



**Attleboro District Court
Attleboro, MA**

**HVAC SYSTEM
EVALUATIONS
COVID-19**

Office of Court Management
September 14, 2021



Section 1

Existing Conditions & Site Observations

Tighe & Bond visited the James H. Sullivan Courthouse in Attleboro, MA on June 9, 2021. While on site we inspected the HVAC equipment and toured the facility to determine if the spaces generally matched usages noted on the architectural plans.

Site Visit Attendees:

- *Bristol County Employees:*
 - Leo Dumas
 - Alberto (Last name unknown)
- *Tighe & Bond*
 - Todd Holland, PE, Senior Mechanical Engineer
 - Matt Mancini, Staff Mechanical Engineer

1.1 Existing Ventilation System

The Attleboro District Court was constructed in 1910, has two above-grade stories and a basement, and is approximately 22,000 square feet in size. The HVAC equipment has been upgraded or replaced and appears to be between 15 and 30 years old. Tighe & Bond did not have access to mechanical drawings for this building, only architectural drawings.

Much of the HVAC equipment appears to be poor condition, at or near the end of its service life. Systems are by various manufacturers and appear to be of different ages and vintages, from replacements or upgrades over the years. There is one new split system serving the Juvenile Probation offices on the lower level, which uses R-410 refrigerant and appears to be installed during the last year. Most other systems are older and use R-22 refrigerant, which has been phased out of production.

Some areas are cooled by six separate split system air handlers that range between 1.5 tons and 5 tons cooling capacity. Five of the remote condensing units are located outdoors on grade in a fenced-in area, and one is located on the lower front roof. The air handlers are located in various places indoors, often in cramped spaces with poor service access. The filters we were able to access were 1" thick throwaway type with non-pleated media, rated MERV-4. None of the air handlers had outdoor air intakes, recirculating 100% of the airflow. Without accurate HVAC plans, we were unable to determine which units served which spaces, or how the air handlers were paired with condensing units.

A ductless mini-split serves the lobby area, with the outdoor unit located next to the main entry stairs.

Perimeter areas on the first floor are cooled and heated by 13 packaged terminal air conditioning (PTAC) fan coils with electric heat. There are primarily two types, the McQuay units appear to be older and the Islandaire units look like replacements. However, both types appear to be in poor condition. These units do not appear to bring in any outdoor air.

Several offices, the Jury Pool Room on the lower level, and Courtroom 3 are cooled by window air conditioning units. These are of various sizes, ages, and physical condition.

The holding cells in the lockup area do not have any ventilation.

Table 1 summarizes the air handlers' assumed airflow rates, the MERV rating of the filters we were able to access, and the observed condition. Since we do not have mechanical drawings, we numbered the units starting at the north corner of the fenced-in area, proceeding clockwise. CU-6 is located on the low roof. We have assumed the original design airflow based on condensing unit nameplate cooling capacity and 400 cfm per ton. Actual design airflows should be verified either with the air handler manufacturers or by a balancing contractor.

TABLE 1
Existing Air Handling Units

Unit	Original Design Airflow (CFM)***	Original Design Min. O.A. (CFM)	Pre/Final Filters	Condition
AC-1/CU-1 (Carrier)	1,000	0	Unknown	Poor
AC-2/CU-2 (EcoTemp)	1,200	0	MERV-4	Poor
AC-3/CU-3 (Carrier)	2,000	0	Unknown	Poor
AC-4/CU-4 (York*)	800	0	Unknown	Good
AC-5/CU-5 (Goodman**)	600	0	Unknown	Poor
AC-6/CU-6 (Trane)	1,600	0	Unknown	Poor

* New unit serving juvenile probation area

** Assumed to pair with Lennox CB18 AC unit

*** Original design airflow estimated based upon assumed condensing unit nameplate cooling capacity

Toilet rooms have individual exhaust fans that are interlocked with the lights. There is one in-line exhaust fan serving the Juvenile Probation area, but this did not appear to be functional at the time of our visit. The fan motor was turned on, but no airflow was detectable at the exhaust grille.

