AMERESCO

Airflow Testing Report

Prepared for

Portland Public Schools

August 2021

9700 SW Capitol Hwy, Suite 110
Portland, OR 97219
ameresco.com

PROJECT OVERVIEW

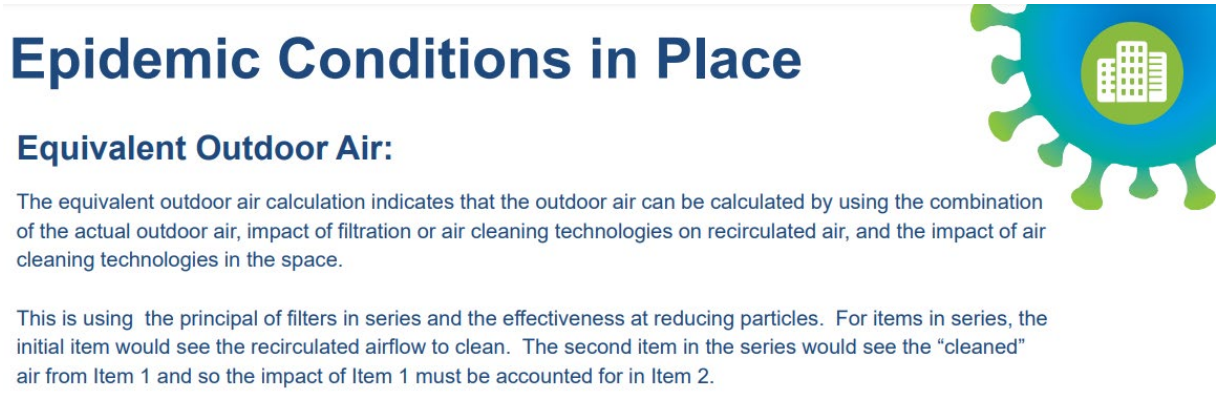
As part of the continuing process to ensure a safe return to in-person learning, Portland Public Schools has contracted with Ameresco to test the airflow and ventilation of all educational and office spaces in each school. The data is reviewed by both Ameresco and PPS personnel to identify any potential shortcomings in the airflow from the HVAC systems. To accomplish this task, Ameresco has partnered with a local NEBB certified Test-Adjust-Balance (TAB) firm, Neudorfer Engineers, who will measure the airflow to each zone with calibrated measurement equipment in accordance with current testing standards and procedures. As part of this effort, HVAC professionals will review the operation of the HVAC equipment serving every educational and office space in each school.

Ameresco is pleased to have partnered with PPS over the last decade as the district's Energy Services Company (ESCO) on six energy efficiency construction projects, four service projects, and numerous energy audits. Our partnership has resulted in reducing over 3,000 tons of CO_2 and other GHG emissions and over $1,000,000 in utility cost savings per year. Ameresco appreciates this opportunity to play a small role in the safe reopening of schools.

About Ameresco, Inc.
Founded in 2000, Ameresco, Inc. (NYSE:AMRC) is a leading cleantech integrator and renewable energy asset developer, owner and operator. Our comprehensive portfolio includes energy efficiency, infrastructure upgrades, asset sustainability and renewable energy solutions delivered to clients throughout North America and the United Kingdom. Ameresco's sustainability services in support of clients' pursuit of Net Zero include upgrades to a facility's energy infrastructure and the development, construction, and operation of distributed energy resources. Ameresco has successfully completed energy saving, environmentally responsible projects with Federal, state and local governments, healthcare and educational institutions, housing authorities, and commercial and industrial customers. With its corporate headquarters in Framingham, MA, Ameresco has more than 1,000 employees providing local expertise in the United States, Canada, and the United Kingdom. For more information, visit www.ameresco.com.

Explanation of ASHRAE Total Effective Air Changes per Hour (ACH_e) Calculation

ASHRAE has been updating their Building Readiness document to reflect the most current understanding in the engineering community for how to operate and maintain buildings during the pandemic. Their update on 4/27/2021 provided an explanation of the impact air filters and air cleaning devices have on the air in buildings. They provided the methodology, formulas, and an Excel-based tool for determining the equivalent outside air a space is receiving by having a mix of outside air, filtered recirculated air, and additional air filtration or cleaning devices in the room. Here is the explanation from ASHRAE:



As part of the airflow testing project that Portland Public Schools has partnered with Ameresco to complete, we are including the calculation of the Total Effective Air Changes per Hour (ACH_e) to show the impact of the air filtration that is active in nearly all spaces in the PPS schools. The formula for doing so is:

$$\mathrm{ACH_e} = \left(ACH_{oa} + ACH_f\right) * E_Z + ACH_ir$$

where:

- $\mathrm{ACH_{oa}}$ = air changes per hour of outside air = outside airflow in cubic feet per minute * 60 minutes per hour / room volume in cubic feet
- $\mathrm{ACH_f}$ = air changes per hour of clean air from filtered recirculated air with filters of the specified MERV rating as determined by ASHRAE
- E_z = Zone Air Distribution Effectiveness = how effective the HVAC system is at circulating and mixing the air to distribute the clean air throughout the room
- ACH_ir = the air changes per hour of clean air from portable air filters in the room = number of filters * CADR * 60 minutes per hour / room volume in cubic feet
    - CADR = Clear Air Delivery Rate = the CFM of clean air as specified by the manufacturer of the air filter

In order to include these calculations in the airflow testing reports, Ameresco and PPS have made the following assumptions as not all the variables are known:

1. PPS is in process of upgrading the air filters in their HVAC systems to MERV 13 and plans to be complete with that project for the start of the ’21-’22 school year. In this report and for the sake of the ACH_e calculation, we are using the filters that are in place at the time of the measurements, so some of them are still MERV 8.
2. ASHRAE has guidelines for what should be used for the Zone Air Distribution Effectiveness (E_z) based on the HVAC system configuration, but they do not provide a value for every HVAC system and room configuration. For the majority of PPS rooms, an E_z of 0.8 – 1.0 would be most appropriate, so we have made the conservative assumption of using 0.8 for every space as that yields the lower ACH_e.
3. The CADR for a given air filter is from manufacturer ratings and is based on certain conditions (fan speed, particulate size, filter cleanliness, etc.) that change with operating conditions.

