Worcester Public Schools

Ventilation Assessment
&
COVID-19
Mitigation Strategies

for

Worcester Technical High School
Worcester, MA

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Worcester Public Schools

A. Preface:

Worcester Public School has as Nault Architects Inc. and their consultant Seaman Engineering Corporation (SEC) to review all of their occupied buildings and comment on existing natural and mechanical ventilation.

The first part of the report is SEC's evaluation of the existing mechanical systems.

The second part of the report is an evaluation of the natural ventilation. The Building Code requires ventilation of each occupied space and that can be achieved either through mechanical of natural ventilation methods. If the natural ventilation path is chosen, there must be a clear opening(s) in the space that meet or exceed the 4% of the total room square footage. After the field survey of each room / window type was complete, the ventilation information was added to a spread sheet for calculation of the 4% and color-coding. The calculations were also color-coded on a floor plans of the building for a better overall understanding of the existing conditions.

The natural ventilation color-coding (on the spreadsheet and plans) is as follows:

- **Green Spaces**: meets or exceed the code minimum natural ventilation.
- **Yellow Spaces**: does **not** meet the code minimum natural ventilation, but does have operable window to allow some natural ventilation.
- **Red Spaces**: does not meet the code minimum natural ventilation and does not have any operable windows.

It should be reiterated that the second part of this report is only measuring natural ventilation. Therefore, newer buildings or buildings with large amounts of fixed windows may have large amounts of red and/or yellow spaces, but that doesn't mean they are not code compliant, they may be relying on mechanical ventilation. However, for this part of the report, were asked to show a baseline for all schools without mechanical equipment.

B. Building Description:

Worcester Technical High School:
Worcester Technical High School is located in the North Quadrant of Worcester at 1 Skyline Drive. The School was built in 2006, houses grades 9-12, has 144 classrooms and the building is 400,000 square feet. The widows are original to the 2006 construction.

C. Table of Contents:

1) Mechanical Ventilation Report

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I. EXECUTIVE SUMMARY

This report briefly describes the existing ventilation systems at the Worcester Vocational Technical High School in Worcester, MA as well as their capabilities to support current code required ventilation rates. In addition, we have evaluated the systems ability to support recommendations in accordance with the American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) Epidemic Task Force Building Readiness Guidelines (updated 10-20-2020). Several of the ASHRAE recommendations as well as those from the Harvard T.H. Chan School of Public Health and other industry sources have been presented for consideration to assist in further mitigating virus transmission through the buildings heating, ventilation, and air conditioning (HVAC) systems.

Our inspection of the existing systems was limited to visual observations coupled with review of original design drawings, when available. The findings presented in this report presume the systems are operational and delivering air quantities indicated on the original design drawings. Proper operational testing of each piece of equipment and airflow measuring would be required to confirm such operation.

During, our visual inspection we also took several spot measurements of air quality in various locations throughout the school. Measurements taken were limited to Temperature (°F), Relative Humidity (% RH), CO_2 (carbon dioxide in ppm), CH_2O (formaldehyde in ppm) and Total Volatile Organic Compounds (TVOC in ppm).

The results of the readings taken during our inspection were only used to identify areas where possible ventilation issues may exist and/or to identify areas where a source contaminant may be causing elevated levels.

COVID-19 Control Measures:

In line with the current American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) Epidemic Task Force Building Readiness Guidelines (updated 10-20-2020) and those from the Harvard T.H. Chan School of Public Health - 5-Step Guide to Checking Ventilation Rates in Classrooms, as well as other industry recommendations the following HVAC COVID Control Measures (CCM's) are presented for consideration to assist in mitigating virus transmission thru the HVAC systems. The following descriptions are abbreviated with additional detail found later within the report.

As of the writing of this report, the City of Worcester Public Schools (WPS) has already begun implementation of several of the measures noted below. For enhanced measures, WPS has begun to incorporate Bipolar Ionization (see ECCM-#3) extensively throughout the Worcester Vocational Technical High School to address the current pandemic condition.

<u>CCM #1 – Pre & Post Purge Ventilation</u> – Pre- and post-purge ventilation of occupiable spaces using outside air introduced thru the HVAC systems for an extended period of time prior to and after occupancy.

Most of the HVAC systems supporting the Worcester Technical High School are capable of implementing this measure.

CCM #2 – Increased Ventilation - Increase the quantity of outdoor air ventilation for improved space dilution where systems allow. Disable demand ventilation reset. The Harvard T.H. Chan School of Public Health identifies 3 outdoor air changes per hour (ACH) as the "bare minimum" during a pandemic condition.

Many of the HVAC systems supporting the Worcester Technical High School are either already meeting the 3 ACH requirement or are capable of increasing outdoor air subject to outdoor ambient conditions and equipment limitations. For the four (4) RTU's serving most of the building's classroom spaces, more extensive control related work shall be required as described later in this report to accomplish this CCM as the units are limited to some extent by a factory controller.

CCM #3 – Improved Filtration - Improve filtration to up to MERV-13 or higher on recirculating air handling systems which can support such filtration.

Except for the fan power VAV terminals and smaller fan coil systems, a majority of the main air handling systems in the building appear to be capable of supporting increased filtration up to a maximum of MERV 13. Systems must be tested and adjusted to accommodate the pressure drop associated with the increased filter efficiency. In addition, more frequent filter changes would be expected to limit reduction in ventilation air as the filters load.

In addition to the above suggested measures, we have also presented Enhanced HVAC COVID-19 Control Measures (ECCM) which could be considered for implementation. Where the above CCM's cannot be employed, one or more of the ECCM measures outlined herein may be utilized to improve indoor air quality. The following descriptions are abbreviated with additional detail found later within the report.

ECCM #1: Portable Room Purifiers - Portable room air purifiers may be used in select areas to help clean the air within that space. These can be especially helpful where rooms have low outdoor air changes per hour and cannot be supplied with additional outdoor air or improved system ventilation.

ECCM #2: UV-C Light Sterilization - UV-C lights could be considered for insertion in equipment and ductwork to help neutralize virus's as it is exposed to the light.

ECCM #3: Bipolar Ionization – Air ionizers may be installed in air handling systems or portable units installed in rooms to improve indoor air quality. These systems cause particles and airborne contaminants to bind together thereby increasing their size, so they tend to either drop out of the breathing zone or be better removed by air filtration. Recent studies have also shown Bipolar Ionization may inhibit the COVID-19 viruses' ability to infect.

WPS has begun to incorporate Bipolar Ionization extensively throughout the Worcester Technical High School to address the current pandemic condition.

Recommendations Summary:

Based on our site inspections, sample air quality readings and review of original drawings we found that a majority of the occupied areas of the Worcester Vocational Technical High School comply with current ventilation codes with few exceptions noted herein. However, in order to address the pandemic level conditions currently in place the following table summarizes our recommendations, several of which, align with the American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) Epidemic Task Force Building Readiness Guidelines (updated 10-20-2020) as well as those from the Harvard T.H. Chan School of Public Health.

WPS has already begun to incorporate Bipolar Ionization (ECCM-#3) extensively throughout the Worcester Vocational High School to address the current pandemic condition.

Space	Exist. O.A. Vent. Systems	Recommendations
General Classrooms	Packaged Rooftop Mixed Air Systems	CCM - #1, #2 & #3 ECCM - #1 or #3 (*see note below)
Science Classrooms	Packaged Rooftop Mixed Air Systems	CCM - #1 & #3 ECCM - #3
Art Classrooms	Packaged Rooftop Mixed Air Systems	CCM - #1 & #3 ECCM - #3
Auditorium	Packaged Rooftop Mixed Air System	CCM - #1, #2 & #3 ECCM - #2 or #3
Gymnasium	Air Handlers	CCM - #1, #2 & #3 ECCM - #2 or #3
Admin. & Guidance Office	Packaged Rooftop Mixed Air Systems	CCM - #1, #2 & #3 ECCM - #1 or #3 (*see note below)
Trade Shops	Mixed Air Handling Systems	CCM - #1, #2 & #3 ECCM - #1 or #3 (in related classrooms) ECCM - #3

**Note*: For individual classrooms and other areas noted, ECCM #1 – Portable Air Filtration and/or ECCM #3 – Ionization, are noted as possible options to improve air cleaning and changeover during pandemic conditions.*

Inevitably, during a pandemic, the best approach is a multi-faceted one which should include the above HVAC strategies as well as proper housekeeping (cleaning of spaces and surfaces),

occupant actions (hand cleaning, wearing masks, social distancing, following recommended CDC guidelines) and other mitigation strategies.

II. HVAC VENTILATION ASSESSMENT

A. GENERAL

Over the last several weeks we performed site inspections of the existing school building to assess the ventilation systems in place. Manufacturer and model information was obtained from the existing ventilation equipment, when available/accessible, and visual conditions were noted.

For our review, original design drawings as well as drawings of various modifications over the years for the school were received from school facilities. In addition, we have also received and reviewed the available HVAC control drawings to ascertain current control configuration. We have used these documents to ascertain the original design ventilation rates so as to compare them to current ventilation codes and standards.

Our inspection was limited to visual assessment of systems and did not include operational testing of each piece of equipment or airflow measuring. We have however, taken some spot measurements of air quality in various locations throughout the school. Measurements taken were limited to:

- Temperature (°F)
- Relative Humidity (% RH)
- CO_2 (carbon dioxide in ppm)
- CH_2O (formaldehyde in ppm)
- Total Volatile Organic Compounds (TVOC in ppm)

These readings were taken at a specific moment in time and may vary during the day based on space occupancy, use and activities as well as the operational state of the HVAC systems. For example, most all spaces surveyed were unoccupied or very lightly occupied and as such most all CO_2 levels were low since space CO_2 is primarily generated by occupants.

