New Bedford Superior Court
New Bedford, MA

HVAC SYSTEM EVALUATIONS COVID-19

Office of Court Management

February 3, 2021

Tighe&Bond

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Section 1
Existing Conditions & Site Observations

Tighe & Bond visited the New Bedford Superior Courthouse on November 5th, 2020. While on site we inspected the air handling equipment and toured the facility to determine if the spaces generally matched usages noted on the architectural plans.

Site Visit Attendees:

- *Bristol County:*
  - Scott Augiar, Courthouse Facilities Staff
  - Bryan Moniz, Courthouse Facilities Staff
- *Tighe & Bond*
  - Sean Pringle, PE, Mechanical Engineer
  - Caitlin DeWolfe, Staff Engineer

1.1 Existing Ventilation System

The New Bedford Superior Courthouse was constructed in 1830 and is approximately 22,000 square feet in size. Tighe & Bond was provided with limited HVAC drawings from an undated major HVAC system renovation, likely prior to 1990, and additional minor improvements in 2003.

Most areas of the building (excluding the second floor courtroom, second floor lockup area, and first floor judge's room) do not have any means of mechanical ventilation. While the fan coil units in many rooms do re-circulate air to provide heating and cooling, they do not provide any outdoor ventilation air, and the filtration provided by these units is limited. The mesh filters observed in the fan coils typically have a MERV rating of 5 to 7. Building areas without adequate ventilation and filtration significantly increase the risk of spreading viruses like COVID-19, especially in areas with high occupant density. Consider significantly reducing occupancy or relocating occupants to other areas with adequate ventilation.

The perimeter rooms generally have very large windows with operable sashes.

The second floor courtroom and the second floor lockup areas are served by makeup air units (MAU) located in the attic. Each MAU has an outdoor air damper, hot / chilled water coil fed from a two pipe distribution, and a supply fan. Neither unit was operational at the time of the visit, and it appeared that they had not been operational in some time. The makeup air units are in poor condition.

A steam boiler provides steam heat to steam radiators and to a steam to hot water heat exchanger, which supplies hot water to the perimeter fan coil units. Cooling is provided via a 60 ton air cooled chiller which provides chilled water to the fan coils through the same two pipe distribution system. The majority of the heating and cooling is provided via the fan coil units. The fan coil units are in fair condition.

A fan coil unit serves the first floor Judge's room that appears to have at one point provided outdoor air through ductwork connected through the wall to an intake air louver. However,

the outdoor air opening was filled with fiberglass insulation and does not appear to have been used in some time. No other fan coils appear to have openings to the exterior.

Most of the restrooms have a small toilet exhaust fan ducted through or mounted in the window, but several of the smaller private restrooms did not have any mechanical exhaust. The exhaust in the first floor public restroom was not operational at the time of the visit.

Table 1 summarizes the air handling units' designed airflow rates, the MERV rating of the installed filters, and the condition.

TABLE 1
Existing Air Handling Units

Unit	Original Design Airflow (CFM)	Original Design Min. O.A. (CFM)	Filters	Condition
MAU-1 (Lockup)	100	100	1" Frame, MERV Unknown	Inoperable
MAU-2 (2nd Floor Courtroom)	600	600	1" Frame, MERV Unknown	Inoperable
Fan Coil Units	Varies	0	1" Mesh MERV Unknown	Fair

Photo 1 – Representative Makeup Air Unit

Photo 2 – Representative Fan Coil Unit

1.2 Existing Control System

All HVAC air handling equipment is controlled by local electric controls. The fan coils are controlled with return air temperature sensors. The makeup air unit controls are in very poor condition. We did not see any evidence of a Building Management System (BMS) during our site visit. The toilet exhaust fans are manually operated.

Section 2
Recommendations

Below is a list of recommendations that we propose for the New Bedford Superior Courthouse. Please refer to the "Master Recommendation List" for further explanation and requirements of the stated recommendations.

2.1 Filtration Efficiency Recommendations

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

RF-1: *Replace 1" Mesh filters with 1" MERV-13 filters.*

The TAB Contractor and/or Engineer shall verify that the existing equipment can accommodate a MERV-13 filter per Appendix A in the overview of recommendations report. Note that the increased pressure drop associated with upgrading to MERV 13 filters is generally higher with 1" filters than with 2" filters. The filters will also require more frequent replacement.

This recommendation applies to the fan coils, and the MAU's if they are repaired. If the MAU's are replaced, we recommend specifying a unit that accommodates 2" MERV-13 filters.

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

This recommendation applies to the existing MAU's if they are repaired or replaced.

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

Provide a local alarm in an area that will be noticed by staff.

2.2 Testing & Balancing Recommendations

It is unknown to Tighe & Bond when the last time the units were tested and balanced. Also, the code requirements to determine the outside air flow rates that were used to design the original system were different than the 2015 International Mechanical Code (IMC) and current ASHRAE Standard 62.1 requirements.

We recommend the following testing and balancing measures be implemented:

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

We recommend testing and balancing the outdoor air flow rates for all air handling units to the recommended minimum O.A. rates listed in Table 2.

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)
MAU-1	100	100	70	100
MAU-2	600	600	1,200	600

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.

