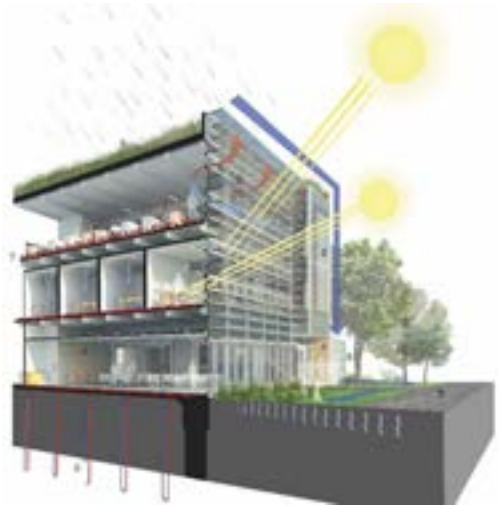
University of Massachusetts Amherst

Department of Architecture



ARCH-DES 601-1 / Graduate Design Studio IV / Spring 2017

Course Number / Course Title: ARCH 601-1 / Graduate Design Studio IV

Number of Credits: 6

Type of Course: Studio *Pre-requisites:* ARCH-DES 600 or by permission of instructor

Meeting Time and Location: Monday / Wednesday 12:45 PM – 3:45 PM / Design Building 480

Professor: Ajla Aksamija, PhD, LEED AP BD+C, CDT

Email address: aaksamija@umass.edu

Office Hours: Wednesday 10:00 AM to 12:00 PM in room 331, Design Building

A. General Information

Studio Guidelines:

The Department of Architecture at UMass Amherst has a vibrant and engaging studio culture that emphasizes mutual respect, professionalism, and shared responsibilities among students, faculty, administrators and practitioners. For more information about the policy, please visit: https://www.umass.edu/architecture/content/umass-amherst-studio-culture-policy.

Please read this document and be familiar with the guidelines.

B. Course Description

What is this course about?

This graduate design studio is intended to develop students' skills in designing high-performance, carbon-neutral, resilient buildings. The course is structured to allow students to incorporate sustainable design strategies, and to investigate methods for improving energy efficiency and meeting net-zero energy goals. The studio will focus on a redevelopment project in East Boston, Massachusetts, where students will be designing a new Resiliency Research and Education Center. This mixed-use building is envisioned as the region's dedicated multidisciplinary research center for resilience and sustainability issues, as well as education and community outreach activities. The studio has been selected to participate in the Architecture2030 Challenge Curriculum Project, therefore, we will be collaborating with this organization throughout the semester. The students will learn about the advances in technology, sustainable and high-performance building systems, building simulations and energy modeling, high-performance building envelopes, as well as novel ways to represent their ideas and design.

Students will address these following questions:

- What are the appropriate design strategies for high-performance mixed-use buildings?
- How to integrate passive sustainable design strategies and advanced building technologies/renewable energy systems to design carbon-neutral buildings?
- What are the appropriate design strategies for revitalization of urban environments?

Early weeks of the studio will focus on site analysis and programming. Students will be expected to develop concepts and visual representations of their designs, and proceed with schematic design during the middle part of the semester. Mid-term review will be scheduled to provide feedback and direction for next stages of the design. The last part of the semester will focus on design development, energy modeling, and preparation of the documentation for final review.

C. Course Objectives

What can I expect to learn by studying this course?

- Research methodologies
- Site analysis
- The role of precedents and case studies
- Programming
- Design of mixed-use buildings (research centers and educational buildings)
- Emerging building technologies
- Advanced building systems and new construction materials
- Digital design skills and software programs, especially focusing on building performance analysis and energy modeling
- Development of design communication skills through written, verbal, 2D and 3D formats.

D. Learning Activities

What opportunities does the course provide for me to learn? What will I be expected to do?

The primary activity of the studio will be to examine sustainable and resilient design strategies for mixed-use research and education building, as well as methods for urban revitalization. There will be opportunities for individual work and for team collaborations. Studio time will be used to share research and analysis, and to work with instructor and peers to continue and advance individual and team designs. Work will be reviewed and discussed in individual desk critiques, informal pin-up sessions and more formal final reviews in the studio.

Class discussions, readings and written responses will supplement the studio work.

E. Assessment

How will my learning in this course be assessed?

Assessments will be based on the ability to define and creatively resolve design situations and to expand the project into the technical aspects and prepare design documentation. Grades will also be a reflection of the level of intensity of performance, which is expected to be at the professional entry level in the field of architecture**.**

Assignments: Assignments will generally be due every two to three weeks and grades will be given for each assignment. It is important that assignments be handed in on time. Late work will result in deducted points. In the case of outstanding circumstances, please email the instructor before the assignment deadline.

Participation: Participation is required and will be individually noted throughout the semester. Attendance is mandatory except when announced by the instructor. After three (unexcused) absences a letter grade is deducted for each additional absence. Please email the instructor promptly to explain any absences.

Mid-term Review: Mid-term review will be scheduled to discuss design concept, progress and further design steps. Students will be expected to clearly communicate their design concepts via digital or physical models, perspectives, plans, elevations, sections, site plans and other necessary design information.

Final Review: Final review will be scheduled to review design development and documentation. Students will be expected to produce high-quality presentation material describing their designs using multiple digital and analog media. Students will be expected to clearly communicate their designs, and include site analysis, plans, sections, elevations, section, physical and digital models, material selection, and systems.

Grade Distribution:

- Assignments: 20%

- Participation: 10%
- Mid-term Review: 20%
- Final Review: 50%.

**Please review the Department of Architecture Student Guidelines for detailed grading criteria.*

F. Instructional Materials

What materials will I need for this course?

Reading

Recommended texts:

Aksamija, *Sustainable Facades: Design Methods for High-Performance Building Envelopes*, John Wiley & Sons (2013).

Bradshaw, *The Building Environment: Active and Passive Control Systems,* 3rd ed., John Wiley & Sons (2006).

Kwok and Grondzik, *The Green Studio Handbook: Environmental Strategies for Schematic Design,* 2nd ed., Elsevier (2011).

Watch and Kliment. *Building Type Basics for Research Laboratories,* 2nd ed., John Wiley & Sons (2008).

Equipment and Materials

Basic drawing, modeling, drafting, model making supplies and equipment are required for this studio. Laptops and other equipment for digital design process are also required.

Please use caution when using and manipulating ALL materials. Read health and safety literature supplied with purchases. Aerosol sprays and solvents may not be used in the studio. Exercise caution when cutting materials with sharp blades!

Department of Architecture Lecture Series

Students are required to attend Department of Architecture Lecture Series. Please visit Department's website for full schedule, dates and times of lectures.

G. Documentation of Work

BE SURE TO DOCUMENT YOUR WORK FOR YOUR PORTFOLIO.

YOUR ORIGINAL PROCESS AND FINAL WORK WILL BE COLLECTED DURING AND AT THE END OF THE SEMESTER AND WILL BE ARCHIVED FOR THE ACCREDITATION PROCESS. IN ADDITION, AT THE END OF THE SEMESTER EACH STUDENT MUST SUBMIT A CD WITH HIGH RESOLUTION DOCUMENTATION OF ALL WORK INCLUDING SCANS OR DIGITAL COPIES OF ALL 2D AND 3D DIGITAL DOCUMENTS. THIS WORK MUST BE NEATLY ORGANIZED AND LABELED ACCORDING TO ASSIGNMENT AND DATE.

H. Course Schedule

Week	Monday	Wednesday
1: 1/23 to 1/27	Introductions Project introduction *Assignment 1: Case studies (sustainable and net-zero energy buildings)*	Desk critiques
2: 1/30 to 2/3	**Assignment 1 due on 1/30**	*Assignment 2: Site analysis, program analysis, code analysis, concept development*
3: 2/6 to 2/10	Desk critiques	Desk critiques
4: 2/13 to 2/17	Desk critiques	Desk critiques
5: 2/20 to 2/24	No class (Presidents' Day Holiday)	**Assignment 2 due on 2/22** *Assignment 3: Schematic design documents (plans, sections, elevations, perspectives for Mid-term Review)*
6: 2/27 to 3/3	Desk critiques and schematic design documentation	Desk critiques and schematic design documentation
7: 3/6 to 3/10	Desk critiques and schematic design documentation	Desk critiques and schematic design documentation
8: 3/13 to 3/17	Spring break	Spring break
9: 3/20 to 3/24	Preparation for Mid-term review	**Mid-term Review** **(Assignment 3 due on 3/22)**
10: 3/27 to 3/31	*Assignment 4: Energy modeling for schematic design/design development*	Desk critiques
11: 4/3 to 4/7	Desk critiques	Desk critiques
12: 4/10 to 4/14	Desk critiques	**Assignment 4 due on 4/12** *Assignment 5: Design development documentation (plans, sections, elevations, perspectives, plans indicating building systems, written documentation, models)*
13: 4/17 to 4/21	No class (Patriot's Day Holiday), class meets on Tuesday, 4/18	Desk critiques and design development
14: 4/24 to 4/28	Desk critiques and design development	Desk critiques and design development
15: 5/1 to 5/5	Preparation for Final review (Last day of classes)	Final review

*schedule subject to change

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Project Overview: Resiliency Research and Education Center, East Boston

The purpose of this project is to investigate sustainable and resilient design strategies for carbon-neutral buildings, as well as revitalization of urban environments. Students will be designing a new, mixed-use building, dedicated to interdisciplinary resiliency and sustainability research, as well as educational and community outreach activities. Students will be taking into account environmentally conscious design, energy-efficiency strategies, passive and active design methods, advanced building systems and renewable energy sources.

The building site is located in East Boston, surrounded by Marginal St. on the north side, Piers Park on the east, Bremen St. on the west and the Boston Main Channel on the south.

Students will be expected to perform site analysis, program and building code analysis at the beginning of the course. Then, a design concept should be developed, taking into account programmatic elements and passive sustainable design strategies.

During the schematic design, students will identify spatial arrangement and organization of the program, structural grid, building envelope, treatment of the site, as well as MEP building systems and their integration with architecture. Students will be expected to produce plans, sections, elevations, physical and digital models, diagrams, and will be expected to use simulation tools. Following feedback and critique from the instructor, students will develop energy model of their design (using eQuest or other energy modeling software). Students will develop two energy models—baseline building and alternative design, which should investigate the effects of energy-efficient design strategies (improved thermal performance of building envelope, daylight strategies, and energy efficient HVAC systems). Based on the results, students will engage in design development, and will also investigate methods for meeting net-zero energy goals through implementation of renewable energy systems. Students will also develop strategies for improving the site, such as introducing urban farming, park and an extension of East Boston Greenway.

During the design development stage, students will be expected to develop detailed plans, sections, elevations, physical and digital models, technical details, and diagrams that convey their design solutions, spatial organization, building envelope treatment, and MEP systems. Students should incorporate results of the energy modeling to improve building performance. Students should demonstrate approach and strategies for integrating the building within the site, as well as urban revitalization techniques.

Building site.

Program

Program element	**Area**
Building	
Lobby	1,000 SF
Café	3,000 SF
Auditorium	6,500 SF
Research laboratories	
Collaborative laboratory	3,000 SF
Environmental science (12 laboratories: 2,000 SF each)	24,000 SF
Building science laboratory	6,000 SF
Fabrication laboratory	6,000 SF
Testing laboratory	6,000 SF
Flexible laboratory	4,000 SF
Offices	
Administrative offices (10 offices, 100 SF each)	1,000 SF
Research offices (30 offices, 100 SF each)	3,000 SF
Collaborative/open plan office space	8,000 SF
Conference rooms	
Small conference rooms (5, 200 SF each)	1,000 SF
Large conference rooms (2, 500 SF each)	1,000 SF
Classrooms (15 classrooms, 500 SF each)	7,500 SF
Bathrooms	3,000 SF
Mechanical and service	10,000 SF
Bike parking	1,000 SF
Parking	5,000 SF
Total (Building)	100,000 SF
Site	
Outdoor research space	10,000 SF
Urban farm	30,000 SF
Extension of East Boston Greenway	50,000 SF
Park	50,000 SF
Total (Site improvements)	160,000 SF

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Assignment 1: Case Studies and Precedents

Case Studies

1. Students should perform research and identify three case studies (net-zero energy or extremely low energy research laboratory/educational buildings) and prepare documentation that illustrates characteristics of these buildings.