TVOC's sources can vary widely and include but are not limited to paints, finishes, adhesives, cigarette smoke, pesticides, personal care products, car exhaust, new furnishings, wall coverings, cleansers, and cooking fuels. The meter used included the following chemicals in its TVOC analysis: Acetone, Ethylene Glycol, Formaldehyde, Xylene, 1,3-Butadiene, Tetrachloroethene, Hydrogen Sulfide, Ammonia, Toluene, Benzene, Methylene Chloride, Perchloroethylene, and MTBE. The meter cannot read every possible VOC nor quantify percentages of various VOC's. In addition, we did notice the TVOC readings tended to drift up during the study, possibly due to a calibration issue, as such, the readings in this report were only used to identify areas where possible ventilation issues may exist and/or to identify areas where a source contaminant may be causing elevated levels.

The report ventilation calculations presume, the existing systems are operating to the levels reflected on the original design drawings. Testing and balancing by a certified balancer would be required to confirm actual airflows.

For ventilation calculations, data from current codes including the International Mechanical Code (IMC) 2015 and ASHRAE 62.1-Ventilation for Acceptable Indoor Air Quality were used. The outdoor airflow values have been corrected to adjust for the distribution systems ability to get the outdoor air to the space breathing zone with the breathing zone being within 6 feet of the occupied floor. This correction factor also known as the Zone Air Distribution Effectiveness (ZDE), varies based on how and where the air is introduced and removed from the room as well as the temperature of the air entering the room. Some examples of ZDE for various systems are as follows:

Distribution Configuration	ZDE
Ceiling supply of cool air (air below room temp.)	1.0
Ceiling supply of warm air & floor return	1.0
Clg. supply of warm Air >15F above space temp. & clg. return	0.8
Floor supply of warm air & floor return	1.0
Floor supply of warm air & ceiling return	0.7
Displacement cooling floor supply & ceiling return	1.2

For example, a displacement cooling system with a ZDE of 1.2 would require 17% (1.0 / 1.2) less outside air to properly ventilate a space than a system with warm air supplied at the ceiling level being that the displacement system is more effective in getting the outdoor air into the breathing zone. A room with a ZDE of 0.8 would require 25% (1.0 / 1.2) more outdoor air to comply with ventilation standards.

This report contains a brief description of the types of ventilation systems serving the building as well as makes recommendations, where applicable, to improve ventilation of area served by these systems. Our evaluation considered the recommendations made by the American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) Epidemic Task Force Building Readiness Guidelines (updated 10-20-2020) as well as those from the Harvard T.H. Chan School of Public Health and other industry sources. All to assist in further mitigating virus transmission through the buildings heating, ventilation, and air conditioning (HVAC) systems.

B. EVALUATION

The following evaluation is based on visual observation of systems and equipment and excludes any operational testing which we understand is on-going by WPS. Evaluation includes information obtained from Worcester Public Schools on current air filters as well as existing building mechanical plans when available. In some cases, equipment was not accessible, and assessment was based only on original design drawings where available.

General Classrooms:

A majority of the classrooms in the building are heated, ventilated, and cooled via four (4) packaged variable air volume (VAV) rooftop units. These units consist of evaporative cooled DX condensers supporting DX cooling coils, return fans, exhaust and mixing dampers, hot water coils and supply fans. A fifth unit, RTU-1A is a constant volume unit of similar configuration which supports the auditorium space. Hot water is fed to all these units from the building's central boiler plant. The units are fitted with 4" thick air filters with an estimated efficiency of MERV 8.

These air handling systems appear to be capable of supporting increased filtration up to a maximum of MERV 13 (see CCM-#3). Systems must be tested and adjusted to accommodate the added pressure drop associated with this increased filter efficiency. In addition, more frequent filter changes would be expected to limit reduction in ventilation air as the filters load.

Each of the classroom air handlers deliver conditioned air to the classroom and associated spaces via a ducted supply air system and a partially ducted plenum return air system. The supply air to each classroom runs through either a VAV terminal or fan powered FVAV terminal fitted with damper operators, series fans for FVAV's and hot water coils for control of primary air and temperature of air delivered to the space they serve. The fan powered VAV's have 1" thick filters with an estimated MERV rating of 7 or 8. These units can support a maximum filter rating of MERV 8. A DDC space thermostat controls the operation of the VAV damper, FVAV motor and the hydronic heating valve.

As these are mixed air systems, the amount of outdoor air delivered to each space varies based on the amount of primary air being introduced through the respective VAV terminal. According to the design drawings the percentage of outdoor air from each of the five central systems is 40% of the design supply air with the exception of RTU-1-A which is 14%. RTU-1A is a single zone system supporting only the auditorium space.

For a standard classroom, current code would require 10 CFM per person of outside air plus 0.12 CFM per SF. The zone air distribution effectiveness for the classrooms varies from 1.0 to 0.8 with the lower factor due to the presence of ceiling supply and return terminals coupled with air that may be warmer than 15°F above space in certain areas such as those spaces with greater thermal heat loss. As such, an average classroom of 800 SF with 26

occupants (25 students + 1 teacher) would require 445 CFM inclusive of the 0.8 correction or 356 CFM with the 1.0 factor.

As noted previously most of the classrooms are supported from a VAV system with series style FVAV terminals. These terminals deliver a maximum total and primary airflow of approximately 1,000 CFM +/- (varies by room). Based on the supporting RTU systems having 40% outside air, per design, this would yield a maximum of 400 CFM of outside air to a room. This amount is close to meeting the code required outdoor air of 356 CFM to 445 CFM depending on space air distribution effectiveness. However, if the primary air reduces which it does for a typical VAV terminal, the percentage of outdoor air would drop thereby potentially under ventilating the space. For example, the current control drawings reflect VAV terminal primary air dropping to 20% of design in most cases which is approx. 50% of the required outdoor air presuming a room is fully occupied. A minimum primary airflow of 20% is typically too low to support classroom occupancies which can have high density occupancies. Increase of these minimums and/or override of minimums based on space CO_2 as well as possibly increasing RTU outdoor air would improve the ventilation to this space.

Current mechanical code would require VAV systems such as this to have the ability to maintain the outdoor air volume constant across the unit's variable supply airflow operation. For example, if the unit provided 40% outside air at full airflow such as all four (4) classroom VAV units do, if the units total airflow dropped to 50% the outdoor airflow quantity should remain constant thereby making the outdoor air percentage 80%. This would help maintain proper outdoor airflow to the various spaces as there VAV terminals vary. Based on the current control drawings and sequence of operation, the existing units do not operate in this fashion and do not monitor the amount of outdoor air the units are introducing.

In addition, these types of multi-zone systems generally require a higher percentage of outdoor air to achieve compliance with current code and ASHRAE 62.1-Ventilation for Acceptable Indoor Air Quality standards. These standards factor in the individual ventilation needs of various spaces in a multi-zone system as well as the respective VAV terminals minimum and maximum ranges.

Science & Art Rooms:

The science rooms and the former art room are supported by the same central RTU units as the normal classrooms. The current science/chemistry rooms are approx. 1,000 SF in size and are each supplied with 1,100 CFM of supply air from a FVAV terminal with a MERV 7 or 8 filter. These FVAV terminals can support a maximum filter rating of MERV 8. Each are also fully exhausted with 1,100 CFM of exhaust to a roof exhaust fan.

Per the current code, science rooms and art rooms require higher ventilation levels than general use classrooms. Art rooms require 0.7 CFM/SF of exhaust and science rooms require 1.0 CFM per SF of exhaust. It appears the ventilation levels for the former art room is not compliant for exhaust, however, it is no longer used for art so would suffice as general classroom space. The science rooms are compliant although to maintain proper make-up air for the exhaust, the FVAV would need to maintain a high level of primary air which may

tend to overcool the rooms. Additional make-up air would also be required for labs with fume hoods or an interlock to reduce space exhaust when the hood is active.

Fume hoods in the science spaces are of the bypass fixed volume type. When enabled, the hoods are exhausted through roof exhaust fans.

Gymnasium:

The gymnasium is supplied with air from two (2) 15,000 CFM air handlers located in a mechanical mezzanine level. The air handlers are mixed air units which introduces a percentage of outside air into the recirculating air stream. Each unit has mixing dampers, angle filter box, hot water heating coil, face & bypass dampers, and a fan section. Relief air from the space is accomplished via a single axial fan connected to the common return air duct which discharges through a wall louver. The air handling units have 2" pleated filters with an estimated MERV rating of 8.

These air handling systems appear to be capable of supporting increased filtration up to a maximum of MERV 13 (see CCM-#3). Systems must be tested and adjusted to accommodate the added pressure drop associated with this increased filter efficiency. In addition, more frequent filter changes would be expected to limit reduction in ventilation air as the filters load.

The gymnasium ventilation needs are based on a percentage of play area and spectator area. Play area requires an outdoor air volume of 0.3 CFM per SF whereas the spectator area requires 7.5 CFM per person plus 0.06 CFM per SF. The zone air distribution effectiveness is 1.0 based on ceiling supply and floor returns. With actual spectator area unknown, presuming the entire gym is play area would yield a required outdoor air rate of 3,900 CFM.

Per the control drawings each unit's minimum outside air is 50% of the design supply volume. This would equate to 7,500 CFM per unit and 15,000 CFM for the gymnasium space as a whole. Although the spectator occupancy and area must be verified, it appears the gymnasium space would be capable of accommodate upwards of 1,400 spectators at its current ventilation level.

Cafeteria, Media Center & Offices:

The cafeteria, Media Center & Offices are supported by the same central RTU units which support the classroom spaces.

All these spaces are supported with either VAV and/or FVAV terminals. These VAV and FVAV terminals are fitted with damper operators, series fans for FVAV's and hot water coils for control of primary air and temperature of air delivered to the space they serve. The fan powered VAV's have 1" thick filters with an estimated MERV rating of 7. These units can support a maximum filter rating of MERV 8. A DDC space thermostat controls the operation of the VAV damper, FVAV motor and the hydronic heating valve.

As these are mixed air systems, the amount of outdoor air delivered to each space varies based on the amount of primary air being introduced through the respective VAV terminal. According to the design drawings the percentage of outdoor air from the central systems is 40% of the design supply air.

