NEW YORK HARBOR SCHOOL

Renovation and Extension of New York's Maritime Secondary School

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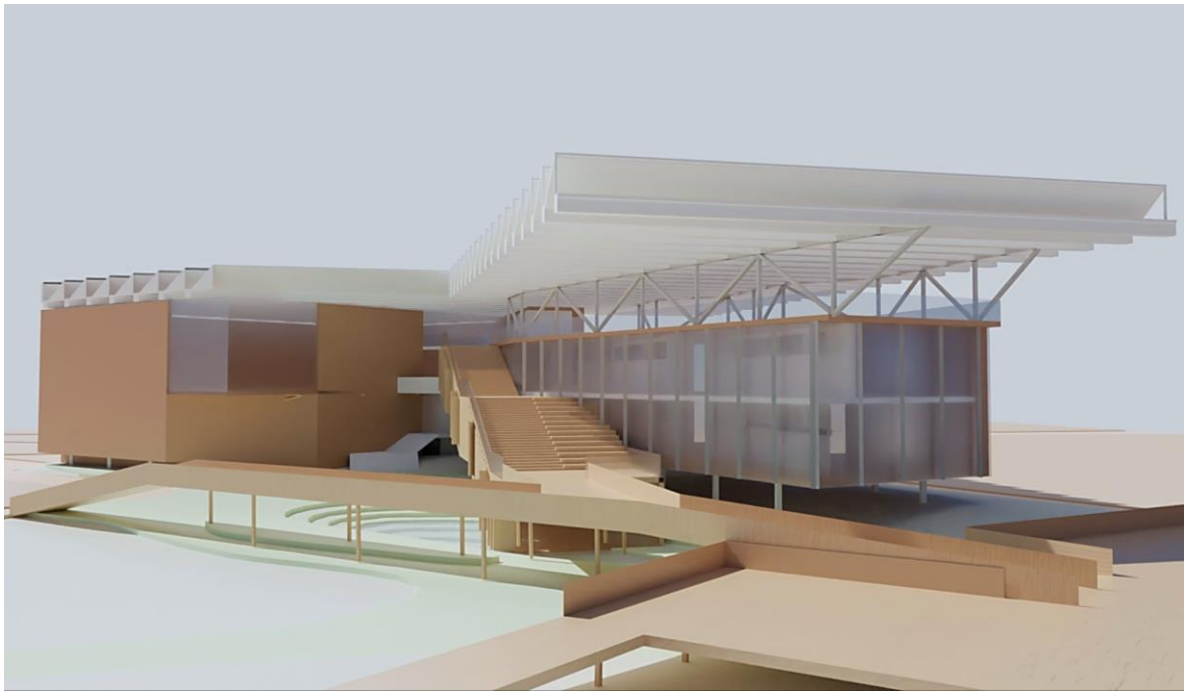

Project Data

Location: Governors Island, New York City, USA
Climate Zone: ASHRAE 4A
Lot Size: 7 Acres
Building Size: Retrofit: 32,000 ft^2, 3 storeys
New Building: 60,000 ft^2, 2 storeys
Occupancy: 900 students
Construction Cost: \$878/ft^2 (\$79 million)
Site EUI: 19 kBtu/ft^2/year
Source EUI w/ PV: -12kBtu/ft^2/year

Technical Specifications

Thermal Performance (ft^2 ·°F·h/BTU): Walls: R-20; Roof: R-40; Foundation: R-10; Window: 0.2 Btu/h·ft^2·F

HVAC: Geothermal Heat Exchanger, Heat Pumps, Radiant Panels, Hydronic Heating/Cooling, Dedicated Outdoor Air System w/ Energy Recovery

On-Site PV: 36,993 ft^2 {350 kBtu/ft^2/yr @22% Effy}

Project Summary

The New York Harbor School is a New York City public high school that occupies a unique position as an institution since it is located on Governors Island. The Harbor School is dedicated to a career preparatory education built on the city's maritime experience and provides students with opportunities to learn on, in, and around the water. The school is submerged in the history of the city, with the current building being a renovation of what used to be a hospital for the Coast Guard.

