BIOCLIMATIC DESIGN

Research at Assateague State Park

SCHOOL OF ARCHITECTURE, PLANNING & PRESERVATION

Prepared by the University of Maryland School of Architecture, Planning & Preservation

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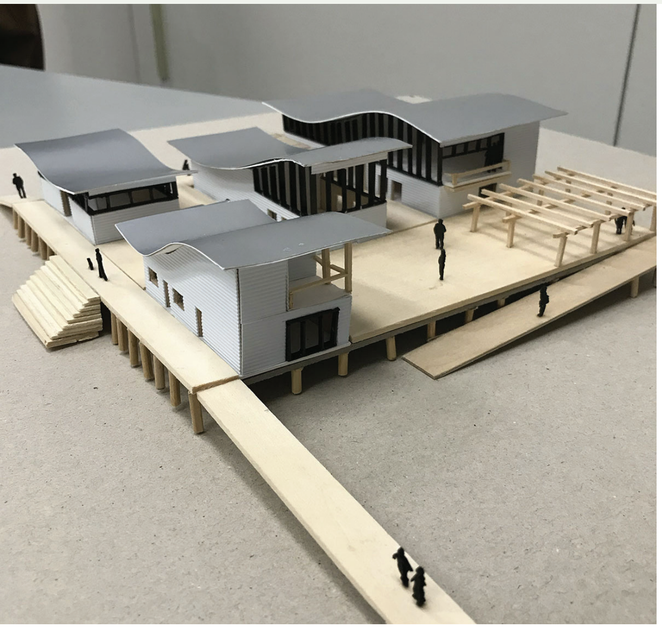
1 EXECUTIVE SUMMARY

EXECUTIVE SUMMARY



IMAGES CLOCKWISE FROM TOP LEFT: CENTENO + DEGROFF FINAL MODEL; MARCO LOH PRESENTING FINAL PROJECT; JAMERO + LEE MODELS; DISCUSSION AFTER FINAL REVIEW

This research study, conducted in a graduate-level design studio, began with a shared vision that people and nature can co-exist in a mutually beneficial relationship.

Angela Baldwin, Park Manager at Assateague State Park, and her colleagues from NOAA, the Maryland Park Service, the Chesapeake Coastal Service, and other DNR offices, challenged the University of Maryland team to test this vision in the design of a new day use facility for Assateague State Park, a much-beloved, special place that is increasingly vulnerable to the effects of climate change.

The climate crisis requires architects to deepen their understanding of resilient design strategies. These range from place-based climate-responsive knowledge rarely taught in schools of architecture, to more technically advanced tools such as computer energy modeling, efficient mechanical equipment and on-site renewable energy.

Section 2 of this report gives an overview of DNR's project goals and the process followed by the University of Maryland team for their investigation. **Section 3** discusses Assateague's unique vulnerabilities and opportunities as a demonstration site for climate resilience, while **Section 4** discusses the requirements for the building program.

Section 5 identifies and illustrates the four themes that guided the students' research and design proposals: thermal delight, climate resilience, ocean threshold, and adaptive reuse. These themes informed the introduction of bioclimatic (passive) design principles early in the process and influenced ideas and decisions about form, orientation, and integration with the site. Teams tested passive, low-energy strategies, iterated via computer energy modeling and refined in consultation with technical experts from several disciplines.

Section 6 introduces each of the fourteen team projects and highlights their ideas, approach to form, and key metrics. **Section 7** summarizes findings and recommendations that emphasize the synergies between good passive design principles, energy-efficiency, and climate resilience. These technical considerations contribute to and enhance visitors' enjoyment of the special place that is Assateague State Park.

2 PROJECT INTRODUCTION

PROJECT INTRODUCTION

Assateague State Park is a two-mile long segment of the 37-mile Assateague Island, a barrier island bordered by the Atlantic Ocean on the east and the Sinepuxent Bay on the west. It is one of Maryland's most visited state parks — much beloved by the 1.7 million yearly visitors who come for the day or to camp — and its only oceanfront park.

STUDENTS CHAT WITH LIFEGUARD AND RECORD IMPRESSIONS DURING THEIR SITE VISIT

The existing day use facility at Assateague State Park includes a snack bar, gift shop, bathrooms, changing rooms, and a lifeguard office distributed across three buildings. The complex has served the people of Maryland for 30 years, accommodating up to 2,500 visitors on busy summer weekends, and is now nearing the end of its useful life.

The client team from Maryland Department of Natural Resources (MD-DNR) has several goals for the planned renovation / reconstruction project. They see the project as an opportunity to promote resilience, to better serve the needs of beach visitors and park staff, and also to consider creative ways to generate income from the facilities.

Twenty-nine graduate students of Architecture at the University of Maryland School of Architecture, Planning and Preservation were tasked with re-imagining the day use facilities, which include the three buildings and associated outdoor deck areas, all of which sit on a 9,000 square foot concrete and wood platform. The students' designs all propose to remove the existing buildings but retain the existing concrete platform as part of their projects.

This study was framed as a process of imagining what the newly renovated facility could be. Student teams took client goals as a starting point, with a particular focus on **climate resilience*** and occupant comfort, and tested what designs would result from a **bioclimatic*** approach.

The University of Maryland School of Architecture, Planning and Preservation graduate curriculum includes a pair of co-requisite courses called Integrated Design Studio (ARCH 600) and Advanced Technology (ARCH 611), respectively. This project was developed in the context of this pair of courses.

In architectural education, design studio courses typically focus on the study of form and space in relationship to intention, meaning, and problem solving. The study of material, assembly, and performance of buildings is typically the focus of technology courses outside the studio. This pair of courses is rooted in the conviction that, for buildings to achieve true excellence and highest value, there is a necessary interdependence between design and technology. Together, both design and technology play a front and center role in this combined course, producing the maximum value for the Assateague day use building study.

In this pair of courses, students design a relatively small building to a high degree of detail. To create such a building in any studio setting, whether academic or professional, requires an organized process that allows the design tasks to move logically from one phase or scale to another, as well as allowing for ample iteration within each phase. Students' projects are the material realization of rigorous design inquiry, exploration, research, and solid architectural thinking all along the way.

HAIDER + KAKU FINAL REVIEW

STUDENTS, CLIENT TEAM, AND CONSULTANTS DISCUSS PROJECTS IN A ROUND-ROBIN FORMAT (2018 PHOTO).

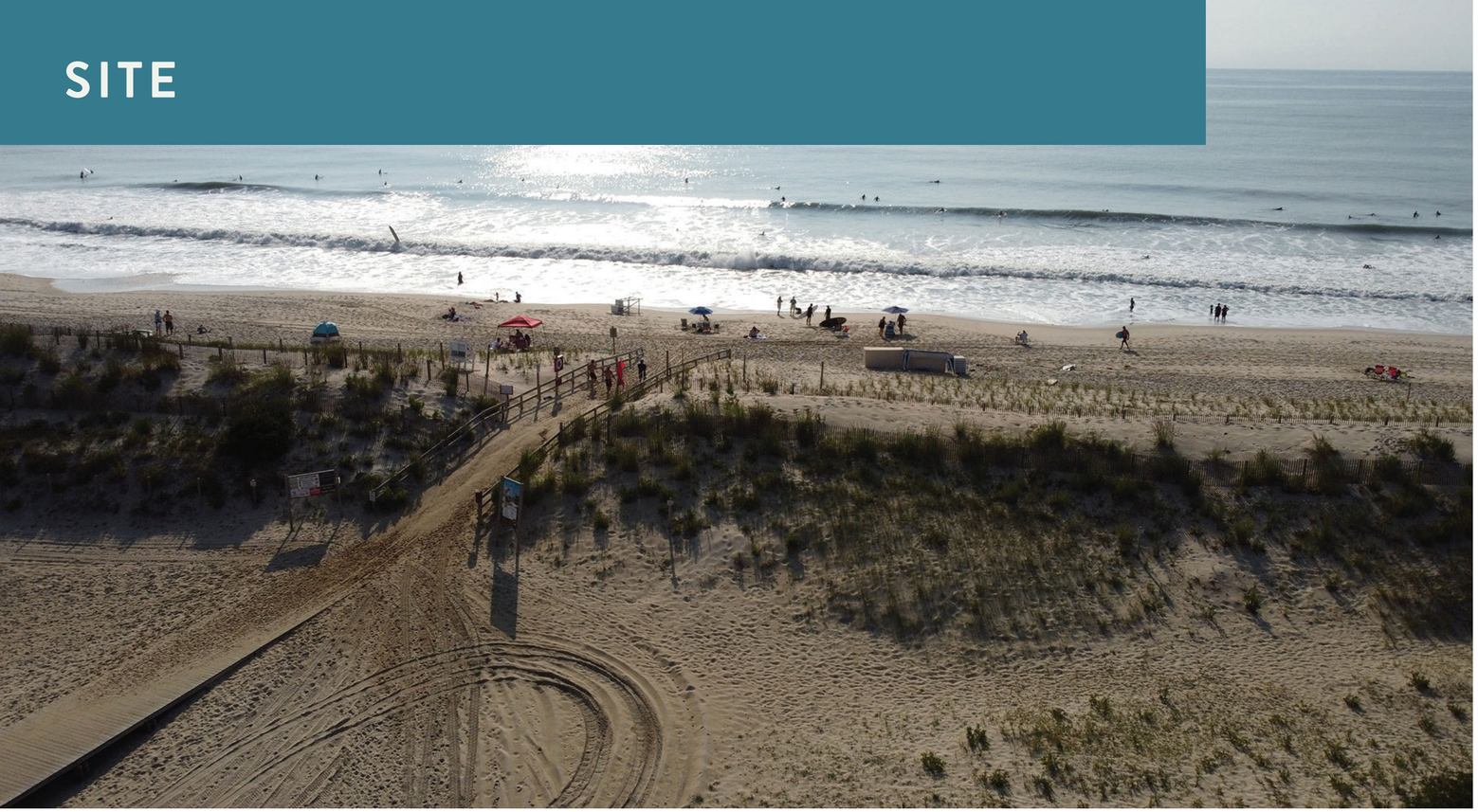
ISLAM + TRAM PREPARE FOR FINAL REVIEW

NOTE ON TERMINOLOGY:

We have tried to keep this report as clear and readable as possible. Some jargon is unavoidable, so we have included a brief **Glossary** of technical terms at the end. The first time such a word is used, it's marked with an asterisk.

3 SITE

SITE



LEFT: CAMPING AT ASSATEAGUE STATE PARK

Assateague State Park is home to an incredible diversity of habitats, each with its own plants, animals, and natural features. According to MD-DNR:

"Its two miles of ocean beaches offer swimming, beachcombing, sunbathing, surfing and fishing. The bayside offers visitors the chance to explore secluded coves by canoe or kayak. The marsh areas have a variety of wildlife, including deer, waterfowl and feral horses."

In the 1950s, much of the island was platted and slated for development as a southern extension of Ocean City, MD. Assateague State Park was created in 1956 from a gift of 540 acres and is now 850 acres in size. After a storm destroyed much of the existing island infrastructure in 1962, resort development was scrapped and the land was purchased by the federal government. Assateague Island was dedicated as a National Seashore on September 21, 1965. Some deeper history may be found on this website.

As a barrier island, Assateague has been a constantly changing landscape since its formation 5,000 years ago. But now the dynamic balance of sand, wind, weather, and water is being upset by a complex new variable: climate change. Winter Storm Jonas in January 2016 and a nor'easter that same May blasted through the two-mile oceanfront dune constructed to protect against storms and damaged critical built and natural infrastructure.

Staff involved in the management of the park have drafted the *Assateague Climate Change Adaptation and Resilience Outline Plan* to prioritize ways to support recreational activities in the context of an ever-changing natural environment. As the report notes on page 14, infrastructure — from roads and parking lots to the day use and camper facilities — are critical to the visitor experience and heavily used given the park's popularity.

The report also warns, on page 15, that existing facilities, including the day use facility described here — along with the ranger station, visitor center, and bathhouses — are vulnerable to the impacts of climate change. "Strong winds

CLOCKWISE TOP LEFT: DUNE BREACHES FROM WINTER STORM JONAS, JANUARY 2016; DAMAGE FROM MAY 2016 NOR'EASTER

can threaten the integrity of buildings, carrying sand and debris that lead to faster deterioration. More frequent and intense rainstorms paired with road flooding can weaken structural integrity as well. . . . Without enhancing the resilience of buildings on site, buildings could become unsafe or inaccessible for guests before, after, or during storms."

The State of Maryland's investment in the renovation and/or reconstruction of the day use building can contribute in significant ways to the climate resilience of the park, and potentially act as a model for future development in vulnerable coastal areas.

This design effort defined the site narrowly as the existing building's foundation and immediate environs, but note here that the surrounding landscape is a critical part of the reconsideration of this facility. For instance, the 370-space parking lot is a hostile expanse of asphalt in need of shady, protected paths to the building and the beach. All of the projects presented here include some thought and suggestions addressing the parking lot or other aspects of the day use area beyond the immediate site.

The existing 1990 building sits on a concrete foundation raised above the level of the sand. This foundation is a pedestal-type structure comprising concrete **auger cast piles*** which support a network of concrete beams. Our project proposals for the new day use facility take this existing foundation as a starting point. (See section **5.4, Adaptive Reuse**, for more details.)

PARK STAFF DISCUSS CHALLENGES AND OPPORTUNITIES FOR THE PROJECT WITH STUDENTS DURING A SITE VISIT IN SEPTEMBER 2021.

4 PROJECT PROGRAM

PROJECT PROGRAM

PURPOSE OF THE DAY USE BUILDING

The current facility provides day visitors to the beach with restrooms, a cafe, and a gift shop. The facility includes three buildings and outdoor areas constructed on a 9,000 square foot platform. In discussions with the clients, we considered their needs and aspirations and produced the program of spaces, both interior and exterior, contained in the spreadsheet at the end of this section.

In the proposed program, the replacements for many of the existing spaces have been resized to better serve the increased visitorship since 1990. The new program also includes additional elements, such as new event spaces that will greatly enhance the visitor experience and possibly generate revenue for the state.

The proposed designs all expanded the existing platform to accommodate the larger spaces. Most designs have an interior building footprint of 9,000 - 10,000 square feet, plus outdoor spaces to circulate, gather, and eat.

NOTES ON PROGRAM ELEMENTS

Outdoor Spaces

The team from MD-DNR suggested the Delaware Seashore's Big Chill Beach Club as a possible example to study. This recent renovation includes a new upper level structure for restaurant, bar, special events, and a spectacular view over the dunes to the ocean. Many student teams drew inspiration for the design of outdoor spaces from this project. (More observations are in section **5.1, Thermal Delight.**)

Outdoor space allocations listed in the spreadsheet were considered a starting point. Each team's approach to exterior spaces fit into the overall concepts for their project. The client's preferences are noted below:

The **entrance point** is meant to draw foot traffic and to welcome visitors. Here, park rangers can post information on weather and surf conditions, including temperature, tides, and wind, as well as notices of special events such as ranger talks or wildlife demonstrations.

Outdoor showers should be easily accessible from the main circulation between the day use facility and the beach access boardwalk and path.

Special gathering spaces could include an outdoor deck or terrace, ideally including an open deck space sized to accommodate a 20′ x 60′ **party tent** with banquet seating for up to 120 people.

Potential **upper levels** could take the form of decks, porches, or observation towers.

Outdoor Spaces

CLOCKWISE FROM BOTTOM LEFT: COVERED PORCH AND PARTY TENT DECK AT BIG CHILL BEACH CLUB AT DELAWARE SEASHORE STATE PARK; OCEAN VIEW FROM UPPER DECK OF BIG CHILL; EXISTING BEACH ACCESS BOARDWALK + PATH

visible from the main arrival area and easy for campers to access, as they rely on it to resupply with food and drink, and to purchase souvenirs. It should have more generous aisles and circulation space than the current store.

The **food service area** will have indoor as well as outdoor seating for a range of food service types. Options might include a casual grill; a sit-down restaurant; and an upper level outdoor bar and cafe. All spaces will be served by a common kitchen.

Indoor Spaces

These notes were influenced both by on-site observations of the existing facility and conversations with the client team about changes to better serve visitors.

The **new toilet facilities** will be smaller than the current ones, as indoor showers will be replaced with outdoor rinse stations. The women's restroom will have nine toilets. The men's should have five urinals and four toilets in stalls. Both of the gendered restrooms will have eight sinks and six to eight private changing areas. At least one of the changing areas will be larger to accommodate wheelchair users.

Two gender-neutral family restrooms will include toilet, sink, and changing area within one room. All plumbing shall be organized in easily-accessible chases for maintenance.

The **lifeguard office** needs storage, space to stage gear, a break area, and a private restroom with shower. It does not need a clear view of the beach, but should be near the public access point for visitor interactions. Lifeguards have requested an observation tower (optional).

The **camp store / gift shop** should be

MENCER + VASQUEZ - RESTAURANT PROPOSAL

The **loading area, storage, and back-of-house for the kitchen and gift shop** all work well currently. We were encouraged to organize these areas similarly to how they are now.

The **event space** will be used for park events, exhibits, gatherings, and presentations by rangers, with the possibility of rental for weddings and other outside group gatherings. It must be near kitchen and restaurant back-of-house service spaces.

Throughout the facility, allocate places for **interactive exhibits and signage**, both indoors and outdoors. Some of these may be stand-alone kiosk-type structures, possibly along the entrance walkway, for outdoor education by park rangers.

Support Spaces

- Space for vending machines in the outdoor public area
- Staff break room to accommodate as many as 8 people
- Storage for cleaning and maintenance supplies
- Storage for nature materials for hands-on demonstrations and educational programs
- Storage for sand wheelchairs, which must be accessible to the main circulation between the day use facility and the beach access boardwalk and path.

IMPORTANT CONSIDERATIONS

- The project will reuse existing concrete piling and beam foundations, but may expand the foundation area to accommodate a larger footprint. Students may also reinforce the existing foundations at limited points to increase bearing capacity. See section **5.4, Adaptive Reuse** for more details.
- Accessibility to all spaces is a strict requirement. This includes any upper deck areas, which may be accessed via ramps. An elevator is not feasible.
- A facility that does not require a lot of ongoing maintenance is key.
- Designs for outdoor eating areas must consider ways to prevent horses from crashing the party.

HOURS OF OPERATION

The bulk of this facility will be used seasonally, largely due to staffing limitations in the off-season. Currently, the four water pumping houses at the park (used for both campground and the day use facility) are shut down during the off-season. All parts of the building are winterized at shutdown to drain water from the plumbing system, so weddings and other special events bring in their own portable bathroom units. Client will consider proposals for composting toilets instead.

YEAR-ROUND SPECIAL SPACE PROPOSAL:

For pedagogical purposes of this studio, we asked each project team to designate, at their discretion, some portion of the building to be used year-round. Each team's justification aligned with their project intentions. Some designated the event space and supporting spaces (kitchen, restaurant) as year-round. Others, just the event space. Teams considered:

- Passive and active heating and cooling
- Restrooms (composting toilets)
- Water, potable and/or nonpotable
- Energy.

CURRENT HOURS OF OPERATION BY PROGRAM ELEMENT

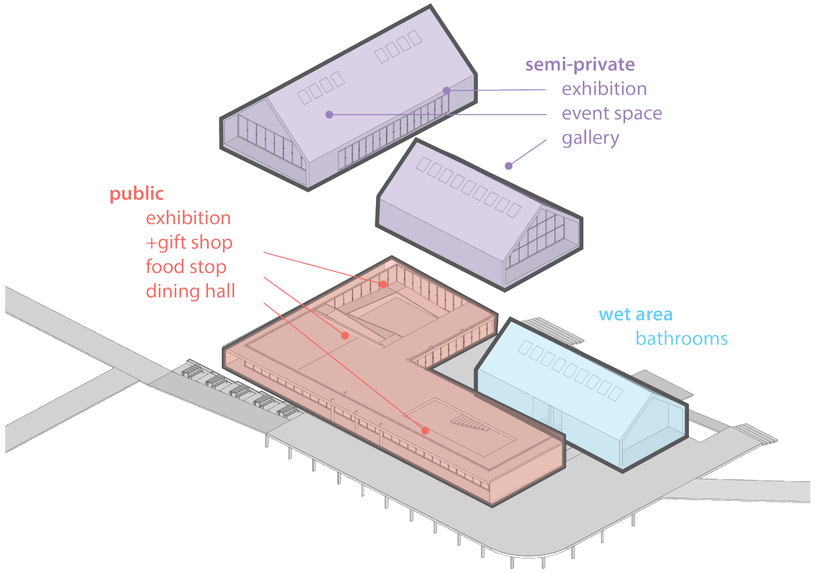
Toilet facilities: open from late April through end of October, when the campground is open.

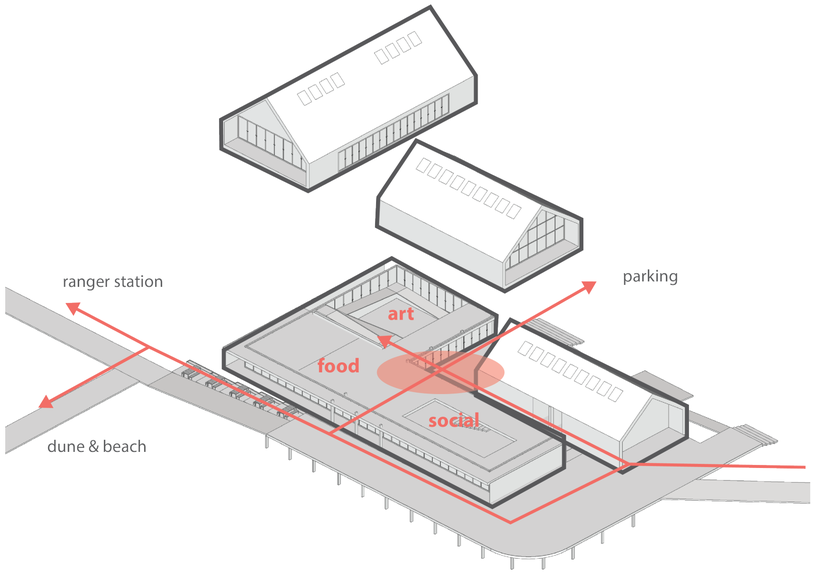
Lifeguard office: operates from early May through mid-October with twelve to sixteen staff members (though typically about eight on shift per day)

Pony Express Gift Shop and Grill:

- Opens Memorial Day weekend, then operates on a limited schedule until about mid-June (weekends only)
- Mid-June through Labor Day, operates up to seven days per week (due to staffing limitations during 2021 season, only open five days per week).
- After Labor Day, hours cut back gradually to four, three, then two days per week through about Indigenous People's Day weekend in October.

LEFT: DIBELLA + KONAN - EVENT SPACE PROPOSAL





BERNSTEIN + LOH + MIRZA

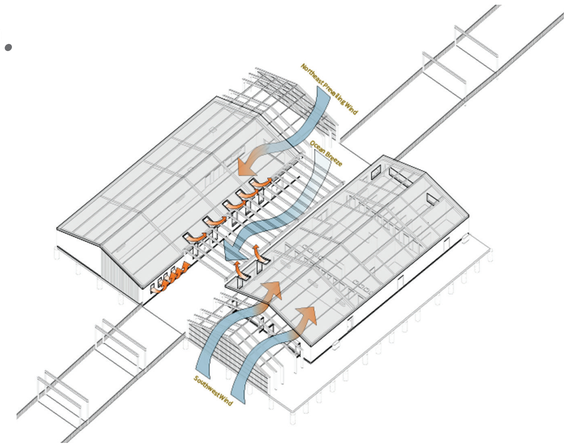
CHART OF SPACES

SPACE	OUTDOOR SF	INDOOR SF	REMARKS
Entrance and Orientation			
Arrival	800		Outdoor space, Place for posting info
Interactive Exhibit Space	400		Associated with outdoor space
Camp store / gift shop		800	
Event space: exhibits, gatherings, ranger presentations		1000	Two means of egress required; include exhibit space
Subtotal		**1800**	
Restaurant and Snack Bar			
Quick cafe / snack bar		600	
Restaurant indoor seating		750	Allow 15sf per person x 50 people
Restaurant outdoor seating	1000		Covered porch or open deck; may be screened porch
Upper deck / porch	1600		Includes outdoor bar, some covered seating
Upper deck tent area	1200		
Kitchen		500	
Staff toilet		30	
Admin Office		60	
Mechanical		0	See below for Mech space allocation
Janitor		800	
Storage		200	
Walk-in coolers		400	
Loading area, trash		400	
Subtotal		**3380**	
Safety and Amenities			
Lifeguard office		300	Observation tower may be considered / proposed
Covered picnic pavilion(s)	200		
Showers	200		All showers outdoor only, cold water
Family bathroom 1		80	Gender neutral
Family bathroom 2		80	Gender neutral
Toilets + changing rooms - men		800	
Toilets + changing rooms - women		800	
Staff break room		200	
Storage for sand wheelchairs		150	
Storage for hands-on nature demo materials		40	
Subtotal		**2450**	
Mechanical, utilities, storage			
Mechanical room		300	Water, heating, A/C
Electrical, telephone, cable, internet closet		80	
I.T. closet		20	
Subtotal		**400**	
Total net square feet		**8030**	
Structure, circulation at 20%		**1606**	
Total Gross Square Feet	**5400**	**9636**	**Maximum allowable overage is 10% over**

5 THEME OVERVIEW

THEME OVERVIEW

The unique conditions at this site inspired four key themes that guided students throughout the semester: thermal delight, climate resilience, ocean threshold, and adaptive reuse.



