



BRISTOL COUNTY SUPERIOR COURT HVAC SYSTEM EVALUATION SUMMARY

Visited February 22, 2021. While on-site, inspected the air handling equipment located in the mechanical rooms and toured the facility to determine if the spaces generally matched usages noted on the architectural plans. The Bristol County Superior Courthouse was constructed in 1890 and is approximately 39,000 square feet in size. The building's historic interiors have generally been preserved and it is on the listed National Register of Historic Places.

1.0 Airflow Rate per Person (Reduced Occupancy)

<i>Courtroom</i>	<i>Total People (Reduced Occupancy)</i>	<i>Total Air</i>		<i>Outdoor Air</i>	
		<i>Supply Airflow (CFM)</i>	<i>Airflow Rate (CFM/Person)</i>	<i>Outside Airflow (CFM)</i>	<i>Airflow Rate (CFM/Person)</i>
Jury Pool Room	11	1,300	34	200	5
Courtroom 1	21	6,000	30	900	4

2.0 Recommendations

Section	Recommendation/Finding	Action
2.1	Filtration Efficiency	
RF-1	Install Air Filters	Deferred
RF-3	Install a differential pressure sensor with a display across the filter bank	N/A
RF-3a	Connect the pressure sensor a local alarm	N/A
2.2	Testing and Balancing	
RTB-1	Test and rebalance air handling unit supply air and minimum outside air flow rates	N/A
RTB-2	Rebalance system return air flow rate	N/A
RTB-5	Test and balance all air inlets and outlets	N/A
2.3	Equipment Maintenance and Upgrades	
	Refer to section 2.7 for recommended upgrades	Deferred
2.4	Control System	
	Refer to section 2.7 for recommended upgrades	Deferred
2.5	Additional Filtration and Air Cleaning	
RFC-1	Install portable HEPA filters in high traffic areas – <i>if courthouse is to operate at a high occupancy (i.e. 50% or greater), install portable HEPA filters in high traffic areas.</i>	Complete
2.6	Humidity Control	
	No actionable items listed – continuous monitoring for seasonal changes	On-going

Bristol County SuperiorHVAC System Evaluation Continued

2.7 Other Recommendations

2.7.1	Replace HVAC System	Deferred
2.7.2	Add Toilet Exhaust to All Restrooms	Deferred
2.7.3	Install a Building Management System	Deferred



**Bristol County Superior Court
Taunton, MA**

**HVAC SYSTEM
EVALUATIONS
COVID-19**

Office of Court Management

April 19, 2021

Section 1

Existing Conditions & Site Observations

Tighe & Bond visited the Bristol County Superior Courthouse on February 22, 2021. While on site we inspected the air handling equipment located in the basement and toured the facility to determine if the spaces generally matched usages noted on the architectural plans.

Site Visit Attendees:

- *Bristol County:*
 - Facilities Superintendent
- *Tighe & Bond*
 - Sean Pringle, PE, Mechanical Engineer
 - Timothy Bill, Staff Mechanical Engineer

1.1 Existing Ventilation System

The Bristol County Superior Courthouse was constructed in 1890 and is approximately 39,000 square feet in size. The building's historic interiors have generally been preserved and it is on the listed National Register of Historic Places.

The HVAC ventilation system is very old and is likely either original or from the early 1900's. A single supply air system provides ventilation to all areas of the courthouse. The system consists of a single large blower that was originally driven with a steam-powered motor. At some point, the blower was modified to operate with an electric motor. A steam coil in the supply air stream heats the supply air. Bypass ducts around the steam coil allow the supply air temperature to be manually adjusted with splitter dampers, as there is no control valve to regulate the steam coil. The supply fan and electric motor are in good condition, but the steam coil is in very poor condition and leaking excessively.

Air returns to the blower through the open atrium and through the basement corridors, a practice that is not permitted by current code. A pair of double doors allow the return air to be restricted or shut off completely. There are two openings in the blower room to the exterior to allow outdoor air to be drawn into the system. However, these have been sealed shut with spray foam. There are no air filters in the return or supply air stream. Many rooms have both supply and relief air openings to allow air to escape when a large amount of outdoor air is being provided.

Aside from one unisex public restroom on the first floor, there are no toilet or general exhaust fans. The main public restrooms have supply air openings only.

Perimeter steam radiators provide supplementary heat to the building. Window air conditioning units have been added in many areas to provide cooling. Steam is provided via a central steam plant in an adjacent building that also serves the Registry of Deeds.

Because the outdoor air openings are sealed shut, and the distribution system has no air filters, the building has no mechanical ventilation and has no means to clean the air as it circulates. There are large operable windows in many areas.

