.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	4 ft²	163	-	4 ft²	-	-
Wall Transmission	104 ft²	124	-	104 ft²	607	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	4 ft²	9	-	4 ft²	93	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	125 W	402	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24581**	**0**	**-**	**701**	**0**

Space Design Load Summary for Bldg.200_L2 210 TR#9A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.200_L2 210 TR#9A" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1800 COOLING OA DB / WB 84.1 °F / 70.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	4 ft²	163	-	4 ft²	-	-
Wall Transmission	104 ft²	124	-	104 ft²	607	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	4 ft²	9	-	4 ft²	93	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	125 W	402	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24581**	**0**	**-**	**701**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.200_L2 210 TR#9A" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
WNW EXPOSURE						
WALL	104	0.080	-	124	-	607
WINDOW 1	4	0.320	0.460	9	163	93

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.200_L3 358J TR#10A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.200_L3 358J TR#10A**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**123.0** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.200_L3 358J TR#10A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.200_L3 358J TR#10A**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **123.0** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	24.6	24.6	78.4 / 66.0	61.4 / 60.2	-	Jul 1400	10.90

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	1.9	69.5 / 70.9	-	1340	0.000	0.000	7

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	24.6	Jul 1700	1.3	123.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.200_L3 358J TR#10A	1	24.6	Jul 1700	1340	1.3	123.0	10.90

Air System Design Load Summary for Bldg.200_L3 358J TR#10A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 83.9 °F / 70.4 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	8 ft²	184	-	8 ft²	-	-
Wall Transmission	199 ft²	138	-	199 ft²	1162	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	8 ft²	15	-	8 ft²	187	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	101 W	319	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24540**	**0**	**-**	**1349**	**0**
Zone Conditioning	-	24522	0	-	1347	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	7 CFM	45	70	7 CFM	580	2
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**24567**	**70**	**-**	**1927**	**2**
Terminal Unit Cooling	-	24567	80	-	0	0
Terminal Unit Heating	-	0	-	-	1927	-
>> Total Conditioning	**-**	**24567**	**80**	**-**	**1927**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.200_L3 358J TR#10A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1700 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	8 ft²	162	-	8 ft²	-	-
Wall Transmission	199 ft²	167	-	199 ft²	1162	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	8 ft²	19	-	8 ft²	187	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	101 W	324	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24555**	**0**	**-**	**1349**	**0**

Space Design Load Summary for Bldg.200_L3 358J TR#10A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.200_L3 358J TR#10A" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1700 COOLING OA DB / WB 85.4 °F / 70.8 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	8 ft²	162	-	8 ft²	-	-
Wall Transmission	199 ft²	167	-	199 ft²	1162	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	8 ft²	19	-	8 ft²	187	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	101 W	324	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24555**	**0**	**-**	**1349**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.200_L3 358J TR#10A" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
NNE EXPOSURE						
WALL	95	0.080	-	59	-	555
WINDOW 1	4	0.320	0.460	10	55	93
ESE EXPOSURE						
WALL	104	0.080	-	108	-	607
WINDOW 1	4	0.320	0.460	10	107	93

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.200_L4 413 TR#11

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.200_L4 413 TR#11**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**120.5** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.200_L4 413 TR#11

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.200_L4 413 TR#11**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **120.5** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	25.7	25.0	78.6 / 66.4	61.6 / 60.4	-	Jul 1500	11.31

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	2.1	69.1 / 70.5	-	1363	0.000	0.000	17

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	25.0	Jul 1800	0.7	120.5

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.200_L4 413 TR#11	1	25.0	Jul 1800	1363	0.7	120.5	11.31

Air System Design Load Summary for Bldg.200_L4 413 TR#11

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	4 ft²	111	-	4 ft²	-	-
Wall Transmission	104 ft²	40	-	104 ft²	607	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	4 ft²	9	-	4 ft²	93	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	99 W	314	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	2	456	540	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24815**	**540**	**-**	**701**	**0**
Zone Conditioning	-	24845	540	-	735	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	17 CFM	129	148	17 CFM	1355	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**24974**	**688**	**-**	**2090**	**1**
Terminal Unit Cooling	-	24974	755	-	0	0
Terminal Unit Heating	-	0	-	-	2090	-
>> Total Conditioning	**-**	**24974**	**755**	**-**	**2090**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.200_L4 413 TR#11

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1800 COOLING OA DB / WB 84.1 °F / 70.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	4 ft²	163	-	4 ft²	-	-
Wall Transmission	104 ft²	124	-	104 ft²	607	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	4 ft²	9	-	4 ft²	93	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	99 W	318	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	2	475	540	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24973**	**540**	**-**	**701**	**0**

Space Design Load Summary for Bldg.200_L4 413 TR#11

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.200_L4 413 TR#11" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1800 COOLING OA DB / WB 84.1 °F / 70.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	4 ft²	163	-	4 ft²	-	-
Wall Transmission	104 ft²	124	-	104 ft²	607	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	4 ft²	9	-	4 ft²	93	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	99 W	318	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	2	475	540	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24973**	**540**	**-**	**701**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.200_L4 413 TR#11" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
WNW EXPOSURE						
WALL	104	0.080	-	124	-	607
WINDOW 1	4	0.320	0.460	9	163	93

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.200_L5 C501B TR#12

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.200_L5 C501B TR#12**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**96.3** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.200_L5 C501B TR#12

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.200_L5 C501B TR#12**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **96.3** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	24.5	24.4	78.2 / 65.9	61.2 / 60.1	-	Aug 1900	13.81

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	1.1	69.8 / 70.6	-	1330	0.000	0.000	6

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	24.4	Jul 1600	0.7	96.3

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.200_L5 C501B TR#12	1	24.4	Jul 1600	1330	0.7	96.3	13.81

Air System Design Load Summary for Bldg.200_L5 C501B TR#12

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1900 COOLING OA DB / WB 82.1 °F / 69.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	8 ft²	94	-	8 ft²	-	-
Wall Transmission	82 ft²	61	-	82 ft²	479	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	8 ft²	14	-	8 ft²	187	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	79 W	255	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24308**	**0**	**-**	**666**	**0**
Zone Conditioning	-	24341	0	-	667	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	6 CFM	24	56	6 CFM	455	2
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**24365**	**56**	**-**	**1122**	**2**
Terminal Unit Cooling	-	24365	88	-	0	0
Terminal Unit Heating	-	0	-	-	1122	-
>> Total Conditioning	**-**	**24365**	**88**	**-**	**1122**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.200_L5 C501B TR#12

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1600 COOLING OA DB / WB 86.0 °F / 71.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	8 ft²	155	-	8 ft²	-	-
Wall Transmission	82 ft²	56	-	82 ft²	479	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	8 ft²	20	-	8 ft²	187	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	79 W	252	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24366**	**0**	**-**	**666**	**0**

Space Design Load Summary for Bldg.200_L5 C501B TR#12

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.200_L5 C501B TR#12" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1600 COOLING OA DB / WB 86.0 °F / 71.0 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	8 ft²	155	-	8 ft²	-	-
Wall Transmission	82 ft²	56	-	82 ft²	479	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	8 ft²	20	-	8 ft²	187	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	79 W	252	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24366**	**0**	**-**	**666**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.200_L5 C501B TR#12" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
NE EXPOSURE						
WALL	82	0.080	-	56	-	479
WINDOW 1	4	0.320	0.460	10	78	93
WINDOW 2	4	0.320	0.460	10	78	93

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.200_L6 635 TR#13

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.200_L6 635 TR#13**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**115.2** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.200_L6 635 TR#13

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.200_L6 635 TR#13**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **115.2** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	17.6	17.5	78.9 / 66.5	61.9 / 60.7	-	Jul 1700	8.30

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	1.1	69.0 / 70.1	-	956	0.000	0.000	7

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	17.5	Jul 1700	0.6	115.2

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.200_L6 635 TR#13	1	17.5	Jul 1700	956	0.6	115.2	8.30

Air System Design Load Summary for Bldg.200_L6 635 TR#13

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1700 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	4 ft²	74	-	4 ft²	-	-
Wall Transmission	86 ft²	64	-	86 ft²	502	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	4 ft²	10	-	4 ft²	93	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	94 W	308	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17516**	**0**	**-**	**596**	**0**
Zone Conditioning	-	17474	0	-	573	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	7 CFM	49	59	7 CFM	540	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**17523**	**59**	**-**	**1113**	**1**
Terminal Unit Cooling	-	17523	107	-	0	0
Terminal Unit Heating	-	0	-	-	1113	-
>> Total Conditioning	**-**	**17523**	**107**	**-**	**1113**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.200_L6 635 TR#13

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1700 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	4 ft²	74	-	4 ft²	-	-
Wall Transmission	86 ft²	64	-	86 ft²	502	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	4 ft²	10	-	4 ft²	93	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	94 W	308	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17516**	**0**	**-**	**596**	**0**

Space Design Load Summary for Bldg.200_L6 635 TR#13

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.200_L6 635 TR#13" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1700 COOLING OA DB / WB 85.4 °F / 70.8 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	4 ft²	74	-	4 ft²	-	-
Wall Transmission	86 ft²	64	-	86 ft²	502	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	4 ft²	10	-	4 ft²	93	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	94 W	308	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17516**	**0**	**-**	**596**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.200_L6 635 TR#13" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
NE EXPOSURE						
WALL	86	0.080	-	64	-	502
WINDOW 1	4	0.320	0.460	10	74	93

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.200E_G E13I TR#7B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.200E_G E13I TR#7B**	Number of zones	**1**	
Equipment Class	**TERM**	Floor Area	**120.6**	ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**	

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.200E_G E13I TR#7B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.200E_G E13I TR#7B**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **120.6** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	24.4	24.3	78.5 / 66.1	61.4 / 60.2	-	Aug 1400	10.96

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	0.6	69.6 / 70.0	-	1321	0.000	0.000	7

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	24.2	Jan 2200	0.0	120.6

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.200E_G E13I TR#7B	1	24.2	Jan 2200	1321	0.0	120.6	10.96

Air System Design Load Summary for Bldg.200E_G E13I TR#7B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1400 COOLING OA DB / WB 83.9 °F / 70.4 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	120 ft²	0	-	120 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	99 W	313	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24197**	**0**	**-**	**0**	**0**
Zone Conditioning	-	24240	0	-	0	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	7 CFM	43	68	7 CFM	569	2
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**24283**	**68**	**-**	**569**	**2**
Terminal Unit Cooling	-	24283	98	-	0	0
Terminal Unit Heating	-	0	-	-	569	-
>> Total Conditioning	**-**	**24283**	**98**	**-**	**569**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.200E_G E13I TR#7B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	120 ft²	0	-	120 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	99 W	323	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24207**	**0**	**-**	**0**	**0**

Space Design Load Summary for Bldg.200E_G E13I TR#7B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.200E_G E13I TR#7B" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	120 ft²	0	-	120 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	99 W	323	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24207**	**0**	**-**	**0**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.200E_G E13I TR#7B" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.200E_L1 E122 TR#8B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.200E_L1 E122 TR#8B**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**110.3** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.200E_L1 E122 TR#8B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.200E_L1 E122 TR#8B**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **110.3** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	24.5	24.3	78.3 / 65.9	61.2 / 60.0	-	Jul 1700	11.97

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	0.5	69.6 / 70.0	-	1320	0.000	0.000	7

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	24.2	Jan 2200	0.0	110.3

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.200E_L1 E122 TR#8B	1	24.2	Jan 2200	1320	0.0	110.3	11.97

Air System Design Load Summary for Bldg.200E_L1 E122 TR#8B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1700 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	90 W	290	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24174**	**0**	**-**	**0**	**0**
Zone Conditioning	-	24275	0	-	0	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	7 CFM	51	65	7 CFM	521	2
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**24326**	**65**	**-**	**521**	**2**
Terminal Unit Cooling	-	24326	129	-	0	0
Terminal Unit Heating	-	0	-	-	521	-
>> Total Conditioning	**-**	**24326**	**129**	**-**	**521**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.200E_L1 E122 TR#8B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	90 W	296	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24179**	**0**	**-**	**0**	**0**

Space Design Load Summary for Bldg.200E_L1 E122 TR#8B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.200E_L1 E122 TR#8B" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	90 W	296	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24179**	**0**	**-**	**0**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.200E_L1 E122 TR#8B" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.200E_L2 E201 TR#9B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.200E_L2 E201 TR#9B**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**126.2** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.200E_L2 E201 TR#9B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.200E_L2 E201 TR#9B**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **126.2** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	24.3	24.3	78.9 / 66.4	61.8 / 60.6	-	Jul 1800	10.48

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	0.6	69.6 / 70.0	-	1322	0.000	0.000	8

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	24.2	Jan 2200	0.0	126.2

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.200E_L2 E201 TR#9B	1	24.2	Jan 2200	1322	0.0	126.2	10.48

Air System Design Load Summary for Bldg.200E_L2 E201 TR#9B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1800 COOLING OA DB / WB 84.1 °F / 70.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	103 W	333	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24217**	**0**	**-**	**0**	**0**
Zone Conditioning	-	24219	0	-	0	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	8 CFM	43	65	8 CFM	596	2
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**24263**	**65**	**-**	**596**	**2**
Terminal Unit Cooling	-	24263	81	-	0	0
Terminal Unit Heating	-	0	-	-	596	-
>> Total Conditioning	**-**	**24263**	**81**	**-**	**596**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.200E_L2 E201 TR#9B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	103 W	338	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24222**	**0**	**-**	**0**	**0**

Space Design Load Summary for Bldg.200E_L2 E201 TR#9B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.200E_L2 E201 TR#9B" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	103 W	338	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24222**	**0**	**-**	**0**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.200E_L2 E201 TR#9B" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.200E_L3 E341 TR#10B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.200E_L3 E341 TR#10B**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **104.4** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.200E_L3 E341 TR#10B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.200E_L3 E341 TR#10B**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **104.4** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	24.4	24.3	78.4 / 66.0	61.4 / 60.2	-	Aug 1800	12.63

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	0.5	69.7 / 70.0	-	1319	0.000	0.000	6

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	24.2	Jan 2200	0.0	104.4

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.200E_L3 E341 TR#10B	1	24.2	Jan 2200	1319	0.0	104.4	12.63

Air System Design Load Summary for Bldg.200E_L3 E341 TR#10B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1800 COOLING OA DB / WB 84.1 °F / 70.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	86 W	276	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24160**	**0**	**-**	**0**	**0**
Zone Conditioning	-	24212	0	-	0	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	6 CFM	39	59	6 CFM	493	2
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**24251**	**59**	**-**	**493**	**2**
Terminal Unit Cooling	-	24251	100	-	0	0
Terminal Unit Heating	-	0	-	-	493	-
>> Total Conditioning	**-**	**24251**	**100**	**-**	**493**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.200E_L3 E341 TR#10B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	86 W	280	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24164**	**0**	**-**	**0**	**0**

Space Design Load Summary for Bldg.200E_L3 E341 TR#10B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.200E_L3 E341 TR#10B" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	86 W	280	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24164**	**0**	**-**	**0**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.200E_L3 E341 TR#10B" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.201_L1 001A TE#37A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.201_L1 001A TE#37A**	Number of zones	**1**	
Equipment Class	**TERM**	Floor Area	**35.5**	ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**	

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.201_L1 001A TE#37A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.201_L1 001A TE#37A**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **35.5** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	10.4	10.4	78.2 / 65.3	61.1 / 59.3	-	Jul 2000	15.89

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	0.2	69.7 / 70.0	-	564	0.000	0.000	2

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	10.3	Jan 2200	0.0	35.5

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.201_L1 001A TE#37A	1	10.3	Jan 2200	564	0.0	35.5	15.89

Air System Design Load Summary for Bldg.201_L1 001A TE#37A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 2000 COOLING OA DB / WB 79.6 °F / 69.1 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	36 ft²	0	-	36 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	29 W	95	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**10330**	**0**	**-**	**0**	**0**
Zone Conditioning	-	10362	0	-	0	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	2 CFM	3	25	2 CFM	168	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**10365**	**25**	**-**	**168**	**1**
Terminal Unit Cooling	-	10365	0	-	0	0
Terminal Unit Heating	-	0	-	-	168	-
>> Total Conditioning	**-**	**10365**	**0**	**-**	**168**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.201_L1 001A TE#37A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	36 ft²	0	-	36 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	29 W	95	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**10331**	**0**	**-**	**0**	**0**

Space Design Load Summary for Bldg.201_L1 001A TE#37A

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.201_L1 001A TE#37A" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	36 ft²	0	-	36 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	29 W	95	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**10331**	**0**	**-**	**0**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.201_L1 001A TE#37A" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.202_L2 207E TR#44

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.202_L2 207E TR#44**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**88.0** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.202_L2 207E TR#44

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.202_L2 207E TR#44**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **88.0** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	18.2	18.2	78.8 / 66.2	62.0 / 60.5	-	Jul 1100	11.42

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	3.8	69.4 / 72.9	-	1005	0.000	0.000	5

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	18.4	Jul 1100	3.4	88.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.202_L2 207E TR#44	1	18.4	Jul 1100	1005	3.4	88.0	11.42

Air System Design Load Summary for Bldg.202_L2 207E TR#44

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1100 COOLING OA DB / WB 75.5 °F / 67.9 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	4 ft²	93	-	4 ft²	-	-
Wall Transmission	68 ft²	949	-	68 ft²	2879	-
Roof Transmission	88 ft²	87	-	88 ft²	308	-
Window Transmission	4 ft²	-1	-	4 ft²	166	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	72 W	224	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**18412**	**0**	**-**	**3354**	**0**
Zone Conditioning	-	18189	0	-	3389	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	5 CFM	-19	48	5 CFM	414	2
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**18170**	**48**	**-**	**3803**	**2**
Terminal Unit Cooling	-	18170	0	-	0	0
Terminal Unit Heating	-	0	-	-	3803	-
>> Total Conditioning	**-**	**18170**	**0**	**-**	**3803**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.202_L2 207E TR#44

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1100 COOLING OA DB / WB 75.5 °F / 67.9 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	4 ft²	93	-	4 ft²	-	-
Wall Transmission	68 ft²	949	-	68 ft²	2879	-
Roof Transmission	88 ft²	87	-	88 ft²	308	-
Window Transmission	4 ft²	-1	-	4 ft²	166	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	72 W	224	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**18412**	**0**	**-**	**3354**	**0**

Space Design Load Summary for Bldg.202_L2 207E TR#44

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.202_L2 207E TR#44" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1100 COOLING OA DB / WB 75.5 °F / 67.9 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	4 ft²	93	-	4 ft²	-	-
Wall Transmission	68 ft²	949	-	68 ft²	2879	-
Roof Transmission	88 ft²	87	-	88 ft²	308	-
Window Transmission	4 ft²	-1	-	4 ft²	166	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	72 W	224	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**18412**	**0**	**-**	**3354**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.202_L2 207E TR#44" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
E EXPOSURE						
WALL	68	0.580	-	949	-	2879
WINDOW 1	4	0.570	0.287	-1	93	166
H EXPOSURE						
ROOF	88	0.048	-	87	-	308

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.203_L3 302 TR#17

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.203_L3 302 TR#17**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**111.1** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.203_L3 302 TR#17

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.203_L3 302 TR#17**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **111.1** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	18.9	18.2	78.4 / 66.2	61.2 / 60.1	-	Jul 1500	8.82

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	1.7	68.7 / 70.2	-	980	0.000	0.000	17

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	18.0	Jul 1500	0.4	111.1

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.203_L3 302 TR#17	1	18.0	Jul 1500	980	0.4	111.1	8.82

Air System Design Load Summary for Bldg.203_L3 302 TR#17

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	111 ft²	153	-	111 ft²	389	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	91 W	290	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	2	456	540	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17959**	**540**	**-**	**389**	**0**
Zone Conditioning	-	18031	540	-	343	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	17 CFM	128	152	17 CFM	1310	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**18159**	**692**	**-**	**1652**	**1**
Terminal Unit Cooling	-	18159	702	-	0	0
Terminal Unit Heating	-	0	-	-	1652	-
>> Total Conditioning	**-**	**18159**	**702**	**-**	**1652**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.203_L3 302 TR#17

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	111 ft²	153	-	111 ft²	389	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	91 W	290	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	2	456	540	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17959**	**540**	**-**	**389**	**0**

Space Design Load Summary for Bldg.203_L3 302 TR#17

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.203_L3 302 TR#17" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 85.4 °F / 70.8 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	111 ft²	153	-	111 ft²	389	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	91 W	290	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	2	456	540	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17959**	**540**	**-**	**389**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.203_L3 302 TR#17" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
H EXPOSURE						
ROOF	111	0.048	-	153	-	389

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.204_L2 200A TR#19

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.204_L2 200A TR#19**	Number of zones	**1**	
Equipment Class	**TERM**	Floor Area	**154.1**	ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**	

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.204_L2 200A TR#19

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.204_L2 200A TR#19**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **154.1** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	17.9	17.8	78.3 / 66.0	61.2 / 60.1	-	Aug 1400	6.26

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	1.3	69.2 / 70.4	-	965	0.000	0.000	9

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	17.7	Jul 1400	0.5	154.1

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.204_L2 200A TR#19	1	17.7	Jul 1400	965	0.5	154.1	6.26

Air System Design Load Summary for Bldg.204_L2 200A TR#19

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1400 COOLING OA DB / WB 83.9 °F / 70.4 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	154 ft²	198	-	154 ft²	540	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	126 W	400	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17657**	**0**	**-**	**540**	**0**
Zone Conditioning	-	17728	0	-	547	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	9 CFM	56	90	9 CFM	726	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**17784**	**90**	**-**	**1273**	**1**
Terminal Unit Cooling	-	17784	100	-	0	0
Terminal Unit Heating	-	0	-	-	1273	-
>> Total Conditioning	**-**	**17784**	**100**	**-**	**1273**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.204_L2 200A TR#19

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 83.9 °F / 70.4 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	154 ft²	215	-	154 ft²	540	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	126 W	400	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17674**	**0**	**-**	**540**	**0**

Space Design Load Summary for Bldg.204_L2 200A TR#19

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.204_L2 200A TR#19" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 83.9 °F / 70.4 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	154 ft²	215	-	154 ft²	540	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	126 W	400	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17674**	**0**	**-**	**540**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.204_L2 200A TR#19" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
H EXPOSURE						
ROOF	154	0.048	-	215	-	540

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.205_L1 108B TR#20

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.205_L1 108B TR#20**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**141.3** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.205_L1 108B TR#20

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.205_L1 108B TR#20**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **141.3** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	17.6	17.5	78.6 / 66.1	61.5 / 60.3	-	Jul 1800	6.74

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	0.7	69.3 / 70.0	-	952	0.000	0.000	8

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	17.4	Jan 2200	0.0	141.3

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.205_L1 108B TR#20	1	17.4	Jan 2200	952	0.0	141.3	6.74

Air System Design Load Summary for Bldg.205_L1 108B TR#20

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1800 COOLING OA DB / WB 84.1 °F / 70.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	141 ft²	0	-	141 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	116 W	373	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17433**	**0**	**-**	**0**	**0**
Zone Conditioning	-	17484	0	-	0	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	8 CFM	51	79	8 CFM	667	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**17535**	**79**	**-**	**667**	**1**
Terminal Unit Cooling	-	17535	85	-	0	0
Terminal Unit Heating	-	0	-	-	667	-
>> Total Conditioning	**-**	**17535**	**85**	**-**	**667**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.205_L1 108B TR#20

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	141 ft²	0	-	141 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	116 W	379	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17439**	**0**	**-**	**0**	**0**

Space Design Load Summary for Bldg.205_L1 108B TR#20

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.205_L1 108B TR#20" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	141 ft²	0	-	141 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	116 W	379	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17439**	**0**	**-**	**0**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.205_L1 108B TR#20" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.205_L2 230A TR#21

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.205_L2 230A TR#21**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**122.4** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.205_L2 230A TR#21

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.205_L2 230A TR#21**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **122.4** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	24.7	24.5	78.5 / 66.1	61.4 / 60.2	-	Aug 1700	10.91

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	1.2	70.4 / 71.3	-	1335	0.000	0.000	7

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	24.5	Sep 1600	0.5	122.4

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.205_L2 230A TR#21	1	24.5	Sep 1600	1335	0.5	122.4	10.91

Air System Design Load Summary for Bldg.205_L2 230A TR#21

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1700 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	4 ft²	143	-	4 ft²	-	-
Wall Transmission	68 ft²	92	-	68 ft²	397	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	4 ft²	10	-	4 ft²	93	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	100 W	322	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24451**	**0**	**-**	**491**	**0**
Zone Conditioning	-	24486	0	-	636	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	7 CFM	56	69	7 CFM	584	2
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**24541**	**69**	**-**	**1220**	**2**
Terminal Unit Cooling	-	24541	110	-	0	0
Terminal Unit Heating	-	0	-	-	1220	-
>> Total Conditioning	**-**	**24541**	**110**	**-**	**1220**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.205_L2 230A TR#21

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Sep 1600 COOLING OA DB / WB 80.2 °F / 68.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	4 ft²	189	-	4 ft²	-	-
Wall Transmission	68 ft²	63	-	68 ft²	397	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	4 ft²	2	-	4 ft²	93	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	100 W	321	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24459**	**0**	**-**	**491**	**0**

Space Design Load Summary for Bldg.205_L2 230A TR#21

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.205_L2 230A TR#21" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Sep 1600 COOLING OA DB / WB 80.2 °F / 68.0 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	4 ft²	189	-	4 ft²	-	-
Wall Transmission	68 ft²	63	-	68 ft²	397	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	4 ft²	2	-	4 ft²	93	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	100 W	321	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24459**	**0**	**-**	**491**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.205_L2 230A TR#21" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
SSW EXPOSURE						
WALL	68	0.080	-	63	-	397
WINDOW 1	4	0.320	0.460	2	189	93

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.205_L3 307E TR#22

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.205_L3 307E TR#22**	Number of zones	**1**	
Equipment Class	**TERM**	Floor Area	**157.9**	ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**	

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.205_L3 307E TR#22

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.205_L3 307E TR#22**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **157.9** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	24.8	24.7	78.7 / 66.3	61.7 / 60.5	-	Aug 1600	8.55

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	1.9	69.4 / 70.7	-	1350	0.000	0.000	9

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	24.7	Aug 1600	1.1	157.9

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.205_L3 307E TR#22	1	24.7	Aug 1600	1350	1.1	157.9	8.55

Air System Design Load Summary for Bldg.205_L3 307E TR#22

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1600 COOLING OA DB / WB 86.0 °F / 71.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	4 ft²	155	-	4 ft²	-	-
Wall Transmission	77 ft²	88	-	77 ft²	450	-
Roof Transmission	158 ft²	180	-	158 ft²	553	-
Window Transmission	4 ft²	10	-	4 ft²	93	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	129 W	414	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24731**	**0**	**-**	**1096**	**0**
Zone Conditioning	-	24652	0	-	1130	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	9 CFM	75	84	9 CFM	744	2
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**24727**	**84**	**-**	**1874**	**2**
Terminal Unit Cooling	-	24727	119	-	0	0
Terminal Unit Heating	-	0	-	-	1874	-
>> Total Conditioning	**-**	**24727**	**119**	**-**	**1874**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.205_L3 307E TR#22

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1600 COOLING OA DB / WB 86.0 °F / 71.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	4 ft²	155	-	4 ft²	-	-
Wall Transmission	77 ft²	88	-	77 ft²	450	-
Roof Transmission	158 ft²	180	-	158 ft²	553	-
Window Transmission	4 ft²	10	-	4 ft²	93	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	129 W	414	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24731**	**0**	**-**	**1096**	**0**

Space Design Load Summary for Bldg.205_L3 307E TR#22

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.205_L3 307E TR#22" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1600 COOLING OA DB / WB 86.0 °F / 71.0 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	4 ft²	155	-	4 ft²	-	-
Wall Transmission	77 ft²	88	-	77 ft²	450	-
Roof Transmission	158 ft²	180	-	158 ft²	553	-
Window Transmission	4 ft²	10	-	4 ft²	93	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	129 W	414	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	7000 W	23884	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**24731**	**0**	**-**	**1096**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.205_L3 307E TR#22" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
SSW EXPOSURE						
WALL	77	0.080	-	88	-	450
WINDOW 1	4	0.320	0.460	10	155	93
H EXPOSURE						
ROOF	158	0.048	-	180	-	553

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.206_L1 145A TR#23

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.206_L1 145A TR#23**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**192.2** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.206_L1 145A TR#23

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.206_L1 145A TR#23**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **192.2** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	17.8	17.7	78.7 / 66.3	61.7 / 60.5	-	Jul 1700	4.99

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	0.9	69.1 / 70.0	-	959	0.000	0.000	12

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	17.6	Jan 2200	0.0	192.2

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.206_L1 145A TR#23	1	17.6	Jan 2200	959	0.0	192.2	4.99

Air System Design Load Summary for Bldg.206_L1 145A TR#23

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1700 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	192 ft²	0	-	192 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	158 W	506	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17566**	**0**	**-**	**0**	**0**
Zone Conditioning	-	17574	0	-	0	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	12 CFM	84	103	12 CFM	907	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**17659**	**103**	**-**	**907**	**1**
Terminal Unit Cooling	-	17659	120	-	0	0
Terminal Unit Heating	-	0	-	-	907	-
>> Total Conditioning	**-**	**17659**	**120**	**-**	**907**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.206_L1 145A TR#23

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	192 ft²	0	-	192 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	158 W	515	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17575**	**0**	**-**	**0**	**0**

Space Design Load Summary for Bldg.206_L1 145A TR#23

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.206_L1 145A TR#23" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	192 ft²	0	-	192 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	158 W	515	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17575**	**0**	**-**	**0**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.206_L1 145A TR#23" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.206_L2 213 TR#24

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.206_L2 213 TR#24**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**133.2** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.206_L2 213 TR#24

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.206_L2 213 TR#24**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **133.2** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	17.6	17.5	78.7 / 66.3	61.6 / 60.4	-	Jul 1500	7.14

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	0.6	69.4 / 70.0	-	951	0.000	0.000	8

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	17.4	Jan 2200	0.0	133.2

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.206_L2 213 TR#24	1	17.4	Jan 2200	951	0.0	133.2	7.14

Air System Design Load Summary for Bldg.206_L2 213 TR#24

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	109 W	347	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17407**	**0**	**-**	**0**	**0**
Zone Conditioning	-	17412	0	-	0	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	8 CFM	59	72	8 CFM	629	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**17471**	**72**	**-**	**629**	**1**
Terminal Unit Cooling	-	17471	97	-	0	0
Terminal Unit Heating	-	0	-	-	629	-
>> Total Conditioning	**-**	**17471**	**97**	**-**	**629**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.206_L2 213 TR#24

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	109 W	357	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17417**	**0**	**-**	**0**	**0**

Space Design Load Summary for Bldg.206_L2 213 TR#24

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.206_L2 213 TR#24" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	109 W	357	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17417**	**0**	**-**	**0**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.206_L2 213 TR#24" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.206_L3 366 TR#25

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.206_L3 366 TR#25**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**105.0** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.206_L3 366 TR#25

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.206_L3 366 TR#25**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **105.0** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	17.9	17.8	78.9 / 66.5	61.9 / 60.7	-	Aug 1600	9.29

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	1.4	69.3 / 70.7	-	975	0.000	0.000	6

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	17.9	Aug 1600	1.0	105.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.206_L3 366 TR#25	1	17.9	Aug 1600	975	1.0	105.0	9.29

Air System Design Load Summary for Bldg.206_L3 366 TR#25

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1600 COOLING OA DB / WB 86.0 °F / 71.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	8 ft²	311	-	8 ft²	-	-
Wall Transmission	68 ft²	78	-	68 ft²	397	-
Roof Transmission	105 ft²	120	-	105 ft²	368	-
Window Transmission	8 ft²	20	-	8 ft²	187	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	86 W	275	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17863**	**0**	**-**	**952**	**0**
Zone Conditioning	-	17789	0	-	937	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	6 CFM	49	53	6 CFM	494	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**17838**	**53**	**-**	**1431**	**1**
Terminal Unit Cooling	-	17838	93	-	0	0
Terminal Unit Heating	-	0	-	-	1431	-
>> Total Conditioning	**-**	**17838**	**93**	**-**	**1431**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.206_L3 366 TR#25

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1600 COOLING OA DB / WB 86.0 °F / 71.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	8 ft²	311	-	8 ft²	-	-
Wall Transmission	68 ft²	78	-	68 ft²	397	-
Roof Transmission	105 ft²	120	-	105 ft²	368	-
Window Transmission	8 ft²	20	-	8 ft²	187	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	86 W	275	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17863**	**0**	**-**	**952**	**0**

Space Design Load Summary for Bldg.206_L3 366 TR#25

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.206_L3 366 TR#25" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1600 COOLING OA DB / WB 86.0 °F / 71.0 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	8 ft²	311	-	8 ft²	-	-
Wall Transmission	68 ft²	78	-	68 ft²	397	-
Roof Transmission	105 ft²	120	-	105 ft²	368	-
Window Transmission	8 ft²	20	-	8 ft²	187	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	86 W	275	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17863**	**0**	**-**	**952**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.206_L3 366 TR#25" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
SSW EXPOSURE						
WALL	68	0.080	-	78	-	397
WINDOW 1	4	0.320	0.460	10	155	93
WINDOW 2	4	0.320	0.460	10	155	93
H EXPOSURE						
ROOF	105	0.048	-	120	-	368

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.207_L1 132A TR#26

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.207_L1 132A TR#26**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**117.6** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.207_L1 132A TR#26

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.207_L1 132A TR#26**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **117.6** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	17.6	17.5	78.4 / 66.0	61.3 / 60.1	-	Jul 1400	8.07

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	0.6	69.5 / 70.0	-	948	0.000	0.000	7

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	17.4	Jan 2200	0.0	117.6

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.207_L1 132A TR#26	1	17.4	Jan 2200	948	0.0	117.6	8.07

Air System Design Load Summary for Bldg.207_L1 132A TR#26

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 83.9 °F / 70.4 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	118 ft²	0	-	118 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	96 W	305	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17365**	**0**	**-**	**0**	**0**
Zone Conditioning	-	17424	0	-	0	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	7 CFM	42	68	7 CFM	555	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**17466**	**68**	**-**	**555**	**1**
Terminal Unit Cooling	-	17466	97	-	0	0
Terminal Unit Heating	-	0	-	-	555	-
>> Total Conditioning	**-**	**17466**	**97**	**-**	**555**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.207_L1 132A TR#26

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	118 ft²	0	-	118 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	96 W	315	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17375**	**0**	**-**	**0**	**0**

Space Design Load Summary for Bldg.207_L1 132A TR#26

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.207_L1 132A TR#26" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	118 ft²	0	-	118 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	96 W	315	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17375**	**0**	**-**	**0**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.207_L1 132A TR#26" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.207_L2 207A TR#27

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.207_L2 207A TR#27**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**136.1** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.207_L2 207A TR#27

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.207_L2 207A TR#27**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **136.1** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	17.6	17.5	78.5 / 66.1	61.4 / 60.2	-	Jul 1800	6.99

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	0.6	69.4 / 70.0	-	951	0.000	0.000	8

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	17.4	Jan 2200	0.0	136.1

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.207_L2 207A TR#27	1	17.4	Jan 2200	951	0.0	136.1	6.99

Air System Design Load Summary for Bldg.207_L2 207A TR#27

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1800 COOLING OA DB / WB 84.1 °F / 70.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	112 W	360	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17420**	**0**	**-**	**0**	**0**
Zone Conditioning	-	17486	0	-	0	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	8 CFM	50	78	8 CFM	642	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**17536**	**78**	**-**	**642**	**1**
Terminal Unit Cooling	-	17536	85	-	0	0
Terminal Unit Heating	-	0	-	-	642	-
>> Total Conditioning	**-**	**17536**	**85**	**-**	**642**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.207_L2 207A TR#27

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	112 W	365	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17425**	**0**	**-**	**0**	**0**

Space Design Load Summary for Bldg.207_L2 207A TR#27

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.207_L2 207A TR#27" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	112 W	365	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17425**	**0**	**-**	**0**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.207_L2 207A TR#27" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.207_L3 307A TR#28

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.207_L3 307A TR#28**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**127.5** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.207_L3 307A TR#28

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.207_L3 307A TR#28**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **127.5** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	17.7	17.6	78.4 / 66.0	61.3 / 60.1	-	Aug 1700	7.52

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	1.0	69.4 / 70.4	-	959	0.000	0.000	8

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	17.6	Jul 1400	0.4	127.5

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.207_L3 307A TR#28	1	17.6	Jul 1400	959	0.4	127.5	7.52

Air System Design Load Summary for Bldg.207_L3 307A TR#28

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1700 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	128 ft²	121	-	128 ft²	447	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	105 W	336	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17516**	**0**	**-**	**447**	**0**
Zone Conditioning	-	17574	0	-	439	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	8 CFM	59	74	8 CFM	602	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**17633**	**74**	**-**	**1041**	**1**
Terminal Unit Cooling	-	17633	82	-	0	0
Terminal Unit Heating	-	0	-	-	1041	-
>> Total Conditioning	**-**	**17633**	**82**	**-**	**1041**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.207_L3 307A TR#28

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 83.9 °F / 70.4 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	128 ft²	178	-	128 ft²	447	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	105 W	331	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17568**	**0**	**-**	**447**	**0**

Space Design Load Summary for Bldg.207_L3 307A TR#28

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.207_L3 307A TR#28" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 83.9 °F / 70.4 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	128 ft²	178	-	128 ft²	447	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	105 W	331	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17568**	**0**	**-**	**447**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.207_L3 307A TR#28" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
H EXPOSURE						
ROOF	128	0.048	-	178	-	447

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.208_L1 107 TR#29

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.208_L1 107 TR#29**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**92.2** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.208_L1 107 TR#29

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.208_L1 107 TR#29**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **92.2** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	17.4	17.3	78.9 / 66.5	61.9 / 60.7	-	Jul 1700	10.25

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	0.4	69.6 / 70.0	-	945	0.000	0.000	6

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	17.3	Jan 2200	0.0	92.2

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.208_L1 107 TR#29	1	17.3	Jan 2200	945	0.0	92.2	10.25

Air System Design Load Summary for Bldg.208_L1 107 TR#29

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1700 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	76 W	243	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17303**	**0**	**-**	**0**	**0**
Zone Conditioning	-	17298	0	-	0	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	6 CFM	39	47	6 CFM	435	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**17337**	**47**	**-**	**435**	**1**
Terminal Unit Cooling	-	17337	54	-	0	0
Terminal Unit Heating	-	0	-	-	435	-
>> Total Conditioning	**-**	**17337**	**54**	**-**	**435**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.208_L1 107 TR#29

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	76 W	247	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17307**	**0**	**-**	**0**	**0**

Space Design Load Summary for Bldg.208_L1 107 TR#29

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.208_L1 107 TR#29" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	76 W	247	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17307**	**0**	**-**	**0**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.208_L1 107 TR#29" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.209_L1 123A TR#30

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.209_L1 123A TR#30**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**121.8** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.209_L1 123A TR#30

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.209_L1 123A TR#30**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **121.8** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	17.5	17.4	78.7 / 66.3	61.7 / 60.5	-	Jul 1600	7.79

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	0.6	69.4 / 70.0	-	949	0.000	0.000	7

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	17.4	Jan 2200	0.0	121.8

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.209_L1 123A TR#30	1	17.4	Jan 2200	949	0.0	121.8	7.79

Air System Design Load Summary for Bldg.209_L1 123A TR#30

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1600 COOLING OA DB / WB 86.0 °F / 71.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	100 W	319	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17379**	**0**	**-**	**0**	**0**
Zone Conditioning	-	17375	0	-	0	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	7 CFM	58	65	7 CFM	575	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**17433**	**65**	**-**	**575**	**1**
Terminal Unit Cooling	-	17433	90	-	0	0
Terminal Unit Heating	-	0	-	-	575	-
>> Total Conditioning	**-**	**17433**	**90**	**-**	**575**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.209_L1 123A TR#30

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	100 W	326	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17386**	**0**	**-**	**0**	**0**

Space Design Load Summary for Bldg.209_L1 123A TR#30

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

TABLE 1.1.A. Component Loads For Space "Bldg.209_L1 123A TR#30" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	100 W	326	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17386**	**0**	**-**	**0**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.209_L1 123A TR#30" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.209_L2 203B TR#31

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name	**Bldg.209_L2 203B TR#31**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**146.4** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.209_L2 203B TR#31

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:31AM

Air System Information

Air System Name ..... **Bldg.209_L2 203B TR#31**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **146.4** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	17.9	17.8	78.4 / 66.1	61.4 / 60.2	-	Jul 1500	6.62

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	1.8	69.1 / 70.9	-	969	0.000	0.000	9

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	17.7	Jul 1700	1.1	146.4

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.209_L2 203B TR#31	1	17.7	Jul 1700	969	1.1	146.4	6.62

Air System Design Load Summary for Bldg.209_L2 203B TR#31

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	4 ft²	51	-	4 ft²	-	-
Wall Transmission	91 ft²	27	-	91 ft²	529	-
Roof Transmission	146 ft²	202	-	146 ft²	513	-
Window Transmission	4 ft²	9	-	4 ft²	93	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	120 W	382	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17730**	**0**	**-**	**1135**	**0**
Zone Conditioning	-	17762	0	-	1109	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	9 CFM	67	83	9 CFM	689	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**17829**	**83**	**-**	**1798**	**1**
Terminal Unit Cooling	-	17829	92	-	0	0
Terminal Unit Heating	-	0	-	-	1798	-
>> Total Conditioning	**-**	**17829**	**92**	**-**	**1798**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.209_L2 203B TR#31

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1700 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	4 ft²	77	-	4 ft²	-	-
Wall Transmission	91 ft²	51	-	91 ft²	529	-
Roof Transmission	146 ft²	161	-	146 ft²	513	-
Window Transmission	4 ft²	10	-	4 ft²	93	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	120 W	385	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17743**	**0**	**-**	**1135**	**0**

Space Design Load Summary for Bldg.209_L2 203B TR#31

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

TABLE 1.1.A. Component Loads For Space "Bldg.209_L2 203B TR#31" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1700 COOLING OA DB / WB 85.4 °F / 70.8 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	4 ft²	77	-	4 ft²	-	-
Wall Transmission	91 ft²	51	-	91 ft²	529	-
Roof Transmission	146 ft²	161	-	146 ft²	513	-
Window Transmission	4 ft²	10	-	4 ft²	93	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	120 W	385	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17743**	**0**	**-**	**1135**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.209_L2 203B TR#31" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
NNW EXPOSURE						
WALL	91	0.080	-	51	-	529
WINDOW 1	4	0.320	0.460	10	77	93
H EXPOSURE						
ROOF	146	0.048	-	161	-	513

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.210_L1 109 TR#32

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name	**Bldg.210_L1 109 TR#32**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**149.0** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.210_L1 109 TR#32

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name ..... **Bldg.210_L1 109 TR#32**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **149.0** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	18.9	18.2	78.4 / 66.2	61.3 / 60.1	-	Aug 1800	6.61

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	2.0	68.5 / 70.4	-	984	0.000	0.000	19

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	18.0	Aug 2000	0.5	149.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.210_L1 109 TR#32	1	18.0	Aug 2000	984	0.5	149.0	6.61

Air System Design Load Summary for Bldg.210_L1 109 TR#32

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1800 COOLING OA DB / WB 84.1 °F / 70.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	86 ft²	102	-	86 ft²	499	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	122 W	394	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	2	475	540	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**18031**	**540**	**-**	**499**	**0**
Zone Conditioning	-	18106	540	-	536	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	19 CFM	119	172	19 CFM	1489	0
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**18224**	**712**	**-**	**2025**	**0**
Terminal Unit Cooling	-	18224	721	-	0	0
Terminal Unit Heating	-	0	-	-	2025	-
>> Total Conditioning	**-**	**18224**	**721**	**-**	**2025**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.210_L1 109 TR#32

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 2000 COOLING OA DB / WB 79.6 °F / 69.1 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	86 ft²	92	-	86 ft²	499	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	122 W	397	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	2	486	540	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**18034**	**540**	**-**	**499**	**0**

Space Design Load Summary for Bldg.210_L1 109 TR#32

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

TABLE 1.1.A. Component Loads For Space "Bldg.210_L1 109 TR#32" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 2000 COOLING OA DB / WB 79.6 °F / 69.1 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	86 ft²	92	-	86 ft²	499	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	122 W	397	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	2	486	540	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**18034**	**540**	**-**	**499**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.210_L1 109 TR#32" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
SSE EXPOSURE						
WALL	86	0.080	-	92	-	499

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.212_L1 100F TE#34

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name	**Bldg.212_L1 100F TE#34**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**35.6** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.212_L1 100F TE#34

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name ..... **Bldg.212_L1 100F TE#34**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **35.6** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	10.4	10.4	78.5 / 65.3	61.5 / 59.4	-	Jul 1700	16.00

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	0.7	70.1 / 71.2	-	570	0.000	0.000	2

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	10.4	Jul 1400	0.5	35.6

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.212_L1 100F TE#34	1	10.4	Jul 1400	570	0.5	35.6	16.00

Air System Design Load Summary for Bldg.212_L1 100F TE#34

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1700 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	59 ft²	58	-	59 ft²	342	-
Roof Transmission	36 ft²	39	-	36 ft²	125	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	29 W	94	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**10426**	**0**	**-**	**466**	**0**
Zone Conditioning	-	10422	0	-	501	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	2 CFM	16	26	2 CFM	169	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**10438**	**26**	**-**	**670**	**1**
Terminal Unit Cooling	-	10438	0	-	0	0
Terminal Unit Heating	-	0	-	-	670	-
>> Total Conditioning	**-**	**10438**	**0**	**-**	**670**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.212_L1 100F TE#34

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 83.9 °F / 70.4 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	59 ft²	56	-	59 ft²	342	-
Roof Transmission	36 ft²	50	-	36 ft²	125	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	29 W	92	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**10434**	**0**	**-**	**466**	**0**

Space Design Load Summary for Bldg.212_L1 100F TE#34

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

TABLE 1.1.A. Component Loads For Space "Bldg.212_L1 100F TE#34" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 83.9 °F / 70.4 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	59 ft²	56	-	59 ft²	342	-
Roof Transmission	36 ft²	50	-	36 ft²	125	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	29 W	92	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**10434**	**0**	**-**	**466**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.212_L1 100F TE#34" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
E EXPOSURE						
WALL	59	0.080	-	56	-	342
H EXPOSURE						
ROOF	36	0.048	-	50	-	125

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.221_L1 109 TR#35

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name	**Bldg.221_L1 109 TR#35**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**124.2** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.221_L1 109 TR#35

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name ..... **Bldg.221_L1 109 TR#35**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **124.2** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	17.7	17.6	78.6 / 66.3	61.7 / 60.5	-	Jul 1900	7.76

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	1.8	69.2 / 70.9	-	964	0.000	0.000	7

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	17.7	Jul 2000	1.2	124.2

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.221_L1 109 TR#35	1	17.7	Jul 2000	964	1.2	124.2	7.76

Air System Design Load Summary for Bldg.221_L1 109 TR#35

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1900 COOLING OA DB / WB 82.1 °F / 69.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	212 ft²	267	-	212 ft²	1235	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	124 ft²	0	-	124 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	102 W	329	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17656**	**0**	**-**	**1235**	**0**
Zone Conditioning	-	17587	0	-	1209	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	7 CFM	28	66	7 CFM	584	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**17615**	**66**	**-**	**1793**	**1**
Terminal Unit Cooling	-	17615	101	-	0	0
Terminal Unit Heating	-	0	-	-	1793	-
>> Total Conditioning	**-**	**17615**	**101**	**-**	**1793**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.221_L1 109 TR#35

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 2000 COOLING OA DB / WB 79.6 °F / 69.1 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	212 ft²	275	-	212 ft²	1235	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	124 ft²	0	-	124 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	102 W	331	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17665**	**0**	**-**	**1235**	**0**

Space Design Load Summary for Bldg.221_L1 109 TR#35

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

TABLE 1.1.A. Component Loads For Space "Bldg.221_L1 109 TR#35" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 2000 COOLING OA DB / WB 79.6 °F / 69.1 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	212 ft²	275	-	212 ft²	1235	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	124 ft²	0	-	124 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	102 W	331	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17665**	**0**	**-**	**1235**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.221_L1 109 TR#35" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
WNW EXPOSURE						
WALL	122	0.080	-	185	-	710
SSE EXPOSURE						
WALL	90	0.080	-	89	-	526

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.232_L1 100F TE#36

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name	**Bldg.232_L1 100F TE#36**	Number of zones	**1**	
Equipment Class	**TERM**	Floor Area	**92.0**	ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**	

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.232_L1 100F TE#36

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name ..... **Bldg.232_L1 100F TE#36**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **92.0** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	17.6	17.5	78.4 / 66.0	61.3 / 60.1	-	Jul 1400	10.34

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	0.7	69.5 / 70.2	-	951	0.000	0.000	6

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	17.4	Jul 1400	0.3	92.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.232_L2 202 TR#36	1	17.4	Jul 1400	951	0.3	92.0	10.34

Air System Design Load Summary for Bldg.232_L1 100F TE#36

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 83.9 °F / 70.4 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	92 ft²	128	-	92 ft²	322	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	75 W	239	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17427**	**0**	**-**	**322**	**0**
Zone Conditioning	-	17476	0	-	268	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	6 CFM	33	53	6 CFM	434	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**17509**	**53**	**-**	**702**	**1**
Terminal Unit Cooling	-	17509	60	-	0	0
Terminal Unit Heating	-	0	-	-	702	-
>> Total Conditioning	**-**	**17509**	**60**	**-**	**702**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.232_L1 100F TE#36

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 83.9 °F / 70.4 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	92 ft²	128	-	92 ft²	322	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	75 W	239	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17427**	**0**	**-**	**322**	**0**

Space Design Load Summary for Bldg.232_L1 100F TE#36

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

TABLE 1.1.A. Component Loads For Space "Bldg.232_L2 202 TR#36" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 83.9 °F / 70.4 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	92 ft²	128	-	92 ft²	322	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	75 W	239	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**17427**	**0**	**-**	**322**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.232_L2 202 TR#36" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
H EXPOSURE						
ROOF	92	0.048	-	128	-	322

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.239_L1 100F TE#37B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name	**Bldg.239_L1 100F TE#37B**	Number of zones	**1**	
Equipment Class	**TERM**	Floor Area	**35.5**	ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**	

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.239_L1 100F TE#37B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name ..... **Bldg.239_L1 100F TE#37B**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **35.5** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	10.7	10.7	78.8 / 65.3	62.0 / 59.4	-	Jul 1600	16.59

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	2.5	69.6 / 73.5	-	589	0.000	0.000	2

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	10.8	Jul 1000	2.3	35.5

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.239_L1 100A TE#37B	1	10.8	Jul 1000	589	2.3	35.5	16.59

Air System Design Load Summary for Bldg.239_L1 100F TE#37B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1600 COOLING OA DB / WB 86.0 °F / 71.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	54 ft²	433	-	54 ft²	2286	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	36 ft²	0	-	36 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	29 W	93	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**10762**	**0**	**-**	**2286**	**0**
Zone Conditioning	-	10643	0	-	2311	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	2 CFM	17	26	2 CFM	167	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**10660**	**26**	**-**	**2478**	**1**
Terminal Unit Cooling	-	10660	0	-	0	0
Terminal Unit Heating	-	0	-	-	2478	-
>> Total Conditioning	**-**	**10660**	**0**	**-**	**2478**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.239_L1 100F TE#37B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1000 COOLING OA DB / WB 72.7 °F / 67.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	54 ft²	462	-	54 ft²	2286	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	36 ft²	0	-	36 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	29 W	90	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**10788**	**0**	**-**	**2286**	**0**

Space Design Load Summary for Bldg.239_L1 100F TE#37B

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

TABLE 1.1.A. Component Loads For Space "Bldg.239_L1 100A TE#37B" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1000 COOLING OA DB / WB 72.7 °F / 67.0 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	54 ft²	462	-	54 ft²	2286	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	36 ft²	0	-	36 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	29 W	90	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**10788**	**0**	**-**	**2286**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.239_L1 100A TE#37B" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
NE EXPOSURE						
WALL	54	0.580	-	462	-	2286

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.240_L1 100B TE#38

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name	**Bldg.240_L1 100B TE#38**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**106.0** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.240_L1 100B TE#38

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name ..... **Bldg.240_L1 100B TE#38**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **106.0** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	18.2	18.1	78.3 / 66.0	61.3 / 60.2	-	Jul 1700	9.37

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	4.7	69.0 / 73.3	-	993	0.000	0.000	6

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	18.2	Jul 1600	4.2	106.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.240_L1 100B TR#38	1	18.2	Jul 1600	993	4.2	106.0	9.37

Air System Design Load Summary for Bldg.240_L1 100B TE#38

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1700 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	90 ft²	738	-	90 ft²	3811	-
Roof Transmission	106 ft²	116	-	106 ft²	371	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	106 ft²	0	-	106 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	87 W	279	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**18193**	**0**	**-**	**4182**	**0**
Zone Conditioning	-	18071	0	-	4155	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	6 CFM	49	60	6 CFM	497	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**18121**	**60**	**-**	**4652**	**1**
Terminal Unit Cooling	-	18121	71	-	0	0
Terminal Unit Heating	-	0	-	-	4652	-
>> Total Conditioning	**-**	**18121**	**71**	**-**	**4652**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.240_L1 100B TE#38

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1600 COOLING OA DB / WB 86.0 °F / 71.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	90 ft²	722	-	90 ft²	3811	-
Roof Transmission	106 ft²	136	-	106 ft²	371	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	106 ft²	0	-	106 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	87 W	278	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**18196**	**0**	**-**	**4182**	**0**

Space Design Load Summary for Bldg.240_L1 100B TE#38

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

TABLE 1.1.A. Component Loads For Space "Bldg.240_L1 100B TR#38" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1600 COOLING OA DB / WB 86.0 °F / 71.0 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	90 ft²	722	-	90 ft²	3811	-
Roof Transmission	106 ft²	136	-	106 ft²	371	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	106 ft²	0	-	106 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	87 W	278	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	5000 W	17060	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**18196**	**0**	**-**	**4182**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.240_L1 100B TR#38" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
NE EXPOSURE						
WALL	90	0.580	-	722	-	3811
H EXPOSURE						
ROOF	106	0.048	-	136	-	371

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.255_L1 106 TE#42

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name	**Bldg.255_L1 106 TE#42**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**34.0** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.255_L1 106 TE#42

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name ..... **Bldg.255_L1 106 TE#42**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **34.0** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	10.4	10.4	78.5 / 65.2	61.4 / 59.2	-	Jul 1600	16.65

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	0.3	69.7 / 70.1	-	566	0.000	0.000	2

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	10.4	Jul 1400	0.1	34.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.255_L1 106 TE#42	1	10.4	Jul 1400	566	0.1	34.0	16.65

Air System Design Load Summary for Bldg.255_L1 106 TE#42

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1600 COOLING OA DB / WB 86.0 °F / 71.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	34 ft²	43	-	34 ft²	119	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	34 ft²	0	-	34 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	28 W	89	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**10368**	**0**	**-**	**119**	**0**
Zone Conditioning	-	10376	0	-	105	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	2 CFM	17	25	2 CFM	160	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**10393**	**25**	**-**	**266**	**1**
Terminal Unit Cooling	-	10393	0	-	0	0
Terminal Unit Heating	-	0	-	-	266	-
>> Total Conditioning	**-**	**10393**	**0**	**-**	**266**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.255_L1 106 TE#42

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 83.9 °F / 70.4 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	34 ft²	47	-	34 ft²	119	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	34 ft²	0	-	34 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	28 W	88	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**10372**	**0**	**-**	**119**	**0**

Space Design Load Summary for Bldg.255_L1 106 TE#42

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

TABLE 1.1.A. Component Loads For Space "Bldg.255_L1 106 TE#42" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1400 COOLING OA DB / WB 83.9 °F / 70.4 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	34 ft²	47	-	34 ft²	119	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	34 ft²	0	-	34 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	28 W	88	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**10372**	**0**	**-**	**119**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.255_L1 106 TE#42" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
H EXPOSURE						
ROOF	34	0.048	-	47	-	119

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.69_L1 102B TE#6

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name	**Bldg.69_L1 102B TE#6**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**32.0** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.69_L1 102B TE#6

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name ..... **Bldg.69_L1 102B TE#6**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **32.0** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	10.3	10.3	78.3 / 64.9	61.3 / 58.9	-	Jul 1200	17.61

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	0.2	69.8 / 70.0	-	563	0.000	0.000	2

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	10.3	Jan 2200	0.0	32.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.69_L1 102B TE#6	1	10.3	Jan 2200	563	0.0	32.0	17.61

Air System Design Load Summary for Bldg.69_L1 102B TE#6

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1200 COOLING OA DB / WB 78.7 °F / 68.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	26 W	82	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**10318**	**0**	**-**	**0**	**0**
Zone Conditioning	-	10341	0	-	0	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	2 CFM	1	25	2 CFM	151	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**10342**	**25**	**-**	**151**	**1**
Terminal Unit Cooling	-	10342	0	-	0	0
Terminal Unit Heating	-	0	-	-	151	-
>> Total Conditioning	**-**	**10342**	**0**	**-**	**151**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.69_L1 102B TE#6

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	26 W	86	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**10322**	**0**	**-**	**0**	**0**

Space Design Load Summary for Bldg.69_L1 102B TE#6

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

TABLE 1.1.A. Component Loads For Space "Bldg.69_L1 102B TE#6" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jan 2200 COOLING OA DB / WB 29.5 °F / 29.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	0 ft²	0	-	0 ft²	0	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	26 W	86	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**10322**	**0**	**-**	**0**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.69_L1 102B TE#6" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.Q1_L1 106A TE#1

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name	**Bldg.Q1_L1 106A TE#1**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**40.0** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.Q1_L1 106A TE#1

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name ..... **Bldg.Q1_L1 106A TE#1**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **40.0** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	11.5	11.5	78.8 / 65.7	62.0 / 59.9	-	Aug 1700	15.92

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	2.8	68.5 / 72.5	-	637	0.000	0.000	2

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	11.7	Aug 1700	2.7	40.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.Q1_L1 106A TE#1	1	11.7	Aug 1700	637	2.7	40.0	15.92

Air System Design Load Summary for Bldg.Q1_L1 106A TE#1

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1700 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	4 ft²	108	-	4 ft²	-	-
Wall Transmission	59 ft²	1203	-	59 ft²	2498	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	4 ft²	17	-	4 ft²	166	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	33 W	105	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**11669**	**0**	**-**	**2665**	**0**
Zone Conditioning	-	11502	0	-	2569	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	2 CFM	17	26	2 CFM	186	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**11520**	**26**	**-**	**2755**	**1**
Terminal Unit Cooling	-	11520	0	-	0	0
Terminal Unit Heating	-	0	-	-	2755	-
>> Total Conditioning	**-**	**11520**	**0**	**-**	**2755**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.Q1_L1 106A TE#1

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1700 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	4 ft²	108	-	4 ft²	-	-
Wall Transmission	59 ft²	1203	-	59 ft²	2498	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	4 ft²	17	-	4 ft²	166	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	33 W	105	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**11669**	**0**	**-**	**2665**	**0**

Space Design Load Summary for Bldg.Q1_L1 106A TE#1

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

TABLE 1.1.A. Component Loads For Space "Bldg.Q1_L1 106A TE#1" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1700 COOLING OA DB / WB 85.4 °F / 70.8 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	4 ft²	108	-	4 ft²	-	-
Wall Transmission	59 ft²	1203	-	59 ft²	2498	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	4 ft²	17	-	4 ft²	166	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	33 W	105	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**11669**	**0**	**-**	**2665**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.Q1_L1 106A TE#1" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
SW EXPOSURE						
WALL	59	0.580	-	1203	-	2498
WINDOW 1	4	0.570	0.287	17	108	166

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.Q27_L1 102A TE#4

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name ..... **Bldg.Q27_L1 102A TE#4**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **63.0** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.Q27_L1 102A TE#4

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name ..... **Bldg.Q27_L1 102A TE#4**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **63.0** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	12.0	12.0	78.3 / 66.1	61.6 / 60.4	-	Aug 1500	10.61

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	6.8	68.7 / 78.1	-	669	0.000	0.000	4

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	12.2	Aug 1500	6.5	63.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.Q27_L1 102A TE#4	1	12.2	Aug 1500	669	6.5	63.0	10.61

Air System Design Load Summary for Bldg.Q27_L1 102A TE#4

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1500 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	128 ft²	1746	-	128 ft²	5420	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	21 ft²	104	-	21 ft²	1073	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	52 W	164	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**12250**	**0**	**-**	**6493**	**0**
Zone Conditioning	-	11974	0	-	6478	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	4 CFM	29	34	4 CFM	294	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**12003**	**34**	**-**	**6772**	**1**
Terminal Unit Cooling	-	12003	42	-	0	0
Terminal Unit Heating	-	0	-	-	6772	-
>> Total Conditioning	**-**	**12003**	**42**	**-**	**6772**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.Q27_L1 102A TE#4

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1500 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	128 ft²	1746	-	128 ft²	5420	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	21 ft²	104	-	21 ft²	1073	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	52 W	164	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**12250**	**0**	**-**	**6493**	**0**

Space Design Load Summary for Bldg.Q27_L1 102A TE#4

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

TABLE 1.1.A. Component Loads For Space "Bldg.Q27_L1 102A TE#4" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1500 COOLING OA DB / WB 85.4 °F / 70.8 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	128 ft²	1746	-	128 ft²	5420	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	21 ft²	104	-	21 ft²	1073	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	52 W	164	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**12250**	**0**	**-**	**6493**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.Q27_L1 102A TE#4" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
S EXPOSURE						
WALL	79	0.580	-	1298	-	3345
E EXPOSURE						
WALL	49	0.580	-	448	-	2075
DOOR	21	0.700	-	104	-	1073

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.Q3_L1 110 TE#2

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name	**Bldg.Q3_L1 110 TE#2**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**30.0** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.Q3_L1 110 TE#2

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name ..... **Bldg.Q3_L1 110 TE#2**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **30.0** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	11.0	11.0	78.8 / 64.9	62.1 / 59.0	-	Aug 1600	20.36

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	2.2	69.3 / 72.7	-	611	0.000	0.000	2

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	11.2	Sep 1500	2.1	30.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.Q3_L1 110 TE#2	1	11.2	Sep 1500	611	2.1	30.0	20.36

Air System Design Load Summary for Bldg.Q3_L1 110 TE#2

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1600 COOLING OA DB / WB 86.0 °F / 71.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	4 ft²	78	-	4 ft²	-	-
Wall Transmission	46 ft²	741	-	46 ft²	1948	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	4 ft²	17	-	4 ft²	166	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	25 W	79	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**11150**	**0**	**-**	**2114**	**0**
Zone Conditioning	-	11026	0	-	2097	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	2 CFM	14	25	2 CFM	141	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**11040**	**25**	**-**	**2238**	**1**
Terminal Unit Cooling	-	11040	0	-	0	0
Terminal Unit Heating	-	0	-	-	2238	-
>> Total Conditioning	**-**	**11040**	**0**	**-**	**2238**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.Q3_L1 110 TE#2

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Sep 1500 COOLING OA DB / WB 79.6 °F / 67.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	4 ft²	115	-	4 ft²	-	-
Wall Transmission	46 ft²	756	-	46 ft²	1948	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	4 ft²	3	-	4 ft²	166	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	25 W	78	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**11188**	**0**	**-**	**2114**	**0**

Space Design Load Summary for Bldg.Q3_L1 110 TE#2

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

TABLE 1.1.A. Component Loads For Space "Bldg.Q3_L1 110 TE#2" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Sep 1500 COOLING OA DB / WB 79.6 °F / 67.8 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	4 ft²	115	-	4 ft²	-	-
Wall Transmission	46 ft²	756	-	46 ft²	1948	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	4 ft²	3	-	4 ft²	166	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	25 W	78	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**11188**	**0**	**-**	**2114**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.Q3_L1 110 TE#2" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
S EXPOSURE						
WALL	46	0.580	-	756	-	1948
WINDOW 1	4	0.570	0.287	3	115	166

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.Q32_L1 105B TE#5

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name ..... **Bldg.Q32_L1 105B TE#5**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **33.0** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.Q32_L1 105B TE#5

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

Air System Information

Air System Name ..... **Bldg.Q32_L1 105B TE#5**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **33.0** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	12.0	12.0	78.8 / 64.6	62.1 / 58.8	-	Jul 1800	20.18

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	4.5	68.4 / 74.6	-	666	0.000	0.000	2

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	12.2	Jul 1800	4.4	33.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.Q32_L1 105B TE#5	1	12.2	Jul 1800	666	4.4	33.0	20.18

Air System Design Load Summary for Bldg.Q32_L1 105B TE#5

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:32AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1800 COOLING OA DB / WB 84.1 °F / 70.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	8 ft²	172	-	8 ft²	-	-
Wall Transmission	97 ft²	1674	-	97 ft²	4107	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	8 ft²	31	-	8 ft²	333	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	27 W	87	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**12200**	**0**	**-**	**4440**	**0**
Zone Conditioning	-	11941	0	-	4335	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	2 CFM	11	29	2 CFM	153	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**11953**	**29**	**-**	**4487**	**1**
Terminal Unit Cooling	-	11953	0	-	0	0
Terminal Unit Heating	-	0	-	-	4487	-
>> Total Conditioning	**-**	**11953**	**0**	**-**	**4487**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.Q32_L1 105B TE#5

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:33AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1800 COOLING OA DB / WB 84.1 °F / 70.5 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	8 ft²	172	-	8 ft²	-	-
Wall Transmission	97 ft²	1674	-	97 ft²	4107	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	8 ft²	31	-	8 ft²	333	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	27 W	87	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**12200**	**0**	**-**	**4440**	**0**

Space Design Load Summary for Bldg.Q32_L1 105B TE#5

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:33AM

TABLE 1.1.A. Component Loads For Space "Bldg.Q32_L1 105B TE#5" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1800 COOLING OA DB / WB 84.1 °F / 70.5 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	8 ft²	172	-	8 ft²	-	-
Wall Transmission	97 ft²	1674	-	97 ft²	4107	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	8 ft²	31	-	8 ft²	333	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	27 W	87	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**12200**	**0**	**-**	**4440**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.Q32_L1 105B TE#5" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
NW EXPOSURE						
WALL	43	0.580	-	674	-	1821
WINDOW 1	4	0.570	0.287	15	81	166
SW EXPOSURE						
WALL	54	0.580	-	1000	-	2286
WINDOW 1	4	0.570	0.287	15	91	166

Dedicated Outdoor Air System (DOAS) Sizing Summary for Bldg.Q4_L1 110 TE#3

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:33AM

Air System Information

Air System Name	**Bldg.Q4_L1 110 TE#3**	Number of zones	**1**
Equipment Class	**TERM**	Floor Area	**63.0** ft²
Air System Type	**SPLT-FC**	Location	**Portland, Maine**

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Sum of space airflow rates**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for Bldg.Q4_L1 110 TE#3

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:33AM

Air System Information

Air System Name ..... **Bldg.Q4_L1 110 TE#3**
Equipment Class ..... **TERM**
Air System Type ..... **SPLT-FC**

Number of zones **1**
Floor Area ..... **63.0** ft²
Location ..... **Portland, Maine**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (°F)	Coil Leaving DB / WB (°F)	Water Flow @ 10.0 °F (gpm)	Time of Peak Coil Load	Zone CFM/ft²
Zone 1	11.7	11.7	78.5 / 66.4	61.9 / 60.8	-	Aug 1400	10.38

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (°F)	Htg Coil Water Flow @20.0 °F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
Zone 1	6.4	67.7 / 76.8	-	654	0.000	0.000	4

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	12.0	Aug 1500	6.3	63.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Bldg.Q4_L1 110 TE#3	1	12.0	Aug 1500	654	6.3	63.0	10.38

Air System Design Load Summary for Bldg.Q4_L1 110 TE#3

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:33AM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1400 COOLING OA DB / WB 83.9 °F / 70.4 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	123 ft²	1459	-	123 ft²	5208	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	21 ft²	86	-	21 ft²	1073	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	52 W	163	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**11944**	**0**	**-**	**6281**	**0**
Zone Conditioning	-	11637	0	-	6063	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Exhaust Fan Load	0 CFM	0	-	0 CFM	0	-
Ventilation Load	4 CFM	22	31	4 CFM	290	1
Ventilation Fan Load	0 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**11660**	**31**	**-**	**6353**	**1**
Terminal Unit Cooling	-	11660	36	-	0	0
Terminal Unit Heating	-	0	-	-	6353	-
>> Total Conditioning	**-**	**11660**	**36**	**-**	**6353**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Zone Design Load Summary for Bldg.Q4_L1 110 TE#3

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:33AM

Zone 1	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1500 COOLING OA DB / WB 85.4 °F / 70.8 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F		
	OCCUPIED T-STAT 75.0 °F			OCCUPIED T-STAT 70.0 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	123 ft²	1474	-	123 ft²	5208	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	21 ft²	104	-	21 ft²	1073	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	52 W	164	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**11978**	**0**	**-**	**6281**	**0**

Space Design Load Summary for Bldg.Q4_L1 110 TE#3

Project Name: 20-055 Togus Heat Loads - Split Systems 09/26/2025
Prepared by: GDM 08:33AM

TABLE 1.1.A. Component Loads For Space "Bldg.Q4_L1 110 TE#3" In Zone "Zone 1"						
	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1500 COOLING OA DB / WB 85.4 °F / 70.8 °F OCCUPIED T-STAT 75.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -3.0 °F / -4.3 °F OCCUPIED T-STAT 70.0 °F		
		Sensible	Latent		Sensible	Latent
SPACE LOADS	**Details**	**(BTU/hr)**	**(BTU/hr)**	**Details**	**(BTU/hr)**	**(BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	123 ft²	1474	-	123 ft²	5208	-
Roof Transmission	0 ft²	0	-	0 ft²	0	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	21 ft²	104	-	21 ft²	1073	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	52 W	164	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	3000 W	10236	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**11978**	**0**	**-**	**6281**	**0**

TABLE 1.1.B. Envelope Loads For Space "Bldg.Q4_L1 110 TE#3" In Zone "Zone 1"						
				COOLING	COOLING	HEATING
	Area	U-Value	Shade	TRANS	SOLAR	TRANS
	(ft²)	(BTU/(hr·ft²·°F))	Coeff.	(BTU/hr)	(BTU/hr)	(BTU/hr)
S EXPOSURE						
WALL	48	0.580	-	789	-	2032
DOOR	21	0.700	-	104	-	1073
E EXPOSURE						
WALL	75	0.580	-	686	-	3176

Structural - MCR Structural Calculations

STRUCTURAL CALCULATIONS

VA TOGUS – MCR BUILDING

EHRM Infrastructure Upgrades

Augusta, Maine

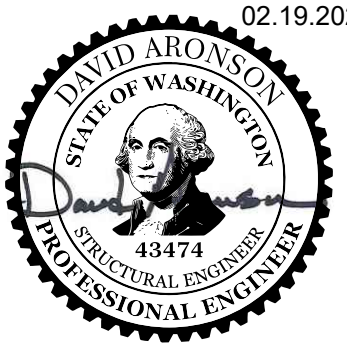
For

GDM, Inc.

