

*Kimbrough Heights Duplex Lot 2 Unit G  
HVAC Load Calculations*

for

Linco Construction



**RHVAC** RESIDENTIAL  
HVAC LOADS

Prepared By:

Kyle Patee  
Four Seasons Heating  
4896 Marshall Street  
Wheat Ridge Colorado 80033  
(303) 423- 1982  
Friday, October 1, 2021

Rhvac is an ACCA approved Manual J and Manual D computer program.  
Calculations are performed per ACCA Manual J 8th Edition, Version 2, and ACCA Manual D.

**Project Report**

**General Project Information**

Project Title: Kimbrough Heights Duplex Lot 2 Unit G  
 Designed By: Kyle Patee  
 Project Date: Friday, October 1, 2021  
 Client Name: Linco Construction  
 Company Name: Four Seasons Heating  
 Company Representative: Kyle Patee  
 Company Address: 4896 Marshall Street  
 Company City: Wheat Ridge Colorado 80033  
 Company Phone: (303) 423- 1982  
 Company Fax: (303) 423-0120  
 Company E-Mail Address: kpatee@fsh1.com  
 Company Website: fourseasonsheatinginc.com

**Design Data**

Reference City: Arvada, Colorado  
 Building Orientation: Front door faces Southwest  
 Daily Temperature Range: High  
 Latitude: 40 Degrees  
 Elevation: 5453 ft.  
 Altitude Factor: 0.818  
 Elevation Total Adj. Factor: 0.964

	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:	1	0.19	80%	30%	70	34.17
Summer:	91	60	17%	50%	75	-34

**Check Figures**

Total Building Supply CFM: 1,267 CFM Per Square ft.: 0.559  
 Square ft. of Room Area: 2,266 Square ft. Per Ton: 946  
 Volume (ft³) of Cond. Space: 20,124

**Building Loads**

Total Heating Required Including Ventilation Air: 33,451 Btuh 33.451 MBH  
 Total Sensible Gain: 23,544 Btuh 100 %  
 Total Latent Gain: -472 Btuh 0 %  
 Total Cooling Required Including Ventilation Air: 23,544 Btuh 1.96 Tons (Based On Sensible + Latent)  
 2.39 Tons (Based On 85% Sensible Capacity)  
 (and 0.964 Total Derating)

**Notes**

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 Calculations are performed per ACCA Manual J 8th Edition, Version 2, and ACCA Manual D.  
 All computed results are estimates as building use and weather may vary.  
 Be sure to select a unit that meets both sensible and latent loads according to the manufacturer's performance data at your design conditions.

**Miscellaneous Report**

System 1 Input Data	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:	1	0.19	80%	30%	70	34.17
Summer:	91	60	17%	50%	75	-34.14

**Duct Sizing Inputs**

	Main Trunk	Runouts
Calculate:	Yes	Yes
Use Schedule:	Yes	Yes
Roughness Factor:	0.00030	0.00030
Pressure Drop:	0.0800 in.wg./100 ft.	0.0800 in.wg./100 ft.
Minimum Velocity:	650 ft./min	450 ft./min
Maximum Velocity:	900 ft./min	560 ft./min
Minimum Height:	8 in.	4 in.
Maximum Height:	10 in.	8 in.

**Outside Air Data**

	Winter	Summer
Infiltration Specified:	0.350 AC/hr 110 CFM	0.350 AC/hr 110 CFM
Infiltration Actual:	0.350 AC/hr	0.350 AC/hr
Above Grade Volume:	X 18,822 Cu.ft. 6,588 Cu.ft./hr X 0.0167	X 18,822 Cu.ft. 6,588 Cu.ft./hr X 0.0167
Total Building Infiltration:	110 CFM	110 CFM
Total Building Ventilation:	52 CFM	52 CFM

---System 1---

Infiltration & Ventilation Sensible Gain Multiplier: 14.40 = (1.10 X 0.818 X 16.00 Summer Temp. Difference)  
 Infiltration & Ventilation Latent Gain Multiplier: -18.99 = (0.68 X 0.818 X -34.14 Grains Difference)  
 Infiltration & Ventilation Sensible Loss Multiplier: 62.09 = (1.10 X 0.818 X 69.00 Winter Temp. Difference)  
 Winter Infiltration Specified: 0.350 AC/hr (110 CFM)  
 Summer Infiltration Specified: 0.350 AC/hr (110 CFM)

Rhvac - Residential & Light Commercial HVAC Loads

Elite Software Development, Inc.