Table 1 summarizes the air handling units’ designed airflow rates, the MERV rating of the installed filters, and the condition of the units. Note that the airflow shown below is an order of magnitude estimate only. The airflow is based on the supply air duct dimensions and modern practices for duct sizing. No drawings or data was available for the original HVAC system.

TABLE 1
Existing Air Handling Units

Unit	Original Design Airflow (CFM)	Original Design Min. O.A. (CFM)	Filters	Condition
Blower	Unknown (25,000 est.)	Unknown	None	Poor



Photo 1 – Blower Seen Through Return Air Doors



Photo 2 – Sealed outdoor air opening.

1.2 Existing Control System

There are no automated or local controls for the existing ventilation system. The steam radiators use local thermostatic valves with wall mounted bulbs for temperature control.

Regulation of the air temperature based on supply air is accomplished through manual adjustment of the splitter dampers, and also with user accessible dampers on individual registers.

Section 2

Recommendations

Below is a list of recommendations for the Bristol County Superior Courthouse. Please refer to the "Master Recommendation List" for further explanation and requirements of the stated recommendations.

As noted above, the courthouse has air circulation, but does not provide filtration or any ventilation. Building areas without adequate ventilation or filtration significantly increase the risk of spreading viruses like COVID-19, 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 areas with adequate ventilation.

2.1 Filtration Efficiency Recommendations

We recommend the following measures be implemented for the existing air handling units:

RF-1: *Install air filters.*

There are currently no filters in the air distribution system. As a short term solution, it may be possible to fabricate and install 2" filter frames and MERV 13 filters at the fan inlets to filter both return and outdoor air. It is likely a fairly low filter air velocity will be required to minimize pressure drop and the effect on airflow.

To ensure that the filter area is adequate, the system airflow should be measured prior to designing the filter frames. The TAB Contractor should measure initial airflow with no added air restriction, and then make a second measurement with simulated additional pressure drop of the filters, by partially closing the return air opening until the air flow begins to drop noticeably. The change in total static pressure will indicate the allowable pressure drop of the filters, and allowable filter velocity. The filter frame should be designed after reviewing the total system airflow and pressure drop capabilities.

Filter racks should be fabricated so that filters fit tightly, and end spacers should be used in each row to minimize filter bypass.

RF-3: *Install a differential pressure sensor with a display across the filter bank.*

RF-3a: *Connect the pressure sensor a local alarm.*

Maximum differential pressure should be set based on the allowable system pressure drop identified in during initial testing. Typically, this is not more than 1.0" w.g.

2.2 Testing & Balancing Recommendations

The air handling system is approximately 100 to 130 years old and it is unknown to Tighe & Bond if or when the system was tested and balanced. No mechanical code was in place at the time the system was initially designed. Recommendations are based on the 2015 International Mechanical Code (IMC) and current ASHRAE Standard 62.1 requirements.

As noted above, the design supply and outdoor airflow is unknown. The supply airflow is based on the supply duct size and typical modern duct sizing guidelines. The actual intended airflows may differ from this estimate dramatically. Also note that because we

do not know the intended airflows for the supply registers in each room, any airflows indicated in this report for these units and areas are estimates. Further engineering review is strongly recommended to establish design airflows for individual spaces.

We recommend the following testing and balancing measures be implemented:

RTB-1: *Test and balance air handling unit supply air and minimum outside air flow rates.*

We recommend testing and balancing the outdoor air flow rates for the blower to the recommended minimum O.A. rate listed in Table 2. Note that in order to implement this measure, the outdoor air dampers (doors) will need to be freed as they are currently sealed shut. A means for marking and securing both the outdoor and return air dampers (doors) in specific locations will need to be established.

TABLE 2
Recommended Air Handler O.A. Flow Rates

Unit	Original Supply Airflow (CFM)	Original Design Min. O.A. (CFM)	Current Code Min. O.A. Requirements (CFM)	Recommended Minimum O.A. (CFM)
Blower	Unknown (25,000 est.)	Unknown	3,800	3,800

Note: Although the ASHRAE Position Document on Infectious Aerosols recommends using the latest published standards and codes as a baseline for minimum ventilation, the mechanical code in effect at the time the HVAC systems were designed and constructed is what governs the required outdoor air flowrate for the HVAC equipment, if there have been no additions, renovations, alterations or changes in occupancy to the building. The 2015 International Mechanical Code does not prevent the continued use of existing systems.

