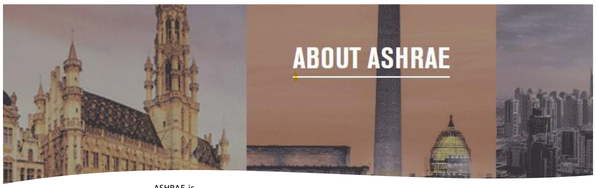


ASHRAE Organization Information

ASHRAE is...

- A Professional Organization supporting engineers, contractors, mfr., and others in the building industry
- 57,000 members in 132 countries
- Headquartered in Atlanta
- a Standards writing organization
- The leader in the industry for standards and guidelines involving building systems, energy efficiency, indoor air quality.

....A diverse organization dedicated to advancing the arts and sciences of heating, ventilation, air conditioning and refrigeration to serve humanity and promote a sustainable world.

OUR TEAM:

Architects:
- HOUSER WALKER ARCHITECTURE
- MCLENNAN DESIGN

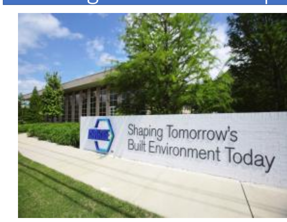
PME Engineer:
- INTEGRAL GROUP

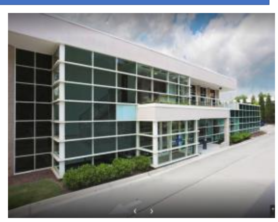
Commissioning Agent:
- EPSTEN GROUP

Contractor:
- SKANSKA

Owner's Project Representative:
- Collins Project Management

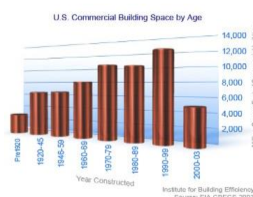
Existing ASHRAE Headquarters





- *1791 Tullie Circle NE, Atlanta, GA*
- *35,000 sq. ft. building – 2 stories with learning center on 1st level*
- *Renovated in 2010 to LEED Platinum level*
- *Sold to CHOA in 2018*

PROJECT GOAL



In developed economics, at least half of the buildings that will be in use in 2050 *have already been built.*[4,5] According to a recent survey by the U.S. Energy Information Agency, 72 percent of floorstock in the U.S., or 46 billion square feet, belongs to buildings over twenty years old.[6]

Project Goal:

To renovate a 1970's building into a high-performing net-zero-ready facility in a cost-effective method that can be replicated in the industry.

What is our Story?

"Our organization relies on harvesting the technical knowledge, volunteer energy, and expertise of our members. We want this space to inspire visitors to participate and honor them for their volunteer service and commitment."

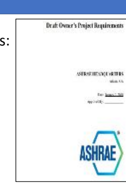
– Jeff Littleton, Executive VP for ASHRAE

New ASHRAE Headquarters

- *180 Technology Parkway, Peachtree Corners, GA*
- *66,000 sq. ft. building – 3 stories*
- *Built in 1970's*
- *Purchased in Dec. 2018*

OWNER PROJECT REQUIREMENTS

Owner's Project Requirement Document establishes owner goals:



Mission Critical Items:

- **SAFETY** – safe work environment and construction
- **AFFORDABLE** – to be constructed within the available budget
- **EXCEED** ASHRAE applicable Standards requirements
- **ACOUSTICS** – Exceed Acoustical levels for Office Environments
- **NET ZERO ENERGY** – to meet low EUI levels

OWNER PROJECT REQUIREMENTS

OPR Requirements to achieve Goals:

- **ASHRAE Standard 189.1 -2017** – Exceed the requirements
- Demand Side Site Energy Consumption of less than **21.4 kBtu/SF/yr. (stretch goal to 15 kBtu/SF/yr)**
- Water Efficiency design such that the project obtains **11 of 11 LEED water use efficiency points.**
- Limit maximum daytime plug load to **0.4 W/SF**
- Exceed Accoustic requirements listed in **ASHRAE Applications Handbook by 3-5 NC/RNC**
- Deliver Outside air at a value of at least **1.3 times the requirements of Standard 62.1** and use Demand Control Ventilation (DCV) for high-occupancy spaces.
- Achieve Spatial Daylighting Autonomy (SDA) – Majority of Occupants achieve generous Daylighting in work space **55% of the time**.
- Achieve Resiliency at a level established by ASHRAE.

ASHRAE STANDARDS we have to meet or exceed…

ANSI/ASHRAE/IES Standard 90.1-2016
ANSI/ASHRAE 55-2017
ANSI/ASHRAE 62.1-2016
ASHRAE Standard 189.1-2017
ASHRAE Guideline 0-2013
ASHRAE Guideline 1-2017
ASHRAE Thermal Guidelines for Data Processing Environments
ASHRAE Advanced Energy Design Guide for Zero Energy Office Buildings

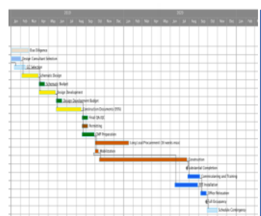
OWNER PROJECT REQUIREMENTS

Metering Requirements:

Mandatory
- HVAC energy
- Lighting energy
- Plug Load energy
- Whole Building energy
- Photovoltaics energy
- Domestic Hot Water Energy

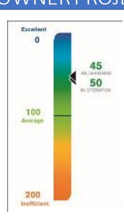
Desirable
- Domestic Water Usage
- Cooling Tower water usage
- Irrigation Water Usage
- Domestic Hot Water Usage

Schedule Constraints



Jan., 2019: Design Team Selection
Feb., 2019: Construction Manager Selection
April 1, 2019: Schematic Design Complete
May 15, 2019: Design Development Complete
August 1, 2019: Construction Documents Complete
Sept. 15, 2019 – Start Construction Phase
August 15, 2020 – Construction Complete
August – Sept., 2020 – Commissioning Efforts
October 2020 – Full Occupancy

OWNER PROJECT REQUIREMENTS



Certification Programs Studied

- LEED
- Green Globes
- WELL Building
- FitWel
- Living Building Challenge
- ASHRAE Building EQ