Analysis

1. Students analyze case study buildings, and identify following aspects:
    a. Building name, location, project team and year of completion
    b. Sustainable design strategies
    c. Response to site, climate, transportation and contextual aspects
    d. Building systems
    e. Daylighting strategies
    f. Building envelope treatment
    g. Employed renewable energy sources
    h. Water use
    i. Availability of actual building performance data
    j. Energy Usage Intensity (EUI)

    The deliverable will be three boards, showing the results of the precedent analysis. Students should keep in mind that we will be digitally projecting, and select the size of the boards accordingly. Assignment is due on Monday, January 30.

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Assignment 2: Site analysis and program development

Site analysis

1. Students should analyze project site and surrounding area, taking into account topography, orientation, climate, landscape, roads and transportation, site context and surrounding buildings.
2. Students should prepare a site plan that shows surrounding area, property lines, site topography, roads, and landscaping. Students should also create diagrams that show results of site analysis (solar position, prevailing winds, pedestrian access and movement, location of green areas/landscape, climate information, contextual aspects).
3. Students, as a team, should work on a physical model of the site. The model should include surrounding buildings, topography, waterfront and landscape. The building site can be left out, so that individual building models that will be built later during conceptual/schematic design can fit.

Program development and design concepts

1. Students should analyze building codes for Boston (2009 International Codes), taking into account building function. Particular attention should be given to egress requirements, fire protection, and ADA requirements.
2. Students should begin analyzing the given building program (for all parts of the building), and start developing bubble diagrams that indicate relationships between different spaces in the program. Students should also analyze sizes and square footage of different spaces, and begin to translate those into volumetric spaces and building massing.
3. Students should develop two basic design concepts for their building, based on the programming exercise and volumetric study, as well site analysis. Particular attention should be paid to orientation and layout of the building, solar exposure, organization of different spaces in the building, movement through the building (horizontal and vertical), potential for natural ventilation and overall form. Students should also develop strategies for site design.
4. Students should use digital and physical models to explore the building form and massing.

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Assignment 3: Schematic design

Students should begin schematic design of their project, which will continue until the Mid-term review. For the Mid-term review, students should complete the following requirements:

1. Site plan with the building massing shown, as well as schematic design of the site
2. Programming diagram, axon or section showing different spaces in the building
3. Digital model of your building and physical model that is able to fit on your site model
4. Diagrams showing sustainable design strategies (daylight, natural ventilation, renewable energy sources, water reuse and recycling if applicable, materials, etc.)
5. Floor plans for each level, which should show building core, elevators and stairs, spatial organization and program, building envelope treatment, and furniture
6. Building elevations (all four)
7. Building sections (at least two)
8. Perspectives of exterior and interior views.

The deliverable will be a minimum of three boards (24x48 in), showing the schematic design, as well as physical massing model that is able to fit on the site model. Mid-term review is scheduled for Wednesday, March 22.

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Assignment 4: Energy modeling

Students should simulate and analyze energy usage of their designed buildings by using eQuest energy modeling software program. Students should:

1. Complete the simulations for the building as currently designed.
2. Then, students should identify energy efficiency measures that can be implemented to reduce the energy consumption of the building, and then students should run the simulations for the alternative design. The energy efficiency measures can include changes to building footprint, improved R-value of the walls, window-to-wall ratio, application of shading devices, improved R-value of the roof, selection of high-efficiency HVAC systems, reductions in lighting loads, modified occupancy schedules, etc.
3. Students should calculate annual energy usage for both scenarios, and should compare the results. Students should also determine Energy Usage Intensity (EUI) for their building, which is annual energy usage per area, and the units are kBtu/SF.
4. Students should prepare a report that outlines modelling strategies, inputs, results and conclusions.

The deliverable will be a report, showing the results for both design scenarios. The report should be uploaded to Udrive by April 12th. Also, students should prepare one board that summarizes energy modeling procedures, inputs and results, and present in class on Wednesday, April 12th.

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Assignment 5: Design development and final review requirements

Students should continue developing their designs and prepare the following design documentation for the final review:

- Site plan indicating location of the site, transportation routes (public and vehicular), topography, urban context, waterfront, and any other information relevant to the site. The site plan should also show building massing, as well outdoor research space, extension of Greenway, urban farm and other landscaping elements
- Site analysis diagrams/concept diagrams
- Overall axonometric view (exploded axon or regular view) showing different programmatic elements (public space, research labs, offices, classrooms) and vertical circulation
- Floor plans for each level, showing building core, elevators and stairs, structural system, spatial organization, building envelope, and furniture layout
- Building elevations (all four)
- Two overall building sections
- Enlarged detailed section(s), plan and partial elevation of building facade
- Plans/diagrams showing different building systems (structural system, mechanical system, building envelope)
- Diagrams showing sustainable design strategies, results of energy modeling, and methods for achieving net-zero energy
- Diagrams showing material choices
- Perspectives of exterior and interior views
- Any other information relevant to the project.

Students should also prepare physical massing model that is able to fit within the site model.

On each board, please include your name, as well as course number and instructor's name.

Students should submit all boards (digital format) and photos of the physical models to Udrive by May 8th. Size of the board will be determined.

On Mon, May 1st, we will have desk crits in class and students should have "almost" final boards ready for instructor's review. Final review will be on Mon, May 8th, from 1 to 4 PM.

Resiliency Research & Education Center

Project Overview
Graduate Design Studio IV
Department of Architecture
University of Massachusetts Amherst

Studio Introductions

Professor: Dr. Ajla Aksamija, LEED AP BD+C, CDT

Erica Shannon
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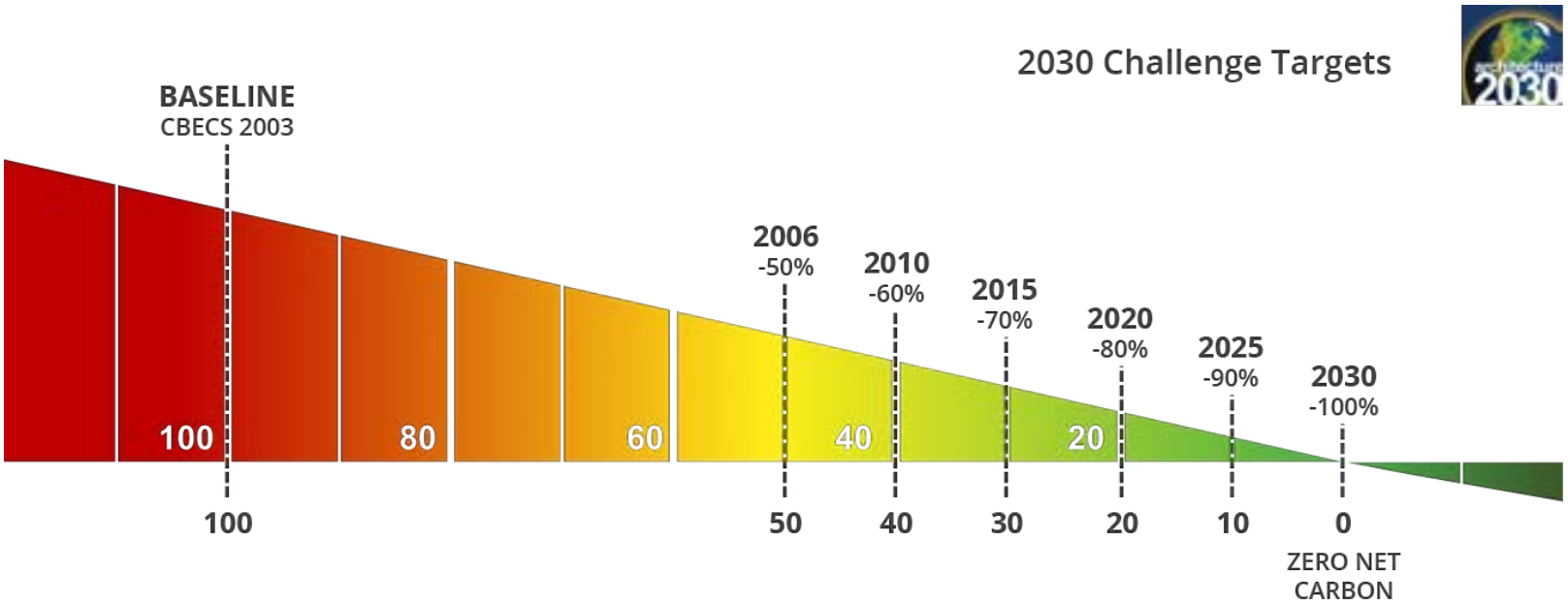
Project: Resilience Research & Education Center

Objective: to investigate sustainable and resilient design strategies for carbon-neutral buildings, impact of climate change, and revitalization of urban environments.

Project: a new, mixed-use building, dedicated to interdisciplinary resiliency and sustainability research, educational and community outreach activities. Students addressed environmentally conscious design, energy-efficiency strategies, passive and active design methods, advanced building systems, methods for reaching net-zero energy goals and renewable energy sources.

Site: East Boston

Architecture 2030 Curriculum Project



Process

Precedents → **Code and site analysis** → **Schematic design** → **Energy modeling** → **Net-zero strategies** → **Design development**

Precedents

Precedent analysis

Sustainable and resilient buildings

Net-zero energy buildings

Code and site analysis

Building code analysis

Site analysis

Program analysis

Concept development

Schematic design

Building volume and massing

Structure

Spatial organization

Passive design strategies

Building envelope

Site treatment

Energy modeling

Initial model for schematic design

Determination of energy usage intensity (EUI)

Second model with maximized energy saving potentials

Established minimum EUI

Net-zero strategies

Methods for reaching net-zero goals

Calculations for PV integrated system

Identification of other renewable systems

Design development

Modified building design based on energy modeling

Detailed facade design

Materials

Site and landscaping

EAST BOSTON

Transportation Analysis

PUBLIC TRANSPORTATION

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

- THE BLUE LINE RUNS DIRECTLY INTO EAST BOSTON, WITH MAVERICK STATION BEING IN CLOSE PROXIMITY TO SITE
- THE SILVER LINE ALSO RUNS INTO EAST BOSTON, BRINGING PASSENGERS DIRECTLY TO LOGAN AIRPORT

OTHER MBTA ROUTES IN BOSTON INCLUDE:

- RED LINE
- GREEN LINE
- ORANGE LINE

PEDESTRIAN + BIKE TRAVEL

EAST BOSTON GREENWAY, LOCATED NEXT TO SITE, CONTAINS SEVERAL BIKE + PEDESTRIAN PATHS THAT INTERCONNECT THROUGHOUT EAST BOSTON

BIKES ON THE MBTA

BICYCLES ARE ALLOWED ON THE BLUE, SILVER, RED, + ORANGE LINES AS WELL AS ON THE COMMUTER RAIL AND THE FERRY, WITH SOME EXCEPTIONS DURING RUSH HOURS

East Boston Green Spaces

BOSTON LOGAN INTERNATIONAL AIRPORT

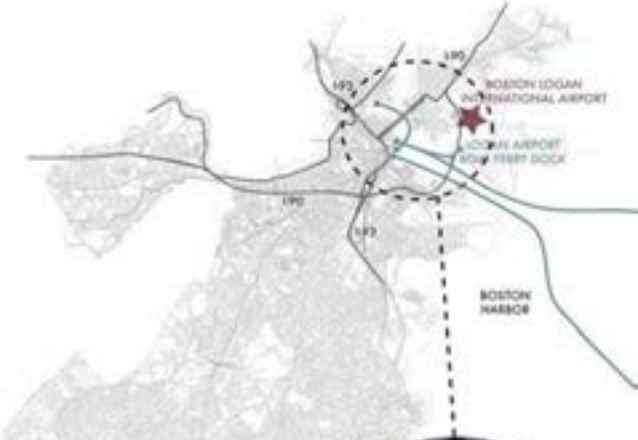
OPENED IN THE 1920'S, THE AIRPORT ACCOUMATES 2,264 ACRES OF EAST BOSTON. IT GREATLY IMPACTED THE SURROUNDING NEIGHBORHOODS. MANY FAMILIES WERE FORCED TO LEAVE THEIR HOMES OR ADJUST TO A HOISIER AND MORE CONGESTED AREA.