NEUDORFER ENGINEERS INC.

TEST REPORT TYPE:
SURVEY REPORT

Portland Public Schools Airflow Testing
Beaumont MS
4043 NE Fremont St, Portland, OR 97212

Job Number: 2021-0297

Project Completion Date: **09/03/21**
Revision Date: **-** **Revision Number:** **-**





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Portland Public Schools Airflow Testing
Beaumont MS

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REPORT TITLE

CERTIFIED TEST: SURVEY REPORT

Project: Portland Public Schools Airflow Testing
Beaumont MS

NEI Job#: 2021-0297

Mechanical Engineer: NA

Architect: NA

HVAC Contractor: NA

TAB Firm: Neudorfer Engineers Inc
Test Engineer: Zach Mayer





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CERTIFICATION

Portland Public Schools Airflow Testing

The data presented in this report is a record of system measurements and final adjustments that have been obtained in accordance with the current edition of the NEBB Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems. Any variances from design quantities, which exceed NEBB tolerances, are noted in the Test-Adjust-Balance Report Project Summary.

Significant / Noteworthy Remarks are noted on the General Remarks and General Field Notes pages. Other remarks are noted on individual test sheets.

Noted deficiencies are not the TAB firms responsibility to repair. Prior to issuance of this report, Deficiency Reports are forwarded to our contracted agent.

Warranty is limited to one year from date of this report. Within that time, any discrepancies, ambiguities, or omissions found in this report will be retested, adjusted, or balanced as needed. A written notification will be required.

Submitted and Certified by:

NEBB TAB Firm:	**Neudorfer Engineers Inc**
Certification No:	**3414**
Expiration Date:	**March 31, 2023**
Certification Date:	**March 31, 2021**
(Date completed)	*Signed and Sealed by:*
NEBB Supervisor:	**Mike Vawter P.E.**
NEBB Supervisor:	**Eric Stotts**





TERMS AND ABBREVIATIONS

Project: **Portland Public Schools Airflow Testing**

AC or ACU	Air Conditioner or Air Conditioning Unit
AH or AHU	Air Handler or Air Handling Unit
AVG	Average
BHP	Brake Horsepower
CAV	Constant Air Volume
CBV	Calbirated Balancing Valve (Circuit Setter)
CC	Cooling Coil
CD	Ceiling Diffuser
CFM	Cubic Feet per Minute
CH	Chiller
CHWS	Chilled Water Supply
CHWR	Chilled Water Return
CP	Circulating Pump
CR	Ceiling Register
CRAC	Computer Room Air Conditioner
CRU	Computer Room Unit
CT	Cooling Tower
CU	Condenser Unit
CUH	Cabinet Unit Heater
CWS	Condenser Water Supply
CWR	Condenser Water Return
DAT	Discharge Air Temperature
DB	Dyr Bulb
DD	Direct Drive
DDC	Direct Digital Controls: EMS Control System for the HVAC
Des.	Design
Dia.	Diameter
Disch.	Discharge
EA	Exhaust Air
EAT	Entering Air Temperature
Economizer	Controls and components that allow an air handler to logically utilize outdoor air for cooling as opposed to the use of mechanical cooling.
EF	Exhaust Fan
EG	Exhaust Grille
EMCS	Energy Management Control System
ERU	Energy Recovery Unit
E.S.P.	External Static Pressure
HRC	Heat Recovery Coil
EWT	Entering Water Temperature
FCU	Fan Coil Unit
FD	Fire Damper
FLA	Full Load Amperage: Maximum amperage a motor can draw.
Flow Hood	Instrument that captures air and converts the reading to CFM.
FHT	Fume Hood Test
FPB	Fan Powered Box
FPM	Feet per Minute
FR	Field Report
FT	Foot, Feet
FTU	Fan Terminal Unit
GPM	Gallons per Minute
HC	Heating Coil
TDH	Pressure Difference across the entering and leaving side of a pump.
HEPA	High Efficiency Particulate Arrestance
HP	Horsepower
HVAC	Heating Ventilation and Air Conditioning
HWS	Heating Water Supply
HWR	Heating Water Return
HX	Heat Exchanger
HZ	Hertz, cycle per second
in.	inches
in.w.g.	inches of water gauge
Kfactor	Correction factor to the free area need to calculate CFM.
KW	Kilowatts
LAT	Leaving Air Temperature
LWG	Low Wall Grille
LWR	Low Wall Register
LWT	Leaving Water Temperature
MAU	Make-up Air Hangling Unit
MBH	1,000 BTUH
N/A	Not Applicable
OSA	Outside Air
OBD	Opposed Blade Damper
∆P	Pressure Drop.
PH	Phase
PSI	Pounds per Square Inch
RA	Return Air
RAD	Radiator
RAT	Return Air Temperature
RF	Return Fan
RH	Relative Humidity
RHC	Reheat Coil
RPM	Revolutions per Minute
RTU	Roof Top Unit
SA	Supply Air
SAT	Supply Air Temerature
S.F.	Service Factor
SF	Supply Fan
SFD	Smoke/Fire Damper
SP	Static Pressure
sq.ft.	square feet
Suct.	Suction
SWG	Sidewall Grille
SWR	Sidewall Register
TAB	Test; Adjust; and Balance
TSP	Total Static Pressure: Difference between the entering and leaving static pressure of a fan.
UH	Unit Heater
VAV	Variable Air Volume; box that contains a motorized damper that modulates airflow.
VD	Volume Damper
VFD	Variable Frequency Drive
Velgrid	Instrument that reads used to read velocity in feet per minute.
VVT	Variable Volume Terminal
WC	Water Column
W.G.	Water Gauge
WB	Wet Bulb

