

Arlington Public Schools Ventilation Assessment – Gunston
March 2021

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Final Draft

DRAFT

VENTILATION ASSESSMENT – Gunston Middle School

Arlington Public Schools is in the process of doing additional assessment of ventilation systems in the less ventilated schools to improve conditions as recommended to open schools. The assessment is to review the available ventilation systems and include long-term planning to increase the ventilation in the classrooms to meet expected occupancy of the facilities.

The buildings are conditioned by different types of HVAC systems, even in the same facility. Thus, a “typical” classroom, that was ventilated differently, was reviewed based on system type in the facility. In general, the main system types include dedicated ventilation units serving the classroom HVAC unit or centrally located HVAC units. In rooms where the ventilation rate were below the recommendations, these systems were reviewed to determine methods to increase the ventilation in the classrooms. The continuation of the ventilation study was review schools in which ventilation rates are to be increased to the extent possible. This report addresses the Gunston Middle School.

The current American Society for Heating, Refrigerating and Air Conditioning (ASHRAE) code 62.1-2010 requires ventilation to be calculated based both on the classroom size (square foot of the room) and classroom occupancy. The classroom ventilation was designed as necessary to meet the current code level ventilation unit. As part of the guidelines for opening buildings, ventilation rates should be increased to the extent possible as a method to dilute airborne contaminants to the extent possible. ASHRAE recommends diluting the room air utilizing ventilation to the extent possible while not adversely affecting space air conditioning.

Harvard T.H. Chan’s Guidelines for opening schools recommend that facilities verify the outside air ventilation system is operational and provide adequate ventilation. In addition to outside air ventilation, the guidelines also recommend that the building HVAC systems provide adequate air movement in the classrooms by using a combination of outdoor air and recirculating air. The target air movement rate in a classroom is to cycle the air in a room, 5 times per hour [called air change rates per hour (ACH)]. Having a minimum of 5 ACH would mean the air is cycled 5 times in an hour – or every 12 minutes. The recommendation for cycling air in the classroom is to allow the HVAC systems to filter the air.

Both Harvard and ASHRAE recommend increasing filtration efficiencies to the highest allowable by the limits of the HVAC system. This varies by HVAC system, with MERV 13 equivalence being the minimum recommended filtration level due to its ability to remove 85 percent of the particles larger than 1 micron. While the virus is smaller than 1 micron, the general consensus is that the virus transmits in droplet form with the RNA infectious dose most likely in a size range greater than 1 micron. If the HVAC system isn’t capable of utilizing MERV 13 filtration, the recommendation is to supplement the room with a fan/filter unit capable of using very high-efficient filters (HEPA) to allow better filtration and to increase the effective, clean air in the room.

Central HVAC systems: Gunston predominantly uses central type air conditioning units mainly located on the roof. These units provide heating, cooling, and ventilation for several classrooms throughout the facility. The ventilation for these units operates using dampers and controls directly connected to the outdoors via to draw outdoor air through the unit. The unit then heat or cools the ventilation air providing the necessary cooling/heating air to the individual classrooms and spaces. Each group of classrooms is served by a dedicated zone duct from the roof top air conditioning unit. The ventilation in these rooms ranges from 2 to 3 (averaging 2.8) air changes per hour. The HVAC system provides an average of almost 5 air changes per hour of filtered/ventilated air (the air is cycled every 12 to 13 minutes). These roof top units are equipped with MERV 8 filters.

Dedicated Ventilation and classroom HVAC systems: Gunston also has several classrooms (approximately 40 percent) which uses central type dedicated ventilation/air handling units mainly located on the roof. These units ventilate several classrooms throughout the facility. Each classroom includes an above ceiling mounted heat pump unit or wall mounted unit(s) which provides temperature controlled to maintain space temperature while the dedicated unit provides the necessary outside air ventilation rates; the ventilation in these rooms equates to approximately 3 air changes per hour (average). The complete HVAC system (fan coil/ventilation air) were designed to meet code and provide over 7.5 air changes per hour of filtered/ventilated air (the air is cycled every 7-8 minutes). The ventilation systems utilized MERV 13 for the outside air (ventilation), while the heat pump units are equipment with MERV 8 filters.

Discussion:

The central system roof top units, can generally provide increased ventilation through the existing HVAC system. The existing ventilation rate is approximately 40%. To meet code level ventilation rates, approximately 60% outside air will be required. This additional ventilation load will have some effect on available operating temperatures.

Issues

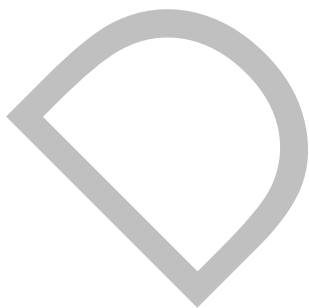
- The existing outside air dampers and controls would need to be adjusted to increase the ventilation rates to approximately 60% of the supply air.
- The outside airflow rates would need to be measured and set by balanced.
- The classrooms will require rebalancing and diffuser adjustments as necessary to provide the adequate supply and ventilation air change rates.
- The increased ventilation rate will greatly restrict available ambient conditions due to increase in outside air loads on the roof top units. The outside air design temperature to operate in the increased ventilation loads would need to be less than 85°F or greater than 30°F.