Four Seasons Heating, Inc  
 Wheat Ridge, CO 80033



Kimbrough Heights Duplex Lot 2 Unit G  
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Load Preview Report

Scope	Net Ton	Rec Ton	ft. <sup>2</sup> /Ton	Area	Sen Gain	Lat Gain	Net Gain	Sen Loss	Sys Htg CFM	Sys Clg CFM	Sys Act CFM	Duct Size
Building	1.96	2.39	946	2,266	23,544	-472	23,544	33,451	480	1,267	1,267	
System 1	1.96	2.39	946	2,266	23,544	-472	23,544	33,451	480	1,267	1,267	28x10
Ventilation					749	-987	749	3,229				
Humidification								3,075				
Zone 1				2,266	22,796	515	23,311	27,147	480	1,267	1,267	28x10
1-Crawlspace				326	89	-51	89	2,119	37	5	37	1--4
2-Den Or Unfinished				140	2,849	-14	2,849	2,702	48	158	158	2--6
3-Lower Bath				43	223	-111	223	911	16	12	16	1--4
4-Mech				29	93	-46	93	376	7	5	7	1--4
5-Entry				117	1,146	-150	1,146	2,010	36	64	64	1--5
6-Living Room				250	4,587	-330	4,587	4,137	73	255	255	3--6
7-Dining				275	2,003	-134	2,003	1,882	33	111	111	2--5
8-Kitchen				143	2,411	969	3,380	2,264	40	134	134	2--5
9-Pantry				38	261	-78	261	699	12	15	15	1--4
10-Powder				34	9	0	9	15	0	1	1	1--4
11-Master Bedroom				188	3,130	215	3,345	2,784	49	174	174	2--6
12-Master Wic				48	371	-52	371	612	11	21	21	1--4
13-Master Bath				106	397	-62	397	781	14	22	22	1--4
14-Upper Hall				207	776	600	1,376	196	3	43	43	1--4
15-Bedroom 2				175	2,701	13	2,714	2,682	47	150	150	2--5
16-Bath 2				58	247	-57	247	619	11	14	14	1--4
17-Roof Access				70	846	-138	846	1,547	27	47	47	1--4
18-Roof Closet				19	654	-59	654	811	14	36	36	1--4
Sum of room airflows may be greater than system airflow because system room airflow option uses the greater of heating or cooling.												

**Duct Size Preview**

Room or Duct Name	Source	Minimum Velocity	Maximum Velocity	Rough Factor	Design L/100	SP Loss	Duct Velocity	Duct Length	Htg Flow	Clg Flow	Act. Flow	Duct Size
System 1												
<b>Supply Runouts</b>												
Zone 1												
1-Crawlspace	Built-In	450	560	0	0.1		429.2		37	5	37	1--4
2-Den Or Unfinished	Built-In	450	560	0	0.1		403.2		48	158	158	2--6
3-Lower Bath	Built-In	450	560	0	0.1		184.5		16	12	16	1--4
4-Mech	Built-In	450	560	0	0.1		76.2		7	5	7	1--4
5-Entry	Built-In	450	560	0	0.1		467.1		36	64	64	1--5
6-Living Room	Built-In	450	560	0	0.1		432.7		73	255	255	3--6
7-Dining	Built-In	450	560	0	0.1		408.1		33	111	111	2--5
8-Kitchen	Built-In	450	560	0	0.1		491.2		40	134	134	2--5
9-Pantry	Built-In	450	560	0	0.1		166.2		12	15	15	1--4
10-Powder	Built-In	450	560	0	0.1		6		0	1	1	1--4
11-Master Bedroom	Built-In	450	560	0	0.1		442.9		49	174	174	2--6
12-Master Wic	Built-In	450	560	0	0.1		236.5		11	21	21	1--4
13-Master Bath	Built-In	450	560	0	0.1		253		14	22	22	1--4
14-Upper Hall	Built-In	450	560	0	0.1		494		3	43	43	1--4
15-Bedroom 2	Built-In	450	560	0	0.1		550.4		47	150	150	2--5
16-Bath 2	Built-In	450	560	0	0.1		157.2		11	14	14	1--4
17-Roof Access	Built-In	450	560	0	0.1		538.9		27	47	47	1--4
18-Roof Closet	Built-In	450	560	0	0.1		416.2		14	36	36	1--4
<b>Other Ducts in System 1</b>												
Supply Main Trunk	Built-In	650	900	0	0.1		651.4		480	1,267	1,267	28x10

