

# Technical Assignment 2

## Building and Plant Energy Analysis Report



### Xanadu Meadowlands Sports Complex Building A East Rutherford, New Jersey

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## Executive Summary

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 1 below summarizes the findings of the ASHRAE Standard 90.1-2004 compliance check.

Table 1 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

The LEED-New Construction Green Building Rating System was used to determine whether or not the building could obtain a LEED certification. After deciding whether or not certain credits were possible it was determined that only 4 credits were already obtained and that with some changes another 17 could be achieved giving the building 21 LEED credits. To gain LEED certification a building must obtain 26 credits; therefore, Building A falls 5 credits short after minor changes were made.

The retail section's mechanical system provides ventilation, heating, and cooling to the common areas of the space. This work is currently the only mechanical work in the contract and costs \$4,902,688. However, the Snowdome is on a separate contract, and the mechanical work alone will cost \$9,493,073. All retail leasable spaces that are not included in the current contract will be finished by the leaser; however, mechanical risers have been provided for the leasers to run any ductwork necessary. The total current mechanical system, along with the designated leaser mechanical risers, consumes 10,480 square feet or 1.8% of the total building floor area. Finally, TRACE 700 was used to perform building design loads, energy usage, and annual utility costs. All data from design documents were used to accurately model all conditions. From the TRACE results, it was estimated that it would cost \$389,797.

## LEED New Construction v2.2 Certification

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System is the nationally accepted benchmark for the design, construction, and operation of high performance green buildings. Developed by the United States Green Building Council, LEED provides a standard point system to help design and eventually rate the quality of the building and its impact on the environment. LEED certification guides are broken into five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality.

Since the Xanadu Sports Complex Building A is currently under construction, the LEED New Construction version 2.2 (LEED NC) will be used to check for LEED certification. There are four levels of LEED certification. They are certified, silver, gold, and platinum in the order from lowest rating to highest. The points needed to be obtained to gain each level of certification can be found with the completed LEED NC checklist in Appendix A.

The Xanadu Sports Complex was not designed to be a LEED certified building. Since many aspects of LEED requirements need to be implemented in the early design phase, it can be expected that a large number of LEED criteria were not met. Table 2 below gives a summary of the points breakdown and whether the prerequisites were met or not.

Table 2: LEED NC v2.2 Point Summary

	Possible Points	Points Currently Attainable	Points Attainable with Changes	Currently Meets Prerequisites
Sustainable Sites	14	2	1	Yes
Water Efficiency	5	0	1	Yes
Energy & Atmosphere	17	1	2	Yes
Materials & Resources	13	0	3	Yes
Indoor Environmental Quality	15	0	6	No
Innovation	5	1	4	Yes
	<b>69</b>	<b>4</b>	<b>17</b>	<b>No</b>

For Building A to obtain the lowest LEED certification, 26 points would need to be acquired. The current design of the building can obtain 4 LEED points and can obtain 17 more points with some minor changes. The rest of the points are currently unobtainable due to the fact that construction has been in progress for over a year, and it is too late to implement a strategy to obtain the credit. Even if some minor changes were made the building would only obtain 21 points which is still 5 points shy of the lowest certification. This would

make it very hard for the Xanadu Sports Complex to gain a LEED rating. However, at this current time even if enough points were obtained, the building would not gain certification due to the fact that a prerequisite for the indoor air quality has not been met. The prerequisite in question is Indoor Environment Quality (IEQ) Prerequisite 1 titled Indoor Air Quality (IAQ). This prerequisite states that the building must comply with ASHAE Standard 62.1 Ventilation Rate Procedure. Technical report one focused heavily on the ventilation rate procedure based on ASHRAE 62.1 2007 and calculations showed that the building does not comply with the standard. As of the time of this report, the mechanical system in Building A had not been installed; therefore, leaving the possibility of a redesign, however, would be a costly revision and would delay construction.

Another area of improvement could be found in Energy and Atmosphere (EA) Credit 1. All retail HVAC equipment in Building A is run from electricity. The rooftop units are cooled using direct expansion, and the heating coils are electrical resistance. Often times the use of electricity in LEED can reduce the obtainable points. A more LEED friendly system would involve a fuel such as natural gas for burner fired heating or to a higher degree, a natural gas fired absorption chiller plant to provide cooling and heating to the entire building.

## ASHRAE Standard 90.1 Retail Envelope Compliance

ASHRAE Standard 90.1-2004 provides a means of creating energy efficient commercial buildings by prescribing minimum requirements for all aspects of the building's design. Section Five of Standard 90.1 provides two compliance paths to meet the requirements of an energy efficient building envelope. The two compliance paths are titled the Prescriptive Building Envelope Option and the Building Envelope Trade-Off Option. The more commonly used method is the Prescriptive Building Envelope Option. The only requirement to use this option is that the vertical fenestration must not exceed 50% of the gross wall area of the building. (ASHRAE 90.1) Most buildings are not comprised of greater than 50% glass area, as is the case with the Xanadu Sports Complex Building A. Building A's envelope is practically free of any windows; the only exception is at the main entrances that are comprised of 100% glass. However, these entrances only make up 5% of the total building's envelope wall area, as shown in Table 3.

**Table 3: Percentage of Glass Area**

Gross Wall Area (SF)	Total Glass Area (SF)	% Total Fenestration
100,200	9,022	9%

The Prescriptive Building Envelope Option compliance path used for this calculation essential requires minimum continuous insulation R-values for all exterior walls, roofs, and floors. It also requires minimum U-values and maximum solar heat gain coefficient (SHGC) for all areas of glazing. The required values are based on the climate zone as to where the building is located. In this particular case the Xanadu Sports Complex is being built in Bergen County, New Jersey which falls into Climate Zone 5A. The required values for Climate Zone 5A are found in Table 5.5-5 in the ASHRAE Standard 90.1-2004. (ASHRAE 90.1) Table 4 in this report provides a brief summary of the envelope compliance results for Building A. A more detailed look at the referenced assemblies' thermal properties can be found in Appendix B of this report.

In addition to the summary found in Table 4, a more complete building envelope analysis was completed using the Department of Energy's Building Energy Codes Program, ComCheck. The envelope compliance report from ComCheck indicates that the total building envelope is in compliance with ASHRAE Standard 90.1-2004 and outperforms the standard by 30%. While some walls do not meet compliance, they represent a small percentage of the overall building. The full ComCheck report can be found in Appendix D.

Table 4: Retail Envelope Compliance Summary

Walls				
Mark	Typical Use	Installed Insulation R-Value	Required Insulation R-Value (Zone 5A)	Complies
W1	1st & 2nd Floor Retail	12	13	No
W1D	3rd Floor Retail	20	13	Yes
W5	Ground Floor Retail	0.5	13	No
W6	Ground Floor Stairs	0.5	13	No

Roofs				
Mark	Typical Use	Installed Insulation R-Value	Required Insulation R-Value (Zone 5A)	Complies
R1	Retail	20	15	Yes

Floors				
Mark	Typical Use	Installed Insulation R-Value	Required Insulation R-Value (Zone 5A)	Complies
R2	Retail	20	15	Yes

Glazing						
Mark	Typical Use	Installed U-Value	Installed SHGC	Max U-Value	Max SHGC	Complies
W10	Entrance Glazing Assembly	0.4	0.32	0.57	0.49	Yes

## ASHRAE Standard 90.1 Retail Lighting and Power Compliance

### Retail Interior Lighting

Section Nine of ASHRAE Standard 90.1-2004 provides maximum allowable wattages for interior and exterior lighting of a building. As with the building envelope section of Standard 90.1, two compliance paths are prescribed to verify lighting load compliance. The first method, The Building Area Method, requires the lighting wattages for all the different types of occupancy categories be summed and then divided by the floor area of occupancy category for the entire building. The calculated power densities are then compared to the maximum allowable power density for that particular occupancy category. The list of allowable power densities can be found in Table 9.5.1 in ASHRAE Standard 90.1-2004.

The second method, Space-by-Space Method, is similar to the first method as in a certain amount of lighting wattage is allowed per area and occupancy type; however, instead of looking at the building as a whole, individual rooms are compared. The Space-by-Space Method was the chosen compliance path and all calculations are based on the requirements of this method. Once again, ComCheck was implemented to verify compliance with Section Nine of Standard 90.1. The ComCheck report lists all the spaces and their occupancy category, the lighting fixtures found in each space, and the total wattage in a given space. The full ComCheck report can be found in Appendix D. Table 5 below provides a brief summary of the interior lighting compliance report. The building lighting as a whole is in compliance with ASHRAE Standard 90.1-2004 Section Nine and is 26% better than the requirements set by the standard. On an individual room scale, the mall common areas, such as the large atrium levels and walkways to retail stores, did not meet individual compliance. However, spaces such as back of house rooms and the parking garage were all in compliance with the standard. Since these spaces make-up a large portion of the building, the results are heavily weighed on the lighting in these spaces. It should be noted that all the retail stores were not included in the lighting compliance calculation. All retail stores are not included in the current contract and will be fit out by individual tenants. For this reason the lighting in these spaces has yet to be designed.

Table 5: Retail Interior Lighting Compliance ComCheck Summary

Proposed Lighting (Watts)	Allowable Lighting (Watts)	Rooms In Compliance	Rooms Not In Compliance	Total Percentage Better Than Code
188,047	254,778	38	10	37%



## Retail Exterior Lighting

Section Nine of ASHRAE Standard 90.1-2004 also provides maximum requirements for wattages of exterior lighting. Building A has three spaces with exterior lighting, two exterior walkways that link the parking garage to the retail section, and a large exterior wall that will be illuminated at night. To verify compliance the total wattages for each space were summed and then compared to Table 9.4.5 in ASHRAE Standard 90.1-2004. Once again, ComCheck was utilized to verify compliance. The full results of the report are found in Appendix D. However, Table 6 summarizes the findings from the ComCheck report. Standard 90.1 allows some types of exterior spaces to be tradable, that is if the space does not comply but there are other spaces that are under lit, the extra wattage can be traded to the under lit spaces. This is the case with the exterior walkways. However, illuminating walls cannot be traded; therefore, the requirements are more strict. Table 6 illustrates and Appendix D shows in more detail that the illuminated exterior wall does not comply with the standard and is 27% worse than the requirements of the standard.

Table 6: Exterior Lighting Compliance ComCheck Summary

Space	Proposed Lighting (Watts)	Allowable Lighting (Watts)	Tradable	Percentage Worse Than Code
Exterior Walk <10'	3,876	374	Yes	90%
Exterior Walk <10'	3,876	374	Yes	90%
Illuminated Wall	13,824	10,101	No	27%

## Retail Power

Section Eight of ASHRAE Standard 90.1-2004 establishes two requirements to meet compliance with the section. The first requirement states that feeder conductors shall be sized for a maximum voltage drop of 2% at design load. The second requirement states that branch circuit conductors shall be sized for a maximum voltage drop of 3% at design load. The Xanadu Sports Complex was designed to meet these requirements, therefore, complies with Section Eight of Standard 90.1-2004.

## ASHRAE Standard 90.1 Retail Mechanical Compliance

Section Six of ASHRAE Standard 90.1-2004 provides minimum efficiencies required for all HVAC equipment. As with the other sections of ASHRAE 90.1, there are two compliance paths to verify compliance. The first approach is titled the Simplified Approach Method. This method requires that a building be under two stories high and under 25,000 SF. Due to the size of building A the Simplified Approach Method is not feasible. The second compliance path titled Mandatory Provision has been utilized in order to verify compliance. The Mandatory Provision method requires that the equipment installed in the building have an efficiency rating equal to or higher than the efficiencies listed in Tables 6.8.1A through 6.8.1G in ASHRAE Standard 90.1.

