



# 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<sub>2</sub> 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](http://www.ameresco.com).

## Explanation of ASHRAE Total Effective Air Changes per Hour (ACH<sub>e</sub>) 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:

### Epidemic Conditions in Place



#### Equivalent Outdoor Air:

The equivalent outdoor air calculation indicates that the outdoor air can be calculated by using the combination of the actual outdoor air, impact of filtration or air cleaning technologies on recirculated air, and the impact of air cleaning technologies in the space.

This is using the principal of filters in series and the effectiveness at reducing particles. For items in series, the initial item would see the recirculated airflow to clean. The second item in the series would see the “cleaned” air from Item 1 and so the impact of Item 1 must be accounted for in Item 2.

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<sub>e</sub>) 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:

$$ACH_e = (ACH_{oa} + ACH_f) * E_z + ACH_{ir}$$

where:

- $ACH_{oa}$  = air changes per hour of outside air = outside airflow in cubic feet per minute \* 60 minutes per hour / room volume in cubic feet
- $ACH_f$  = 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<sub>e</sub> 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<sub>e</sub>.
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  
Rosa Parks ES  
8960 N Woolsey Ave, Portland, OR 97203  
Job Number: 2021-0297**

**Project Completion Date: 08/31/21**  
**Revision Date: - Revision Number: -**



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**Neudorfer Engineers, Inc.**

Consulting Engineers Seattle, Washington - Portland, Oregon



[www.NeudorferEngineers.com](http://www.NeudorferEngineers.com)

**Portland Public Schools Airflow Testing  
Rosa Parks ES**

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**Neudorfer Engineers, Inc.**

Consulting Engineers Seattle, Washington - Portland, Oregon



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## REPORT TITLE

### CERTIFIED TEST: SURVEY REPORT

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**Project:** Portland Public Schools Airflow Testing  
Rosa Parks ES