February 19, 2026

ALL COMPUTATION AND STRUCTURAL ENGINEERING
FOR THIS PROJECT HAVE BEEN PERFORMED
BY MYSELF OR UNDER MY DIRECT SUPERVISION.

02.19.2026



Exp. 04.05.2026

KRAMER GEHLEN & ASSOCIATES, INC.
CONSULTING ENGINEERS
805 Broadway Street, Suite 415
Vancouver, Washington 98660-3310
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VA TOGUS EHRM
MCR BUILDING
AUGUSTA, ME

KGA Project No. 23-072-00

DESCRIPTION OF PROJECT

This project consists of a new building constructed with structural steel beams and columns. Walls are cold-formed metal studs with bypass framing, and full-width brick veneer. The roof structure is made up of metal deck over open-web steel joists. The building is one-story over concrete slab on grade. The building foundation is anticipated to be conventional spread and strip footings. The lateral system is wood structural panel over cold-formed metal studs. MSE retaining walls, which are tiered along some sections, are required to hold the sloping grade behind and adjacent to the new building.

TABLE OF CONTENTS

Lateral Force Analysis	LFA-1 to LFA-30
Steel Framing Design	SF-1 to SF-28
Foundation Design	FN-1 to FN-15
MSE Wall Design	MSE-1 to MSE-112

KGA Structural Engineers
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503-289-2661
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www.kramer-gehlen.com

PROJECT	VA TOGUS EHRM	PROJECT DESCRIPTION	
CLIENT	GDM		
DATE 2/19/26	DESIGN APH		
PROJECT NO. 23072-00	SHEET PD-1		

DEAD LOAD TAKEOFF

EXT. WALL –

BRICK VENEER	40 PSF
CFS @ 16" OC	1.0 PSF
INSULATION	1.2 PSF
PLYWD SHTG	1.6 PSF
5/8 GYPSUM	3.2 PSF
MISC	1.0 PSF
	48.0 PSF

INT. WALL –

CFS @ 16" OC	1.0 PSF
(2) LAYER GYP.	5.0 PSF
	6.0 PSF

ROOF ASSEMBLY –

MEMBRANE	2.0 PSF
RIGID INSUL.	6.75 PSF
VAPOR BARRIER	0.1 PSF
20 GA MTL DECK	2.0 PSF
DROP CEILING	4.0 PSF
MEP	1.5 PSF
MISC	1.5 PSF
	20 PSF

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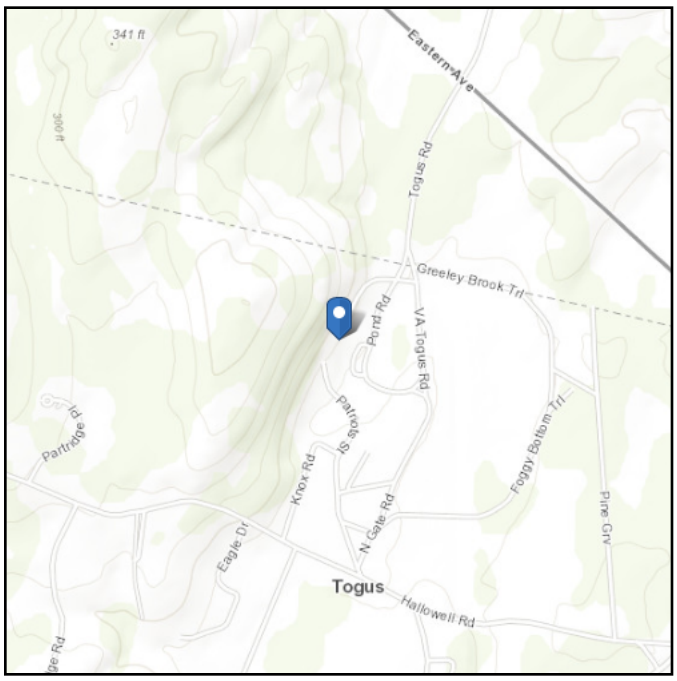
PROJECT: VA TOGUS EHRM
CLIENT: GDM
DEAD LOAD TAKEOFF
DATE: 6/13/23
DESIGN: JRK
PROJECT NO.: 23072-00
SHEET: PD-2

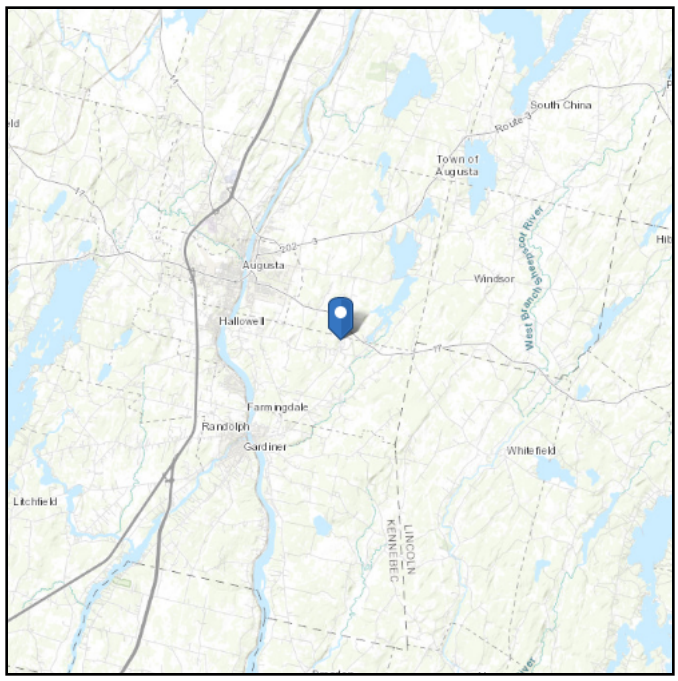
ASCE Hazards Report

Address:
1 Va Ctr
Augusta, Maine
04330

Standard: ASCE/SEI 7-22
Risk Category: IV
Soil Class: C - Very Dense Soil and Soft Rock

Latitude: 44.280517
Longitude: -69.704758
Elevation: 182.16053601942568 ft (NAVD 88)





Wind

Results:

Wind Speed	120 Vmph
10-year MRI	72 Vmph
25-year MRI	79 Vmph
50-year MRI	85 Vmph
100-year MRI	90 Vmph
300-year MRI	100 Vmph
700-year MRI	108 Vmph
1,700-year MRI	115 Vmph
3,000-year MRI	120 Vmph
10,000-year MRI	132 Vmph
100,000-year MRI	154 Vmph
1,000,000-year MRI	176 Vmph

Data Source: ASCE/SEI 7-22, Fig. 26.5-1D and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed: Fri Oct 31 2025

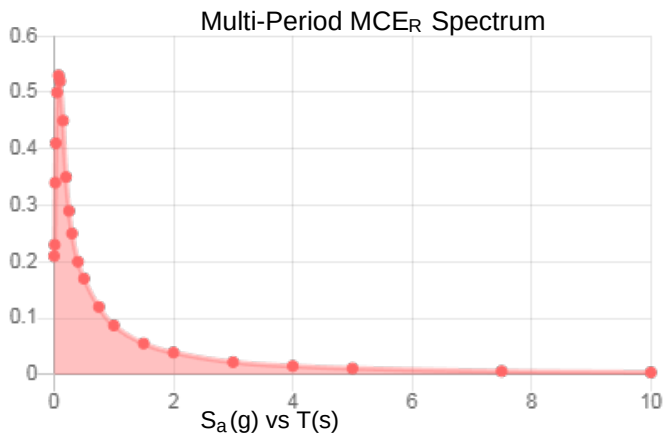
Seismic

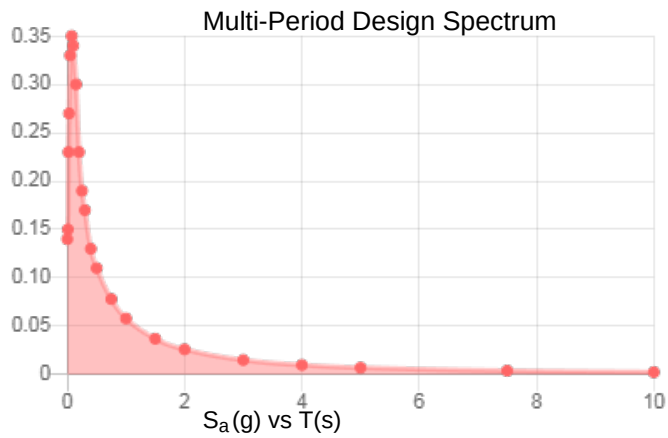
Site Soil Class: C - Very Dense Soil and Soft Rock

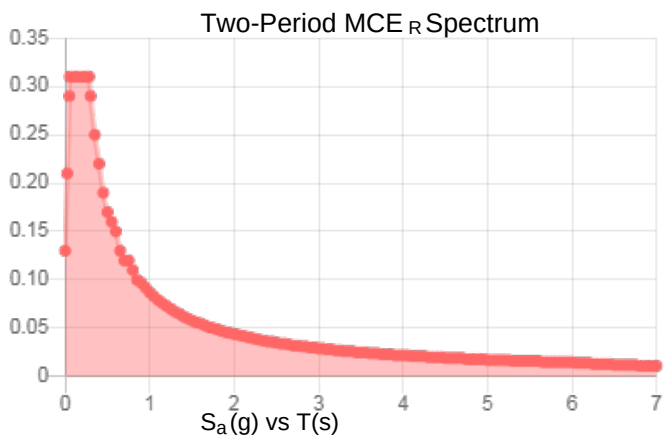
Results:

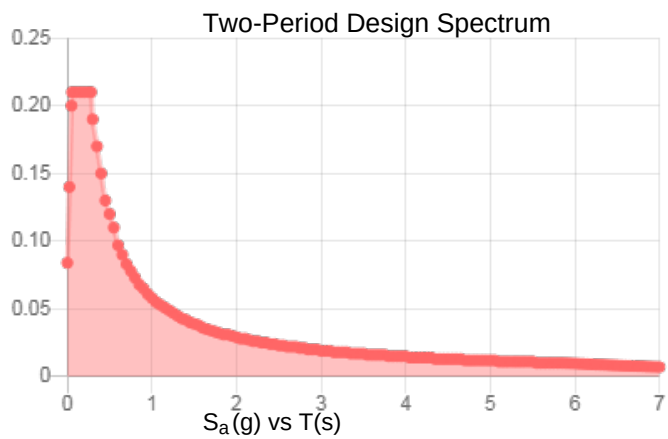
PGA_M :	0.19	T_L :	6
S_{MS} :	0.31	S_S :	0.31
S_{M1} :	0.087	S_1 :	0.068
S_{DS} :	0.21	V_{S30} :	530
S_{D1} :	0.058		

Seismic Design Category: C









MCER Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Snow

Results:

Ground Snow Load, p_g :	123 lb/ft^2
20-year MRI Value:	51.39 lb/ft^2
Winter Wind Parameter:	0.45
Mapped Elevation:	211.3 ft
Data Source:	ASCE/SEI 7-22, Figures 7.6-1 and 7.6-2 A-D
Date Accessed:	Fri Oct 31 2025
	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.
Ground Snow Loads for IRC only, $p_{g(asd)}$:	86.1 lb/ft^2

The ASCE Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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SEISMIC FORCES

In accordance with ASCE 7-22

Tedds calculation version 3.1.05

Site parameters

Site class C

Mapped acceleration parameters (Section 11.4.3)

at short period S_S = **0.31**

at 1 sec period S_1 = **0.068**

Spectral response acceleration parameters

at short period (cl. 11.4.3) S_{MS} = **0.310**

at 1 sec period (cl. 11.4.3) S_{M1} = **0.087**

Design spectral acceleration parameters (Sect 11.4.4)

at short period (Eq. 11.4-1) $S_{DS} = 2 / 3 \times S_{MS}$ = **0.207**

at 1 sec period (Eq. 11.4-1) $S_{D1} = 2 / 3 \times S_{M1}$ = **0.058**

Seismic design category

Risk category (Table 1.5-1) IV

Seismic design category based on short period response acceleration (Table 11.6-1)

C

Seismic design category based on 1 sec period response acceleration (Table 11.6-2)

A

Seismic design category C

Approximate fundamental period

Height above base to highest level of building h_n = **19** ft

From Table 12.8-2:

Structure type All other systems

Building period parameter C_t C_t = **0.02**

Building period parameter x x = **0.75**

Approximate fundamental period (Eq 12.8-7) $T_a = C_t \times (h_n)^x \times 1\text{sec} / (1\text{ft})^x$= **0.182** sec

Building fundamental period (Sect 12.8.2) $T = T_a$ = **0.182** sec

Long-period transition period T_L = **6** sec

Seismic response coefficient

Seismic force-resisting system (Table 12.2-1) B_BUILDING_FRAME_SYSTEMS

24. Light-frame (cold-formed steel) walls sheathed with wood pnls

Response modification factor (Table 12.2-1) R = **7**

Seismic importance factor (Table 1.5-2) I_e = **1.500**

Seismic response coefficient (Sect 12.8.1.1)

Calculated (Eq 12.8-3) $C_{s_calc} = S_{DS} / (R / I_e)$ = **0.0443**

Maximum (Eq. 12.8-4) $C_{s_max} = S_{D1} / ((T / 1\text{ sec}) \times (R / I_e))$ = **0.0683**

Minimum (Eq.12.8-6) $C_{s_min} = \max(0.044 \times S_{DS} \times I_e, 0.01)$ = **0.0136**

Seismic response coefficient C_s = **0.0443**

Seismic base shear (Sect 12.8.1)

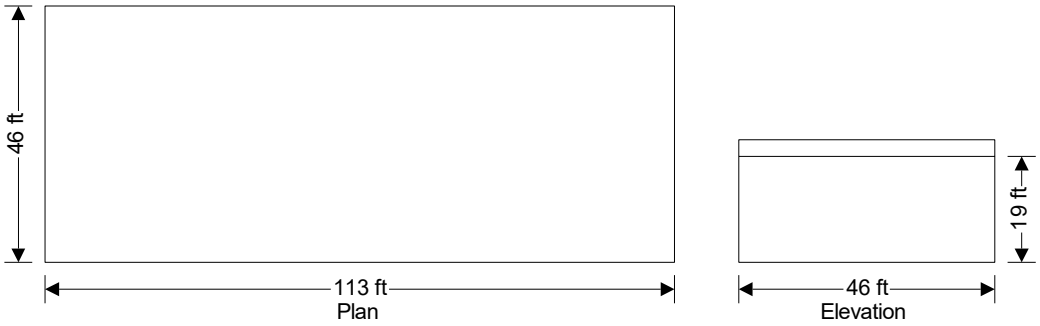
Effective seismic weight of the structure	W = **319.0** kips
Seismic response coefficient	C_s = **0.0443**
Seismic base shear (Eq 12.8-1)	$V = C_s \times W$ = **14.1** kips

WIND LOADING

In accordance with ASCE7-22

Using the directional design method

Tedds calculation version 2.1.19



Building data

Type of roof	Flat
Length of building	b = **113.00** ft
Width of building	d = **46.00** ft
Height to eaves	H = **19.00** ft
Height of parapet	h_p = **3.00** ft
Mean height	h = **19.00** ft

General wind load requirements

Basic wind speed	V = **120.0** mph
Risk category	IV
Wind directionality factor (Table 26.6-1)	K_d = **0.85**
Ground elevation above sea level	z_{gl} = **0** ft
Ground elevation factor	$K_e = \exp(-0.0000362 \times z_{gl}/1ft)$ = **1.00**
Exposure category (cl 26.7.3)	C
Enclosure classification (cl.26.12)	Enclosed buildings
Internal pressure coef +ve (Table 26.13-1)	GC_{pi_p} = **0.18**
Internal pressure coef –ve (Table 26.13-1)	GC_{pi_n} = **-0.18**
Gust effect factor	G_f = **0.85**
Minimum roof design wind load (cl.27.1.5)	p_{min_r} = **8** psf
Minimum wall design wind load (cl.27.1.5)	p_{min_w} = **16** psf

Topography

Topography factor not significant	K_{zt} = 1.0
Velocity pressure equation	$q = 0.00256 \times K_z \times K_{zt} \times K_e \times V^2 \times 1psf/mph^2$

Velocity pressures table

z (ft)	K_z (Table 26.10-1)	q_z (psf)
15.00	0.85	31.33
19.00	0.89	32.81
22.00	0.92	33.77

Peak velocity pressure for internal pressure

Peak velocity pressure – internal (as roof press.) q_i = **32.81** psf

Parapet pressures and forces

Velocity pressure at top of parapet q_p = **33.77** psf

Combined net pressure coefficient, leeward GC_{pnl} = **-1.0**

Combined net parapet pressure, leeward $p_{pl} = K_d \times q_p \times GC_{pnl}$ = **-28.7** psf

Combined net pressure coefficient, windward GC_{pnw} = **1.5**

Combined net parapet pressure, windward $p_{pw} = K_d \times q_p \times GC_{pnw}$ = **43.05** psf

Wind direction 0 deg:

Leeward parapet force $F_{w,wpl_0} = p_{pl} \times h_p \times b$ = **-9.7** kips

Windward parapet force $F_{w,wpw_0} = p_{pw} \times h_p \times b$ = **14.6** kips

Wind direction 90 deg:

Leeward parapet force $F_{w,wpl_90} = p_{pl} \times h_p \times d$ = **-4** kips

Windward parapet force $F_{w,wpw_90} = p_{pw} \times h_p \times d$ = **5.9** kips

Pressures and forces

Net pressure $p = K_d \times q \times G_f \times C_{pe} - K_d \times q_i \times GC_{pi}$

Net force $F_w = p \times A_{ref}$

Roof load case 1 - Wind 0, GC_{pi} 0.18, $-c_{pe}$

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A (-ve)	19.00	-0.90	32.81	-26.35	1073.50	-28.29
B (-ve)	19.00	-0.90	32.81	-26.35	1073.50	-28.29
C (-ve)	19.00	-0.50	32.81	-16.87	2147.00	-36.22
D (-ve)	19.00	-0.30	32.81	-12.13	904.00	-10.97

Total vertical net force $F_{w,v}$ = **-103.77** kips

Total horizontal net force $F_{w,h}$ = **0.00** kips

Walls load case 1 - Wind 0, GC_{pi} 0.18, $-c_{pe}$

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A_1	15.00	0.80	31.33	13.09	1695.00	22.19
A_2	19.00	0.80	32.81	13.94	452.00	6.30
B	19.00	-0.50	32.81	-16.87	2147.00	-36.22
C	19.00	-0.70	32.81	-21.61	874.00	-18.89
D	19.00	-0.70	32.81	-21.61	874.00	-18.89

Overall loading

Projected vertical plan area of wall $A_{vert_w_0} = b \times (H + h_p)$ = **2486.00** ft^2

Projected vertical area of roof $A_{vert_r_0}$ = **0.00** ft^2

Minimum overall horizontal loading $F_{w,total_min} = p_{min_w} \times A_{vert_w_0} + p_{min_r} \times A_{vert_r_0}$ = **39.78** kips

Leeward net force $F_l = F_{w,wB} + F_{w,wpl_0}$ = **-46.0** kips

Windward net force $F_w = F_{w,wA_1} + F_{w,wA_2} + F_{w,wpw_0} =$ **43.1** kips

Overall horizontal loading $F_{w,total} = \max(F_w - F_l + F_{w,h}, F_{w,total_min}) =$ **89.0** kips

Roof load case 2 - Wind 0, GC_{pi} -0.18, -0c_{pe}

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A (+ve)	19.00	-0.18	32.81	0.75	1073.50	0.81
B (+ve)	19.00	-0.18	32.81	0.75	1073.50	0.81
C (+ve)	19.00	-0.18	32.81	0.75	2147.00	1.62
D (+ve)	19.00	-0.18	32.81	0.75	904.00	0.68

Total vertical net force $F_{w,v} =$ **3.91** kips

Total horizontal net force $F_{w,h} =$ **0.00** kips

Walls load case 2 - Wind 0, GC_{pi} -0.18, -0c_{pe}

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A_1	15.00	0.80	31.33	23.13	1695.00	39.21
A_2	19.00	0.80	32.81	23.98	452.00	10.84
B	19.00	-0.50	32.81	-6.83	2147.00	-14.67
C	19.00	-0.70	32.81	-11.57	874.00	-10.12
D	19.00	-0.70	32.81	-11.57	874.00	-10.12

Overall loading

Projected vertical plan area of wall $A_{vert_w_0} = b \times (H + h_p) =$ **2486.00** ft^2

Projected vertical area of roof $A_{vert_r_0} =$ **0.00** ft^2

Minimum overall horizontal loading $F_{w,total_min} = p_{min_w} \times A_{vert_w_0} + p_{min_r} \times A_{vert_r_0} =$ **39.78** kips

Leeward net force $F_l = F_{w,wB} + F_{w,wpl_0} =$ **-24.4** kips

Windward net force $F_w = F_{w,wA_1} + F_{w,wA_2} + F_{w,wpw_0} =$ **64.6** kips

Overall horizontal loading $F_{w,total} = \max(F_w - F_l + F_{w,h}, F_{w,total_min}) =$ **89.0** kips

Roof load case 3 - Wind 90, GC_{pi} 0.18, -c_{pe}

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A (-ve)	19.00	-0.90	32.81	-26.35	437.00	-11.52
B (-ve)	19.00	-0.90	32.81	-26.35	437.00	-11.52
C (-ve)	19.00	-0.50	32.81	-16.87	874.00	-14.75
D (-ve)	19.00	-0.30	32.81	-12.13	3450.00	-41.85

Total vertical net force $F_{w,v} =$ **-79.63** kips

Total horizontal net force $F_{w,h} =$ **0.00** kips

Walls load case 3 - Wind 90, GC_{pi} 0.18, $-c_{pe}$

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A_1	15.00	0.80	31.33	13.09	690.00	9.03
A_2	19.00	0.80	32.81	13.94	184.00	2.57
B	19.00	-0.28	32.81	-11.59	874.00	-10.13
C	19.00	-0.70	32.81	-21.61	2147.00	-46.40
D	19.00	-0.70	32.81	-21.61	2147.00	-46.40

Overall loading

Projected vertical plan area of wall $A_{vert_w_90} = d \times (H + h_p) =$ **1012.00** ft^2

Projected vertical area of roof $A_{vert_r_90} =$ **0.00** ft^2

Minimum overall horizontal loading $F_{w,total_min} = p_{min_w} \times A_{vert_w_90} + p_{min_r} \times A_{vert_r_90} =$ **16.19** kips

Leeward net force $F_l = F_{w,wB} + F_{w,wpl_90} =$ **-14.1** kips

Windward net force $F_w = F_{w,wA_1} + F_{w,wA_2} + F_{w,wpw_90} =$ **17.5** kips

Overall horizontal loading $F_{w,total} = \max(F_w - F_l + F_{w,h}, F_{w,total_min}) =$ **31.6** kips

Roof load case 4 - Wind 90, GC_{pi} -0.18, $+c_{pe}$

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A (+ve)	19.00	-0.18	32.81	0.75	437.00	0.33
B (+ve)	19.00	-0.18	32.81	0.75	437.00	0.33
C (+ve)	19.00	-0.18	32.81	0.75	874.00	0.66
D (+ve)	19.00	-0.18	32.81	0.75	3450.00	2.60

Total vertical net force $F_{w,v} =$ **3.91** kips

Total horizontal net force $F_{w,h} =$ **0.00** kips

Walls load case 4 - Wind 90, GC_{pi} -0.18, $+c_{pe}$

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A_1	15.00	0.80	31.33	23.13	690.00	15.96
A_2	19.00	0.80	32.81	23.98	184.00	4.41
B	19.00	-0.28	32.81	-1.55	874.00	-1.36
C	19.00	-0.70	32.81	-11.57	2147.00	-24.85
D	19.00	-0.70	32.81	-11.57	2147.00	-24.85

Overall loading

Projected vertical plan area of wall $A_{vert_w_90} = d \times (H + h_p) =$ **1012.00** ft^2

Projected vertical area of roof $A_{vert_r_90} =$ **0.00** ft^2

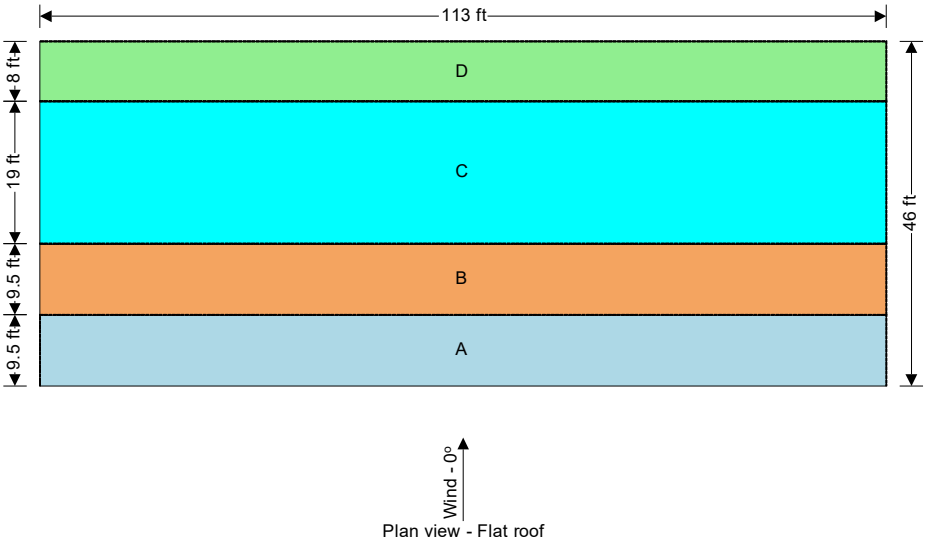
Minimum overall horizontal loading $F_{w,total_min} = p_{min_w} \times A_{vert_w_90} + p_{min_r} \times A_{vert_r_90} =$ **16.19** kips

Leeward net force $F_l = F_{w,wB} + F_{w,wpl_90} =$ **-5.3** kips

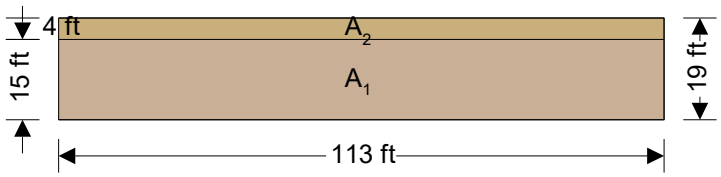
Windward net force $F_w = F_{w,wA_1} + F_{w,wA_2} + F_{w,wpw_90} =$ **26.3** kips

Overall horizontal loading

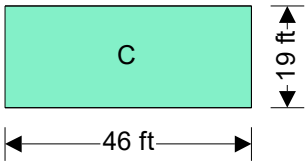
$F_{w,total} = \max(F_w - F_l + F_{w,h}, F_{w,total_min}) = \mathbf{31.6}$ kips



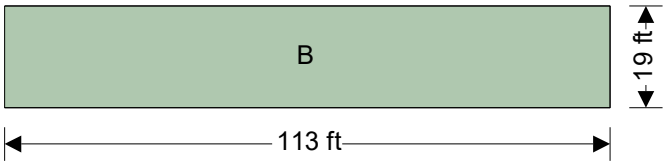
Plan view - Flat roof



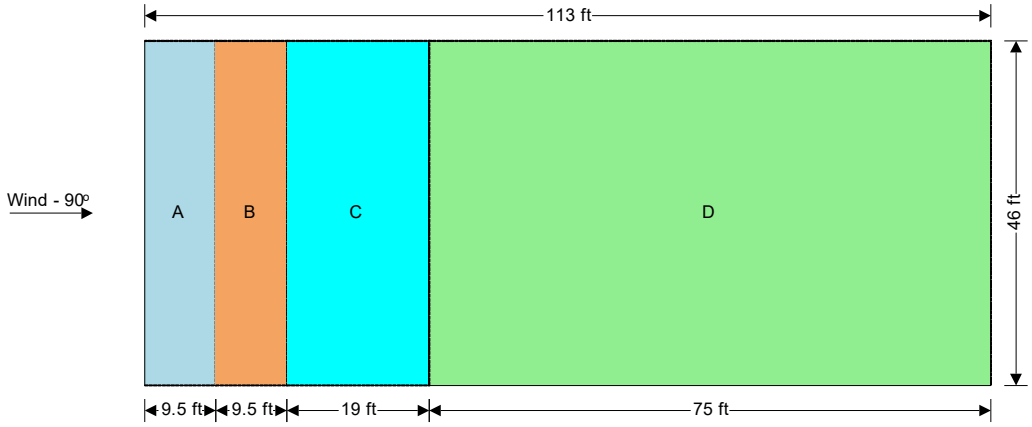
Windward face



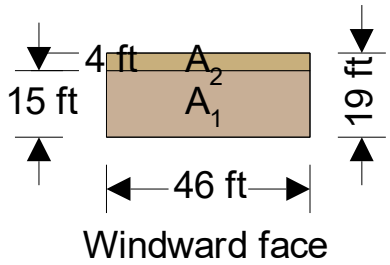
Side face



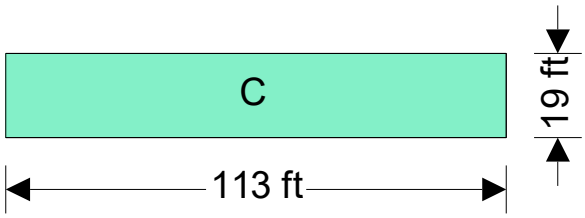
Leeward face



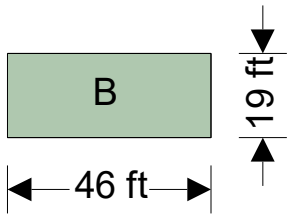
Plan view - Flat roof



Windward face



Side face



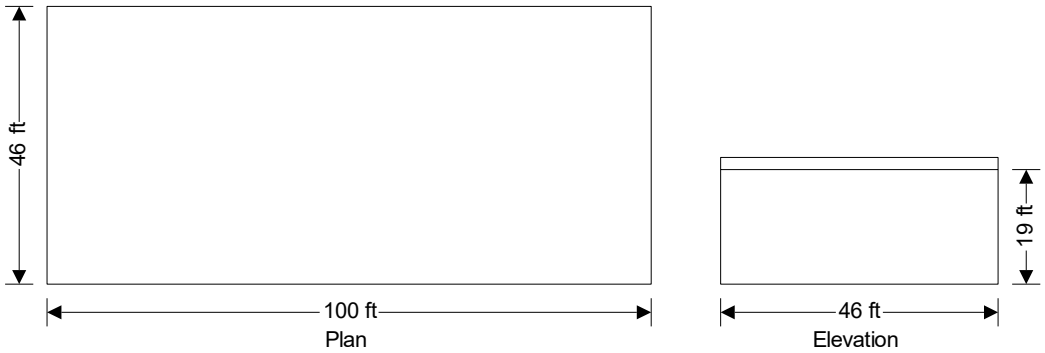
Leeward face

WIND LOADING

In accordance with ASCE7-22

Using the components and cladding design method

Tedds calculation version 2.1.19



Building data

Type of roof	Flat
Length of building	b = **100.00** ft
Width of building	d = **46.00** ft
Height to eaves	H = **19.00** ft
Height of parapet	h_p = **2.00** ft
Mean height	h = **19.00** ft
End zone width	a = max(min(0.1×min(b, d), 0.4×h), 0.04×min(b, d), 3ft) = **4.60** ft

General wind load requirements

Basic wind speed	V = **120.0** mph
Risk category	IV
Wind directionality factor (Table 26.6-1)	K_d = **0.85**
Ground elevation above sea level	z_{gl} = **0** ft
Ground elevation factor	$K_e = \exp(-0.0000362 \times z_{gl}/1\text{ft})$ = **1.00**
Exposure category (cl 26.7.3)	C
Enclosure classification (cl.26.12)	Enclosed buildings
Internal pressure coef +ve (Table 26.13-1)	GC_{pi_p} = **0.18**
Internal pressure coef –ve (Table 26.13-1)	GC_{pi_n} = **-0.18**
Parapet enclosure classification	Enclosed
Parapet internal pressure coef +ve (Table 26.13-1)	GC_{pi_pp} = **0.18**
Parapet internal pressure coef –ve (Table 26.13-1)	GC_{pi_np} = **-0.18**
Gust effect factor	G_f = **0.85**

Topography

Topography factor not significant	K_{zt} = 1.0

Velocity pressure

Velocity pressure coefficient (Table 26.10-1)	K_z = **0.89**
Velocity pressure	$q_h = 0.00256 \times K_z \times K_{zt} \times K_e \times V^2 \times 1\text{psf/mph}^2$ = **32.8** psf

Velocity pressure at parapet

Velocity pressure coefficient (Table 26.10-1) K_z = **0.91**

Velocity pressure $q_p = 0.00256 \times K_z \times K_{zt} \times K_e \times V^2 \times 1\text{psf/mph}^2$ = **33.5** psf

Peak velocity pressure for internal pressure

Peak velocity pressure – internal (as roof press.) q_i = **32.81** psf

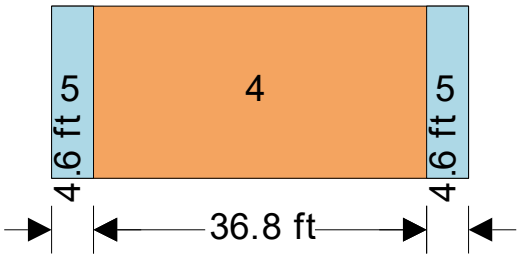
Equations used in tables

Net pressure $p = K_d \times (q_h \times (GC_p - GC_{pi}))$

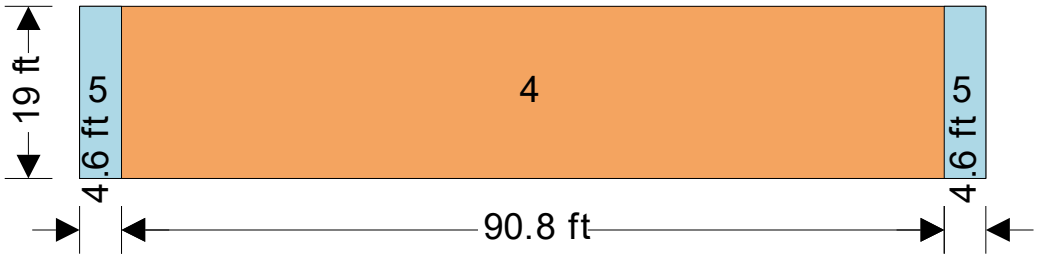
Parapet net pressure $p = K_d \times q_p \text{ x } (GC_p - GC_{pi_p})$

Components and cladding pressures - Wall (Table 30.3-1 and (Figure 30.3-2A))

Component	Zone	Length (ft)	Width (ft)	Eff. area (ft^2)	$+GC_p$	$-GC_p$	Pres (+ve) (psf)	Pres (-ve) (psf)
<=10 sf	4	-	-	10.0	0.90	-0.99	30.1	-32.6
50 sf	4	-	-	50.0	0.79	-0.88	27.0	-29.5
200 sf	4	-	-	200.0	0.69	-0.78	24.4	-26.9
>500 sf	4	-	-	500.1	0.63	-0.72	22.6	-25.1
<=10 sf	5	-	-	10.0	0.90	-1.26	30.1	-40.2
50 sf	5	-	-	50.0	0.79	-1.04	27.0	-34.0
200 sf	5	-	-	200.0	0.69	-0.85	24.4	-28.6
>500 sf	5	-	-	500.1	0.63	-0.72	22.6	-25.1
<=10 (W)	4p	-	-	10.0	0.90	-2.30	30.7	-70.6
<=10 (W)	5p	-	-	10.0	0.90	-3.20	30.7	-96.2
200 (W)	4p	-	-	200.0	0.69	-1.61	24.8	-51.0
200 (W)	5p	-	-	200.0	0.69	-1.82	24.8	-56.9



Elevation of gable wall

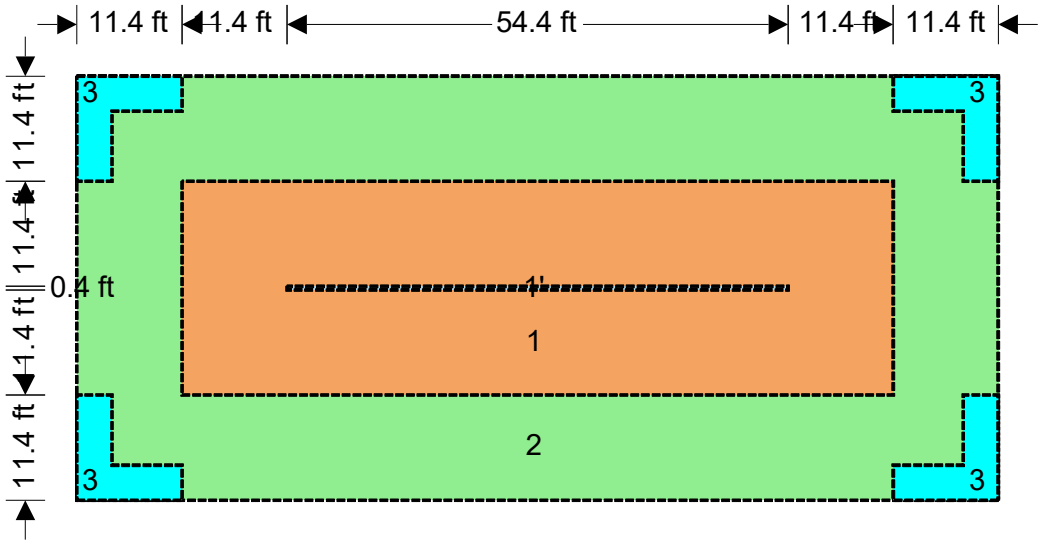


Elevation of side wall

Components and cladding pressures - Roof (Figure 30.3-2A)

Component	Zone	Length (ft)	Width (ft)	Eff. area (ft^2)	$+GC_p$	$-GC_p$	Pres (+ve) (psf)	Pres (-ve) (psf)
<=10 sf	1	-	-	10.0	0.30	-1.70	13.4 #	-52.4
100 sf	1	-	-	100.0	0.20	-1.29	10.6 #	-40.9
200 sf	1	-	-	200.0	0.20	-1.16	10.6 #	-37.5
>500 sf	1	-	-	500.1	0.20	-1.00	10.6 #	-32.9
<=10 sf	2	-	-	10.0	0.30	-2.30	13.4 #	-69.2
100 sf	2	-	-	100.0	0.20	-1.77	10.6 #	-54.4
200 sf	2	-	-	200.0	0.20	-1.61	10.6 #	-49.9
>500 sf	2	-	-	500.1	0.20	-1.40	10.6 #	-44.1
<=10 sf	3	-	-	10.0	0.30	-3.20	13.4 #	-94.3
100 sf	3	-	-	100.0	0.20	-2.14	10.6 #	-64.7
200 sf	3	-	-	200.0	0.20	-1.82	10.6 #	-55.8
>500 sf	3	-	-	500.1	0.20	-1.40	10.6 #	-44.1

The final net design wind pressure, including all permitted reductions, used in the design shall not be less than 16psf acting in either direction



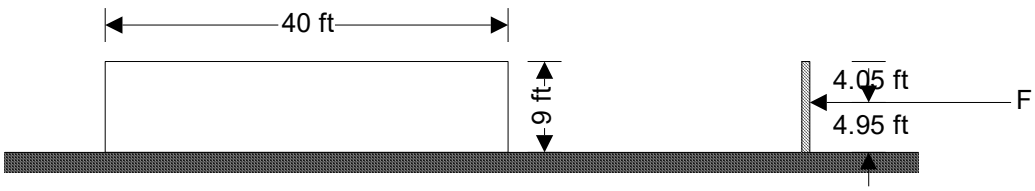
Plan on roof

WIND LOADING

In accordance with ASCE7-22

Using the directional design method

Tedds calculation version 2.1.19



Wall/sign data

Length of wall/sign	B = **40.00** ft
Height of wall/sign	s = **9.00** ft
Height to top of sign	h = **9.00** ft

General wind load requirements

Basic wind speed	V = **120.0** mph
Risk category	IV
Wind directionality factor (Table 26.6-1)	K_d = **0.85**
Ground elevation above sea level	z_{gl} = **0** ft
Ground elevation factor	$K_e = \exp(-0.0000362 \times z_{gl}/1\text{ft})$ = **1.00**
Exposure category (cl 26.7.3)	C
Gust effect factor	G_f = **0.85**
Minimum roof design wind load (cl.27.1.5)	p_{min_r} = **8** psf
Minimum wall design wind load (cl.27.1.5)	p_{min_w} = **16** psf

Topography

Topography factor not significant	K_{zt} = 1.0

Velocity pressure

Velocity pressure coefficient (Table 26.10-1)	K_z = **0.85**
Velocity pressure	$q_h = 0.00256 \times K_z \times K_{zt} \times K_e \times V^2 \times 1\text{psf/mph}^2$ = **31.3** psf
Area of sign	$A_f = B \times s$ = **360** ft^2
Ratio of solid area to gross area	ε = **1.00**

Wall/sign forces – Case A and B

Force coefficient (Figure 29.3-1)	C_{f_A} = **1.35**
Resultant force	$F_A = \max(16\text{psf}, K_d \times q_h \times G_f \times C_{f_A}) \times A_f$ = **11.0** kips

Wall sign forces - Case C

Number of whole regions - main wall	$N_s = \text{Int}(B/s)$ = **4**
Length of balance - main wall	$L_{balance} = B - 3 \times s$ = **13.0** ft

Region 1 - 0.0 ft to 9.0 ft

Force coefficient (Figure 29.3-1)	$C_{f_C_0\text{ to }s}$ = **2.99**
Effective area	$A_{f_C_1} = s \times s$ = **81.0** ft^2
Resultant force	$F_{A_c_1} = \max(16\text{psf}, K_d \times q_h \times G_f \times (1.8 - s / h) \times C_{f_C_0\text{ to }s}) \times A_{f_C_1}$ = **4.4** kips

Region 2 - 9.0 ft to 18.0 ft

Force coefficient (Figure 29.3-1) $C_{f_C_s\ to\ 2s}$ = **1.94**

Effective area $A_{f_C_2} = s \times s$ = **81.0** ft^2

Resultant force $F_{A_c_2} = \max(16psf, K_d \times q_h \times G_f \times (1.8 - s / h) \times C_{f_C_s\ to\ 2s}) \times A_{f_C_2}$ = **2.9** kips

Region 3 - 18.0 ft to 27.0 ft

Force coefficient (Figure 29.3-1) $C_{f_C_2s\ to\ 3s}$ = **1.37**

Effective area $A_{f_C_3} = s \times s$ = **81.0** ft^2

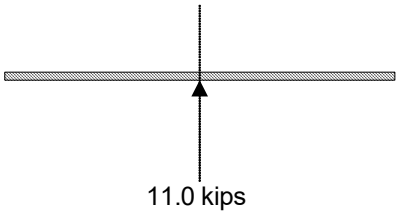
Resultant force $F_{A_c_3} = \max(16psf, K_d \times q_h \times G_f \times (1.8 - s / h) \times C_{f_C_2s\ to\ 3s}) \times A_{f_C_3}$ = **2.0** kips

Region 4 - 27.0 ft to 40.0 ft

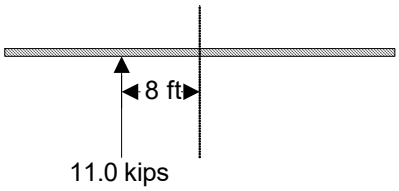
Force coefficient (Figure 29.3-1) $C_{f_C_3s\ to\ 10s}$ = **1.08**

Effective area $A_{f_C_4} = L_{balance} \times s$ = **117.0** ft^2

Resultant force $F_{A_c_4} = \max(16psf, K_d \times q_h \times G_f \times (1.8 - s / h) \times C_{f_C_3s\ to\ 10s}) \times A_{f_C_4}$ = **2.3** kips

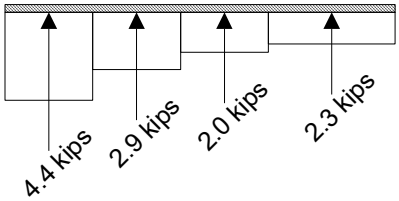


Plan - Case A



Plan - Case B

Plan - Case C



KGA Structural Engineers	project: VA Togus	by: JRK
	location: Togus, Maine	Job No.: 23072-00
	client: GDM	

SEISMIC MASS

Dead Loads		
Roof	20 psf	*Horizontal*
Ext. Wall	48 psf	*Vertical*
Int. Wall	6 psf	*Vertical*

Incre. Floor Heights	
Parapet	3.00 ft
Roof	19.00 ft

ROOF			
Trib ht:	Roof Area	3,140 sq ft	
h (Above) = 3.00 ft	Ext. Wall	5,089 sq ft	
h (Below) = 9.50 ft	Window	113 sq ft	
	Int. Wall	217 ft	
	Roof	62,800 lb	
	Int. Wall	12,369 lb	
	Ext. Wall	244,272 lb	
	TOTAL	**319,441 lb**	**101.73 psf**

TOTAL	319 kips

2024 IBC Static Base Shear, Vertical Distribution of Load

Base Shear (Ultimate) = 14.15 kips

Level	Incr. Ht.	h_x	Total w_x	$w_x h_x^k$	C_{vx} = $w_x h_x$/sum($w_i h_i$)	**Story Force**
Roof	19.00 ft	19.00 ft	319 kips	6,069 kip-ft	1.000	**14 kips**
1		0.00 ft				
Summation:			319 kips	6,069 kip-ft	1.000	14 kips

Story Shear	Overturning Moment	Diaphragm Forces				
		F_{px}	F_{px} max	F_{px} min	F_{px} used	**F_{px} used (ASD)**
14.15 kips	269 kip-ft	14 kips	40 kips	20 kips	20 kips	**14 kips**

Seismic Design Parameters:

Site Class	C
S_S =	0.31
S_1 =	0.068
S_{MS} =	0.310
S_{M1} =	0.087
S_{DS} =	0.207
S_{D1} =	0.058
Importance Factor =	1.5
Response Modification Factor, R =	7.0

Approximate Code Period :

C_U =	1.4	
C_T =	0.020	
x =	0.750	
T_a =	0.182	seconds
T_0 =	0.056	seconds
T_S =	0.281	seconds
T_L =	6.000	seconds
Period Used to Est. Base Shear; T =	**0.182**	seconds
k =	1.000	
S_a/(R/I) =	0.044	
S_a/T(R/I) =	0.243	T < TL
Min =	0.030	
Seismic Coefficient, C_s =	**0.044**	

$T<T_0$:	S_a =	0.485
$T_0<T<T_S$:	S_a =	0.207
$T_S<T<T_L$:	S_a =	0.319
$T_L<T$:	S_a =	10.506
	S_a =	0.207

Incremental Floor Height

Roof to 1st 19.00 ft

Wind Loading (Ultimate)

Transverse Direction

BLDG Length: 45.33 ft

	Wall Loading (PSF)	Story Force (Kips)
Roof	26.28	11.32

Longitudinal Direction

BLDG Length: 112.58 ft

	Wall Loading (PSF)	Story Force (Kips)
Roof	31.48	33.67

Seismic Loading (Ultimate)

	Story Force (Kips)
Roof	14.15

WIND LOAD GOVERNS DESIGN LONG

SEISMIC LOAD GOVERNS DESIGN SHORT

Job: VA Togus
Job No.: 23072-00

Page: Dead Loads
Date: 9/26/2025

Shearwall Dead Loads for HD Calcs

Dead Loads	
Roof	20 psf
Ext. Wall	48 psf
Int. Wall	6 psf
Windows	10 psf

Incre. Floor Hts	
Roof	19.00 ft
	14.00 ft

E/W DIRECTION

		Wall Length						ROOF
Shearwall	Wall Type	Roof			Roof Trib	Roof DL	Wall DL	Total DL
1-1	Ext	20.00 ft			0.00 ft	0 plf	816 plf	**816 plf**
2-1	Ext	26.00 ft			0.00 ft	0 plf	1056 plf	**1056 plf**
Aspect 3-1	Ext	0.00 ft			0.00 ft	0 plf	0 plf	**0 plf**
4-1	Ext	11.00 ft			0.00 ft	0 plf	816 plf	**816 plf**
4-2	Ext	26.00 ft			0.00 ft	0 plf	1056 plf	**1056 plf**

N/S DIRECTION

		Wall Length						ROOF
Shearwall	Wall Type	Roof			Roof Trib	Roof DL	Wall DL	Total DL
A-1	Ext	14.00 ft			0.00 ft	0 plf	816 plf	**816 plf**
A.3-1	Ext	17.75 ft			0.00 ft	0 plf	816 plf	**816 plf**
C-1	Ext	16.75 ft			0.00 ft	0 plf	816 plf	**816 plf**
F-1	Ext	11.00 ft			0.00 ft	0 plf	1056 plf	**1056 plf**

Job: VA Togus — N/S Directio
Job No.: 23072-00 — 9/26/2025

Flexible Diaphragm Shear Wall Load Distribution

Story Shears (Ultimate) ***WIND CONTROLLED**

Roof	**33.7 kips**	**307 plf**
Sum	**33.7 kips**	

Walls

N/S Direction						
Force Line	**Trib Width**	**Trib Ratio**	**L_{Wall}**		**Story Shears**	
			L_1	**L_{TOTAL}**	**$F_{QE, ROOF}$**	**$F_{QE, Total}$**
A-1	**5.88 ft**	0.054	**14.00 ft**	**14.00 ft**	1.8 kips	1.8 kips
A.3-1	**23.25 ft**	0.212	**17.75 ft**	**17.75 ft**	7.1 kips	7.1 kips
C-1	**48.88 ft**	0.446	**16.75 ft**	**16.75 ft**	15.0 kips	15.0 kips
F-1	**31.50 ft**	0.288	**11.00 ft**	**11.00 ft**	9.7 kips	9.7 kips
SUM	109.50 ft	1.000		59.500	33.7 kips	**33.7 kips**

Reaction Line		R to 1st
A-1	L_{TOTAL}	14.00 ft
	F_{QE}	1.8 kips
	vF_{QE}	129 plf
	vV_{QE}	129 plf
		A
A.3-1	L_{TOTAL}	17.75 ft
	F_{QE}	7.1 kips
	vF_{QE}	403 plf
	vV_{QE}	403 plf
		A
C-1	L_{TOTAL}	16.75 ft
	F_{QE}	15.0 kips
	vF_{QE}	897 plf
	vV_{QE}	897 plf
		B
F-1	L_{TOTAL}	11.00 ft
	F_{QE}	9.7 kips
	vF_{QE}	880 plf
	vV_{QE}	880 plf
		B

Job: VA Togus
Job No.: 23072-00

Page: HD Forces NS
Date: 9/26/2025

Incr. Heights	
R	19.00 ft

Wall Shears		LRFD		
Wall ID	R			
A-1	129 plf			
A.3-1	403 plf			
C-1	897 plf			
F-1	880 plf			

Weight Reduction (LRFD)	0.9	0.9D+W or 0.9D+E
Hold Down Offset	1.00 ft	

N/S DIRECTION

		ROOF											
Wall ID	Length	M_{OT}	M_{OT} Acc	Total DL	M_R	M_R Acc	HD Force						
A-1	14.00 ft	34.3 k-ft	34.3 k-ft	816 plf	80.0 k-ft	80.0 k-ft	0.0 k						
A.3-1	17.75 ft	135.8 k-ft	135.8 k-ft	816 plf	128.5 k-ft	128.5 k-ft	1.2 k						
C-1	16.75 ft	285.5 k-ft	285.5 k-ft	816 plf	114.5 k-ft	114.5 k-ft	11.6 k						
F-1	11.00 ft	184.0 k-ft	184.0 k-ft	1056 plf	63.9 k-ft	63.9 k-ft	12.7 k						

KGA Structural Engineers	project: VA Togus	by: JRK
	location: Togus, Maine	Job No.: 23072-00
	client: GDM	

SEISMIC MASS

Dead Loads		
Roof	20 psf	*Horizontal*
Ext. Wall	48 psf	*Vertical*
Int. Wall	6 psf	*Vertical*

Incre. Floor Heights	
Parapet	3.00 ft
Roof	19.00 ft

ROOF			
Trib ht:	Roof Area	3,140 sq ft	
h (Above) = 3.00 ft	Ext. Wall	5,089 sq ft	
h (Below) = 9.50 ft	Window	113 sq ft	
	Int. Wall	217 ft	
	Roof	62,800 lb	
	Int. Wall	12,369 lb	
	Ext. Wall	244,272 lb	
	TOTAL	**319,441 lb**	**101.73 psf**

TOTAL	319 kips

Job: VA Togus
Job No.: 23072-00

Page: N/S Direction
Date: 9/26/2025

Wall ID		R	2ND
A-1		129 plf	0 plf
A.3-1		403 plf	0 plf
C-1		897 plf	0 plf
F-1		880 plf	0 plf
0		#DIV/0!	0 plf
0		#DIV/0!	#DIV/0!
0		#DIV/0!	#DIV/0!

*WIND CONTROLLED

							HOLDOWNS (Ultimate)				HOLDOWNS (Allowable)			
Wall ID	L	R	2ND			SW TYPE	R				R			
A-1	14.00 ft	129 plf	0 plf			A	0.0 k				0.0 k			
A.3-1	17.75 ft	403 plf	0 plf			A	1.2 k				0.7 k			
C-1	16.75 ft	403 plf	0 plf			B	11.6 k				7.0 k			
D-1	11.00 ft	897 plf	0 plf			B	12.7 k				7.6 k			

Job: VA Togus
Job No.: 23072-00

Page:
Date:

Flexible Diaphragm Shear Wall Load Distribution

Story Shears (Ultimate) ***SEISMIC CONTROLLED**

Roof	**14.1 kips**	**337 plf**
Sum	**14.1 kips**	

	E/W Direction							
Walls	**Force Line**	**Trib Width**	**Trib Ratio**	L_{Wall}			**Story Shears**	
				L_1	L_2	L_{TOTAL}	$F_{QE, ROOF}$	$F_{QE, Total}$
	1	**8.88 ft**	0.211	**20.00 ft**		**20.00 ft**	3.0 kips	3.0 kips
	2	**21.00 ft**	0.500	**26.00 ft**		**26.00 ft**	7.1 kips	7.1 kips
Aspect	**3**	**0.00 ft**	0.000	**0.00 ft**		**0.00 ft**	0.0 kips	0.0 kips
	4	**12.13 ft**	0.289	**11.00 ft**	**26.00 ft**	**37.00 ft**	4.1 kips	4.1 kips
	SUM	42.00 ft	1.000			83.000	14.1 kips	**14.1 kips**

Reaction Line		R to 1st
1	L_{TOTAL}	20.00 ft
	F_{QE}	3.0 kips
	vF_{QE}	149 plf
	vV_{QE}	149 plf
		A
2	L_{TOTAL}	26.00 ft
	F_{QE}	7.1 kips
	vF_{QE}	272 plf
	vV_{QE}	272 plf
		A
3	L_{TOTAL}	0.00 ft
	F_{QE}	0.0 kips
	vF_{QE}	0 plf
	vV_{QE}	0 plf
4	L_{TOTAL}	37.00 ft
	F_{QE}	4.1 kips
	vF_{QE}	110 plf
	vV_{QE}	110 plf
		A

Job: VA Togus
Job No.: 23072-00

Page: HD Forces NS
Date: 9/26/2025

Incr. Heights	
R	19.00 ft

Wall Shears				
Wall ID	R			
1	149 plf			
2	272 plf			
3	0 plf			
4	110 plf			

Weight Reduction (LRFD)	0.9
Hold Down Offset	1.00 ft

N/S DIRECTION

		ROOF											
Wall ID	Length	M_{OT}	M_{OT} Acc	Total DL	M_R	M_R Acc	HD Force						
1-1	20.00 ft	56.8 k-ft	56.8 k-ft	816 plf	163.2 k-ft	163.2 k-ft	0.0 k						
2-1	26.00 ft	134.4 k-ft	134.4 k-ft	1056 plf	356.9 k-ft	356.9 k-ft	0.0 k						
3-1	0.00 ft	0.0 k-ft	0.0 k-ft	0 plf	0.0 k-ft	0.0 k-ft	0.0 k						
4-1	11.00 ft	31.2 k-ft	31.2 k-ft	816 plf	49.4 k-ft	49.4 k-ft	0.0 k						
4-2	26.00 ft	54.5 k-ft	54.5 k-ft	1056 plf	356.9 k-ft	356.9 k-ft	0.0 k						

Job: VA Togus
Job No.: 23072-00

Page: E/W Direction
Date: 9/26/2025

Wall ID		R	2ND
1		149 plf	0 plf
2		272 plf	0 plf
3		0 plf	0 plf
4		110 plf	0 plf

							HOLDOWNS (Ultimate)				*SEISMIC CONTROLLED HOLDOWNS (Allowable)			
Wall ID	L	R				SW TYPE	R				R			
1-1	20.00 ft	149 plf				A	0.0 k				0.0 k			
2-1	26.00 ft	272 plf				A	0.0 k				0.0 k			
3-1	0.00 ft	0 plf												
4-1	11.00 ft	110 plf				A	0.0 k				0.0 k			
4-2	26.00 ft	110 plf				A	0.0 k				0.0 k			

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Fax: (360) 696-1572

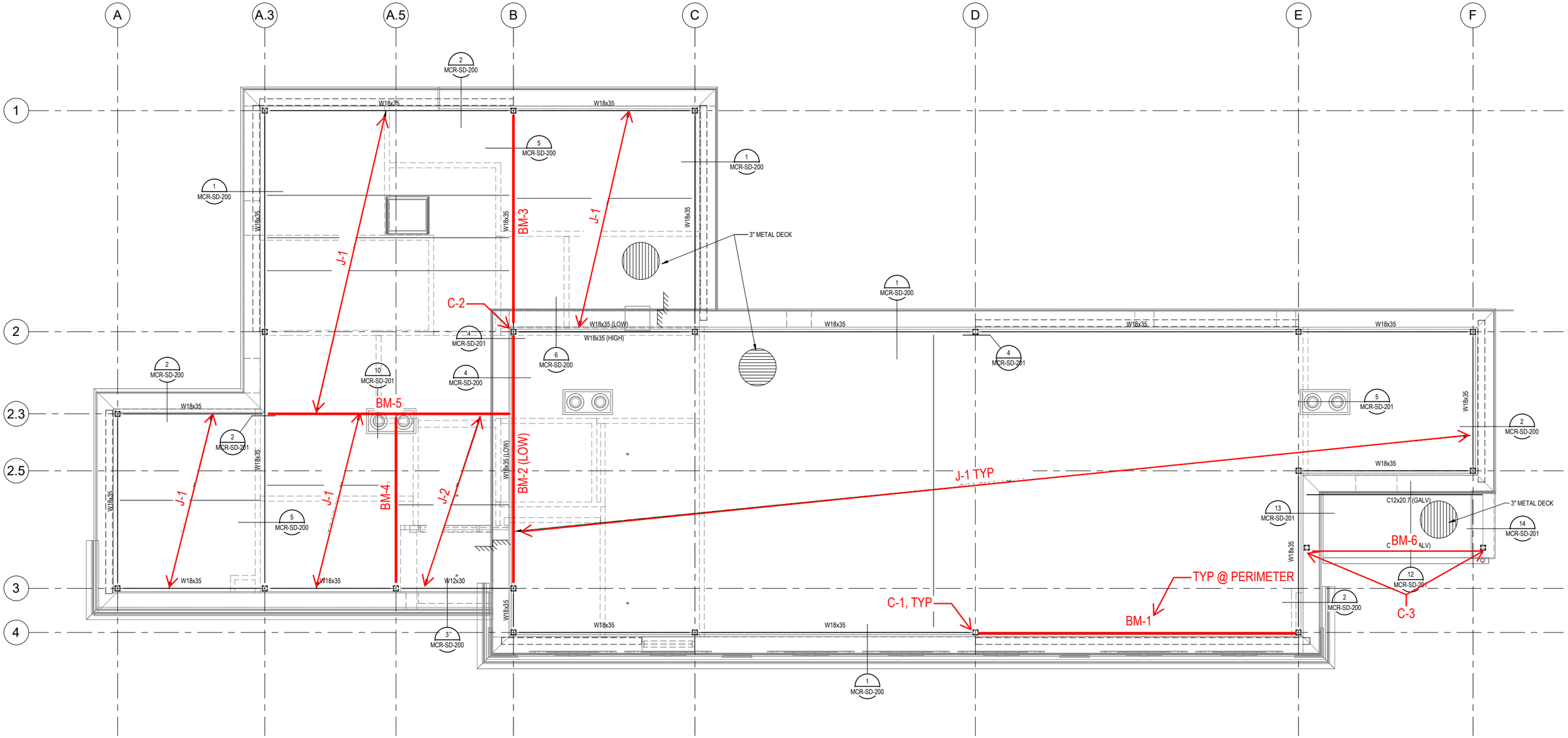
Project:	VA Togus	*By:*	JRK
Location:	Togus, ME	*Job No.:*	23072-00
Client:	GDM		
Shear Wall Design Aid			

Mark	Sheathing Type, Nail Size and Panel Edges Nail Spacing	LRFD Seismic Capacity (plf)
A	7/16" Rated Sheathing 6/12	592
B	7/16" Rated Sheathing 4/12	917
C	7/16" Rated Sheathing 3/12	1,128
D	7/16" Rated Sheathing 2/12	1,242
		N/A
		N/A
		N/A

Mark	Simpson Strong-Tie Holdowns	LRFD Capacity (k)
1	S/HDU4 (54 mil)	4.1
2	S/HDU6 (54 mil)	8.2
3	S/HDU9 (54 mil)	10.8
4	S/HDU11 (54 mil)	12.3
5	S/HDU11 (2-54 mil)	15.5
		#N/A
		#N/A
		#N/A
		#N/A
		#N/A
		#N/A
		#N/A

Shear Wall Deflection

G		psi
E		psi
A		in^2



A
MCR-SF-101

ROOF FRAMING PLAN

1/4" = 1'-0"

NOTES:

1. VERIFY DIMENSIONS W/ ARCH.
2. SEE MCR-SD-200 & MCR-SD-201 FOR STEEL FRAMING DETAILS.
3. TOS X'-X" INDICATES TOP OF STEEL ELEVATIONS.
4. TOC X'-X" INDICATES TOP OF CONCRETE ELEVATIONS.
5. SEE DETAIL 5/MCR-SD-201 FOR ROOF OPENINGS.

