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Peirce Hall, Kenyon College

Technical Report 1:

ASHRAE Standard 62.1 Ventilation and Standard 90.1 Energy Design Evaluation

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Executive Summary

Peirce Hall at Kenyon College, located in Gambier, Ohio underwent a major renovation that began in 2006. About half of the original structure was removed, the interior building systems with the exception of the structure were gutted and redesigned, and additions were constructed expanding the building to the South and East. The building primarily functions as a dining facility for students at the college. However there are also administrative offices, student organization and lounge spaces, a classroom, and computer lab. The multifunctional use of this facility leads to highly varying occupancies and space usage. The purpose of this report is to determine the compliance of the new Peirce Hall mechanical building systems with ASHRAE Standards 62.1 Section 5 and Standard 90.1 Sections 5 through 10.

The ventilation system designed for the new Peirce Hall uses seven air handlers, supplying a total of 77,100 CFM to spaces. The first four units are used for primary ventilation air flow and three additional units are used for make-up air to kitchens, the main servery area, and the loading dock. Ventilation rates determined by ASHRAE Standard 62.1 have been satisfied in almost all areas and in some places greatly over supplied by up to 1146.6%. One air handler has been found to be 14.3% under the required ventilation rate as a result of mainly storage spaces not being ventilated. Further details can be found in the Ventilation Rate Procedure Analysis, Table A.1, and Table A.2. All requirements related to ventilation equipment have been achieved.

Mechanical building systems comply with ASHRAE Standard 90.1 to an extent. Much of the building envelope requirements have been fulfilled, however the added glass roof over the link between dining area serveries created issues with compliance. Section 5 requires that only 5% of a buildings gross roof area be used as skylight. Since the roof is only pitched at a 15 degree angle from a horizontal plane, it is considered a skylight and the roof covers over 11% of the gross roof area. The over use of glazing on the roof may be able to be argued by the low solar heat gain factor associated with the glass used. The SHGC is less than half the required value. Efficiencies of mechanical system components are all acceptable except for that of the cooling tower. This noncompliance may be able to be attributed to the different testing conditions that the efficiency was determined at. Medium pressure steam is supplied to the building from the campus supply relieving the need for a boiler and limiting the service water heating equipment to only one electric hot water heater. This water heater however, is only capable of energy retention values that satisfy the 1989 version of Standard 90.1 Section 7.

Power distribution is design as efficiently as possible at the service entrance, with the required 2% voltage drop being satisfied. On the contrary branch voltage drop has not been specified resulting in noncompliance with Section 8. One goal of the renovation of Peirce Hall was to enhance The Great Hall which was already a signature space on the Kenyon College campus. In the design of the lighting system in this dining area and some others, grand chandeliers were hung from the high ceilings. These luminaires require large amounts of energy and were the reason for noncompliance with Section 9 lighting power densities allowances. Approximately half of the spaces in Peirce hall were compliant with required LPD values. Efficiencies of electric motors were designed to comply with the values provided in Section 10 of Standard 90.1.

Section 62.1 Section 5 Compliance

Section 5.1 Natural Ventilation

The use of natural ventilation systems is not applicable to Peirce Hall.

Section 5.2 Ventilation Air Distribution

The installed air handling systems have been equipped with various means to adjust air flow and retain the minimum ventilation requirements. A combination of variable volume and constant air flow systems are used in conjunction with volume dampers, fan powered terminal units, and variable air volume boxes.

Section 5.3 Exhaust Duct Locations

All exhaust ducts have been negatively pressurized to prevent leakage of potentially harmful contaminants and undesired air from entering occupied spaces. To accomplish this many of the exhaust fans are located on the roof, near to the discharge location of the air.

Section 5.4 Ventilation Controls

In order to control the building environment systems, a BACnet building automation system (BAS) has been installed. All control devices including fan motors can be remotely controlled manually or automatically by the BAS.

Section 5.5 Airstream Surfaces

Ductwork requirements as stated in specification Section 15890-Ductwork include appropriate types of duct for the desired application. Fabricate ductwork is to be from galvanized steel sheet and have a Zinc coating to prevent cracking and flaking.

Section 5.6 Outdoor Air Intakes

Air handlers utilize two design schemes for intake applications. Air handlers located on the lower level of Peirce hall use an underground intake shaft that surfaces at the rear façade. The intake is located away from easily accessed areas and hidden behind landscaping and greenery. The second method of intake used by air handlers located in attic space is via louvers in the façade away from exhaust fans. Installed louvers are storm proof and satisfy Class A by the AMCA Water Penetration Test. Louvers are equipped with ½", 0.063" diameter mesh screens that serve as bird and rodent screens.

Section 5.7 Local Capture of Contaminants

Few areas in Peirce hall produce harmful contaminants, but one of these sources is the chemical storage room located on the basement level. In a situation such as this, the room is negatively pressurized and exhaust is ducted directly to outside.

Section 5.8 Combustion Air

In kitchens and server areas with stoves and other fuel burning appliances, exhaust hoods are provided. Sufficient air is exhausted and made up to facilitate desired indoor air quality.

Section 5.9 Particulate Matter

To control particulate matter, all air handlers use ANSI/UL 900 listed, Class 1 or Class 2 filters and contain a 30% pre-filter and 65% cartridge filter.

Section 5.10 Dehumidification

Although humidity measuring devices are installed in air handling systems, relative humidity does not directly impact the control of air handlers with dehumidification capabilities. No desiccant materials are used, but dehumidification can be achieved by means of sub cooling.

Section 5.11 Drain Pans

Drain pans have been installed under each cooling coil and have been sized to collect the maximum amount of condensate by spanning the whole length of the coil. Pan size requirement option b. of Section 5.11.4, Pan Size has been satisfied by outdoor conditions being dry enough to not produce overwhelming condensate. Pan slope has not been specified; however details have been noted to "Pitch for proper drainage." A negative pressure will be created inside the air handler at the drain pain, hence a p-trap has been specified.

Section 5.12 Finned-Tube Coils & Heat Exchangers

All coils are capable of being easily removed from air handlers to allow for maintenance or modifications.

Section 5.13 Humidifiers and Water Sprayed Systems

One small humidifier is located on the second floor, supplying only one space. This humidifier is supplied by proper quality water and is free of obstructions in distribution.

Section 5.14 Access for Inspection, Cleaning, and Maintenance

Access doors and panels are specified to be located in ducts and equipment to make inspection, cleaning, and maintenance as easy as possible. Sufficient working space inside of the access doors and panels has been granted for required procedures.

Section 5.15 Building Envelope and Interior Surfaces

Peirce Hall is to be an air tight and water tight structure. As such air and vapor barriers can be found in all exterior wall, roof and foundation construction types. Joint sealers and weather stripping types are all required by specified Section 07900-Joint Sealers. All additional requirements of this section are fulfilled and insulation details are further analyzed in Section 90.1.