INSTRUMENT CALIBRATIONS

Portland Public Schools Airflow Testing

Instrument Type	Air Data Meter with Flowhood	Instrument Serial #	**M00475**
Instrument Manufacturer	**Shortridge**	Calibration Date	**11/4/2020**
Instrument Model Number	**ADM 870**	Calibration Due	**11/4/2021**

Instrument Type	Differential Pressure Water Meter	Instrument Serial #	**W14090**
Instrument Manufacturer	**Shortridge**	Calibration Date	**10/16/2020**
Instrument Model Number	**HDM-250**	Calibration Due	**10/16/2021**

Instrument Type	Psychrometer	Instrument Serial #	**8084305**
Instrument Manufacturer	**Extech**	Calibration Date	**10/13/2020**
Instrument Model Number	**RH390**	Calibration Due	**10/13/2021**

Instrument Type	Tachometer	Instrument Serial #	**B185B5022P**
Instrument Manufacturer	**Nidec**	Calibration Date	**10/11/2020**
Instrument Model Number	**MT-200**	Calibration Due	**10/11/2021**

Instrument Type	Amp Probe	Instrument Serial #	**33380179WS**
Instrument Manufacturer	**Fluke**	Calibration Date	**10/9/2020**
Instrument Model Number	**323 Clamp Meter**	Calibration Due	**10/9/2021**

Instrument Type	Digital Thermometer	Instrument Serial #	**45400509WS**
Instrument Manufacturer	**Fluke**	Calibration Date	**10/9/2020**
Instrument Model Number	**52 II**	Calibration Due	**10/9/2021**

Instrument Type	Manometer	Instrument Serial #	**M00475**
Instrument Manufacturer	**Shortridge**	Calibration Date	**11/4/2020**
Instrument Model Number	**ADM 870**	Calibration Due	**11/4/2021**

Instrument Type	Thermal Anemometer	Instrument Serial #	**AVM440742003**
Instrument Manufacturer	**Alnor Instruments**	Calibration Date	**11/9/2020**
Instrument Model Number	**AVM 440**	Calibration Due	**11/9/2021**

Instrument Type	Ultrasonic Flow Meter	Instrument Serial #	**N5K1435T**
Instrument Manufacturer	**Fuji**	Calibration Date	**10/14/2020**
Instrument Model Number	**Portaflow-C**	Calibration Due	**10/14/2021**

PROJECT Portland Public Schools Airflow Testing
LOCATION Beaumont MS; 4043 NE Fremont St, Portland, OR 97212

REPORT SUMMARY

This project has been surveyed per plans and specifications using the National Environmental Balancing Bureau (NEBB) standards and procedures.

The scope of work for this project was to assess the current airflows for each classroom, office, and special purpose space. Air changes per hour were calculated along with the % of OSA for the spaces and any deficiencies found for each piece of equipment has been noted in the following report.

All ventilation equipment was commanded to run by the BMS system. Ventilation units were measured with a flowhood on the supply outlets. Outside air was recorded with a flowhood on the OSA louvre where accessible. AK factors were calculated from flowhood readings. The remaining OSA values were recorded with a velgrid. AHU supply air was recorded by a summation of the outlets as recorded by flowhood or velgrid when appropriate. Outside air was recorded with a velgrid or airfoil and calculated by the free area method.

The measured airflows in this report represent the performance of the equipment at the time of measurement, which vary over time based on operating conditions. There are factors outside the control of Neudorfer that impact airflow, and variance in those factors is expected and normal. One significant factor is the MERV rating and condition of the air filters on the equipment. During the summer of 2021, PPS began upgrading the filters on all their fan systems to MERV 13. Those upgraded filters are more effective at capturing particles but also impact the amount of airflow from the equipment. These filter changes were occurring while the airflow measurement project was happening, so some schools had the new filters, and some had the old filters at the time of measurement. On the data page included this report, there is a line stating whether or not the upgraded filters were in place at the time of measurement.

AIRFLOW SURVEY REPORT

Project: Portland Public Schools Airflow Testing
Location: Beaumont MS; 4043 NE Fremont St, Portland, OR 97212
Filter Status: Upgraded