LEFT AND RIGHT: JAMERO + LEE PROPOSAL FOR OUTDOOR SPACES THAT HIGHLIGHT QUALITIES OF SUN, SHADE, AND OCEAN BREEZES.

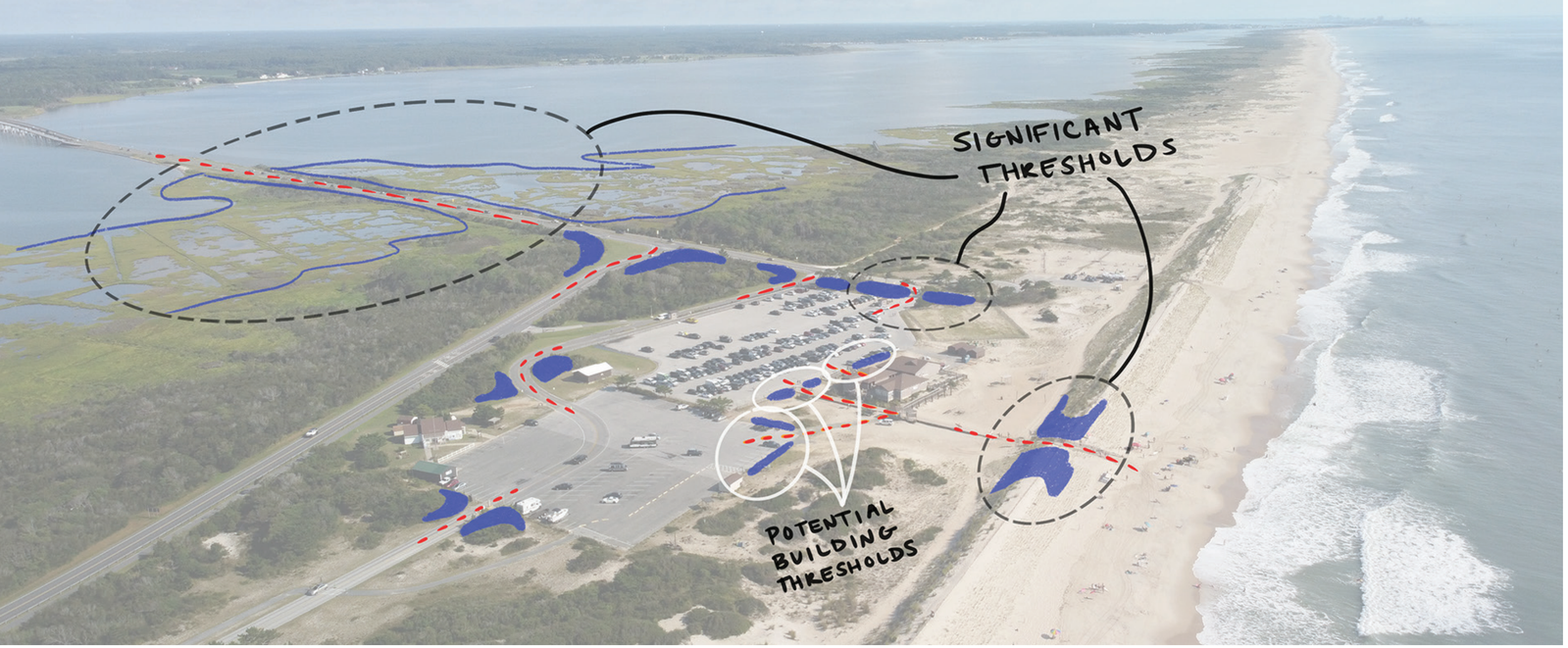
Throughout human history, sunlight and wind have produced comfortable — even delightful — environments. Project teams experimented with bioclimatic design strategies to address human comfort conceptually, incorporate the sensory perceptions of sun and wind into the visitor experience, and explore the form-giving potential of **thermal delight**.

The studio tackled **climate resilience** at three levels: site, building form, and materials. At the building scale, project teams focused on passive systems to improve energy efficiency and allow for **passive survivability***, **high-performance*** mechanical systems, renewable energy systems, and durable, earth-friendly materials.

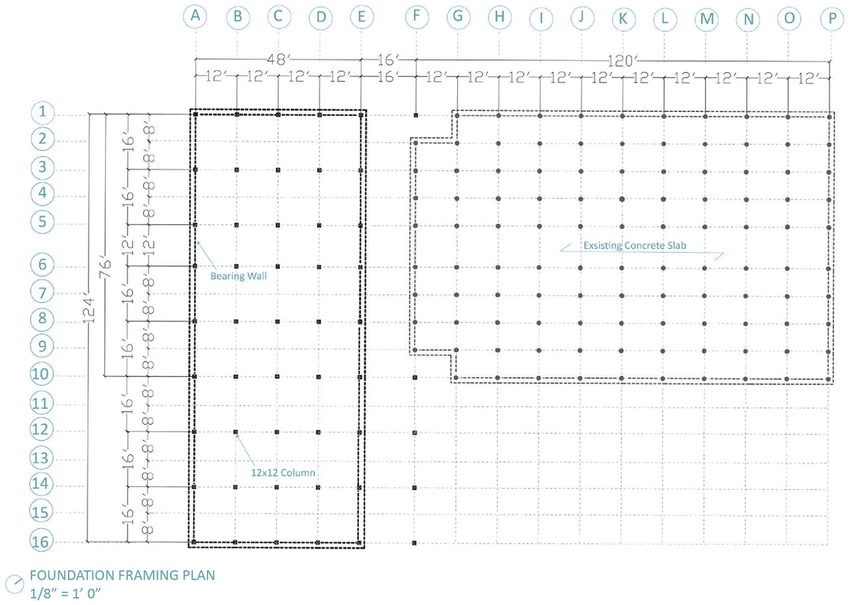
Projects emphasized the many thresholds in the park to highlight the ever-changing, moving landscape and its vulnerability to climate change, and to highlight the journey from the mainland to the beach. Many projects sought to bring awareness to the existing thresholds (bridge, entry road, parking lot, boardwalk, dune crossing) by imagining the day use facility itself as an extended **ocean threshold** experience.

Adaptive reuse* of the existing concrete foundation has several advantages in addition to historical and cultural continuity. Reuse minimizes the embodied energy of the building and reduces disturbances to the vulnerable site ecology that would be caused by large-scale demolition and construction of a new foundation.

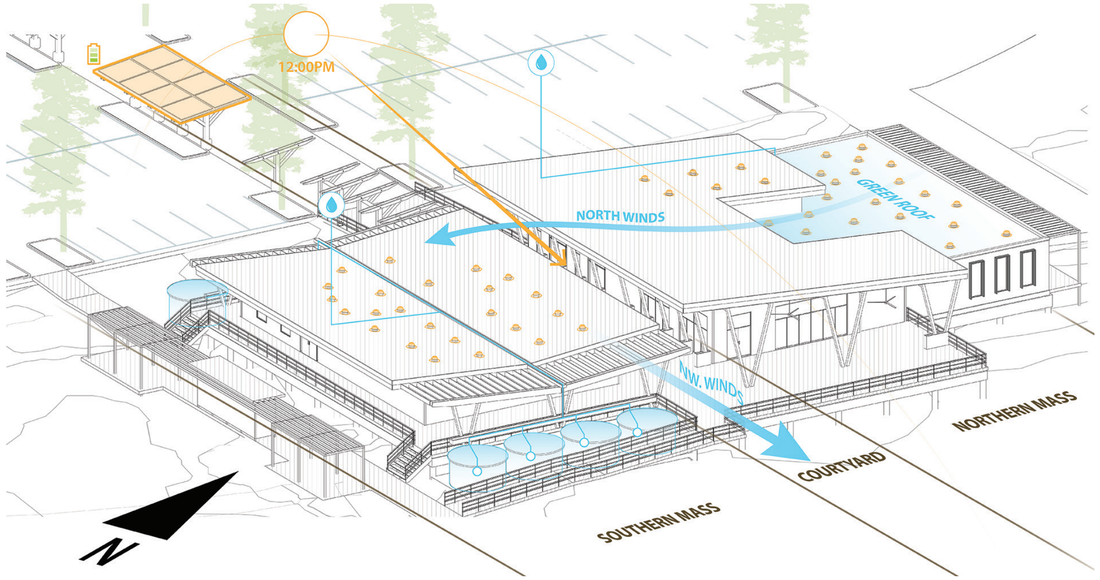
The following four sections provide further detail on each of these guiding themes.

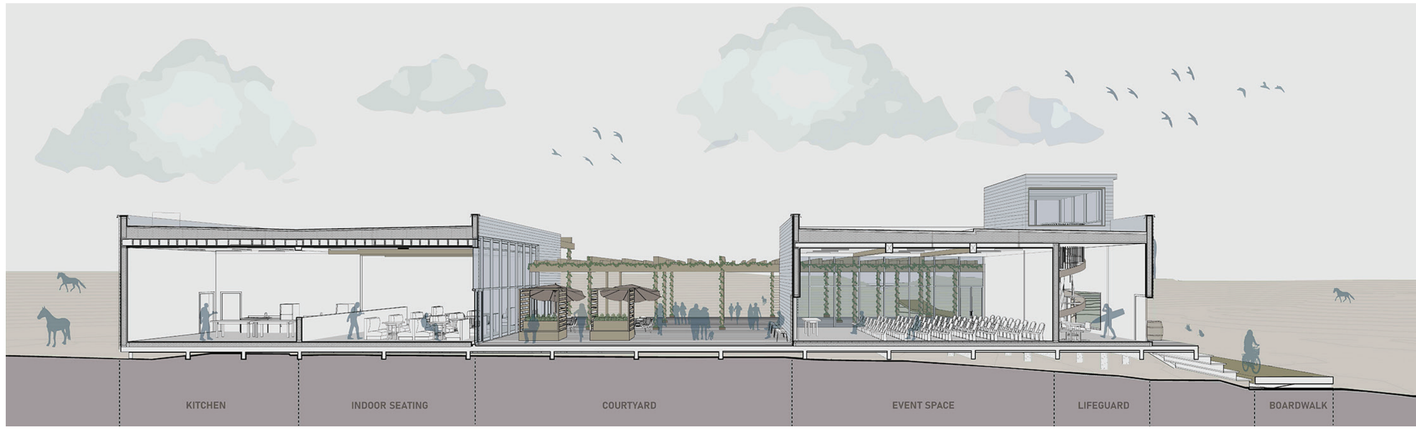


EXISTING SITE THRESHOLDS (ISLAM + TRAM).



MENCER + VAZQUEZ FOUNDATION FRAMING PROPOSAL SHOWING PRESERVATION OF EXISTING CONCRETE PODIUM WITH EXPANSION LIMITED TO ONE SIDE.





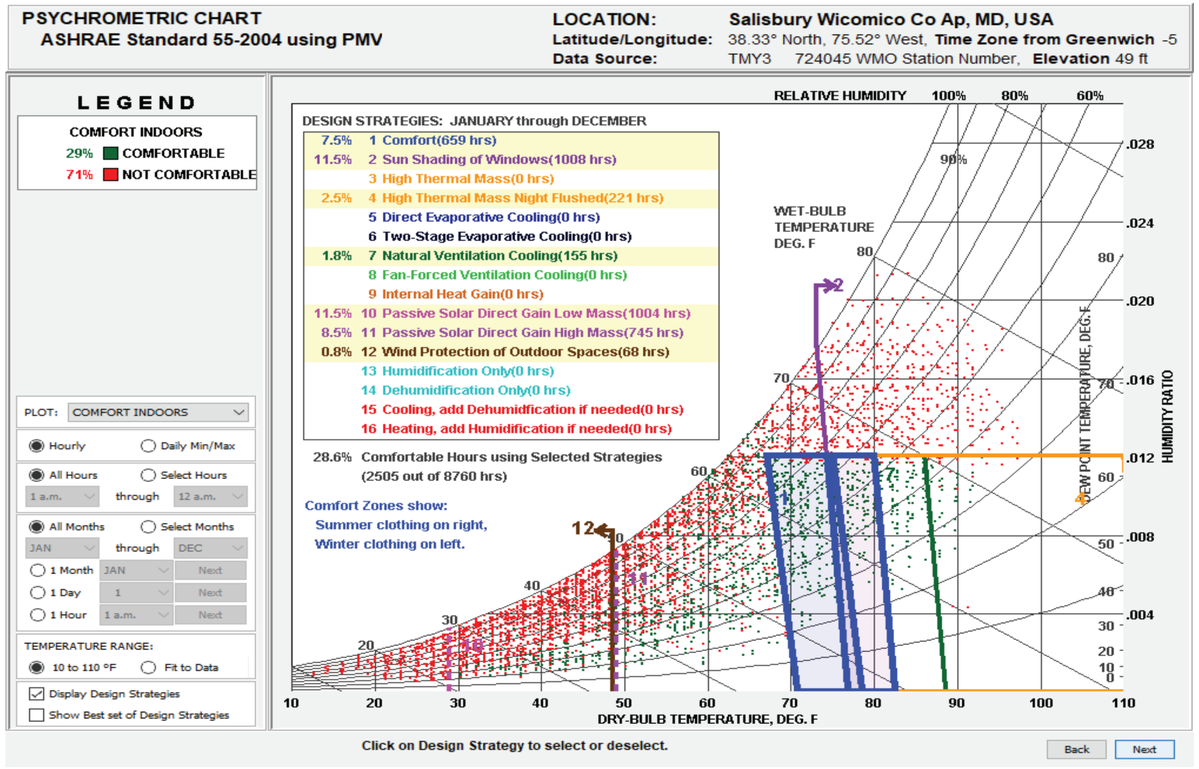
ABOVE: HABIB + ROBERTS BUILDING AS THRESHOLD: BREEZEWAY FOR SHADE AND GATHERING; LEFT: DEFNGIN + EDWARDS DIAGRAM OF PASSIVE STRATEGIES, RENEWABLE ENERGY RESOURCES, AND RAINWATER HARVESTING.

5.1 THERMAL DELIGHT + BIOCLIMATIC DESIGN

THERMAL DELIGHT + BIOCLIMATIC DESIGN

The modern **psychrometric chart*** has a small Goldilocks area of comfort: neither too hot, cold, humid, nor dry. Ever more sophisticated mechanical systems have eclipsed the lost art of **passive strategies***, those that rely on natural energy sources such as sunlight and wind to produce comfortable environments.

Good passive design uses the building itself as the tool for comfort. Reliance on air conditioning and heating as a default fix-all has been a cultural bias since the early 20th century, the era of cheap energy and climate ignorance. As a result, the study of passive design has often relied on anecdotes and rules of thumb.



"Thermal qualities—warm, cool, humid, airy, radiant, cozy—are an important part of our experience of a space; they not only influence what we choose to do there but also how we feel about the space."

- Lisa Heschong
Thermal Delight in Architecture

Our approach was two-fold: First, in the early schematic phase of design, we tested the form-giving effects of passive strategies such as natural ventilation, daylighting, and shading. Second, in later design development, we analyzed the building form and passive strategies using computer **energy modeling***, and dug into the best practices for detailing exterior walls. The solid empirical evidence of the energy models and good building science tested the effectiveness of and refined passive strategies. (There's more on this second step in section **5.2, Climate Resilience**.)

This early emphasis on bioclimatic design strategies was an experiment in thinking about thermal delight conceptually, so that when students later used the energy modeling tools, they brought more strategic intention.

LEFT: PERLA + REGISTER - PYSCHOMETRIC CHART

The modern bias toward conditioning all interior spaces to a single, narrow standard ignores the reality that different comfort experiences can be memorable and even meaningful to people. Who hasn't enjoyed a porch swing and a cool glass of lemonade on a hot August afternoon? Or warmed in a sunny window gazing at new snow, coffee cup in hand?

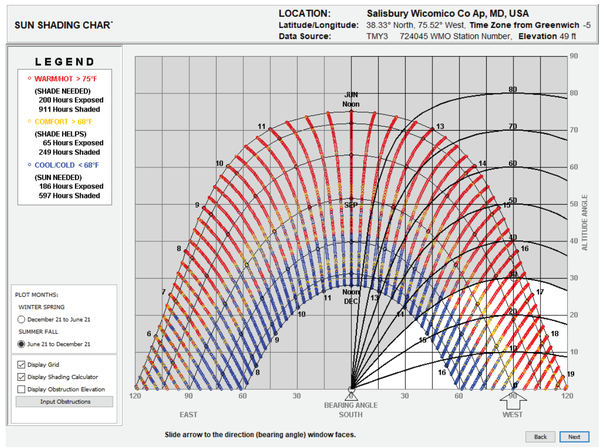
Many teams considered the possibility that thermally delightful spaces tend to be where people congregate and gather. Even on a 95-degree day, the shady breezeway of the Delaware Seashore's Big Chill Beach Club is very pleasant.

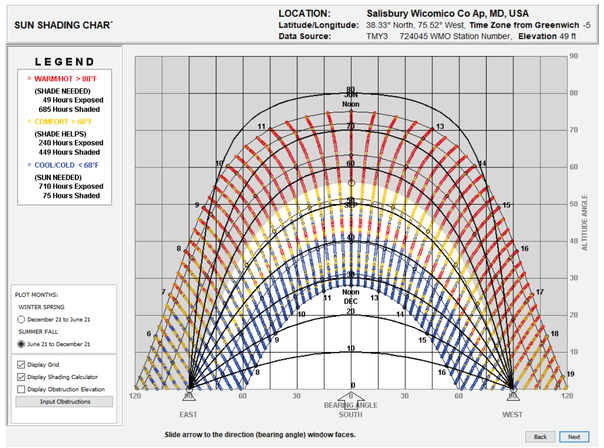
The project teams learned and applied **bioclimatic design principles*** to select and analyze passive strategies to provide reasonable comfort to building occupants. These strategies were prioritized before active heating, ventilation, air conditioning (HVAC) systems. (**Section 5.2, Climate Resilience**, has more details on these high-performing systems.)

The project proposals are not "HVAC-free." The intent was to see how far passive strategies, rationally applied, could go to provide defensible human comfort during the six months of the bulk of building operations. Each student team proposed a portion of the facility to be open year-round, providing various justifications including revenue-generation, special events, and expanded access for hardy visitors.

Many teams intentionally created varied thermal environments within their projects by adding sheltered outdoor areas. These spaces celebrate the strong sun and ocean breeze that characterize a beach visit instead of blocking them out, while protecting occupants from the harshest rays and strongest winds.

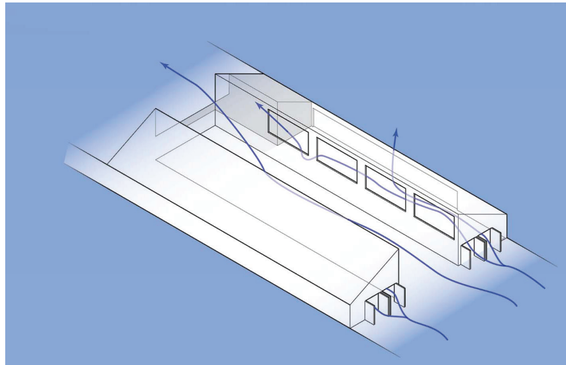
SHADY RESPITE AT THE BIG CHILL'S BREEZEWAY SHADES AND COOLS



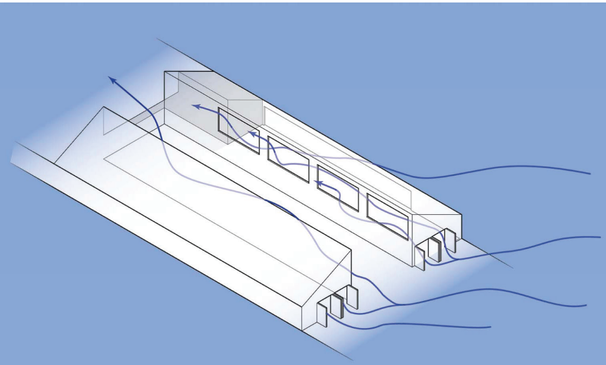


SUN SHADING STUDIES USING CLIMATE ADVISOR

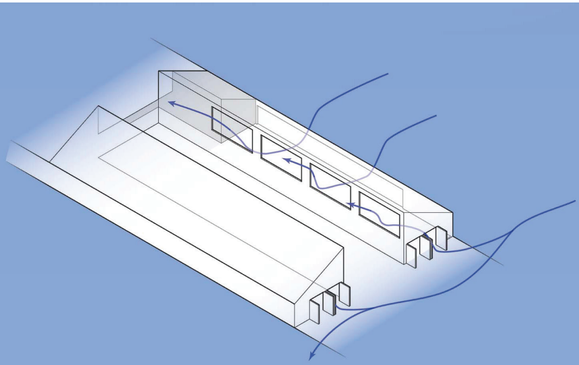
BELOW: LONG + MORA - WIND DIAGRAMS



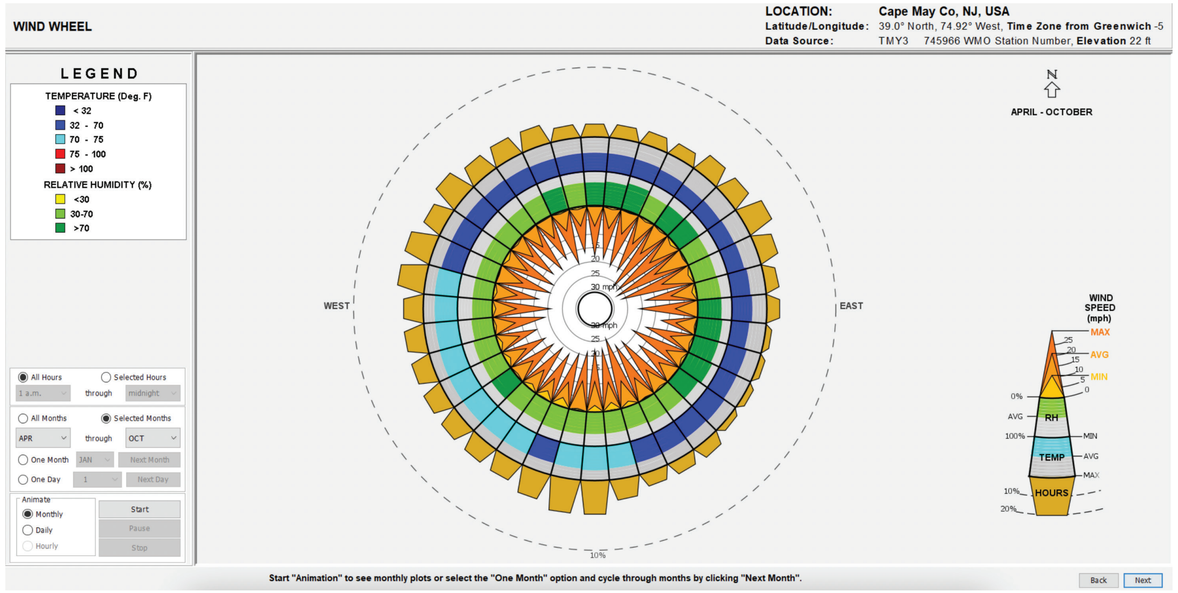
Ventilation | South Winds



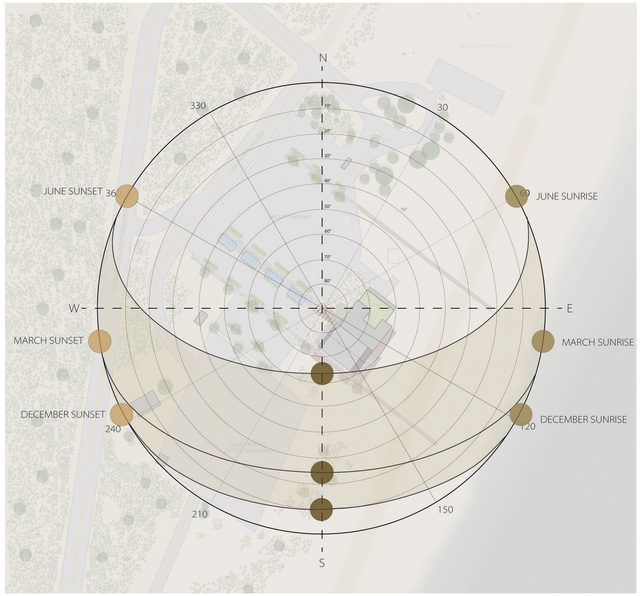
Southeast Winds



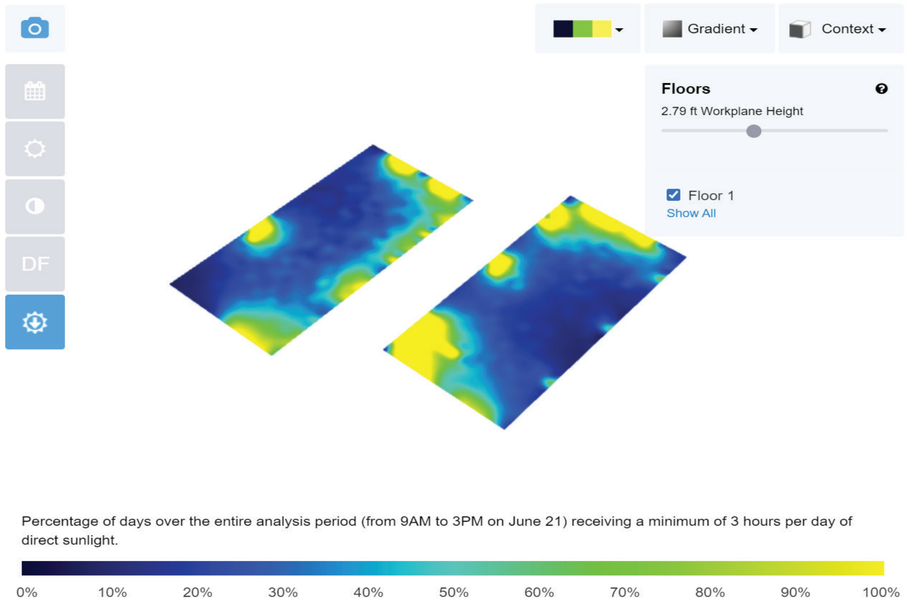
East Winds



LONG + MORA



DEFNGIN + EDWARDS



The computer tool Climate Consultant was used to guide and validate the bioclimatic strategies. The ability to tune to time of day and time of year helped guide teams' decision-making. The interface allows a designer to study the optimal shading angles to prevent overheating while also taking advantage of solar heating in winter.