Section 5.16 Buildings with Attached Parking Garages

This section is not applicable, as Peirce Hall has no attached parking garage.

Section 5.17 Air Classification and Recirculation

All areas of Peirce Hall have been given air classifications as provided by Section 62.1 Table 6-1, Minimum Ventilation Rates in Breathing Zone and Table 6-4 Exhaust Rates. Areas served by air handlers with economizer cycling only recirculate air of the acceptable designated or re-designated class. Classifications for spaces can be found in Table A.1.

Section 5.18 Requirements for Buildings Containing ETS Areas and ETS-Free Areas.

Smoking is not permitted in Peirce Hall.

Ventilation Rate Procedure Analysis

For the process of analyzing Peirce Hall's ventilation systems, all air handling units were considered. Smaller air conditioning units were neglected since they supplied less than 3% of the total ventilation air required by the building.

All ventilation requirements were successfully met by the minimum ventilation provided by the installed air handling units except for one. Values and percent differences in required and provided ventilation rates can be observed in Table A.2, Air Handler Characteristics. Approximately half of the air handlers provide within 30% of the required ventilation. The reason for AHU-3 not meeting the minimum ventilation requirement is some spaces that require ventilation by Standard 62.1 were not ventilated. These areas include mostly storage space which does not seem to be an area where ventilation would be critical. The most significant reason for discrepancies in required and provided air flows is related to exhaust make-up and occupancy densities in the kitchens, food preparation, and clean-up areas.

In areas where exhaust is required such as kitchens, make-up ventilation rates and occupant densities are not specified by ASHRAE Standard 62.1. As a result of this ventilation rates for kitchens and areas following similar circumstances are assumed to be the same as the area based exhaust rate of 0.7 CFM per square foot, regardless of the need to negatively pressurize the zone. Since the primary function of Peirce Hall is as a dining hall, a large kitchen staff should be anticipated. In the design of the hall's ventilation system, an occupant density of 20 people per 1,000 square feet and ventilation requirement of 20 CFM per person was used. This was the main factor in calculating differing ventilation rates of up to 1146.6% in these areas.

ASHRAE 90.1 Compliance

Section 5, Building Envelope

Section 5.1 General

All envelope elements are subject to the Gambier, Ohio climate zone 5A requirements. Each space qualifies for nonresidential conditioned space and no space will be designed under semiheated or unconditioned requirements. Alterations in fenestration of the original Peirce hall satisfy current standard requirements of improved performance with the use of insulated glass.

Section 5.2 Compliance Paths

Peirce Hall does not comply with Section 5, Building Envelope. The amount of fenestration in the façade is acceptable, but the percentage of skylight glazing is too large resulting in failure of option a. By failing to fully comply with Section 5.4, the second option specified by Section 5.6, Building envelope Trade-Off Option cannot be satisfied.

Section 5.3 Simplified Building (Not Used)

Section 5.4 Mandatory Provisions

A variety of sealants are used to weatherproof Peirce Hall. Specification section 07900-Joint Sealers states the intent to maintain long term [20 year minimum] air tight and water tight seals. Polyurethane, silicone, and acrylic latex sealers are three materials commonly used. Loop type vinyl weather stripping astragal and rubber weatherstripping around the perimeter of the loading dock coiling door has been specified to cover this vulnerable area. However, vestibules are absent at building entrances resulting in failure to comply with section 5.4.

Section 5.5 Prescriptive Building Envelope Option

Envelope assembly thermal characteristics, as displayed in Figure 1 are all acceptable except for the quality of the roof insulation. The percentage of fenestration in the façade of Peirce Hall is acceptable at 23%. However, the 12% skylight to gross roof percentage exceeds the acceptable value of 5%.

90.1 Building Envelope Requirements and Values						
Surface	U-Value (Btu/H-Ft^2-°F)		R-Value		SHGC	
	Required	Actual	Required	Actual	Required	Actual
Roof	0.065	0.068	19	15		
Exterior Wall	0.113	0.085	11.4	11.81		
Sub-Grade Walls	C-0.119	C-0.092	7.5	10		
Slab-On-Grade	F-1.020	F-0.55	7.5	10		
Window	0.55	0.900			0.4	0.38
Skylight	0.69	0.520			0.39	0.18

Figure 1. 90.1 Building Envelope Requirements and Values

Section 5.6 Building Envelope Trade-Off Option

By failing to comply with Section 5.4, Section 5.6 is not applicable.

Section 5.7 Submittals

Information on space design conditions were presented to the authority having jurisdiction via a Basis of Design rather than a formal submittal format.

Section 5.8 Product Information and Installation Requirements

All insulation requirements have been satisfied except for noting the R-value in some instances. However, these values can be easily calculated with the specified product characteristics and corresponding material data. Although SHGC, VLT, and U-values for glazing types are provided window assembly U-values have not been specified. U-values for doors also have not been defined. All installation requirements for building components can be found in the respected specification area.

Section 5 Discussion

Section 5 clearly worked against the design intent of Peirce Hall. One of the most notable design features is the large class skylight covering the link between serveries. Using so much glass gave some lightness and a more modern feel to the stone gothic architectural design. The skylight accounts for over 11% of the total roof area, alone rendering the building noncompliant with Section 5. However this should be disputable as the quality of glass used in the skylight has less than half the solar heat gain coefficient required and satisfies all U-value restrictions.

Another issue in the design of the Peirce Hall addition that causes problems with building envelope compliance is the lack of vestibule use at main entrances. A vestibule could have easily been constructed at any of the addition's main entrances, and would not have produced any unsightly side effects. Although the entrance to the building that is most often used is located in the existing portion of the structure, use of vestibules at the rear entrances would have benefitted the building significantly.

Section 6, Heating, Ventilating, and Air Conditioning

Section 6.1 General

All mechanical equipment of the original Peirce Hall was gutted and replaced with the current system. Therefore, all systems must comply with new equipment standards.

Section 6.2 Compliance Paths

Due to noncompliant areas in Section 6.4 and 6.5, the project does not fully comply with Section 6 of ASHRAE Standard 90.1.

Section 6.3 Simplified Approach Option for HVAC Systems

Peirce Hall does not comply with requirements for use of the simplified approach.

Section 6.4 Mandatory Provisions

Equipment Efficiencies

The designed heating and cooling systems for Peirce Hall were completed in 2005, leading to the requirement of some exceptions. The air conditioner condensing unit's efficiencies satisfy the standard values prior to 2006. However, in comparison to the updated standards the efficiencies are noncompliant. The cooling tower flow rate per motor horsepower was slightly lower than what is required making this noncompliant, but the chiller performance exceeds the required COP. No boilers are required since all major heating loads are provided by the campus steam system. Compared required and actual values are as listed in Figure 2.