Recommendations:

- The existing, multi-zone roof top units will need to be replaced. These units will need to be designed to accommodate the higher ventilation rates. To achieve this level of ventilation, the RTUs will require energy recovery sections that allow higher levels of ventilation.
- The units would need to be increase in capacity to accommodate the higher outside air loads.
- Several classrooms will require rebalancing and diffuser adjustments as necessary to provide the adequate supply and ventilation air change rates. Approximately 1/3 of the of 32 classrooms will need classroom diffuser and airflow adjustments to achieve desired air change rates and ventilation airflows.

Additional recommendation:

- The equipment is 2018 vintage, thus should not require replacement, however, the MZ system design could be revised to a water source HP design with heat pump units (at the space) and revising the MZ RTUs into direct DOAS units.
 - All classrooms on each MZ, would be modified to receive a HP unit.
 - Ductwork revisions.
 - OA distribution generally to be done by original ductwork.
 - Provide dedicated HVAC to the Non-classroom areas that maybe also be served by a Multi-zone unit.



APPENDIX A

Disclaimers

General air change data

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Disclaimers

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- The information in this document is provided as general guidance based on the current information available utilizing the strategies developed by ASHRAE and Harvard. HVAC systems play only a small role in infectious disease transmission, the airflow information provided in these documents are not mitigation strategies. Additional non-HVAC mitigation strategies to be used includes:
 - **Building Occupancy Levels Allowed**
 - **Face mask requirements**
 - **Social distancing between desks, students, teachers, etc.**
 - **Directional flow for movement through the building**
 - **Personal hygiene**
 - **Cleaning requirements**
 - **Touchless services.**
- It is important to note that HVAC strategies are means to improve the air quality and reduce risk but will not prevent all possibility of virus transmission, user should acknowledge that there is a no “zero risk” scenario. HVAC improvements are intended to be used as part of an overall risk reduction strategy for reopening schools. Each building and situation are unique and the guidance provided doesn’t not equally apply to all buildings or classrooms.
- The information in this report is based on the very latest recommendations but the COVID-19 crisis remains an ever-evolving situation and this assessment and our recommendations are not intended to override or supersede any current or future guidance from health and government experts. This guidance should be used in conjunction with relevant guidance and research from governmental agencies. This information is not a substitute for guidance as recommended by health care professionals.
- CMTA does not warrant the accuracy or completeness of this guidance, by adopting these recommendations for use, each adopter agrees to accept the full responsibility in connection with their use. CMTA assumes no responsibility for any injury, loss, or damage arising out of or in connection with this guidance.

