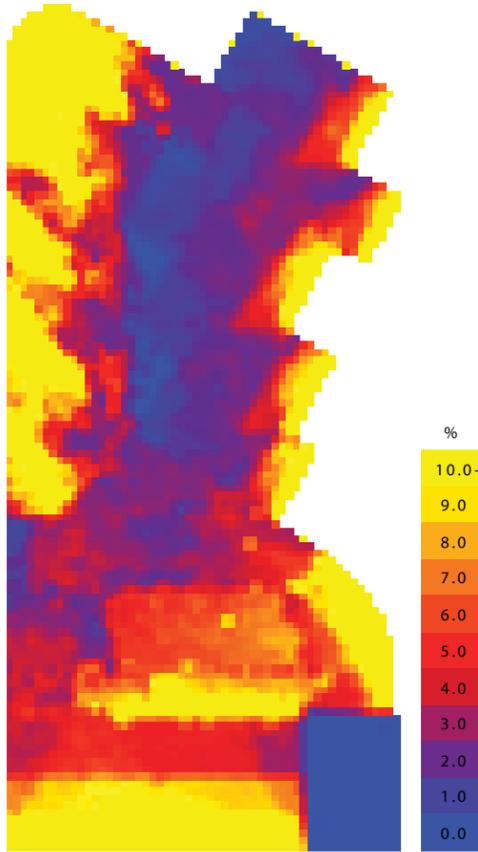
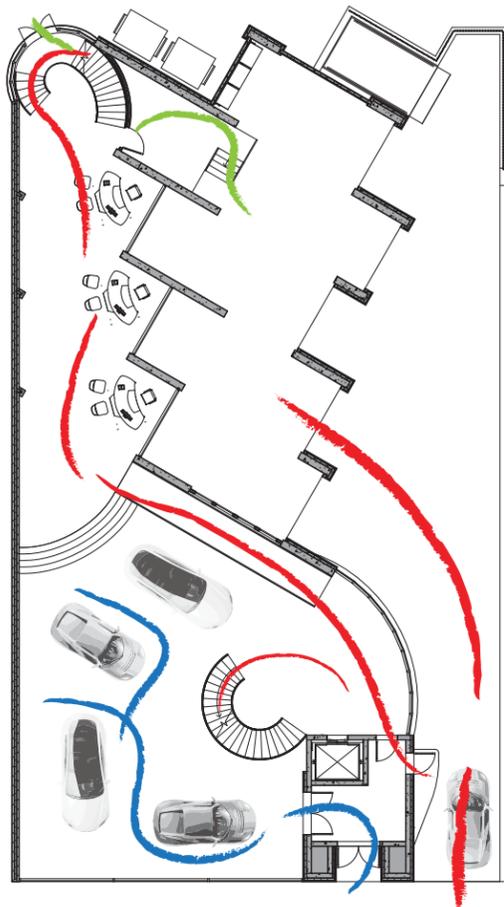


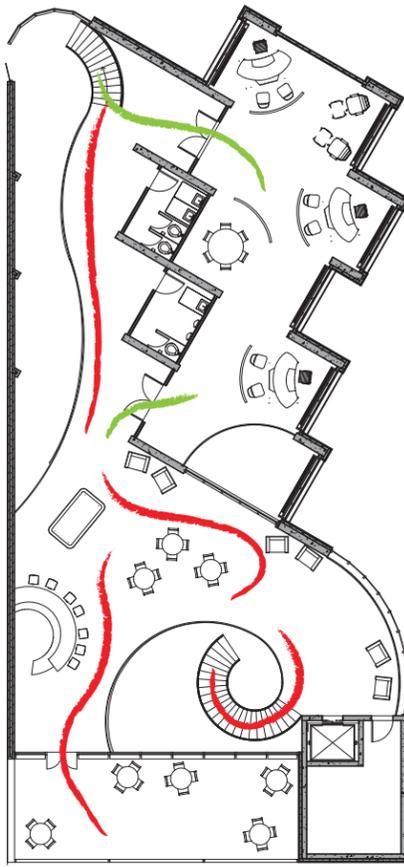
INTERIOR DAYLIGHTING  
CURRENT SCHEME



LOWER LEVEL



UPPER LEVEL



STORMWATER CALCULATIONS

Monthly Averages

Jan	3.21
Feb	2.63
Mar	3.60
Apr	2.77
May	3.82
June	3.13
July	3.66
Aug	3.94
Sep	3.79
Oct	3.22
Nov	3.02
Dec	3.05

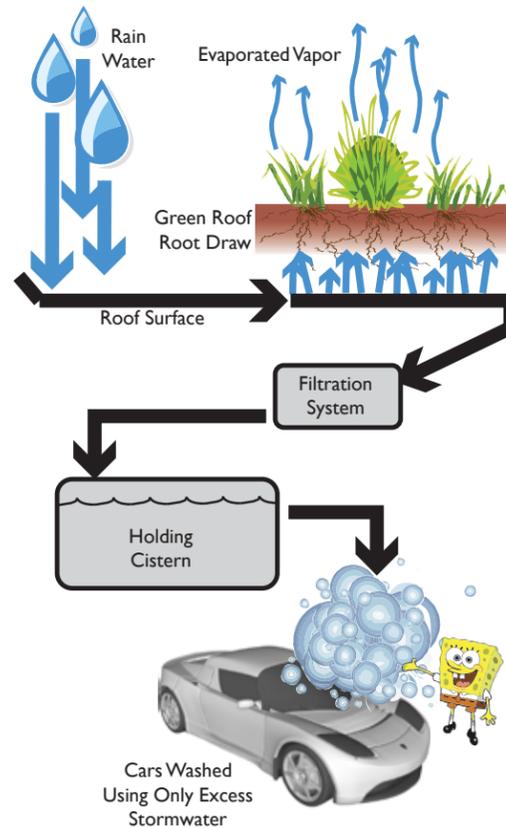
Avg 3.34

Roof Area  
4,400 sq ft  
4,400 \* 144 = 633,600 sq in

Average Monthly Total  
633,600 sq in x 3.34 in  
= 2,116,224 cubic inches  
= 1,225 cubic feet  
= 9,161 gallons  
= 34.68 cubic meters  
= 34,679 liters

9,161 gal / 40 (gal/wash) = 229 washes  
229 / 30 days = 7 washes per day

Seven Carwashes Everyday!



PHOTOVOLTAIC CALCULATIONS

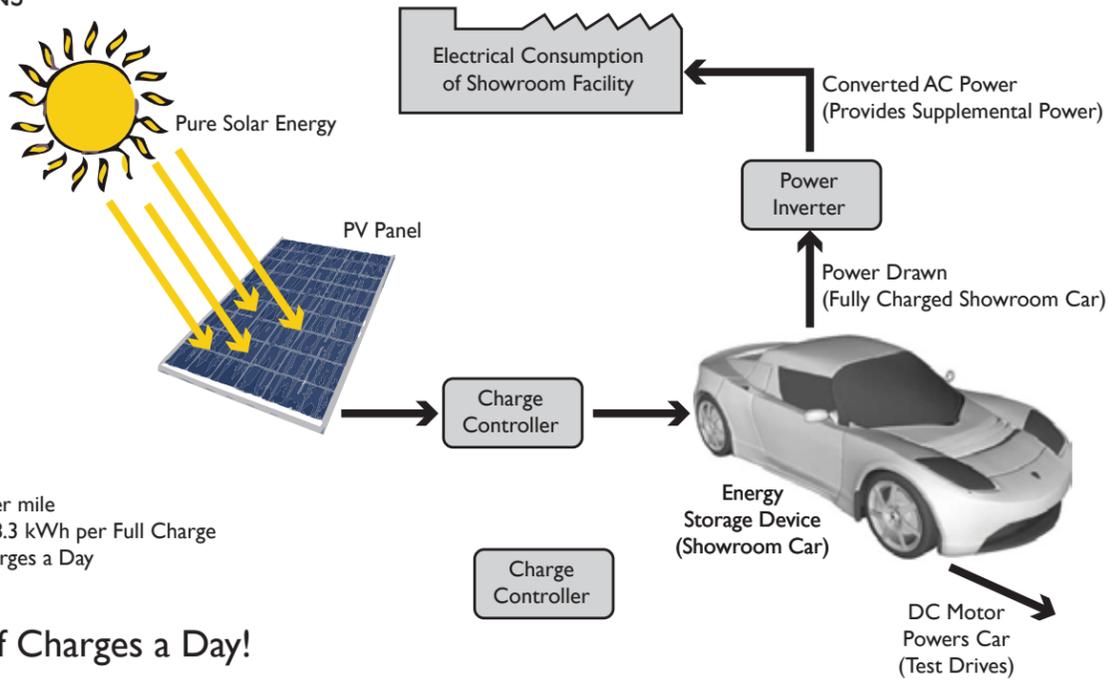
AVERAGE SURFACE INSOLATION  
4 kWh / sq m (Daily)

PANEL EFFICIENCY  
x 27% (Surface to Usable DC)

PANEL AREA  
6' x 40' x 4 bays = 960 sq ft  
6' x 24' x 1 bay = 144 sq ft  
(convert to m) = 102.5 sq m

POWER GENERATION  
4 kWh \* .27 = 1.08 kWh per sq m  
1.08 \* 102.5 = 110.7 kWh per day

POWER CONSUMPTION  
Car Efficiency (Plug to Wheel) = .28 kWh per mile  
Car Consumption = .28 \* 244 mi range = 68.3 kWh per Full Charge  
Cars per Day = 110.7 / 68.3 = 1.62 Car Charges a Day



More than One and a Half Charges a Day!