90.1 HVAC Minimum Equipment Efficiencies			
Equipment	Efficiency		Compliancy
	Required	Actual	
Chiller	[COP]		
	4.9	5.1	Yes
Cooling Tower	[gpm/hp]		
	38.2	36.15	No
ACCU	[SEER]		
1	10	11.3	Yes
2	10	11.5	Yes
3	10	11.5	Yes
4	10	10.6	Yes
5	10	11.3	Yes
6	10	11.5	Yes

Figure 2. 90.1 HVAC Minimum Equipment Efficiencies

Controls

Each space in the hall with variable supply air volume capabilities contains a resistance temperature device or thermistor. Where there is not, alternate means of temperature sensing is provided such as differential supply and return air temperatures, duct sensors, and immersion sensors. All devices related to control logic and HVAC equipment control conforms to a standard BACnet Device profile as specified by ASHRAE/ANSI 135-2001. In addition, a building automation system controls scheduling of units to maximize energy savings by implementing features like night setback, optimum start controls, and temperature range dead band of 5°F.

Elevator and stair shafts are not ventilated or exhausted to be equipped with motorized dampers. On the contrary, main exhaust and supply entrances and exits utilize motorized dampers with the capability to withstand four times the differential pressure required. Additional requirements for ventilation and capacity controls have been satisfied.

Duct and Pipe Insulation

All ductwork is insulated with the exception of a few locations such as return ducts with air-conditioned spaces above and below them. Duct insulation is never less than R-4, satisfying R-3.5 requirements and in areas requiring additional insulation such as outdoors where a value of R-6 is required by the standard, a minimum of R-9 is specified. All applied pipe insulation thicknesses comply with this section's requirements. A summary of these values can be found in Figure 3 below.

Minimum Pipe Insulation			
Temperature Range	Pipe Size [in]	Insulation Thickness	
		Required	Actual
40-100	≤4	1	1
	>4	1	1.5
100-250	2	2	1.5
	2.5-4	2	2
	4-5	2	2.5
	>6	2	3.5
251-340	≤1	1.5	2
	1.25-4	3	3
	>4	3	3.5

Figure 3. Minimum Pipe Insulation

Section 6.5 Prescriptive Path

Air Systems

Each air handler with cooling capability is equipped with the necessary components for proper economizer cycling. Air enthalpy condition is used to control cycling, while motorized dampers at air intake and exhaust louvers control air flow. Only one air handler supplies over 70% ventilation air and no additional provisions are taken to recover energy other than through the economizer cycle.
There is no use of reheating or re-cooling of air or water in any system. Most fans are powered by reasonably sized motors, but a few are slightly over the limit set by Section 6.5.3.1.2. Motor Nameplate

Horsepower as shown in Figure 4. Variable frequency drives are not installed in two motors with power of over 10 hp.

Kitchen equipment that requires an exhaust hood have properly sized hoods, exhaust the required amount of air, and are sufficient compensated for with make-up air.

Maximum Allowable Name Plate Horsepower				
AHU	CFM	Flow Control	HP	Allowable Name Plate HP
1	8000	Constant	15	8.8
2	11300	Constant	15	12.43
3	6800	VFD	10	10.2
4	30000	VFD	40	45
5	6850	VFD	10	10.275
6	10500	VFD	15	15.75
7	3680	Constant	2	4.048

Figure 4. Maximum Allowable Name Plate Horsepower

Hydronic Systems

The Bacnet control system allows capacities of primary components of the hydronic system to be controlled and optimized by the building automated system. Pumps with power over 10 HP are all equipped with variable frequency drives to maximize energy savings. Motorized control valves and variable frequency drives control the flow of chilled, heated, and condensed water through the components of Peirce Hall's hydronic systems. The installed cooling tower's efficiency is considered inadequate by Table 6.8.1G Performance Requirements for Heat Rejection Equipment.

Section 6.6 Compliance Path (Not Used)

Section 6.7 Submittals

Submittals including operating instructions, maintenance manuals, parts lists, performance, balance , and acceptance tests results have all be required by mechanical specification Section 15010-General Provisions, Mechanical.

Section 6 Discussion

Mechanical system performance in Peirce Hall satisfies most of the requirements required by Section 6. Utilizing steam to directly feed air handling unit heating coils and create hot water for use in radiant flooring and fin tube systems replaced the need for a boiler. This made one less efficiency restriction applicable. A part of the system that could not be considered satisfactory was the efficiency of the cooling tower. The required performance of the cooling tower is about 2 gallons per minute per horsepower greater than the performance delivered. The environment used to measure the performance characteristics of the installed cooling tower had a wet bulb temperature that was 3 degrees Fahrenheit lower than the test conditions used to assemble the standard. This difference in operating environment

could have been the cause of this lack in performance capability, by requiring greater air flow to produce the same temperature range.

The allowable nameplate horsepower of air handlers 1 and 2 were under the installed motor capabilities. This resulted in the noncompliance of Section 6.5. To remedy this for the motor with AHU-2, a variable frequency drive can be incorporated with the motors. This is reasonable since is motor is over 10 horsepower, and in doing so the name plate horsepower of the motor becomes 16.95; almost two horsepower greater than what is installed. The allowable motor nameplate horsepower on AHU-1 would increase to 12 by using the same method. The installed motor power would still be over by 3 hp, making this motor seem oversized to produce 3,000 CFM less than AHU-2.

Section 7, Service Water Heating

Service water for Peirce Hall is heated by means of one two steam semi-instantaneous water heaters and an electric storage water heater. Table 7.8 does not list minimum performance requirements for steam supplied water heaters. Hence, by 7.4.2 there is not required minimum efficiency for these units. The single electric water heater is noted to have sufficient thermal resistance to satisfy the 1989 version of Standard 90.1 requirements. However, the resilience of the insulation is not enough to comply with the 2007 version.

Section 8, Power

Section 8 tries to limit the amount of energy lost in the distribution of power throughout buildings. Voltage drop is limited to 2% of the design load in feeders and 3% of the design load in branch circuits. Peirce Hall's electrical system was designed to limit feeder voltage drop to less than 2%, however a branch circuit voltage drop was not specified resulting in a failure to comply with Section 8.