The media center ventilation needs are similar to that for the general classrooms with 10 CFM per person and 0.12 CFM per SF. The zone air distribution effectiveness for the media center is 0.8 with the lower factor due to the presence of ceiling supply and return terminals coupled with air that may be warmer than 15°F above space temperature. As such, with an estimated occupant load of 100 people the required outdoor air would be 1,700 CFM.

The main portion of the media center is supported by two FVAV terminals for a total combined maximum air rate of 6,600 CFM. The scheduled primary air minimum is 20% which would equate to only 1,320 CFM well below the required ventilation air. Increase of these minimums and/or override of minimums based on space CO_2 as well as possibly increasing RTU outdoor air would improve the ventilation to this space.

The cafeteria space is supported with FVAV terminals. Based on the previous noted potential issues with under-ventilation of high-density areas such as the media center and classrooms, we suspect this space may also be impacted by such. Resolutions such as increasing VAV minimums and/or override of minimums based on space CO_2 as well as possibly increasing RTU outdoor air could improve the ventilation to this space.

The office spaces are supported by VAV and FVAV terminals. In general, lower minimum primary air positions may support lower occupancy office spaces however, this can vary based on the peak design airflow to the space as well as high density areas such as conference rooms. Resolutions such as increasing VAV minimums and/or override of minimums based on space CO_2 as well as possibly increasing RTU outdoor air could improve the ventilation to these spaces.

Trade Shops:

Most trade shops are supported by dedicated constant volume air handlers supporting their respective areas and per design appear to be well ventilated except as otherwise noted herein. These air handlers are configured as either mixed air systems which introduce a percentage of outside air into the recirculating air stream or 100% outdoor air systems. The units have mixing dampers, angle filter box, hot water heating coil and a fan section. The units are of the variable air volume (VAV) style and have inlet guide vanes on the fans to control supply air volume. The units have 2" pleated filters with an estimated MERV rating of 8.

These air handling systems appear to be capable of supporting increased filtration up to a maximum of MERV 13 (see CCM-#3). Systems must be tested and adjusted to accommodate the added pressure drop associated with this increased filter efficiency. In addition, more frequent filter changes would be expected to limit reduction in ventilation air as the filters load.

A majority of the units provide a percentage of outside air varying from 40% in typical shop spaces up to 100% in some cases where make-up air is required such as in the welding shop and auto body shop paint spray application. In several shops the ventilation requirements of the code are driven more by required exhaust and associated make-up air then they are by space occupant load. In addition, dependent on the shop, recirculation of air between unlike spaces is not permitted. The current systems appear to comply with this except for some systems feeding common corridors and associated related classrooms.

Some trade shops that require specialized ventilation and/or areas in which we noted some deficiencies are as follows:

- Carpentry & Metal Shops: These shops require 0.5 CFM per SF of exhaust and associated make-up air which generally exceeds the outdoor air needs of 0.18 CFM per SF plus 10 CFM per person. The current systems appear to comply with this requirement while keeping the space under a slight negative pressure.
- Automotive Shop: This shop requires 0.75 CFM per SF of exhaust and associated make-up air. The current systems appear to comply with this requirement while keeping the space under a slight negative pressure. During our site inspection it was noted that one of the two air handlers serving the space was not operational and exhaust fan operation was questionable. The adjacent auto body shop also had its system off during our inspection which we were told was done temporarily to facilitate better acoustics while instructors teach during remote learning. These systems should be made operational to ensure proper indoor air quality for the space as well as to prevent odor migration to other areas of the building.
- Beauty Salon: The beauty salon is supported by one of the classrooms RTU systems. This shop requires 0.6 CFM per SF of exhaust and associated make-up air which may exceed the outdoor air needs of 0.12 CFM per SF plus 20 CFM per person dependent on actual occupancy. The current system appears to meet these needs with an exhaust system which removes much of the air supplied from the RTU VAV system from the salon portion of the space. However, the VAV terminal serving this space would need to maintain higher minimum airflow to insure adequate make-up air. Current code would also require a local exhaust at any manicure or pedicure stations where applicable.

Controls:

Most of the major HVAC systems supporting the school are controlled by a building energy management system (EMS). The EMS system was installed and is currently supported by Automated Logic. It appears the system controls most of the building HVAC systems including the rooftop units, air handlers, VAV & FVAV terminals, exhaust fans, etc.… The five (5) custom packaged RTU units have factory furnished controls which control much of their internal operation with the EMS commanding occupied, unoccupied modes and resetting temperatures.

The operating schedule for much of the equipment is based on the school's occupancy schedule. The schedule is adjustable via the front-end computer workstation.

C. IAQ & Ventilation Summary

IAQ Summary:

During our inspection we obtained spot measurements of air quality in various locations throughout the school. Measurements taken were limited to:

- Temperature (°F)
- Relative Humidity (% RH)
- CO_2 (carbon dioxide in ppm)
- CH_2O (formaldehyde in ppm)
- Total Volatile Organic Compounds (TVOC in ppm)

The readings were taken at a specific moment in time and may vary during the day based on space occupancy, use and activities as well as the operational state of the HVAC systems. For example, most all spaces surveyed were unoccupied or very lightly occupied and as such most all CO_2 levels were low since space CO_2 is primarily generated by occupants.

In addition, we noted some elevated TVOC levels and/or formaldehyde levels in areas which would not generally be expected to have such elevated levels. Although TVOC's (which includes formaldehyde) may come from varied sources such as cleaners, air fresheners and such, formaldehyde levels are often from off-gassing of furnishings or building materials. It is important to note that elevated levels of TVOC's may have been partially caused by recent enhanced cleaning measures or due to ventilation systems that were not in full operation at the time.

Measurements taken included space humidity. Humidity levels has been found to play a role in the controlling the spread of COVID-19. ASHRAE recommends winter humidity levels be kept between 40% to 50% and summer humidity levels between 50% and 60% with a summer target of 50%. Maintaining humidity levels within the above ranges has been found to limit the growth and transmission of certain bacteria and viruses as well as supports respiratory function. The below chart is taken from the 2020 ASHRAE Handbook – HVAC Systems and Equipment and reflects the impact of space humidity on the increase or decrease of effect on various space contaminants. This chart only reflects increase or decrease of effect from humidity and does not intend to imply that there is zero growth or impact of a certain contaminant when the sloped bar graph zero's out.

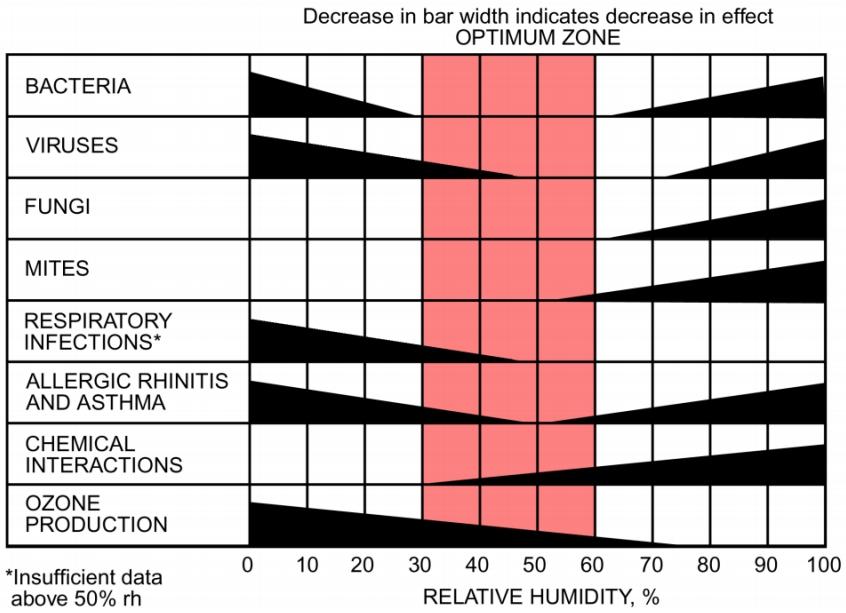

Fig. 1 Optimum Humidity Range for Human Comfort and Health
(Adapted from Sterling et al. 1985)

The Worcester Vocational Technical High School HVAC systems have no active humidity control.

Space dehumidification is limited only to those areas which have air conditioning cooling. However, this dehumidification is not actively controlled by a humidity setpoint. Moisture removal only occurs when these systems are operating in the cooling mode. As such, space humidity may climb above 60% during periods when low thermal loads require less cooling (i.e., a cool damp day) or swing above and below 60% as the systems cycle based on space temperature.

Caution must be taken when considering adding active humidification to existing buildings as it is imperative that the buildings thermal envelope and vapor barriers be reviewed. Although newer structures, such as Worcester Vocational Technical High School often have a fair vapor barrier the varying wall and window construction and thermal characteristics may limit the ability for active humidification. Adding humidity in the wintertime without consideration of the building construction could result in moisture condensation on windows and within wall assemblies which may create a damaging and unhealthy condition for the building and its occupants. Review of the building envelope should take place prior to consideration of the addition of any humidification system. As such, our recommendations contained with this report exclude active humidification control until such time as the envelope can be reviewed.

The IAQ readings taken during the time of the inspection are contained within the table below. In addition, the table reflects the outdoor air exchange rate in the rooms based on design data from existing plans.

The document entitled "5-Step Guide to Checking Ventilation Rates in Classrooms" from the Harvard T.H. Chan School of Public Health recommends a target outdoor air exchange rate during these pandemic conditions. The document identifies 5 air changes per hour (ACH) and above as "excellent" down to a 3 ACH being considered "bare minimum". Many of the general classrooms in the Worcester Vocational Technical High School have a design outdoor air exchange rate of 3 or above meeting the bare minimum criteria. When the outdoor air exchange rate is lower than the target 5 ACH, the document recommends the following strategies:

1. Increase outdoor air (see CCM #2)
2. Use MERV 13 filters (or greater) on recirculated air (see CCM #3)
3. Add portable air cleaners with HEPA filters to the classroom (see ECCM #1)

It should be made clear however, that a room that has less that what this document considers the bare minimum outdoor air exchange rate may meet or exceed the most current ventilation standards and therefore is not under ventilated. The 5 ACH or greater recommendation is meant to address the pandemic conditions being experienced as this level of ACH would equate to nearly 100% outside air requirement for a conventional mixed air cooling & heating system.