Without any additional studies or airflow documentation, we cannot determine if the existing ventilation system can support the recommended outdoor air. It is likely that the space can be adequately heated with the existing steam coil and ventilated with the recommended outdoor air during cold and moderate dry weather. However, as there is no cooling system, humidity will likely be an issue during the summer. It may not be possible to operate with outdoor air with the existing system during warm or humid weather, and the outdoor dampers may need to be mostly or fully closed during these periods to prevent moisture and humidity issues. High humidity increases human susceptibility to viruses and can cause mold growth. We recommend operating in this manner in the immediate to short term only. See Section 2.7.2 for long term recommendations.

The average airflow rate per person is estimated below in Table 3. As the total and individual room airflows are unknown, all values below are estimates. These values are based on estimated total and room supply airflow rates and the recommended outdoor airflow rates shown in Table 2. 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 required occupancy.

TABLE 3
Average Airflow Rate per Person (ESTIMATED)

	<i>All spaces</i>	<i>Courtrooms</i>	<i>Non-Courtroom Spaces</i>
Total Occupancy (People)	280	150	130
Total Supply Air (CFM/Person)	90	40	150
Outdoor Air (CFM/Person)	14	6	22

The estimated airflow rate per person for each Courtroom and the Jury Pool Room is shown below in Table 4. These values are based on full occupancy without taking diversity into account, the original full design supply airflow rate, and the recommended outdoor airflow rate. The airflow rate per person assumes the estimated supply airflow is being delivered to the room.

TABLE 4
Airflow Rate per Person (Full Occupancy - ESTIMATED)

<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>Outside Airflow (CFM)</i>	<i>Airflow Rate (CFM/Person)</i>
Jury Pool Room	38	1,300	34	200	5
Courtroom 1	213	6,000	30	900	4

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 Pool Room, based on a reduced occupancy schedule determined by the Office of Court Management, is shown below in Table 4a. The airflow rate per person assumes the estimated supply airflow is being delivered to the room.

TABLE 4a
Airflow Rate per Person (Reduced Occupancy - ESTIMATED)

<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>Outside Airflow (CFM)</i>	<i>Airflow Rate (CFM/Person)</i>
Jury Pool Room	11	1,300	120	200	43
Courtroom 1	21	6,000	300	900	40

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

RTB-2: *Rebalance system return air flow rate.*

We recommend testing and balancing the return fan airflow rate to ensure the correct quantity of return air is being delivered to the air handler.

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

We were not provided with any design documents showing the ductwork or intended airflows. If design documents showing the required airflows and ductwork are not available, the required airflows should be established by an engineer and rebalanced to provide appropriate air volumes based on loads, and the code required ventilation rates for each space.

Note that many spaces have user-adjustable dampers. These may need to be removed to allow the system to be properly balanced and to prevent tampering.

2.3 Equipment Maintenance & Upgrades

Refer to section 2.7 for recommended upgrades.

2.4 Control System Recommendations

Refer to section 2.7 for recommended upgrades.

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 Courthouse 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. They should also be considered for Courtrooms, 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.

2.6 Humidity Control

Humidification

Installing duct mounted or portable humidifiers can help maintain the relative humidity levels recommended by ASHRAE during the winter. 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.

Dehumidification

Since the existing air distribution system does not include cooling or dehumidification, consider the use of portable dehumidifiers. Dehumidifiers can alleviate excessive humidity in occupied areas.

2.7 Other Recommendations

2.7.1 Replace HVAC System

The existing air system is antiquated and uncontrolled, and currently does not provide outdoor air and should be replaced. While it has historic value, and appears to be well designed for the time, it requires frequent adjustments to operate and provides no cooling or humidity control. Introducing humid outdoor air without cooling will reduce occupant comfort and may damage the building over time. Operable windows do exist, and natural ventilation is allowable by code. However, windows are typically not opened during cold or hot outdoor air temperatures. We recommend a study of the Courthouse to determine how feasible it is to install mechanical heating, cooling, and ventilation in all occupied spaces while preserving the historic interiors and appearance of the courthouse.

The existing air distribution ductwork is built into the walls and may be difficult retrofit with a VAV system. The use of room equipment to provide heating and cooling, in conjunction with a dedicated outdoor air (DOAS) system may be an option that allows the appearance of the courthouse interiors to be generally maintained.

2.7.2 Add Toilet Exhaust to All Restrooms

Toilet exhaust is required by code to manage odors and humidity. We recommend installing toilet exhaust systems in all restrooms. If the Office of Court Management intends to implement recommendation 2.7.1, we recommend that temporary toilet exhaust systems be installed in the interim.

2.7.3 Install a Building Management System

As recommendation 2.7.1 is a significant undertaking, we recommend installing a modern building management system to control and monitor HVAC equipment as part of this project. This recommendation is an energy saving and maintenance measure and does not affect the indoor air quality of the building.

Disclaimer

Tighe and Bond cannot in anyway 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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