MBTA FERRY TRANSPORTATION

THE FERRY CONNECTS TO EAST BOSTON VIA LOGAN AIRPORT BOAT FERRY DOCK, WITH A FREE SHUTTLEBUS BRINGING PASSENGERS FROM THE DOCK TO LOGAN INTERNATIONAL AIRPORT TERMINAL.

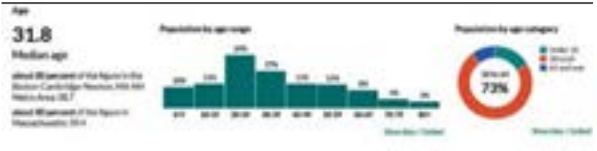
'BIG DIG' + HIGHWAY SYSTEM

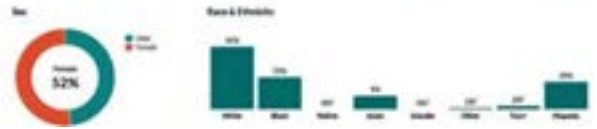
BOSTON'S NEW HIGHWAY SYSTEM WAS OPENED IN 2002, FOLLOWING THE CONSTRUCTION KNOWN AS THE 'BIG DIG'. THE NEW HIGHWAY SYSTEM CONNECTED I-90 TO EAST BOSTON, + EXPANDED I-93 TO MORE AREAS OF BOSTON

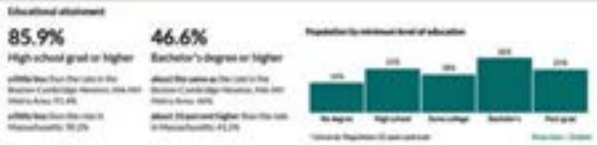


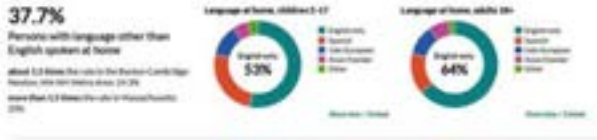
Congestion Near Site

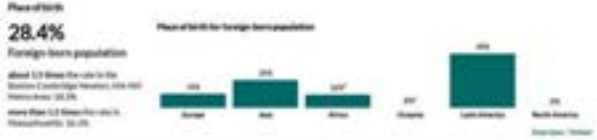
Demographics

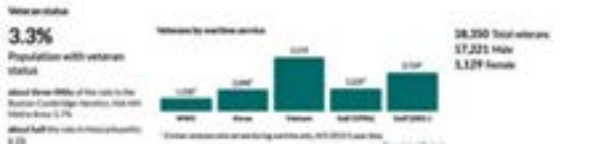


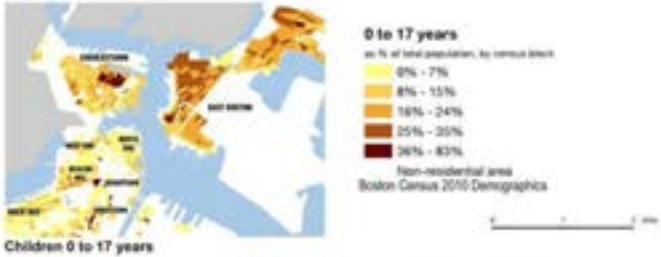


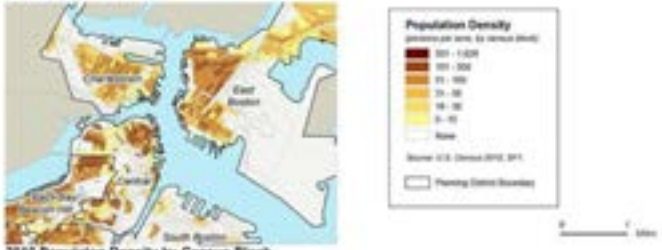


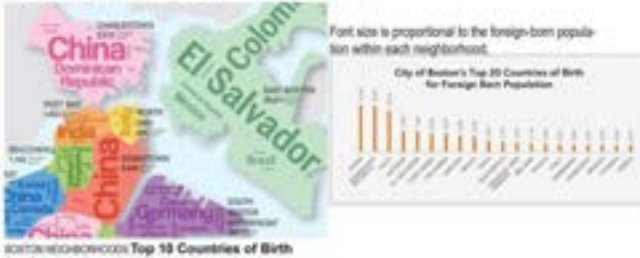




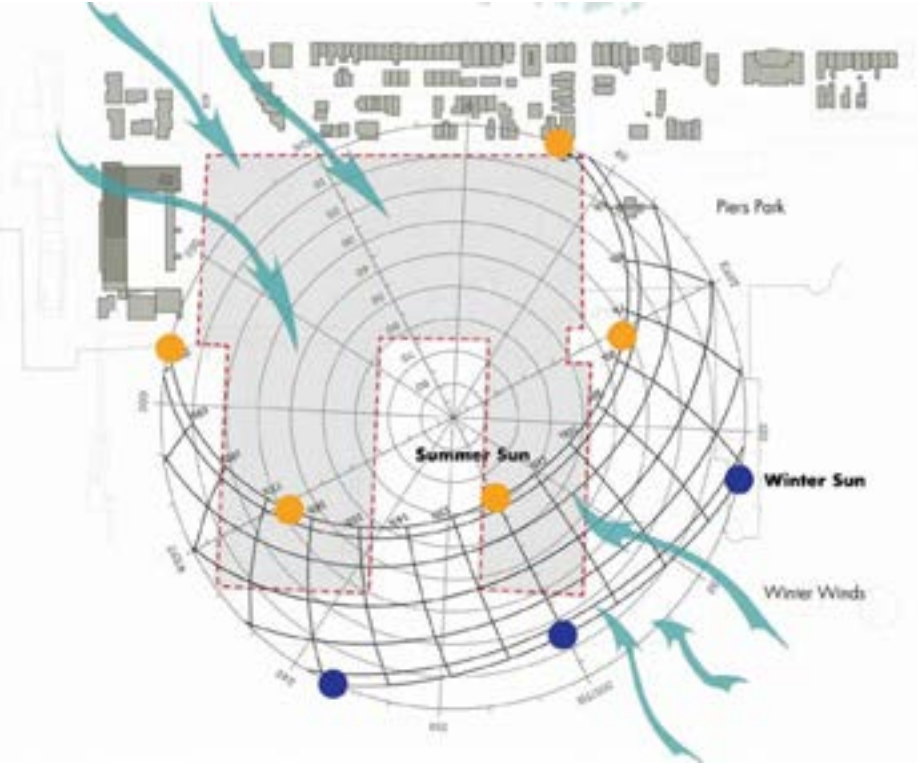


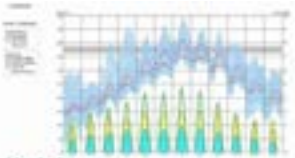


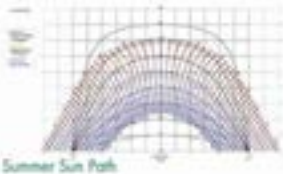


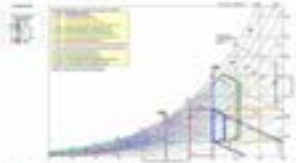


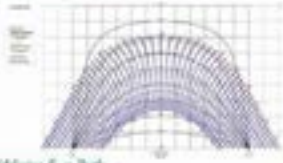
Climate Analysis



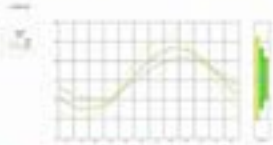

Hourly Averages

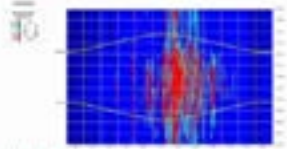

Summer Sun Path


Psycrometric Chart


Winter Sun Path

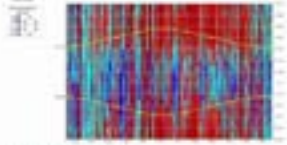

Monthly Temperature


Ground Temperature


Dry Bulb Temperature

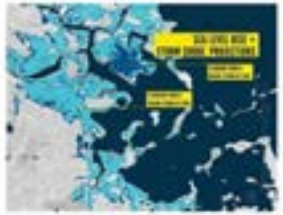
Sky Cover


Sky Cover


Relative Humidity


Relative Humidity

Temperature Data
Source : Logan Int'l Airport, Boston Ma



Program

Building program

Lobby 1,000 SF, Café 3,000 SF

Auditorium 6,500 SF

Research laboratories

- Collaborative laboratory 3,000 SF
- Environmental science (12 laboratories: 2,000 SF each)
- Building science laboratory 6,000 SF
- Fabrication laboratory 6,000 SF
- Testing laboratory 6,000 SF
- Flexible laboratory 4,000 SF

Offices

- Administrative offices (10 offices, 100 SF each)
- Research offices (30 offices, 100 SF each)
- Collaborative/open plan office space 8,000 SF

Conference rooms

- Small conference rooms (5, 200 SF each)
- Large conference rooms (2, 500 SF each)

Classrooms (15 classrooms, 500 SF each)

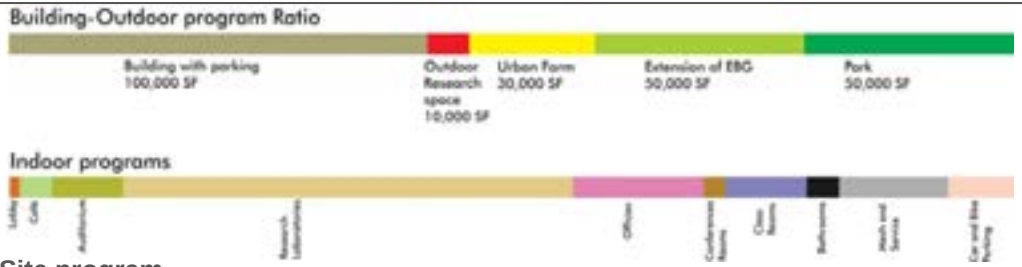
Bathrooms 3,000 SF

Mechanical and service 10,000 SF

Bike parking 1,000 SF

Parking 5,000 SF.