The following tables describe areas and systems where the above measures as well as others presented in this report may be applied.

Worcester Voke School IAQ Sampling Summary											
Space Tested	Temperature	Humidity	CO2	TVOC	HCHO	Room Area	Room Height	Volume	Original Design OA	Original OA	Notes
	°F	% RH	%	ppm	ppm	SqFt	Ft	Cubic Ft	CFM	ACH	
Ground Floor											
Culinary Arts	70.3	44.8	442	0.25	0.11	2461	10.08	24807	8270	20	
Restaurant	70.9	45.3	466	0.31	0	1711	10.08	17247	1240	4.3	
Cafeteria	71.5	43	436	0.42	0	9173	8.5	77971	4044	3.1	
Biological Tech	73.7	42	441	1.32	0.2	1133	9.92	11239	520	2.8	3
First Floor											
Auditorium + Stage	69.5	45.9	431	0	0	6900	32.58	224802	3500	0.9	1
Multipurpose Room	71.7	43.3	455	0.28	0	1622	10.08	16350	800	2.9	
Computer Composition	68.8	48.6	462	1.42	0.38	553	10.08	5574	344	3.7	1
Preschool	67.9	51.1	488	0.1	0	1136	9.67	10985	588	3.2	
Administration	72.2	44	480	0.33	0	757	9.92	7509	480	3.8	
Nurse	72.8	45	456	0.9	0.11	344	8.58	2952	160	3.3	1
Guidence	72.9	42.2	565	0.1	0.02	270	8.58	2317	160	4.1	
Salon	70.2	42.3	430	0.28	0	1264	9.83	12425	700	3.4	
Classroom near Salon	74.6	41.5	428	0.25	0	715	9.67	6914	328	2.8	
Classroom near Auditorium	74	41.9	535	1.1	0.23	526	10.08	5302	280	3.2	1
Plumbing & Pipe Fitting	69.9	44.4	457	0.45	0	4418	23.5	103823	1640	0.9	
Animal Science (Sheet Metal)	69.5	44.3	433	0.28	0	4603	23.58	108539	7700	4.3	
Carpentry	68.9	46.8	457	0.25	0	5560	23.58	131105	1392	0.6	
Automotive Collision	68.8	45.9	486	1.54	0	5667	23.5	133175	2248	1	2
Automotive Technician	68.7	45.9	485	1.68	0	12709	23.58	299678	6480	1.3	2
Second Floor											
Computer Lab	70.5	45.5	444	0	0	1618	10	16180	880	3.3	
Business Info	70.3	43.1	443	0	0	1268	9.83	12464	740	3.6	
Press Room	70.1	40.8	453	0	0	6228	9.83	61221	2360	2.3	
Vet Clinic	68.6	43.5	531	0.26	0	536	7.5	4020	160	2.4	
Third Floor											
Science Classroom	68.7	43.7	428	0.03	0	1056	10	10560	440	2.5	
Typical Green Classroom	68.4	47.2	405	0.55	0.05	794	9.83	7805	384	3	
Typical Blue Classroom	69.5	45.4	467	1.01	0	781	9.92	7748	384	3	1
H.V.A.C	64.1	48.5	420	0	0	3664	17.92	65659	1800	1.6	
Painting & Decorating	66.7	48.5	488	0.04	0	2637	17.92	47255	1836	2.3	
Machine Technology	68.5	43	491	0.47	0	7727	17.92	138468	4800	2.1	
Typical Orange Classroom	69	44.7	476	1.12	0	776	9.92	7698	368	2.9	1, 3
Fourth Floor											
Drafting	69.4	45.2	475	0.82	0	1492	9.92	14801	560	2.3	
Science	72.1	44.7	470	0.9	0	1059	11.33	11998	600	3	
Administration Area	70.9	44.2	538	1.3	0	210	7.83	1644	80	2.9	1
Telecommunication	68.5	47.2	484	0.95	0	1547	20.83	32224	752	1.4	1
Electro Mechanical	68.4	47.6	480	1.27	0	1236	20.83	25746	784	1.8	2
Media Center	69.1	44.7	457	0	0	5722	21.25	121593	2640	1.3	
Former Art Room	70.8	42.5	430	0.03	0	1523	9.83	14971	840	3.4	
Athletic Building											
Exercise Room	69.3	39.9	416	0	0	643	9.67	6218	1000	9.6	
Men's Locker Room	68.2	42.2	475	0	0	825	8.58	7079	1700	14.4	
Gymnasium	71	36.6	416	0	0	13040	36.58	477003	7500	0.9	
Weight Room	665	39.2	424	0	0	2588	10	25880	1616	3.7	

IAQ Summary Table Notes:

1. *TVOC's and/or CH_2O higher than anticipated for an office or general use space. Suggest further review of ventilation systems serving the areas and review of cleaners used. In classroom near auditorium, we found a bottle of cleaner on its side with leakage from cap which may have been a contributor.*
2. *Elevated TVOC levels in these shops may be due to, paints, cleaners and various building products located in the space. During our inspection it was noted that the Auto Body HV unit was off and the one of the two Automotive HV units were off which may also account for the elevated levels in those areas. Suggest repair or enabling of HV and exhaust systems in shop areas to ensure proper operation as well as to establish a slight space negative pressure to limit odor migration to other parts of the building.*

3. *Elevated TVOC levels were noted in some classrooms and hallways above or in the vicinity of the automotive and auto body shop areas. This may be due to the systems in those shops not being operational. See note #2 above.*

Ventilation System Summary & Recommendations:

The following table is based on original design drawings and reflect most of the systems which provide ventilation air to the building. The units ID tag, area served, ventilation data and filter efficiencies are listed. The table also reflects possible COVID Control Measures (CCM) and Enhanced COVID Control Measures (ECCM) described later in this report which may apply to such systems to improve performance either during pandemic conditions and/or post pandemic conditions.

Worcester Tech High School Ventilation System Summary

Unit ID	Area Served	Exist. Supply CFM	Exist. O.A. CFM	Exist. O.A. %	Exist. Filter Qty & Size	Exist. Filter MERV Rating	Exist. Filter Vel. Velocity (FPM)	Proposed CCM #	Proposed ECCM #	Notes
RTU-1-A	Auditorium	24400	3500	14	(12) 24x24x4 (4) 12x24x4	8	436	1, 2, 3	3	b, c
RTU-2-A	A Bldg. Classrooms +	47000	19000	40		8		1, 2, 3	3	a, b
RTU-3-B	B Bldg. Classrooms +	42000	17000	40	(20) 24x24x4 (4) 12x24x4	8	477	1, 2, 3	3	a, b
RTU-4-B	B Bldg. Classrooms +	50000	20000	40	(20) 24x24x4 (4) 12x24x4	8	568	1, 2, 3	3	a, b
RTU-5-D	D Bldg. Classrooms +	50000	20000	40	(20) 24x24x4 (4) 12x24x4	8	568	1, 2, 3	3	a, b
HV-1-B	Boiler Rm	10000	10000	100		8				
HV-2-C	Plumb. Shop	6310	2525	40		8		1, 2, 3	3	b, d
HV-3-C	Sheet Metal Shop	8710	8710	100		8		1	3	
HV-4-C	Carpentry Shop	6470	2590	40		8		1, 2, 3	3	b, d
HV-5-C	HVAC Shop	4500	1800	40		8		1, 2, 3	3	b, d
HV-6-C	Interior Shop	7600	3040	40		8		1, 2, 3	3	b, d
HV-7-C	Elec. Shop	7280	2915	40		8		1, 2, 3	3	b, d
HV-8-D	Construction Lab	3480	1395	40		8		1, 2, 3	3	b, d
HV-9-D	Auto Body Shop + Rel.	7590	3040	40		8		1, 2, 3	3	b, d
HV-10-D	Auto Repair Shop + Rel.	10200	4080	40		8		1, 2, 3	3	b, d
HV-11-D	Machine Shop	6000	2400	40		8		1, 2, 3	3	b, d
HV-12-D	Welding Shop	11200	11200	100		8		1		
HV-13-D	Welding Shop	3750	1500	40		8		1, 2, 3	3	b, d
HV-14-D	Welding Shop	10000	10000	100		8		1	3	
HV-15-D	Welding Shop	11940	11940	100		8		1	3	
HV-16-E	Storage	2515	505	20		8				
HV-17-E	Locker Rooms	13105	13105	100		8		1	3	
HV-18-E	Lobby	3590	1080	30		8		1, 2, 3	3	b
HV-19-E	Weight Room	4665	1870	40	(4) 20x25x2	8	336	1, 2, 3	3	b
HV-20-E	Gymnasium (2 units)	15000	7500	50	(12) 20x20x2 (4) 20x25x2	8	318	1, 2, 3	3	b, c
HV-21-D	Auto Repair Shop	9400	3760	40		8		1, 2, 3	3	b, d
HV-22-E	Boiler Rm	1800	1800	100		8				
HV-23-D	Mech Rm	1200	1200	100		8				
HV-24-D	Auto Body Booth MAU	13000	13000	100		8				

Ventilation System Summary Notes:

a. *To improve the ventilation effectiveness and outdoor airflow control of the classroom systems we would recommend airflow stations be added to the supply fan, return fan, outdoor airflow and exhaust airflow of each of the four (4) units serving the classroom RTU-2-A, RTU-3-B, RTU-4-B & RTU-5-D along with associated control improvements.*

For individual classrooms and other areas noted, ECCM #1 – Portable Air Filtration and/or ECCM #3 – Ionization, are noted as possible options to improve air cleaning and changeover during pandemic conditions.

b. *CCM # 3 - Improved Filtration is predicated on the unit being able to support such filtration.*

c. *Disable any CO_2 demand ventilation reset or occupancy sensor-based system shutdown (during scheduled occupied periods) during pandemic conditions.*

d. *Space activities in certain shop areas may preclude the use of higher eff. filters due to the speed in which they would load. In these shops, a pre-filter may be necessitated in the return air stream of which the fan would need to be able to compensate for.*

II. COVID-19 HVAC MITIGATION MEASURES

A. HVAC COVID-19 CONTROL MEASURES

In line with the current American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) Epidemic Task Force Building Readiness Guidelines (updated 10-20-2020) and those from the Harvard T.H. Chan School of Public Health - 5-Step Guide to Checking Ventilation Rates in Classrooms, as well as other industry recommendations the following HVAC COVID Control Measures (CCM's) are presented for consideration to assist in mitigating virus transmission thru the HVAC systems.