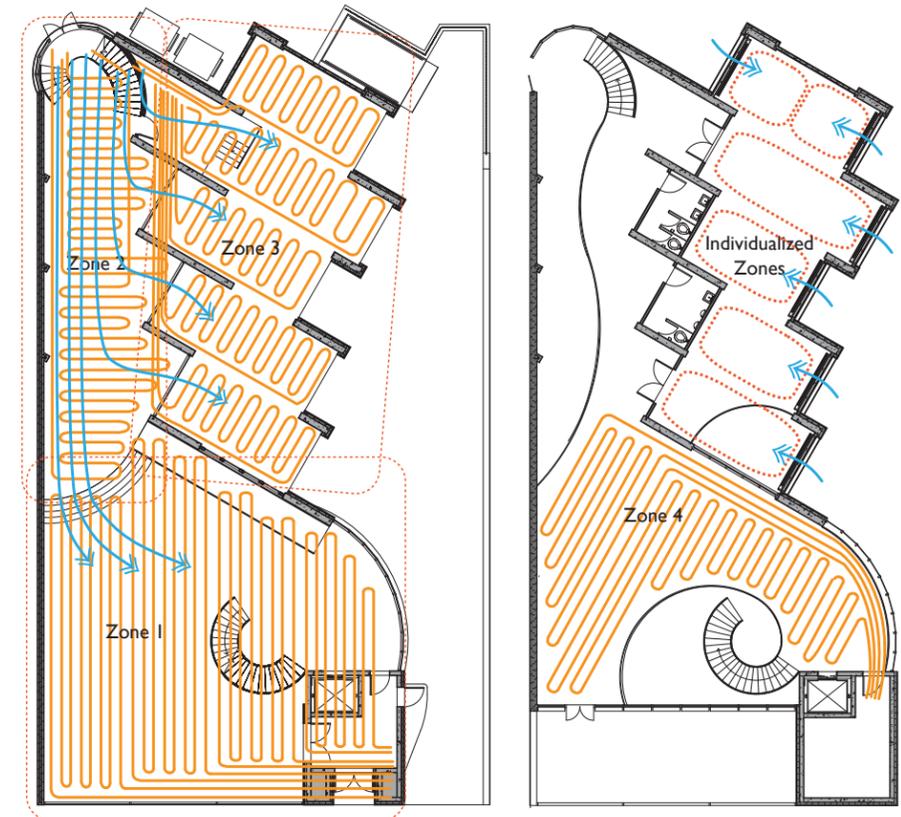
TESLA MOTORS  
ELECTRIC CAR SHOWROOM

WAGSTAFF STUDIO

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A CLEAN START    BUILT AROUND THE DRIVER    COMMITTED TO ELECTRIC    SPARKING THE EVOLUTION



# SITE ANALYSIS & BUILDING MASSING

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## SITE ANALYSIS

The site is situated on a busy street in the heart of Georgetown, DC. The area is considered a historic district, although historic preservation codes will not apply for this project.

The foundation is assumed to be level across the front (south) facade and rise to a +6 foot elevation connecting to a rear alleyway. The eastern party wall is approximately fifty feet and the western is about thirty-five.

Climate data shows moderate temperate swings through the year with lows in the winter below zero and summer highs above a hundred. Averages range between thirty-five and seventy-nine. The area has roughly four thousand heating degree days and twenty-two hundred cooling degree days.

Additionally, winter winds are primarily strong from the north and summer winds from the south. Average monthly rainfall is consistently between two and three inches.

