CareFirst Cumberland

Cumberland, MD

Technical Report II

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Mechanical Option

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Submitted: October, 12, 2012

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Executive Summary

Technical report 2 analyzes energy consumption on the CareFirst Cumberland in Cumberland, MD which was completed in 2011. The CareFirst Cumberland consists of a 45,000 SF, provide 2 floors above grade. The space is mostly used for the office spaces, providing more than 200 workstations. The purpose of this report is compared the designed energy consumption and calculated energy consumption of the building annually. ASHRAE Standard 90.1-Energy Standard for Buildings was used general block load assumption. For each assumption made for calculation, it was compare to the actual designed value. The result came out to be the designed value is higher than a calculated value, because the engineer usually oversized for the critical load.

Project Background

CareFirst Cumberland relocated in new building for expansion due to lack of office spaces. VOA Architect and Venderweil, LLC., worked with sustainably energy solution of geothermal system into the CareFirst Cumberland. With façade of clay brick wall with a strip of stone in a center, the CareFirst Cumberland has simple form of rectangular; each exterior façade faced 4 different directions. Most of the space in the CareFirst Cumberland served as office usage. For second floor of the building, open offices are provided perimeter and core zone. For the employee in CareFirst, exercise rooms and cafeteria is provided in first floor. In center of the building space, lobby or breakroom areas are used for social events. The north side of 1st building is not designed for future use.

Mechanical Summary

The CareFirst Cumberland has geothermal water source system with Dedicated Outdoor Air (DOA) system primarily support the ventilation of the building. With rooftop unit, the outdoor air intake provided 9000 CFM into the building, then it will be serve into second floor, and branch ductworks connected into first floor. The duck works arranged in core of the building to have branch duck work with the geothermal heat pump unit in each designed thermal zone. To condition air in the CareFirst Cumberland, 45 geothermal heat pumps were used that could of recover about 140, 000 Btu/hr. The geothermal water source piping connected to each of the units. IT Computer laboratory, elevator machine room, few mechanical/electrical ventilated air with separated air-conditioned unit, direct coil. Seven of the electrical heaters used in the tenant expansion space to not to affect interior spaces that are right next to the future space. Also, some of them were used for the main electrical/mechanical, egress corridor, and vestibule for heat recovery.

Load Calculation

The building load and energy Trane Air Conditioning economics 700, known as TRACE, is HVAC design tool that has complete load, system, energy and economic analysis program for comparing energy and economic impact of building. This program was created by Trane, which is HVAC equipment Distribution Company for commercial, industrial and institutional buildings.

Design Conditions

The CareFirst Cumberland is classified as nonresidential conditioned space located in Cumberland, MD, corresponding to the cold-humid 4a climate zone determined by Figure/Table B-1 located in ASHRAE 90.1.2007. Weather data was selected in Weather Library from the ASHRAE 90.1.2007, but since there is no weather data on Cumberland, Maryland, I choose Baltimore, Maryland. TRACE weather inputs are shown in Appendix A. The typical thermostat parameter condition is specified by Venderweil Engineer, LLC. In Table 1 below.

Typical Thermostat Parameter	
Cooling Dry Bulb (^{0}F)	75
Heating Dry Bulb (^{0}F)	70
Relative Humidity %	50
Cooling Drift Point (^{0}F)	80±3
Heating Drift Point (^{0}F)	60±3

Table 1- Thermostat Condition

Model Design

Zones were separated into perimeter and interior zones, these thermal zones based on different occupancy, equipment, and envelope loads. The CareFirst Space separated into 4 different usage of building, which is office, conference, corridor, and lobby. Some of the general usage of building, such as storage, waiting area, training room and café area are treated as office area. Each area created in template file with general data of internal load, airflow, thermostat, and construction. Then the building divided into 12 zones based on usage, perimeter or core space, and unit. After creating all template, room, and mechanical system, each zone assigned with the template that created previously. For the solar heat gain through building façade, the direction of the building must considered. The shape of the building is only direction of four sides, SSW, NNE, SEE, and NWW. This direction will be expressed in angle in the Trace 700, so it will be 22.5^0, 112.5^0, 202.5^0, and 292.5^0. The area take off the each wall attached in Appendix C. To analysis the economic for utilities of the building annually, electric demand and consumption, and natural gas are added into the utilities rate. Since the purpose of the energy model in technical report 2 is define annual energy consumption annually, the equipment installed cost and life cycle cost excluded from the calculation.