Room	Equipment Info		Room Dimensions					Airflow Measurements			Calculated ACH					Notes
	Served By	Equipment Type	Room Length	Room Width	Room Area	Room Height	Room Volume	Total CFM Supply	OA CFM Supply	OA %	Air Changes per Hour (supply)	Air Changes per Hour (OA)	# of Portable Filters	Total Effective Air Changes per Hour (ACH_e) with Portable Filter	Total Effective Air Changes per Hour (ACH_e) without Portable Filter	
Lower Level 1																
Rm 11	AH2	AHU	20.3	32.9	668	9.2	6,144	500	0	0%	4.9	0.0	2	8.6	3.5	OSA damper closed.
Rm 12A	MZ-1	AHU	29.4	23.6	694	9.0	9,168	745	574	77%	4.9	3.8	1	5.5	3.8	Additional volume: 21.7x7.7x8 and 21.1x8.0x9.4.
Rm 13A	MZ-1	AHU	30.0	22.0	660	9.0	5,940	710	547	77%	7.2	5.5	1	8.2	5.6	
Rm 14A	MZ-1	AHU	18.4	29.6	545	9.1	5,753	470	362	77%	4.9	3.8	1	6.5	3.8	Additional volume: 23.9x4.7x7.1.
16A	AH2	AHU	14.9	20.2	301	7.4	2,227	145	0	0%	3.9	0.0	1	9.8	2.8	OSA damper closed.
16C	AH2	AHU	14.1	11.7	165	7.6	1,254	150	0	0%	7.2	0.0	1	17.6	5.2	OSA damper closed.
First Floor																
Rm 1	North FCU	FCU	24.7	23.8	588	12.0	7,054	90	25	28%	0.8	0.2	1	2.8	0.6	
Rm 3	North FCU	FCU	66.8	38.5	2,365	11.8	27,907	805	225	28%	1.7	0.5	2	2.4	1.3	Not a rectangular room.
5	North FCU	FCU	25.1	14.6	366	12.0	4,398	330	92	28%	4.5	1.3	1	6.9	3.3	
Rm 8	North FCU	FCU	33.4	24.6	570	11.8	6,726	270	76	28%	2.4	0.7	1	4.1	1.8	Not a rectangular room.
Rm 140	UV	UV	22.6	50.0	1,130	12.1	16,271	1,010	430	43%	3.7	1.6	1	3.8	2.8	Additional volume: 12.2x6.6x8.9 and 21.2x7.4x12.
Rm 119	UV	UV	51.6	24.2	1,249	9.9	12,362	1,330	70	5%	6.5	0.3	1	5.9	4.7	
140C	-	-	11.5	6.0	69	12.2	842	-	-	-	0.0	0.0	1	18.5	0.0	Ventilation supplied by adjacent spaces.
Rm 138	UV	UV	29.9	22.3	667	12.2	8,135	685	270	39%	5.1	2.0	1	5.7	3.8	
Rm 136	UV	UV	37.5	24.4	915	12.2	11,163	985	410	42%	5.3	2.2	1	5.4	4.0	
Rm 134	UV	UV	22.3	38.4	856	12.2	10,447	1,020	515	50%	5.9	3.0	1	5.9	4.5	
132	-	-	22.0	12.3	271	12.2	3,301	-	-	-	0.0	0.0	1	4.7	0.0	Ventilation supplied by adjacent spaces.
113	-	-	23.1	17.2	397	11.0	7,092	-	-	-	0.0	0.0	1	2.2	0.0	Ventilation supplied by adjacent spaces.
113A	-	-	18.2	12.5	228	12.3	2,798	-	-	-	0.0	0.0	1	5.6	0.0	Ventilation supplied by adjacent spaces.
113B	-	-	18.5	7.2	133	8.7	1,159	-	-	-	0.0	0.0	1	13.5	0.0	Ventilation supplied by adjacent spaces.
Gym 111	Main Fan	AHU	60.0	80.8	4,848	26.5	128,472	8,875	3,505	39%	4.1	1.6	1	3.2	3.1	
120	210 FCU	FCU	14.6	12.6	184	8.4	1,545	175	18	10%	6.8	0.7	1	15.0	4.9	
124	210 FCU	FCU	11.6	16.8	195	9.0	1,754	325	33	10%	11.1	1.1	1	17.0	8.1	

Date: 8/23/2021 Readings By: Mayer

AIRFLOW SURVEY REPORT

Project: Portland Public Schools Airflow Testing
Location: Beaumont MS; 4043 NE Fremont St, Portland, OR 97212
Filter Status: Upgraded

