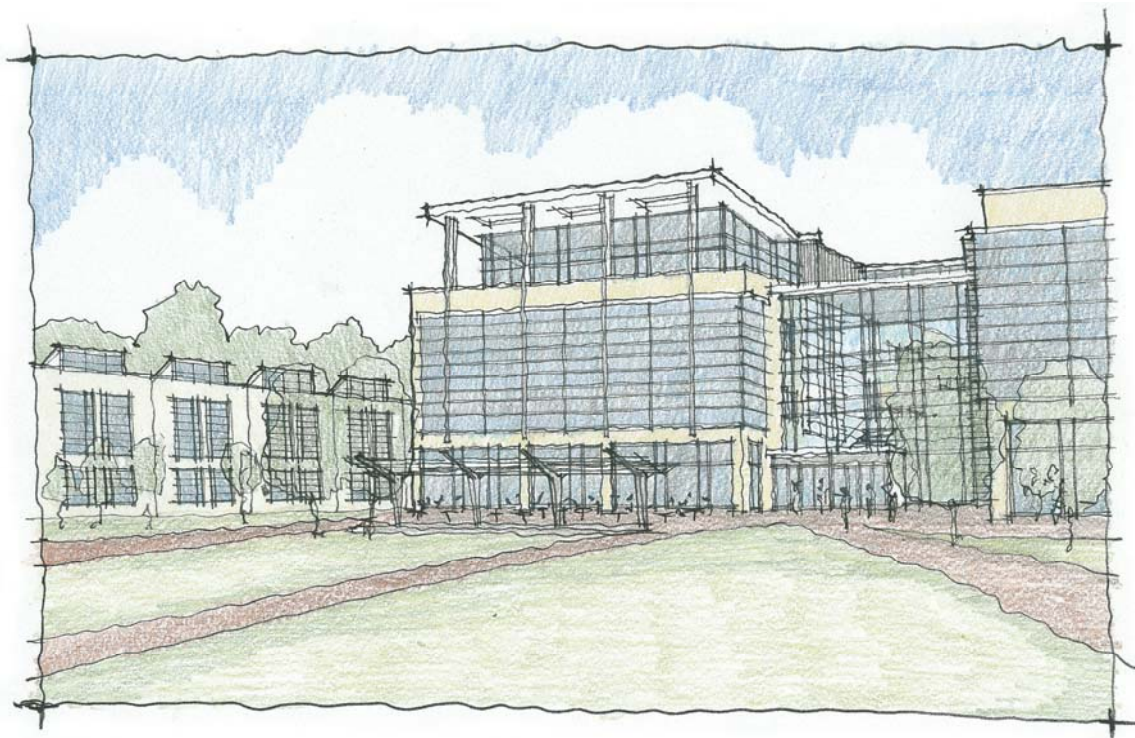


STUDENT SERVICES BUILDING
HOWARD COMMUNITY COLLEGE
COLUMBIA, MD

TECHNICAL ASSIGNMENT #1
ASHRAE STANDARD 62.1- 2004 VENTILATION COMPLIANCE EVALUATION



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Mechanical Option
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Executive Summary:

The ventilation system of the Student Services Building at Howard Community College was evaluated using ASHRAE 62.1-2004. The results of this evaluation are that the designed system meets and exceeds the ventilation required by the latest ASHRAE ventilation standard. The 6 air handling systems in the Student Services Building are typical Variable Air Volume with reheat type systems except AHU #6 which is a Constant Volume Variable Temperature with reheat. AHU #1 has a capacity of 36,300 cfm and serves the 1st floor, atrium, 2nd floor, and 3rd floor. AHU #2 has a capacity of 32,300 cfm and serves the south wing 2nd and 3rd floors. AHU #3 has a capacity of 11,000 cfm and serves the south wing 4th floor. AHU #5 has a capacity of 15,000 cfm and serves the south wing 1st floor dining room. AHU #6 has a capacity of 5700 cfm and serves the South wing first floor kitchen.