J-1 JOISTS

ASD

STANDARD LOAD TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown In Pounds Per Linear Foot (plf)

Joist Designation	18K3	18K4	18K5	18K6	18K7	18K9	18K10	20K3	20K4	20K5	20K6	20K7	20K9	20K10	22K4	22K5	22K6	22K7	22K9	22K10	22K11
Depth (In.)	18	18	18	18	18	18	18	20	20	20	20	20	20	20	22	22	22	22	22	22	22
Approx. Wt. (lbs./ft.)	6.4	7.2	7.7	8.4	8.9	10.1	11.6	6.5	7.2	7.7	8.4	8.9	10.1	11.6	7.3	7.7	8.5	9.0	10.2	11.7	11.9
Span (ft.) ↓																					
18	550	550	550	550	550	550	550														
	550	550	550	550	550	550	550														
19	514	550	550	550	550	550	550	550	550	550	550	550	550	550							
	494	523	523	523	523	523	523	550	550	550	550	550	550	550							
20	463	550	550	550	550	550	550	517	550	550	550	550	550	550							
	423	490	490	490	490	490	490	517	550	550	550	550	550	550							
21	420	506	550	550	550	550	550	468	550	550	550	550	550	550	550	550	550	550	550	550	550
	364	426	460	460	460	460	460	453	520	520	520	520	520	520	550	550	550	550	550	550	550
22	382	460	518	550	550	550	550	426	514	550	550	550	550	550	550	550	550	550	550	550	550
	316	370	414	438	438	438	438	393	461	490	490	490	490	490	548	548	548	548	548	548	548
23	349	420	473	516	550	550	550	389	469	529	550	550	550	550	518	550	550	550	550	550	550
	276	323	362	393	418	418	418	344	402	451	468	468	468	468	491	518	518	518	518	518	518
24	320	385	434	473	526	550	550	357	430	485	528	550	550	550	475	536	550	550	550	550	550
	242	284	318	345	382	396	396	302	353	396	430	448	448	448	431	483	495	495	495	495	495
25	294	355	400	435	485	550	550	329	396	446	486	541	550	550	438	493	537	550	550	550	550
	214	250	281	305	337	377	377	266	312	350	380	421	426	426	381	427	464	474	474	474	474
26	272	328	369	402	448	538	550	304	366	412	449	500	550	550	404	455	496	550	550	550	550
	190	222	249	271	299	354	361	236	277	310	337	373	405	405	338	379	411	454	454	454	454
27	252	303	342	372	415	498	550	281	339	382	416	463	550	550	374	422	459	512	550	550	550
	169	198	222	241	267	315	347	211	247	277	301	333	389	389	301	337	367	406	432	432	432
28	234	282	318	346	385	463	548	261	315	355	386	430	517	550	348	392	427	475	550	550	550
	151	177	199	216	239	282	331	189	221	248	269	298	353	375	270	302	328	364	413	413	413
29	218	263	296	322	359	431	511	243	293	330	360	401	482	550	324	365	398	443	532	550	550
	136	159	179	194	215	254	298	170	199	223	242	268	317	359	242	272	295	327	387	399	399
30	203	245	276	301	335	402	477	227	274	308	336	374	450	533	302	341	371	413	497	550	550
	123	144	161	175	194	229	269	153	179	201	218	242	286	336	219	245	266	295	349	385	385
31	190	229	258	281	313	376	446	212	256	289	314	350	421	499	283	319	347	387	465	550	550
	111	130	146	158	175	207	243	138	162	182	198	219	259	304	198	222	241	267	316	369	369
32	178	215	242	264	294	353	418	199	240	271	295	328	395	468	265	299	326	363	436	517	549
	101	118	132	144	159	188	221	126	147	165	179	199	235	276	180	201	219	242	287	337	355
33	168	202	228	248	276	332	393	187	226	254	277	309	371	440	249	281	306	341	410	486	532
	92	108	121	131	145	171	201	114	134	150	163	181	214	251	164	183	199	221	261	307	334
34	158	190	214	233	260	312	370	176	212	239	261	290	349	414	235	265	288	321	386	458	516
	84	98	110	120	132	156	184	105	122	137	149	165	195	229	149	167	182	202	239	280	314
35	149	179	202	220	245	294	349	166	200	226	246	274	329	390	221	249	272	303	364	432	494
	77	90	101	110	121	143	168	96	112	126	137	151	179	210	137	153	167	185	219	257	292
36	141	169	191	208	232	278	330	157	189	213	232	259	311	369	209	236	257	286	344	408	467
	70	82	92	101	111	132	154	88	103	115	125	139	164	193	126	141	153	169	201	236	269
37								148	179	202	220	245	294	349	198	223	243	271	325	386	442
								81	95	106	115	128	151	178	116	130	141	156	185	217	247
38								141	170	191	208	232	279	331	187	211	230	256	308	366	419
								74	87	98	106	118	139	164	107	119	130	144	170	200	228
39								133	161	181	198	220	265	314	178	200	218	243	292	347	397
								69	81	90	98	109	129	151	98	110	120	133	157	185	211
40								127	153	172	188	209	251	298	169	190	207	231	278	330	377
								64	75	84	91	101	119	140	91	102	111	123	146	171	195
41															161	181	197	220	264	314	359
															85	95	103	114	135	159	181
42															153	173	188	209	252	299	342
															79	88	96	106	126	148	168
43															146	165	179	200	240	285	326
															73	82	89	99	117	138	157
44															139	157	171	191	229	272	311
															68	76	83	92	109	128	146

JOIST SPAN = 25'
SPACING = 48"
D+S = 95 PSF
DIST. LOAD = 95 PSF (4 FT) = 380 PLF

J-2 JOISTS

ASD

STANDARD LOAD TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown In Pounds Per Linear Foot (plf)

Joist Designation	10K1	12K1	12K3	12K5	14K1	14K3	14K4	14K6	16K2	16K3	16K4	16K5	16K6	16K7	16K9
Depth (in.)	10	12	12	12	14	14	14	14	16	16	16	16	16	16	16
Approx. Wt (lbs./ft.)	5.0	5.0	5.7	7.1	5.2	6.0	6.7	7.7	5.5	6.3	7.0	7.5	8.1	8.6	10.0
Span (ft.) ↓															
10	550 550														
11	550 542														
12	550 455	550 550	550 550	550 550											
13	479 363	550 510	550 510	550 510											
14	412 289	500 425	550 463	550 463	550 550	550 550	550 550	550 550							
15	358 234	434 344	543 428	550 434	511 475	550 507	550 507	550 507							
16	313 192	380 282	476 351	550 396	448 390	550 467	550 467	550 467	550 550	550 550	550 550	550 550	550 550	550 550	550 550
17	277 159	336 234	420 291	550 366	395 324	495 404	550 443	550 443	512 488	550 526	550 526	550 526	550 526	550 526	550 526
18	246 134	299 197	374 245	507 317	352 272	441 339	530 397	550 408	456 409	508 456	550 490	550 490	550 490	550 490	550 490
19	221 113	268 167	335 207	454 269	315 230	395 287	475 336	550 383	408 347	455 386	547 452	550 455	550 455	550 455	550 455
20	199 97	241 142	302 177	409 230	284 197	356 246	428 287	525 347	368 297	410 330	493 386	550 426	550 426	550 426	550 426
21		218 123	273 153	370 198	257 170	322 212	388 248	475 299	333 255	371 285	447 333	503 373	548 405	550 406	550 406
22		199 106	249 132	337 172	234 147	293 184	353 215	432 259	303 222	337 247	406 289	458 323	498 351	550 385	550 385
23		181 93	227 116	308 150	214 128	268 160	322 188	395 226	277 194	308 216	371 252	418 282	455 307	507 339	550 363
24		166 81	208 101	282 132	196 113	245 141	295 165	362 199	254 170	283 189	340 221	384 248	418 269	465 298	550 346
25					180 100	226 124	272 145	334 175	234 150	260 167	313 195	353 219	384 238	428 263	514 311
26					166 88	209 110	251 129	308 156	216 133	240 148	289 173	326 194	355 211	395 233	474 276
27					154 79	193 98	233 115	285 139	200 119	223 132	268 155	302 173	329 188	366 208	439 246
28					143 70	180 88	216 103	265 124	186 106	207 118	249 138	281 155	306 168	340 186	408 220
29									173 95	193 106	232 124	261 139	285 151	317 167	380 198
30									161 86	180 96	216 112	244 126	266 137	296 151	355 178
31									151 78	168 87	203 101	228 114	249 124	277 137	332 161
32									142 71	158 79	190 92	214 103	233 112	259 124	311 147

JOIST SPAN = 10'
SPACING = 48"
D+S = 95 PSF
DIST. LOAD = 95 PSF (4 FT) = 380 PLF

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Steel Beam

Project File: roof_framing_current.ec6

LIC# : KW-06016429, Build:20.25.10.02 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: BM-1

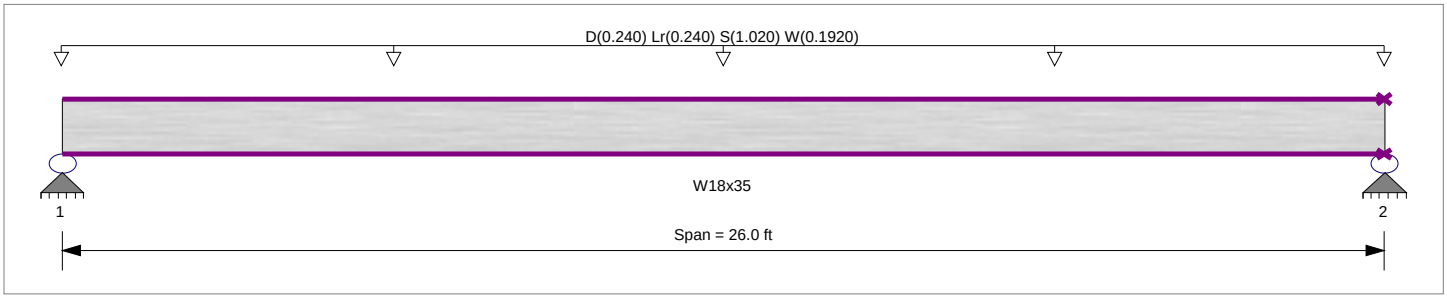
Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : AISC 360-22
Load Combination Set : ASCE 7-22 / IBC 2024

Material Properties

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

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



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.020, Lr = 0.020, S = 0.0850, W = 0.0160 ksf, Tributary Width = 12.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.490 : 1	Maximum Shear Stress Ratio =	0.118 : 1
Section used for this span	W18x35	Section used for this span	W18x35
Mu : Applied	122.187 k-ft	Vu : Applied	18.798 k
Mn * Phi : Allowable	249.375 k-ft	Vn * Phi : Allowable	159.30 k
Load Combination	+1.20D+S+0.50W	Load Combination	+1.20D+S+0.50W
		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	0.712 in	Ratio =	437	>=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.691 in	Ratio =	452	>=180	Span: 1 : +D+0.70S
Max Upward Total Deflection	0 in	Ratio =	0	<180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+1.40D													
Dsgn. L = 26.00 ft	1	0.130	0.031	32.53		32.53	277.08	249.38	1.00	1.00	5.01	159.30	159.30
+1.20D+0.50Lr													
Dsgn. L = 26.00 ft	1	0.152	0.037	38.03		38.03	277.08	249.38	1.00	1.00	5.85	159.30	159.30
+1.20D+0.30S													
Dsgn. L = 26.00 ft	1	0.216	0.052	53.74		53.74	277.08	249.38	1.00	1.00	8.27	159.30	159.30
+1.20D+1.60Lr													
Dsgn. L = 26.00 ft	1	0.242	0.058	60.33		60.33	277.08	249.38	1.00	1.00	9.28	159.30	159.30
+1.20D+1.60Lr+0.50W													
Dsgn. L = 26.00 ft	1	0.274	0.066	68.45		68.45	277.08	249.38	1.00	1.00	10.53	159.30	159.30
+1.20D+S													
Dsgn. L = 26.00 ft	1	0.457	0.110	114.08		114.08	277.08	249.38	1.00	1.00	17.55	159.30	159.30
+1.20D+S+0.50W													
Dsgn. L = 26.00 ft	1	0.490	0.118	122.19		122.19	277.08	249.38	1.00	1.00	18.80	159.30	159.30
+1.20D+0.50Lr+W													
Dsgn. L = 26.00 ft	1	0.218	0.052	54.25		54.25	277.08	249.38	1.00	1.00	8.35	159.30	159.30
+1.20D+0.30S+W													
Dsgn. L = 26.00 ft	1	0.281	0.068	69.97		69.97	277.08	249.38	1.00	1.00	10.76	159.30	159.30
+0.90D+W													
Dsgn. L = 26.00 ft	1	0.149	0.036	37.14		37.14	277.08	249.38	1.00	1.00	5.71	159.30	159.30
+1.20D+0.150S													

KGA Structural Engineers
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Steel Beam

Project File: roof_framing_current.ec6

LIC# : KW-06016429, Build:20.25.10.02 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: BM-1

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
Dsgn. L = 26.00 ft	1	0.164	0.039	40.81		40.81	277.08	249.38	1.00	1.00	6.28	159.30	159.30
+0.90D													
Dsgn. L = 26.00 ft	1	0.084	0.020	20.91		20.91	277.08	249.38	1.00	1.00	3.22	159.30	159.30

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	S Only	0.7123	13.074		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	13.260	13.260
Max Upward from Load Combinations	12.857	12.857
Max Upward from Load Cases	13.260	13.260
D Only	3.575	3.575
+D+Lr	6.695	6.695
+D+0.70S	12.857	12.857
+D+0.750Lr	5.915	5.915
+D+0.5250S	10.537	10.537
+D+0.60W	5.073	5.073
+D+0.750Lr+0.450W	7.038	7.038
+D+0.5250S+0.450W	11.660	11.660
+0.60D+0.60W	3.643	3.643
+D+0.10S	4.901	4.901
+0.60D	2.145	2.145
Lr Only	3.120	3.120
S Only	13.260	13.260
W Only	2.496	2.496

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Steel Beam

Project File: roof_framing_current.ec6

LIC# : KW-06016429, Build:20.25.10.02 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: BM-2

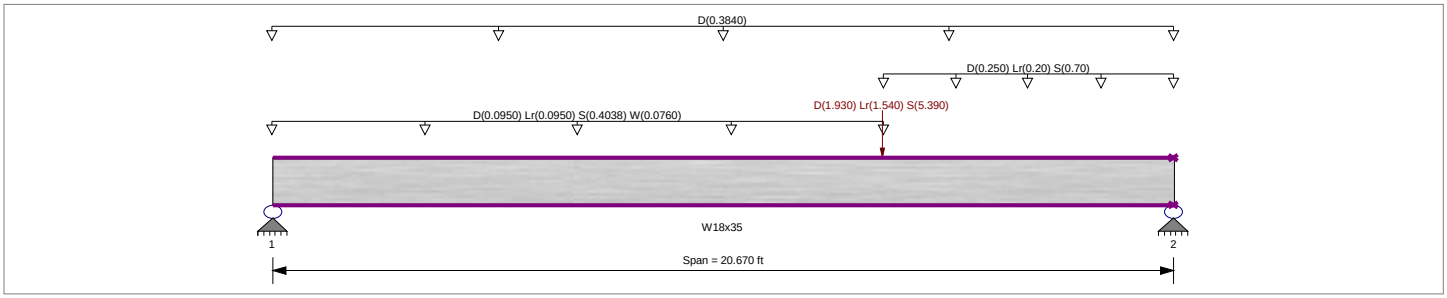
Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : AISC 360-22
Load Combination Set : ASCE 7-22 / IBC 2024

Material Properties

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

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



Applied Loads

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

Beam self weight calculated and added to loading
Load for Span Number 1
Uniform Load : D = 0.020, Lr = 0.020, S = 0.0850, W = 0.0160 ksf, Extent = 0.0 -->> 14.0 ft, Tributary Width = 4.750 ft
Uniform Load : D = 0.0250, Lr = 0.020, S = 0.070 ksf, Extent = 14.0 -->> 20.670 ft, Tributary Width = 10.0 ft
Point Load : D = 1.930, Lr = 1.540, S = 5.390 k @ 14.0 ft, (BM-5)
Uniform Load : D = 0.0480 ksf, Tributary Width = 8.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.366** : 1	Maximum Shear Stress Ratio =	**0.117** : 1
Section used for this span	**W18x35**	Section used for this span	**W18x35**
Mu : Applied	91.325 k-ft	Vu : Applied	18.645 k
Mn * Phi : Allowable	249.375 k-ft	Vn * Phi : Allowable	159.30 k
Load Combination	+1.20D+S+0.50W	Load Combination	+1.20D+S+0.50W
		Location of maximum on span	20.670 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.229 in	Ratio =	1,080	>=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.349 in	Ratio =	711	>=180	Span: 1 : +D+0.70S
Max Upward Total Deflection	0 in	Ratio =	0	<180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+1.40D													
Dsgn. L = 20.67 ft	1	0.203	0.066	50.70		50.70	277.08	249.38	1.00	1.00	10.48	159.30	159.30
+1.20D+0.50Lr													
Dsgn. L = 20.67 ft	1	0.199	0.065	49.60		49.60	277.08	249.38	1.00	1.00	10.29	159.30	159.30
+1.20D+0.30S													
Dsgn. L = 20.67 ft	1	0.230	0.074	57.24		57.24	277.08	249.38	1.00	1.00	11.83	159.30	159.30
+1.20D+1.60Lr													
Dsgn. L = 20.67 ft	1	0.254	0.083	63.34		63.34	277.08	249.38	1.00	1.00	13.16	159.30	159.30
+1.20D+1.60Lr+0.50W													
Dsgn. L = 20.67 ft	1	0.260	0.084	64.74		64.74	277.08	249.38	1.00	1.00	13.34	159.30	159.30
+1.20D+S													
Dsgn. L = 20.67 ft	1	0.361	0.116	89.99		89.99	277.08	249.38	1.00	1.00	18.46	159.30	159.30
+1.20D+S+0.50W													
Dsgn. L = 20.67 ft	1	0.366	0.117	91.33		91.33	277.08	249.38	1.00	1.00	18.64	159.30	159.30
+1.20D+0.50Lr+W													
Dsgn. L = 20.67 ft	1	0.211	0.067	52.56		52.56	277.08	249.38	1.00	1.00	10.65	159.30	159.30
+1.20D+0.30S+W													
Dsgn. L = 20.67 ft	1	0.241	0.077	60.15		60.15	277.08	249.38	1.00	1.00	12.19	159.30	159.30

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Steel Beam

Project File: roof_framing_current.ec6

LIC# : KW-06016429, Build:20.25.10.02 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: BM-2

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+0.90D+W													
Dsgn. L = 20.67 ft	1	0.143	0.045	35.63		35.63	277.08	249.38	1.00	1.00	7.10	159.30	159.30
+1.20D+0.150S													
Dsgn. L = 20.67 ft	1	0.202	0.065	50.32		50.32	277.08	249.38	1.00	1.00	10.41	159.30	159.30
+0.90D													
Dsgn. L = 20.67 ft	1	0.131	0.042	32.60		32.60	277.08	249.38	1.00	1.00	6.74	159.30	159.30

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+0.70S	0.3489	10.748		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	10.463	14.123
Max Upward from Load Combinations	10.463	14.123
Max Upward from Load Cases	6.231	9.481
D Only	6.102	7.486
+D+Lr	7.694	10.099
+D+0.70S	10.463	14.123
+D+0.750Lr	7.296	9.446
+D+0.5250S	9.373	12.464
+D+0.60W	6.524	7.703
+D+0.750Lr+0.450W	7.612	9.608
+D+0.5250S+0.450W	9.690	12.626
+0.60D+0.60W	4.083	4.708
+D+0.10S	6.725	8.435
+0.60D	3.661	4.492
Lr Only	1.592	2.612
S Only	6.231	9.481
W Only	0.704	0.360

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Steel Beam

Project File: roof_framing_current.ec6

LIC# : KW-06016429, Build:20.25.10.02 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

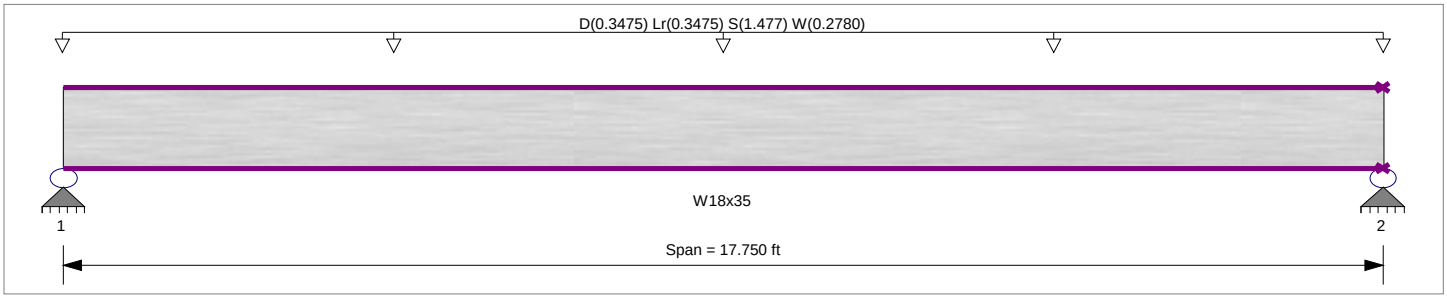
DESCRIPTION: BM-3

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : AISC 360-22
Load Combination Set : ASCE 7-22 / IBC 2024

Material Properties

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



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.020, Lr = 0.020, S = 0.0850, W = 0.0160 ksf, Tributary Width = 17.375 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.328** : 1	Maximum Shear Stress Ratio =	**0.116** : 1
Section used for this span	**W18x35**	Section used for this span	**W18x35**
Mu : Applied	81.714 k-ft	Vu : Applied	18.415 k
Mn * Phi : Allowable	249.375 k-ft	Vn * Phi : Allowable	159.30 k
Load Combination	+1.20D+S+0.50W	Load Combination	+1.20D+S+0.50W
		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	0.224 in	Ratio =	950	>=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.215 in	Ratio =	991	>=180	Span: 1 : +D+0.70S
Max Upward Total Deflection	0 in	Ratio =	0	<180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+1.40D													
Dsgn. L = 17.75 ft	1	0.085	0.030	21.09		21.09	277.08	249.38	1.00	1.00	4.75	159.30	159.30
+1.20D+0.50Lr													
Dsgn. L = 17.75 ft	1	0.100	0.035	24.92		24.92	277.08	249.38	1.00	1.00	5.62	159.30	159.30
+1.20D+0.30S													
Dsgn. L = 17.75 ft	1	0.142	0.050	35.53		35.53	277.08	249.38	1.00	1.00	8.01	159.30	159.30
+1.20D+1.60Lr													
Dsgn. L = 17.75 ft	1	0.160	0.057	39.97		39.97	277.08	249.38	1.00	1.00	9.01	159.30	159.30
+1.20D+1.60Lr+0.50W													
Dsgn. L = 17.75 ft	1	0.182	0.064	45.45		45.45	277.08	249.38	1.00	1.00	10.24	159.30	159.30
+1.20D+S													
Dsgn. L = 17.75 ft	1	0.306	0.108	76.24		76.24	277.08	249.38	1.00	1.00	17.18	159.30	159.30
+1.20D+S+0.50W													
Dsgn. L = 17.75 ft	1	0.328	0.116	81.71		81.71	277.08	249.38	1.00	1.00	18.41	159.30	159.30
+1.20D+0.50Lr+W													
Dsgn. L = 17.75 ft	1	0.144	0.051	35.87		35.87	277.08	249.38	1.00	1.00	8.08	159.30	159.30
+1.20D+0.30S+W													
Dsgn. L = 17.75 ft	1	0.186	0.066	46.47		46.47	277.08	249.38	1.00	1.00	10.47	159.30	159.30
+0.90D+W													
Dsgn. L = 17.75 ft	1	0.098	0.035	24.51		24.51	277.08	249.38	1.00	1.00	5.52	159.30	159.30
+1.20D+0.150S													

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Steel Beam

Project File: roof_framing_current.ec6

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DESCRIPTION: BM-3

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
Dsgn. L = 17.75 ft	1	0.107	0.038	26.80		26.80	277.08	249.38	1.00	1.00	6.04	159.30	159.30
+0.90D													
Dsgn. L = 17.75 ft	1	0.054	0.019	13.56		13.56	277.08	249.38	1.00	1.00	3.06	159.30	159.30

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	S Only	0.2240	8.926		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	13.107	13.107
Max Upward from Load Combinations	12.570	12.570
Max Upward from Load Cases	13.107	13.107
D Only	3.395	3.395
+D+Lr	6.479	6.479
+D+0.70S	12.570	12.570
+D+0.750Lr	5.708	5.708
+D+0.5250S	10.276	10.276
+D+0.60W	4.875	4.875
+D+0.750Lr+0.450W	6.818	6.818
+D+0.5250S+0.450W	11.386	11.386
+0.60D+0.60W	3.517	3.517
+D+0.10S	4.705	4.705
+0.60D	2.037	2.037
Lr Only	3.084	3.084
S Only	13.107	13.107
W Only	2.467	2.467

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Steel Beam

Project File: roof_framing_current.ec6

LIC# : KW-06016429, Build:20.25.10.02 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

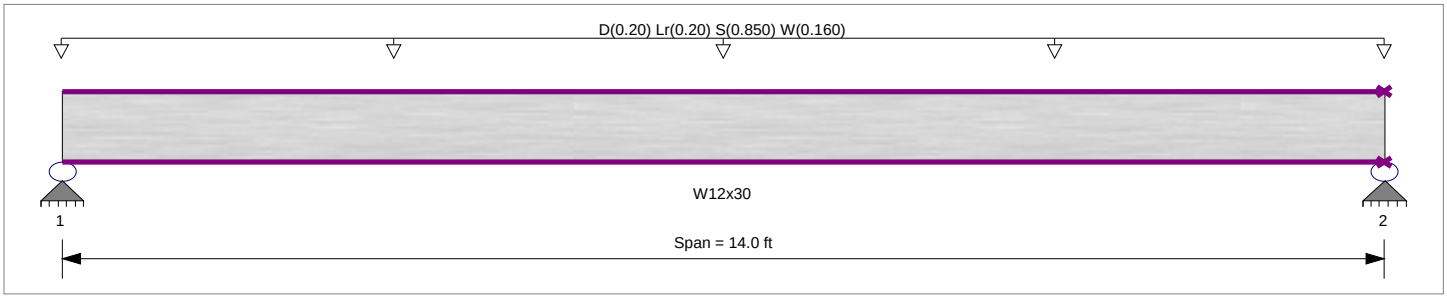
DESCRIPTION: BM-4

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : AISC 360-22
Load Combination Set : ASCE 7-22 / IBC 2024

Material Properties

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



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.020, Lr = 0.020, S = 0.0850, W = 0.0160 ksf, Tributary Width = 10.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.183** : 1	Maximum Shear Stress Ratio =	**0.088** : 1
Section used for this span	**W12x30**	Section used for this span	**W12x30**
Mu : Applied	29.547 k-ft	Vu : Applied	8.442 k
Mn * Phi : Allowable	161.625 k-ft	Vn * Phi : Allowable	95.940 k
Load Combination	+1.20D+S+0.50W	Load Combination	+1.20D+S+0.50W
		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	0.107 in	Ratio =	1,571	>=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.104 in	Ratio =	1619	>=180	Span: 1 : +D+0.70S
Max Upward Total Deflection	0 in	Ratio =	0	<180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+1.40D													
Dsgn. L = 14.00 ft	1	0.049	0.023	7.89		7.89	179.58	161.63	1.00	1.00	2.25	95.94	95.94
+1.20D+0.50Lr													
Dsgn. L = 14.00 ft	1	0.057	0.027	9.21		9.21	179.58	161.63	1.00	1.00	2.63	95.94	95.94
+1.20D+0.30S													
Dsgn. L = 14.00 ft	1	0.080	0.039	13.01		13.01	179.58	161.63	1.00	1.00	3.72	95.94	95.94
+1.20D+1.60Lr													
Dsgn. L = 14.00 ft	1	0.090	0.043	14.60		14.60	179.58	161.63	1.00	1.00	4.17	95.94	95.94
+1.20D+1.60Lr+0.50W													
Dsgn. L = 14.00 ft	1	0.102	0.049	16.56		16.56	179.58	161.63	1.00	1.00	4.73	95.94	95.94
+1.20D+S													
Dsgn. L = 14.00 ft	1	0.171	0.082	27.59		27.59	179.58	161.63	1.00	1.00	7.88	95.94	95.94
+1.20D+S+0.50W													
Dsgn. L = 14.00 ft	1	0.183	0.088	29.55		29.55	179.58	161.63	1.00	1.00	8.44	95.94	95.94
+1.20D+0.50Lr+W													
Dsgn. L = 14.00 ft	1	0.081	0.039	13.13		13.13	179.58	161.63	1.00	1.00	3.75	95.94	95.94
+1.20D+0.30S+W													
Dsgn. L = 14.00 ft	1	0.105	0.050	16.93		16.93	179.58	161.63	1.00	1.00	4.84	95.94	95.94
+0.90D+W													
Dsgn. L = 14.00 ft	1	0.056	0.027	8.99		8.99	179.58	161.63	1.00	1.00	2.57	95.94	95.94
+1.20D+0.150S													

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Steel Beam

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LIC# : KW-06016429, Build:20.25.10.02 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: BM-4

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
Dsgn. L = 14.00 ft +0.90D	1	0.061	0.029	9.89		9.89	179.58	161.63	1.00	1.00	2.82	95.94	95.94
Dsgn. L = 14.00 ft	1	0.031	0.015	5.07		5.07	179.58	161.63	1.00	1.00	1.45	95.94	95.94

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	S Only	0.1069	7.040		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	5.950	5.950
Max Upward from Load Combinations	5.775	5.775
Max Upward from Load Cases	5.950	5.950
D Only	1.610	1.610
+D+Lr	3.010	3.010
+D+0.70S	5.775	5.775
+D+0.750Lr	2.660	2.660
+D+0.5250S	4.734	4.734
+D+0.60W	2.282	2.282
+D+0.750Lr+0.450W	3.164	3.164
+D+0.5250S+0.450W	5.238	5.238
+0.60D+0.60W	1.638	1.638
+D+0.10S	2.205	2.205
+0.60D	0.966	0.966
Lr Only	1.400	1.400
S Only	5.950	5.950
W Only	1.120	1.120

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Steel Beam

Project File: roof_framing_current.ec6

LIC# : KW-06016429, Build:20.25.10.02 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: BM-5

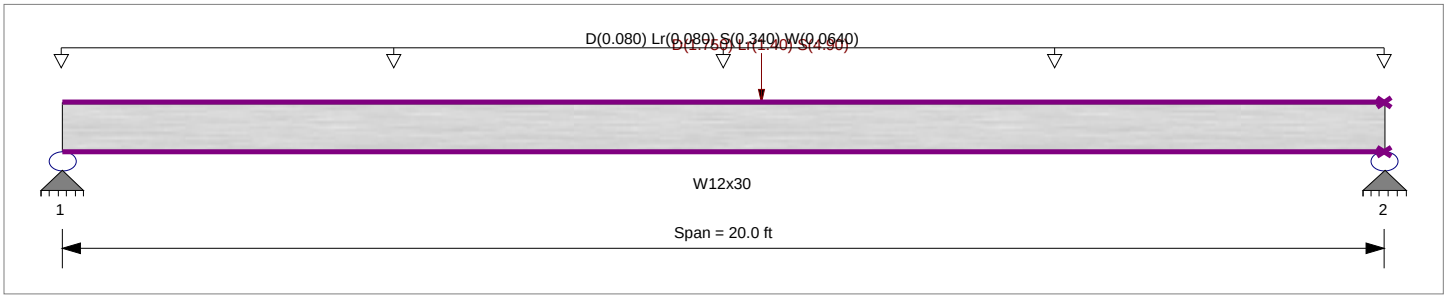
Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : AISC 360-22
Load Combination Set : ASCE 7-22 / IBC 2024

Material Properties

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

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



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.020, Lr = 0.020, S = 0.0850, W = 0.0160 ksf, Tributary Width = 4.0 ft
Point Load : D = 1.750, Lr = 1.40, S = 4.90 k @ 10.580 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.371 : 1	Maximum Shear Stress Ratio =	0.091 : 1
Section used for this span	W12x30	Section used for this span	W12x30
Mu : Applied	59.972 k-ft	Vu : Applied	8.743 k
Mn * Phi : Allowable	161.625 k-ft	Vn * Phi : Allowable	95.940 k
Load Combination	+1.20D+S+0.50W	Load Combination	+1.20D+S+0.50W
		Location of maximum on span	20.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.382 in	Ratio =	627	>=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.398 in	Ratio =	602	>=180	Span: 1 : +D+0.70S
Max Upward Total Deflection	0 in	Ratio =	0	<180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+1.40D													
Dsgn. L = 20.00 ft	1	0.123	0.030	19.87		19.87	179.58	161.63	1.00	1.00	2.84	95.94	95.94
+1.20D+0.50Lr													
Dsgn. L = 20.00 ft	1	0.139	0.033	22.51		22.51	179.58	161.63	1.00	1.00	3.20	95.94	95.94
+1.20D+0.30S													
Dsgn. L = 20.00 ft	1	0.182	0.044	29.44		29.44	179.58	161.63	1.00	1.00	4.23	95.94	95.94
+1.20D+1.60Lr													
Dsgn. L = 20.00 ft	1	0.214	0.051	34.57		34.57	179.58	161.63	1.00	1.00	4.90	95.94	95.94
+1.20D+1.60Lr+0.50W													
Dsgn. L = 20.00 ft	1	0.224	0.054	36.16		36.16	179.58	161.63	1.00	1.00	5.22	95.94	95.94
+1.20D+S													
Dsgn. L = 20.00 ft	1	0.361	0.088	58.38		58.38	179.58	161.63	1.00	1.00	8.42	95.94	95.94
+1.20D+S+0.50W													
Dsgn. L = 20.00 ft	1	0.371	0.091	59.97		59.97	179.58	161.63	1.00	1.00	8.74	95.94	95.94
+1.20D+0.50Lr+W													
Dsgn. L = 20.00 ft	1	0.159	0.040	25.70		25.70	179.58	161.63	1.00	1.00	3.84	95.94	95.94
+1.20D+0.30S+W													
Dsgn. L = 20.00 ft	1	0.202	0.051	32.63		32.63	179.58	161.63	1.00	1.00	4.87	95.94	95.94
+0.90D+W													
Dsgn. L = 20.00 ft	1	0.099	0.026	15.97		15.97	179.58	161.63	1.00	1.00	2.46	95.94	95.94

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Steel Beam

Project File: roof_framing_current.ec6

LIC# : KW-06016429, Build:20.25.10.02 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: BM-5

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+1.20D+0.150S													
Dsgn. L = 20.00 ft	1	0.144	0.035	23.24		23.24	179.58	161.63	1.00	1.00	3.33	95.94	95.94
+0.90D													
Dsgn. L = 20.00 ft	1	0.079	0.019	12.78		12.78	179.58	161.63	1.00	1.00	1.82	95.94	95.94

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+0.70S	0.3984	10.114		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	5.920	6.220
Max Upward from Load Combinations	5.920	6.220
Max Upward from Load Cases	5.708	5.992
D Only	1.924	2.026
+D+Lr	3.384	3.566
+D+0.70S	5.920	6.220
+D+0.750Lr	3.019	3.181
+D+0.5250S	4.921	5.172
+D+0.60W	2.308	2.410
+D+0.750Lr+0.450W	3.307	3.469
+D+0.5250S+0.450W	5.209	5.460
+0.60D+0.60W	1.539	1.599
+D+0.10S	2.495	2.625
+0.60D	1.155	1.215
Lr Only	1.459	1.541
S Only	5.708	5.992
W Only	0.640	0.640

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Steel Beam

Project File: roof_framing_current.ec6

LIC# : KW-06016429, Build:20.25.10.02 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: BM-6

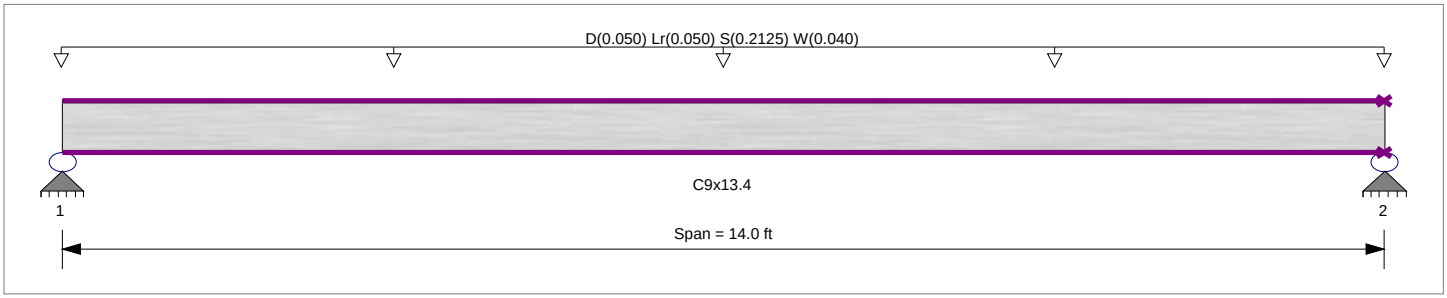
Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : AISC 360-22
Load Combination Set : ASCE 7-22 / IBC 2024

Material Properties

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

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



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.020, Lr = 0.020, S = 0.0850, W = 0.0160 ksf, Tributary Width = 2.50 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.160** : 1	Maximum Shear Stress Ratio =	**0.038** : 1
Section used for this span	**C9x13.4**	Section used for this span	**C9x13.4**
Mu : Applied	7.560 k-ft	Vu : Applied	2.160 k
Mn * Phi : Allowable	47.250 k-ft	Vn * Phi : Allowable	56.619 k
Load Combination	+1.20D+S+0.50W	Load Combination	+1.20D+S+0.50W
		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	0.133 in	Ratio =	1,262	>=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.133 in	Ratio =	1264	>=180	Span: 1 : +D+0.70S
Max Upward Total Deflection	0 in	Ratio =	0	<180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+1.40D													
Dsgn. L = 14.00 ft	1	0.046	0.011	2.17		2.17	52.50	47.25	1.00	1.00	0.62	62.91	56.62
+1.20D+0.50Lr													
Dsgn. L = 14.00 ft	1	0.052	0.012	2.48		2.48	52.50	47.25	1.00	1.00	0.71	62.91	56.62
+1.20D+0.30S													
Dsgn. L = 14.00 ft	1	0.073	0.017	3.43		3.43	52.50	47.25	1.00	1.00	0.98	62.91	56.62
+1.20D+1.60Lr													
Dsgn. L = 14.00 ft	1	0.081	0.019	3.82		3.82	52.50	47.25	1.00	1.00	1.09	62.91	56.62
+1.20D+1.60Lr+0.50W													
Dsgn. L = 14.00 ft	1	0.091	0.022	4.31		4.31	52.50	47.25	1.00	1.00	1.23	62.91	56.62
+1.20D+S													
Dsgn. L = 14.00 ft	1	0.150	0.036	7.07		7.07	52.50	47.25	1.00	1.00	2.02	62.91	56.62
+1.20D+S+0.50W													
Dsgn. L = 14.00 ft	1	0.160	0.038	7.56		7.56	52.50	47.25	1.00	1.00	2.16	62.91	56.62
+1.20D+0.50Lr+W													
Dsgn. L = 14.00 ft	1	0.073	0.017	3.46		3.46	52.50	47.25	1.00	1.00	0.99	62.91	56.62
+1.20D+0.30S+W													
Dsgn. L = 14.00 ft	1	0.093	0.022	4.41		4.41	52.50	47.25	1.00	1.00	1.26	62.91	56.62
+0.90D+W													
Dsgn. L = 14.00 ft	1	0.050	0.012	2.38		2.38	52.50	47.25	1.00	1.00	0.68	62.91	56.62
+1.20D+0.150S													

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Steel Beam

Project File: roof_framing_current.ec6

LIC# : KW-06016429, Build:20.25.10.02 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: BM-6

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
Dsgn. L = 14.00 ft	1	0.056	0.013	2.64		2.64	52.50	47.25	1.00	1.00	0.76	62.91	56.62
+0.90D													
Dsgn. L = 14.00 ft	1	0.030	0.007	1.40		1.40	52.50	47.25	1.00	1.00	0.40	62.91	56.62

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	S Only	0.1331	7.040		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.488	1.488
Max Upward from Load Combinations	1.485	1.485
Max Upward from Load Cases	1.488	1.488
D Only	0.444	0.444
+D+Lr	0.794	0.794
+D+0.70S	1.485	1.485
+D+0.750Lr	0.706	0.706
+D+0.5250S	1.225	1.225
+D+0.60W	0.612	0.612
+D+0.750Lr+0.450W	0.832	0.832
+D+0.5250S+0.450W	1.351	1.351
+0.60D+0.60W	0.434	0.434
+D+0.10S	0.593	0.593
+0.60D	0.266	0.266
Lr Only	0.350	0.350
S Only	1.488	1.488
W Only	0.280	0.280

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Steel Column

Project File: roof_framing_current.ec6

LIC# : KW-06016429, Build:20.25.10.02 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: C-1, TYP

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : AISC 360-22
Load Combinations Used : ASCE 7-22 / IBC 2024

General Information

Steel Section Name : **HSS5x5x5/16**

Analysis Method :	Load Resistance Factor
Steel Stress Grade	
Fy : Steel Yield	46.0 ksi
E : Elastic Bending Modulus	29,000.0 ksi

Overall Column Height	19.0 ft
Top & Bottom Fixity	Top & Bottom Pinned
Brace condition :	

Unbraced Length for buckling ABOUT X-X Axis = 19.0 ft, K = 1.0
Unbraced Length for buckling ABOUT Y-Y Axis = 19.0 ft, K = 1.0

Applied Loads

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

Column self weight included : 362.520 lbs * Dead Load Factor
LINKED AXIAL LOAD(s)
BM-1, Support 1: Axial Load at 19 ft, Xecc = 5.5 in,
D = 3.575 Lr = 3.120 S = 13.260 W = 2.496 k
BM-1, Support 1: Axial Load at 19 ft, Xecc = -5.5 in,
D = 3.575 Lr = 3.120 S = 13.260 W = 2.496 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.4609** : 1

Load Combination	+1.20D+S+0.50W	
Location of max.above base	0.0	ft
At maximum location values are . . .		
Pu	38.031	k
0.9 * Pn	82.521	k
Mu-x	0.0	k-ft
0.9 * Mn-x :	31.602	k-ft
Mu-y	0.0	k-ft
0.9 * Mn-y :	31.602	k-ft

PASS Maximum Shear Stress Ratio **0.0** : 1

Load Combination	0.0	
Location of max.above base	0.0	ft
At maximum location values are . . .		
Vu : Applied	0.0	k
Vn * Phi : Allowable	0.0	k

Maximum Load Reactions . .

Top along X-X	0.02479 k
Bottom along X-X	0.02479 k
Top along Y-Y	0.02479 k
Bottom along Y-Y	0.02479 k

Maximum Load Deflections . . .

Along Y-Y -0.01226 in at 5.839 ft above base
for load combination : S Only

Along X-X -0.01226 in at 5.839 ft above base
for load combination : S Only

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios: Stress Ratio	Status	Location

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial (k) @ Base	Rx (k) @ Base	Rx (k) @ Top	Ry (k) @ Base	Ry (k) @ Top	Mx (k-ft) @ Base	Mx (k-ft) @ Top	My (k-ft) @ Base	My (k-ft) @ Top

Extreme Reactions

Item	Extreme Value	Axial (k) @ Base	Rx (k) @ Base	Rx (k) @ Top	Ry (k) @ Base	Ry (k) @ Top	Mx (k-ft) @ Base	Mx (k-ft) @ Top	My (k-ft) @ Base	My (k-ft) @ Top

Maximum Deflections for Load Combinations

Load Combination	Max. Deflection in X dir	Distance	Max. Deflection in Y dir	Distance

Steel Section Properties : HSS5x5x5/16

Steel Section Properties : HSS5x5x5/16

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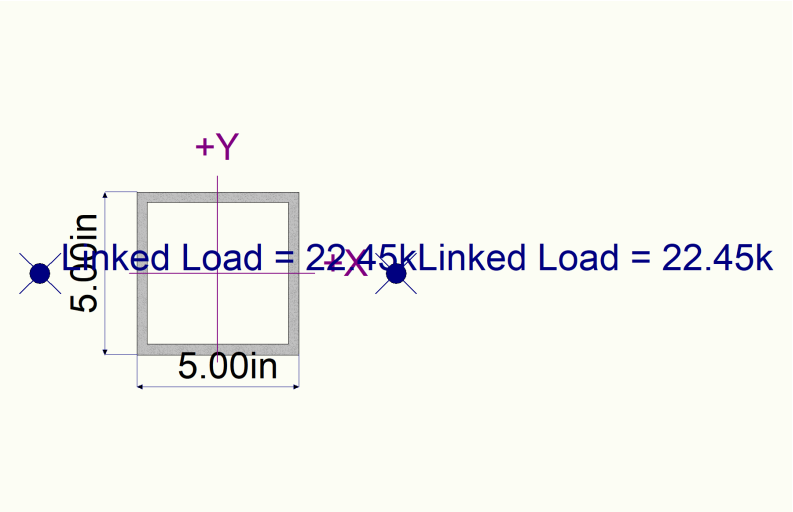
Steel Column

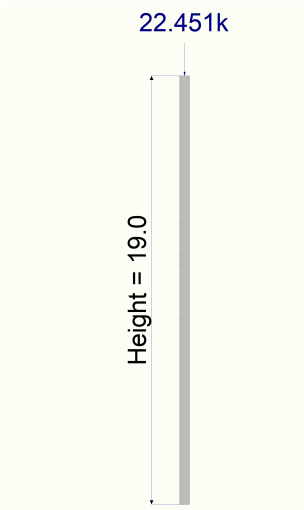
Project File: roof_framing_current.ec6

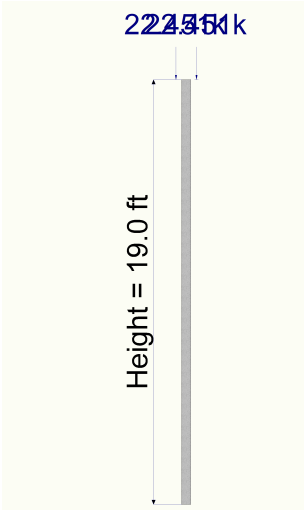
DESCRIPTION: C-1, TYP

Depth	=	5.000	in	I xx	=	19.00	in^4	J	=	31.200 in^4
Design Thick	=	0.291	in	S xx	=	7.62	in^3			
Width	=	5.000	in	R xx	=	1.900	in			
Wall Thick	=	0.313	in	Zx	=	9.160	in^3			
Area	=	5.260	in^2	I yy	=	19.000	in^4	C	=	12.800 in^3
Weight	=	19.080	plf	S yy	=	7.620	in^3			
				R yy	=	1.900	in			
Ycg	=	0.000	in							

Sketches







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Steel Column

Project File: roof_framing_current.ec6

DESCRIPTION: C-2

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : AISC 360-22
Load Combinations Used : ASCE 7-22 / IBC 2024

General Information

Steel Section Name : **HSS5x5x5/16**
Analysis Method : Load Resistance Factor
Steel Stress Grade
Fy : Steel Yield 46.0 ksi
E : Elastic Bending Modulus 29,000.0 ksi

Overall Column Height 19.0 ft
Top & Bottom Fixity Top & Bottom Pinned
Brace condition :
Unbraced Length for buckling ABOUT X-X Axis = 12 ft, K = 1.0
Unbraced Length for buckling ABOUT Y-Y Axis = 12 ft, K = 1.0

Applied Loads

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

Column self weight included : 362.520 lbs * Dead Load Factor
AXIAL LOADS . . .
+X High Beam: Axial Load at 19.0 ft, Xecc = 5.50 in, D = 2.060, LR = 1.80, S = 7.650, W = 1.440 k
-Y High Beam: Axial Load at 19.0 ft, Yecc = -3.0 in, D = 1.210, LR = 0.840, S = 3.570, W = 0.670 k
+X Low Beam: Axial Load at 12.0 ft, Xecc = 5.50 in, D = 1.210, LR = 0.840, S = 3.570, W = 0.670 k
LINKED AXIAL LOAD(s)
BM-2, Support 2: Axial Load at 12 ft, Yecc = -5.5 in,
D = 7.486 Lr = 2.612 S = 9.481 W = 0.3603 k
BM-3, Support 1: Axial Load at 12 ft, Yecc = 5.5 in,
D = 3.395 Lr = 3.084 S = 13.107 W = 2.467 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.5564** : 1
Load Combination +1.20D+S+0.50W
Location of max.above base 11.987 ft
At maximum location values are . . .
Pu 59.050 k
0.9 * Pn 147.972 k
Mu-x 0.9114 k-ft
0.9 * Mn-x : 31.602 k-ft
Mu-y -4.684 k-ft
0.9 * Mn-y : 31.602 k-ft

PASS Maximum Shear Stress Ratio **0.007859** : 1
Load Combination +1.20D+S+0.50W
Location of max.above base 0.0 ft
At maximum location values are . . .
Vu : Applied 0.3908 k
Vn * Phi : Allowable 49.720 k

Maximum Load Reactions . .
Top along X-X 0.2707 k
Bottom along X-X 0.2707 k
Top along Y-Y 0.1146 k
Bottom along Y-Y 0.1146 k

Maximum Load Deflections . . .
Along Y-Y 0.09113 in at 9.181 ft above base
for load combination :+D+Lr
Along X-X -0.3061 in at 10.329 ft above base
for load combination :S Only

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios: Stress Ratio	Status	Location
+1.40D	0.177	PASS	11.99 ft	1.49	1.46	75.79	75.79	0.003	PASS	0.00 ft
+1.20D+0.50Lr	0.179	PASS	11.99 ft	1.49	1.46	75.79	75.79	0.003	PASS	0.00 ft
+1.20D+0.30S	0.305	PASS	11.99 ft	1.49	1.46	75.79	75.79	0.004	PASS	0.00 ft
+1.20D+1.60Lr	0.339	PASS	11.99 ft	1.49	1.46	75.79	75.79	0.004	PASS	0.00 ft
+1.20D+1.60Lr+0.50W	0.360	PASS	11.99 ft	1.49	1.46	75.79	75.79	0.004	PASS	0.00 ft
+1.20D+S	0.536	PASS	11.99 ft	1.49	1.46	75.79	75.79	0.007	PASS	0.00 ft
+1.20D+S+0.50W	0.556	PASS	11.99 ft	1.49	1.46	75.79	75.79	0.008	PASS	0.00 ft
+1.20D+0.50Lr+W	0.202	PASS	11.99 ft	1.49	1.46	75.79	75.79	0.004	PASS	0.00 ft
+1.20D+0.30S+W	0.346	PASS	11.99 ft	1.49	1.46	75.79	75.79	0.005	PASS	0.00 ft
+0.90D+W	0.136	PASS	11.99 ft	1.49	1.46	75.79	75.79	0.002	PASS	0.00 ft
+1.20D+0.150S	0.184	PASS	11.99 ft	1.49	1.46	75.79	75.79	0.003	PASS	0.00 ft
+0.90D	0.114	PASS	11.99 ft	1.49	1.46	75.79	75.79	0.002	PASS	0.00 ft

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Steel Column

Project File: roof_framing_current.ec6

DESCRIPTION: C-2

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial (k) @ Base	Rx (k) @ Base	Rx (k) @ Top	Ry (k) @ Base	Ry (k) @ Top	Mx (k-ft) @ Base	Mx (k-ft) @ Top	My (k-ft) @ Base	My (k-ft) @ Top
D Only	15.724	0.079	-0.079	-0.115	0.115				
+D+Lr	24.900	0.143	-0.143	-0.114	0.114				
+D+0.70S	41.888	0.268	-0.268	-0.086	0.086				
+D+0.750Lr	22.606	0.127	-0.127	-0.114	0.114				
+D+0.5250S	35.347	0.221	-0.221	-0.093	0.093				
+D+0.60W	19.088	0.109	-0.109	-0.089	0.089				
+D+0.750Lr+0.450W	25.129	0.150	-0.150	-0.095	0.095				
+D+0.5250S+0.450W	37.870	0.244	-0.244	-0.074	0.074				
+0.60D+0.60W	12.799	0.078	-0.078	-0.044	0.044				
+D+0.10S	19.461	0.106	-0.106	-0.111	0.111				
+0.60D	9.434	0.047	-0.047	-0.069	0.069				
Lr Only	9.176	0.064	-0.064	0.000	-0.000				
S Only	37.378	0.271	-0.271	0.041	-0.041				
W Only	5.608	0.051	-0.051	0.042	-0.042				

Extreme Reactions

Item	Extreme Value	Axial (k) @ Base	Rx (k) @ Base	Rx (k) @ Top	Ry (k) @ Base	Ry (k) @ Top	Mx (k-ft) @ Base	Mx (k-ft) @ Top	My (k-ft) @ Base	My (k-ft) @ Top
Axial, Base Max		41.888								
Axial, Base Min		5.608								
Rx, Base Max			0.271							
Rx, Base Min			0.047							
Rx, Top Max				-0.047						
Rx, Top Min				-0.271						
Ry, Base Max					0.042					
Ry, Base Min					-0.115					
Ry, Top Max						0.115				
Ry, Top Min						-0.042				

Maximum Deflections for Load Combinations

Load Combination	Max. Deflection in X dir		Distance		Max. Deflection in Y dir		Distance	
D Only	-0.0860	in	10.201	ft	0.084	in	8.926	ft
+D+Lr	-0.1580	in	10.201	ft	0.091	in	9.181	ft
+D+0.70S	-0.3003	in	10.201	ft	0.090	in	10.074	ft
+D+0.750Lr	-0.1400	in	10.201	ft	0.089	in	9.054	ft
+D+0.5250S	-0.2467	in	10.201	ft	0.088	in	9.691	ft
+D+0.60W	-0.1206	in	10.201	ft	0.071	in	9.181	ft
+D+0.750Lr+0.450W	-0.1659	in	10.201	ft	0.080	in	9.309	ft
+D+0.5250S+0.450W	-0.2726	in	10.201	ft	0.079	in	10.074	ft
+0.60D+0.60W	-0.0862	in	10.201	ft	0.038	in	9.436	ft
+D+0.10S	-0.1166	in	10.201	ft	0.084	in	9.054	ft
+0.60D	-0.0516	in	10.201	ft	0.050	in	8.926	ft
Lr Only	-0.0720	in	10.329	ft	0.011	in	13.389	ft
S Only	-0.3061	in	10.329	ft	0.035	in	14.409	ft
W Only	-0.0576	in	10.329	ft	-0.021	in	7.906	ft

Steel Section Properties : HSS5x5x5/16

Steel Section Properties : HSS5x5x5/16

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Steel Column

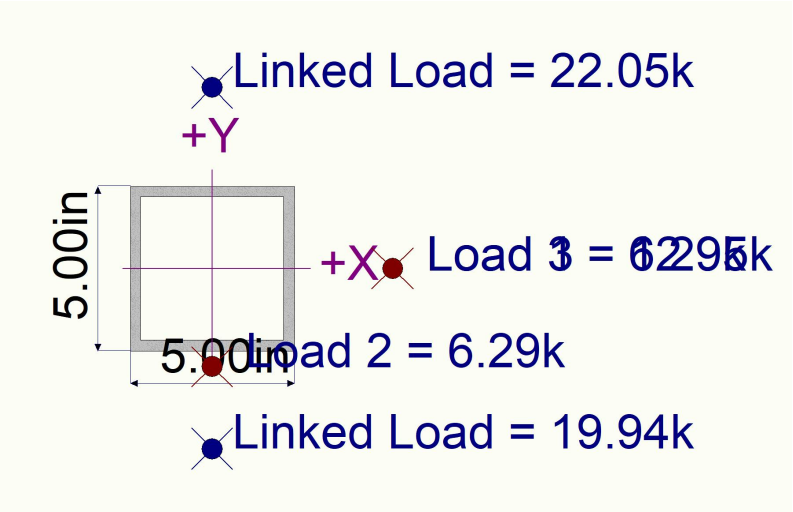
Project File: roof_framing_current.ec6

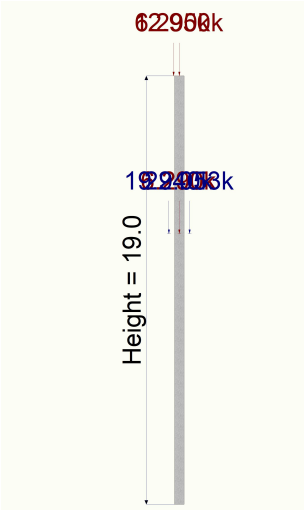
LIC# : KW-06016429, Build:20.25.10.02 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

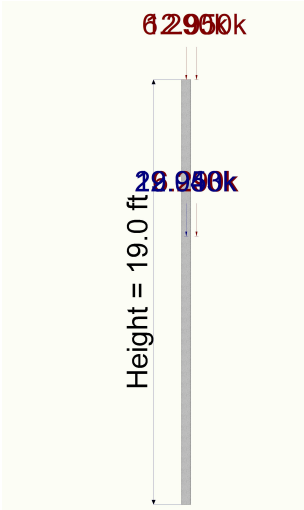
DESCRIPTION: C-2

Depth	=	5.000	in	I xx	=	19.00	in^4	J	=	31.200 in^4
Design Thick	=	0.291	in	S xx	=	7.62	in^3			
Width	=	5.000	in	R xx	=	1.900	in			
Wall Thick	=	0.313	in	Zx	=	9.160	in^3			
Area	=	5.260	in^2	I yy	=	19.000	in^4	C	=	12.800 in^3
Weight	=	19.080	plf	S yy	=	7.620	in^3			
				R yy	=	1.900	in			
Ycg	=	0.000	in							

Sketches







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Steel Column

Project File: roof_framing_current.ec6

LIC# : KW-06016429, Build:20.25.10.02 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: C-3

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : AISC 360-22
Load Combinations Used : ASCE 7-22 / IBC 2024

General Information

Steel Section Name : **HSS4x4x1/4**

Analysis Method :	Load Resistance Factor
Steel Stress Grade	
Fy : Steel Yield	46.0 ksi
E : Elastic Bending Modulus	29,000.0 ksi

Overall Column Height	10.0 ft
Top & Bottom Fixity	Top & Bottom Pinned
Brace condition :	

Unbraced Length for buckling ABOUT X-X Axis = 10.0 ft, K = 1.0
Unbraced Length for buckling ABOUT Y-Y Axis = 10.0 ft, K = 1.0

Applied Loads

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

Column self weight included : 122.10 lbs * Dead Load Factor
LINKED AXIAL LOAD(s)
BM-6, Support 1: Axial Load at 10 ft, Xecc = 2 in, Yecc = 2 in,
D = 0.4438 Lr = 0.350 S = 1.488 W = 0.280 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.05677** : 1

Load Combination	+1.20D+S+0.50W	
Location of max.above base	9.933	ft
At maximum location values are . . .		
Pu	2.307	k
0.9 * Pn	91.738	k
Mu-x	-0.3576	k-ft
0.9 * Mn-x :	16.181	k-ft
Mu-y	-0.3576	k-ft
0.9 * Mn-y :	16.181	k-ft

PASS Maximum Shear Stress Ratio **0.001131** : 1

Load Combination	+1.20D+S+0.50W	
Location of max.above base	0.0	ft
At maximum location values are . . .		
Vu : Applied	0.0360	k
Vn * Phi : Allowable	31.842	k

Maximum Load Reactions . .

Top along X-X	0.02479 k
Bottom along X-X	0.02479 k
Top along Y-Y	0.02479 k
Bottom along Y-Y	0.02479 k

Maximum Load Deflections . . .

Along Y-Y -0.01226 in at 5.839 ft above base
for load combination : S Only

Along X-X -0.01226 in at 5.839 ft above base
for load combination : S Only

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios: Stress Ratio	Status	Location

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial (k) @ Base	Rx (k) @ Base	Rx (k) @ Top	Ry (k) @ Base	Ry (k) @ Top	Mx (k-ft) @ Base	Mx (k-ft) @ Top	My (k-ft) @ Base	My (k-ft) @ Top

Extreme Reactions

Item	Extreme Value	Axial (k) @ Base	Rx (k) @ Base	Rx (k) @ Top	Ry (k) @ Base	Ry (k) @ Top	Mx (k-ft) @ Base	Mx (k-ft) @ Top	My (k-ft) @ Base	My (k-ft) @ Top

Maximum Deflections for Load Combinations

Load Combination	Max. Deflection in X dir	Distance	Max. Deflection in Y dir	Distance

Steel Section Properties : HSS4x4x1/4

Steel Section Properties : HSS4x4x1/4

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Steel Column

Project File: roof_framing_current.ec6

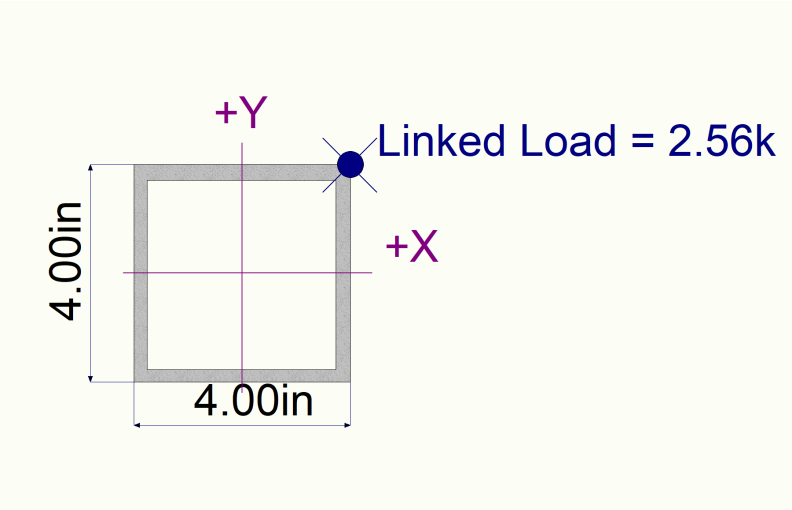
LIC# : KW-06016429, Build:20.25.10.02 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

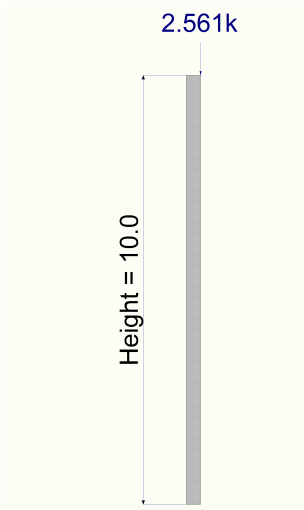
DESCRIPTION: C-3

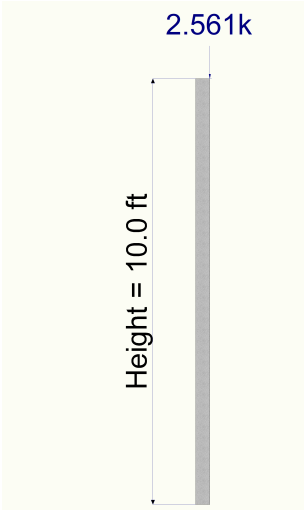
Depth	=	4.000	in	I xx	=	7.80	in^4	J	=	12.800	in^4
Design Thick	=	0.233	in	S xx	=	3.90	in^3				
Width	=	4.000	in	R xx	=	1.520	in				
Wall Thick	=	0.250	in	Zx	=	4.690	in^3				
Area	=	3.370	in^2	I yy	=	7.800	in^4	C	=	6.560	in^3
Weight	=	12.210	plf	S yy	=	3.900	in^3				
				R yy	=	1.520	in				

Ycg	=	0.000	in

Sketches







Company:	Kramer Gehlen & Associates	Page:	1
Address:	805 Broadway St. Suite 415	Specifier:	
Phone I Fax:	(360) 693-1621 |	E-Mail:	
Design:	Inside Corner Baseplate	Date:	10/30/2025
Fastening point:			

Specifier's comments:

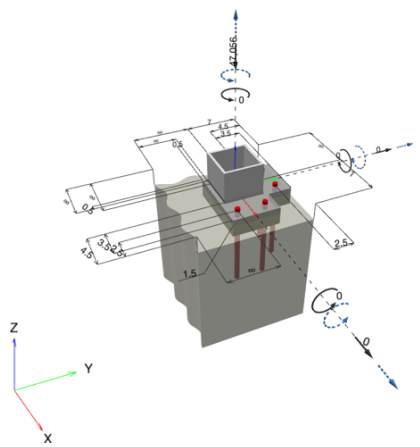
1 Anchor Design

1.1 Input data

Anchor type and diameter:	**Hex Head ASTM F 1554 GR. 36 5/8**
Item number:	not available
Specification text:	∅ 5/8 in Hex Head ASTM F 1554 GR. 36 with 8 in nominal embedment depth per Technical data , cast in place installation per MPII,
Effective embedment depth:	h_{ef} = 8.000 in.
Material:	ASTM F 1554
Evaluation Service Report:	Hilti Technical Data
Issued I Valid:	- | -
Proof:	Design Method ACI 318-19 / CIP
Shear edge breakout verification:	Row closest to edge (Case 3 only from ACI 318-19 Fig. R.17.7.2.1b)
Stand-off installation:	grouted standoff; restraint level (anchor plate): 2.00; e_b = 1.500 in.; t = 0.750 in.
	grout compressive strength > f_c' = 2,500 psi
Anchor plate[CBFEM] :	l_x x l_y x t = 9.000 in. x 9.000 in. x 0.750 in.;
Profile:	Square HSS (AISC), HSS5X5X.3125; (L x W x T) = 5.000 in. x 5.000 in. x 0.312 in.
Base material:	cracked concrete, 2500, f_c' = 2,500 psi; h = 60.000 in.
Reinforcement:	tension: not present, shear: not present;
	edge reinforcement: none or < No. 4 bar

[CBFEM] - The anchor calculation is based on a component-based Finite Element Method (CBFEM)

Geometry [in.] & Loading [lb, in.lb]



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Company:	Kramer Gehlen & Associates	Page:	2
Address:	805 Broadway St. Suite 415	Specifier:	
Phone I Fax:	(360) 693-1621 |	E-Mail:	
Design:	Inside Corner Baseplate	Date:	10/30/2025
Fastening point:			

1.1.1 Unfactored loads

	Sustained load factor	Load factor f_1 or f_2	V_x [lb]	V_y [lb]	N [lb]	M_x [in.lb]	M_y [in.lb]	M_z [in.lb]
D (Dead)	1.000	-	-	-	-14,840	-	-	-
F (Fluid)	1.000	-	-	-	-	-	-	-
T (Temperature)	1.000	-	-	-	-	-	-	-
L (Live)	1.000	0.500	-	-	-	-	-	-
H (Lateral)	1.000	-	-	-	-	-	-	-
L_r (Roof live)	1.000	-	-	-	-5,220	-	-	-
S (Snow)	1.000	0.200	-	-	-18,280	-	-	-
R (Rain)	-	-	-	-	-	-	-	-
W (Wind)	-	-	-	-	-	-	-	-
E (Earthquake)	-	-	-	-	-	-	-	-

1.1.2 Load combination and design results

1.1.2.1 Load combination

Load case	Load combination
Equation (16-1)	1.4 (D + F)
Equation (16-2a)	1.2 (D + F) + 1.6 (L + H) + 0.5 (L_r)
Equation (16-2b)	1.2 (D + F) + 1.6 (L + H) + 0.5 (S)
Equation (16-2c)	1.2 (D + F) + 1.6 (L + H) + 0.5 (R)
Equation (16-3a)	1.2 (D + F) + 1.6 (L_r) + 1.6 (H) + f_1L
Equation (16-3b)	1.2 (D + F) + 1.6 (S) + 1.6 (H) + f_1L
Equation (16-3c)	1.2 (D + F) + 1.6 (R) + 1.6 (H) + f_1L
Equation (16-3d)	1.2 (D + F) + 1.6 (L_r) + 1.6 (H) + (0.5 W)
Equation (16-3e)	1.2 (D + F) + 1.6 (S) + 1.6 (H) + (0.5 W)
Equation (16-3f)	1.2 (D + F) + 1.6 (R) + 1.6 (H) + (0.5 W)
Equation (16-4a)	1.2 (D + F) + 1.0 (W) + f_1L + 1.6 (H) + 0.5 (L_r)
Equation (16-4b)	1.2 (D + F) + 1.0 (W) + f_1L + 1.6 (H) + 0.5 (S)
Equation (16-4c)	1.2 (D + F) + 1.0 (W) + f_1L + 1.6 (H) + 0.5 (R)
Equation (16-5)	1.2 (D + F) + 1.0 (E) + f_1L + 1.6 (H) + f_2S
Equation (16-6)	0.9 (D) + 1.0 (W) + 1.6 (H)
Equation (16-7)	0.9 (D + F) + 1.0 (E) + 1.6 (H)

Input data and results must be checked for conformity with the existing conditions and for plausibility!
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Company:	Kramer Gehlen & Associates	Page:	3
Address:	805 Broadway St. Suite 415	Specifier:	
Phone I Fax:	(360) 693-1621 |	E-Mail:	
Design:	Inside Corner Baseplate	Date:	10/30/2025
Fastening point:			

1.1.2.2 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
Equation (16-1)	1.4 (D + F)	N = -20,776; V_x = 0; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	no	1
Equation (16-2a)	1.2 (D + F) + 1.6 (L + H) + 0.5 (L_r)	N = -20,418; V_x = 0; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	no	1
Equation (16-2b)	1.2 (D + F) + 1.6 (L + H) + 0.5 (S)	N = -26,948; V_x = 0; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	no	1
Equation (16-2c)	1.2 (D + F) + 1.6 (L + H) + 0.5 (R)	N = -17,808; V_x = 0; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	no	1
Equation (16-3a)	1.2 (D + F) + 1.6 (L_r) + 1.6 (H) + f_1L	N = -26,160; V_x = 0; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	no	1
Equation (16-3b)	1.2 (D + F) + 1.6 (S) + 1.6 (H) + f_1L	N = -47,056; V_x = 0; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	no	2
Equation (16-3c)	1.2 (D + F) + 1.6 (R) + 1.6 (H) + f_1L	N = -17,808; V_x = 0; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	no	1
Equation (16-3d)	1.2 (D + F) + 1.6 (L_r) + 1.6 (H) + (0.5 W)	N = -26,160; V_x = 0; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	no	1
Equation (16-3e)	1.2 (D + F) + 1.6 (S) + 1.6 (H) + (0.5 W)	N = -47,056; V_x = 0; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	no	2
Equation (16-3f)	1.2 (D + F) + 1.6 (R) + 1.6 (H) + (0.5 W)	N = -17,808; V_x = 0; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	no	1
Equation (16-4a)	1.2 (D + F) + 1.0 (W) + f_1L + 1.6 (H) + 0.5 (L_r)	N = -20,418; V_x = 0; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	no	1
Equation (16-4b)	1.2 (D + F) + 1.0 (W) + f_1L + 1.6 (H) + 0.5 (S)	N = -26,948; V_x = 0; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	no	1
Equation (16-4c)	1.2 (D + F) + 1.0 (W) + f_1L + 1.6 (H) + 0.5 (R)	N = -17,808; V_x = 0; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	no	1
Equation (16-5)	1.2 (D + F) + 1.0 (E) + f_1L + 1.6 (H) + f_2S	N = -21,464; V_x = 0; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	no	1
Equation (16-6)	0.9 (D) + 1.0 (W) + 1.6 (H)	N = -13,356; V_x = 0; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	no	1
Equation (16-7)	0.9 (D + F) + 1.0 (E) + 1.6 (H)	N = -13,356; V_x = 0; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	no	1

Input data and results must be checked for conformity with the existing conditions and for plausibility!
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Company:	Kramer Gehlen & Associates	Page:	4
Address:	805 Broadway St. Suite 415	Specifier:	
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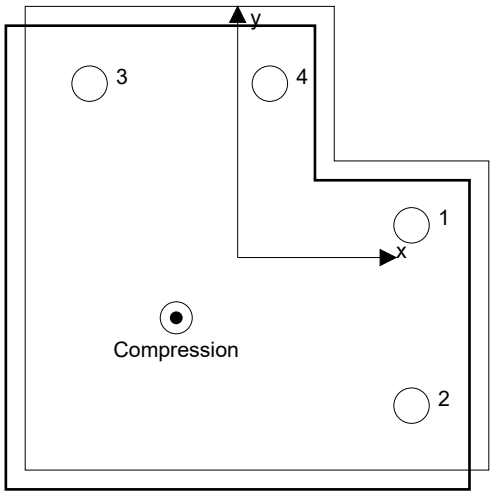
Design:	Inside Corner Baseplate	Date:	10/30/2025
Fastening point:			

1.2 Load case/Resulting anchor forces

Controlling load case: Equation (16-3e) 1.2 (D + F) + 1.6 (S) + 1.6 (H) + (0.5 W)



Anchor reactions [lb]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	-0	4	0	-4
2	-1	8	7	-4
3	-1	8	-4	7
4	-0	4	-4	0

Resulting tension force in (x/y)=(-/-): 0 [lb]
Resulting compression force in (x/y)=(-1.567/-1.545): 47,111 [lb]

Anchor forces are calculated based on a component-based Finite Element Method (CBFEM)

1.3 Tension load

	Load N_{ua} [lb]	Capacity ϕ N_n [lb]	Utilization $\beta_N = N_{ua}/\phi$ N_n	Status
Steel Strength*	-1	9,831	1	OK
Pullout Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	N/A	N/A	N/A	N/A
Concrete Side-Face Blowout, direction **	N/A	N/A	N/A	N/A

* highest loaded anchor **anchor group (anchors in tension)

Input data and results must be checked for conformity with the existing conditions and for plausibility!
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Company:	Kramer Gehlen & Associates	Page:	5
Address:	805 Broadway St. Suite 415	Specifier:	
Phone I Fax:	(360) 693-1621 |	E-Mail:	
Design:	Inside Corner Baseplate	Date:	10/30/2025
Fastening point:			

1.3.1 Steel Strength

$N_{sa} = A_{se,N}\, f_{uta}$ ACI 318-19 Eq. (17.6.1.2)

$\phi\ N_{sa} \geq N_{ua}$ ACI 318-19 Table 17.5.2

Variables

$A_{se,N}$ [in.^{2}]	f_{uta} [psi]
0.23	58,000

Calculations

N_{sa} [lb]
13,108

Results

N_{sa} [lb]	ϕ_{steel}	$\phi\ N_{sa}$ [lb]	N_{ua} [lb]
13,108	0.750	9,831	-1

The steel proof was done for the highest absolute force per anchor - in this case compression loading. Please be aware that buckling should be verified separately

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Company:	Kramer Gehlen & Associates	Page:	6
Address:	805 Broadway St. Suite 415	Specifier:	
Phone I Fax:	(360) 693-1621 |	E-Mail:	
Design:	Inside Corner Baseplate	Date:	10/30/2025
Fastening point:			

1.4 Shear load

	Load V_{ua} [lb]	Capacity $\phi\ V_n$ [lb]	Utilization $\beta_V = V_{ua}/\phi\ V_n$	Status
Steel Strength*	8	4,090	1	OK
Steel failure (with lever arm)*	8	593	2	OK
Pryout Strength*	8	6,202	1	OK
Concrete edge failure in direction x+**	11	1,291	1	OK

* highest loaded anchor **anchor group (relevant anchors)
When the input edge distance is set to "infinity", edge breakout verification is not performed in that direction

1.4.1 Steel Strength

$V_{sa} = 0.6\ A_{se,V}\ f_{uta}$ ACI 318-19 Eq. (17.7.1.2b)
$\phi\ V_{steel} \geq V_{ua}$ ACI 318-19 Table 17.5.2

Variables

$A_{se,V}$ [in.^{2}]	f_{uta} [psi]
0.23	58,000

Calculations

V_{sa} [lb]
7,865

Results

V_{sa} [lb]	ϕ_{steel}	ϕ_{eb}	$\phi\ V_{sa}$ [lb]	V_{ua} [lb]
7,865	0.650	0.800	4,090	8

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Company:	Kramer Gehlen & Associates	Page:	7
Address:	805 Broadway St. Suite 415	Specifier:	
Phone I Fax:	(360) 693-1621 |	E-Mail:	
Design:	Inside Corner Baseplate	Date:	10/30/2025
Fastening point:			

1.4.2 Steel failure (with lever arm)

V_s^M	$= \frac{\alpha_M \cdot M_s}{L_b}$	bending equation for stand-off
M_s	$= M_s^0 \left(1 - \frac{N_{ua}}{\phi N_{sa}}\right)$	resultant flexural resistance of anchor
M_s^0	$= (1.2)\ (S)\ (f_{u,min})$	characteristic flexural resistance of anchor
$\left(1 - \frac{N_{ua}}{\phi N_{sa}}\right)$		reduction for tensile force acting simultaneously with a shear force on the anchor
S	$= \frac{\pi (d)^3}{32}$	elastic section modulus of anchor bolt at concrete surface
L_b	$= z + (n)(d_0)$	internal lever arm adjusted for spalling of the surface concrete
ϕV_s^M	$\geq V_{ua}$	ACI 318-19 Table 17.5.2

Variables

α_M	$f_{u,min}$ [psi]	N_{ua} [lb]	ϕN_{sa} [lb]	z [in.]	n	d_0 [in.]
2.00	58,000	-1	9,831	1.875	0.500	0.625

Calculations

M_s^0 [in.lb]	$\left(1 - \frac{N_{ua}}{\phi N_{sa}}\right)$	M_s [in.lb]	L_b [in.]
998	1.000	998	2.187

Results

V_s^M [lb]	ϕ_{steel}	ϕV_s^M [lb]	V_{ua} [lb]
912	0.650	593	8

Input data and results must be checked for conformity with the existing conditions and for plausibility!
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Company:	Kramer Gehlen & Associates	Page:	8
Address:	805 Broadway St. Suite 415	Specifier:	
Phone I Fax:	(360) 693-1621 |	E-Mail:	
Design:	Inside Corner Baseplate	Date:	10/30/2025
Fastening point:			

1.4.3 Pryout Strength

$V_{cp} = k_{cp} \left[\left(\frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ed,N} \; \psi_{c,N} \; \psi_{cp,N} \; N_b \right]$ ACI 318-19 Eq. (17.7.3.1a)

$\phi \; V_{cp} \geq V_{ua}$ ACI 318-19 Table 17.5.2

A_{Nc} see ACI 318-19, Section 17.6.2.1, Fig. R 17.6.2.1(b)

$A_{Nc0} = 9 \, h_{ef}^2$ ACI 318-19 Eq. (17.6.2.1.4)

$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2 \, e'_N}{3 \, h_{ef}}} \right) \leq 1.0$ ACI 318-19 Eq. (17.6.2.3.1)

$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}} \right) \leq 1.0$ ACI 318-19 Eq. (17.6.2.4.1b)

$\psi_{cp,N} = \text{MAX} \left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}} \right) \leq 1.0$ ACI 318-19 Eq. (17.6.2.6.1b)

$N_b = k_c \; \lambda_a \; \sqrt{f'_c} \; h_{ef}^{1.5}$ ACI 318-19 Eq. (17.6.2.2.1)

Variables

k_{cp}	h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]
2	8.000	0.000	0.000	2.500

$\psi_{c,N}$	c_{ac} [in.]	k_c	λ_a	f'_c [psi]
1.000	-	24	1.000	2,500

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
123.25	576.00	1.000	1.000	0.763	1.000	27,153

Results

V_{cp} [lb]	$\phi_{concrete}$	$\phi \; V_{cp}$ [lb]	V_{ua} [lb]
8,860	0.700	6,202	8

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Company:	Kramer Gehlen & Associates	Page:	9
Address:	805 Broadway St. Suite 415	Specifier:	
Phone I Fax:	(360) 693-1621 |	E-Mail:	
Design:	Inside Corner Baseplate	Date:	10/30/2025
Fastening point:			

1.4.4 Concrete edge failure in direction x+

$V_{cbg} = \left(\frac{A_{Vc}}{A_{Vc0}}\right) \psi_{ec,V}\ \psi_{ed,V}\ \psi_{c,V}\ \psi_{h,V}\ \psi_{parallel,V}\ V_b$ — ACI 318-19 Eq. (17.7.2.1b)

$\phi\ V_{cbg} \geq V_{ua}$ — ACI 318-19 Table 17.5.2

A_{Vc} see ACI 318-19, Section 17.7.2.1, Fig. R 17.7.2.1(b)*

$A_{Vc0} = 4.5\ c_{a1}^2$ — ACI 318-19 Eq. (17.7.2.1.3)

$\psi_{ec,V} = \left(\frac{1}{1 + \frac{e_v'}{1.5c_{a1}}}\right) \leq 1.0$ — ACI 318-19 Eq. (17.7.2.3.1)

$\psi_{ed,V} = 0.7 + 0.3\left(\frac{c_{a2}}{1.5c_{a1}}\right) \leq 1.0$ — ACI 318-19 Eq. (17.7.2.4.1b)

$\psi_{h,V} = \sqrt{\frac{1.5c_{a1}}{h_a}} \geq 1.0$ — ACI 318-19 Eq. (17.7.2.6.1)

$V_b = \left(7\left(\frac{l_e}{d_a}\right)^{0.2} \sqrt{d_a}\right) \lambda_a \sqrt{f_c'}\ c_{a1}^{1.5}$ — ACI 318-19 Eq. (17.7.2.2.1a)

Variables

c_{a1} [in.]	c_{a2} [in.]	e_{cV} [in.]	$\psi_{c,V}$	h_a [in.]
2.500	5.250	1.192	1.000	60.000

l_e [in.]	λ_a	d_a [in.]	f_c' [psi]	$\psi_{parallel,V}$
5.000	1.000	0.625	2,500	1.000

Calculations

A_{Vc} [in.^{2}]	A_{Vc0} [in.^{2}]	$\psi_{ec,V}$	$\psi_{ed,V}$	$\psi_{h,V}$	V_b [lb]
41.25	28.13	0.759	1.000	1.000	1,658

Results

V_{cbg} [lb]	$\phi_{concrete}$	$\phi\ V_{cbg}$ [lb]	V_{ua} [lb]
1,845	0.700	1,291	11

*Anchor row defined by: Anchor 1, 2; Case 3 controls

When the input edge distance is set to "infinity", edge breakout verification is not performed in that direction

1.5 Combined tension and shear loads, per ACI 318-19 section 17.8

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.000	0.014	5/3	1	OK

$\beta_{NV} = \beta_N^{\zeta} + \beta_V^{\zeta} <= 1$

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Company:	Kramer Gehlen & Associates	Page:	10
Address:	805 Broadway St. Suite 415	Specifier:	
Phone I Fax:	(360) 693-1621 |	E-Mail:	
Design:	Inside Corner Baseplate	Date:	10/30/2025
Fastening point:			

1.6 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (ETAG 001/Annex C, EOTA TR029, etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid base plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- The equations presented in this report are based on imperial units. When inputs are displayed in metric units, the user should be aware that the equations remain in their imperial format.
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- ACI 318 does not specifically address anchor bending when a stand-off condition exists. PROFIS Engineering calculates a shear load corresponding to anchor bending when stand-off exists and includes the results as a shear Design Strength!
- For additional information about ACI 318 strength design provisions, please go to https://viewer.joomag.com/profis-design-guide-us-en-summer-2021/0841849001625154758?short&/
- Attention! In case of compressive anchor forces a buckling check as well as the proof of the local load transfer into and within the base material (incl. punching) has to be done separately.
- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (EN1992-4, AS5216, etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with FEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!