**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**

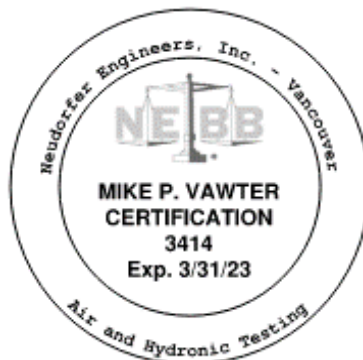
Expiration Date: **March 31, 2023**

Certification Date: **March 31, 2021**

*(Date completed)* **Signed and Sealed by:**

NEBB Supervisor: **Mike Vawter P.E.**

NEBB Supervisor: **Eric Stotts**





# Neudorfer Engineers, Inc.

Consulting Engineers Seattle, Washington - Portland, Oregon



www.NeudorferEngineers.com

## TERMS AND ABBREVIATIONS

**Project:** Portland Public Schools Airflow Testing

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

## INSTRUMENT CALIBRATIONS

### Portland Public Schools Airflow Testing

<b>Instrument Type</b>	Air Data Meter with Flowhood	<b>Instrument Serial #</b>	<b>M00475</b>
<b>Instrument Manufacturer</b>	<b>Shortridge</b>	<b>Calibration Date</b>	<b>11/4/2020</b>
<b>Instrument Model Number</b>	<b>ADM 870</b>	<b>Calibration Due</b>	<b>11/4/2021</b>
<b>Instrument Type</b>	Differential Pressure Water Meter	<b>Instrument Serial #</b>	<b>W14090</b>
<b>Instrument Manufacturer</b>	<b>Shortridge</b>	<b>Calibration Date</b>	<b>10/16/2020</b>
<b>Instrument Model Number</b>	<b>HDM-250</b>	<b>Calibration Due</b>	<b>10/16/2021</b>
<b>Instrument Type</b>	Psychrometer	<b>Instrument Serial #</b>	<b>8084305</b>
<b>Instrument Manufacturer</b>	<b>Extech</b>	<b>Calibration Date</b>	<b>10/13/2020</b>
<b>Instrument Model Number</b>	<b>RH390</b>	<b>Calibration Due</b>	<b>10/13/2021</b>
<b>Instrument Type</b>	Tachometer	<b>Instrument Serial #</b>	<b>B185B5022P</b>
<b>Instrument Manufacturer</b>	<b>Nidec</b>	<b>Calibration Date</b>	<b>10/11/2020</b>
<b>Instrument Model Number</b>	<b>MT-200</b>	<b>Calibration Due</b>	<b>10/11/2021</b>
<b>Instrument Type</b>	Amp Probe	<b>Instrument Serial #</b>	<b>33380179WS</b>
<b>Instrument Manufacturer</b>	<b>Fluke</b>	<b>Calibration Date</b>	<b>10/9/2020</b>
<b>Instrument Model Number</b>	<b>323 Clamp Meter</b>	<b>Calibration Due</b>	<b>10/9/2021</b>
<b>Instrument Type</b>	Digital Thermometer	<b>Instrument Serial #</b>	<b>45400509WS</b>
<b>Instrument Manufacturer</b>	<b>Fluke</b>	<b>Calibration Date</b>	<b>10/9/2020</b>
<b>Instrument Model Number</b>	<b>52 II</b>	<b>Calibration Due</b>	<b>10/9/2021</b>
<b>Instrument Type</b>	Manometer	<b>Instrument Serial #</b>	<b>M00475</b>
<b>Instrument Manufacturer</b>	<b>Shortridge</b>	<b>Calibration Date</b>	<b>11/4/2020</b>
<b>Instrument Model Number</b>	<b>ADM 870</b>	<b>Calibration Due</b>	<b>11/4/2021</b>
<b>Instrument Type</b>	Thermal Anemometer	<b>Instrument Serial #</b>	<b>AVM440742003</b>
<b>Instrument Manufacturer</b>	<b>Alnor Instruments</b>	<b>Calibration Date</b>	<b>11/9/2020</b>
<b>Instrument Model Number</b>	<b>AVM 440</b>	<b>Calibration Due</b>	<b>11/9/2021</b>
<b>Instrument Type</b>	Ultrasonic Flow Meter	<b>Instrument Serial #</b>	<b>N5K1435T</b>
<b>Instrument Manufacturer</b>	<b>Fuji</b>	<b>Calibration Date</b>	<b>10/14/2020</b>
<b>Instrument Model Number</b>	<b>Portaflow-C</b>	<b>Calibration Due</b>	<b>10/14/2021</b>



PROJECT	Portland Public Schools Airflow Testing
LOCATION	Rosa Parks ES; 8960 N Woolsey Ave, Portland, OR 97203

## 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: Rosa Parks ES; 8960 N Woolsey Ave, Portland, OR 97203  
Filter Status: Upgraded

Room Floor Plan # (Actual #)	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																
Conf. Rm A100	RTU-02	RTU	23.5	17.6	414	10.7	4,426	165	100	62%	2.2	1.4	2	8.8	1.7	
A103	RTU-02	RTU	16.6	10.0	166	10.5	1,743	250	155	62%	8.6	5.3	1	15.6	6.6	
A104	RTU-02	RTU	10.3	10.5	108	10.0	1,082	55	35	62%	3.1	1.9	1	16.8	2.4	
Conf. Rm A105	RTU-02	RTU	16.0	9.8	157	10.0	1,568	255	160	62%	9.8	6.1	1	17.5	7.5	
A107	RTU-02	RTU	25.0	16.2	405	10.0	4,050	240	150	62%	3.6	2.2	1	6.6	2.7	
A108	RTU-02	RTU	21.0	16.1	338	10.0	3,381	330	205	62%	5.9	3.6	1	9.1	4.5	
A109	RTU-02	RTU	8.4	11.4	96	10.0	958	50	30	62%	3.1	1.9	1	18.7	2.4	
A110	RTU-02	RTU	8.4	11.4	96	10.0	958	55	35	62%	3.4	2.2	1	22.3	6.0	
A111	RTU-02	RTU	9.2	12.7	117	10.0	1,168	90	55	62%	4.6	2.8	1	21.3	8.0	
A120	RTU-02	RTU	19.2	39.0	749	12.0	8,986	240	150	62%	1.6	1.0	1	3.0	1.2	
A121	RTU-02	RTU	10.5	10.0	105	12.0	1,260	115	70	62%	5.5	3.3	1	16.6	4.2	
A122	RTU-02	RTU	9.3	10.2	95	12.0	1,138	105	65	62%	5.5	3.4	1	18.0	4.3	
A127	RTU-02	RTU	15.5	11.9	184	10.0	1,845	615	380	62%	20.0	12.4	1	23.8	15.4	
Library A126	RTU-02	RTU	58.5	35.8	2,094	17.0	35,603	2,217	1,375	62%	3.7	2.3	1	3.3	2.9	
Library A125	RTU-02	RTU	23.1	34.5	797	11.0	8,766	240	150	62%	1.6	1.0	1	3.0	1.3	
C101	RTU-01	RTU	26.7	42.2	1,127	11.0	12,394	100	100	100%	0.5	0.5	1	1.6	0.4	Note #2
C102	RTU-01	RTU	31.8	35.9	1,142	11.0	12,558	175	175	100%	0.8	0.8	1	1.9	0.7	Note #2
C103	RTU-01	RTU	31.8	35.9	1,142	11.0	12,558	840	840	100%	4.0	4.0	1	4.5	3.2	Note #2
C104	RTU-01	RTU	29.4	39.2	1,152	11.0	12,677	305	305	100%	1.4	1.4	1	2.4	1.2	Note #2
C105	RTU-01	RTU	24.8	39.2	972	11.0	10,694	210	210	100%	1.2	1.2	1	2.4	0.9	Note #2
C106	RTU-01	RTU	24.8	39.2	972	11.0	10,694	415	415	100%	2.3	2.3	1	3.3	1.9	Note #2
C107	RTU-01	RTU	24.8	39.2	972	11.0	10,694	130	130	100%	0.7	0.7	1	2.0	0.6	Note #2
C108	RTU-01	RTU	24.8	39.2	972	11.0	10,694	160	160	100%	0.9	0.9	1	2.2	0.7	Note #2
C109	RTU-01	RTU	24.7	39.6	978	11.0	10,759	105	105	100%	0.6	0.6	1	1.9	0.5	Note #2