The difference in the designed outdoor air requirements verses the required OA requirements per ASHRAE Standard 62.1-2004 is due to the fact that the design team used the ventilation requirements of ASHRAE Standard 62.1-2001. The majority of the spaces were designed for 20 cfm per person and the new Standard typically only calls for 5 cfm per person in addition to 0.06cfm/ft².

VARIABLES:

A_z = zone floor area:

D = occupant diversity

E_z = The zone air distribution effectiveness determined using Table 6-2.

P_s = system population

P_z = zone population:

R_a = outdoor airflow rate required per unit area as determined from Table 6-1.

R_p = outdoor airflow rate required per person as determined from Table 6-1.

V_{bz} = the breathing zone outdoor airflow

V_{ot} = the outdoor air intake flow

V_{ou} = The design uncorrected outdoor air intake

Note: The uncorrected outdoor air intake (V_{ou}) is adjusted for diversity but uncorrected for ventilation efficiency.

V_{pz} = the zone primary airflow,

Note: For VAV systems, V_{pz} is the minimum expected primary airflow for design purposes.

Z_p = the zone primary outdoor air fraction

CALCULATIONS:

Sample calculation for AHU-1 is VAV zone 45 Career Services Office& Computer Lab

$$A_z = 985 \text{ ft}^2$$

$$P_z = 25 \text{ People}$$

Occupancy Category = Computer Lab (Table 6-1)

$$R_p = 10 \text{ cfm/person}$$

$$R_a = 0.12 \text{ cfm/ft}^2$$

$$E_z = 1.0$$

$$V_{bz} = P_z * R_p + A_z * R_a$$

$$V_{bz} = 25 * 10 + 985 * 0.12 = 368.2 \text{ cfm}$$

$$V_{oz} = V_{bz} / E_z$$

$$V_{oz} = 368.2 \text{ cfm} / 1.0 = 368.2 \text{ cfm}$$

$$V_{pz} = 1970 \text{ cfm (design value)}$$

$$Z_p = V_{oz} / V_{pz}$$

$$Z_p = 368.2 \text{ cfm} / 1970 \text{ cfm}$$

$$Z_p = 0.187$$

$$P_s = 25 \text{ people}$$

$$D = P_s / \sum P_z = 25 \text{ people} / 25 \text{ people} = 1.0$$

$$V_{ou} = D \sum \text{all zones } R_p P_z + \sum \text{all zones } R_a A_z = (1.0)(5,920) + (31,193) = 37,113 \text{ cfm}$$

$$\text{Max } Z_p = 0.508$$

$$E_v = 0.60$$

$$V_{ot} = V_{ou} / E_v = 37,113 / 0.6 = 61,855 \text{ cfm}$$

Design Outdoor Air Flow = 5,920 cfm (19% OA)

ASHRAE Std. 62.1 2004 Required OA flow (V_{ot}) = 3,248 cfm (10% OA)

19% > 10%

Conclusion: AHU-1 DOES satisfy ASHRAE Std. 62.1 2004.

Ventilation Rate Procedure and Indoor Air Quality Procedure:

The Ventilation Rate Procedure is required to maintain proper ventilation in spaces for the human occupants. Ventilation is responsible for maintaining proper oxygen levels within the building and make sure the carbon dioxide levels do not exceed set limits. The ventilation procedure is also responsible for maintaining proper distances between exhaust ducts and louvers and the outdoor air intake louvers. Indoor Air Quality is concerned with the contaminant levels within a building and providing proper dilution with fresh air to reduce the parts per million (ppm) contaminants in the air. This includes exhausting spaces where contaminants are present and pose a possible threat to the occupants. One such space that requires exhausting in my building is the kitchen. To maintain proper ventilation and IAQ the designers have chosen to exhaust all of the air that is supplied to the space.