MAU-1 appears appropriately sized to provide ventilation air to the lockup area if it were operable. MAU-2 seems to be significantly undersized for the second floor courtroom. The existing MAU louvers are suitable for the original design airflow. Increasing the airflow may result in water being drawn in through the louver.

Since the MAU's are inoperable and in poor condition, the units should be replaced. Refer to section 2.7.1.

The airflow rate per person is shown below in Table 3. These values are based on the recommended outdoor airflow and the original design supply airflow rates shown in Table 2 above. Only the areas with mechanical ventilation are shown. This table assumes the units are operational, however the MAUs serving these spaces are currently inoperable.

TABLE 3
Average Airflow Rate Per Person

	Lockup Area	***Second Floor Courtroom***
Total Occupancy (People)	7	170
Total Supply Air (CFM/Person)	14	3.6
Outdoor Air (CFM/Person)	14	3.6

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

TABLE 4
Airflow Rate per Person (Full Occupancy)

		Total Air		Outdoor Air	
Courtroom	Total People	Supply Airflow (CFM)	Airflow Rate (CFM/Person)	Outside Airflow (CFM)	Airflow Rate (CFM/Person)
First Floor Courtroom*	150	0	0	0	0
Second Floor Courtroom**	170	600	3.6	600	3.6

Note: If occupancy is further reduced, the airflow rate per person will increase, assuming full airflow is being delivered to the space.
*This space is not ventilated.
**The MAU serving this space is not operable.

The airflow rate per person for each courtroom, 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 full supply airflow is being delivered to the room continuously and the equipment is operational.

TABLE 4a
Airflow Rate per Person (Reduced Occupancy)

		Total Air		Outdoor Air	
Courtroom	Total People	Supply Airflow (CFM)	Airflow Rate (CFM/Person)	Outside Airflow (CFM)	Airflow Rate (CFM/Person)
First Floor Courtroom*	27	0	0	0	0
Second Floor Courtroom**	34	600	18	600	18

Note: If occupancy is further reduced, the airflow rate per person will increase, assuming full airflow is being delivered to the space.
*This space is not ventilated.
**The MAU serving this space is not operable.

RTB-6: *Test and balance all air handler chilled and hot water coils.*

This is recommended for the fan coils.

2.3 Equipment Maintenance & Upgrades

We recommend the following equipment maintenance and upgrades:

RE-7: *Test the existing air handler control valves and actuators for proper operation.*

This is recommended for the fan coils.

2.4 Control System Recommendations

We do not recommend any control sequence improvements. Refer to Section 2.7 for HVAC system recommendations.

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.

Due to the lack of ventilation in the Courthouse, we recommend the use of portable HEPA filters or similar air purification approaches if the courthouse is to be occupied in the near term, until adequate ventilation is added to the building.

2.6 Humidity Control

Installing duct mounted or portable humidifiers can help maintain the relative humidity levels recommended by ASHRAE. The feasibility of using duct mounted humidification or portable humidifiers 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. We are not aware if this building was constructed to accommodate a humidification system.

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.

The lockup area may benefit from local humidification if the existing MAU's are repaired or replaced. MAU-1 is a 100% outside air system. This lockup area has a relatively high ventilation rate and will tend to have a lower humidity during the heating season than other areas. Studies indicate that as relative humidity is reduced below 40%, susceptibility to viruses such as COVID-19 progressively increases.

2.7 Other Recommendations

2.7.2 Replace MAU-1 and MAU-2

Due to the age and condition of MAU-1 and MAU-2, we recommend replacing the existing units, rather than making repairs. MAU-1 is appropriately sized for the lockup area and could be replaced with a similar unit.

MAU-2 is significantly undersized for the space ventilation airflow requirements. The current arrangement does not provide adequate supply air distribution, as there is only a single supply grille in one corner of the room. Increasing the outdoor air delivered to the space will require a significantly larger louver opening, additional supply grilles, and possibly additional ductwork in the attic above the courtroom. With the increase in outdoor air, a means of relief air would also be required. Further system analysis and improvements are required to execute this recommendation.

2.7.4 Replace Toilet Exhaust Fans and Controls

At the time of the visit, at least one toilet room exhaust fan did not appear to be working, and several private toilet rooms did not have any mechanical exhaust. We recommend verifying which exhaust fans work and replacing the fans that are inoperable and adding exhaust fans and ductwork in restrooms where there is not toilet exhaust currently.

If all new ventilation systems are provided for the Courthouse, a more energy efficient option is to route the toilet exhausts through an energy recovery system, if possible, and eliminate individual exhaust fans. This will eliminate several exhaust fans, reducing fan maintenance, and allow the toilet exhaust air to precondition supply air, saving on heating and cooling costs.

2.7.3 Install New Dedicated Outdoor Air Ventilation Systems for Areas Without Ventilation

Much of the building is without any mechanical ventilation. However, the existing air conditioning and heating systems appear to be in good condition and according to staff keep the building comfortable. Consider the addition of a dedicated outdoor air system (DOAS) to provide the code-required ventilation air to each space. The use of energy recovery as part of this system can reduce the operating cost to provide the required ventilation air.

The addition of a DOAS (or any whole building ventilation system) will require a substantial and invasive construction project. New ductwork would be required to serve most rooms. Due to the constraints of the existing building construction, adding new ductwork may be difficult. The use of a DOAS reduces the size of the ductwork and may reduce the impact to finished areas.

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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