



# SYOSSET SCHOOL DISTRICT

*Ventilation Options*

*September 30, 2020*

*Revised October 8, 2020*

## SEPTEMBER 29 MEMO HIGHLIGHTS

- AC projects in Elementary Schools to be completed in 2020
- AC in SouthWoods Auditorium to be completed in 2020
- AC at the High School to be completed in 2020
  - Includes RTUs for Art, Science, Library and Home Economics rooms.
- Elementary School furnace replacements scheduled 2021
- Johnson Controls EPC work with respect to building control systems provides opportunity for increased ventilation controls.
- AC projects for balance of High School and Middle School classrooms ready for Bid.
  - Decision on ventilation options here-in can lead to cost savings on remaining AC projects to be awarded.

# COVID GUIDANCE - SED

- Page 53 of SED Reopening Guidance

## Ventilation

### Ventilation Mandatory Requirements

- Maintain adequate, code required ventilation (natural or mechanical) as designed.

If other air cleaning equipment is proposed, submit to OFP for review and approval.

Districts and schools are encouraged to increase the fresh air ventilation rate to the extent possible to aid in maintaining a healthy indoor air quality. We recognize there are many different types of ventilation systems, natural or mechanical, that may be limited for increasing ventilation outside air due to available heat or fan/relief airflow capacity. Schools may consider installing a higher efficiency filter. A higher efficiency filter may require a larger filter housing and will create greater resistance to airflow, and the fan and HVAC system may require rebalancing to maintain the code required ventilation rate.

# COVID GUIDANCE - ASHRAE

- Many position papers, guidance documents.



## GUIDANCE FOR THE RE-OPENING OF SCHOOLS

appears below. Many different HVAC system types are used in educational facilities, so adaptation of these guidelines to specific cases is necessary. *Please consult the full guidance for important details and consider reaching out to qualified design professionals for detailed analysis as needed.*

- **Inspection and Maintenance:** Consider assessing the condition of systems and making necessary repairs. All building owners and service professionals should follow ASHRAE Standard 180-2018 "Standard Practice for the Inspection and Maintenance of Commercial HVAC Systems."
- **Ventilation:** A good supply of outside air, in accordance with ASHRAE Standard 62.1-2019, to dilute indoor contaminants is a first line of defense against aerosol transmission of SARS-CoV-2. Pre- and post-occupancy purge cycles are recommended to flush the building with clean air.
- **Filtration:** Use of at least MERV-13 rated filters is recommended if it does not adversely impact system operation. If MERV-13 filters cannot be used, including when there is no mechanical ventilation of a space, portable HEPA air cleaners in occupied spaces may be considered.
- **Air Cleaning:** Air cleaners such as germicidal ultraviolet air disinfection devices may also be considered to supplement ventilation and filtration. Technologies and specific equipment should be evaluated to ensure they will effectively clean space air without generating additional contaminants or negatively impacting space air distribution.

When possible, ASHRAE recommends **operating the equipment with 100-percent outdoor air** to avoid recirculation.<sup>2</sup> Of course, this will require the ventilation system to have sufficient cooling, dehumidification, heating, and humidification capacity to properly condition this excess outdoor airflow during extreme weather conditions. During mild weather, the existing system might not have a problem maintaining desired indoor temperature and humidity conditions, but that might not be the case when it is very hot or very cold outside.

For non-healthcare spaces, recommendations under this category involve keeping indoor humidity levels within the optimal range. The *ASHRAE Position Document on Infectious Aerosols* states:

"scientific literature generally reflects the most unfavorable survival for microorganisms [is] when the relative humidity is between 40 and 60 percent."<sup>2</sup>

# COVID GUIDANCE - CDC

## Administrative and engineering controls: Possibilities for schools

- ✓ Cleaning staff should **clean and disinfect frequently touched surfaces at least once a day, or more frequently if possible.** If once daily, cleaning and disinfecting can take place either before the school opens or after it closes.
- ✓ School administrators, cleaning staff, and select students should walk through the school together and decide which surfaces are touched frequently by students and staff and therefore should be the target of cleaning and disinfection efforts.
- ✓ **Increase ventilation and air flow.** Ensure ventilation systems (when present) are working properly. Increase circulation of outdoor air within buildings by opening windows and doors if it is safe to do so.
- ✓ Provide the cleaning staff with cleaning supplies (soap/detergent, bleach, buckets) and PPE specific for the disinfectant to wear when mixing, cleaning, and disinfecting (for example, rubber gloves, thick aprons, and closed shoes). PPE should be

## COVID RESPONSE

- Performed room-by-room review of each school
- Identified spaces with no ventilation
- Implemented emergency ventilation project to:
  - Provide ventilation to rooms with no operable windows
  - Installed exhaust fans in Nurse's offices / Isolation rooms to ensure negative pressure with respect to adjacent rooms / corridors
  - Provided portable HEPA filter units in Nurse's Offices
- Identified Rooms with Operable Windows as source of ventilation air