Section 9, Lighting

To determine Peirce Hall's compliance to Section 9, Lighting the Space-by-Space method was used. The results of this can be found in Table A.3 that shows compliant and noncompliant space lighting density values. Approximately half of the interior spaces of the hall comply with the lighting power density limits provided by Section 9. The majority of noncompliant spaces are restrooms, changing rooms, and dining areas. In the case of restrooms, producing uniform light at the required intensity across the entire floor area is near impossible without excess fixtures. For the appeal of the dining areas, as some of the signature spaces on the Kenyon College campus, some extravagant chandeliers and fixtures were used. These luminaires consumed up to 1500 watts which led these spaces to certain incompliance. Exterior lighting is minimal and uses far less power than the standard requires.

Section 10, Other Equipment

Efficiencies of motors used in mechanical building systems have all been specified in specification section 15170-Motors and Motor Controllers. Figure 5 shows the specified values that define motor characteristics. This table is identical to the table in Standard 90.1 Section 10, hence confirming compliance.

Motor Efficiencies						
Number of Poles	ODP			TEFC		
Motor HP	3600	1800	1200	1200	1800	3600
1	X	82.5	80	80	82.5	75.5
1.5	82.5	84	84	85.5	84	82.5
2	84	84	85.5	86.5	84	84
3	84	86.5	86.5	87.5	87.5	85.5
5	85.5	87.5	87.5	87.5	87.5	87.5
7.5	87.5	88.5	88.5	89.5	89.5	88.5
10	88.5	89.5	90.2	89.5	89.5	89.5
15	89.5	91	90.2	90.2	91	90.2
20	90.2	91	91	90.2	91	90.2
25	91	91.7	91.7	91.7	92.4	91
30	91	92.4	92.4	91.7	92.4	91
40	91.7	93	93	93	93	91.7

Figure 5. Motor Efficiencies

Appendix

A.1 Space Information

(Table located on the following pages)

Space and System Information									
Level	Room Name	Room No.	Area (ft^2)	Use	Occupancy Category	Outdoor Air Rate		Occupancy Density [#/1000 ft^2]	Combined Outdoor Air Rate [cfm/person]
						R_p [cfm/person]	R_a [cfm/ft^2]		
B	WATER/FIRE PUMP ROOM	B01	400	Mechanical room (equipment)	Electrical equipment room		0.06		
B	SWITCH GEAR ROOM	B02	160	Mechanical room (electrical)	Electrical equipment room		0.06		
B	TRASH ROOM	B03	250	Temporary garbage storage	Trash room				
B	LOADING DOCK	B04	769	Loading area	Shipping/receiving		0.12		
B	CATERING STORAGE	B04B	181	Storage (general)	Storage room		0.12		
B	W.I.C.	B05	65	Storage (general)	Storage room		0.12		
B	CHEMICAL STORAGE	B06	66	Storage (hazardous)	Storage room, chemical				
B	CAN WASH	B07	161	Washing room	Kitchen-Commercial				
B	ELEV. MACH.	B08	76	Mechanical room (elevator)	Elevator machine room		0.12		
B	STAIR 4	B09	168	Circulation	Corridor		0.06		
M	STORAGE	M01	247	Storage (general)	Storage room		0.12		
M	STAIR 4	M02	168	Circulation	Corridor		0.06		
L	MEMORIAL STAIR TOWER	L01	319	Circulation	Corridor		0.06		
L	LOWER LOBBY	L02	248	Gathering/circulation	Lobby/prefunction	7.5	0.06	30	10
L	PUB	L03	4001	Gathering/bar	Bar, cocktail lounge	7.5	0.18	100	9
L	CORRIDOR	L04	151	Circulation	Corridor		0.06		
L	ELEV. MACH.	L05	57	Mechanical room (elevator)	Elevator machine room		0.12		
L	MECHANICAL ROOM	L06	342	Mechanical room (equipment)	Electrical equipment room		0.06		
L	DATA	L07	108	Mechanical room (electrical)	Electrical equipment room		0.06		
L	STAIR 2	L08	216	Circulation	Corridor		0.06		
L	COMPUTER LAB	L09	1072	Computer Lab	Computer (not printing)	5	0.06	4	20
L	PRINTER	L10	48	Student printing	Copy, printing room				
L	A/V ROOM	L12	150	Mechanical room (electrical)	Electrical equipment room		0.06		
L	CORRIDOR	L13	320	Circulation	Corridor		0.06		
L	MECHANICAL ROOM	L14	590	Mechanical room (equipment)	Electrical equipment room		0.06		
L	LOWER DINING LOBBY	L15	1702	Gathering/circulation	Lobby/prefunction	7.5	0.06	30	10
L	STAIR 3	L16	155	Circulation	Corridor		0.06		
L	VESTIBULE	L17	58	Seperation of restrooms	Corridor		0.06		
L	MENS ROOM	L18	250	Restroom	Toilets-public				
L	UNISEX	L19	74	Restroom	Toilets-private				
L	WOMENS ROOM	L20	309	Restroom	Toilets-public				
L	ALTERNATE DINING A	L21	902	Gathering/dining	Cafeteria/fast-food dining	7.5	0.18	100	9
L	LOWER DINING	L22	2773	Gathering/dining	Cafeteria/fast-food dining	7.5	0.18	100	9
L	ALTERNATE DINING B	L23	258	Gathering/dining	Cafeteria/fast-food dining	7.5	0.18	100	9
L	ALTERNATE DINING C	L24	369	Gathering/dining	Cafeteria/fast-food dining	7.5	0.18	100	9
L	ALTERNATE DINING D	L25	241	Gathering/dining	Cafeteria/fast-food dining	7.5	0.18	100	9
L	BEVERAGE SERVICE	L26	123	Drink distribution	Coffee station	5	0.06	20	11
L	TRAY RACKS	L27	79	Storage (general)	Storage room		0.12		
L	JANITOR CLOSET	L27B	29	Storage (janitor)	Janitor closet				
L	SODA CLOSET	L28	108	Storage (general)	Storage room		0.12		
L	MECHANICAL ROOM	L29	1516	Mechanical room (equipment)	Electrical equipment room		0.06		
L	ELECTRICAL CLOSET	L29B	36	Mechanical room (electrical)	Electrical equipment room		0.06		
L	ELEV. MACH.	L30	63	Mechanical room (elevator)	Elevator machine room		0.12		