Request for Proposal for Planning and Design Services

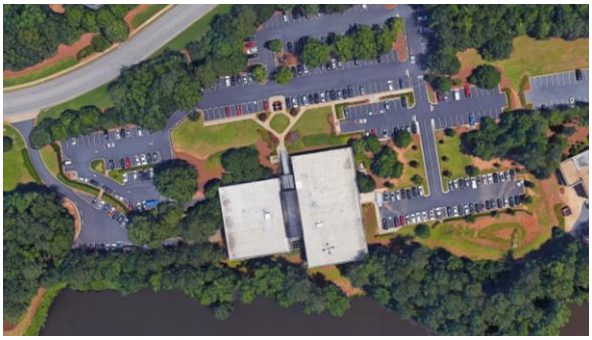
ASHRAE
New Headquarters Building
Peachtree Corners, GA

January 4, 2019

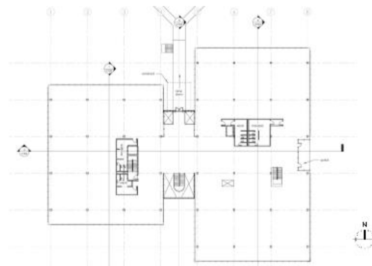
TABLE OF CONTENTS
1. Introduction and Project Description
2. Proposal Requirements
3. Instructions

HOW DO WE ACHIEVE OUR PROJECT GOAL?

- Set Construction Budget: $ 8,570,000 ($130/sq. ft. minus donations & PV)
- Set Project Schedule: Must move out by Oct., 2020
- Set Project Criteria: Owner Project Requirements were set
- Hire the right team!



Existing Upper Level Floor Plan



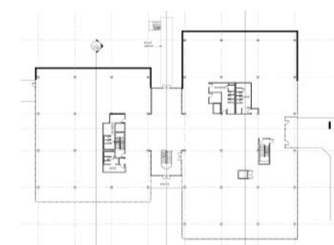
Program Summary

Initial Program (areas in NSF):

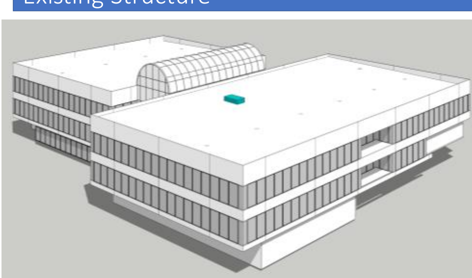
Departmental Areas:

Administrative Staff:	1,044
Marketing:	2,055
Development:	633
Member Services:	1,137
Technology:	1,089
Finance & Admin Services:	1,713
Publications & Education:	2,383
Shared Conference/Meeting:	4,500
Service Spaces:	7,961
Conference Center:	6,180
Total Net Program Area:	28,725
Gross Program Area:	44,000 gsf (approx.)

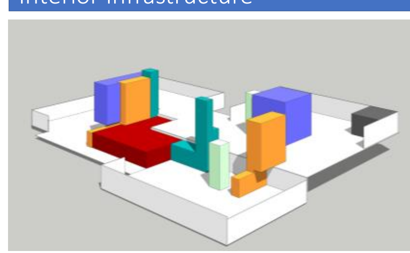
Existing Middle Level Floor Plan



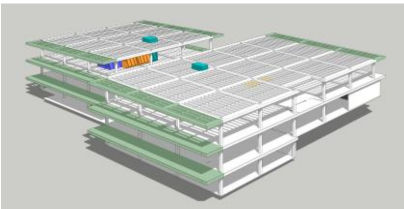
Existing Structure



Interior Infrastructure

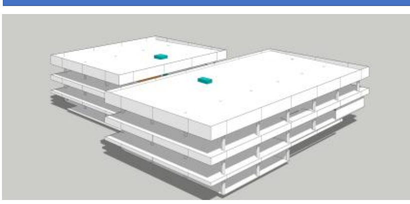


Frame



ASHRAE

Wall Panels



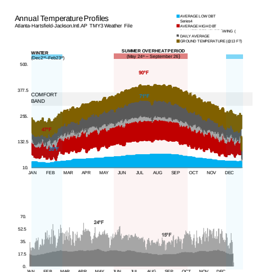
ASHRAE

Annual Air & Ground Temperature Profiles

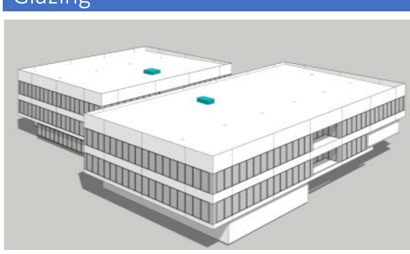
Key Climate Factors: Atlanta Georgia

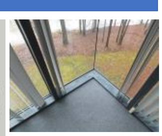
Key Climate Design Drivers

- **Summer:** May to September (Avg. OA>70ºF)
    - Extreme Hot Week Period: Jul 6 - Jul 12, Maximum Temp= 98.06F (36.7C). Future climate to be accounted for.
    - Exterior shading beneficial May-September to minimize unwanted summertime solar gains and enable low-energy passive cooling strategies.
- **Winter**: December to February (Avg. OA< 50ºF)
    - Extreme Cold Week Period : Jan 6 to Jan 12, Minimum Temp=8.96F (-12.8C)
    - Leverage passive solar gains through south-facing façade fenestration to offset supplemental heating requirements.
- **Diurnal Swing**: Average Diurnal swing between 15-24ºF suggests an opportunity to leverage thermal mass to reduce peak indoor temperatures, reduce cooling energy, and improve occupant thermal comfort.
- **Ground and Water Temperatures:** Relatively stable ground (and Lake) temperatures suggest a potential heat source and sink for the HVAC system.