Load Assumptions

The CareFirst Cumberland's construction documents, specifications, and relevant design calculation was supplied by Venderweil Engineer, LLC to analysis the energy modeling in TRACE. ASHRAE standards of design were used if the data was not found in given documentation. For general heat gain in the building from lighting, people, equipment, and solar energy from exterior construction data obtained from the ASHRAE Standard 90.1. This data was automatically selected in Trace 700 when the general usage of the space. Also, the equipment load from each ventilation unit each zone was included in the load assumptions.

Occupancy Assumptions

The Venderweil Engineer, LLC provide occupancy calculation on construction documents for the building ventilation calculation. According to ASHRAE 62.1.2007 Table 6-1, the designed occupant density, in unit of number of people per 1000 square feet, the designed value is higher than the standard. Table 2 compares the designed occupant density for the common space in the building with the ASHRAE standard. The higher occupancy density will create a higher refrigeration density and latent load and latent load, since more occupancy density will create more occupants in same amount of the area, higher ventilation rate and refrigeration density must be provided for comfort zone. This topic will be discussed more in depth in the calculated load vs. designed load section of this report. With gross floor area of 46,739 SF total, the CareFirst Cumberland can hold up to 445 people in the building. With ASHARE stand, I assumed that occupancy for the CareFirst Cumberland is 372 people in the building. Designed occupancy is over-estimated than ASHRAE Standard to prevent whenever there are more occupancy when is supposed to be in the building.

Modeled Occupant Density		
	People/1000sf	
Space	Designed	ASHRAE
Lobby	30	10
Office Spaces	7	5
Conference Rooms	50	50
Corridor	0	0

Table 2- Occupant Density Comparison

Ventilation Assumption

The Venderweil Engineer, LLC designed to have a minimum ventilation rate of the common spaces for the CareFirst Cumberland. According to ASHRAE 62.1.2007 Table 6-1, the designed ventilation rate, in unit of cubic feet per minute per person, the designed value is higher than the standard. Therefore, the CareFirst Cumberland provides more air than ASHRAE standard, which means complied. The ventilation is 100% outside air intake delivered from the rooftop dedicated outdoor air system (DOAS) unit to each zone. The outside air intake is ducted into the heat pumps for each zone, and the return into plenum above ceiling. With outside supply air and returned air mixed together to energy recovery, therefore geothermal heat pump is ducted into outside air intake, but it is not always will provide 100% outside air supply. The exfiltration through building façade is about 0.03 CFM/SF.

Modeled Ventilation Rate		
	cfm/person	
Space	Designed	ASHRAE
Lobby	15	11
Office Spaces	20	17
Conference Rooms	20	6
Corridor	0	0

Table 3-Ventilation Rate Comparison

Lighting and Equipment Electrical Load Assumptions

The lighting load information for the energy model calculation was provided by the Venderweil Engineer, LLC for cooling load. To be compared with designed value and values in standard, typical lighting power densities provided in Table 9.6.1 ASHRAE Standard 90.1.2007. Designed lighting density calculated by each room area with internal heat gain each space. The calculation spreadsheet attached in Appendix A. The lighting power density power for designed and ASHARE chart is shown below Table 4. Designed lighting power density is greater than ASHRAE standard, therefore the CareFirst Cumberland is over-estimated with lighting heating load. The electrical load will be assumed to the 0.5 W/ft^2 for the office area for the workstation, such as computers, printer, and phones. Most of the spaces of the CareFirst Cumberland are office usage. Miscellaneous electrical load, such as ventilation unit and electrical heat unit added into calculation separately.