Summary	
System 1	
Heating Flow:	480
Cooling Flow:	1267

**Total Building Summary Loads**

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
CST GLASS NWCS.27.30: Glazing-CUSTOM GLASS U=.27 SHCG=.30, u-value 0.27, SHGC 0.3	430.7	8,027	0	10,851	10,851
11D: Door-Wood - Solid Core	20	538	0	172	172
C15B15-4: Wall-Basement, Custom, R-15 DRAPE INSULATION ON FOUNDATION WALL	310.4	1,115	0	37	37
C15B15-4: Part-Basement, Custom, R-15 DRAPE INSULATION ON FOUNDATION WALL	77.1	229	0	0	0
C12E20-OSW: Wall-Frame, Custom, 2X6 WALL WITH R20 INSULATION	2002.3	8,155	0	1,585	1,585
C12E20-OSW: Part-Frame, Custom, 2X6 WALL WITH R20 INSULATION	994.7	234	0	117	117
C18A1-8-49: Roof/Ceiling-	856.7	1,183	0	308	308
21A-20: Floor-Basement, Concrete slab, any thickness, 2 or more feet below grade, no insulation below floor, any floor cover, shortest side of floor slab is 20' wide	325.6	607	0	0	0
20P-30: Floor-Over open crawl space or garage, Passive, R-30 blanket insulation, any cover	100.8	243	0	21	21
Subtotals for structure:		20,331	0	13,091	13,091
People:	4		800	920	1,720
Equipment:			1,800	3,800	5,600
Lighting:	0			0	0
Ductwork:		0	0	0	0
Infiltration: Winter CFM: 110, Summer CFM: 110		6,816	-2,085	1,581	-504
Ventilation: Winter CFM: 52, Summer CFM: 52		3,229	-987	749	-239
Humidification (Winter) 8.38 gal/day :		3,075	0	0	0
AED Excursion:		0	0	3,404	3,404
<b>Total Building Load Totals:</b>		<b>33,451</b>	<b>-472</b>	<b>23,544</b>	<b>23,072</b>

Check Figures			
Total Building Supply CFM:	1,267	CFM Per Square ft.:	0.559
Square ft. of Room Area:	2,266	Square ft. Per Ton:	946
Volume (ft³) of Cond. Space:	20,124		

Building Loads			
Total Heating Required Including Ventilation Air:	33,451 Btuh	33.451 MBH	
Total Sensible Gain:	23,544 Btuh	100 %	
Total Latent Gain:	-472 Btuh	0 %	
Total Cooling Required Including Ventilation Air:	23,544 Btuh	1.96 Tons (Based On Sensible + Latent)	
		2.39 Tons (Based On 85% Sensible Capacity)	
		(and 0.964 Total Derating)	

**Notes**  
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 Be sure to select a unit that meets both sensible and latent loads according to the manufacturer's performance data at your design conditions.