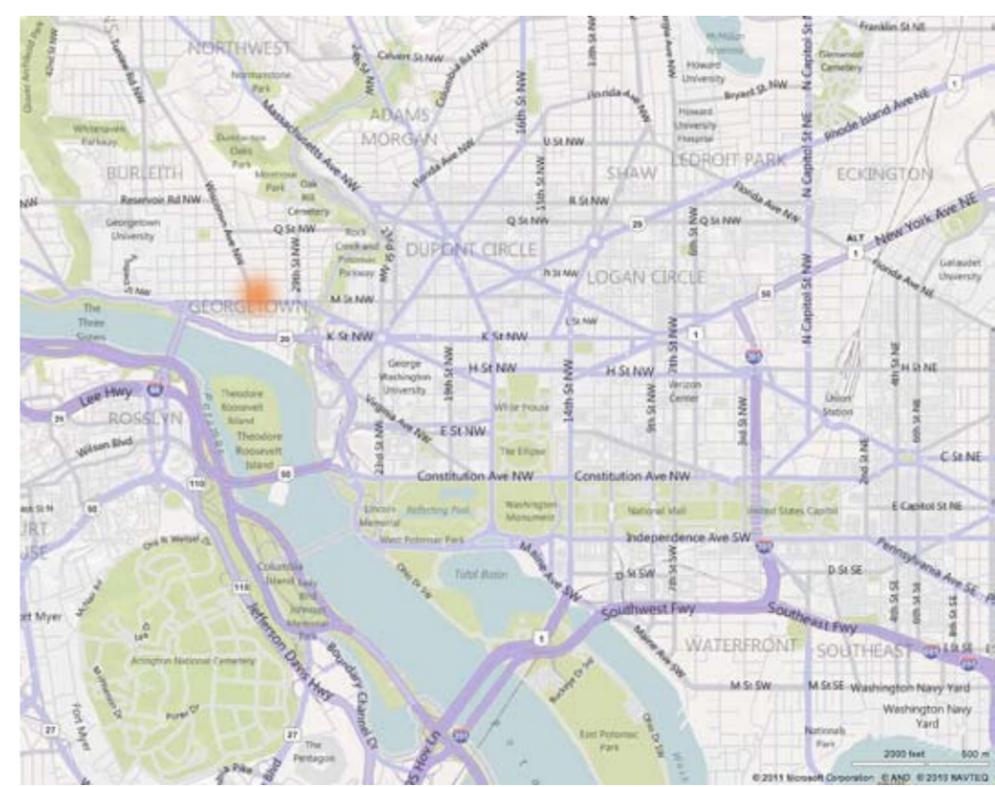
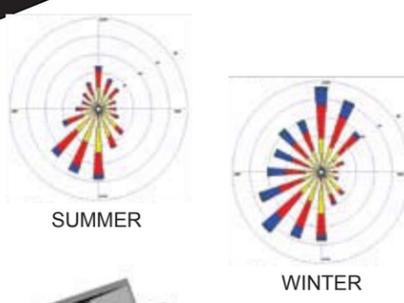
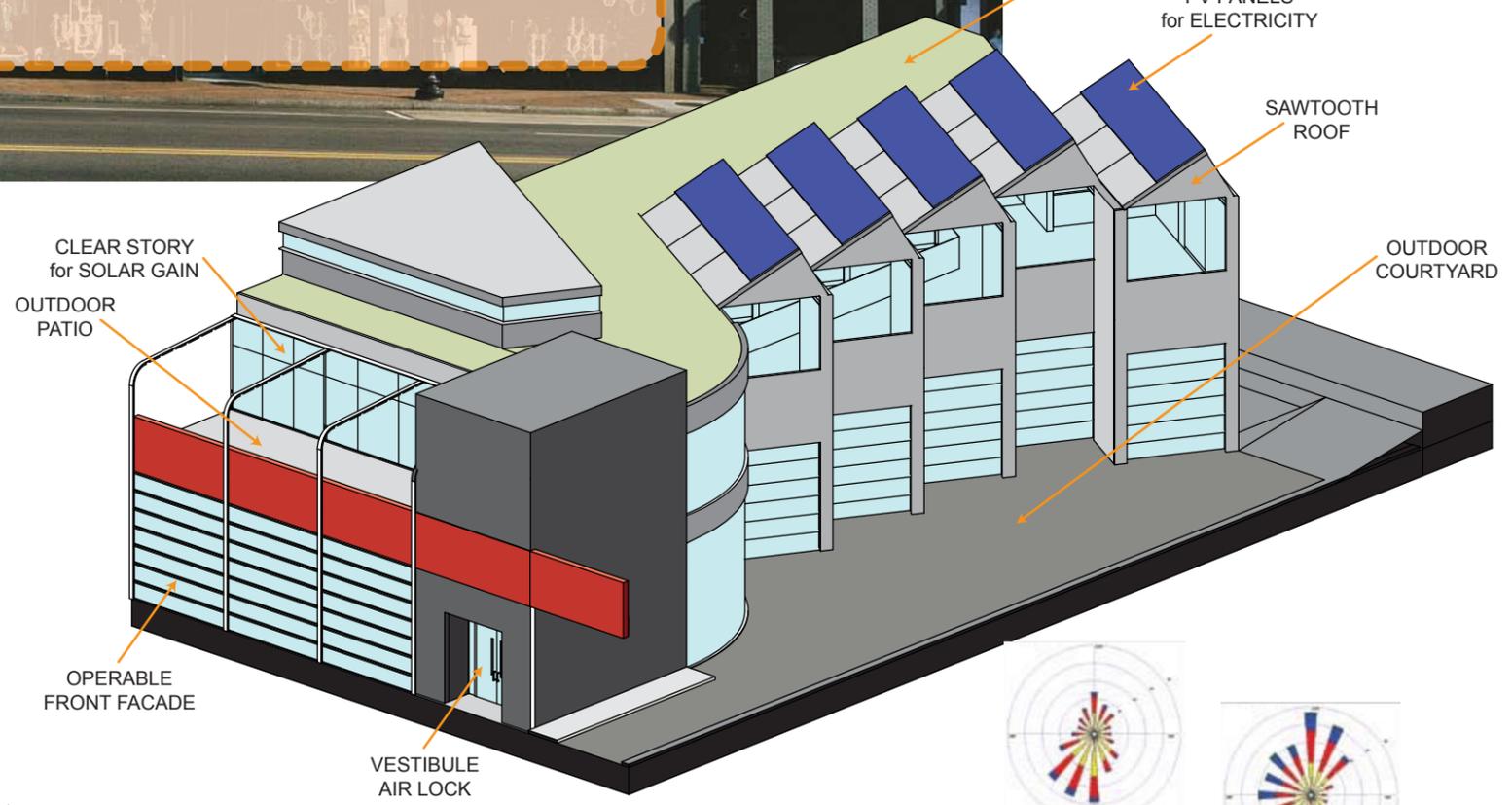
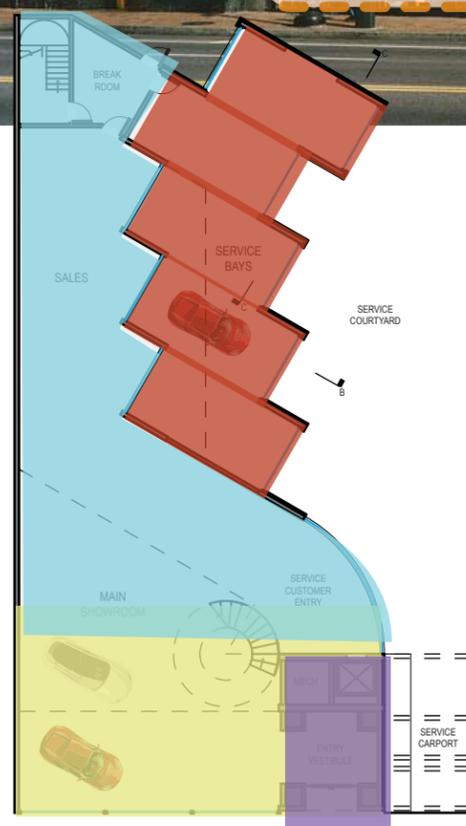
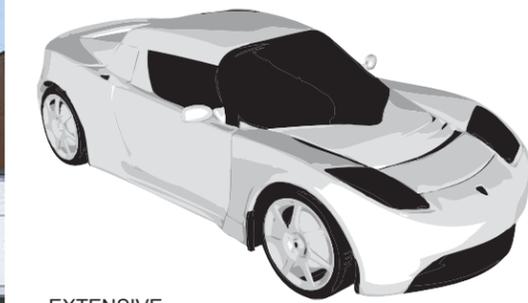
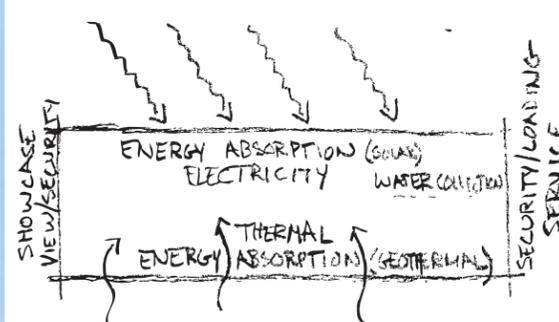
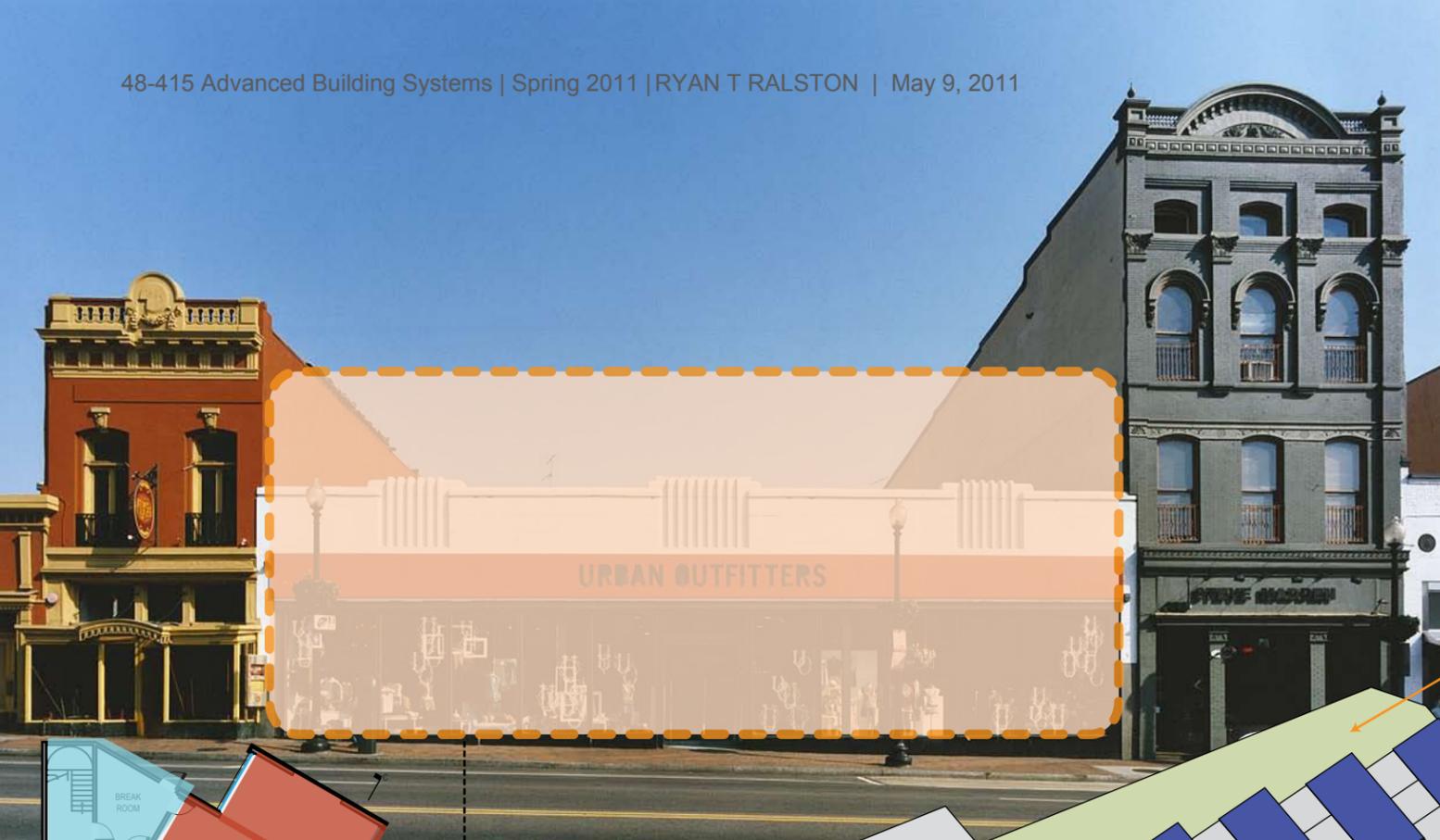
## INITIAL MASSING

General climate analysis revealed opportunities to utilize solar gains in winter months as well as southern wind in summer months. These two natural climate factors would drive the initial massing on the site.

A sawtooth roof form was utilized to take advantage of stack effect ventilation that was encouraged by natural wind flows. Additionally the form allows for capture of northern light through skylights and energy through southern tilted photo voltaic panels.

At the front facade a glazed overhead door allows for sunlight to flood the showroom floor. An additional set back clear story is utilized to gain day lighting deeper into the space. The solar gain through this large area of frontal glass will later be controlled in response to quantitative thermal studies.

Additional massing of the building was modified in response to programmatic features. Such as the curved wall that responds to vehicular movement in the side courtyard space.