Lighting Power Density		
	W/sq. ft.	
Space	Designed	ASHRAE
Lobby	1.5	1.3
Storage	1.3	0.8
Office	1.9	1.1
Post Office	2.0	1.2
Corridor	1.0	0.5
Conference	2.0	1.3
Food Preparation	2.0	1.2
Exercise Area	2.0	0.9
Playing Area	2.0	1.4
Seating Area	1.0	0.9

Table 4-Lighting Power Density Comparison

Construction

For each of usage space, general construction wall data were used. Data was provided from the VOA Architecture, Architecture and Core drawing wall type. The CareFirst Cumberland has similar exterior all side, therefore I used general exterior data, which is face brink, 8" clay tile and 6" insulation. Floor slab on grade is 4" HW Concrete, and for the second floor, concrete on metal frame was used for the calculation. SBS modified roof membrane was used in the CareFirst Cumberland with ½" roof board, 4" rigid polyisocyanurate insulation, vapor retarde, ½" roof board, and 1 ½" galvanized roof deck. However, within a choice in Trace 700, there is short range of selection, therefore 2" HW Concrete, 6" Insulation, 2" HW Roof Terrace System. For the interior partition, typical ¾" gypsum board was selected and ¼" double glass was selected for the window. Exterior wall high for each story is 15', but the floor to ceiling height in the interior is 10'. Within 5', the structural and mechanical distribution duck work included. Also, the plenum placed above the ceiling for returned air. The input data for the office attached in Appendix B.

Schedules

The CareFirst Cumberland is general office building; therefore the usage hour is usually within range of 8am to 6pm. The control of mechanical system scheduled with whether occupants are in or out of the space. To provide conditioned space for work productivity, the schedule should be earlier than occupants enter into the building. The internal load will gradually rise with occupants, therefore, the conditioned supply air can be scheduled depends on occupant's work hour.

Calculated Load vs. Design Load Analysis

The Vandeweil Engineer LLC, did not perform Energy modeling for the CareFirst Cumberland, because the building was not design to be LEED certified. However, the information on each geothermal heat pump unit that serving each zone was provided. The list of the designed thermal zones and designed load of envelope and internal is provided in Appendix D. All the comparison for load assumption was mention previously and the comparison of designed and ASHRAE Standard block loads. Occupancy assumption in Table 2, ventilation assumption in Table 3, and lighting power density for lighting load in Table 4 are listed. With 12

zone separation, input data of area of space, perimeter of exterior wall, height, building material type, internal load, and units were used in Trace 700 to calculate. At the end of the calculation, the actual calculated load in each zone provided. The list of zone and calculated load is attached in Table 5 below.

Calculated Load (Btu/hr)		
Zone	Envelope	Internal
Conference_1st	22996	22271
Corridor_1st	8708	9215
IT Comm Room	0	1317
Lobby_1st	30746	33140
Lobby_2nd	22131	13500
Office_1st	165607	103316
Office_2nd	351006	207404
Rm 186 Telcom Demarc	0	306
Rm 195 Eelev Mach Room	62	275
Rm 296	0	360
Rm 201	42026	10149
Rm 219	0	4793
	643282	406046
Total Btu/hr		1049328
Total tons		87.444

Table 5-List of Thermal Zones and its Calculated Load

The comparison of designed and calculated load is provided on Table 6 below.

Load (Btu/hr)		
	Designed	Calculated
Total tons	120	90

Table 6-Designed and Calculated Load Comparison

Calculated load is underestimated than actual designed load, because the calculation was made to use only one type of wall type, and it did not have exactly same material of the CareFirst Cumberland. Also, some of the spaces were included in the calculation process, which were mechanical room, electrical room, and other machinery spaces. Even though calculated load is little off for the designed load, in selection of the equipment, units are selected oversized.

Energy Calculation and Operating Cost

Trance Trace 700 was used to model a full year energy simulation of the CareFirst Cumberland. Then, Trace 700 calculation report were compared to actual energy usage data and utility bills supplied to the CareFirst Cumberland.

Energy Consumption

Trace 700 Report of energy consumption for the each month attached in below Table 7. The CareFirst is primarily used electrical energy in the building. The building energy uses in primary heating and cooling, auxiliary, and lighting. The boiler used natural gas, however, it consumption is fair low to ignore, because the geothermal source system can handle heat rejection and heat recovery. The secondary heat rejection, cooling tower is used, and for the heat recovery, the boiler in mechanical room was used, but as mentioned, the boiler rarely used in the building. For the electrical consumption, in month of July has peak consumption compared to other months. Water supply provided to the unit heater and geothermal system.