There is perimeter radiation throughout the building for heat, supplied by a Weil-McLain gas-fired boiler rated for 1.2 million Btu/hr output. The boiler appeared to be in good condition.



Photo 1 –Representative Split-System Air Handler



Photo 2 –Representative Window Air Conditioner



Photo 3 –Representative PTAC Fan Coil



Photo 4 – Outdoor Condensing Units

Note that Photo 4 shows five condensing units that are from four different manufacturers and are of various sizes and ages. One unit was offline and under repair at the time of our visit.

1.2 Existing Control System

The split systems are controlled by programmable thermostats with 7-day schedules. All units were set to run the fan in "auto" mode, which runs the supply fan only when the unit is actively cooling. The units run seasonally, only when cooling is required, and do not provide mechanical ventilation.



Photo 5 – Representative Thermostat



Photo 6 – Timeclock for Exhaust Fan

The exhaust fan serving the Juvenile Probation area is controlled by a motorized timeclock, set turn the fan on at 7:00 AM and off at 10:30 AM. Note that this type of timeclock requires a manual reset after a power failure.

The PTAC fan coils have unit-mounted controls.

The small exhaust fans in toilet rooms are interlocked with the light switches.

Section 2

Recommendations

Below is a list of recommendations that we propose for the Attleboro District Court. Please refer to the "Master Recommendation List" for further explanation and requirements of the stated recommendations. Please note that many of these recommendations are contingent upon providing code-minimum or greater mechanical ventilation, which is currently nonexistent.

Building areas without adequate ventilation and filtration significantly increase the risk of spreading viruses like SARS-CoV-2, especially areas with high occupant density and where people occupy the same space for relatively long periods of time. Consider significantly reducing occupancy or relocating occupants to other facilities with adequate ventilation.

2.1 Filtration Efficiency Recommendations

It is unlikely that the filters in the existing air handlers and PTAC units can be upgraded to MERV-13, which would meet the minimum ASHRAE recommendations for filtration during the pandemic. Consulting with the manufacturers can help determine if the equipment can accommodate the increase in system static pressure requirements associated with more efficient filters, and to what extent an upgrade is possible. We recommend the following measures be implemented for the existing air handling units that serve occupied areas:

RF-1: *Replace filters.*

We recommend the continued use of filters with the highest MERV rating feasible for each system type, based on consultation with the manufacturers.

2.2 Testing & Balancing Recommendations

The air handling units are of various ages, we have no access to design documents, and it is unknown to Tighe & Bond if they were ever tested and balanced.

We recommend the following testing and balancing measures be implemented:

RTB-1: *Test and balance air handling unit supply airflow rates.*

We recommend testing and balancing the total supply airflow rates for all air handling units to the original design level.

Because we do not have access to design documents, our ventilation air analysis considered the building as two spaces, courtrooms and non-courtroom areas. Because we do not have supply airflows for individual rooms, we cannot determine if there are any spaces outside of the courtrooms that would not be able to receive the correct quantity of outdoor air based on today's code requirements at full occupancy.

In addition to measuring the total supply airflow for each system, the testing and balancing contractor should also verify which spaces each system serves.

The average airflow rate per person is shown below in Table 2. These values are based on our calculation of code-required outdoor airflow rates. We were not provided the total supply airflow rates for any of the units. The airflow rate per person assumes a diversity factor of 70%, meaning the maximum number of occupants assumed to be in all zones at all times equates to 70% of the code default occupancy.

TABLE 2
Average Airflow Rate per Person

	<i>All Spaces</i>	<i>Courtrooms</i>	<i>Non-Courtroom Spaces</i>
Total Occupancy (People)	297	216	81
Total Supply Air (CFM/Person)	Unknown	Unknown	Unknown
Outdoor Air (CFM/Person)	22	10	54

The airflow rate per person for each courtroom and jury room is shown below in Table 3. These values are based on full default code occupancy, without taking diversity into account, and our calculated code-required outdoor airflow rates. The outdoor airflow rate per person assumes the calculated code minimum outdoor airflows are being delivered.