LEFT: JAMERO + LEE

BIOCLIMATIC DESIGN STRATEGIES LOOKED AT FORM, ARRANGEMENT OF SPACES, AND LOCATION OF WINDOWS AND DOORS FOR NATURAL LIGHT AND VENTILATION.

Summary of bioclimatic design strategies tested in these projects:

- **Shading (on south) or vertical fins (on east and west)**
  - » Limit solar gain in summer
  - » Admit passive or active solar heat in winter
  - » Potential to produce electricity (shades can be solar panels)
- **Natural ventilation**
  - » Locate openings to control airflow
    - In summer, any breezes might be welcome
    - In spring and fall, allow warming winds from south, block or redirect cooler air from north
  - » Take advantage of the Venturi effect
    - Air accelerates through small openings and slows through large openings
    - Control and direct airflow through buildings through strategic placement of openings (example: dogtrot house)
    - Higher air velocity = greater cooling potential
    - Steer the wind with fins or casement windows to scoop air into openings
  - » Take advantage of the Bernoulli effect
    - Wind flowing around a building creates higher pressure on the windward side and lower pressure on the leeward (downstream) side
    - Take advantage of the suction effect to pull air through the building
    - Stack effect ventilation - enhances airflow as warm air rises
  - » Use Ceiling fans

5.2 CLIMATE RESILIENCE

CLIMATE RESILIENCE

The site is in what MD-DNR defines as the Critical Area for the protection of the Chesapeake Bay, and is subject to Maryland Coast Smart construction guidelines, as well as the newer Coast Smart design guidelines for capital projects within the Climate Ready Action Boundary (C.R.A.B.). Students researched and discussed these and other climate resiliency policies and strategies.

The studio tackled climate resilience with a focus on energy at three levels: **site**, **building,** and **materials**. At the **site level**, the design solutions were required to respond to the site's unique microclimate and vulnerabilities. At the building level, design solutions optimized bioclimatic strategies to reduce energy consumption and carbon emissions, as well as plan for passive survivability in the absence of electricity following a severe storm. The decision was made to utilize low-energy, high performance mechanical systems where needed. At the **material level**, teams proposed low-impact materials that could minimize the building's embodied **carbon footprint*** but still withstand the harsh marine environment.

Each scheme's bioclimatic approach began by identifying passive design strategies that not only improve energy performance, but increase comfort in the context of rising summer temperatures. Next, the focus shifted to the **enclosure*** and applying sound building science to design **high-performance thermal envelopes***. Moving to active systems, students designed HVAC and lighting systems to improve occupant comfort with the lowest possible energy use, and finally explored renewable energy options to offset the required energy use.

To design high performance buildings, teams studied reference projects, participated in master classes, and consulted with practicing professionals. Teams employed the following tools to study and evaluate design solutions and predict building performance:

- **Wall section*** drawings
- **R-value*** calculations
- Psychrometric chart
- Window-to-wall ratios
- Computer energy modeling.

Our clients expressed a strong desire for the new building to demonstrate the possibilities and best practices for building in vulnerable places. To that end, the projects aimed for net-zero energy consumption.*

Passive Systems: Students began the design process by considering the site and available natural resources, such as sun and wind, based on local weather and climate data. Early design iterations explored the most important and effective ways to harvest these resources. Common strategies considered included natural ventilation, sun shading during warm months, solar heat gain for cool months.

Building Envelope: Teams developed wall section drawings with an attention to separating building enclosure from structure and achieving best practices in layering in the building envelope: water, heat, airflow, and vapor flow barriers. Students also explored strategies for integrating openings and preventing **thermal breaks*** to optimize thermal integrity of the exterior walls and roof. One of the most visible aspects of the

teams' explorations was their wall sections. Architects use this valuable process tool to study and express many aspects of their designs:

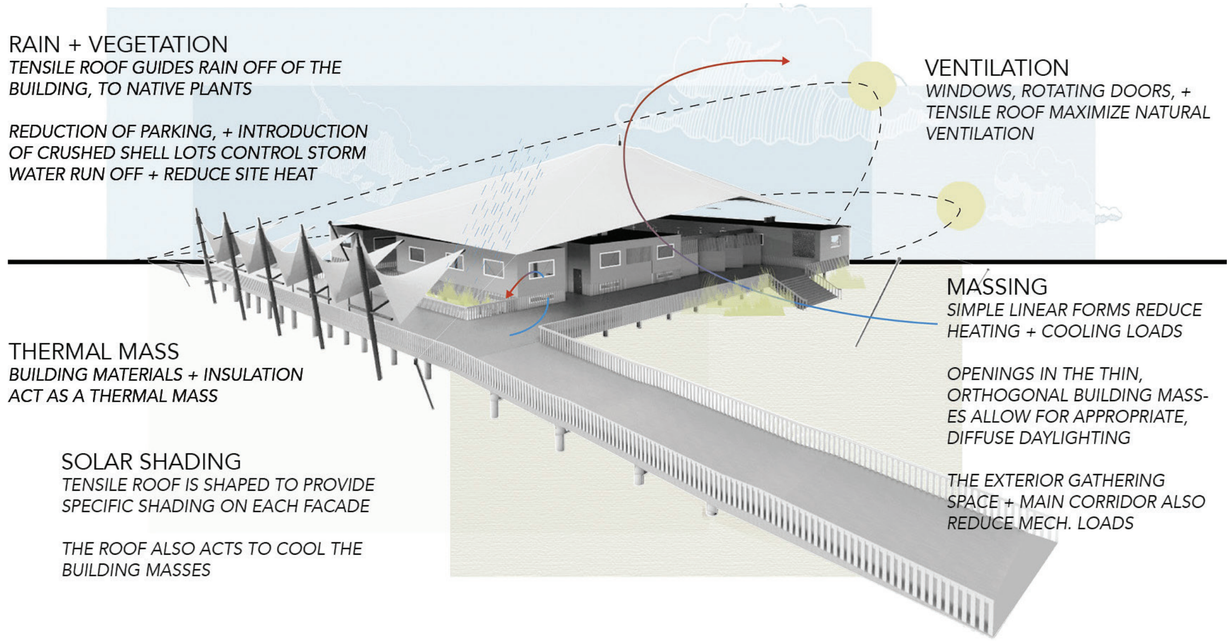
- Conceptual ideas of the whole
- Relationships of structure to enclosure (thermal envelope)
- Alternative ways to achieve desired R-values, particularly in coordination with energy modeling
- Integration of systems (ventilation, sun shading, mechanical elements, lighting).

Active Systems: Recommendations from mechanical engineers with decades of field experience helped the teams focus on the most practical high-performance mechanical system solutions for Assateague's unique requirements. Teams used Sefaira, an energy modeling software, to optimize the design of their active HVAC and lighting systems, and integrate them with the previously selected passive strategies. The goal of the passive and active strategies, paired with a well-designed envelope, was to reduce the energy use of the building as much as possible. **Energy Use Intensity (EUI)*** is a common indicator of energy efficiency (See section **6, Project Proposals** for EUIs of the student proposals).

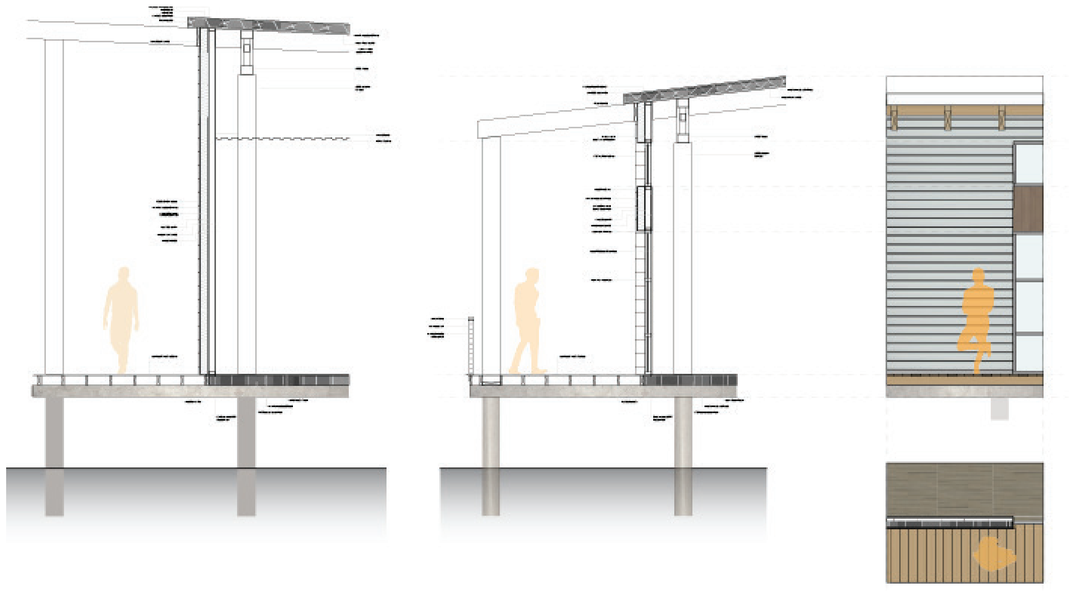
Most teams selected **Variable Refrigerant Flow (VRF)*** systems for heating and cooling, combined with some form of **Energy Recovery Ventilation (ERV)***. Importantly for this project, many students selected VRF systems or other split-system heat pump technologies to allow portions of the facility to remain operational while the rest was shut down in the off-season.

Renewable Energy: Once each project had optimized design of passive strategies, building envelope, and active systems, the teams explored renewable energy systems. All teams chose to include solar photovoltaic systems in the project, given the challenges of wind and geothermal at the site. Many proposed deploying solar canopies in the parking lot to meet renewable targets and also provide shade in the extensive asphalt area.

Materials: In addition, teams considered embodied energy impacts in the selection of materials. Designs balance the need for durable materials capable of withstanding



PERLA + REGISTER PROPOSAL FOR USE OF PASSIVE STRATEGIES.



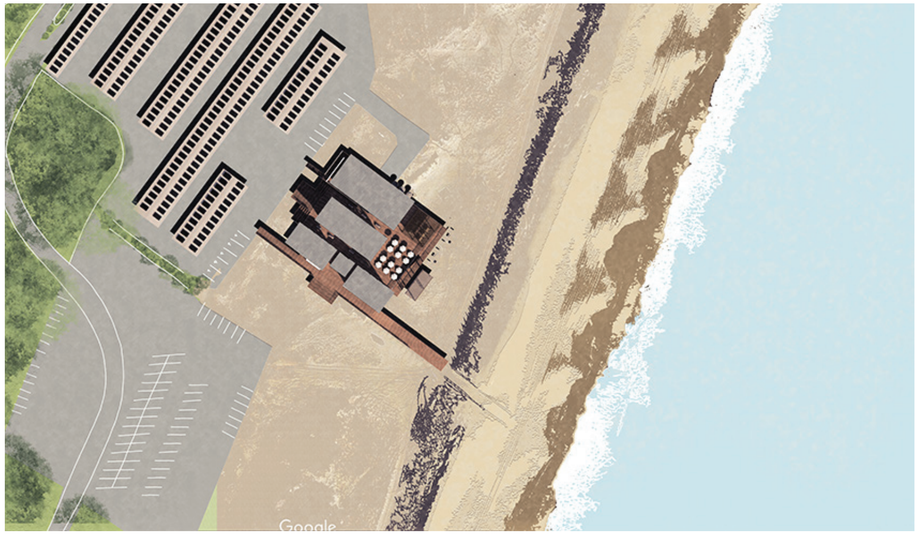
JENKINS + SMITH WALL SECTIONS SHOWING RELATIONSHIP OF STRUCTURE, ENCLOSURE, AND SHADING ELEMENTS.

the harsh marine environment (which often are more energy-intensive to produce) with a desire to use lower impact or locally-sourced resources. Teams considered the following aspects of materials:

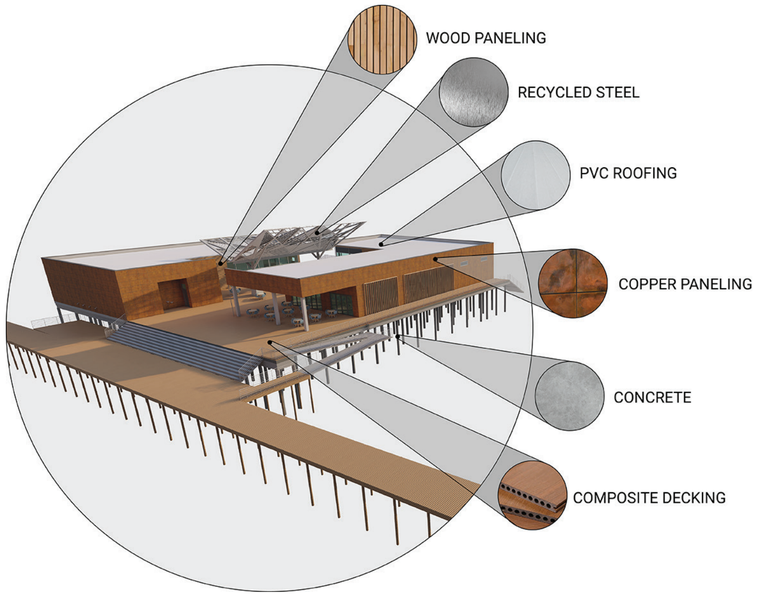
- Embodied energy
- Longevity
- Low or no toxicity
- Locally sourced
- Renewable / natural.

Common material selections included:

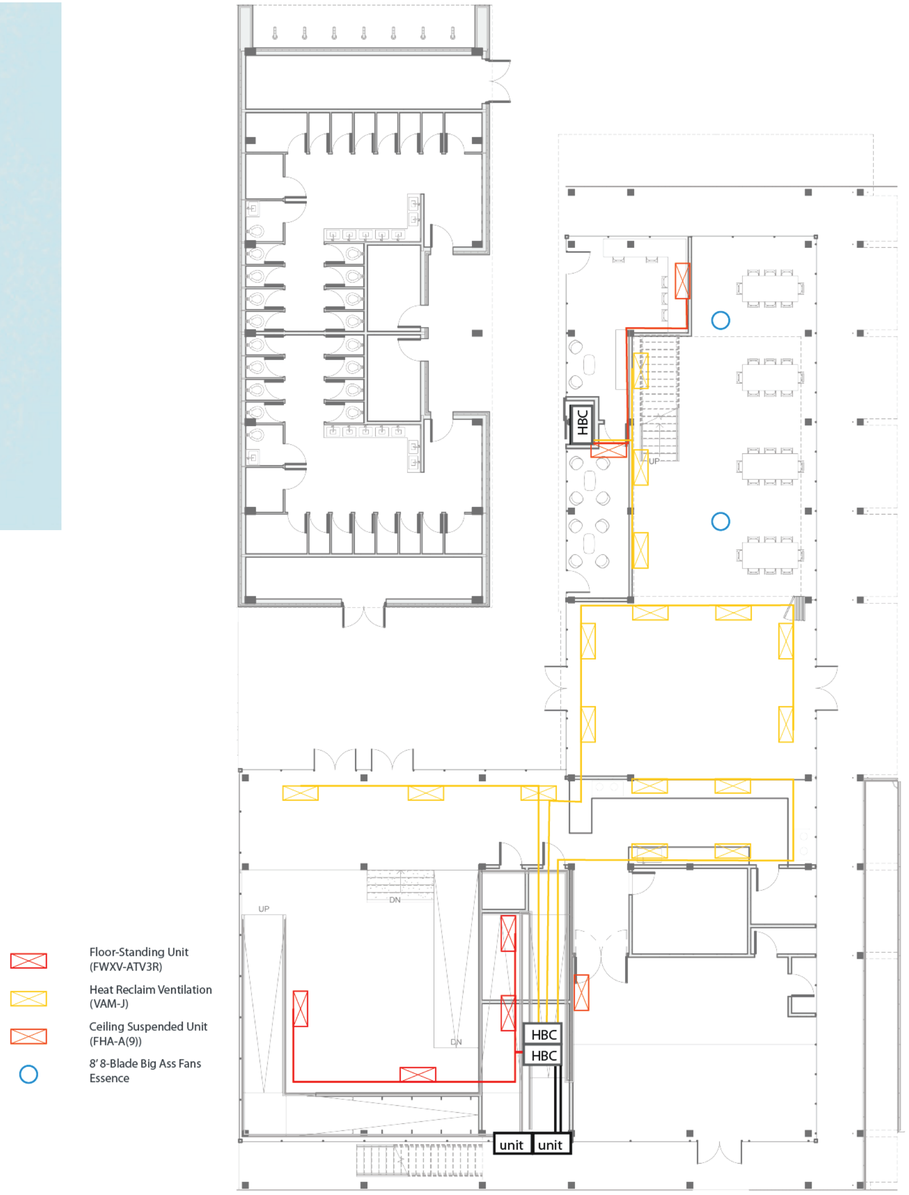
- **Engineered wood products** such as glue-laminated timber were frequently selected as structural materials due to their ability to span longer distances with a lower carbon footprint
- **Wood products** such as cedar or bark shingles were used as exterior finishes by many teams
- **Copper** siding and roofing
- **Fiber cement** siding
- **Salvaged wood** (from existing building)
- **Heat or chemically treated wood** (low toxicity)
- **Steel** with high-recycled content.



CENTENO + DEGROFF PV CANOPIES SHADE PARKING AREA



MATERIAL PALETTE PROPOSED BY BENHAM + GURSOY



BERNSTEIN + LOH + MIRZA MECHANICAL SYSTEMS DIAGRAM.

5.3 OCEAN THRESHOLD

OCEAN THRESHOLD

At a continental scale, Assateague acts as a threshold between the Atlantic Ocean and North America. The island itself is a threshold between two bodies of water: ocean and bay. The journey of crossing the bay, arriving on the island, leaving one's vehicle, and crossing the dune to the beach can be thought of as a series of thresholds, one after another.

A threshold is a place of "both-and." The space on a bridge or in a doorway is neither inside nor outside; it is a third place with its own qualities, a space that makes the relationship between inside and outside, or land and water, possible. In mythology, the threshold is the point of leaving behind all that one knows and venturing into uncharted territory. Who can predict what lies ahead?

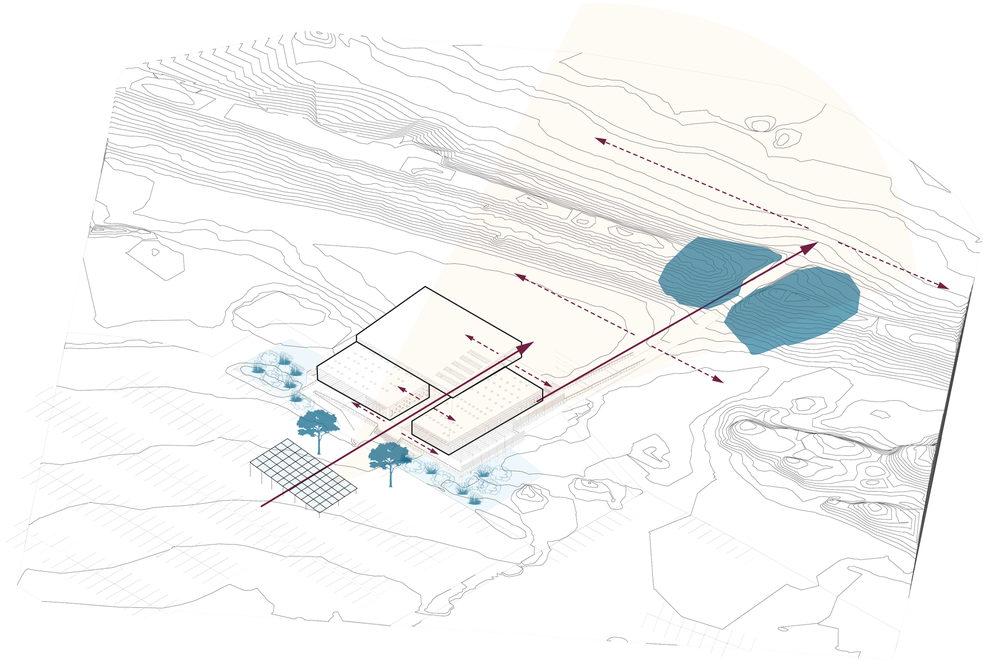
In ancient stories, Janus is the guardian of the threshold. He is the god of beginnings, gates, transitions, time, doorways, passages, and endings. He is depicted as having two faces, so he can look in both directions, toward the past and the future. The month January is aptly named for him.

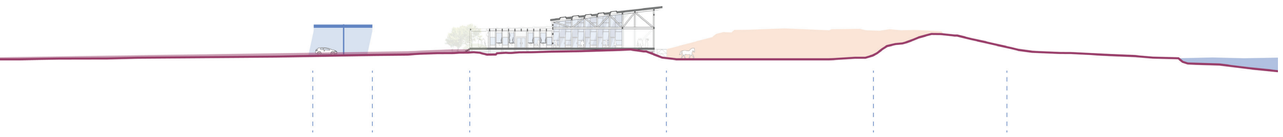
Many projects addressed the idea of a threshold at this larger, temporal scale as well, attempting to design for an unknown, unpredictable future in which climate change radically reshapes the island. This project can mark a shift from the building and development patterns of recent decades to the new ways of thinking that will be required in coming years, while still looking to the past—especially to indigenous and vernacular building traditions—for inspiration.

OCEAN THRESHOLD: DUNE, PEOPLE, HORSES, SAND FENCE

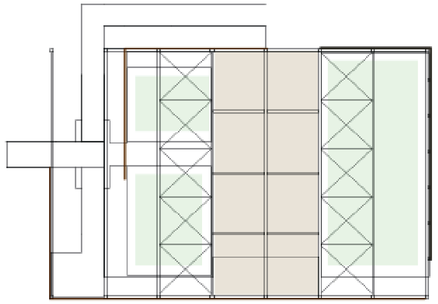
Emphasizing thresholds on Assateague also highlights the ever-changing, moving landscape, and its vulnerability to climate change. Many projects sought to bring awareness to the existing thresholds (bridge, entry road, parking lot, boardwalk, dune crossing) by imagining the day use facility itself as an extended threshold experience.

Layering the program offers a series of internal thresholds that mirror and amplify the site threshold condition.

