Technical Assignment #2

Building and Plant Energy Analysis

The Gateway at MICA
Baltimore, MD

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Mechanical Option

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Executive Summary

The purpose of this report is to evaluate The Gateway at MICA located in Baltimore, MD for its efficiency and energy consumption. It was evaluated using the LEED-NC 2.2 checklist, ASHRAE Standard 90.1-2004 and Carrier's HAP 4.20 Analysis Program.

In using the LEED-NC 2.2 checklist it was found that The Gateway at MICA was eligible for 13 of the 69 credits. Another 12 points are easily obtainable by choosing different materials for the building and implementing a few plans. This, however, is still not enough credits for a LEED certification as the minimum is 26 credits. Although at the point where 25 credits are obtained designing for an extra credit is extremely easy. So, if the owner were to decide that they want this building to be LEED certified it would not be too difficult to do.

The next part of the assignment was to check the compliance of the building with ASHRAE Standard 90.1-2004. In doing this evaluation the building envelope was checked for compliance as well as the HVAC systems and the lighting of the building. It was found that the building envelope did not comply with ASHRAE Standard 90.1-2004 but all other parts of the building evaluated with the standard did comply.

There was also an evaluation of lost rentable space due to mechanical equipment as well as the mechanical system first cost. This information can be found within the report.

The building energy and load data was found using Carrier's HAP program. The Gateway at MICA was modeled using this program and all load data as well as energy utilization data that was obtained from this program is included in this report.

Mechanical System Summary

The air-side system of The Gateway at MICA consists of four, 100% outdoor air economizing, draw thru AHUs. Three of the AHUs are located in the third floor mechanical room while the fourth is in the 10th level penthouse. The three units in the mechanical room service spaces on the first two levels of the building, while the penthouse unit serves the studio space on each floor of the student living level.

AHU-1 serves the public spaces and rooms on level one and two including some parts of the lobby, the café, conference rooms, offices, and other various spaces throughout levels one and two. This unit has a supply max of 14,500 cfm and supply min of 6,000 cfm. The outside air max and min are 14,500 cfm and 2,900 cfm respectively.

AHU-2 serves the multi-purpose performance space including the booth as well as the facilities office. AHU-2 has a supply maximum and minimum of 9,600 cfm and 4,000 cfm respectively. The multi-purpose space is roughly 3,100 ft^2 and located in the center of the building plan. This space is a double height space with a monitoring booth at one of the room on the second level which is also serviced by AHU-2.

AHU-3 provides air for the lobby/pre-function space and the gallery as well. This is the only constant volume AHU in The Gateway at MICA. The gallery is a single height space just inside the main entrance of the building. This space opens to the lobby/pre-function space which is a double height space. The total floor area for these spaces is roughly 3,600 ft^2. The supply maximum and minimum of AHU-3 is 12,000 cfm and 5,000 cfm respectively. The outdoor air maximum is 12,000 cfm and the minimum is 3,200 cfm.

AHU-4 serves the studio spaces on level three through nine. These seven spaces each have an area of 848 ft^2 and are provided for the students to do work without having to leave their living quarters. The maximum supply and outdoor air for this unit is 11,600 cfm while the minimum supply and outdoor air is 7,000 cfm.

All spaces supplied by AHU-1, AHU-2, and AHU-3 are have terminal units equipped with water-side reheat coils to condition the air as per the requirements of that spaces occupants.

All student apartments on level three through nine have operable windows so the only air-side component of the system on these levels is the exhaust fans for the bathrooms. Each room is equipped with its own water source fan coil unit (FCU) to circulate and condition air. The building was originally designed as a four pipe system so each FCU operates independently and can either heat or cool year round, however, due to value engineering it will be constructed as a two-pipe system.

All of the water side equipment is located in the tenth level penthouse. There are two boilers and two air cooled chillers. The two air cooled screw chillers are identical and each provide 200 tons of cooling capacity. The chilled water system is regulated by two 380 GPM end suction pumps with a third 380 GPM standby pump. The boilers are also identical and controlled by one control panel. The cast iron boilers are used for heating purposes and each have a minimum output of 1632 MBH and are regulated by two 150 GPM pumps.

Each stairwell is pressurized with outdoor air from a rooftop mounted fan. The stairwell that goes to the ninth level is pressurized with 15000 CFM and is supplied air on odd numbered levels starting with level three. The stairwell serving the tenth level penthouse is pressurized with 16000 CFM and provides air on even numbered floors starting with the second level. These two stairwells have a gravity controlled relief hood at the roof level.

LEED-NC 2.2 Evaluation

The Gateway at MICA was not designed to comply with LEED classification therefore some points will not be awarded because it is impractical to design to those standards unless the owner is specifically looking to obtain a LEED rating.

Sustainable Sites

SS Credit 1: 1 point is obtained for this. The Gateway at MICA is to be constructed on a brown site.

SS Credit 2: Because of the location and site condition 1 point is available for this credit based on option 2.

SS Credit 3: An automobile repair shop previously existed on this site. This qualifies for 1 point.

SS Credit 4.1: The building is located four blocks from an existing light rail station, well within ½ mile. 1 point.

SS Credit 4.4: There is no parking being provided on site so technically MICA would qualify for this credit. However, there is a new lot planned for parking on a different site across North Ave. Because of this, no point will be awarded for SS Credit 4.4.

SS Credit 6.2: Because the building is in Baltimore this credit is easily obtainable because of storm water drain regulations.

Water Efficiency

No LEED credits were obtained for this section.

Energy & Atmosphere

EA Credit 4: There are no refrigerants used in the HVAC system. 1 point.

Materials & Resources

MR Prerequisite 1: This is easily done by initiating a recycling program in the building and designating an area for collections.

MR Credit 2.1: This is easily obtained by initiating a program to reuse construction material waste.

MR Credit 5.1: Concrete is a large portion of the project and that will all come from local companies.

MR Credit 5.2: As above, the concrete is more than 20% of the project cost.

MR Credit 7: There is no wood used on this project.

Indoor Environmental Quality

EQ Prerequisite 2: This is easily obtained by prohibiting smoking in the building.

EQ Credit 8.1: Since the building envelope is almost entirely glass, this would apply.

EQ Credit 8.2: Same as above.

Innovative & Design Process

ID Credit 2: There were principal participants on the project that are LEED accredited professionals.

Based on the LEED checklist, The Gateway at MICA obtained 13 of the possible 69 credits for certification. Since a minimum of 26 credits are required to obtain a certified rating this building does not qualify for a LEED rating.