Room	Equipment Info		Room Dimensions					Airflow Measurements			Calculated ACH					Notes
	Served By	Equipment Type	Room Length	Room Width	Room Area	Room Height	Room Volume	Total CFM Supply	OA CFM Supply	OA %	Air Changes per Hour (supply)	Air Changes per Hour (OA)	# of Portable Filters	Total Effective Air Changes per Hour (ACH_e) with Portable Filter	Total Effective Air Changes per Hour (ACH_e) without Portable Filter	
First Floor																
126	210 FCU	FCU	11.6	11.2	130	9.0	1,169	175	18	10%	9.0	0.9	1	19.9	6.5	
128A	210 FCU	FCU	11.8	15.1	178	8.6	1,532	195	20	10%	7.6	0.8	1	15.7	5.6	
Conf. Room 110	210 FCU	FCU	14.3	12.7	182	10.3	1,871	305	31	10%	9.8	1.0	1	15.5	7.1	Open to adjacent space.
112	210 FCU	FCU	15.1	12.6	190	7.9	1,503	270	27	10%	10.8	1.1	1	18.2	7.8	
114	210 FCU	FCU	13.9	10.0	139	7.9	1,098	100	10	10%	5.5	0.5	1	18.2	4.0	
Conf. Room 116	210 FCU	FCU	21.2	13.8	293	8.0	2,340	195	20	10%	5.0	0.5	1	10.3	3.6	
108	-	-	14.5	12.4	180	12.2	2,565	-	-	-	0.0	0.0	1	6.1	0.0	**Note #1**, Ventilation supplied by adjacent spaces.
108A	-	-	7.9	7.5	59	8.9	527	-	-	-	0.0	0.0	1	29.6	0.0	Ventilation supplied by adjacent spaces.
107B	-	-	12.4	18.1	224	12.3	2,761	-	-	-	0.0	0.0	1	5.7	0.0	Ventilation supplied by adjacent spaces.
107	-	-	23.1	17.2	397	12.3	7,654	-	-	-	0.0	0.0	1	2.0	0.0	Ventilation supplied by adjacent spaces.
107A	-	-	9.1	14.7	134	8.1	1,084	-	-	-	0.0	0.0	1	14.4	0.0	Ventilation supplied by adjacent spaces.
Rm 106	UV	UV	34.2	22.0	752	12.2	9,179	615	325	53%	4.0	2.1	1	4.8	3.1	
Rm 104	UV	UV	21.7	37.4	812	12.2	13,060	965	415	43%	4.4	1.9	1	4.5	3.3	Additional volume: 23.4x15x9.
RM 102	UV	UV	30.0	22.2	666	12.1	8,059	685	240	35%	5.1	1.8	1	5.7	3.8	
Rm 100	UV	UV	30.0	22.2	666	12.1	8,059	610	295	48%	4.5	2.2	1	5.4	3.4	
101	UV	UV	21.1	22.4	473	12.2	5,766	610	30	5%	6.3	0.3	1	7.3	4.6	
101B	-	-	8.4	14.2	119	12.3	1,467	-	-	-	0.0	0.0	1	10.6	0.0	Open to adjacent space (101).
30	FC-2	FCU	25.8	11.9	307	9.0	2,763	0	0	0%	0.0	0.0	1	5.6	0.0	Unit disassembled.
29A	SF-5	AHU	44.0	25.8	902	8.9	8,030	325	175	54%	2.4	1.3	1	3.8	1.9	Non-rectangular room.
29D	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0	N/A	0.0	This is the walk-in cooler.
Rm 20A	SF-3	AHU	31.4	27.5	864	9.0	7,772	680	490	72%	5.2	3.8	1	6.1	4.1	
Rm 23A	SF-2	AHU	58.1	26.7	1,551	9.0	13,961	880	0	0%	3.8	0.0	1	3.8	2.7	OSA damper is closed.
23B	-	-	8.1	7.0	57	9.0	510	-	-	-	0.0	0.0	0	N/A	0.0	Ventilation provided by adjacent spaces.
Auditorium 26A	SF-1	AHU	89.9	65.8	5,915	27.2	160,899	9,400	4,365	46%	3.0	1.4	1	2.4	2.3	
26B	-	-	39.3	27.1	1,065	23.1	24,602	-	-	-						Open and shared with Auditorium.

Date: 8/23/2021 Readings By: Mayer

Neudorfer Engineers. Inc.
Consulting Engineers Seattle Portland
www.NeudorferEngineers.com

AIRFLOW SURVEY REPORT

Project: Portland Public Schools Airflow Testing
Location: Beaumont MS; 4043 NE Fremont St, Portland, OR 97212
Filter Status: Upgraded

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First Floor																
Cafeteria 27B	SF-4	AHU	82.3	56.8	4,675	15.6	72,924	3,205	840	26%	2.6	0.7	1	2.2	2.0	
Second Floor																
Rm 200	UV	UV	29.9	22.0	658	12.3	8,091	820	400	49%	6.1	3.0	1	6.5	4.6	
Rm 201	UV	UV	29.9	22.0	658	12.4	8,157	545	310	57%	4.0	2.3	1	5.0	3.1	
Rm 202	UV	UV	29.9	22.0	658	12.3	8,091	580	340	59%	4.3	2.5	1	5.2	3.3	
Rm 204	UV	UV	29.9	23.0	688	12.4	8,527	675	370	55%	4.7	2.6	1	5.5	3.6	
Rm 206	UV	UV	29.7	22.0	653	12.4	8,102	690	410	59%	5.1	3.0	1	5.8	3.9	
Rm 208	UV	UV	29.9	22.0	658	12.4	8,157	565	335	59%	4.2	2.5	1	5.1	3.2	
209	-	-	16.3	9.4	153	12.4	1,900	-	-	-	0.0	0.0	1	8.2	0.0	Ventilation supplied by adjacent spaces.
Rm 213	210 FCU	FCU	30.0	22.0	660	12.4	8,184	536	65	12%	3.9	0.5	1	4.8	2.9	
Library 210	210 FCU	FCU	79.2	50.0	3,960	11.0	43,560	2,370	237	10%	3.3	0.3	2	3.1	2.4	
210A	210 FCU	FCU	16.2	15.1	245	10.8	2,642	280	28	10%	6.4	0.6	1	10.5	4.6	
Conf. Room 210B	210 FCU	FCU	15.2	10.7	163	9.0	1,464	235	24	10%	9.6	1.0	1	17.7	7.0	
Library 210C	210 FCU	FCU	15.3	15.1	231	13.0	3,003	520	52	10%	10.4	1.0	1	12.8	7.6	
Library 210D	210 FCU	FCU	10.7	12.9	138	8.5	1,173	280	28	10%	14.3	1.4	1	23.7	10.4	
Library 210E	210 FCU	FCU	14.7	11.0	162	9.1	1,471	210	21	10%	8.6	0.9	1	16.8	6.2	
Rm 215	UV	UV	29.9	22.0	658	12.4	8,157	680	310	46%	5.0	2.3	1	5.7	3.8	
Rm 212	UV	UV	29.9	22.0	658	12.4	8,157	745	440	59%	5.5	3.2	1	6.1	4.2	
Rm 214	UV	UV	29.9	22.0	658	12.4	8,157	655	330	50%	4.8	2.4	1	5.6	3.7	
Rm 216	UV	UV	29.3	24.4	715	12.4	8,865	585	185	32%	4.0	1.3	1	4.7	2.9	
Rm 218	UV	UV	29.9	21.9	655	12.4	8,120	620	155	25%	4.6	1.1	1	5.3	3.4	
Rm 220	UV	UV	30.0	22.0	660	12.4	8,184	635	170	27%	4.7	1.2	1	5.4	3.4	
Rm 222	UV	UV	30.0	22.0	660	12.4	8,184	835	170	20%	6.1	1.2	1	6.4	4.5	
Rm 227	UV	UV	39.0	23.3	909	12.4	11,268	690	110	16%	3.7	0.6	1	4.1	2.7	