Date: 8/6/2021

Readings By: Mayer/Suyematsu

AIRFLOW SURVEY REPORT

Project:Portland Public Schools Airflow Testing

Location:Rosa Parks ES; 8960 N Woolsey Ave, Portland, OR 97203

Filter Status:Upgraded

Room Floor Plan # (Actual #)	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																
C110	RTU-01	RTU	29.7	31.2	927	11.0	10,193	100	101	100%	0.6	0.6	1	2.0	0.5	Note #2
C111	RTU-01	RTU	37.0	26.5	981	11.0	10,786	185	185	100%	1.0	1.0	1	2.3	0.8	Note #2
C125	RTU-01	RTU	46.5	28.0	1,302	10.7	13,931	400	400	100%	1.7	1.7	1	2.5	1.4	Note #2
C100	RTU-01	RTU	46.5	28.0	1,302	10.7	13,931	795	795	100%	3.4	3.4	1	3.9	2.7	Note #2
Conf. Rm B133	RTU-07	RTU	33.3	25.0	833	14.3	11,905	665	306	46%	3.4	1.5	1	3.8	2.5	
B134	RTU-07	RTU	25.1	22.6	567	14.3	8,112	490	225	46%	3.6	1.7	1	4.7	2.7	
B130	RTU-07	RTU	11.2	33.9	380	12.0	4,556	200	92	46%	2.6	1.2	1	5.4	2.0	
B132	RTU-07	RTU	8.9	12.3	109	10.0	1,095	70	32	46%	3.8	1.8	1	17.2	2.9	
B136	RTU-07	RTU	10.0	8.6	86	10.0	860	70	32	46%	4.9	2.2	1	21.8	3.7	
Library B129	RTU-07	RTU	22.0	23.0	506	14.0	7,084	340	156	46%	2.9	1.3	1	4.4	2.2	
B128	RTU-07	RTU	16.2	33.4	541	14.0	7,575	330	152	46%	2.6	1.2	1	4.0	2.0	
B127	RTU-07	RTU	15.5	33.5	519	14.0	7,270	250	115	46%	2.1	0.9	0	N/A	1.6	Note #1
B126	RTU-07	RTU	9.6	21.2	204	10.0	2,035	105	48	46%	3.1	1.4	1	10.0	2.3	
B125	RTU-07	RTU	14.3	8.7	124	10.0	1,244	100	46	46%	4.8	2.2	1	16.2	3.6	
B124	RTU-07	RTU	17.2	8.6	148	10.0	1,479	65	30	46%	2.6	1.2	1	12.5	2.0	
B121	RTU-07	RTU	42.2	22.9	966	18.1	17,491	215	99	46%	0.7	0.3	1	1.4	0.6	
Conf. Rm B142	RTU-07	RTU	14.4	21.6	311	12.0	3,732	240	110	46%	3.9	1.8	1	7.1	2.9	
B140	RTU-07	RTU	7.5	15.6	117	10.0	1,170	60	28	46%	3.1	1.4	1	15.7	2.3	
B122	RTU-07	RTU	40.5	80.5	3,260	20.3	66,183	3,375	1,553	46%	3.1	1.4	1	2.6	2.3	
Rm B103	RTU-04	RTU	36.6	30.3	1,109	14.0	15,526	2,130	170	8%	8.2	0.7	1	7.0	6.0	
Rm B102	RTU-05	RTU	27.0	37.2	1,004	12.5	12,555	1,335	160	12%	6.4	0.8	1	5.9	4.7	
B102A	RTU-05	RTU	10.4	7.9	82	10.0	822	70	8	12%	5.1	0.6	1	22.7	3.7	
B101A	RTU-05	RTU	14.5	10.4	151	12.5	1,885	170	20	12%	5.4	0.6	1	12.2	3.9	
Rm B101	RTU-03	RTU	26.2	37.3	977	12.5	12,216	1,810	505	28%	8.9	2.5	1	7.9	6.6	