However, based on the evaluation of the LEED checklist 12 points can easily be obtained by doing the following:

- Use different building materials to reduce the heat island effect
- Use different plumbing fixtures to cut back on water use
- Use different luminaires and lamps to reduce light pollution.
- Implement plans to: reuse construction waste, monitor air during construction, flush-out the building with outdoor air before occupancy,
- Use adhesives & sealants, paints & coatings, and carpets, composite wood & agrifiber products with VOC levels according the table in the LEED manual

All of these things can be done with little cost to the owner bringing the total points to 25. This is still 1 point short of a certification but with minimal design efforts a LEED certification can be obtained for The Gateway at MICA.

For the completed LEED checklist, see Appendix A.

Building Envelope Compliance

Because the vertical fenestration area is greater than 50% of the gross wall area the Building Envelope Trade-Off Option will be used.

In order to determine whether or not the building complied with the standard, the envelope performance factor had to be calculated using Normative Appendix C of ASHRAE Standard 90.1. The way compliance is determined is by determining the envelope performance factor (EPF) for the proposed building and then the base building. The difference between these two numbers by envelope component determines whether or not the building complies.

For the purposes of this report a program, EnvStd 5.0, was used to determine compliancy. With this program, first space-conditioning categories were determined. In The Gateway at MICA, it was determined that there were two space categories, Residential and Non-Residential. For the calculation, an area of 81604 ft^2 was used for the Residential space and 32746 ft^2 for the Non-Residential space. After determining floor areas for analysis wall and window areas were determined for each space.

Wall types consisting of concrete, CMU with solid grout fill, and composite aluminum panel were all used. The built-up roof and slab on grade were also taken into consideration.

There are several types of glass windows in the building envelope of the building. The area of each type of fenestration was calculated and then entered into the program based on U-Value, SHGC and transmittance values.

When calculated by the program, the EPF of the proposed building was determined to be 32101. The EPF for the base building was determined to be 27685, the difference being 4417.

Because the EPF of the proposed building was greater than that of the base building, it was determined that the building envelope does not comply with ASHRAE Standard 90.1-2004.

Assumptions

For the calculations above there were several assumptions made. R values for all materials were assumed and not obtained from construction documents or material data applying to this project. A few U values were assumed because these numbers could not be found in the specs. Gross wall areas were estimated as well because of the shape of the building. The doors were assumed to be the same type of fenestration they are surrounded by because the doors are glass as well.

Please refer to Appendix B for the results from the EnvStd 5.0 program.

Minimum Equipment Efficiencies

This section analyzes and determines whether or not the components of the HVAC systems comply with ASHRAE Standard 90.1-2004.

The first component analyzed is the chiller. The cooling effect from the chiller is 200 tons and the power needed to obtain that is 224.7 KW. First, the COP of the chiller is obtained and then compared to Table 6.8.1C from the standard.

Cooling effect = 200 tons

Compressor KW = 224.7 KW → 63.89 tons

COP = 200/63.89 = 3.13

From Table 6.8.1C Minimum COP is 2.80 so the chiller complies with the Standard.

The second component checked for compliance is the boiler. The boiler used in this building is a gas fired boiler with a net minimum output of 1632 MBH. The fuel burning rate is 2049 MBH.

1632/2049 = 0.80 → 80%

Table 6.8.1F states that for a gas fired boiler <2500 MBH the minimum efficiency is 75%. The 80% efficiency exceeds the minimum, so the boiler complies with the standard.

Lighting Power Density

In order to calculate the lighting power density for the building the space by space method was used. First, all spaces were classified as a space on the list in the ASHRAE standard 90.1 table 9.6.1. After this was done, all luminaires in each space were counted and all spaces in the same category were added together. After this is done there is a list of total floor area for each categorized space and the total luminaire count for each category. Next, the watts per each luminaire were determined and then totaled. This total wattage is what is used in finding the watt per square foot for each space.

Now with the total watts for each categorized space and total square footage for each categorized space the actual lighting power density (LPD) can be determined. This actual LPD is then compared to the value given in table 9.6.1 of the standard. If it less than the allowable number in the standard then it complies with the standard, if it exceeds the LPD on the table then it fails to comply.

In doing these calculations it was found that of the 16 different space categories in the building, 6 of them did not comply.

As per the standard, trade-offs are allowed between the spaces as long as the total LPD does not exceed the allowed LPD. The total LPD is 20.3 and the allowed is 16.2, so this again, does not comply.

Assumptions

In order to calculate the lighting power density for the building some spaces in the building had to be classified as a typical space in order to find a lighting density for that space. The list below describes what unclassified spaces were classified as.

- All parts of the lobby were assumed as lobby, this includes all vestibules, gallery, and security space.
- Studio space was assumed to be classroom.
- Student affairs are conference.
- Active storage includes all labeled storage rooms and loading dock, custodial, coat, trash
- Tickets and mail office

For room wattages, lamp watts were used because a ballast schedule was not included. Some watts were assumed because the data for said lamps were unattainable at the time of this report.

Please see Appendix C for the Lighting Power Density for each categorized space in the building.

Lost Rentable Space

The lost rentable space of the building is the space consumed by mechanical equipment. This space includes the mechanical room and all support spaces as well as duct shafts, pipe chases and other various spaces for equipment.

In order to obtain a number for the space consumed by mechanical equipment including ducts, the square footage was taken from the drawings of each floor then added together.

The total square foot area of the building is 120,130 ft^2. The total area found for all mechanical spaces was 6,281 ft^2. This, in turn, gives the percentage of lost rentable space at 5.2%.

The table below has the total area for the mechanical spaces and the building and also gives the percentage of lost rentable space due to mechanical equipment and ventilation shafts, pipe chases and ductwork.

Area	s.f.
Mechanical Space	6,281
Total Building Area	120,130
Percentage of Lost Rentable Space	5.2

Please see Appendix D for the breakdown of the Mechanical spaces.

Mechanical System First Cost

The mechanical system first cost information was provided by RTKL Associates Inc. and is as follows. The plumbing cost is $822,000, the HVAC cost is $1,827,000 and the fire protection is $338,000.

The total first cost for the mechanical system is $2,987,000 and $34.14 per square foot.

The detailed breakdown of the first cost for the mechanical system can be found in Appendix E.

Design Load Estimates

To obtain the design load estimates Carrier's HAP version 4.20 was used to simulate the building. Using data from the construction documents the total annual cooling load of the building was calculated by HAP 4.20 to be 1,765,000 kBTU.