Date: 8/23/2021 Readings By: Mayer

Neudorfer Engineers. Inc.
Consulting Engineers Seattle Portland
www.NeudorferEngineers.com

AIRFLOW SURVEY REPORT

Project: Portland Public Schools Airflow Testing
Location: Beaumont MS; 4043 NE Fremont St, Portland, OR 97212
Filter Status: Upgraded

Room	Equipment Info		Room Dimensions					Airflow Measurements			Calculated ACH					Notes
	Served By	Equipment Type	Room Length	Room Width	Room Area	Room Height	Room Volume	Total CFM Supply	OA CFM Supply	OA %	Air Changes per Hour (supply)	Air Changes per Hour (OA)	# of Portable Filters	Total Effective Air Changes per Hour (ACH_e) with Portable Filter	Total Effective Air Changes per Hour (ACH_e) without Portable Filter	
Second Floor																
Rm 225	UV	UV	30.0	23.3	699	12.4	8,668	540	165	31%	3.7	1.1	1	4.6	2.8	
208A	210 FCU	FCU	12.7	5.7	72	9.0	652	145	15	10%	13.4	1.3	1	33.7	9.7	

Date: 8/23/2021 Readings By: Mayer

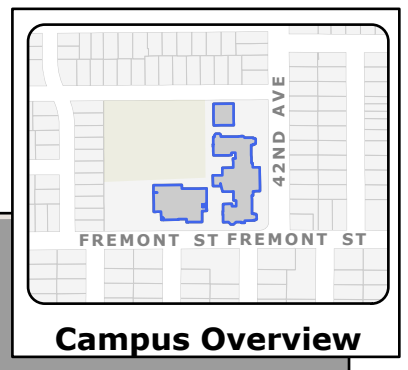
Project: Portland Public Schools Airflow Testing
Location: Beaumont MS; 4043 NE Fremont St, Portland, OR 97212

NOTE #	NOTE DESCRIPTION
1	Additional volume: 4.4x9.7x8.7.

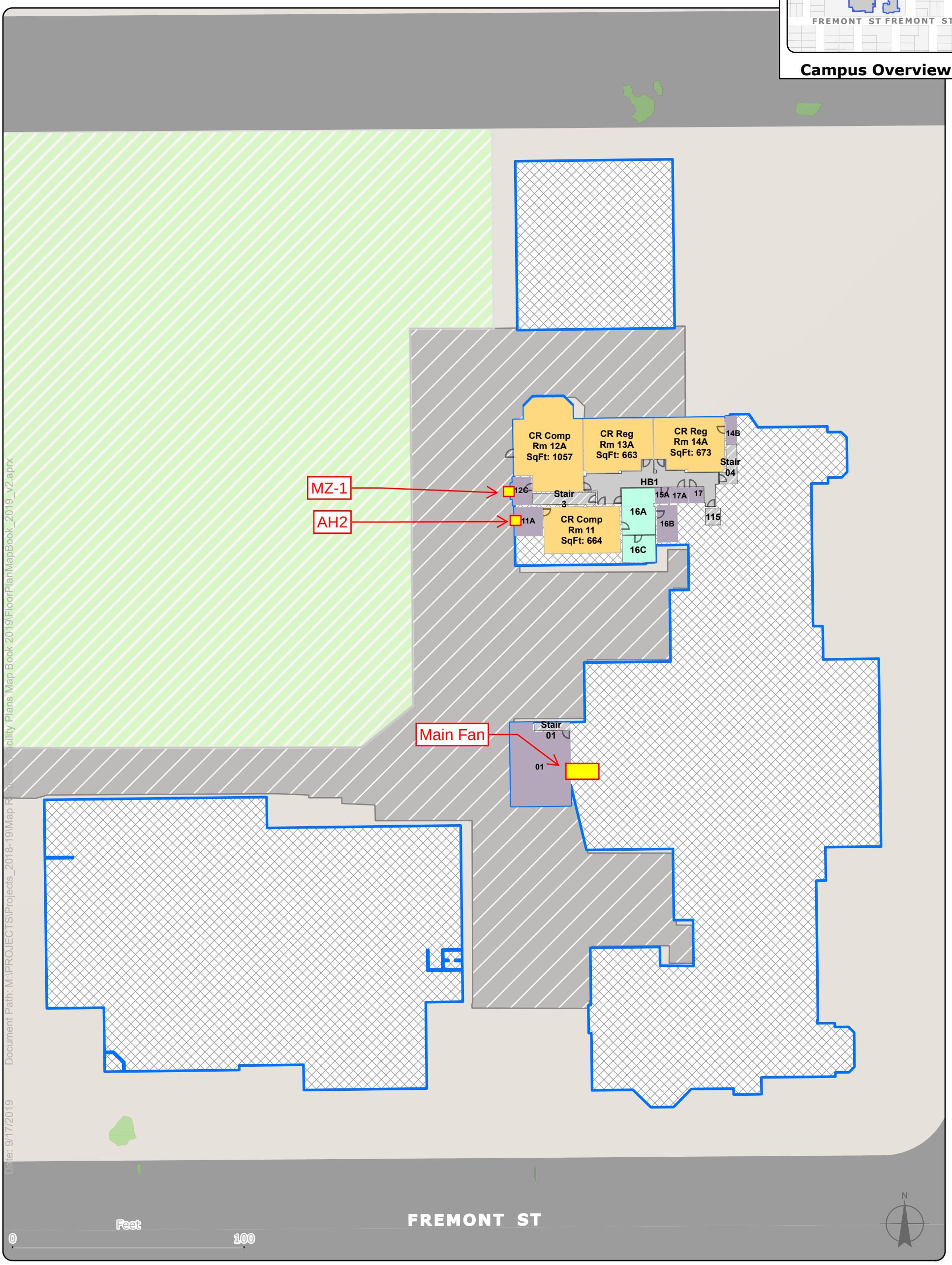
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BEAUMONT: Lower Level 1