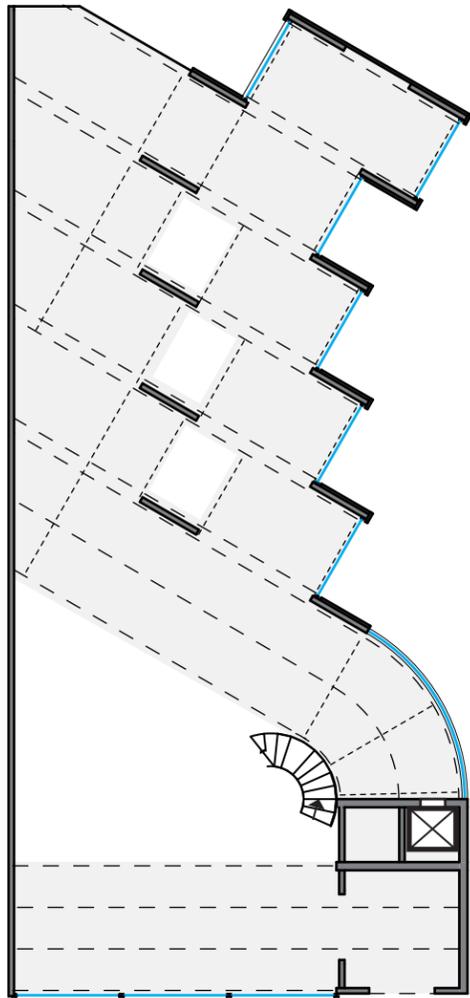


# BUILDING STRUCTURE

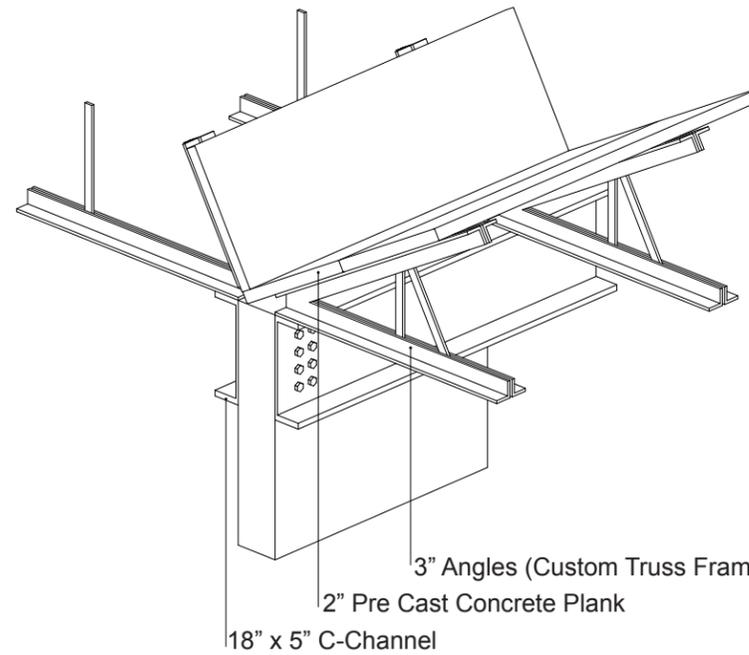
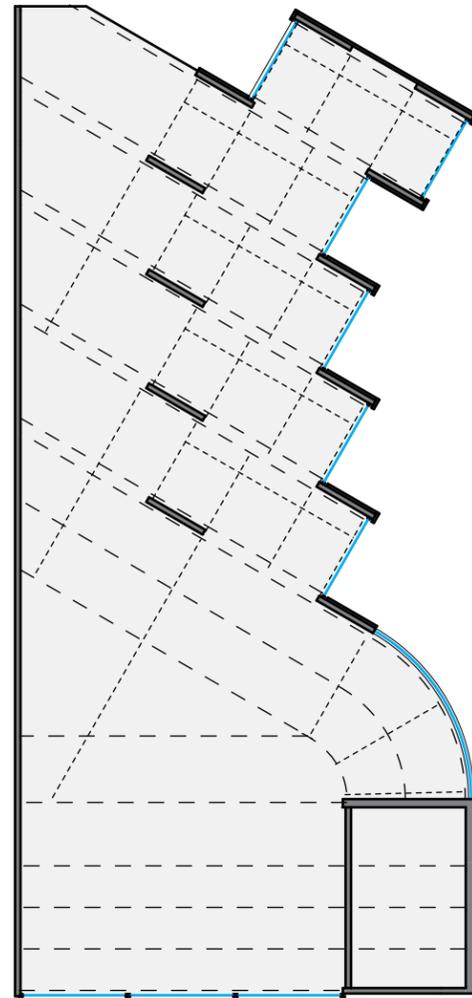
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SECOND FLOOR FRAMING PLAN



ROOF FRAMING PLAN

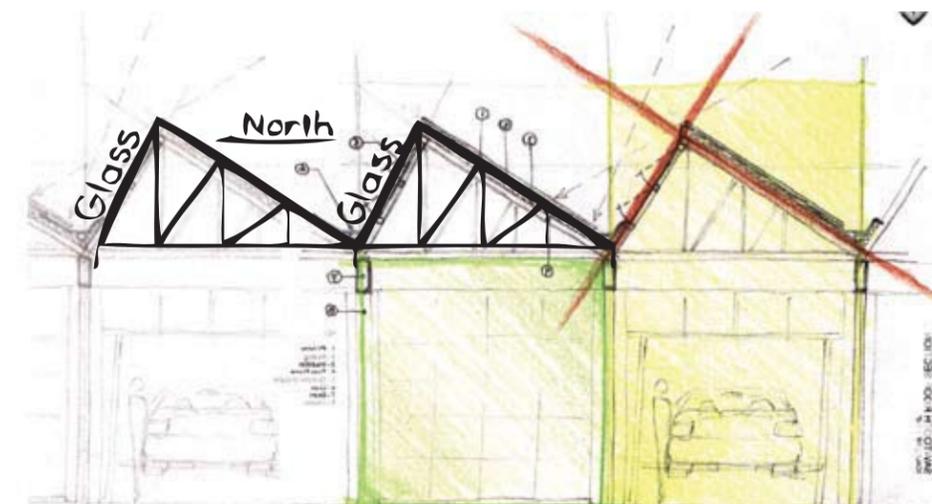
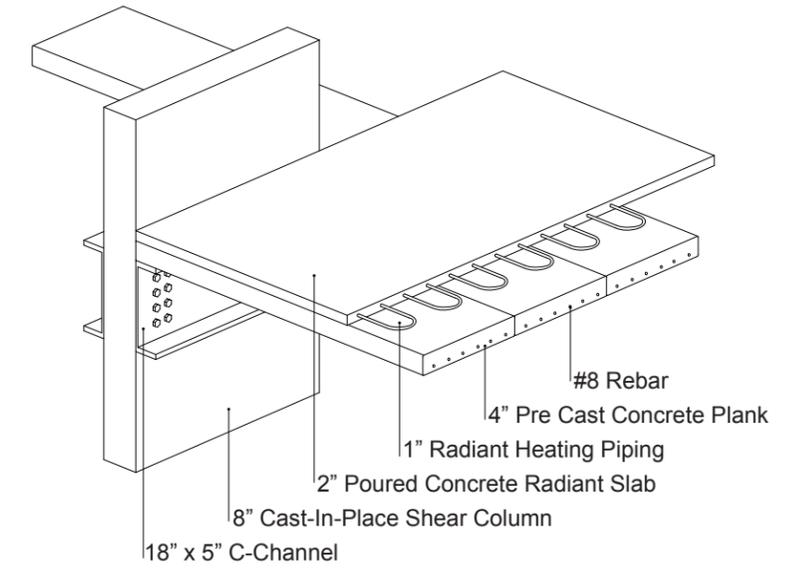
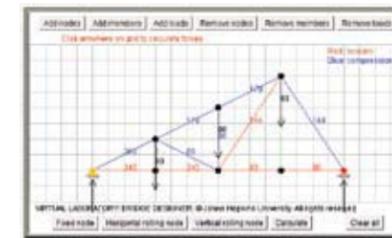
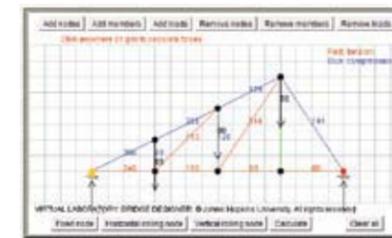
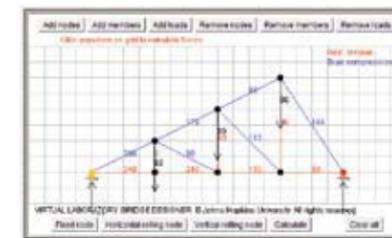
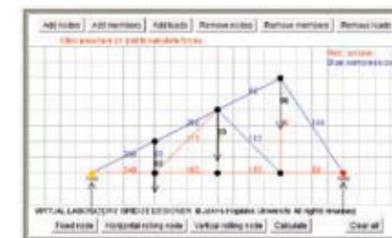
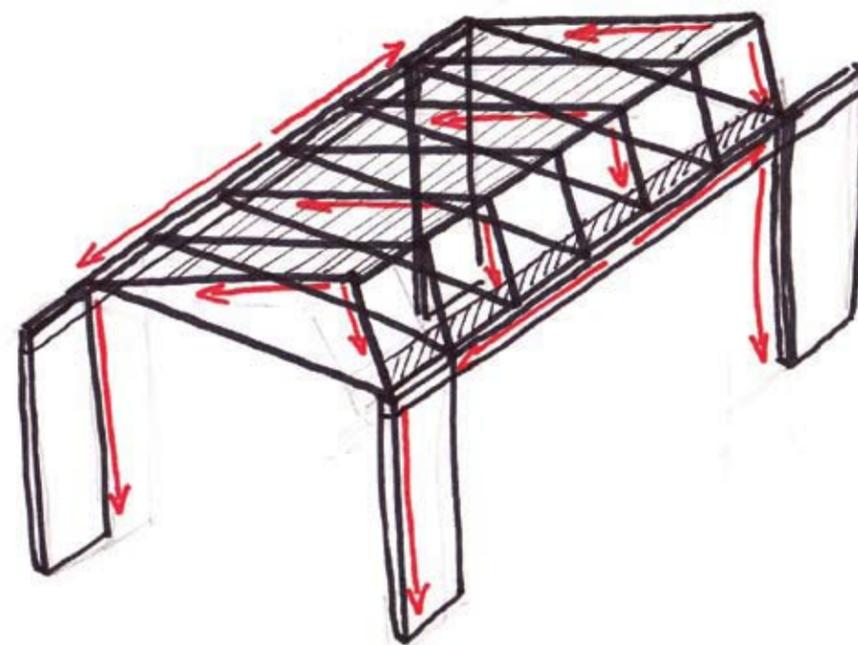
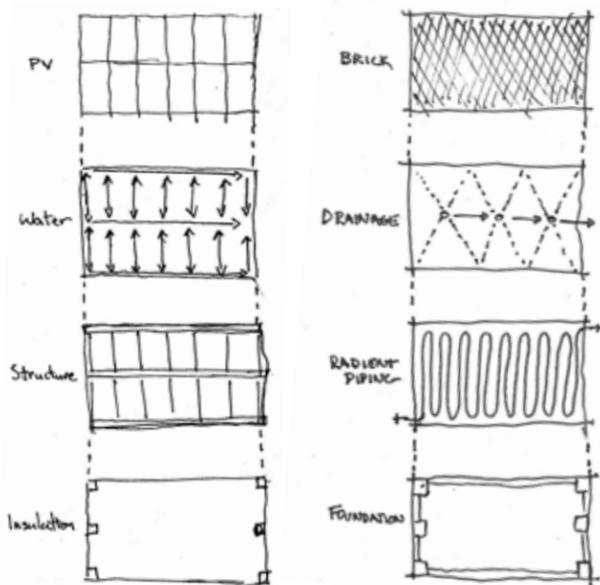


LAYERED COMPONENT CONCEPT

The core concept behind the structuring of the building is layering. This was an early idea that has developed from a simple sandwich of pieces to a more integrated system that incorporates numerous systems into a more compact form. The component system also allows for more in-shop fabrication; speeding deliver of the final product as well as allowing tighter tolerances.