The ASHRAE Epidemic Task Force recommends several measures to assist in COVID-19 mitigation with more aggressive action with epidemic conditions in place (ECiP) and post-epidemic conditions in place (P-ECiP). For ECiP conditions in place the HVAC COVID-19 Control Measures (CCM) that could be readily applied to the Worcester Vocational Technical High School surveyed are outline herein. Refer to the Ventilation System Summary Table for applicable CCM recommendations.

It is imperative that all systems be maintained and checked to confirm proper operation in line with their original design, adjusted where applicable, as described herein. In addition, a Testing and Balancing company should be enlisted to adjust and confirm all systems are properly achieving their design outdoor air, supply air and exhaust air levels.

CCM #1 – Pre & Post Purge

Pre- and post-purge ventilation of occupiable spaces using outside air introduced the HVAC systems. This would be accomplished by starting the ventilation systems in occupied mode (i.e., OA at design or higher) 4 hours prior to schedule building occupancy and maintain the occupied mode for 4-hours after occupancy ends.

Most of the HVAC systems supporting the Worcester Technical High School are capable of implementing this measure.

CCM #2 – Increased Ventilation

Increase outdoor air ventilation for improved space dilution where systems allow. This would entail increasing the minimum outdoor air damper positions on all mixed air style systems within the limits of the equipment capacity and overriding any demand ventilation reset schemes (i.e., CO_2 reset). A control sequence would need to be implemented for the respective air handlers which would limit the outdoor air volume to the unit's respective capability such that proper control of the discharge air can be maintained as well as freeze protection of coils. In addition, sequence would need to include limitation based on boiler plant and cooling system capabilities and summertime moisture limitations. For buildings which have anti-freeze in water-based heating and/or cooling systems, concern of unitary coil freeze up is reduced.

Most of the HVAC systems supporting the Worcester Technical High School are capable of implementing this measure subject to outdoor ambient conditions and equipment limitations. For the four (4) RTU's serving most of the building's classroom spaces, more extensive control related work shall be required as described later in this report to accomplish this CCM as the units are limited to some extent by a factory controller.

CCM #3 – Improved Filtration

Improve filtration to up to MERV-13 on air handling systems, especially those which recirculate air. In addition, if possible, as filters are replaced provide sealant or gasketing between and/or around filters to reduced air bypass around filter sections. Higher filtration on 100% outdoor air systems is not as critical as they do not recirculate space air albeit improved filtration possibly as high as MERV 11 may be considered subject to unit fan capabilities. Most, room terminal fan coil units cannot support filtration in excess of MERV 8. All replacement filters for these terminal units should meet MERV 8 requirements. Note: Prior to implementation of higher filtration levels, existing equipment capabilities must be reviewed to verify it can support the added pressure drop imposed by MERV-13 filtration. Testing and balancing to confirm current airflow, pressure drops, and fan motor power coupled with manufacturer published data would be required to confirm the unit's capability for improved filtration.

Except for the fan power VAV terminals and smaller fan coil systems, a majority of the main air handling systems in the building appear to be capable of supporting increased filtration up to a maximum of MERV 13. Systems must be tested and adjusted to accommodate the pressure drop associated with the increased filter efficiency. In addition, more frequent filter changes would be expected to limit reduction in ventilation air as the filters load.

B. ENHANCED HVAC COVID-19 CONTROL MEASURES

In addition to the suggested above measures below are some Enhanced HVAC COVID-19 Control Measures (ECCM) which could be considered for implementation. Refer to the Ventilation System Summary Table under the respective schools for applicable recommendations.

ECCM #1: Portable Room Purifiers

Portable room air purifiers may be used in select areas to help clean the air within that space. These could be applied in areas such as those where the population is in a higher risk group of developing COVID-19 complications or anywhere where real time space cleaning is required. Products which include HEPA filters and fans with air exchange rate appropriate for the size room should be selected.

ECCM #2: UV-C Light Sterilization

UV-C lights can be inserted in equipment and ductwork to help neutralize viruses as it is exposed to the light. UV technology has been studied and used extensively, primarily in hospital settings for virus and bacteria control and in the general HVAC primarily to prevent build-up on coils. To properly mitigate the virus an extended run of return air duct would need to be identified to allow for adequate exposure to UV-C light since a light bar just at the unit coil or filter will primarily just prevent build-up of mold, bacteria, and viruses on those surfaces.

ECCM #3: Bi-Polar Ionization

Air ionizers are meant to be installed in the supply air duct or plenum downstream of fans and filters. They are also offered as portable units for room application. In Worcester Technical High Schools case they could be installed in the supply air duct of the respective mixed air handling systems. WPS has already begun to incorporate Bipolar Ionization extensively throughout the Worcester Technical High School to address the current pandemic condition.

Air ionizers appear to be showing quite a bit of promise for low system impact in retrofit application. For years, these products have been used to primarily clean air of dust and particles by forcing the particles to bind together and either drop out of the breathing zone and/or better be able to be captured by HVAC system air filters by making particles larger. Recently, there are studies which claim to show the ionizers work on neutralizing viruses in the space prior to needing to draw these pollutants back to the units where filters and/or other cleaning technology such as UV-C could occur.

ASHRAE has not taken a definitive stance on Bipolar Ionization with regard to virus mitigation as of yet and has deferred to CDC's comment that it is still considered an emerging technology in this regard. Bipolar Ionization has been used for decades primarily for the removal of particles within the air. During that period, its use was focused more on facilities such as convention centers, casinos, and the like as there are large amounts of

occupant and activity generated pollutants. Only recently has Bipolar Ionization been looked at for virus mitigation which is why ASHRAE and CDC still view it as an emerging technology being that there are not extensive 3rd party studies and reviews of its capability in this regard.

That said, even ignoring its potential virus neutralizing capabilities, the ability of the product to bind smaller particles into larger particles results in an overall desirable indoor air quality benefit in that it increases the capabilities of air filters to filter the air as well as promotes particles to drop out of the breathing zone. We do, however, recommend the technology be provided on systems that meet code required outdoor air ventilation levels as this technology is not a replacement for outdoor air.

Inevitably, during an epidemic, the best approach is a multi-faceted one and should include the above HVAC strategies as well as proper housekeeping (cleaning of spaces and surfaces), occupant actions (hand cleaning, wearing masks, social distancing, following recommended CDC guidelines) and other mitigation strategies.