L	CORRIDOR	L31	451	Circulation	Corridor		0.06		
L	ADMIN OFFICE	L32	598	Administrative office	Office Space	5	0.06	5	17
L	OFFICE	L33	151	Administrative office	Office Space	5	0.06	5	17
L	PUB SUPPORT	L34	350	Food preperation	Kitchen-Commercial				
L	CORRIDOR	L35	855	Circulation	Corridor		0.06		
L	ELECTRICAL CLOSET	L36	142	Mechanical room (electrical)	Electrical equipment room		0.06		
L	DATA	L37	44	Mechanical room (electrical)	Electrical equipment room		0.06		
L	VESTIBULE	L38	56	Seperation of restrooms	Corridor		0.06		
L	WOMENS ROOM	L39	43	Restroom	Toilets-private				
L	WOMENS LOCKER	L40	307	Changing room	Locker/dressing rooms				
L	VESTIBULE	L41	57	Seperation of restrooms	Corridor		0.06		
L	MENS LOCKER	L42	265	Changing room	Locker/dressing rooms				
L	MENS ROOM	L43	43	Restroom	Toilets-private				
L	JANITOR CLOSET	L44	33	Storage (janitor)	Janitor closet				
L	CATERING STORAGE	L45	265	Storage (general)	Storage room		0.12		
L	ROUGH PREP/CATERING	L46	899	Kitchen/food preperation	Kitchen-Commercial				
L	W.I.C.	L47	109	Storage (general)	Storage room		0.12		
L	COOLER PREP	L48	212	Food preperation	Kitchenette				
L	DRY STORAGE	L49	246	Storage (general)	Storage room		0.12		
L	W.I.C.	L50	173	Storage (general)	Storage room		0.12		
L	W.I.F.	L51	157	Cold storage	Refrigerant machinery room				
L	W.I.C.	L52	97	Storage (general)	Storage room		0.12		
L	W.I.F.	L53	93	Cold storage	Refrigerant machinery room				
L	DAIRY W.I.C.	L54	44	Cold storage	Refrigerant machinery room				
L	STAIR 4	L55	151	Circulation	Corridor		0.06		
1	MEMORIAL STAIR TOWER	101	310	Circulation	Corridor		0.06		
1	LOBBY	102	459	Gathering/circulation	Lobby/prefunction	7.5	0.06	30	10
1	GREAT HALL	103	4148	Gathering/dining	Cafeteria/fast-food dining	7.5	0.18	100	9
1	VESTIBULE	105	66	Seperation of restrooms	Corridor		0.06		
1	MENS ROOM	106	184	Restroom	Toilets-public				
1	WOMENS ROOM	107	205	Restroom	Toilets-public				
1	STAIR 2	108	162	Circulation	Corridor		0.06		
1	PEIRCE LOUNGE	109	1116	Gathering/dining	Cafeteria/fast-food dining	7.5	0.18	100	9
1	LOGGIA	110	183	Circulation	Corridor		0.06		
1	BUFFET SERVERY	111	120	Food distribution	Kitchenette				
1	COAT ROOM	112	326	Storage (general)	Storage room		0.12		
1	SERVERY LINK	113	3777	Circulation/gathering	Break Room	5	0.06	25	10
1	DINING HALL	114	4658	Gathering/dining	Cafeteria/fast-food dining	7.5	0.18	100	9
1	DISH ROOM	115	802	Washing room	Kitchen-Commercial				
1	STAIR 3	116	344	Circulation	Corridor		0.06		
1	A/V CLOSET	116B	35	Storage (general)	Storage room		0.12		
1	SERVERY	117	5002	Food distribution	Cafeteria/fast-food dining	7.5	0.18	10	9
1	STAIR 4	118	176	Circulation	Corridor		0.06		
1	DRY STORAGE	119	93	Storage (general)	Storage room		0.12		
1	W.I.C.	120	92	Storage (general)	Storage room		0.12		
1	W.I.F.	121	92	Cold storage	Refrigerant machinery room				
1	POT WASH	122	137	Washing room	Kitchen-Commercial				

1	CLOSET	122B	19	Storage (general)	Storage room		0.12		
1	UNISEX	123	57	Restroom	Toilets-private				
1	JANITOR CLOSET	124	40	Storage (janitor)	Janitor closet				
1	OFFICE	125	117	Administrative office	Office Space	5	0.06	5	17
2	STAIR 1	201	314	Circulation	Corridor		0.06		
2	LOBBY	202	231	Gathering/circulation	Lobby/prefunction	7.5	0.06	30	10
2	BALCONY	203	30	View point	Corridor		0.06		
2	CORRIDOR	204	218	Circulation	Corridor		0.06		
2	ELECTRICAL CLOSET	205	15	Mechanical room (electrical)	Electrical equipment room		0.06		
2	UNISEX	206	71	Restroom	Toilets-private				
2	STUDENT ORG. LOUNGE	207	359	Gathering	Break Room	5	0.06	25	10
2	STAIR 2	208	156	Circulation	Corridor		0.06		
2	CLOSET	209	45	Storage (general)	Storage room		0.12		
2	BEMIS MUSIC ROOM	210	1079	Music Classroom	Music/theatre/dance	10	0.06	35	12
2	MECHANICAL CLOSET	211	34	Mechanical room (equipment)	Electrical equipment room		0.06		
2	MEETING ROOM	212	279	Conference/meeting	Conference/meeting	5	0.06	50	6
2	EXISTING ATTIC	213	1332	Mechanical room (equipment)	Electrical equipment room		0.06		
2	NEW ATTIC	214	1178	Mechanical room (equipment)	Electrical equipment room		0.06		
2	STAIR 4	215	279	Circulation	Corridor		0.06		
3	MEMORIAL STAIR TOWER	301	314	Circulation	Corridor		0.06		
3	LOBBY	302	70	Circulation	Corridor		0.06		
3	CORRIDOR	303	334	Circulation	Corridor		0.06		
3	OFFICE	304	321	Administrative office	Office Space	5	0.06	5	17
3	CLOSET	305	7	Storage (general)	Storage room		0.12		
3	UNISEX	306	72	Restroom	Toilets-private				
3	OFFICE	307	231	Administrative office	Office Space	5	0.06	5	17
3	STAIR 2	308	147	Circulation	Corridor		0.06		
3	JANITOR CLOSET	309	37	Storage (janitor)	Janitor closet				
3	OFFICE	310	217	Administrative office	Office Space	5	0.06	5	17
3	CLOSET	311	20	Storage (general)	Storage room		0.12		
3	OFFICE	312	197	Administrative office	Office Space	5	0.06	5	17
3	CLOSET	313	14	Storage (general)	Storage room		0.12		
3	OFFICE	314	231	Administrative office	Office Space	5	0.06	5	17
3	CLOSET	315	69	Storage (general)	Storage room		0.12		
3	CLOSET	316	22	Storage (general)	Storage room		0.12		
3	STAIR 5	318	40	Circulation	Corridor		0.06		

Space and System Information (continued)