Total (Building): 100,000 SF



Site program

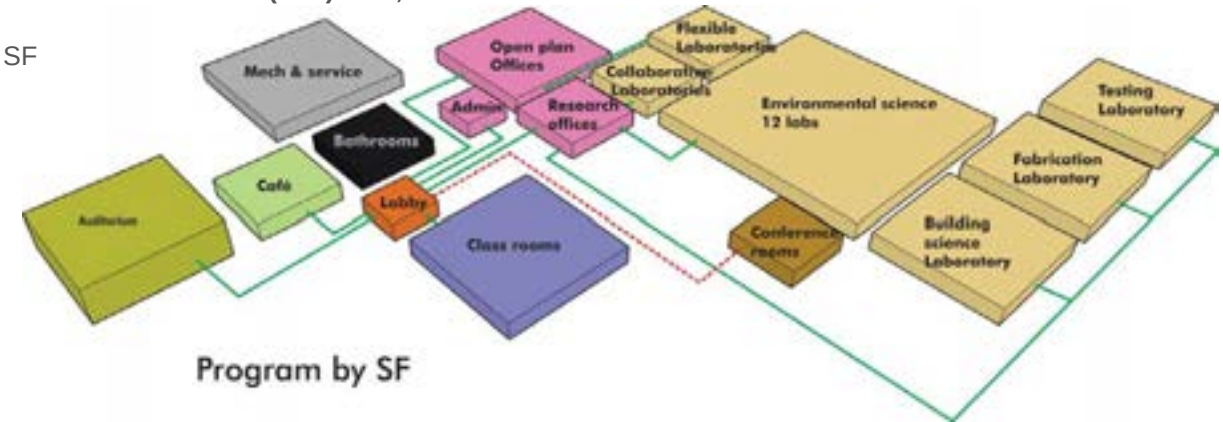
Outdoor research space 10,000 SF

Urban farm 30,000 SF

Extension of East Boston Greenway 50,000 SF

Park 50,000 SF

Total (Site): 160,000 SF



RYAN RENDANO

RESILIENCY RESEARCH & EDUCATION CENTER

ARCH 601 - GRAD DIV
DR. AJLA AKSAMIJA

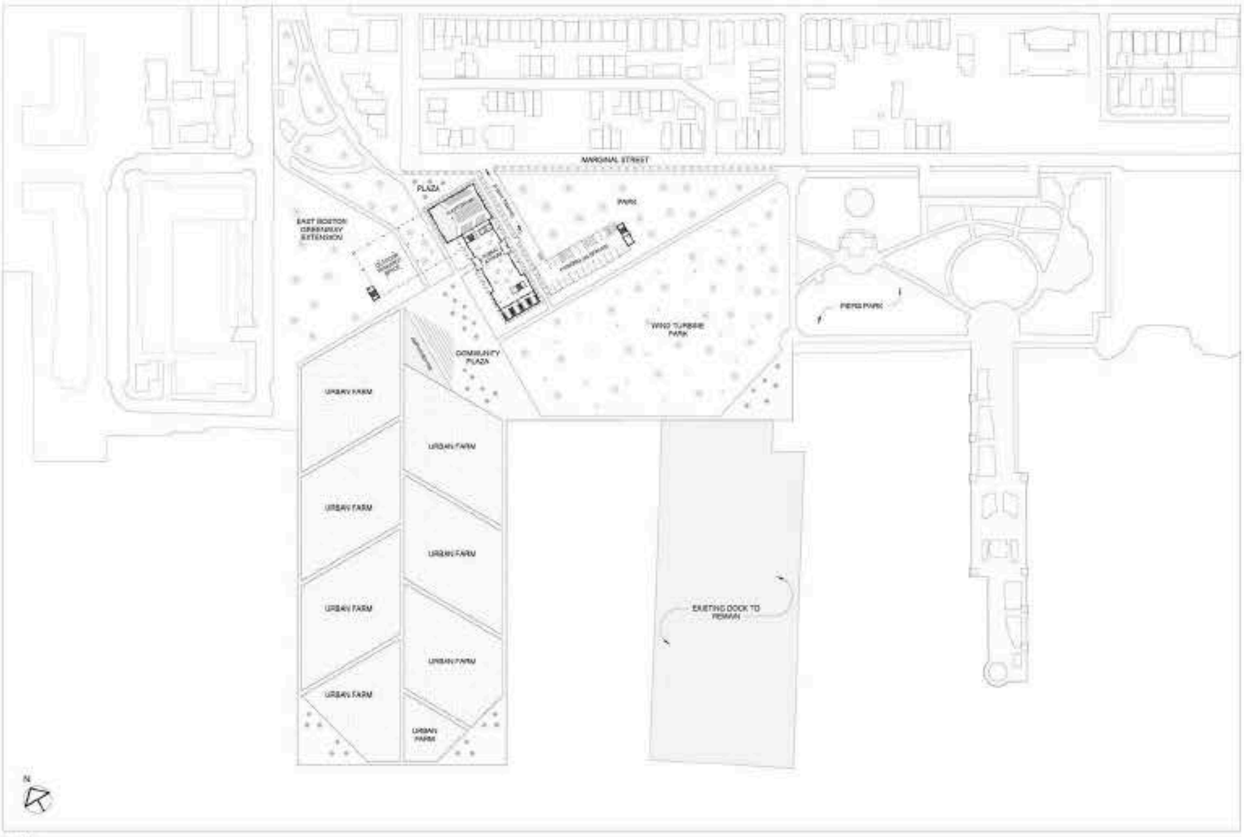
SOUTHWEST EXTERIOR PERSPECTIVE

SITE CONCEPT DIAGRAM

PROJECT OVERVIEW

Located on the East Boston waterfront, the Resiliency Research and Education Center divides research and educational functions into two rectilinear masses, conjoined by a central public atrium wing. The majority of the building's form is oriented along the east-west axis, maximizing northern and southern exposures while minimizing the east and west. Long and narrow volumes with central circulation probide ample opportunities for passive ventilation, while maximizing natural views and daylight. All roofs are angled true south to maximize renewable solar power via PV arrays.

The building's mass timber frame structure naturally sequesters carbon, and provides a viable alternative to traditional concrete and steel construction. The research and education wings are both lifted one story off of the ground to provide resiliency against future sea level rise, and create a direct pedestrian connection between the East Boston Greenway and adjacent Piers Park. Together, the three forms rise and unfold to embrace the East Boston waterfront.



1 Site Plan
1" = 100'-0"

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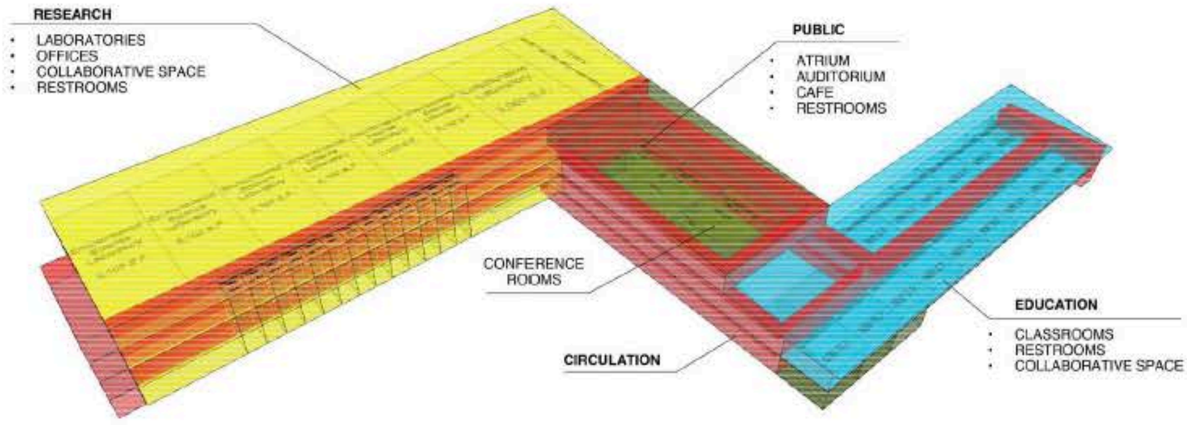
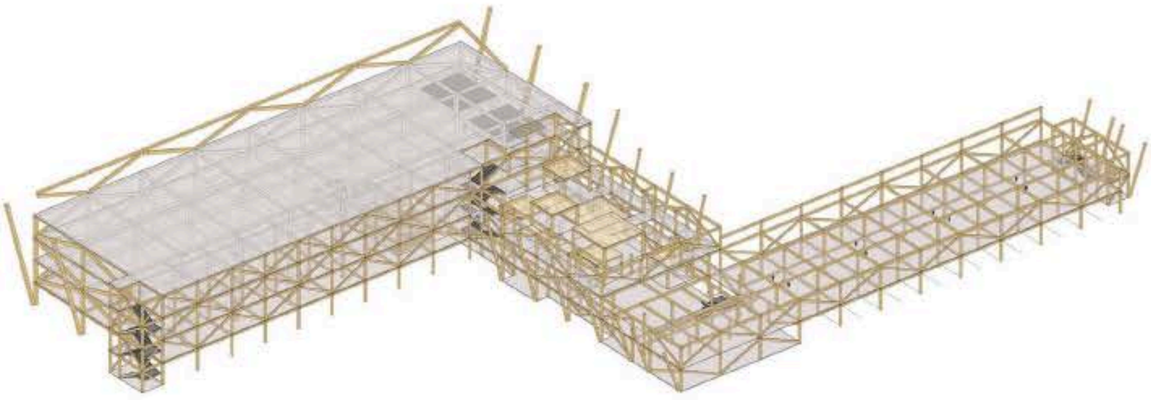
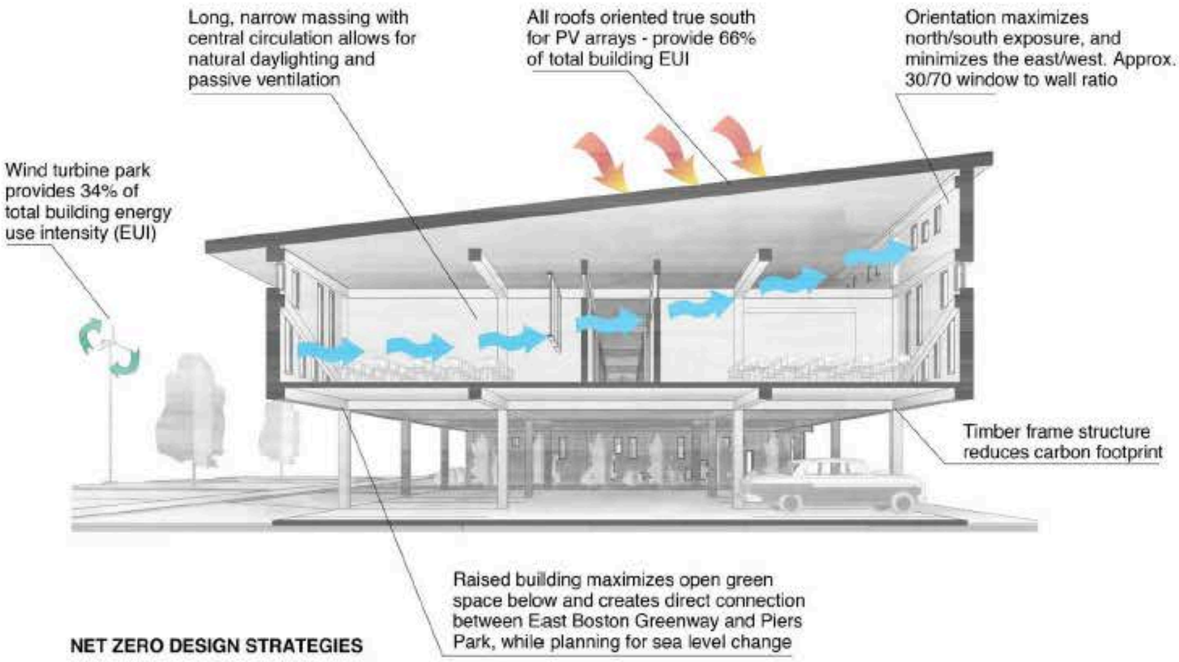


PROGRAMMING DIAGRAM



1 Mass Timber Structural System



NET ZERO DESIGN STRATEGIES

ENERGY MODELING RESULTS

01 - BASELINE DESIGN

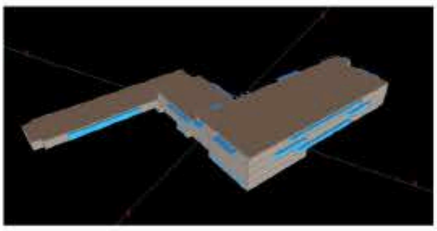
Annual Electric Consumption = 3,634,272.05 KBtu
Annual Gas Consumption = 1,894,100 KBtu
Total Building Area = 119,450 S.F.
Total Energy Use Intensity (EUI) = 46.28 KBtu / S.F.
Total Energy Reduction from Baseline = N/A

02 - OPTIMIZED DESIGN

Annual Electric Consumption = 2,704,804.67 KBtu
Annual Gas Consumption = 1,597,500 KBtu
Total Building Area = 119,450 S.F.
Total Energy Use Intensity (EUI) = 36.02 KBtu / S.F.
Total Energy Reduction from Baseline = 22.18%

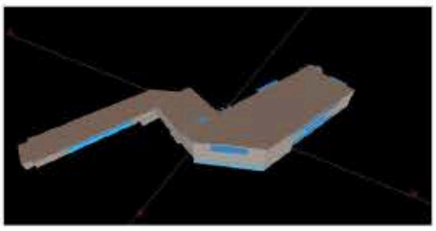
03 - OPTIMIZED ALTERNATE MASSING

Annual Electric Consumption = 2,619,330.53 KBtu
Annual Gas Consumption = 1,716,800 KBtu
Total Building Area = 119,846 S.F.
Total Energy Use Intensity (EUI) = 36.18 KBtu / S.F.
Total Energy Reduction from Baseline = 21.83%