2) Natural Ventilation Summary

Worcester Technical High School

	Room Name / Number	Space Use	Net Floor Area (SF)	4% of Net Area	Number of windows by Type														Total open Area (SF)	Difference between actual and required SF	PASS?	Additional Notes
					1 CASEMENT	2.94	2 AWNING	3.44	3 AWNING	2.73	4 AWNING	1.85	5 AWNING	4.22	6 CASEMENT	4.31	7 AWNING	4.48				
Building A																						
Ground Floor	A001 - Cafeteria	food	9173	366.92															0.00	366.92	NO	
	A003 - Food Court & 006 - Kitchen	food	4607	184.28															0.00	184.28	NO	
	A007 - Dish Wash	food	481	19.24															0.00	19.24	NO	
	A013 - Office	office	98	3.92															0.00	3.92	NO	
	A014 - Locker	support	78	3.12															0.00	3.12	NO	
	A015 - Related	support	415	16.6															0.00	16.60	NO	
	A016 - Storage	storage	471	18.84															0.00	18.84	NO	
	A017 - Faculty Dining	food	79	3.16		4													11.77	-8.61	YES	
	A019 - Tech Serv	office	8,200	328															0.00	328.00	NO	
	A020 - Bakery	food	1851	74.04															0.00	74.04	NO	
	A022 - Freezer	food	169	6.76															0.00	6.76	NO	
	A023 - Cooler	food	179	7.16															0.00	7.16	NO	
	A024 - Dry Storage	food	147	5.88															0.00	5.88	NO	
	A025 - Related	support	584	23.36															0.00	23.36	NO	
	A026 - Sanitize	food	545	21.8															0.00	21.80	NO	
	A028 - Office	office	130	5.2															0.00	5.20	NO	
	A029 - Supply	storage	91	3.64															0.00	3.64	NO	
	A030 - Boys Locker Room	locker room	209	8.36															0.00	8.36	NO	
	A031 - Girls Locker Room	locker room	209	8.36															0.00	8.36	NO	
	A032 - Receiving	support	456	18.24															0.00	18.24	NO	
	A033 - Mech	mech	213	8.52															0.00	8.52	NO	
	A034 - Trash	support	314	12.56															0.00	12.56	NO	
	A035 - Laundry	support	333	13.32															0.00	13.32	NO	
	A035A - Storage	storage	135	5.4															0.00	5.40	NO	
	A036 - Trade Kitchen	food	2461	98.44								5							9.24	89.20	NO	
	037 - Dry Storage	storage	129	5.16															0.00	5.16	NO	
	038 - Freezer	food	145	5.8															0.00	5.80	NO	
	A039 - Cooler	food	145	5.8															0.00	5.80	NO	
	A043 - Supply	support	40	1.6															0.00	1.60	NO	
	A046 - Supply	support	72	2.88															0.00	2.88	NO	
	A047 - Elec	mech	101	4.04															0.00	4.04	NO	
	A048 - Supply	support	114	4.56															0.00	4.56	NO	
	A050 - Hotel Restaurant	food	1621	64.84		3													8.83	56.01	NO	
	A051 - Office	office	117	4.68															0.00	4.68	NO	
	A053 - Girls Locker	lockers	153	6.12															0.00	6.12	NO	
	A054 - Boys Locker	lockers	176	7.04															0.00	7.04	NO	
	A057 - Sup	support	111	4.44															0.00	4.44	NO	
	A058 - Hostess	support	178	7.12															0.00	7.12	NO	
	A059 - Conf Room	conference	398	15.92		1													2.94	12.98	NO	
	A060 - Restaurant	food	1711	68.44															0.00	68.44	NO	
First Floor	A101 - Waiting / A102 Main Office	office	757	30.28															0.00	30.28	NO	
	A102A - Systems	support	112	4.48															0.00	4.48	NO	
	A105 - Director	office	219	8.76															0.00	8.76	NO	
	A106 - Principal	office	239	9.56															0.00	9.56	NO	
	A108 - Files	support	119	4.76															0.00	4.76	NO	
	A112 - Conference Room	conference	239	9.56															0.00	9.56	NO	
	A113 - Office	office	65	2.6															0.00	2.60	NO	
	A118 - Infant Area	nursery	450	18															0.00	18.00	NO	
	A120 - Transitional Toddler	child	360	14.4															0.00	14.40	NO	
	A121 - Office	office	125	5															0.00	5.00	NO	
	A122 - Toddler Area	child	383	15.32															0.00	15.32	NO	
	A123 - Laundry	child	51	2.04															0.00	2.04	NO	
	A124 - Kitchen	child	275	11															0.00	11.00	NO	
	A129 - Office	office	119	4.76															0.00	4.76	NO	
	A130 - Preschool / Daycare - Center	child	1136	45.44															0.00	45.44	NO	
	A136 - Early Childhood Related	child	542	21.68		2													5.89	15.79	NO	
	A137 - Early Childhood Methods	child	646	25.84															0.00	25.84	NO	
	A139 - Girls Room	toilet	319	12.76															0.00	12.76	NO	
	A141 - Lower Auditorium	aud	4483	179.32															0.00	179.32	NO	
	A142 - Stage	aud	2417	96.68															0.00	96.68	NO	
	A148 - Band Room	classroom	1622	64.88		2													5.89	58.99	NO	
	A149 - Storage	storage	241	9.64															0.00	9.64	NO	
	A150 - Storage	storage	80	3.2															0.00	3.20	NO	
	A151 - Office	office	197	7.88															0.00	7.88	NO	
	A152 - Library	support	103	4.12															0.00	4.12	NO	
	A153 - Classroom	classroom	488	19.52		2													5.89	13.63	NO	
	A154 - Practice	classroom	46	1.84															0.00	1.84	NO	
	A155 - Practice	classroom	46	1.84															0.00	1.84	NO	
	A156 - Aud Storage	storage	90	3.6															0.00	3.60	NO	
	A157 - Computer Comp / Mini Room	classroom	553	22.12		2													5.89	16.23	NO	
	A158 - Classroom	classroom	526	21.04		2													5.89	15.15	NO	
	A160 - Retail #2	retail	336	13.44															0.00	13.44	NO	
	A161 - Bakery	retail	205	8.2															0.00	8.20	NO	
	A162 - Retail #1	retail	360	14.4															0.00	14.40	NO	
	A165 - Bank	classroom	558	22.32															0.00	22.32	NO	
	A167 - Finance & Market	classroom	697	27.88		2													5.89	21.99	NO	
	A168 - Finance & Market	classroom	735	29.4		2													5.89	23.51	NO	
	A169 - Coats	storage	91	3.64															0.00	3.64	NO	
	A171 / A172 - Conference Room	conference	2963	118.52		8													23.54	94.98	NO	
	A173 - IDF	support	74	2.96															0.00	2.96	NO	
	A174 - Elec	elec	93	3.72															0.00	3.72	NO	
	A175 - Linen	support	98	3.92															0.00	3.92	NO	
	A176 / A177 - Hostess / Kitchen	support	538	21.52															0.00	21.52	NO	
Second Floor	Auditorium Upper	aud	2343	93.72															0.00	93.72	NO	
	Auditorium Upper																					

Building B																				
Ground Floor	B002 - Cafeteria	café	9173	366.92													0.00	366.92	NO	
	B011 - Primary Elec	elec	733	29.32													0.00	29.32	NO	
	B012A - Emerg Elec	elec	256	10.24													0.00	10.24	NO	
	B012 - Telecomm	tele	240	9.6													0.00	9.60	NO	
	B014 - Inst Room / Prep	support	288	11.52													0.00	11.52	NO	
	B016 - Bio Tech Lab	classroom	1133	45.32	2												5.89	39.43	NO	
	B017 - Gown / Support	support	63	2.52													0.00	2.52	NO	
	B018 - Clean Room	support	257	10.28													0.00	10.28	NO	
	B019 - Storage	storage	137	5.48													0.00	5.48	NO	
	B020 - Lab Room	classroom	781	31.24													0.00	31.24	NO	
	B021 - Environmental Tech Lab	classroom	1483	59.32	2												5.89	53.43	NO	
	B023 - Mech Room	Mech	4689	187.56													0.00	187.56	NO	
	B024 - Fire Protection	Fire	394	15.76													0.00	15.76	NO	
First Floor	B109 - Classroom	classroom	715	28.6	2												5.89	22.71	NO	
	B110 - Classroom	classroom	706	28.24	2												5.89	22.35	NO	
	B111 - Classroom	classroom	704	28.16	2												5.89	22.27	NO	
	B114 - Waiting	office	118	4.72													0.00	4.72	NO	
	B115 - Reception	office	344	13.76													0.00	13.76	NO	
	B116 - Office	office	99	3.96													0.00	3.96	NO	
	B117 - Rest Area	office	454	18.16													0.00	18.16	NO	
	B121	support	49	1.96													0.00	1.96	NO	
	B123 - Exam	support	94	3.76	1												2.94	0.82	NO	
	B124 - Exam	support	98	3.92	1												2.94	0.98	NO	
	B125 - Nurse Practice	support	98	3.92	1												2.94	0.98	NO	
	B126 - Nurse Office	support	97	3.88	1												2.94	0.94	NO	
	B127 - Case Manager	support	98	3.92	1												2.94	0.98	NO	
	B128 - Waiting Room / Asst Sect	office	279	11.16													0.00	11.16	NO	
	B129 - Office	office	79	3.16													0.00	3.16	NO	
	B131 - Comp Lab	office	73	2.92													0.00	2.92	NO	
	B133 - Office	office	105	4.2													0.00	4.20	NO	
	B133 - Admin Office - 1	office	160	6.4	1												2.94	3.46	NO	
	B134 - Guidance Director	office	106	4.24	1												2.94	1.30	NO	
	B136 - Social Worker	office	106	4.24	1												2.94	1.30	NO	
	B138 - Psych	office	106	4.24	1												2.94	1.30	NO	
	B139 - Conference Room	office	216	8.64													0.00	8.64	NO	
	B140 - Reception	office	446	17.84													0.00	17.84	NO	
	B141 - Office	office	88	3.52													0.00	3.52	NO	
	B148 - Manicure	classroom	599	23.96													0.00	23.96	NO	
	B149 - Salon	classroom	1264	50.56													0.00	50.56	NO	
	B150 - Demonstration Lab	classroom	565	22.6													0.00	22.60	NO	
	B151 - Dispensary	support	219	8.76													0.00	8.76	NO	
	B151 - Locker	support	180	7.2													0.00	7.20	NO	
	B154 - Practical Lab	classroom	154	6.16													0.00	6.16	NO	
	B157 - Work Room	classroom	335	13.4													0.00	13.40	NO	
	B157A - Copies	support	91	3.64													0.00	3.64	NO	
	B158 - Ass Dir	office	149	5.96													0.00	5.96	NO	
	B159 - Guidance	office	159	6.36													0.00	6.36	NO	
	B160 - Team Room	classroom	320	12.8													0.00	12.80	NO	
	B161 - Team Room	classroom	306	12.24													0.00	12.24	NO	
	B162 - Team Room	classroom	308	12.32													0.00	12.32	NO	
	B163 - Team Room	classroom	314	12.56													0.00	12.56	NO	
	B164 - Meeting Room	conference	164	6.56													0.00	6.56	NO	
	B165 - Classroom	classroom	165	6.6													0.00	6.60	NO	
	B166 - Classroom	classroom	725	29													0.00	29.00	NO	
	B167 - Classroom	classroom	730	29.2													0.00	29.20	NO	
	B168 - Classroom	classroom	730	29.2													0.00	29.20	NO	
	B169 - Classroom	classroom	738	29.52													0.00	29.52	NO	
Second Floor	B201 / B202 - Computer Lab	classroom	1618	64.72													0.00	64.72	NO	
	B203 - Parent Meeting	meeting	371	14.84													0.00	14.84	NO	
	B210 - Bio Chem Lab	classroom	1055	42.2		8											27.50	14.70	NO	
	B211 - Lab Prep	support	323	12.92													0.00	12.92	NO	
	B212 - Bio Chem Lab	classroom	1056	42.24		8											27.50	14.74	NO	
	B216 - Business Info System	classroom	1268	50.72	4												11.77	38.95	NO	
	B217 - Work Room	support	171	6.84													0.00	6.84	NO	
	B218 - Files	support	105	4.2													0.00	4.20	NO	
	B219 - BIS Related	support	770	30.8													0.00	30.80	NO	
	B220 - BIS Related	support	749	29.96													0.00	29.96	NO	
	B221 - Classroom	classroom	779	31.16	2												5.89	25.27	NO	
	B222 - Classroom	classroom	778	31.12	2												5.89	25.23	NO	
	B223 - Classroom	classroom	792	31.68	2												5.89	25.79	NO	
	B224 - ESL	classroom	543	21.72	1												2.94	18.78	NO	
	B232 - Digital Print Room	support	588	23.52													0.00	23.52	NO	
	B233 - Storage	storage	285	11.4													0.00	11.40	NO	
	B234 - Client Services	office	252	10.08													0.00	10.08	NO	
	B235 - Related Serv	support	858	34.32	2												5.89	28.43	NO	
	B236 - Computer Imaging	classroom	1766	70.64	4												11.77	58.87	NO	
	B237 / B238 / B239 - Graphics Com	classroom	6228	249.12	3												8.83	240.29	NO	
	B241 - Supply	support	965	38.6													0.00	38.60	NO	
	B242 - Storage	storage	91	3.64													0.00	3.64	NO	
	B243 - Elec	elec	114	4.56													0.00	4.56	NO	
Third Floor	B301 - Computer Lab	classroom	1619	64.76													0.00	64.76	NO	
	B303 - Spec Edu	classroom	371	14.84													0.00	14.84	NO	
	B310 - Bio / Chem Lab	classroom	1056	42.24	2												5.89	36.35	NO	
	B311 - Lab Prep	support	321	12.84													0.00	12.84	NO	
	B312 - Bio / Chem Lab	classroom	1059	42.36						6							11.09	31.27	NO	
	B314 - Spec Edu	classroom	405	16.2													0.00	16.20	NO	
	B316 - Classroom	classroom	772	30.88	2												5.89	24.99	NO	
	B317 - Classroom	classroom	781	31.24	2												5.89	25.35	NO	
	B318 - Classroom	classroom	781	31.24	2												5.89	25.35	NO	
	B319 - Classroom	classroom	779	31.16	2												5.89	25.27	NO	
	B329 - Classroom	classroom	794	31.76	2												5.89	25.87	NO	
	B322 - Classroom	classroom	544	21.76	1												2.94	18.82	NO	
	B323 - Classroom	classroom	769	30.76	2												5.89	24.87	NO	
	B325 - Storage	storage	91	3.64													0.00	3.64	NO	
	B326 - Team Work Room	classroom	377	15.08													0.00	15.08	NO	
	B327 - Assistant Dir	office	168	6.72													0.00	6.72	NO	
	B328 - Guidance	Office	1221	48.84													0.00	48.84	NO	
	Room 330 - Team Meeting	classroom	737	29.48	2												5.89	23.59	NO	
	B335 - Waiting Room	office	168	6.72													0.00	6.72	NO	
	B336 - Waiting Room	office	91	3.64													0.00	3.64	NO	
	B339 - Storage	storage	82	3.28													0.00	3.28	NO	
	B340 - Related	support	745	29.8													0.00	29.80	NO	
	B341 - Team Room	classroom	278	11.12													0.00	11.12	NO	
	B341 - Practical Lab	classroom	1498	59.92	2												5.89	54.03	NO	
	B342 - Team Room	classroom	281	11.24													0.00	11.24	NO	
	B343 - Team Room	classroom	281	11.24													0.00	11.24	NO	
	B344 - Team Room	classroom	290	11.6													0.00	11.60	NO	
	B345 - Practical Lab	classroom	1677	67.08	2												5.89	61.19	NO	
	B347 - Computer Lab	classroom	665	26.6													0.00	26.60	NO	
	B348 - Practical Lab	classroom	997	39.88	2												5.89	33.99	NO	
	B349 - Storage	storage	144	5.76	2												5.89	-0.13	YES	
	B350 - Veterinary Tech	classroom	646	25.84													0.00	25.84	NO	
	B351 - Elec	elec	58	2.32													0.00	2.32	NO	
	B352 - Elec	elec	112	4.48													0.00	4.48	NO	
	B353 - IDF	support	103	4.12													0.00	4.12	NO	
Forth Floor	B401 - Conference Room	conference	1635	65.4													0.00	65.40	NO	
	B403 - Student Concil	office	273	10.92													0.00	10.92	NO	
	B410 - Art Room	classroom	1523	60.92										2			8.61	52.31	NO	
	B410A - Storage	storage	165	6.6													0.00	6.60	NO	
	B411 - Kiln	support	91	3.64													0.00	3.64	NO	
	B412 - Computers	support	134	5.36													0.00	5.36	NO	
	B413 - Media Center	classroom	5722	228.88													0.00	228.88	NO	
	B414 - Prof Library	office	158	6.32													0.00	6.32	NO	
	B415 - AV Dist.	office	225	9													0.00	9.00	NO	
	B417 - Periodical Storage / Media	storage	273	10.92													0.00	10.92	NO	
	B418 - Office	office	101	4.04													0.00	4.04	NO	
	B422 - TV Studio	classroom	635	25.4													0.00	25.40	NO	
	B423 - Production	classroom	333	13.32													0.00	13.32	NO	
	B424 - Editing	classroom	50	2													0.00	2.00	NO	
	B425 - Electric	elec	62	2.48													0.00	2.48	NO	
	B426 - Computer Lab	classroom	688	27.52													0.00	27.52	NO	
	B427 - MDF / IDF Storage	support / storage	557	22.28													0.00	22.28	NO	