FIRST FLOOR

SECOND FLOOR

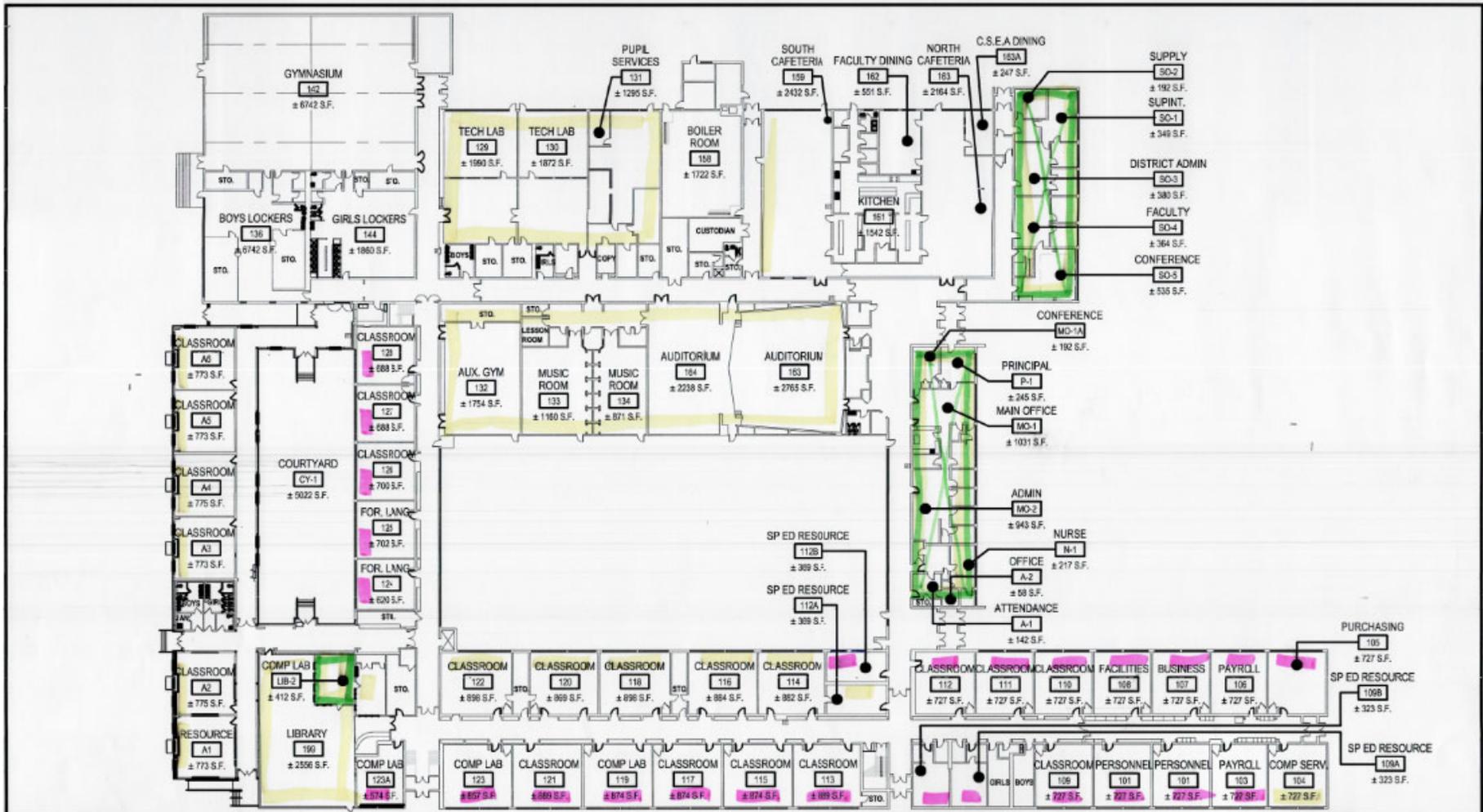
Client

## Syosset Central School District HB Thompson Middle School

- - Addressed in A/E Project
- - Addressed in Pre Opening Work
- - Operable windows
- - Existing HAV or U.V