At the time of writing this report the actual data calculated by the engineer could not be obtained so there is no number to compare this cooling load to.

The calculated loads for AHU-1 are as follows:

- 5.7 tons
- 5772 cfm total supply air
- 0.74 cfm/ft^2 total supply air
- 1182 cfm ventilation rate
- 0.15 cfm/ft^2 ventilation rate

The calculated loads for AHU-2 are as follows:

- 3.5 tons
- 2776 cfm total supply air
- 0.64 cfm/ft^2 total supply air
- 1064 cfm ventilation rate
- 0.25 cfm/ft^2 ventilation rate

The calculated loads for AHU-3 are as follows:

- 0 tons
- 7958 cfm total supply air
- 2.19 cfm/ft^2 total supply air
- 608 cfm ventilation rate
- 0.17 cfm/ft^2 ventilation rate

The calculated loads for AHU-4 are as follows:

- 2.9 tons
- 1905 cfm total supply air
- 0.32 cfm/ft^2 total supply air
- 1488 cfm ventilation rate
- 0.25 cfm/ft^2 ventilation rate

For more load data see Appendix F.

Annual Energy Consumption and Operating Costs

The annual energy consumption and operating cost data was obtained from HAP 4.20. There was no data obtained from the engineer to compare the calculated data to nor was an energy bill available because the building is still under construction.

The annual energy consumed by the building was estimated to be 494,000 kWh and 5,000 Therms.

The Fuel Costs for the building were assumed for the calculations because cost data for the building could not be obtained. The assumed cost for electric was $0.115/kWh and $1.40 per therm.

The annual cost to operate all HVAC systems, chiller, fans, lighting, and equipment is as follows:

- HVAC systems - $29,600
- Chiller - $14,700
- Fans - $6,000
- Lighting - $30,200
- Equipment - $8,900

The annual cooling cost for The Gateway at MICA was calculated to be $14,700.

For more cost data see Appendix G.

Appendix A

LEED-NC

LEED-NC Version 2.2 Registered Project Checklist

The Gateway at MICA
Baltimore, Maryland

Yes	?	No			
0	**0**	**0**	**Sustainable Sites**		**14** Points
Y			Prereq 1	**Construction Activity Pollution Prevention**	Required
1			Credit 1	**Site Selection**	1
1			Credit 2	**Development Density & Community Connectivity**	1
1			Credit 3	**Brownfield Redevelopment**	1
1			Credit 4.1	**Alternative Transportation**, Public Transportation Access	1
		0	Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1
		0	Credit 4.3	**Alternative Transportation**, Low-Emitting and Fuel-Efficient Vehicles	1
		0	Credit 4.4	**Alternative Transportation**, Parking Capacity	1
		0	Credit 5.1	**Site Development,** Protect of Restore Habitat	1
		0	Credit 5.2	**Site Development,** Maximize Open Space	1
1			Credit 6.1	**Stormwater Design,** Quantity Control	1
1			Credit 6.2	**Stormwater Design,** Quality Control	1
		0	Credit 7.1	**Heat Island Effect,** Non-Roof	1
		0	Credit 7.2	**Heat Island Effect,** Roof	1
		0	Credit 8	**Light Pollution Reduction**	1

Yes	?	No			
0	**0**	**0**	**Water Efficiency**		**5** Points
		0	Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1
		0	Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1
		0	Credit 2	**Innovative Wastewater Technologies**	1
		0	Credit 3.1	**Water Use Reduction**, 20% Reduction	1
		0	Credit 3.2	**Water Use Reduction**, 30% Reduction	1

Yes	?	No			
0	**0**	**0**	**Energy & Atmosphere**		**17** Points
Y			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	Required
Y			Prereq 2	**Minimum Energy Performance**	Required
Y			Prereq 3	**Fundamental Refrigerant Management**	Required
		0	Credit 1	**Optimize Energy Performance**	1 to 10
		0	Credit 2	**On-Site Renewable Energy**	1 to 3
		0	Credit 3	**Enhanced Commissioning**	1
1			Credit 4	**Enhanced Refrigerant Management**	1
		0	Credit 5	**Measurement & Verification**	1
		0	Credit 6	**Green Power**	1

Yes	?	No	Materials & Resources		13 Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
		0	Credit 1.1	**Building Reuse**, Maintain 75% of Existing Walls, Floors & Roof	1
		0	Credit 1.2	**Building Reuse**, Maintain 100% of Existing Walls, Floors & Roof	1
		0	Credit 1.3	**Building Reuse**, Maintain 50% of Interior Non-Structural Elements	1
		0	Credit 2.1	**Construction Waste Management**, Divert 50% from Disposal	1
		0	Credit 2.2	**Construction Waste Management**, Divert 75% from Disposal	1
		0	Credit 3.1	**Materials Reuse**, 5%	1
		0	Credit 3.2	**Materials Reuse**,10%	1
		0	Credit 4.1	**Recycled Content**, 10% (post-consumer + ½ pre-consumer)	1
		0	Credit 4.2	**Recycled Content**, 20% (post-consumer + ½ pre-consumer)	1
1			Credit 5.1	**Regional Materials**, 10% Extracted, Processed & Manufactured Regiona	1
1			Credit 5.2	**Regional Materials**, 20% Extracted, Processed & Manufactured Regiona	1
		0	Credit 6	**Rapidly Renewable Materials**	1
1			Credit 7	**Certified Wood**	1
0	0	0			

Yes	?	No	Indoor Environmental Quality		15 Points
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Required
		0	Credit 1	**Outdoor Air Delivery Monitoring**	1
		0	Credit 2	**Increased Ventilation**	1
		0	Credit 3.1	**Construction IAQ Management Plan**, During Construction	1
		0	Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy	1
		0	Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	1
		0	Credit 4.2	**Low-Emitting Materials**, Paints & Coatings	1
		0	Credit 4.3	**Low-Emitting Materials**, Carpet Systems	1
		0	Credit 4.4	**Low-Emitting Materials**, Composite Wood & Agrifiber Products	1
		0	Credit 5	**Indoor Chemical & Pollutant Source Control**	1
		0	Credit 6.1	**Controllability of Systems**, Lighting	1
		0	Credit 6.2	**Controllability of Systems**, Thermal Comfort	1
		0	Credit 7.1	**Thermal Comfort**, Design	1
		0	Credit 7.2	**Thermal Comfort**, Verification	1
1			Credit 8.1	**Daylight & Views**, Daylight 75% of Spaces	1
1			Credit 8.2	**Daylight & Views**, Views for 90% of Spaces	1
0	0	0			