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Company:	Kramer Gehlen & Associates	Page:	11
Address:	805 Broadway St. Suite 415	Specifier:	
Phone I Fax:	(360) 693-1621 |	E-Mail:	
Design:	Inside Corner Baseplate	Date:	10/30/2025
Fastening point:			

1.7 Installation data

Profile: Square HSS (AISC), HSS5X5X.3125; (L x W x T) = 5.000 in. x 5.000 in. x 0.312 in.

Hole diameter in the fixture: d_f = 0.687 in.

Plate thickness (input): 0.750 in.

Anchor type and diameter: Hex Head ASTM F 1554 GR. 36 5/8

Item number: not available

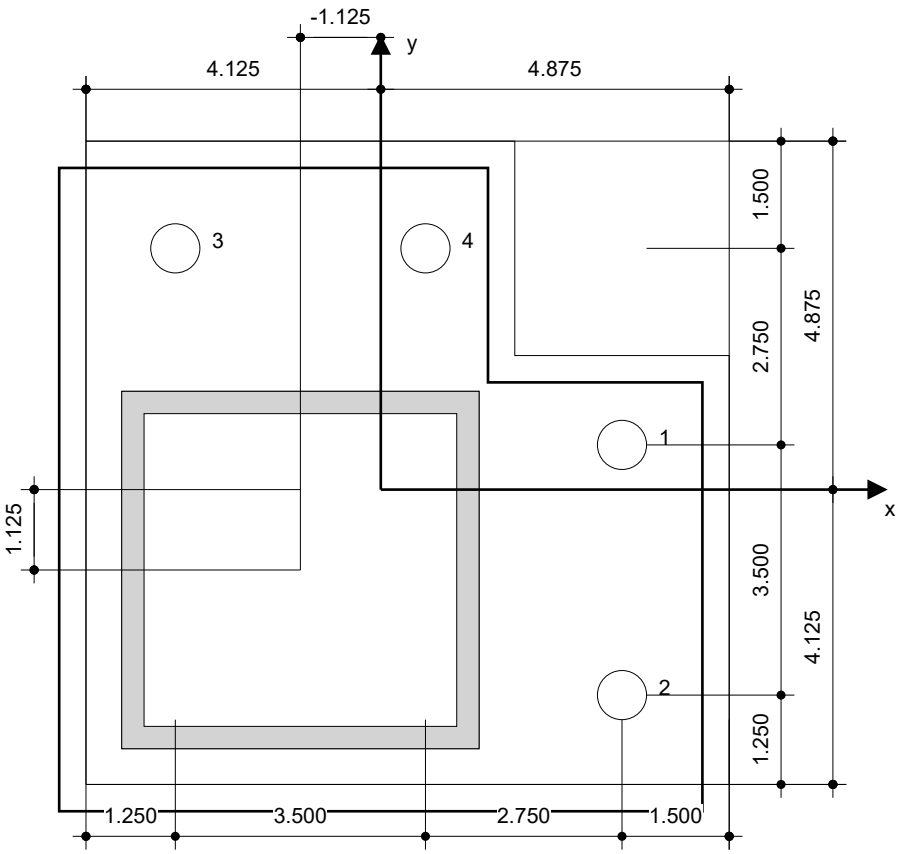
Maximum installation torque: -

Hole diameter in the base material: - in.

Hole depth in the base material: 8.000 in.

Minimum thickness of the base material: 8.922 in.

∅ 5/8 in Hex Head ASTM F 1554 GR. 36 with 8 in nominal embedment depth per Technical data , cast in place installation per MPII



Coordinates Anchor [in.]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	3.375	0.625	-	2.500	-	5.250
2	3.375	-2.875	-	2.500	-	8.750
3	-2.875	3.375	-	8.750	-	2.500
4	0.625	3.375	-	5.250	-	2.500

Input data and results must be checked for conformity with the existing conditions and for plausibility!
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2 Anchor plate design

2.1 Input data

Anchor plate:	Shape: Custom l_x x l_y x t = 9.000 in x 9.000 in x 0.750 in Calculation: CBFEM Material: ASTM A36; F_y = 36,000 psi; ε_{lim} = 5.00%
Anchor type and size:	Hex Head ASTM F 1554 GR. 36 5/8, h_{ef} = 8.000 in
Anchor stiffness:	The anchor is modeled considering stiffness values determined from load displacement curves tested in an independent laboratory. Please note that no simple replacement of the anchor is possible as the anchor stiffness has a major impact on the load distribution results.
Design method:	AISC and LRFD-based design using component-based FEM
Stand-off installation:	e_b = 1.500 in (Stand-off with grouting); t = 0.750 in
Profile:	HSS5X5X.3125; (L x W x T x FT) = 5.000 in x 5.000 in x 0.313 in x - Material: ASTM A500 Gr.B Rect; F_y = 46,000 psi; ε_{lim} = 5.00% Eccentricity x: -1.125 in Eccentricity y: -1.125 in
Base material:	Cracked concrete; 2500; $f_{c,cyl}$ = 2,500 psi; h = 60.000 in
Welds (profile to anchor plate):	Type of redistribution: Plastic Material: E70xx
Mesh size:	Number of elements on edge: 8 Min. size of element: 0.394 in Max. size of element: 1.969 in

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2.2 Summary

	Description	Profile		Anchor plate			Welds [%]	Concrete [%]
		σ_{Ed} [psi]	ε_{Pl} [%]	σ_{Ed} [psi]	ε_{Pl} [%]	Hole bearing [%]		
1	Equation (16-1)	6,836	0.00	3,783	0.00	1	21	19
2	Equation (16-2a)	6,718	0.00	3,718	0.00	1	20	19
3	Equation (16-2b)	8,867	0.00	4,907	0.00	1	27	25
4	Equation (16-2c)	5,860	0.00	3,242	0.00	1	18	16
5	Equation (16-3a)	8,608	0.00	4,763	0.00	1	26	24
6	**Equation (16-3b)**	**15,483**	**0.00**	**8,568**	**0.00**	**1**	**46**	**43**
7	Equation (16-3c)	5,860	0.00	3,242	0.00	1	18	16
8	Equation (16-3d)	8,608	0.00	4,763	0.00	1	26	24
9	Equation (16-3e)	15,483	0.00	8,568	0.00	1	46	43
10	Equation (16-3f)	5,860	0.00	3,242	0.00	1	18	16
11	Equation (16-4a)	6,718	0.00	3,718	0.00	1	20	19
12	Equation (16-4b)	8,867	0.00	4,907	0.00	1	27	25
13	Equation (16-4c)	5,860	0.00	3,242	0.00	1	18	16
14	Equation (16-5)	7,063	0.00	3,908	0.00	1	21	20
15	Equation (16-6)	4,395	0.00	2,432	0.00	1	14	12
16	Equation (16-7)	4,395	0.00	2,432	0.00	1	14	12

2.3 Anchor plate classification

Results below are displayed for the decisive load combinations: Equation (16-3b)

Anchor tension forces	Equivalent rigid anchor plate (CBFEM)	Component-based Finite Element Method (CBFEM) anchor plate design
Anchor 1	0 lb	-0 lb
Anchor 2	-2 lb	-1 lb
Anchor 3	-2 lb	-1 lb
Anchor 4	0 lb	-0 lb

User accepted to consider the selected anchor plate as rigid by his/her engineering judgement. This means the anchor design guidelines can be applied.

2.4 Profile/Stiffeners/Plate

Profile and stiffeners are verified at the level of the steel to concrete connection. The connection design does not replace the steel design for critical cross sections, which should be performed outside of PROFIS Engineering.

2.4.1 Equivalent stress and plastic strain

Part	Load combination	Material	f_y [psi]	ε_{lim} [%]	σ_{Ed} [psi]	ε_{Pl} [%]	Status
Plate	Equation (16-3b)	ASTM A36	36,000	5.00	8,568	0.00	OK
Profile	Equation (16-3b)	ASTM A500 Gr.B Rect	46,000	5.00	8,506	0.00	OK
Profile	Equation (16-3b)	ASTM A500 Gr.B Rect	46,000	5.00	10,914	0.00	OK
Profile	Equation (16-3b)	ASTM A500 Gr.B Rect	46,000	5.00	10,688	0.00	OK
Profile	Equation (16-3b)	ASTM A500 Gr.B Rect	46,000	5.00	15,483	0.00	OK

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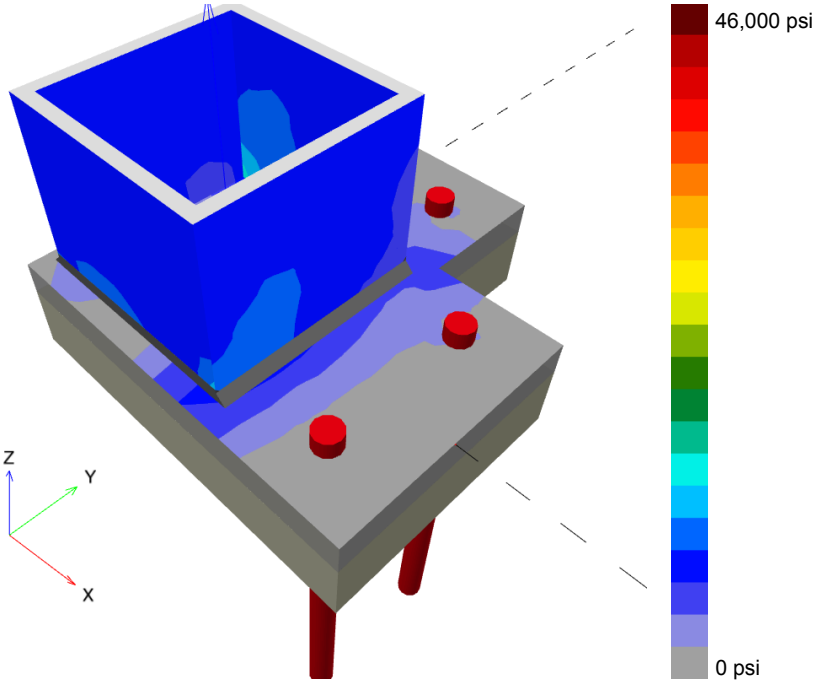
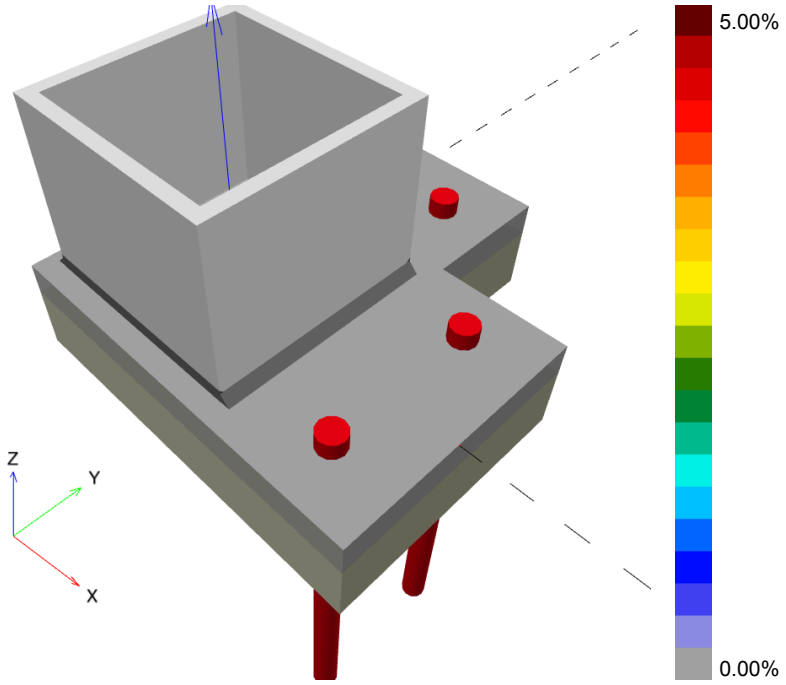
2.4.1.1 Equivalent stress

Results below are displayed for the decisive load combination: 6 - Equation (16-3b)



2.4.1.2 Plastic strain

Results below are displayed for the decisive load combination: 1 - Equation (16-1)



2.4.2 Plate hole bearing resistance, AISC 360-16 Section J3

Decisive load combination: 6 - Equation (16-3b)

Equations

R_n = min(1.2 l_c t F_u , 2.4 d t F_u) (AISC 360-16 J3-6a, c)

ϕR_n = 0.75 R_n

V ≤ ϕR_n

Variables

	l_c [in]	t [in]	F_u [psi]	d [in]	R_n [lb]
Anchor 1	0.907	0.750	58,000	0.625	47,341
Anchor 2	8.016	0.750	58,000	0.625	65,250
Anchor 3	8.103	0.750	58,000	0.625	65,250
Anchor 4	0.908	0.750	58,000	0.625	47,399

Results

	V [lb]	ϕR_n [lb]	Utilization [%]	Status
Anchor 1	4	35,506	1	OK
Anchor 2	8	48,938	1	OK
Anchor 3	8	48,938	1	OK
Anchor 4	4	35,549	1	OK

2.5 Welds

Profiles are modeled without taking the corner radius into account. Special rules for welding (e.g. for cold-formed profiles ...) are not taken into account by the software.

2.5.1 Anchor plate to profile

Decisive load combination: 6 - Equation (16-3b)

Equations

$$F_{nw} = 0.6\, F_{EXX}\, (1.0 + 0.5\sin^{1.5}\Theta)$$

$$\phi R_n = \phi\, F_{nw}\, A_w$$

$$\text{Utilization} = \frac{F_n}{\phi\, R_n}$$

Variables

Edge	X_u	T_h [in]	L_s [in]	L [in]	L_c [in]	F_{EXX} [psi]	Θ [°]	A_w [in²]
Member 1-tfl 1	E70xx	◢0.157	0.223	4.982	0.554	70,000	49.7	0.09
Member 1-bfl 1	E70xx	0.157◣	0.223	4.965	0.552	70,000	83.4	0.09

Results

Edge	F_n [lb]	ϕR_n [lb]	Utilization [%]	Status
Member 1-tfl 1	1,683	3,660	46	OK
Member 1-bfl 1	1,801	4,091	45	OK

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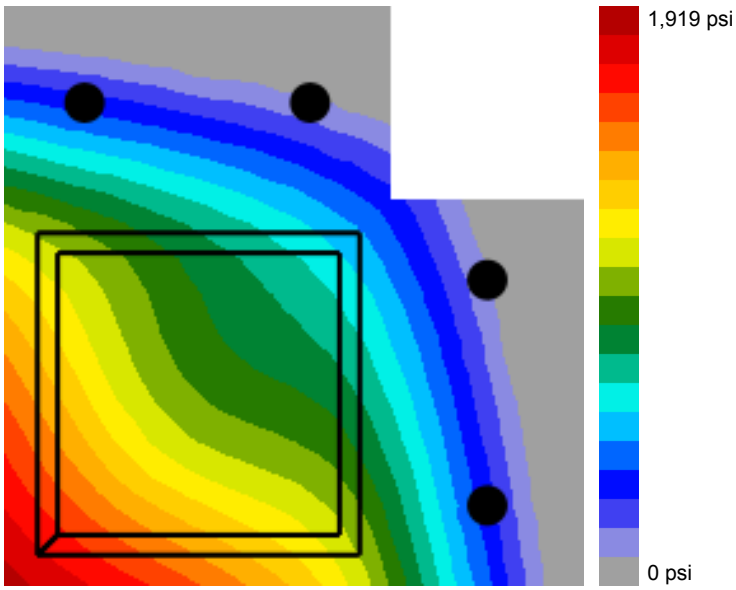
2.6 Concrete

Decisive load combination: 6 - Equation (16-3b)

2.6.1 Compression in concrete under the anchor plate



2.6.2 Concrete block compressive strength resistance check, AISC 360-16 Section J8

Equations

$$F_p = \phi\, f_{p,max}$$

$$f_{p,max} = 0.85\, f_c' \sqrt{\left(\frac{A_2}{A_1}\right)} \le 1.7\, f_c' \sqrt{\left(\frac{A_2}{A_1}\right)} \le 2$$

$$\sigma = \frac{N}{A_1}$$

$$\text{Utilization} = \frac{\sigma}{F_p}$$

Variables

N [lb]	f_c' [psi]	ϕ	A_1 [in²]	A_2 [in²]
47,111	2,500	0.65	54.01	122.01

Results

Load combination	F_p [psi]	σ [psi]	Utilization [%]	Status
Equation (16-3b)	2,076	872	43	OK

2.7 Symbol explanation

A_1	Loaded area of concrete
A_2	Supporting area
A_w	Effective area of weld critical element
d	Nominal diameter of the bolt
ε_{lim}	Limit plastic strain
ε_{Pl}	Plastic strain from CBFEM results
f_c	Concrete compressive strength
f_c'	Concrete compressive strength
F_{EXX}	Electrode classification number, i.e. minimum specified tensile strength
F_u	Specified minimum tensile strength of the connected material
F_n	Force in weld critical element
F_{nw}	Nominal stress of the weld material
F_p	Concrete block design bearing strength
$f_{p,max}$	Concrete block design bearing strength maximum
f_y	Yield strength
l_c	Clear distance, in the direction of the force, between the edge of the hole and the edge of the adjacent hole or edge of the material
L	Length of weld
L_c	Length of weld critical element
L_s	Leg size of weld
N	Resulting compression force
σ	Average stress in concrete
σ_{Ed}	Equivalent stress
ϕ	Resistance factor
ϕR_n	Factored resistance
R_n	Resistance
t	Thickness of the anchor plate
Θ	Angle of loading measured from the weld longitudinal axis
T_h	Throat thickness of weld
V	Resultant of shear forces Vy, Vz in bolt.
X_u	Filler metal tensile strength

2.8 Warnings

- By using the CBFEM calculation functionality of PROFIS Engineering you may act outside the applicable design codes and your specified anchor plate may not behave rigid. Please, validate the results with a professional designer and/or structural engineer to ensure suitability and adequacy for your specific jurisdiction and project requirements.
- The anchor is modeled considering stiffness values determined from load displacement curves tested in an independent laboratory. Please note that no simple replacement of the anchor is possible as the anchor stiffness has a major impact on the load distribution results.

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3 Summary of results

Design of the anchor plate, anchors, welds and other elements are based on CBFEM (component based finite element method) and AISC.

	Load combination	Max. utilization	Status
Anchors	Equation (16-3e)	2%	OK
Anchor plate	Equation (16-3b)	24%	OK
Welds	Equation (16-3b)	46%	OK
Concrete	Equation (16-3b)	43%	OK
Profile	Equation (16-3b)	34%	OK

Fastening meets the design criteria!

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4 Remarks; Your Cooperation Duties

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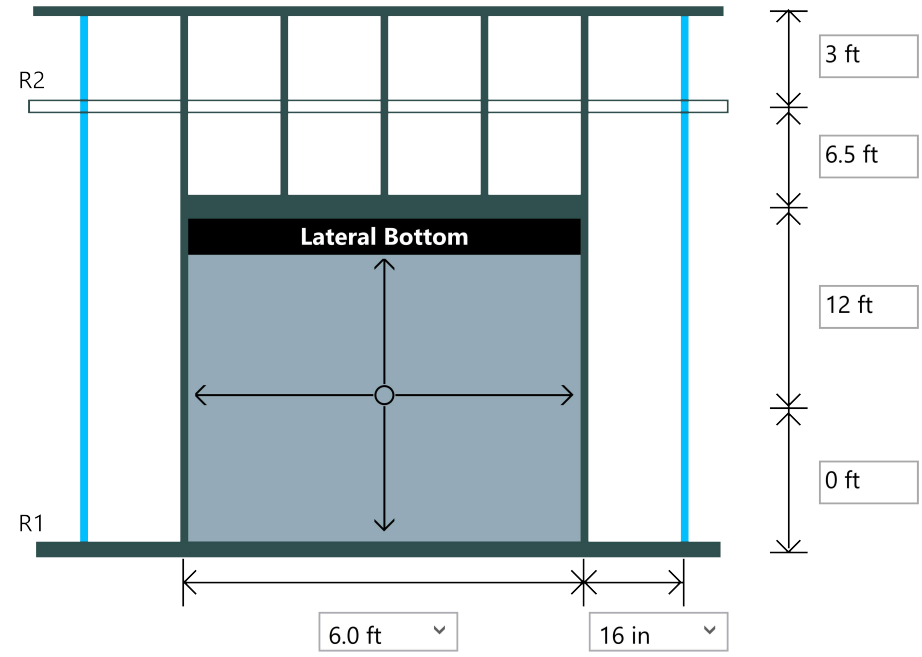


Lateral Pressure to: 4-Ways

Design Loads

Wall Lateral Pressure :	**19 psf**
Parapet Lateral Pressure :	**19 psf**
RO Lateral Pressure :	**4-Ways**
Lateral element force multiplier	
Strength :	**1.0**
Deflection :	**0.7**
Header:	**Box (lateral top, bottom)**
Gravity Load at Header:	**48 psf**
Cant. Deflection:	**2 x Cantilever**

Back-to-Back Member L/6 Interconnection Spacing per AISI S100 D1.1

Member	Span	Cantilever
Jamb Studs	37.0 in	6.0 in

See AISI S100 D1.1 for Add'nl Requirements

Brace Settings

Component(s)	Members(s)	Flexural Bracing	Axial KyLy	Axial KtLt	Distortional K-Phi(lb-in/in)	Distortional Lm	Interconnection Spacing
Wall Studs	600S200-68(50), Single@16 in o/c	Full	60 in	60 in	0	None	N/A
Jamb Studs	600S200-68(50), Back-To-Back	Full	60 in	60 in	0	None	12 in
Vertical Header	600S200-68(50), Boxed	Full	N/A	N/A	0	None	N/A
Lat. Top Head	600T125-43(33), Single	Full	N/A	N/A	0	None	N/A
Lat. Bottom Head	600T125-43(33), Single	Full	N/A	N/A	0	None	N/A

Analysis Results

Component(s)	Members(s)	Axial Load (lb)	Max KL/r	Max. Moment (ft-lb)	Max. Shear (lb)	Bottom Reaction (lb)	Top or End Reaction (lb)
Wall Studs	600S200-68(50), Single@16 in o/c	0.0	N/A	1027.5	240.5	228.2	316.5
Jamb Studs	600S200-68(50), Back-To-Back	1368.0	96	2740.2	542.0	627.5	474.7
Vertical Header	600S200-68(50), Boxed	N/A	N/A	2052.0	1368.0	N/A	1368.0
Lat. Top Head	600T125-43(33), Single	N/A	N/A	218.7	145.8	N/A	145.8
Lat. Bottom Head	600T125-43(33), Single	N/A	N/A	171.0	85.5	N/A	85.5

Design Results

Component(s)	Members(s)	Deflection Span	Deflection Parapet	A + M Interaction	V + M Interaction	Web Stiffners	Design OK
Wall Studs	600S200-68(50), Single@16 in o/c	L/613	L/407	0.311	0.05	NA	Yes
Jamb Studs	600S200-68(50), Back-To-Back	L/463	L/304	0.502	0.38	NA	Yes
Vertical Header	600S200-68(50), Boxed	L/1310	NA	0.28	0.28	No	Yes
Lat. Top Head	600T125-43(33), Single	L/3786	NA	0.29	0.29	No	Yes
Lat. Bottom Head	600T125-43(33), Single	L/5043	NA	0.23	0.06	No	Yes

Simpson Strong-Tie® Connectors @ Studs

	Connector	Anchor

Support	Rx(lb)	Ry(lb)	Simpson Strong-Tie® Connector	Interaction	Interaction
R2	316.50	0.00	SCB45.5(2) & (2) #12-24 SST X or XL to A36 Steel	41.64 %	28.39 %
R1	228.17	1376.00	600T125-33 (33) & (2) .157" SST PDPA/PDPAT-62KP to steel (3/16" to 1/2" thickness)	33.16 %	51.81 %

* Reference catalog for connector and anchor requirement notes as well as screw placements requirement

Simpson Strong-Tie® Connectors @ Jambs

Support	Rx(lb)	Ry(lb)	Simpson Strong-Tie® Connector	Connector Interaction	Anchor Interaction
R2	474.65	0.00	SCB45.5(2) & (2) #12-24 SST X or XL to A36 Steel	62.45 %	42.57 %
R1	627.47	2440.00	600T125-43 (33) & (3) .157" SST PDPA/PDPAT-62KP to steel (3/16" to 1/2" thickness)	79.89 %	73.01 %

* Reference catalog for connector and anchor requirement notes as well as screw placements requirement

Simpson Strong-Tie® Wall Stud Bridging Connectors @ Studs

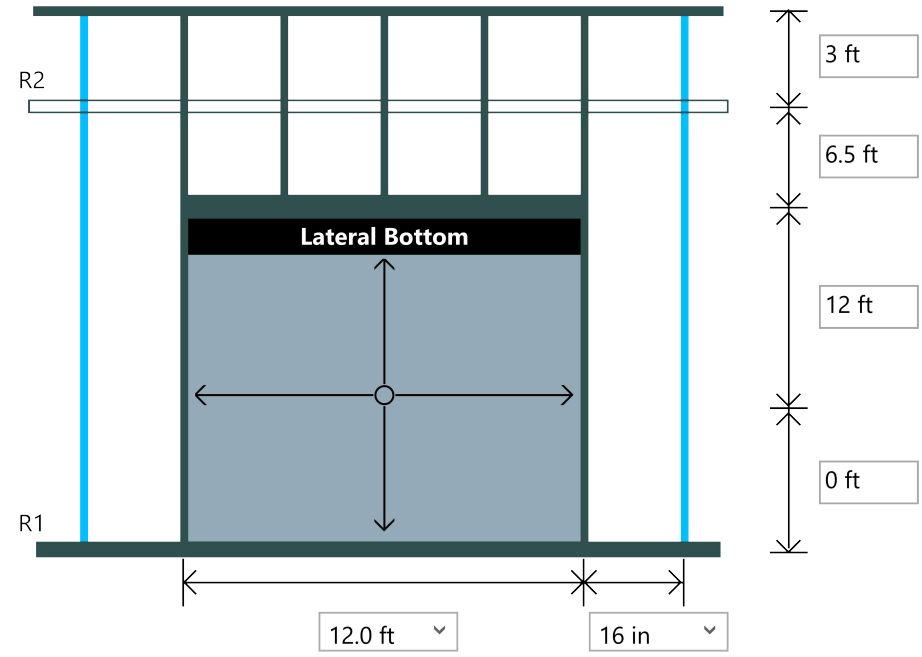
Span/Parapet	Bracing Length(in.)	Design Number of Braces	Pn(lb.)	LSUBH (Min)[1]	LSUBH (Max)[1]	SUBH (Min)[1]	SUBH (Max)[1]	MSUBH (Min)[1]	MSUBH (Max)[1]
Top Parapet	Span	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Span	Span	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Simpson Strong-Tie® Wall Stud Bridging Connectors @ Jambs

Span/Parapet	Bracing Length(in.)	Design Number of Braces	Pn(lb.)	LSUBH (Min)[1]	LSUBH (Max)[1]	SUBH (Min)[1]	SUBH (Max)[1]	MSUBH (Min)[1]	MSUBH (Max)[1]
Top Parapet	Span	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Span	Varies	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes:

1) Values in parentheses are stress ratios.
2) Bridging connectors are not designed for back-back, box, or built-up sections.
3) Reference www.strongtie.com for latest load data, important information, and general notes.
4) CFS Designer will not select bridging connectors unless all flexural and axial bracing settings are the same.
5) If the bracing length is larger than the span length, bridging connectors are not designed.



Lateral Pressure to: 4-Ways

Design Loads

Wall Lateral Pressure :	**19 psf**
Parapet Lateral Pressure :	**19 psf**
RO Lateral Pressure :	**4-Ways**
Lateral element force multiplier	
Strength :	**1.0**
Deflection :	**0.7**
Header:	**Box (lateral top, bottom)**
Gravity Load at Header:	**48 psf**
Cant. Deflection:	**2 x Cantilever**

Back-to-Back Member L/6 Interconnection Spacing per AISI S100 D1.1

Member	Span	Cantilever
Jamb Studs	37.0 in	6.0 in

See AISI S100 D1.1 for Add'nl Requirements

Brace Settings

Component(s)	Members(s)	Flexural Bracing	Axial KyLy	Axial KtLt	Distortional K-Phi(lb-in/in)	Distortional Lm	Interconnection Spacing
Wall Studs	600S200-68(50), Single@16 in o/c	Full	60 in	60 in	0	None	N/A
Jamb Studs	600S200-68(50), Back-To-Back	Full	60 in	60 in	0	None	12 in
Vertical Header	800S200-68(50), Boxed	Full	N/A	N/A	0	None	N/A
Lat. Top Head	600T150-54(50), Single	Full	N/A	N/A	0	None	N/A
Lat. Bottom Head	600T150-54(50), Single	Full	N/A	N/A	0	None	N/A

Analysis Results

Component(s)	Members(s)	Axial Load (lb)	Max KL/r	Max. Moment (ft-lb)	Max. Shear (lb)	Bottom Reaction (lb)	Top or End Reaction (lb)
Wall Studs	600S200-68(50), Single@16 in o/c	0.0	N/A	1027.5	240.5	228.2	316.5
Jamb Studs	600S200-68(50), Back-To-Back	2736.0	96	4601.2	798.9	1140.9	791.1
Vertical Header	800S200-68(50), Boxed	N/A	N/A	8208.0	2736.0	N/A	2736.0
Lat. Top Head	600T150-54(50), Single	N/A	N/A	874.7	291.6	N/A	291.6
Lat. Bottom Head	600T150-54(50), Single	N/A	N/A	1368.0	342.0	N/A	342.0

Design Results

Component(s)	Members(s)	Deflection Span	Deflection Parapet	A + M Interaction	V + M Interaction	Web Stiffners	Design OK
Wall Studs	600S200-68(50), Single@16 in o/c	L/613	L/407	0.311	0.05	NA	Yes
Jamb Studs	600S200-68(50), Back-To-Back	L/276	L/177	0.950	0.64	NA	Yes
Vertical Header	800S200-68(50), Boxed	L/325	NA	0.76	0.76	R1, R2	Yes
Lat. Top Head	600T150-54(50), Single	L/642	NA	0.58	0.58	No	Yes
Lat. Bottom Head	600T150-54(50), Single	L/428	NA	0.90	0.13	No	Yes

Simpson Strong-Tie® Connectors @ Studs

	Connector	Anchor

Support	Rx(lb)	Ry(lb)	Simpson Strong-Tie® Connector	Interaction	Interaction
R2	316.50	0.00	SCB45.5(2) & (2) #12-24 SST X or XL to A36 Steel	41.64 %	28.39 %
R1	228.17	1376.00	600T125-33 (33) & (2) .157" SST PDPA/PDPAT-62KP to steel (3/16" to 1/2" thickness)	33.16 %	51.81 %

* Reference catalog for connector and anchor requirement notes as well as screw placements requirement

Simpson Strong-Tie® Connectors @ Jambs

Support	Rx(lb)	Ry(lb)	Simpson Strong-Tie® Connector	Connector Interaction	Anchor Interaction
R2	791.05	0.00	SCB45.5(3) & (2) #12-24 SST X or XL to A36 Steel	79.90 %	70.95 %
R1	1140.86	3808.00	600T125-54 (50) & (3) .157" SST PDPA/PDPAT-62KP to steel (3/16" to 1/2" thickness)	69.24 %	92.75 %

* Reference catalog for connector and anchor requirement notes as well as screw placements requirement

Simpson Strong-Tie® Wall Stud Bridging Connectors @ Studs

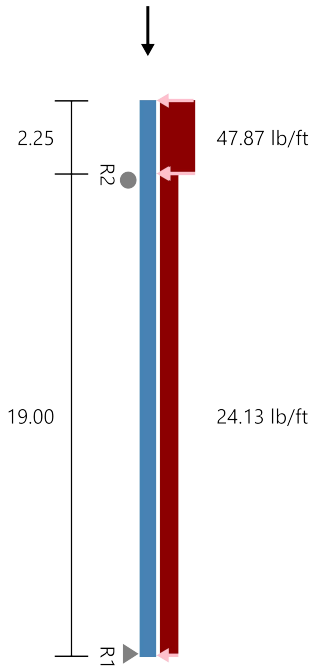
Span/Parapet	Bracing Length(in.)	Design Number of Braces	Pn(lb.)	LSUBH (Min)[1]	LSUBH (Max)[1]	SUBH (Min)[1]	SUBH (Max)[1]	MSUBH (Min)[1]	MSUBH (Max)[1]
Top Parapet	Span	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Span	Span	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Simpson Strong-Tie® Wall Stud Bridging Connectors @ Jambs

Span/Parapet	Bracing Length(in.)	Design Number of Braces	Pn(lb.)	LSUBH (Min)[1]	LSUBH (Max)[1]	SUBH (Min)[1]	SUBH (Max)[1]	MSUBH (Min)[1]	MSUBH (Max)[1]
Top Parapet	Span	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Span	Varies	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes:

1) Values in parentheses are stress ratios.
2) Bridging connectors are not designed for back-back, box, or built-up sections.
3) Reference www.strongtie.com for latest load data, important information, and general notes.
4) CFS Designer will not select bridging connectors unless all flexural and axial bracing settings are the same.
5) If the bracing length is larger than the span length, bridging connectors are not designed.



Section : 600S200-68 (50 ksi) @ 16" o.c. Single C Stud (punched)
Maxo = 3642.4 ft-lb **Va =** 5350.3 lb **I =** 4.10 in^4

Loads have not been modified for strength checks
Loads have been multiplied by 0.70 for deflection calculations

Bridging Connectors - Design Method =AISI S100

Span	Axial KyLy, KtLt	Flexual, Distortional	Connector	Stress Ratio
Top Cant.	Sheathed, Sheathed	Full, 27.0"	N/A	-
Span	Sheathed, Sheathed	Full, 228.0"	N/A	-

Web Crippling

Support	Load (lb)	Bearing (in)	Pa (lb)	M (ft-lbs)	Max Int.	Stiffener?
R2	343.3	--Shear Connection w/ clip--				NO
R1	222.9	--Stud/Track Design, Ref Connectors--				NO

Gravity Load

Type	Load (lb)
Uniform	66.67plf (Top Cantilever), 66.67plf (Span)

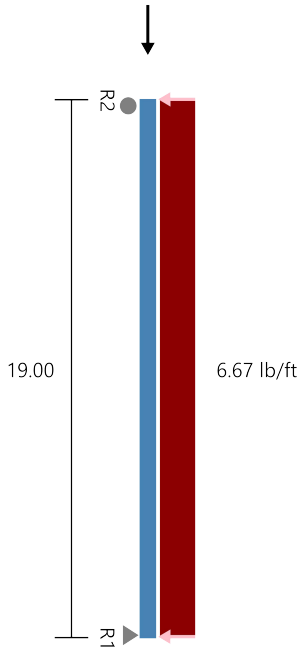
	Code Check	Required	Allowed	Interaction	Notes
Top Cant.	Max. Axial, lbs	150.0(c)	3777.8(c)	4%	KΦ=0.00 lb-in/in Max KL/r = 63
	Max. Shear, lbs	107.7	2878.9	4%	Shear (Punched)
	Max. Moment (MaFy, Ma-dist), ft-lbs	121.2	3307.5	4%	Ma-dist (control),KΦ=0.00 lb-in/in
	Moment Stability, ft-lbs	77.4	3642.4	2%	
	Shear/Moment	0.05	1.00	5%	Shear 107.7, Moment 121.2
	Axial/Moment	0.08	1.00	8%	Axial 150.0(c), Moment 121.2
	Deflection Cant., in	0.136	--meets L/396--		2 x Cantilever
Span	Max. Axial, lbs	1416.7(c)	3777.8(c)	38%	KΦ=0.00 lb-in/in Max KL/r = 98
	Max. Shear, lbs	235.6	2878.9	8%	Shear (Punched)
	Max. Moment (MaFy, Ma-dist), ft-lbs	1029.3	3307.5	31%	Ma-dist (control),KΦ=0.00 lb-in/in
	Moment Stability, ft-lbs	1029.3	3642.4	28%	
	Shear/Moment	0.28	1.00	28%	Shear 0.0, Moment 1029.3
	Axial/Moment	0.57	1.00	57%	Axial 964.5(c), Moment 956.7
	Deflection Span, in	0.382	--meets L/597--		

Support	Rx(lb)	Ry(lb)	Simpson Strong-Tie Connector	Connector Interaction	Anchor Interaction
R2	343.3	0.0	SCB45.5(2) & (2) #12-24 SST X or XL to A36 Steel	45.18 %	30.79 %
R1	222.9	1416.7	600T125-33 (33) & (2) .157" SST PDPA/PDPAT-62KP to steel (3/16" to 1/2" thickness)	32.40 %	50.61 %

* Reference catalog for connector and anchor requirement notes as well as screw placement requirements

Project Name: CFS Wall Framing
Model: Wall Stud - Interior
Code: 2012 NASPEC [AISI S100-2012]

Date: 08/17/2023
Simpson Strong-Tie® CFS Designer™ 5.0.1.0



Section : 362S162-43 (33 ksi) @ 16" o.c. Single C Stud (punched)
Maxo = 612.0 ft-lb **Va =** 1739.1 lb **I =** 0.71 in^4

Loads have not been modified for strength checks
Loads have not been modified for deflection calculations

Bridging Connectors - Design Method =AISI S100

Span	Axial KyLy, KtLt	Flexual, Distortional	Connector	Stress Ratio
Span	NA	Full, 228.0"	N/A	-

Web Crippling

Support	Load (lb)	Bearing (in)	Pa (lb)	M (ft-lbs)	Max Int.	Stiffener?
R2	63.3	--Shear Connection w/ clip--				NO
R1	63.3	--Stud/Track Design, Ref Connectors--				NO

Gravity Load

Type	Load (lb)
Uniform	13.33plf (Span)

	Code Check	Required	Allowed	Interaction	Notes
Span	Max. Axial, lbs	0.0(t)	-	0%	KΦ=0.00 lb-in/in Max KL/r = N/A
	Max. Shear, lbs	63.3	675.7	9%	Shear (Punched)
	Max. Moment (MaFy, Ma-dist), ft-lbs	300.8	612.0	49%	MaFy (control),KΦ=0.00 lb-in/in
	Moment Stability, ft-lbs	300.8	612.0	49%	
	Shear/Moment	0.49	1.00	49%	Shear 0.0, Moment 300.8
	Axial/Moment	0.49	1.00	49%	Axial 0.0(c), Moment 0.0
	Deflection Span, in	0.934	--meets L/244--		

Support	Rx(lb)	Ry(lb)	Simpson Strong-Tie Connector	Connector Interaction	Anchor Interaction
R2	63.3	0.0	SCB45.5(2) & (2) #12-24 SST X or XL to A36 Steel	10.38 %	5.68 %
R1	63.3	253.3	362T125-33 (33) & (2) .157" SST PDPA/PDPAT-62KP to steel (3/16" to 1/2" thickness)	14.52 %	14.38 %

* Reference catalog for connector and anchor requirement notes as well as screw placement requirements

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General Footing

Project File: foundations_current.ec6

LIC# : KW-06016429, Build:20.25.10.02 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: F4-12

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : ACI 318-19
Load Combinations Used : ASCE 7-22 / IBC 2024

General Information

Material Properties

f'c : Concrete 28 day strength	=	3.0	ksi
fy : Rebar Yield	=	60.0	ksi
Ec : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	150.0	pcf
φ Values Flexure	=	0.90	
Shear	=	0.750	

Analysis Settings

Min Steel % Bending Reinf.	=		
Min Allow % Temp Reinf.	=		
Min. Overturning Safety Factor	=	1.0	: 1
Min. Sliding Safety Factor	=	1.0	: 1
Add Ftg Wt for Soil Pressure	:	Yes	
Use ftg wt for stability, moments & shears	:	Yes	
Add Pedestal Wt for Soil Pressure	:	Yes	
Use Pedestal wt for stability, mom & shear	:	Yes	

Soil Design Values

Allowable Soil Bearing	=	5.0	ksf
Soil Density	=	125.0	pcf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.30	

Increases based on footing Depth

Footing base depth below soil surface	=	5.0	ft
Allow press. increase per foot of depth	=		ksf
when footing base is below	=		ft

Increases based on footing plan dimension

Allowable pressure increase per foot of depth	=		ksf
when max. length or width is greater than	=		ft

Dimensions

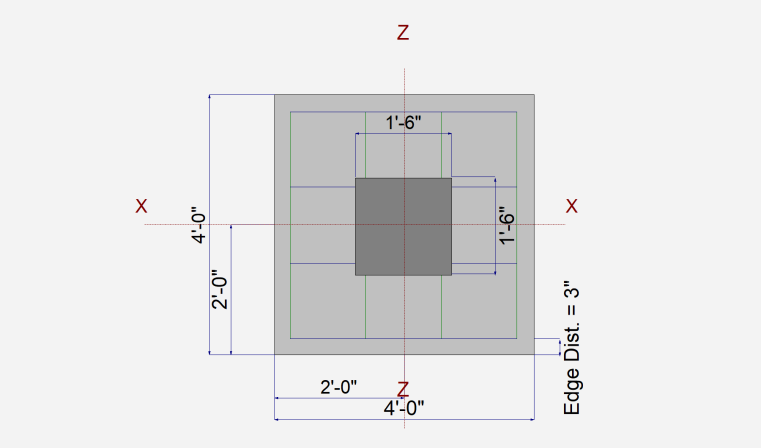
Width parallel to X-X Axis	=	4.0	ft
Length parallel to Z-Z Axis	=	4.0	ft
Footing Thickness	=	12.0	in

Pedestal dimensions...

px : parallel to X-X Axis	=	18.0	in
pz : parallel to Z-Z Axis	=	18.0	in
Height	=	48.0	in

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation	n/a
# Bars required within zone	n/a
# Bars required on each side of zone	n/a



Bottom Reinforcing

Bars parallel to X-X Axis (resisting Z Flexure)

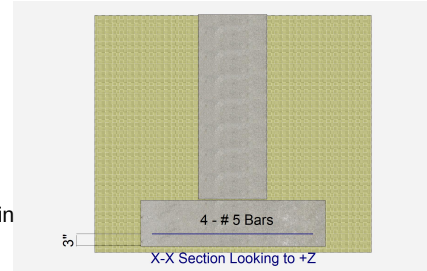
Number of Bars	=		4.0
Reinforcing Bar Size	=	#	5

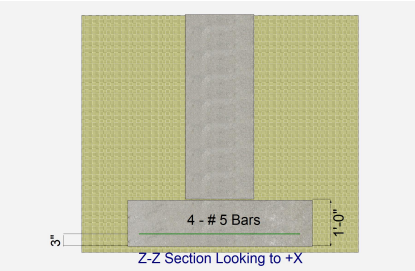
Bars parallel to Z-Z Axis (resisting X Flexure)

Number of Bars	=		4.0
Reinforcing Bar Size	=	#	5

Rebar Centerline to Edge of Concrete...

at Bottom of footing	=	3.0	in





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General Footing

Project File: foundations_current.ec6

LIC# : KW-06016429, Build:20.25.10.02 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: F4-12

Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	8.160	6.240		26.520	4.990			k
OB : Overburden	=								ksf
M-xx	=								k-ft
M-zz	=								k-ft
V-x	=								k
V-z	=								k

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.4668	Soil Bearing	2.334 ksf	5.0 ksf	+D+0.70S about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.1573	Z Flexure (+X) Bot Tens	1.908 k-ft/ft	12.131 k-ft/ft	+1.20D+S+0.50W
PASS	0.1573	Z Flexure (-X) Bot Tens	1.908 k-ft/ft	12.131 k-ft/ft	+1.20D+S+0.50W
PASS	0.836	Min Steel X Flexure Bottom	0.259 in2/ft	0.310 in2/ft	n/a
PASS	0.1573	X Flexure (+Z) Bot Tens	1.908 k-ft/ft	12.131 k-ft/ft	+1.20D+S+0.50W
PASS	0.1573	X Flexure (-Z) Bot Tens	1.908 k-ft/ft	12.131 k-ft/ft	+1.20D+S+0.50W
PASS	0.836	Min Steel Z Flexure Bottom	0.259 in2/ft	0.310 in2/ft	n/a
PASS	0.0	Z Flexure (+X) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.0	Z Flexure (-X) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.000	Min Steel X Flexure Top	0.000 in2/ft	0.000 in2/ft	n/a
PASS	0.0	X Flexure (+Z) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.0	X Flexure (-Z) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.000	Min Steel Z Flexure Top	0.000 in2/ft	0.000 in2/ft	n/a
PASS	0.2324	1-way Shear (+X)	10.855 psi	46.704 psi	+1.20D+S+0.50W
PASS	0.2324	1-way Shear (-X)	10.855 psi	46.704 psi	+1.20D+S+0.50W
PASS	0.2324	1-way Shear (+Z)	10.855 psi	46.704 psi	+1.20D+S+0.50W
PASS	0.2324	1-way Shear (-Z)	10.855 psi	46.704 psi	+1.20D+S+0.50W
PASS	0.1679	2-way Punching	27.595 psi	164.317 psi	+1.20D+S+0.50W

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc (in)	Zecc (in)	Actual Soil Bearing Stress @ Location Bottom, -Z	Top, +Z	Left, -X	Right, +X	Actual / Allow Ratio
X-X, D Only	5.0	n/a	0.0	1.174	1.174	n/a	n/a	0.235
X-X, +D+Lr	5.0	n/a	0.0	1.564	1.564	n/a	n/a	0.313
X-X, +D+0.70S	5.0	n/a	0.0	2.334	2.334	n/a	n/a	0.467
X-X, +D+0.750Lr	5.0	n/a	0.0	1.467	1.467	n/a	n/a	0.293
X-X, +D+0.5250S	5.0	n/a	0.0	2.044	2.044	n/a	n/a	0.409
X-X, +D+0.60W	5.0	n/a	0.0	1.361	1.361	n/a	n/a	0.272
X-X, +D+0.750Lr+0.450W	5.0	n/a	0.0	1.607	1.607	n/a	n/a	0.321
X-X, +D+0.5250S+0.450W	5.0	n/a	0.0	2.185	2.185	n/a	n/a	0.437
X-X, +0.60D+0.60W	5.0	n/a	0.0	0.8916	0.8916	n/a	n/a	0.178
X-X, +D+0.10S	5.0	n/a	0.0	1.340	1.340	n/a	n/a	0.268
X-X, +0.60D	5.0	n/a	0.0	0.7044	0.7044	n/a	n/a	0.141
Z-Z, D Only	5.0	0.0	n/a	n/a	n/a	1.174	1.174	0.235
Z-Z, +D+Lr	5.0	0.0	n/a	n/a	n/a	1.564	1.564	0.313
Z-Z, +D+0.70S	5.0	0.0	n/a	n/a	n/a	2.334	2.334	0.467
Z-Z, +D+0.750Lr	5.0	0.0	n/a	n/a	n/a	1.467	1.467	0.293
Z-Z, +D+0.5250S	5.0	0.0	n/a	n/a	n/a	2.044	2.044	0.409
Z-Z, +D+0.60W	5.0	0.0	n/a	n/a	n/a	1.361	1.361	0.272
Z-Z, +D+0.750Lr+0.450W	5.0	0.0	n/a	n/a	n/a	1.607	1.607	0.321
Z-Z, +D+0.5250S+0.450W	5.0	0.0	n/a	n/a	n/a	2.185	2.185	0.437
Z-Z, +0.60D+0.60W	5.0	0.0	n/a	n/a	n/a	0.8916	0.8916	0.178
Z-Z, +D+0.10S	5.0	0.0	n/a	n/a	n/a	1.340	1.340	0.268
Z-Z, +0.60D	5.0	0.0	n/a	n/a	n/a	0.7044	0.7044	0.141

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General Footing

Project File: foundations_current.ec6

DESCRIPTION: F4-12

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.5732	+Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +1.40D	0.5732	-Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +1.20D+0.50Lr	0.6436	+Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +1.20D+0.50Lr	0.6436	-Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +1.20D+0.30S	0.8797	+Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +1.20D+0.30S	0.8797	-Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +1.20D+1.60Lr	0.9787	+Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +1.20D+1.60Lr	0.9787	-Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +1.20D+1.60Lr+0.50W	1.101	+Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +1.20D+1.60Lr+0.50W	1.101	-Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +1.20D+S	1.786	+Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +1.20D+S	1.786	-Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +1.20D+S+0.50W	1.908	+Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +1.20D+S+0.50W	1.908	-Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +1.20D+0.50Lr+W	0.8872	+Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +1.20D+0.50Lr+W	0.8872	-Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +1.20D+0.30S+W	1.123	+Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +1.20D+0.30S+W	1.123	-Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +0.90D+W	0.6121	+Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +0.90D+W	0.6121	-Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +1.20D+0.150S	0.6855	+Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +1.20D+0.150S	0.6855	-Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +0.90D	0.3685	+Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
X-X, +0.90D	0.3685	-Z	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +1.40D	0.5732	-X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +1.40D	0.5732	+X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +1.20D+0.50Lr	0.6436	-X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +1.20D+0.50Lr	0.6436	+X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +1.20D+0.30S	0.8797	-X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +1.20D+0.30S	0.8797	+X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +1.20D+1.60Lr	0.9787	-X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +1.20D+1.60Lr	0.9787	+X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +1.20D+1.60Lr+0.50W	1.101	-X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +1.20D+1.60Lr+0.50W	1.101	+X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +1.20D+S	1.786	-X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +1.20D+S	1.786	+X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +1.20D+S+0.50W	1.908	-X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +1.20D+S+0.50W	1.908	+X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +1.20D+0.50Lr+W	0.8872	-X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +1.20D+0.50Lr+W	0.8872	+X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +1.20D+0.30S+W	1.123	-X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +1.20D+0.30S+W	1.123	+X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +0.90D+W	0.6121	-X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +0.90D+W	0.6121	+X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +1.20D+0.150S	0.6855	-X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +1.20D+0.150S	0.6855	+X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +0.90D	0.3685	-X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK
Z-Z, +0.90D	0.3685	+X	Bottom	0.2592	ACI 7.6.1.1	0.310	12.131	OK

One Way Shear X

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	3.26 psi	3.26 psi	3.26 psi	46.70 psi	0.07	OK
+1.20D+0.50Lr	3.66 psi	3.66 psi	3.66 psi	46.70 psi	0.08	OK
+1.20D+0.30S	5.01 psi	5.01 psi	5.01 psi	46.70 psi	0.11	OK
+1.20D+1.60Lr	5.57 psi	5.57 psi	5.57 psi	46.70 psi	0.12	OK
+1.20D+1.60Lr+0.50W	6.26 psi	6.26 psi	6.26 psi	46.70 psi	0.13	OK

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General Footing

Project File: foundations_current.ec6

DESCRIPTION: F4-12

One Way Shear X

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.20D+S	10.16 psi	10.16 psi	10.16 psi	46.70 psi	0.22	OK
+1.20D+S+0.50W	10.86 psi	10.86 psi	10.86 psi	46.70 psi	0.23	OK
+1.20D+0.50Lr+W	5.05 psi	5.05 psi	5.05 psi	46.70 psi	0.11	OK
+1.20D+0.30S+W	6.39 psi	6.39 psi	6.39 psi	46.70 psi	0.14	OK
+0.90D+W	3.48 psi	3.48 psi	3.48 psi	46.70 psi	0.07	OK
+1.20D+0.150S	3.90 psi	3.90 psi	3.90 psi	46.70 psi	0.08	OK
+0.90D	2.10 psi	2.10 psi	2.10 psi	46.70 psi	0.04	OK

One Way Shear Z

Load Combination...	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	3.26 psi	3.26 psi	3.26 psi	46.70 psi	0.07	OK
+1.20D+0.50Lr	3.66 psi	3.66 psi	3.66 psi	46.70 psi	0.08	OK
+1.20D+0.30S	5.01 psi	5.01 psi	5.01 psi	46.70 psi	0.11	OK
+1.20D+1.60Lr	5.57 psi	5.57 psi	5.57 psi	46.70 psi	0.12	OK
+1.20D+1.60Lr+0.50W	6.26 psi	6.26 psi	6.26 psi	46.70 psi	0.13	OK
+1.20D+S	10.16 psi	10.16 psi	10.16 psi	46.70 psi	0.22	OK
+1.20D+S+0.50W	10.86 psi	10.86 psi	10.86 psi	46.70 psi	0.23	OK
+1.20D+0.50Lr+W	5.05 psi	5.05 psi	5.05 psi	46.70 psi	0.11	OK
+1.20D+0.30S+W	6.39 psi	6.39 psi	6.39 psi	46.70 psi	0.14	OK
+0.90D+W	3.48 psi	3.48 psi	3.48 psi	46.70 psi	0.07	OK
+1.20D+0.150S	3.90 psi	3.90 psi	3.90 psi	46.70 psi	0.08	OK
+0.90D	2.10 psi	2.10 psi	2.10 psi	46.70 psi	0.04	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	8.29 psi	164.32 psi	0.05	OK
+1.20D+0.50Lr	9.31 psi	164.32 psi	0.06	OK
+1.20D+0.30S	12.72 psi	164.32 psi	0.08	OK
+1.20D+1.60Lr	14.16 psi	164.32 psi	0.09	OK
+1.20D+1.60Lr+0.50W	15.92 psi	164.32 psi	0.10	OK
+1.20D+S	25.83 psi	164.32 psi	0.16	OK
+1.20D+S+0.50W	27.60 psi	164.32 psi	0.17	OK
+1.20D+0.50Lr+W	12.83 psi	164.32 psi	0.08	OK
+1.20D+0.30S+W	16.25 psi	164.32 psi	0.10	OK
+0.90D+W	8.85 psi	164.32 psi	0.05	OK
+1.20D+0.150S	9.92 psi	164.32 psi	0.06	OK
+0.90D	5.33 psi	164.32 psi	0.03	OK

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General Footing

Project File: foundations_current.ec6

LIC# : KW-06016429, Build:20.25.10.02 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: F5-18

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : ACI 318-19
Load Combinations Used : ASCE 7-22 / IBC 2024

General Information

Material Properties

f'c : Concrete 28 day strength	=	3.0	ksi
fy : Rebar Yield	=	60.0	ksi
Ec : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	150.0	pcf
φ Values Flexure	=	0.90	
Shear	=	0.750	

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	Yes
Use Pedestal wt for stability, mom & shear	:	Yes

Soil Design Values

Allowable Soil Bearing	=	5.0	ksf
Soil Density	=	125.0	pcf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.30	

Increases based on footing Depth

Footing base depth below soil surface	=	5.0	ft
Allow press. increase per foot of depth	=		ksf
when footing base is below	=		ft

Increases based on footing plan dimension

Allowable pressure increase per foot of depth	=		ksf
when max. length or width is greater than	=		ft

Dimensions

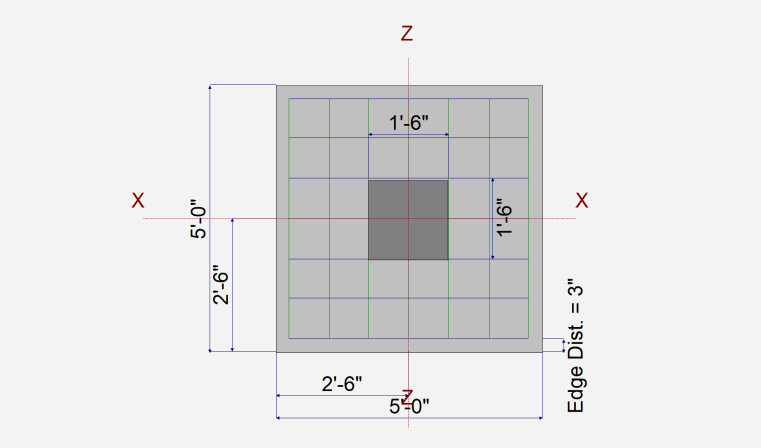
Width parallel to X-X Axis	=	5.0	ft
Length parallel to Z-Z Axis	=	5.0	ft
Footing Thickness	=	18.0	in

Pedestal dimensions...

px : parallel to X-X Axis	=	18.0	in
pz : parallel to Z-Z Axis	=	18.0	in
Height	=	48.0	in

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation	n/a
# Bars required within zone	n/a
# Bars required on each side of zone	n/a



Bottom Reinforcing

Bars parallel to X-X Axis (resisting Z Flexure)

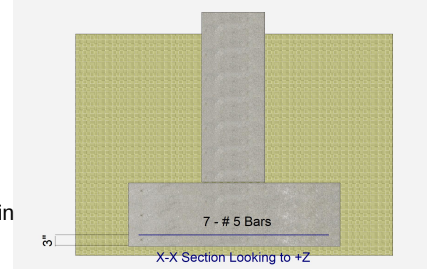
Number of Bars	=		7.0
Reinforcing Bar Size	=	#	5

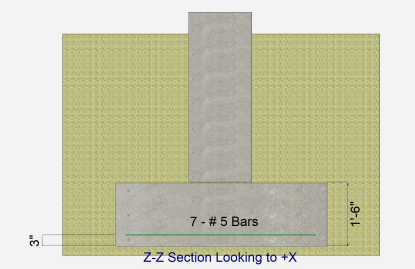
Bars parallel to Z-Z Axis (resisting X Flexure)

Number of Bars	=		7.0
Reinforcing Bar Size	=	#	5

Rebar Centerline to Edge of Concrete...

at Bottom of footing	=	3.0	in





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General Footing

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LIC# : KW-06016429, Build:20.25.10.02 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: F5-18

Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	15.720	9.180		37.380	5.610			k
OB : Overburden	=								ksf
M-xx	=								k-ft
M-zz	=								k-ft
V-x	=								k
V-z	=								k

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.4706	Soil Bearing	2.353 ksf	5.0 ksf	+D+0.70S about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.1280	Z Flexure (+X) Bot Tens	3.644 k-ft/ft	28.464 k-ft/ft	+1.20D+S+0.50W
PASS	0.1280	Z Flexure (-X) Bot Tens	3.644 k-ft/ft	28.464 k-ft/ft	+1.20D+S+0.50W
PASS	0.896	Min Steel X Flexure Bottom	0.389 in2/ft	0.434 in2/ft	n/a
PASS	0.1280	X Flexure (+Z) Bot Tens	3.644 k-ft/ft	28.464 k-ft/ft	+1.20D+S+0.50W
PASS	0.1280	X Flexure (-Z) Bot Tens	3.644 k-ft/ft	28.464 k-ft/ft	+1.20D+S+0.50W
PASS	0.896	Min Steel Z Flexure Bottom	0.389 in2/ft	0.434 in2/ft	n/a
PASS	0.0	Z Flexure (+X) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.0	Z Flexure (-X) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.000	Min Steel X Flexure Top	0.000 in2/ft	0.000 in2/ft	n/a
PASS	0.0	X Flexure (+Z) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.0	X Flexure (-Z) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.000	Min Steel Z Flexure Top	0.000 in2/ft	0.000 in2/ft	n/a
PASS	0.150	1-way Shear (+X)	6.610 psi	44.067 psi	+1.20D+S+0.50W
PASS	0.150	1-way Shear (-X)	6.610 psi	44.067 psi	+1.20D+S+0.50W
PASS	0.150	1-way Shear (+Z)	6.610 psi	44.067 psi	+1.20D+S+0.50W
PASS	0.150	1-way Shear (-Z)	6.610 psi	44.067 psi	+1.20D+S+0.50W
PASS	0.1295	2-way Punching	21.283 psi	164.317 psi	+1.20D+S+0.50W

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc (in)	Zecc (in)	Actual Soil Bearing Stress @ Location Bottom, -Z	Top, +Z	Left, -X	Right, +X	Actual / Allow Ratio
X-X, D Only	5.0	n/a	0.0	1.306	1.306	n/a	n/a	0.261
X-X, +D+Lr	5.0	n/a	0.0	1.673	1.673	n/a	n/a	0.335
X-X, +D+0.70S	5.0	n/a	0.0	2.353	2.353	n/a	n/a	0.471
X-X, +D+0.750Lr	5.0	n/a	0.0	1.581	1.581	n/a	n/a	0.316
X-X, +D+0.5250S	5.0	n/a	0.0	2.091	2.091	n/a	n/a	0.418
X-X, +D+0.60W	5.0	n/a	0.0	1.441	1.441	n/a	n/a	0.288
X-X, +D+0.750Lr+0.450W	5.0	n/a	0.0	1.682	1.682	n/a	n/a	0.336
X-X, +D+0.5250S+0.450W	5.0	n/a	0.0	2.192	2.192	n/a	n/a	0.438
X-X, +0.60D+0.60W	5.0	n/a	0.0	0.9182	0.9182	n/a	n/a	0.184
X-X, +D+0.10S	5.0	n/a	0.0	1.455	1.455	n/a	n/a	0.291
X-X, +0.60D	5.0	n/a	0.0	0.7836	0.7836	n/a	n/a	0.157
Z-Z, D Only	5.0	0.0	n/a	n/a	n/a	1.306	1.306	0.261
Z-Z, +D+Lr	5.0	0.0	n/a	n/a	n/a	1.673	1.673	0.335
Z-Z, +D+0.70S	5.0	0.0	n/a	n/a	n/a	2.353	2.353	0.471
Z-Z, +D+0.750Lr	5.0	0.0	n/a	n/a	n/a	1.581	1.581	0.316
Z-Z, +D+0.5250S	5.0	0.0	n/a	n/a	n/a	2.091	2.091	0.418
Z-Z, +D+0.60W	5.0	0.0	n/a	n/a	n/a	1.441	1.441	0.288
Z-Z, +D+0.750Lr+0.450W	5.0	0.0	n/a	n/a	n/a	1.682	1.682	0.336
Z-Z, +D+0.5250S+0.450W	5.0	0.0	n/a	n/a	n/a	2.192	2.192	0.438
Z-Z, +0.60D+0.60W	5.0	0.0	n/a	n/a	n/a	0.9182	0.9182	0.184
Z-Z, +D+0.10S	5.0	0.0	n/a	n/a	n/a	1.455	1.455	0.291
Z-Z, +0.60D	5.0	0.0	n/a	n/a	n/a	0.7836	0.7836	0.157