H  
2  
M

architects  
+  
engineers

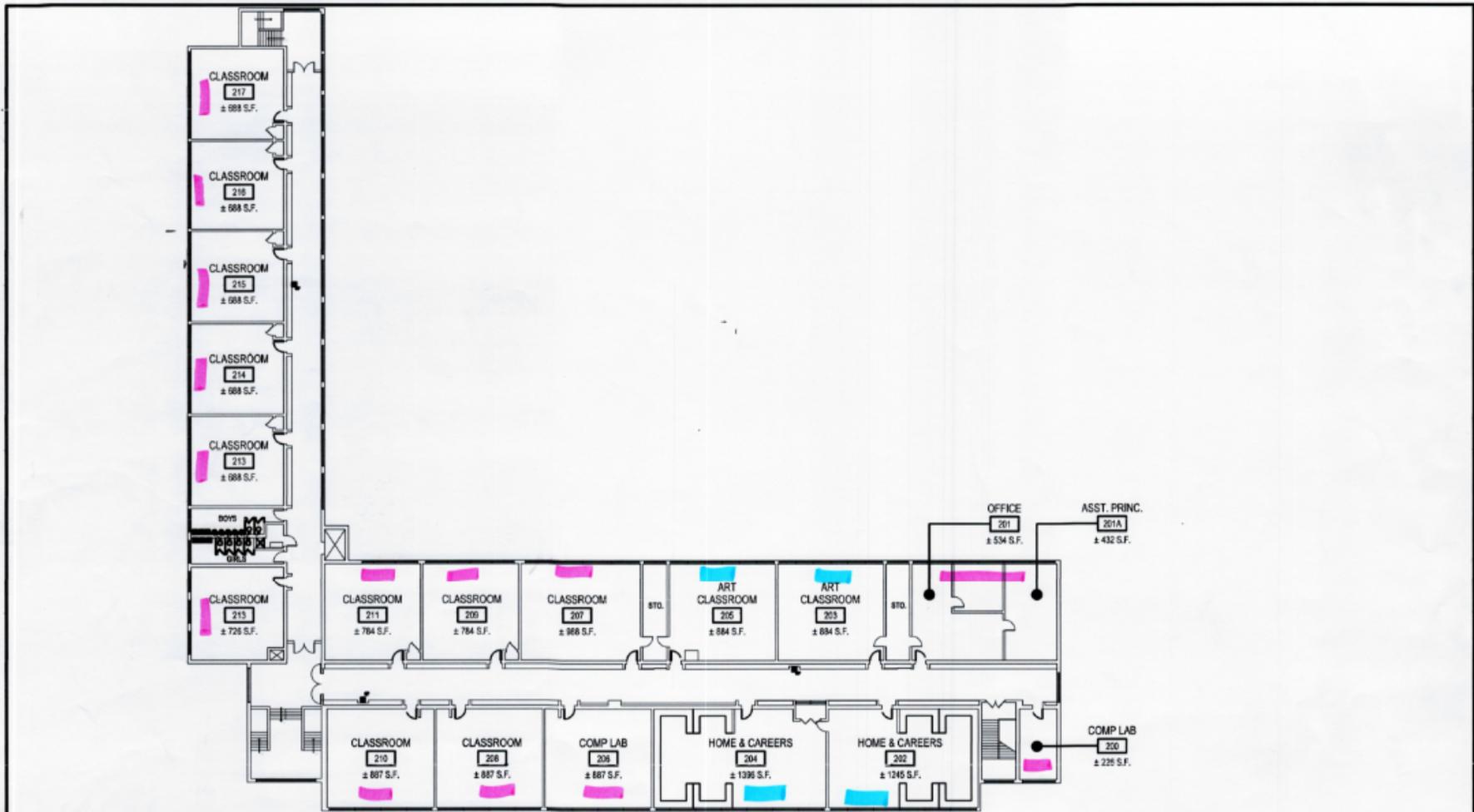


Client

## Syosset Central School District South Woods Middle School

- - Addressed in A/C Project
- - Addressed in Pre-Opening Work
- - Operable Windows
- - Existing HVAC or UV

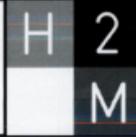
**H 2 M** architects + engineers



Client

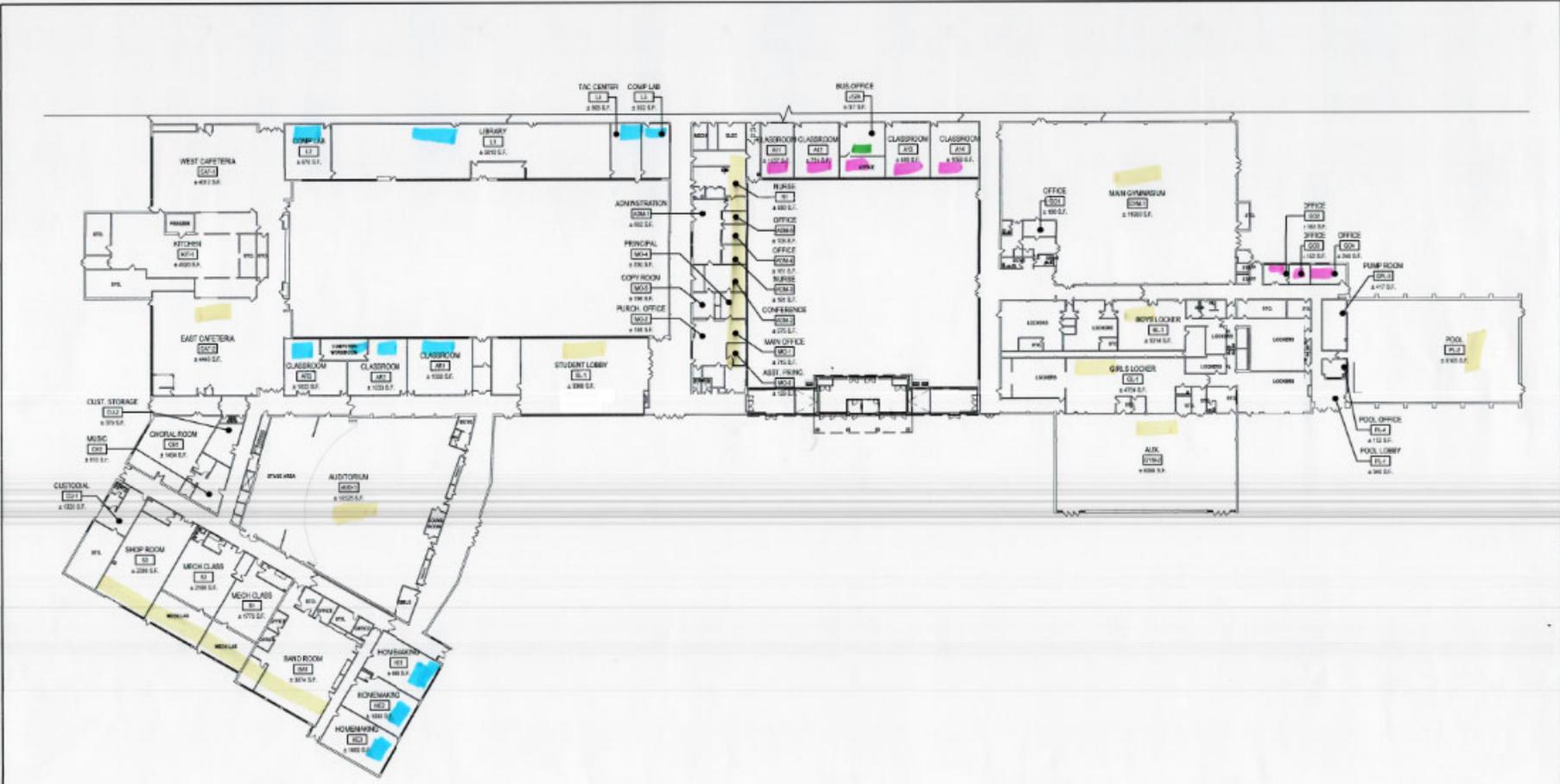
**Syosset Central School District  
South Woods Middle School  
2nd Floor**

