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Advanced Architectural Design

Columbia GSAPP
The Gowanus Canal in Brooklyn is considered one of the most polluted sites in the country. It is said that residents and businesses along the canal historically dumped anything from trash to carcasses into the canal, and a simple whiff of the surrounding area proves this to be true. Tasked with creating a cultural center that embraced material reuse, the project aimed to extract the abundant amount of sludge from the canal to be used as a material to form bricks. These ‘sludge bricks’ would then be fired and used to assemble a self-supporting Catalan brick vault structure that beckons back to the canal’s industrial past of brick factories, while ushering in a new future of sustainability. Intended to house three different cultural institutions focused on different mediums (visual arts, performance, and digital art), the structure uses the necessary structural drop downs of the brick vaults as permanently occupied rooms, while leaving the remaining space as semi-programmed flexible areas meant to promote collaboration between mediums. These transformable spaces are flanked by optional curtains that can be deployed when further privacy is needed. Special variations of the sludge brick are incorporated into the structure when necessary, such as glass bricks that allow light within the space, acoustic bricks that insulate sound sensitive areas, and grass bricks which allow the roof to grow wild with vegetation. Along the interior is a brick production line which is constantly operating, as canal-faring robots extract and process sludge for the creation of bricks to be sold as a means of funding for the cultural institutions the building serves.
Greetings from Gowanus

Cultural Matter

Canal section

Sludge collecting
1. Robots collecting sludge from Gowanus
2. Gathering the sludge on the shore

Water filtering
3. Water gets into the filtering pool
4. Filtering through various layers
5. Filtered water goes back to the canal

Brick production
6. Collected sludge being prepared for production
7. Aggregate mix with filtered water
8. Molding according to the desired size
9. Air drying
10. Bricks getting ready for shipping
11. Loading into trucks for shipping

Production diagram
Brooklyn Army Terminal acts as a barrier between the urban fabric and the waterfront. Due to the level differences between the surrounding streets and BAT, there are no visual or physical connections which it is making BAT completely inaccessible from the street level. Therefore, this project proposes three streets connecting the urban fabric to the waterfront while piercing through both buildings and making the atrium more accessible to its occupants.

Multiple programs are located in these streets for the local neighborhood, visitors, and workers. To provide a circular economy, the atrium is filled with retail spaces, selling/exhibiting the products produced in BAT, where BAT provides goods for retail spaces and retail spaces provide network/opportunity/cash for BAT. Also, another inaccessible part, the roof is used for agriculture, which also provides produce for retail spaces. To connect the roof and the atrium, vertical circulation/ramps are proposed just next to the atrium, connecting all floors. To solve the visual inaccessibility, glass openings to manufacturing spaces are placed according to the tenant profile and how much exposure they want. Also, pocket spaces are placed in between manufacturing spaces and vertical streets which act as a directory for BAT and include programs for visitors and workers to encounter and interact.
streets of BAT

atrium

gallery spaces
for artists working in BAT

retail spaces
selling products manufactured in BAT

cafe/restaurants
using products manufactured in BAT

grocery
selling products produced in roof

manufacturing hub

goods and services
street / passage

retail stores

atrium section
Our food system is failing. One of the main reasons for the failure is that it is largely centralized. Agricultural industry is becoming more monopolized every day while the average meal in the US travels about 1,500 miles from farm to plate. During this transportation, 40% of the nutrition is lost and 1/3 of the food goes to waste.

The impacts of climate change and extreme weather events are devastating for centralized food production. More than four million acres have burned in 2020 from California wildfires. Smoke is also affected the working schedules during the wildfires, preventing workers to work safely, delaying harvest and leading to waste crops. COVID-19 pandemic was also a key figure in the failure of the food system. Supply chain problem made it harder to find fresh produce, causing an increase in prices.

These factors resulted in a drastic increase in food insecurity rates in Los Angeles in 2020. When we look at the demographics in Los Angeles, it is seen that obesity and income are directly related. When income decreases, access to healthy food decreases, and obesity increases. In the US, every year around 200 billion dollars are spent on obesity treatment.

The project proposes a decentralized food system in Los Angeles to decrease food insecurity and provide fresh produce to underdeveloped neighborhoods. Central Alameda is chosen as a case study site, where the income is low and obesity is high. Project offers solutions on two different scales. The first one is accessory feeding units (AFU) for backyards as a replacement for accessory dwelling units (ADU). It’s a 1.5x1.5m modular hydroponic unit, working with a lease agreement, for people to produce their own fresh produce in their backyards. Second scale is in the car parks. Elevated modular structures with three different programs; hydroponic farms, recycling centers, and community gardens. Hydroponic farms will provide fresh produce to people with no backyards (AFU), schools, and industrial areas. Recycling centers will recycle plastic bottles to manufacture parts of AFUs and trays for hydroponic farms. Lastly, community gardens, which are located in the main intersections, offering locals a gathering space and a ground for agricultural education to students in nearby schools.
Food insecurity is the lack of consistent access to enough food for an active, healthy life.