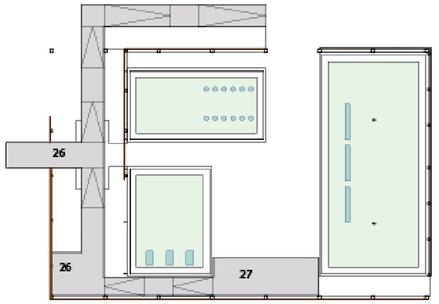




TRAM + ISLAM

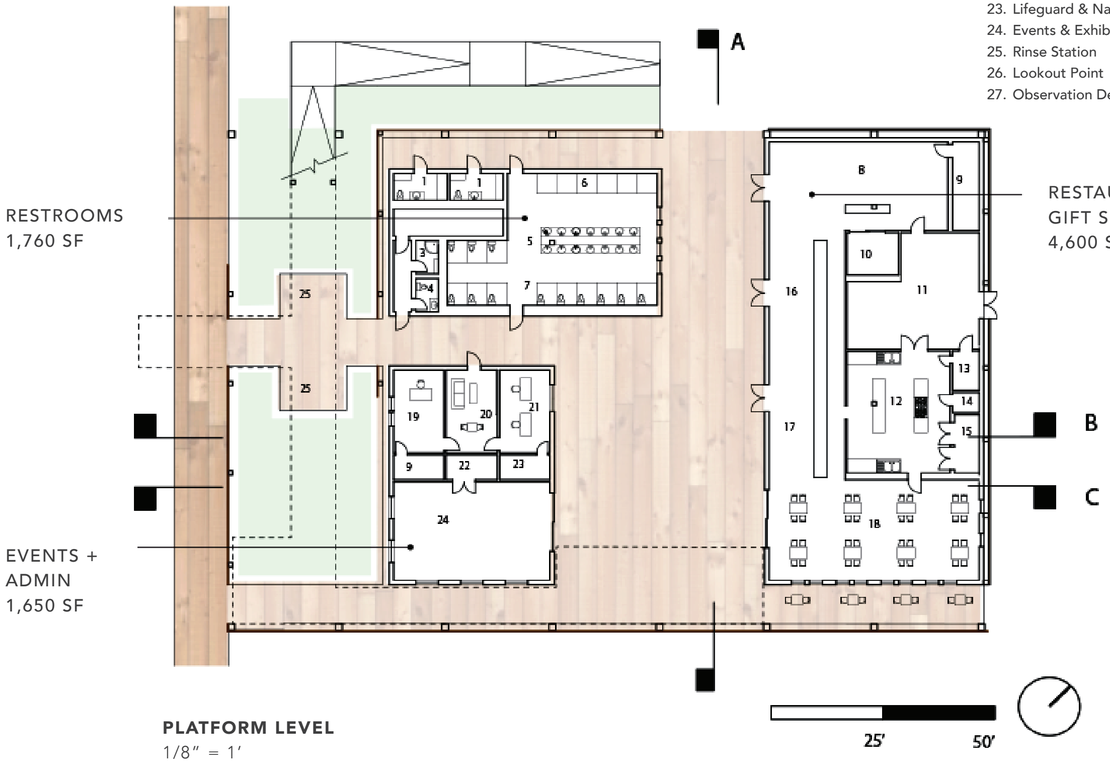


CANOPY LEVEL
1/16" = 1'



DECK LEVEL
1/16" = 1'

1. Family Restroom
2. Mechanical & Janitorial
3. Staff Shower
4. Staff WC
5. Sinks
6. Changing Stalls
7. WC Stalls
8. Gift Shop
9. Electrical & IT Closet
10. Sand Wheelchair Storage
11. Loading & Storage
12. Kitchen
13. Trash
14. Water Heater
15. Cold Storage
16. Snack Bar
17. Restaurant Order Counter
18. Restaurant Seating
19. Administrative Office
20. Staff Break Room
21. Lifeguard Office
22. Events Storage
23. Lifeguard & Nature Demo Storage
24. Events & Exhibits Flex Space
25. Rinse Station
26. Lookout Point
27. Observation Deck



PLATFORM LEVEL
1/8" = 1'

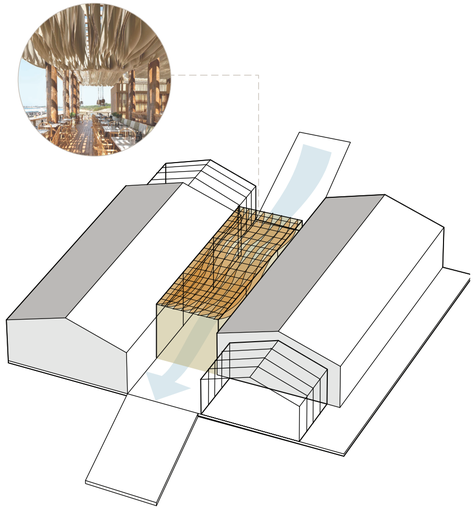
KAKU + HAIDER

Internal courtyards create a place to celebrate the transition from parking lot to beach.

KAKU + HAIDER

JENKINS + SMITH

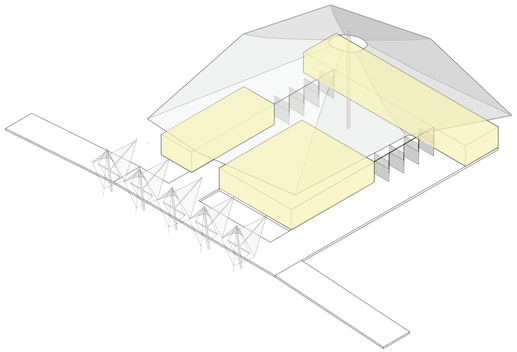
Axial, covered breezeways—linear spaces that organize the various parts of the program—center the experience of the procession toward the ocean.



JAMERO + LEE

KONAN + DIBELLA

JENKINS + SMITH



PERLA + REGISTER

DEFNGIN + EDWARDS

5.4 ADAPTIVE REUSE

ADAPTIVE REUSE

Quoting a 1986 National Park Service brief, the author Anne Grimmer defines adaptive reuse as "the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values."

For this project, we adaptively reused the existing foundation. Teams assumed that the existing buildings on top of the platform would be removed, but they retained (and generally expanded) the platform itself. This approach provided several advantages:

- it reduced the embodied energy of the building
- it limited disturbance to the vulnerable, constantly shifting site
- it provided historical and cultural continuity.

The existing foundation, built in 1990, is a pedestal type structure comprising concrete **auger cast piles*** that support a network of concrete beams infilled with hollow core 6-inch concrete planks and topped with a 3-inch concrete slab. Together with our client, we found it inconceivable that such a robust structure would not be reused. Accounting for the carbon impact of concrete is complex and depends upon many factors, but there is general agreement that one major ingredient, cement, is very energy-intensive to produce. Depending on the fuel source for that energy, concrete is responsible for a large percentage of carbon emissions, as compared with other building materials. By re-using the existing foundation, instead of constructing an entirely new one, teams significantly reduced the quantity of concrete required, and thus the embodied energy, of the projects.

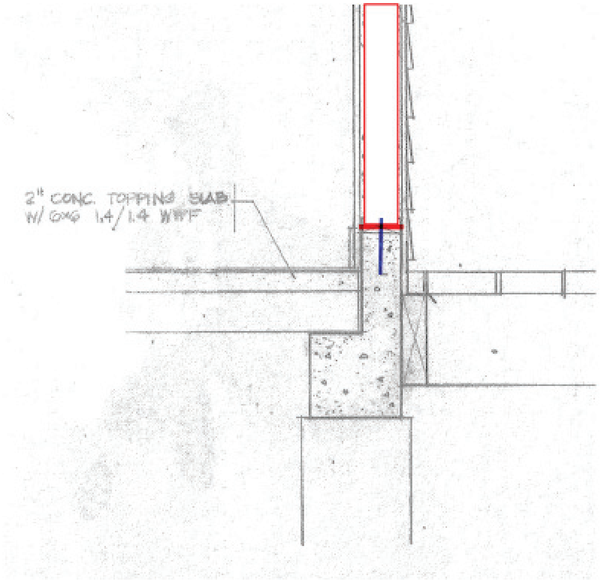
STUDENTS DOCUMENT EXISTING FOUNDATION DURING SITE VISIT

Further, any construction project on this sensitive site presents challenges. The heavy equipment required for a new poured-in-place concrete foundation is damaging to the fragile site, so limiting the scope and footprint of any new foundation helps preserve the delicate ecology.

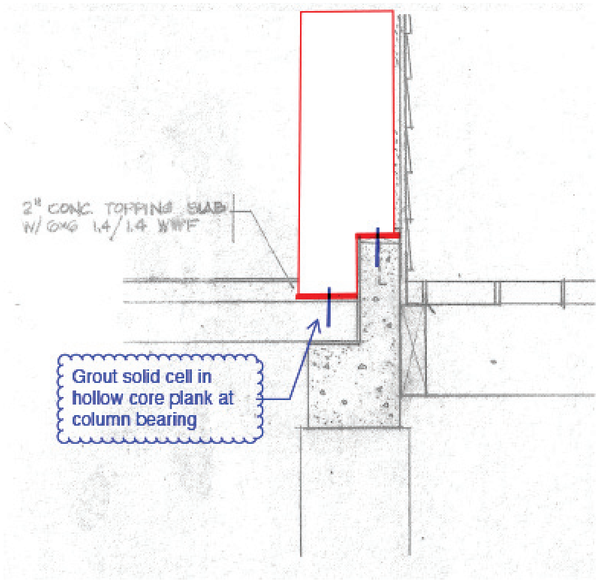
This adaptive reuse approach was not without its challenges, as it required creative approaches to insulation and structural design.

The existing concrete platform is not insulated. Design teams were required to insulate the floor as part of the overall thermal envelope (see section **5.2, Climate Resilience**). However, because the existing platform is raised over a crawl space, there is potential for exposure to water from below. As a result, teams could not insulate below the concrete platform, as would be typical and best practice. Instead, project teams modeled assemblies of furring, rigid insulation, plywood deck, and a vapor barrier above the platform.

EXISTING DAY USE BUILDING BUILT IN 1990



DETAIL FOR NEW BEARING WALL



RECOMMENDATION FOR A NEW COLUMN

To understand the capacity of the original structure and the unique considerations of building on a pre-existing foundation, we consulted with structural engineer Gary Strand of SGH. His assessment is based on the 1990 construction drawings provided by the client. Currently the building is supported on 15-ton, 20-ton and 25-ton capacity concrete auger-cast piles. This indicates they were sized for a single-story wood structure on the platform and cannot support additional weight without modification. With that information, we noted the following:

- The existing structural grid is primarily 8-feet by 12-feet. Students were instructed that point loads (new columns) should come down on existing columns, not along the beams or in the center of floor bays, and bearing walls should be aligned with the foundation column grid.
- Any part of a new structure that bears on the existing structure is limited to one story.
- Students could add an additional upper level, but any new structure (such as a second-level deck or porch) was to be supported in one of two ways:
  - on structure located beyond the existing platform, or
  - by reinforcing the existing structure (this is expensive and should be limited to a few key points).

Guided by Gary Strand, project teams conceptualized two ways to connect their new structure with the existing foundation at the perimeter of the platform. Posts or simple bearing walls supporting lighter loads could bear directly on the concrete curb. For heavier loads, the post would bear at both levels without demolishing the existing curb.

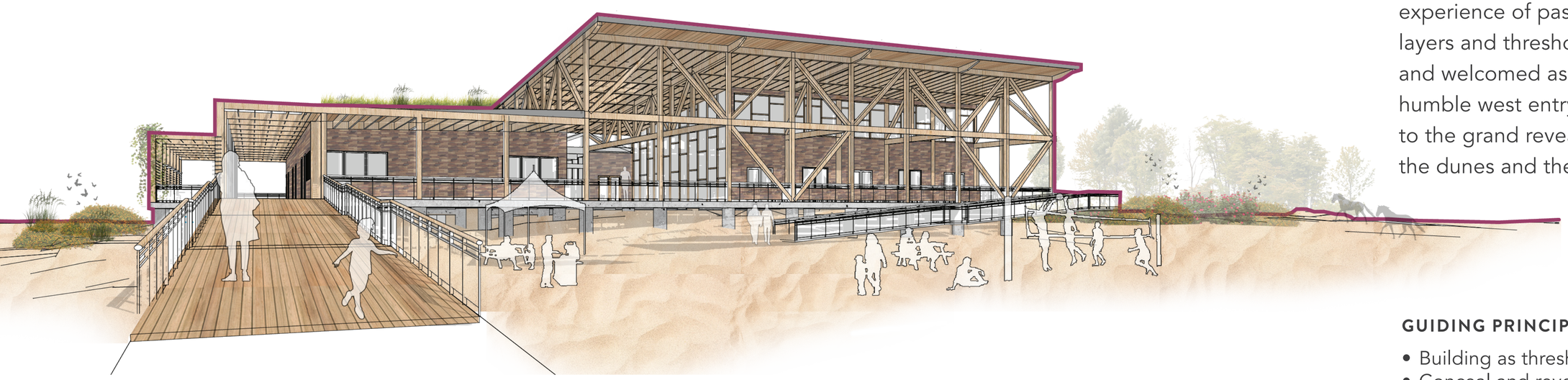
A note on material reuse. The current building comprises a wood-frame structure on top of a concrete pile foundation. The wood structure may have some salvageable components to be recycled into the new building as trim, finishes, or for other purposes.

In addition to the challenges of reusing the existing structure, there is the question of whether the existing finish floor elevation must be raised higher to accommodate new requirements for Base Flood Elevation under Maryland's Coast Smart Code or C.R.A.B. To simplify this study, we assumed it would not be necessary.

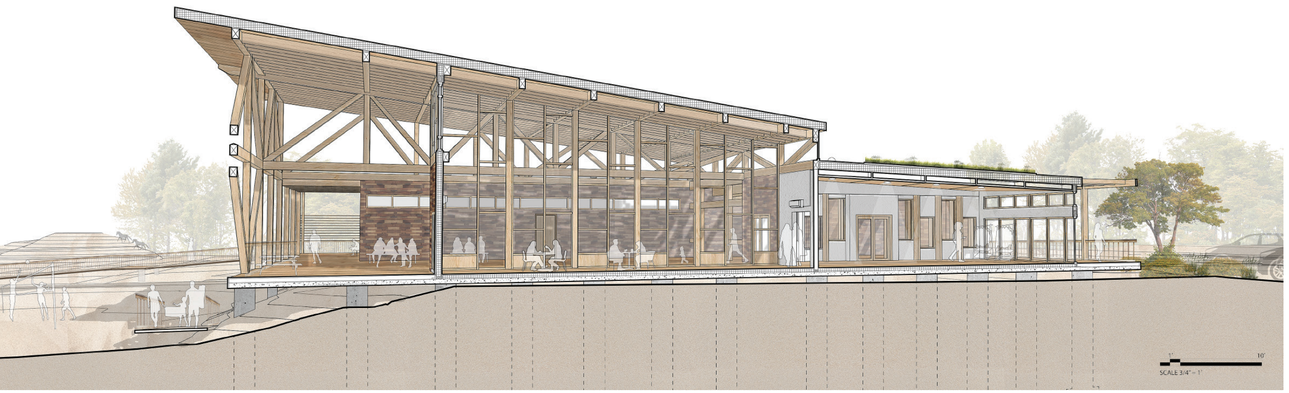
6 PROJECT PROPOSALS

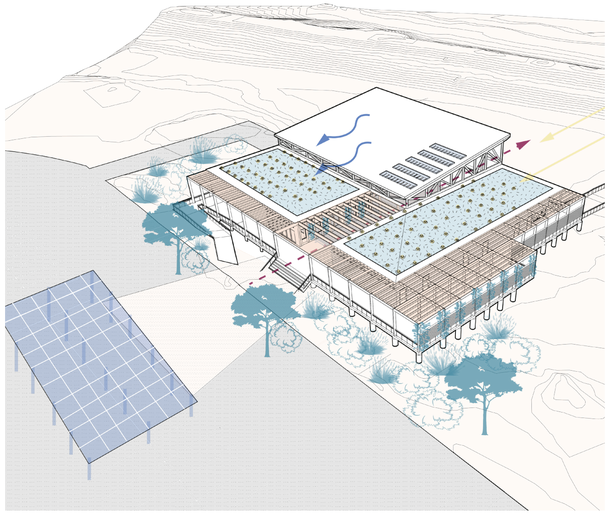
BARRIER BREEZEWAY R. Maisha Islam and Judy Tram

This design is composed of two buildings with a breezeway between and a trellis and porch wrapping around. The contrast of concealing and revealing heightens the experience of passing through a series of layers and thresholds. Visitors are guided and welcomed as they move from the humble west entry on the parking lot side to the grand reveal of the east porch facing the dunes and the ocean.



THE PORTICO ON THE DUNE-FACING SIDE FEATURES A PITCHED ROOF AND EXPOSED STRUCTURE TO CONVEY THE IDEA OF A REVEAL.





SOLAR PV IN THE PARKING LOT FORMS PART OF THE SERIES OF THRESHOLDS EXPERIENCED BY VISITORS.

GUIDING PRINCIPLES:

- Building as threshold
- Conceal and reveal
- Approach and arrival

RESILIENCE STRATEGIES:

- Native plants
- Natural ventilation
- Daylighting
- Sun shading

KEY METRICS:

- EUI: 27
- Wall R-Value: 24
- Roof R-Value: 41
- Building Footprint: 9,219 sf

BARRIER BREEZEWAY

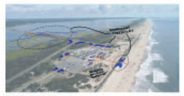
FORMING THRESHOLDS, PROVIDING SHELTER, & EXPRESSING ARRIVAL ON ASSATEAGUE ISLAND

R. MAISHA ISLAM & JUDY TRAM

PROCESS

SITE CONTEXT 1:6000

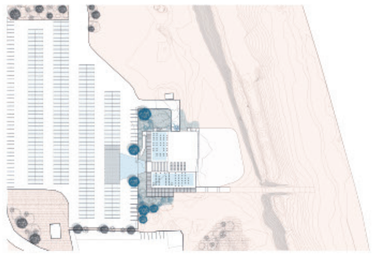
SITE CONTEXT 1:1000



SITE THRESHOLDS

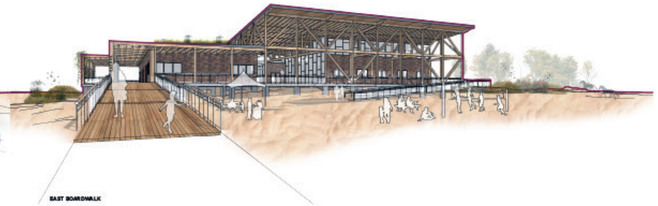
SITE AXIS

THRESHOLD & REVEAL

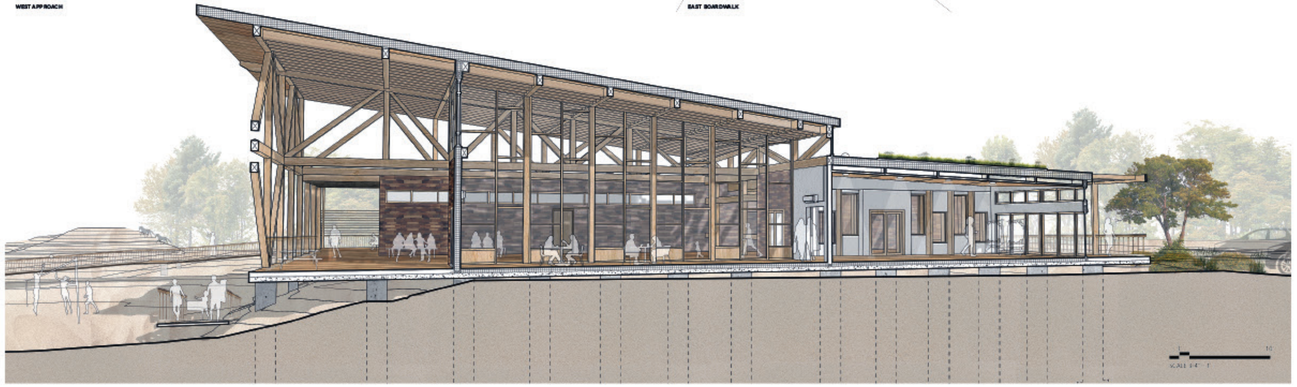


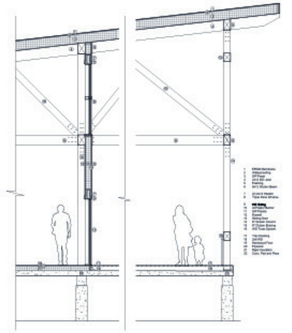
SITE PLAN 1/32" = 1'

WEST APPROACH



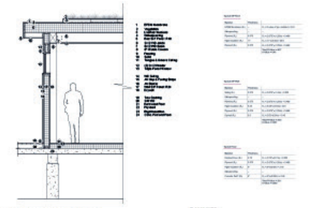
EAST BOARDWALK





GLAZING SECTION 1/2" TRIL 3/4" = 1'

FACADE DETAIL 3/4" = 1'



TYPICAL WALL SECTION DETAIL 3/4" = 1'

R-VALUES

PLAN 1/2 TRIL 3/4" = 1'

MATERIALS

LONG SITE SECTION 1/32" = 1'

LATERAL SITE SECTION 1/32" = 1'

WEST ELEVATION 1/8" = 1'

SOUTH ELEVATION 1/8" = 1'

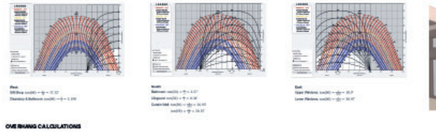
EAST ELEVATION 1/8" = 1'

NORTH ELEVATION 1/8" = 1'

EAST-WEST SECTION 1/8" = 1'

NORTH-SOUTH SECTION 1/8" = 1'

GLAZING PERCENTAGES



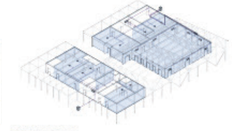
OVERHANG CALCULATIONS

WEST ENTRY

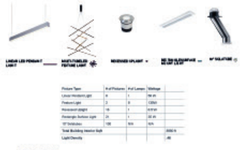
BIKE ZEWAY

RES TAURANT & EVENT SPACE

MODEL 1/16" = 1'

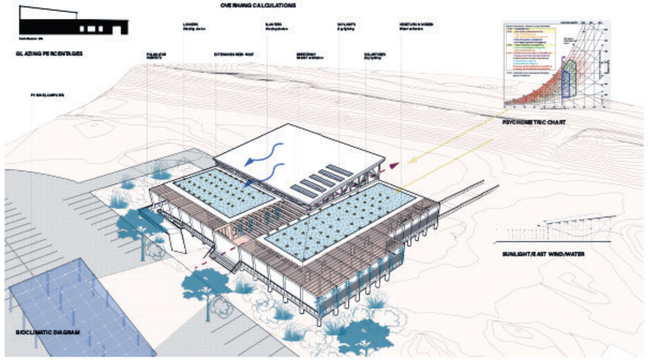


COLLISION DETECTION



LIGHT DENSITY

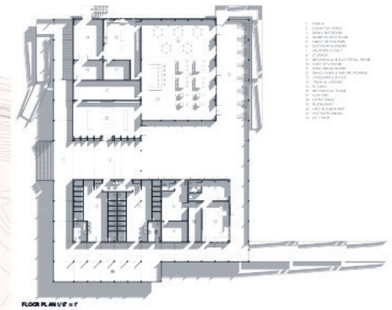
R-VALUE CURVES



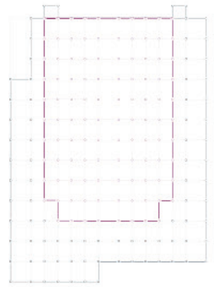
BIOCLIMATIC DIAGRAM

PSYCHOMETRIC CHART

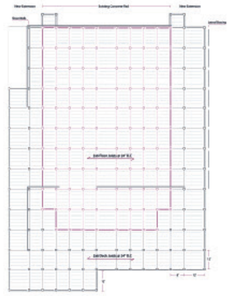
SUNLIGHT/EAST WIND/WATER



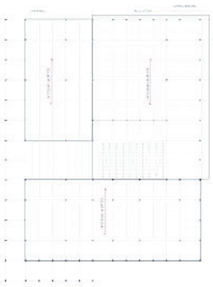
FLOOR PLAN 1/8" = 1'



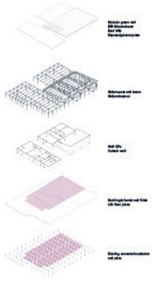
FOUNDATION PLAN 1/8" = 1'



FIRST FLOOR FRAMING PLAN 1/8" = 1'



ROOF FRAMING PLAN 1/8" = 1'



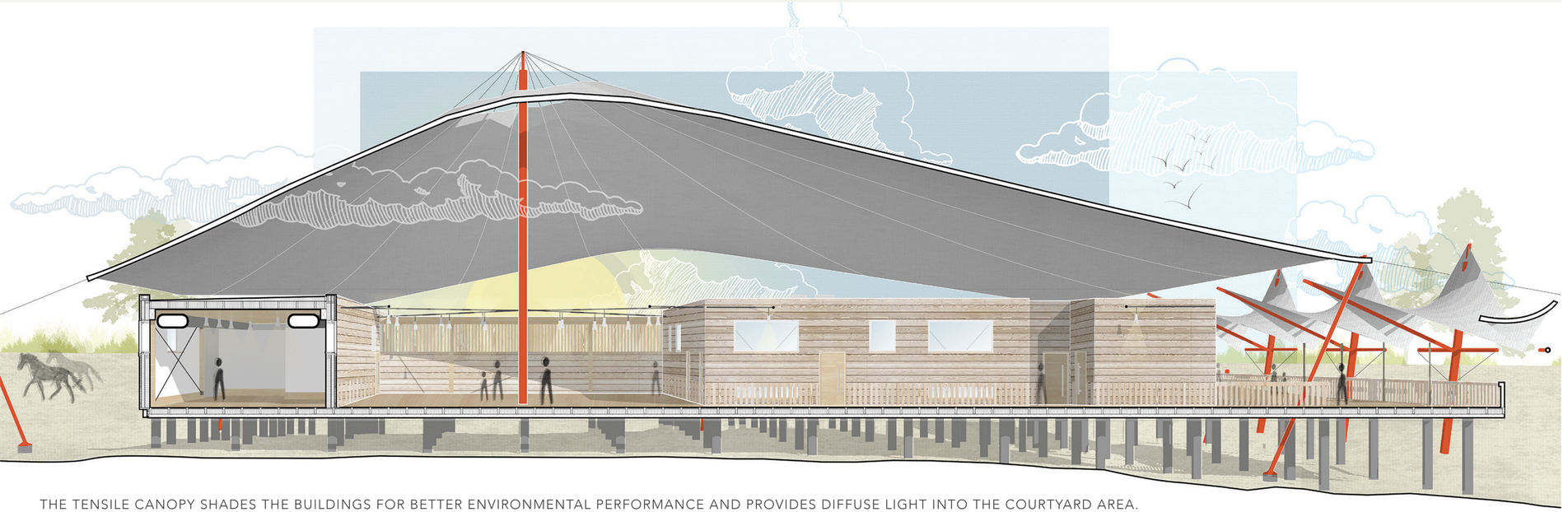
STRUCTURAL AXON

MECHANICAL PLAN 1/8" = 1

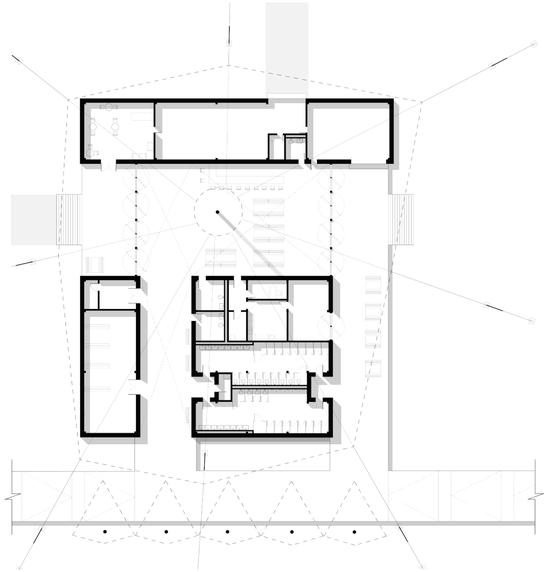
LIGHTING PLAN 1/8" = 1'