Yes	?	No	Innovation & Design Process		5 Points
			Credit 1.1	**Innovation in Design**: Provide Specific Title	1
			Credit 1.2	**Innovation in Design**: Provide Specific Title	1
			Credit 1.3	**Innovation in Design**: Provide Specific Title	1
			Credit 1.4	**Innovation in Design**: Provide Specific Title	1
1			Credit 2	**LEED® Accredited Professional**	1
0	0	0			

			Project Totals (pre-certification estimates)		69 Points
13	0	56	**Certified** 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-69 points		

Appendix B

Project Summary Information
Name: MICA
City/State/Zip: Baltimore, MD
Climate Location: Baltimore, Maryland
Standard EnvStd climate data is used for compliance
Criteria Table: 4A
Floor Area (ft²): 114350
Gross Wall Area (ft²): 60252
Window Area (ft²): 43767
Window Wall Ratio: 0.726
Gross Roof Area (ft²): 13140
Skylight Area (ft²): 0
Skylight Roof Ratio: 0.000
Door Area (ft²): 0

Compliance Summary -- FAILS

EPF	Proposed	Standard	Margin
Roofs	1094	1862	769
Skylights	0	0	0
Exterior Walls and Windows	29817	21226	-8591
Below-Grade Walls	0	0	0
Floors	0	0	0
Slabs	1	241	240
Daylighting Potential	9193	10943	1750
Total	40105	34273	-5832

Opaque Construction Schedule

Code	Description	Net Area/Length	U-factor	HC	R-Cav	R-Shth
C-1	User Defined-Wall, Above Grade-Mass-Solid Concrete-Cont. Insulation, Uninterupted by Framing-Concrete_Wall (User Defined)	4067	0.570	n.a.	1.8	10.0
C-2	User Defined-Wall, Above Grade-Mass-Conc. Masonry Units, Solid Grout-Cont. Insulation, Uninterupted by Framing-Block_Wall (User Defined)	4920	0.520	n.a.	1.9	10.0
C-3	User Defined-Wall, Above Grade-Metal Building-Double Layer-Composite_Panel (User Defined)	7498	0.300	n.a.	0.6	1.3
C-4	User Defined-Roof-Insulation Entirely Above Deck or Mass-Roof (User Defined)	13140	0.037	n.a.	27.0	0.0
C-5	User Defined-Slab-Unheated-None-Slab (User Defined)	540	0.004	n.a.	0.0	0.0
Total		30165				

Fenestration Schedule

Code	Description	Area	U-factor	SHGC	SC	Tvis
G-1	User Defined-Window-Fixed-Aluminum with Thermal Break-Clear-GL-02 (User Defined)	26204	0.240	0.540	0.628	0.760
G-2	User Defined-Window-Fixed-Aluminum with Thermal Break-Clear-GL-03 (User Defined)	0	0.240	0.540	0.628	0.760
G-3	User Defined-Window-Fixed-Aluminum with Thermal Break-Clear-GL-07 (User Defined)	11047	0.240	0.360	0.419	0.470
G-4	User Defined-Window-Fixed-Aluminum with Thermal Break-Clear-GL-08 (User Defined)	6516	0.200	0.300	0.349	0.520
G-5	User Defined-Window-Fixed-Aluminum with Thermal Break-Clear-GL-11 (User Defined)	0	0.200	0.290	0.337	0.520
Total Area		43767				

Space Category: Residential

Floor Area (ft²): 81604
Gross Wall Area (ft²): 41016
Window Area (ft²): 37916
Window Wall Ratio: 0.924
Gross Roof Area (ft²): 13140
Skylight Area (ft²): 0
Skylight Roof Ratio: 0.000
Door Area (ft²): 0

Surfaces

Name	Type	Const. Code	Area	Orient	Notes
North_Wall	Wall	C-3	11535	North	n.a.
South	Wall	C-3	10187	South	n.a.
Roof	Roof	C-4	13140	n/a	n.a.
East	Wall	C-3	10173	East	n.a.
West	Wall	C-3	9121	West	n.a.
Total			54156		

Openings

Name	Type	Const. Code	Area	Orient.	Notes
GL-02	Window	G-1	1716	North	n.a.
GL-07	Window	G-3	5709	North	n.a.
GL-08	Window	G-4	4010	North	n.a.
GL-02	Window	G-1	5627	South	n.a.
GL-07	Window	G-3	2850	South	n.a.
GL-08	Window	G-4	710	South	n.a.
GL-02	Window	G-1	7168	East	n.a.
GL07	Window	G-3	650	East	n.a.
GL-08	Window	G-4	1355	East	n.a.
GL-02	Window	G-1	5842	West	n.a.
GL-07	Window	G-3	1838	West	n.a.
GL-08	Window	G-4	441	West	n.a.
Total			37916		

Space Category: Non-Residential
Floor Area (ft²): 32746
Gross Wall Area (ft²): 19236
Window Area (ft²): 5851
Window Wall Ratio: 0.304
Gross Roof Area (ft²): 0
Skylight Area (ft²): 0
Skylight Roof Ratio: 0.000
Door Area (ft²): 0

Surfaces

Name	Type	Const. Code	Area	Orient	Notes
Slab	Slab	C-5	540	n/a	n.a.
North	Wall	C-1	4748	North	n.a.
South	Wall	C-3	4784	South	n.a.
East	Wall	C-2	4920	East	n.a.
West	Wall	C-3	4784	West	n.a.
Total			19776		

Openings

Name	Type	Const. Code	Area	Orient.	Notes
GL-02	Window	G-1	681	North	n.a.
GL-02	Window	G-1	870	South	n.a.
GL-02	Window	G-1	4300	West	n.a.
Total			5851		

Appendix C

Space Type	LPD (W/ ft^2)	Area (ft^2)	Power (W)	Actual LPD	Compliance
Office-Enclosed	1.1	983	924	0.94	N
Conference/Meeting/Multi-Purpose	1.3	6546	14791	2.26	Y
Lobby	1.3	5711	7404	1.30	Y
Food Preparation	1.2	1287	2194	1.70	Y
Restrooms	0.9	880	1490	1.69	Y
Corridor/Transition	0.5	15229	11624	0.76	Y
Equipment Room	1.2	623	802	1.29	Y
Control Room	0.5	1446	1944	1.34	Y
Stairs-Active	0.6	3375	2296	0.68	Y
Active Storage	0.8	2483	1260	0.51	N
Inactive Storage	0.3	688	2626	3.82	Y
Dormitory-Living Quarters	1.1	58181	25405	0.44	N
Electrical/Mechanical	1.5	6387	3640	0.57	N
Classroom	1.4	5809	4170	0.72	N
Workshop	1.9	932	1288	1.38	N
Laundry	0.60	368	336	0.91	Y