Date: 8/6/2021

Readings By: Mayer/Suyematsu

AIRFLOW SURVEY REPORT

Project:Portland Public Schools Airflow Testing

Location:Rosa Parks ES; 8960 N Woolsey Ave, Portland, OR 97203

Filter Status:Upgraded

Room Floor Plan # (Actual #)	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																
Cafeteria B100	RTU-03	RTU	52.0	80.4	4,181	20.2	84,452	1,810	507	28%	1.3	0.4	1	1.1	1.0	
B110	MAU-01+FC-1	MAU+FC	44.9	25.6	1,149	10.0	11,494	1,595	1,595	100%	8.3	8.3	1	8.0	6.7	
B113	-	-	6.6	9.0	59	19.5	1,158	-	-	-	0	0	0	N/A	0.0	Note #3
B111	FC-1	FC	22.4	8.3	186	9.0	1,673	85	85	100%	3.0	3.0	1	11.8	2.4	
Second Floor																
C200	RTU-01	RTU	27.0	45.9	1,239	18.8	23,299	590	590	100%	1.5	1.5	1	1.9	1.2	
C201	RTU-01	RTU	42.2	22.2	937	11.0	10,305	200	200	100%	1.2	1.2	1	2.4	0.9	
C202	RTU-01	RTU	43.3	24.4	1,057	11.0	11,622	625	625	100%	3.2	3.2	1	3.9	2.6	
C203	RTU-01	RTU	28.4	33.2	943	11.0	10,372	515	515	100%	3.0	3.0	1	3.9	2.4	
C204	RTU-01	RTU	24.7	39.5	976	11.0	10,732	700	700	100%	3.9	3.9	1	4.6	3.1	
C205	RTU-01	RTU	24.7	39.5	976	11.0	10,732	180	180	100%	1.0	1.0	1	2.3	0.8	
C206	RTU-01	RTU	39.2	24.7	968	11.0	10,651	145	145	100%	0.8	0.8	1	2.1	0.7	
C207	RTU-01	RTU	39.3	24.8	975	11.0	10,721	795	795	100%	4.4	4.4	1	5.0	3.6	
C208	RTU-01	RTU	39.6	24.7	978	11.0	10,759	1,185	1,185	100%	6.6	6.6	1	6.7	5.3	
C209	RTU-01	RTU	39.3	24.0	943	11.0	10,375	240	240	100%	1.4	1.4	1	2.6	1.1	
C210	RTU-01	RTU	31.1	31.1	967	10.9	10,543	255	255	100%	1.5	1.5	1	2.6	1.2	
C211	RTU-01	RTU	37.0	26.0	962	11.0	10,582	665	665	100%	3.8	3.8	1	4.5	3.0	
C217	RTU-01	RTU	7.8	12.6	98	8.0	786	270	270	100%	20.6	20.6	1	36.3	16.5	
C220	RTU-01	RTU	45.7	27.4	1,252	18.9	23,666	150	150	100%	0.4	0.4	1	1.0	0.3	