Glazing

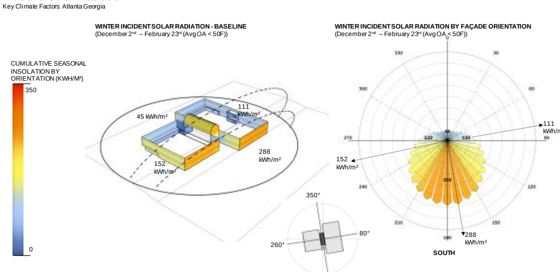




ASHRAE

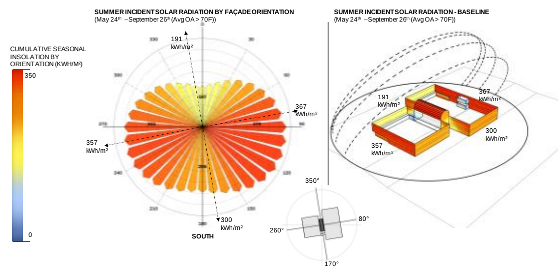
Incident Solar Radiation - WINTER

Key Climate Factors: Atlanta Georgia



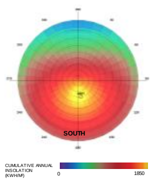
Incident Solar Radiation - SUMMER

Key Climate Factors: Atlanta Georgia



Rooftop Photovoltaic (PV) Generation Potential

Key Climate Factors: Atlanta Georgia

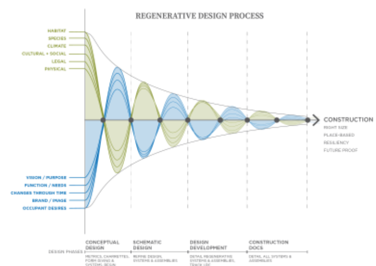


	30 DEGREE PANEL TILT	10 DEGREE PANEL TILT	E-W DUAL-TILT PANELS (@ 8°)
	Option 1	**Option 2**	**Option 3**
Annual Insolation (kWh/m2)	1847	1787	1657 (West-Facing) / 1632 (East)
PV Panel Efficiency (%)	19%	19%	19%
System Losses (%)	15%	15%	15%
Inverter Losses (%)	4%	4%	4%
PV Panel Area (55-68% Roof Utilization*) (m2)	620 -713	884 -1,078	1,178 -1,430
DC System Size (kW)	118 -136	168 -205	224 -272
Annual PV Generation Potential (kWh/yr)	180,000 - 207,000	248,000 - 299,000	304,000 - 365,000
Annual PV Generation Potential (EUI**) (kBtu/ft2/yr)	**9 -10**	**12 -15**	**15 -18**
Schematic Layout			

* Total roof area used for PV panel area estimate = 27,017 ft2 (2,510 m2)

** Floor area used for EUI calculation: 68,118 ft2 (6,328 m2)

Regenerative Design

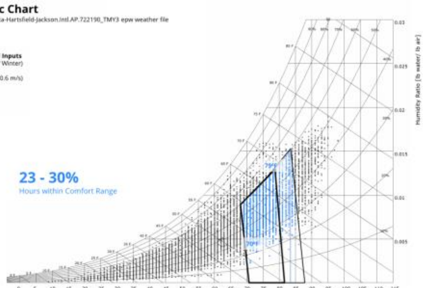


Psychrometric Chart

Key Climate Factors: Atlanta-Hartsfield-Jackson.Intl.AP.722190_TMY3 epw weather file

ASHRAE- 55 PMV Method Inputs
- Clo: 0.61-1.0 (Summer/ Winter)
- Met: 1.1 (Typing)
- Air Speed: 0 -118 fpm (0.6 m/s)

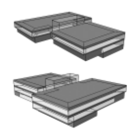
- RH Upper Limit: 60%



Path to Net Zero Energy

Energy Model Input Assumptions

General Parameters	
Project / Building	ASHRAE HQ
Occupancy	Office
Location	Altanta, GA
Weather File	Atlanta, GA
Climate Zone	ASHRAE 3A

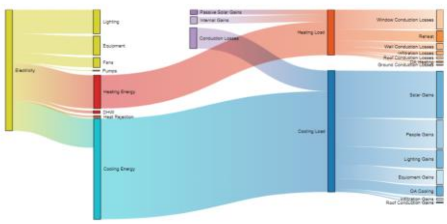


Envelope	Existing	90.1-2016	Recommended
Wall Assembly	U-0.3 (R-3.0)	U-0.122 (R-8.0)	**U-0.058 (R-17)**
Roof Assembly	U0.047 (R-21)	U-0.039 (R-25)	**U-0.028 (R-35)**
Window Assembly	U-0.59 SHGC-0.52	U-0.45 SHGC-0.25	**U-0.40 SHGC-0.25**
Window to Wall Ratio	~50%	40%	**40%**
External Shade Depth	N/A	N/A	**1'** (to be further optimized for visual, thermal comfort)
Infiltration	0.0448 cfm/ft²	0.0448 cfm/ft²	**0.0112 cfm/ft²**

HVAC System Parameters			
System Description	VAV PFP Boxes	-	-
Total Static Pressure	Supply/Exhaust	in	4" / 1"
Fan Min Turn Down	-	%	10%
Ventilation Airflow	-	cfm	8,317
Total Airflow Capacity (Existing)	-	cfm	72,861
Total Airflow Capacity (ASHRAE 90.1-2016)	-	cfm	54,061
Demand Control Ventilation	None	-	-
Airside Economizer	Dry-bulb High Limit	ºF	65ºF
Airside Heat Recovery	Sensible Eff / Latent Eff	%	50% / 50%
Cooling Coil	DX Cooling Coil	EER	9.5
Heating Coil	Electric Resistance	%	100%
Reheat Coil	Electric Resistance	%	100%
Supply Air Temperature	-	ºF	55ºF
Supply Air Control	Warmest Zone Reset	ºF	10ºF
Domestic Hot Water			
System Description	Electric Resistance	-	-
DHW System Efficiency	-	%	98%
DHW Supply Water Temperature	-	ºF	140ºF
DHW Delta-T Water Temperature	-	ºF	30ºF