Appendix D

Type	Floor	Name	Area (s.f.)
Room	1	Fire Pump	164
Room	1	Generator	459
Room	2	Mechanical Room	1912
Room	10	Penthouse	2890
Shaft	2	HVAC Chase	16
Shaft	2	Duct Shaft	2.5
Shaft	2	Duct Shaft	22.5
Shaft	2	Duct Shaft	22.5
Shaft	2	Duct Shaft	22.5
Shaft	2	Duct Shaft	30
Shaft	3	HVAC Chase	65.5
Shaft	3	Stair Pressurization	10.1
Shaft	3	Stair Pressurization	10.4
Shaft	3	Water Piping	3
Shaft	4	Stair Pressurization	10.1
Shaft	4	Stair Pressurization	10.4
Shaft	4	HVAC Chase	65.5
Shaft	4	Exhaust Shaft (1)	4.5
Shaft	4	Exhaust Shaft (9)	18
Shaft	5	Stair Pressurization	10.1
Shaft	5	Stair Pressurization	10.4
Shaft	5	HVAC Chase	65.5
Shaft	5	Exhaust Shaft (1)	4.5
Shaft	5	Exhaust Shaft (9)	18
Shaft	6	Stair Pressurization	10.1
Shaft	6	Stair Pressurization	10.4
Shaft	6	HVAC Chase	65.5
Shaft	6	Exhaust Shaft (1)	4.5
Shaft	6	Exhaust Shaft (9)	18
Shaft	7	Stair Pressurization	10.1
Shaft	7	Stair Pressurization	10.4
Shaft	7	HVAC Chase	65.5
Shaft	7	Exhaust Shaft (1)	4.5
Shaft	7	Exhaust Shaft (9)	18
Shaft	8	Stair Pressurization	10.1
Shaft	8	Stair Pressurization	10.4
Shaft	8	HVAC Chase	65.5
Shaft	8	Exhaust Shaft (1)	4.5
Shaft	8	Exhaust Shaft (9)	18
Shaft	9	Stair Pressurization	10.1
Shaft	9	Stair Pressurization	10.4
Shaft	9	HVAC Chase	65.5
Shaft	9	Exhaust Shaft (1)	4.5
Shaft	9	Exhaust Shaft (9)	18
		Total Area (s.f)	**6281**

Appendix E

08 MECHANICAL

082 HEATING, VENTILATING, AIR CONDITIONING

1520 HVAC	Quantity				Unit Price	Total
48.8 BHP Gas fired hot water boiler	2	EA			24500	49,000
Boiler flues	1	LS			4600.00	4,600
Heating water pumps	4	EA			4200.00	16,800
Heating water circulators	6	EA			4200.00	25,200
Heating system accessories	1	LS			2600.00	2,600
200 Ton Air cooled chiller	2	EA			106000	212,000
Chilled water pumps	3	EA			7700.00	23,100
Chilled water accessories	1	LS			2800.00	2,800
Air handling units with full outside air (AHU 1-3)	36,500	CFM			3.50	127,750
Air handling units with full energy recovery	Deleted					
Return air fans	3	EA			3200.00	9,600
Studio floor units	6	EA			5500.00	33,000
Stair pressure fans	2	EA			5200.00	10,400
Exhaust fans	1	LS			7540.00	7,540
Vertical fancoil units	244	EA			1150.00	280,600
Horizontal fancoil units	13	EA			1330.00	17,290
Split system units	2	EA			5600.00	11,200
Balcony enclosure fancoil units	10	EA			1150.00	11,500
Chilled water pipe and insulation:						
½" to 1" Threaded steel pipe	1,240	LF			24.00	29,760
1¼" to 2" Threaded steel pipe	1,880	LF			29.00	54,520
3" Welded steel pipe	150	LF			42.40	6,360
4" Welded steel pipe	600	LF			45.40	27,240
5" Welded steel pipe	240	LF			73.90	17,736
6" Welded steel pipe	40	LF			176.00	7,040
½" to 2" Valves	20	EA			62.00	1,240
4" Valves	8	EA			440.00	3,520
5" Valves	12	EA			720.00	8,640
6" Valves	6	EA			920.00	5,520

08 MECHANICAL

082 HEATING, VENTILATING, AIR CONDITIONING

1520 HVAC	Quantity				Unit Price	Total
Heating water pipe and insulation:						
½" to 1" Threaded steel pipe	300	LF			24.00	7,200
1¼" to 2" Threaded steel pipe	150	LF			29.00	4,350
3" Welded steel pipe	150	LF			46.00	6,900
4" Welded steel pipe	140	LF			55.50	7,770
3" Valves	12	EA			320.00	3,840
4" Valves	6	EA			440.00	2,640
Condensate drain pipe	1,620	LF			16.00	25,920
Supply air ductwork	19,560	LBS			5.50	107,580
Exposed spiral wound duct	2,120	LBS			7.50	15,900
Return air duct	18,100	LBS			5.50	99,550
Exhaust air ductwork	3,970	LBS			5.50	21,835
Stair pressurization duct	5,910	LBS			5.50	32,505
Ductwrap insulation	18,680	SF			1.90	35,492
Ductboard insulation	4,450	SF			5.00	22,250
Dampers and accessories	1	LS			7650.00	7,650
Diffusers and registers	310	EA			120.00	37,200
VAV units	37	EA			1100.00	40,700
Unit heaters	26	EA			880.00	22,880
Miscellaneous fancoil units, fans, etc.	16	EA			1000.00	16,000
Automatic controls/energy management	1	LS			167000	167,000
General provisions, testing, balancing	1	LS			135337	135,337

082 HEATING, VENTILATING, AIR CONDITIONING 1,827,055

Appendix F

Air System Sizing Summary for AHU-1

Project Name: MICAhap
Prepared by: psuae

10/30/2006
06:21PM

Air System Information

Air System Name	**AHU-1**		Number of zones	**29**	
Equipment Class	**CW AHU**		Floor Area	**7852.0**	ft²
Air System Type	**VAV**		Location	**Baltimore, Maryland**	

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM	**Peak zone sensible load**		Calculation Months	**Jan to Dec**	
Space CFM	**Individual peak space loads**		Sizing Data	**Calculated**	