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General Footing

Project File: foundations_current.ec6

DESCRIPTION: F5-18

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	1.379	+Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +1.40D	1.379	-Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +1.20D+0.50Lr	1.463	+Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +1.20D+0.50Lr	1.463	-Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +1.20D+0.30S	1.869	+Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +1.20D+0.30S	1.869	-Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +1.20D+1.60Lr	2.082	+Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +1.20D+1.60Lr	2.082	-Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +1.20D+1.60Lr+0.50W	2.254	+Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +1.20D+1.60Lr+0.50W	2.254	-Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +1.20D+S	3.472	+Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +1.20D+S	3.472	-Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +1.20D+S+0.50W	3.644	+Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +1.20D+S+0.50W	3.644	-Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +1.20D+0.50Lr+W	1.807	+Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +1.20D+0.50Lr+W	1.807	-Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +1.20D+0.30S+W	2.213	+Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +1.20D+0.30S+W	2.213	-Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +0.90D+W	1.230	+Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +0.90D+W	1.230	-Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +1.20D+0.150S	1.526	+Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +1.20D+0.150S	1.526	-Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +0.90D	0.8867	+Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
X-X, +0.90D	0.8867	-Z	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +1.40D	1.379	-X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +1.40D	1.379	+X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +1.20D+0.50Lr	1.463	-X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +1.20D+0.50Lr	1.463	+X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +1.20D+0.30S	1.869	-X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +1.20D+0.30S	1.869	+X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +1.20D+1.60Lr	2.082	-X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +1.20D+1.60Lr	2.082	+X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +1.20D+1.60Lr+0.50W	2.254	-X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +1.20D+1.60Lr+0.50W	2.254	+X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +1.20D+S	3.472	-X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +1.20D+S	3.472	+X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +1.20D+S+0.50W	3.644	-X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +1.20D+S+0.50W	3.644	+X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +1.20D+0.50Lr+W	1.807	-X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +1.20D+0.50Lr+W	1.807	+X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +1.20D+0.30S+W	2.213	-X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +1.20D+0.30S+W	2.213	+X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +0.90D+W	1.230	-X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +0.90D+W	1.230	+X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +1.20D+0.150S	1.526	-X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +1.20D+0.150S	1.526	+X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +0.90D	0.8867	-X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK
Z-Z, +0.90D	0.8867	+X	Bottom	0.3888	ACI 7.6.1.1	0.4340	28.464	OK

One Way Shear X

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	2.50 psi	2.50 psi	2.50 psi	44.07 psi	0.06	OK
+1.20D+0.50Lr	2.66 psi	2.66 psi	2.66 psi	44.07 psi	0.06	OK
+1.20D+0.30S	3.39 psi	3.39 psi	3.39 psi	44.07 psi	0.08	OK
+1.20D+1.60Lr	3.78 psi	3.78 psi	3.78 psi	44.07 psi	0.09	OK
+1.20D+1.60Lr+0.50W	4.09 psi	4.09 psi	4.09 psi	44.07 psi	0.09	OK

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General Footing

Project File: foundations_current.ec6

DESCRIPTION: F5-18

One Way Shear X

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.20D+S	6.30 psi	6.30 psi	6.30 psi	44.07 psi	0.14	OK
+1.20D+S+0.50W	6.61 psi	6.61 psi	6.61 psi	44.07 psi	0.15	OK
+1.20D+0.50Lr+W	3.28 psi	3.28 psi	3.28 psi	44.07 psi	0.07	OK
+1.20D+0.30S+W	4.01 psi	4.01 psi	4.01 psi	44.07 psi	0.09	OK
+0.90D+W	2.23 psi	2.23 psi	2.23 psi	44.07 psi	0.05	OK
+1.20D+0.150S	2.77 psi	2.77 psi	2.77 psi	44.07 psi	0.06	OK
+0.90D	1.61 psi	1.61 psi	1.61 psi	44.07 psi	0.04	OK

One Way Shear Z

Load Combination...	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	2.50 psi	2.50 psi	2.50 psi	44.07 psi	0.06	OK
+1.20D+0.50Lr	2.66 psi	2.66 psi	2.66 psi	44.07 psi	0.06	OK
+1.20D+0.30S	3.39 psi	3.39 psi	3.39 psi	44.07 psi	0.08	OK
+1.20D+1.60Lr	3.78 psi	3.78 psi	3.78 psi	44.07 psi	0.09	OK
+1.20D+1.60Lr+0.50W	4.09 psi	4.09 psi	4.09 psi	44.07 psi	0.09	OK
+1.20D+S	6.30 psi	6.30 psi	6.30 psi	44.07 psi	0.14	OK
+1.20D+S+0.50W	6.61 psi	6.61 psi	6.61 psi	44.07 psi	0.15	OK
+1.20D+0.50Lr+W	3.28 psi	3.28 psi	3.28 psi	44.07 psi	0.07	OK
+1.20D+0.30S+W	4.01 psi	4.01 psi	4.01 psi	44.07 psi	0.09	OK
+0.90D+W	2.23 psi	2.23 psi	2.23 psi	44.07 psi	0.05	OK
+1.20D+0.150S	2.77 psi	2.77 psi	2.77 psi	44.07 psi	0.06	OK
+0.90D	1.61 psi	1.61 psi	1.61 psi	44.07 psi	0.04	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	8.06 psi	164.32 psi	0.05	OK
+1.20D+0.50Lr	8.55 psi	164.32 psi	0.05	OK
+1.20D+0.30S	10.92 psi	164.32 psi	0.07	OK
+1.20D+1.60Lr	12.16 psi	164.32 psi	0.07	OK
+1.20D+1.60Lr+0.50W	13.17 psi	164.32 psi	0.08	OK
+1.20D+S	20.28 psi	164.32 psi	0.12	OK
+1.20D+S+0.50W	21.28 psi	164.32 psi	0.13	OK
+1.20D+0.50Lr+W	10.56 psi	164.32 psi	0.06	OK
+1.20D+0.30S+W	12.93 psi	164.32 psi	0.08	OK
+0.90D+W	7.19 psi	164.32 psi	0.04	OK
+1.20D+0.150S	8.91 psi	164.32 psi	0.05	OK
+0.90D	5.18 psi	164.32 psi	0.03	OK

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Wall Footing

Project File: foundations_current.ec6

LIC# : KW-06016429, Build:20.25.07.31 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: 1/SD-100 - Wall Footing

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : ACI 318-19
Load Combinations Used : ASCE 7-22 / IBC 2024

General Information

Material Properties

f'c : Concrete 28 day strength	=	3.0	ksi
fy : Rebar Yield	=	60.0	ksi
Ec : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	150.0	pcf
φ Values Flexure	=	0.90	
Shear	=	0.750	

Analysis Settings

Min Steel % Bending Reinf.	=	0.0018	
Min. Overturning Safety Factor	=	1.0 : 1	
Min. Sliding Safety Factor	=	1.0 : 1	
AutoCalc Footing Weight as DL :		Yes	

Soil Design Values

Allowable Soil Bearing	=	5.0	ksf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.30	

Increases based on footing Depth

Reference Depth below Surface	=		ft
Allow. Pressure Increase per foot of depth	=		ksf
when base footing is below	=		ft

Increases based on footing Width

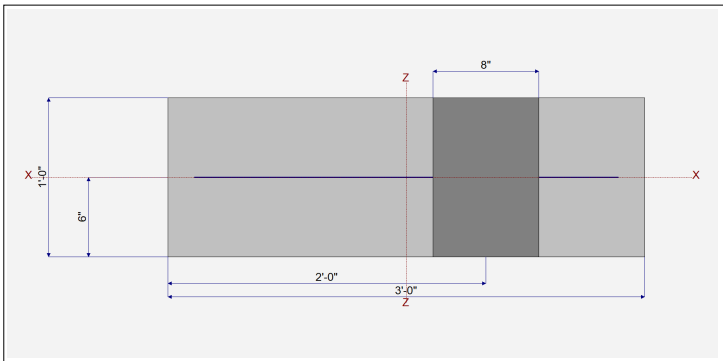
Allow. Pressure Increase per foot of width	=		ksf
when footing is wider than	=		ft

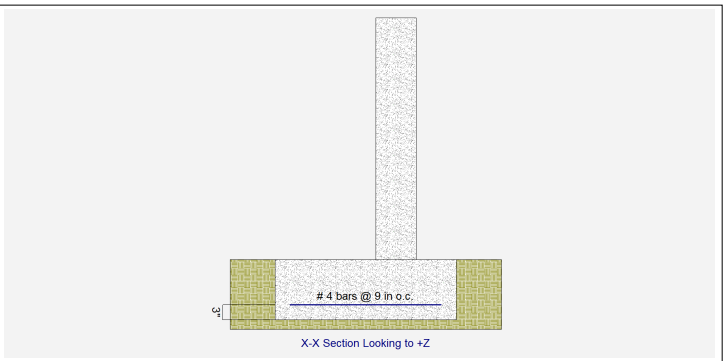
Adjusted Allowable Bearing Pressure = 0.0 ksf

Dimensions

Footing Width	=	3.0 ft	Footing Thickness	=	12.0 in	Bars along X-X Axis			
Wall Thickness	=	8.0 in	Rebar Centerline to Edge of Concrete...			Bar spacing	=	9.00	
Wall center offset from center of footing	=	6 in	at Bottom of footing	=	3.0 in	Reinforcing Bar Size	=	#	4

Reinforcing





Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	1.460							k
OB : Overburden	=								ksf
V-x	=								k
M-zz	=								k-ft

Vx applied = in above top of footing

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Wall Footing

Project File: foundations_current.ec6

LIC# : KW-06016429, Build:20.25.07.31 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: 1/SD-100 - Wall Footing

DESIGN SUMMARY

Design OK

	Factor of Safety	Item	Applied	Capacity	Governing Load Combination
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift

	Utilization Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.0	Soil Bearing	0.0 ksf	0.0 ksf	0.0
PASS	0.0	Z Flexure (+X)	0.0 k-ft	0.0 k-ft	No Moment
PASS	0.0	Z Flexure (-X)	0.0 k-ft	0.0 k-ft	No Moment
PASS	N/A	1-way Shear (+X)	N/A psi	0.0 psi	N/A
PASS	N/A	1-way Shear (-X)	N/A psi	0.0 psi	N/A

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Actual Soil Bearing Stress -X	Actual Soil Bearing Stress +X	Actual / Allowable Ratio

Overturning Stability

Units : k-ft

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Which Side ?	Tension @ Bot. or Top ?	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status

One Way Shear

Units : k

Load Combination...	vu @ -X	vu @ +X	vu:Max	Φ vn	vu / Φ vn	Status

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Wall Footing

Project File: foundations_current.ec6

LIC# : KW-06016429, Build:20.25.07.31 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: 3/SD-100 - Utility Yard Wall Footing

Code References

Governing Code : IBC 2024
Referenced Design Standard(s) : ACI 318-19
Load Combinations Used : ASCE 7-22 / IBC 2024

General Information

Material Properties

f'c : Concrete 28 day strength	=	3.0	ksi
fy : Rebar Yield	=	60.0	ksi
Ec : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	150.0	pcf
φ Values Flexure	=	0.90	
Shear	=	0.750	

Analysis Settings

Min Steel % Bending Reinf.	=	0.0018	
Min. Overturning Safety Factor	=	1.0 : 1	
Min. Sliding Safety Factor	=	1.0 : 1	
AutoCalc Footing Weight as DL :		Yes	

Soil Design Values

Allowable Soil Bearing	=	5.0	ksf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.30	

Increases based on footing Depth

Reference Depth below Surface	=		ft
Allow. Pressure Increase per foot of depth	=		ksf
when base footing is below	=		ft

Increases based on footing Width

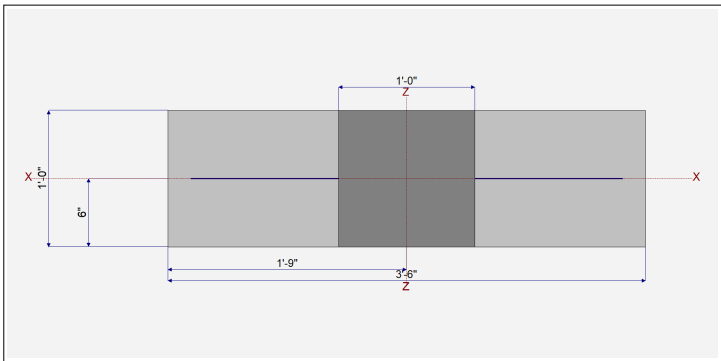
Allow. Pressure Increase per foot of width	=		ksf
when footing is wider than	=		ft

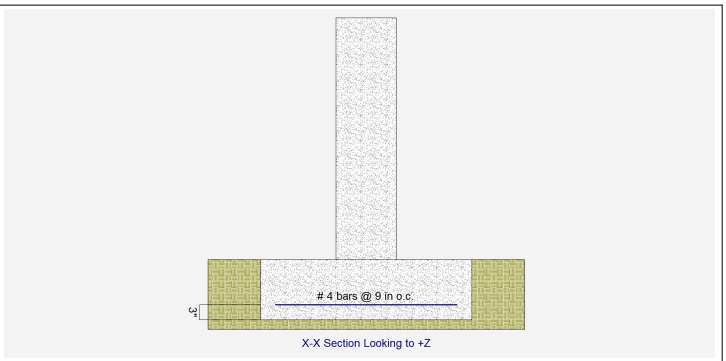
Adjusted Allowable Bearing Pressure = 0.0 ksf

Dimensions

Footing Width	=	3.50 ft	Footing Thickness	=	12.0 in	Bars along X-X Axis			
Wall Thickness	=	12.0 in	Rebar Centerline to Edge of Concrete...			Bar spacing	=	9.00	
Wall center offset from center of footing	=	0 in	at Bottom of footing	=	3.0 in	Reinforcing Bar Size	=	#	4

Reinforcing





Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	1.680							k
OB : Overburden	=								ksf
V-x	=								k
M-zz	=						1.370		k-ft
Vx applied	=		in above top of footing						

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Wall Footing

Project File: foundations_current.ec6

LIC# : KW-06016429, Build:20.25.07.31 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: 3/SD-100 - Utility Yard Wall Footing

DESIGN SUMMARY

Design OK

	Factor of Safety	Item	Applied	Capacity	Governing Load Combination
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift

	Utilization Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.0	Soil Bearing	0.0 ksf	0.0 ksf	0.0
PASS	0.0	Z Flexure (+X)	0.0 k-ft	0.0 k-ft	No Moment
PASS	0.0	Z Flexure (-X)	0.0 k-ft	0.0 k-ft	No Moment
PASS	N/A	1-way Shear (+X)	N/A psi	0.0 psi	N/A
PASS	N/A	1-way Shear (-X)	N/A psi	0.0 psi	N/A

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Actual Soil Bearing Stress -X	Actual Soil Bearing Stress +X	Actual / Allowable Ratio

Overturning Stability

Units : k-ft

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Which Side ?	Tension @ Bot. or Top ?	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status

One Way Shear

Units : k

Load Combination...	vu @ -X	vu @ +X	vu:Max	Φ vn	vu / Φ vn	Status

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Masonry Slender Wall

Project File: foundations_current.ec6

LIC# : KW-06016429, Build:20.25.07.31 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: 3/SD-100 - Masonry Utility Yard Wall

Code References

Calculations per TMS 402-22, IBC 2024
Load Combinations Used : ASCE 7-22 / IBC 2024

General Information

Calculations per TMS 402-22, IBC 2024

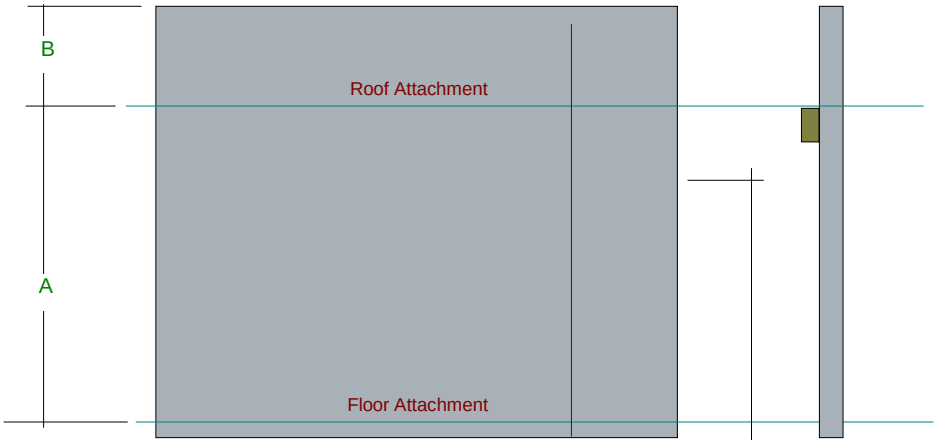
Construction Type : Grouted Hollow Concrete Masonry

F'm	=	1.50 ksi	Nom. Wall Thickness		8	in	Temp Diff across thickness	=	deg F
Fy - Yield	=	60.0 ksi	Actual Thickness		7.625	in	Min Allow Out-of-plane Defl Ra	=	0.0
Fr - Rupture	=	61.0 psi	Rebar "d" distance		3.8125	in			
Em = f'm *	=	900.0	Lower Level Rebar . . .				Minimum Vertical Steel %	=	0.0020
Max % of ρ bal.	=	0.005277	Bar Size	#	5				
Grout Density	=	140 pcf	Bar Spacing		16	in			
Block Weight		Normal Weight							
Wall Weight	=	86.0 psf							
		Wall is Solid Grouted							

One-Story Wall Dimensions

A Clear Height = 9.0 ft
B Parapet height = ft

Wall Support Condition Top Free, Bottom Fix



Lateral Loads

Wind Loads :

Full area WIND load 33.60 psf

Seismic Loads :

Wall Weight Seismic Load Input Method : ASCE seismic factors entered

SDS Value per ASCE 12.11.1 S_{DS} * I = 0.4080

Fp = Wall Wt. * 0.1632 = 14.035 psf

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Masonry Slender Wall

Project File: foundations_current.ec6

LIC# : KW-06016429, Build:20.25.07.31 KRAMER GEHLEN & ASSOCIATES (c) ENERCALC, LLC 1982-2025

DESCRIPTION: 3/SD-100 - Masonry Utility Yard Wall

DESIGN SUMMARY

Results reported for "Strip Width" of 12.0 in

	Governing Load Combination . . .	Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check +0.9544D+W	Maximum Bending Stress Rat	**0.4071**		
		Max Mu	-1.371 k-ft	Phi * Mn	3.368 k-ft
PASS	Service Deflection Check W Only	Actual Defl. Ratio L/	527	Allowable Defl. Ratio	150.0
		Max. Deflection	0.4101 in		/2 for Cantilever
PASS	Axial Load Check +1.20D+W	Max Pu / Ag	10.143 psi	Max. Allow. Defl.	1.440 in
		Location	0.150 ft	0.2 * f'm	300.0 psi
FAIL	Reinforcing Limit Check				
		Actual ñ	0.005082	Max Allow ñ	0.004890

Maximum Reactions *for Load Combination...*

Top Horizontal	0.0	0.0 k
Base Horizontal	W Only	302.40 k
Vertical Reaction	+D+0.60W	0.7740 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	0.2*f'm*b*t k	Moment Values Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	As Ratio	0.6 * rho bal	Bar 'd'
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+0.50W at 0.00 to 0.30	0.929	27.468	0.59	0.68	0.90	3.41	0.233	0.0051	0.0049	0.00
+1.20D+W at 0.00 to 0.30	0.929	27.468	0.59	1.37	0.90	3.41	0.233	0.0051	0.0049	0.00
+0.9544D+W at 0.00 to 0.30	0.739	27.468	0.59	1.37	0.90	3.37	0.233	0.0051	0.0050	0.00
+0.8456D+E at 0.00 to 0.30	0.654	27.468	0.59	0.57	0.90	3.35	0.233	0.0051	0.0050	0.00
+0.8456D-E at 0.00 to 0.30	0.654	27.468	0.59	0.57	0.90	3.35	0.233	0.0051	0.0050	0.00

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Mactual k-ft	Stiffness I gross in^4	I cracked in^4	I effective in^4	Deflections Deflection in	Defl. Ratio
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
+D+0.60W at 8.70 to 9.00	0.026	0.59	0.00	443.30	40.09	443.300	0.098	2,194.0
+D+0.450W at 8.70 to 9.00	0.026	0.59	0.00	443.30	40.09	443.300	0.037	5,775.8
+0.60D+0.450W at 8.70 to 9.00	0.016	0.59	0.00	443.30	40.07	443.300	0.037	5,780.2
+D+0.70E at 8.70 to 9.00	0.026	0.59	0.00	443.30	40.09	443.300	0.023	9,479.8
+D-0.70E at 8.70 to 9.00	0.026	0.59	0.00	443.30	40.09	443.300	0.023	9,479.8
+D+0.5250E at 8.70 to 9.00	0.026	0.59	0.00	443.30	40.09	443.300	0.017	12,639.7
+D-0.5250E at 8.70 to 9.00	0.026	0.59	0.00	443.30	40.09	443.300	0.017	12,639.7
+0.60D+0.70E at 8.70 to 9.00	0.015	0.59	0.00	443.30	40.07	443.300	0.023	9,486.6
+0.60D-0.70E at 8.70 to 9.00	0.015	0.59	0.00	443.30	40.07	443.300	0.023	9,486.6
W Only at 8.70 to 9.00	0.001	0.59	0.00	443.30	40.04	443.300	0.410	526.7
E Only at 8.70 to 9.00	0.000	0.59	0.00	443.30	40.04	443.300	0.032	6,647.9
E Only * -1.0 at 8.70 to 9.00	0.000	0.59	0.00	443.30	40.04	443.300	0.032	6,647.9

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.0 k	0.00 k	0.774 k
+D+0.60W	0.2 k	0.00 k	0.774 k
+D+0.450W	0.1 k	0.00 k	0.774 k
+0.60D+0.450W	0.1 k	0.00 k	0.464 k

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DESCRIPTION: 3/SD-100 - Masonry Utility Yard Wall

+D+0.70E	0.1 k	0.00 k	0.774 k
+D-0.70E	0.1 k	0.00 k	0.774 k
+D+0.5250E	0.1 k	0.00 k	0.774 k
+D-0.5250E	0.1 k	0.00 k	0.774 k
+0.60D+0.70E	0.1 k	0.00 k	0.464 k
+0.60D-0.70E	0.1 k	0.00 k	0.464 k
W Only	0.3 k	0.00 k	0.000 k
E Only	0.1 k	0.00 k	0.000 k
E Only * -1.0	0.1 k	0.00 k	0.000 k

MSE RETAINING WALLS

GENERAL INFO

SOILS:

→ FOLLOWING GEOTECH INSTRUCTION ON (E) SOILS & STRUC FILL REQS

REINFORCED SOIL –

γ = 130PCF
ϕ = 34°
C = 0 PSF (ASSUMED FOR SANDS & FILL, TYP)
δ = 2/3 ϕ = 23°

γ_{SAT} = 130 PCF (UNKOWN, BUT WALL WILL BE WELL DRAINED, TYP FOR SOILS)

RETAINED SOIL –

γ = 125PCF
ϕ = 30°
C = 0 PSF
δ = 2/3 ϕ = 20°

γ_{SAT} = 125PCF

FOUNDATION SOIL – MATCHES "RETAINED SOIL"

MSE WALL:

- REDI-ROCK WALL W/ 28" OR 41" BLOCKS + CAP BLOCK
- MIRAGRID 2X OR 10X REINF FABRIC
- ROCK FND PAD W/ MIRAFI GEOGRID REINF TO DISTRIBUTE FORCES

SURCHARGE LOADS:

- 250PSF ROAD
- 100 PSF TYP LANDSCAPE THAT CAN BE ACCESSED
- 60 PSF GROUND SNOW LOAD (DOES NOT CONTROL HERE)

WALL DRAINAGE:

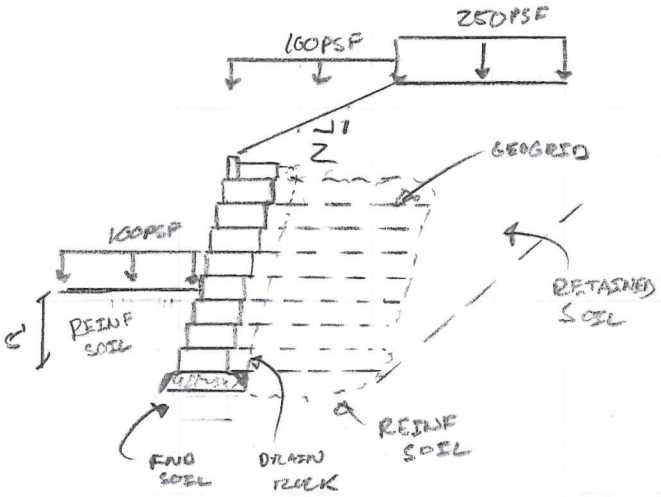
- FOLLOWING GEOTECH REPORT & REDI-ROCK GUIDES
- DRAIN SIZED BY CIVIL

OTHER: q_{ALL} = 5000PSF → USE SF = 1.3 FOR BEARING CHECK TO BE CONSERVATIVE
FROST DEPTH = 5'-0

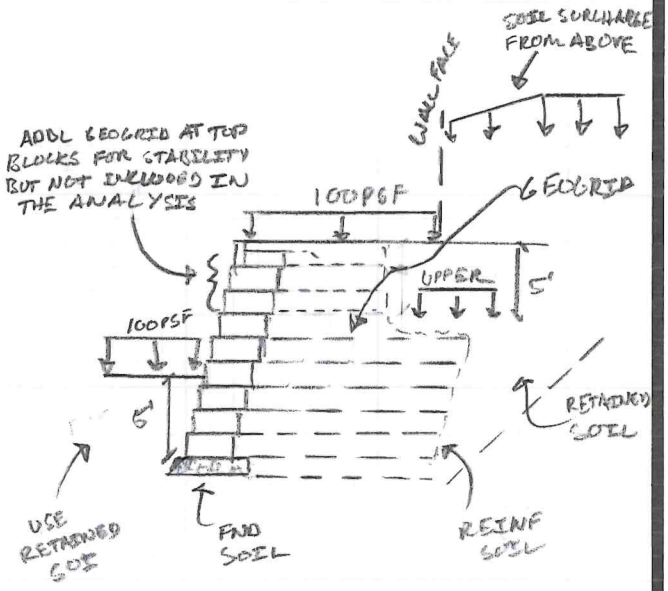
KGA Structural Engineers KRAMER GEHLEN ASSOCIATES	PROJECT VA TOGUS	MSE RETAINING WALLS	
	CLIENT GDM		
805 Broadway St. Suite 415 Vancouver, WA 98660-3310	360-693-1621 503-289-2661 Fax: 360-696-1572 www.kramer-gehlen.com	DATE 2/11/26	DESIGN APH
		PROJECT NO. 23072-00	SHEET

DESIGN APPROACH

- DESIGN UPPER WALL INDEPENDENTLY, THEN APPLY WALL BEARING PESSURE TO LOWER WALL (MAX) AS A LOCATED SURCHARGE LOAD ACTING VERTICALLY.
- ADDITIONAL HORIZONTAL SURCHARGE LOADS FROM THE UPPER WALL BEING EMBEDED 5' IN SOIL IGNORED AS THE UPPER WALL WAS DESIGNED W/O THIS SOIL RESISTING WALL FORCES (DESIGNED AS "AT REST")
- WHERE THERE IS NO UPPER WALL, LOWER WALL WAS DESIGNED W/O ADDL SURCHARGE
- LOWER WALL DESIGNED W/ EMBEDMENT RESISTING PARTIALLY (½ PASSIVE)



UPPER WALL



LOWER WALL

- MIN REINF LENGTH = 0.6H OR 4FT, WHICHEVER IS GREATER
- GLOBAL STABILITY ANALYSIS USES BISHOP METHOD W/ 1.4 SF

SEISMIC LOADS:

- UNIFORM DISTRIBUTION

$K_h = S_{DS}/2.5 = 0.109$

$S_{DS} = 0.272$ (SITE CLASS C, TYPE IV)

→ NOT CONSIDERING VERTICAL LOADS ($K_v = 0$)

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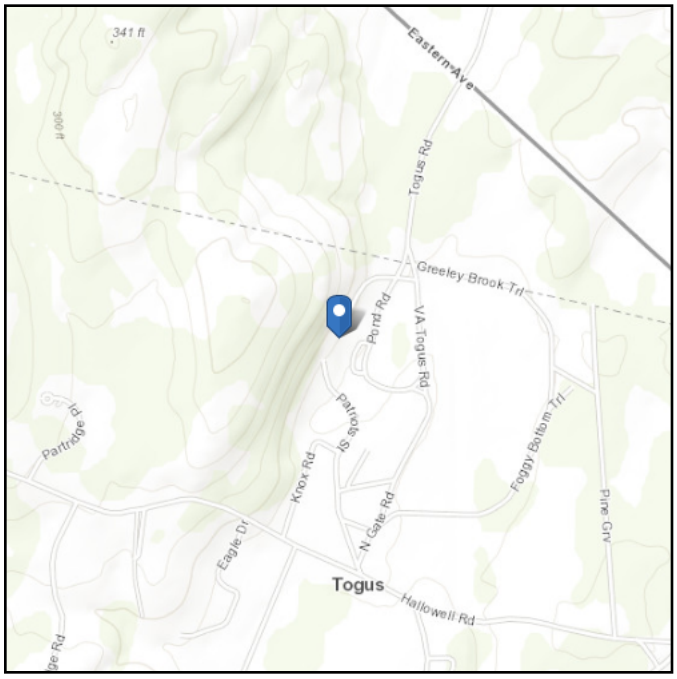
PROJECT	VA TOGUS
CLIENT	GDM
	MSE RETAINING WALLS
DATE	2/11/26
DESIGN	APH
PROJECT NO.	23072-00
SHEET	

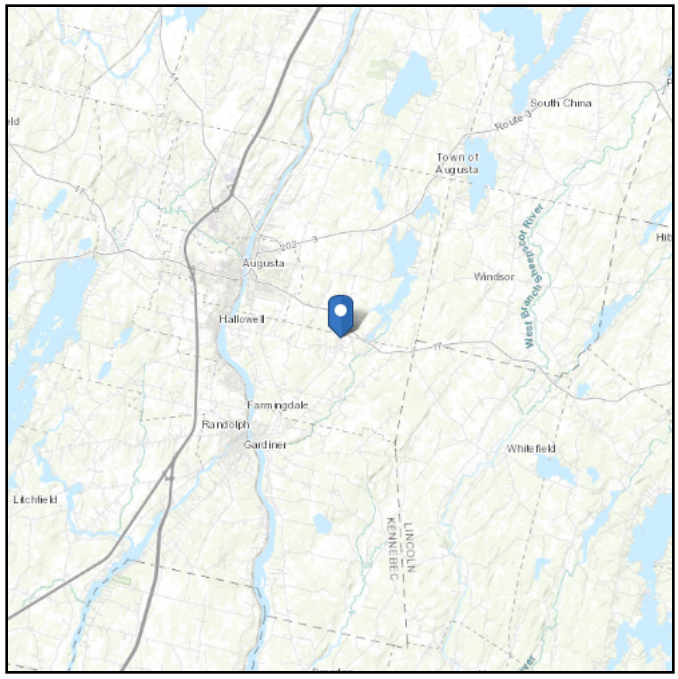
ASCE Hazards Report

Address:
1 Va Ctr
Augusta, Maine
04330

Standard: ASCE/SEI 7-16
Risk Category: IV
Soil Class: C - Very Dense Soil and Soft Rock

Latitude: 44.280517
Longitude: -69.704758
Elevation: 182.16053601942568 ft (NAVD 88)





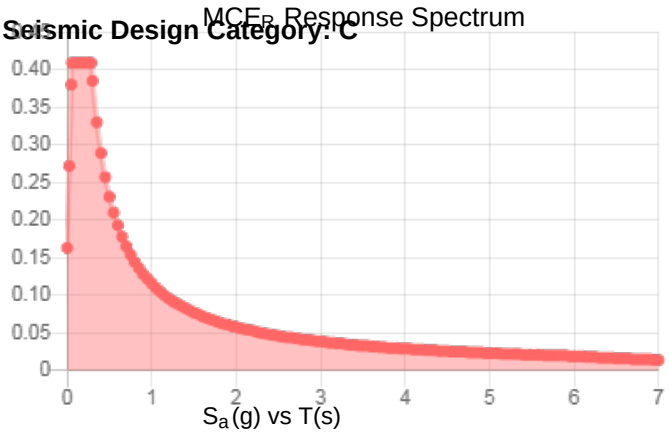
Seismic

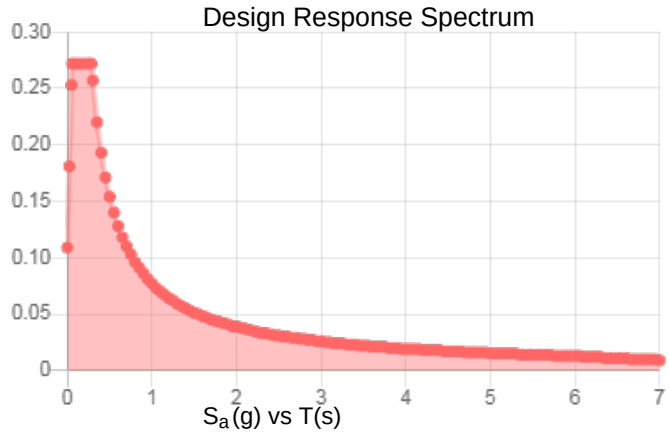
Site Soil Class: C - Very Dense Soil and Soft Rock

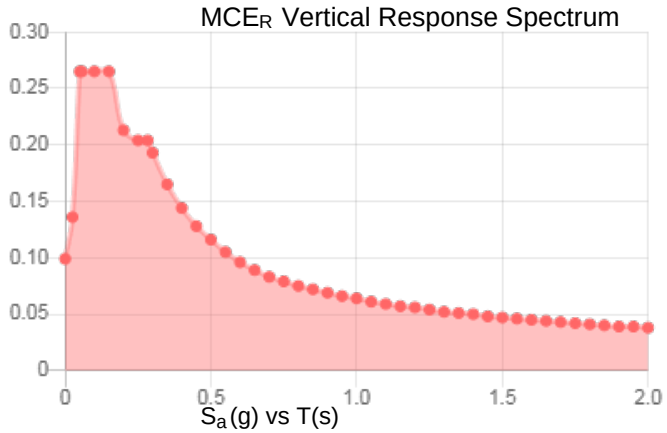
Results:

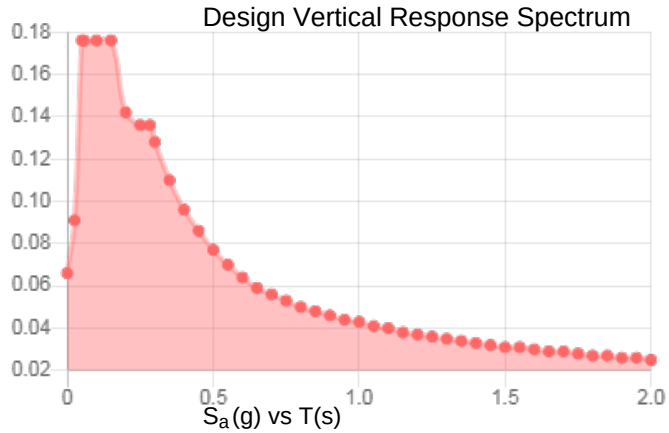
S_S :	0.314	S_{D1} :	0.077
S_1 :	0.077	T_L :	6
F_a :	1.3	PGA :	0.192
F_v :	1.5	PGA_M :	0.232
S_{MS} :	0.409	F_{PGA} :	1.208
S_{M1} :	0.116	I_e :	1.5
S_{DS} :	0.272	C_v :	0.81

Seismic Design Category: C









Data Accessed: **Fri Feb 13 2026**

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-16 and ASCE/SEI 7-16 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-16 Ch. 21 are available from USGS.

Snow

Results:

Ground Snow Load, p_g:	60 lb/ft^2
Mapped Elevation:	182.2 ft
Data Source:	ASCE/SEI 7-16, Table 7.2-8
Date Accessed:	Fri Feb 13 2026

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.

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Analysis of Redi Rock wall

Input data

Project : VA Togus
Part : Retaining Walls
Description : Upper Wall - 16ft
Customer : GDM
Author : APH
Date : 2/9/2026
Project ID : VA Togus EHRM
Project number : 23072-00

Settings

(input for current task)

Wall analysis

Verification methodology : Safety factors (ASD)
Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00

Safety factors			
Transient design situation			
Safety factor for overturning :	SF_o =	1.50	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	1.30	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Blocks

No.	Description	Block height h [in]	Block width w [in]	Unit weight γ [pcf]
1	Block 28 PC	18.00	28.00	120.00
2	Top block 28	18.00	28.00	120.00

No.	Description	Shear bearing capacity of joint F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Block friction f [°]
1	Block 28 PC	6061.00	11276.00	44.00
2	Top block 28	6061.00	11276.00	44.00

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[Redi-Rock International | (231) 237 - 9500 ext 3010| engineering@redi-rock.com| www.redi-rock.com]

Setbacks

No.	Setback s [in]
1	0.000
2	0.033
3	0.135
6	0.269

Geometry

No. group	Description	Count	Setback s [in]
1	Block 28 PC	3	0.13
2	Block 28 PC	10	0.13
3	Top block 28	1	-

Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 1.50 ft
Height h = 1.50 ft
Width b = 5.33 ft

Material

Soil creating foundation - Foundation Soil

Types of reinforcements

No.	Name	Type of reinforcement	Line type	Tensile strength		
				T_{ult} [lbf/ft]	R_t [lbf/ft]	R_{con} [lbf/ft]
2	Miragrid 8XT	Miragrid 8XT	– – – – – – – – – –	7600.00	4537.99	4007.27
3	Miragrid 10XT	Miragrid 10XT	– · – · – · – · – · –	10200.00	6090.46	5285.45

2. Miragrid 8XT

Reinforcement details

Short-term char. strength	T_{ult}	=	7600.00	lbf/ft
Creep red. factor	RF_{CR}	=	1.45	
Durability red. factor	RF_D	=	1.10	
Installation damage red. factor	RF_{ID}	=	1.05	
Long-term design strength	R_t	=	4537.99	lbf/ft
Coefficient of direct slip along reinforcement	C_{ds}	=	0.80	
Coefficient of interaction of soil and geo-reinforcement	C_i	=	0.80	
Scale correction factor	α	=	1.0	
Long-term strength reduction factor	CR_{cr}	=	0.580	
Calculation of long-term connection strength	R_{con}	=	4007.27	lbf/ft

3. Miragrid 10XT

Reinforcement details

Short-term char. strength	T_{ult}	=	10200.00	lbf/ft
Creep red. factor	RF_{CR}	=	1.45	
Durability red. factor	RF_D	=	1.10	
Installation damage red. factor	RF_{ID}	=	1.05	

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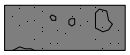
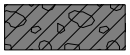
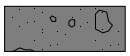
Long-term design strength	R_t	=	6090.46	lbf/ft
Coefficient of direct slip along reinforcement	C_{ds}	=	0.80	
Coefficient of interaction of soil and geo-reinforcement	C_i	=	0.80	
Scale correction factor	α	=	1.0	
Long-term strength reduction factor	CR_{cr}	=	0.570	
Calculation of long-term connection strength	R_{con}	=	5285.45	lbf/ft

Reinforcements

Input mode : table of reinforcements
Top reinforcement : straight (25%)

No.	Consider	Name	Geometry	Length of reinforcement l [ft]	End pt. coordinate l_k [ft]
1	Yes	Miragrid 8XT	input length	12.75	
2	Yes	Miragrid 8XT	input length	12.75	
3	Yes	Miragrid 8XT	input length	12.75	
4	Yes	Miragrid 8XT	input length	12.75	
5	Yes	Miragrid 8XT	input length	12.75	
6	Yes	Miragrid 8XT	input length	12.75	
7	Yes	Miragrid 8XT	input length	12.75	
8	Yes	Miragrid 8XT	input length	12.75	
9	Yes	Miragrid 8XT	input length	12.75	
10	Yes	Miragrid 8XT	input length	12.75	
11	Yes	Miragrid 8XT	input length	12.75	
12	Yes	Miragrid 8XT	input length	12.75	
13	Yes	Miragrid 8XT	input length	12.75	
14	Yes	Miragrid 10XT	input length	16.00	

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	Foundation Soil		30.00	0.0	125.00	62.50	20.00
2	Reinforced Soil		34.00	0.0	130.00	67.50	23.00
3	Retained Soil		30.00	0.0	125.00	62.50	20.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Foundation Soil

Unit weight :	γ	=	125.0 pcf
Stress-state :	effective		
Angle of internal friction :	φ_{ef}	=	30.00 °
Cohesion of soil :	c_{ef}	=	0.0 psf
Angle of friction struc.-soil :	δ	=	20.00 °
Saturated unit weight :	γ_{sat}	=	125.0 pcf

Reinforced Soil

Unit weight :	γ	=	130.0 pcf

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Stress-state : effective
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 23.00 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Retained Soil
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 20.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	-	0.00 .. ∞	Retained Soil	

Terrain profile

Terrain behind construction has the slope 1: 4.00 (slope angle is 14.04 °).
Embankment height is 6.75 ft, embankment length is 27.00 ft.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge new	Surcharge change	Action	Mag.1 [lbf/ft²]	Mag.2 [lbf/ft²]	Ord.x x [ft]	Length l [ft]	Depth z [ft]
1	Yes		variable	250.00		27.00	12.00	on terrain
2	Yes		variable	100.00		0.00	27.00	on terrain

No.	Name
1	Road
2	Yard

Resistance on front face of the structure

Resistance on front face of the structure: at rest
Soil on front face of the structure - Reinforced Soil
Soil thickness in front of structure h = 6.50 ft
Terrain surcharge f = 100.0 lbf/ft²

Terrain in front of structure is flat.

Earthquake

Factor of horizontal acceleration K_h = 0.1088
Factor of vertical acceleration K_v = 0.0000

Water below the GWT is restricted.

Settings of the stage of construction

Design situation : transient
Reduction of soil/soil friction angle : do not reduce

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Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
FF resistance	-715.9	-1.67	1.0	-0.27	1.000
Resistance on front face	-220.2	-2.50	0.2	2.54	1.000
Weight - reinforced soil	0.0	-12.21	40761.4	10.28	1.000
Earthquake - soil wedge	4434.8	-12.21	0.0	10.28	1.000
Active pressure	10314.9	-8.71	6957.3	20.08	1.000
Earthq.- act.pressure	3351.9	-16.99	2260.9	20.08	1.000
Road	874.3	-12.01	589.7	20.08	1.000
Yard	296.0	-19.67	199.7	20.08	1.000
Weight - wall	0.0	-10.33	5784.2	2.02	1.000
Earthq.- constr.	629.3	-10.33	0.0	2.02	1.000
Yard	0.0	-23.24	1791.7	11.12	1.000

Verification of complete wall

Place of verification : bottom of blocks

Check for overturning stability

Resisting moment M_{res} = 651776.1 lbfft/ft
Overturning moment M_{ovr} = 222062.3 lbfft/ft

Safety factor = 2.94 > 1.50
Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 32001.79 lbf/ft
Active horizontal force H_{act} = 18965.08 lbf/ft

Safety factor = 1.69 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-230462.9	17183.47	-15440.43	0.000	3223.9

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-230462.9	17183.47	-15440.43

Verification of foundation soil

Place of verification : bottom of leveling pad
Stress in the footing bottom : rectangle

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Eccentricity verification
Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity
Max. stress at footing bottom σ = 3223.9 psf
Allowable bearing capacity of foundation soil R_d = 5000.0 psf

Safety factor = 1.55 > 1.30
Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Verification of slip on georeinforcement No. 1

Forces acting on construction (verification of reinforcement No.: 1)

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-10.33	5817.7	-0.31	1.000
Earthq.- constr.	633.0	-10.33	0.0	-0.31	1.000
Active pressure	10200.7	-7.87	6606.8	12.75	1.000
Earthq.- act.pressure	3491.8	-16.14	2348.2	12.75	1.000
Road	737.0	-9.72	485.6	12.75	1.000
Yard	459.7	-15.23	310.1	12.75	1.000
Weight - reinforced soil	0.0	-11.13	35179.8	6.93	1.000
Earthquake - soil wedge	3819.4	-11.13	0.0	6.93	1.000
Yard	0.0	-22.61	1291.8	6.29	1.000

Verification against slip along geotextile No.: 1

Inclination of slip surface = 90.00 °
Overall normal force acting on reinforcement = 46222.28 lbf/ft
Coefficient of reduction of slip along geo-textile = 0.95
Resistance along geo-reinforcement = 29618.46 lbf/ft
Wall resistance = 3358.85 lbf/ft
Overall bearing capacity of reinforcements = 0.00 lbf/ft

Check for slip:
Resisting horizontal force H_{res} = 32977.30 lbf/ft
Active horiz. force H_{act} = 14889.13 lbf/ft

Factor of safety = 2.21 > 1.50
Slip along geotextile is SATISFACTORY

Calculation of internal stability No. 1

Calculated forces and strength of reinforcements

No.	Name	F_x [lbf/ft]	Depth z[ft]	R_t [lbf/ft]	Utiliz. [%]	T_p [lbf/ft]	Utiliz. [%]	R_{con} [lbf/ft]	Utiliz. [%]
1	Miragrid 8XT	-570.73	21.00	1134.50	75.46	8331.33	10.28	1001.82	85.45
2	Miragrid 8XT	-1110.34	19.50	2269.00	73.40	14647.76	11.37	2003.64	83.12
3	Miragrid 8XT	-1025.51	18.00	2269.00	67.80	12762.48	12.05	2003.64	76.77
4	Miragrid 8XT	-958.39	16.50	2269.00	63.36	11006.84	13.06	2003.64	71.75

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No.	Name	F_x [lbf/ft]	Depth z[ft]	R_t [lbf/ft]	Utiliz. [%]	T_p [lbf/ft]	Utiliz. [%]	R_{con} [lbf/ft]	Utiliz. [%]
5	Miragrid 8XT	-915.56	15.00	2269.00	60.53	9380.83	14.64	2003.64	68.54
6	Miragrid 8XT	-872.72	13.50	2269.00	57.69	7884.45	16.60	2003.64	65.34
7	Miragrid 8XT	-829.89	12.00	2269.00	54.86	6517.70	19.10	2003.64	62.13
8	Miragrid 8XT	-787.06	10.50	2269.00	52.03	5280.58	22.36	2003.64	58.92
9	Miragrid 8XT	-744.22	9.00	2269.00	49.20	4173.09	26.75	2003.64	55.72
10	Miragrid 8XT	-701.39	7.50	2269.00	46.37	3195.23	32.93	2003.64	52.51
11	Miragrid 8XT	-658.56	6.00	2269.00	43.54	2347.01	42.09	2003.64	49.30
12	Miragrid 8XT	-615.72	4.50	2269.00	40.70	1628.41	56.72	2003.64	46.10
13	Miragrid 8XT	-572.89	3.00	2269.00	37.87	1039.45	82.67	2003.64	42.89
14	Miragrid 10XT/ Miragrid 8XT	-785.92	1.50	2657.11	44.37	1625.81	72.51	2323.18	50.74

Check for tensile strength (reinforcement No.1)
Tension strength R_t = 1134.50 lbf/ft
Force in reinforcement F_x = 570.73 lbf/ft

Safety factor = 1.99 > 1.50
Reinforcement for tensile strength is SATISFACTORY

Check for pull out resistance (reinforcement No.13)
Pull out resistance T_p = 1039.45 lbf/ft
Force in reinforcement F_x = 572.89 lbf/ft

Safety factor = 1.81 > 1.50
Reinforcement for pull out resistance is SATISFACTORY

Verification of connection strength (reinforcement No.1)
Connection strength R_{con} = 1001.82 lbf/ft
Force in reinforcement F_x = 570.73 lbf/ft

Safety factor = 1.76 > 1.50
Connection strength is SATISFACTORY

Overall verification - reinforcement is SATISFACTORY

Slope stability analysis

Input data (Construction stage 1)

Project

Settings

(input for current task)

Stability analysis

Verification methodology : Safety factors (ASD)
Earthquake analysis : Standard

Safety factors			
Transient design situation			
Safety factor :	SF_s =	1.40	[–]

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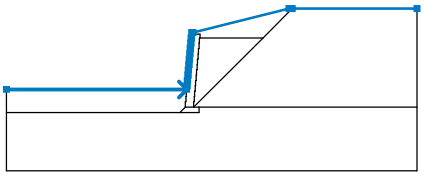
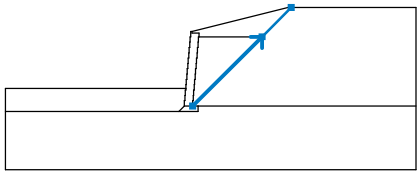
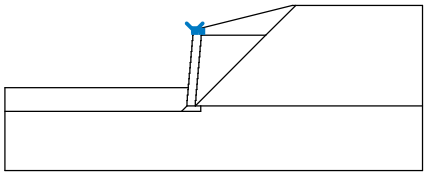
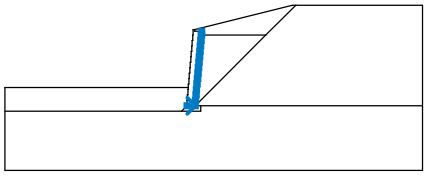
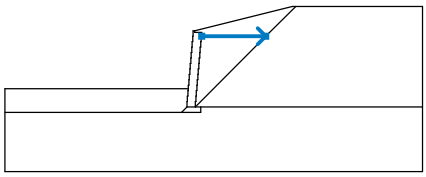
Anchors

Verification methodology : Safety factors (ASD)

Safety factors			
Safety factor for steel strength :	SF_t =	1.50	[–]
Safety factor for pull out resistance (soil) :	SF_e =	1.50	[–]
Safety factor for pull out resistance (grouting) :	SF_c =	1.50	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		-52.50	-16.00	-1.76	-16.00	-1.76	-15.00
		-1.63	-15.00	-1.63	-13.50	-1.49	-13.50
		-1.49	-12.00	-1.36	-12.00	-1.36	-10.50
		-1.22	-10.50	-1.22	-9.00	-1.09	-9.00
		-1.09	-7.50	-0.95	-7.50	-0.95	-6.00
		-0.82	-6.00	-0.82	-4.50	-0.69	-4.50
		-0.69	-3.00	-0.55	-3.00	-0.55	-1.50
		-0.42	-1.50	-0.42	0.00	0.00	0.00
		27.00	6.75	27.92	6.75	63.00	6.75
2		0.17	-21.00	19.67	-1.50	27.92	6.75
3		0.00	0.00	0.00	-0.42	1.92	-0.42
4		-2.17	-21.00	0.17	-21.00	0.17	-19.50
		0.30	-19.50	0.30	-18.00	0.44	-18.00
		0.44	-16.50	0.57	-16.50	0.57	-15.00
		0.71	-15.00	0.71	-13.50	0.84	-13.50
		0.84	-12.00	0.98	-12.00	0.98	-10.50
		1.11	-10.50	1.11	-9.00	1.24	-9.00
		1.24	-7.50	1.38	-7.50	1.38	-6.00
		1.51	-6.00	1.51	-4.50	1.65	-4.50
		1.65	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
5		1.92	-1.50	19.67	-1.50		

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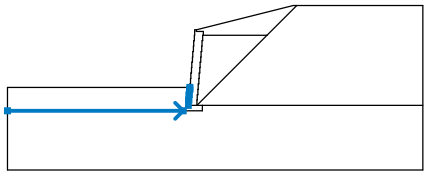
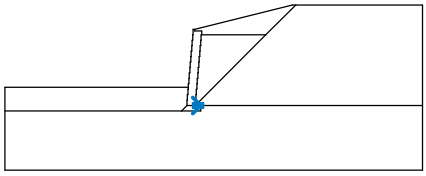
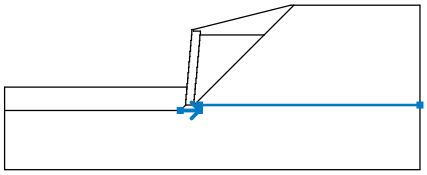
No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-52.50	-22.50	-3.67	-22.50	-2.17	-21.00
		-2.17	-19.50	-2.03	-19.50	-2.03	-18.00
		-1.90	-18.00	-1.90	-16.50	-1.76	-16.50
		-1.76	-16.00				
7		0.17	-21.00	1.66	-21.00		
8		-3.67	-22.50	1.66	-22.50	1.66	-21.00
		63.00	-21.00				

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	Foundation Soil		30.00	0.0	125.0
2	Reinforced Soil		34.00	0.0	130.0
3	Retained Soil		30.00	0.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	Foundation Soil		125.0		
2	Reinforced Soil		130.0		
3	Retained Soil		125.0		

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Soil parameters

Foundation Soil

Unit weight :	γ =	125.0 pcf
Stress-state :	effective	
Shear strength :	Mohr-Coulomb	
Angle of internal friction :	φ_{ef} =	30.00 °
Cohesion of soil :	c_{ef} =	0.0 psf
Saturated unit weight :	γ_{sat} =	125.0 pcf

Reinforced Soil

Unit weight :	γ =	130.0 pcf
Stress-state :	effective	
Shear strength :	Mohr-Coulomb	
Angle of internal friction :	φ_{ef} =	34.00 °
Cohesion of soil :	c_{ef} =	0.0 psf
Saturated unit weight :	γ_{sat} =	130.0 pcf

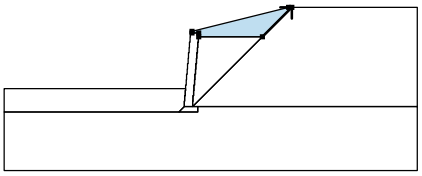
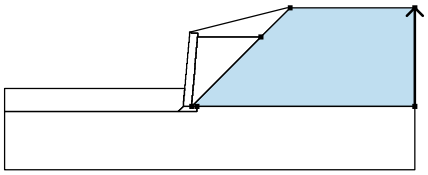
Retained Soil

Unit weight :	γ =	125.0 pcf
Stress-state :	effective	
Shear strength :	Mohr-Coulomb	
Angle of internal friction :	φ_{ef} =	30.00 °
Cohesion of soil :	c_{ef} =	0.0 psf
Saturated unit weight :	γ_{sat} =	125.0 pcf

Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure		120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft] x	z	x	z	Assigned soil
1		19.67	-1.50	27.92	6.75	Reinforced Soil
		27.00	6.75	0.00	0.00	
		0.00	-0.42	1.92	-0.42	
		1.92	-1.50			
2		63.00	-21.00	63.00	6.75	Retained Soil
		27.92	6.75	19.67	-1.50	
		0.17	-21.00	1.66	-21.00	

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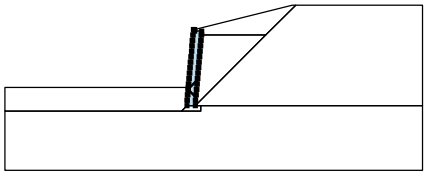
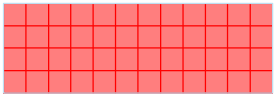
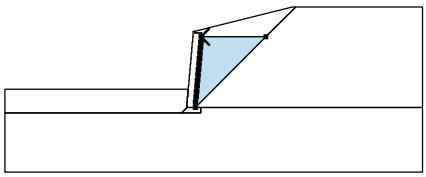
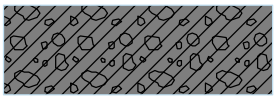
No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
3		-1.76	-16.50	-1.90	-16.50	Material of structure 
		-1.90	-18.00	-2.03	-18.00	
		-2.03	-19.50	-2.17	-19.50	
		-2.17	-21.00	0.17	-21.00	
		0.17	-19.50	0.30	-19.50	
		0.30	-18.00	0.44	-18.00	
		0.44	-16.50	0.57	-16.50	
		0.57	-15.00	0.71	-15.00	
		0.71	-13.50	0.84	-13.50	
		0.84	-12.00	0.98	-12.00	
		0.98	-10.50	1.11	-10.50	
		1.11	-9.00	1.24	-9.00	
		1.24	-7.50	1.38	-7.50	
		1.38	-6.00	1.51	-6.00	
		1.51	-4.50	1.65	-4.50	
		1.65	-3.00	1.78	-3.00	
		1.78	-1.50	1.92	-1.50	
		1.92	-0.42	0.00	-0.42	
		0.00	0.00	-0.42	0.00	
		-0.42	-1.50	-0.55	-1.50	
		-0.55	-3.00	-0.69	-3.00	
		-0.69	-4.50	-0.82	-4.50	
		-0.82	-6.00	-0.95	-6.00	
		-0.95	-7.50	-1.09	-7.50	
		-1.09	-9.00	-1.22	-9.00	
		-1.22	-10.50	-1.36	-10.50	
		-1.36	-12.00	-1.49	-12.00	
		-1.49	-13.50	-1.63	-13.50	
		-1.63	-15.00	-1.76	-15.00	
		-1.76	-16.00			
4		1.92	-1.50	1.78	-1.50	Reinforced Soil 
		1.78	-3.00	1.65	-3.00	
		1.65	-4.50	1.51	-4.50	
		1.51	-6.00	1.38	-6.00	
		1.38	-7.50	1.24	-7.50	
		1.24	-9.00	1.11	-9.00	
		1.11	-10.50	0.98	-10.50	
		0.98	-12.00	0.84	-12.00	
		0.84	-13.50	0.71	-13.50	
		0.71	-15.00	0.57	-15.00	
		0.57	-16.50	0.44	-16.50	
		0.44	-18.00	0.30	-18.00	
		0.30	-19.50	0.17	-19.50	
		0.17	-21.00	19.67	-1.50	

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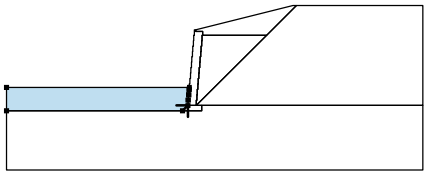
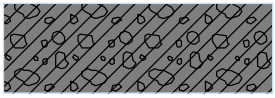
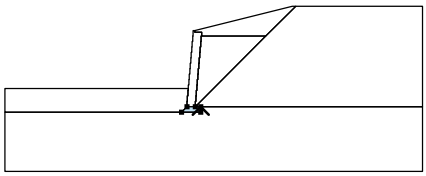
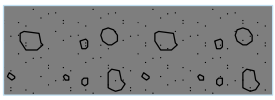
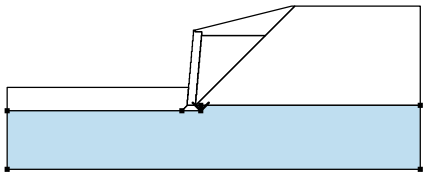
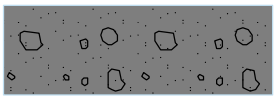
No.	Surface position	Coordinates of surface points [ft] x	z	x	z	Assigned soil
5		-3.67	-22.50	-2.17	-21.00	Reinforced Soil 
		-2.17	-19.50	-2.03	-19.50	
		-2.03	-18.00	-1.90	-18.00	
		-1.90	-16.50	-1.76	-16.50	
		-1.76	-16.00	-52.50	-16.00	
		-52.50	-22.50			
6		1.66	-22.50	1.66	-21.00	Foundation Soil 
		0.17	-21.00	-2.17	-21.00	
		-3.67	-22.50			
7		1.66	-21.00	1.66	-22.50	Retained Soil 
		-3.67	-22.50	-52.50	-22.50	
		-52.50	-38.90	63.00	-38.90	
		63.00	-21.00			

Reinforcements

No.	Point to the left x [ft]	z [ft]	Point to the right x [ft]	z [ft]	Length L [ft]	Strength R_t [lbf/ft]	Pull out resist.	End of reinf.
1	0.17	-21.00	12.92	-21.00	12.75	1134.5	C = 0.80	Fixed
2	0.30	-19.50	13.05	-19.50	12.75	2269.0	C = 0.80	Fixed
3	0.44	-18.00	13.19	-18.00	12.75	2269.0	C = 0.80	Fixed
4	0.57	-16.50	13.32	-16.50	12.75	2269.0	C = 0.80	Fixed
5	0.71	-15.00	13.46	-15.00	12.75	2269.0	C = 0.80	Fixed
6	0.84	-13.50	13.59	-13.50	12.75	2269.0	C = 0.80	Fixed
7	0.98	-12.00	13.73	-12.00	12.75	2269.0	C = 0.80	Fixed
8	1.11	-10.50	13.86	-10.50	12.75	2269.0	C = 0.80	Fixed
9	1.24	-9.00	13.99	-9.00	12.75	2269.0	C = 0.80	Fixed
10	1.38	-7.50	14.13	-7.50	12.75	2269.0	C = 0.80	Fixed
11	1.51	-6.00	14.26	-6.00	12.75	2269.0	C = 0.80	Fixed
12	1.65	-4.50	14.40	-4.50	12.75	2269.0	C = 0.80	Fixed
13	1.78	-3.00	14.53	-3.00	12.75	2269.0	C = 0.80	Fixed
14	1.92	-1.50	17.92	-1.50	16.00	2657.1	C = 0.80	Fixed

Surcharge

No.	Type	Type of action	Location z [ft]	Origin x [ft]	Length l [ft]	Width b [ft]	Slope α [°]	Magnitude q, q_1, f, F, x	q_2, z	unit
1	strip	variable	on terrain	x = 27.00	l = 12.00		0.00	250.0		lbf/ft^2
2	strip	variable	on terrain	x = 0.00	l = 27.00		0.00	100.0		lbf/ft^2
3	strip	permanent	on terrain	x = -52.50	l = 50.33		0.00	100.0		lbf/ft^2

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Surcharges

No.	Name
1	Road
2	Yard

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Horizontal seismic coefficient : K_h = 0.1088
Vertical seismic coefficient : K_v = 0.0000

Settings of the stage of construction

Design situation : transient

Results (Construction stage 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-3.47	[ft]	Angles :	α_1 =	-27.44	[°]
	z =	24.70	[ft]		α_2 =	66.96	[°]
Radius :	R =	45.86	[ft]				
The slip surface after optimization.							

Total weight of soil above the slip surface: 97574.8 lbf/ft

Reinforcement bearing capacity

Reinforcement	Bearing capacity [lbf/ft]
1	0.0
2	2269.0
3	0.0
4	0.0
5	0.0
6	0.0
7	0.0
8	0.0
9	0.0
10	0.0
11	0.0
12	0.0
13	0.0
14	0.0

Slope stability verification (Bishop)

Sum of active forces : F_a = 43490.3 lbf/ft
Sum of passive forces : F_p = 62029.3 lbf/ft

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Sliding moment : M_a = 1994463.3 lbfft/ft
Resisting moment : M_p = 2844664.3 lbfft/ft
Factor of safety = 1.43 > 1.40
Slope stability ACCEPTABLE

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Analysis of Redi Rock wall

Input data

Project : VA Togus
Part : Retaining Walls
Description : Upper Wall - 13ft
Customer : GDM
Author : APH
Date : 2/9/2026
Project ID : VA Togus EHRM
Project number : 23072-00

Settings

(input for current task)

Wall analysis

Verification methodology : Safety factors (ASD)
Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00

Safety factors			
Transient design situation			
Safety factor for overturning :	SF_o =	1.50	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	1.30	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Blocks

No.	Description	Block height h [in]	Block width w [in]	Unit weight γ [pcf]
1	Block 28 PC	18.00	28.00	120.00
2	Top block 28	18.00	28.00	120.00

No.	Description	Shear bearing capacity of joint F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Block friction f [°]
1	Block 28 PC	6061.00	11276.00	44.00
2	Top block 28	6061.00	11276.00	44.00

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Setbacks

No.	Setback s [in]
1	0.000
2	0.033
3	0.135
6	0.269

Geometry

No. group	Description	Count	Setback s [in]
1	Block 28 PC	3	0.13
2	Block 28 PC	8	0.13
3	Top block 28	1	-

Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 1.50 ft
Height h = 1.50 ft
Width b = 5.33 ft

Material

Soil creating foundation - Foundation Soil

Types of reinforcements

No.	Name	Type of reinforcement	Line type	Tensile strength		
				T_{ult} [lbf/ft]	R_t [lbf/ft]	R_{con} [lbf/ft]
2	Miragrid 8XT	Miragrid 8XT	- - - - - - - - - -	7600.00	4537.99	4007.27
3	Miragrid 10XT	Miragrid 10XT	— · — · — · — · —	10200.00	6090.46	5285.45

2. Miragrid 8XT

Reinforcement details

Short-term char. strength	T_{ult}	=	7600.00	lbf/ft
Creep red. factor	RF_{CR}	=	1.45	
Durability red. factor	RF_D	=	1.10	
Installation damage red. factor	RF_{ID}	=	1.05	
Long-term design strength	R_t	=	4537.99	lbf/ft
Coefficient of direct slip along reinforcement	C_{ds}	=	0.80	
Coefficient of interaction of soil and geo-reinforcement	C_i	=	0.80	
Scale correction factor	α	=	1.0	
Long-term strength reduction factor	CR_{cr}	=	0.580	
Calculation of long-term connection strength	R_{con}	=	4007.27	lbf/ft

3. Miragrid 10XT

Reinforcement details

Short-term char. strength	T_{ult}	=	10200.00	lbf/ft
Creep red. factor	RF_{CR}	=	1.45	
Durability red. factor	RF_D	=	1.10	
Installation damage red. factor	RF_{ID}	=	1.05	

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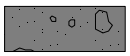
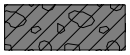
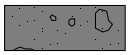
Long-term design strength	R_t	=	6090.46	lbf/ft
Coefficient of direct slip along reinforcement	C_{ds}	=	0.80	
Coefficient of interaction of soil and geo-reinforcement	C_i	=	0.80	
Scale correction factor	α	=	1.0	
Long-term strength reduction factor	CR_{cr}	=	0.570	
Calculation of long-term connection strength	R_{con}	=	5285.45	lbf/ft

Reinforcements

Input mode : table of reinforcements
Top reinforcement : straight (25%)

No.	Consider	Name	Geometry	Length of reinforcement l [ft]	End pt. coordinate l_k [ft]
1	Yes	Miragrid 8XT	input length	11.00	
2	Yes	Miragrid 8XT	input length	11.00	
3	Yes	Miragrid 8XT	input length	11.00	
4	Yes	Miragrid 8XT	input length	11.00	
5	Yes	Miragrid 8XT	input length	11.00	
6	Yes	Miragrid 8XT	input length	11.00	
7	Yes	Miragrid 8XT	input length	11.00	
8	Yes	Miragrid 8XT	input length	11.00	
9	Yes	Miragrid 8XT	input length	11.00	
10	Yes	Miragrid 8XT	input length	11.00	
11	Yes	Miragrid 8XT	input length	11.00	
12	Yes	Miragrid 10XT	input length	13.00	

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	Foundation Soil		30.00	0.0	125.00	62.50	20.00
2	Reinforced Soil		34.00	0.0	130.00	67.50	23.00
3	Retained Soil		30.00	0.0	125.00	62.50	20.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Foundation Soil

Unit weight :	γ	=	125.0 pcf
Stress-state :	effective		
Angle of internal friction :	φ_{ef}	=	30.00 °
Cohesion of soil :	c_{ef}	=	0.0 psf
Angle of friction struc.-soil :	δ	=	20.00 °
Saturated unit weight :	γ_{sat}	=	125.0 pcf

Reinforced Soil

Unit weight :	γ	=	130.0 pcf
Stress-state :	effective		
Angle of internal friction :	φ_{ef}	=	34.00 °

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Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 23.00 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Retained Soil
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 20.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	-	0.00 .. ∞	Retained Soil	

Terrain profile

Terrain behind construction has the slope 1: 2.00 (slope angle is 26.57 °).
Embankment height is 5.00 ft, embankment length is 10.00 ft.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge new	Surcharge change	Action	Mag.1 [lbf/ft²]	Mag.2 [lbf/ft²]	Ord.x x [ft]	Length l [ft]	Depth z [ft]
1	Yes		variable	250.00		10.00	12.00	on terrain
2	Yes		variable	100.00		0.00	10.00	on terrain

No.	Name
1	Road
2	Yard

Resistance on front face of the structure

Resistance on front face of the structure: at rest
Soil on front face of the structure - Reinforced Soil
Soil thickness in front of structure h = 6.50 ft
Terrain surcharge f = 100.0 lbf/ft²

Terrain in front of structure is flat.

Earthquake

Factor of horizontal acceleration K_h = 0.1088
Factor of vertical acceleration K_v = 0.0000

Water below the GWT is restricted.