The retail section of Building A is equipped solely with direct expansion (DX) cooling and electrical resistant heating units. For this case the efficiency values for each unit were found in Table 6.8.1A in Standard 90.1. The required unit efficiency is based on the equipment type, the unit's capacity, and heating type. Table 7 lists the required values found from ASHRAE Standard 90.1 and the actual efficiencies of the installed equipment.

Table 7: Retail HVAC Equipment Efficiency Compliance Summary

Mark	Type	Capacities (kBtu/hr)		Actual Efficiency	Efficiency Requirement	Complies
		Cooling	Heating			
RTU-A1	DX Cooling with Electric Heating	458	512	EER= 9.5	EER= 9.5	Yes
RTU-A2	DX Cooling with Electric Heating	458	512	EER= 9.5	EER= 9.5	Yes
RTU-A3	DX Cooling with Electric Heating	930	648	EER= 9.2	EER= 9.2	Yes
RTU-A4	DX Cooling with Electric Heating	930	648	EER= 9.2	EER= 9.2	Yes
AC-A1	DX Cooling	57.8	NA	EER= 12.8	EER= 10.3	Yes

In addition to equipment efficiency, Section Six covers additional requirements to help ensure an overall efficient HVAC system. The additional requirements include the installation of an economizer for certain climate zones, minimum insulation thickness for ducts exposed to unconditioned spaces, and minimum insulation thickness for piping. Table 8 gives a brief summary of whether or not Building A meets these additional requirements. In colder climates larger units must be installed with economizers to take

advantage of free cooling when the conditions are correct. Duct installation is not applicable for Building A due to the fact that all ductwork travels through conditioned spaces. Finally, due to the fact that all the units are DX cooling with electric resistance heating, there is not any steam, hot water, or chilled water lines running from a central plant to the roof top units; therefore, the pipe insulation requirement is not applicable.

Table 8: Additional Retail HVAC System Requirements Compliance Summary

Requirement	When Applicable	Building A	Applicable
Economizer	Climate zone of: 2b, 5a, 6a, 7, 8 Capacity >135,000Btu/hr	Climate zone of: 5a Capacity: Varies by Unit	Yes
Duct Insulation	Duct travels through unconditioned space	All duct travels in conditioned spaces	No
Pipe Insulation	For all HVAC related steam, hot water, and chilled water piping	None	No

Economizer				
Unit	Capacity (Btu/hr)	Economizer Required	Economizer Installed	Compliance
RTU-A1	458,000	Yes	Yes	Yes
RTU-A2	458,000	Yes	Yes	Yes
RTU-A3	930,000	Yes	Yes	Yes
RTU-A4	930,000	Yes	Yes	Yes
AC-A1	57,800	No	No	Yes

Section Six also places limitations on the power of an air handling unit's supply fan based on the amount of supply air provided in cubic feet per minute (cfm). The first part of Table 7 lists the four rooftop units and the small air conditioning unit found at the entrance of the ground floor. All the units in Building A are in compliance with Section Six Unit Fan Power Limitations with the exception of RTU-A2 which serves the first and second floor common areas on the west side of the building. Section Ten of ASHRAE Standard 90.1-2004 also provides minimum requirements for all motors. The required efficiency is based on the motor's RPM and size. The second part of Table 9 lists a summary of the efficiency for all motors with known data in Building A. Relevant data was found through Greenheck's website, the manufacturer of all the exhaust fans. However, data could not be obtained

through the supply fan manufacturer, Trane, due to the fact that the model of air handling unit is no longer in production.

Table 9: Fan Motor Compliance Summary

Air Handling Unit Fan Power Limitations					
Mark	Supply Air (cfm)	Supply Fan Hp	Requirement (Hp/1000 cfm)	Actual (Hp/1000 cfm)	Compliance
RTU-A1	16,100	20	1.2	1.2	Yes
RTU-A2	16,100	25	1.2	1.6	No
RTU-A3	31,000	30	1.1	1.0	Yes
RTU-A4	31,000	30	1.1	1.0	Yes
AC-A1	2,000	1	1.2	0.5	Yes

Fan Motor Efficiency Summary						
Mark	Input Hp	BHP	Efficiency	RPM	Required Efficiency	Compliance
EF-A1	1.50	1.41	94%	1,379	84.0%	Yes
EF-A2	1.50	1.41	94%	1,725	84.0%	Yes
EF-A3	0.50	0.42	84%	1,056	80.0%	Yes
EF-A4	0.33	0.25	76%	965	80.0%	No
EF-A5	0.50	0.42	84%	1,029	80.0%	Yes
EF-A6	0.75	0.63	84%	1,249	82.5%	Yes
EF-A7	0.75	0.63	84%	1,249	82.5%	Yes
EF-A8	0.75	0.63	84%	1,249	82.5%	Yes
EF-A9	1.50	1.41	94%	1,407	84.0%	Yes
EF-A10	1.50	1.41	94%	894	84.0%	Yes

Finally, it should be noted that Section Seven of Standard 90.1 lists minimum required equipment efficiencies for hot water systems. Table 7.8 in Standard 90.1 lists the minimum efficiencies categorized by equipment type and capacity. Table 10 of this report summarizes the verification of hot water equipment efficiency in Building A. After an extensive search, the standby losses for the higher capacity electric heaters could not be found. The latest product technical data sheets published by the manufacturer state that the 65 gallon heater meets all requirements of ASHRAE Standard 90.1-1999; however, this is all that is listed for efficiency.

Table 10: Hot Water Equipment Compliance Summary

Mark	Type	Volume (gal)	Capacity (kW)	Requirement	Actual	Compliance
DWH-A1	Electric	65	15	SL = 302 Btu/hr	Not Listed	Incomplete
DWH-A2	Electric	65	15	SL = 302 Btu/hr	Not Listed	Incomplete
DWH-A4	Electric	20	6	EF = 0.90	EF = 0.93	Yes

## Indoor Ski Resort Mechanical System

While ASHRAE Standard 90.1-2004 can be used to rate the energy efficiency of the retail section of Building A, the indoor ski resort presents such a unique case that energy standards cannot be used to rate the system. While indoor ski resorts are a relatively new concept, they are quickly growing in popularity. With each new completion of an indoor ski resort new strides are made to decrease the large amount of energy it takes to create and maintain proper skiing conditions year round.

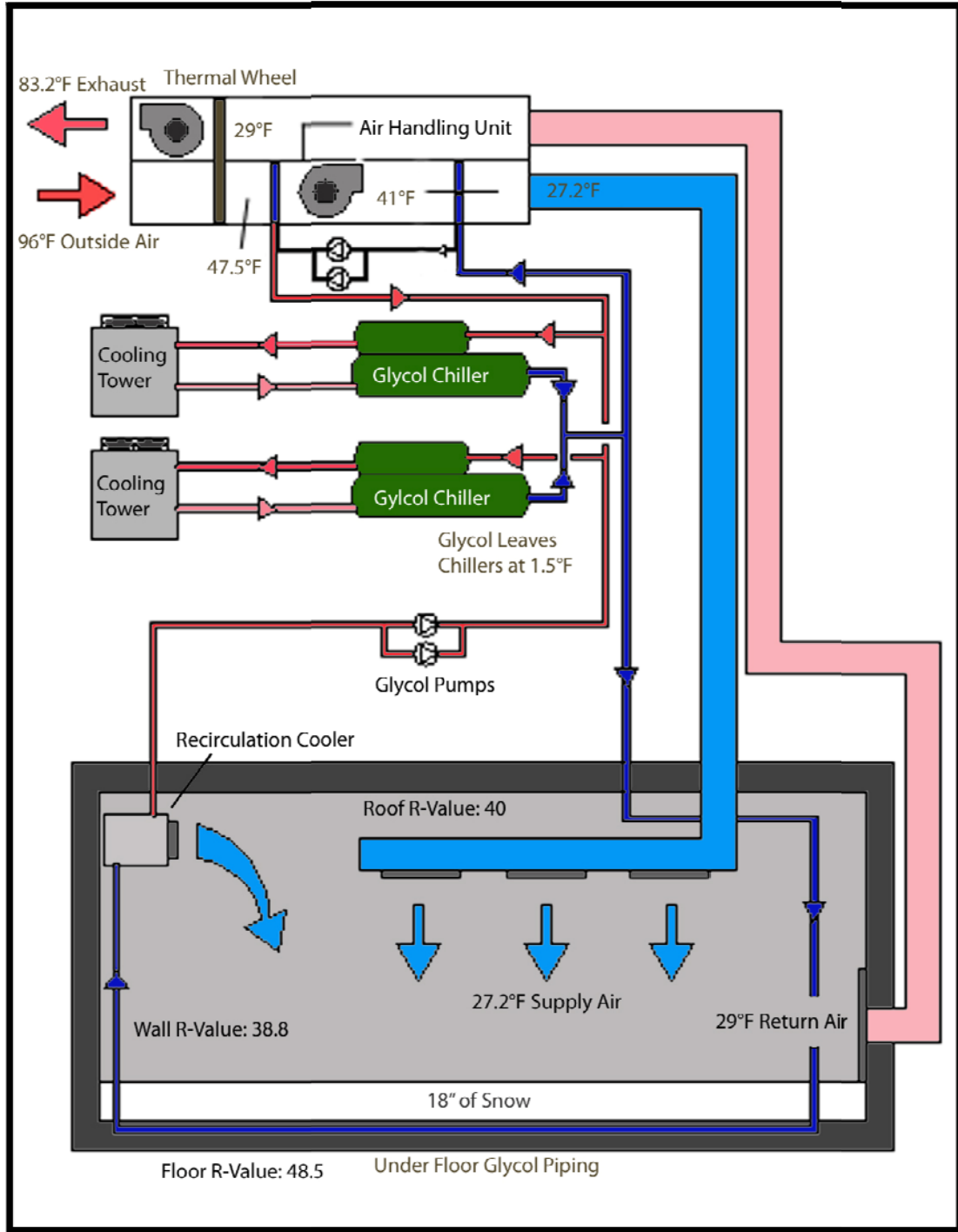
The challenge of an indoor ski resort is to ensure that snow can be maintained year round and to maintain a highly controlled environment. During normal day operation, temperatures must be maintained between 30°F and 32°F. However, at night fresh snow is made on a daily schedule and temperatures must be cooled to approximately 24°F to ensure proper snow making. The Xanadu Snowdome plans to achieve ideal conditions by using cooled supply air, under floor glycol piping, recirculation coolers and snow guns to provide the best skiing conditions every day of the year.

The Snowdome ventilation system is comprised of a single 30,000 cfm air handling unit with 15,000 cfm of the supply air being outside air. The unit uses a main common intake system with one primary and two secondary cooling coils. The air is pre-cooled by means of a thermal wheel and then cooled down to above freezing by the primary cooling coil. The air is then cooled below freezing by the secondary coils which are fed by a cold glycol system. A hot glycol system line is also fed to the secondary coils and will only be used when the coils need to be defrosted. The system is fully variable in volume, achieved by using inverters on the fans, to suit the current occupancy.

Two 222 ton electric screw chillers operating at 1.5°F leaving glycol temperature provide the cold glycol to the air handling unit's coils, under floor piping matrix, recirculation coolers, and snow guns. Both chillers operate in conjunction with an evaporative condenser located on the roof of the Snowdome mechanical mezzanine which houses all the mechanical equipment.