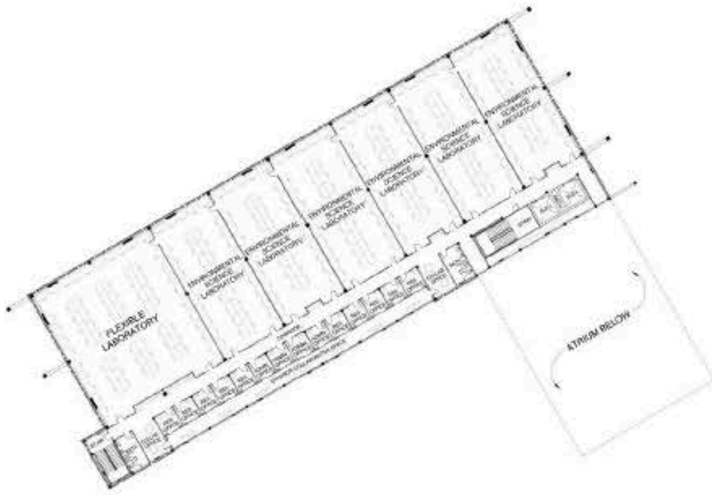


(Left) Original massing used for 01 - Baseline Design and 02 - Optimized Design simulations

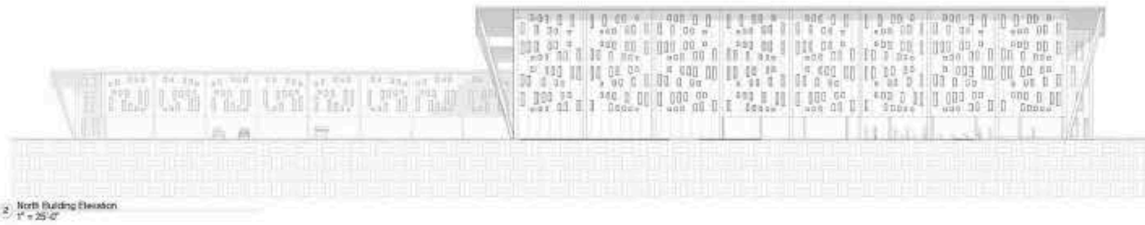
(Right) Alternate massing design used for simulation 03 - Optimized Alternate Massing



RESILIENCY RESEARCH & EDUCATION CENTER

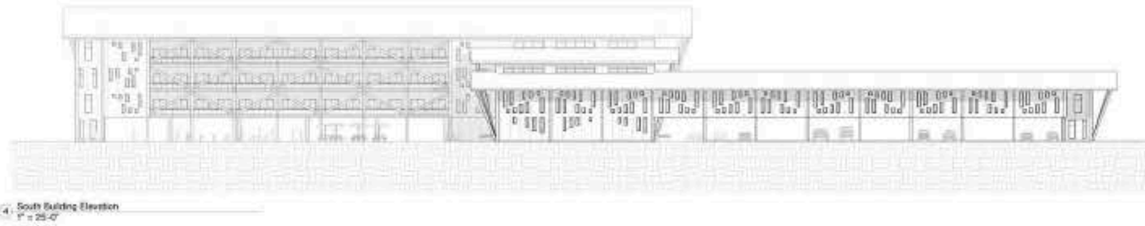


1 Level 04
1" = 25'-0"



2 North Building Elevation
1" = 25'-0"

3 East Building Elevation
1" = 25'-0"



4 South Building Elevation
1" = 25'-0"

5 West Building Elevation
1" = 25'-0"

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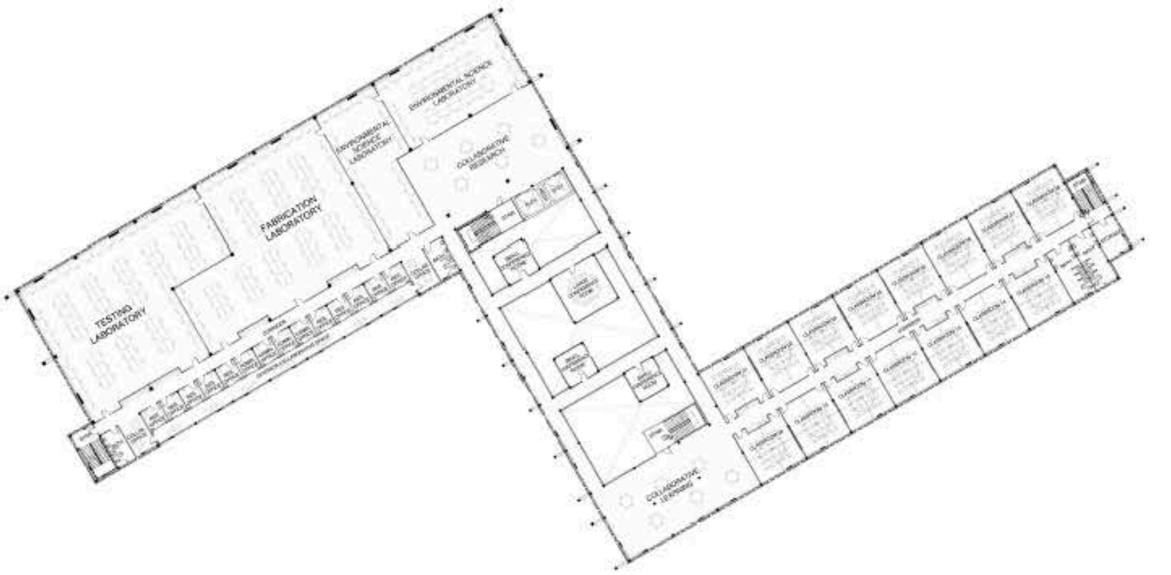
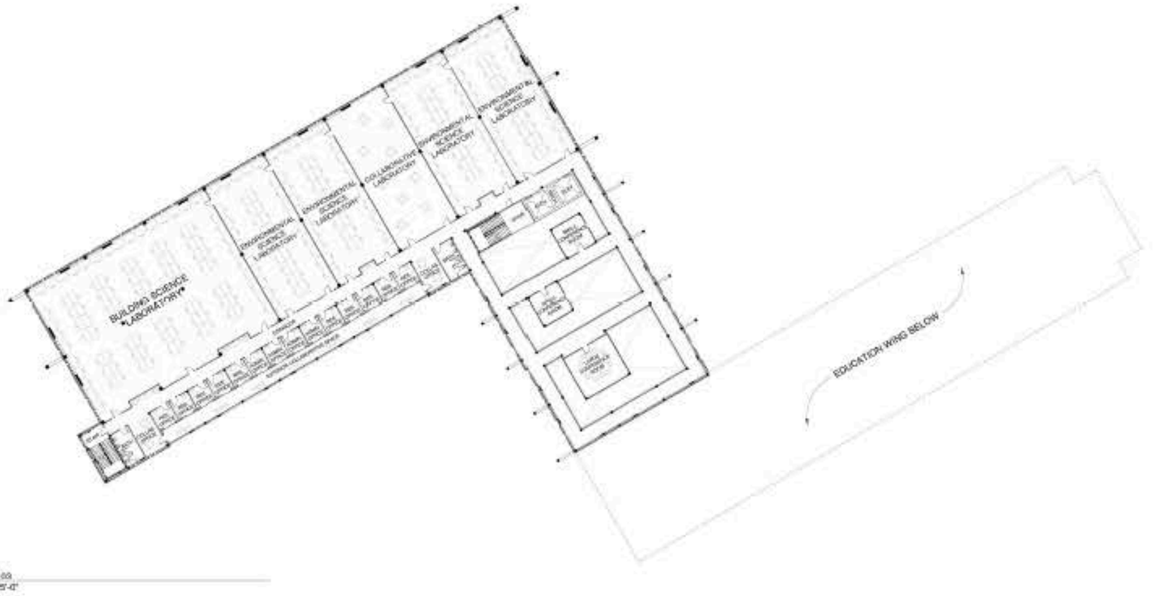
1 Level 01
1" = 25'-0"