**System 1 Summary Loads**

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
CST GLASS NWCS.27.30: Glazing-CUSTOM GLASS U=.27 SHCG=.30, u-value 0.27, SHGC 0.3	430.7	8,027	0	10,851	10,851
11D: Door-Wood - Solid Core	20	538	0	172	172
C15B15-4: Wall-Basement, Custom, R-15 DRAPE INSULATION ON FOUNDATION WALL	310.4	1,115	0	37	37
C15B15-4: Part-Basement, Custom, R-15 DRAPE INSULATION ON FOUNDATION WALL	77.1	229	0	0	0
C12E20-OSW: Wall-Frame, Custom, 2X6 WALL WITH R20 INSULATION	2002.3	8,155	0	1,585	1,585
C12E20-OSW: Part-Frame, Custom, 2X6 WALL WITH R20 INSULATION	994.7	234	0	117	117
C18A1-8-49: Roof/Ceiling-	856.7	1,183	0	308	308
21A-20: Floor-Basement, Concrete slab, any thickness, 2 or more feet below grade, no insulation below floor, any floor cover, shortest side of floor slab is 20' wide	325.6	607	0	0	0
20P-30: Floor-Over open crawl space or garage, Passive, R-30 blanket insulation, any cover	100.8	243	0	21	21
Subtotals for structure:		20,331	0	13,091	13,091
People:	4		800	920	1,720
Equipment:			1,800	3,800	5,600
Lighting:	0			0	0
Ductwork:		0	0	0	0
Infiltration: Winter CFM: 110, Summer CFM: 110		6,816	-2,085	1,581	-504
Ventilation: Winter CFM: 52, Summer CFM: 52		3,229	-987	749	-239
Humidification (Winter) 8.38 gal/day :		3,075	0	0	0
AED Excursion:		0	0	3,404	3,404
<b>System 1 Load Totals:</b>		<b>33,451</b>	<b>-472</b>	<b>23,544</b>	<b>23,072</b>

**Check Figures**

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Square ft. of Room Area:	2,266	Square ft. Per Ton:	946
Volume (ft³) of Cond. Space:	20,124		

**System Loads**

Total Heating Required Including Ventilation Air:	33,451 Btuh	33.451 MBH
Total Sensible Gain:	23,544 Btuh	100 %
Total Latent Gain:	-472 Btuh	0 %
Total Cooling Required Including Ventilation Air:	23,544 Btuh	1.96 Tons (Based On Sensible + Latent)
		2.39 Tons (Based On 85% Sensible Capacity) (and Total Derating)

**Notes**

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 Be sure to select a unit that meets both sensible and latent loads according to the manufacturer's performance data at your design conditions.



### System 1 Room Load Summary

No	Room Name	Area SF	Htg Sens Btuh	Min Htg CFM	Run Duct Size	Run Duct Vel	Clg Sens Btuh	Clg Lat Btuh	Min Clg CFM	Act Sys CFM
---Zone 1---										
1	Crawlspace	326	2,119	37	1-4	429	89	-51	5	37
2	Den Or Unfinished	140	2,702	48	2-6	403	2,849	-14	158	158
3	Lower Bath	43	911	16	1-4	185	223	-111	12	16
4	Mech	29	376	7	1-4	76	93	-46	5	7
5	Entry	117	2,010	36	1-5	467	1,146	-150	64	64
6	Living Room	250	4,137	73	3-6	433	4,587	-330	255	255
7	Dining	275	1,882	33	2-5	408	2,003	-134	111	111
8	Kitchen	143	2,264	40	2-5	491	2,411	969	134	134
9	Pantry	38	699	12	1-4	166	261	-78	15	15
10	Powder	34	15	0	1-4	6	9	0	1	1
11	Master Bedroom	188	2,784	49	2-6	443	3,130	215	174	174
12	Master Wic	48	612	11	1-4	237	371	-52	21	21
13	Master Bath	106	781	14	1-4	253	397	-62	22	22
14	Upper Hall	207	196	3	1-4	494	776	600	43	43
15	Bedroom 2	175	2,682	47	2-5	550	2,701	13	150	150
16	Bath 2	58	619	11	1-4	157	247	-57	14	14
17	Roof Access	70	1,547	27	1-4	539	846	-138	47	47
18	Roof Closet	19	811	14	1-4	416	654	-59	36	36
	Ventilation		3,229				749	-987		
	Humidification		3,075							
	<b>System 1 total</b>	<b>2,266</b>	<b>33,451</b>	<b>480</b>			<b>23,544</b>	<b>-472</b>	<b>1,267</b>	<b>1,267</b>