Mounted along the ceiling of the Snowdome are recirculation coolers and snow guns. Both devices will be run using the cold glycol system during normal operation. However, when the devices need to be defrosted, the cold glycol system will be shut off, and the hot glycol system will be turned on for defrosting. The snow guns also require compressed air for the use of snow making; therefore, a compressed air line will be provided to each snow gun. Image 1 shows a basic schematic of the main mechanical system equipment in the indoor ski resort.

Image 1: Major Snowdome Mechanical Equipment Schematic



## Initial Mechanical System Cost and Lost Rentable Space

### Mechanical Equipment Initial Cost

The current scope of work for Building A includes two contracts. One contract is for the retail section of the building while a separate contract is for the indoor ski resort. The retail section mechanical work is strictly for the common areas which make up walkways from stores, restrooms, exit corridors, and utility rooms. All tenant spaces will be completed at the cost of the leaser at a later date. The major retail mechanical equipment is comprised of four rooftop units, a smaller air conditioning unit, and various wall mounted electric heaters for utility rooms and exit stairways. The Snowdome indoor ski resort mechanical system equipment consists of a single air handling unit, two 222 ton electric screw chillers, 2 cooling towers, 13 roof mounted recirculation coolers, multiple snow making guns, and an under floor glycol piping matrix. Table 11 provides a breakdown of all mechanical costs included in the current contract.

Table 11: Building A Mechanical Costs

Building Section	Work	Cost	Area (SF)	Cost/SF
Parking Garage	Plumbing	\$640,230	795,864	\$0.80
	HVAC*	\$26,875		\$0.03
Retail Section Common Spaces	Plumbing	\$1,527,000	60,829	\$25.10
	HVAC*	\$1,196,469		\$19.67
	RTU's	\$426,155		\$7.01
	Smoke Exhaust	\$72,766		\$1.20
	Ductwork	\$1,013,193		\$16.66
Snowdome	All HVAC	\$9,493,073	160,000	\$59.33
		<b>\$14,395,761</b>	<b>1,016,693</b>	<b>\$14.16</b>

\* Note: HVAC costs includes exhaust fans, controls, condensate piping, electric space heaters, installation, and startup costs



## Lost Rentable Space Due to the Mechanical System

Table 12 details the usable floor area for each category of space and how much of it is comprised by mechanical system components. The retail section of Building A has three main mechanical risers that will be left empty for tenant use when they complete their individual mechanical system. The retail section saves space by using rooftop units instead of designating mechanical rooms in potential leasable areas. There are also designated areas for tenant RTU's near the tenant mechanical risers. The largest area of mechanical space in leasable area comes from the ski resort. A mechanical room that houses all the ski resort's mechanical equipment is located adjacent to the Snowdome.

Table 12: Lost Space Due to Mechanical Equipment

Space Type	Area (SF)	Area of Mechanical (SF)	Percentage of Mechanical
Mall Common Area	46,392	0	0.0%
Retail Space	366,938	1,093	0.3%
Exit Corridors	7,656	0	0.0%
Electrical Rooms	6,781	0	0.0%
Ski Resort	160,000	9,387	5.9%
	<b>587,767</b>	<b>10,480</b>	<b>1.8%</b>

## Design Load Calculation

To estimate design loads, annual energy consumption, and operating costs for Xanadu Sports Complex Building A, Trane Air Conditioning Economics (TRACE) 700 software was used as the building energy simulation program. To accurately calculate design loads, design data was used when the information was available. The room areas, wall areas, wall assemblies, ventilation rates, equipment loads, and lighting loads were all entered into the building model using design documents. All other data was not available from design documents, and various assumptions had to be made. The occupancy number for a given room was obtained through the default occupancy densities prescribed by ASHRAE. While it is recognized that often times using these default occupancy densities are on the conservative side, it will ensure the peak loads are in fact a worst case scenario. Also, based on the planned hour of operations a fairly accurate occupancy schedule can be derived. Appendix D in this report includes the graphs showing the occupancy schedules used in the design load calculations. Another assumption comes from the fact that all the retail spaces have not been designed in the current contract. To simulate these spaces, recommended lighting densities and occupancy densities were used to estimate internal loads. Once the design load was finished for the retail spaces, a package rooftop unit was sized for each space and included in the energy analysis. Table 13 lists the roof top unit capacities calculated from the load calculations.

The ASHRAE Handbook of Fundamentals lists the design outdoor conditions that are used for load calculations. The ASHRAE Handbook lists the closest city, Newark, New Jersey, as having a design summer temperature of 91°F DBT and a 73°F WBT. A winter design temperature of 14°F DBT and WBT will not be used due to the fact that Trace assumes dry winter conditions for certain climate zones. Other weather factors assigned by Trace are clearness factors of 0.99 and a ground reflectance value of 0.2.

Appendix D provides detailed information on design load inputs such as occupancy schedules, occupancy densities, and the occupancy heat generation. Also, Appendix B details the R-Values used for the calculation of each wall assembly and breaks down the thermal properties of each component.

Table 13: Building A Design Loads

Unit	Area (SF)	Cooling (MBh)	Heating (MBh)	SF/Ton
<b>Designed In Current Contract</b>				
Entrance Air Conditioner	2,101	57.9	NA	435
RTU-A1	16,623	458	512	436
RTU-A2	29,832	458	512	782
RTU-A3	7,596	930	649	98
RTU-A4	5,381	930	649	70
Snowdome	160,000	5328	NA	360
<b>Calculated Leaser Units</b>				
Cabela's RTU	200,794	5,613	4,430	429
117c- Specialty Store RTU	3,920	108	85	434
Sky Venture RTU	13,260	173	145	920
Golfdom RTU	20,498	574	457	428
120b- Specialty Store RTU	12,996	361	286	432
Princeton Ski RTU	11,297	314	248	432
Ski Lodge RTU	26,812	6,677	4,606	482
Burton RTU	7,724	213	167	434
Cubra Libre RTU	19,906	2,791	2,190	434
Ipapeze RTU	7,016	196	155	430
Chickie & Pete's RTU	26,921	1,203	1,297	269
Night Club 1 RTU	8,832	586	1,070	181
Night Club 2 RTU	6,962	462	844	181
<b>Miscellaneous</b>				
Unit Heaters	NA	NA	31	NA
Stair Heaters	NA	NA	12	NA
	<b>588,471</b>	<b>27,053</b>	<b>18,345</b>	<b>414</b>
	<b>Totals</b>			<b>Average</b>

## Annual Energy Consumption and Operating Costs

Based on the results from the design load calculations from TRACE 700, the buildings energy use and cost of operation can be determined. Each separate system was created in the energy model, and all the major equipment efficiencies found during the ASHRAE 90.1 compliance check and relevant data were used from design documents to accurately model energy use. For items such as supply air fans, the design document listed static pressure was inputted and TRACE estimates the efficiency based on the type of fan. The annual energy consumption calculated using the TRACE energy model was broken into six categories. The results can be found in Table 14.

Table 14: Annual Energy Consumption

Component	Annual Energy Consumption Summary (kWh)
Lighting	7,418,382
Receptacles	2,774,240
Cooling	2,412,629
Heating	4,143,470
Fans	750,000
Snowdome	4,391,635
	21,890,356

To accurately model the annually operating costs, utility rates needed to be derived. Due to the fact that the building is under construction, utility bills for past months are not present to formulate a utility rate. However, the utility to the site is known to be Public Service Enterprise Group (PSEG) Power. From their website, rates were obtained and are summarized in Table 15.

Table 15: PSEG Electricity Rates

Charge Type	Months	Rate
Electric Demand On Peak	October-May	\$3.894 /kW
	June-September	\$7.227 /kW
Electric Demand Off Peak	October-May	\$2.923 /kW
	June-September	\$5.420 /kW
Electric Consumption On Peak	October-May	\$0.088 /kWh
	June-September	\$0.097 /kWh
Electric Consumption Off Peak	October-May	\$0.070 /kWh
	June-September	\$0.071 /kWh

Based on these electricity rates, the cost to run all the equipment in the building can be estimated. Image 2 below shows a summary of the cost breakdown broken into six categories. The results show that the largest utility cost comes from the lighting which accounts for 34% of the entire building's annual operation costs. The Snowdome also accounts for a large amount of energy which is understandable considering the massive amount of energy it takes to maintain a large space at freezing temperature year round. The building's HVAC equipment in total accounts for 69% of the total cost it will take to operate the building on a yearly basis.

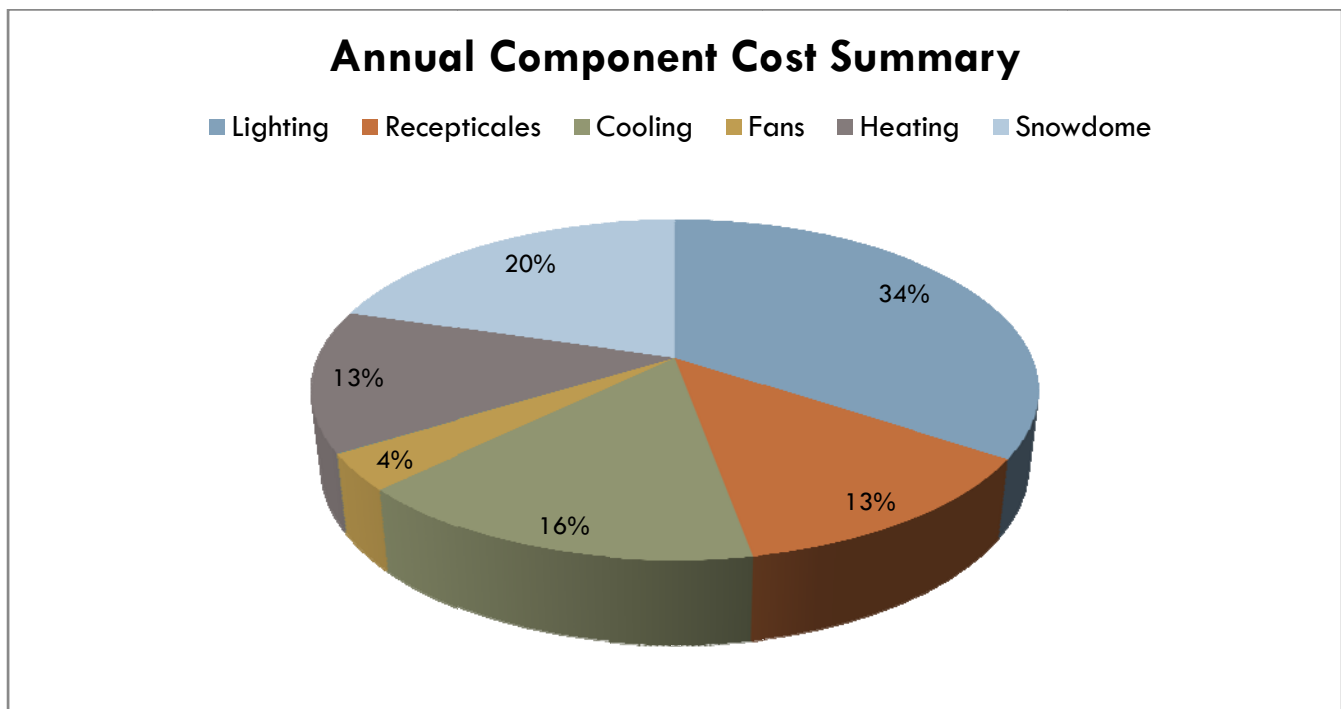


Figure 2: Annual Component Cost Summary

A breakdown of the operation cost on a monthly basis reveals lower costs in the heating season and higher costs in the cooling season. This is a result from the increase of utility rates during the summer months. The actual values of the monthly breakdown are found in Table 16. Also a graphical representation of this data is found in Figure 3.