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Alternative: 1	**Technical Report 2**												
Electric													
On-Pk Cons. (kWh)	34,356	31,132	37,634	32,737	36,045	36,203	32,932	37,850	32,905	36,041	34,363	32,720	414,917
Off-Pk Cons. (kWh)	68,109	61,641	61,663	63,062	64,397	61,404	68,474	63,008	64,515	62,987	61,061	67,810	768,131
On-Pk Demand (kW)	140	140	140	140	140	140	140	140	140	140	140	140	140
Off-Pk Demand (kW)	148	147	140	140	140	140	140	140	140	140	140	141	148
Water													
Cons. (1000gal)	9	8	11	13	20	21	24	22	20	13	11	9	181

ACADEMIC USE

Energy Consumption		
Building	118,076	Btu/(ft2-year)
Source	354,264	Btu/(ft2-year)
Floor Area	34,196	ft2

Environmental Impact Analysis	
CO2	15,855,690 lbm/year
SO2	142,781 gm/year
NOX	27,323 gm/year

Table 7-Energy Consumption Monthly

Energy Comparison

The actual utility bill/data were not available from the Vanderweil Engineer, LLC. Therefore designed energy consumption cannot be compared with the actual designed energy consumption. However, with the load calculation comparison, the actual energy consumption assumed to be higher than the designed energy consumption.

Cost Analysis

A cost analysis evaluated by Trace 700 monthly below on Table 8. Again, peak load in month of July, therefore the utility cost in July will be highest out of the year. Total monthly cost is $ 5750 average. For total designed annual utility cost is $ 69029. Utility cost per area is $2.02 per square feet.

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
					------- Monthly Utility Costs -------								
Alternative 1													
Electric													
On-Pk Cons. ($)	1,718	1,557	1,882	1,637	1,802	1,810	1,647	1,892	1,645	1,802	1,718	1,636	20,746
Off-Pk Cons. ($)	2,043	1,849	1,850	1,892	1,932	1,842	2,054	1,890	1,935	1,890	1,832	2,034	23,044
On-Pk Demand ($)	1,397	1,397	1,397	1,397	1,398	1,398	1,399	1,399	1,398	1,397	1,397	1,397	16,771
Off-Pk Demand ($)	740	736	698	698	699	699	699	699	699	698	698	705	8,468
Total ($):	5,898	5,538	5,827	5,624	5,831	5,749	5,798	5,880	5,678	5,787	5,645	5,772	69,029
Monthly Total ($):	5,898	5,538	5,827	5,624	5,831	5,749	5,798	5,880	5,678	5,787	5,645	5,772	69,029

Building Area = 34,196 ft²
Utility Cost Per Area = 2.02 $/ft²

ACADEMIC USE

Table 8-Monthly Cost Analysis

Emissions

By using the RegGridemissionfactors2007.pdf in AE481 mechanical database, the modeled natural gas can be calculated. In the Trace 700 energy model, environmental Impact Analysis has been made for the emission rate below on Table 9. Total CO_2 was calculated to be nearly 16 million pounds annually.

Environmental Impact Analysis	
CO2	15,855,690 lbm/year
SO2	142,781 gm/year
NOX	27,323 gm/year

USE

Table 9-Emissions Analysis

References

ANSI/AHSRAE. (2007). Standard 62.1-2007, Ventilation for Acceptable indoor Air Quality. Atlanta, GA: American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc.

ANSI/AHSRAE. (2007). Standard 90.1-2007, Energy Standard for Buildings Except Low-Rise Residential Building. Atlanta, GA: American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc.

CareFirst Cumberland. Contruction Documents. CareFirst Cumberland, Cumberland, MD.

Project Team

- Owner: CFBC Properties, LLC.
- General Contractor: Carl Belt, Inc., http://www.thebeltgroup.com/
- Architects: VOA Associates, Inc.,http://www.voa.com/
- Civil Engineer: SPECS, Consulting Engineers & Surveyors, http://www.specllc.com/
- MEP Engineer: R.G. Vanderweil Engineers, LLP,http://www.vanderweil.com/
- Structural Engineer: Tadjer Coher Edelson Associates, Inc.,http://www.tadjerco.com/