Date: 8/6/2021

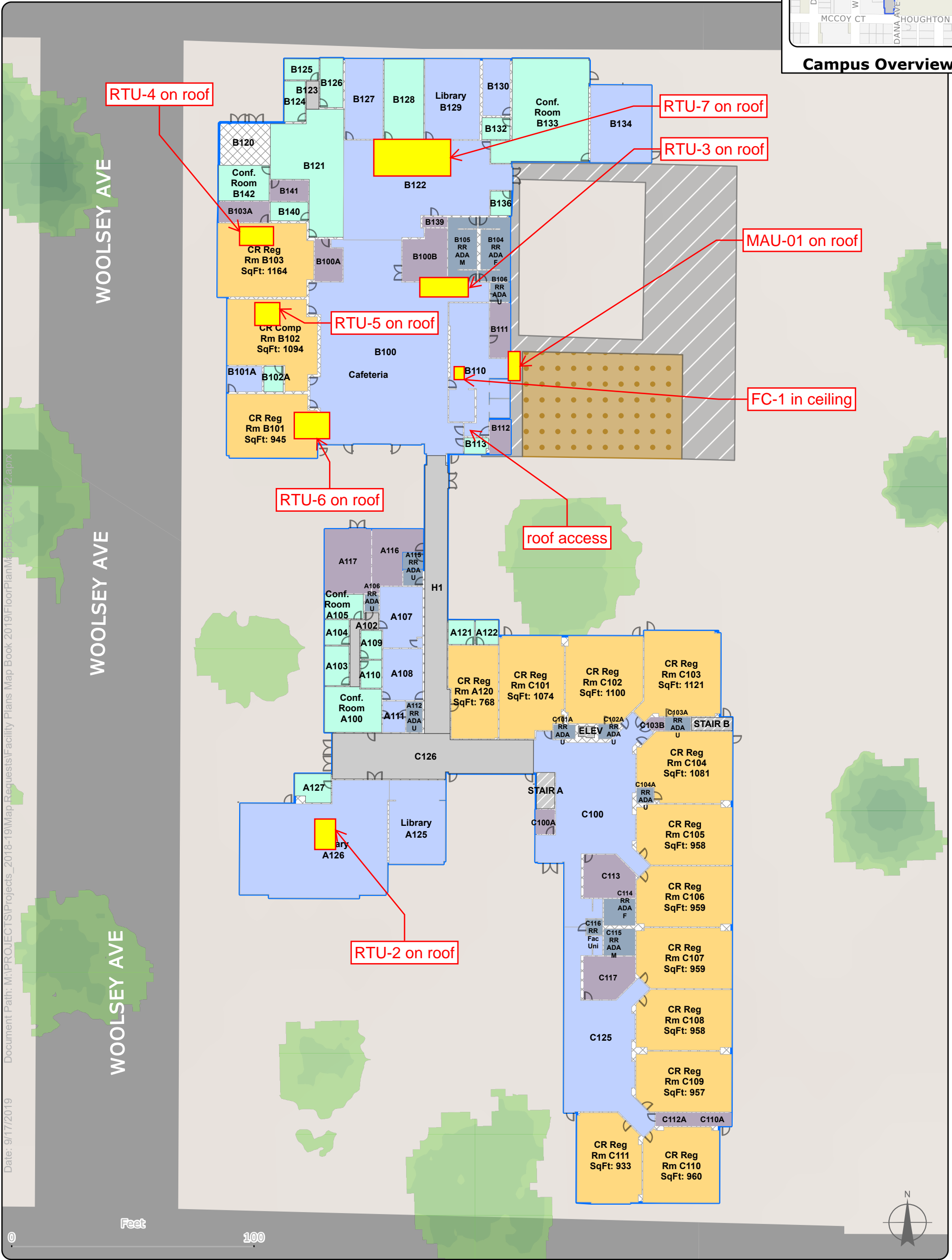
Readings By: Mayer/Suyematsu



Location: Rosa Parks ES; 8960 N Woolsey Ave, Portland, OR 97203

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ROSA PARKS: First Floor

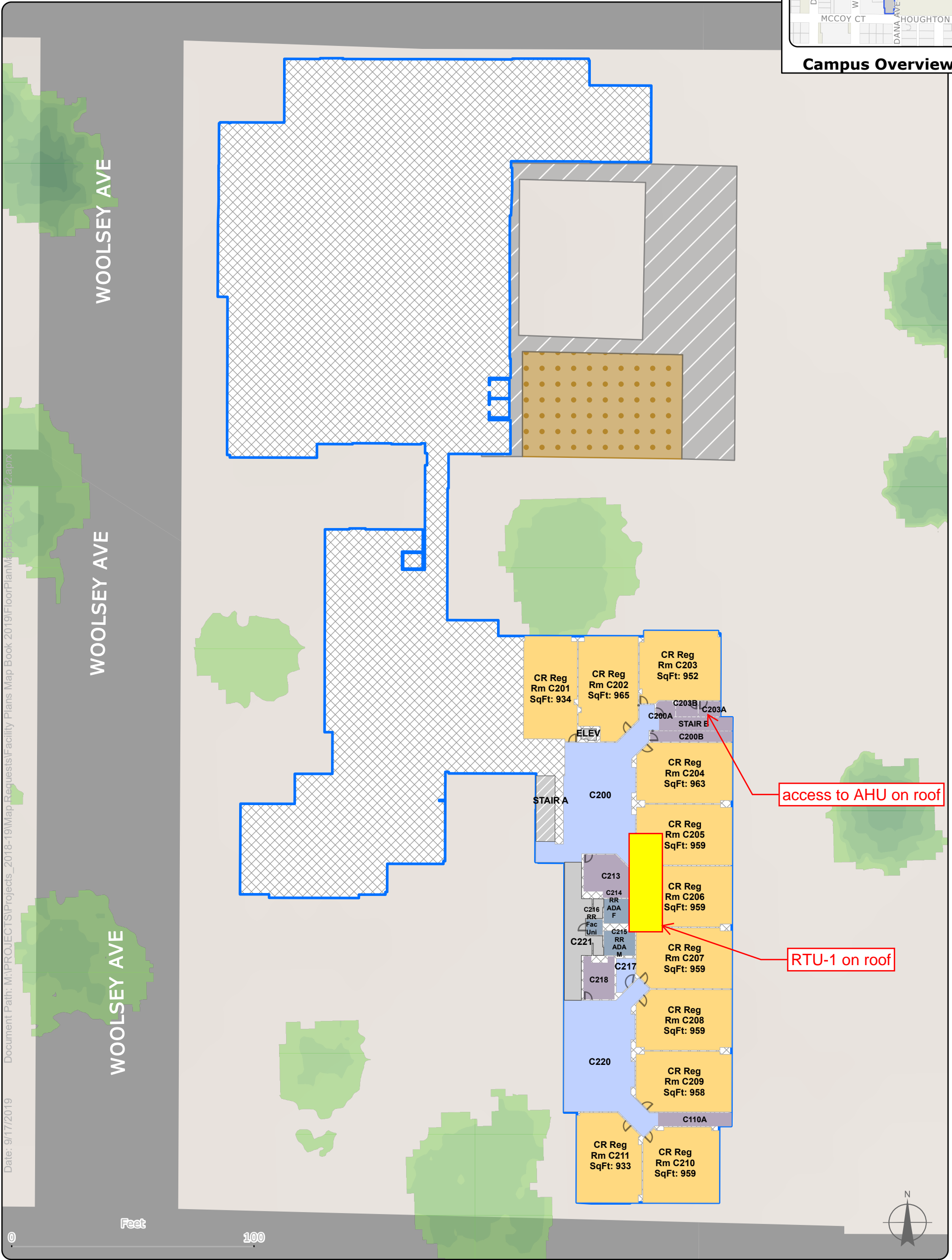


Space Use	School Grounds
<div></div> Classroom	<div></div> Campus Footprints
<div></div> Office	<div></div> Athletic Field
<div></div> Rest Room	<div></div> Playground: Paved
<div></div> Special Purpose	<div></div> Playground: Unpaved
<div></div> Corridor	<div></div> Streets
<div></div> Other	<div></div> Doors
<div></div> Stairs/Elevator	

Total Number Of Rooms By Classification

Classrooms: 15	Special Purpose: 15
Office Spaces: 21	Storage: 12

ROSA PARKS: Second Floor



Space Use		School Grounds	
	Classroom		Campus Footprints
	Office		Athletic Field
	Rest Room		Playground: Paved
	Special Purpose		Playground: Unpaved
	Corridor		Streets
	Other		Doors
	Stairs/Elevator		

**Total Number Of Rooms By Classification**

Classrooms: 11	Special Purpose: 3
Office Spaces: 0	Storage: 7