TABLE 3
Airflow Rate per Person (Full Occupancy)

<i>Courtroom</i>	<i>Total People</i>	<i>Total Air</i>		<i>Outdoor Air</i>	
		<i>Supply Airflow (CFM)</i>	<i>Airflow Rate (CFM/Person)</i>	<i>Outdoor Airflow (CFM)</i>	<i>Airflow Rate (CFM/Person)</i>
Courtroom 1	155	Unknown	Unknown	1,134	7
Courtroom 2	47	Unknown	Unknown	344	7
Courtroom 3	47	Unknown	Unknown	344	7
Juvenile Courtroom	60	Unknown	Unknown	438	7
Jury Deliberation	11	Unknown	Unknown	84	8
Jury Pool Room	19	Unknown	Unknown	147	8

Note: Courtroom occupant density is based on 70 people/1,000 square feet, per the 2015 International Mechanical Code

The airflow rate per person for each courtroom and the jury rooms, shown below in Table 3a, are based on the reduced occupancy schedule determined by the Office of Court Management.

TABLE 3a
Airflow Rate per Person (Reduced Occupancy)

<i>Courtroom</i>	<i>Total People</i>	<i>Total Air</i>		<i>Outdoor Air</i>	
		<i>Supply Airflow (CFM)</i>	<i>Airflow Rate (CFM/Person)</i>	<i>Outdoor Airflow (CFM)</i>	<i>Airflow Rate (CFM/Person)</i>
Courtroom 1	20	Unknown	Unknown	1,134	57
Courtroom 2	11	Unknown	Unknown	344	31
Courtroom 3	11	Unknown	Unknown	344	31
Juvenile Courtroom	9	Unknown	Unknown	438	49
Jury Deliberation	4	Unknown	Unknown	84	21
Jury Pool Room	5	Unknown	Unknown	147	29

Note: If occupancy is further reduced, the airflow rate per person will increase, assuming full airflow is being delivered to the space.

RTB-5: *Test and balance all air inlets and outlets.*

If specific areas within the courthouse experience regular cooling comfort complaints this may be an indication of a lack of airflow to the space. We recommend testing and balancing the air inlets and outlets serving those spaces to the designed values.

2.3 Equipment Maintenance & Upgrades

We recommend the following equipment maintenance and upgrades:

RE-2: *Clean air handler coils and drain pans.*

2.4 Control System Recommendations

We recommend the following for the control system:

RC-1: *Implement a pre-occupancy flush sequence.*

This sequence should start all air handlers and fan coils before the building is occupied, with the start time calculated to provide three air changes per hour (ACH) of ventilation air, or provide two hours of operation before occupants arrive.

2.5 Additional Filtration and Air Cleaning

We recommend the installation of the following air cleaning devices:

RFC-1: *Install portable HEPA filters.*

If the Attleboro District Court is to operate at a high capacity (i.e. 50% occupancy or greater), we recommend installing portable HEPA filters in high traffic areas, such as entrance lobbies or where people congregate outside courtrooms. They should also be considered for courtrooms, jury rooms, and general offices, depending on

the occupancy of the room and how much noise is generated from the filters. The noise levels will vary depending on the manufacturer and fan speed setting.

According to EPA guidelines, units should be sized to provide 5 air changes per hour (ACH) airflow. Below is a list of specific areas where we recommend placing portable HEPA filtration units, including offices if those spaces are regularly occupied by more than one person. If any of these spaces have only a single occupant, a HEPA filter is not needed.