Room No.	Exhaust Rate [cfm/unit]	Exhaust Rate [cfm/ft^2]	Air Class	Design Occupancy [people]	Required Exhaust [cfm]	V_{bz} OA Flow [cfm]	E_z Distribution Efficiency	V_{oz} Zone OA Flow [cfm]	Z_p	V_{pz} Actual Supply [cfm]	Actual Exhaust [cfm]	Actual Return [cfm]	Serving AHU	Serving EF
B01			1	0	0	24	1	24	0.020	1180	1080		7	15
B02			1	0	0	9.6	1	9.6	0.013	750	700		7	15
B03		1	3	0	250	250	0.8	312.5	0.406	770	890		7	15
B04			1	0	0	92.28	1	92.28	**0.094**	980			7	
B04B			1	0	0	21.72	1	21.72			100			15
B05			1	0	0	7.8	1	7.8						
B06		1.5	4	0	99	99	0.8	123.75			100			15
B07		0.7	2	0	112.7	112.7	0.8	140.875			575			15
B08			1	0	0	9.12	1	9.12						
B09			1	0	0	10.08	1	10.08						
M01			1	0	0	29.64	1	29.64						
M02			1	0	0	10.08	1	10.08						
L01			1	0	0	19.14	1	19.14						
L02			1	7.44	0	70.68	1	70.68	**0.707**	100			3	
L03			2	400.1	0	3720.93	1	3720.93	**1.034**	3600		3500	2	2
L04			1	0	0	9.06	1	9.06						
L05			1	0	0	6.84	1	6.84						
L06			1	0	0	20.52	1	20.52						
L07			1	0	0	6.48	1	6.48						
L08			1	0	0	12.96	1	12.96						
L09			1	4.288	0	85.76	1	85.76	0.055	1560		1400	3	3
L10		0.5	2	0	24	24	0.8	30						
L12			1	0	0	9	1	9						
L13			1	0	0	19.2	0.8	24	0.240	100		200	3	3
L14			1	0	0	35.4	1	35.4						
L15			1	51.06	0	485.07	1	485.07	0.426	1140			4	4
L16			1	0	0	9.3	1	9.3						
L17			1	0	0	3.48	1	3.48	0.004	900			4	
L18	70		2	0	490	490	0.8	612.5	1.361	450	525		4	9
L19	50		2	0	50	50	0.8	62.5			150			9
L20	70		2	0	490	490	0.8	612.5	1.361	450	525		4	9
L21			2	90.2	0	838.86	1	838.86	**0.599**	1400			4	
L22			2	277.3	0	2578.89	1	2578.89	0.594	4340			4	
L23			2	25.8	0	239.94	1	239.94	0.381	630			4	
L24			2	36.9	0	343.17	1	343.17	0.343	1000			4	
L25			2	24.1	0	224.13	1	224.13	0.509	440			4	
L26			1	2.46	0	19.68	1	19.68			250			18
L27			1	0	0	9.48	1	9.48			125			18
L27B		1	3	0	29	29	0.8	36.25			50			18
L28			1	0	0	12.96	1	12.96			250			18
L29			1	0	0	90.96	1	90.96						
L29B			1	0	0	2.16	1	2.16						
L30			1	0	0	7.56	1	7.56						

L31			1	0	0	27.06	1	27.06						
L32			1	2.99	0	50.83	1	50.83	0.064	800			1	
L33			1	0.755	0	12.835	1	12.835	**0.064**	200			1	
L34		0.7	2	0	245	245	0.8	306.25	0.352	870			1, 5	5
L35			1	0	0	51.3	1	51.3						
L36			1	0	0	8.52	1	8.52						
L37			1	0	0	2.64	1	2.64						
L38			1	0	0	3.36	1	3.36						
L39	50		2	0	50	50	0.8	62.5			100			10
L40		0.25	2	0	76.75	76.75	0.8	95.9375			300			10
L41			1	0	0	3.42	1	3.42						
L42		0.25	2	0	66.25	66.25	0.8	82.8125			300			10
L43	50		2	0	50	50	0.8	62.5			100			10
L44		1	3	0	33	33	0.8	41.25			50			10
L45			1	0	0	31.8	1	31.8						
L46		0.7	2	0	629.3	629.3	0.8	786.625	0.105	7500			1, 5	24, 1
L47			1	0	0	13.08	1	13.08						
L48		0.3	2	0	63.6	63.6	1	63.6	0.212	300			1	1
L49			1	0	0	29.52	1	29.52			400			16
L50			1	0	0	20.76	1	20.76						
L51			3	0	0	0								
L52			1	0	0	11.64	1	11.64						
L53			3	0	0	0								
L54			3	0	0	0								
L55			1	0	0	9.06	1	9.06						
101			1	0	0	18.6	1	18.6						
102			1	13.77	0	130.815	1	130.815						
103			2	414.8	0	3857.64	1	3857.64	0.502	7680		7400	2	2
105			1	0	0	3.96	1	3.96						
106	70		2	0	210	210	0.8	262.5	1.050	250		300	3	12
107	70		2	0	210	210	0.8	262.5	1.050	250		300	3	12
108			1	0	0	9.72	1	9.72						
109			2	111.6	0	1037.88	1	1037.88	0.692	1500		1400	3	3
110			1	0	0	10.98	1	10.98						
111		0.3	2	0	36	36	1	36	0.480	75			3	
112			1	0	0	39.12	1	39.12	0.065	600			3	
113			1	94.425	0	698.745	1	698.745	0.063	11020		10500	4	4
114			2	465.8	0	4331.94	1	4331.94	0.401	10800		10400	4	4
115		0.7	2	0	561.4	561.4	1	561.4	0.802	700			4	
116			1	0	0	20.64	1	20.64						
116B			1	0	0	4.2	1	4.2						
117			2	50.02	0	1275.51	1	1275.51	**0.080**	15900			1, 6	6-8, 21-23
118			1	0	0	10.56	1	10.56						
119			1	0	0	11.16	1	11.16			150			16, 1
120			1	0	0	11.04	1	11.04						
121			3	0	0	0								
122		0.7	2	0	95.9	95.9	0.8	119.875			225			16