Table 16: Monthly Utility Costs

Month	On Peak	Off Peak	Total
January	\$14,936	\$15,469	\$30,405
February	\$13,595	\$14,367	\$27,962
March	\$10,386	\$12,691	\$23,077
April	\$11,236	\$8,370	\$19,606
May	\$27,539	\$8,014	\$35,553
June	\$27,539	\$19,582	\$47,121
July	\$29,760	\$21,064	\$50,824
August	\$28,960	\$20,752	\$49,712
September	\$23,923	\$17,280	\$41,203
October	\$10,862	\$7,908	\$18,770
November	\$10,484	\$8,247	\$18,731
December	\$12,412	\$14,421	\$26,833
<b>Total</b>	<b>\$221,632</b>	<b>\$168,165</b>	<b>\$389,797</b>

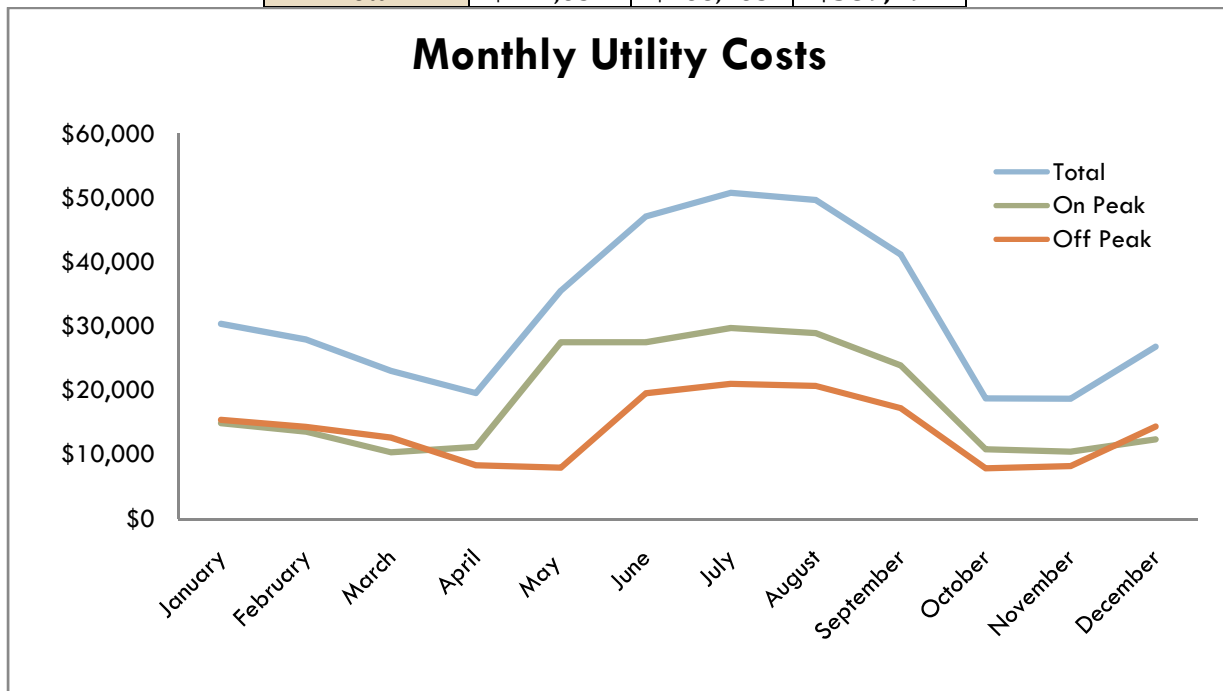


Figure 3: Monthly Utility Costs

Since the HVAC equipment makes up 69% of all annual utility costs, a dollar value of \$268,960 can be associated with the amount of money it takes to heat and cool the building year round. The above data also yields an annual value of \$0.24 per square foot and an annual heating value of \$0.10 per square foot. Aside from an analysis of the economic impact, an environmental impact analysis was also performed. Based on the total amount of electricity the building will consume in a given year, an estimate of the emissions created to power the building can be found. Table 17 lists the amount of emissions that will be produced in a year in order to operate Building A.

Table 17 Annual Emission Summary

Emission	Amount Produced (lb)
CO <sub>2</sub>	30,199,236
SO <sub>x</sub>	97,130
NO <sub>x</sub>	164,967
Particulates	14,062

Ideally, energy analysis results from the design engineer would be present to compare my findings with theirs. However, these results are not available. Therefore, for future reports involving any potential redesigns or changes the results from this report will be used as the baseline of comparison.

## References

ASHRAE. 2005, 2005 ASHRAE Handbook – Fundamentals. American Society of Heating Refrigeration and Air Conditioning Engineers, Inc., Atlanta, GA. 2001.

ASHRAE. 2004, ANSI/ASHRAE, Standard 90.1 – 2004, Energy Standard for Buildings Except Low-Rise Residential Buildings. American Society of Heating Refrigeration and Air Conditioning Engineers, Inc., Atlanta, GA. 2004.

LEED. 2005, LEED 2005 Green Building Rating System For New Construction & Major Renovations. Leadership in Energy & Environmental Design, Washington, DC. 2003.

Turner Construction Company. 2007, Mechanical Construction Documents. Turner Construction Company, East Rutherford, NJ. 2007.

Turner Construction Company. 2007, Architectural Construction Documents. Turner Construction Company, East Rutherford, NJ. 2007.

Turner Construction Company. 2007, Electrical Construction Documents. Turner Construction Company, East Rutherford, NJ. 2007.



# Appendix A: LEED v2.2 Checklist



LEED-NC

## LEED-NC Version 2.2 Registered Project Checklist

Xanadu Sports Complex Building A  
East Rutherford, New Jersey

Yes ? No

**2 1 11 Sustainable Sites 14 Points**

Y									
					Prereq 1	Construction Activity Pollution Prevention			Required
X					Credit 1	Site Selection			1
				X	Credit 2	Development Density & Community Connectivity			1
				X	Credit 3	Brownfield Redevelopment			1
X					Credit 4.1	Alternative Transportation, Public Transportation Access			1
				X	Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms			1
				X	Credit 4.3	Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles			1
				X	Credit 4.4	Alternative Transportation, Parking Capacity			1
				X	Credit 5.1	Site Development, Protect or Restore Habitat			1
				X	Credit 5.2	Site Development, Maximize Open Space			1
				X	Credit 6.1	Stormwater Design, Quantity Control			1
	X				Credit 6.2	Stormwater Design, Quality Control			1
				X	Credit 7.1	Heat Island Effect, Non-Roof			1
				X	Credit 7.2	Heat Island Effect, Roof			1
				X	Credit 8	Light Pollution Reduction			1

Yes ? No

**1 1 4 Water Efficiency 5 Points**

				X	Credit 1.1	Water Efficient Landscaping, Reduce by 50%			1
				X	Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation			1
				X	Credit 2	Innovative Wastewater Technologies			1
	X				Credit 3.1	Water Use Reduction, 20% Reduction			1
				X	Credit 3.2	Water Use Reduction, 30% Reduction			1

Yes ? No

**1 2 3 Energy & Atmosphere 17 Points**

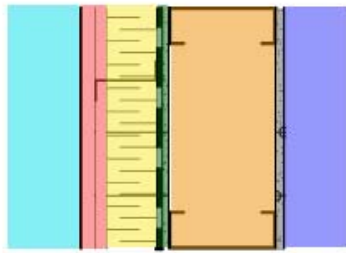
Y									
					Prereq 1	Fundamental Commissioning of the Building Energy Systems			Required
Y					Prereq 2	Minimum Energy Performance			Required
Y					Prereq 3	Fundamental Refrigerant Management			Required
X					Credit 1	Optimize Energy Performance			1 to 10
				X	Credit 2	On-Site Renewable Energy			1 to 3
	X				Credit 3	Enhanced Commissioning			1
				X	Credit 4	Enhanced Refrigerant Management			1
	X				Credit 5	Measurement & Verification			1
				X	Credit 6	Green Power			1

continued...

Yes ? No			
3	10	<b>Materials &amp; Resources</b>	<b>13 Points</b>
Y		Prereq 1 <b>Storage &amp; Collection of Recyclables</b>	Required
	X	Credit 1.1 <b>Building Reuse, Maintain 75% of Existing Walls, Floors &amp; Roof</b>	1
	X	Credit 1.2 <b>Building Reuse, Maintain 100% of Existing Walls, Floors &amp; Roof</b>	1
	X	Credit 1.3 <b>Building Reuse, Maintain 50% of Interior Non-Structural Elements</b>	1
	X	Credit 2.1 <b>Construction Waste Management, Divert 50% from Disposal</b>	1
	X	Credit 2.2 <b>Construction Waste Management, Divert 75% from Disposal</b>	1
	X	Credit 3.1 <b>Materials Reuse, 5%</b>	1
	X	Credit 3.2 <b>Materials Reuse, 10%</b>	1
	X	Credit 4.1 <b>Recycled Content, 10% (post-consumer + ½ pre-consumer)</b>	1
	X	Credit 4.2 <b>Recycled Content, 20% (post-consumer + ½ pre-consumer)</b>	1
	X	Credit 5.1 <b>Regional Materials, 10% Extracted, Processed &amp; Manufactured Region</b>	1
	X	Credit 5.2 <b>Regional Materials, 20% Extracted, Processed &amp; Manufactured Region</b>	1
	X	Credit 6 <b>Rapidly Renewable Materials</b>	1
	X	Credit 7 <b>Certified Wood</b>	1
Yes ? No			
6	9	<b>Indoor Environmental Quality</b>	<b>15 Points</b>
N		Prereq 1 <b>Minimum IAQ Performance</b>	Required
Y		Prereq 2 <b>Environmental Tobacco Smoke (ETS) Control</b>	Required
	X	Credit 1 <b>Outdoor Air Delivery Monitoring</b>	1
	X	Credit 2 <b>Increased Ventilation</b>	1
	X	Credit 3.1 <b>Construction IAQ Management Plan, During Construction</b>	1
	X	Credit 3.2 <b>Construction IAQ Management Plan, Before Occupancy</b>	1
	X	Credit 4.1 <b>Low-Emitting Materials, Adhesives &amp; Sealants</b>	1
	X	Credit 4.2 <b>Low-Emitting Materials, Paints &amp; Coatings</b>	1
	X	Credit 4.3 <b>Low-Emitting Materials, Carpet Systems</b>	1
	X	Credit 4.4 <b>Low-Emitting Materials, Composite Wood &amp; Agrifiber Products</b>	1
	X	Credit 5 <b>Indoor Chemical &amp; Pollutant Source Control</b>	1
	X	Credit 6.1 <b>Controllability of Systems, Lighting</b>	1
	X	Credit 6.2 <b>Controllability of Systems, Thermal Comfort</b>	1
	X	Credit 7.1 <b>Thermal Comfort, Design</b>	1
	X	Credit 7.2 <b>Thermal Comfort, Verification</b>	1
	X	Credit 8.1 <b>Daylight &amp; Views, Daylight 75% of Spaces</b>	1
	X	Credit 8.2 <b>Daylight &amp; Views, Views for 90% of Spaces</b>	1
Yes ? No			
1	4	<b>Innovation &amp; Design Process</b>	<b>5 Points</b>
	X	Credit 1.1 <b>Innovation in Design: Provide Specific Title</b>	1
	X	Credit 1.2 <b>Innovation in Design: Provide Specific Title</b>	1
	X	Credit 1.3 <b>Innovation in Design: Provide Specific Title</b>	1
	X	Credit 1.4 <b>Innovation in Design: Provide Specific Title</b>	1
	X	Credit 2 <b>LEED® Accredited Professional</b>	1
Yes ? No			
4	17	<b>Project Totals (pre-certification estimates)</b>	<b>69 Points</b>
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points			