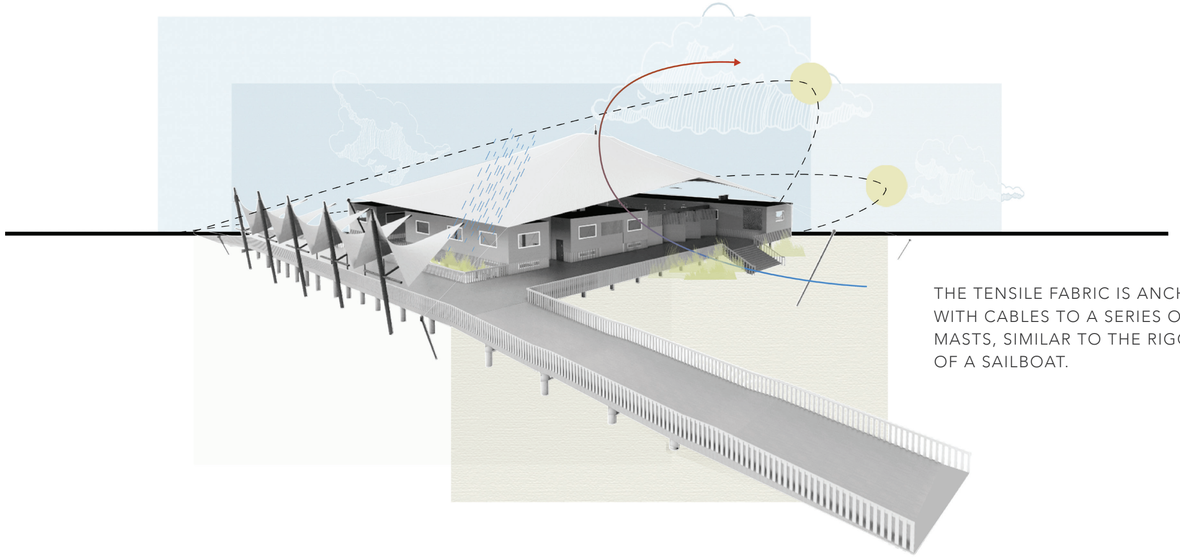
ENERGY MODEL

BREEZEWAY Vincenza Perla and Austin Register



THE TENSILE CANOPY SHADES THE BUILDINGS FOR BETTER ENVIRONMENTAL PERFORMANCE AND PROVIDES DIFFUSE LIGHT INTO THE COURTYARD AREA.





THE TENSILE FABRIC IS ANCHORED WITH CABLES TO A SERIES OF MASTS, SIMILAR TO THE RIGGING OF A SAILBOAT.

Inspired by the way sailboats adapt to ever-changing conditions, this project creates spaces that blur the line between indoors and outdoors. The Breezeway features a dramatic tensile structure shading three simple buildings and a central outdoor area. A kinetic wall with rotating panels protects visitors from harsh gales or welcomes gentle breezes. At a site level, this project proposes replacing the asphalt of the parking lot with crushed shells and rewilding it with native vegetation.

GUIDING PRINCIPLES:

- Adaptability
- Mediate built and natural environments
- Draw from vernacular and nautical traditions

RESILIENCE STRATEGIES:

- Native landscaping
- Pervious surfaces
- Natural ventilation
- Daylighting
- Sun shading

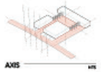
KEY METRICS:

- EUI: 22
- Wall R-Value: 48
- Roof R-Value: 60
- Building Footprint: 7,900 sf

MODEL

SITE PLAN

NORTH/ SOUTH + EAST/ WEST SITE SECTIONS

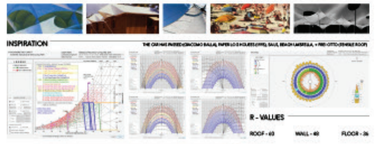


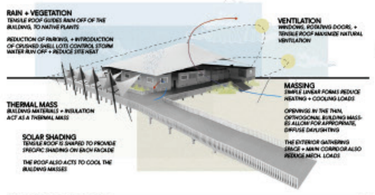
AXIS

MASSING

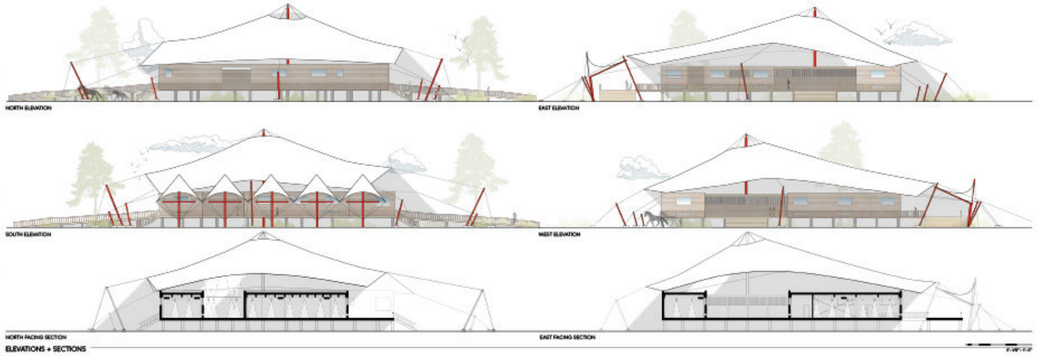
VENTILATION

ZONES





BIOCLIMATIC CONSIDERATIONS



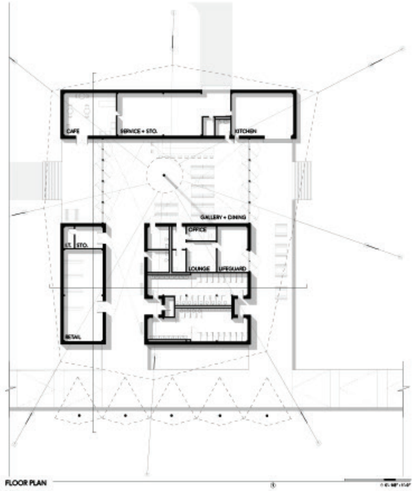
ELEVATIONS + SECTIONS

BOARDWALK

EXTERIOR CORRIDOR

EVENT SPACE

INTERIOR

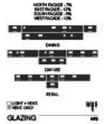


FLOOR PLAN

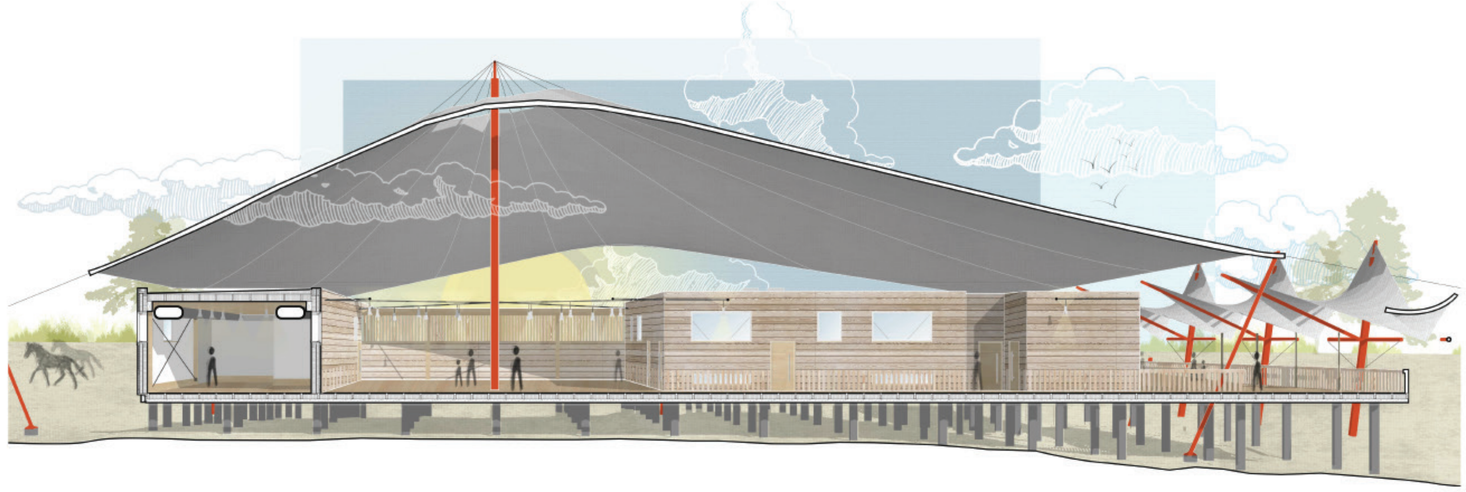
PARTI

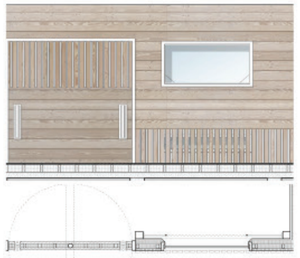
PROGRAM

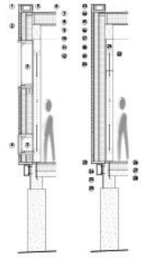
FIG. / VOID



GLAZING





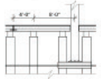


ENLARGED ELEVATION, PLAN, + WALL SECTIONS

TENSILE DETAIL

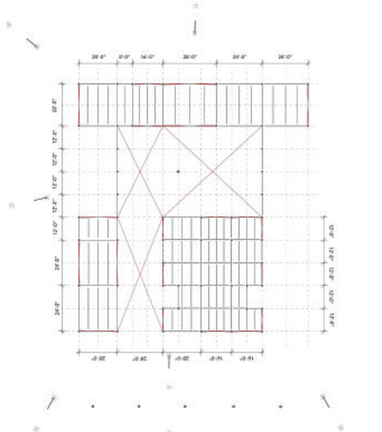
TENSILE OPENING

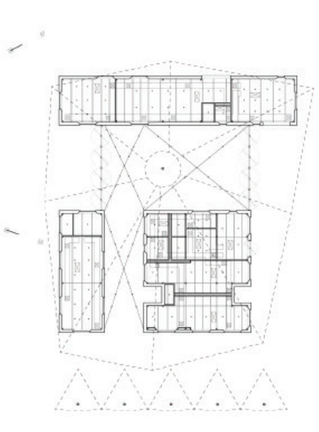
GUY WIRE DETAIL



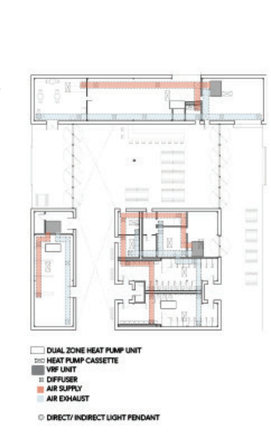
NEW SLAB DETAIL

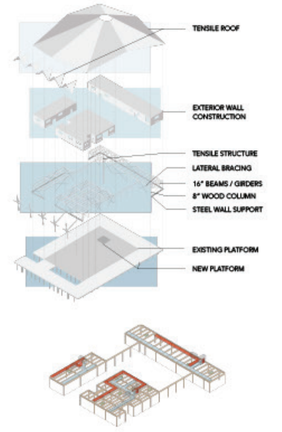
TIE DOWN DETAIL



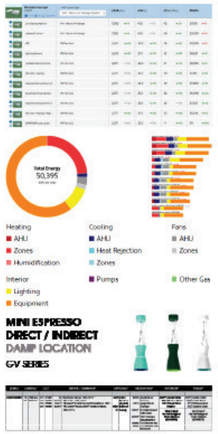


FRAMING PLAN, REFLECTED CEILING PLAN, + MECHANICAL PLAN



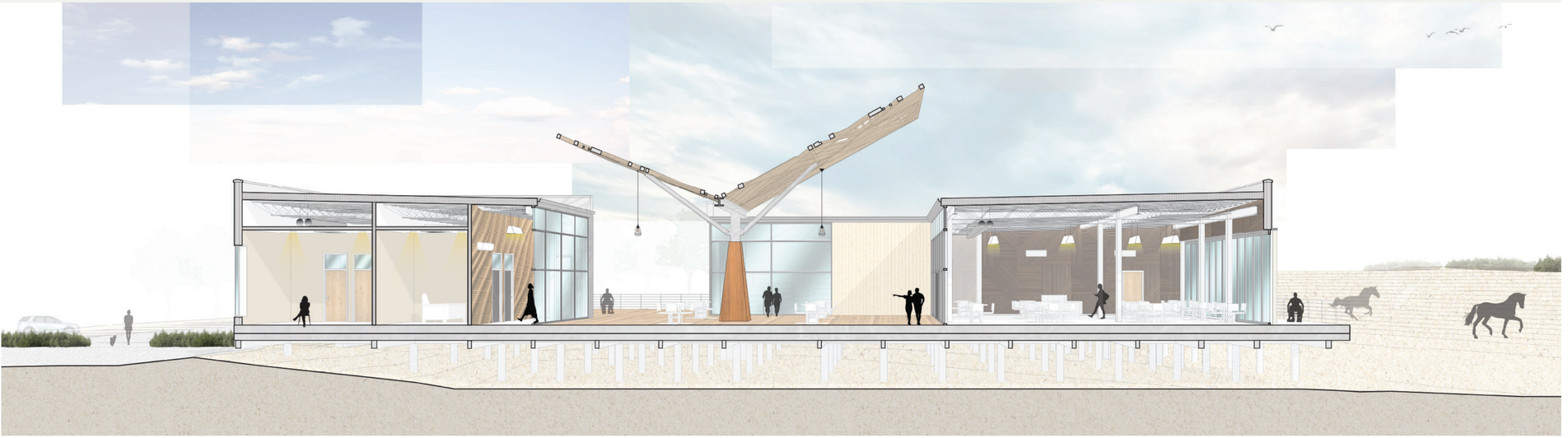


STRUCTURE VS. ENCLOSURE + COLLISION DIAGRAM

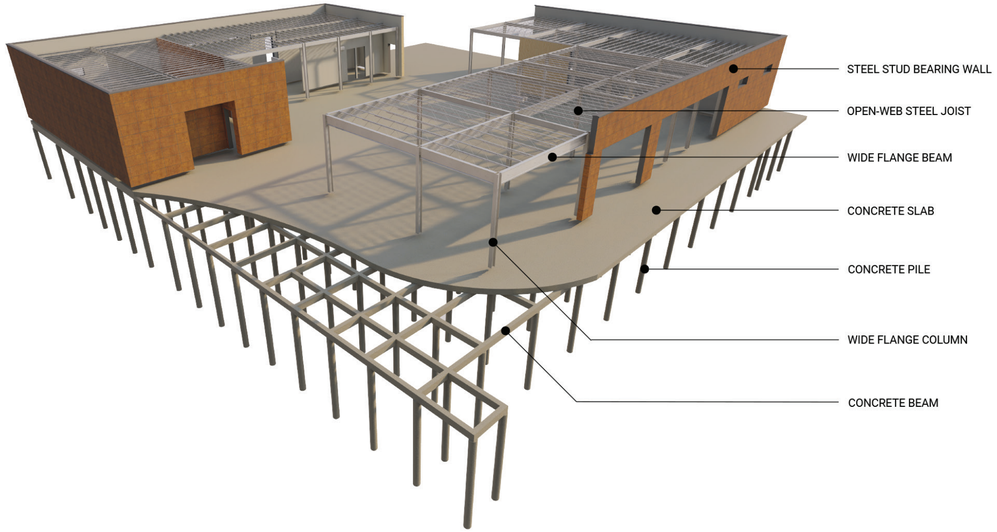


ENERGY MODELING + LIGHTING SPECS

COASTAL CANOPY Austin Benham and Talha Gursoy



THE SHADING STRUCTURE USES RECYCLED STEEL FOR TWO WINGS THAT CANTILEVER OVER THE COURTYARD.



DIAGRAMS OF WINDOW-TO-WALL RATIOS AND STRUCTURAL ELEMENTS

A strong diagonal axis organizes the visitor's journey from arrival to ocean. The path widens to a central courtyard between two buildings housing the day use facility. A shading structure anchors the courtyard and provides protection from the sun, while guiding breezes into interior spaces. The intricacy of the sculptural shading structure contrasts with the simplicity of the building forms and serves as a beacon for visitors.

GUIDING PRINCIPLES:

- Moments of respite
- Axial promenade
- Landmark

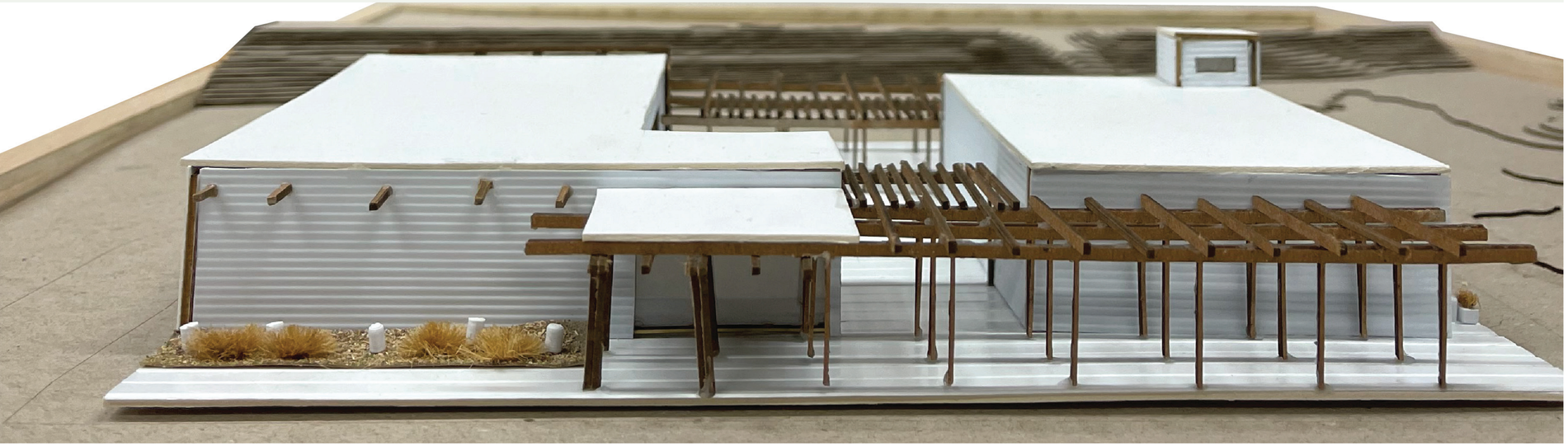
RESILIENCE STRATEGIES:

- Native plants
- Natural ventilation
- Rainwater collection and reuse
- Daylighting
- Sun shading

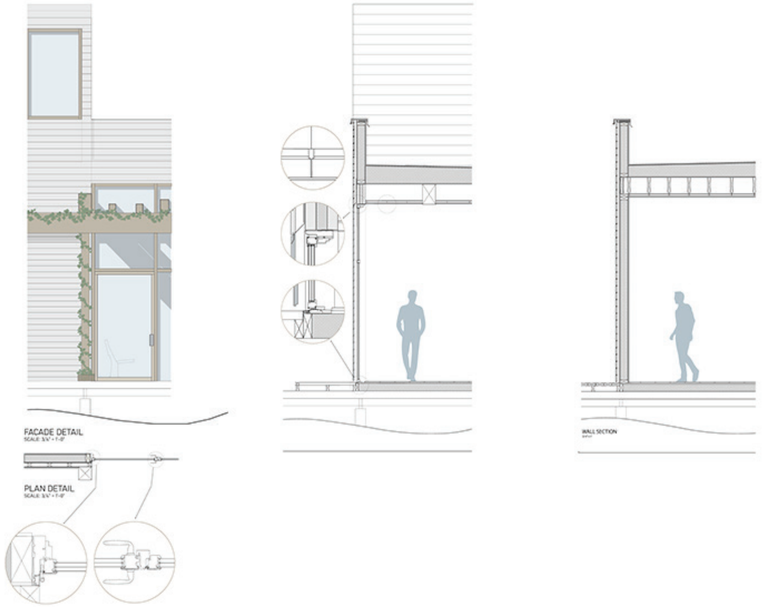
KEY METRICS:

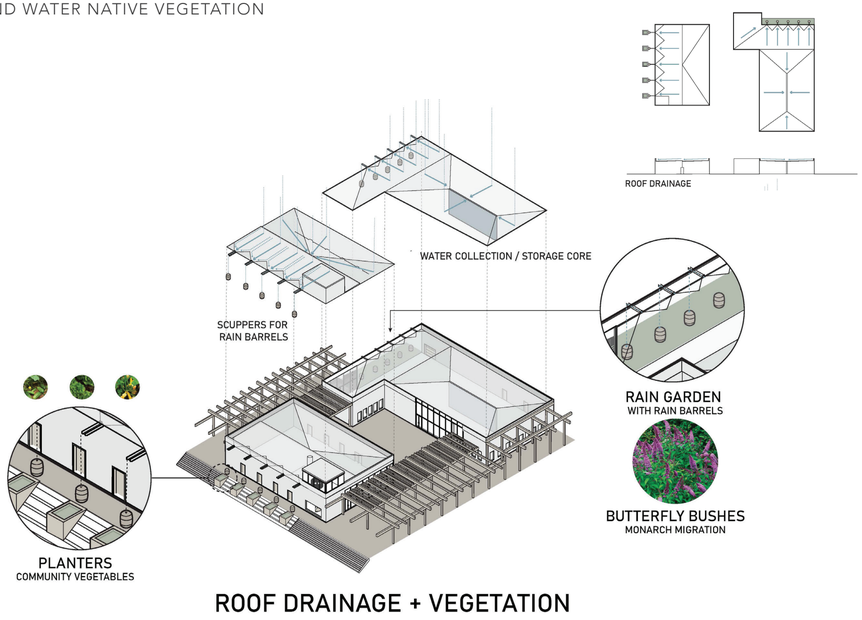
- EUI: 14
- Wall R-Value: 35
- Roof R-Value: 25
- Building Footprint: 20,160 sf

COASTAL RESPITE Lea Roberts and Samanty Habib



THE DESIGN CELEBRATES RAINWATER HARVESTING WITH SCULPTURAL SCUPPERS THAT DRAIN TO RAIN BARRELS AND WATER NATIVE VEGETATION





ROOF DRAINAGE + VEGETATION

Extensive trellises and a large central courtyard mediate between activities, and act as thresholds between mainland and beach. The trellises mark the primary facades and blur the lines between inside and outside. The courtyard invites visitors to rest and provides respite from the harsh sunlight and wind. An observation tower for the lifeguards, accessed by spiral stairs, contrasts with the horizontal lines of buildings, trellises, and sand dunes.