STRUCTURAL SYSTEM

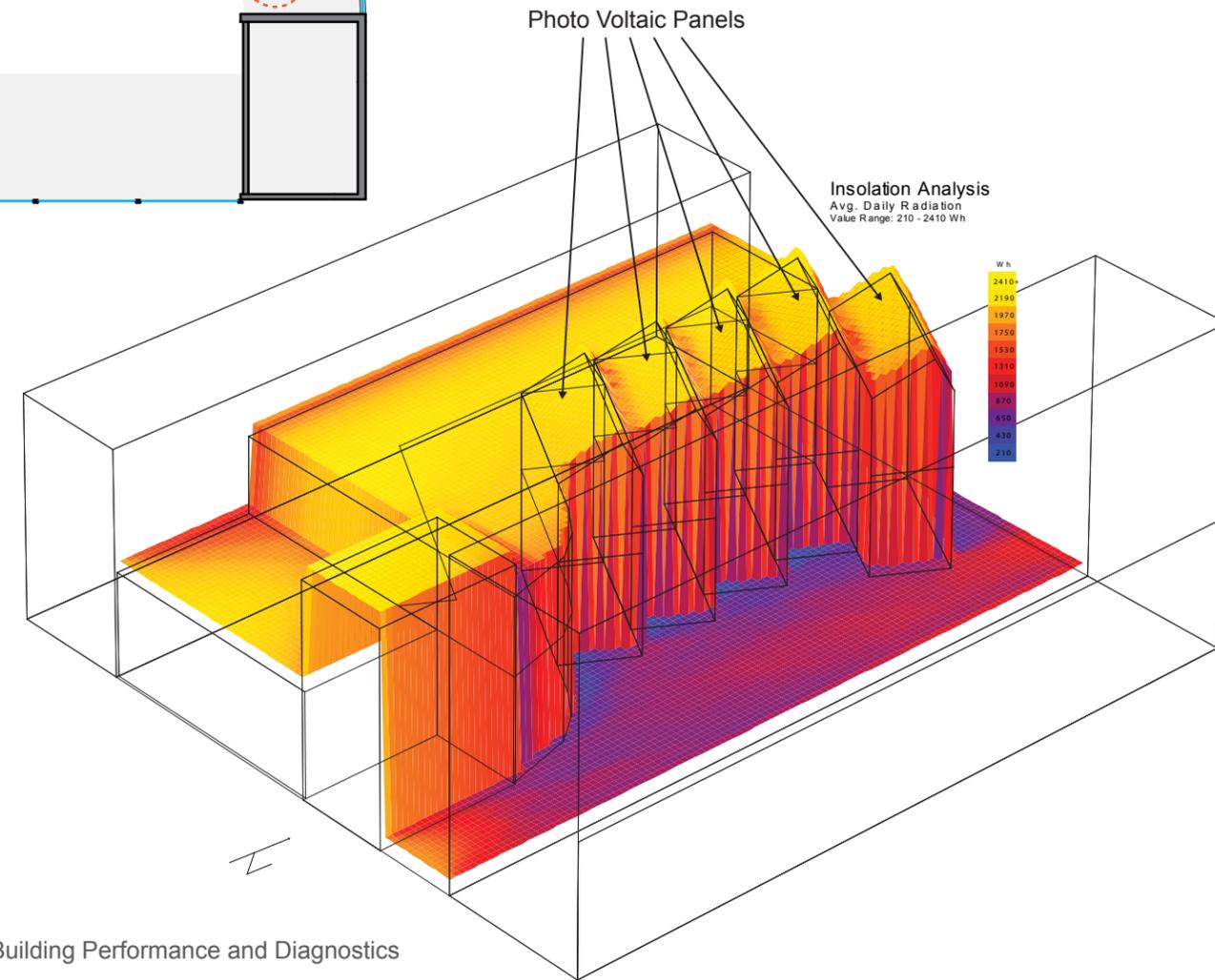
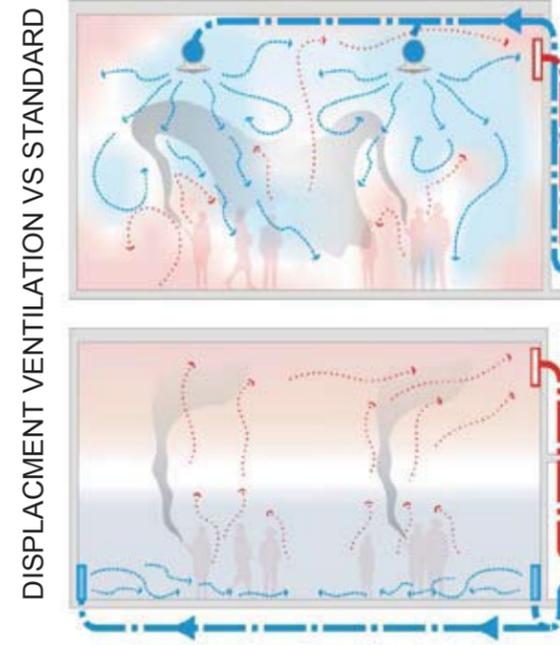
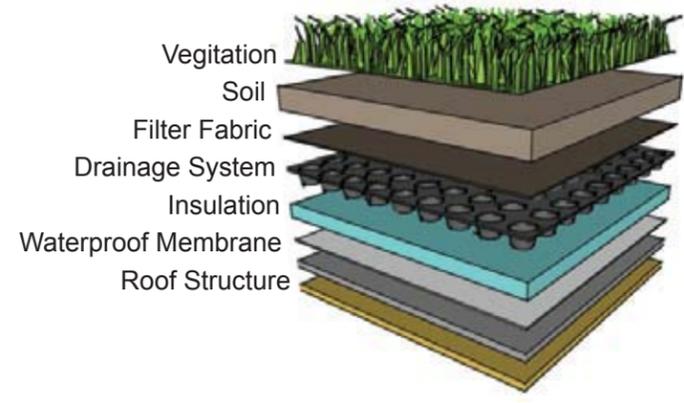
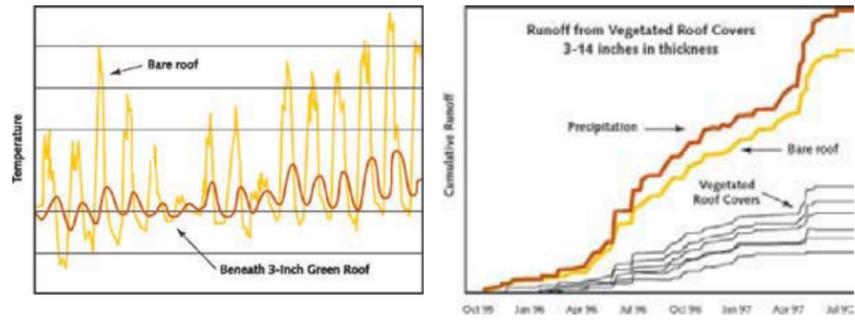
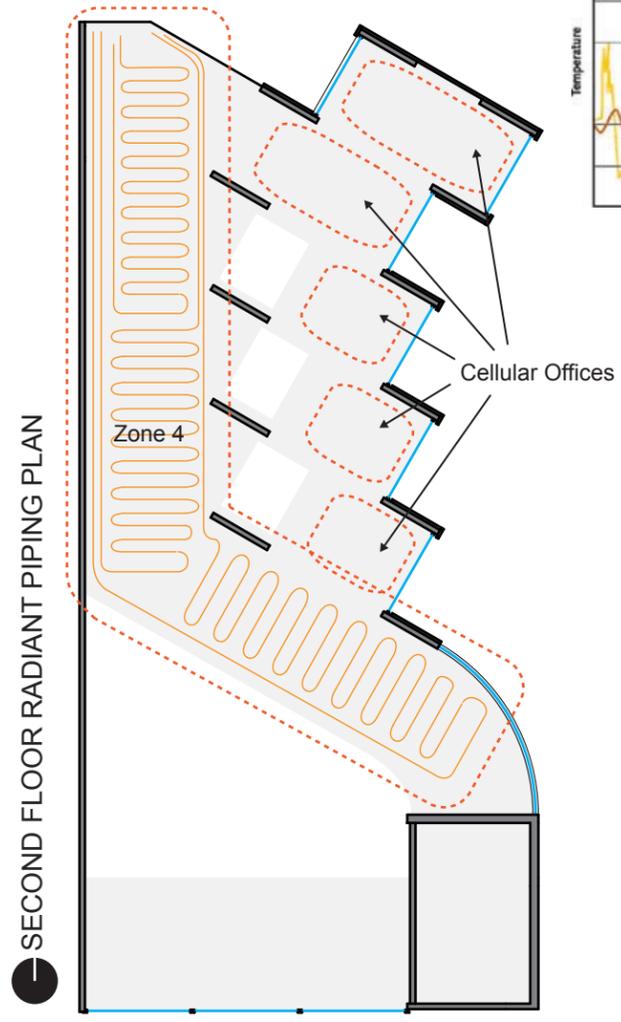
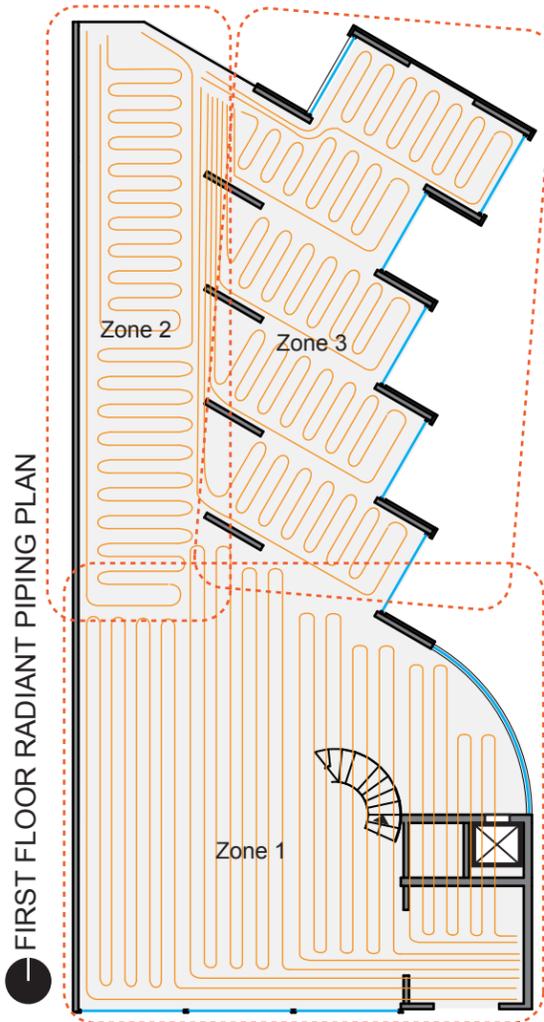
The general structural system is a hybrid of both steel and concrete. Poured in place shear columns provide vertical force resolution as well as mitigation of lateral forces. The floors are precast numerous systems into a more compact form. The component system also allows for more in-shop fabrication; speeding deliver of the final product as well as allowing tighter tolerances. The roofs and patio are handed in similar fashion with the addition of insulation and weather-proofing. The saw-tooth roof form is supported by custom trusses that can be fabricated in shop and delivered to the site for erection.