Campus Overview



Space Use

- Classroom
- Office
- Rest Room
- Special Purpose
- Corridor
- Other
- Stairs/Elevator

School Grounds

- Campus Footprints
- Athletic Field
- Playground: Paved
- Playground: Unpaved
- Streets
- Doors

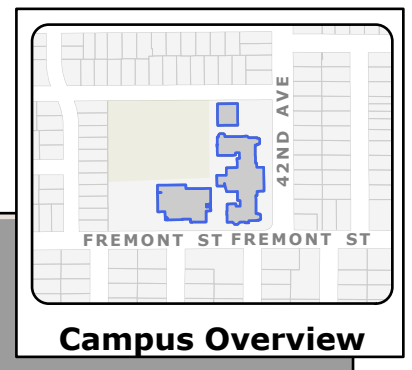
Total Number Of Rooms By Classification

Classrooms: 4	Special Purpose: 0
Office Spaces: 2	Storage: 4

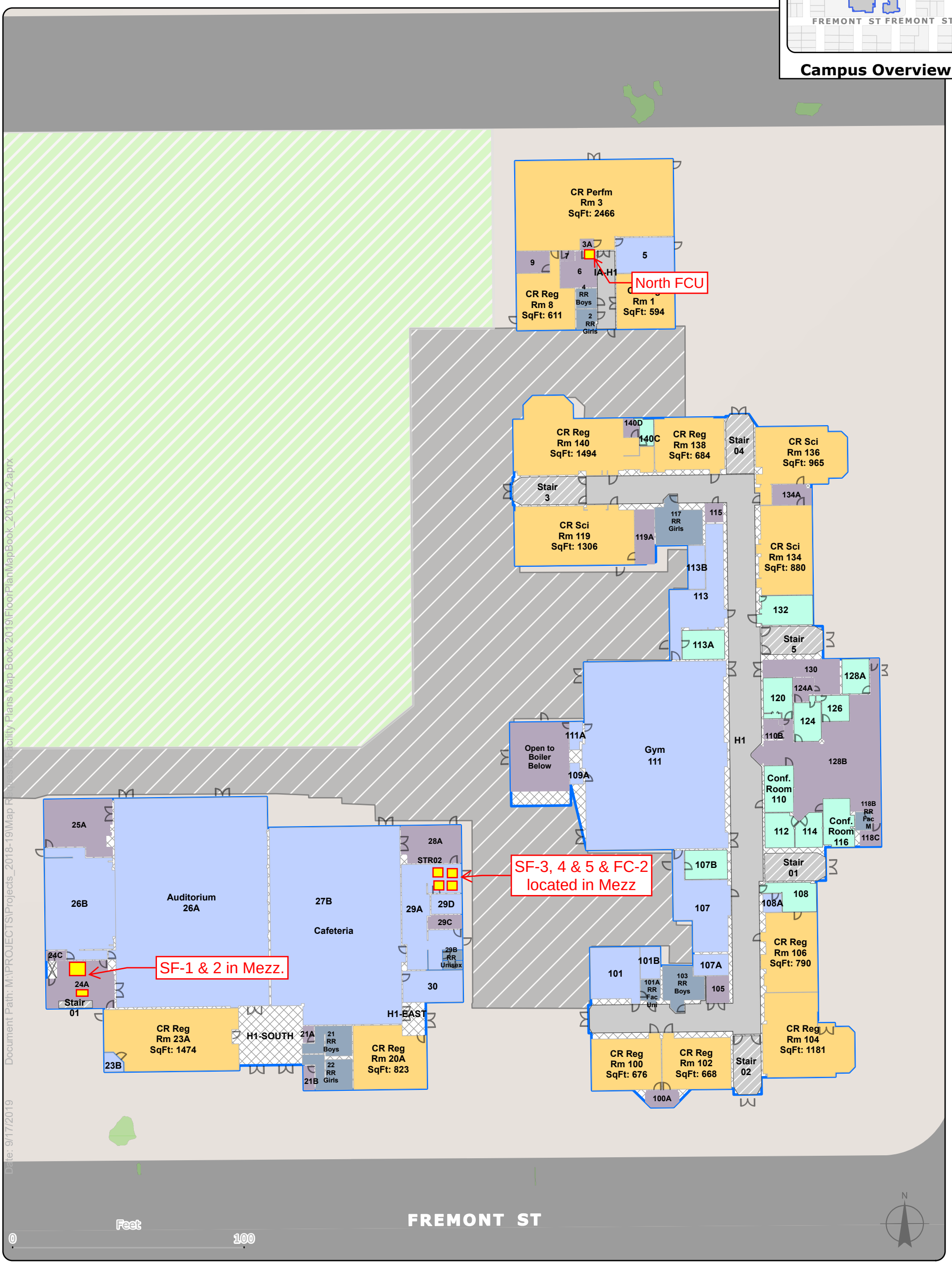
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BEAUMONT: First Floor