## Appendix B: Assembly Thermal Properties

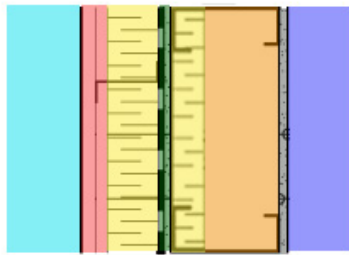
### W1 Retail 1st and 2nd Floor Exterior Wall



- Outside Air Film: R-0.17 (ASHRAE)
- Aluminum Panel: R-2.75
- 3" Semi-Rigid Insulation: R-12
- Vapour Barrier / 0.5" Sheathing: R-0.5
- 8" Metal Studs / Air Gap: R-2.16 (ASHRAE)
- 5/8" Gypsum: R-0.56 (ASHRAE)
- Indoor Air Film: R-0.68 (ASHRAE)

W1 Assembly R-Value: **18.82**

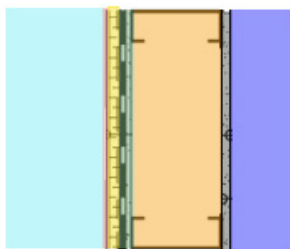
### W1D Retail 3rd Floor Exterior Wall



- Outside Air Film: R-0.17 (ASHRAE)
- Aluminum Panel: R-2.75
- 4" Semi-Rigid Insulation: R-20
- Vapour Barrier / 0.5" Sheathing: R-0.5
- 8" Metal Studs / Air Gap: R-2.16 (ASHRAE)
- 5/8" Gypsum: R-0.56 (ASHRAE)
- Indoor Air Film: R-0.68 (ASHRAE)

W1D Assembly R-Value: **28.26**

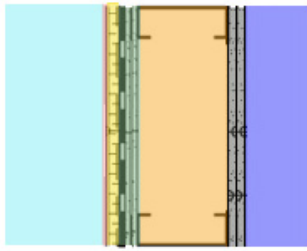
### W5 Ground Floor Typical Exterior Wall



- Outside Air Film: R-0.17 (ASHRAE)
- Acrylic Stucco: R-1.08 (ASHRAE)
- 1" Rigid Insulation / Vapour Barrier: R-0.5
- 5/8" Sheathing: R-0.75
- 8" Metal Studs / Air Gap: R-2.16 (ASHRAE)
- 5/8" Gypsum: R-0.56 (ASHRAE)
- Indoor Air Film: R-0.68 (ASHRAE)

W5 Assembly R-Value: **5.9**

### W6 Ground Floor Stair Exterior Wall



- Outside Air Film: R-0.17 (ASHRAE)
- Acrylic Stucco: R-1.08 (ASHRAE)
- 1" Rigid Insulation / Vapour Barrier: R-0.5
- 2 Layers 5/8" Sheathing: R-1.5
- 8" Metal Studs / Air Gap: R-2.16 (ASHRAE)
- 2 Layers 5/8" Gypsum: R-1.12 (ASHRAE)
- Indoor Air Film: R-0.68 (ASHRAE)

W6 Assembly R-Value: **7.21**

# Appendix C: ComCheck Compliance Report



COMcheck Software Version 3.5.0

## Envelope Compliance Certificate

### 90.1 (2004) Standard

Report Date: 10/22/07

Data filename: C:\Program Files\Check\COMcheck\Xanadu.cck

#### Section 1: Project Information

Project Title: Xanadu Sports Complex Building A

Construction Site:

Route 120  
East Rutherford, NJ 07073

Owner/Agent:

Colony Capital, LLC  
660 Madison Avenue  
New York, NY 10065, NY 10065  
212-230-3300

Designer/Contractor:

#### Section 2: General Information

Building Location (for weather data): East Rutherford, New Jersey  
Heating Degree Days (base 65 degrees F): 5362  
Cooling Degree Days (base 50 degrees F): 3224  
Building Type for Envelope Requirements: Non-Residential  
Project Type: New Construction  
Vertical Glazing / Wall Area Pct: 9%

Activity Type(s)	Floor Area
Retail:Mall Concourse	2101
Common Space Types:Electrical/Mechanical	470
Common Space Types:Electrical/Mechanical	178
Common Space Types:Electrical/Mechanical	244
Common Space Types:Electrical/Mechanical	692
Common Space Types:Electrical/Mechanical	327
Common Space Types:Electrical/Mechanical	294
Common Space Types:Electrical/Mechanical	383
Retail:Mall Concourse	287
Retail:Mall Concourse	2017
Retail:Mall Concourse	3142
Retail:Mall Concourse	6678
Retail:Mall Concourse	6678
Common Space Types:Electrical/Mechanical	453
Common Space Types:Corridor/Transition	663
Common Space Types:Electrical/Mechanical	284
Common Space Types:Electrical/Mechanical	487
Common Space Types:Electrical/Mechanical	292
Common Space Types:Corridor/Transition	1389
Common Space Types:Inactive Storage	75
Common Space Types:Restrooms	488
Common Space Types:Restrooms	483
Common Space Types:Inactive Storage	438
Common Space Types:Corridor/Transition	889
Retail:Mall Concourse	298
Retail:Mall Concourse	1474
Retail:Mall Concourse	5136
Retail:Mall Concourse	5136
Common Space Types:Electrical/Mechanical	466

Project Title: Xanadu Sports Complex Building A  
Data filename: C:\Program Files\Check\COMcheck\Xanadu.cck

Report date: 10/22/07  
Page 1 of 11

Common Space Types:Corridor/Transition	1125
Common Space Types:Electrical/Mechanical	282
Common Space Types:Electrical/Mechanical	422
Common Space Types:Electrical/Mechanical	236
Common Space Types:Corridor/Transition	1187
Common Space Types:Inactive Storage	75
Common Space Types:Restrooms	475
Common Space Types:Restrooms	498
Common Space Types:Corridor/Transition	2518
Retail:Mall Concourse	3368
Retail:Mall Concourse	3535
Retail:Mall Concourse	3535
Common Space Types:Electrical/Mechanical	338
Common Space Types:Corridor/Transition	1210
Common Space Types:Electrical/Mechanical	284
Common Space Types:Electrical/Mechanical	412
Common Space Types:Electrical/Mechanical	237
Retail:Mall Concourse	3007
Parking Garage:Garage Area	795864

**Section 3: Requirements Checklist**

Envelope PASSES: Design 30% better than code.

**Climate-Specific Requirements:**

Component Name/Description	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor
Retail Roof R1: Insulation Entirely Above Deck	122710	---	20.0	0.048	0.063
Retail Roof R1C: Insulation Entirely Above Deck	36414	---	30.0	0.032	0.063
Snowdome Roof: Insulation Entirely Above Deck	159989	---	20.0	0.048	0.063
A-001 W5: Steel-Framed, 16" o.c.	1756	4.6	0.5	0.169	0.084
C3: Insulated Metal, Swinging	56	---	---	0.182	0.700
C4: Insulated Metal, Swinging	21	---	---	0.182	0.700
Snowdome Stair W6: Steel-Framed, 16" o.c.	6406	6.0	0.5	0.150	0.084
B1: Insulated Metal, Swinging	28	---	---	0.182	0.700
Exit Stair A1 W6: Steel-Framed, 16" o.c.	1665	6.0	0.5	0.150	0.084
B1: Insulated Metal, Swinging	28	---	---	0.182	0.700
Exit Stair A2 W6: Steel-Framed, 16" o.c.	1665	6.0	0.5	0.150	0.084
B1: Insulated Metal, Swinging	28	---	---	0.182	0.700
Exit Stair A3 W6: Steel-Framed, 16" o.c.	1665	6.0	0.5	0.150	0.084
B1: Insulated Metal, Swinging	28	---	---	0.182	0.700
Exit Stair A4 W6: Steel-Framed, 16" o.c.	537	6.0	0.5	0.150	0.084
B1: Insulated Metal, Swinging	28	---	---	0.182	0.700
A-014 W5: Steel-Framed, 16" o.c.	3478	4.6	0.5	0.169	0.084
A-005 W10: Steel-Framed, 16" o.c.	2609	12.0	0.0	0.128	0.084
Window 1: Metal Frame with Thermal Break:Double Pane with Low-E, Clear, Fixed, SHGC 0.40	2087	---	---	0.083	0.570
Glass Slider: Glass, Clear, SHGC 0.40	80	---	---	0.083	0.570
Glass Slider: Glass, Clear, SHGC 0.40	80	---	---	0.083	0.570
Exit Stair A6 W6: Steel-Framed, 16" o.c.	1665	6.0	0.5	0.150	0.084
B1: Insulated Metal, Swinging	28	---	---	0.182	0.700
Exit Stair A7 W6: Steel-Framed, 16" o.c.	1665	6.0	0.5	0.150	0.084
B1: Insulated Metal, Swinging	28	---	---	0.182	0.700
1st & 2nd South Wall W1: Steel-Framed, 16" o.c.	15062	8.0	12.0	0.053	0.084
1st & 2nd West Wall W1: Steel-Framed, 16" o.c.	17170	8.0	12.0	0.053	0.084
1st & 2nd North Wall W1: Steel-Framed, 16" o.c.	11254	8.0	12.0	0.053	0.084
C4: Insulated Metal, Swinging	21	---	---	0.182	0.700
C4: Insulated Metal, Swinging	21	---	---	0.182	0.700
C4: Insulated Metal, Swinging	21	---	---	0.182	0.700
A-104 W10: Steel-Framed, 16" o.c.	2505	12.0	0.0	0.128	0.084
Window 1 copy 1: Metal Frame with Thermal Break:Double Pane with Low-E, Clear, Fixed, SHGC 0.40	2087	---	---	0.083	0.570

Glass Slider: Glass, Clear, SHGC 0.40	80	---	---	0.083	0.570
A-215 W10: Steel-Framed, 16" o.c.	2505	12.0	0.0	0.128	0.084
Window 1 copy 2: Metal Frame with Thermal Break:Double Pane with Low-E, Clear, Fixed, SHGC 0.40	2087	---	---	0.083	0.570
Glass Slider: Glass, Clear, SHGC 0.40	80	---	---	0.083	0.570
3rd South Wall W1D: Steel-Framed, 16" o.c.	8474	14.0	20.0	0.035	0.084
3rd West Wall W1D: Steel-Framed, 16" o.c.	12407	14.0	20.0	0.035	0.084
A-315 W10: Steel-Framed, 16" o.c.	2505	12.0	0.0	0.128	0.084
Window 1 copy 3: Metal Frame with Thermal Break:Double Pane with Low-E, Clear, Fixed, SHGC 0.40	2087	---	---	0.083	0.570
Glass Slider: Glass, Clear, SHGC 0.40	80	---	---	0.083	0.570
3rd North Wall W1D: Steel-Framed, 16" o.c.	950	14.0	20.0	0.035	0.084
Retail Floor: Concrete Floor (over unconditioned space)	159124	---	30.0	0.030	0.087

(a) Budget U-factors are used for software baseline calculations ONLY, and are not code requirements.

**Insulation:**

- 1. Open-blown or poured loose-fill insulation has not been used in attic roof spaces with ceiling slope greater than 3 in 12.
- 2. Wherever vents occur, they are baffled to deflect incoming air above the insulation.
- 3. Recessed lights, equipment and ducts are not affecting insulation thickness.
- 4. No roof insulation is installed on a suspended ceiling with removable ceiling panels.
- 5. All exterior insulation is covered with protective material.
- 6. Cargo and loading dock doors are equipped with weather seals.