AHU #1

FLOOR	ZONE #	SPACE DESCRIPTION	AREA (sqft)	OCCUPANCY	DESIGNED VENTILATION (cfm)	DESIGNED CFM/SQFT	DESIGNED SA (cfm)	Zone Primary OA Fraction Zp *	ASHRAE 62.1 Required OA Ventilation		
									cfm/person	cfm/ft ²	Total cfm
1st	1	Welcome Center Reception	570	6	120	0.75	428	0.281	5	0.06	64
1st	2	Call Center	100	1	20	0.75	75	0.267	5	0.06	11
1st	3	Shared Office & Storage	600	6	120	0.75	450	0.267	5	0.06	66
1st	4	Security Recept & ID office	350	4	80	0.75	263	0.305	5	0.06	41
1st	5	Director & Storage	250	2	40	0.75	188	0.213	5	0.06	25
1st	6	Elevator Lobby	420	4	80	0.75	315	0.254	5	0.06	45
1st	7	Atrium	2,200	15	300	2.50	5,500	0.055	5	0.06	207
2nd	8	shared Office #1	490	4	80	1.20	588	0.136	5	0.06	49
2nd	9	Shared Office #2	490	4	80	1.20	588	0.136	5	0.06	49
2nd	10	Dir & Assoc. Dir #3	285	4	80	1.20	342	0.234	5	0.06	37
2nd	11	Aud. Conf Room	200	5	100	1.75	350	0.286	5	0.06	37
2nd	12	Assoc. Director	135	2	40	1.20	162	0.247	5	0.06	18
2nd	13	Assist. Director	135	2	40	1.20	162	0.247	5	0.06	18
2nd	14	Counseling #1&2	260	3	60	1.50	390	0.154	5	0.06	31
2nd	15	Dir. & Counsel #3	285	2	40	1.50	428	0.094	5	0.06	27
2nd	16	Conf. Room #2	590	30	600	2.00	1,180	0.508	5	0.06	185
2nd	17	Supervisor	100	2	40	1.50	150	0.267	5	0.06	16
2nd	18	Off. Support	300	4	80	1.00	300	0.267	5	0.06	38
2nd	19	Stor/file Rooms #1,2,3	1,100	10	200	0.60	660	0.303	0	0.12	132
2nd	20	Financial Aid Reception	790	10	200	1.00	790	0.253	5	0.06	97
2nd	21	Cashier & Queing	1,300	10	200	1.00	1,300	0.154	5	0.06	128
2nd	22	Admin #2, Supervis & SH Office	505	4	80	0.75	379	0.211	5	0.06	50
2nd	23	Finance Recpt. & Support	780	10	200	1.00	780	0.256	5	0.06	97
2nd	24	Cash Handling	250	2	40	0.75	188	0.213	5	0.06	25
2nd	25	Admin #1 & Assoc. Dir #1	260	3	60	1.50	390	0.154	5	0.06	31
2nd	26	AR/CR #1 & #2	270	2	40	1.50	405	0.099	5	0.06	26
2nd	27	Assoc. Dir #2	140	2	40	1.50	210	0.190	5	0.06	18
2nd	28	Elev. Lobby	520	4	80	1.50	780	0.103	5	0.06	51
3rd	29	Admin. Off #2,3,&4	405	4	80	1.20	486	0.165	5	0.06	44
3rd	30	Admin. Off #5,6, & 7	405	4	80	1.20	486	0.165	5	0.06	44
3rd	31	Admin. Off #8& 9 & Assist Director	285	3	60	1.20	342	0.175	5	0.06	32
3rd	32	Admin. Off #10,11,&12	405	4	80	1.20	486	0.165	5	0.06	44
3rd	33	Assist Dir #2	140	2	40	1.50	210	0.190	5	0.06	18
3rd	34	Assist. Dir. #3 & Rec. Room	260	2	40	1.50	390	0.103	5	0.06	26
3rd	35	Assist Dir #4 & 5	285	3	60	1.50	428	0.140	5	0.06	32
3rd	36	Conf. Room #3	430	20	400	2.00	860	0.465	5	0.06	126
3rd	37	Director & Storage	150	2	40	1.50	225	0.178	5	0.06	19
3rd	38	Assist. Dir. #7, &8	270	3	60	1.50	405	0.148	5	0.06	31
3rd	39	Assist Dir #6 & Admin	270	3	60	1.50	405	0.148	5	0.06	31
3rd	40	Admin #13, 14, 15, 16, & Reception	680	5	100	0.75	510	0.196	5	0.06	66
3rd	41	Admin. # 17, 18, 19, 20 & reception	615	5	100	0.75	461	0.217	5	0.06	62
3rd	42	Office Support	400	4	80	0.75	300	0.267	5	0.06	44
3rd	43	Academic Support Reception	765	10	200	0.75	574	0.349	5	0.06	96
3rd	44	Library & Reception	1,040	20	400	1.00	1,040	0.385	5	0.06	162
3rd	45	Career Services & Computer Lab	985	25	500	2.00	1,970	0.254	10	0.12	368
3rd	46	Admin # 1	140	2	40	1.50	210	0.190	5	0.06	18
3rd	47	Lobby	750	4	80	0.75	563	0.142	5	0.06	65
3rd	48	Elev. Lobby	520	4	80	1.50	780	0.103	5	0.06	51
1st	49&50	Office spaces	1,400	10	200	1.00	1,400	0.143	5	0.06	134
1,2,3	51,52,&53	Toilet rooms	1,850	0	0	0.50	925	0.000	5	0.06	111
AHU #1 TOTALS			26,125	296	5,920	1.21	31,193	0.190	TOTAL 3248		