Space Type Inputs			Internal Load Parameters							Thermal Zone Parameters						
Space Type	Area [SF]	Area in Model [%]	# People	Area/person [SF/Person]	People/Area [Person/SF]	Lighting [W/SF]	Eqp Load [W/SF]	DHW [gal/hr/p]	DHW [gpm]	OA Rate [CFM/SF]	OA Rate [CFM/P]	OA Rate [CFM]	TStat Clg [deg F]	TStat Htg [deg F]	Clg Setback [deg F]	Htg Setback [deg F]
Office	65,914	97%	132	500	0.0020	0.637	0.5	0.18	0.4	0.078	6.5	5,998	75	70	80	60
Atrium	1,885	3%	283	6.67	0.1499	0.390	0.5	0	0.0	0.078	6.5	1,984	75	70	80	60
Lobby	318	0%	48	6.67	0.1499	0.585	0.5	0	0.0	0.078	6.5	335	75	70	80	60
TOTAL	68,117		462	147	0.0068	0.6	0.5		0.4			8,317				

Energy Use Characterization
ASHRAE Headquarters



Interactive Graph: https://www.elementa.nyc/projects/ashrae/

Envelope Sensitivity Analysis
ASHRAE Headquarters

Preliminary envelope performance targets based on point of diminishing Energy Use Intensity (EUI) savings shown at right:

Parameter	Existing Performance	ASHRAE 90.1-2016	Recommended
Wall Assembly	U-0.3 (R-3.0)	U-0.122 (R-8.0)	**U-0.058 (R-17)**
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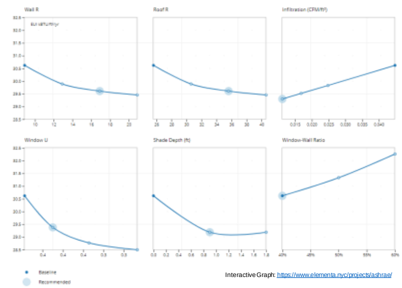
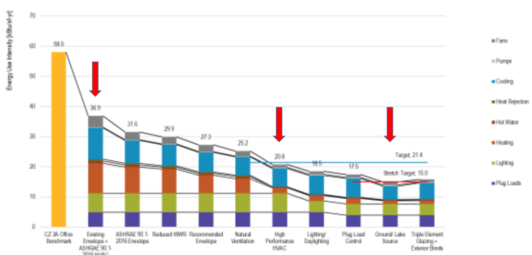
Window Assembly	U-0.59 SHGC-0.52	U-0.45 SHGC-0.25	**U-0.40 SHGC-0.25**
Window to Wall Ratio	~50%	40%	**40%**
External Shade Depth	N/A	N/A	**1'** (to be further optimized for visual, thermal comfort)
Infiltration	0.025 cfm/ft²	0.045 cfm/ft²	**0.011 cfm/ft²**

ASHRAE NZE AEDG recommends R-15.6 wall for Climate Zone 3!



Interactive Graph: https://www.elementa.nyc/projects/ashrae/

Existing Envelope + ASHRAE 90.1 HVAC



Energy Analysis Assumptions
ASHRAE Headquarters

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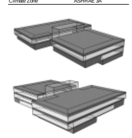

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Reheat Coil	Electric Resistance	%	100%
Supply Air Temperature	-	ºF	55ºF
Supply Air Control	Warmest Zone Reset	ºF	10ºF
Domestic Hot Water			
System Description	Electric Resistance	-	-
DHW System Efficiency	-	%	98%
DHW Supply Water Temperature	-	ºF	140ºF
DHW Delta-T Water Temperature	-	ºF	30ºF

Primary Envelope Factors

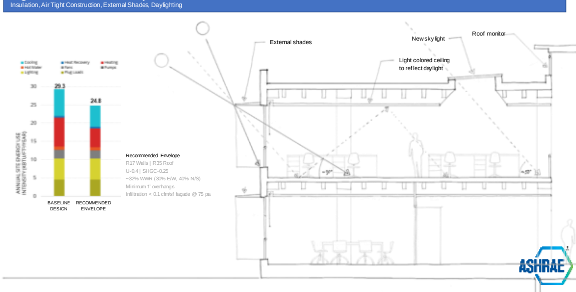
Window to Wall Ratios (WWR)

Important to define the optimum area of openings relative to achieving daylight autonomy goals, as well as maximize the thermal efficiency of the wall.

Air Infiltration and Insulation

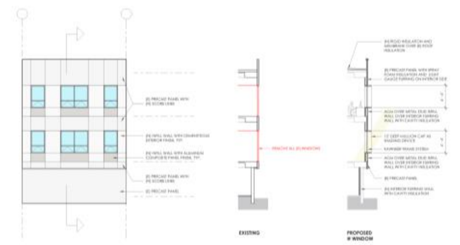
Where was the optimal R-Value for each part of the exterior envelope and how were we containing air infiltration.

High Performance Envelope
Insulation, Air Tight Construction, External Shades, Daylighting



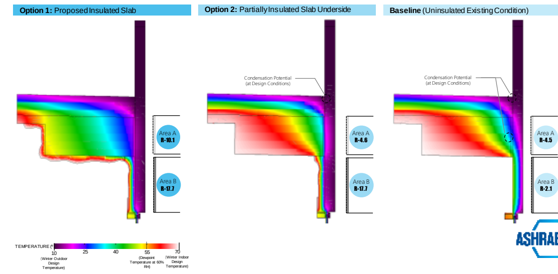
Option A | Minimal Intervention

PRESERVE PRECAST PANELS. HANDLE R-VALUE AND INFILTRATION REQUIREMENTS FROM THE INTERIOR.



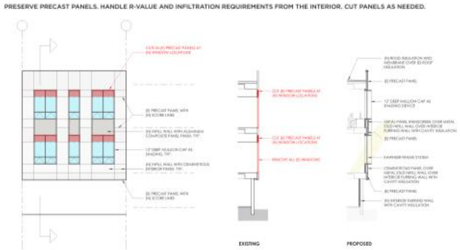
THERM Analysis: Option A, **Detail 1**

Analysis Details



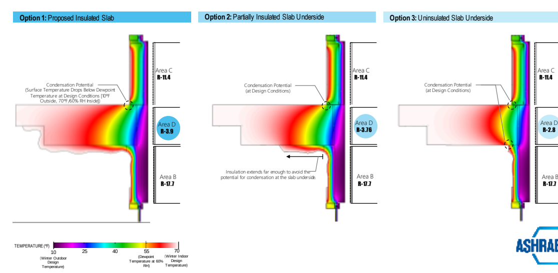
Option B | Modified Minimal Intervention

PRESERVE PRECAST PANELS. HANDLE R-VALUE AND INFILTRATION REQUIREMENTS FROM THE INTERIOR. CUT PANELS AS NEEDED.