**Fenestration and Doors:**

- 7. Windows and skylights are labeled and certified by the manufacturer for U-factor and SHGC.
- 8. Fixed windows and skylights unlabeled by the manufacturer have been site labeled using the default U-factor and SHGC.
- 9. Other unlabeled vertical fenestration, operable and fixed, that are unlabeled by the manufacturer have been site labeled using the default U-factor and SHGC. No credit has been given for metal frames with thermal breaks, low-emissivity coatings, gas fillings, or insulating spacers.

**Air Leakage and Component Certification:**

- 10. All joints and penetrations are caulked, gasketed, weather-stripped, or otherwise sealed.
- 11. Windows, doors, and skylights certified as meeting leakage requirements.
- 12. Component R-values & U-factors labeled as certified.
- 13. Building entrance doors have a vestibule and equipped with closing devices.
  - Exceptions:*
  - Buildings less than four stories above grade. Building entrances with revolving doors.
  - Doors that open directly from a space less than 3000 sq. ft. in area.
- 14. Insulation installed according to manufacturer's instructions, in substantial contact with the surface being insulated, and in a manner that achieves the rated R-value without compressing the insulation.

**Section 4: Compliance Statement**

*Compliance Statement:* The proposed envelope design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed envelope system has been designed to meet the 90.1 (2004) Standard requirements in COMcheck Version 3.5.0 and to comply with the mandatory requirements in the Requirements Checklist.

Jason Sambolt

Name - Title

Signature

Date



COMcheck Software Version 3.5.0

# Lighting and Power Compliance Certificate

## 90.1 (2004) Standard

Report Date: 10/22/07

Data filename: C:\Program Files\Check\COMcheck\Xanadu.cck

### Section 1: Project Information

Project Title: Xanadu Sports Complex Building A

Construction Site:  
Route 120  
East Rutherford, NJ 07073

Owner/Agent:  
Colony Capital, LLC  
660 Madison Avenue  
New York, NY 10065, NY 10065  
212-230-3300

Designer/Contractor:

### Section 2: General Information

Building Use Description by: Activity Type  
Project Type: New Construction

Activity Type(s)	Floor Area
Retail:Mall Concourse	2101
Common Space Types:Electrical/Mechanical	470
Common Space Types:Electrical/Mechanical	178
Common Space Types:Electrical/Mechanical	244
Common Space Types:Electrical/Mechanical	692
Common Space Types:Electrical/Mechanical	327
Common Space Types:Electrical/Mechanical	294
Common Space Types:Electrical/Mechanical	383
Retail:Mall Concourse	287
Retail:Mall Concourse	2017
Retail:Mall Concourse	3142
Retail:Mall Concourse	6678
Retail:Mall Concourse	6678
Common Space Types:Electrical/Mechanical	453
Common Space Types:Corridor/Transition	863
Common Space Types:Electrical/Mechanical	284
Common Space Types:Electrical/Mechanical	487
Common Space Types:Electrical/Mechanical	292
Common Space Types:Corridor/Transition	1389
Common Space Types:Inactive Storage	75
Common Space Types:Restrooms	488
Common Space Types:Restrooms	483
Common Space Types:Inactive Storage	438
Common Space Types:Corridor/Transition	889
Retail:Mall Concourse	298
Retail:Mall Concourse	1474
Retail:Mall Concourse	5136
Retail:Mall Concourse	5136
Common Space Types:Electrical/Mechanical	466
Common Space Types:Corridor/Transition	1125
Common Space Types:Electrical/Mechanical	282
Common Space Types:Electrical/Mechanical	422
Common Space Types:Electrical/Mechanical	236

Project Title: Xanadu Sports Complex Building A  
Data filename: C:\Program Files\Check\COMcheck\Xanadu.cck

Report date: 10/22/07  
Page 4 of 11



Common Space Types:Corridor/Transition	1187
Common Space Types:Inactive Storage	75
Common Space Types:Restrooms	475
Common Space Types:Restrooms	498
Common Space Types:Corridor/Transition	2518
Retail:Mall Concourse	3398
Retail:Mall Concourse	3535
Retail:Mall Concourse	3535
Common Space Types:Electrical/Mechanical	338
Common Space Types:Corridor/Transition	1210
Common Space Types:Electrical/Mechanical	284
Common Space Types:Electrical/Mechanical	412
Common Space Types:Electrical/Mechanical	237
Retail:Mall Concourse	3007
Parking Garage:Garage Area	795864

### Section 3: Requirements Checklist

#### Interior Lighting:

- 1. Total proposed watts must be less than or equal to total allowed watts.

Allowed Watts	Proposed Watts	Complies
254778	188047	YES

- 2. Exit signs 5 Watts or less per side.

#### Controls, Switching, and Wiring:

- 3. Independent manual or occupancy sensing controls for each space (remote switch with indicator allowed for safety or security).

- 4. Occupant sensing control in class rooms, conference/meeting rooms, and employee lunch and break rooms.

*Exceptions:*

Spaces with multi-scene control; shop classrooms, laboratory classrooms, and preschool through 12th grade classrooms.

- 5. Automatic shutoff control for lighting in >5000 sq.ft buildings by time-of-day device, occupant sensor, or other automatic control.

*Exceptions:*

24 hour operation lighting; patient care areas; where auto shutoff would endanger safety or security.

- 6. Master switch at entry to hotel/motel guest room.

- 7. Separate control device for display/accent lighting, case lighting, task lighting, nonvisual lighting, lighting for sale, and demonstration lighting.

- 8. Photocell/astronomical time switch on exterior lights.

*Exceptions:*

Covered vehicle entrance/exit areas requiring lighting for safety, security and eye adaptation.

- 9. Tandem wired one-lamp and three-lamp ballasted luminaires (No single-lamp ballasts).

*Exceptions:*

Electronic high-frequency ballasts;

Luminaires not on same switch;

Recessed luminaires 10 ft. apart or surface/pendant not continuous;

Luminaires on emergency circuits.

#### Voltage Drop:

- 10. Feeder conductors have been designed for a maximum voltage drop of 2 percent.

- 11. Branch circuit conductors have been designed for a maximum voltage drop of 3 percent.

### Section 4: Compliance Statement

*Compliance Statement:* The proposed lighting design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed lighting system has been designed to meet the 90.1 (2004) Standard requirements in COMcheck Version 3.5.0 and to comply with the mandatory requirements in the Requirements Checklist.

Jason Sambolt

Name - Title

Signature

Date

### Section 5: Post Construction Compliance Statement



COMcheck Software Version 3.5.0

## Lighting Application Worksheet

### 90.1 (2004) Standard

Report Date:

Data filename: C:\Program Files\Check\COMcheck\Xanadu.ock

#### Section 1: Allowed Lighting Power Calculation

A Area Category	B Floor Area (ft <sup>2</sup> )	C Allowed Watts / ft <sup>2</sup>	D Allowed Watts (B x C)
Retail:Mall Concourse	2101	1.7	3572
Common Space Types:Electrical/Mechanical	470	1.5	705
Common Space Types:Electrical/Mechanical	178	1.5	267
Common Space Types:Electrical/Mechanical	244	1.5	366
Common Space Types:Electrical/Mechanical	692	1.5	1038
Common Space Types:Electrical/Mechanical	327	1.5	490
Common Space Types:Electrical/Mechanical	294	1.5	441
Common Space Types:Electrical/Mechanical	383	1.5	574
Retail:Mall Concourse	287	1.7	488
Retail:Mall Concourse	2017	1.7	3429
Retail:Mall Concourse	3142	1.7	5341
Retail:Mall Concourse	6678	1.7	11353
Retail:Mall Concourse	6678	1.7	11353
Common Space Types:Electrical/Mechanical	453	1.5	680
Common Space Types:Corridor/Transition	863	0.5	432
Common Space Types:Electrical/Mechanical	284	1.5	426
Common Space Types:Electrical/Mechanical	487	1.5	730
Common Space Types:Electrical/Mechanical	292	1.5	438
Common Space Types:Corridor/Transition	1389	0.5	694
Common Space Types:Inactive Storage	75	0.3	22
Common Space Types:Restrooms	488	0.9	439
Common Space Types:Restrooms	483	0.9	435
Common Space Types:Inactive Storage	438	0.3	131
Common Space Types:Corridor/Transition	889	0.5	444
Retail:Mall Concourse	298	1.7	507
Retail:Mall Concourse	1474	1.7	2506
Retail:Mall Concourse	5136	1.7	8731
Retail:Mall Concourse	5136	1.7	8731
Common Space Types:Electrical/Mechanical	466	1.5	699
Common Space Types:Corridor/Transition	1125	0.5	562
Common Space Types:Electrical/Mechanical	282	1.5	423
Common Space Types:Electrical/Mechanical	422	1.5	633
Common Space Types:Electrical/Mechanical	236	1.5	354
Common Space Types:Corridor/Transition	1187	0.5	594
Common Space Types:Inactive Storage	75	0.3	22
Common Space Types:Restrooms	475	0.9	428
Common Space Types:Restrooms	498	0.9	448
Common Space Types:Corridor/Transition	2518	0.5	1259
Retail:Mall Concourse	3398	1.7	5777
Retail:Mall Concourse	3535	1.7	6010
Retail:Mall Concourse	3535	1.7	6010
Common Space Types:Electrical/Mechanical	338	1.5	507
Common Space Types:Corridor/Transition	1210	0.5	605

Common Space Types:Electrical/Mechanical	284	1.5	426
Common Space Types:Electrical/Mechanical	412	1.5	618
Common Space Types:Electrical/Mechanical	237	1.5	356
Retail:Mall Concourse	3007	1.7	5112
Parking Garage:Garage Area	795864	0.2	159173
			<b>Total Allowed Watts = 254778</b>