- Courtroom 1
- Judge's Secretary
- Probation Offices
- Juv. Clerk's Clerical
- Courtroom 2
- Jury Deliberation
- Jury Pool Room
- Juvenile Courtroom
- Courtroom 3
- Civil Clerks' Office
- Juvenile Probation
- Judges' Lobbies

2.6 Humidity Control

Installing duct mounted or portable humidifiers can help maintain the relative humidity levels recommended by ASHRAE. The feasibility of adding active humidification is determined by the building envelope. Buildings that were not designed to operate with active humidification can potentially be damaged due to a lack of a vapor barrier, adequate insulation, and air tightness.

Duct mounted humidifiers must be engineered, integrated into the building control system, tested, and commissioned. They are available in many configurations but require substantial maintenance and additional controls. They also run the risk of adversely affecting IAQ from growing microorganisms or leaking water through poorly sealed ductwork damaging insulation and ceilings. Portable humidifiers are easier to install and require less maintenance, but still have the potential to damage the building envelope.

While active humidification is not recommended as a whole building solution due to high installation costs, operational costs, potential to damage the building envelope and adversely affect poor IAQ, it may be warranted as a temporary solution in some areas.

2.7 Other Recommendations

We recommend a complete redesign and replacement of the ventilation and cooling systems at this facility.

2.7.1 Replace Older Split Systems

Light commercial air handlers and outdoor condensing units have a life expectancy of approximately 15 years. Most of the split systems here are in poor condition, and none of them were designed with outdoor air intakes. The older systems use R-22 refrigerant, an ozone-depleting chemical that has been phased out of production, making it expensive to replace or replenish when a failure occurs. Consider replacing these units immediately. Replacement units will not only use a more environmentally friendly refrigerant, they will be more energy efficient, and can use heat pump technology to minimize the use of natural gas for heating and allow year-round operation. The new systems should also be specified to provide code-required outdoor air volumes and have MERV-13 filters.

2.7.2 Provide Mechanical Ventilation for All Occupied Areas

None of the rooms at the Attleboro District Court presently have mechanical ventilation, and only some of the areas have operable windows. Several corridors and other interior spaces do not have operable windows or any mechanical ventilation. Consider adding to or modifying the existing cooling systems to serve these areas.

2.7.3 Run Supply Fans Continuously During Occupied Hours

All existing units were set to run the fan in "auto" mode, which runs the supply fan only when the unit is actively cooling. As these systems are modified or replaced to provide ventilation air and use higher-efficiency filters, the controls should also be modified to run the supply fans continuously in occupied mode, to supply ventilation air to the spaces year-round. Note that this may cause comfort issues because supply air temperature can fluctuate as the heating and cooling is staged on and off, and the systems should be designed installed to operate continuously when the facility is occupied.

2.7.4 Replace PTAC Units

Most of the PTAC fan coils are beyond their expected service life of 20 years, are in poor condition, do not have high-efficiency filters, and do not appear to provide ventilation air to the spaces they serve. New unit ventilators can provide ventilation air, have more efficient electronically commutated motors, have much quieter fans, and can use MERV-13 filters.

2.7.5 Repair or Replace Exhaust Fans and/or Controls

We recommend repairing or replacing the motors, or controls for exhaust fans that were not working at the time of our visit. For small toilet rooms with individual fans, we recommend using a time delay relay that runs the fans for a period after the lights are switched off, such as the Panasonic SmartExhaust AirCycler combination fan/light timer control.

Disclaimer

Tighe and Bond cannot in any way guarantee the effectiveness of the proposed recommendations to reduce the presence or transmission of viral infection. Our scope of work is intended to inform the Office of Court Management on recommendations for best practices based on the guidelines published by ASHRAE and the CDC. Please note that these recommendations are measures that may help reduce the risk of airborne exposure to COVID-19 but cannot eliminate the exposure or the threat of the virus. Implementing the proposed recommendations will not guarantee the safety of building occupants. Tighe & Bond will not be held responsible should building occupants contract the virus. The Office of Court Management should refer to other guidelines, published by the CDC and other governing entities, such as social distancing, wearing face masks, cleaning and disinfecting surfaces, etc. to help reduce the risk of exposure of COVID-19 to building occupants.

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