# MECHANICAL SYSTEMS

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## GOALS

The design goal for the building's mechanical systems is fairly simple. Provide a comfortable environment in the most efficient way possible. While this has remained the primary goal throughout the design process, some efficiency has needed to be compromised at times for various reasons.

## RADIANT FLOORS & VENTILATION

The primary heating system will be a radiant slab that is heated by a ground-source heat pump. This system will also be used to provide a portion of cooling with an additional forced-air cooling system with humidity control to prevent condensation on radiant cooling surfaces. Displacement ventilation will be provided through a raised floor plenum in the service mezzanine. Radiant floors are zoned and multi looped depending on zone size and thermal requirements.

## CELLULAR OFFICE HEAT PUMPS

Packaged terminal air conditioning units are located in each office space to provide these spaces with local heating and cooling. These also provide a greater amount of user control over the thermal comfort of individual spaces that are outside the realm of public space. This also allows this secondary system to be shutdown for evening hours when offices will be empty but the larger public spaces may be open for evening events.

## ELECTRICAL & PHOTO VOLTAIC

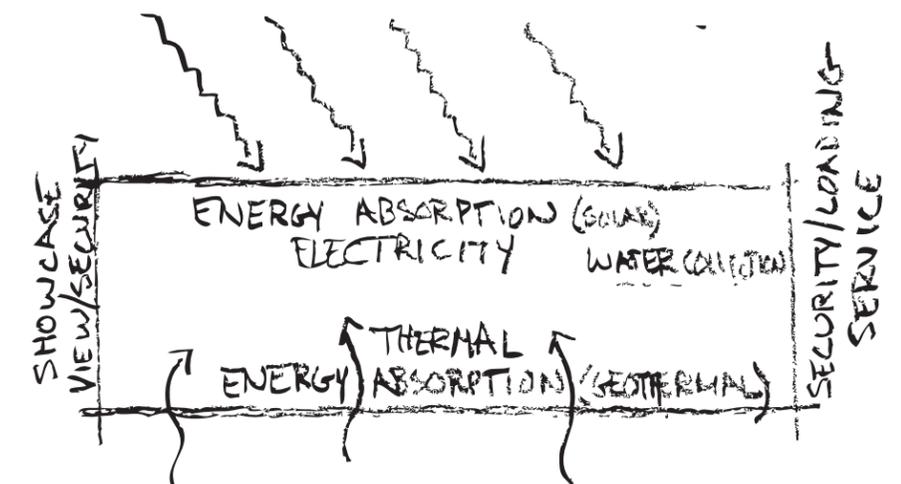
Lighting will be high-efficiency fixtures that are primarily task based. More general lighting will be sparse, relying heavily on natural daylighting from a combination of skylights, clear stories and glass curtain walls. A percentage of the electricity used on site will be provided by roof mounted photo voltaic panels.

## STORMWATER MANAGEMENT

The roof system is designed to manage stormwater with a combination extensive greenroof and grey water cistern. Sawtooth roofs will shed water onto a large green roof area that will absorb a percentage of stormwater while also providing a first stage of biofiltering for excess water that will be collected in an interior cistern. This water will be treated and used the buildings grey water needs.

## SUPPLEMENTAL SYSTEMS

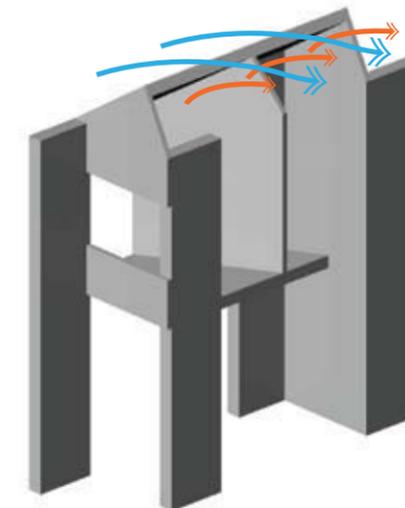
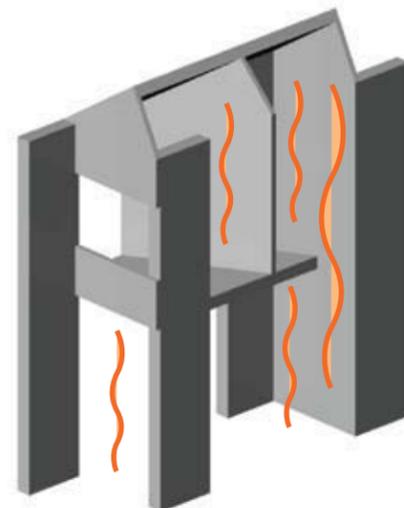
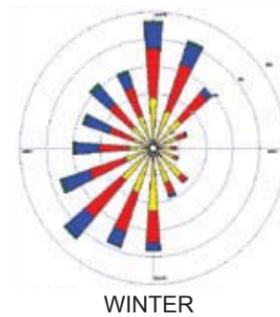
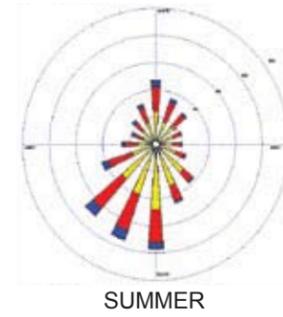
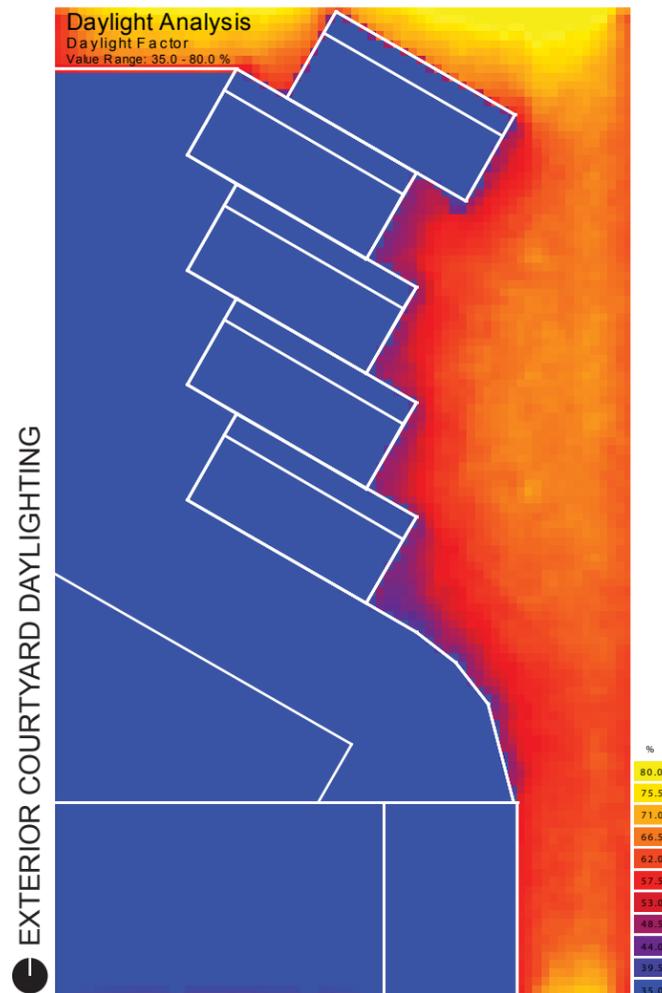
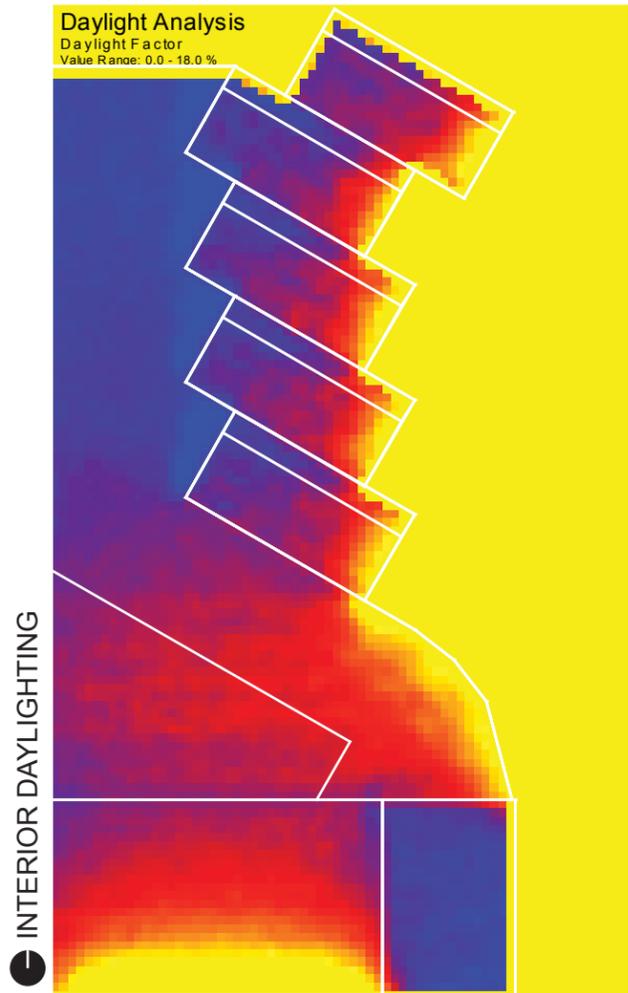
In addition to the primary systems a few asupplementing systems help the entire building perform effectively. Air curtains in the mechanic's service bays help contain the interior environment when garage doors are open. Indicator lights are installed in offices to notify occupants when passive methods should be utilized. A central computer system controls these indicator lights as well as the relation of radiant surfaces and humidity control.