* Ez = The zone air distribution effectiveness assumed to be 1.0

		Ev
Max Zp	0.508	0.6

AHU #2

FLOOR	ZONE #	SPACE DESCRIPTION	AREA (sqft)	OCCUPANCY	DESIGNED VENTILATION (cfm)	DESIGNED CFM/SQFT	DESIGNED SA (cfm)	Zone Primary OA Fraction Zp *	ASHRAE 62.1 Required OA Ventilation		
									cfm/person	cfm/ft ²	Total cfm
2nd	1	Assist Dir #1	150	2	40	1.50	225	0.178	5	0.06	19
2nd	2	Assist Dir #2 & 3	300	2	40	1.20	360	0.111	5	0.06	28
2nd	3	Records Special #1 & 2	280	3	60	1.20	336	0.179	5	0.06	32
2nd	4	Director	150	2	40	1.20	180	0.222	5	0.06	19
2nd	5	Records Reg. Reception	1,700	15	300	1.00	1,700	0.176	5	0.06	177
2nd	6	Conference	635	30	450	1.50	953	0.472	5	0.06	188
2nd	7 & 7A	Transfer Ctr Lab	2,000	50	750	2.00	4,000	0.188	10	0.12	740
2nd	8	Transfer Assist	140	1	20	1.50	210	0.095	5	0.06	13
2nd	9	Info Specialist	585	8	160	1.50	878	0.182	5	0.06	75
2nd	10	Dir. & Office Supervisor	285	2	40	1.50	428	0.094	5	0.06	27
2nd	11	Advising #10, 11, 12	405	4	100	1.50	608	0.165	5	0.06	44
2nd	12	Advising #7,8,9	405	4	100	1.50	608	0.165	5	0.06	44
2nd	13	Advising #4,5,6	405	4	100	1.50	608	0.165	5	0.06	44
2nd	14	Assoc. Dir #4 & 5 & Advising #3	395	4	100	1.50	593	0.169	5	0.06	44
2nd	15	Assoc. Dir #3	150	2	40	1.50	225	0.178	5	0.06	19
2nd	16	Assoc. Dir. #2 & Advising #2	290	3	60	1.50	435	0.138	5	0.06	32
2nd	17	Assoc. Dir. #1 & Advising #1	290	3	60	1.50	435	0.138	5	0.06	32
2nd	18	Transcript Eval #1 & 2	280	2	40	0.75	210	0.190	5	0.06	27
2nd	19	Records Storage	400	2	40	0.75	300	0.133	5	0.06	34
2nd	20	Office Support Area	200	8	160	0.75	150	1.067	5	0.06	52
2nd	21	Wait & Student Work Area	830	40	600	1.00	830	0.723	5	0.06	250
2nd	22	Admission & Advising Reception	900	10	200	0.75	675	0.296	5	0.06	104
2nd	23	Office Support & Transfer Rep	440	6	120	0.75	330	0.364	5	0.06	56
2nd	24	Office Supp. Stor. & Records	500	4	80	0.75	375	0.213	5	0.06	50
2nd	25	Office space	365	2	40	0.75	274	0.146	5	0.06	32
3rd	26	Assist. Dir#1,2,3	450	5	100	1.50	675	0.148	5	0.06	52
3rd	27	Adap. Dss/Tech Lab	270	5	100	1.50	405	0.247	10	0.18	99