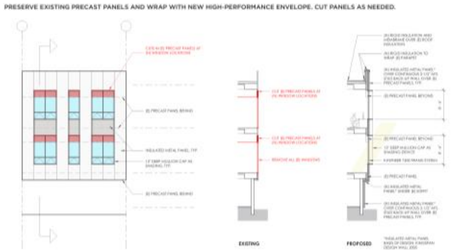
THERM Analysis: Option A, **Detail 2**

Analysis Details

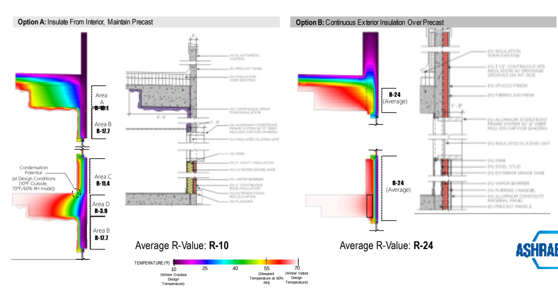


Option C | High Performance Envelope 1

PRESERVE EXISTING PRECAST PANELS AND WRAP WITH NEW HIGH-PERFORMANCE ENVELOPE. CUT PANELS AS NEEDED.



THERM Analysis: **Wall Assembly R-value**



Schematic Design Integration

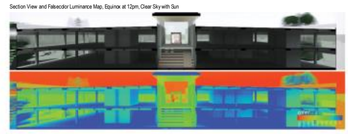
Open Office | Relationship to Light

Schematic Design Integration

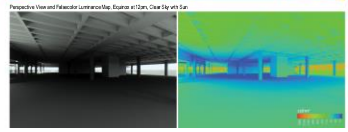
EXISTING RIBBON WINDOWS AND EXISTING GLASS

DAYLIGHT PATTERNS

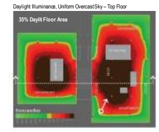
Section View and Falsecolor Luminance Map, Equinox at 12pm, Clear Sky with Sun



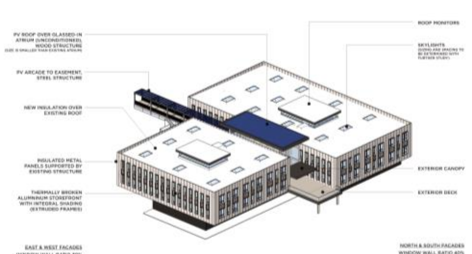
Perspective View and Falsecolor Luminance Map, Equinox at 12pm, Clear Sky with Sun



Daylight Illuminance, Uniform Overcast Sky – Top Floor



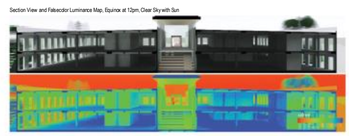
Daylight Illuminance, Uniform Overcast Sky – Mid Floor



40% WWR N & S, 30% WWR E & W + EXISTING WINDOW HEAD

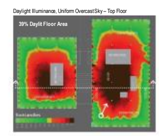
DAYLIGHT PATTERNS

Section View and Falsecolor Luminance Map, Equinox at 12pm, Clear Sky with Sun

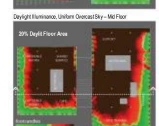


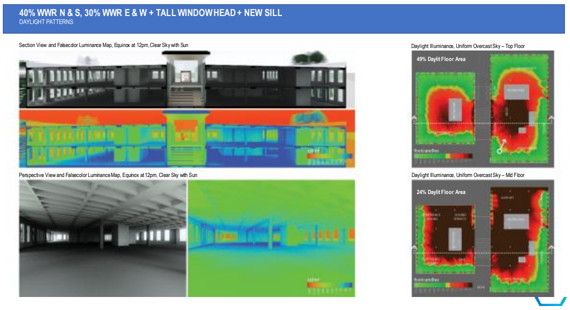
Perspective View and Falsecolor Luminance Map, Equinox at 12pm, Clear Sky with Sun

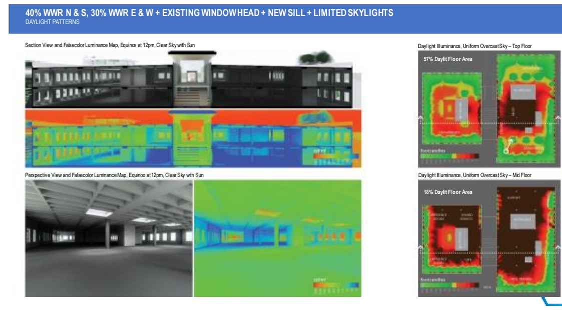
Daylight Illuminance, Uniform Overcast Sky – Top Floor

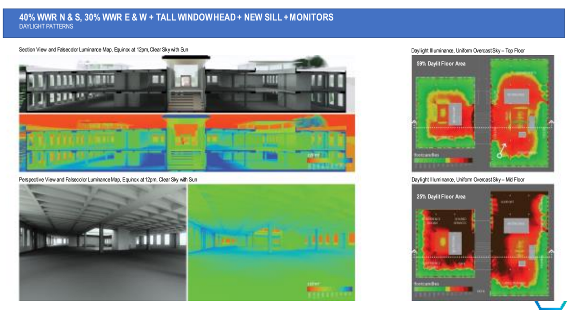


Daylight Illuminance, Uniform Overcast Sky – Mid Floor



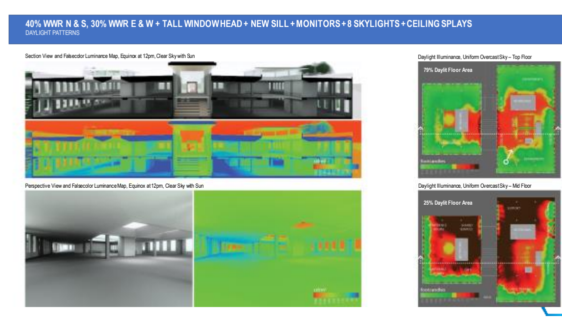

40% WWR N & S, 30% WWR E & W + TALL WINDOWHEAD + NEW SILL
DAYLIGHT PATTERNS
Section View and Falsecolor Luminance Map, Equinox at 12pm, Clear Sky with Sun
Perspective View and Falsecolor Luminance Map, Equinox at 12pm, Clear Sky with Sun
Daylight Illuminance, Uniform Overcast Sky – Top Floor
49% Daylit Floor Area
Daylight Illuminance, Uniform Overcast Sky – Mid Floor
24% Daylit Floor Area