GUIDING PRINCIPLES:

- Mediate built and natural environments
- Moments of respite
- Procession through courtyard

RESILIENCE STRATEGIES:

- Native landscaping
- Pervious surfaces
- Rainwater collection and reuse
- Daylighting

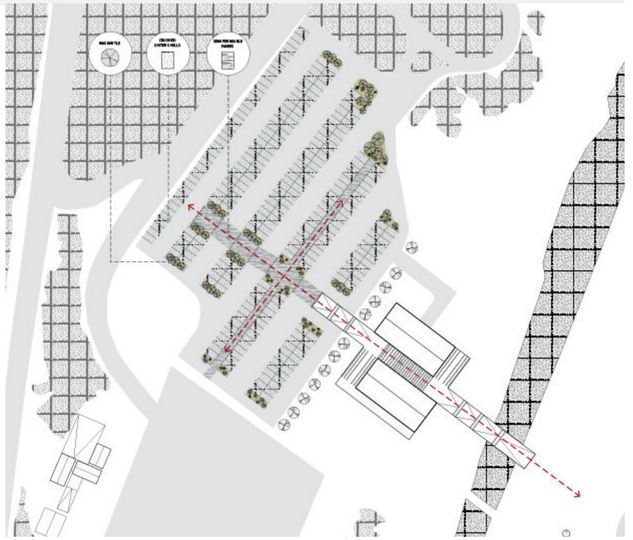
KEY METRICS:

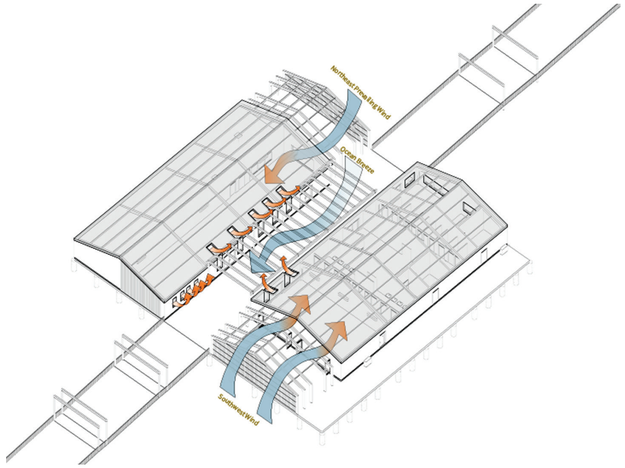
- EUI: 31
- Wall R-Value: 32
- Roof R-Value: 46
- Building Footprint: 8,928 sf

ECO/NNECTION

Samantha Jamero and Jihee Lee

EACH BUILDING FEATURES AN OUTDOOR SPACE DEFINED BY A TRELLIS, WHICH EXTENDS THE INDOOR SPACES OUTDOORS.





TRANSITIONS ARE ALSO REFLECTED AT THE SITE SCALE, WHERE THE PATHWAY MOVES FROM THE PARKING LOT TO THE DUNES.

Inspired by the ecotones—transitions between distinct biological communities—on Assateague, this project highlights moments in the journey from arrival to beach. A wider, more spacious boardwalk passes through the center of the day-use facilities to ease circulation and invite informal moments of pause. This broad boardwalk is shaded by a wood-frame trellis featuring a draped fabric sculpture that flutters in the northeast prevailing wind, creating a visual representation of the breezes experienced by visitors.

GUIDING PRINCIPLES:

- Mediate built and natural environments
- Axial promenade
- Sensory experiences

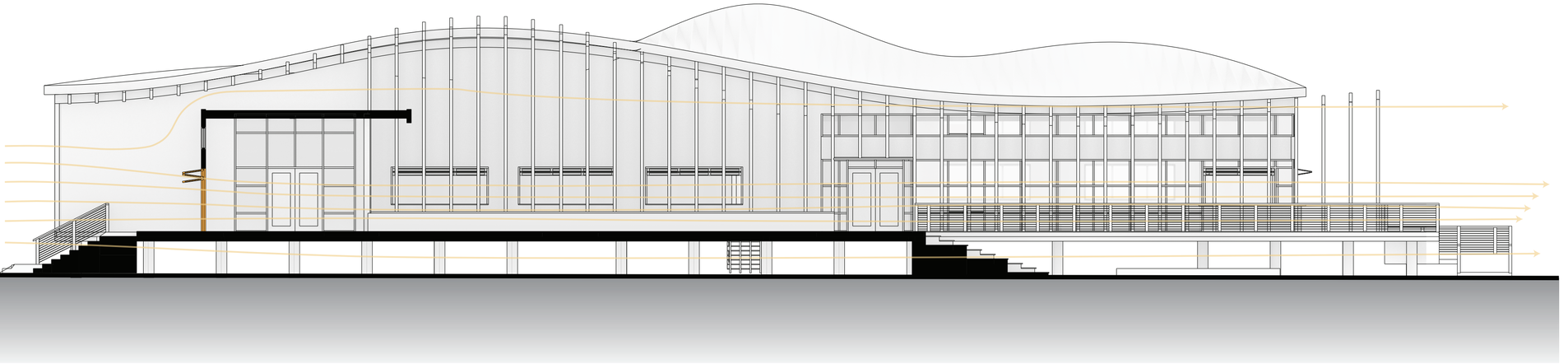
RESILIENCE STRATEGIES:

- Native landscaping
- Pervious surfaces
- Natural ventilation
- Daylighting
- Sun shading

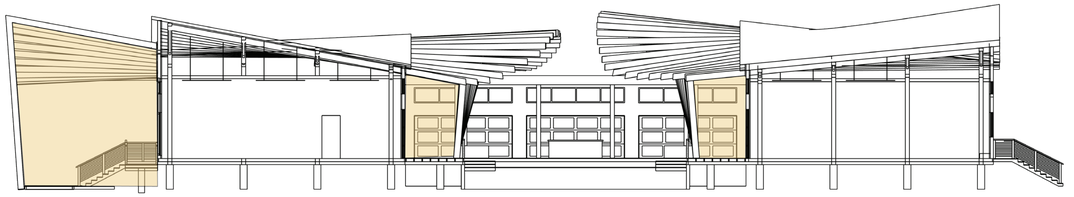
KEY METRICS:

- EUI: 24
- Wall R-Value: 41
- Roof R-Value: 32
- Building Footprint: 9,216 sf

GALE GATEWAY Talisha Jenkins and Jamal Smith



THE FORM OF THE UNDULATING ROOF HELPS DRAW AIR THROUGH THE BUILDINGS FOR NATURAL VENTILATION.



ON THE INTERIOR, THE RAFTERS ARE SUPPORTED BY CUSTOM STEEL TRUSSES, WHICH GIVE THE ROOF ITS UNIQUE SHAPE.

PROJECT DREW INSPIRATION FROM BUILT AND NATURAL FORMS AROUND THE SITE

Inspired by the thresholds and organic forms on the island, this project consists of two buildings connected at the center by an expansive open courtyard. Each building's dramatic undulating roof expresses the flow of wind across the site. The rafters of this roof are echoed as pergolas on the exterior that provide shade to the outdoor circulation areas and create thresholds between the courtyard and the interior.

GUIDING PRINCIPLES:

- Building as threshold
- Mediate built and natural environments
- Drawing on natural forms

RESILIENCE STRATEGIES:

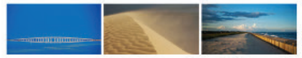
- Natural ventilation
- Daylighting
- Sun shading

KEY METRICS:

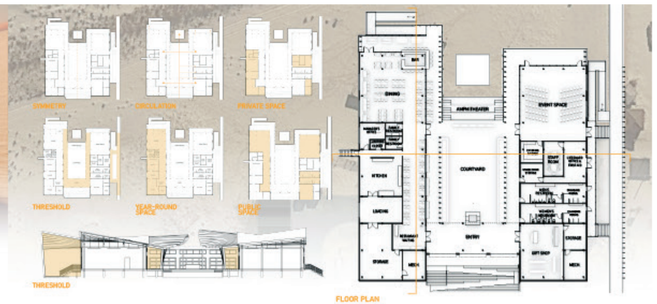
- EUI: 22
- Wall R-Value: 28
- Roof R-Value: 25
- Building Footprint: 10,240 sf

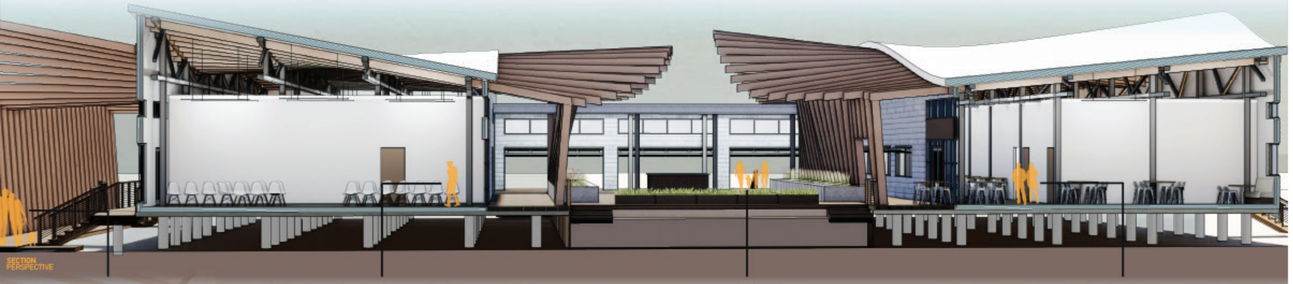
GALE GATEWAY

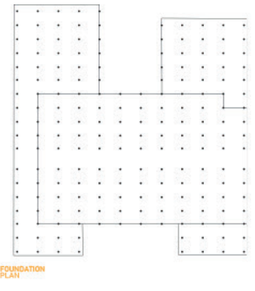
GALE /gāl/ a very strong wind
GATEWAY /gāt, wā/ a passage into or out of a place or condition

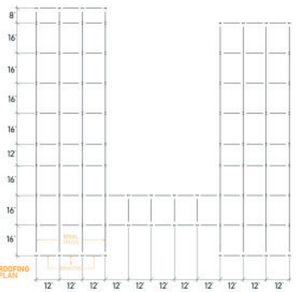


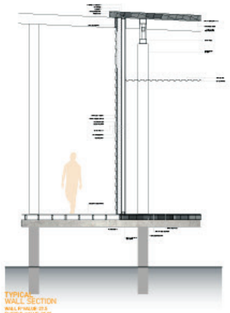
THE OPENING IS A THRESHOLD THAT BOTH UNITES AND SEPARATES.
A THRESHOLD IS AN ELEMENT THAT CREATES TWO DISTINCT ZONES WHILE PROVIDING A TRANSITION.
IT STANDS BOTH FOR A BREAK AND CONTINUITY, A BOUNDARY AND ACCESS.
THRESHOLDS AND TRANSITIONAL SPACES CAN ALSO BE LOCATIONS IN THEIR OWN RIGHT.
THEY EMPHASIZE TWO ZONES' SEPERATION WHILE OFFERING A CHANCE TO OVERCOME IT BY CREATING A VISUAL OR SPATIAL CONNECTION.

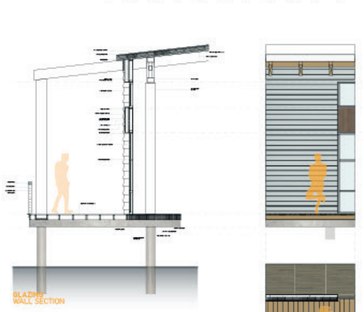


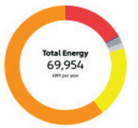


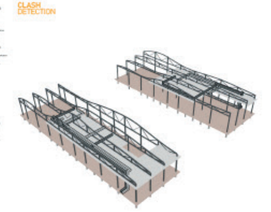


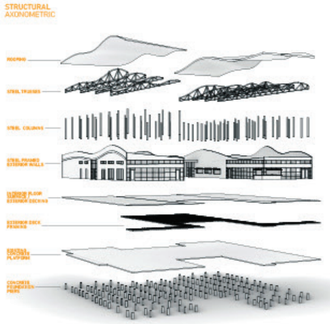


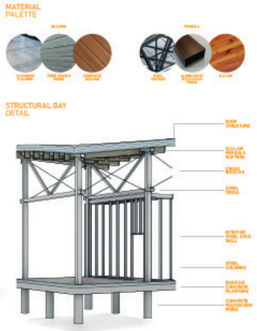


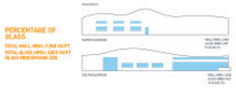






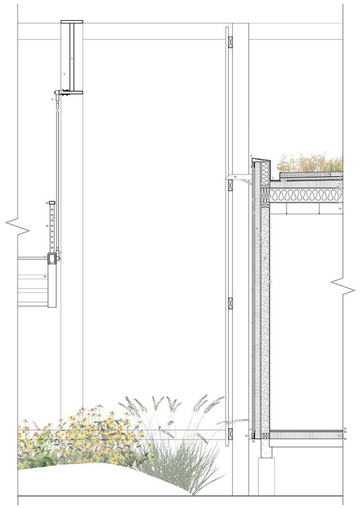




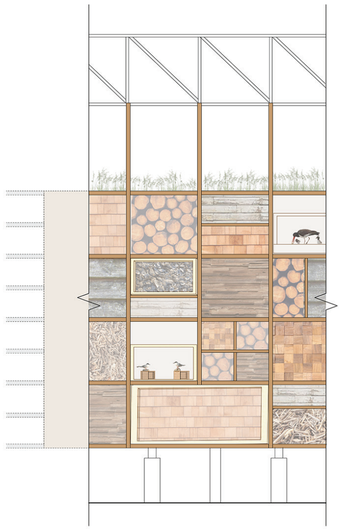


HABITAT Almas Haider and Upasana Kaku

THE HABITAT WALL FEATURES SALVAGED AND REUSED MATERIALS ALONG WITH NESTING BOXES FOR THREATENED SPECIES.



WALL SECTION THROUGH EVENTS PAVILION WITH RAMP DETAIL



HABITAT WALL ELEVATION

Three pavilion-like buildings nest within a larger superstructure that includes spaces designed for the flora and fauna of the island. At every scale—from a parking lot returned to nature, to buildings with extensive green roofs, to walls that incorporate local materials and bird habitat—the design invites plants and animals to occupy spaces alongside human visitors. As the day use parking lot has been largely returned to nature, visitors would arrive on the site via a drop-off loop with a shaded waiting area.

GUIDING PRINCIPLES:

- Regenerative design
- Universal design
- Promenade and discovery

RESILIENCE STRATEGIES:

- Native landscaping and green roofs
- Natural ventilation
- Daylighting
- Sun shading
- Retractable canopy

KEY METRICS:

- EUI: 18
- Wall R-Value: 33
- Roof R-Value: 38
- Building Footprint: 8,000 sf

THE HABITAT

Almas Haider + Upasana Kaku

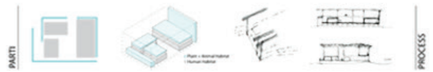
The Habitat, a proposed design for the Assateague State Park day use center, embraces the unique and threatened ecosystem of this fragile barrier island. This project offers an alternative vision for visitor facilities on the island as opportunities for regenerative design. In this vision, humans tread more lightly on the land, constructing a built environment that reduces impacts on local systems, and even increases habitat for threatened species.

The project consists of pavilion-like buildings, nested within a larger superstructure that also contains a series of spaces designed specifically for the flora and fauna of the island. At every scale - from the site with a re-wilded parking lot, to the buildings with extensive green roofs, to the walls that incorporate local materials and bird habitat - the design includes opportunities for plants and animals to occupy the new facility alongside beach-going humans.

SITE PLAN 1/32" = 1'


SITE PLAN 1:10,000

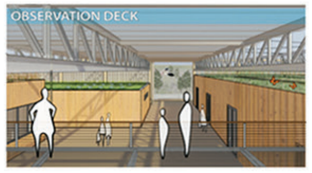

SITE PLAN 1:5000



CANOPY LEVEL
1/16" = 1'

DECK LEVEL
1/16" = 1'

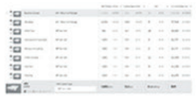
PLATFORM LEVEL
1/8" = 1'



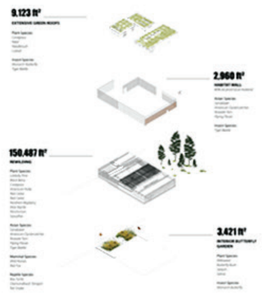
- 29,273 kWh
Total energy use March to November, inclusive; based on Sefaira energy model

+ 43,312 kWh
Annual production for a 30 kW solar PV array at the site, according to PV Watts

+14,039 kWh
Net electricity produced by the facility



18 EUI
Usage before the addition of photovoltaic panels

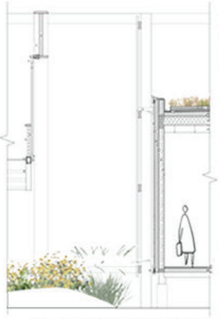


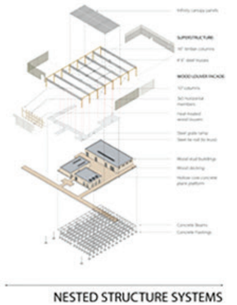
REGENERATIVE DESIGN


HABITAT WALL FACADE
1/4" = 1'


PAVILION FACADE
1/4" = 1'


WALL SECTION THROUGH RESTAURANT PAVILION
1/4" = 1'


WALL SECTION THROUGH EVENTS PAVILION WITH RAMP DETAIL
1/4" = 1'

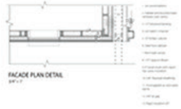

NESTED STRUCTURE SYSTEMS

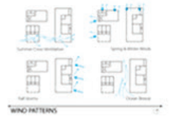

AMERICAN OYSTERCATCHER NESTING BOX
Crushed gravel from existing site paving


ROSEATE TERN TERRACES
Nesting boom made by local students

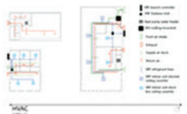

SHELL DISPLAY BOX
Chesapeake oyster shells from local restaurants encased by wire mesh

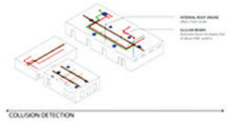

SALVAGED MATERIALS
Siding, shingles, raw timber, driftwood and other found materials and objects from Assateague Island as well as existing site demolition

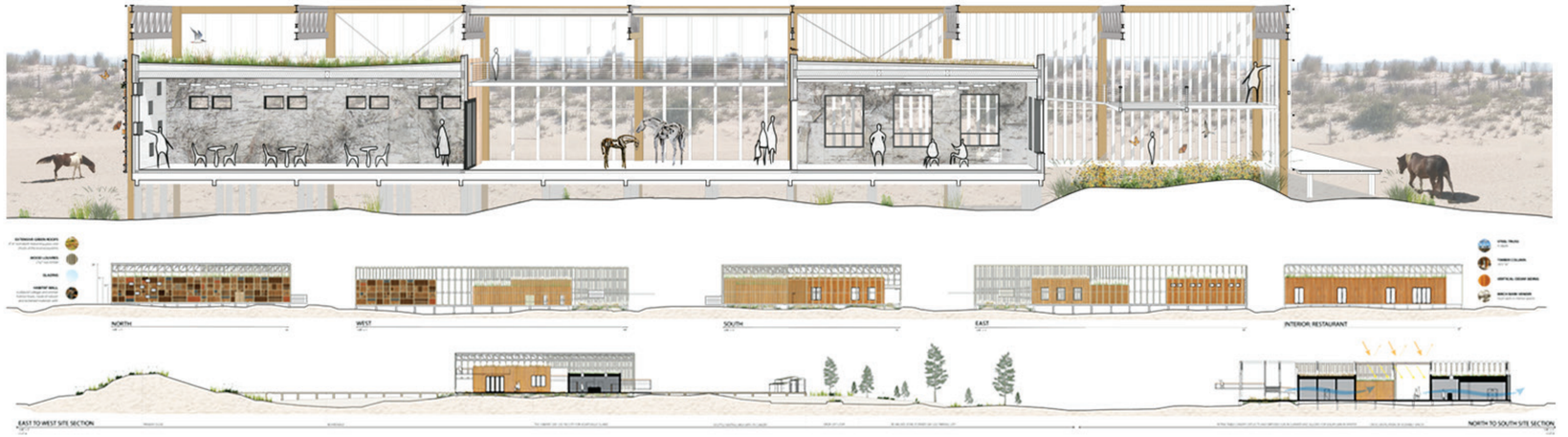

FACADE PLAN DETAIL
3/4" = 1'

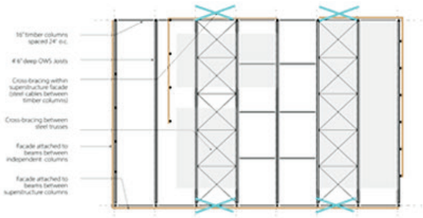

WIND PATTERNS


LIGHTING

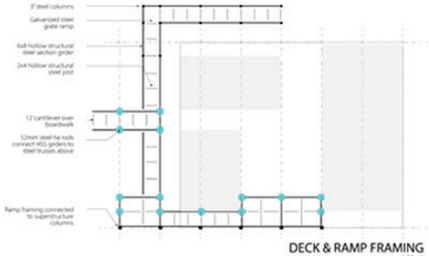

HVAC


COLLISION DETECTION

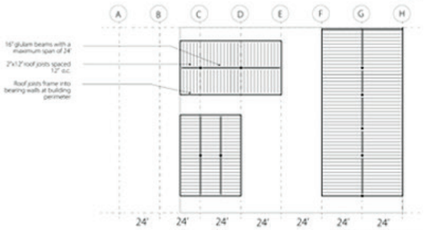




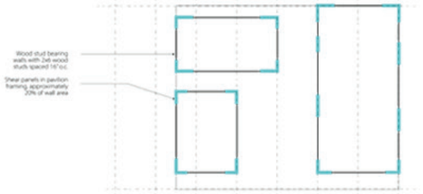
SUPERSTRUCTURE FRAMING
1/8" = 1'



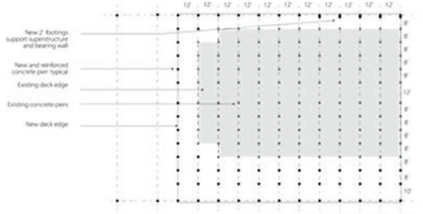
DECK & RAMP FRAMING
1/8" = 1'



ROOF FRAMING
1/8" = 1'



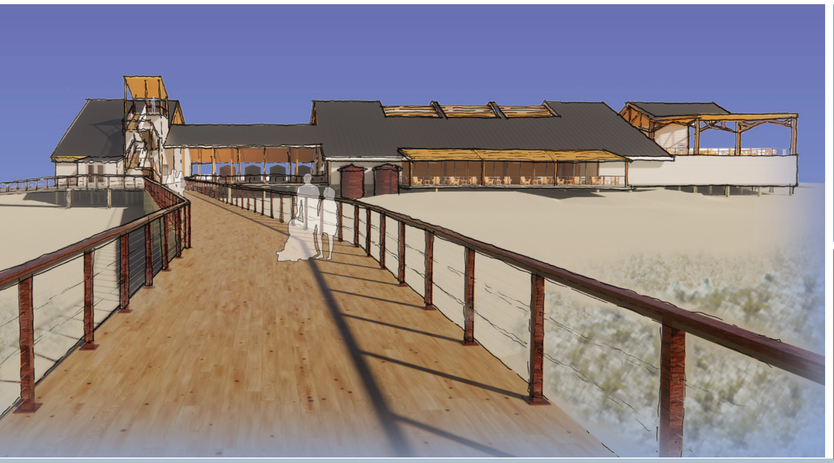
GROUND FLOOR FRAMING
1/8" = 1'

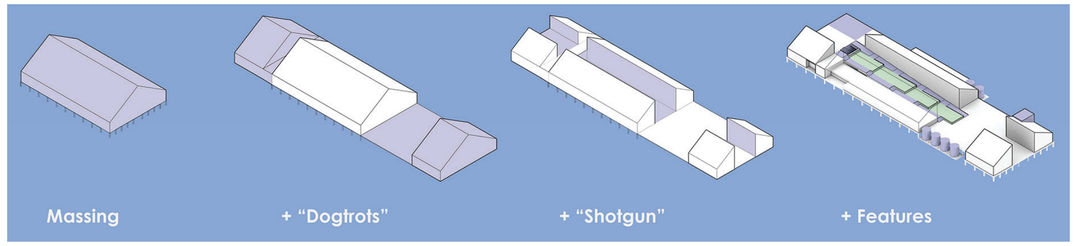


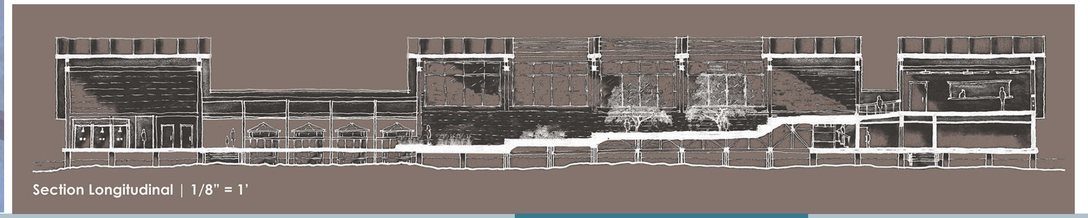
FOUNDATION FRAMING
1/8" = 1'

HORIZON LINE James Long and Miguel Mora

THE CENTRAL COURTYARD WAS INSPIRED BY THE TYPICAL VILLAGE FORMS OF THE FIRST NATIONS THAT INHABITED ASSATEAGUE ISLAND, WHICH HAD RIVERS RUNNING THROUGH THEIR CENTERS.







Section Longitudinal | 1/8" = 1'

This project draws inspiration from the linear nature of the sand dunes and the horizon line, two dominant natural forms of Assateague Island. The building also mediates between the built and natural environments: a solid facade, reflecting the constructed dunes of the state park, faces the parking lot and an open facade faces the beach. A sheltered courtyard at the center of the facility is the symbolic hearth for the building and allows access to a second-floor bar and viewing terrace.