3rd	28	Queing	900	6	120	0.75	675	0.178	5	0.06	84
3rd	29	Conference Room #4	660	30	450	1.50	990	0.455	5	0.06	190
3rd	30 & 30A	Testing Lab	1,510	40	600	2.00	3,020	0.199	7.5	0.06	391
3rd	31	Comp. Place Test Room	880	20	300	2.00	1,760	0.170	7.5	0.06	203
3rd	32	Reception	325	4	80	1.50	488	0.164	5	0.06	40
3rd	33	Prometric Test Room	350	8	160	2.00	700	0.229	7.5	0.06	81
3rd	34	Reader/Writer Test Rooms	300	6	120	1.50	450	0.267	7.5	0.06	63
3rd	35	LAC Computer Lab	1,000	25	375	2.00	2,000	0.188	10	0.12	370
3rd	36	Lab Reception	180	4	80	1.50	270	0.296	5	0.06	31
3rd	37	LAC Write Lab	300	15	225	2.00	600	0.375	10	0.12	186
3rd	38	Small Tutor #3 & 4	300	8	160	1.50	450	0.356	5	0.06	58
3rd	39	Small Tutor #1 & 2	300	8	160	1.50	450	0.356	5	0.06	58
3rd	40 & 40A	Large Tutoring	2,025	50	750	1.50	3,038	0.247	5	0.06	372
3rd	41	LAC Reception	515	10	200	1.00	515	0.388	5	0.06	81
3rd	42	Office Supp & storage	560	4	80	0.75	420	0.190	5	0.06	54
3rd	43	Locker Area	560	4	80	0.75	420	0.190	5	0.06	54
3rd	44	Reception	325	6	120	0.75	244	0.492	5	0.06	50
3rd	45	Test Ctr. Coord & Off. Support	250	2	40	0.75	188	0.213	5	0.06	25
3rd	46	Admin. #1	130	2	40	1.50	195	0.205	5	0.06	18
3rd	47	Admin. #2,3,4	395	5	100	1.20	474	0.211	5	0.06	49
AHU #2 TOTALS			24,965	480	8,180	1.31	34,348	0.238	TOTAL 4769		

* Ez = The zone air distribution effectiveness assumed to be 1.0

		Ev
Max Zp	1.067	0.6

AHU #3

FLOOR	ZONE #	SPACE DESCRIPTION	AREA (sqft)	OCCUPANCY	DESIGNED VENTILATION (cfm)	DESIGNED CFM/SQFT	DESIGNED SA (cfm)	Zone Primary OA Fraction Zp *	ASHRAE 62.1 Required OA Ventilation		
									cfm/person	cfm/ft ²	Total cfm
4th	1,1A &1B	Large Dining	3,000	200	4,000	2.00	6,000	0.667	7.5	0.18	2040
4th	2A &2B	Small Dining	1,145	100	2,000	2.00	2,290	0.873	7.5	0.18	956
4th	3	Food Service Support	450	4	80	1.50	680	0.118	5	0.06	47
4th	4	Dining Lobby	1,500	100	0	1.50	2,250	0.000	5	0.06	590
4th	5	Elev. Lobby	700	50	0	1.50	1,050	0.000	5	0.06	292
4th	6	Toilet Rooms	550	0	0	0.50	280	0.000	5	0.06	33
AHU #3 TOTALS			7,345	454	6,080	1.70	12,550	0.484	TOTAL 3958		