Settings of the stage of construction

Design situation : transient
Reduction of soil/soil friction angle : do not reduce

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Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
FF resistance	-715.9	-1.67	1.0	-0.27	1.000
Resistance on front face	-220.2	-2.50	0.2	2.54	1.000
Weight - reinforced soil	0.0	-11.31	32679.7	9.21	1.000
Earthquake - soil wedge	3555.5	-11.31	0.0	9.21	1.000
Active pressure	7369.2	-7.67	4970.4	16.81	1.000
Earthq.- act.pressure	2200.0	-15.33	1484.0	16.81	1.000
Road	576.4	-17.58	388.8	16.81	1.000
Weight - wall	0.0	-8.83	4944.2	1.89	1.000
Earthq.- constr.	537.9	-8.83	0.0	1.89	1.000
Road	0.0	-23.00	1229.2	14.35	1.000
Yard	0.0	-20.50	1000.0	6.90	1.000

Verification of complete wall

Place of verification : bottom of blocks

Check for overturning stability

Resisting moment M_{res} = 449772.0 lbfft/ft
Overturning moment M_{ovr} = 143587.8 lbfft/ft

Safety factor = 3.13 > 1.50
Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 25612.72 lbf/ft
Active horizontal force H_{act} = 13302.99 lbf/ft

Safety factor = 1.93 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-162427.0	15160.50	-12897.06	0.000	2844.4

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-162427.0	15160.50	-12897.06

Verification of foundation soil

Place of verification : bottom of leveling pad
Stress in the footing bottom : rectangle

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Eccentricity verification
Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity
Max. stress at footing bottom σ = 2844.4 psf
Allowable bearing capacity of foundation soil R_d = 5000.0 psf

Safety factor = 1.76 > 1.30
Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Verification of slip on georeinforcement No. 1

Forces acting on construction (verification of reinforcement No.: 1)

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-8.83	4976.8	-0.45	1.000
Earthq.- constr.	541.5	-8.83	0.0	-0.45	1.000
Active pressure	7925.8	-7.30	5014.4	11.00	1.000
Earthq.- act.pressure	2178.7	-15.31	1458.7	11.00	1.000
Road	861.2	-14.92	580.9	11.00	1.000
Weight - reinforced soil	0.0	-10.39	28189.0	6.06	1.000
Earthquake - soil wedge	3058.9	-10.39	0.0	6.06	1.000
Road	0.0	-23.00	359.3	10.28	1.000
Yard	0.0	-20.50	1000.0	4.56	1.000

Verification against slip along geotextile No.: 1

Inclination of slip surface = 90.00 °
Overall normal force acting on reinforcement = 36602.35 lbf/ft
Coefficient of reduction of slip along geo-textile = 0.95
Resistance along geo-reinforcement = 23454.16 lbf/ft
Wall resistance = 2873.37 lbf/ft
Overall bearing capacity of reinforcements = 0.00 lbf/ft

Check for slip:
Resisting horizontal force H_{res} = 26327.54 lbf/ft
Active horiz. force H_{act} = 10965.73 lbf/ft

Factor of safety = 2.40 > 1.50
Slip along geotextile is SATISFACTORY

Calculation of internal stability No. 1

Calculated forces and strength of reinforcements

No.	Name	F_x [lbf/ft]	Depth z[ft]	R_t [lbf/ft]	Utiliz. [%]	T_p [lbf/ft]	Utiliz. [%]	R_{con} [lbf/ft]	Utiliz. [%]
1	Miragrid 8XT	-551.38	18.00	1134.50	72.90	6658.39	12.42	1001.82	82.56
2	Miragrid 8XT	-1072.57	16.50	2269.00	70.91	11599.13	13.87	2003.64	80.30
3	Miragrid 8XT	-1054.38	15.00	2269.00	69.70	9998.12	15.82	2003.64	78.94
4	Miragrid 8XT	-1029.15	13.50	2269.00	68.04	8513.75	18.13	2003.64	77.05

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No.	Name	F_x [lbf/ft]	Depth z[ft]	R_t [lbf/ft]	Utiliz. [%]	T_p [lbf/ft]	Utiliz. [%]	R_{con} [lbf/ft]	Utiliz. [%]
5	Miragrid 8XT	-989.52	12.00	2269.00	65.42	7146.04	20.77	2003.64	74.08
6	Miragrid 8XT	-949.90	10.50	2269.00	62.80	5894.97	24.17	2003.64	71.11
7	Miragrid 8XT	-910.27	9.00	2269.00	60.18	4760.56	28.68	2003.64	68.15
8	Miragrid 8XT	-870.65	7.50	2269.00	57.56	3742.79	34.89	2003.64	65.18
9	Miragrid 8XT	-740.06	6.00	2269.00	48.92	2802.60	39.61	2003.64	55.40
10	Miragrid 8XT	-696.97	4.50	2269.00	46.08	1968.82	53.10	2003.64	52.18
11	Miragrid 8XT	-654.16	3.00	2269.00	43.25	1277.65	76.80	2003.64	48.97
12	Miragrid 10XT/ Miragrid 8XT	-907.13	1.50	2657.11	51.21	1479.65	91.96	2323.18	58.57

Check for tensile strength (reinforcement No.1)
Tension strength R_t = 1134.50 lbf/ft
Force in reinforcement F_x = 551.38 lbf/ft

Safety factor = 2.06 > 1.50
Reinforcement for tensile strength is SATISFACTORY

Check for pull out resistance (reinforcement No.12)
Pull out resistance T_p = 1479.65 lbf/ft
Force in reinforcement F_x = 907.13 lbf/ft

Safety factor = 1.63 > 1.50
Reinforcement for pull out resistance is SATISFACTORY

Verification of connection strength (reinforcement No.1)
Connection strength R_{con} = 1001.82 lbf/ft
Force in reinforcement F_x = 551.38 lbf/ft

Safety factor = 1.82 > 1.50
Connection strength is SATISFACTORY

Overall verification - reinforcement is SATISFACTORY

Slope stability analysis

Input data (Construction stage 1)

Project

Settings

(input for current task)

Stability analysis

Verification methodology : Safety factors (ASD)
Earthquake analysis : Standard

Safety factors			
Transient design situation			
Safety factor :	SF_s =	1.40	[–]

Anchors

Verification methodology : Safety factors (ASD)

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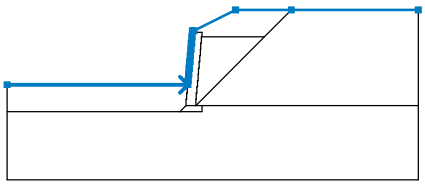
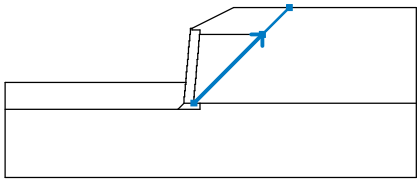
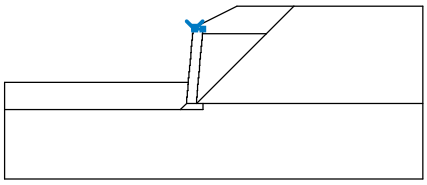
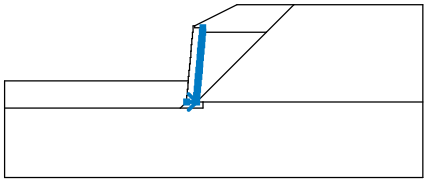
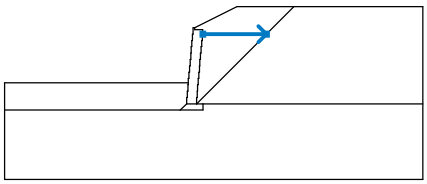
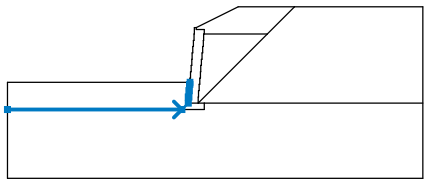
Safety factors			
Safety factor for steel strength :	SF_t =	1.50	[–]
Safety factor for pull out resistance (soil) :	SF_e =	1.50	[–]
Safety factor for pull out resistance (grouting) :	SF_c =	1.50	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		-45.00	-13.00	-1.49	-13.00	-1.49	-12.00
		-1.36	-12.00	-1.36	-10.50	-1.22	-10.50
		-1.22	-9.00	-1.09	-9.00	-1.09	-7.50
		-0.95	-7.50	-0.95	-6.00	-0.82	-6.00
		-0.82	-4.50	-0.69	-4.50	-0.69	-3.00
		-0.55	-3.00	-0.55	-1.50	-0.42	-1.50
		-0.42	0.00	0.00	0.00	10.00	5.00
		23.44	5.00	54.00	5.00		
2		0.44	-18.00	16.94	-1.50	23.44	5.00
3		0.00	0.00	0.00	-0.42	1.92	-0.42
4		-1.90	-18.00	0.44	-18.00	0.44	-16.50
		0.57	-16.50	0.57	-15.00	0.71	-15.00
		0.71	-13.50	0.84	-13.50	0.84	-12.00
		0.98	-12.00	0.98	-10.50	1.11	-10.50
		1.11	-9.00	1.24	-9.00	1.24	-7.50
		1.38	-7.50	1.38	-6.00	1.51	-6.00
		1.51	-4.50	1.65	-4.50	1.65	-3.00
		1.78	-3.00	1.78	-1.50	1.92	-1.50
		1.92	-0.42				
5		1.92	-1.50	16.94	-1.50		
6		-45.00	-19.50	-3.40	-19.50	-1.90	-18.00
		-1.90	-16.50	-1.76	-16.50	-1.76	-15.00
		-1.63	-15.00	-1.63	-13.50	-1.49	-13.50
		-1.49	-13.00				

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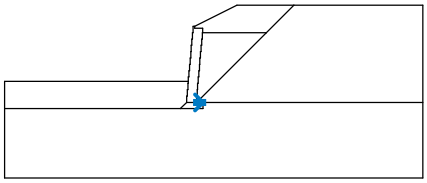
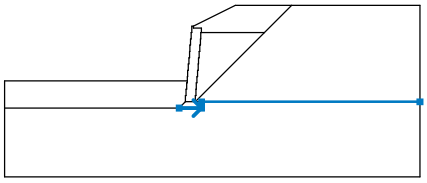
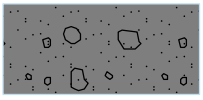
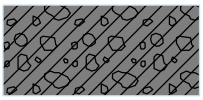
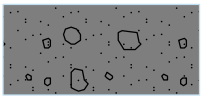
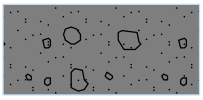
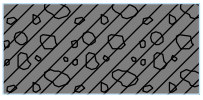
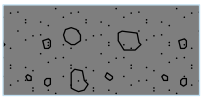
No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
7		0.44	-18.00	1.93	-18.00		
8		-3.40	-19.50	1.93	-19.50	1.93	-18.00
		54.00	-18.00				

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	Foundation Soil		30.00	0.0	125.0
2	Reinforced Soil		34.00	0.0	130.0
3	Retained Soil		30.00	0.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	Foundation Soil		125.0		
2	Reinforced Soil		130.0		
3	Retained Soil		125.0		

Soil parameters

Foundation Soil

Unit weight : γ = 125.0 pcf
Stress-state : effective
Shear strength : Mohr-Coulomb
Angle of internal friction : φ_{ef} = 30.00 °

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Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

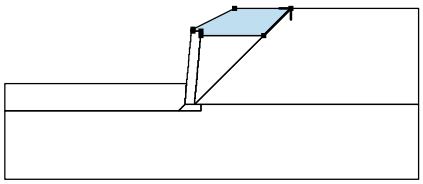
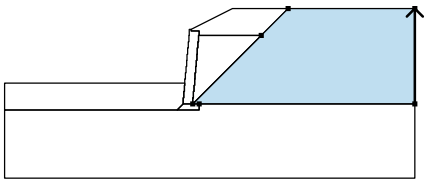
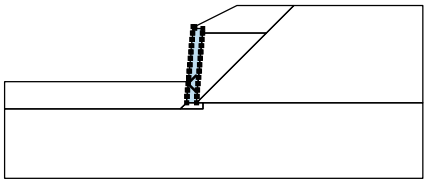
Reinforced Soil
Unit weight : γ = 130.0 pcf
Stress-state : effective
Shear strength : Mohr-Coulomb
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

Retained Soil
Unit weight : γ = 125.0 pcf
Stress-state : effective
Shear strength : Mohr-Coulomb
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure		120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		16.94	-1.50	23.44	5.00	Reinforced Soil
		10.00	5.00	0.00	0.00	
		0.00	-0.42	1.92	-0.42	
		1.92	-1.50			
2		54.00	-18.00	54.00	5.00	Retained Soil
		23.44	5.00	16.94	-1.50	
		0.44	-18.00	1.93	-18.00	
3		-1.49	-13.50	-1.63	-13.50	Material of structure
		-1.63	-15.00	-1.76	-15.00	
		-1.76	-16.50	-1.90	-16.50	
		-1.90	-18.00	0.44	-18.00	
		0.44	-16.50	0.57	-16.50	
		0.57	-15.00	0.71	-15.00	
		0.71	-13.50	0.84	-13.50	
		0.84	-12.00	0.98	-12.00	

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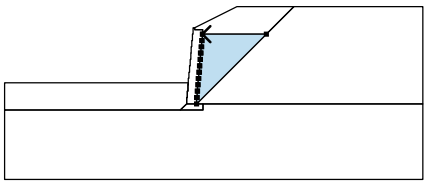
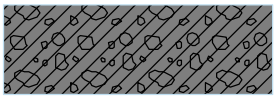
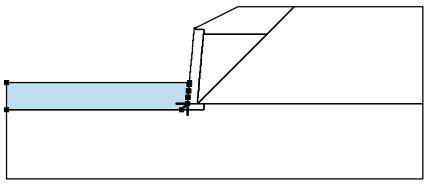
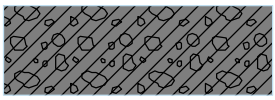
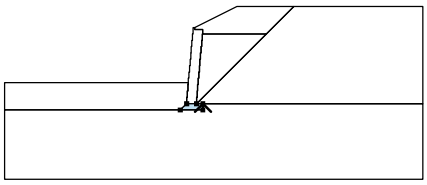
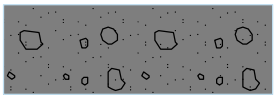
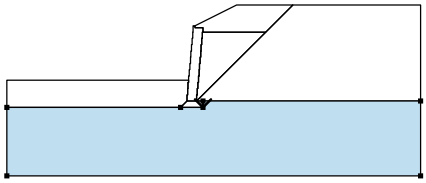
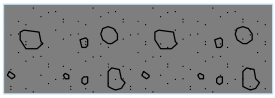
No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
		0.98	-10.50	1.11	-10.50	
		1.11	-9.00	1.24	-9.00	
		1.24	-7.50	1.38	-7.50	
		1.38	-6.00	1.51	-6.00	
		1.51	-4.50	1.65	-4.50	
		1.65	-3.00	1.78	-3.00	
		1.78	-1.50	1.92	-1.50	
		1.92	-0.42	0.00	-0.42	
		0.00	0.00	-0.42	0.00	
		-0.42	-1.50	-0.55	-1.50	
		-0.55	-3.00	-0.69	-3.00	
		-0.69	-4.50	-0.82	-4.50	
		-0.82	-6.00	-0.95	-6.00	
		-0.95	-7.50	-1.09	-7.50	
		-1.09	-9.00	-1.22	-9.00	
		-1.22	-10.50	-1.36	-10.50	
		-1.36	-12.00	-1.49	-12.00	
		-1.49	-13.00			
4		1.92	-1.50	1.78	-1.50	Reinforced Soil 
		1.78	-3.00	1.65	-3.00	
		1.65	-4.50	1.51	-4.50	
		1.51	-6.00	1.38	-6.00	
		1.38	-7.50	1.24	-7.50	
		1.24	-9.00	1.11	-9.00	
		1.11	-10.50	0.98	-10.50	
		0.98	-12.00	0.84	-12.00	
		0.84	-13.50	0.71	-13.50	
		0.71	-15.00	0.57	-15.00	
		0.57	-16.50	0.44	-16.50	
		0.44	-18.00	16.94	-1.50	
5		-3.40	-19.50	-1.90	-18.00	Reinforced Soil 
		-1.90	-16.50	-1.76	-16.50	
		-1.76	-15.00	-1.63	-15.00	
		-1.63	-13.50	-1.49	-13.50	
		-1.49	-13.00	-45.00	-13.00	
		-45.00	-19.50			
6		1.93	-19.50	1.93	-18.00	Foundation Soil 
		0.44	-18.00	-1.90	-18.00	
		-3.40	-19.50			
7		1.93	-18.00	1.93	-19.50	Retained Soil 
		-3.40	-19.50	-45.00	-19.50	
		-45.00	-35.90	54.00	-35.90	
		54.00	-18.00			

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Reinforcements

No.	Point to the left		Point to the right		Length	Strength	Pull out resist.	End of reinf.
	x [ft]	z [ft]	x [ft]	z [ft]	L [ft]	R_t [lbf/ft]		
1	0.44	-18.00	11.44	-18.00	11.00	1134.5	C = 0.80	Fixed
2	0.57	-16.50	11.57	-16.50	11.00	2269.0	C = 0.80	Fixed
3	0.71	-15.00	11.71	-15.00	11.00	2269.0	C = 0.80	Fixed
4	0.84	-13.50	11.84	-13.50	11.00	2269.0	C = 0.80	Fixed
5	0.98	-12.00	11.98	-12.00	11.00	2269.0	C = 0.80	Fixed
6	1.11	-10.50	12.11	-10.50	11.00	2269.0	C = 0.80	Fixed
7	1.24	-9.00	12.24	-9.00	11.00	2269.0	C = 0.80	Fixed
8	1.38	-7.50	12.38	-7.50	11.00	2269.0	C = 0.80	Fixed
9	1.51	-6.00	12.51	-6.00	11.00	2269.0	C = 0.80	Fixed
10	1.65	-4.50	12.65	-4.50	11.00	2269.0	C = 0.80	Fixed
11	1.78	-3.00	12.78	-3.00	11.00	2269.0	C = 0.80	Fixed
12	1.92	-1.50	14.92	-1.50	13.00	2657.1	C = 0.80	Fixed

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	variable	on terrain	x = 10.00	l = 12.00		0.00	250.0		lbf/ft^2
2	strip	variable	on terrain	x = 0.00	l = 10.00		0.00	100.0		lbf/ft^2
3	strip	permanent	on terrain	x = -45.00	l = 43.10		0.00	100.0		lbf/ft^2

Surcharges

No.	Name
1	Road
2	Yard

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Horizontal seismic coefficient : K_h = 0.1088
Vertical seismic coefficient : K_v = 0.0000

Settings of the stage of construction

Design situation : transient

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Results (Construction stage 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-2.29	[ft]	Angles :	α_1 =	-32.38	[°]
	z =	14.86	[ft]		α_2 =	72.61	[°]
Radius :	R =	32.99	[ft]				
The slip surface after optimization.							

Total weight of soil above the slip surface: 68741.9 lbf/ft

Reinforcement bearing capacity

Reinforcement	Bearing capacity [lbf/ft]
1	0.0
2	2269.0
3	0.1
4	0.0
5	0.0
6	0.0
7	0.0
8	0.0
9	0.0
10	0.0
11	0.0
12	0.0

Slope stability verification (Bishop)

Sum of active forces : F_a = 29759.3 lbf/ft
Sum of passive forces : F_p = 45927.5 lbf/ft

Sliding moment : M_a = 981760.1 lbfft/ft
Resisting moment : M_p = 1515148.1 lbfft/ft

Factor of safety = 1.54 > 1.40

Slope stability ACCEPTABLE

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Analysis of Redi Rock wall

Input data

Project : VA Togus
Part : Retaining Walls
Description : Upper Wall - 10ft
Customer : GDM
Author : APH
Date : 2/9/2026
Project ID : VA Togus EHRM
Project number : 23072-00

Settings

(input for current task)

Wall analysis

Verification methodology : Safety factors (ASD)
Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00

Safety factors			
Transient design situation			
Safety factor for overturning :	SF_o =	1.50	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	1.30	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Blocks

No.	Description	Block height h [in]	Block width w [in]	Unit weight γ [pcf]
1	Block 28 PC	18.00	28.00	120.00
2	Top block 28	18.00	28.00	120.00

No.	Description	Shear bearing capacity of joint F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Block friction f [°]
1	Block 28 PC	6061.00	11276.00	44.00
2	Top block 28	6061.00	11276.00	44.00

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Setbacks

No.	Setback s [in]
1	0.000
2	0.033
3	0.135
6	0.269

Geometry

No. group	Description	Count	Setback s [in]
1	Block 28 PC	3	0.13
2	Block 28 PC	6	0.13
3	Top block 28	1	-

Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 1.00 ft
Height h = 1.00 ft
Width b = 4.33 ft

Material

Soil creating foundation - Foundation Soil

Types of reinforcements

No.	Name	Type of reinforcement	Line type	Tensile strength		
				T_{ult} [lbf/ft]	R_t [lbf/ft]	R_{con} [lbf/ft]
2	Miragrid 8XT	Miragrid 8XT	– – – – – – – – – –	7600.00	4537.99	4007.27
3	Miragrid 10XT	Miragrid 10XT	– · – · – · – · – · –	10200.00	6090.46	5285.45

2. Miragrid 8XT

Reinforcement details

Short-term char. strength	T_{ult}	=	7600.00	lbf/ft
Creep red. factor	RF_{CR}	=	1.45	
Durability red. factor	RF_D	=	1.10	
Installation damage red. factor	RF_{ID}	=	1.05	
Long-term design strength	R_t	=	4537.99	lbf/ft
Coefficient of direct slip along reinforcement	C_{ds}	=	0.80	
Coefficient of interaction of soil and geo-reinforcement	C_i	=	0.80	
Scale correction factor	α	=	1.0	
Long-term strength reduction factor	CR_{cr}	=	0.580	
Calculation of long-term connection strength	R_{con}	=	4007.27	lbf/ft

3. Miragrid 10XT

Reinforcement details

Short-term char. strength	T_{ult}	=	10200.00	lbf/ft
Creep red. factor	RF_{CR}	=	1.45	
Durability red. factor	RF_D	=	1.10	
Installation damage red. factor	RF_{ID}	=	1.05	

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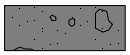
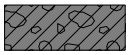
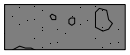
Long-term design strength	R_t	=	6090.46	lbf/ft
Coefficient of direct slip along reinforcement	C_{ds}	=	0.80	
Coefficient of interaction of soil and geo-reinforcement	C_i	=	0.80	
Scale correction factor	α	=	1.0	
Long-term strength reduction factor	CR_{cr}	=	0.570	
Calculation of long-term connection strength	R_{con}	=	5285.45	lbf/ft

Reinforcements

Input mode : table of reinforcements
Top reinforcement : straight (25%)

No.	Consider	Name	Geometry	Length of reinforcement l [ft]	End pt. coordinate l_k [ft]
1	Yes	Miragrid 8XT	input length	9.00	
2	Yes	Miragrid 8XT	input length	9.00	
3	Yes	Miragrid 8XT	input length	9.00	
4	Yes	Miragrid 8XT	input length	9.00	
5	Yes	Miragrid 8XT	input length	9.00	
6	Yes	Miragrid 8XT	input length	9.00	
7	Yes	Miragrid 8XT	input length	9.00	
8	Yes	Miragrid 8XT	input length	9.00	
9	Yes	Miragrid 8XT	input length	9.00	
10	Yes	Miragrid 10XT	input length	11.25	

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	Foundation Soil		30.00	0.0	125.00	62.50	20.00
2	Reinforced Soil		34.00	0.0	130.00	67.50	23.00
3	Retained Soil		30.00	0.0	125.00	62.50	20.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Foundation Soil

Unit weight :	γ	=	125.0 pcf
Stress-state :	effective		
Angle of internal friction :	φ_{ef}	=	30.00 °
Cohesion of soil :	c_{ef}	=	0.0 psf
Angle of friction struc.-soil :	δ	=	20.00 °
Saturated unit weight :	γ_{sat}	=	125.0 pcf

Reinforced Soil

Unit weight :	γ	=	130.0 pcf
Stress-state :	effective		
Angle of internal friction :	φ_{ef}	=	34.00 °
Cohesion of soil :	c_{ef}	=	0.0 psf
Angle of friction struc.-soil :	δ	=	23.00 °

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Saturated unit weight : γ_{sat} = 130.0 pcf

Retained Soil

Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 20.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	-	0.00 .. ∞	Retained Soil	

Terrain profile

Terrain behind construction has the slope 1: 2.00 (slope angle is 26.57 °).
Embankment height is 5.00 ft, embankment length is 10.00 ft.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge new	Surcharge change	Action	Mag.1 [lbf/ft²]	Mag.2 [lbf/ft²]	Ord.x x [ft]	Length l [ft]	Depth z [ft]
1	Yes		variable	250.00		10.00	12.00	on terrain
2	Yes		variable	100.00		0.00	10.00	on terrain

No.	Name
1	Road
2	Yard

Resistance on front face of the structure

Resistance on front face of the structure: at rest
Soil on front face of the structure - Reinforced Soil
Soil thickness in front of structure h = 6.50 ft
Terrain surcharge f = 100.0 lbf/ft²

Terrain in front of structure is flat.

Earthquake

Factor of horizontal acceleration K_h = 0.1088
Factor of vertical acceleration K_v = 0.0000

Water below the GWT is restricted.

Settings of the stage of construction

Design situation : transient
Reduction of soil/soil friction angle : do not reduce

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Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
FF resistance	-866.3	-1.83	1.3	-0.26	1.000
Resistance on front face	-242.3	-2.75	0.2	2.54	1.000
Weight - reinforced soil	0.0	-9.81	23400.9	8.16	1.000
Earthquake - soil wedge	2546.0	-9.81	0.0	8.16	1.000
Active pressure	5572.2	-6.67	3758.4	14.79	1.000
Earthq.- act.pressure	1663.6	-13.33	1122.1	14.79	1.000
Road	719.6	-13.24	485.4	14.79	1.000
Weight - wall	0.0	-7.33	4104.2	1.75	1.000
Earthq.- constr.	446.5	-7.33	0.0	1.75	1.000
Road	0.0	-20.00	791.7	13.21	1.000
Yard	0.0	-17.50	1000.0	6.63	1.000

Verification of complete wall

Place of verification : bottom of blocks

Check for overturning stability

Resisting moment M_{res} = 294623.9 lbfft/ft
Overturning moment M_{ovr} = 94856.0 lbfft/ft

Safety factor = 3.11 > 1.50
Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 19012.64 lbf/ft
Active horizontal force H_{act} = 9839.42 lbf/ft

Safety factor = 1.93 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-119374.9	11237.67	-12627.67	0.000	2595.3

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-119374.9	11237.67	-12627.67

Verification of foundation soil

Place of verification : bottom of leveling pad
Stress in the footing bottom : rectangle

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Eccentricity verification
Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity
Max. stress at footing bottom σ = 2595.3 psf
Allowable bearing capacity of foundation soil R_d = 6250.0 psf

Safety factor = 2.41 > 1.30
Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Verification of slip on georeinforcement No. 1

Forces acting on construction (verification of reinforcement No.: 1)

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-7.33	4122.7	-0.58	1.000
Earthq.- constr.	448.6	-7.33	0.0	-0.58	1.000
Active pressure	6032.7	-6.33	3793.4	9.00	1.000
Earthq.- act.pressure	1651.7	-13.20	1103.6	9.00	1.000
Road	1000.1	-10.48	654.5	9.00	1.000
Yard	8.3	-19.70	5.6	9.00	1.000
Weight - reinforced soil	0.0	-8.74	19427.8	4.97	1.000
Earthquake - soil wedge	2105.6	-8.74	0.0	4.97	1.000
Yard	0.0	-17.43	970.6	4.15	1.000

Verification against slip along geotextile No.: 1

Inclination of slip surface = 90.00 °
Overall normal force acting on reinforcement = 25955.61 lbf/ft
Coefficient of reduction of slip along geo-textile = 0.95
Resistance along geo-reinforcement = 16631.92 lbf/ft
Wall resistance = 2380.25 lbf/ft
Overall bearing capacity of reinforcements = 0.00 lbf/ft

Check for slip:
Resisting horizontal force H_{res} = 19012.16 lbf/ft
Active horiz. force H_{act} = 8692.81 lbf/ft

Factor of safety = 2.19 > 1.50
Slip along geotextile is SATISFACTORY

Calculation of internal stability No. 1

Calculated forces and strength of reinforcements

No.	Name	F_x [lbf/ft]	Depth z[ft]	R_t [lbf/ft]	Utiliz. [%]	T_p [lbf/ft]	Utiliz. [%]	R_{con} [lbf/ft]	Utiliz. [%]
1	Miragrid 8XT	-489.77	15.00	1134.50	64.76	4573.40	16.06	1001.82	73.33
2	Miragrid 8XT	-949.42	13.50	2269.00	62.76	7730.80	18.42	2003.64	71.08
3	Miragrid 8XT	-909.79	12.00	2269.00	60.15	6431.44	21.22	2003.64	68.11
4	Miragrid 8XT	-870.17	10.50	2269.00	57.53	5248.74	24.87	2003.64	65.14

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No.	Name	F_x [lbf/ft]	Depth z[ft]	R_t [lbf/ft]	Utiliz. [%]	T_p [lbf/ft]	Utiliz. [%]	R_{con} [lbf/ft]	Utiliz. [%]
5	Miragrid 8XT	-830.54	9.00	2269.00	54.91	4182.68	29.79	2003.64	62.18
6	Miragrid 8XT	-790.92	7.50	2269.00	52.29	3233.27	36.69	2003.64	59.21
7	Miragrid 8XT	-660.33	6.00	2269.00	43.65	2400.51	41.26	2003.64	49.43
8	Miragrid 8XT	-617.23	4.50	2269.00	40.80	1684.40	54.97	2003.64	46.21
9	Miragrid 8XT	-574.43	3.00	2269.00	37.97	1084.94	79.42	2003.64	43.00
10	Miragrid 10XT/ Miragrid 8XT	-786.78	1.50	2657.11	44.42	1440.90	81.90	2323.18	50.80

Check for tensile strength (reinforcement No.1)
Tension strength R_t = 1134.50 lbf/ft
Force in reinforcement F_x = 489.77 lbf/ft

Safety factor = 2.32 > 1.50
Reinforcement for tensile strength is SATISFACTORY

Check for pull out resistance (reinforcement No.10)
Pull out resistance T_p = 1440.90 lbf/ft
Force in reinforcement F_x = 786.78 lbf/ft

Safety factor = 1.83 > 1.50
Reinforcement for pull out resistance is SATISFACTORY

Verification of connection strength (reinforcement No.1)
Connection strength R_{con} = 1001.82 lbf/ft
Force in reinforcement F_x = 489.77 lbf/ft

Safety factor = 2.05 > 1.50
Connection strength is SATISFACTORY

Overall verification - reinforcement is SATISFACTORY

Slope stability analysis

Input data (Construction stage 1)

Project

Settings

(input for current task)

Stability analysis

Verification methodology : Safety factors (ASD)
Earthquake analysis : Standard

Safety factors			
Transient design situation			
Safety factor :	SF_s =	1.40	[–]

Anchors

Verification methodology : Safety factors (ASD)

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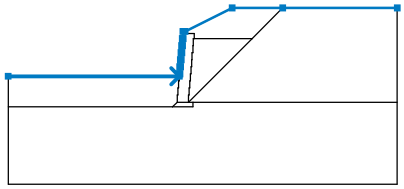
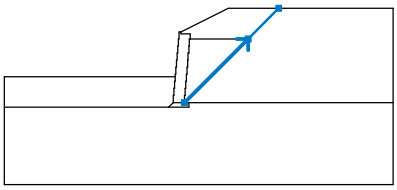
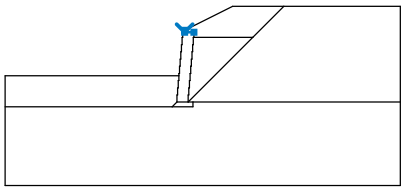
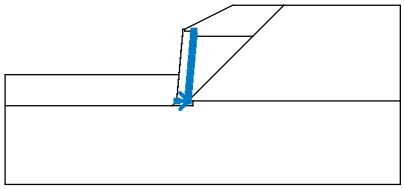
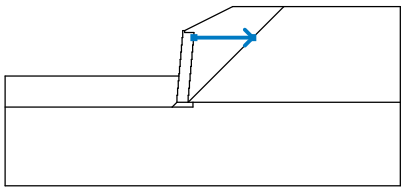
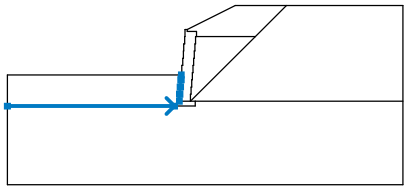
Safety factors			
Safety factor for steel strength :	SF_t =	1.50	[–]
Safety factor for pull out resistance (soil) :	SF_e =	1.50	[–]
Safety factor for pull out resistance (grouting) :	SF_c =	1.50	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		-37.50	-9.50	-1.22	-9.50	-1.22	-9.00
		-1.09	-9.00	-1.09	-7.50	-0.95	-7.50
		-0.95	-6.00	-0.82	-6.00	-0.82	-4.50
		-0.69	-4.50	-0.69	-3.00	-0.55	-3.00
		-0.55	-1.50	-0.42	-1.50	-0.42	0.00
		0.00	0.00	10.00	5.00	20.71	5.00
		45.00	5.00				
2		0.71	-15.00	14.21	-1.50	20.71	5.00
3		0.00	0.00	0.00	-0.42	1.92	-0.42
4		-1.63	-15.00	0.71	-15.00	0.71	-13.50
		0.84	-13.50	0.84	-12.00	0.98	-12.00
		0.98	-10.50	1.11	-10.50	1.11	-9.00
		1.24	-9.00	1.24	-7.50	1.38	-7.50
		1.38	-6.00	1.51	-6.00	1.51	-4.50
		1.65	-4.50	1.65	-3.00	1.78	-3.00
		1.78	-1.50	1.92	-1.50	1.92	-0.42
5		1.92	-1.50	14.21	-1.50		
6		-37.50	-16.00	-2.63	-16.00	-1.63	-15.00
		-1.63	-13.50	-1.49	-13.50	-1.49	-12.00
		-1.36	-12.00	-1.36	-10.50	-1.22	-10.50
		-1.22	-9.50				

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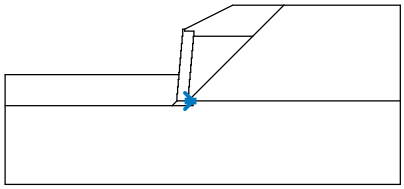
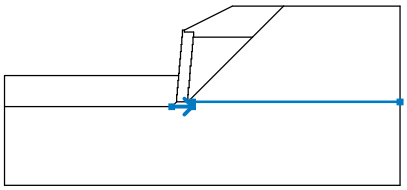
No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
7		0.71	-15.00	1.70	-15.00		
8		-2.63	-16.00	1.70	-16.00	1.70	-15.00
		45.00	-15.00				

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	Foundation Soil		30.00	0.0	125.0
2	Reinforced Soil		34.00	0.0	130.0
3	Retained Soil		30.00	0.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	Foundation Soil		125.0		
2	Reinforced Soil		130.0		
3	Retained Soil		125.0		

Soil parameters

Foundation Soil

Unit weight : γ = 125.0 pcf
Stress-state : effective
Shear strength : Mohr-Coulomb

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Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

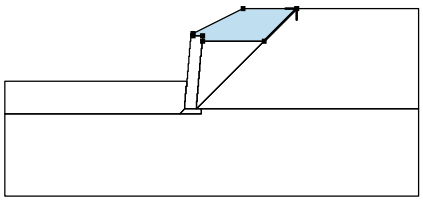
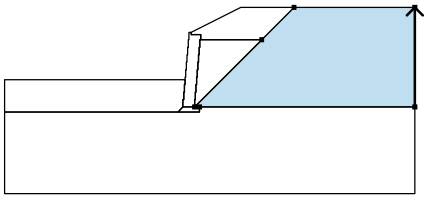
Reinforced Soil
Unit weight : γ = 130.0 pcf
Stress-state : effective
Shear strength : Mohr-Coulomb
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

Retained Soil
Unit weight : γ = 125.0 pcf
Stress-state : effective
Shear strength : Mohr-Coulomb
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure		120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		14.21	-1.50	20.71	5.00	Reinforced Soil
		10.00	5.00	0.00	0.00	
		0.00	-0.42	1.92	-0.42	
		1.92	-1.50			
2		45.00	-15.00	45.00	5.00	Retained Soil
		20.71	5.00	14.21	-1.50	
		0.71	-15.00	1.70	-15.00	

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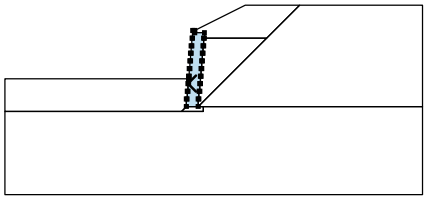
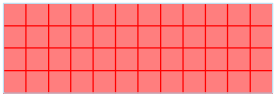
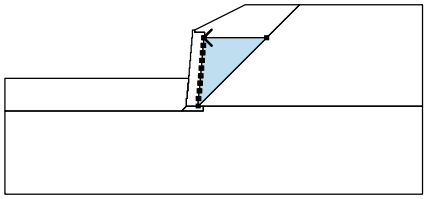
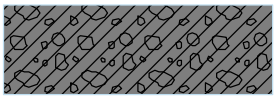
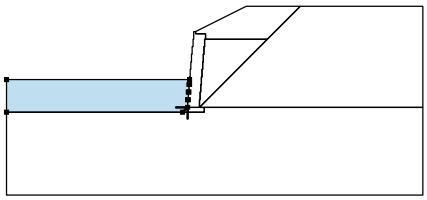
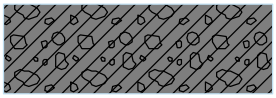
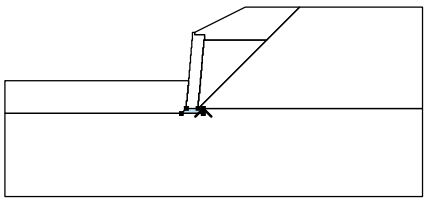
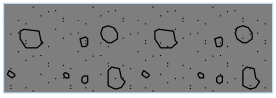
No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
3		-1.22	-10.50	-1.36	-10.50	Material of structure 
		-1.36	-12.00	-1.49	-12.00	
		-1.49	-13.50	-1.63	-13.50	
		-1.63	-15.00	0.71	-15.00	
		0.71	-13.50	0.84	-13.50	
		0.84	-12.00	0.98	-12.00	
		0.98	-10.50	1.11	-10.50	
		1.11	-9.00	1.24	-9.00	
		1.24	-7.50	1.38	-7.50	
		1.38	-6.00	1.51	-6.00	
		1.51	-4.50	1.65	-4.50	
		1.65	-3.00	1.78	-3.00	
		1.78	-1.50	1.92	-1.50	
		1.92	-0.42	0.00	-0.42	
		0.00	0.00	-0.42	0.00	
		-0.42	-1.50	-0.55	-1.50	
		-0.55	-3.00	-0.69	-3.00	
		-0.69	-4.50	-0.82	-4.50	
		-0.82	-6.00	-0.95	-6.00	
		-0.95	-7.50	-1.09	-7.50	
		-1.09	-9.00	-1.22	-9.00	
		-1.22	-9.50			
4		1.92	-1.50	1.78	-1.50	Reinforced Soil 
		1.78	-3.00	1.65	-3.00	
		1.65	-4.50	1.51	-4.50	
		1.51	-6.00	1.38	-6.00	
		1.38	-7.50	1.24	-7.50	
		1.24	-9.00	1.11	-9.00	
		1.11	-10.50	0.98	-10.50	
		0.98	-12.00	0.84	-12.00	
		0.84	-13.50	0.71	-13.50	
		0.71	-15.00	14.21	-1.50	
5		-2.63	-16.00	-1.63	-15.00	Reinforced Soil 
		-1.63	-13.50	-1.49	-13.50	
		-1.49	-12.00	-1.36	-12.00	
		-1.36	-10.50	-1.22	-10.50	
		-1.22	-9.50	-37.50	-9.50	
		-37.50	-16.00			
6		1.70	-16.00	1.70	-15.00	Foundation Soil 
		0.71	-15.00	-1.63	-15.00	
		-2.63	-16.00			

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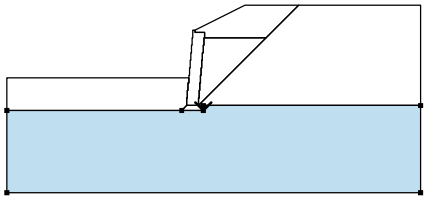
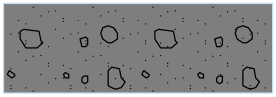
No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
7		1.70	-15.00	1.70	-16.00	Retained Soil 
		-2.63	-16.00	-37.50	-16.00	
		-37.50	-32.40	45.00	-32.40	
		45.00	-15.00			

Reinforcements

No.	Point to the left		Point to the right		Length	Strength	Pull out resist.	End of reinf.
	x [ft]	z [ft]	x [ft]	z [ft]	L [ft]	R_t [lbf/ft]		
1	0.71	-15.00	9.71	-15.00	9.00	1134.5	C = 0.80	Fixed
2	0.84	-13.50	9.84	-13.50	9.00	2269.0	C = 0.80	Fixed
3	0.98	-12.00	9.98	-12.00	9.00	2269.0	C = 0.80	Fixed
4	1.11	-10.50	10.11	-10.50	9.00	2269.0	C = 0.80	Fixed
5	1.24	-9.00	10.24	-9.00	9.00	2269.0	C = 0.80	Fixed
6	1.38	-7.50	10.38	-7.50	9.00	2269.0	C = 0.80	Fixed
7	1.51	-6.00	10.51	-6.00	9.00	2269.0	C = 0.80	Fixed
8	1.65	-4.50	10.65	-4.50	9.00	2269.0	C = 0.80	Fixed
9	1.78	-3.00	10.78	-3.00	9.00	2269.0	C = 0.80	Fixed
10	1.92	-1.50	13.17	-1.50	11.25	2657.1	C = 0.80	Fixed

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	variable	on terrain	x = 10.00	l = 12.00		0.00	250.0		lbf/ft^2
2	strip	variable	on terrain	x = 0.00	l = 10.00		0.00	100.0		lbf/ft^2
3	strip	permanent	on terrain	x = -37.50	l = 35.87		0.00	100.0		lbf/ft^2

Surcharges

No.	Name
1	Road
2	Yard

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Horizontal seismic coefficient : K_h = 0.1088
Vertical seismic coefficient : K_v = 0.0000

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Settings of the stage of construction

Design situation : transient

Results (Construction stage 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-3.32	[ft]	Angles :	α_1 =	-37.02	[°]
	z =	13.43	[ft]		α_2 =	72.93	[°]
Radius :	R =	28.72	[ft]				
The slip surface after optimization.							

Total weight of soil above the slip surface: 52327.2 lbf/ft

Reinforcement bearing capacity

Reinforcement	Bearing capacity [lbf/ft]
1	0.0
2	2269.0
3	9.2
4	0.0
5	0.0
6	0.0
7	0.0
8	0.0
9	0.0
10	0.0

Slope stability verification (Bishop)

Sum of active forces : F_a = 22280.3 lbf/ft

Sum of passive forces : F_p = 37649.5 lbf/ft

Sliding moment : M_a = 639889.1 lbfft/ft

Resisting moment : M_p = 1081294.2 lbfft/ft

Factor of safety = 1.69 > 1.40

Slope stability ACCEPTABLE

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Analysis of Redi Rock wall

Input data

Project : VA Togus
Part : Retaining Walls
Description : Upper Wall - 7ft
Customer : GDM
Author : APH
Date : 2/9/2026
Project ID : VA Togus EHRM
Project number : 23072-00

Settings

(input for current task)

Wall analysis

Verification methodology : Safety factors (ASD)
Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00

Safety factors			
Transient design situation			
Safety factor for overturning :	SF_o =	1.50	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	1.30	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Blocks

No.	Description	Block height h [in]	Block width w [in]	Unit weight γ [pcf]
1	Block 28 PC	18.00	28.00	120.00
2	Top block 28	18.00	28.00	120.00

No.	Description	Shear bearing capacity of joint F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Block friction f [°]
1	Block 28 PC	6061.00	11276.00	44.00
2	Top block 28	6061.00	11276.00	44.00

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Setbacks

No.	Setback s [in]
1	0.000
2	0.033
3	0.135
6	0.269

Geometry

No. group	Description	Count	Setback s [in]
1	Block 28 PC	3	0.13
2	Block 28 PC	4	0.13
3	Top block 28	1	-

Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 1.00 ft
Height h = 1.00 ft
Width b = 4.33 ft

Material

Soil creating foundation - Foundation Soil

Types of reinforcements

No.	Name	Type of reinforcement	Line type	Tensile strength		
				T_{ult} [lbf/ft]	R_t [lbf/ft]	R_{con} [lbf/ft]
2	Miragrid 8XT	Miragrid 8XT		7600.00	4537.99	4007.27
3	Miragrid 10XT	Miragrid 10XT		10200.00	6090.46	5285.45

2. Miragrid 8XT

Reinforcement details

Short-term char. strength	T_{ult}	=	7600.00	lbf/ft
Creep red. factor	RF_{CR}	=	1.45	
Durability red. factor	RF_D	=	1.10	
Installation damage red. factor	RF_{ID}	=	1.05	
Long-term design strength	R_t	=	4537.99	lbf/ft
Coefficient of direct slip along reinforcement	C_{ds}	=	0.80	
Coefficient of interaction of soil and geo-reinforcement	C_i	=	0.80	
Scale correction factor	α	=	1.0	
Long-term strength reduction factor	CR_{cr}	=	0.580	
Calculation of long-term connection strength	R_{con}	=	4007.27	lbf/ft

3. Miragrid 10XT

Reinforcement details

Short-term char. strength	T_{ult}	=	10200.00	lbf/ft
Creep red. factor	RF_{CR}	=	1.45	
Durability red. factor	RF_D	=	1.10	
Installation damage red. factor	RF_{ID}	=	1.05	

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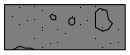
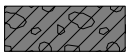
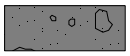
Long-term design strength	R_t	=	6090.46	lbf/ft
Coefficient of direct slip along reinforcement	C_{ds}	=	0.80	
Coefficient of interaction of soil and geo-reinforcement	C_i	=	0.80	
Scale correction factor	α	=	1.0	
Long-term strength reduction factor	CR_{cr}	=	0.570	
Calculation of long-term connection strength	R_{con}	=	5285.45	lbf/ft

Reinforcements

Input mode : table of reinforcements
Top reinforcement : straight (25%)

No.	Consider	Name	Geometry	Length of reinforcement l [ft]	End pt. coordinate l_k [ft]
1	Yes	Miragrid 8XT	input length	7.50	
2	Yes	Miragrid 8XT	input length	7.50	
3	Yes	Miragrid 8XT	input length	7.50	
4	Yes	Miragrid 8XT	input length	7.50	
5	Yes	Miragrid 8XT	input length	7.50	
6	Yes	Miragrid 8XT	input length	7.50	
7	Yes	Miragrid 8XT	input length	7.50	
8	Yes	Miragrid 10XT	input length	9.33	

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	Foundation Soil		30.00	0.0	125.00	62.50	20.00
2	Reinforced Soil		34.00	0.0	130.00	67.50	23.00
3	Retained Soil		30.00	0.0	125.00	62.50	20.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Foundation Soil

Unit weight :	γ	=	125.0 pcf
Stress-state :	effective		
Angle of internal friction :	φ_{ef}	=	30.00 °
Cohesion of soil :	c_{ef}	=	0.0 psf
Angle of friction struc.-soil :	δ	=	20.00 °
Saturated unit weight :	γ_{sat}	=	125.0 pcf

Reinforced Soil

Unit weight :	γ	=	130.0 pcf
Stress-state :	effective		
Angle of internal friction :	φ_{ef}	=	34.00 °
Cohesion of soil :	c_{ef}	=	0.0 psf
Angle of friction struc.-soil :	δ	=	23.00 °
Saturated unit weight :	γ_{sat}	=	130.0 pcf

Retained Soil

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Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 20.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	-	0.00 .. ∞	Retained Soil	

Terrain profile

Terrain behind construction has the slope 1: 2.00 (slope angle is 26.57 °).
Embankment height is 5.00 ft, embankment length is 10.00 ft.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge new	Surcharge change	Action	Mag.1 [lbf/ft²]	Mag.2 [lbf/ft²]	Ord.x x [ft]	Length l [ft]	Depth z [ft]
1	Yes		variable	250.00		10.00	12.00	on terrain
2	Yes		variable	100.00		0.00	10.00	on terrain

No.	Name
1	Road
2	Yard

Resistance on front face of the structure

Resistance on front face of the structure: at rest
Soil on front face of the structure - Reinforced Soil
Soil thickness in front of structure h = 6.00 ft
Terrain surcharge f = 100.0 lbf/ft²

Terrain in front of structure is flat.

Earthquake

Factor of horizontal acceleration K_h = 0.1088
Factor of vertical acceleration K_v = 0.0000

Water below the GWT is restricted.

Settings of the stage of construction

Design situation : transient
Reduction of soil/soil friction angle : do not reduce

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
FF resistance	-715.9	-1.67	1.0	-0.27	1.000
Resistance on front face	-220.2	-2.50	0.2	2.54	1.000

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Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - reinforced soil	0.0	-8.11	16221.0	7.21	1.000
Earthquake - soil wedge	1764.8	-8.11	0.0	7.21	1.000
Active pressure	4026.0	-5.67	2715.4	12.60	1.000
Earthq.- act.pressure	1201.9	-11.33	810.7	12.60	1.000
Road	876.8	-8.78	591.4	12.60	1.000
Weight - wall	0.0	-5.83	3264.2	1.62	1.000
Earthq.- constr.	355.1	-5.83	0.0	1.62	1.000
Road	0.0	-17.00	311.7	11.98	1.000
Yard	0.0	-14.50	1000.0	6.36	1.000

Verification of complete wall

Place of verification : bottom of blocks

Check for overturning stability

Resisting moment M_{res} = 184159.2 lbfft/ft
Overturning moment M_{ovr} = 58774.0 lbfft/ft

Safety factor = 3.13 > 1.50
Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 13665.76 lbf/ft
Active horizontal force H_{act} = 7288.46 lbf/ft

Safety factor = 1.87 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-76830.6	9223.62	-10057.27	0.000	2130.2

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-76830.6	9223.62	-10057.27

Verification of foundation soil

Place of verification : bottom of leveling pad
Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

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Verification of bearing capacity

Max. stress at footing bottom σ = 2130.2 psf
Allowable bearing capacity of foundation soil R_d = 6250.0 psf

Safety factor = 2.93 > 1.30
Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Verification of slip on georeinforcement No. 1

Forces acting on construction (verification of reinforcement No.: 1)

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-5.83	3282.1	-0.72	1.000
Earthq.- constr.	357.1	-5.83	0.0	-0.72	1.000
Active pressure	4345.7	-5.33	2727.4	7.50	1.000
Earthq.- act.pressure	1215.7	-10.78	811.2	7.50	1.000
Road	855.7	-7.94	553.7	7.50	1.000
Yard	48.6	-15.45	32.8	7.50	1.000
Weight - reinforced soil	0.0	-7.14	13296.6	4.12	1.000
Earthquake - soil wedge	1438.5	-7.14	0.0	4.12	1.000
Yard	0.0	-14.12	847.5	3.26	1.000

Verification against slip along geotextile No.: 1

Inclination of slip surface = 90.00 °
Overall normal force acting on reinforcement = 18269.05 lbf/ft
Coefficient of reduction of slip along geo-textile = 0.95
Resistance along geo-reinforcement = 11706.50 lbf/ft
Wall resistance = 1894.92 lbf/ft
Overall bearing capacity of reinforcements = 0.00 lbf/ft

Check for slip:

Resisting horizontal force H_{res} = 13601.42 lbf/ft
Active horiz. force H_{act} = 6465.76 lbf/ft

Factor of safety = 2.10 > 1.50
Slip along geotextile is SATISFACTORY

Calculation of internal stability No. 1

Calculated forces and strength of reinforcements

No.	Name	F_x [lbf/ft]	Depth z[ft]	R_t [lbf/ft]	Utiliz. [%]	T_p [lbf/ft]	Utiliz. [%]	R_{con} [lbf/ft]	Utiliz. [%]
1	Miragrid 8XT	-401.86	12.00	1134.50	53.13	3109.58	19.38	1001.82	60.17
2	Miragrid 8XT	-773.66	10.50	2269.00	51.15	5063.46	22.92	2003.64	57.92
3	Miragrid 8XT	-734.04	9.00	2269.00	48.53	4024.40	27.36	2003.64	54.95
4	Miragrid 8XT	-694.41	7.50	2269.00	45.91	3101.99	33.58	2003.64	51.99
5	Miragrid 8XT	-563.82	6.00	2269.00	37.27	2296.24	36.83	2003.64	42.21
6	Miragrid 8XT	-520.73	4.50	2269.00	34.42	1607.13	48.60	2003.64	38.98
7	Miragrid 8XT	-477.92	3.00	2269.00	31.59	1034.67	69.29	2003.64	35.78
8	Miragrid 10XT/ Miragrid 8XT	-641.27	1.50	2657.11	36.20	1283.13	74.96	2323.18	41.40

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Check for tensile strength (reinforcement No.1)
Tension strength R_t = 1134.50 lbf/ft
Force in reinforcement F_x = 401.86 lbf/ft

Safety factor = 2.82 > 1.50
Reinforcement for tensile strength is SATISFACTORY

Check for pull out resistance (reinforcement No.8)
Pull out resistance T_p = 1283.13 lbf/ft
Force in reinforcement F_x = 641.27 lbf/ft

Safety factor = 2.00 > 1.50
Reinforcement for pull out resistance is SATISFACTORY

Verification of connection strength (reinforcement No.1)
Connection strength R_{con} = 1001.82 lbf/ft
Force in reinforcement F_x = 401.86 lbf/ft

Safety factor = 2.49 > 1.50
Connection strength is SATISFACTORY

Overall verification - reinforcement is SATISFACTORY

Slope stability analysis

Input data (Construction stage 1)

Project

Settings

(input for current task)

Stability analysis

Verification methodology : Safety factors (ASD)
Earthquake analysis : Standard

Safety factors			
Transient design situation			
Safety factor :	SF_s =	1.40	[–]

Anchors

Verification methodology : Safety factors (ASD)

Safety factors			
Safety factor for steel strength :	SF_t =	1.50	[–]
Safety factor for pull out resistance (soil) :	SF_e =	1.50	[–]
Safety factor for pull out resistance (grouting) :	SF_c =	1.50	[–]

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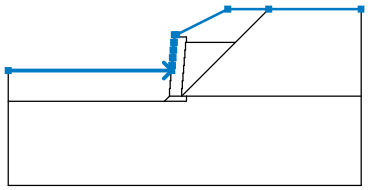
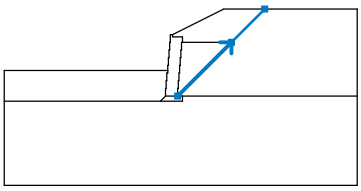
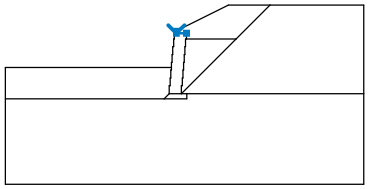
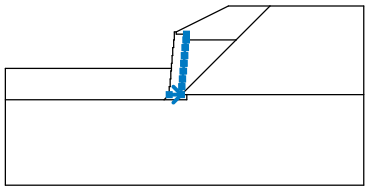
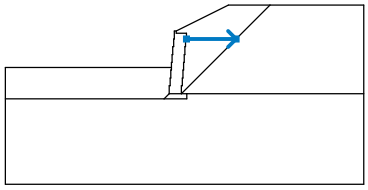
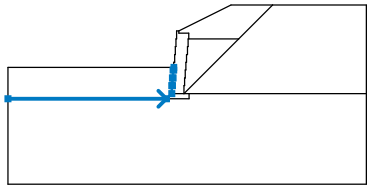
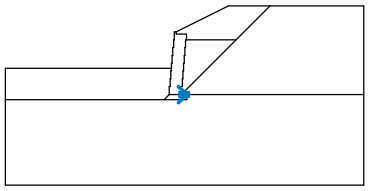
Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		-32.80	-7.00	-0.95	-7.00	-0.95	-6.00
		-0.82	-6.00	-0.82	-4.50	-0.69	-4.50
		-0.69	-3.00	-0.55	-3.00	-0.55	-1.50
		-0.42	-1.50	-0.42	0.00	0.00	0.00
		10.00	5.00	17.98	5.00	36.00	5.00
2		0.98	-12.00	11.48	-1.50	17.98	5.00
3		0.00	0.00	0.00	-0.42	1.92	-0.42
4		-1.36	-12.00	0.98	-12.00	0.98	-10.50
		1.11	-10.50	1.11	-9.00	1.24	-9.00
		1.24	-7.50	1.38	-7.50	1.38	-6.00
		1.51	-6.00	1.51	-4.50	1.65	-4.50
		1.65	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
5		1.92	-1.50	11.48	-1.50		
6		-32.80	-13.00	-2.36	-13.00	-1.36	-12.00
		-1.36	-10.50	-1.22	-10.50	-1.22	-9.00
		-1.09	-9.00	-1.09	-7.50	-0.95	-7.50
		-0.95	-7.00				
7		0.98	-12.00	1.97	-12.00		

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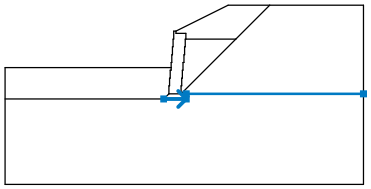
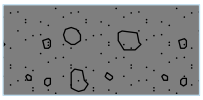
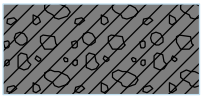
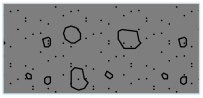
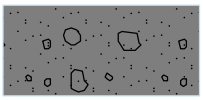
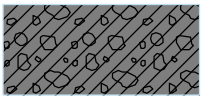
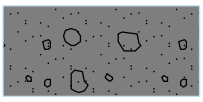
No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
8		-2.36	-13.00	1.97	-13.00	1.97	-12.00
		36.00	-12.00				

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	Foundation Soil		30.00	0.0	125.0
2	Reinforced Soil		34.00	0.0	130.0
3	Retained Soil		30.00	0.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	Foundation Soil		125.0		
2	Reinforced Soil		130.0		
3	Retained Soil		125.0		

Soil parameters

Foundation Soil

Unit weight : γ = 125.0 pcf
Stress-state : effective
Shear strength : Mohr-Coulomb
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

Reinforced Soil

Unit weight : γ = 130.0 pcf

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Stress-state :	effective
Shear strength :	Mohr-Coulomb
Angle of internal friction :	φ_{ef} = 34.00 °
Cohesion of soil :	c_{ef} = 0.0 psf
Saturated unit weight :	γ_{sat} = 130.0 pcf

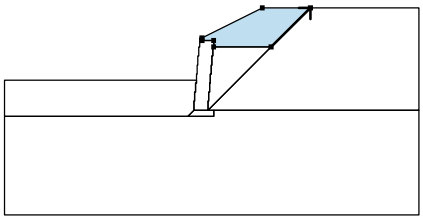
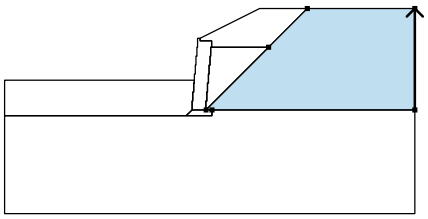
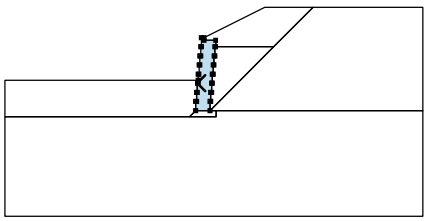
Retained Soil

Unit weight :	γ = 125.0 pcf
Stress-state :	effective
Shear strength :	Mohr-Coulomb
Angle of internal friction :	φ_{ef} = 30.00 °
Cohesion of soil :	c_{ef} = 0.0 psf
Saturated unit weight :	γ_{sat} = 125.0 pcf

Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure		120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft] x	z	x	z	Assigned soil
1		11.48	-1.50	17.98	5.00	Reinforced Soil
		10.00	5.00	0.00	0.00	
		0.00	-0.42	1.92	-0.42	
		1.92	-1.50			
2		36.00	-12.00	36.00	5.00	Retained Soil
		17.98	5.00	11.48	-1.50	
		0.98	-12.00	1.97	-12.00	
3		-0.95	-7.50	-1.09	-7.50	Material of structure
		-1.09	-9.00	-1.22	-9.00	
		-1.22	-10.50	-1.36	-10.50	
		-1.36	-12.00	0.98	-12.00	
		0.98	-10.50	1.11	-10.50	
		1.11	-9.00	1.24	-9.00	
		1.24	-7.50	1.38	-7.50	
		1.38	-6.00	1.51	-6.00	
		1.51	-4.50	1.65	-4.50	
		1.65	-3.00	1.78	-3.00	
		1.78	-1.50	1.92	-1.50	

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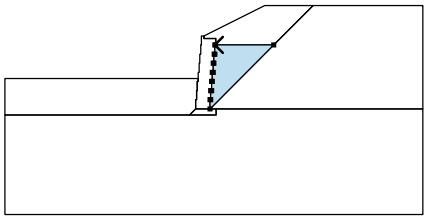
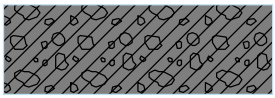
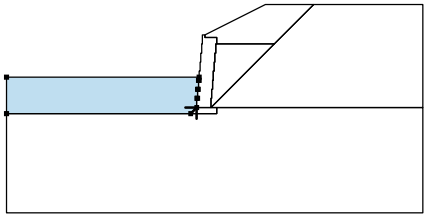
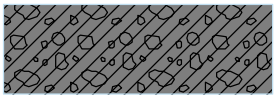
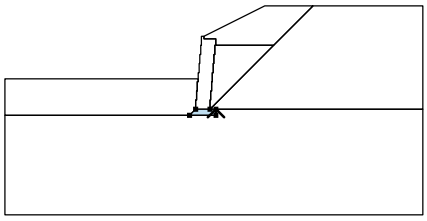
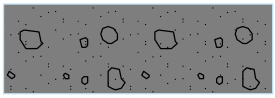
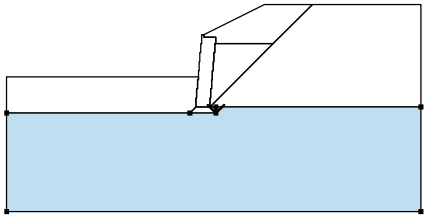
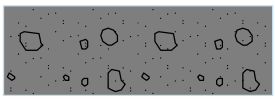
No.	Surface position	Coordinates of surface points [ft] x	z	x	z	Assigned soil
		1.92	-0.42	0.00	-0.42	
		0.00	0.00	-0.42	0.00	
		-0.42	-1.50	-0.55	-1.50	
		-0.55	-3.00	-0.69	-3.00	
		-0.69	-4.50	-0.82	-4.50	
		-0.82	-6.00	-0.95	-6.00	
		-0.95	-7.00			
4		1.92	-1.50	1.78	-1.50	Reinforced Soil 
		1.78	-3.00	1.65	-3.00	
		1.65	-4.50	1.51	-4.50	
		1.51	-6.00	1.38	-6.00	
		1.38	-7.50	1.24	-7.50	
		1.24	-9.00	1.11	-9.00	
		1.11	-10.50	0.98	-10.50	
		0.98	-12.00	11.48	-1.50	
5		-2.36	-13.00	-1.36	-12.00	Reinforced Soil 
		-1.36	-10.50	-1.22	-10.50	
		-1.22	-9.00	-1.09	-9.00	
		-1.09	-7.50	-0.95	-7.50	
		-0.95	-7.00	-32.80	-7.00	
		-32.80	-13.00			
6		1.97	-13.00	1.97	-12.00	Foundation Soil 
		0.98	-12.00	-1.36	-12.00	
		-2.36	-13.00			
7		1.97	-12.00	1.97	-13.00	Retained Soil 
		-2.36	-13.00	-32.80	-13.00	
		-32.80	-29.40	36.00	-29.40	
		36.00	-12.00			

Reinforcements

No.	Point to the left x [ft]	z [ft]	Point to the right x [ft]	z [ft]	Length L [ft]	Strength R_t [lbf/ft]	Pull out resist.	End of reinf.
1	0.98	-12.00	8.48	-12.00	7.50	1134.5	C = 0.80	Fixed
2	1.11	-10.50	8.61	-10.50	7.50	2269.0	C = 0.80	Fixed
3	1.24	-9.00	8.74	-9.00	7.50	2269.0	C = 0.80	Fixed
4	1.38	-7.50	8.88	-7.50	7.50	2269.0	C = 0.80	Fixed
5	1.51	-6.00	9.01	-6.00	7.50	2269.0	C = 0.80	Fixed

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No.	Point to the left		Point to the right		Length	Strength	Pull out resist.	End of
	x [ft]	z [ft]	x [ft]	z [ft]	L [ft]	R_t [lbf/ft]		reinf.
6	1.65	-4.50	9.15	-4.50	7.50	2269.0	C = 0.80	Fixed
7	1.78	-3.00	9.28	-3.00	7.50	2269.0	C = 0.80	Fixed
8	1.92	-1.50	11.25	-1.50	9.33	2657.1	C = 0.80	Fixed

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	variable	on terrain	x = 10.00	l = 12.00		0.00	250.0		lbf/ft^2
2	strip	variable	on terrain	x = 0.00	l = 10.00		0.00	100.0		lbf/ft^2
3	strip	permanent	on terrain	x = -32.80	l = 31.44		0.00	100.0		lbf/ft^2

Surcharges

No.	Name
1	Road
2	Yard

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Horizontal seismic coefficient : K_h = 0.1088
Vertical seismic coefficient : K_v = 0.0000

Settings of the stage of construction

Design situation : transient

Results (Construction stage 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-0.29	[ft]	Angles :	α_1 =	-37.21	[°]
	z =	12.76	[ft]		α_2 =	71.77	[°]
Radius :	R =	24.81	[ft]				
The slip surface after optimization.							

Total weight of soil above the slip surface: 40782.4 lbf/ft

Reinforcement bearing capacity

Reinforcement Bearing capacity [lbf/ft]

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1	0.0
2	544.5
3	0.0
4	0.0
5	0.0
6	0.0
7	0.0
8	0.0

Slope stability verification (Bishop)

Sum of active forces : F_a = 16677.9 lbf/ft

Sum of passive forces : F_p = 28333.2 lbf/ft

Sliding moment : M_a = 413779.9 lbfft/ft

Resisting moment : M_p = 702946.3 lbfft/ft

Factor of safety = 1.70 > 1.40

Slope stability ACCEPTABLE

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Analysis of Redi Rock wall

Input data

Project : VA Togus
Part : Retaining Walls
Description : Lower Wall - 13ft
Customer : GDM
Author : APH
Date : 2/9/2026
Project ID : VA Togus EHRM
Project number : 23072-00

Settings

(input for current task)

Wall analysis

Verification methodology : Safety factors (ASD)
Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00

Safety factors			
Transient design situation			
Safety factor for overturning :	SF_o =	1.50	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	1.30	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Blocks

No.	Description	Block height h [in]	Block width w [in]	Unit weight γ [pcf]
1	Block 28 PC	18.00	28.00	120.00
2	Block 41 PC	18.00	40.50	120.00
3	Top block 28	18.00	28.00	120.00

No.	Description	Shear bearing capacity of joint F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Block friction f [°]
1	Block 28 PC	6061.00	11276.00	44.00
2	Block 41 PC	6061.00	11276.00	44.00
3	Top block 28	6061.00	11276.00	44.00

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Setbacks

No.	Setback s [in]
1	0.000
2	0.033
3	0.135
6	0.269

Geometry

No. group	Description	Count	Setback s [in]
1	Block 41 PC	9	0.13
2	Block 28 PC	2	0.13
3	Top block 28	1	-

Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 2.00 ft
Height h = 2.00 ft
Width b = 7.33 ft

Material

Soil creating foundation - Foundation Soil

Types of reinforcements

No.	Name	Type of reinforcement	Line type	Tensile strength		
				T_{ult} [lbf/ft]	R_t [lbf/ft]	R_{con} [lbf/ft]
4	Miragrid 20XT	Miragrid 20XT		16000.00	9553.66	8000.00
5	Miragrid 24XT	Miragrid 24XT		28000.00	16718.91	12218.18

4. Miragrid 20XT

Reinforcement details

Short-term char. strength	T_{ult}	=	16000.00	lbf/ft
Creep red. factor	RF_{CR}	=	1.45	
Durability red. factor	RF_D	=	1.10	
Installation damage red. factor	RF_{ID}	=	1.05	
Long-term design strength	R_t	=	9553.66	lbf/ft
Coefficient of direct slip along reinforcement	C_{ds}	=	0.80	
Coefficient of interaction of soil and geo-reinforcement	C_i	=	0.80	
Scale correction factor	α	=	1.0	
Long-term strength reduction factor	CR_{cr}	=	0.550	
Calculation of long-term connection strength	R_{con}	=	8000.00	lbf/ft

5. Miragrid 24XT

Reinforcement details

Short-term char. strength	T_{ult}	=	28000.00	lbf/ft
Creep red. factor	RF_{CR}	=	1.45	
Durability red. factor	RF_D	=	1.10	
Installation damage red. factor	RF_{ID}	=	1.05	

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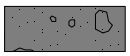
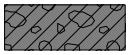
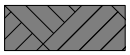
Long-term design strength	R_t	=	16718.91	lbf/ft
Coefficient of direct slip along reinforcement	C_{ds}	=	0.80	
Coefficient of interaction of soil and geo-reinforcement	C_i	=	0.80	
Scale correction factor	α	=	1.0	
Long-term strength reduction factor	CR_{cr}	=	0.480	
Calculation of long-term connection strength	R_{con}	=	12218.18	lbf/ft

Reinforcements

Input mode : table of reinforcements
Top reinforcement : straight (25%)

No.	Consider	Name	Geometry	Length of reinforcement l [ft]	End pt. coordinate l_k [ft]
1	Yes	Miragrid 20XT	input length	15.00	
2	Yes	Miragrid 20XT	input length	15.00	
3	Yes	Miragrid 20XT	input length	15.00	
4	Yes	Miragrid 20XT	input length	15.00	
5	Yes	Miragrid 20XT	input length	16.00	
6	Yes	Miragrid 20XT	input length	16.00	
7	Yes	Miragrid 24XT	input length	17.00	
8	Yes	Miragrid 24XT	input length	17.00	
9	Yes	Miragrid 24XT	input length	17.00	
10	No	Miragrid 8XT	input length	7.00	
11	No	Miragrid 8XT	input length	7.00	
12	No	Miragrid 8XT	input length	7.00	

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	Foundation Soil		30.00	0.0	125.00	62.50	30.00
2	Reinforced Soil		34.00	0.0	130.00	67.50	34.00
3	Retained Soil		30.00	0.0	125.00	62.50	30.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Foundation Soil

Unit weight :	γ	=	125.0 pcf
Stress-state :	effective		
Angle of internal friction :	φ_{ef}	=	30.00 °
Cohesion of soil :	c_{ef}	=	0.0 psf
Angle of friction struc.-soil :	δ	=	30.00 °
Saturated unit weight :	γ_{sat}	=	125.0 pcf

Reinforced Soil

Unit weight :	γ	=	130.0 pcf
Stress-state :	effective		
Angle of internal friction :	φ_{ef}	=	34.00 °

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Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 34.00 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Retained Soil
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 30.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	19.50	0.00 .. 19.50	Reinforced Soil	
2	-	19.50 .. ∞	Retained Soil	

Terrain profile

Terrain behind construction has the slope 1: 6.00 (slope angle is 9.46 °).
Embankment height is 2.00 ft, embankment length is 12.00 ft.