- - Addressed in A/C Project
- - Addressed in Pre Opening Work
- - Operable Windows
- - Existing HVAC or UV



architects  
+  
engineers





PARTIAL FIRST FLOOR PLAN

Client

**Syosset Central School District  
Syosset High School**

H	2	architects + engineers
	M	



# AIR CONDITIONING SYSTEMS NOT USED

- Individual Ducted Roof Top Units
  - Too expensive
- Grouped Ducted Roof Top Units
  - Provides no individual room control unless use of VAVs and reheat coils
  - Cost prohibitive – need a BMS
- Unit Ventilators
  - Unitary Packaged – Compressor is inside cabinet – Noisy
  - Remote Condenser – 1:1 on roof – 40 – 60 condensers to maintain
  - Remote VRF Condenser – One condenser supplies multiple Unit Ventilators
    - Requires separate EEV controls enclosure and power (adjacent or in ceiling)
    - New / unproven. A lot of control problems

# AIR CONDITIONING SYSTEMS USED

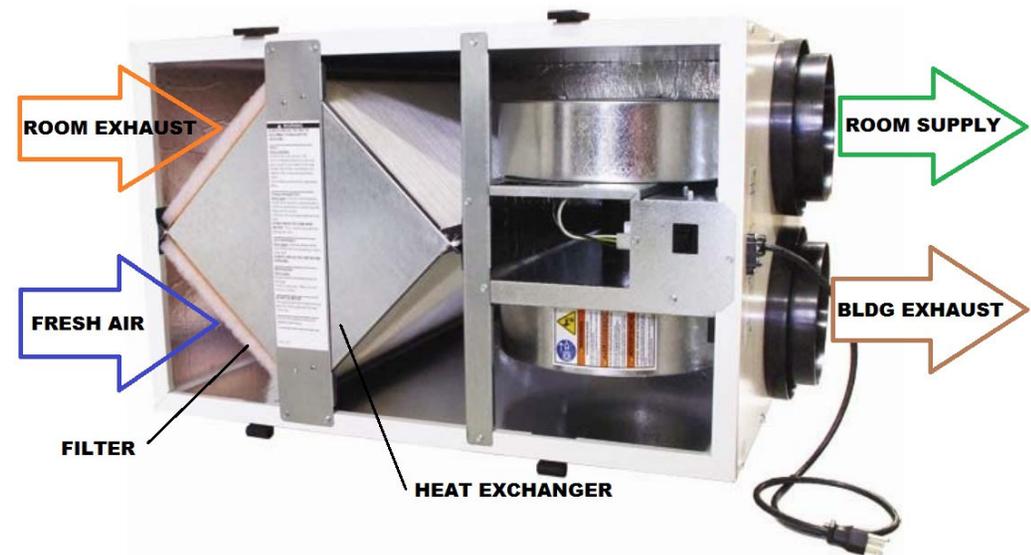
- Most Classrooms: Ductless split indoor units to single condenser.
  - Provide individual heating and cooling control
  - Does not provide ventilation air
  - Improved filtration (over existing)
- Science, Art, Home Economics, Auditoriums: Ducted Roof Top Units
  - Provides heating and cooling
  - Provides ventilation air
  - MERV13 filters

# VENTILATION OPTIONS

- Option 1: Close Windows
  - Allowed by SED
  - Complies with building code in effect for these buildings.
  - Building code for modern buildings requires more ventilation.
  - Opening windows for additional ventilation may lead to occupant comfort complaints and real issues.
- Option 2: ERV – lower construction costs; higher maintenance costs
- Option 3: DOAS – higher construction costs; longer lifespan
- Option 4: Unit Ventilators – cannot be constructed until Summer 2021

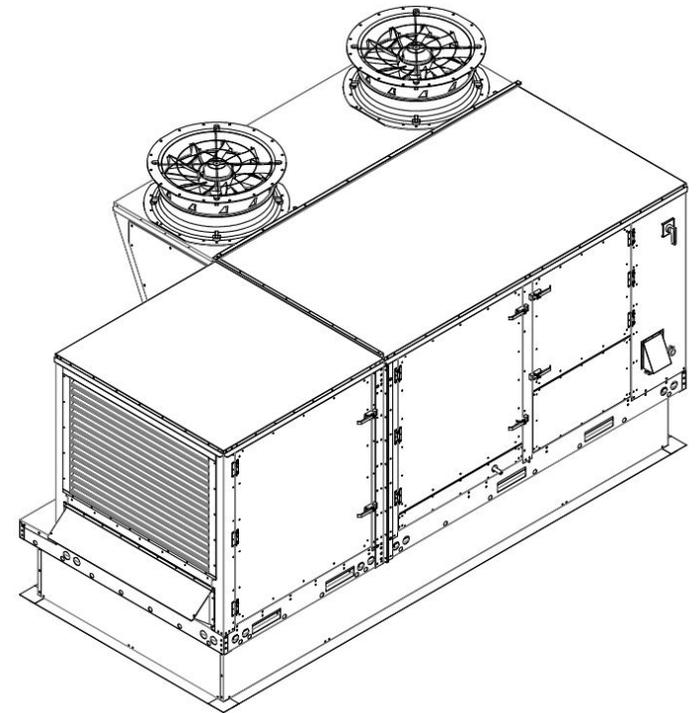
# VENTILATION EQUIPMENT

- ERV – Energy Recover Ventilator
  - Low cost
  - Easy to install – all construction inside classroom ceilings
  - Saves approximately 25% energy over “open window”
  - Requires supplemental heat in winter
  - Good for individual application
  - Not recommended building wide
  - High electric heat cost
  - High maintenance
  - Short life span