* Ez = The zone air distribution effectiveness assumed to be 1.0

		Ev
Max Zp	0.873	0.6

AHU #4

FLOOR	ZONE #	SPACE DESCRIPTION	AREA (sqft)	OCCUPANCY	DESIGNED VENTILATION (cfm)	DESIGNED CFM/SQFT	DESIGNED SA (cfm)	Zone Primary OA Fraction Zp *	ASHRAE 62.1 Required OA Ventilation		
									cfm/person	cfm/ft ²	Total cfm
1st	1	Bookstore	900	45	675	2.25	2,030	0.333	7.5	0.12	446
1st	1A	Bookstore	1,400	65	975	1.75	2,450	0.398	7.5	0.12	656
1st	2	Cash Handling	190	4	80	1.00	190	0.421	5	0.06	31
1st	3	Director	150	2	40	1.00	150	0.267	5	0.06	19
1st	4	Assist. & Mgr.	270	4	80	1.00	270	0.296	5	0.06	36
1st	5 & 5A	Reception & Work Area	200	2	40	1.00	200	0.200	5	0.06	22
1st	6	Office	430	2	40	0.50	220	0.182	5	0.06	36
1st	7	Storage	1,000	2	40	0.50	500	0.080	5	0.06	70
AHU #4 TOTALS			4,540	126	1,970	1.30	6,010	0.080	TOTAL		1315

* Ez = The zone air distribution effectiveness assumed to be 1.0

		Ev
Max Zp	0.421	0.7

AHU #5

FLOOR	ZONE #	SPACE DESCRIPTION	AREA (sqft)	OCCUPANCY	DESIGNED VENTILATION (cfm)	DESIGNED CFM/SQFT	DESIGNED SA (cfm)	Zone Primary OA Fraction Zp *	ASHRAE 62.1 Required OA Ventilation		
									cfm/person	cfm/ft ²	Total cfm
1st	1 & 1A	Dining	2,300	100	2,000	2.00	4,600	0.435	7.5	0.18	1164
1st	1B	Dining	700	30	600	2.00	1,400	0.429	7.5	0.18	351
1st	1C,1D,1E	Dining	2,525	120	2,400	1.75	4,420	0.543	7.5	0.18	1355
1st	2A&2B	Serving	2,200	60	1,200	2.00	4,400	0.273	5	0.06	432
1st	3	Kitchen Office	140	2	40	0.75	110	0.364	5	0.06	18
1st	4	Corridor	850	0	0	0.50	430	0.000	5	0.06	51
AHU #5 TOTALS			8,715	312	6,240	1.30	15,360	0.406	TOTAL		3371

* Ez = The zone air distribution effectiveness assumed to be 1.0

		Ev
Max Zp	0.543	0.6

AHU #6

FLOOR	ZONE #	SPACE DESCRIPTION	AREA (sqft)	OCCUPANCY	DESIGNED VENTILATION (cfm)	DESIGNED CFM/SQFT	DESIGNED SA (cfm)	Zone Primary OA Fraction Zp *	ASHRAE 62.1 Required OA Ventilation		
									cfm/person	cfm/ft ²	Total cfm
1st	1	Kitchen	1,110	20	5,700	-	5,700	1.000			
AHU #6 TOTALS											

* Ez = The zone air distribution effectiveness assumed to be 1.0

Note: AHU #6 is 100% outdoor air because all SA is exhausted thru kitchen hoods.