ASHRAE Standards Compliance

ASHRAE Standard 62.1 Ventilation Requirements

The American Society of Heating, Refrigerating and Air-Conditioning Engineers Standard 62.1 (ASHRAE 2007) provides a source to ensure that minimum ventilation requirements are met within a building. Proper outdoor air ventilation to spaces in the building is essential in maintaining a proper level of indoor air quality. Every day the Xanadu Meadowlands Sports Complex will entertain thousands of occupants for long periods of time. For this reason excellent indoor air quality is critical in ensuring the well being of every guest to this state of the art facility. To evaluate the effectiveness of the ventilation systems in the Xanadu Sports Complex Building A, calculations have been conducted using the ASHRAE Standard 62.1 guidelines to determine whether or not the current system meets the standards requirements.

The retail section of the buildings receives ventilations from four rooftop air handling units (RTUs) while the Snowdome indoor ski resort is served by a single air handling unit (AHU) housed in a mechanical room adjacent to the ski resort. For this analysis, the required ventilation rates for various spaces are governed based on the peak occupancy, the use of the space, and the floor area of the space. (ASHRAE 2007)

The majority of the retail space is comprised of a single large atrium that is open from the first to third floor. Two of the RTUs will provide ventilation directly to the first and second floor walkways of the atrium while back of house rooms are to draw fresh air supplied to the atrium through corridors. Two larger RTUs supply fresh air to the third floor; however, these two units have been oversized to allow air to drop from the top of the atrium and supply more fresh air to the first and second floor. The ground floor of the retail section houses a loading dock and back of house rooms that are supplied fresh air through louvers in the exterior walls.

The ASHRAE 62.1 compliance analysis of Building A revealed some potential ventilation problems. The largest problem is that ductwork only supplies fresh air to the central atrium. There is no ductwork to the other spaces which are required to have ventilation. In place of ductwork, the design is meant to have the over ventilated atrium air work its way through various passageways and corridors to the rooms in need of ventilation. Besides the air having to travel long distances through corridors, it also must try to find its way through door cracks since there are no louvers to allow the corridor air in. This presents a problem since only a minority of the rooms are equipped with exhaust fans to create a negative pressure to draw air from the corridors. Another area of concern is the placement of the return grilles. The only return grilles are placed at the top of the atrium,

the same place where the majority of all the air for the building is supposed to be supplied from. This presents a large threat of short circuiting which would cause all the spaces to receive little to no ventilation. The AHU compliance summary table is listed below demonstrating how the poor air distribution in AHU-1 and AHU-2 are creating low ventilation efficiencies which increases the demand of fresh outdoor air.

Table 1: Air Handling Unit Compliance Summary

Air Handling Unit	Serves	Ventilation Efficiency	Required O.A. (cfm)	Supplied O.A. (cfm)	Meets Standard?
RTU-1	1st & 2nd Floor East Common Areas	0.6	9,410	1,358	**No**
RTU-2	1st & 2nd Floor West Common Areas	0.6	11,564	1,637	**No**
RTU-3	3rd Floor	1.0	1,515	3,039	**Yes**
RTU-4	3rd Floor	1.0	1,563	3,038	**Yes**
AHU-Snowdome	Indoor Ski Resort	1.0	48,000	15,000	**No**

Problems also arose with the natural ventilation louvers that are installed on the ground floor. In all cases either the louver-free area was too small or the louver was too close to a confinement source.

It is to be noted that many of the discrepancies in the compliance are due to differences from ASHRAE Standard 62.1 2007 and the Building Officials and Code Administrators 1996 code which is the governing code for this project.

The results from the ventilation calculations as prescribed by ASHRAE 62.1 Ventilation Rate Procedure show some potential problems in the mechanical system when it comes to proper ventilation. The roof top units that serve the retail section of the building dump the majority of all the air from the units directly into the large atrium space and nowhere else. This design reduces the amount of ductwork needed and essentially uses the corridors as the duct to carry ventilation air to spaces. This can present a problem since in some cases spaces are relying on air to travel from the atrium though hundreds of feet of corridors to spaces that need ventilation. On top of the long distances the air must travel to corridors. The majority of rooms that are supposed to receive ventilation through the corridors are not negatively pressurized; therefore, it is practical that many of these spaces will never see ventilation. Since the only ductwork that exists serves the atrium and ignores branches of the building, the system efficiency used to calculate the total required ventilation is very low. This is causing much higher ventilation rates to all spaces served by RTU-1 and RTU-2.