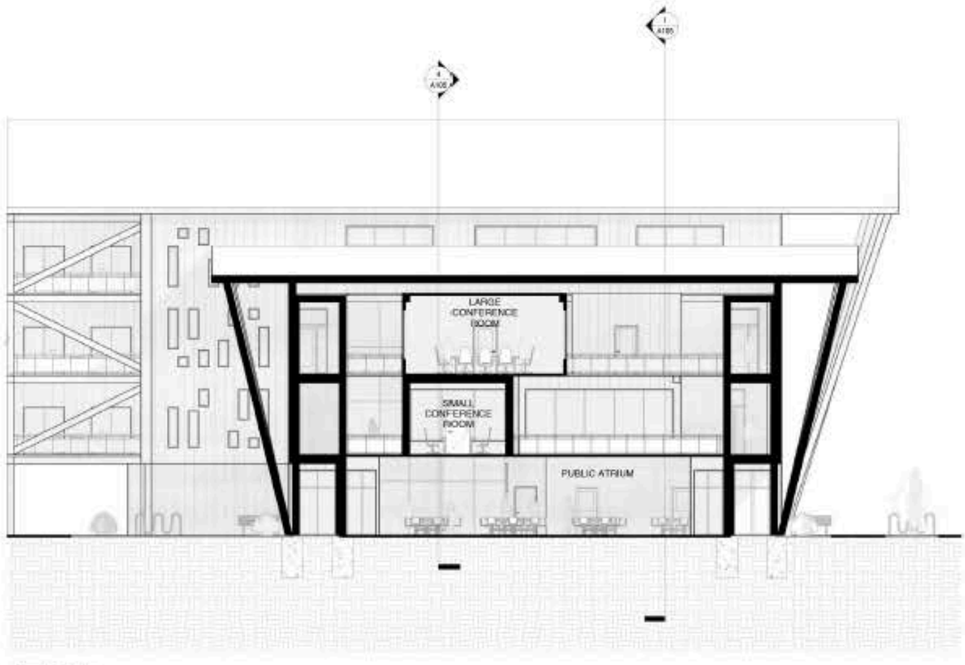


2 Level 02
1" = 25'-0"

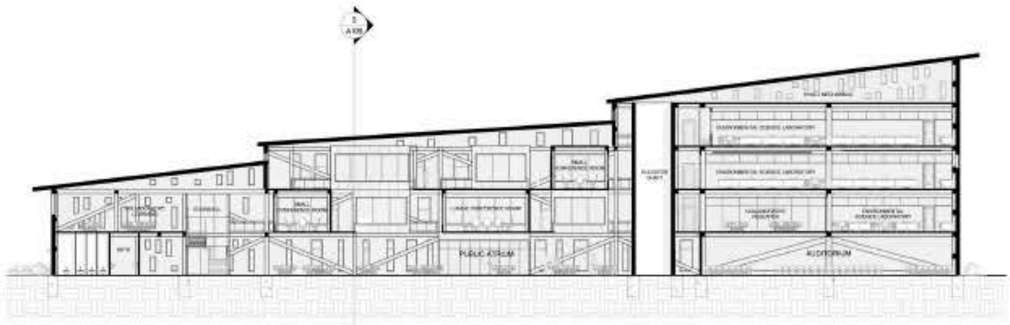


3 Level 03
1" = 25'-0"

RESILIENCY RESEARCH & EDUCATION CENTER

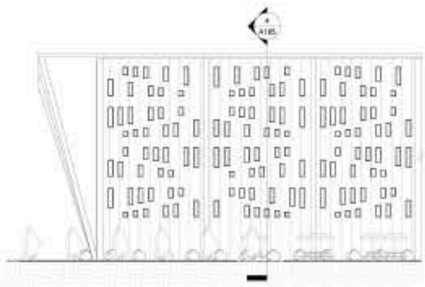


2 Atrium North Section
1/8" = 1'-0"

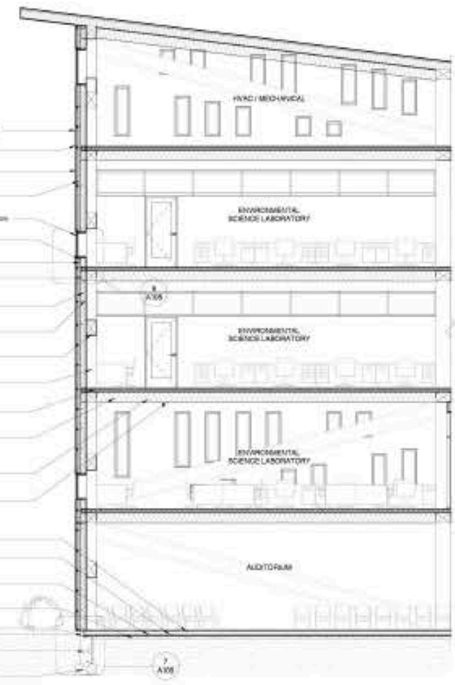


1 West Building Section
1" = 15'-0"

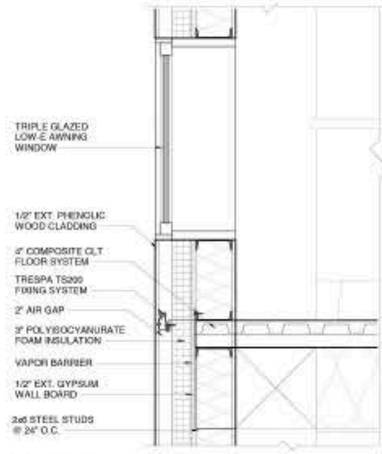
DETAILS



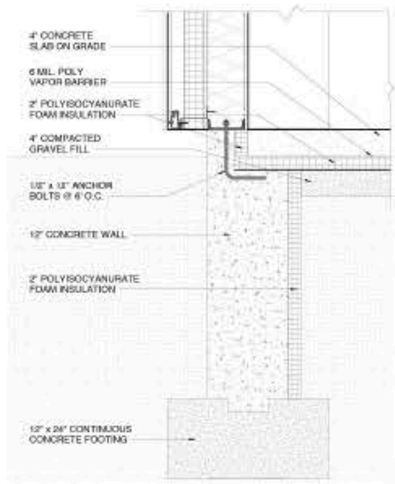
3 Partial North Facade
1/16" = 1'-0"



4 Section AA
3/16" = 1'-0"

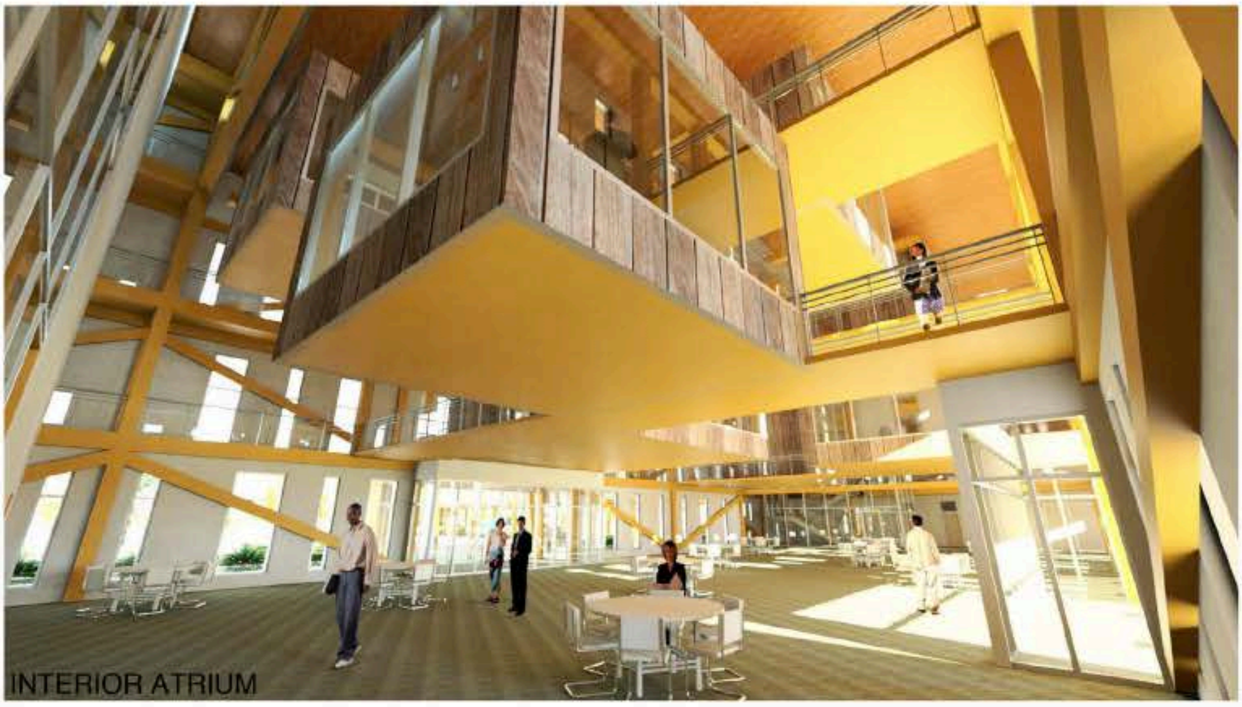


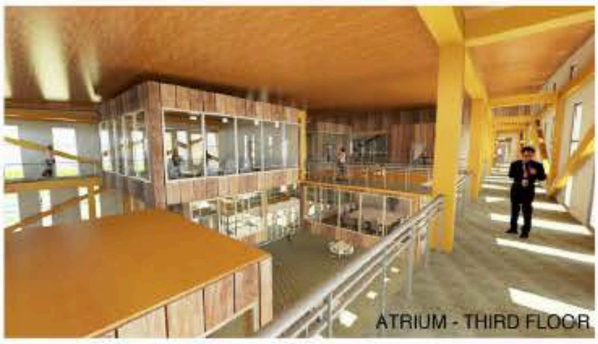
6 Detail 01 - Window Condition
1 1/2" = 1'-0"