**Section 2: Proposed Lighting Power Calculation**

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
<b>Retail:Mall Concourse (2101 sq.ft.)</b>				
Linear Fluorescent 1: BD-2: Surface Single Lamp Strip / Other / Electronic	1	8	32	256
HID 1: BA: Recessed Downlight / Metal Halide 70W / Electronic	1	22	70	1540
Linear Fluorescent 2: BZ: Surface Four Lamp Strips / Other / Electronic	4	16	114	1824
Linear Fluorescent 2 copy 1: CA: Surface Four Lamp Strips / Other / Electronic	4	6	114	684
Linear Fluorescent 4: BD: Surface Single Lamp Strip / Other / Electronic	1	32	32	1024
<b>Common Space Types:Electrical/Mechanical (470 sq.ft.)</b>				
Linear Fluorescent 5: G-1: 4x2 Industrial Fixture / Other / Electronic	2	8	64	512
<b>Common Space Types:Electrical/Mechanical (178 sq.ft.)</b>				
Linear Fluorescent 5 copy 1: G-1: 4x2 Industrial Fixture / Other / Electronic	2	3	64	192
<b>Common Space Types:Electrical/Mechanical (244 sq.ft.)</b>				
Linear Fluorescent 5 copy 2: G-1: 4x2 Industrial Fixture / Other / Electronic	2	4	64	256
<b>Common Space Types:Electrical/Mechanical (692 sq.ft.)</b>				
Linear Fluorescent 5 copy 3: G-1: 4x2 Industrial Fixture / Other / Electronic	2	6	64	384
<b>Common Space Types:Electrical/Mechanical (327 sq.ft.)</b>				
Linear Fluorescent 5 copy 4: G-1: 4x2 Industrial Fixture / Other / Electronic	2	5	64	320
<b>Common Space Types:Electrical/Mechanical (294 sq.ft.)</b>				
Linear Fluorescent 5 copy 5: G-1: 4x2 Industrial Fixture / Other / Electronic	2	3	64	192
<b>Common Space Types:Electrical/Mechanical (383 sq.ft.)</b>				
Linear Fluorescent 5 copy 6: G-1: 4x2 Industrial Fixture / Other / Electronic	2	3	64	192
<b>Retail:Mall Concourse (287 sq.ft.)</b>				
HID 1 copy 1: BA: Recessed Downlight / Metal Halide 70W / Electronic	1	3	70	210
Linear Fluorescent 4 copy 1: BD: Surface Single Lamp Strip / Other / Electronic	1	8	32	256
<b>Retail:Mall Concourse (2017 sq.ft.)</b>				
HID 1 copy 2: BA: Recessed Downlight / Metal Halide 70W / Electronic	1	5	70	350
Linear Fluorescent 4 copy 2: BD: Surface Single Lamp Strip / Other / Electronic	1	20	32	640
<b>Retail:Mall Concourse (3142 sq.ft.)</b>				
Linear Fluorescent 4 copy 3: BD: Surface Single Lamp Strip / Other / Electronic	1	36	32	1152
HID 4: CI: Recessed Lensed Wall Washer / Metal Halide 70W / Electronic	1	15	70	1050
HID 4 copy 1: CI-1: Recessed Lensed Wall Washer / Metal Halide 70W / Electronic	1	4	70	280
<b>Retail:Mall Concourse (6678 sq.ft.)</b>				
HID 6: BB: Recessed Accent Light / Metal Halide 70W / Electronic	1	16	70	1120
HID 7: BW: Recessed Downlight / Metal Halide 32W / Electronic	1	4	35	140
Linear Fluorescent 15: BV: Surface Single Lamp Strip / Other / Electronic	1	6	32	192
<b>Retail:Mall Concourse (6678 sq.ft.)</b>				
HID 6 copy 1: BB: Recessed Accent Light / Metal Halide 70W / Electronic	1	16	70	1120
Linear Fluorescent 15 copy 1: BV: Surface Single Lamp Strip / Other / Electronic	1	6	32	192
HID 7 copy 1: BW: Recessed Downlight / Metal Halide 32W / Electronic	1	4	35	140
<b>Common Space Types:Electrical/Mechanical (453 sq.ft.)</b>				
Linear Fluorescent 5 copy 7: G-1: 4x2 Industrial Fixture / Other / Electronic	2	6	64	384
<b>Common Space Types:Corridor/Transition (863 sq.ft.)</b>				
Linear Fluorescent 5 copy 8: G: 4x2 Industrial Surface Fixture / Other / Electronic	2	9	64	576
<b>Common Space Types:Electrical/Mechanical (284 sq.ft.)</b>				
Linear Fluorescent 5 copy 8: G-1: 4x2 Industrial Fixture / Other / Electronic	2	3	64	192
<b>Common Space Types:Electrical/Mechanical (487 sq.ft.)</b>				

Linear Fluorescent 5 copy 9: G-1: 4x2 Industrial Fixture / Other / Electronic	2	6	64	384
Common Space Types:Electrical/Mechanical (292 sq.ft.)				
Linear Fluorescent 5 copy 10: G-1: 4x2 Industrial Fixture / Other / Electronic	2	4	64	256
Common Space Types:Corridor/Transition (1389 sq.ft.)				
Linear Fluorescent 5 copy 9: G: 4x2 Industrial Surface Fixture / Other / Electronic	2	8	64	512
Common Space Types:Inactive Storage (75 sq.ft.)				
Linear Fluorescent 5 copy 11: G-1: 4x2 Industrial Fixture / Other / Electronic	2	1	64	64
Common Space Types:Restrooms (488 sq.ft.)				
Compact Fluorescent 1: CG: Recessed Downlight / Twin Tube 24/26/27W / Electronic	2	10	26	260
Linear Fluorescent 24: CH: Surface Two Lamp Strip / Other / Electronic	2	3	32	96
Common Space Types:Restrooms (483 sq.ft.)				
Compact Fluorescent 1 copy 1: CG: Recessed Downlight / Twin Tube 24/26/27W / Electronic	2	10	26	260
Linear Fluorescent 24 copy 1: CH: Surface Two Lamp Strip / Other / Electronic	2	3	32	96
Common Space Types:Inactive Storage (438 sq.ft.)				
Linear Fluorescent 5 copy 12: G-1: 4x2 Industrial Fixture / Other / Electronic	2	4	64	256
Common Space Types:Corridor/Transition (889 sq.ft.)				
Linear Fluorescent 5 copy 10: G: 4x2 Industrial Surface Fixture / Other / Electronic	2	6	64	384
Retail:Mail Concourse (298 sq.ft.)				
HID 1 copy 3: BA: Recessed Downlight / Metal Halide 70W / Electronic	1	3	70	210
Linear Fluorescent 4 copy 4: BD: Surface Single Lamp Strip / Other / Electronic	1	8	32	256
Retail:Mail Concourse (1474 sq.ft.)				
HID 6 copy 2: BB: Recessed Accent Light / Metal Halide 70W / Electronic	1	8	70	560
Linear Fluorescent 4 copy 5: BD: Surface Single Lamp Strip / Other / Electronic	1	20	32	640
Retail:Mail Concourse (5136 sq.ft.)				
HID 6 copy 3: BB: Recessed Accent Light / Metal Halide 70W / Electronic	1	37	70	2590
HID 7 copy 2: BW: Recessed Downlight / Metal Halide 32W / Electronic	1	2	35	70
Linear Fluorescent 15 copy 2: BV: Surface Single Lamp Strip / Other / Electronic	1	12	32	384
HID 6 copy 4: BB: Recessed Accent Light / Metal Halide 150W / Electronic	1	13	150	1950
Retail:Mail Concourse (5136 sq.ft.)				
HID 6 copy 4: BB: Recessed Accent Light / Metal Halide 70W / Electronic	1	37	70	2590
HID 7 copy 3: BW: Recessed Downlight / Metal Halide 32W / Electronic	1	1	35	35
Linear Fluorescent 15 copy 3: BV: Surface Single Lamp Strip / Other / Electronic	1	12	32	384
HID 6 copy 5: BB: Recessed Accent Light / Metal Halide 150W / Electronic	1	13	150	1950
Common Space Types:Electrical/Mechanical (486 sq.ft.)				
Linear Fluorescent 5 copy 13: G-1: 4x2 Industrial Fixture / Other / Electronic	2	6	64	384
Common Space Types:Corridor/Transition (1125 sq.ft.)				
Linear Fluorescent 5 copy 11: G: 4x2 Industrial Surface Fixture / Other / Electronic	2	10	64	640
Common Space Types:Electrical/Mechanical (282 sq.ft.)				
Linear Fluorescent 5 copy 14: G-1: 4x2 Industrial Fixture / Other / Electronic	2	3	64	192
Common Space Types:Electrical/Mechanical (422 sq.ft.)				
Linear Fluorescent 5 copy 15: G-1: 4x2 Industrial Fixture / Other / Electronic	2	3	64	192
Common Space Types:Electrical/Mechanical (236 sq.ft.)				
Linear Fluorescent 5 copy 16: G-1: 4x2 Industrial Fixture / Other / Electronic	2	2	64	128
Common Space Types:Corridor/Transition (1187 sq.ft.)				
Linear Fluorescent 5 copy 12: G: 4x2 Industrial Surface Fixture / Other / Electronic	2	7	64	448
Common Space Types:Inactive Storage (75 sq.ft.)				
Linear Fluorescent 5 copy 17: G-1: 4x2 Industrial Fixture / Other / Electronic	2	1	64	64
Common Space Types:Restrooms (475 sq.ft.)				
Linear Fluorescent 24 copy 2: CH: Surface Two Lamp Strip / Other / Electronic	2	3	32	96
Compact Fluorescent 1 copy 2: CG: Recessed Downlight / Twin Tube 24/26/27W / Electronic	2	10	26	260
Common Space Types:Restrooms (498 sq.ft.)				
Linear Fluorescent 24 copy 3: CH: Surface Two Lamp Strip / Other / Electronic	2	3	32	96

Compact Fluorescent 1 copy 3: CG: Recessed Downlight / Twin Tube 24/28/27W / Electronic	2	10	26	260
<b>Common Space Types:Corridor/Transition (2518 sq.ft.)</b>				
HID 4 copy 1: CI: Recessed Lensed Wall Washer / Metal Halide 70W / Electronic	1	12	70	840
HID 6 copy 6: BB: Recessed Accent Light / Metal Halide 150W / Electronic	1	10	150	1500
Linear Fluorescent 4 copy 6: BD: Surface Single Lamp Strip / Other / Electronic	1	46	32	1472
<b>Retail:Mail Concourse (3398 sq.ft.)</b>				
Linear Fluorescent 5 copy 13: G: 4x2 Industrial Surface Fixture / Other / Electronic	2	18	64	1152
HID 1 copy 4: BA: Recessed Downlight / Metal Halide 70W / Electronic	1	2	70	140
<b>Retail:Mail Concourse (3535 sq.ft.)</b>				
HID 1 copy 5: BA: Recessed Downlight / Metal Halide 70W / Electronic	1	2	70	140
HID 22: BN: Surface Adjustable Accent Light / Metal Halide 150W / Electronic	1	15	150	2250
HID 23: BH-6: Surface Theatrical Floodlight / Metal Halide 150W / Electronic	1	20	150	3000
HID 23 copy 1: BH-7: Surface Theatrical Floodlight / Metal Halide 150W / Electronic	1	4	150	600
<b>Retail:Mail Concourse (3535 sq.ft.)</b>				
HID 1 copy 6: BA: Recessed Downlight / Metal Halide 70W / Electronic	1	1	70	70
HID 22 copy 1: BN: Surface Adjustable Accent Light / Metal Halide 150W / Electronic	1	15	150	2250
HID 23 copy 1: BH-6: Surface Theatrical Floodlight / Metal Halide 150W / Electronic	1	20	150	3000
HID 23 copy 2: BH-7: Surface Theatrical Floodlight / Metal Halide 150W / Electronic	1	4	150	600
<b>Common Space Types:Electrical/Mechanical (338 sq.ft.)</b>				
Linear Fluorescent 5 copy 18: G-1: 4x2 Industrial Fixture / Other / Electronic	2	4	64	256
<b>Common Space Types:Corridor/Transition (1210 sq.ft.)</b>				
Linear Fluorescent 5 copy 14: G: 4x2 Industrial Surface Fixture / Other / Electronic	2	8	64	512
<b>Common Space Types:Electrical/Mechanical (284 sq.ft.)</b>				
Linear Fluorescent 5 copy 19: G-1: 4x2 Industrial Fixture / Other / Electronic	2	3	64	192
<b>Common Space Types:Electrical/Mechanical (412 sq.ft.)</b>				
Linear Fluorescent 5 copy 20: G-1: 4x2 Industrial Fixture / Other / Electronic	2	5	64	320
<b>Common Space Types:Electrical/Mechanical (237 sq.ft.)</b>				
Linear Fluorescent 5 copy 21: G-1: 4x2 Industrial Fixture / Other / Electronic	2	4	64	256
<b>Retail:Mail Concourse (3007 sq.ft.)</b>				
HID 6 copy 7: BB: Recessed Accent Light / Metal Halide 150W / Electronic	1	12	150	1800
HID 4 copy 2: CI: Recessed Lensed Wall Washer / Metal Halide 70W / Electronic	1	10	70	700
HID 4 copy 2: CI-1: Recessed Lensed Wall Washer / Metal Halide 70W / Electronic	1	4	70	280
<b>Parking Garage:Garage Area (795864 sq.ft.)</b>				
HID 35: PA: Surface Pendant Garage Luminaire / Metal Halide 175W / Electronic	1	768	175	134400
				<b>Total Proposed Watts = 189047</b>

### Section 3: Compliance Calculation

If the Total Allowed Watts minus the Total Proposed Watts is greater than or equal to zero, the building complies.