Central Cooling Coil Sizing Data

Total coil load	**5.7**	Tons	Load occurs at	**Jul 1800**	
Total coil load	**68.2**	MBH	OA DB / WB	**91.1 / 74.5**	°F
Sensible coil load	**33.5**	MBH	Entering DB / WB	**60.0 / 58.6**	°F
Coil CFM at Jul 1800	**5008**	CFM	Leaving DB / WB	**53.8 / 53.7**	°F
Max block CFM at Jul 1800	**5772**	CFM	Coil ADP	**53.1**	°F
Sum of peak zone CFM	**5792**	CFM	Bypass Factor	**0.100**	
Sensible heat ratio	**0.491**		Resulting RH	**46**	%
ft²/Ton	**1381.2**		Design supply temp.	**55.0**	°F
BTU/(hr-ft²)	**8.7**		Zone T-stat Check	**29 of 29**	OK
Water flow @ 10.0 °F rise	**13.65**	gpm	Max zone temperature deviation	**0.0**	°F

Precool Coil Sizing Data

Total coil load	**9.5**	Tons	Load occurs at	**Jul 1700**	
Total coil load	**113.9**	MBH	OA DB / WB	**92.4 / 74.8**	°F
Sensible coil load	**109.3**	MBH	Entering DB / WB	**80.6 / 66.1**	°F
Coil CFM at Jul 1700	**4949**	CFM	Leaving DB / WB	**60.0 / 58.6**	°F
Max coil CFM	**5772**	CFM	Bypass Factor	**0.100**	
Sensible heat ratio	**0.960**				
Water flow @ 10.0 °F rise	**22.80**	gpm			

Preheat Coil Sizing Data

Max coil load	**1.3**	MBH	Load occurs at	**Des Htg**	
Coil CFM at Des Htg	**58**	CFM	Ent. DB / Lvg DB	**29.0 / 50.0**	°F
Max coil CFM	**5772**	CFM			
Water flow @ 20.0 °F drop	**0.13**	gpm			

Supply Fan Sizing Data

Actual max CFM at Jul 1800	**5772**	CFM	Fan motor BHP	**2.94**	BHP
Standard CFM	**5740**	CFM	Fan motor kW	**2.19**	kW
Actual max CFM/ft²	**0.74**	CFM/ft²	Fan static	**1.75**	in wg

Outdoor Ventilation Air Data

Design airflow CFM	**1182**	CFM	CFM/person	**17.91**	CFM/person
CFM/ft²	**0.15**	CFM/ft²			

Air System Sizing Summary for AHU-2

Project Name: MICAhap
Prepared by: psuae

10/30/2006
06:22PM

Air System Information

Air System Name	**AHU-2**		Number of zones	**4**	
Equipment Class	**CW AHU**		Floor Area	**4309.0**	ft²
Air System Type	**VAV**		Location	**Baltimore, Maryland**	

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM	**Peak zone sensible load**		Calculation Months	**Jan to Dec**	
Space CFM	**Individual peak space loads**		Sizing Data	**Calculated**	

Central Cooling Coil Sizing Data

Total coil load	**3.5**	Tons	Load occurs at	**May 0600**	
Total coil load	**42.2**	MBH	OA DB / WB	**65.8 / 64.8**	°F
Sensible coil load	**16.5**	MBH	Entering DB / WB	**60.0 / 59.9**	°F
Coil CFM at May 0600	**2456**	CFM	Leaving DB / WB	**53.7 / 53.8**	°F
Max block CFM at Jan 2300	**2776**	CFM	Coil ADP	**53.0**	°F
Sum of peak zone CFM	**2776**	CFM	Bypass Factor	**0.100**	
Sensible heat ratio	**0.392**		Resulting RH	**57**	%
ft²/Ton	**1226.3**		Design supply temp.	**55.0**	°F
BTU/(hr-ft²)	**9.8**		Zone T-stat Check	**4 of 4**	OK
Water flow @ 10.0 °F rise	**8.44**	gpm	Max zone temperature deviation	**0.0**	°F

Precool Coil Sizing Data

Total coil load	**7.5**	Tons	Load occurs at	**Jul 1600**	
Total coil load	**89.6**	MBH	OA DB / WB	**93.0 / 75.0**	°F
Sensible coil load	**62.0**	MBH	Entering DB / WB	**83.5 / 70.1**	°F
Coil CFM at Jul 1600	**2456**	CFM	Leaving DB / WB	**60.0 / 58.8**	°F
Max coil CFM	**2776**	CFM	Bypass Factor	**0.100**	
Sensible heat ratio	**0.692**				
Water flow @ 10.0 °F rise	**17.93**	gpm			

Preheat Coil Sizing Data

Max coil load	**0.1**	MBH	Load occurs at	**Des Htg**	
Coil CFM at Des Htg	**28**	CFM	Ent. DB / Lvg DB	**47.0 / 50.0**	°F
Max coil CFM	**2776**	CFM			
Water flow @ 20.0 °F drop	**0.01**	gpm			

Supply Fan Sizing Data

Actual max CFM at Jan 2300	**2776**	CFM	Fan motor BHP	**1.78**	BHP
Standard CFM	**2761**	CFM	Fan motor kW	**1.33**	kW
Actual max CFM/ft²	**0.64**	CFM/ft²	Fan static	**1.75**	in wg

Outdoor Ventilation Air Data

Design airflow CFM	**1064**	CFM	CFM/person	**6.74**	CFM/person
CFM/ft²	**0.25**	CFM/ft²			

Air System Sizing Summary for AHU-3

Project Name: MICAhap
Prepared by: psuae

10/30/2006
06:23PM

Air System Information

Air System Name	**AHU-3**	Number of zones	**1**	
Equipment Class	**CW AHU**	Floor Area	**3627.0**	ft²
Air System Type	**SZCAV**	Location	**Baltimore, Maryland**	

Sizing Calculation Information

Zone and Space Sizing Method:

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

Central Cooling Coil Sizing Data

No central cooling coil loads occurred during this calculation.

Central Heating Coil Sizing Data

Max coil load	**130.4**	MBH	Load occurs at	**Des Htg**	
Coil CFM at Des Htg	**7958**	CFM	BTU/(hr-ft²)	**36.0**	
Max coil CFM	**7958**	CFM	Ent. DB / Lvg DB	**60.0 / 75.3**	°F
Water flow @ 20.0 °F drop	**13.05**	gpm			

Precool Coil Sizing Data

Total coil load	**14.4**	Tons	Load occurs at	**Aug 1700**	
Total coil load	**172.3**	MBH	OA DB / WB	**92.4 / 74.8**	°F
Sensible coil load	**150.5**	MBH	Entering DB / WB	**77.6 / 65.9**	°F
Coil CFM at Aug 1700	**7958**	CFM	Leaving DB / WB	**60.0 / 58.9**	°F
Max coil CFM	**7958**	CFM	Bypass Factor	**0.100**	
Sensible heat ratio	**0.873**				
Water flow @ 10.0 °F rise	**34.49**	gpm			

Preheat Coil Sizing Data

No heating coil loads occurred during this calculation.