7 Detail 02 - Slab Condition
1 1/2" = 1'-0"

RESILIENCY RESEARCH & EDUCATION CENTER


INTERIOR ATRIUM


ATRIUM - THIRD FLOOR

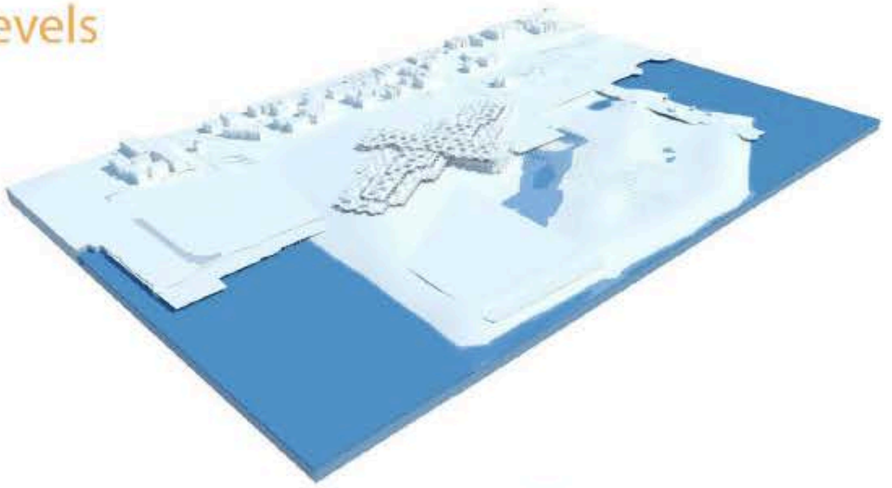

EDUCATION CORRIDOR


OFFICE BALCONY

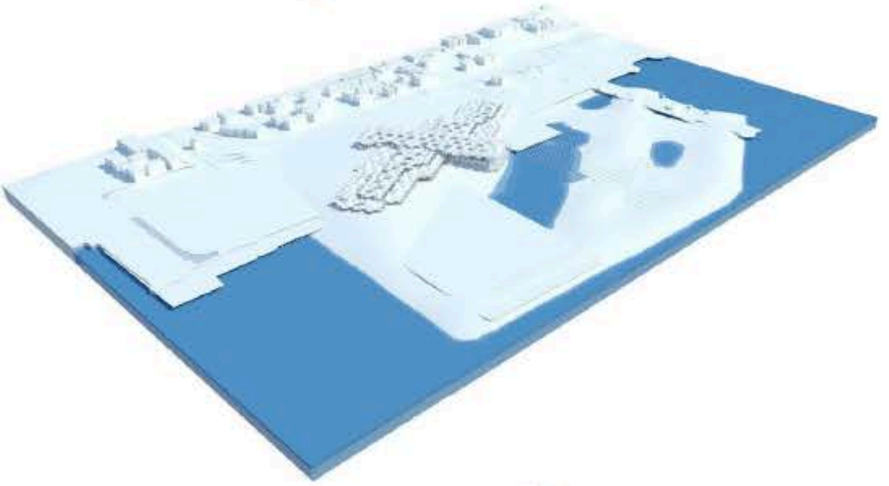

RESEARCH LABORATORY


NORTHEAST EXTERIOR PERSPECTIVE

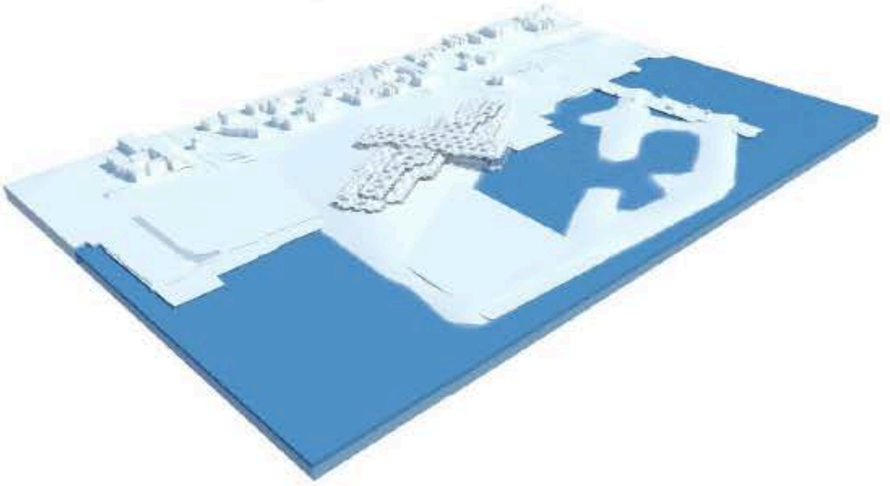
Sea Levels



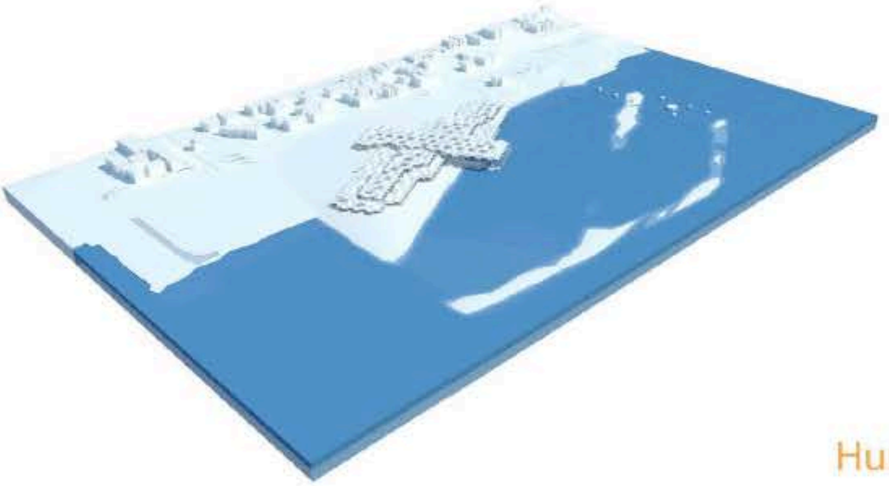
Low Tide



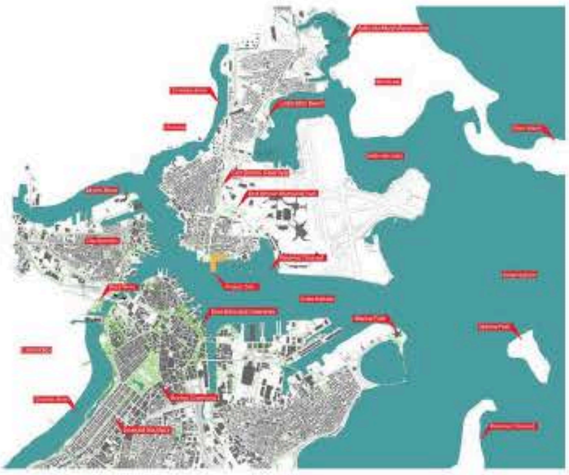
High Tide

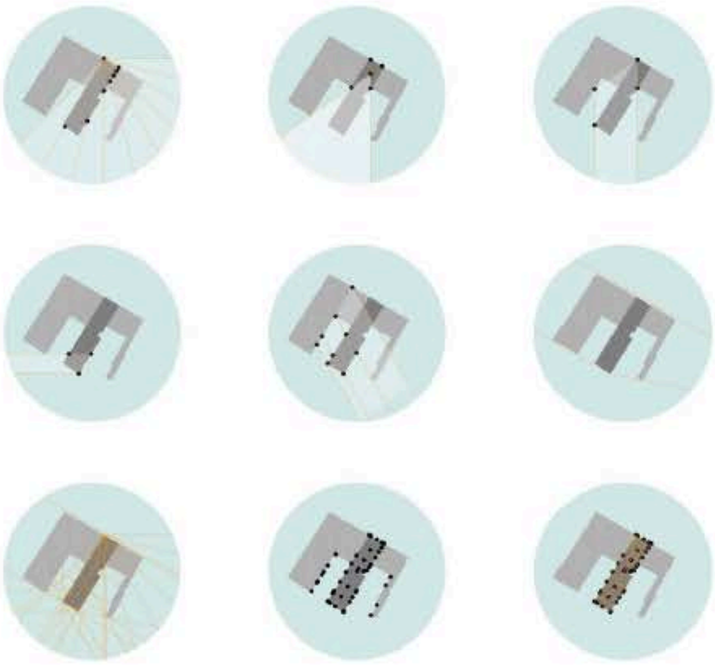


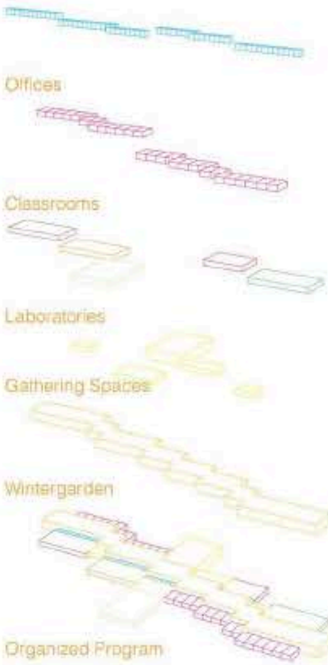
2050



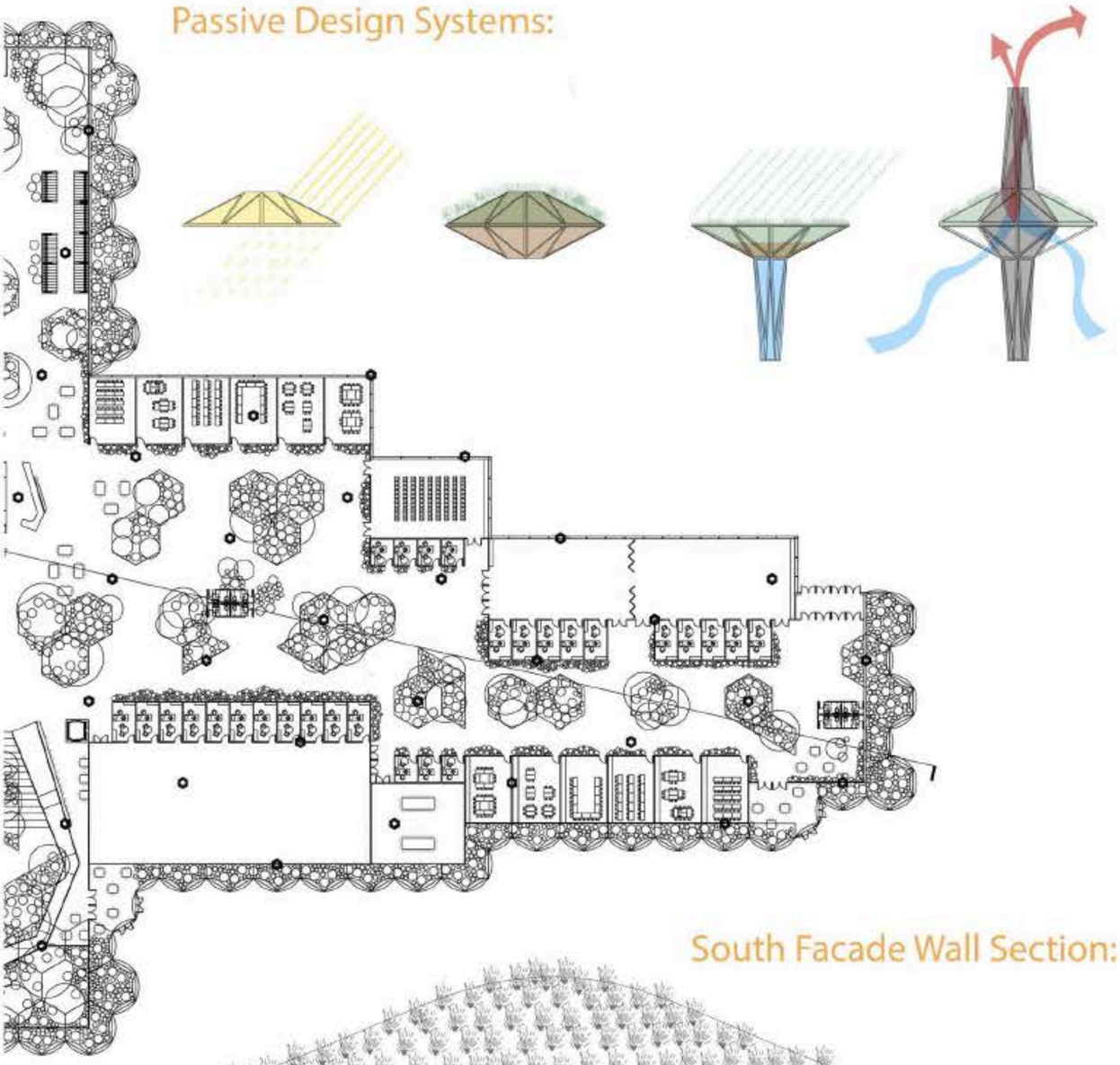
Huricane Sandy



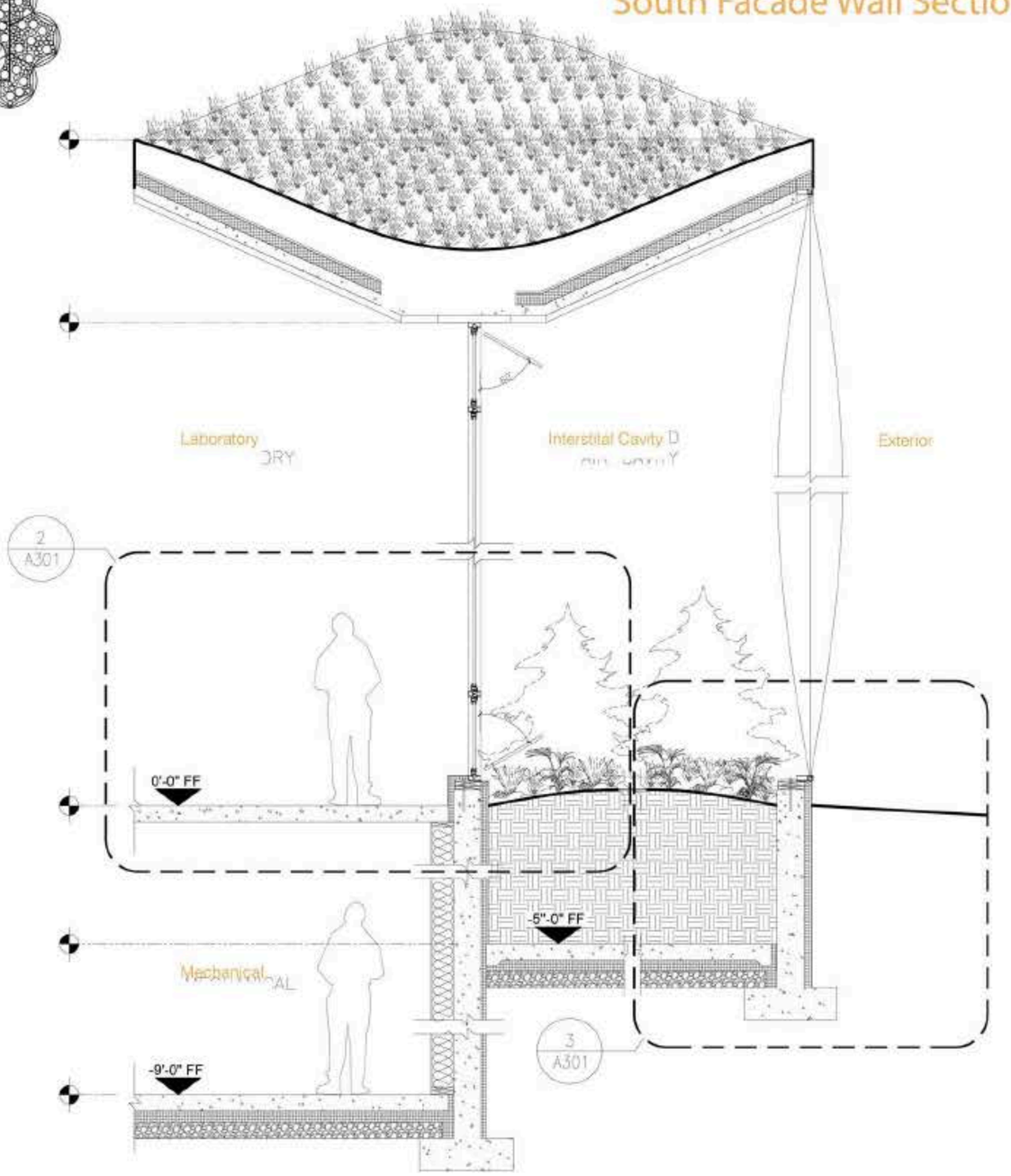


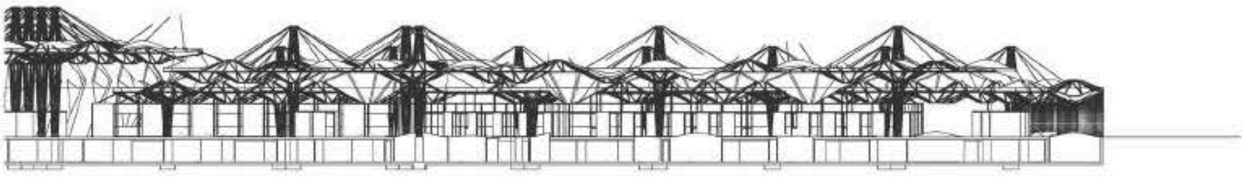

Offices
Classrooms
Laboratories
Gathering Spaces
Wintergarden
Organized Program

Passive Design Systems:

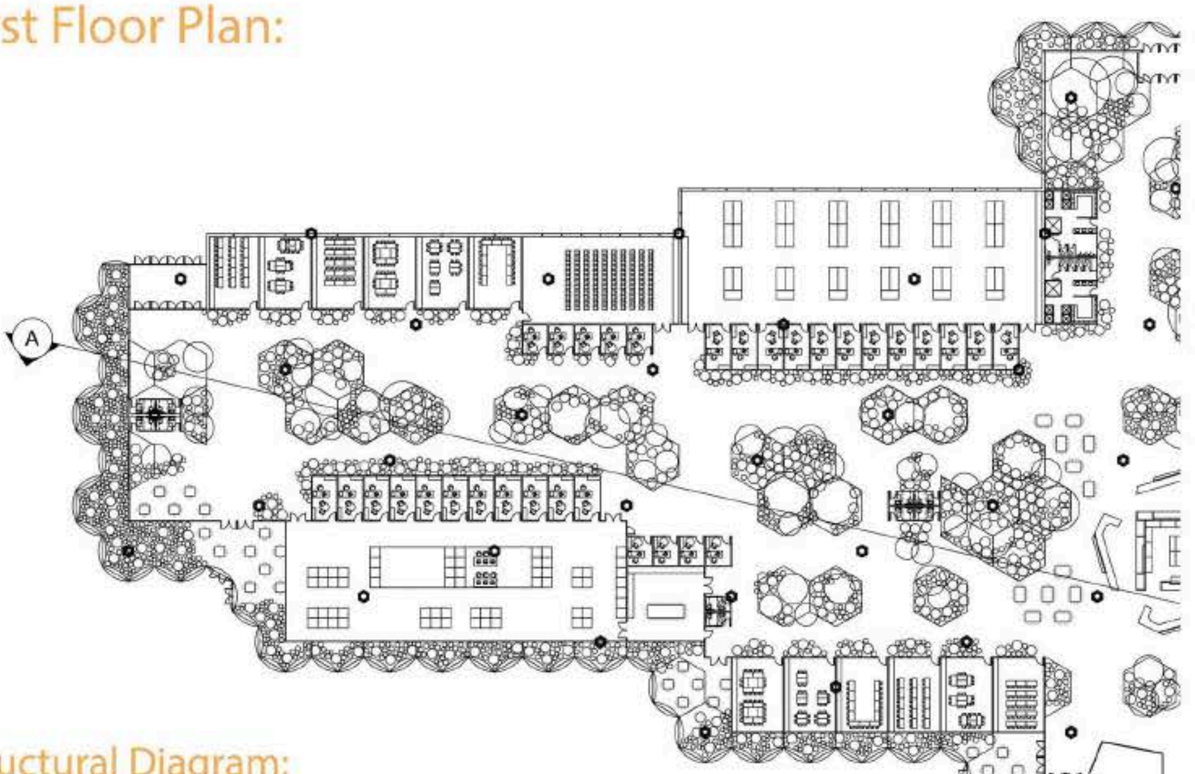


South Facade Wall Section:

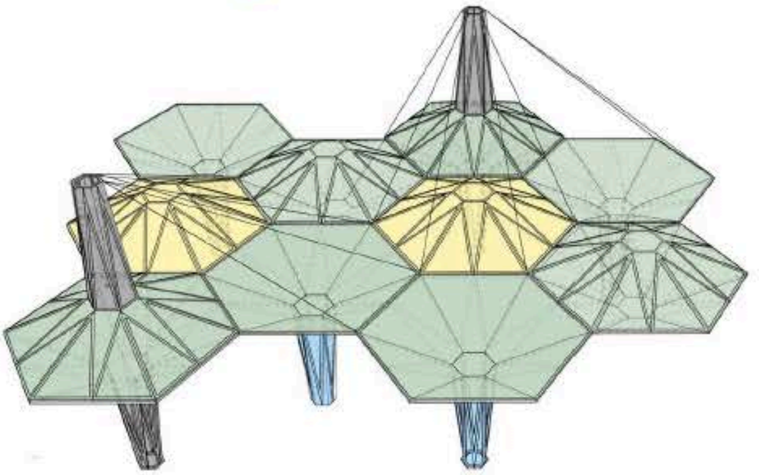




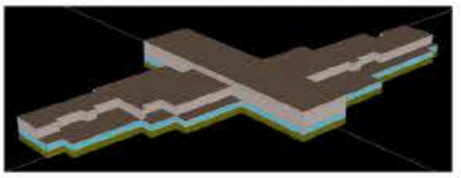
First Floor Plan:



Structural Diagram:



Baseline Simulation:

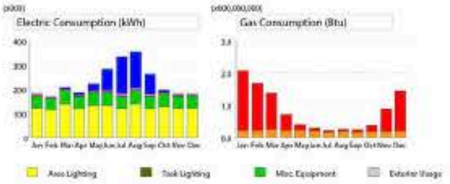


Electric
(Kwh X 1000)
= 2,748.9

Gas
(Btu X 1,000,000,000)
= 9.86

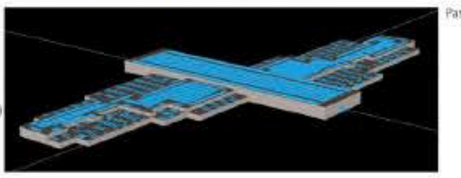
Area = 162,981 sf

EUI = 118.05



Simulation 01: Baseline Model
- Ashrae Defaults
- Basic Building Geometry
- 7 Defined Building Shells
- Zones Defined by Area Percentage and Function

Passive Strategies:



Passive Improvements:

Electric:
759.23
759,230 Btu

Conversion Factor:
3,412.141641
2590600298.09 Btu
2,590,600.29 KBtu

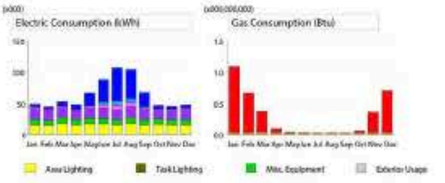
3,390,000 KBtu

Gas:
3.39
3,390,000,000 Btu

3,390,000 KBtu

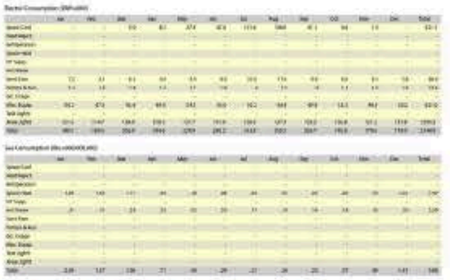
Total Energy:
5,900,600.29 KBtu

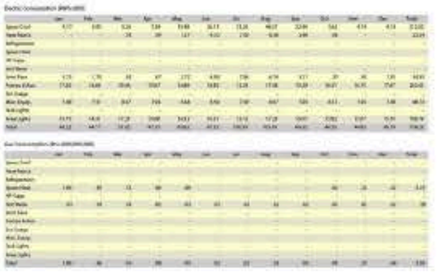
Total Energy:
5,900,600.29 KBtu



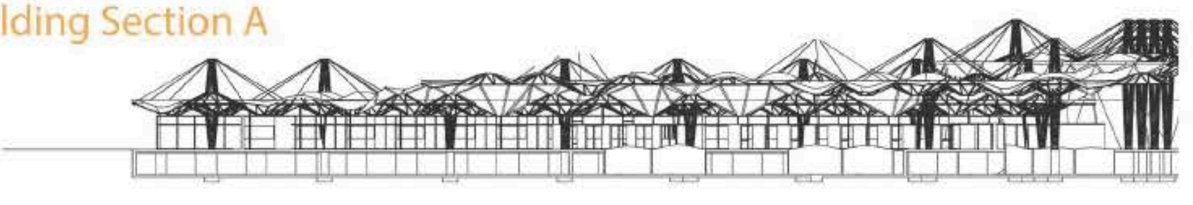
Passive Improvements:

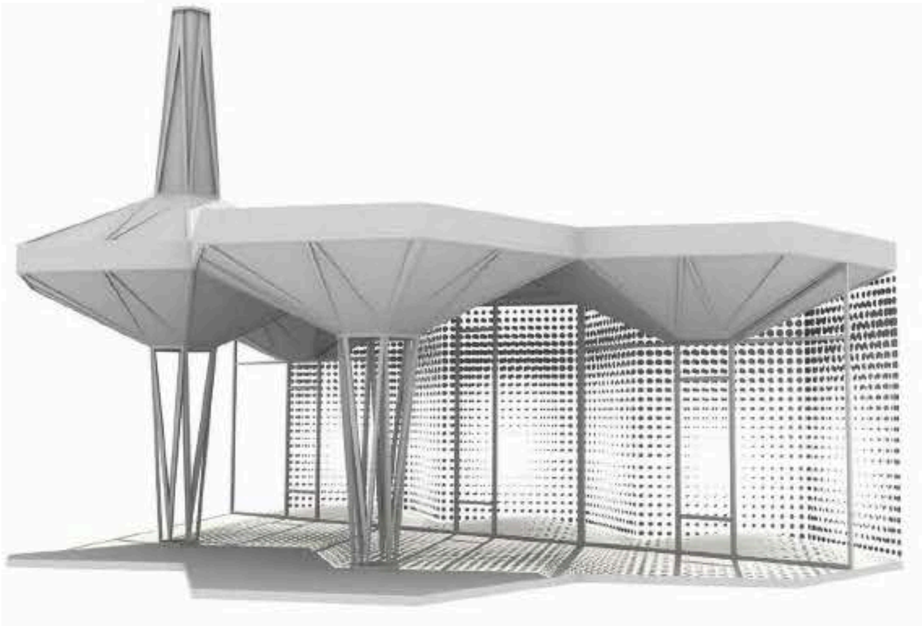
Envelope (Custom Roof R30, Custom Wall R20) Double Skin South Facade
= -32 kBTU/ft2/yr
Volume Reduction, Zoning, Shell Definition
= 28 kBTU/ft2/yr
Window-to-Wall Ratio (S:80%, N:20%, E:18%, W:10%)
= -8 kBTU/ft2/yr
Natural Daylighting (skylights)
= +50 kBTU/ft2/yr
Window Performance (Triple-Pane, Argon Fills, Low-e, Thermally Broken Frames
= -1 kBTU/ft2/yr
Simulated Hydronic Heating & Cooling System (Hot Water Coils & Chilled Temperature Set Points for Indoor Spaces and Heating & Cooling Systems)
= -42 kBTU/ft2/yr
Miscellaneous Load Reductions
= -3 kBTU/ft2/yr
Active Lighting Reductions
= -15 kBTU/ft2/yr





Building Section A

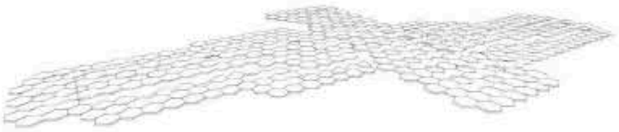




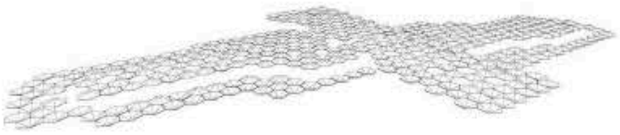
Towers & Tension Cables

Skylights

Green Roof Planters

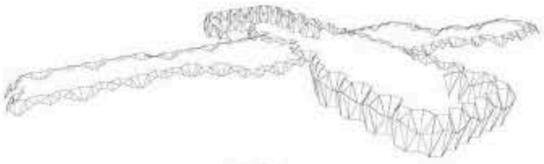


Canopy Panels

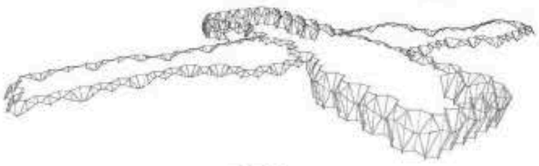


Hexagonal Canopy Space Fram

ETFE Curtain Wall Panels



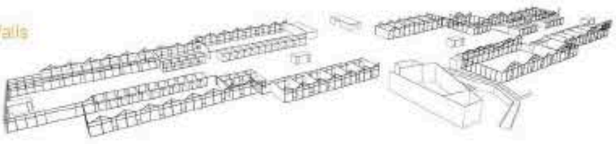
Clerestory & Vertcal Space Frame



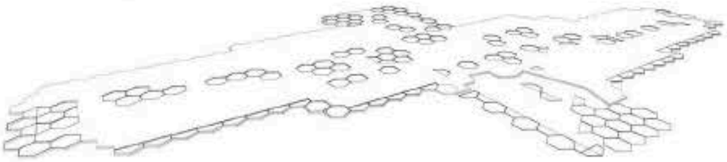
Lily Pad Columns

South Facade Fritted ETFE Panels

Interior Partitions & Inner Curtain Walls



First Floor Concrete Slabs



Integral Planters

Basement Walls & Columns

Spread Footings

Assembled Massing Model


Skewed Foldings
Assembled Massing Model


First Floor Concrete Slabs
Interior Planters
Basement Walls & Columns
Roof Framing
Site Model Existing Model