122B			1	0	0	2.28	1	2.28						
123	50		2	0	50	50	0.8	62.5			75			10
124		1	3	0	40	40	0.8	50			50			10
125			1	0.585	0	9.945	1	9.945	0.038	265			1	
201			1	0	0	18.84	1	18.84						
202			1	6.93	0	65.835	1	65.835						
203			1	0	0	1.8	1	1.8						
204			1	0	0	13.08	1	13.08						
205			1	0	0	0.9	1	0.9						
206	25		2	0	25	25	0.8	31.25			100			12
207			1	8.975	0	66.415	1	66.415	0.083	800		720	3	3
208			1	0	0	9.36	1	9.36						
209			1	0	0	5.4	1	5.4						
210			1	37.765	0	442.39	1	442.39	2.107	210			ACU-6	ACU-6
211			1	0	0	2.04	1	2.04						
212			1	13.95	0	86.49	1	86.49	0.138	625			3	
213			1	0	0	79.92	1	79.92						
214			1	0	0	70.68	1	70.68						
215			1	0	0	16.74	1	16.74						
301			1	0	0	18.84	1	18.84						
302			1	0	0	4.2	1	4.2						
303			1	0	0	20.04	1	20.04	0.115	175			3	
304			1	1.605	0	27.285	1	27.285	0.067	410		380	3	3
305			1	0	0	0.84	1	0.84						
306	50		2	0	50	50	0.8	62.5			100			12
307			1	1.155	0	19.635	1	19.635	0.044	450		400	3	3
308			1	0	0	8.82	1	8.82						
309		1	3	0	37	37	0.8	46.25			50			12
310			1	1.085	0	18.445	1	18.445	0.105	175		160	3	3
311			1	0	0	2.4	1	2.4						
312			1	0.985	0	16.745	1	16.745	0.096	175		160	3	3
313			1	0	0	1.68	1	1.68						
314			1	1.155	0	19.635	1	19.635	0.056	350		315	3	3
315			1	0	0	8.28	1	8.28	0.066	125		110	3	3
316			1	0	0	2.64	1	2.64						
318			1	0	0	2.4	1	2.4						

A.2 Air Handler Characteristics

(Table located on the following pages)

Air Handler Characteristics						
AHU	System	Location	CFM	Starter	Flow Control	Economizer
1	Kitchen/Servery	New Attic 214	8000	Yes	Volume Dampers	Yes
2	Pub/Peirce Hall	Mech L29	11300	Yes	VAV Terminal Units	Yes
3	Tower	Mech L14	6800	VFD	VAV Terminal Units	Yes
4	Dining Hall	Mech L29	30000	VFD	VAV Terminal Units	Yes
5	Catering Make-Up	New Attic 214	6850	VFD	Constant	No
6	Servery Make-Up	New Attic 214	10500	VFD	Volume Dampers	No
7	Loading Dock B04	Loading Dock B04	3680	Yes	Volume Dampers	No

Air Handler Characteristics (continued)										
AHU	$Z_{p\ Max}$	E_v	D	$\Sigma(R_p x P_z)$ [cfm]	$\Sigma(R_a x A_z)$ [cfm]	V_{ou} [cfm]	V_{ot} [cfm]	ΣV_{oz} [cfm]	Min Ventilation Provided [cfm]	Percent Difference
1	0.06	1	0.010	149.15	578.15	579.63	579.63	845.90	2100	148.3%
2	1.03	0.638	0.379	6111.75	1466.82	3785.47	5933.35	7578.57	9200	21.4%
3	0.71	0.492	0.071	1058.79	476.82	551.86	1121.67	2101.41	1800	-14.3%
4	0.60	0.690	0.496	7755.83	1988.40	5835.93	8457.87	11530.63	15000	30.1%
5	0.28	0.8	0.000	0.00	653.90	653.90	817.37	817.37	6850	738.1%
6	0.08	1	0.015	247.50	594.54	598.34	598.34	842.32	10500	1146.6%
7	0.094	1	0.000	0.00	375.88	375.88	375.88	438.38	3680	739.5%

A.3 Lighting Density Compliance

(Table located on the following pages)

Lighting Density Compliance

Level	Room No.	Use	Area (SF)	Luminaire Characteristics									LPD [W/ft^2]	
				Type	Wattage	Number	Type	Watts/Type	Number	Type	Watts/Type	Number	Actual	Accepted
B	B01	Mechanical room (equipment)	400	FS2	32	4							0.3	1.5
B	B02	Mechanical room (electrical)	160	FS2	32	2							0.4	1.5
B	B03	Temporary garbage storage	250	FS2	32	2							0.3	0.8
B	B04	Loading area	769	FG3	60	9							0.7	0.8
B	B04B	Storage (general)	181	FG3	60	2							0.7	0.8
B	B05	Storage (general)	65	NONE									0.0	0.8
B	B06	Storage (hazardous)	66	FS2	32	1							0.5	0.8
B	B07	Washing room	161	FS2	32	2							0.4	0.6
B	B08	Mechanical room (elevator)	76	FS2	32	1							0.4	1.5
B	B09	Circulation	168	AY14	150	3							2.7	0.6
M	M01	Storage (general)	247	NONE									0.0	0.3
M	M02	Circulation	168	NONE									0.0	0.6
L	L01	Circulation	319	AZ6	60	1	AY6	100	4				1.4	0.6
L	L02	Gathering/circulation	248	AZ3	160	1							0.6	1.3
L	L03	Gathering/bar	4001	VS1	75	44	VD2	75	67	PH1	500	10	3.6	1.2
				AP1	200	2	AY3	50	8	AY4	50	2		
L	L04	Circulation	151	AZ6	60	2							0.8	0.5
L	L05	Mechanical room (elevator)	57	FS4	60	1							1.1	1.5
L	L06	Mechanical room (equipment)	342	FS4	60	6	AZ6	60	1				1.2	1.5
L	L07	Mechanical room (electrical)	108	FS4	60	2							1.1	1.5
L	L08	Circulation	216	AZ6	60	2							0.6	0.6
L	L09	Computer Lab	1072	VD1	75	9	FP1	120	6				1.3	1.4
L	L10	Student printing	48	VD1	75	1							1.6	0.8
L	L12	Mechanical room (electrical)	150	FS4	60	2							0.8	1.5
L	L13	Circulation	320	VD1	75	6	VC1	75	3				2.1	0.5
L	L14	Mechanical room (equipment)	590	FS4	60	6							0.6	1.5
L	L15	Gathering/circulation	1702	VD1	75	13	QW1	32	14				0.8	1.3
L	L16	Circulation	155	OPEN TO ABOVE									0.0	0.6
L	L17	Seperation of restrooms	58	CD1	32	2							1.1	0.5
L	L18	Restroom	250	CD1	32	3	FG1	31	2	FF2	31	2	0.9	0.9
L	L19	Restroom	74	CD1	32	4	FG1	31	2	FF2	31	2	3.4	0.9
L	L20	Restroom	309	CD1	32	3							0.3	0.9
L	L21	Gathering/dining	902	AD2	150	13							2.2	1.4
L	L22	Gathering/dining	2773	AD1	150	48	AY13	300	4				3.0	1.4
L	L23	Gathering/dining	258	AD2	150	4							2.3	1.4
L	L24	Gathering/dining	369	AD2	150	5							2.0	1.4
L	L25	Gathering/dining	241	AD2	150	4							2.5	1.4
L	L26	Drink distribution	123	AD2	150	2							2.4	1.3
L	L27	Storage (general)	79	AD2	150	2							3.8	0.8
L	L27B	Storage (janitor)	29	FG4	68	1							2.3	0.8
L	L28	Storage (general)	108	FG4	68	2							1.3	0.8
L	L29	Mechanical room (equipment)	1516	FS4	60	19							0.8	1.5
L	L29B	Mechanical room (electrical)	36	FS2	32	1							0.9	1.5