It can be noted that assumptions were made on occupancy levels from the ASHRAE default occupancy density which may change the amount of ventilation needed in spaces; however, for this particular problem no direct ventilation from ducted diffuses are provided to spaces other than the atrium and mall walkways. It is fully possible that the over ventilated atrium air does reach the rooms that need ventilation through the corridors, but this type of design does not satisfy the principle of ASHRAE 62.1.

The Snowdome's air handling unit seems to be very undersized for the amount of ventilation that will be needed for such a large space. Using the Ventilation Rate Procedure, the current amount of outdoor air needs to be increased 3.2 times. Discrepancies may have been caused from the assumption of the occupancy category or also from the variations from ASHRAE 62.1 2007 and the code used to design this project which is Building Officials and Code Administrators (BOCA) 1996.

The natural ventilation analysis of the ground floor also shows some areas that can potentially be under ventilated. Three of the spaces are to be ventilated using natural ventilation that would be delivered through louvers on the exterior walls; however, the free area of the louvers is very small in comparison to the minimum requirements presented by ASHRAE 62.1. Besides not meeting the size requirements, the louvered natural ventilation also fails the Air Intake Minimum Separation Distance which can be found in Table 5 of ASHRAE 62.1 (ASHRAE 2007). This section requires that any opening that is to be used for natural ventilations be at a minimum of 25 feet from truck loading docks, which in this case is closer than the requirement. The rest of the spaces on the ground floor are completely closed off and do not have either exterior louvers or interior louvers to gain ventilation from other rooms. The complete ASHRAE 62.1 compliance calculations can be found in Appendix B of this report.

ASHRAE Standard 90.1

The American Society of Heating, Refrigerating and Air-Conditioning Engineers Standard 90.1 (ASHRAE 90.1) provide a source to ensure proper energy efficiency is met within a building. Standard 90.1 was utilized to verify compliance for the Xanadu Sports Complex Building A retail section. The Snowdome portion of the building is not a commercial space and is a very special case. For this reason 90.1 does not apply to this part of the building. Areas that were analyzed consisted of minimum thermal properties of the building envelope; minimum wattages on the interior and exterior lighting; minimum efficiencies of heating, ventilating, air conditioning, and hot water service equipment; and minimum efficiencies of motors. Since Xanadu resides in East Rutherford, New Jersey, a climate zone of 5A was used to determine the proper values to meet compliance with the standard. Calculations were carried out as prescribed by the ASHRAE Standard 90.1, and the

Department of Energy's Energy Code software, ComCheck, was also used to verify the findings. Table 2 below summarizes the findings of the ASHRAE Standard 90.1-2004 compliance check.

Table 2 ASHRAE Standard 90.1-2004 Compliance Summary

Building Envelope	Interior Lighting	Exterior Lighting	HVAC Equipment Efficiencies	HVAC Economizer	Duct Insulation	Pipe Insulation	Motor Efficiencies
30% Better Than Requirements	37% Better Than Requirements	Does Not Comply	Complies	Complies	Not Applicable	Not Applicable	Does Not Comply

As shown in Table 2, the existing building only has two areas of concern when it comes to the compliance of ASHRAE Standard 90.1. The exterior of the building is washed by multiple lighting fixtures that surround the base of the building. The large amount of exterior lighting wattage does not comply with the prescribed standard. Due to the fact that the exterior lighting is largely an architectural feature, a solution to the non-compliance will not be discussed in this report. Similarly, since the motors present in the HVAC equipment will be replaced with new equipment in the redesign, the non-compliance is no longer an issue and will not be discussed further in this report.

While Standard 90.1 did not present any large problems to be considered in the redesign, Standard 62.1 did reveal significant problems with the ventilation system. The non-compliance of Standard 62.1 is enough of a concern that a small portion of the mechanical system redesign work will focus on properly ventilation the building as prescribed by Standard 62.1