System 1 Main Trunk Size: 28x10 in.  
 Velocity: 651 ft./min  
 Loss per 100 ft.: 0.037 in.wg

### Cooling System Summary

	Cooling Tons	Sensible/Latent Split	Sensible Btuh	Latent Btuh	Total Btuh
Net Required:	1.96	102% / -2%	23,544	-472	23,544
Recommended:	2.39	85% / 15%	24,423	4,310	28,733
Actual:	2.88	85% / 15%	29,410	5,190	34,600

### Equipment Data

	Heating System	Cooling System
Type:	Natural Gas Furnace	Standard Air Conditioner
Model:	915SB48080E17	CA13NA036BN**D
Indoor Model:		CNPV*3717AL*+TDR
Brand:	BRYANT	13 SEER AC
Description:	Natural Gas or Propane Furnace	
Efficiency:	95.5 AFUE	13 SEER
Sound:		
Capacity:	78000	34600
Sensible Capacity:	n/a	29,410 Btuh
Latent Capacity:	n/a	5,190 Btuh
AHRI Reference No.:	n/a	9871271



**Building Rotation Report**

All rotation degree values in this report are clockwise with respect to the project's original orientation.  
 Building orientation as entered (zero degrees rotation): Front door faces Southwest

**Individual Rooms**

Rm. No.	Room Name	0° Rot. CFM	45° Rot. CFM	90° Rot. CFM	135° Rot. CFM	180° Rot. CFM	225° Rot. CFM	270° Rot. CFM	315° Rot. CFM	High Duct Size
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**System 1:**

**Zone 1:**

1	Crawlspace	*37	37	37	37	37	37	37	37	1--4
2	Den Or Unfinished	*158	138	125	113	132	135	142	137	2--6
3	Lower Bath	*16	16	16	16	16	16	16	16	1--4
4	Mech	*7	7	7	7	7	7	7	7	1--4
5	Entry	64	*65	49	36	49	59	54	45	1--5
6	Living Room	255	*265	190	123	190	241	217	172	3--6
7	Dining	111	65	95	122	109	77	109	*133	2--5
8	Kitchen	134	*137	120	107	120	125	114	109	2--5
9	Pantry	15	*16	13	12	13	14	12	12	1--4
10	Powder	*1	0	0	0	0	0	0	0	1--4
11	Master Bedroom	*174	153	138	127	145	148	155	152	2--6
12	Master Wic	21	*21	15	11	15	20	18	14	1--4
13	Master Bath	22	14	19	23	21	16	21	*26	1--4
14	Upper Hall	*43	40	37	37	37	37	37	40	1--4
15	Bedroom 2	*150	143	138	128	145	139	135	125	2--5
16	Bath 2	14	*15	13	11	13	14	12	11	1--4
17	Roof Access	47	28	40	51	46	33	46	*55	1--5
18	Roof Closet	36	18	31	42	37	24	37	*45	1--4

\* Indicates highest CFM of all rotations.