APPENDIX A

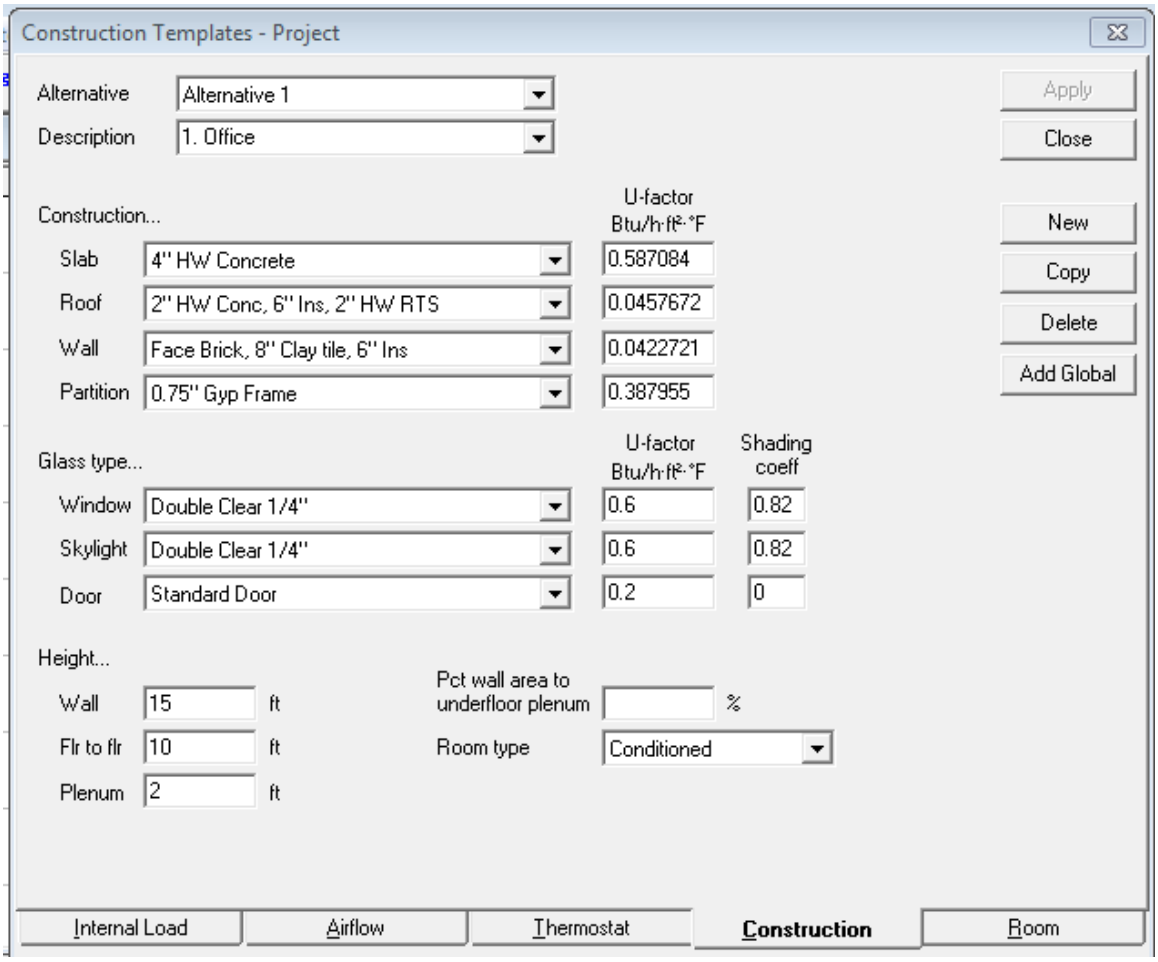
Room#	Name	Use	Btu/hr	W	Area	W/sf
100	Vestibule	Lobby	0	0	126	0
101	Reception	Lobby	2041	598.1583	400	1.495396
102	Storage	Storage	444	130.1236	130	1.000951
103	Facilities	Office	1468	430.2285	215	2.001063
104	Mail Room	Post Office	1468	430.2285	215	2.001063
105	Loading/Storage	Storage	1109	325.016	325	1.000049
108	Corridor	Corridor	1365	400.0422	400	1.000106
109	Conference Room	Conference	2696	790.12	395	2.000304
110	Conference Room	Conference	2696	790.12	395	2.000304
111	Breakout Area	Food Preparation	1420	416.1611	320	1.300503
112	Training Room	Exercise Area	6655	1950.389	975	2.000399
113	Corridor	Corridor	386	113.1255	113	1.001111
114	IT Comm Room	Office	2491	730.0404	730	1.000055
115	IT Config	Office	1536	450.1574	225	2.000699
116	Training Room	Exercise Area	5597	1640.32	820	2.00039
117	Corridor	Corridor	341	99.93728	100	0.999373
117	Multipurpose/Wellnes Center	Playing Area	5461	1600.462	800	2.000577
118	Egress Corridor	Corridor	0	0	485	0
118A	Café/Mutipurpose	Seating Area	2048	600.2098	600	1.00035
118B	Café/Mutipurpose	Seating Area	768	225.0787	225	1.00035
118C	Café/Mutipurpose	Seating Area	1075	315.0516	315	1.000164
118D	Café/Mutipurpose	Seating Area	3072	900.3148	900	1.00035
119	Corridor	Corridor	904	264.9364	265	0.99976
119A	Mech Room	Elec/Mech Room	0	0	400	0
119B	Fire Control Room	Elec/Mech	0	0	110	0