Total Allowed Watts = 254778  
 Total Proposed Watts = 189047  
 Project Compliance = 66731

**Lighting PASSES: Design 26% better than code.**



COMcheck Software Version 3.5.0

## Exterior Lighting Compliance Certificate

### 90.1 (2004) Standard

Report Date: 10/22/07

Data filename: C:\Program Files\Check\COMcheck\Xanadu.ock

#### Section 1: Project Information

Project Title: Xanadu Sports Complex Building A

Construction Site:

Route 120  
East Rutherford, NJ 07073

Owner/Agent:

Colony Capital, LLC  
660 Madison Avenue  
New York, NY 10065, NY 10065  
212-230-3300

Designer/Contractor:

#### Section 2: Exterior Lighting Area/Surface Power Calculation

A Exterior Area/Surface	B Quantity	C Allowed Watts / Unit	D Tradable Wattage	E Allowed Watts (C x D)	F Proposed Watts
Illuminated area of wall or surface	50509 ft2	0.2	No	10102	13824
Walkway < 10 feet wide	374 ft of walkway length	1	Yes	374	3876
Walkway < 10 feet wide	374 ft of walkway length	1	Yes	374	3876
Total Tradable Watts* =				748	7752
Total Allowed Watts =				10850	
Total Allowed Supplemental Watts** =				542	

\* Wattage tradeoffs are only allowed between tradable areas/surfaces.

\*\* A supplemental allowance equal to 5% of total allowed wattage may be applied toward compliance of both non-tradable and tradable areas/surfaces.

#### Section 3: Exterior Lighting Fixture Schedule

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Illuminated area of wall or surface (50509 ft2): Non-tradable Wattage				
Linear Fluorescent 1: XC: Surface Weatherproof sign light / Other / Electronic	2	96	144	13824
Walkway < 10 feet wide (374 ft of walkway length): Tradable Wattage				
Linear Fluorescent 2: BZ: Surface Fou Lamp Strip / Other / Electronic	4	34	114	3876
Walkway < 10 feet wide (374 ft of walkway length): Tradable Wattage				
Linear Fluorescent 2 copy 1: BZ: Surface Fou Lamp Strip / Other / Electronic	4	34	114	3876
Total Tradable Proposed Watts =				7752

#### Section 4: Requirements Checklist

##### Lighting Wattage:

1. Within each non-tradable area/surface, total proposed watts must be less than or equal to total allowed watts. Across all tradable areas/surfaces, total proposed watts must be less than or equal to total allowed watts.

Compliance: Fails: One or more non-tradable exterior lighting use areas fail

##### Controls, Switching, and Wiring:

2. All exemption claims are associated with fixtures that have a control device independent of the control of the nonexempt lighting.

Project Title: Xanadu Sports Complex Building A  
Data filename: C:\Program Files\Check\COMcheck\Xanadu.ockReport date: 10/22/07  
Page 10 of 11

- 3. All nonexempt lighting fixtures shall be controlled by a photosensor or astronomical time switch that is capable of automatically turning off the fixture when sufficient daylight is available or the lighting is not required.

**Exterior Lighting Efficacy:**

- 4. All exterior building grounds luminaires that operate at greater than 100W have minimum efficacy of 60 lumen/watt..  
*Exceptions:*

Controlled by motion sensor or exempt from consideration under the provisions of Section 505.6.2.

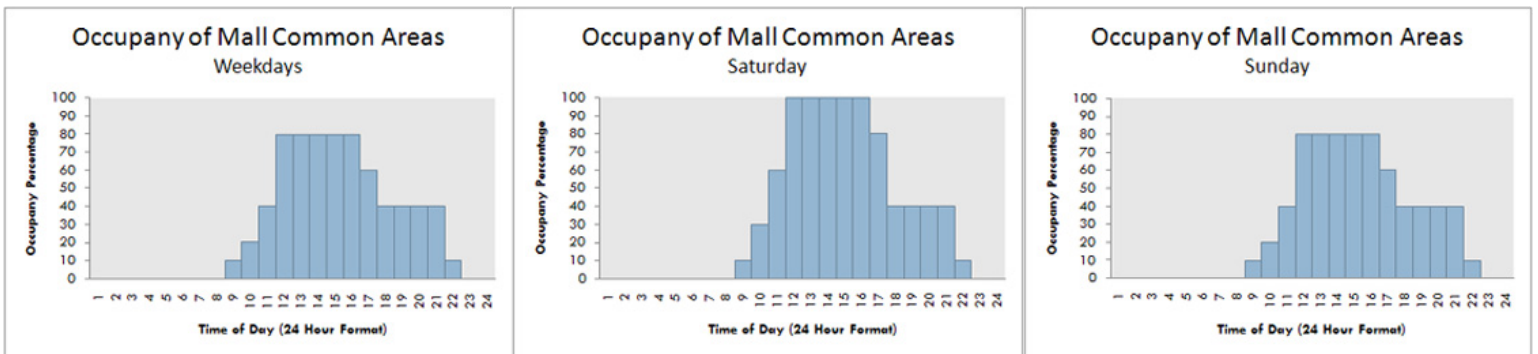
**FAILS: Fails: One or more non-tradable exterior lighting use areas fail**

# Appendix D: Design Load Schedules and Inputs

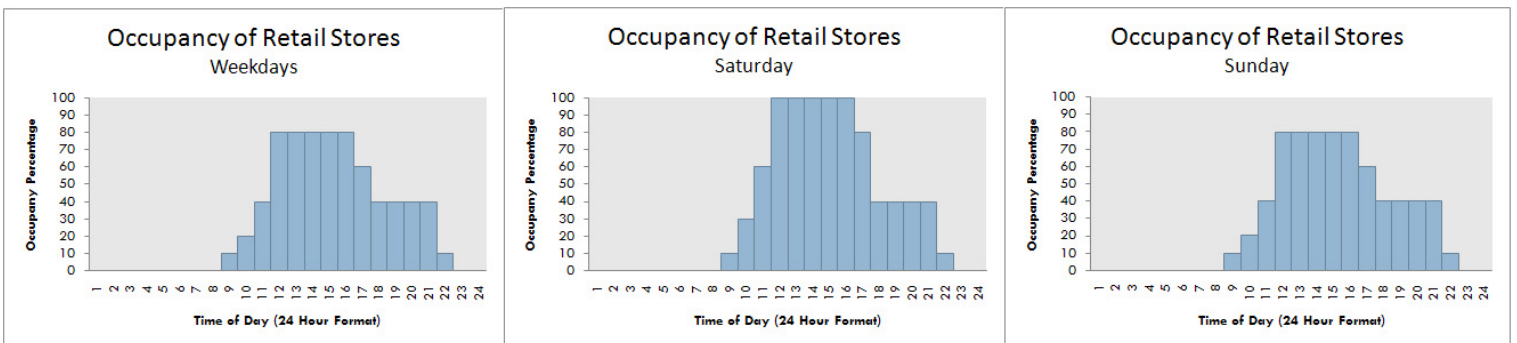
## Internal Loads From Occupants

Space Type	Heat Generation		Occupancy Density (SF/person)
	Sensible (Btu/h)	Latent (Btu/h)	
Night Club	305	545	10
Gyms (Playing Area)	525	925	7
Mall Common Area	250	200	25
Restaurant	275	275	14
Retail Stores	250	200	67

## Occupancy Schedules of Mall Common Areas

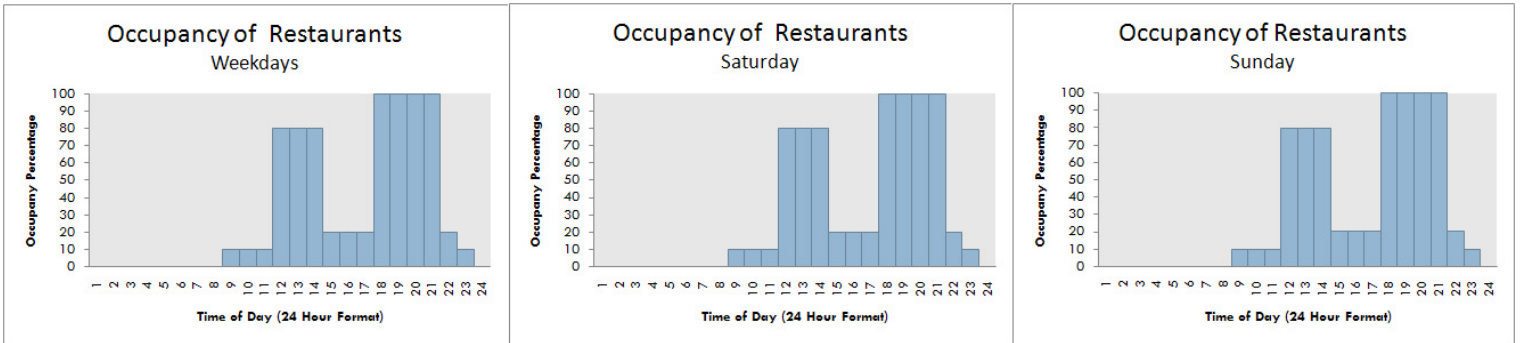


## Occupancy Schedules of Retail Stores

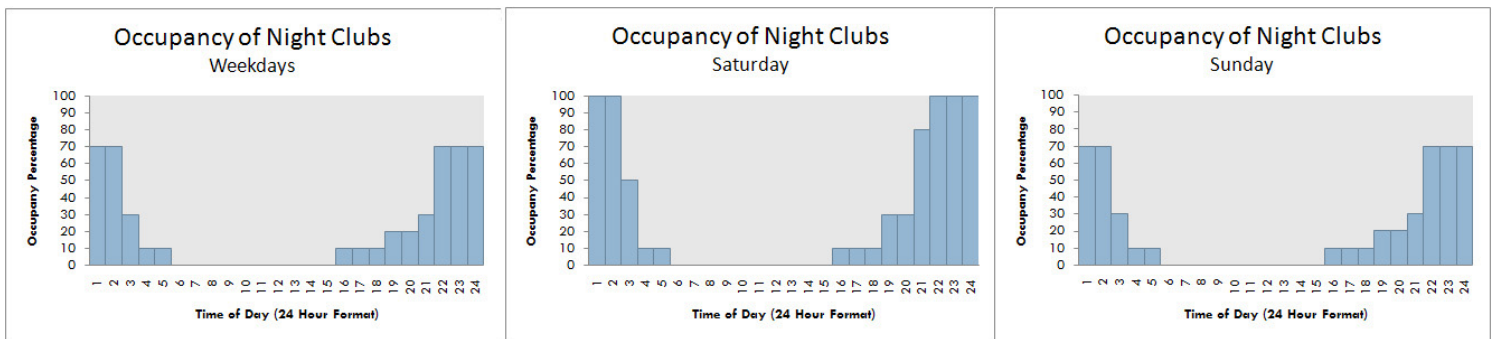




### Occupancy Schedules of Restaurants



### Occupancy Schedules of Night Clubs



### Occupancy Schedules of Gyms