**Whole Building**

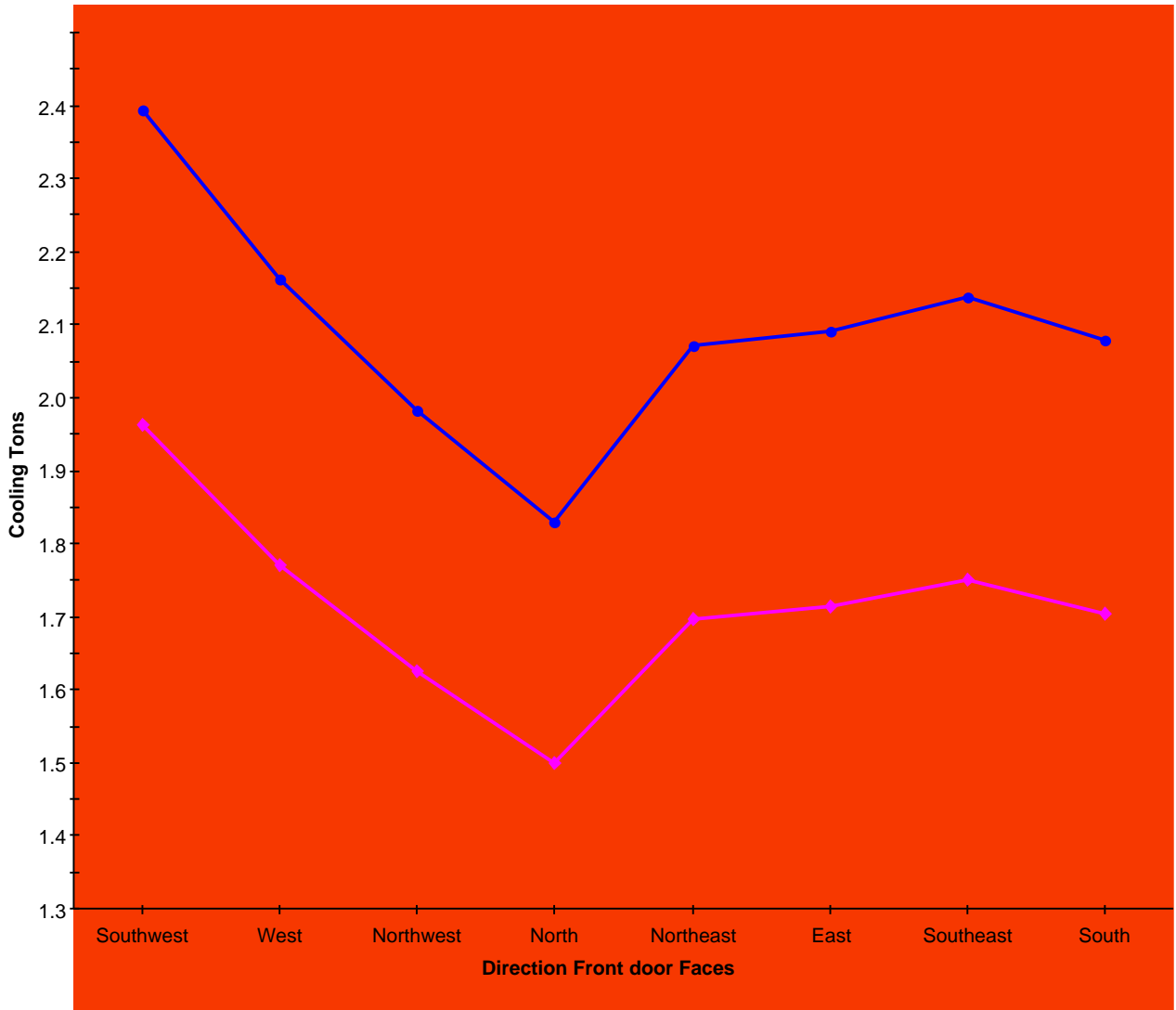
Rotation Degrees	Front door Faces	Supply CFM	Sensible Gain	Latent Gain	Net Tons	Recommended Tons
0°	Southwest	*1,267	*23,544	*-472	*1.96	*2.39
45°	West	1,140	21,262	-472	1.77	2.16
90°	Northwest	1,042	19,499	-472	1.62	1.98
135°	North	957	17,981	-472	1.50	1.83
180°	Northeast	1,090	20,375	-472	1.70	2.07
225°	East	1,101	20,566	-472	1.71	2.09
270°	Southeast	1,126	21,017	-472	1.75	2.14
315°	South	1,094	20,446	-472	1.70	2.08

\* Indicates highest value of all rotations.