GUIDING PRINCIPLES:

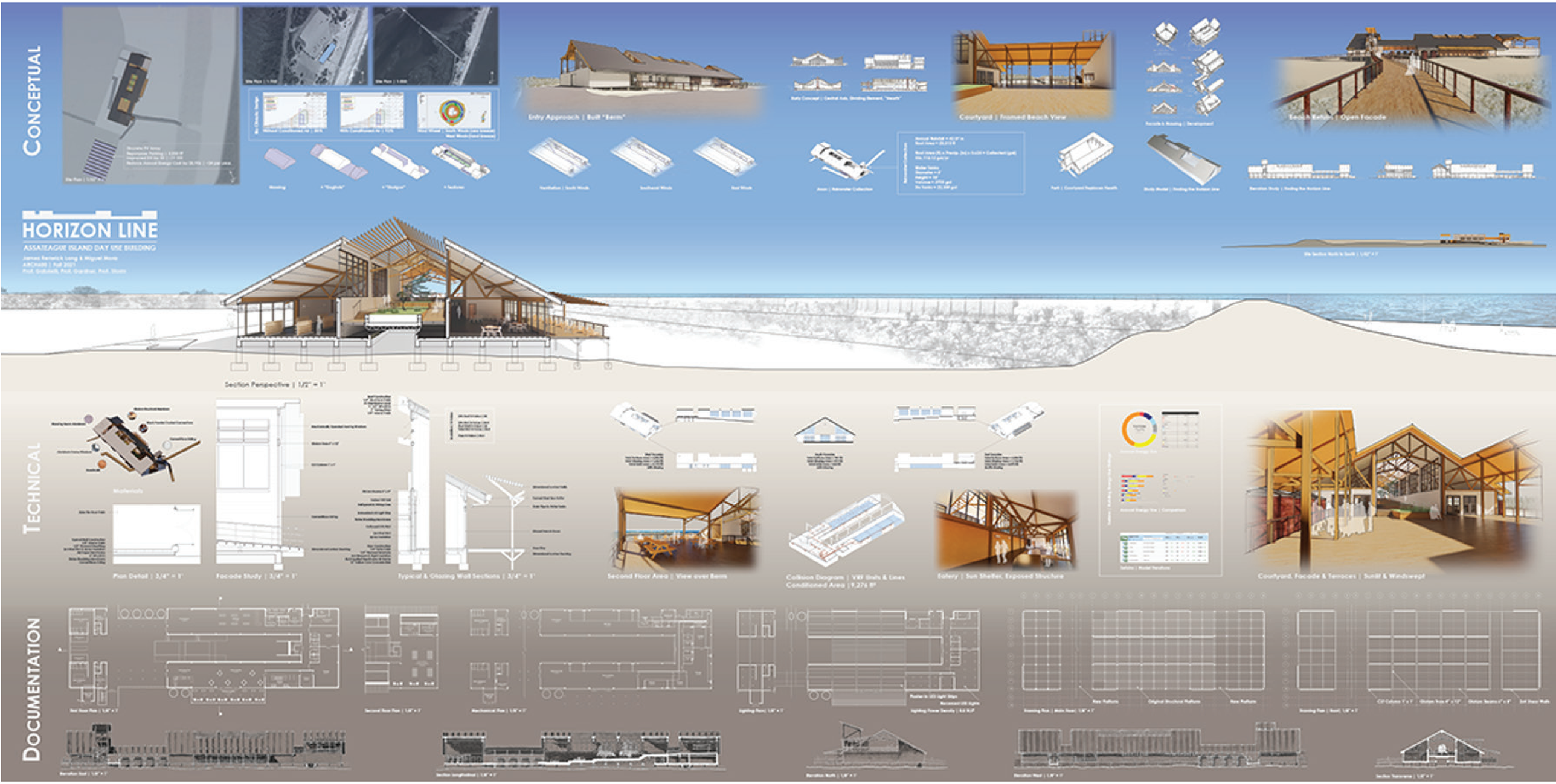
- Mediate natural and built environments
- Symmetry
- Horizontality

RESILIENCE STRATEGIES:

- Natural ventilation
- Rainwater collection and reuse
- Natural daylighting
- Sun shading

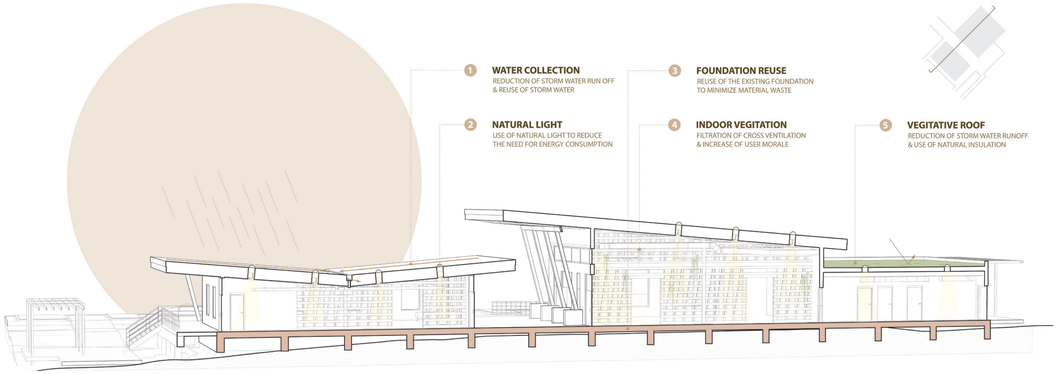
KEY METRICS:

- EUI: 19
- Wall R-Value: 56
- Roof R-Value: 58
- Building Footprint: 21,960 sf


CONCEPTUAL
Entry Approach | Built "Berm"
Courtyard | Framed Beach View
Beach Return | Open Facade
HORIZON LINE
ASSATEAGUE ISLAND DAY USE BUILDING
James Reinwick Long & Miguel Mora
ARCH400 | Fall 2021
Prof. Gabrielli, Prof. Gardner, Prof. Storm
Section Perspective | 1/2" = 1'
TECHNICAL
Materials
Plan Detail | 3/4" = 1'
Facade Study | 3/4" = 1'
Typical A Glazing Wall Sections | 3/4" = 1'
Second Floor Area | View over Berm
Collision Diagram | VAV Units & Lines
Conditioned Area | 9,276 ft²
Eatery | Sun Shelter, Exposed Structure
Courtyard, Facade & Terraces | Sunlit & Windswept
DOCUMENTATION

THE HORSESHOE Marcelino Defngin and Chase Edwards

THE BUILDINGS CAPTURE SEASONAL WINDS TO ASSIST IN COOLING AND VENTILATION. NATURAL VENTILATION IS COMPLEMENTED WITH CEILING FANS.



IN ADDITION TO NATURAL VENTILATION, THE PROJECT ALSO INCORPORATES SOLAR PV PANELS, LOCAL AND DURABLE MATERIALS, WATER COLLECTION CISTERNS, AND NATIVE SITE PLANTINGS.

This design celebrates the outdoors with a number of sheltered exterior spaces, each providing visitors with a unique experience. These indoor / outdoor zones include shaded seating areas, a trellised observation deck, and a covered breezeway running between the two buildings. Designed with a limited carbon footprint, the Horseshoe is a net-zero facility with each building mass intended to optimize stack and cross-ventilation.

GUIDING PRINCIPLES:

- Approach and arrival
- Mediate natural and built environment
- Sensory experiences

RESILIENCE STRATEGIES:

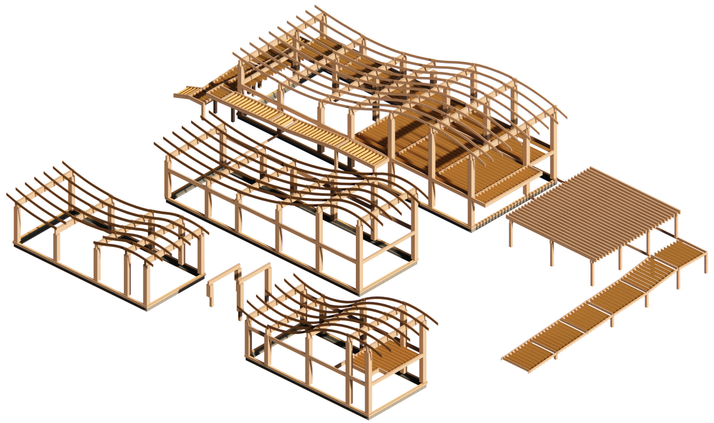
- Native landscaping and green roofs
- Natural ventilation
- Rainwater collection and reuse
- Natural daylighting
- Sun shading

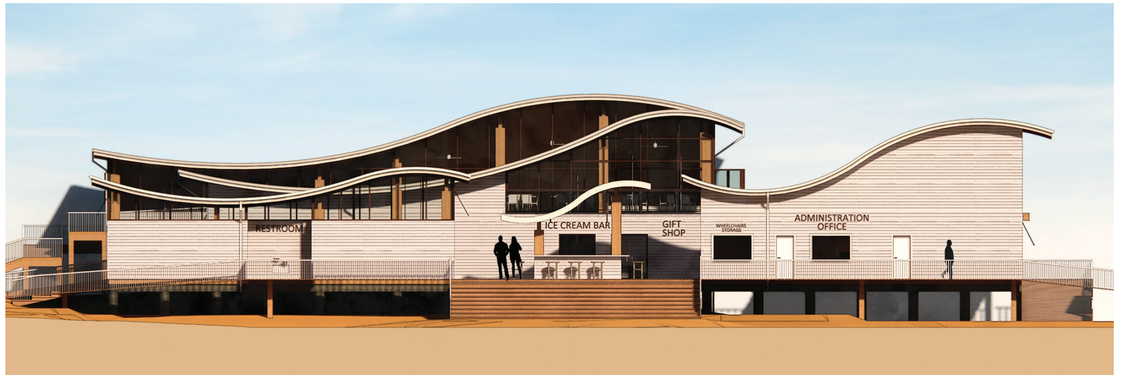
KEY METRICS:

- EUI: 16
- Wall R-Value: 28
- Roof R-Value: 59
- Building Footprint: 10,944 sf

IMMERSION Cristhy Centeno and Andrew DeGroff

THE SECOND LEVEL INCLUDES A LIFEGUARD TOWER, EVENT SPACE, AND BALCONY THAT PROVIDES VIEWS TOWARD THE WATER AND OCEAN CITY.





This project replicates natural forms on the interior and exterior, connecting visitors to nature throughout their time on the site, from the entrance to the event space with views of the ocean. The proposed day use facility includes four bar-shaped buildings with wavy roofs, creating a layered effect reminiscent of the nearby dunes and rolling ocean waves. Inside, the exposed columns, beams, and dowel-laminated timber walls create the impression of standing in a forest.

GUIDING PRINCIPLES:

- Integration with the landscape
- Gathering and celebration
- Drawing on natural forms

RESILIENCE STRATEGIES:

- Native plants
- Natural ventilation
- Rainwater collection and reuse
- Daylighting
- Sun shading

KEY METRICS:

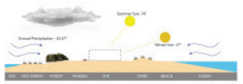
- EUI: 42
- Wall R-Value: 28
- Roof R-Value: 35
- Building Footprint: 9,280 sf

IMMERSION

Assateague Island Visitor Center and Day-Use Building
Cristiny Centeno + Andrew DeGroff
ARCH 6004411
Professor Gabrieli, Gardner and Storm / Hu and Binder
December 13, 2021

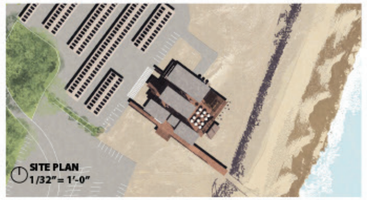
SITE ANALYSIS

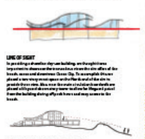
Our site is located on Assateague Island, West Ocean City on Maryland's Eastern Shore. Prevailing winds come from the Northwest, West and from the ocean. Almost completely vacant of trees or vegetation, the site is flanked by a 18-foot sand dune that runs parallel to the shore, obstructing views to the beach and ocean; with forest and salt marshes inland of our site. Assateague Island is a barrier island that is constantly changing from sand deposits that form along the coastline.




SITE PLAN
1:500


SITE PLAN
1:100


SITE PLAN
1/32" = 1'-0"

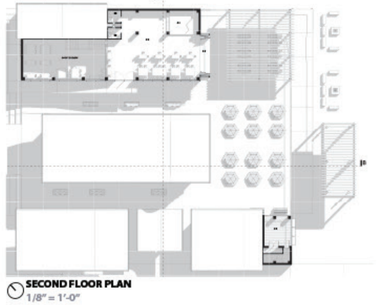



FIRST FLOOR PLAN w/ CONTEXT
1/8" = 1'-0"

PLAN LEGEND:

FIRST FLOOR
1 Janitor Closet
2 Storage
3 Mechanical Room
4 Loading Dock
5 Walk-In Cooler
6 Catering Kitchen
7 Restroom
8 Restaurant
9 Outdoor Pavilion
10 Campfire Area
11 Outdoor Showers
12 Coffee Shop
13 Storage
14 Mechanical Room
15 Gift Shop
16 Outdoor Dining
17 Main Restroom
18 Women's Restroom
19 Ice Cream/Hot Chocklate Bar
20 I.T. Closet
21 Electrical Room
22 Administration Office
23 Mechanical Room
24 Staff Bathroom
25 Staff Breakroom
26 Sand Wheelchair Storage
27 Lifeguard Office
28 Boardwalk

SECOND FLOOR
29 Bathroom
30 Event Space
31 Stage
32 Outdoor Balcony
33 Lifeguard Observation Tower


SECOND FLOOR PLAN
1/8" = 1'-0"

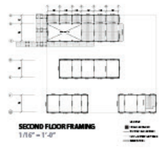

NORTH ELEVATION - 2% WWR
1/8" = 1'-0"

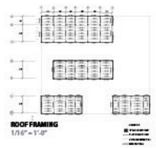

EAST ELEVATION- 43% WWR
1/8" = 1'-0"

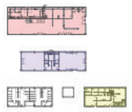

SOUTH ELEVATION- 60% WWR
1/8" = 1'-0"

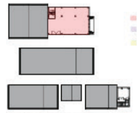

WEST ELEVATION- 27% WWR
1/8" = 1'-0"


FOUNDATION FRAMING
1/16" = 1'-0"

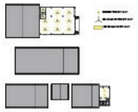

SECOND FLOOR FRAMING
1/16" = 1'-0"


ROOF FRAMING
1/16" = 1'-0"


HVAC PLAN- FIRST FLOOR
1/16" = 1'-0"


HVAC PLAN- SECOND FLOOR
1/16" = 1'-0"


LIGHTING PLAN- FIRST FLOOR
1/16" = 1'-0"


LIGHTING PLAN- SECOND FLOOR
1/16" = 1'-0"


SEASONAL OPERATIONS


MECHANICAL SECTION


USER CIRCULATION

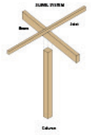

HVAC COLLISION DETECTION


STRUCTURAL AXON

SUSTAINABLE DESIGN STRATEGIES


LONGITUDINAL SITE SECTION
1/32" = 1'-0"


LATERAL SITE SECTION
1/32" = 1'-0"


BUILDING CONNECTIONS


LONGITUDINAL SECTION
1/32" = 1'-0"


TRANVERSE SECTION
1/32" = 1'-0"


PARKING LOT APPROACH


MAIN PATH TO BEACH


ICE CREAM BAR


OUTDOOR PAVILION TRELLIS


EVENT SPACE AND RESTAURANT


BALCONY VIEW TO BEACH

BUILDING MATERIALITY

EXTERIOR
shiplap wood siding
timber decking
aluminum louvers
triple low-e glazing
metal-seamed roof

INTERIOR
hardwood floor (oak)
hardwood floor (white oak)
aluminum mullions

STRUCTURE
concrete decking and pilings
dowel-laminated timber walls
glulam column
wood I-joists
glulam curved rafters

SITE MATERIALITY

PARKING
low-carbon asphalt
grass pavers
solar panels

VEGETATION
waxmyrtle shrubs
beachgrass
bench and tree planter

DEPOSITS
sand

WALL SECTION A- GLAZING WALL
3/4" = 1'-0"

WALL SECTION B- SHEAR WALL
3/4" = 1'-0"

PLAN DETAIL

STRUCTURE VS ENCLOSURE

WALL SECTION DETAIL

FACADE DETAIL

FACADE PLAN DETAIL

CLIMATE CONSULTANT

Annual Energy Use
Total Energy
150,878

Annual CO_2e (for Renewables) - Comparison

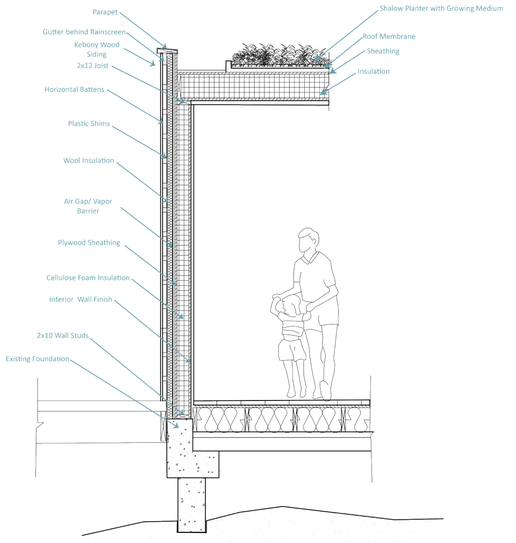
SEFAIRA MODEL

WALL R-VALUE
FLOOR R-VALUE
ROOF R-VALUE

PHOTOS OF PHYSICAL MODEL

LINC Abigail Mencer and Carlos Vazquez

THE PRIMARY BUILDING OPERATES YEAR-ROUND, HOUSING THE RESTAURANT, EXHIBIT SPACE, AND OFFICES. THE SMALLER BUILDING HOUSES THE GIFT SHOP, RESTROOMS, AND LIFEGUARD OFFICES AND IS OPEN DURING THE SUMMER SEASON.



FLAT PORTIONS OF THE ROOF ARE VEGETATED TO INCLUDE ELEMENTS OF NATURE.

The Linear Interconnected Nature Corridor (LINC) links the built and natural worlds. A trellis over the primary walkway between the two buildings guides visitors into and through the facility. The buildings have introverted solid façades on the parking lot side. In contrast, the ocean-facing side features an open facade and an outdoor porch that steps down to an extensive event space directly on the sand.

GUIDING PRINCIPLES:

- Mediate built and natural environments
- Building as threshold
- Axial promenade

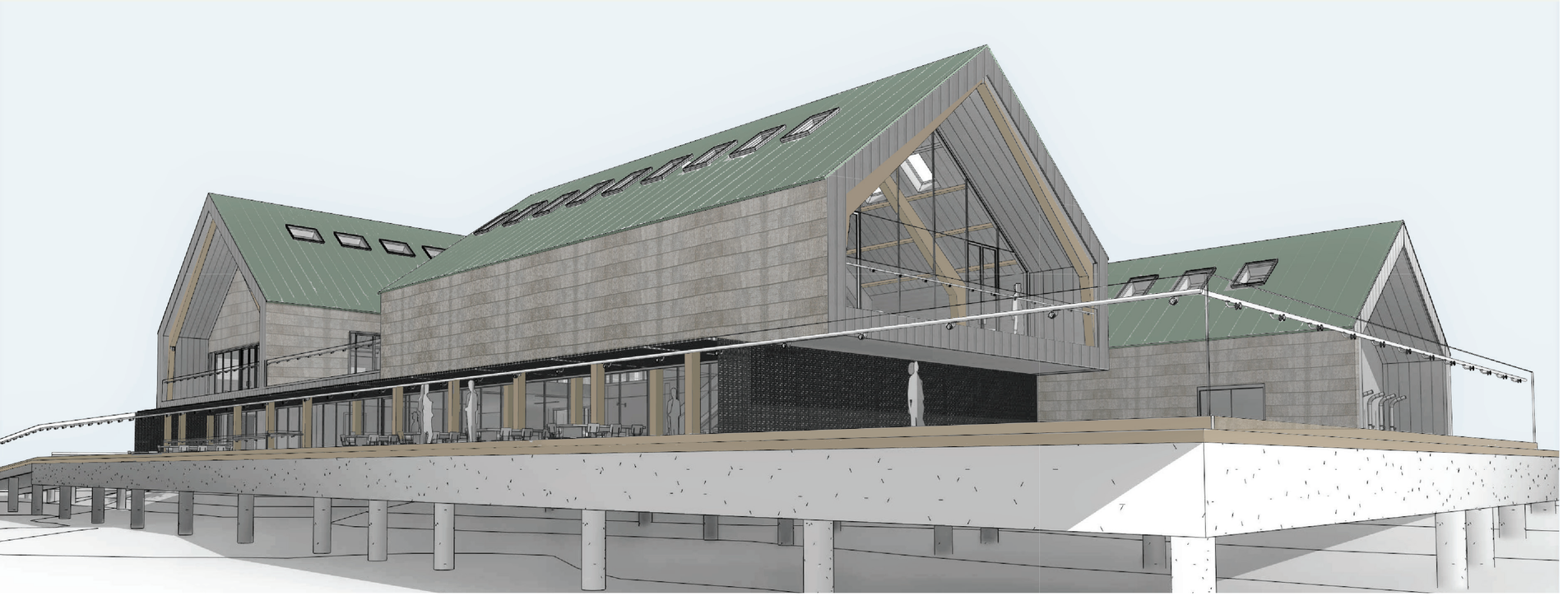
RESILIENCE STRATEGIES:

- Green roofs
- Natural ventilation
- Daylighting

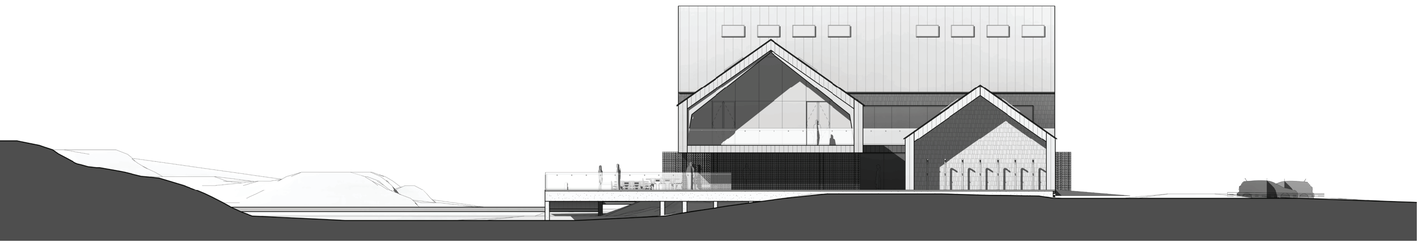
KEY METRICS:

- EUI: 27
- Wall R-Value: 48
- Roof R-Value: 47
- Building Footprint: 10,968 sf

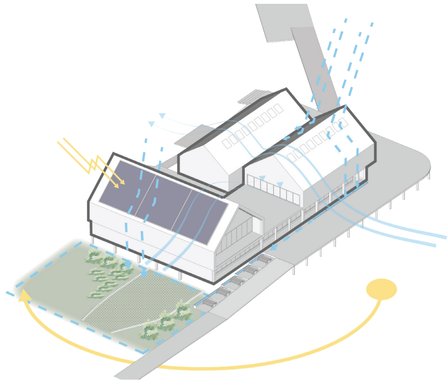
THE LONGSHORE Ben Bernstein, Marco Loh, and Farasatulislam Mirza



THE COPPER ROOF WILL INITIALLY APPEAR BRIGHT LIKE THE SUNSET, AND EVENTUALLY DEVELOP A GREEN PATINA THAT ECHOES THE FLORA ATOP THE DUNES.



THE SECOND LEVEL INCLUDES AN EVENT SPACE, TERRACE, AND MAIN DINING HALL WITH VIEWS TO OCEAN CITY AND ACTS AS A DESTINATION FOR VISITORS.



The Longshore acts as a landmark, echoing the landscape of Assateague Island while standing out from it. Materials such as bark shingles and a copper roof will change and age, harmonizing with textures and colors in the surrounding natural environment. In contrast, the forms of the buildings—a full two stories with sharply pitched roofs—protrude from the landscape as sharp angles and crisp lines, distinct from the organic forms of the natural landscape.