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge new	Surcharge change	Action	Mag.1 [lbf/ft²]	Mag.2 [lbf/ft²]	Ord.x x [ft]	Length l [ft]	Depth z [ft]
1	Yes		permanent	3225.00		10.00	5.33	4.50
2	Yes		variable	100.00		0.00	12.00	on terrain
3	Yes		permanent	2080.00	2960.00	14.00	27.00	on terrain
4	Yes		permanent	2960.00		41.00	12.00	on terrain

No.	Name
1	Upper Wall
2	Yard
3	Upper Soil
4	Upper Soil-2

Resistance on front face of the structure

Resistance on front face of the structure: 1/2 pass., 1/2 at rest
Soil on front face of the structure - Retained Soil
Soil thickness in front of structure h = 7.00 ft
Terrain surcharge f = 100.0 lbf/ft²

Terrain in front of structure is flat.

Earthquake

Factor of horizontal acceleration K_h = 0.1088
Factor of vertical acceleration K_v = 0.0000

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Water below the GWT is restricted.

Settings of the stage of construction

Design situation : transient
Reduction of soil/soil friction angle : do not reduce

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
FF resistance	-2734.2	-1.67	0.5	-0.27	1.000
Resistance on front face	-249.8	-2.50	0.2	3.58	1.000
Weight - reinforced soil	0.0	-10.16	41910.1	12.24	1.000
Earthquake - soil wedge	4559.8	-10.16	0.0	12.24	1.000
Active pressure	5572.0	-6.67	3758.4	21.45	1.000
Earthq.- act.pressure	1663.6	-13.33	1122.1	21.45	1.000
Upper Soil	11060.3	-9.63	7460.3	21.45	1.000
Upper Soil-2	2714.0	-2.83	1830.6	21.45	1.000
Weight - wall	0.0	-8.30	6631.7	2.27	1.000
Earthq.- constr.	721.5	-8.30	0.0	2.27	1.000
Upper Wall	0.0	-13.50	17189.2	14.56	1.000
Yard	0.0	-19.00	1200.0	7.90	1.000
Upper Soil	0.0	-20.00	12056.8	18.67	1.000

Verification of complete wall

Place of verification : bottom of blocks

Check for overturning stability
Resisting moment M_{res} = 1316869.1 lbfft/ft
Overturning moment M_{ovr} = 220672.5 lbfft/ft

Safety factor = 5.97 > 1.50
Wall for overturning is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 59695.22 lbf/ft
Active horizontal force H_{act} = 23307.21 lbf/ft

Safety factor = 2.56 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.08	1174.2	1.27	1.000
Earthq.- constr.	127.8	-2.08	0.0	1.27	1.000
Weight - earth wedge	0.0	-4.36	128.9	1.64	1.000

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Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Earthquake - soil wedge	14.0	-4.36	0.0	1.64	1.000
Active pressure	360.0	-1.61	252.4	2.42	1.000
Earthq.- act.pressure	130.2	-3.25	125.5	2.48	1.000
Upper Wall	0.0	-4.77	0.0	2.29	1.000
Yard	92.6	-2.17	67.2	2.46	1.000
Upper Soil	0.0	-4.77	0.0	2.29	1.000
Upper Soil-2	0.0	-4.77	0.0	2.29	1.000
Yard	0.0	-4.63	160.9	1.49	1.000

Verification of most stressed block No. 10

Check for overturning stability

Resisting moment M_{res} = 3033.0 lbfft/ft
Overturning moment M_{ovr} = 1530.8 lbfft/ft

Safety factor = 1.98 > 1.50
Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 7904.69 lbf/ft
Active horizontal force H_{act} = 724.64 lbf/ft

Safety factor = 10.91 > 1.50
Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-428565.6	27488.69	-36591.08	0.000	3750.2

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-428565.6	27488.69	-36591.08

Verification of foundation soil

Place of verification : bottom of leveling pad
Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 3750.2 psf
Allowable bearing capacity of foundation soil R_d = 5000.0 psf

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Safety factor = 1.33 > 1.30
Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Verification of slip on georeinforcement No. 1

Forces acting on construction (verification of reinforcement No.: 1)

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-8.30	6688.5	-1.10	1.000
Earthq.- constr.	727.7	-8.30	0.0	-1.10	1.000
Active pressure	5626.4	-6.60	3763.1	15.00	1.000
Earthq.- act.pressure	1660.3	-13.34	1119.8	15.00	1.000
Upper Soil	10858.4	-9.43	7291.4	15.00	1.000
Upper Soil-2	1698.1	-1.71	1118.5	15.00	1.000
Weight - reinforced soil	0.0	-9.60	36458.7	7.95	1.000
Earthquake - soil wedge	3936.2	-9.60	0.0	7.95	1.000
Upper Wall	0.0	-13.50	17189.2	11.19	1.000
Yard	0.0	-19.00	1200.0	4.52	1.000
Upper Soil	0.0	-20.00	5255.8	13.76	1.000

Verification against slip along geotextile No.: 1

Inclination of slip surface	=	90.00	°
Overall normal force acting on reinforcement	=	73396.40	lbf/ft
Coefficient of reduction of slip along geo-textile	=	0.95	
Resistance along geo-reinforcement	=	47031.17	lbf/ft
Wall resistance	=	3861.63	lbf/ft
Overall bearing capacity of reinforcements	=	0.00	lbf/ft

Check for slip:

Resisting horizontal force H_{res} = 50892.80 lbf/ft
Active horiz. force H_{act} = 19843.24 lbf/ft

Factor of safety = 2.56 > 1.50
Slip along geotextile is SATISFACTORY

Calculation of internal stability No. 1

Calculated forces and strength of reinforcements

No.	Name	F_x [lbf/ft]	Depth z[ft]	R_t [lbf/ft]	Utiliz. [%]	T_p [lbf/ft]	Utiliz. [%]	R_{con} [lbf/ft]	Utiliz. [%]
1	Miragrid 20XT	-1037.28	18.00	2388.42	65.14	10257.40	15.17	2000.00	77.80
2	Miragrid 20XT	-2120.79	16.50	4776.83	66.60	18101.98	17.57	4000.00	79.53
3	Miragrid 20XT	-2163.19	15.00	4776.83	67.93	15833.64	20.49	4000.00	81.12
4	Miragrid 20XT	-2164.19	13.50	4776.83	67.96	13709.80	23.68	4000.00	81.16
5	Miragrid 20XT	-2195.93	12.00	4776.83	68.96	12777.04	25.78	4000.00	82.35
6	Miragrid 20XT	-1321.72	10.50	4776.83	41.50	10838.55	18.29	4000.00	49.56
7	Miragrid 24XT/ Miragrid 20XT	-704.25	9.00	6568.14	16.08	9752.74	10.83	5054.55	20.90
8	Miragrid 24XT	-516.03	7.50	8359.46	9.26	7938.45	9.75	6109.09	12.67
9	Miragrid 24XT	-528.27	6.00	8359.46	9.48	6277.12	12.62	6109.09	12.97
10	Miragrid 8XT/ Miragrid 24XT	-1421.13	4.50	4179.73	51.00	4707.41	45.28	3054.55	69.79

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Check for tensile strength (reinforcement No.5)
Tension strength R_t = 4776.83 lbf/ft
Force in reinforcement F_x = 2195.93 lbf/ft

Safety factor = 2.18 > 1.50
Reinforcement for tensile strength is SATISFACTORY

Check for pull out resistance (reinforcement No.10)
Pull out resistance T_p = 4707.41 lbf/ft
Force in reinforcement F_x = 1421.13 lbf/ft

Safety factor = 3.31 > 1.50
Reinforcement for pull out resistance is SATISFACTORY

Verification of connection strength (reinforcement No.5)
Connection strength R_{con} = 4000.00 lbf/ft
Force in reinforcement F_x = 2195.93 lbf/ft

Safety factor = 1.82 > 1.50
Connection strength is SATISFACTORY

Overall verification - reinforcement is SATISFACTORY

Slope stability analysis

Input data (Construction stage 1)

Project

Settings

(input for current task)

Stability analysis

Verification methodology : Safety factors (ASD)
Earthquake analysis : Standard

Safety factors			
Transient design situation			
Safety factor :	SF_s =	1.39	[–]

Anchors

Verification methodology : Safety factors (ASD)

Safety factors			
Safety factor for steel strength :	SF_t =	1.50	[–]
Safety factor for pull out resistance (soil) :	SF_e =	1.50	[–]
Safety factor for pull out resistance (grouting) :	SF_c =	1.50	[–]

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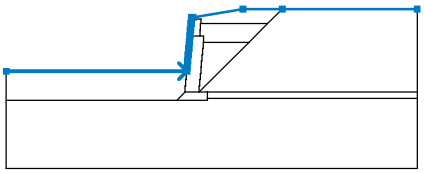
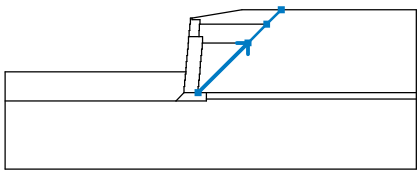
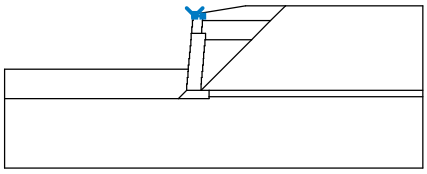
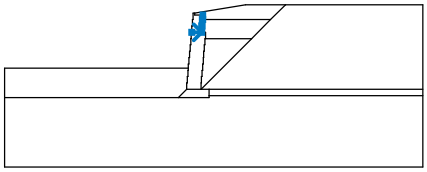
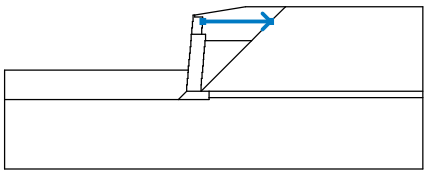
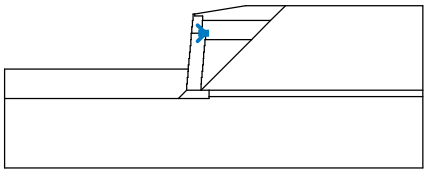
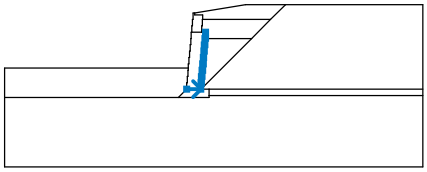
Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		-45.00	-13.00	-1.49	-13.00	-1.49	-12.00
		-1.36	-12.00	-1.36	-10.50	-1.22	-10.50
		-1.22	-9.00	-1.09	-9.00	-1.09	-7.50
		-0.95	-7.50	-0.95	-6.00	-0.82	-6.00
		-0.82	-4.50	-0.69	-4.50	-0.69	-3.00
		-0.55	-3.00	-0.55	-1.50	-0.42	-1.50
		-0.42	0.00	0.00	0.00	12.00	2.00
		21.48	2.00	54.00	2.00		
2		1.48	-18.00	13.48	-6.00	17.98	-1.50
		21.48	2.00				
3		0.00	0.00	0.00	-0.42	1.92	-0.42
4		-0.69	-4.50	1.65	-4.50	1.65	-3.00
		1.78	-3.00	1.78	-1.50	1.92	-1.50
		1.92	-0.42				
5		1.92	-1.50	17.98	-1.50		
6		1.65	-4.50	2.55	-4.50		
7		-1.90	-18.00	1.48	-18.00	1.48	-16.50
		1.61	-16.50	1.61	-15.00	1.75	-15.00
		1.75	-13.50	1.88	-13.50	1.88	-12.00
		2.02	-12.00	2.02	-10.50	2.15	-10.50
		2.15	-9.00	2.29	-9.00	2.29	-7.50
		2.42	-7.50	2.42	-6.00	2.55	-6.00
		2.55	-4.50				

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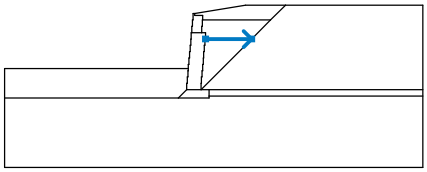
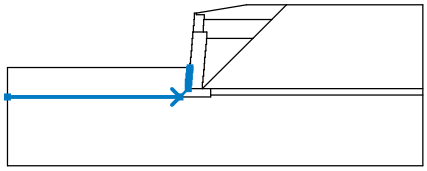
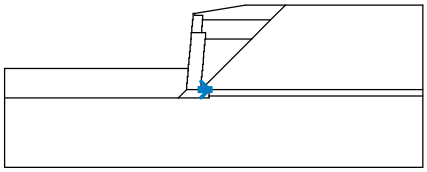
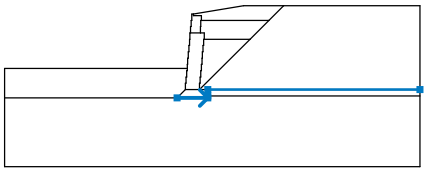
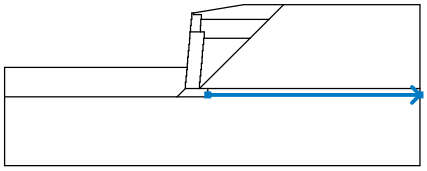
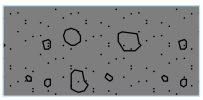
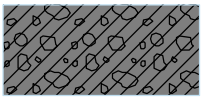
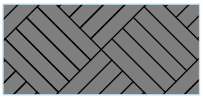
No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
8		2.55	-6.00	13.48	-6.00		
9		-45.00	-20.00	-3.90	-20.00	-1.90	-18.00
		-1.90	-16.50	-1.76	-16.50	-1.76	-15.00
		-1.63	-15.00	-1.63	-13.50	-1.49	-13.50
		-1.49	-13.00				
10		1.48	-18.00	3.43	-18.00		
11		-3.90	-20.00	3.43	-20.00	3.43	-19.50
		3.43	-18.00	54.00	-18.00		
12		3.43	-19.50	54.00	-19.50		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	Foundation Soil		30.00	0.0	125.0
2	Reinforced Soil		34.00	0.0	130.0
3	Retained Soil		30.00	0.0	125.0

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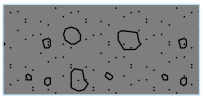
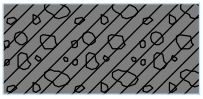
Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	Foundation Soil		125.0		
2	Reinforced Soil		130.0		
3	Retained Soil		125.0		

Soil parameters

Foundation Soil

Unit weight : γ = 125.0 pcf
Stress-state : effective
Shear strength : Mohr-Coulomb
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

Reinforced Soil

Unit weight : γ = 130.0 pcf
Stress-state : effective
Shear strength : Mohr-Coulomb
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

Retained Soil

Unit weight : γ = 125.0 pcf
Stress-state : effective
Shear strength : Mohr-Coulomb
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure		120.0

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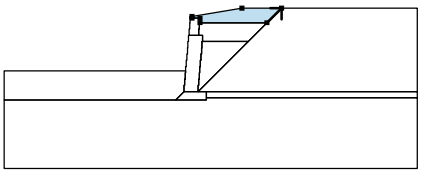
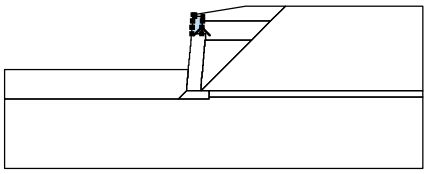
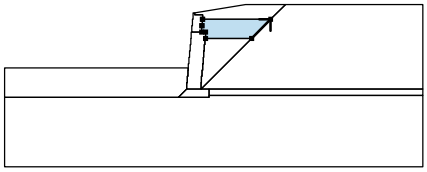
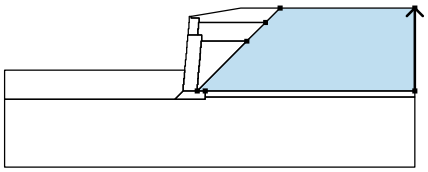
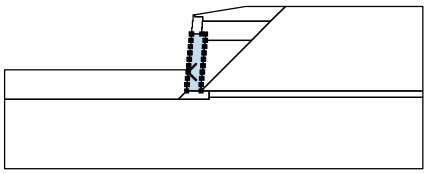
Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		17.98	-1.50	21.48	2.00	Reinforced Soil
		12.00	2.00	0.00	0.00	
		0.00	-0.42	1.92	-0.42	
		1.92	-1.50			
2		1.65	-4.50	1.65	-3.00	Material of structure
		1.78	-3.00	1.78	-1.50	
		1.92	-1.50	1.92	-0.42	
		0.00	-0.42	0.00	0.00	
		-0.42	0.00	-0.42	-1.50	
		-0.55	-1.50	-0.55	-3.00	
		-0.69	-3.00	-0.69	-4.50	
3		13.48	-6.00	17.98	-1.50	Reinforced Soil
		1.92	-1.50	1.78	-1.50	
		1.78	-3.00	1.65	-3.00	
		1.65	-4.50	2.55	-4.50	
		2.55	-6.00			
4		54.00	-18.00	54.00	2.00	Reinforced Soil
		21.48	2.00	17.98	-1.50	
		13.48	-6.00	1.48	-18.00	
		3.43	-18.00			
5		-1.49	-13.50	-1.63	-13.50	Material of structure
		-1.63	-15.00	-1.76	-15.00	
		-1.76	-16.50	-1.90	-16.50	
		-1.90	-18.00	1.48	-18.00	
		1.48	-16.50	1.61	-16.50	
		1.61	-15.00	1.75	-15.00	
		1.75	-13.50	1.88	-13.50	
		1.88	-12.00	2.02	-12.00	
		2.02	-10.50	2.15	-10.50	
		2.15	-9.00	2.29	-9.00	
		2.29	-7.50	2.42	-7.50	
		2.42	-6.00	2.55	-6.00	
		2.55	-4.50	1.65	-4.50	
		-0.69	-4.50	-0.82	-4.50	
		-0.82	-6.00	-0.95	-6.00	
		-0.95	-7.50	-1.09	-7.50	
		-1.09	-9.00	-1.22	-9.00	
		-1.22	-10.50	-1.36	-10.50	
		-1.36	-12.00	-1.49	-12.00	
		-1.49	-13.00			

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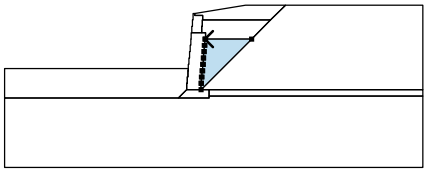
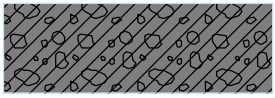
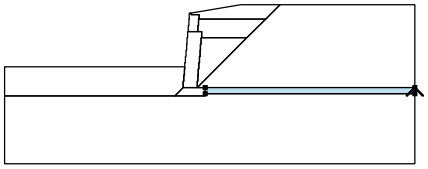
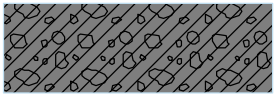
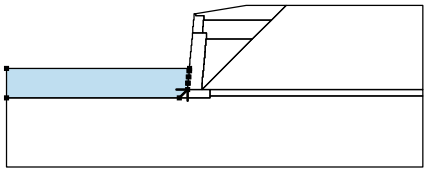
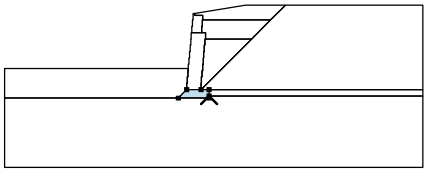
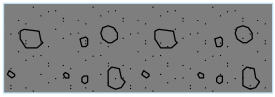
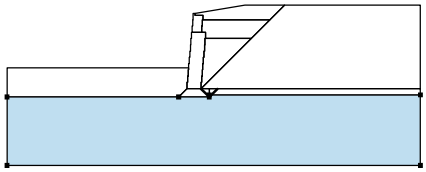
No.	Surface position	Coordinates of surface points [ft] x	z	x	z	Assigned soil
6		2.55	-6.00	2.42	-6.00	Reinforced Soil 
		2.42	-7.50	2.29	-7.50	
		2.29	-9.00	2.15	-9.00	
		2.15	-10.50	2.02	-10.50	
		2.02	-12.00	1.88	-12.00	
		1.88	-13.50	1.75	-13.50	
		1.75	-15.00	1.61	-15.00	
		1.61	-16.50	1.48	-16.50	
		1.48	-18.00	13.48	-6.00	
7		54.00	-19.50	54.00	-18.00	Reinforced Soil 
		3.43	-18.00	3.43	-19.50	
8		-3.90	-20.00	-1.90	-18.00	Retained Soil
		-1.90	-16.50	-1.76	-16.50	
		-1.76	-15.00	-1.63	-15.00	
		-1.63	-13.50	-1.49	-13.50	
		-1.49	-13.00	-45.00	-13.00	
		-45.00	-20.00			
9		3.43	-20.00	3.43	-19.50	Foundation Soil 
		3.43	-18.00	1.48	-18.00	
		-1.90	-18.00	-3.90	-20.00	
10		3.43	-19.50	3.43	-20.00	Retained Soil
		-3.90	-20.00	-45.00	-20.00	
		-45.00	-36.40	54.00	-36.40	
		54.00	-19.50			

Reinforcements

No.	Point to the left x [ft]	z [ft]	Point to the right x [ft]	z [ft]	Length L [ft]	Strength R_t [lbf/ft]	Pull out resist.	End of reinf.
1	1.48	-18.00	16.48	-18.00	15.00	2388.4	C = 0.80	Fixed
2	1.61	-16.50	16.61	-16.50	15.00	4776.8	C = 0.80	Fixed
3	1.75	-15.00	16.75	-15.00	15.00	4776.8	C = 0.80	Fixed
4	1.88	-13.50	16.88	-13.50	15.00	4776.8	C = 0.80	Fixed
5	2.02	-12.00	18.02	-12.00	16.00	4776.8	C = 0.80	Fixed
6	2.15	-10.50	18.15	-10.50	16.00	4776.8	C = 0.80	Fixed
7	2.29	-9.00	19.29	-9.00	17.00	6568.1	C = 0.80	Fixed
8	2.42	-7.50	19.42	-7.50	17.00	8359.5	C = 0.80	Fixed
9	2.55	-6.00	19.55	-6.00	17.00	8359.5	C = 0.80	Fixed

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No.	Point to the left		Point to the right		Length	Strength	Pull out resist.	End of
	x [ft]	z [ft]	x [ft]	z [ft]	L [ft]	R_t [lbf/ft]		reinf.
10	2.55	-4.50	19.55	-4.50	17.00	4179.7	C = 0.80	Fixed

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	permanent	z = -4.50	x = 10.00	l = 5.33		0.00	3225.0		lbf/ft^2
2	strip	variable	on terrain	x = 0.00	l = 12.00		0.00	100.0		lbf/ft^2
3	trapezoid	permanent	on terrain	x = 14.00	l = 27.00		0.00	2080.0	2960.0	lbf/ft^2
4	strip	permanent	on terrain	x = 41.00	l = 12.00		0.00	2960.0		lbf/ft^2
5	strip	permanent	on terrain	x = -45.00	l = 43.10		0.00	100.0		lbf/ft^2

Surcharges

No.	Name
1	Upper Wall
2	Yard
3	Upper Soil
4	Upper Soil-2

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Horizontal seismic coefficient : K_h = 0.1088
Vertical seismic coefficient : K_v = 0.0000

Settings of the stage of construction

Design situation : transient

Results (Construction stage 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-2.61	[ft]	Angles :	α_1 =	-38.70	[°]
	z =	20.62	[ft]		α_2 =	64.39	[°]
Radius :	R =	43.08	[ft]				
The slip surface after optimization.							

Total weight of soil above the slip surface: 104076.1 lbf/ft

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Reinforcement bearing capacity

Reinforcement	Bearing capacity [lbf/ft]
1	11.0
2	0.0
3	0.0
4	0.0
5	0.0
6	0.0
7	0.0
8	0.0
9	0.0
10	0.0

Slope stability verification (Bishop)

Sum of active forces : F_a = 78724.8 lbf/ft

Sum of passive forces : F_p = 110091.4 lbf/ft

Sliding moment : M_a = 3391463.1 lbfft/ft

Resisting moment : M_p = 4742737.6 lbfft/ft

Factor of safety = 1.40 > 1.39

Slope stability ACCEPTABLE

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Analysis of Redi Rock wall

Input data

Project : VA Togus
Part : Retaining Walls
Description : Single Wall - 13ft
Customer : GDM
Author : APH
Date : 2/9/2026
Project ID : VA Togus EHRM
Project number : 23072-00

Settings

(input for current task)

Wall analysis

Verification methodology : Safety factors (ASD)
Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00

Safety factors			
Transient design situation			
Safety factor for overturning :	SF_o =	1.50	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	1.30	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Blocks

No.	Description	Block height h [in]	Block width w [in]	Unit weight γ [pcf]
1	Block 28 PC	18.00	28.00	120.00
2	Top block 28	18.00	28.00	120.00

No.	Description	Shear bearing capacity of joint F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Block friction f [°]
1	Block 28 PC	6061.00	11276.00	44.00
2	Top block 28	6061.00	11276.00	44.00

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Setbacks

No.	Setback s [in]
1	0.000
2	0.033
3	0.135
6	0.269

Geometry

No. group	Description	Count	Setback s [in]
1	Block 28 PC	3	0.13
2	Block 28 PC	8	0.13
3	Top block 28	1	-

Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 1.50 ft
Height h = 1.50 ft
Width b = 5.33 ft

Material

Soil creating foundation - Foundation Soil

Types of reinforcements

No.	Name	Type of reinforcement	Line type	Tensile strength		
				T_{ult} [lbf/ft]	R_t [lbf/ft]	R_{con} [lbf/ft]
2	Miragrid 8XT	Miragrid 8XT	– – – – – – – – – –	7600.00	4537.99	4007.27
3	Miragrid 10XT	Miragrid 10XT	– · – · – · – · – · –	10200.00	6090.46	5285.45

2. Miragrid 8XT

Reinforcement details

Short-term char. strength	T_{ult}	=	7600.00	lbf/ft
Creep red. factor	RF_{CR}	=	1.45	
Durability red. factor	RF_D	=	1.10	
Installation damage red. factor	RF_{ID}	=	1.05	
Long-term design strength	R_t	=	4537.99	lbf/ft
Coefficient of direct slip along reinforcement	C_{ds}	=	0.80	
Coefficient of interaction of soil and geo-reinforcement	C_i	=	0.80	
Scale correction factor	α	=	1.0	
Long-term strength reduction factor	CR_{cr}	=	0.580	
Calculation of long-term connection strength	R_{con}	=	4007.27	lbf/ft

3. Miragrid 10XT

Reinforcement details

Short-term char. strength	T_{ult}	=	10200.00	lbf/ft
Creep red. factor	RF_{CR}	=	1.45	
Durability red. factor	RF_D	=	1.10	
Installation damage red. factor	RF_{ID}	=	1.05	

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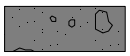
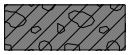
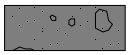
Long-term design strength	R_t	=	6090.46	lbf/ft
Coefficient of direct slip along reinforcement	C_{ds}	=	0.80	
Coefficient of interaction of soil and geo-reinforcement	C_i	=	0.80	
Scale correction factor	α	=	1.0	
Long-term strength reduction factor	CR_{cr}	=	0.570	
Calculation of long-term connection strength	R_{con}	=	5285.45	lbf/ft

Reinforcements

Input mode : table of reinforcements
Top reinforcement : straight (25%)

No.	Consider	Name	Geometry	Length of reinforcement l [ft]	End pt. coordinate l_k [ft]
1	Yes	Miragrid 8XT	input length	11.00	
2	Yes	Miragrid 8XT	input length	11.00	
3	Yes	Miragrid 8XT	input length	11.00	
4	Yes	Miragrid 8XT	input length	11.00	
5	Yes	Miragrid 8XT	input length	11.00	
6	Yes	Miragrid 8XT	input length	11.00	
7	Yes	Miragrid 8XT	input length	11.00	
8	Yes	Miragrid 8XT	input length	11.00	
9	Yes	Miragrid 8XT	input length	11.00	
10	Yes	Miragrid 8XT	input length	11.00	
11	Yes	Miragrid 8XT	input length	11.00	
12	Yes	Miragrid 10XT	input length	13.75	

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	Foundation Soil		30.00	0.0	125.00	62.50	20.00
2	Reinforced Soil		34.00	0.0	130.00	67.50	23.00
3	Retained Soil		30.00	0.0	125.00	62.50	20.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Foundation Soil

Unit weight :	γ	=	125.0 pcf
Stress-state :	effective		
Angle of internal friction :	φ_{ef}	=	30.00 °
Cohesion of soil :	c_{ef}	=	0.0 psf
Angle of friction struc.-soil :	δ	=	20.00 °
Saturated unit weight :	γ_{sat}	=	125.0 pcf

Reinforced Soil

Unit weight :	γ	=	130.0 pcf
Stress-state :	effective		
Angle of internal friction :	φ_{ef}	=	34.00 °

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Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 23.00 °
Saturated unit weight : γ_{sat} = 130.0 pcf

Retained Soil
Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 20.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	-	0.00 .. ∞	Retained Soil	

Terrain profile

Terrain behind construction has the slope 1: 4.00 (slope angle is 14.04 °).

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge new	Surcharge change	Action	Mag.1 [lbf/ft²]	Mag.2 [lbf/ft²]	Ord.x x [ft]	Length l [ft]	Depth z [ft]
1	Yes		variable	100.0				on terrain

No.	Name
1	Yard

Resistance on front face of the structure

Resistance on front face of the structure: 1/2 pass., 1/2 at rest
Soil on front face of the structure - Retained Soil
Soil thickness in front of structure h = 6.50 ft
Terrain surcharge f = 100.0 lbf/ft²

Terrain in front of structure is flat.

Earthquake

Factor of horizontal acceleration K_h = 0.1088
Factor of vertical acceleration K_v = 0.0000

Water below the GWT is restricted.

Settings of the stage of construction

Design situation : transient
Reduction of soil/soil friction angle : do not reduce

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Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
FF resistance	-2734.2	-1.67	0.5	-0.27	1.000
Resistance on front face	-249.8	-2.50	0.2	2.54	1.000
Weight - reinforced soil	0.0	-10.53	30369.7	9.18	1.000
Earthquake - soil wedge	3304.2	-10.53	0.0	9.18	1.000
Active pressure	8104.3	-7.31	5466.2	17.56	1.000
Earthq.- act.pressure	3068.9	-14.61	2070.0	17.56	1.000
Yard	568.8	-10.96	383.7	17.56	1.000
Weight - wall	0.0	-8.83	4944.2	1.89	1.000
Earthq.- constr.	537.9	-8.83	0.0	1.89	1.000
Yard	0.0	-19.96	1566.7	9.73	1.000

Verification of complete wall

Place of verification : bottom of blocks

Check for overturning stability

Resisting moment M_{res} = 442560.3 lbfft/ft
Overturning moment M_{ovr} = 144642.5 lbfft/ft

Safety factor = 3.06 > 1.50
Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 24572.61 lbf/ft
Active horizontal force H_{act} = 12600.13 lbf/ft

Safety factor = 1.95 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-167669.0	14361.30	-15603.25	0.000	2694.4

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-167669.0	14361.30	-15603.25

Verification of foundation soil

Place of verification : bottom of leveling pad
Stress in the footing bottom : rectangle

Eccentricity verification

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Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity
Max. stress at footing bottom σ = 2694.4 psf
Allowable bearing capacity of foundation soil R_d = 5000.0 psf

Safety factor = 1.86 > 1.30
Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Verification of slip on georeinforcement No. 1

Forces acting on construction (verification of reinforcement No.: 1)

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-8.83	4976.8	-0.45	1.000
Earthq.- constr.	541.5	-8.83	0.0	-0.45	1.000
Active pressure	7790.5	-6.63	5028.9	11.00	1.000
Earthq.- act.pressure	2763.8	-13.88	1858.2	11.00	1.000
Yard	559.4	-10.14	368.4	11.00	1.000
Weight - reinforced soil	0.0	-9.58	26182.8	5.97	1.000
Earthquake - soil wedge	2840.6	-9.58	0.0	5.97	1.000
Yard	0.0	-19.43	1143.7	5.28	1.000

Verification against slip along geotextile No.: 1

Inclination of slip surface = 90.00 °
Overall normal force acting on reinforcement = 34581.90 lbf/ft
Coefficient of reduction of slip along geo-textile = 0.95
Resistance along geo-reinforcement = 22159.50 lbf/ft
Wall resistance = 2873.37 lbf/ft
Overall bearing capacity of reinforcements = 0.00 lbf/ft

Check for slip:
Resisting horizontal force H_{res} = 25032.87 lbf/ft
Active horiz. force H_{act} = 11113.74 lbf/ft

Factor of safety = 2.25 > 1.50
Slip along geotextile is SATISFACTORY

Calculation of internal stability No. 1

Calculated forces and strength of reinforcements

No.	Name	F_x [lbf/ft]	Depth z[ft]	R_t [lbf/ft]	Utiliz. [%]	T_p [lbf/ft]	Utiliz. [%]	R_{con} [lbf/ft]	Utiliz. [%]
1	Miragrid 8XT	-459.84	18.00	1134.50	60.80	6187.21	11.15	1001.82	68.85
2	Miragrid 8XT	-887.11	16.50	2269.00	58.65	10647.10	12.50	2003.64	66.41
3	Miragrid 8XT	-844.27	15.00	2269.00	55.81	9049.39	13.99	2003.64	63.21
4	Miragrid 8XT	-801.43	13.50	2269.00	52.98	7581.32	15.86	2003.64	60.00
5	Miragrid 8XT	-758.59	12.00	2269.00	50.15	6242.87	18.23	2003.64	56.79
6	Miragrid 8XT	-715.75	10.50	2269.00	47.32	5034.05	21.33	2003.64	53.58

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No.	Name	F_x [lbf/ft]	Depth z[ft]	R_t [lbf/ft]	Utiliz. [%]	T_p [lbf/ft]	Utiliz. [%]	R_{con} [lbf/ft]	Utiliz. [%]
7	Miragrid 8XT	-672.92	9.00	2269.00	44.49	3954.86	25.52	2003.64	50.38
8	Miragrid 8XT	-630.08	7.50	2269.00	41.65	3005.30	31.45	2003.64	47.17
9	Miragrid 8XT	-587.24	6.00	2269.00	38.82	2185.36	40.31	2003.64	43.96
10	Miragrid 8XT	-544.40	4.50	2269.00	35.99	1495.05	54.62	2003.64	40.76
11	Miragrid 8XT	-501.56	3.00	2269.00	33.16	934.37	80.52	2003.64	37.55
12	Miragrid 10XT/ Miragrid 8XT	-683.73	1.50	2657.11	38.60	1308.91	78.36	2323.18	44.15

Check for tensile strength (reinforcement No.1)
Tension strength R_t = 1134.50 lbf/ft
Force in reinforcement F_x = 459.84 lbf/ft

Safety factor = 2.47 > 1.50
Reinforcement for tensile strength is SATISFACTORY

Check for pull out resistance (reinforcement No.11)
Pull out resistance T_p = 934.37 lbf/ft
Force in reinforcement F_x = 501.56 lbf/ft

Safety factor = 1.86 > 1.50
Reinforcement for pull out resistance is SATISFACTORY

Verification of connection strength (reinforcement No.1)
Connection strength R_{con} = 1001.82 lbf/ft
Force in reinforcement F_x = 459.84 lbf/ft

Safety factor = 2.18 > 1.50
Connection strength is SATISFACTORY

Overall verification - reinforcement is SATISFACTORY

Slope stability analysis

Input data (Construction stage 1)

Project

Settings

(input for current task)

Stability analysis

Verification methodology : Safety factors (ASD)
Earthquake analysis : Standard

Safety factors			
Transient design situation			
Safety factor :	SF_s =	1.40	[–]

Anchors

Verification methodology : Safety factors (ASD)

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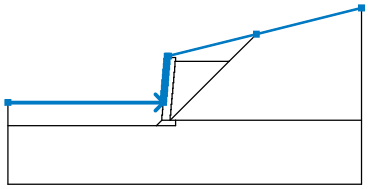
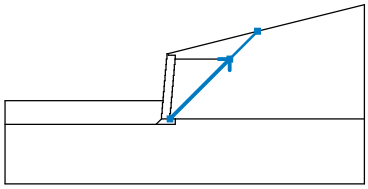
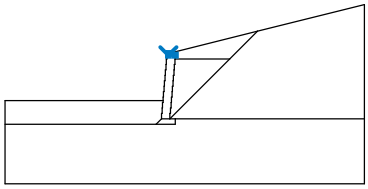
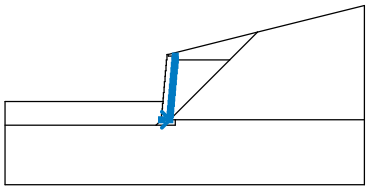
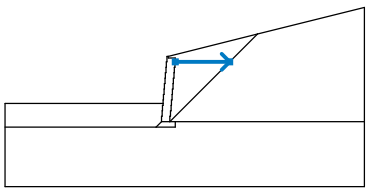
Safety factors			
Safety factor for steel strength :	SF_t =	1.50	[–]
Safety factor for pull out resistance (soil) :	SF_e =	1.50	[–]
Safety factor for pull out resistance (grouting) :	SF_c =	1.50	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		-45.00	-13.00	-1.49	-13.00	-1.49	-12.00
		-1.36	-12.00	-1.36	-10.50	-1.22	-10.50
		-1.22	-9.00	-1.09	-9.00	-1.09	-7.50
		-0.95	-7.50	-0.95	-6.00	-0.82	-6.00
		-0.82	-4.50	-0.69	-4.50	-0.69	-3.00
		-0.55	-3.00	-0.55	-1.50	-0.42	-1.50
		-0.42	0.00	0.00	0.00	24.58	6.15
		54.00	13.50				
2		0.44	-18.00	16.93	-1.50	24.58	6.15
3		0.00	0.00	0.00	-0.42	1.92	-0.42
4		-1.90	-18.00	0.44	-18.00	0.44	-16.50
		0.57	-16.50	0.57	-15.00	0.71	-15.00
		0.71	-13.50	0.84	-13.50	0.84	-12.00
		0.98	-12.00	0.98	-10.50	1.11	-10.50
		1.11	-9.00	1.24	-9.00	1.24	-7.50
		1.38	-7.50	1.38	-6.00	1.51	-6.00
		1.51	-4.50	1.65	-4.50	1.65	-3.00
		1.78	-3.00	1.78	-1.50	1.92	-1.50
		1.92	-0.42				
5		1.92	-1.50	16.93	-1.50		

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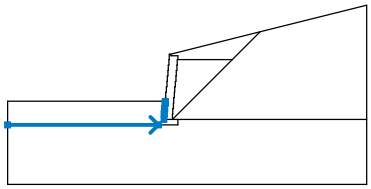
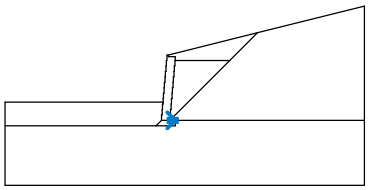
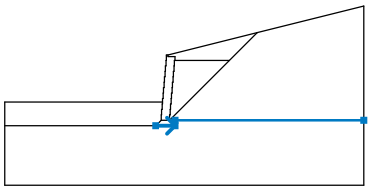
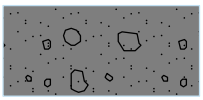
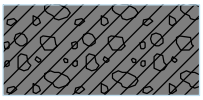
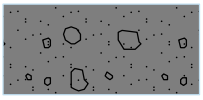
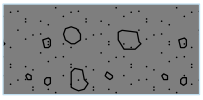
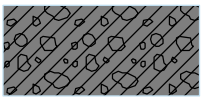
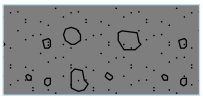
No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
6		-45.00	-19.50	-3.40	-19.50	-1.90	-18.00
		-1.90	-16.50	-1.76	-16.50	-1.76	-15.00
		-1.63	-15.00	-1.63	-13.50	-1.49	-13.50
		-1.49	-13.00				
7		0.44	-18.00	1.93	-18.00		
8		-3.40	-19.50	1.93	-19.50	1.93	-18.00
		54.00	-18.00				

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	Foundation Soil		30.00	0.0	125.0
2	Reinforced Soil		34.00	0.0	130.0
3	Retained Soil		30.00	0.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	Foundation Soil		125.0		
2	Reinforced Soil		130.0		
3	Retained Soil		125.0		

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Soil parameters

Foundation Soil

Unit weight :	γ =	125.0 pcf
Stress-state :	effective	
Shear strength :	Mohr-Coulomb	
Angle of internal friction :	φ_{ef} =	30.00 °
Cohesion of soil :	c_{ef} =	0.0 psf
Saturated unit weight :	γ_{sat} =	125.0 pcf

Reinforced Soil

Unit weight :	γ =	130.0 pcf
Stress-state :	effective	
Shear strength :	Mohr-Coulomb	
Angle of internal friction :	φ_{ef} =	34.00 °
Cohesion of soil :	c_{ef} =	0.0 psf
Saturated unit weight :	γ_{sat} =	130.0 pcf

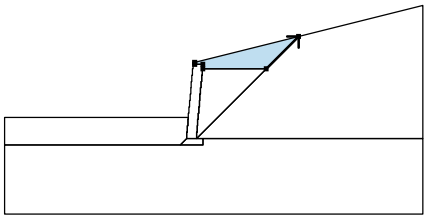
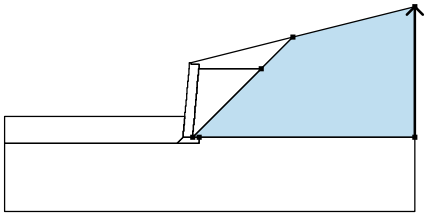
Retained Soil

Unit weight :	γ =	125.0 pcf
Stress-state :	effective	
Shear strength :	Mohr-Coulomb	
Angle of internal friction :	φ_{ef} =	30.00 °
Cohesion of soil :	c_{ef} =	0.0 psf
Saturated unit weight :	γ_{sat} =	125.0 pcf

Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure		120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft] x	z	x	z	Assigned soil
1		16.93	-1.50	24.58	6.15	Reinforced Soil
		0.00	0.00	0.00	-0.42	
		1.92	-0.42	1.92	-1.50	
2		54.00	-18.00	54.00	13.50	Retained Soil
		24.58	6.15	16.93	-1.50	
		0.44	-18.00	1.93	-18.00	

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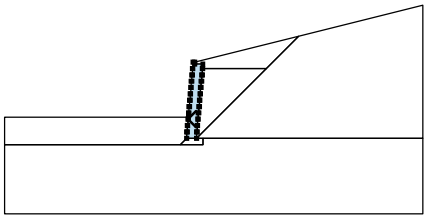
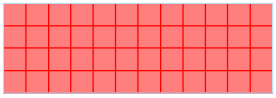
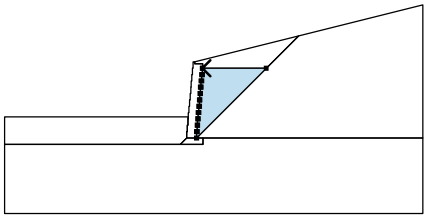
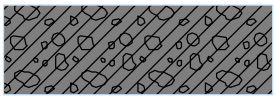
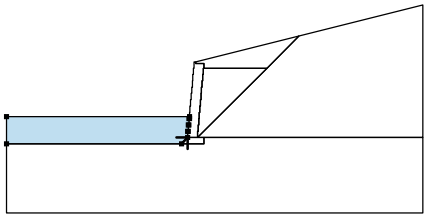
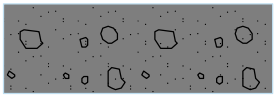
No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
3		-1.49	-13.50	-1.63	-13.50	Material of structure 
		-1.63	-15.00	-1.76	-15.00	
		-1.76	-16.50	-1.90	-16.50	
		-1.90	-18.00	0.44	-18.00	
		0.44	-16.50	0.57	-16.50	
		0.57	-15.00	0.71	-15.00	
		0.71	-13.50	0.84	-13.50	
		0.84	-12.00	0.98	-12.00	
		0.98	-10.50	1.11	-10.50	
		1.11	-9.00	1.24	-9.00	
		1.24	-7.50	1.38	-7.50	
		1.38	-6.00	1.51	-6.00	
		1.51	-4.50	1.65	-4.50	
		1.65	-3.00	1.78	-3.00	
		1.78	-1.50	1.92	-1.50	
		1.92	-0.42	0.00	-0.42	
		0.00	0.00	-0.42	0.00	
		-0.42	-1.50	-0.55	-1.50	
		-0.55	-3.00	-0.69	-3.00	
		-0.69	-4.50	-0.82	-4.50	
		-0.82	-6.00	-0.95	-6.00	
		-0.95	-7.50	-1.09	-7.50	
		-1.09	-9.00	-1.22	-9.00	
		-1.22	-10.50	-1.36	-10.50	
		-1.36	-12.00	-1.49	-12.00	
		-1.49	-13.00			
4		1.92	-1.50	1.78	-1.50	Reinforced Soil 
		1.78	-3.00	1.65	-3.00	
		1.65	-4.50	1.51	-4.50	
		1.51	-6.00	1.38	-6.00	
		1.38	-7.50	1.24	-7.50	
		1.24	-9.00	1.11	-9.00	
		1.11	-10.50	0.98	-10.50	
		0.98	-12.00	0.84	-12.00	
		0.84	-13.50	0.71	-13.50	
		0.71	-15.00	0.57	-15.00	
		0.57	-16.50	0.44	-16.50	
		0.44	-18.00	16.93	-1.50	
5		-3.40	-19.50	-1.90	-18.00	Retained Soil 
		-1.90	-16.50	-1.76	-16.50	
		-1.76	-15.00	-1.63	-15.00	
		-1.63	-13.50	-1.49	-13.50	
		-1.49	-13.00	-45.00	-13.00	
		-45.00	-19.50			

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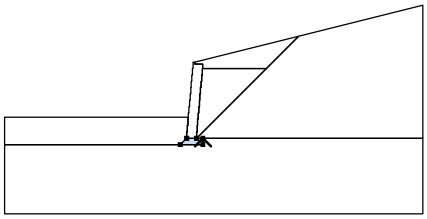
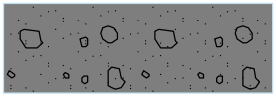
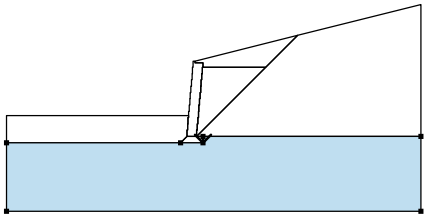
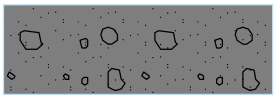
No.	Surface position	Coordinates of surface points [ft] x	z	x	z	Assigned soil
6		1.93	-19.50	1.93	-18.00	Foundation Soil 
		0.44	-18.00	-1.90	-18.00	
		-3.40	-19.50			
7		1.93	-18.00	1.93	-19.50	Retained Soil 
		-3.40	-19.50	-45.00	-19.50	
		-45.00	-35.90	54.00	-35.90	
		54.00	-18.00			

Reinforcements

No.	Point to the left x [ft]	z [ft]	Point to the right x [ft]	z [ft]	Length L [ft]	Strength R_t [lbf/ft]	Pull out resist.	End of reinf.
1	0.44	-18.00	11.44	-18.00	11.00	1134.5	C = 0.80	Fixed
2	0.57	-16.50	11.57	-16.50	11.00	2269.0	C = 0.80	Fixed
3	0.71	-15.00	11.71	-15.00	11.00	2269.0	C = 0.80	Fixed
4	0.84	-13.50	11.84	-13.50	11.00	2269.0	C = 0.80	Fixed
5	0.98	-12.00	11.98	-12.00	11.00	2269.0	C = 0.80	Fixed
6	1.11	-10.50	12.11	-10.50	11.00	2269.0	C = 0.80	Fixed
7	1.24	-9.00	12.24	-9.00	11.00	2269.0	C = 0.80	Fixed
8	1.38	-7.50	12.38	-7.50	11.00	2269.0	C = 0.80	Fixed
9	1.51	-6.00	12.51	-6.00	11.00	2269.0	C = 0.80	Fixed
10	1.65	-4.50	12.65	-4.50	11.00	2269.0	C = 0.80	Fixed
11	1.78	-3.00	12.78	-3.00	11.00	2269.0	C = 0.80	Fixed
12	1.92	-1.50	15.67	-1.50	13.75	2657.1	C = 0.80	Fixed

Surcharge

No.	Type	Type of action	Location z [ft]	Origin x [ft]	Length l [ft]	Width b [ft]	Slope α [°]	Magnitude q, q_1, f, F, x	q_2, z	unit
1	strip	variable	on terrain	x = 0.00	l = 54.00		0.00	100.0		lbf/ft^2
2	strip	permanent	on terrain	x = -45.00	l = 43.10		0.00	100.0		lbf/ft^2

Surcharges

No.	Name
1	Yard

Water

Water type : No water

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Tensile crack

Tensile crack not input.

Earthquake

Horizontal seismic coefficient : K_h = 0.1088
Vertical seismic coefficient : K_v = 0.0000

Settings of the stage of construction

Design situation : transient

Results (Construction stage 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-2.73	[ft]	Angles :	α_1 =	-23.26	[°]
	z =	44.52	[ft]		α_2 =	59.58	[°]
Radius :	R =	62.61	[ft]				
The slip surface after optimization.							

Total weight of soil above the slip surface: 110468.4 lbf/ft

Reinforcement bearing capacity

Reinforcement	Bearing capacity [lbf/ft]
1	0.0
2	828.8
3	0.0
4	0.0
5	0.0
6	0.0
7	0.0
8	0.0
9	0.0
10	0.0
11	0.0
12	0.0

Slope stability verification (Bishop)

Sum of active forces : F_a = 44388.3 lbf/ft
Sum of passive forces : F_p = 64280.0 lbf/ft

Sliding moment : M_a = 2779154.4 lbfft/ft
Resisting moment : M_p = 4024571.2 lbfft/ft
Factor of safety = 1.45 > 1.40
Slope stability ACCEPTABLE

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Analysis of Redi Rock wall

Input data

Project : VA Togus
Part : Retaining Walls
Description : Single Wall - 10ft
Customer : GDM
Author : APH
Date : 2/9/2026
Project ID : VA Togus EHRM
Project number : 23072-00

Settings

(input for current task)

Wall analysis

Verification methodology : Safety factors (ASD)
Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00

Safety factors			
Transient design situation			
Safety factor for overturning :	SF_o =	1.50	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	1.30	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Blocks

No.	Description	Block height h [in]	Block width w [in]	Unit weight γ [pcf]
1	Block 28 PC	18.00	28.00	120.00
2	Top block 28	18.00	28.00	120.00

No.	Description	Shear bearing capacity of joint F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Block friction f [°]
1	Block 28 PC	6061.00	11276.00	44.00
2	Top block 28	6061.00	11276.00	44.00

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Setbacks

No.	Setback s [in]
1	0.000
2	0.033
3	0.135
6	0.269

Geometry

No. group	Description	Count	Setback s [in]
1	Block 28 PC	3	0.13
2	Block 28 PC	6	0.13
3	Top block 28	1	-

Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 1.00 ft
Height h = 1.00 ft
Width b = 4.33 ft

Material

Soil creating foundation - Foundation Soil

Types of reinforcements

No.	Name	Type of reinforcement	Line type	Tensile strength		
				T_{ult} [lbf/ft]	R_t [lbf/ft]	R_{con} [lbf/ft]
2	Miragrid 8XT	Miragrid 8XT	– – – – – – – – – –	7600.00	4537.99	4007.27
3	Miragrid 10XT	Miragrid 10XT	– · – · – · – · – · –	10200.00	6090.46	5285.45

2. Miragrid 8XT

Reinforcement details

Short-term char. strength	T_{ult}	=	7600.00	lbf/ft
Creep red. factor	RF_{CR}	=	1.45	
Durability red. factor	RF_D	=	1.10	
Installation damage red. factor	RF_{ID}	=	1.05	
Long-term design strength	R_t	=	4537.99	lbf/ft
Coefficient of direct slip along reinforcement	C_{ds}	=	0.80	
Coefficient of interaction of soil and geo-reinforcement	C_i	=	0.80	
Scale correction factor	α	=	1.0	
Long-term strength reduction factor	CR_{cr}	=	0.580	
Calculation of long-term connection strength	R_{con}	=	4007.27	lbf/ft

3. Miragrid 10XT

Reinforcement details

Short-term char. strength	T_{ult}	=	10200.00	lbf/ft
Creep red. factor	RF_{CR}	=	1.45	
Durability red. factor	RF_D	=	1.10	
Installation damage red. factor	RF_{ID}	=	1.05	

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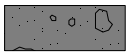
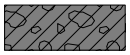
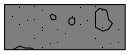
Long-term design strength	R_t	=	6090.46	lbf/ft
Coefficient of direct slip along reinforcement	C_{ds}	=	0.80	
Coefficient of interaction of soil and geo-reinforcement	C_i	=	0.80	
Scale correction factor	α	=	1.0	
Long-term strength reduction factor	CR_{cr}	=	0.570	
Calculation of long-term connection strength	R_{con}	=	5285.45	lbf/ft

Reinforcements

Input mode : table of reinforcements
Top reinforcement : straight (25%)

No.	Consider	Name	Geometry	Length of reinforcement l [ft]	End pt. coordinate l_k [ft]
1	Yes	Miragrid 8XT	input length	9.00	
2	Yes	Miragrid 8XT	input length	9.00	
3	Yes	Miragrid 8XT	input length	9.00	
4	Yes	Miragrid 8XT	input length	9.00	
5	Yes	Miragrid 8XT	input length	9.00	
6	Yes	Miragrid 8XT	input length	9.00	
7	Yes	Miragrid 8XT	input length	9.00	
8	Yes	Miragrid 8XT	input length	9.00	
9	Yes	Miragrid 8XT	input length	9.00	
10	Yes	Miragrid 10XT	input length	11.25	

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	Foundation Soil		30.00	0.0	125.00	62.50	20.00
2	Reinforced Soil		34.00	0.0	130.00	67.50	23.00
3	Retained Soil		30.00	0.0	125.00	62.50	20.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Foundation Soil

Unit weight :	γ	=	125.0 pcf
Stress-state :	effective		
Angle of internal friction :	φ_{ef}	=	30.00 °
Cohesion of soil :	c_{ef}	=	0.0 psf
Angle of friction struc.-soil :	δ	=	20.00 °
Saturated unit weight :	γ_{sat}	=	125.0 pcf

Reinforced Soil

Unit weight :	γ	=	130.0 pcf
Stress-state :	effective		
Angle of internal friction :	φ_{ef}	=	34.00 °
Cohesion of soil :	c_{ef}	=	0.0 psf
Angle of friction struc.-soil :	δ	=	23.00 °

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Saturated unit weight : γ_{sat} = 130.0 pcf

Retained Soil

Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 20.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	-	0.00 .. ∞	Retained Soil	

Terrain profile

Terrain behind construction has the slope 1: 4.00 (slope angle is 14.04 °).

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge new	Surcharge change	Action	Mag.1 [lbf/ft²]	Mag.2 [lbf/ft²]	Ord.x x [ft]	Length l [ft]	Depth z [ft]
1	Yes		variable	100.0				on terrain

No.	Name
1	Yard

Resistance on front face of the structure

Resistance on front face of the structure: 1/2 pass., 1/2 at rest
Soil on front face of the structure - Retained Soil
Soil thickness in front of structure h = 6.00 ft
Terrain surcharge f = 100.0 lbf/ft²

Terrain in front of structure is flat.

Earthquake

Factor of horizontal acceleration K_h = 0.1088
Factor of vertical acceleration K_v = 0.0000

Water below the GWT is restricted.

Settings of the stage of construction

Design situation : transient
Reduction of soil/soil friction angle : do not reduce

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
FF resistance	-2734.2	-1.67	0.5	-0.27	1.000
Resistance on front face	-249.8	-2.50	0.2	2.54	1.000

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Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - reinforced soil	0.0	-8.84	20910.5	7.95	1.000
Earthquake - soil wedge	2275.1	-8.84	0.0	7.95	1.000
Active pressure	5645.2	-6.10	3807.6	14.79	1.000
Earthq.- act.pressure	2137.6	-12.20	1441.9	14.79	1.000
Yard	474.8	-9.15	320.2	14.79	1.000
Weight - wall	0.0	-7.33	4104.2	1.75	1.000
Earthq.- constr.	446.5	-7.33	0.0	1.75	1.000
Yard	0.0	-16.65	1316.7	8.21	1.000

Verification of complete wall

Place of verification : bottom of blocks

Check for overturning stability

Resisting moment M_{res} = 266537.0 lbfft/ft
Overturning moment M_{ovr} = 83025.7 lbfft/ft

Safety factor = 3.21 > 1.50
Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 17497.50 lbf/ft
Active horizontal force H_{act} = 7995.17 lbf/ft

Safety factor = 2.19 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-114455.8	10217.80	-14678.91	0.000	2359.8

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-114455.8	10217.80	-14678.91

Verification of foundation soil

Place of verification : bottom of leveling pad
Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

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Verification of bearing capacity

Max. stress at footing bottom σ = 2359.8 psf
Allowable bearing capacity of foundation soil R_d = 5000.0 psf

Safety factor = 2.12 > 1.30

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Verification of slip on georeinforcement No. 1

Forces acting on construction (verification of reinforcement No.: 1)

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-7.33	4122.7	-0.58	1.000
Earthq.- constr.	448.6	-7.33	0.0	-0.58	1.000
Active pressure	5441.8	-5.54	3510.6	9.00	1.000
Earthq.- act.pressure	1928.9	-11.60	1296.8	9.00	1.000
Yard	467.6	-8.47	307.8	9.00	1.000
Weight - reinforced soil	0.0	-8.02	17949.0	4.88	1.000
Earthquake - soil wedge	1944.7	-8.02	0.0	4.88	1.000
Yard	0.0	-16.21	970.6	4.15	1.000

Verification against slip along geotextile No.: 1

Inclination of slip surface = 90.00 °
Overall normal force acting on reinforcement = 24034.70 lbf/ft
Coefficient of reduction of slip along geo-textile = 0.95
Resistance along geo-reinforcement = 15401.03 lbf/ft
Wall resistance = 2380.25 lbf/ft
Overall bearing capacity of reinforcements = 0.00 lbf/ft

Check for slip:

Resisting horizontal force H_{res} = 17781.28 lbf/ft
Active horiz. force H_{act} = 7838.33 lbf/ft

Factor of safety = 2.27 > 1.50

Slip along geotextile is SATISFACTORY

Calculation of internal stability No. 1

Calculated forces and strength of reinforcements

No.	Name	F_x [lbf/ft]	Depth z[ft]	R_t [lbf/ft]	Utiliz. [%]	T_p [lbf/ft]	Utiliz. [%]	R_{con} [lbf/ft]	Utiliz. [%]
1	Miragrid 8XT	-383.67	15.00	1134.50	50.73	4235.35	13.59	1001.82	57.45
2	Miragrid 8XT	-734.85	13.50	2269.00	48.58	7052.11	15.63	2003.64	55.01
3	Miragrid 8XT	-692.01	12.00	2269.00	45.75	5763.14	18.01	2003.64	51.81
4	Miragrid 8XT	-649.17	10.50	2269.00	42.92	4603.81	21.15	2003.64	48.60
5	Miragrid 8XT	-606.33	9.00	2269.00	40.08	3574.10	25.45	2003.64	45.39
6	Miragrid 8XT	-563.50	7.50	2269.00	37.25	2674.01	31.61	2003.64	42.19
7	Miragrid 8XT	-520.66	6.00	2269.00	34.42	1903.56	41.03	2003.64	38.98
8	Miragrid 8XT	-477.82	4.50	2269.00	31.59	1262.73	56.76	2003.64	35.77
9	Miragrid 8XT	-434.98	3.00	2269.00	28.76	751.53	86.82	2003.64	32.56
10	Miragrid 10XT/ Miragrid 8XT	-583.11	1.50	2657.11	32.92	955.99	91.49	2323.18	37.65

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Check for tensile strength (reinforcement No.1)
Tension strength R_t = 1134.50 lbf/ft
Force in reinforcement F_x = 383.67 lbf/ft

Safety factor = 2.96 > 1.50
Reinforcement for tensile strength is SATISFACTORY

Check for pull out resistance (reinforcement No.10)
Pull out resistance T_p = 955.99 lbf/ft
Force in reinforcement F_x = 583.11 lbf/ft

Safety factor = 1.64 > 1.50
Reinforcement for pull out resistance is SATISFACTORY

Verification of connection strength (reinforcement No.1)
Connection strength R_{con} = 1001.82 lbf/ft
Force in reinforcement F_x = 383.67 lbf/ft

Safety factor = 2.61 > 1.50
Connection strength is SATISFACTORY

Overall verification - reinforcement is SATISFACTORY

Slope stability analysis

Input data (Construction stage 1)

Project

Settings

(input for current task)

Stability analysis

Verification methodology : Safety factors (ASD)
Earthquake analysis : Standard

Safety factors			
Transient design situation			
Safety factor :	SF_s =	1.40	[–]

Anchors

Verification methodology : Safety factors (ASD)

Safety factors			
Safety factor for steel strength :	SF_t =	1.50	[–]
Safety factor for pull out resistance (soil) :	SF_e =	1.50	[–]
Safety factor for pull out resistance (grouting) :	SF_c =	1.50	[–]

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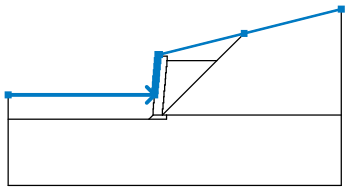
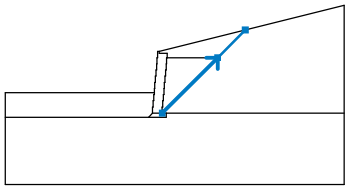
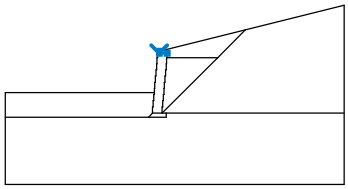
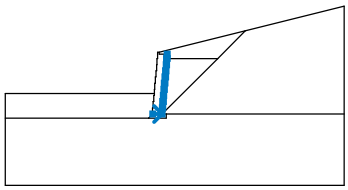
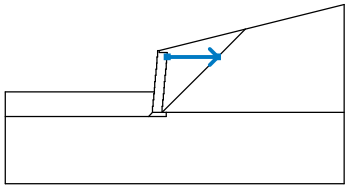
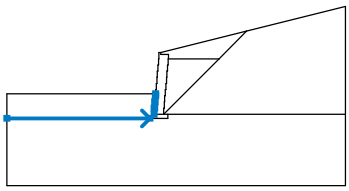
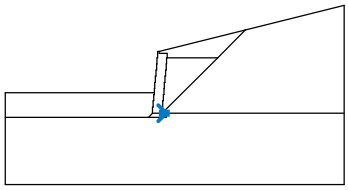
Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		-37.50	-10.00	-1.22	-10.00	-1.22	-9.00
		-1.09	-9.00	-1.09	-7.50	-0.95	-7.50
		-0.95	-6.00	-0.82	-6.00	-0.82	-4.50
		-0.69	-4.50	-0.69	-3.00	-0.55	-3.00
		-0.55	-1.50	-0.42	-1.50	-0.42	0.00
		0.00	0.00	20.94	5.24	45.00	11.25
2		0.71	-15.00	14.20	-1.50	20.94	5.24
3		0.00	0.00	0.00	-0.42	1.92	-0.42
4		-1.63	-15.00	0.71	-15.00	0.71	-13.50
		0.84	-13.50	0.84	-12.00	0.98	-12.00
		0.98	-10.50	1.11	-10.50	1.11	-9.00
		1.24	-9.00	1.24	-7.50	1.38	-7.50
		1.38	-6.00	1.51	-6.00	1.51	-4.50
		1.65	-4.50	1.65	-3.00	1.78	-3.00
		1.78	-1.50	1.92	-1.50	1.92	-0.42
5		1.92	-1.50	14.20	-1.50		
6		-37.50	-16.00	-2.63	-16.00	-1.63	-15.00
		-1.63	-13.50	-1.49	-13.50	-1.49	-12.00
		-1.36	-12.00	-1.36	-10.50	-1.22	-10.50
		-1.22	-10.00				
7		0.71	-15.00	1.70	-15.00		

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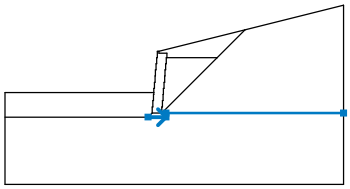
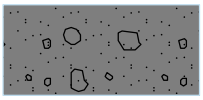
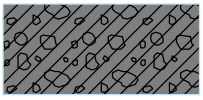
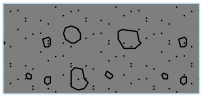
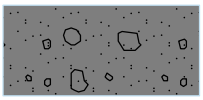
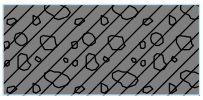
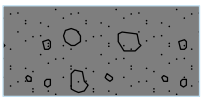
No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
8		-2.63	-16.00	1.70	-16.00	1.70	-15.00
		45.00	-15.00				

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	Foundation Soil		30.00	0.0	125.0
2	Reinforced Soil		34.00	0.0	130.0
3	Retained Soil		30.00	0.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	Foundation Soil		125.0		
2	Reinforced Soil		130.0		
3	Retained Soil		125.0		

Soil parameters

Foundation Soil

Unit weight : γ = 125.0 pcf
Stress-state : effective
Shear strength : Mohr-Coulomb
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

Reinforced Soil

Unit weight : γ = 130.0 pcf

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Stress-state :	effective
Shear strength :	Mohr-Coulomb
Angle of internal friction :	φ_{ef} = 34.00 °
Cohesion of soil :	c_{ef} = 0.0 psf
Saturated unit weight :	γ_{sat} = 130.0 pcf

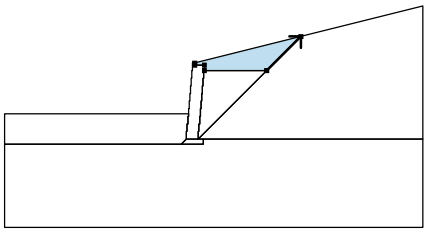
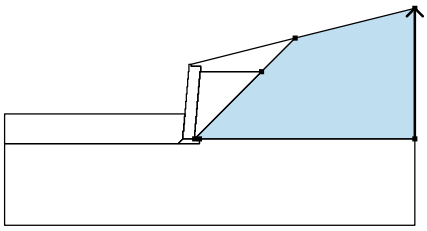
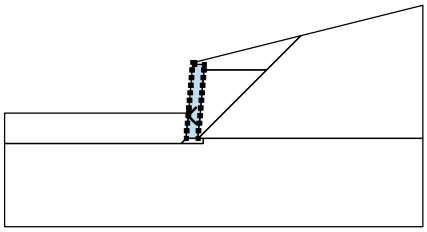
Retained Soil

Unit weight :	γ = 125.0 pcf
Stress-state :	effective
Shear strength :	Mohr-Coulomb
Angle of internal friction :	φ_{ef} = 30.00 °
Cohesion of soil :	c_{ef} = 0.0 psf
Saturated unit weight :	γ_{sat} = 125.0 pcf

Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure		120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		14.20	-1.50	20.94	5.24	Reinforced Soil
		0.00	0.00	0.00	-0.42	
		1.92	-0.42	1.92	-1.50	
2		45.00	-15.00	45.00	11.25	Retained Soil
		20.94	5.24	14.20	-1.50	
		0.71	-15.00	1.70	-15.00	
3		-1.22	-10.50	-1.36	-10.50	Material of structure
		-1.36	-12.00	-1.49	-12.00	
		-1.49	-13.50	-1.63	-13.50	
		-1.63	-15.00	0.71	-15.00	
		0.71	-13.50	0.84	-13.50	
		0.84	-12.00	0.98	-12.00	
		0.98	-10.50	1.11	-10.50	
		1.11	-9.00	1.24	-9.00	
		1.24	-7.50	1.38	-7.50	
		1.38	-6.00	1.51	-6.00	

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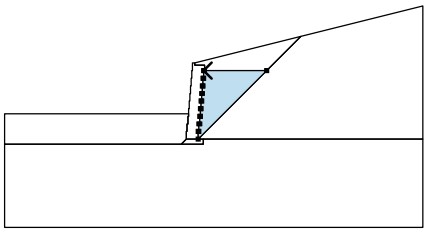
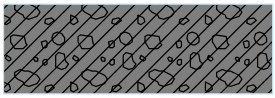
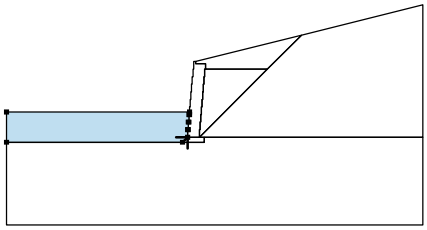
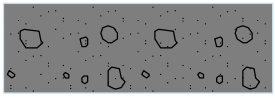
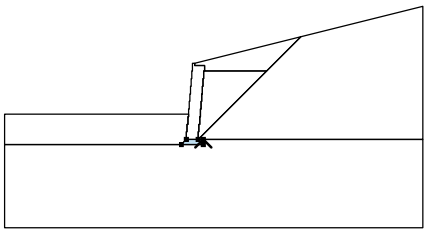
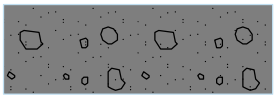
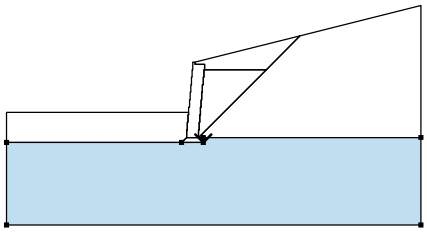
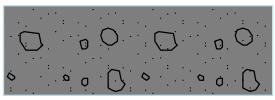
No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
		1.51	-4.50	1.65	-4.50	
		1.65	-3.00	1.78	-3.00	
		1.78	-1.50	1.92	-1.50	
		1.92	-0.42	0.00	-0.42	
		0.00	0.00	-0.42	0.00	
		-0.42	-1.50	-0.55	-1.50	
		-0.55	-3.00	-0.69	-3.00	
		-0.69	-4.50	-0.82	-4.50	
		-0.82	-6.00	-0.95	-6.00	
		-0.95	-7.50	-1.09	-7.50	
		-1.09	-9.00	-1.22	-9.00	
		-1.22	-10.00			
4		1.92	-1.50	1.78	-1.50	Reinforced Soil 
		1.78	-3.00	1.65	-3.00	
		1.65	-4.50	1.51	-4.50	
		1.51	-6.00	1.38	-6.00	
		1.38	-7.50	1.24	-7.50	
		1.24	-9.00	1.11	-9.00	
		1.11	-10.50	0.98	-10.50	
		0.98	-12.00	0.84	-12.00	
		0.84	-13.50	0.71	-13.50	
		0.71	-15.00	14.20	-1.50	
5		-2.63	-16.00	-1.63	-15.00	Retained Soil 
		-1.63	-13.50	-1.49	-13.50	
		-1.49	-12.00	-1.36	-12.00	
		-1.36	-10.50	-1.22	-10.50	
		-1.22	-10.00	-37.50	-10.00	
		-37.50	-16.00			
6		1.70	-16.00	1.70	-15.00	Foundation Soil 
		0.71	-15.00	-1.63	-15.00	
		-2.63	-16.00			
7		1.70	-15.00	1.70	-16.00	Retained Soil 
		-2.63	-16.00	-37.50	-16.00	
		-37.50	-32.40	45.00	-32.40	
		45.00	-15.00			

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Reinforcements

No.	Point to the left		Point to the right		Length	Strength	Pull out resist.	End of reinf.
	x [ft]	z [ft]	x [ft]	z [ft]	L [ft]	R_t [lbf/ft]		
1	0.71	-15.00	9.71	-15.00	9.00	1134.5	C = 0.80	Fixed
2	0.84	-13.50	9.84	-13.50	9.00	2269.0	C = 0.80	Fixed
3	0.98	-12.00	9.98	-12.00	9.00	2269.0	C = 0.80	Fixed
4	1.11	-10.50	10.11	-10.50	9.00	2269.0	C = 0.80	Fixed
5	1.24	-9.00	10.24	-9.00	9.00	2269.0	C = 0.80	Fixed
6	1.38	-7.50	10.38	-7.50	9.00	2269.0	C = 0.80	Fixed
7	1.51	-6.00	10.51	-6.00	9.00	2269.0	C = 0.80	Fixed
8	1.65	-4.50	10.65	-4.50	9.00	2269.0	C = 0.80	Fixed
9	1.78	-3.00	10.78	-3.00	9.00	2269.0	C = 0.80	Fixed
10	1.92	-1.50	13.17	-1.50	11.25	2657.1	C = 0.80	Fixed

Surcharge

No.	Type	Type of action	Location	Origin	Length	Width	Slope	Magnitude		
			z [ft]	x [ft]	l [ft]	b [ft]	α [°]	q, q_1, f, F, x	q_2, z	unit
1	strip	variable	on terrain	x = 0.00	l = 45.00		0.00	100.0		lbf/ft^2
2	strip	permanent	on terrain	x = -37.50	l = 35.87		0.00	100.0		lbf/ft^2

Surcharges

No.	Name
1	Yard

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Horizontal seismic coefficient : K_h = 0.1088
Vertical seismic coefficient : K_v = 0.0000

Settings of the stage of construction

Design situation : transient

Results (Construction stage 1)

Analysis 1

Circular slip surface

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Slip surface parameters							
Center :	x =	-4.21	[ft]	Angles :	α_1 =	-25.95	[°]
	z =	36.84	[ft]		α_2 =	59.15	[°]
Radius :	R =	52.09	[ft]				
The slip surface after optimization.							