Supply Fan Sizing Data

Actual max CFM	**7958**	CFM	Fan motor BHP	**3.48**	BHP
Standard CFM	**7914**	CFM	Fan motor kW	**2.59**	kW
Actual max CFM/ft²	**2.19**	CFM/ft²	Fan static	**1.50**	in wg

Outdoor Ventilation Air Data

Design airflow CFM	**608**	CFM	CFM/person	**11.69**	CFM/person
CFM/ft²	**0.17**	CFM/ft²			

Air System Sizing Summary for AHU-4

Project Name: MICAhap
Prepared by: psuae

10/30/2006
06:24PM

Air System Information

Air System Name	**AHU-4**		Number of zones	**7**	
Equipment Class	**CW AHU**		Floor Area	**5936.0**	ft²
Air System Type	**VAV**		Location	**Baltimore, Maryland**	

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM	**Peak zone sensible load**		Calculation Months	**Jan to Dec**	
Space CFM	**Individual peak space loads**		Sizing Data	**Calculated**	

Central Cooling Coil Sizing Data

Total coil load	**2.9**	Tons	Load occurs at	**Oct 0700**	
Total coil load	**34.4**	MBH	OA DB / WB	**61.0 / 60.3**	°F
Sensible coil load	**13.6**	MBH	Entering DB / WB	**60.0 / 59.9**	°F
Coil CFM at Oct 0700	**1685**	CFM	Leaving DB / WB	**52.5 / 52.5**	°F
Max block CFM at Jan 2300	**1905**	CFM	Coil ADP	**51.6**	°F
Sum of peak zone CFM	**1905**	CFM	Bypass Factor	**0.100**	
Sensible heat ratio	**0.397**		Resulting RH	**47**	%
ft²/Ton	**2072.8**		Design supply temp.	**55.0**	°F
BTU/(hr-ft²)	**5.8**		Zone T-stat Check	**7 of 7**	OK
Water flow @ 10.0 °F rise	**6.88**	gpm	Max zone temperature deviation	**0.0**	°F

Precool Coil Sizing Data

Total coil load	**6.6**	Tons	Load occurs at	**Jul 1600**	
Total coil load	**79.8**	MBH	OA DB / WB	**93.0 / 75.0**	°F
Sensible coil load	**53.6**	MBH	Entering DB / WB	**89.6 / 72.8**	°F
Coil CFM at Jul 1600	**1685**	CFM	Leaving DB / WB	**60.0 / 58.6**	°F
Max coil CFM	**1905**	CFM	Bypass Factor	**0.100**	
Sensible heat ratio	**0.672**				
Water flow @ 10.0 °F rise	**15.96**	gpm			

Preheat Coil Sizing Data

Max coil load	**8.3**	MBH	Load occurs at	**Jan 0500**	
Coil CFM at Jan 0500	**1560**	CFM	Ent. DB / Lvg DB	**45.0 / 50.0**	°F
Max coil CFM	**1905**	CFM			
Water flow @ 20.0 °F drop	**0.83**	gpm			

Supply Fan Sizing Data

Actual max CFM at Jan 2300	**1905**	CFM	Fan motor BHP	**2.44**	BHP
Standard CFM	**1894**	CFM	Fan motor kW	**1.82**	kW
Actual max CFM/ft²	**0.32**	CFM/ft²	Fan static	**3.50**	in wg

Outdoor Ventilation Air Data

Design airflow CFM	**1488**	CFM	CFM/person	**35.44**	CFM/person
CFM/ft²	**0.25**	CFM/ft²			

Appendix G

Annual Cost Summary

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Table 1. Annual Costs

Component	MICA ($)
Air System Fans	6,034
Cooling	14,706
Heating	7,278
Pumps	1,541
Cooling Tower Fans	0
HVAC Sub-Total	**29,559**
Lights	30,217
Electric Equipment	0
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	**30,217**
Grand Total	**59,776**

Table 2. Annual Cost per Unit Floor Area

Component	MICA ($/ft²)
Air System Fans	0.278
Cooling	0.677
Heating	0.335
Pumps	0.071
Cooling Tower Fans	0.000
HVAC Sub-Total	**1.361**
Lights	1.391
Electric Equipment	0.000
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	**1.391**
Grand Total	**2.752**
Gross Floor Area (ft²)	21724.0
Conditioned Floor Area (ft²)	21724.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 3. Component Cost as a Percentage of Total Cost

Component	MICA (%)
Air System Fans	10.1
Cooling	24.6
Heating	12.2
Pumps	2.6
Cooling Tower Fans	0.0
HVAC Sub-Total	**49.4**
Lights	50.6
Electric Equipment	0.0
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	**50.6**
Grand Total	**100.0**

Annual Energy and Emissions Summary

Table 1. Annual Costs

Component	MICA ($)
HVAC Components	
Electric	22,292
Natural Gas	7,267
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	**29,559**
Non-HVAC Components	
Electric	30,217
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	**30,217**
Grand Total	**59,776**

Table 2. Annual Energy Consumption

Component	MICA
HVAC Components	
Electric (kWh)	192,741
Natural Gas (Therm)	5,191
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	261,229
Natural Gas (Therm)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	453,970
Natural Gas (Therm)	5,191
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Table 3. Annual Emissions