# VENTILATION EQUIPMENT

- DOAS – Dedicated Outside Air System
  - Median cost
  - Roof top construction – roof top ductwork, requires gas
  - Saves approximately 25% energy over “open window”
  - Efficient gas heat in winter
  - Provides pre-cooling
  - Reduces room AC unit sizing
  - Efficient gas heat
  - Low maintenance
  - Median life span

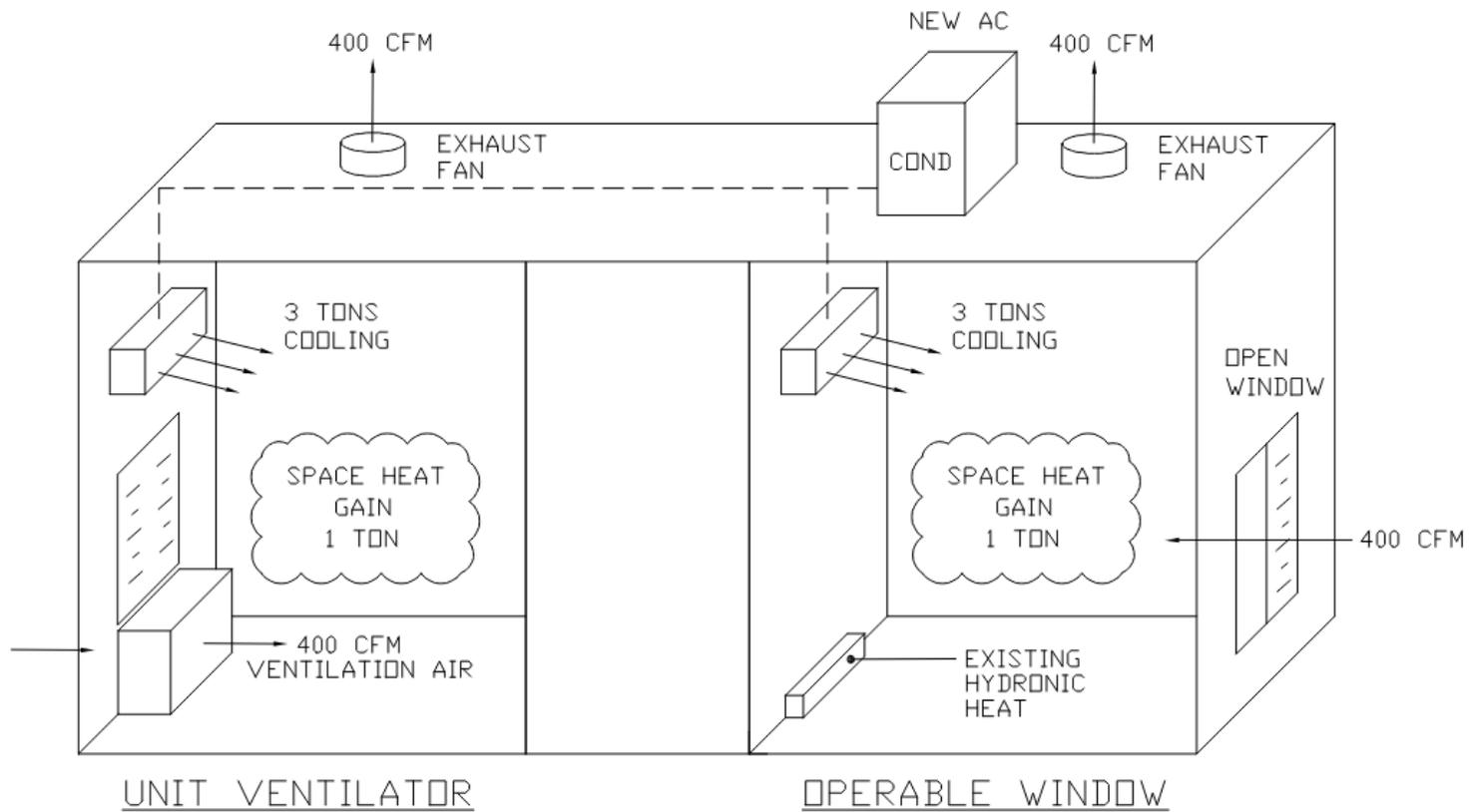


# VENTILATION EQUIPMENT

- Unit Ventilator
  - High cost
  - Construction in classrooms, wall openings and ceilings
  - No energy savings (no ERV option)
  - Requires school distribution piping upgrades
  - Simple / familiar system
  - Median maintenance
  - Longest life span