		Room				
119C	Water/sprinkler Room	Elec/Mech Room	0	0	120	0
119D	Main Elec	Elec/Mech Room	0	0	110	0
119E	Emergency Elec	Elec/Mech Room	0	0	50	0
120A	Open Office	Office	4966	1455.392	728	1.999164
120B	Open Office	Office	6143	1800.336	900	2.000374
120C	Open Office	Office	1536	450.1574	225	2.000699
120D	Open Office	Office	2099	615.1565	308	1.997261
121	Office	Office	765	224.1995	112	2.001781
122	Corridor	Corridor	1587	465.104	456	1.019965
123	Closet	Storage	205	60.0796	60	1.001327
124	Office	Office	819	240.0253	120	2.000211
125	Office	Office	785	230.0609	115	2.00053
126	District Office Waiting	Office	3379	990.2876	495	2.000581
127	Office	Office	853	249.9897	125	1.999918
129	Mothers Room	Nursery	491	143.898	72	1.998583
130	Copy	Office	1092	320.0338	160	2.000211
131	Corridor	Corridor	683	200.1676	200	1.000838
194	Elevator Lobby	Lobby	2241	656.7726	505	1.30054
195	Elec	Elec/Mech Room	0	0	65	0
196	Elev Mach Room	Elec/Mech Room	0	0	45	0
201	Conference Room	Conference	2457	720.076	360	2.000211
202	Coats	Storage	751	220.0965	110	2.000877
203	Office	Office	751	220.0965	110	2.000877
204	Office	Office	751	220.0965	110	2.000877

205A	Open Office	Office	8328	2440.697	1220	2.000571
205B	Open Office	Office	8703	2550.599	1275	2.00047
205C	Open Office	Office	4437	1300.357	650	2.000549
205D	Open Office	Office	8328	2440.697	1220	2.000571
207	Open Office	Office	5939	1740.55	870	2.000632
208	Office	Office	751	220.0965	110	2.000877
209	Office	Office	1325	388.3194	194	2.001646
210A	Open Office	Office	3618	1060.332	530	2.000626
210B	Open Office	Office	8703	2550.599	1275	2.00047
210C	Open Office	Office	6143	1800.336	900	2.000374
210D	Open Office	Office	6143	1800.336	900	2.000374
211	Breakout Area	Food Preparation	2867	840.2352	420	2.00056
212	Copy Print	Office	734	215.1143	215	1.000531
213	Pantry	Seating Area	666	195.1854	195	1.000951
214	Corridor	Corridor	751	220.0965	220	1.000439
215	Office	Office	751	220.0965	110	2.000877
216	Office	Office	751	220.0965	110	2.000877
216	Tele	Elec/Mech Room	205	60.0796	60	1.001327
217A	Open Office	Office	4778	1400.294	700	2.00042
217B	Open Office	Office	4778	1400.294	700	2.00042
217C	Open Office	Office	6314	1850.452	925	2.000488
217D	Open Office	Office	6314	1850.452	925	2.000488
217E	Open Office	Office	5120	1500.525	750	2.000699
218	Office	Office	751	220.0965	110	2.000877
219	Conference Room	Conference	1160	339.9626	170	1.99978
221	Office	Office	990	290.1405	145	2.000969
222	Conference Room	Conference	956	280.1761	140	2.001258
223A	Open Office	Office	4881	1430.481	715	2.000672