# NATURAL SYSTEMS

WAGSTAFF STUDIO

3111 M ST NW, GEORGETOWN, D.C.



## GOALS

A primary goal since the project's start has been the utilization of natural systems. The hope is that by utilizing daylight and natural ventilation the overall energy consumption of the building will decrease by a large amount. Additionally naturally lit and ventilated spaces will become more pleasing environment for building occupants.

## VENTILATION

Natural ventilation will be used during periods in the year that the exterior climate allows. Indicator lights on operable windows are controlled by a central computer that monitors the interior and exterior conditions. The lights notify occupants when it would be advisable to rely on natural sources for climate control. Primary office ventilation relies on a stack effect of the sawtooth roof form as well as cross ventilation from wall mounted windows. The operable front facade allows the entire storefront to become an open-air space that is completely naturally conditioned.

## OPERABLE STOREFRONT

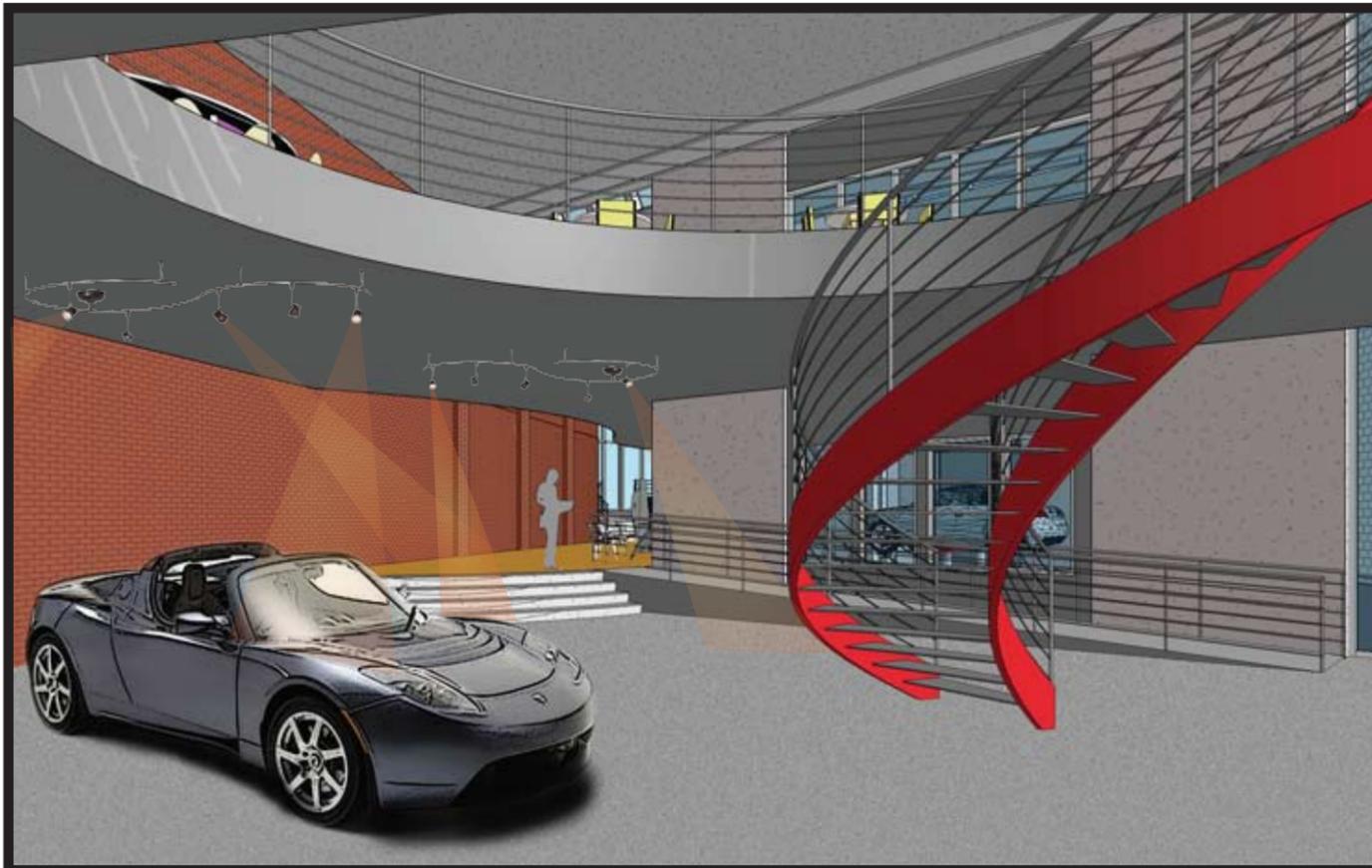
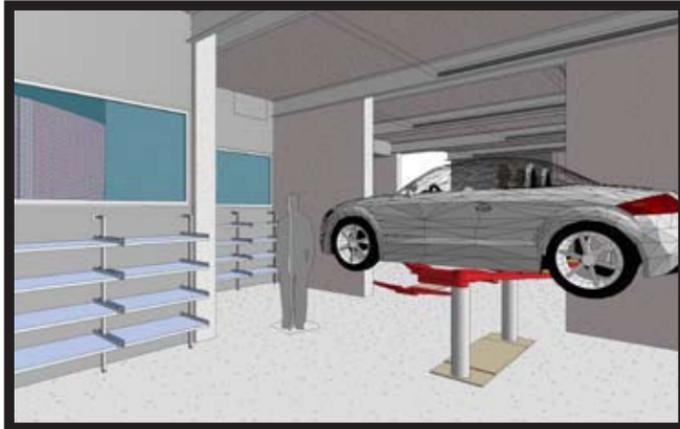
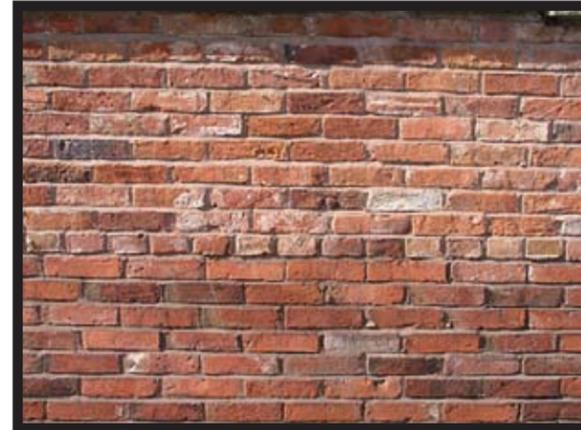
The operable storefront serves two purposes. When closed, it is the primary enclosure for the building's front facade while still allowing unobstructed views. When open, the storefront becomes an extension of the outdoor sidewalk. The tracked glass panels rise to the second level to provide covering for the outdoor patio on the second level.