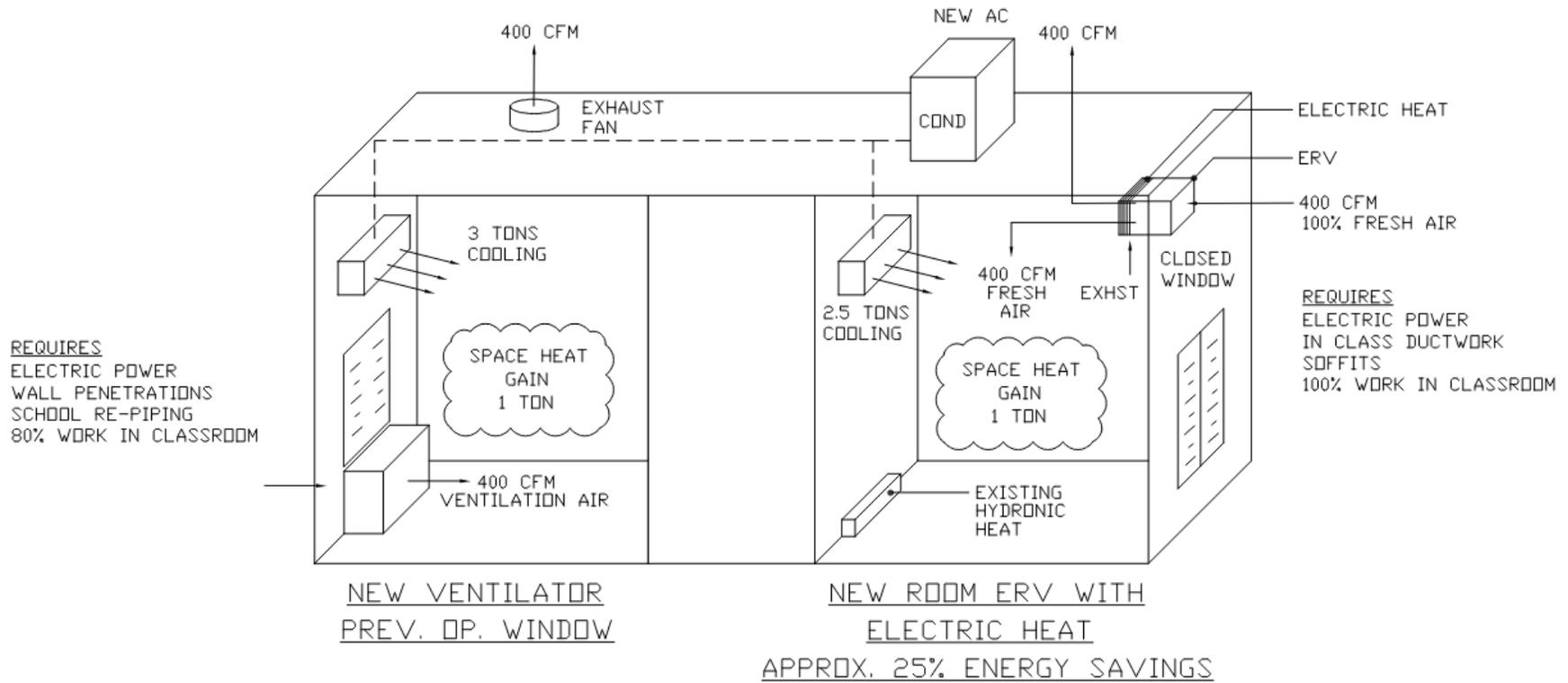


# CURRENT BUILDING SYSTEMS



TYPICAL 1000SF CLASSROOM

# UNIT VENTILATOR VS. ERV OPTION

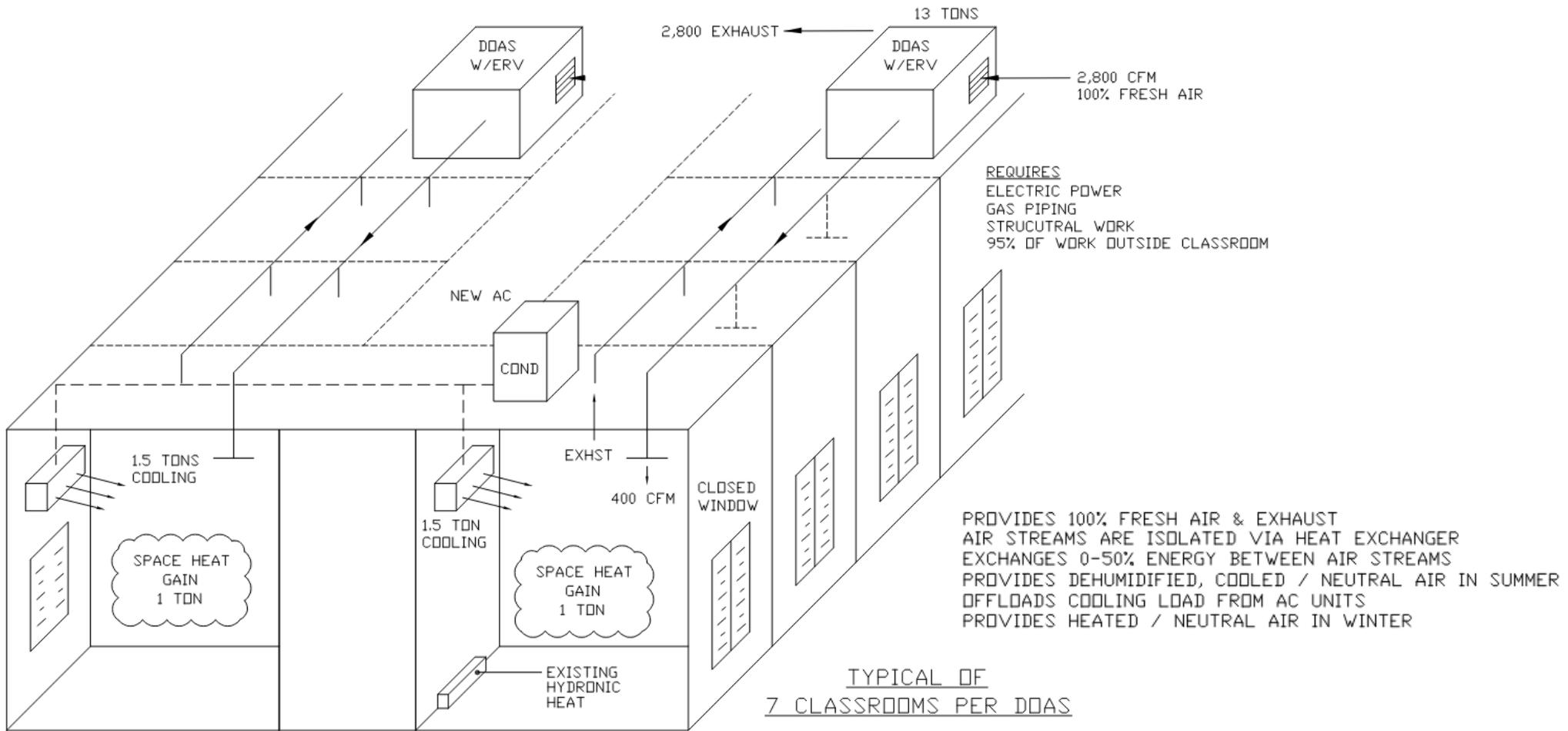


## TYPICAL 1000SF CLASSROOM VENTILATION OPTIONS

UV: HEATING ONLY UNIT VENTILATOR  
 PROVIDES VENTILATION AIR AS REQUIRED  
 NO ENERGY RECOVERY  
 A/C SYSTEM MUST TREAT VENTILATION AIR  