223B	Open Office	Office	4881	1430.481	715	2.000672
223C	Open Office	Office	4198	1230.313	615	2.000509
223D	Open Office	Office	9215	2700.651	1350	2.000482
223E	Open Office	Office	8396	2460.626	1230	2.000509
224	Office	Office	751	220.0965	110	2.000877
225	Office	Office	751	220.0965	110	2.000877
294	Office	Office	4096	1200.42	660	1.818818

APPENDIX B


Construction Templates - Project
Alternative
Alternative 1
Description
1. Office
Apply
Close
Construction...
U-factor Btu/h·ft²·°F
Slab
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Roof
2" HW Conc, 6" Ins, 2" HW RTS
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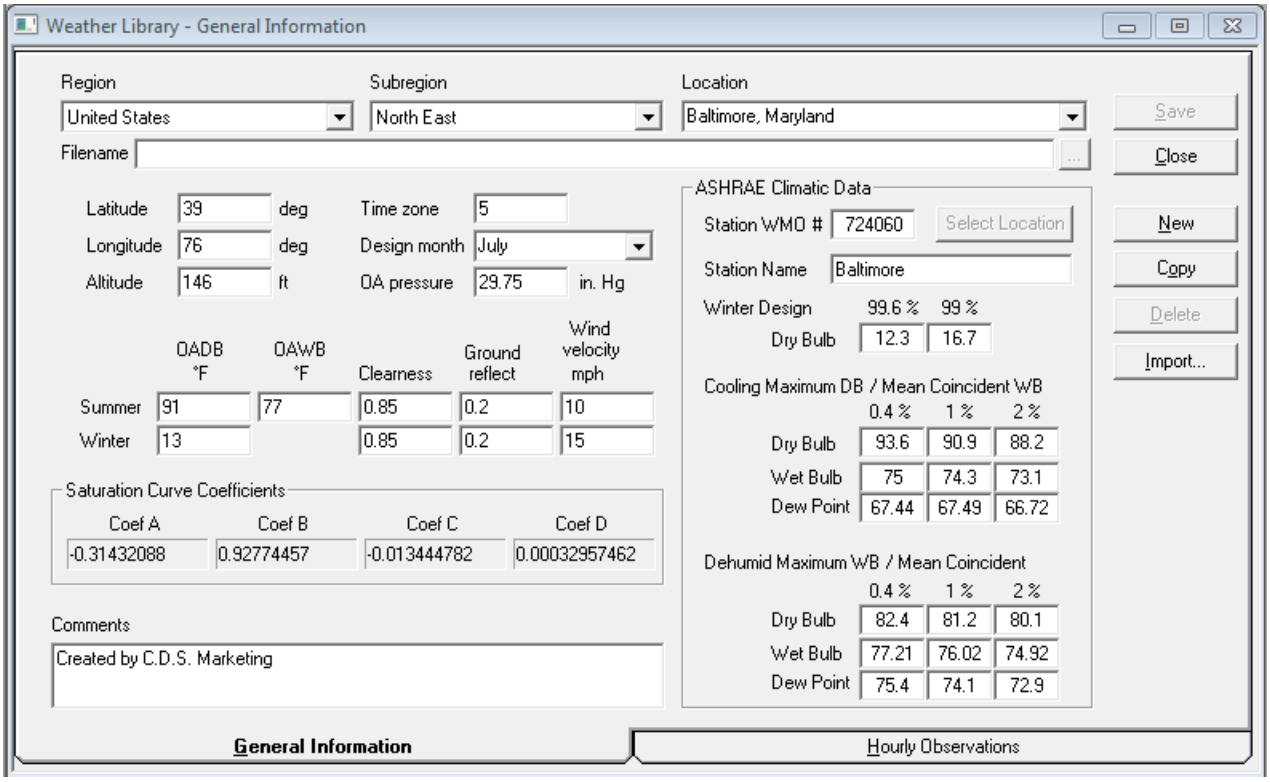
Wall
Face Brick, 8" Clay tile, 6" Ins
0.0422721
Partition
0.75" Gyp Frame
0.387955
New
Copy
Delete
Add Global
Glass type...
U-factor Btu/h·ft²·°F
Shading coeff
Window
Double Clear 1/4"
0.6
0.82
Skylight
Double Clear 1/4"
0.6
0.82
Door
Standard Door
0.2
0
Height...
Wall
15
ft
Flr to flr
10
ft
Plenum
2
ft
Pct wall area to underfloor plenum
%
Room type
Conditioned
Internal Load
Airflow
Thermostat
Construction
Room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United States
Subregion
North East
Location
Baltimore, Maryland
Save
Close
Filename
Latitude 39 deg
Longitude 76 deg
Altitude 146 ft
Time zone 5
Design month July
OA pressure 29.75 in. Hg
OADB °F
OAWB °F
Clearness
Ground reflect
Wind velocity mph
Summer 91 77 0.85 0.2 10
Winter 13 0.85 0.2 15
Saturation Curve Coefficients
Coef A -0.31432088
Coef B 0.92774457
Coef C -0.013444782
Coef D 0.00032957462
Comments
Created by C.D.S. Marketing
ASHRAE Climatic Data
Station WMO # 724060
Select Location
Station Name Baltimore
Winter Design 99.6 % 99 %
Dry Bulb 12.3 16.7
Cooling Maximum DB / Mean Coincident WB
0.4 % 1 % 2 %
Dry Bulb 93.6 90.9 88.2
Wet Bulb 75 74.3 73.1
Dew Point 67.44 67.49 66.72
Dehumid Maximum WB / Mean Coincident
0.4 % 1 % 2 %
Dry Bulb 82.4 81.2 80.1
Wet Bulb 77.21 76.02 74.92
Dew Point 75.4 74.1 72.9
New
Copy
Delete
Import...
General Information
Hourly Observations