GUIDING PRINCIPLES:

- Landmark
- Integration with the landscape
- Promenade and discovery

RESILIENCE STRATEGIES:

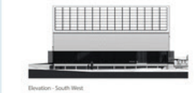
- Natural ventilation
- Rainwater collection and reuse
- Daylighting

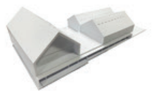
KEY METRICS:

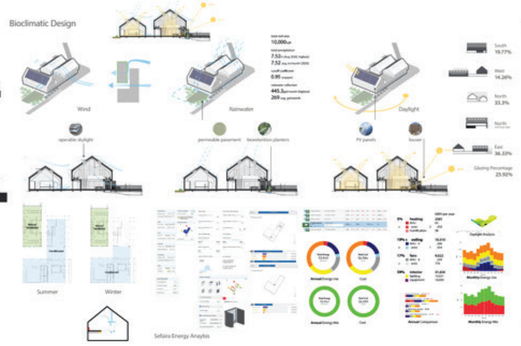
- EUI: 22
- Wall R-Value: 52
- Roof R-Value: 52
- Building Footprint: 8,706 sf

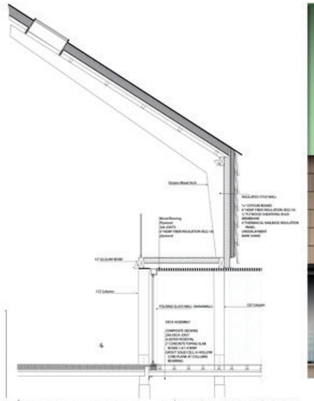
The Longshore is designed to act as a landmark while framing selective views of Assateague Island. The project is designed to provide comfort, community, culture, and a connection with nature. The Longshore makes use of materiality that echoes the texture and color of the surrounding landscape. The bark shingle skin of the structure places it among the pines. The glazing is like the water of the sea, transparent and flowing across portions of the facade. The copper roof will age into the site, at first appearing bright like the sunset, eventually developing a green patina that sets it in place among the flora atop the dunes. The copper will contribute to how the bark will age and integrate with the surrounding environment.
However, the form protrudes from the landscape. The geometry makes use of sharp angles and clear lines, contrasting with the organic forms around it. The steep pitch of the roof will catch the sun and cast shadows below it. The periphery of the Longshore contains shaded spots along the boardwalk, creating gradient to the entry sequence and ambient light to the interior. The pitched roofs provide a grandiosity to the event space and dining area, while providing a means for ventilating the restroom structure.

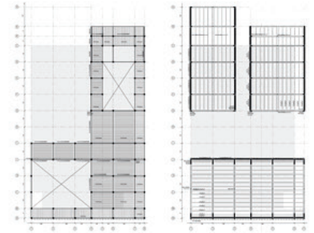
by Ben Bernstein, Chuen Chi Loh, Farasat Mirza

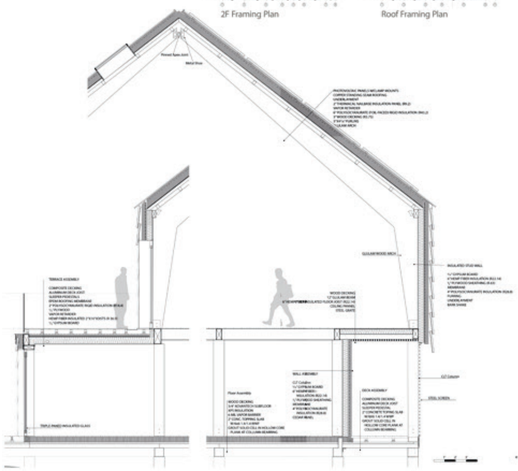


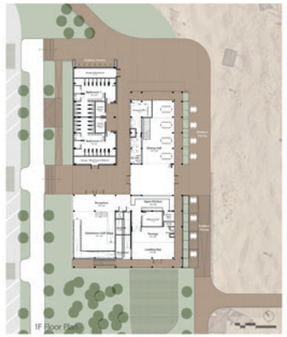


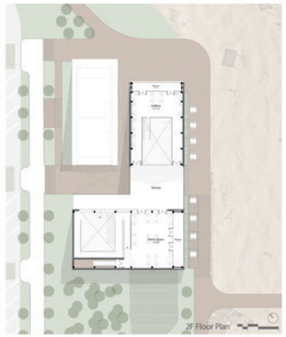


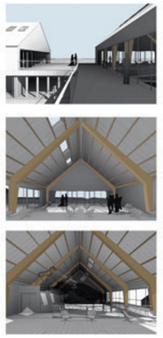


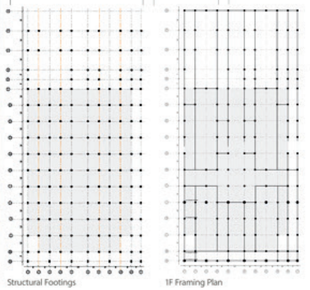


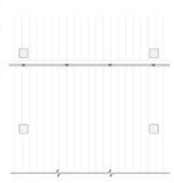


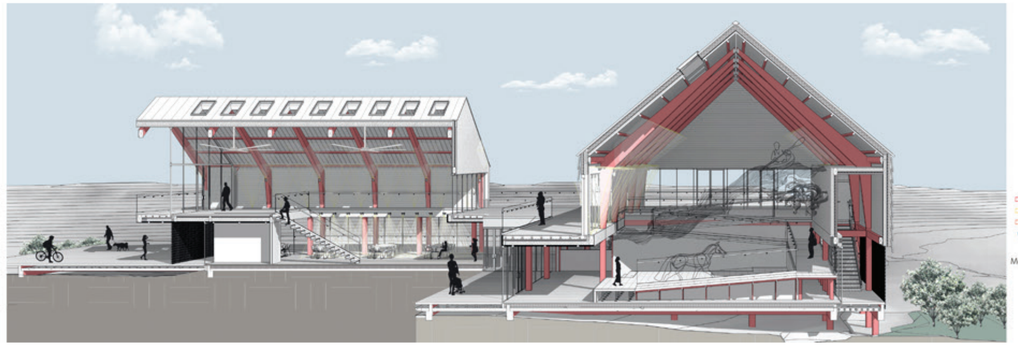








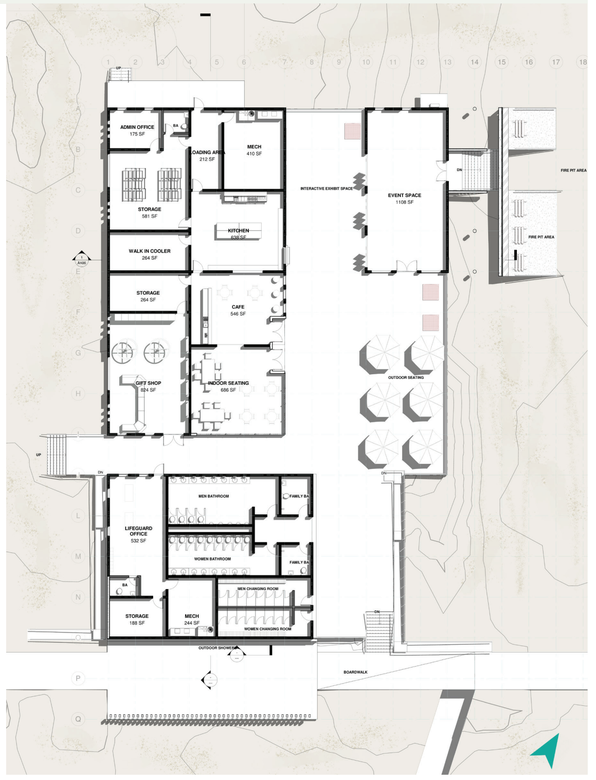




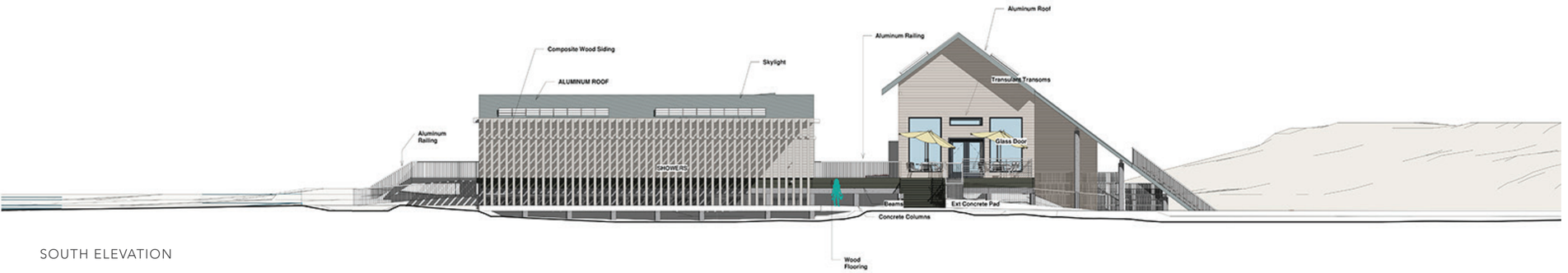
THREE-POINT GATEWAY

Selina Dandy and Daryl Vargas

THE THREE BUILDINGS PROVIDE VARIED SPACES TO ACCOMMODATE THE DIVERSITY OF USER GROUPS AND VISITORS OF ALL AGES.



GROUND FLOOR PLAN: 1/8" = 1'



SOUTH ELEVATION

Three buildings are organized around circulation and seating areas, emphasizing gathering, celebration, and storytelling. These priorities are most evident in the events building, which includes an interactive outdoor area leading to a flexible interior space. The roof of the building slopes dramatically down to the sand and a fire pit area, forming a unique set of bleachers for gatherings and campfire talks.

GUIDING PRINCIPLES:

- Building as threshold
- Integration with the landscape
- History and storytelling

RESILIENCE STRATEGIES:

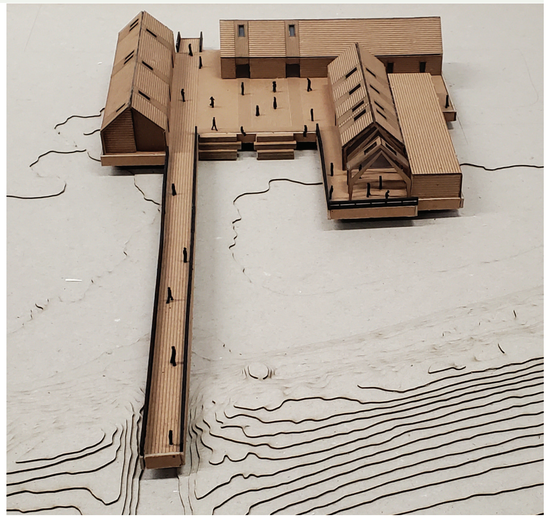
- Native landscaping
- Pervious surfaces
- Natural ventilation
- Daylighting
- Sun shading
- Photovoltaic glass

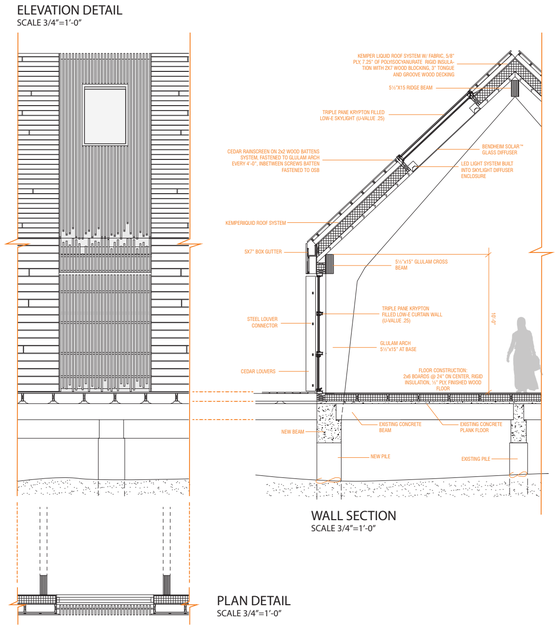
KEY METRICS:

- EUI: 18
- Wall R-Value: 41
- Roof R-Value: 64
- Building Footprint: 9,519 sf

THE VILLAGE Nicholas DiBella and Yan Konan

THE SIMPLE FORMS OF THE BUILDINGS AND MATERIALS LIKE THE CEDAR RAINSCREEN WERE INSPIRED BY VERNACULAR ARCHITECTURE OF INDIGENOUS PEOPLES AND EARLY COLONISTS OF THE AREA.





The Village at Assateague acts as a connector between the past and the future, nature and the built environment, the parking lot and the beach. In this project, the traditional form of the urban plaza, a versatile connector and gathering space, has been adapted to create a flexible outdoor space for park visitors to find rest and activities. This outdoor room is ringed by a collection of buildings containing visitor facilities, recalling the organization of the camping loops within the state park.

GUIDING PRINCIPLES:

- Building as connector
- Axial promenade
- Drawing on vernacular traditions

RESILIENCE STRATEGIES:

- Native landscaping
- Pervious surfaces
- Natural ventilation
- Daylighting
- Sun shading

KEY METRICS:

- EUI: 21
- Wall R-Value: 37
- Roof R-Value: 54
- Building Footprint: 9,890 sf

7 RECOMMENDATIONS

RECOMMENDATIONS

The current climate crisis asks architects to deepen their understanding and application of strategies for climate change mitigation. This study demonstrates the successful integration of bioclimatic (passive) design principles early in the process of a graduate-level design studio.

Where structural engineers must immerse themselves in the numbers before gaining an intuitive grasp of structures, for architecture students, when it comes to technical aspects, the reverse is true. We encouraged student teams to develop an intuitive sense about bioclimatic design strategies, then validate and expand their understanding of strategies, active and passive, using quantitative energy modeling tools.

The Climate Consultant software and weather data from the Assateague area guided student teams to hypothesize the most effective bioclimatic strategies for their projects. These strategies informed the projects' form and orientation on site. Teams tested the impact on energy efficiency of these passive design decisions, as well as a selection of efficient mechanical and electrical systems, using the Sefaira whole-building energy simulation tool.

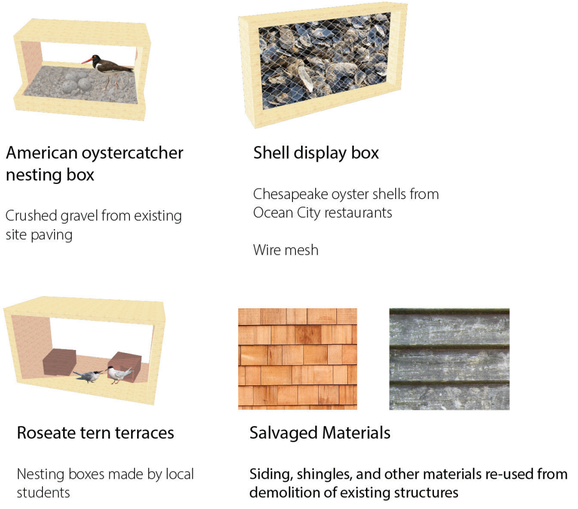
Teams refined their projects through multiple iterations of analysis and redesign until energy use reached an EUI of 22 kBTU/ft2/year or less. Only after achieving this performance level through passive design and efficient active system specification were teams permitted to integrate renewable energy systems in order to achieve net-zero operations.

Four conclusions grew out of the teams' passive and quantitative explorations:

- First, good passive design uses the building itself as the vehicle for generating comfortable thermal conditions.
- Second, approaches to climate resilience should focus on three levels: site, building, and materials.
- Third, emphasizing thresholds, for this project in particular, highlights the ever-changing, moving landscape, and its vulnerability to climate change.
- Finally, adaptive reuse can minimize the long-term climatic impact of a structure.

In addition to the conclusions that grew out of the teams' work, several strategies and themes emerged. The special properties of the place inspired both meaning and form. Some projects drew from indigenous

PASTEL DRAWING BY PERLA



MATERIALS DIAGRAM BY KAKU AND HAIDER

STUDY MODELS AND FINAL MODEL BY MENCER + VAZQUEZ

history. Some selected materials and forms that echo traditional architecture of the area. Others emulated wave forms, shell spirals, and branching forms found in nature. One project incorporated a habitat for birds and butterflies.

All of the teams prioritized best views and solar orientation, though the height of the dune presented a challenge. No direct views to the beach from the ground floor are possible, making second-level spaces an attractive possibility. The projects with a second floor provided ramps for access, acknowledging that an elevator would be impractical and unlikely.

The projects provided direct outside access for most, and in some cases, all of the main program elements. Teams included gathering places for refuge from the sun and funneled breezes for natural cooling, both indoors and outdoors. Many also designed sheltered, sunny exterior spaces for comfort in cooler months. While conceptual approaches to thermal comfort did not come intuitively to designers used to living in conditioned spaces, the students' awareness of the form-giving potential for natural ventilation, shading and daylighting grew to guide their work.

8 GLOSSARY + SOURCES

GLOSSARY + SOURCES

Glossary of Terms

ADAPTIVE REUSE

In architecture, the term describes the process of reusing older buildings (or components of them) for a new purpose.

AUGER CAST PILES

The piers supporting the existing day use facility are auger cast piles, which are installed by rotating a hollow shaft auger into the soil to a specified depth and then pumping concrete or grout through the shaft as the auger is withdrawn. Steel reinforcement is inserted into the freshly poured concrete. They can be used in areas with weaker soils (including sand) and high groundwater.

BIOCLIMATIC (APPROACH OR DESIGN)

The process of using natural energy flows to maximize human comfort. It describes the use of passive approaches to optimizing temperature and humidity (such as natural ventilation, shading, passive solar heating), and can also include tactics such as daylighting, rainwater harvesting, and stormwater management.

BUILDING ENCLOSURE

The part of the building that separates interior from exterior, sometimes also referred to as the building envelope. It may include wall assemblies, windows, doors, roof assemblies, and floor assemblies. See also, thermal envelope, below.

BUILDING SCIENCE

The study of the behavior of a building as a system in the context of energy efficiency, occupant comfort, air quality, and overall building performance. Building science draws on multiple disciplines including physics, chemistry, engineering, and architecture to support high-performing buildings.

CARBON FOOTPRINT

The total greenhouse gas emissions created by an individual, organization, event, or activity. In architecture, carbon footprint refers to the emissions associated with a building, and includes both operational carbon (the emissions resulting from energy use and other aspects of the building use). See also, embodied carbon, below.

CLIMATE RESILIENCE

The capacity to prepare for, respond to, and recover from the adverse effects of climate change.

EMBODIED CARBON

(Or, embodied energy.) The emissions associated with the materials and construction of a building. It includes emissions from resource extraction, manufacturing, transport and installation of materials, along with end-of-life processes.

ENERGY MODELING

The use of computer-based models to simulate the energy consumption of a building, based on inputs such as building massing, systems, and local weather conditions.

ENERGY RECOVERY VENTILATOR (ERV)

The term used to describe heat exchangers that use energy from conditioned exhaust air to pre-treat incoming fresh air as part of a building ventilation system. For example, during the cooling season, an ERV would transfer thermal energy between cooler air being exhausted from a building to temper (cool and possibly dehumidify) warmer air from the outside coming into the building.

ENERGY USE INTENSITY (EUI)

The annual energy use of a building, measured in kBtu, divided by the floor area of the building, measured in square feet. EUI is used as an indicator of the energy efficiency of a facility, to benchmark efficiency by building type and to allow comparisons between different buildings and climates.

HIGH-PERFORMANCE (BUILDING AND/OR SYSTEMS)

A building that has been optimized for improved performance on a number of attributes over its entire lifecycle. These attributes include, among others, energy efficiency; carbon impact; occupant comfort, health and safety; operations and functionality.

NET-ZERO ENERGY CONSUMPTION

A target in which a building produces as much energy as it consumes over the course of a year. Energy use can be measured at the site (net-zero site energy) or at the source (net-zero source energy). The US Department of Energy uses the source energy criteria, describing a net-zero energy building as: “An energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy.” Using source energy as the key metric accounts for the site energy plus energy losses in the extraction, production, and transmission of that energy.

PASSIVE SURVIVABILITY

A building's ability to sustain basic habitable conditions in the event of extended power outages. It most frequently refers to the ability to protect occupants from extreme temperatures without mechanical heating or cooling, and may also encompass an ability to provide safe drinking water.

PASSIVE STRATEGIES

Building design and construction strategies that rely on ambient energy flows, such as sunlight, gravity, temperature differences, and wind, or non-powered systems such as shading structures, to improve occupant comfort.

PERFECT WALL

A term coined by the Building Science Corporation to describe the optimal wall assembly in a given climate zone to act as an environmental separator. It consists of a water control layer, an air control layer, a vapor control layer, and a thermal control layer, listed in order of importance.

PSYCHROMETRIC CHART

A tool used in the design of heating and cooling systems to represent the range of temperature and humidity required for comfortable, healthy indoor spaces.

R-VALUE

The measure of a material or assembly's resistance to conductive heat flow. For materials, such as insulation, R-values are provided for a given thickness. For assemblies, such as a wall composed of multiple layers, a "whole wall" R-value is calculated to take into account the thermal resistance of each material and its relative size and thickness within the assembly. A higher R-value indicates greater resistance to thermal flows, or a more effective insulating ability.

THERMAL ENVELOPE

The elements of a building that separate interior, conditioned spaces from exterior or non-conditioned space. It includes wall and roof assemblies, insulation, windows/doors, and other weather-sealing elements. The goal of the thermal envelope is to control the flow of heat into and out of the building's conditioned spaces.

THERMAL BREAK

Also known as a thermal bridge or gap in the thermal envelope, a thermal break refers to an element of a building that conducts the flow of heat in or out. Examples include wood or metal studs in a stud wall, steel columns, or other structural elements such as beams that extend from interior to exterior.

VARIANT REFRIGERANT FLOW (VRF)

An air conditioning system with one outdoor condensing unit and multiple indoor units, where varying the amount of refrigerant flowing to each indoor unit allows for temperature control. VRF systems can work as air conditioners (cooling only) or heat pumps (heating and cooling, and sometimes dehumidification). They are increasingly popular in high-performing buildings because they are highly energy efficient, require minimal mechanical space and ductwork, and allow for flexible zoning.

WALL SECTION

A technical drawing used in architecture and construction that represents a slice through a wall assembly, showing the structure and materials of the wall, and systems such as mechanical and lighting, often with specific measurements.

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9 ACKNOWLEDGMENTS

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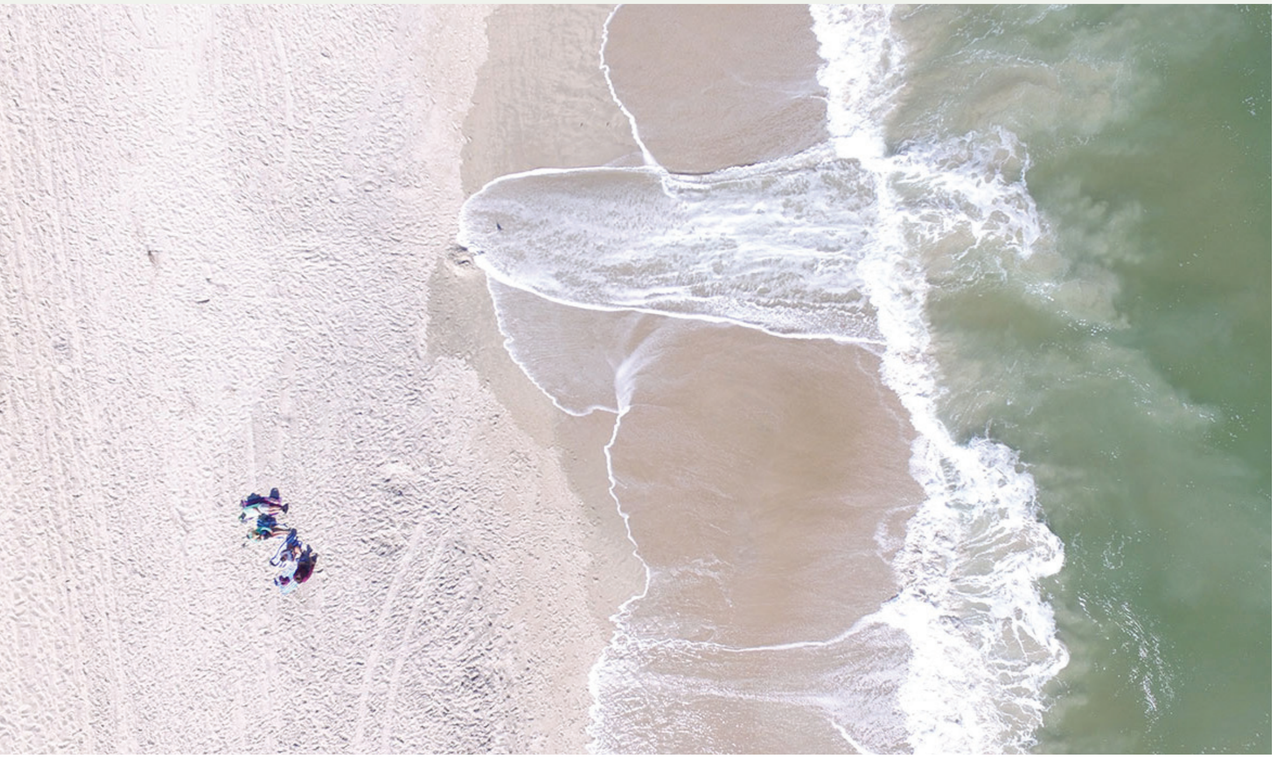

Integrated design is a collaborative process. This investigation tapped the expertise of many professional consultants, old friends of the studio and new colleagues. MD-DNR staff and agency representatives gave generously of their time and experience. With the enthusiastic participation of everyone involved, the students tested creative ideas, made discoveries, and produced an abundance of good work to inform the future design of the Assateague State Park day use facility.

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This report was prepared by the ARCH600/611 teaching team using federal funds under award number NA19NOS4190162 from NOAA, U.S. Department of Commerce. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of NOAA or the U.S. Department of Commerce.