Location		Area	HVAC System Type	Design Year	Number of Class rooms	Classrm Size (SF)	OA CFM per Classrm	Ceiling Height	Room Volume	Room OA ACH	Number of Blue	Blue AIR 211+ Airflow	Equivalent ACH	Harvard Room ACH
15	Gunston	Ground	HPs and DOAS	2018	15	825	375	9.0	7425	3.03	1	350	2.83	5.86
	Middle	Ground - Home Ec	HPs and DOAS	2018	1	1800	600	9.0	16200	2.22	2	350	2.59	4.81
		Ground - Art	HPs and DOAS	2018	1	1465	495	9.0	13185	2.25	2	350	3.19	5.44
		Grd - CPU Lab	RTU-8 - MZ Unit (40% OA)	2018	1	980	584	9.0	8820	3.97	1	350	2.38	6.35
		Grd --MP Class	RTU-8 - MZ Unit (40% OA)	2018	1	825	421	9.0	7425	3.40	1	350	2.83	6.23
		Grd -- Classroom	RTU-15	2018	1	920	475	9.0	8280	3.44	1	350	2.54	5.98
		Grd -- Classroom	RTU-16	2018	1	915	475	9.0	8235	3.46	1	350	2.55	6.01
		Grd - (J) - Arts	RTU-8 - MZ Unit (40% OA)	2018	1	815	421	9.0	7335	3.45	1	350	2.86	6.31
		Grd - (J) - Weight	RTU-8 - MZ Unit (40% OA)	2018	1	830	421	9.0	7470	3.38	1	350	2.81	6.19
		Grd - East (J)	RTU-11 (40% OA)	2018	1	725	284	9.0	6525	2.61	1	350	3.22	5.83
		Grd - East (J)	RTU-11 (40% OA)	2018	2	725	296	9.0	6525	2.72	1	350	3.22	5.94
		Grd - East (J)	RTU-11 (40% OA)	2018	1	1025	252	9.0	9225	1.64	2	350	4.55	6.19
		Grd - East (J)	RTU-12 (40% OA)	2018	1	710	262	9.0	6390	2.46	1	350	3.29	5.75
		Grd - East (J)	RTU-12 (40% OA)	2018	2	600	215	9.0	5400	2.39	1	350	3.89	6.28
		Grd - (J) Comp Lab	RTU-12 (40% OA)	2018	1	825	525	9.0	7425	4.24	1	350	2.83	7.07
		Grd - East (J)	RTU-12 (40% OA)	2018	1	945	499	9.0	8505	3.52	1	350	2.47	5.99
		Lvl 1 - Area B	RTU-11 (40% OA)	2018	1	760	304	9.0	6840	2.67	1	350	3.07	5.74
		Lvl 1 - Area B	RTU-11 (40% OA)	2018	1	830	332	9.0	7470	2.67	1	350	2.81	5.48
		Lvl 1 - Area B	HPs and DOAS	2018	6	825	375	9.0	7425	3.03	1	350	2.83	5.86
		Lvl 1 - (B) Science	HPs and DOAS	2018	2	1000	580	9.0	9000	3.87	1	350	2.33	6.20
		Lvl 1 - (D) Science	HPs and DOAS	2018	2	1000	580	9.0	9000	3.87	1	350	2.33	6.20
		Lvl 1 - Area D	HPs and DOAS	2018	2	825	375	9.0	7425	3.03	1	350	2.83	5.86
		Lvl 1 - Area G	RTU-8 - MZ Unit (40% OA)	2018	1	735	317	9.0	6615	2.87	1	350	3.17	6.05
		Lvl 1 - Area G	RTU-8 - MZ Unit (40% OA)	2018	1	725	296	9.0	6525	2.72	1	350	3.22	5.94
		Lvl 1 - Area G	RTU-8 - MZ Unit (40% OA)	2018	1	725	292	9.0	6525	2.68	1	350	3.22	5.90
		Lvl 1 - (I) CPU Lab	RTU-8 - MZ Unit (40% OA)	2018	1	910	500	9.0	8190	3.67	1	350	2.56	6.23
		Lvl 1 - (K) Spec Ed	RTU-11 (40% OA)	2018	1	706	232	9.0	6354	2.19	1	350	3.31	5.50
		Lvl 1 - (K) Spec Ed	RTU-11 (40% OA)	2018	1	555	204	9.0	4995	2.45	1	350	4.20	6.65
		Lvl 1 - (K) Band	RTU-11 (40% OA)	2018	1	1535	495	9.0	13815	2.15	2	350	3.04	5.19
		Lvl 1 - East (K)	RTU-12 (40% OA)	2018	1	740	258	9.0	6660	2.32	1	350	3.15	5.48
		Lvl 1 - East (K)	RTU-12 (40% OA)	2018	1	730	318	9.0	6570	2.91	1	350	3.20	6.10
		Lvl 1 - (K) Music	RTU-12 (40% OA)	2018	1	1345	499	9.0	12105	2.47	1	350	1.73	4.21
		Lvl 1 - East (K)	RTU-12 (40% OA)	2018	1	735	323	9.0	6615	2.93	1	350	3.17	6.10
		Lvl 1 - East M	RTU-10 MZ Unit (40% OA)	2018	2	815	384	9.0	7335	3.14	1	350	2.86	6.00
		Lvl 1 - East M	RTU-10 MZ Unit (40% OA)	2018	1	825	300	9.0	7425	2.42	1	350	2.83	5.25
		Lvl 1 - East M	RTU-10 MZ Unit (40% OA)	2018	1	800	336	9.0	7200	2.80	1	350	2.92	5.72
		Lvl 1 - East M	RTU-10 MZ Unit (40% OA)	2018	1	780	344	9.0	7020	2.94	1	350	2.99	5.93
		Lvl 1 - East M	RTU-10 MZ Unit (40% OA)	2018	1	825	320	9.0	7425	2.59	1	350	2.83	5.41
		Lvl 2 - East N	RTU-10 MZ Unit (40% OA)	2018	1	735	312	9.0	6615	2.83	1	350	3.17	6.00
		Lvl 2 - East N	RTU-10 MZ Unit (40% OA)	2018	1	740	308	9.0	6660	2.77	1	350	3.15	5.93
		Lvl 2 - East N	RTU-10 MZ Unit (40% OA)	2018	1	740	260	9.0	6660	2.34	1	350	3.15	5.50
		Lvl 2 - East N	RTU-10 MZ Unit (40% OA)	2018	1	785	341	9.0	7065	2.89	1	350	2.97	5.87
		Lvl 2 - East N	RTU-10 MZ Unit (40% OA)	2018	1	1020	376	9.0	9180	2.46	1	350	2.29	4.75
					68	33541	378			2.82			2.99	5.81