40% WWR N & S, 30% WWR E & W + EXISTING WINDOWHEAD + NEW SILL + LIMITED SKYLIGHTS
DAYLIGHT PATTERNS
Section View and Falsecolor Luminance Map, Equinox at 12pm, Clear Sky with Sun
Perspective View and Falsecolor Luminance Map, Equinox at 12pm, Clear Sky with Sun
Daylight Illuminance, Uniform Overcast Sky – Top Floor
57% Daylit Floor Area
Daylight Illuminance, Uniform Overcast Sky – Mid Floor
18% Daylit Floor Area


40% WWR N & S, 30% WWR E & W + TALL WINDOWHEAD + NEW SILL + MONITORS
DAYLIGHT PATTERNS
Section View and Falsecolor Luminance Map, Equinox at 12pm, Clear Sky with Sun
Perspective View and Falsecolor Luminance Map, Equinox at 12pm, Clear Sky with Sun
Daylight Illuminance, Uniform Overcast Sky – Top Floor
59% Daylit Floor Area
Daylight Illuminance, Uniform Overcast Sky – Mid Floor
25% Daylit Floor Area

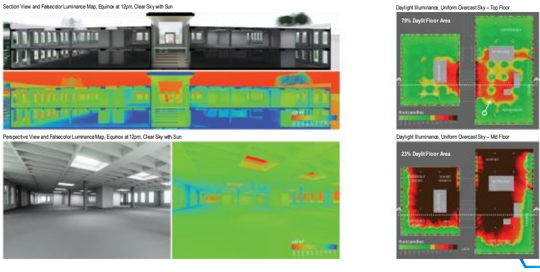

40% WWR N & S, 30% WWR E & W + TALL WINDOWHEAD + NEW SILL + MONITORS + 8 SKYLIGHTS
DAYLIGHT PATTERNS
Section View and Falsecolor Luminance Map, Equinox at 12pm, Clear Sky with Sun
Perspective View and Falsecolor Luminance Map, Equinox at 12pm, Clear Sky with Sun
Daylight Illuminance, Uniform Overcast Sky – Top Floor
78% Daylit Floor Area
Daylight Illuminance, Uniform Overcast Sky – Mid Floor
25% Daylit Floor Area


40% WWR N & S, 30% WWR E & W + EXISTING WINDOWHEAD + NEW SILL + MONITORS
DAYLIGHT PATTERNS
Section View and Falsecolor Luminance Map, Equinox at 12pm, Clear Sky with Sun
Perspective View and Falsecolor Luminance Map, Equinox at 12pm, Clear Sky with Sun
Daylight Illuminance, Uniform Overcast Sky – Top Floor
45% Daylit Floor Area
Daylight Illuminance, Uniform Overcast Sky – Mid Floor
19% Daylit Floor Area


40% WWR N & S, 30% WWR E & W + TALL WINDOWHEAD + NEW SILL + MONITORS + 8 SKYLIGHTS + CEILING SPLAYS
DAYLIGHT PATTERNS
Section View and Falsecolor Luminance Map, Equinox at 12pm, Clear Sky with Sun
Perspective View and Falsecolor Luminance Map, Equinox at 12pm, Clear Sky with Sun
Daylight Illuminance, Uniform Overcast Sky – Top Floor
79% Daylit Floor Area
Daylight Illuminance, Uniform Overcast Sky – Mid Floor
25% Daylit Floor Area

40% WWR N & S, 30% WWR E & W + TALL WINDOW HEAD + NEW SILL + 25 SKYLIGHTS

DAYLIGHT PATTERNS



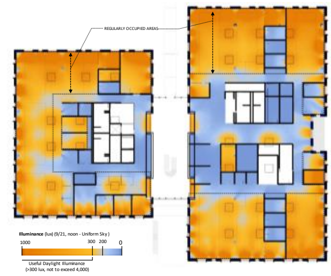
Tall Windows, 26 Skylights

70%

Percentage of regularly occupied workspaces on the upper level with useful daylight illuminance (>300 lux) at the workplane

Key Findings:

- In accordance with OPR Requirements, the vast majority of regularly occupied work spaces are expected to receive useful daylight illuminance (>300 lux).
- 18 of the 26 skylights could be considered critical to achieving useful daylight illuminance within occupant work areas while the remaining skylights provide daylight and a connection to the outdoors to circulation and office support areas
- Opaque partitions running parallel to the façade to be avoided in order to maintain the daylight distribution shown at right.



Final Window Wall Ratios

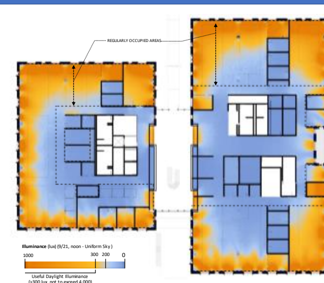
Tall Windows, No Skylights

46%

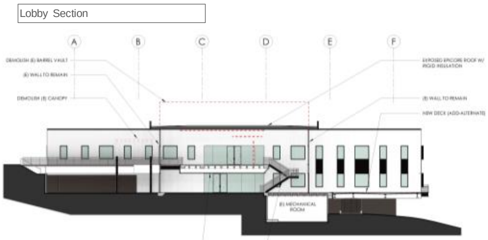
Percentage of regularly occupied workspaces on the upper level with useful daylight illuminance (>300 lux) at the workplane

Key Findings:

- Without skylights, only 46% of the workstations shown at right are expected to receive useful daylight levels (>300 lux),
- OPR daylight requirements will not be met.
- Electric light dimming with daylight responsive controls will be reduced (more electric lighting energy)



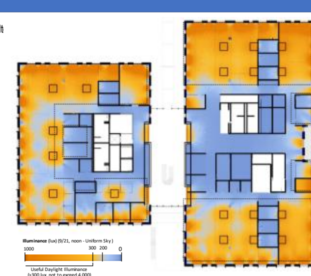
Lobby Section



Short Windows, 18 Skylights (VE Alt

57%

Percentage of regularly occupied workspaces on the upper level with useful daylight illuminance (>300 lux) at the workplane

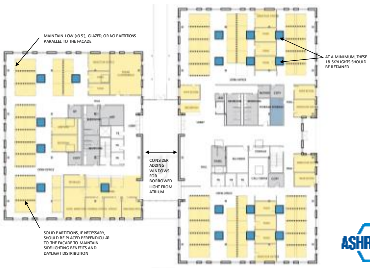


Daylight Strategies

Skylights
- Adding skylights doubles the daylit floor area on the upper floor, providing useful daylight illuminance to 70% of work areas and offering significant opportunity for electric light dimming. If the number of skylights must be reduced for VE purposes, IG recommends that the 18 skylights shown at right (in blue) be maintained, at a minimum.

Raised Windows
- Raising the window height increases the daylit floor area percentage from 36-46% compared to the VE Design. SD proposed window cuts should be retained if budget permits.

Interior Desk Layout
- Tall and/or opaque desk partitions running parallel to the façade must be avoided in order to maintain side-lighting benefits.



HVAC Option 1: All-Air TZHP System

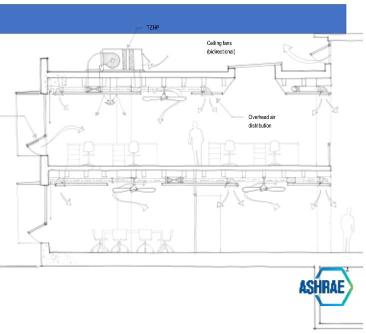
TZHP – Thermodynamically Zoned Heat Pumps

System Type
Rooftop Packaged Thermodynamically Zoned ASHPs with DOAS, enthalpy heat recovery, DCV, and a desiccant wheel

Air Distribution Options
Overhead, Mixed Air

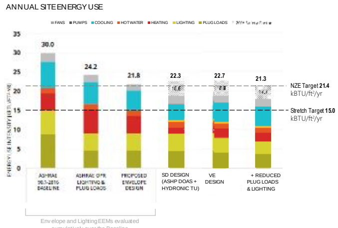
Mixed-Mode Ventilation
Operable windows and atrium exhaust
Ceiling fans with reverse control

Night-Flush / Airside Economizer
Fan-assisted night flush



Path to NZE Update

ANNUAL SITE ENERGY USE



CHANGES TO THE 100% SD DESIGN
- Insulation removed at overhang
- 3" New Roof Insulation in lieu of 4": R-30 assembly
- Existing Atrium to remain
- Skylights removed
- Detailed thermal zoning added to model based on latest floor plan
- Internal gains & diversities updated based on latest floor plan
- HVAC updated to match latest design

TAKEAWAYS
- 50% increase in heating energy
- 25% increase in cooling energy
- Atrium alone accounts for 15% of EUI
- With 20% safety factor, current design is above NZE target

HVAC Option 2: Hydronic Systems

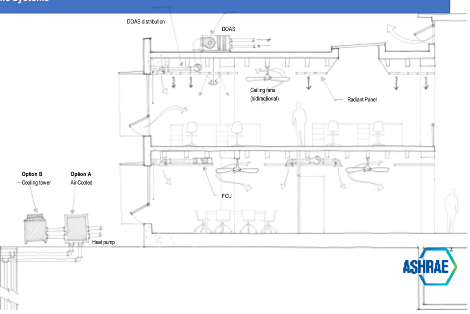
DOAS with Hydronic Terminal Units

DOAS
With enthalpy heat recovery and DCV
Option 1A: Add desiccant wheel
Option 1B: Add DX Trim Coil

CW Terminal Unit Options
Radiant Ceiling Panels
Sensible Fan Terminal Units

Heat Pump Options
Option A: Air-Cooled HP
Option B: Water-Cooled HP
Option C: Ground-Source HP

Night-Flush & Mixed-Mode Ventilation
See Previous



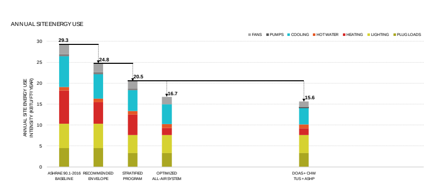
HVAC Concept Overview

Process

1. Demand more from the building envelope both thermally and tightness - Architect
2. Demand more from the building occupants in terms of plug loads and day lighting - Owner
3. Utilize high efficiency systems to reduce energy demands (hydronic vs. airside, DOAS) - Engineer
4. Right size equipment based on these demands – Accountability Required
5. Provide flexible and systems which provide exemplary environmental comfort

All-Air TZHP vs. Hydronic System

ANNUAL SITE ENERGY USE



Path to NZE Recap

NZE Target 21.4 kBTU/ft²/yr

Stretch Target 15.0 kBTU/ft²/yr

HVAC System Design

Resulting System Needs

- Hydronic Systems reduce energy - Radiant
- Smaller, modular control – control valves and ceiling fans vs VAV terminal units and ductwork
- Simultaneous heating and cooling – Heat Pump and/or heat recovery machines
- Decouple temperature from humidity – DOAS
- Recover energy whenever possible

System Overview

Outdoor Air Cooled Modular Heat Pump

Staged Pumping

Air Cooled DOAS decoupled from waterside systems

WSHP for transient or potentially humid spaces utilize CHWR.

Overhead Radiant Panels for heating/cooling at exterior zones, cooling only at interior zones.

Ceiling Fans to induce cooling and improve environmental comfort.