The U.S. Department of Agriculture (USDA)
Accessory feeding unit can produce more than 25 pounds of fresh produce per month. $3,000 per unit + $1,000 government fund = 300 pounds of produce per year = $1,800 to compensate in ≈1 year.

Monthly leafy green consumption of an average person: 15 pounds.

AFU vs. ADU:

- AFU: $2,000 per unit
  - 56 units: $112,000
  - 24 units: $48,000
  - 12 units: $24,000
  - 3.6 pounds per 20 people

- ADU: $300 per sqf
  - 1st office, 1,200 sqf: $360,000
  - 2nd office, 693 sqf: $207,900
  - 1st office, 350 sqf: $105,000
  - 3rd office, 120 sqf: $36,000
  - 4th office, 80 sqf: $24,000

Tour:

- 25 pounds per month
- 50 pounds per month
- 75 pounds per month
- 100 pounds per month
- 150 pounds per month
flex farms
-hydroponic farming unit by fork farms

plywood base

carbon

water tank
-350 L

reverse umbrella structure for rain water collecting

pv strips

what's in the box

A x8
B x4
C x10
D x8
E x6
F x2
H x1
J x1
K x8
M x2
N x1
O x7
L x2

exploded

decentralize LA

the tour

54

55
When I walk through the High Line, instead of looking at the High Line, I always look around, looking for the reflections of the High Line through the glass facades. Reflections give you a new perspective, overlapping the moments of the visitors and the people living in those buildings.

It is incredible to see how close the adjacent buildings are, how exposed the private lives of the people living in those buildings are. The apartments are either vacant or have closed curtains. I try to see what the interior looks like, and what people are doing inside from the tiniest openings. Is it just me or everyone is like that? Imagine paying millions of dollars for an apartment in a Zaha Hadid building and living with closed curtains, or a green barrier on your balcony. Otherwise, people walking on the High Line becomes your closest neighbor, even a roommate.
reflections of high line
architectural photography
33 Thomas Street, formerly known as the AT&T Long Lines building, in Manhattan was used as a telephone exchange. Since it housed solid-state switching equipment, which required a high level of security and space, it has no windows and has a solid facade. Since it is no longer used for this purpose, the aim of the project was to convert this building into a residential tower. To do so openings are required in the facade to get sunlight. The facade is divided into an alternating pattern to allow for flexibility in design for residential units. This alternating pattern always allows for a living room and bedroom to be next to one another. Living rooms include a balcony and the protrusion of the balcony is adjusted according to how much sunlight each space captures.

The existing building is modeled in Revit. Then to do the solar analysis, using Rhino inside, model is imported to Rhino, and Ladybug plug-in is used for the analysis. After that, existing facade is replaced with new balcony and window families in Revit. Balcony family has a parameter that adjusts the protrusion. The sunlight data, gathered using Ladybug, is imported to Dynamo and the protrusion parameters are changed accordingly.
the façade at 33 thomas street, formerly known as the AT&T long lines building, reflects the original use of the building. the windowless skyscraper was used for the telephone exchange. the façade is made of precast concrete panels clad with granite.

the upper floors of the façade capture most of the sunlight. on this diagram, red represents the most time exposed to the sun, while blue represents the least amount of time exposed to the sun.

our proposal is to convert 33 thomas street into a residential tower. the facade is divided into an alternating pattern to allow for flexibility in design for residential units. this alternating pattern always allows for a living room and bedroom to be next to one another.

by extracting the living room modules we are able to see how much sunlight each living room captures during the day.

the living rooms of each unit would include a balcony. this balcony is the changing parameter within our design process. the protrusion of the balcony is adjusted according to how much sunlight each space captures.
Columbia University's Morningside campus offers grass and hardscape areas that can be used for a variety of outdoor or tented events. The existing plaza layouts are organized more generically and have not been designed to allow for flexibility of uses. Our approach is to introduce singularity to the design of the plaza by optimizing the interior layout for circulation, designing for sunlight, and introducing plan distribution of four program types: these programs would include a large event, dining, workstation, and a leisure area that is manageable through the use of a multipurpose seating device. Through this, we are aiming to activate the plaza as a dynamic point on campus. The modularity of the canopy design and the generative design approach makes it possible for the project to be incorporated into other public event spaces on campus such as Dodge Plaza which also lacked a clear approach.
generative design

redesigning dodge

shortest walk optimization

optimal outcome
redesigning dodge

large event

dining

leisure

work

space types

space formation

generative design