Building C																					
First Floor	C102 - Reception	office	194	7.76														0.00	7.76	NO	
	C103 - Spec Edu Director	office	122	4.88														0.00	4.88	NO	
	C104 - Bilingual Fac	office	157	6.28														0.00	6.28	NO	
	C105 - Conference	conference	184	7.36														0.00	7.36	NO	
	C106 - Storage	storage	53	2.12														0.00	2.12	NO	
	C107 - Storage	storage	71	2.84														0.00	2.84	NO	
	C109 - Plumbing & Pipe Fittings	classroom	4418	176.72						4		4						18.33	158.39	NO	
	C110 - Related	support	617	24.68														0.00	24.68	NO	
	C111 - Lockers	lockers	154	6.16														0.00	6.16	NO	
	C112 - Lockers	lockers	221	8.84														0.00	8.84	NO	
	C117 - Computer Lab	classroom	744	29.76														0.00	29.76	NO	
	C119 - Related	support	703	28.12														0.00	28.12	NO	
	C120 - Sheet Metal Shop	classroom	4603	184.12						2		2						9.17	174.95	NO	
	C127 - Basic Carpentry Shop	classroom	2055	82.2														0.00	82.20	NO	
	C129 - Carpentry Shop	classroom	5,560	222.4														0.00	222.40	NO	
	C130 - Related	support	667	26.68														0.00	26.68	NO	
	C132 - Lockers	lockers	219	8.76														0.00	8.76	NO	
Second Floor	C202 - OT / PT	classroom	536	21.44		2												5.89	15.55	NO	
	C203 - Classroom	classroom	796	31.84														0.00	31.84	NO	
	C204 - Fan Room	mech	855	34.2														0.00	34.20	NO	
Third Floor	C301 - Storage	storage	188	7.52														0.00	7.52	NO	
	C304 - Lockers	lockers	167	6.68														0.00	6.68	NO	
	C305 - HVAC	classroom	3664	146.56						2		2						9.17	137.39	NO	
	C309 - Classroom	classroom	839	33.56														0.00	33.56	NO	
	C312 - Painting and Decorating	classroom	2637	105.48						2		2						9.17	96.31	NO	
	C313 - Plaint Spray Room	classroom	808	32.32														0.00	32.32	NO	
	C314 - Storage	storage	212	8.48														0.00	8.48	NO	
	C316 - Client Services	office	118	4.72														0.00	4.72	NO	
	C323 - Related	support	696	27.84														0.00	27.84	NO	
	C325 - Electrical	classroom	2136	85.44						1		1						4.58	80.86	NO	
	C326 - VDV Room	classroom	2004	80.16						3		3						13.75	66.41	NO	
	C328 - Basic Electrical	classroom	1210	48.4														0.00	48.40	NO	
	C329 - Client Services	office	136	5.44														0.00	5.44	NO	
	C330 - Electrical Storage	storage	272	10.88														0.00	10.88	NO	
	C332 - Lockers	lockers	165	6.6														0.00	6.60	NO	
	C336 - Classroom	classroom	690	27.6		2												5.89	21.71	NO	
	C337 - Classroom	classroom	769	30.76													2	8.96	21.80	NO	
	C338 - Classroom	classroom	769	30.76													2	8.96	21.80	NO	
	C339 - Classroom	classroom	789	31.56													2	8.96	22.60	NO	
	C340 - Classroom	classroom	780	31.2													2	8.96	22.24	NO	
	C341 - Classroom	classroom	780	31.2													2	8.96	22.24	NO	
	C342 - Classroom	classroom	781	31.24													2	8.96	22.28	NO	
Fourth Floor	C401 - Spec Edu	classroom	177	362														0.00	362.00	NO	
	C404 - Elec / Mech Shop 1	classroom	1236	49.44		4				2		2						20.94	28.50	NO	
	C406 - Elec / Mech Shop 2	classroom	1104	44.16		4												11.77	32.39	NO	
	C407 - General Sci Physics	classroom	1059	42.36		2												5.89	36.47	NO	
	C408 - Lab Prep	support	168	6.72														0.00	6.72	NO	
	C409 - General Sci / Physics	classroom	1048	41.92		2												5.89	36.03	NO	
	C410 - Elec / Mech Shop 3	classroom	692	27.68		2												5.89	21.79	NO	
	C411 - Classroom	classroom	789	31.56													2	8.96	22.60	NO	
	C412 - Telecommunications	classroom	1174	46.96													3	13.44	33.52	NO	
	C414 - IDF	support	59	2.36														0.00	2.36	NO	
	C415 - Storage	storage	216	8.64													1	4.48	4.16	NO	
	C416 - Telecommunication Shop 2	classroom	1547	61.88													4	17.92	43.96	NO	
	C417 - Telecommunication Shop 3	classroom	776	31.04													2	8.96	22.08	NO	
	C418 - Janitor Closet	support	52	2.08														0.00	2.08	NO	
Building D																					
First Floor	D102 - Construction Cluster Lab	meeting	1933	77.32														0.00	77.32	NO	
	D103 - Mech Room	mech	386	15.44														0.00	15.44	NO	
	D104A - Supply	storage	123	4.92														0.00	4.92	NO	
	D105 - Emergency Elec	elec	443	17.72														0.00	17.72	NO	
	D106 - Primary Elec	elec	395	15.8														0.00	15.80	NO	
	D108 - Automotive Collision Tech	classroom	5943	237.72						2		4						12.86	224.86	NO	
	D109 - Related	support	859	34.36														0.00	34.36	NO	
	D120 - Automotive Technician	classroom	12709	508.36						8		8						36.67	471.69	NO	
	D121 - Related	support	1131	45.24														0.00	45.24	NO	
	D121A - Client Serv	office	266	10.64												2		8.61	2.03	NO	
Second Floor	D200 - Unassigned	n/a	457	18.28														0.00	18.28	NO	
Third Floor	D303 - Team Room	classroom	323	12.92														0.00	12.92	NO	
	D304 - Team Room	classroom	322	12.88														0.00	12.88	NO	
	D305 - Team Room	classroom	321	12.84														0.00	12.84	NO	
	D307 - Team Room	classroom	317	12.68														0.00	12.68	NO	
	D308 - Team Room	classroom	581	23.24														0.00	23.24	NO	
	D310 - Work Room	support	415	16.6														0.00	16.60	NO	
	D311 - Assistant Dir	office	135	5.4														0.00	5.40	NO	
	D312 - Spec Edu	office	112	4.48														0.00	4.48	NO	
	D314 - Electrical Storage	storage	176	7.04														0.00	7.04	NO	
	D317 - Machine Technology	classroom	7727	309.08						7		7						32.08	277.00	NO	
	D318 - Classroom	classroom	878	35.12														0.00	35.12	NO	
	D320 - Storage	storage	49	1.96														0.00	1.96	NO	
	D324 - Storage	storage	80	3.2														0.00	3.20	NO	
	D325 - Welding & Metals Tech	classroom	5187	207.48		2				2		2						15.05	192.43	NO	
	D326 - Related	support	592	23.68														0.00	23.68	NO	
	D327 - Testing / Comp	classroom	258	10.32														0.00	10.32	NO	
	D332 - Oxygen	storage	50	2														0.00	2.00	NO	
	D333 - Acetylene	storage	49	1.96														0.00	1.96	NO	
	D334 - Spec Edu	classroom	322	12.88														0.00	12.88	NO	
	D335 - Electrical	storage	80	3.2														0.00	3.20	NO	
	D336 - Storage Room	storage	77	3.08														0.00	3.08	NO	
	D337 - Computer Lab	classroom	918	36.72													2	8.96	27.76	NO	
	D338 - Classroom	classroom	786	31.44													2	8.96	22.48	NO	
	D339 - Classroom	classroom	789	820													2	8.96	811.04	NO	
	D340 - Classroom	classroom	780	31.2													2	8.96	22.24	NO	
	D341 - Classroom	classroom	780	31.2													2	8.96	22.24	NO	
	D342 - Classroom	classroom	776	31.04													2	8.96	22.08	NO	
	D343 - Classroom	classroom	788	31.52													2	8.96	22.56	NO	
Fourth Floor	D401 - Meeting Room	conference	734	29.36														0.00	29.36	NO	
	D401A - Work	support	115	4.6														0.00	4.60	NO	
	D402 - Spec Edu	classroom	143	5.72														0.00	5.72	NO	
	D403 - Storage	storage	383	15.32		1												2.94	12.38	NO	
	D405 - Guidance	office	190	7.6														0.00	7.60	NO	
	D406 - Dark Room	support	321	12.84														0.00	12.84	NO	
	D407 - Team Room	classroom	435	17.4														0.00	17.40	NO	
	D408 - Team Room	classroom	427	17.08														0.00	17.08	NO	
	D409 - Team Room	classroom	433	17.32														0.00	17.32	NO	
	D410 - Team Room	classroom	505	20.2														0.00	20.20	NO	
	D412 - Storage	storage	201	8.04														0.00	8.04	NO	
	D413 - Assit Dir Office	office	210	8.4														0.00	8.40	NO	
	D415 - Electric Room	elec	83	3.32														0.00	3.32	NO	
	D416 - IDF	support	81	3.24														0.00	3.24	NO	
	D417 - Storage	storage	381	15.24		1												2.94	12.30	NO	
	D418 - Drafting / CAD	classroom	882	35.28		3												8.83	26.45	NO	
	D419 - Drafting / Cad Related	classroom	585	23.4		2												5.89	17.51	NO	
	D420 - General Sci / Physics	classroom	1059	42.36		2												5.89	36.47	NO	
	D421 - Lab Prep	classroom	167	6.68														0.00	6.68	NO	
	D422 - Janitor's	support	53	2.12														0.00	2.12	NO	
	D423 - General Sci / Physics	classroom	1059	42.36		2												5.89	36.47	NO	
	E424 - Spec Edu	classroom	319	12.76		2												5.89	6.87	NO	
	D425 - Drafting / CAD	classroom	1492	59.68													4	17.92	41.76	NO	
	D425A - Storage	storage	124	4.96														0.00	4.96	NO	
	D426 - Drafting / CAD Supplies	storage	194	7.76														0.00	7.76	NO	
	D427 - Drafting / CAD Comp D	classroom	1484	59.36													4	17.92	41.44	NO	
	D428 - Classroom	classroom	774	30.96													2	8.96	22.00	NO	
	D429 - Classroom	classroom	777	31.08													2	8.96	22.12	NO	
	D430 - Classroom	classroom	787	31.48													2	8.96	22.52	NO	