Component	MICA
CO2 (lb)	0
SO2 (kg)	0
NOx (kg)	0

Table 4. Annual Cost per Unit Floor Area

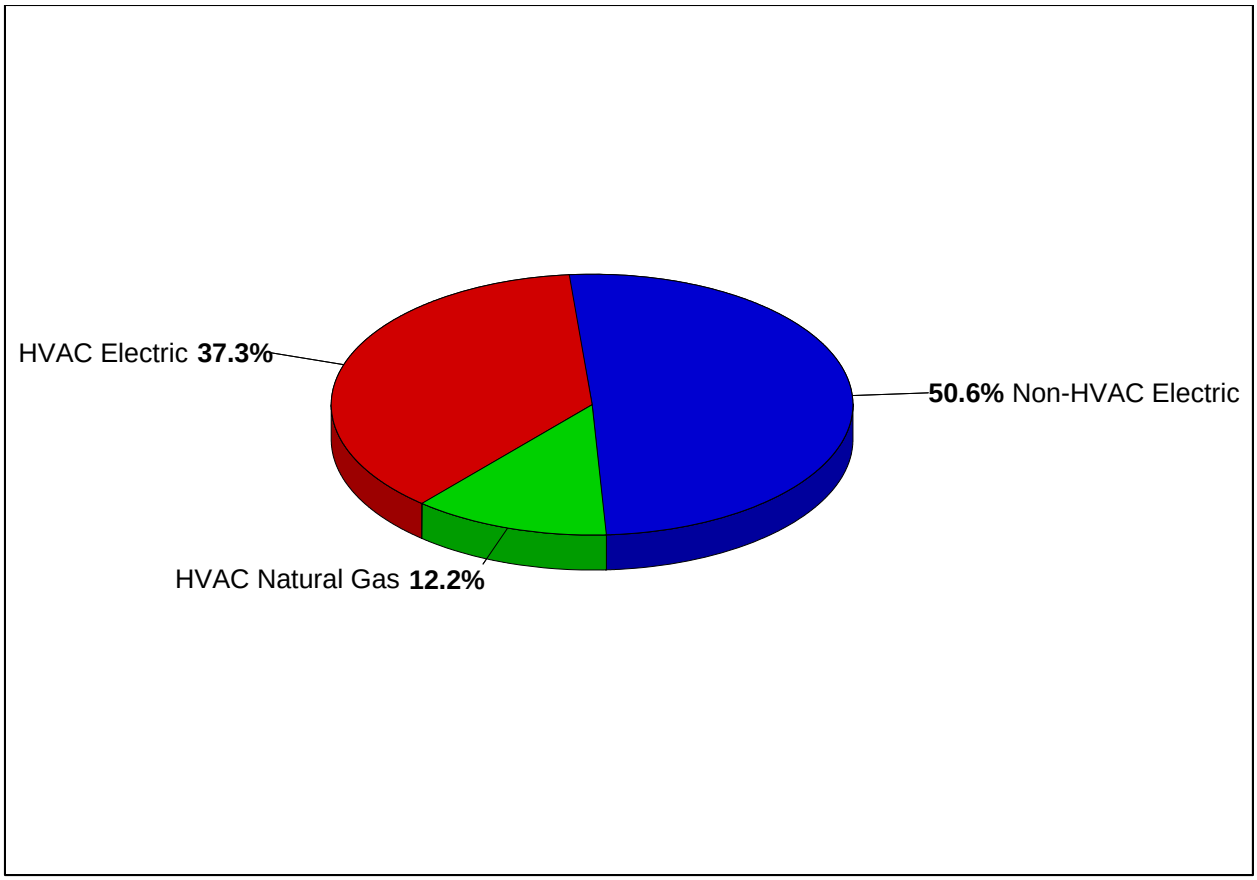
Component	MICA ($/ft²)
HVAC Components	
Electric	1.026
Natural Gas	0.335
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	**1.361**
Non-HVAC Components	
Electric	1.391
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	**1.391**
Grand Total	**2.752**
Gross Floor Area (ft²)	21724.0
Conditioned Floor Area (ft²)	21724.0

Note: Values in this table are calculated using the Gross Floor Area.

Table 5. Component Cost as a Percentage of Total Cost

Component	MICA (%)
HVAC Components	
Electric	37.3
Natural Gas	12.2
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	**49.4**
Non-HVAC Components	
Electric	50.6
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	**50.6**
Grand Total	**100.0**

Annual Energy Costs - MICA



1. Annual Costs

Component	Annual Cost ($/yr)	($/ft²)	Percent of Total (%)
HVAC Components			
Electric	22,292	1.026	37.3
Natural Gas	7,267	0.335	12.2
Fuel Oil	0	0.000	0.0
Propane	0	0.000	0.0
Remote Hot Water	0	0.000	0.0
Remote Steam	0	0.000	0.0
Remote Chilled Water	0	0.000	0.0
HVAC Sub-Total	**29,559**	**1.361**	**49.4**
Non-HVAC Components			
Electric	30,217	1.391	50.6
Natural Gas	0	0.000	0.0
Fuel Oil	0	0.000	0.0
Propane	0	0.000	0.0
Remote Hot Water	0	0.000	0.0
Remote Steam	0	0.000	0.0
Non-HVAC Sub-Total	**30,217**	**1.391**	**50.6**
Grand Total	**59,776**	**2.752**	**100.0**

Note: Cost per unit floor area is based on the gross building floor area.

Gross Floor Area ..... **21724.0** ft²
Conditioned Floor Area ..... **21724.0** ft²

Energy Budget by System Component - MICA

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10/29/2006
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1. Annual Coil Loads

Component	Load (kBTU)	(kBTU/ft²)
Cooling Coil Loads	1,764,831	81.239
Heating Coil Loads	413,192	19.020
Grand Total	**2,178,023**	**100.259**

2. Energy Consumption by System Component

Component	Site Energy (kBTU)	Site Energy (kBTU/ft²)	Source Energy (kBTU)	Source Energy (kBTU/ft²)
Air System Fans	177,977	8.193	635,633	29.260
Cooling	433,871	19.972	1,549,539	71.329
Heating	519,405	23.909	520,226	23.947
Pumps	45,461	2.093	162,360	7.474
Cooling Towers	0	0.000	0	0.000
HVAC Sub-Total	**1,176,714**	**54.167**	**2,867,760**	**132.009**
Lights	891,313	41.029	3,183,262	146.532
Electric Equipment	0	0.000	0	0.000
Misc. Electric	0	0.000	0	0.000
Misc. Fuel Use	0	0.000	0	0.000
Non-HVAC Sub-Total	**891,313**	**41.029**	**3,183,262**	**146.532**
Grand Total	**2,068,027**	**95.196**	**6,051,022**	**278.541**

Notes:

1. 'Cooling Coil Loads' is the sum of all air system cooling coil loads.
2. 'Heating Coil Loads' is the sum of all air system heating coil loads.
3. Site Energy is the actual energy consumed.
4. Source Energy is the site energy divided by the electric generating efficiency (28.0%).
5. Source Energy for fuels equals the site energy value.
6. Energy per unit floor area is based on the gross building floor area.
   Gross Floor Area ..... **21724.0** ft²
   Conditioned Floor Area ..... **21724.0** ft²

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