L	L30	Mechanical room (elevator)	63	FS4	60	1							1.0	1.5
L	L31	Circulation	451	VD1	75	9	VC1	75	2				1.8	0.5
L	L32	Administrative office	598	FP1	120	4							0.8	1.1
L	L33	Administrative office	151	FP1	120	1							0.8	1.1
L	L34	Food preperation	350	FG3	60	4							0.7	1.2
L	L35	Circulation	855	FG4	68	15							1.2	0.5
L	L36	Mechanical room (electrical)	142	FS4	60	2							0.8	1.5
L	L37	Mechanical room (electrical)	44	FS4	60	1							1.4	1.5
L	L38	Seperation of restrooms	56	FG4	68	1							1.2	0.5
L	L39	Restroom	43	FG4	68	1							1.6	0.9
L	L40	Changing room	307	FG4	68	6							1.3	0.6
L	L41	Seperation of restrooms	57	FG4	68	1							1.2	0.5
L	L42	Changing room	265	FG4	68	6							1.5	0.6
L	L43	Restroom	43	FG4	68	1							1.6	0.9
L	L44	Storage (janitor)	33	FG4	68	1							2.1	0.8
L	L45	Storage (general)	265	NONE									0.0	0.8
L	L46	Kitchen/food preperation	899	FG4	68	10							0.8	1.2
L	L47	Storage (general)	109	FG4	68	1							0.6	0.8
L	L48	Food preperation	212	FG4	68	4							1.3	1.2
L	L49	Storage (general)	246	FG4	68	6							1.7	0.8
L	L50	Storage (general)	173	SELF LIT									0.0	0.8
L	L51	Cold storage	157	SELF LIT									0.0	0.3
L	L52	Storage (general)	97	SELF LIT									0.0	0.8
L	L53	Cold storage	93	SELF LIT									0.0	0.3
L	L54	Cold storage	44	OPEN TO L35									0.0	0.3
L	L55	Circulation	151	AY14	46	3							0.9	0.6
1	101	Circulation	310	AY6	60	3							0.6	0.6
1	102	Gathering/circulation	459	AY7	450	3							2.9	1.3
1	103	Gathering/dining	4148	AZ7	1200	10							2.9	1.4
1	105	Seperation of restrooms	66	AZ6	60	1							0.9	0.5
1	106	Restroom	184	CD1	32	3	FG1	31	3	FF1	27	2	1.3	0.9
1	107	Restroom	205	CD1	32	3	FG1	31	2	FF1	27	2	1.0	0.9
1	108	Circulation	162	AZ11	15	1	AZ12	150	2				1.9	0.6
1	109	Gathering/dining	1116	AZ10	480	3							1.3	1.2
1	110	Circulation	183	VD1	75	4							1.6	0.5
1	111	Food distribution	120	VD1	75	2							1.3	1.2
1	112	Storage (general)	326	VD1	75	16							3.7	0.8
1	113	Circulation/gathering	3777	AT1	150	26	VD1	75	16				1.4	0.5
1	114	Gathering/dining	4658	AY2	1500	12							3.9	1.4
1	115	Washing room	802	FG4	68	17							1.4	0.6
1	116	Circulation	344	AT1	150	4							1.7	0.6
1	116B	Storage (general)	35	FS2	32	1							0.9	1.5
1	117	Food distribution	5002	AD1	150	49	VD2	75	44	VC2	75	21	2.5	1.2
				FW1	75	4								
1	118	Circulation	176	AY14	46	2							0.5	0.6
1	119	Storage (general)	93	FG2	60	1							0.6	0.8
1	120	Storage (general)	92	OPEN TO 117									0.0	0.8

1	121	Cold storage	92	OPEN TO 117									0.0	0.3
1	122	Washing room	137	FG2	60	3							1.3	0.6
1	122B	Storage (general)	19	OPEN TO 117									0.0	0.3
1	123	Restroom	57	FG2	60	1							1.1	0.9
1	124	Storage (janitor)	40	FG2	60	1							1.5	0.8
1	125	Administrative office	117	FG2	60	2							1.0	1.1
2	201	Circulation	314	AY6	46	2							0.3	0.6
2	202	Gathering/circulation	231	AZ4	160	1							0.7	1.3
2	203	View point	30	OPEN TO 103									0.0	0.5
2	204	Circulation	218	AZ5	80	1	AZ6	60	3				1.2	0.5
2	205	Mechanical room (electrical)	15	FG2	60	1							4.0	1.5
2	206	Restroom	71	CD1	32	2							0.9	0.9
2	207	Gathering	359	AY10	60	1							0.2	1.2
2	208	Circulation	156	AZ12	150	2							1.9	0.6
2	209	Storage (general)	45	OPEN TO 210									0.0	0.3
2	210	Music Classroom	1079	AZ14	150	6	AZ13	480	5				3.1	1.4
2	211	Mechanical room (equipment)	34	FS2	32	1							0.9	1.5
2	212	Conference/meeting	279	FP1	120	1							0.4	1.3
2	213	Mechanical room (equipment)	1332	FS2	32	6							0.1	1.5
2	214	Mechanical room (equipment)	1178	FS2	32	9	AY14	46	1				0.3	1.5
2	215	Circulation	279	AY14	46	3							0.5	0.6
3	301	Circulation	314	AZ1	800	1	AY6	60	1				2.7	0.6
3	302	Circulation	70	AZ6	60	1							0.9	0.5
3	303	Circulation	334	AZ6	60	5	AY5	50	1				1.0	0.5
3	304	Administrative office	321	VC1	75	5	FP1	120	2				1.9	1.1
3	305	Storage (general)	7	NONE									0.0	0.3
3	306	Restroom	72	CD1	32	2							0.9	0.9
3	307	Administrative office	231	FP1	120	2							1.0	1.1
3	308	Circulation	147	AY5	50	2							0.7	0.6
3	309	Storage (janitor)	37	FG4	68	1							1.8	0.8
3	310	Administrative office	217	FP1	120	2							1.1	1.1
3	311	Storage (general)	20	FG4	68	1							3.4	0.3
3	312	Administrative office	197	AY12	60	2	FP1	120	1				1.2	1.1
3	313	Storage (general)	14	FG4	68	1							4.9	0.3
3	314	Administrative office	231	FP1	120	2							1.0	1.1
3	315	Storage (general)	69	NONE									0.0	0.3
3	316	Storage (general)	22	NONE									0.0	0.3
3	318	Circulation	40	AY5	50	1							1.3	0.6