Building E																					
First Floor	E102 - Exercise Room	gym	643	25.72														0.00	25.72	NO	
	E103 - Elevator Mach	mech	54	2.16														0.00	2.16	NO	
	E104 - Storage	storage	67	2.68														0.00	2.68	NO	
	E105 - Visiting Team Women's	locker	260	10.4														0.00	10.40	NO	
	E108 - Shower	locker	88	3.52														0.00	3.52	NO	
	E109 - Visiting Team Men's	locker	270	10.8														0.00	10.80	NO	
	E112 - Shower	locker	88	3.52														0.00	3.52	NO	
	E113 - Men's Lockers	locker	825	33														0.00	33.00	NO	
	E114 - Shower	locker	399	15.96														0.00	15.96	NO	
	E115 - Men's	toilet room	256	10.24														0.00	10.24	NO	
	E116 - Storage	storage	195	7.8														0.00	7.80	NO	
	E117 - Team Lockers	locker	345	13.8														0.00	13.80	NO	
	E119 - P.E. Office	office	374	14.96														0.00	14.96	NO	
	E122 - Lockers	locker	112	4.48														0.00	4.48	NO	
	E123 - Women's Lockers	locker	840	33.6														0.00	33.60	NO	
	E124 - Shower	locker	322	12.88														0.00	12.88	NO	
	E127 - Women's	toilet room	247	9.88														0.00	9.88	NO	
	E128 - Team Lockers	locker	323	12.92														0.00	12.92	NO	
	E130 - P.E. Office	office	298	11.92														0.00	11.92	NO	
	E131 - Storage	storage	55	2.2														0.00	2.20	NO	
	E133 - Lockers	locker	89	3.56														0.00	3.56	NO	
	E135 - Training	support	325	13														0.00	13.00	NO	
	E137 - Classroom	classroom	319	12.76														0.00	12.76	NO	
	E139 - Paper Storage	storage	242	9.68														0.00	9.68	NO	
	E140 - Office	office	242	9.68														0.00	9.68	NO	
	E141 - Cust Office	office	155	6.2														0.00	6.20	NO	
	E142 - General Storage	storage	444	17.76														0.00	17.76	NO	
	E143 - Lunch Room	office	306	12.24														0.00	12.24	NO	
	E148 - Workshop	support	181	7.24														0.00	7.24	NO	
	E150 - Storage Garage	storage	2140	85.6														0.00	85.60	NO	
	E151 - Storage Garage	storage	1557	62.28														0.00	62.28	NO	
	E152 - Emergency Elec	elec	85	3.4														0.00	3.40	NO	
	E153 - Boiler Room	mech	356	14.24														0.00	14.24	NO	
Second Floor	-	-		0														0.00	0.00	NO	
Third Floor	E201 - Lobby	lobby	1038	41.52														0.00	41.52	NO	
	E202 - Storage	storage	167	6.68														0.00	6.68	NO	
	E203 - Men"s	toilet room	235	9.4														0.00	9.40	NO	
	E204 - Women's	toilet room	232	9.28														0.00	9.28	NO	
	E205 - Janitor's Closet	support	48	1.92														0.00	1.92	NO	
	E206 - Consessions	foor	81	3.24														0.00	3.24	NO	
	E208 - Gymnasium	gym	13040	521.6														0.00	521.60	NO	
	E209 - Gym Office	office	160	6.4														0.00	6.40	NO	
	E210 - Gym Storage	storage	1026	41.04														0.00	41.04	NO	
	E211 - IDF	support	72	2.88														0.00	2.88	NO	
	E212 - Emergency Elec	elec	70	2.8														0.00	2.80	NO	
Fourth Floor	E301 - Helth Fitness Office	office	279	11.16														0.00	11.16	NO	
	E302 - Weight Room	gym	2588	103.52														0.00	103.52	NO	
	E308 - Storage	storage	151	6.04														0.00	6.04	NO	
Fifth Floor	Mech Mezzanine	mech	2278	91.12														0.00	91.12	NO	

Window Type	Width	Height	Projection	Venting
1 - Casement	18	38.5	7.5	2.94
2 - Awning	27.5	38.5	7.5	3.44
3 - Awning	34.5	18	7.5	2.73
4 - Awning	18	17.5	7.5	1.85
5 - Awning	58	18	8	4.22
6 - Casement	41.5	36	8	4.31
7 - Awning	30	56	7.5	4.48

Room Color Key	
	Rooms that meet or exceed the minimum code required ventilation
	Rooms that do not meet the code required ventilation, but have operable windows.
	Rooms that do not have operable windows (either fixed or none present)