APPENDIX C

Zone	Area	Extrior Perimeter				Opening Area			
1st Floor		292.5 (NW)	202.5 (SW)	112.5 (SE)	22.5 (NE)	292.5 (NW)	202.5 (SW)	112.5 (SE)	22.5 (NE)
Office_1st	9895	98	37	107.12	25	650	286.3	758	140.5
Conference_1st	790			30				150.8	
Corridor_1st	1421		9.7		7.8		48.5		42
Lobby_1st	1031	18.8		9.8		232.52		146.5	
IT Comm Room	730								
2nd Floor									
Office_2nd	19864	198.5	105	210	105	1570	760	1567.43	760
Lobby_2nd	420			9.8					
Room 201	360								
Room 219	170								

APPENDIX D

	Designed Load (Btu/hr)	
1st Floor	Envelope	Internal
GXHP-101	7301	15644
GXHP-102	12150	21676
GXHP-103	16097	25264
GXHP-104		38062
GXHP-105	17618	17689
GXHP-106	1459	17553
GXHP-107	19525	16851
GXHP-108	18374	23375
GXHP-109	0	29986
GXHP-110	10871	35991
GXHP-111	15840	42794

GXHP-112	9210	34674
GXHP-113	14477	35391
GXHP-114	991	9471
2nd Floor		
GXHP-201	10023	15801
GXHP-202	1884	41861
GXHP-203	28723	42013
GXHP-204	17168	22248
GXHP-205	1884	41861
GXHP-206	5535	30504
GXHP-207	11673	17621
GXHP-208	0	10699
GXHP-209	0	8515
GXHP-210	1390	31324
GXHP-211	33348	42013
GXHP-	1390	31324

212		
GXHP-213	2997	6963
GXHP-214	18814	25863
GXHP-215	1428	32006
GXHP-216	332	2201
GXHP-217	0	5350
GXHP-218	0	5350
GXHP-219	641	2747
GXHP-220	18814	27213
GXHP-221	1428	33350
GXHP-222	0	2675
GXHP-223	0	6145
GXHP-224	0	7461
GXHP-225	0	3364
GXHP-226	24024	23178
GXHP-	25149	22222

227		
GXHP-228	14295	23122
GXHP-229	2084	45860
GXHP-230	1899	42134
GXHP-231	12902	21292
	381738	1038701
Total Btu/hr		1420439
Total tons		118.3699167