Although plans to expand the school have recently been announced for The Harbor School's expansion by the NYC School Construction Authority, our proposal challenges the attitude of strict standardization to showcase the unique characteristics of the school, its site, and its students. We are designing a net zero, sustainable design for the new academic building that will be an addition to the school's campus. The unique location poses an obstacle to our design since the school is in a flood zone. To combat this, we are building above the design flood elevation designated by FEMA and working to make the building a haven for the community in times of inclimate weather. Our combination of design and mechanical systems limit the amount of energy that the building uses, and PV systems supplement the remaining energy that the campus needs. In totality, our design accounts for the flood risk posed by our location, is as efficient as possible on its own, and includes measures to make the building net zero using renewable energy.

Design Strategy

The design has three overarching sections: the retrofit of Building 555 into classroom spaces, the design of a new academic building on the adjacent triangular site housing sports facilities and new lab spaces, and the landscape in between the buildings.

Our design follows five key objectives: the creation of a campus that would connect the existing building to the expansion, as well as provide exterior spaces of gathering and leisure for students; the integration of the campus into the larger urban composition of the island; respecting the codes of historical preservation for the existing buildings; consideration of climate conditions and methods to collect and store renewable energy, and systems and materials that would allow the construction to operate at net-zero carbon emissions; and lastly the mitigation of potential flooding damage that would affect the campus and its community.

Project Highlights

1. Architecture - The New Academic Building places the program along a staggered North-South axis, creating a serrated bar that ends with the larger program volumes of the lobby, pool, and gymnasium. The West facade is a landscaped wall that acts as a thermal mass for the classrooms. The North-South axis is also followed by the sawtooth roof canopy, which provides shading over a landscaped basin and skylights into the building.

2. Engineering - For periods that have higher load demands, a geothermal heat pump effectively distributes heating and cooling throughout the spaces using radiant panels to meet the building's needs. The geothermal ground heat exchanger loops will be integrated with the pile foundations underneath the new building. A dedicated outdoor air system (DOAS) with a heat recovery system provides ventilation for each space while minimizing and collecting wasted heat in exhaust air.

3. Market Analysis - The cost of the building is estimated to be $79,000,000. Annual operational costs are expected to be reduced due to energy efficient systems and potential cost reductions due to governmental funding for sustainable building.

4. Durability and Resilience - All mechanical systems are placed on higher levels of the buildings for resiliency in case of flooding. The PV system with battery storage serves to power the building during potential power outages.

5. Embodied Environmental Impact – Local materials sourcing and use of carbon-negative CLT superstructure reduce embodied carbon. The debris/waste from the demolition of the renovation will be used as fill for its basement.

6. Integrated Performance - Our structure is optimized to garner the maximum passive heating, cooling, and ventilation to lower the building's energy consumption throughout the year. For the retrofit, acoustically protected vents allow for cross ventilation throughout the building and the solar chimney draws out the heated air from the building to maintain a comfortable climate for the occupants.

7. Occupant Experience – LED lighting systems and outlets are strategically placed based on occupancy/vacancy and room dimensions/finishes while emphasizing the effects of lighting on learning experiences with the use of AV systems in classrooms and public assembly areas. Clean, light, wooden finishes will highlight the building's materiality while enhancing the classroom environment.

8. Comfort and Environmental Quality - The DOAS will have a bypass valve for when the building is in natural ventilation mode which will be turned on by the building management system (BMS) when the outside conditions meet ideal conditions. The BMS will also: 1) coordinate electric lighting/automated solar shades when usable daylight is available, and, 2) warn users to keep windows closed when the building is actively cooling or will stop circulating chilled water to avoid condensation. Grey water and rainwater will be collected and recycled on-site for use in toilets and landscape irrigation, reducing water waste.

9. Energy Performance - Geothermal heat pumps have a high Coefficient of Performance (COP) and paired with radiant panels that eliminate duct losses will increase the efficiency of the system. The DOAS with heat recovery can recover energy in exhausted air and will reduce heating and cooling loads. Solar panels will be placed on the roof of the new building and have an expected output of 2,848,461 kBtu/yr.