 USES EXISTING BOILER PLANT TO HEAT

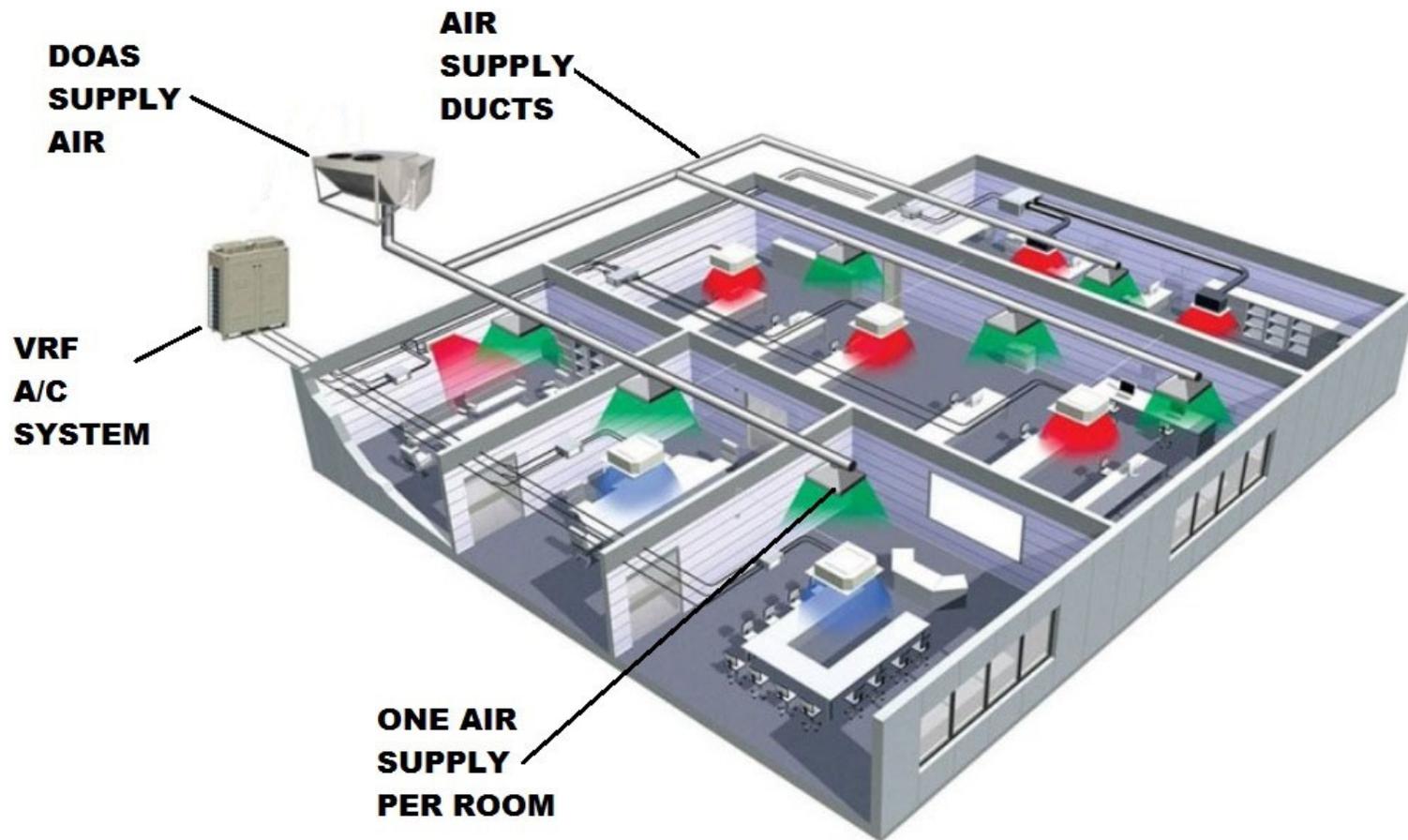
ERV: ENERGY RECOVERY VENTILATOR  
 PROVIDES 100% FRESH AIR & EXHAUST  
 PRE-HEATS OR PRE-COOLS OUTSIDE AIR VIA EXHAUST AIR  
 AIR STREAMS ARE ISOLATED VIA HEAT EXCHANGER  
 EXCHANGES 0-50% ENERGY BETWEEN AIR STREAMS  
 REQUIRES SUPPLEMENTAL ELECTRIC HEAT IN WINTER