**Building Rotation Report (cont'd)**

**Building Rotation Tonnage**

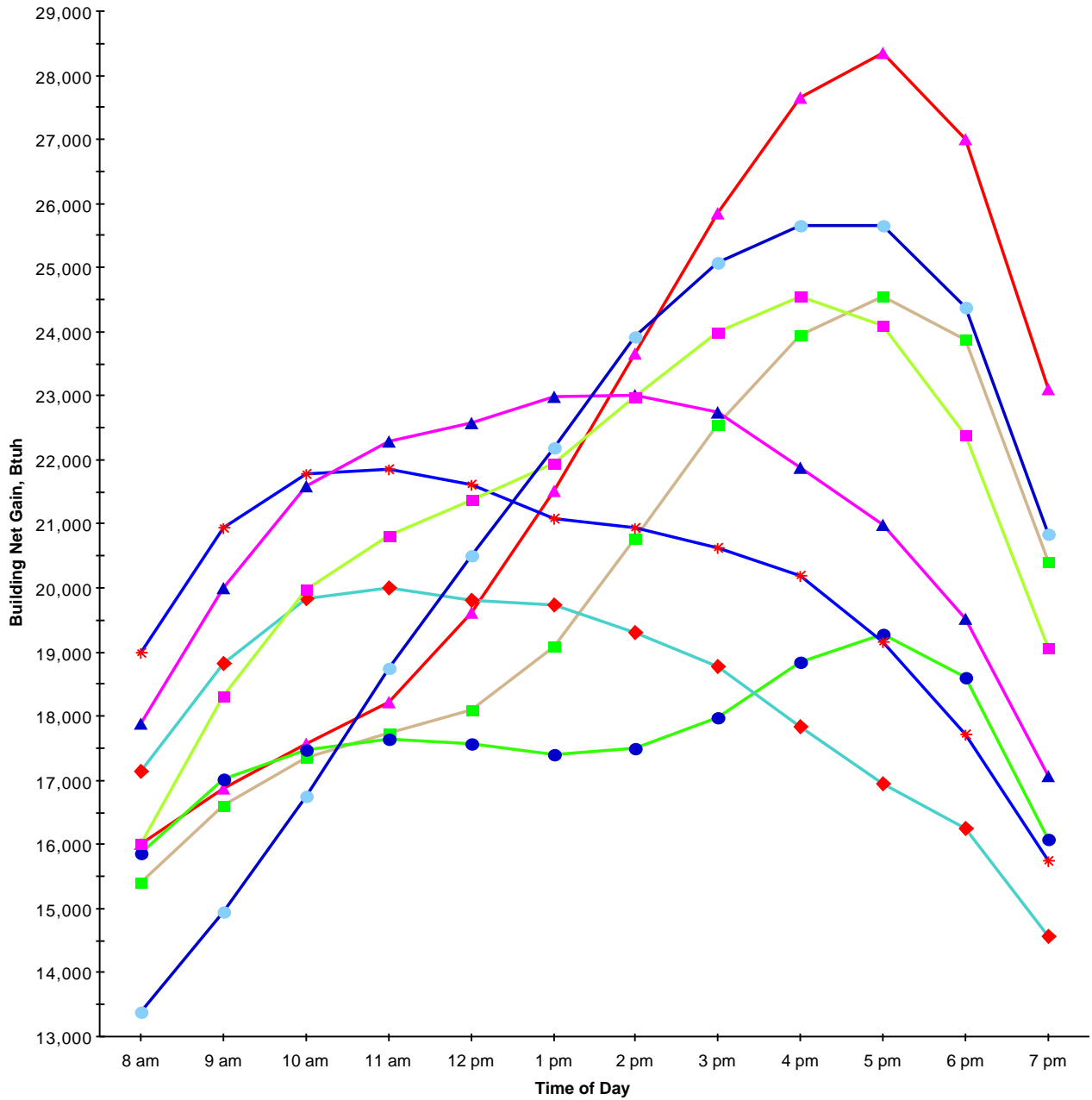


—●— Building Recommended Tonnage  
—◆— Building Net Tonnage



**Building Rotation Report (cont'd)**

**Building Rotation Hourly Net Gain**



- ▲ Front door faces Southwest
- Front door faces West
- Front door faces Northwest
- ◆ Front door faces North
- \* Front door faces Northeast
- ▲ Front door faces East
- Front door faces Southeast
- Front door faces South