Campus Overview



Space Use

- Classroom
- Office
- Rest Room
- Special Purpose
- Corridor
- Other
- Stairs/Elevator

School Grounds

- Campus Footprints
- Athletic Field
- Playground: Paved
- Playground: Unpaved
- Streets
- Doors

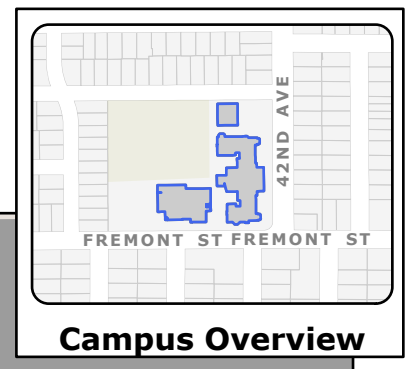
Total Number Of Rooms By Classification

Classrooms: 14	Special Purpose: 18
Office Spaces: 13	Storage: 22

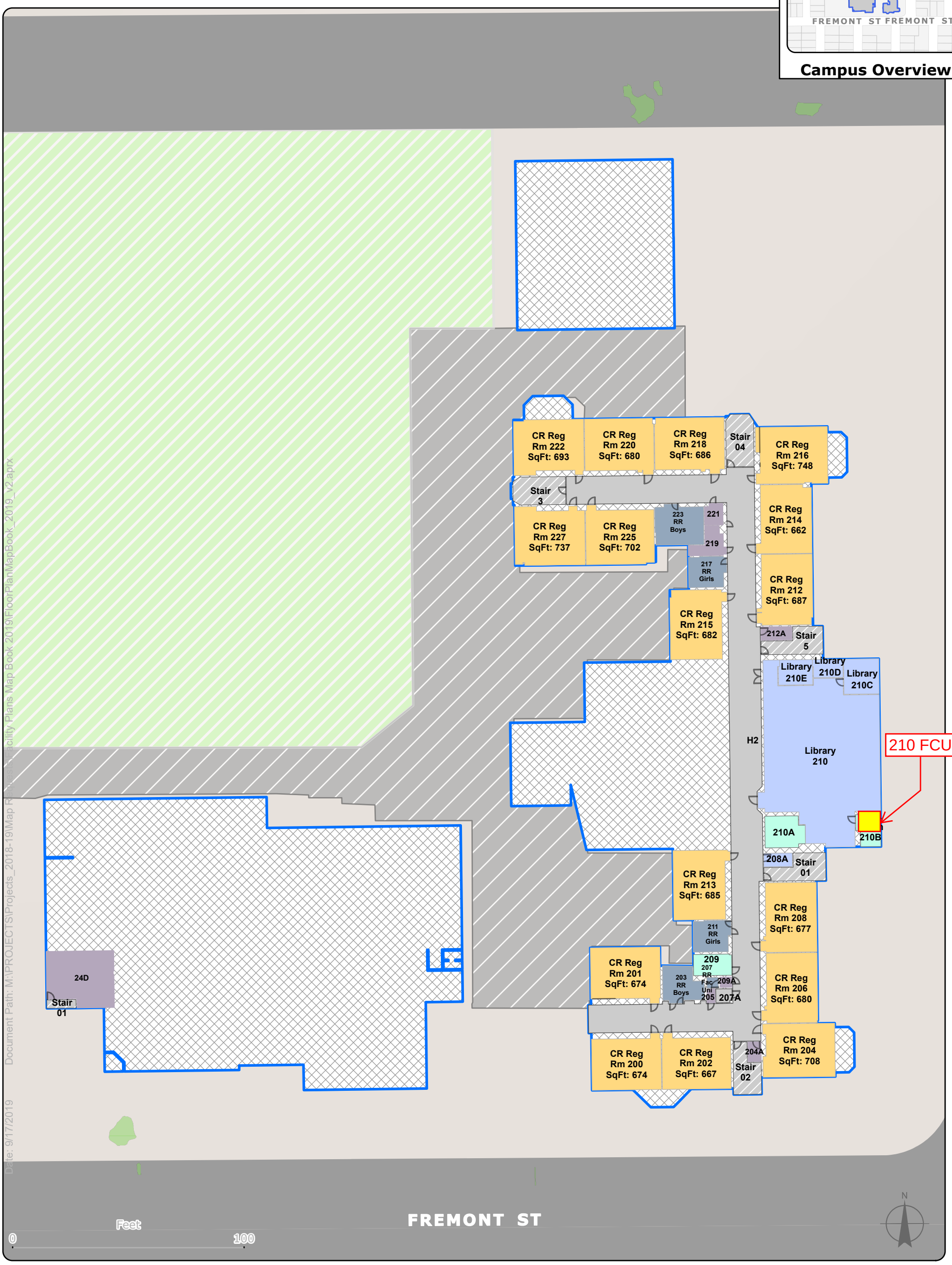
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DO NOT DISTRIBUTE

BEAUMONT: Second Floor



Campus Overview



Space Use

- Classroom
- Office
- Rest Room
- Special Purpose
- Corridor
- Other
- Stairs/Elevator

School Grounds

- Campus Footprints
- Athletic Field
- Playground: Paved
- Playground: Unpaved
- Streets
- Doors

Total Number Of Rooms By Classification

Classrooms: 16	Special Purpose: 5
Office Spaces: 3	Storage: 5