Total weight of soil above the slip surface: 75549.9 lbf/ft

Reinforcement bearing capacity

Reinforcement	Bearing capacity [lbf/ft]
1	0.0
2	1420.2
3	0.0
4	0.0
5	0.0
6	0.0
7	0.0
8	0.0
9	0.0
10	0.0

Slope stability verification (Bishop)

Sum of active forces : F_a = 31191.5 lbf/ft

Sum of passive forces : F_p = 48141.6 lbf/ft

Sliding moment : M_a = 1624766.0 lbfft/ft

Resisting moment : M_p = 2507696.6 lbfft/ft

Factor of safety = 1.54 > 1.40

Slope stability ACCEPTABLE

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Analysis of Redi Rock wall

Input data

Project : VA Togus
Part : Retaining Walls
Description : Single Wall - 7ft
Customer : GDM
Author : APH
Date : 2/9/2026
Project ID : VA Togus EHRM
Project number : 23072-00

Settings

(input for current task)

Wall analysis

Verification methodology : Safety factors (ASD)
Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00

Safety factors			
Transient design situation			
Safety factor for overturning :	SF_o =	1.50	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	1.30	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Blocks

No.	Description	Block height h [in]	Block width w [in]	Unit weight γ [pcf]
1	Block 28 PC	18.00	28.00	120.00
2	Top block 28	18.00	28.00	120.00

No.	Description	Shear bearing capacity of joint F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Block friction f [°]
1	Block 28 PC	6061.00	11276.00	44.00
2	Top block 28	6061.00	11276.00	44.00

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Setbacks

No.	Setback s [in]
1	0.000
2	0.033
3	0.135
6	0.269

Geometry

No. group	Description	Count	Setback s [in]
1	Block 28 PC	3	0.13
2	Block 28 PC	4	0.13
3	Top block 28	1	-

Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 1.00 ft
Height h = 1.00 ft
Width b = 4.33 ft

Material

Soil creating foundation - Foundation Soil

Types of reinforcements

No.	Name	Type of reinforcement	Line type	Tensile strength		
				T_{ult} [lbf/ft]	R_t [lbf/ft]	R_{con} [lbf/ft]
2	Miragrid 8XT	Miragrid 8XT		7600.00	4537.99	4007.27
3	Miragrid 10XT	Miragrid 10XT		10200.00	6090.46	5285.45

2. Miragrid 8XT

Reinforcement details

Short-term char. strength	T_{ult}	=	7600.00	lbf/ft
Creep red. factor	RF_{CR}	=	1.45	
Durability red. factor	RF_D	=	1.10	
Installation damage red. factor	RF_{ID}	=	1.05	
Long-term design strength	R_t	=	4537.99	lbf/ft
Coefficient of direct slip along reinforcement	C_{ds}	=	0.80	
Coefficient of interaction of soil and geo-reinforcement	C_i	=	0.80	
Scale correction factor	α	=	1.0	
Long-term strength reduction factor	CR_{cr}	=	0.580	
Calculation of long-term connection strength	R_{con}	=	4007.27	lbf/ft

3. Miragrid 10XT

Reinforcement details

Short-term char. strength	T_{ult}	=	10200.00	lbf/ft
Creep red. factor	RF_{CR}	=	1.45	
Durability red. factor	RF_D	=	1.10	
Installation damage red. factor	RF_{ID}	=	1.05	

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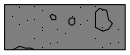
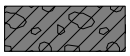
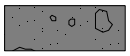
Long-term design strength	R_t	=	6090.46	lbf/ft
Coefficient of direct slip along reinforcement	C_{ds}	=	0.80	
Coefficient of interaction of soil and geo-reinforcement	C_i	=	0.80	
Scale correction factor	α	=	1.0	
Long-term strength reduction factor	CR_{cr}	=	0.570	
Calculation of long-term connection strength	R_{con}	=	5285.45	lbf/ft

Reinforcements

Input mode : table of reinforcements
Top reinforcement : straight (25%)

No.	Consider	Name	Geometry	Length of reinforcement l [ft]	End pt. coordinate l_k [ft]
1	Yes	Miragrid 8XT	input length	7.50	
2	Yes	Miragrid 8XT	input length	7.50	
3	Yes	Miragrid 8XT	input length	7.50	
4	Yes	Miragrid 8XT	input length	7.50	
5	Yes	Miragrid 8XT	input length	7.50	
6	Yes	Miragrid 8XT	input length	7.50	
7	Yes	Miragrid 8XT	input length	7.50	
8	Yes	Miragrid 10XT	input length	9.33	

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	Foundation Soil		30.00	0.0	125.00	62.50	20.00
2	Reinforced Soil		34.00	0.0	130.00	67.50	23.00
3	Retained Soil		30.00	0.0	125.00	62.50	20.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Foundation Soil

Unit weight :	γ	=	125.0 pcf
Stress-state :	effective		
Angle of internal friction :	φ_{ef}	=	30.00 °
Cohesion of soil :	c_{ef}	=	0.0 psf
Angle of friction struc.-soil :	δ	=	20.00 °
Saturated unit weight :	γ_{sat}	=	125.0 pcf

Reinforced Soil

Unit weight :	γ	=	130.0 pcf
Stress-state :	effective		
Angle of internal friction :	φ_{ef}	=	34.00 °
Cohesion of soil :	c_{ef}	=	0.0 psf
Angle of friction struc.-soil :	δ	=	23.00 °
Saturated unit weight :	γ_{sat}	=	130.0 pcf

Retained Soil

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Unit weight : γ = 125.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Angle of friction struc.-soil : δ = 20.00 °
Saturated unit weight : γ_{sat} = 125.0 pcf

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	-	0.00 .. ∞	Retained Soil	

Terrain profile

Terrain behind construction has the slope 1: 4.00 (slope angle is 14.04 °).

Water influence

Ground water table is located below the structure.

Input surface surcharges

No.	Surcharge new	Surcharge change	Action	Mag.1 [lbf/ft²]	Mag.2 [lbf/ft²]	Ord.x x [ft]	Length l [ft]	Depth z [ft]
1	Yes		variable	100.0				on terrain

No.	Name
1	Yard

Resistance on front face of the structure

Resistance on front face of the structure: 1/2 pass., 1/2 at rest
Soil on front face of the structure - Retained Soil
Soil thickness in front of structure h = 6.00 ft
Terrain surcharge f = 100.0 lbf/ft²

Terrain in front of structure is flat.

Earthquake

Factor of horizontal acceleration K_h = 0.1088
Factor of vertical acceleration K_v = 0.0000

Water below the GWT is restricted.

Settings of the stage of construction

Design situation : transient
Reduction of soil/soil friction angle : do not reduce

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
FF resistance	-2734.2	-1.67	0.5	-0.27	1.000
Resistance on front face	-249.8	-2.50	0.2	2.54	1.000
Weight - reinforced soil	0.0	-7.18	14216.7	6.99	1.000
Earthquake - soil wedge	1546.8	-7.18	0.0	6.99	1.000
Active pressure	3701.6	-4.94	2496.6	12.60	1.000

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Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Earthq.- act.pressure	1401.6	-9.87	945.4	12.60	1.000
Yard	384.4	-7.41	259.3	12.60	1.000
Weight - wall	0.0	-5.83	3264.2	1.62	1.000
Earthq.- constr.	355.1	-5.83	0.0	1.62	1.000
Yard	0.0	-13.41	1124.7	6.98	1.000

Verification of complete wall

Place of verification : bottom of blocks

Check for overturning stability

Resisting moment M_{res} = 159090.8 lbfft/ft
Overturning moment M_{ovr} = 42954.6 lbfft/ft

Safety factor = 3.70 > 1.50
Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 12235.30 lbf/ft
Active horizontal force H_{act} = 4405.58 lbf/ft

Safety factor = 2.78 > 1.50
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-71684.3	8018.66	-12097.87	0.000	1851.9

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-71684.3	8018.66	-12097.87

Verification of foundation soil

Place of verification : bottom of leveling pad
Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 1851.9 psf
Allowable bearing capacity of foundation soil R_d = 6000.0 psf

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Safety factor = 3.24 > 1.30
Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Verification of slip on georeinforcement No. 1

Forces acting on construction (verification of reinforcement No.: 1)

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-5.83	3282.1	-0.72	1.000
Earthq.- constr.	357.1	-5.83	0.0	-0.72	1.000
Active pressure	3586.6	-4.48	2306.7	7.50	1.000
Earthq.- act.pressure	1266.1	-9.39	850.7	7.50	1.000
Yard	379.8	-6.85	249.5	7.50	1.000
Weight - reinforced soil	0.0	-6.49	12181.3	4.06	1.000
Earthquake - soil wedge	1317.2	-6.49	0.0	4.06	1.000
Yard	0.0	-13.06	847.5	3.26	1.000

Verification against slip along geotextile No.: 1

Inclination of slip surface = 90.00 °
Overall normal force acting on reinforcement = 16435.79 lbf/ft
Coefficient of reduction of slip along geo-textile = 0.95
Resistance along geo-reinforcement = 10531.77 lbf/ft
Wall resistance = 1894.92 lbf/ft
Overall bearing capacity of reinforcements = 0.00 lbf/ft

Check for slip:
Resisting horizontal force H_{res} = 12426.70 lbf/ft
Active horiz. force H_{act} = 5232.54 lbf/ft

Factor of safety = 2.37 > 1.50
Slip along geotextile is SATISFACTORY

Calculation of internal stability No. 1

Calculated forces and strength of reinforcements

No.	Name	F_x [lbf/ft]	Depth z[ft]	R_t [lbf/ft]	Utiliz. [%]	T_p [lbf/ft]	Utiliz. [%]	R_{con} [lbf/ft]	Utiliz. [%]
1	Miragrid 8XT	-307.51	12.00	1134.50	40.66	2853.90	16.16	1001.82	46.04
2	Miragrid 8XT	-582.59	10.50	2269.00	38.51	4555.61	19.18	2003.64	43.61
3	Miragrid 8XT	-539.75	9.00	2269.00	35.68	3533.05	22.92	2003.64	40.41
4	Miragrid 8XT	-496.91	7.50	2269.00	32.85	2640.12	28.23	2003.64	37.20
5	Miragrid 8XT	-454.07	6.00	2269.00	30.02	1876.82	36.29	2003.64	33.99
6	Miragrid 8XT	-411.24	4.50	2269.00	27.19	1243.14	49.62	2003.64	30.79
7	Miragrid 8XT	-368.40	3.00	2269.00	24.35	739.09	74.77	2003.64	27.58
8	Miragrid 10XT/ Miragrid 8XT	-482.48	1.50	2657.11	27.24	796.13	90.91	2323.18	31.15

Check for tensile strength (reinforcement No.1)
Tension strength R_t = 1134.50 lbf/ft
Force in reinforcement F_x = 307.51 lbf/ft

Safety factor = 3.69 > 1.50
Reinforcement for tensile strength is SATISFACTORY

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Check for pull out resistance (reinforcement No.8)
Pull out resistance T_p = 796.13 lbf/ft
Force in reinforcement F_x = 482.48 lbf/ft

Safety factor = 1.65 > 1.50
Reinforcement for pull out resistance is SATISFACTORY

Verification of connection strength (reinforcement No.1)
Connection strength R_{con} = 1001.82 lbf/ft
Force in reinforcement F_x = 307.51 lbf/ft

Safety factor = 3.26 > 1.50
Connection strength is SATISFACTORY

Overall verification - reinforcement is SATISFACTORY

Slope stability analysis

Input data (Construction stage 1)

Project

Settings

(input for current task)

Stability analysis

Verification methodology : Safety factors (ASD)
Earthquake analysis : Standard

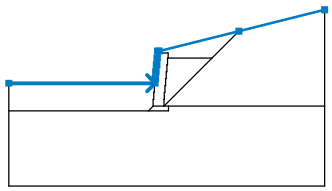
Safety factors			
Transient design situation			
Safety factor :	SF_s =	1.40	[–]

Anchors

Verification methodology : Safety factors (ASD)

Safety factors			
Safety factor for steel strength :	SF_t =	1.50	[–]
Safety factor for pull out resistance (soil) :	SF_e =	1.50	[–]
Safety factor for pull out resistance (grouting) :	SF_c =	1.50	[–]

Interface

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		-32.80	-7.00	-0.95	-7.00	-0.95	-6.00
		-0.82	-6.00	-0.82	-4.50	-0.69	-4.50
		-0.69	-3.00	-0.55	-3.00	-0.55	-1.50
		-0.42	-1.50	-0.42	0.00	0.00	0.00
		17.30	4.33	36.00	9.00		

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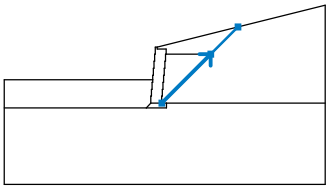
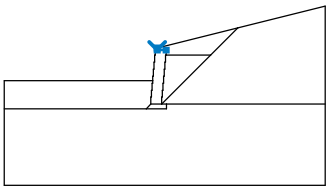
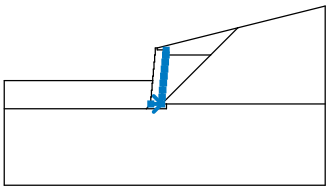
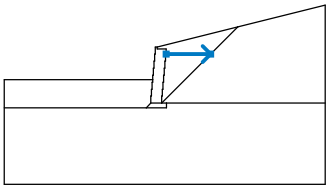
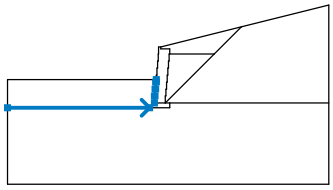
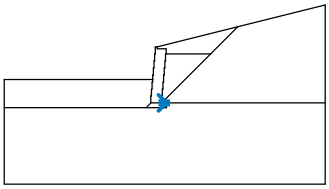
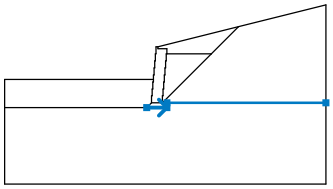
No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
2		0.98	-12.00	11.47	-1.50	17.30	4.33
3		0.00	0.00	0.00	-0.42	1.92	-0.42
4		-1.36	-12.00	0.98	-12.00	0.98	-10.50
		1.11	-10.50	1.11	-9.00	1.24	-9.00
		1.24	-7.50	1.38	-7.50	1.38	-6.00
		1.51	-6.00	1.51	-4.50	1.65	-4.50
		1.65	-3.00	1.78	-3.00	1.78	-1.50
		1.92	-1.50	1.92	-0.42		
5		1.92	-1.50	11.47	-1.50		
6		-32.80	-13.00	-2.36	-13.00	-1.36	-12.00
		-1.36	-10.50	-1.22	-10.50	-1.22	-9.00
		-1.09	-9.00	-1.09	-7.50	-0.95	-7.50
		-0.95	-7.00				
7		0.98	-12.00	1.97	-12.00		
8		-2.36	-13.00	1.97	-13.00	1.97	-12.00
		36.00	-12.00				

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Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	Foundation Soil		30.00	0.0	125.0
2	Reinforced Soil		34.00	0.0	130.0
3	Retained Soil		30.00	0.0	125.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	Foundation Soil		125.0		
2	Reinforced Soil		130.0		
3	Retained Soil		125.0		

Soil parameters

Foundation Soil

Unit weight : γ = 125.0 pcf
Stress-state : effective
Shear strength : Mohr-Coulomb
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

Reinforced Soil

Unit weight : γ = 130.0 pcf
Stress-state : effective
Shear strength : Mohr-Coulomb
Angle of internal friction : φ_{ef} = 34.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 130.0 pcf

Retained Soil

Unit weight : γ = 125.0 pcf
Stress-state : effective
Shear strength : Mohr-Coulomb

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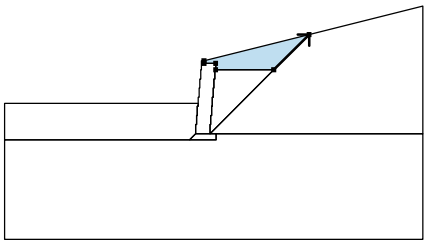
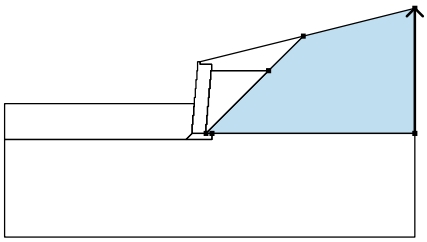
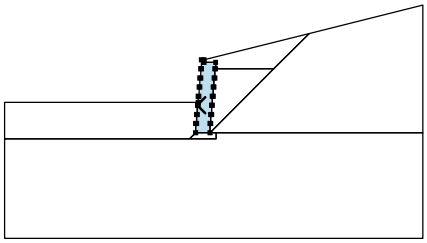
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 0.0 psf
Saturated unit weight : γ_{sat} = 125.0 pcf

Rigid Bodies

No.	Name	Sample	γ [pcf]
1	Material of structure		120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		11.47	-1.50	17.30	4.33	Reinforced Soil
		0.00	0.00	0.00	-0.42	
		1.92	-0.42	1.92	-1.50	
2		36.00	-12.00	36.00	9.00	Retained Soil
		17.30	4.33	11.47	-1.50	
		0.98	-12.00	1.97	-12.00	
3		-0.95	-7.50	-1.09	-7.50	Material of structure
		-1.09	-9.00	-1.22	-9.00	
		-1.22	-10.50	-1.36	-10.50	
		-1.36	-12.00	0.98	-12.00	
		0.98	-10.50	1.11	-10.50	
		1.11	-9.00	1.24	-9.00	
		1.24	-7.50	1.38	-7.50	
		1.38	-6.00	1.51	-6.00	
		1.51	-4.50	1.65	-4.50	
		1.65	-3.00	1.78	-3.00	
		1.78	-1.50	1.92	-1.50	
		1.92	-0.42	0.00	-0.42	
		0.00	0.00	-0.42	0.00	
		-0.42	-1.50	-0.55	-1.50	
		-0.55	-3.00	-0.69	-3.00	
		-0.69	-4.50	-0.82	-4.50	
		-0.82	-6.00	-0.95	-6.00	
		-0.95	-7.00			

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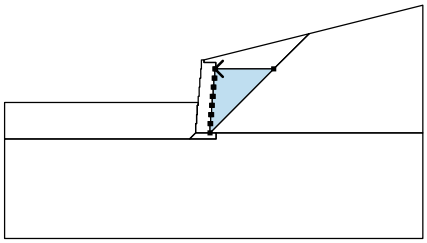
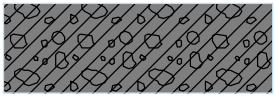
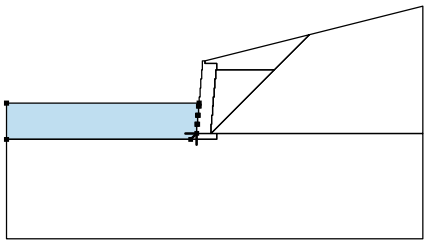
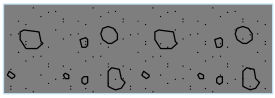
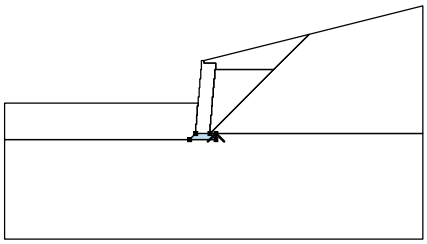
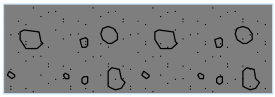
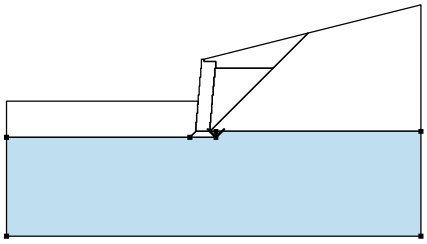
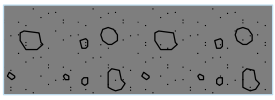
No.	Surface position	Coordinates of surface points [ft] x	z	x	z	Assigned soil
4		1.92	-1.50	1.78	-1.50	Reinforced Soil 
		1.78	-3.00	1.65	-3.00	
		1.65	-4.50	1.51	-4.50	
		1.51	-6.00	1.38	-6.00	
		1.38	-7.50	1.24	-7.50	
		1.24	-9.00	1.11	-9.00	
		1.11	-10.50	0.98	-10.50	
		0.98	-12.00	11.47	-1.50	
5		-2.36	-13.00	-1.36	-12.00	Retained Soil 
		-1.36	-10.50	-1.22	-10.50	
		-1.22	-9.00	-1.09	-9.00	
		-1.09	-7.50	-0.95	-7.50	
		-0.95	-7.00	-32.80	-7.00	
		-32.80	-13.00			
6		1.97	-13.00	1.97	-12.00	Foundation Soil 
		0.98	-12.00	-1.36	-12.00	
		-2.36	-13.00			
7		1.97	-12.00	1.97	-13.00	Retained Soil 
		-2.36	-13.00	-32.80	-13.00	
		-32.80	-29.40	36.00	-29.40	
		36.00	-12.00			

Reinforcements

No.	Point to the left x [ft]	z [ft]	Point to the right x [ft]	z [ft]	Length L [ft]	Strength R_t [lbf/ft]	Pull out resist.	End of reinf.
1	0.98	-12.00	8.48	-12.00	7.50	1134.5	C = 0.80	Fixed
2	1.11	-10.50	8.61	-10.50	7.50	2269.0	C = 0.80	Fixed
3	1.24	-9.00	8.74	-9.00	7.50	2269.0	C = 0.80	Fixed
4	1.38	-7.50	8.88	-7.50	7.50	2269.0	C = 0.80	Fixed
5	1.51	-6.00	9.01	-6.00	7.50	2269.0	C = 0.80	Fixed
6	1.65	-4.50	9.15	-4.50	7.50	2269.0	C = 0.80	Fixed
7	1.78	-3.00	9.28	-3.00	7.50	2269.0	C = 0.80	Fixed
8	1.92	-1.50	11.25	-1.50	9.33	2657.1	C = 0.80	Fixed

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Surcharge

No.	Type	Type of action	Location z [ft]	Origin x [ft]	Length l [ft]	Width b [ft]	Slope α [°]	Magnitude q, q_1, f, F, x	q_2, z	unit
1	strip	variable	on terrain	x = 0.00	l = 36.00		0.00	100.0		lbf/ft²
2	strip	permanent	on terrain	x = -32.80	l = 31.44		0.00	100.0		lbf/ft²

Surcharges

No.	Name
1	Yard

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Horizontal seismic coefficient : K_h = 0.1088
Vertical seismic coefficient : K_v = 0.0000

Settings of the stage of construction

Design situation : transient

Results (Construction stage 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-2.12	[ft]	Angles :	α_1 =	-30.10	[°]
	z =	25.97	[ft]		α_2 =	61.62	[°]
Radius :	R =	38.11	[ft]				
The slip surface after optimization.							

Total weight of soil above the slip surface: 49331.4 lbf/ft

Reinforcement bearing capacity

Reinforcement	Bearing capacity [lbf/ft]
1	0.0
2	0.0
3	0.0
4	0.0
5	0.0
6	0.0
7	0.0
8	0.0

Slope stability verification (Bishop)

Sum of active forces : F_a = 19251.0 lbf/ft
Sum of passive forces : F_p = 31584.0 lbf/ft

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Sliding moment : M_a = 733653.9 lbfft/ft
Resisting moment : M_p = 1203664.5 lbfft/ft
Factor of safety = 1.64 > 1.40
Slope stability ACCEPTABLE

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Blast Analysis Calculations

Protection Engineering CONSULTANTS

A SUBMITTAL FOR:

DEPARTMENT OF VETERANS AFFAIRS – TOGUS VA MEDICAL CENTER EHRM INFRASTRUCTURE UPGRADES

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Project No. 25-120

October 13, 2025

CONTENTS

1 INTRODUCTION 3
2 APPLICABLE CODES AND STANDARDS 3
3 SITE PLAN CONSIDERATIONS 3
4 BUILDING ENTRANCES AND EXITS 3
5 BLAST RESISTANT BUILDING ENVELOPE REQUIREMENTS 4
5.1 Non-Load Bearing Wall Systems 4
5.2 Exterior Doors 4
6 BLAST RESISTANT STRUCTURAL SYSTEM REQUIREMENTS 4

TOGUS VAMC – AUGUSTA, ME: EHRM INFRASTRUCURE UPGRADES – BLAST DESIGN REPORT

1 INTRODUCTION

Protection Engineering Consultants (PEC) is working with GDM to provide support for physical security compliance for the utility enclosure included in the EHRM Infrastructure Upgrade project at the Togus VAMC in Maine. Consistent with the building classification per PSRDM Table 1-4, the equipment in the utility yard is considered Critical and is required to comply with the PSRDM accordingly. This report specifically addresses how site features and enclosure design satisfy the blast design requirements in Chapters 6 & 7 of the PSRDM. In addition, select sections from Chapters 3 & 4 of the PSRDM are included in this narrative based on how they affect blast analysis calculations.

The project scope specifically includes analysis of the open-top enclosure for Critical equipment. Therefore, per Table 8-3 in Section 8.6 of the PSRDM, the utility enclosure is required to comply with the blast resistant design considerations in accordance with Chapters 6 & 7 of the PSRDM. It is PEC's understanding that based on written direction from the VA as well as project age, GDM was directed to implement the July 1, 2022 revision of the PSRDM. It is assumed that there is no previous threat/vulnerability assessment to modify threats and protection requirements from the baseline in PSRDM.

2 APPLICABLE CODES AND STANDARDS

The following blast design and physical security criteria are applicable:

- VA Physical Security and Resiliency Design Manual, PSRDM (July 1, 2022)
- VA Physical Security Design Standards Data Definitions (Restricted)
- Blast Protection of Buildings (59), American Society of Civil Engineers (ASCE)

3 SITE PLAN CONSIDERATIONS

This project is an EHRM infrastructure upgrade. Site-wide improvements for physical security measures were not included in the original scope of work and are generally not required by Table 8-3 of the PSRDM. However, based on the site layout, the separation between the utility enclosure and internal roadways and parking satisfies the minimum standoff distances required per Section 3.3 of the PSRDM.

4 BUILDING ENTRANCES AND EXITS

There are no public entrances or lobbies near the utility enclosure requiring the implementation of blast-related physical security measures from Chapter 4 of the PSRDM. Therefore, the utility enclosure is not required to consider the blast loading caused by an interior blast threat.

5 BLAST RESISTANT BUILDING ENVELOPE REQUIREMENTS

The building envelope of the utility enclosure is designed to withstand the design level vehicle threat (W1) located at a minimum standoff distance of 50-ft, but to a load no greater than GP2 (Section 6.2 PSRDM). Secondary structural elements and non-structural elements are designed to minimize injury and damage. In general, dynamic structural response analyses are performed using simplified single-degree-of-freedom (SDOF) analytical methods per Section 6.7 of the PSRDM.

5.1 NON-LOAD BEARING WALL SYSTEMS

Non-load bearing wall systems were designed to withstand the maximum peak pressure and corresponding impulse while sustaining a maximum wall response per Section 6.2 of the PSRDM. The wall systems, in conjunction with fenestration, was evaluated using a tributary area approach with single-degree-of-freedom (SDOF) analysis available in SBEDS (Single-degree-of-freedom Blast Effects Design Spreadsheets).

The wall response was limited to a support rotation and ductility corresponding to the limits for Moderate Damage per ASCE 59-11. The enclosure consists of standalone cantilevered walls that are not directly attached to primary structural elements, such as gravity load systems and the LFRS of the main building. Rebound forces are accounted for in the detailing and design of the walls.

5.2 EXTERIOR DOORS

The hollow metal door opening included in the enclosure shall be constructed using debris mitigating materials such as laminated glass and heavy gauge metal (14-gauge minimum), shall open outwards, and have sufficient anchorage to structural supports. Frame response shall be limited to a maximum displacement of L/40 for blast design and L/20 for balanced design (Section 6.3.1.3 PSRDM). Prescriptive performance requirements and other pertinent blast-design information has been provided in a form appropriate for inclusion in specifications and vendor submittals will be reviewed for compliance with blast design requirements.

6 BLAST RESISTANT STRUCTURAL SYSTEM REQUIREMENTS

As discussed above, the equipment enclosure consists of standalone cantilevered walls that are not directly attached to supporting structural elements, such as the gravity load systems or the LFRS of the main building. Therefore, there are no structural elements supporting the enclosure that need to be design in accordance with Chapter 7 of the PSRDM.

Appendix – Blast Analysis Calculations

PEC PROJECT NO. 25-120:

EHRM INFRASTRUCTURE UPGRADES
TOGUS VA MEDICAL CENTER

Building: 25-120 Togus VAMC | Component: Screenwall | By: SPC | Date: 10/8/2025

SBEDS v5.1: Reinforced Masonry

User Info: Fill in Yellow Cells, See Note Below for White Cells[3]

Span Length, L:	9	ft
Width Resisting Blast Load / Loaded Width; Bw	0.7	Note: 0 < Bw <=1.0
BoundaryConditions:	One-Way: Cantilever, Uniformly Loaded	
Response Type:	Flexural Only / Type I	

Structural & Material Properties

Total Wall Thickness, T:	7.625	in
Spacing of Reinforcing Steel **(See diagram in cell R37 for diagram of steel input terms)**		
Bars Spanning Parallel to L, b_L:	16	in
Not Used for One-Way Response	0	
Area of Reinforcing Steel **(*Symmetric reinforcement assumed)**		
Steel Parallel to L (Negative Moment Region), AsL:	0.31	in^2
Leave Input Blank for One-Way Response	0	
Negative Moment Steel Parallel to L, AsnL: *	0.31	in²
Blank for One-Way Response		
Thickness of Cover to Center of Bars: d **(*Symmetric reinforcement assumed)**		
Loaded Side Spanning Parallel to L:	3.8125	in
Leave Input Blank for One-Way Response	0	
Unloaded Side Spanning Parallel to L:*	3.8125	in
Leave Input Blank for One-Way Response		
Masonry Type:	Light Weight CMU	
Supported Weight, w:	20	psf
Percent of Void Space Grouted	50	%
Masonry Compressive Strength, f`m:	2,000	psi
Masonry Dynamic Compr. Increase Factor:	1.19	
Wall Self-Weight, W:	48.44	psf
Masonry Dynamic Compr. Strength, $f`_{dm}$:	2,380	psi
Masonry Elastic Modulus, E_m:	2,000,000	psi
Select Reinforcement:	A615, A616, A706 (All Gr. 60)	
Reinf. Steel Yield Strength, f_s:	60,000	psi
Reinf. Steel Ultimate Strength, f_u:	90,000	psi
Average Increase Factor:	1.1	
Dynamic Increase Factor:	1.22	
Dynamic Reinf. Steel Yield Stress, f_{ds}:	80,520	psi
Reinf. Steel Elastic Modulus, E_s:	29,000,000	psi
No Dynamic Axial Load [5] Static Axial Load; P':	0	lb/in Note:(P>=0)
Leave Blank for No Axial Load	0	in
Leave Input Blank for One-Way Response	0	ft

Calculated Properties

Rebound Positive H-Direction Moment Capacity, M_{pH}:	0	lb-in/in
Inbound Positive H-Direction Moment Capacity, M_{pH}:	0	lb-in/in
Reinforcement Ratio, ρ_{pH} (Tension only and Net[6]):	0.000	0.000
Rebound Negative H-Direction Moment Capacity, M_{nH}:	0	lb-in/in
Inbound Negative H-Direction Moment Capacity, M_{nH}:	0	lb-in/in
Reinforcement Ratio, ρ_{nH} (Tension only and Net[6]):	0.000	0.000
Rebound Positive L-Direction Moment Capacity, M_{pL}:	0	lb-in/in
Inbound Positive L-Direction Moment Capacity, M_{pL}:	0	lb-in/in
Reinforcement Ratio, ρ_{pL} (Tension only and Net[6]):	0.000	0.000
Rebound Negative L-Direction Moment Capacity, M_{nL}:	5,346	lb-in/in
Inbound Negative L-Direction Moment Capacity, M_{nL}:	5,346	lb-in/in
Reinforcement Ratio, ρ_{nL} (Tension only and Net[6]):	0.005	0.005
Reinforcement Ratio Check:	Reinforcement OK	
Equiv. Stress Block Factor, β_1:	0.85	
Over-Reinf. Criteria - 50% of Balanced Reinf. Ratio	0.0055	
Average Cover Depth for Moment of Inertia, dc_{avg}:	3.81	in
Average Moment of Inertia, I_{avg}:	16	in^4/in

Click to Input Blast Parameters

Blast Load Type
Pressure-time history file
Gravity Displacement
None (vertical component)

Pressure-Time Input

Time (ms)	Pressure (psi)
N/A	N/A

Charge Weight (W) and Standoff (R)	
W (lb)	Explosive Type
N/A	N/A
W(TNT Equiv)(lb)	R (ft)
N/A	N/A
Blast Load Phase	
N/A	
Blast Load Orientation	
N/A	
Parameters for Reflected Loads	
Wall Height (ft)[1]	N/A
Wall Width (ft)[1]	N/A
Incidence Angle[2]	N/A

See notes under B69

Load Files-AXIAL(above),BLAST(below)
N/A
W1 at 50ft, Screenwall.csv
Response Criteria
Flexure
LOP/Type: MLOP/Secondary-NS

θ (deg)	μ
2	N/A

See All COE Response Criteria for

Dynamic Reaction Factors		
Shear Constant	Elastic	Plastic
F constant =	0.31	0.25
R constant =	0.69	0.75

Solution Control

Inbound Natural Period:	128.19	ms
Rebound Natural Period:	128.19	ms
Max Recommended Time Step	0.01	msec
Time Step:	0.1	msec
% of Critical Damping:	2	%
Initial Velocity:	0	in/ms

SDOF Properties

Property	Inbound	Rebound	Units
Mass, M	861.0	861.0	$psi\text{-}ms^2/in$
Load-Mass Factors, K_{LM}			
K_{LM1}	0.65	0.65	
K_{LM2}	0.65	0.65	
K_{LM3}	0.66	0.66	
K_{LM4}	0.66	0.66	
K_{LM5}	0.66	0.66	
Stiffness, K			
K_1	1.34	1.34	psi/in
K_2	1.34	1.34	psi/in
K_3	0.00	0.00	psi/in
K_4	0.00	0.00	psi/in
K_5	0.00	0.00	psi/in
Resistance, R			
R_1	0.64	-0.64	psi
R_2	0.64	-0.64	psi
R_3	0.64	-0.64	psi
R_4	0.64	-0.64	psi
Yield Displacement, x			
x1	0.48	-0.48	in
x2	0.48	-0.48	in
x3	0.48	-0.48	in
x4	0.48	-0.48	in
Equiv Yield Defl., X_E	0.477	-0.48	in

Results Summary

θ_{max} =	0.62	deg.	Design Criteria:	MLOP/Secondary-NS	
μ =	2.46		Response meets input design criteria		
X_{max} Inbound =	1.17	in	at time =	48.10	msec
X_{min} Rebound =	0.00	in	at time =	0.00	msec
R_{max} =	0.64	psi	at time =	48.10	msec
R_{min} =	-0.60	psi	at time =	112.20	msec
Shortest Yield Line Distance to Determine θ:				108.0	in

Equivalent Static Reactions*

Peak Reactions Based on Ultimate Flexural Resistance: Vu		
Vu at support A*** =	99.0	lb/in
Vu at support B*** =	0.0	lb/in
Maximum Vu at distance d from support *** =	95.5	lb/in
Shear Capacity		
Diagonal Shear Capacity: $V_{c,diag}$ =	250.6	lb/in
Tensile steel depth for shear calculations, d:	3.81	in
*Results based on Max Shear Region (See Note 7) ****		
Diagonal Shear at support:	Shear is OK	
Diagonal Shear at distance d from support:	Shear is OK	
*Shear Steel Area per unit spacing (s), Avs.Required in Max Shear Region***		
Diagonal bars @ support per unit spacing (s);	0.0000	in^2/in^2
Stirrups for shear @ d from support per unit spacing (s);	0.0000	in^2/in^2

* Based on larger of inbound and rebound ultimate flexural resistance, not including tension or compression membrane.

**Multiply Avs values by flexural bar spacing and stirrup spacing to get stirrup area

***Assumes shear is concentrated within wall width that resists blast. If shear is distributed over larger ratio of blast loaded width Bw', increase shear capacity by Bw'/Bw

Error/Warning Messages

Notes:

[1] Used for clearing of reflected load

[2] Angle in degrees from normal

[3] Entering data in white cells will OVERWRITE formulas and cause ERRONEOUS results!! To recover formulas, save your input data and reinitiate Component Type on Intro worksheet.

[4] Shear controlled response ONLY occurs if the user sets the "Shear Flag" > 0. This response typically has very limited ductility - a maximum value of 1 is assumed in SBEDS. The user should clearly understand shear-controlled response when using the shear flag - see User's Guide.

[5] Axial load per unit width on analyzed component from saved Dynamic Shear History file for supported component. Dynamic axial load includes static gravity load of supported horizontal member.

[6] Net is tensile steel reinf. ratio minus any compression (i.e. rebound) steel reinf. ratio

[7] For internal loading, user must check diagonal shear at support (SBEDS does not check this)

Building: 25-120 Togus VAMC *Component:* Screenwall *By:* SPC *Date:* 10/8/2025

SBEDS v5.1: Reinforced Masonry

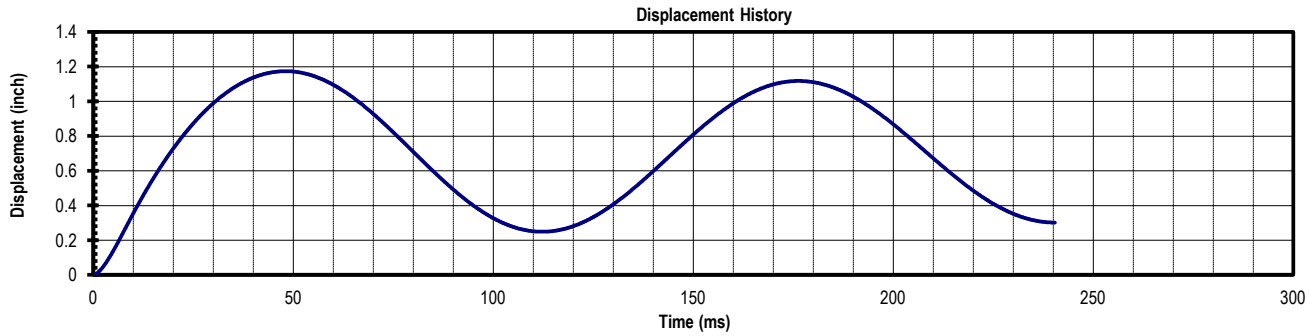
Results Summary					
θ_{max} =	0.62	deg.			
μ =	2.46				
X_{max} =	1.17	in	at time =	48.10	msec
X_{min} =	0.00	in	at time =	0.00	msec
R_{max} =	0.64	psi	at time =	48.10	msec
R_{min} =	-0.60	psi	at time =	112.20	msec

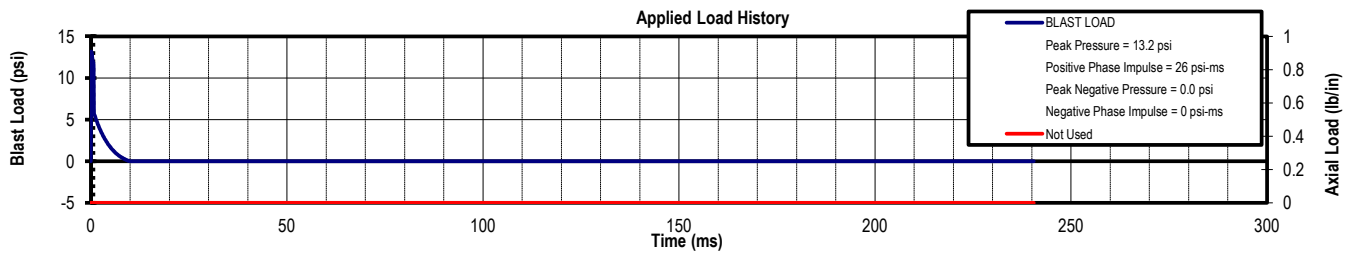
Note: See General Items section of User's Guide for information on maximum time of calculated response.

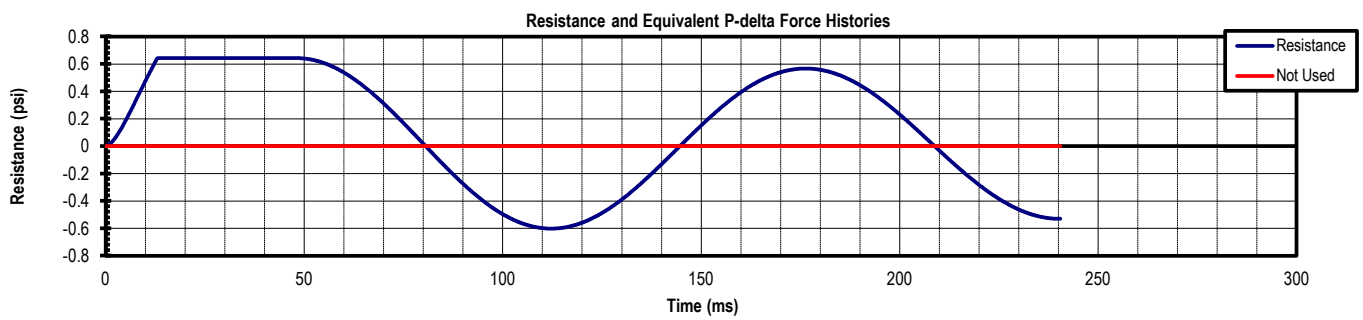
Peak Dynamic Reactions		
V_{max} =	4.08	psi

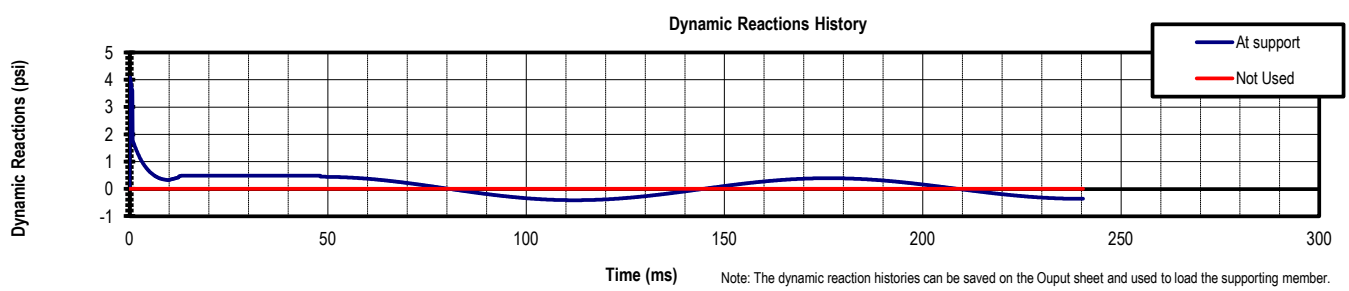
Strain Rate to Yield*		
Steel	0.00	1/sec
Masonry	0.15	1/sec

*Per Section 4.3 of UFC 3-340-02. Note:Based on max.response (instead of yield) when ductility ratio<1.0

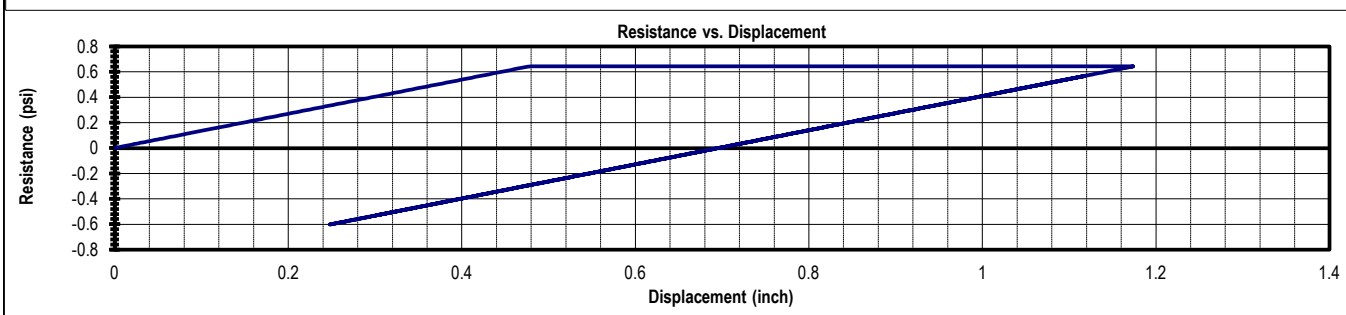








Note: The dynamic reaction histories can be saved on the Ouput sheet and used to load the supporting member.



Building: 25-120 Togus VAMC *Component:* Enclosure Doors *By:* SPC, GR *Date:* 10/8/2025

SBEDS v5.1: Door Component

Conventional Hollow Metal Doors	
Door Type:	14 gauge vertically stiffened door

Click to Input Blast Load

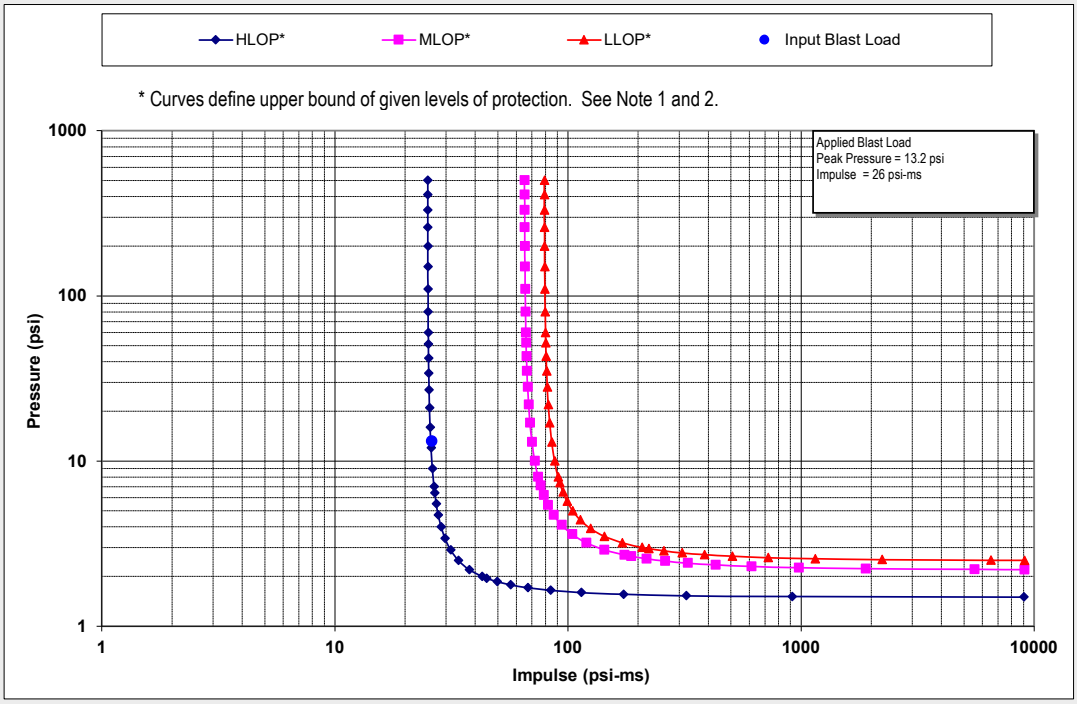
Detailed Door Information	
Nominal Door Panel Height:	7 ft
Nominal Door Panel Width:	3 ft
Door Weight:	9.7 psf
Door Type:	Single Door Panel
Door Seating Direction:	Seated by Blast Load
Door Frame Type:	Stiffened or Unsttiffened

Note: User should ignore any message that Excel "cannot plot zero or negative values".

Limitations on Analysis of Doors with SBEDS

1. Structural component and its connection to building framing should be designed to resist blast load over supported door area.
2. Door frame connections to supporting structural component should equal the lesser of: 1) the ultimate resistance of this member multiplied by the supported door area, or 2) 20 kips (89 kN). Also, doors supported by wood studs have low blast resistance and cannot be analyzed with SBEDS.
3. Analysis results are only applicable for specified door types.

Blast Load Type	
Manual input	
Pressure-Time Input	
Pressure (psi)	Impulse (psi-ms)
13.2	26
Charge Weight (W) and Standoff (R)	
W (lb)	Explosive Type
N/A	N/A
W(TNT Equiv)(lb)	R (ft)
N/A	N/A
Blast Load Phase	
N/A	
Blast Load Orientation	
N/A	
Parameters for Reflected Loads	
Wall Height (ft)[1]	N/A
Wall Width (ft)[1]	N/A
Incidence Angle[2]	N/A



Door Response Criteria	
LOP/Type	MLOP/Secondary-NS

Results Summary	
Design LOP Criteria:	MLOP/Secondary-NS
Calculated LOP:	MLOP/Secondary-NS
Response meets input design criteria	

Save Plotted Data to DPLOT File

Notes

[1] Whole area of P-i diagram between curves (i.e. underneath curve of interest) provide designated level of protection. See Figure 3-4 in PDC-TR 06-08 Rev 1 for more information.

[2] User should ignore any message that Excel "cannot plot zero or negative values". Just click "OK" and continue with input.

Analysis demonstrates conventionally constructed hollow metal doors are sufficient. Therefore, specify HM doors that are constructed with 14-ga metals and anchored for a total reaction of 20-kip.

Building: 25-120 Togus VAMC` *Component:* Removable Door Mullion *By:* SPC/GR *Date:* 10/8/2025

SBEDS v5.1: Steel / Aluminum Beam or Beam-Column

User Info: Fill in Yellow Cells, See Note Below for White Cells[3]		
Span, L:	7	ft
Spacing, B:	4	ft
Boundary Conditions:	Simple-Simple, Uniformly Loaded	
Response Type:	Flexural	

Structural & Material Properties		
Axis of Bending:	Strong (X-X)	
Shape Size:	HSS 3X2X1/4	
Self-Weight, w:	7.08	lb/ft
Moment of Inertia, I:	2	in^4
Section Modulus:Z(hot-rolled beam),S(cold-formed beam):	2	in^3
Web Thickness, tw:	0.250	in
Depth, d:	3.00	in
Area, A:	1.97	in^2
Supported Weight, W:	9	psf
Loaded Area Factor - Enter 1.0 for Uniform Load	1	
Inbound Unbraced Length for Compression Flange, $L_{br,i}$:	7	ft (0 for fully braced)
Rebound Unbraced Length for Compression Flange, $L_{br,r}$:	7	ft (0 for fully braced)
Material Type:	A500, Gr. B (steel tubes & pipes)	
Yield Strength, f_y:	46,000	psi
Ultimate Strength, f_u:	62,000	psi
Elastic Modulus, E:	29000000	psi
Static Strength Increase Factor:	1.1	
Dynamic Increase Factor:	1.19	
Dynamic Yield Stress, f_{dy}:	60,214	psi
No Dynamic Axial Load — * Static Axial Load, P:		lb — Note: (P>=0)
Leave Blank for No Dynamic Axial Load		ft
Leave Blank for No Axial Load		in

Calculated Properties		
Positive Moment Capacity, M_p:	110,192	lb-in
Negative Moment Capacity, Mn:	110,192	lb-in
Negative/Positive Moment Capacity Ratio, MR:	1.00	
Ratio of Axial Load to Axial Load Capacity	0.00	

See All COE Response Criteria for AT/FP

Click to Input Blast Parameters

Blast Load Type
Pressure-time history file
Gravity Displacement
None (vertical component)

Pressure-Time Input	
Time (ms)	Pressure (psi)
N/A	N/A

Charge Weight (W) and Standoff (R)	
W (lb)	Explosive Type
N/A	N/A
W(TNT Equiv)(lb)	R (ft)
N/A	N/A
Blast Load Phase	
N/A	
Blast Load Orientation	
N/A	
Parameters for Reflected Loads	
Wall Height (ft)[1]	N/A
Wall Width (ft)[1]	N/A
Incidence Angle[2]	N/A

See notes under B51

Load Files-AXIAL(above),BLAST(below)
AxialLoad Input File Not Selected
W1 at 50-ft, Screenwall.csv

Response Criteria[6]	
Flexure - compact section	
LOP/Type	MLOP/Secondary-NS
θ (deg)	μ
3	3

Dynamic Reaction Factors		
Shear Constant	Elastic	Plastic
F constant =	0.11	0.12
R constant =	0.39	0.38

Solution Control		
Inbound Natural Period:	54.80	ms
Rebound Natural Period:	54.80	ms
Max Recommended Time Step	0.10	ms
Time Step:	0.1	ms
% of Critical Damping:	5	%
Initial Velocity:	0	in/ms

SDOF Properties			
Property	Inbound	Rebound	Units
Mass, M	193.6	193.6	psi-ms²/in
Load-Mass Factors, K_{LM}			
K_{LM1}	0.78	0.78	
K_{LM2}	0.78	0.78	
K_{LM3}	0.66	0.66	
Stiffness, K			
K_1	1.99	1.99	psi/in
K_2	1.99	1.99	psi/in
K_3	0.00	0.00	psi/in
Resistance, R			
R_1	2.60	-2.60	psi
R_2	2.60	-2.60	psi
Yield Displacement, x			
x1	1.31	-1.31	in
x2	1.31	-1.31	in
Equiv Yield Defl., X_E	1.31	-1.31	in

Error/Warning Messages

Notes:

[1] Used for clearing of reflected load

[2] Angle in degrees from normal

[3] Entering data in white cells will OVERWRITE formulas and cause ERRONEOUS results!!
To recover formulas, save your input data and reinitiate Component Type on Intro worksheet.

[4] Axial load per unit width on analyzed component from saved Dynamic Shear History file for supported component. The total dynamic axial load is this axial load per unit width multiplied by the input axially loaded width, Ba. Dynamic axial load includes includes static gravity load of supported horizontal member.

[5] Shear controlled response ONLY occurs if the user sets the "Shear Flag" > 0. This response typically has very limited ductility - a maximum value of 1 is assumed in SBEDS. The user should clearly understand shear-controlled response when using the shear flag - see User's Guide.

[6] For Response Criteria: TM = tension membrane

[6] If a user defined Beam section is selected, no calculated compact section check on the beam section is done

Results Summary					
θ_{max} =	1.91	deg.	Design Criteria:	MLOP/Secondary-NS	
μ =	1.07		Response meets input design criteria		
X_{max} Inbound =	1.40	in	at time =	15.20	msec
X_{min} Rebound =	-1.03	in	at time =	42.60	msec
R_{max} =	2.60	psi	at time =	15.20	msec
R_{min} =	-2.22	psi	at time =	42.60	msec
Shortest Yield Line Distance to Determine θ:				42.0	in

Equivalent Static Reactions*		
Peak Reactions Based on Ultimate Flexural Resistance: Vu		
Vu at Support A =	5,247	lb
Vu at Support B =	5,247	lb
Shear Capacity		
Shear Capacity: V_s =	49,677	lb
Results for Shear Check	Shear is OK	
Maximum Tensile Force in Beam	N/A	

* Based on larger of inbound and rebound ultimate flexural resistance, not including including tension membrane.

Analysis demonstrates a conventional removable mullion (as a 3x2x1/4 tube) is sufficient. Therefore, specify that mullions are anchored for a total reaction of 5,250-lbs.

Building: 25-120 Togus VAMC` Component: Removable Door Mullion By: SPC/GR Date: 10/8/2025

SBEDS v5.1: Steel / Aluminum Beam or Beam-Column

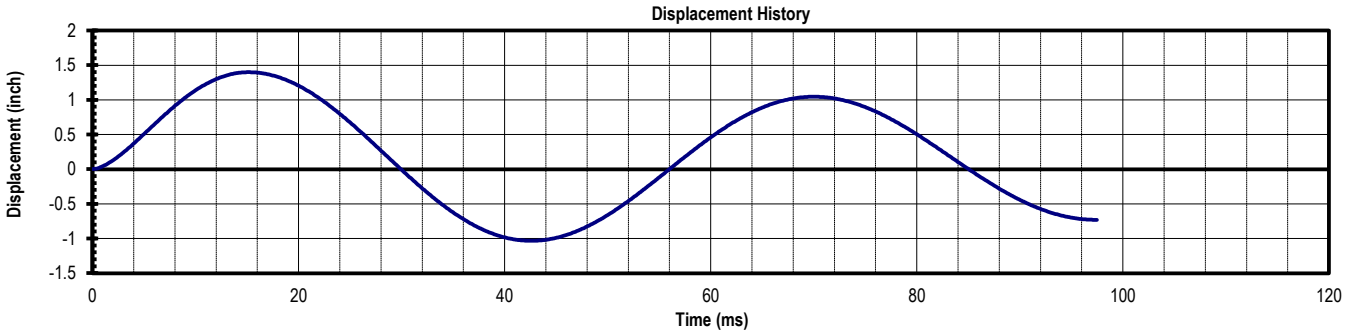
Results Summary					
θ_{max} =	1.91	deg.			
μ =	1.07				
X_{max} =	1.40	in	at time =	15.20	msec
X_{min} =	-1.03	in	at time =	42.60	msec
R_{max} =	2.60	psi	at time =	15.20	msec
R_{min} =	-2.22	psi	at time =	42.60	msec

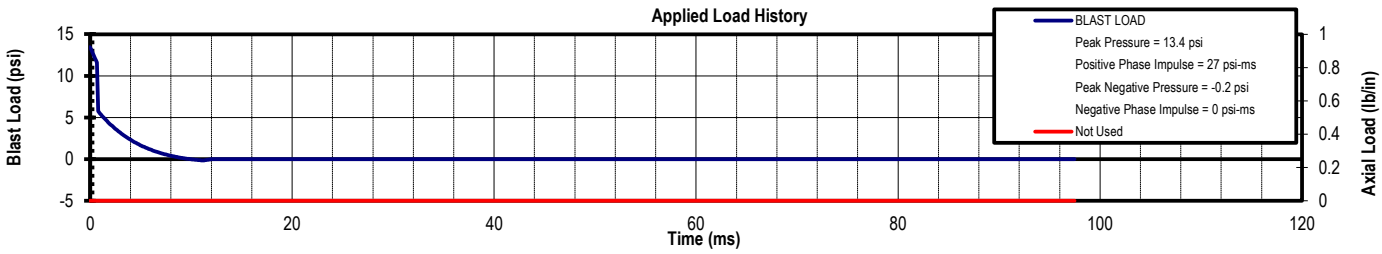
Note: See General Items section of User's Guide for information on maximum time of calculated response.

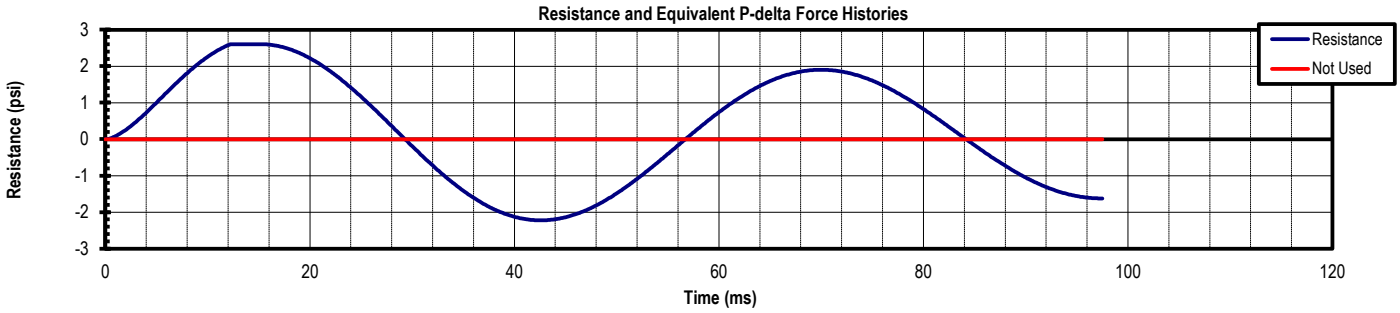
Peak Dynamic Reactions		
V_{max} =	1.48	psi

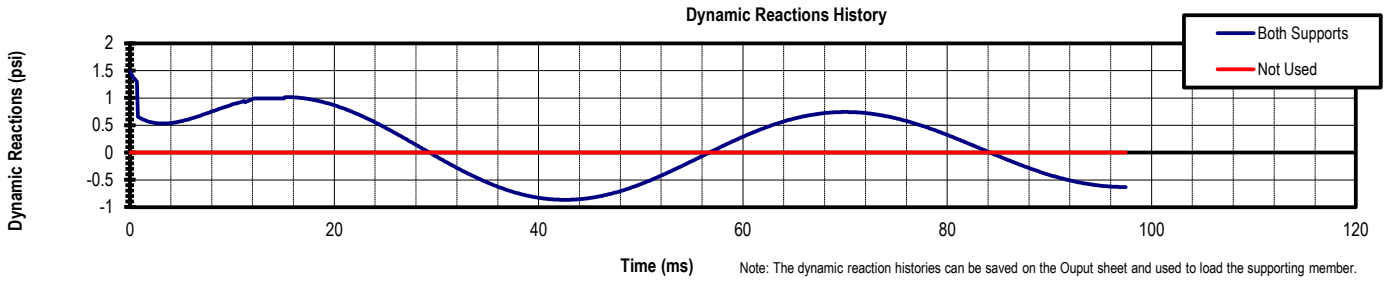
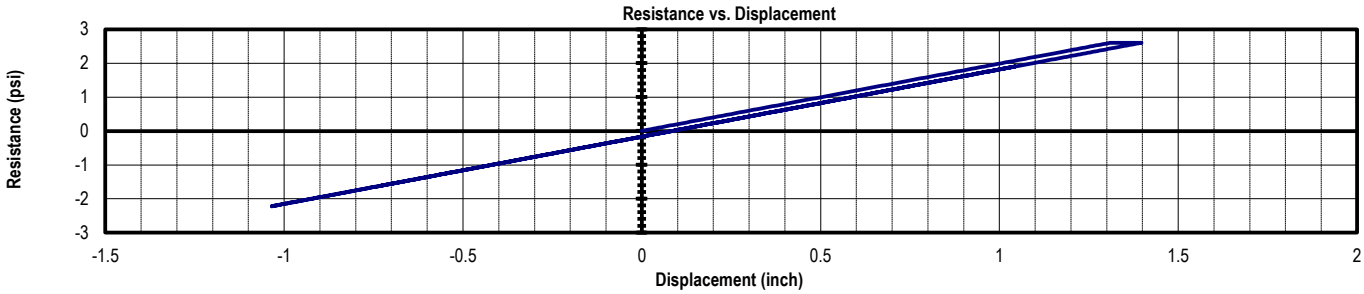
Strain Rate to Yield*		
Strain Rate =	0.17	1/sec

*Per Section 4.3 of UFC 3-340-02. Note:Based on max.response (instead of yield) when ductility ratio<1.0









Note: The dynamic reaction histories can be saved on the Ouput sheet and used to load the supporting member.