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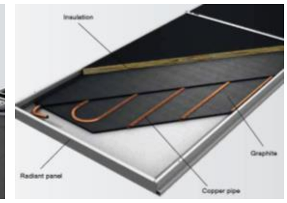
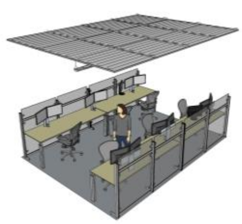
Overhead Radiant Systems



- Panels contain a multi-pass single circuit coil.
- Panels may be piped in series (up to 64 square feet of active panel)
- Quick disconnects for hoses allow for ease of installation and replacement.
- Piping to the panels will be PEX tubing concealed above the cloud/array.

ASHRAE

Overhead Radiant Systems



- Radiant Panels form clouds above the occupied spaces
- All heating and cooling in these spaces are provided by the panels.
- Ventilation is cool/neutral temperature air delivered directly to the space and not directly responsible for temperature control within the zone.

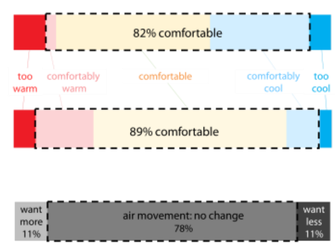
ASHRAE

Supplemental Ceiling Fans

Before fan install
Indoor temperature ~ 72 °F
(n = 29)

After fan install
and air conditioning failure
Indoor temperature ~ 80 °F
(n = 28)

Air speeds
~40 – 150 fpm



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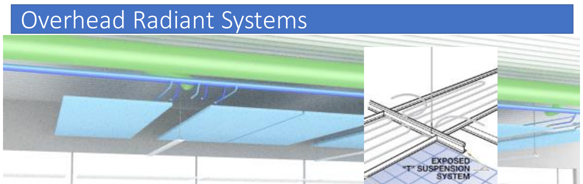
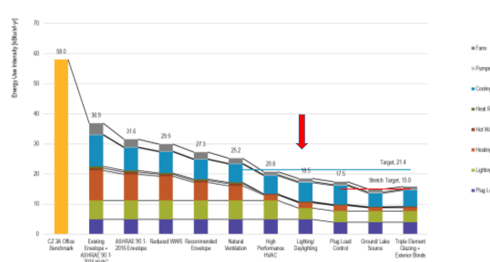
Overhead Radiant Systems



- Areas between the clouds are open to structure above and provide access for other trades mounted in the ceiling plane. No direct drilling.
- Rigid piping in exposed areas for aesthetic reasons. Insulation on supply piping only.
- Panel support system is required.
- Duct distribution is only for ventilation quantities only (about 0.15 cfm/sf)
- Air distribution is constant volume and provided by Fabric Duct, reducing diffuser count and duct branches.
- Ceiling fans throughout the space increase air mixing and induce capacity.

Overhead Radiant Systems



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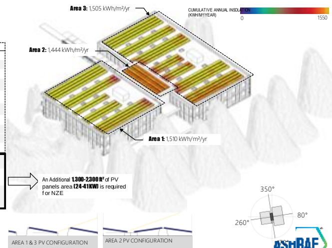
Rooftop PV Generation Potential: HVAC Option 2 (Hydronic Systems)

ROOFTOP PHOTOVOLTAIC (PV) ENERGY GENERATION POTENTIAL

		Area 1	Area 2	Area 3	Total
Annual Insolation	(kWh/m2)	1510	1444	1505	1,500
Array Tilt (Flat=0)	Degrees	10	8	10	8-10
Array Azimuth (S=180)	Degrees	170	80/260	170	Varies
PV Panel Efficiency	(%)	19.5%	19.5%	19.5%	19.5%
System Losses	(%)	15%	15%	15%	15%
Inverter Losses	(%)	4%	4%	4%	4%
PV Panel Area	(m2)	378	116	594	1,088
Roof Utilization	(%)	38%	60%	39%	40%
# 405W Panels*	#	183	54	295	532
DC System Size	(kW)	74	22	119	215
Annual Energy Generation Potential	(kWh/yr)	91,000	27,000	142,000	**260,000**
Annual EUI Offset (EUI**)	(kBtu/ft2/yr)	4.57	1.35	7.13	**13.0**
Annual Energy Generation Per Panel Area	(kWh/m²/yr)	241	233	239	**239**

* Based on LG NeON 2 (405W) Dimensions and Specifications
** Floor area used for EUI calculation: 68,000 ft2

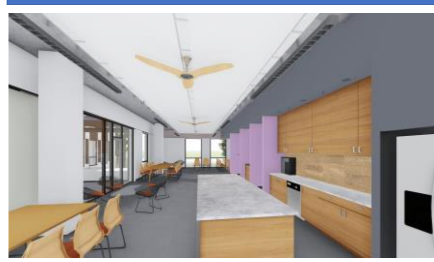


Interior Lobby

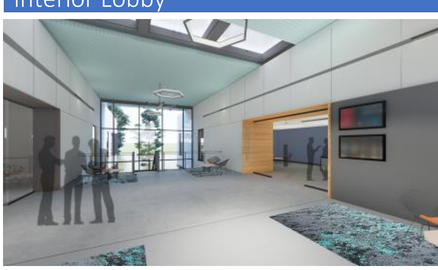
Semi-Final Design

REFLECTIVE SILVER

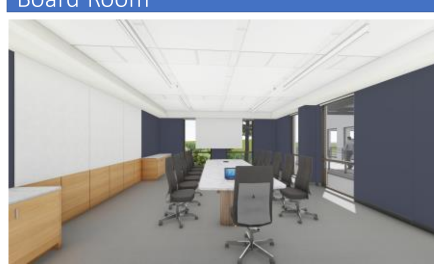
Staff Common Room



Interior Lobby



Board Room



LESSONS LEARNED (SO FAR)

- Atlanta Construction Market
- Building Infrastructure Costs
  - ✓Plumbing System Replacement
  - ✓Electrical System Replacement
  - ✓Fire Protection System Replacement
- Envelope Improvement Scope to meet EUI

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QUESTIONS?

GINGER SCOGGINS
gscoggins@engineereddesigns.com

www.ashrae.org/newhq

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