# DOAS OPTION



NEW DOAS WITH ERV

# DOAS OPTION



# VENTILATION OPTIONS SUMMARY

<b>High School</b>	<b>Number of Rooms</b>	<b>ERV System</b>	<b>DOAS System</b>	<b>Unit Ventilators (1)</b>
Equipment Qty	60	60	9	60
Installed Cost Opinion		\$ 1,028,129	\$ 2,094,126	\$ 2,100,000
<b>HBT Middle School</b>	<b>Number of Rooms</b>	<b>ERV System</b>	<b>DOAS System</b>	<b>Unit Ventilators (1)</b>
Equipment Qty	56	56	8	56
Installed Cost Opinion		\$ 959,587	\$ 1,896,544	\$ 2,100,000
<b>South Woods Middle School</b>	<b>Number of Rooms</b>	<b>ERV System</b>	<b>DOAS System</b>	<b>Unit Ventilators (1)</b>
Equipment Qty	40	40	6	40
Installed Cost Opinion		\$ 685,420	\$ 1,397,311	\$ 1,960,000
<b>Elementary Schools</b>	<b>Number of Rooms</b>	<b>ERV System</b>	<b>ERV System</b>	<b>ERV System</b>
<b>Baylis-2, Berry Hill-6, AP Willits-2</b>	10	10	10	10
Installed Cost Opinion		\$ 171,355	\$ 171,355	\$ 171,355
Total Ventilation System Construction Cost Opinion (3)		\$ 2,844,491	\$ 5,559,335	\$ 6,331,355
Construction cost reduction on Air Conditioning Project (4)		Negligible	\$ 500,000	Not Applicable
<b>System Comparison</b>		<b>ERV System</b>	<b>DOAS System</b>	<b>Unit Ventilators (1)</b>
Lead Time		4-6 weeks	4-6 weeks	16 weeks
Filtration Type		100% Outside Air	100% Outside Air	25% Outside Air
Recirculation / Indoor Air Filtration		None	None	75% Recirculation
Majority of work location		In ceilings - may require soffits	On Roof	In classroom
Compatibility with Ductless Splits		Median	Best	Least
Heat Source		Electric	Gas	Hot Water (2)
Maintenance		Median	Least	Most
Service Life		5 years	15 years	25 years
Comperable Cost		Lowest	Median	Highest
Annual Heating Cost		\$ 112,000	\$ 17,000	\$ 23,000
Notes:				
1. Costs shown include 40% escalation from 2015 BCS.				
2. Will require heating hot water piping upgrades throughout building.				
3. The costs do not include escalation, premium time labor cost, other expedited costs.				
4. Approx. 10 % construction cost reduction on remaining High School and Middle School AC projects due to DOAS system load reduction on room side equipment size.				

# VENTILATION OPTIONS - 15 YEAR COST

Year	Cost Items	ERV System (1)	DOAS System (3)	Unit Ventilators (4)
<b>Yr 1</b>	Construction Cost	\$ 2,844,491	\$ 5,559,335	\$ 6,331,355
<b>Yr. 1-5</b>	Heat Energy Cost	\$ 560,000	\$ 85,000	\$ 115,000
<b>Yr. 1-5</b>	Maintenance Cost	\$ 255,839	\$ 171,733	\$ 93,600
<b>Yr. 1-5</b>	<b>Total</b>	<b>\$ 3,660,330</b>	<b>\$ 5,816,068</b>	<b>\$ 6,539,955</b>
<b>Yr. 6</b>	50% ERV Replacement Cost (2)	\$ 390,000	\$ -	\$ -
<b>Yr. 6-10</b>	Heat Energy Cost	\$ 560,000	\$ 85,000	\$ 115,000
<b>Yr. 6-10</b>	Maintenance Cost	\$ 255,839	\$ 171,733	\$ 93,600
<b>Yr. 1-10</b>	<b>Total</b>	<b>\$ 4,866,169</b>	<b>\$ 6,072,802</b>	<b>\$ 6,748,555</b>
<b>Yr. 11-15</b>	50% ERV Replacement Cost (2)	\$ 390,000	\$ -	\$ -
<b>Yr. 11-15</b>	Heat Energy Cost	\$ 560,000	\$ 85,000	\$ 115,000
<b>Yr. 11-15</b>	Maintenance Cost	\$ 255,839	\$ 171,733	\$ 93,600
<b>Yr. 1-15</b>	<b>Total</b>	<b>\$ 6,072,007</b>	<b>\$ 6,329,535</b>	<b>\$ 6,957,155</b>
Notes:				
1. Qty - 156 Units - Assumes changing filters monthly				
2. Qty - 78 Units - Assumes 50% of ERV units failing where replacment is more economical than repair				
3. Qty - 23 Units - Assumes changing filters quarterly				
4. Qty - 156 Units - Assumes changing filters every two months				