## PANELIZED ENCLOSURE

The majority of the buildings enclosure system is panel based. Concrete structural elements are clad by panels of insulation and stone veneer or metal plate, depending on the general overarching architectural composition. The panel based system allows for higher fabrication tolerances and cleaner finishes. On site construction efficiency will also be increased with this system.

## DAYLIGHTING

Natural daylight has been a priority for nearly all spaces in this design. The front facade is set back on the second level to help bring daylight deeper into the showroom space. Office windows provide sufficient direct light along with diffuse northern light from north facing skylights. These skylights also feed double height light wells to bring light the the back side of service bays. The design is currently being modified to allow the deeper spaces to gain access to the light well, as they are insufficiently daylit as seen in the ecotect studies to the left. Additionally the current series of iterations will work with some controlling devices on the southern facade to help control the solar gains. These will include louvers integrated into mullions on the second level windows and an angling of the first floor storefront in order to allow it to become self shading. The angle will also help reduce glare on the glass and increase it's transparency.



# INTERIOR SYSTEMS

WAGSTAFF STUDIO

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## INTERIOR MATERIALS

The material palette was chosen in response to aesthetic quality in addition to structural capability, thermal consideration and light reflective quality. Primary exposed materials include precast concrete, brick, reclaimed hardwood and red powder coated steel. The first two of those four are direct expressions of the material as a component of the structural system. The brick is utilized in select locations to maintain a local feel to the space. The hardwood provides a differentiating surface to mark transition between public and private spaces and gives a 'warmer' and less industrial feel. The red steel was chosen as an accent that also tied back into the branding of the building. Additional red carpeting on the upper level helps this color branding of the buildings spaces.

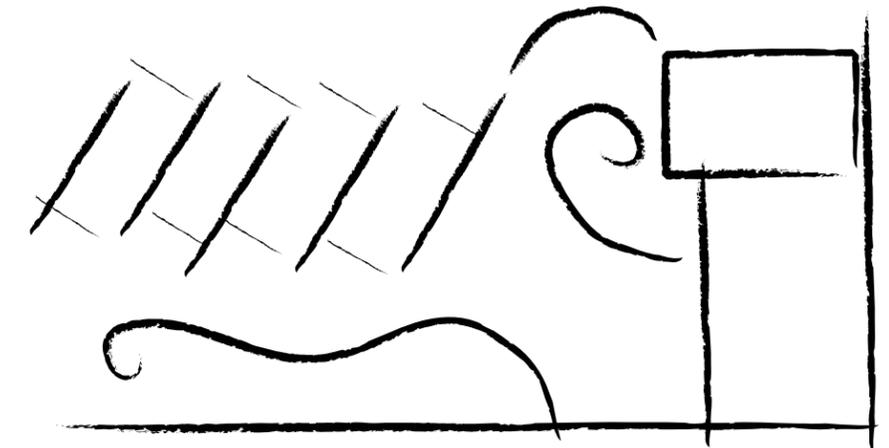
## INTERIOR LIGHTING

The primary light source during daytime hours will be from natural daylight brought into the building by both side mounted windows as well as northern facing skylights. Extensive studies have been conducted throughout the design process to insure sufficient day lighting in the interior spaces. As a supplement to this day lighting, more focused task lighting is utilized to ensure proper light levels when nature does not provide sufficient light. Artificial lighting also allows for accenting of products in the showroom spaces, as demonstrated in the lower left rendering.

The majority of lighting that has been specified is low energy use LED with dimmable controls, as well as occupancy sensors. The goal is to reduce wasted resources and light the entire showroom with energy harvested through the site's solar collection array. The mounting system is based off a highly modifiable monorail track system. The system allows for high levels of customizability for various showroom and office space layouts.

## LAYOUT OF SPACES

The design of interior spaces was laid out in such a way that modification of space is an easy process that has very little interference with primary building components. Open floor plans with small mobile partitions allow the office space to adapt to changing needs. The open showroom space also allows for changing layouts that hold the interest of new customers. The addition of curved special elements helps free the organization from strict gridded layout schemes that quickly become trite and boring. Furniture is selected as individual pieces that work together within a larger system of composition while also providing a beauty of design by themselves. The effortless composition of curvilinear objects within an architecture is dependant upon the smooth integration of the numerous architectural geometry systems. The goal is to have an architecture that suggests spacial organization without forcing it.



Human Performance Criteria	Systems Integration									
	Site				Structure	Building Enclosure	Interior (include Lighting here)	Mechanical (Ventilation, Heating, Cooling, Wiring & Cabling)	Energy Generation Systems	Water Systems
	Siting	Massing	Climate	Orientation						
<b>1a. Thermal Performance - Heat</b> -Air Temperature -Radiant temperature -Humidity -Air Speed <b>Occupancy Factors and Controls</b>	for Siting	Large Glass facade on South direct gain	primary heating relies on solar gain	south facade allows for direct gain in winter	Integrated Radiant	R-40 Walls R-60 Roof Louvers control heat gain	N/A	Zoned Radiant Heat Individualized Offices Displacement Ventilation	Closed Loop Ground Source Heat Pump	radiant loop
<b>1b. Thermal Performance - Cool</b> -Air Temperature -Radiant temperature -Humidity -Air Speed <b>Occupancy Factors and Controls</b>		Sawtooth roof provide heat venting	windings moderate spring fall weather to advantage	souther bays control heat gain in summer	Integrated Radiant	R-40 Walls R-60 Roof Operable Windows	N/A	Zoned Radiant Cool Individualized Offices Moisture Control System Displacement Ventilation	Closed Loop Ground Source Heat Pump	radiant loop + dehumidification
<b>3. Spatial Performance</b> -Individual space layout -Aggregate space layout -Conveniences and Services -Amenities <b>Occupancy Factors and Controls</b>	Allow	layout bused off car movement	N/A	open east to outdoor space	Structure defines spacing & units for efficiency	lots of glass to open space	open spaces with double height to increase visual connections	Warmed floors make the space comfort close to occupants.	N/A	N/A
<b>3. Visual Performance</b> -Ambient & Task Light Levels -Contrast and Brightness Ratios -Color Rendition -View/Visual Information <b>Occupancy Factors and Controls</b>	Doesn't	Offset second level south facade gains light	Natural Light Providing Daylighting	Open court on east brings in more light	Accented Red steel Beams inline w/ Brand Image	Lowered south face to reduce glare	Skylights Task Light Louvers to reduce glare	N/A	N/A	N/A
<b>4. Acoustic Performance</b> -Sound Source -Sound Path -Sound Receiver <b>Occupancy Factors and Controls</b>	Urban Siting	Auto Bays/ Office Public Separated by Solid Walls	N/A	N/A	Concrete Massing helps absorb sound	N/A	Panels in Auto Bays	Quiet Radiant Systems Heat Pump Units + Displacement Vent also quiet	Quiet Radiant System Individual Office Units provide bg sound	N/A
<b>5. Indoor Air Quality Performance</b> -Fresh Air -Fresh Air Movement & Distribution -Mass Pollutants -Energy Pollutants <b>Occupancy Factors and Controls</b>	Tight Urban Siting	Sawtooth Roof Allow Fresh Air Ventilation	Natural Air Ventilation along with purified air	N/A	N/A	Building can be sealed w/ operable windows	Displacement Ventilation (In Low Return High)	Make Up Air System for Showrooms Offices Individualized	Displacement Ventilation uses less energy to move less required air.	dehumidification (key to radiant cooling system)
<b>6. Building Integrity</b> -Loads -Moisture -Temperature -Air Movement -Radiation & Light -Security: fire, natural or human-made disaster, chem or bio attack	Tight	Individual Program Units that can be secured individually	N/A	Open court can be locked from public right of ways for security purposes.	Primary structures of concrete + steel... reduced susceptibility to fire	Build can be sealed completely w/ ventilable for harsh weather	Occupant sensors Greenlight Windows Task Lights	Moisture Control Sys	N/A	Roof System helps collect water while also sealing water from interiors.

Building Performance Criteria										
<b>1. Renewable Energy Generation</b> - Method, Placement - Measurement, Verification - Component Systems Placement - Energy Pollutants/Retrofit Method <b>Occupancy Factors and Controls</b>	N/A	PV angled to south to maximize collection	N/A	PV angled south for maximum collection.	Radiant integrated into structure	Roof PV integrated as roof surface.	N/A	Ground Source Heat Pump	Roof Mount PV (PV charges cars, cars power building)	Rainwater Collection (PV charges cars, cars power building)
<b>2. Water Cascades</b> - Blackwater Systems - Fresh Water Supply - Grey Water Retention - Component Systems Placement <b>High Performance Products</b>	N/A	N/A	Rainwater calculations made to understand forms.	N/A	Radiant water integrated into structure	N/A	N/A	Rainwater Bed for Carwashing System.	Reuse of Rainwater	Rainwater Collection help support car washing
<b>3. Materiality</b> - Sustainable Features - Unit Dimensioning - Climate Suitability/Adaptability - Performance Metrics	N/A	N/A	N/A	N/A	based off standard unit sizes (pre cast)	highly insulated	palette chosen to increase aesthetic quality sustainability	N/A	N/A	N/A