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By implementing Farm to Building materials and techniques, this project catalyzes the following inquiries: How might we rethink the act of building by not only consciously confronting ecological extraction and the capabilities of human labor, but by designing the means to ameliorate harmful effects of these metabolic flows? In doing so, can we see buildings and their construction materials not as static assemblages, frozen in time, but as unending flows of matter and energy?

The earthen installation, located at the entrance to the Geoscience Building, was designed to provide insight during its construction, its occupation, and its dissipation. During fabrication builders and spectators alike were able to situate its movements of material extraction, procurement, and labor as metabolic flows in which extracted layers of earth were relocated, remixed, and returned to the earth as a habitable, exterior space on campus.

In its constructed state, the installation acts as an occupiable sitting area. While structures are typically considered to be something other than the earth, merely placed on top of it, this installation offers students, staff, and visitors a chance to inhabit the earth itself. The installation will continue to teach, perhaps most significantly, during its erosion. The solubility of the project provides an expedited simulation of how built environments dissipate over time, providing visceral and tangible lessons about maintenance and care.

The project offers insight into inherently terrestrial techniques of construction that are, in many ways, commensurate with and reflective of the ecological research undertaken in various fields at Lamont-Doherty. Ultimately, this short summer workshop offered students and faculty from both schools an academic playing field in which to watch and debate how we ought to make things in the world, and what might or should happen to them when they’re gone.
Design development

Material testing
The footing for the installation was required not to penetrate the existing concrete slab on which it rests. Moreover, the school administration asked that the entire installation be removable and recyclable at some point in the future. Responding to these criteria, students designed a stone footing to be built with a minimal amount of lime mortar such that it is bound only to itself, but not to the existing concrete slab. The stone prevents capillary water intrusion into the raw concrete walls and also provides splash protection during heavy storms. The stone footing will one day be removed without damage to the concrete slab.
Steps for ramming process

Roof detail for wall protection
material
conservation
Indoor
environmental
quality
Empowerment
Safety & security
Health & well-being
Community resilience
Social & cultural life

WHY ON EARTH?
The social life cycle of earth materials compared to conventional materials

In collaboration with Lola Ben Alon, as part of a Natural Materials Lab research

Presented and published at Earth USA 2022 conference

Earth materials are known for their self-sufficiency, community engagement, and vernacular nature. Building materials such as cob, light straw clay, and rammed earth are non-toxic and often provide local employment opportunities and enhancement of local economies. However, while there is a widespread consensus on the social benefits of earth materials, a systematic analysis that quantifies these benefits is currently lacking. To address this need, this study uses social life cycle assessment (SLCA), an increasingly robust methodology, to contribute to a full triple bottom line life cycle assessment (LCA) of earth materials by combining societal, environmental, and financial attributes for individuals and communities. This SLCA provides enumerated impact results from an online survey of different stakeholders, including manufacturers, designers, researchers, and homeowners of earth houses. Similar to an environmental LCA, this SLCA impact assessment is quantified using indicators across the entire life cycle of the building material while prioritizing areas of “hot spots” in the analysis to determine the significance of the social concern for the specific earth material or product. The results are provided in terms of health and safety, worker conditions, regional impacts and community engagements, and regional sustainability. They show that natural materials outperform conventional materials in almost all aspects of the SLCA framework, with the exception of the provision of social benefits and professional development opportunities for workers in extraction, production, and construction phases.
Comparison of Earth and Bio-Based Materials VS Conventional Materials based on Spread of Responses

Comparison of Earth and Bio-Based Materials VS Conventional Materials based on Normalized Scores

Earth & Biosbased Materials - Social LCA Score Map

Conventional Materials - Social LCA Score Map
In light of the continual fight for social justice, it is essential to approach public spaces with lenses of inclusivity and community resilience. Amongst other public spaces in Manhattan, Morningside Park plays a critical role in showing the occurring tensions between two very distinct communities: the predominantly white community of Columbia University on the west side of the park, and the mainly African American and Hispanic communities on the east of the park.

Gradual social-scape provocatively reshapes Morningside Park in order to make it a safe, inviting, and connecting public space. The intents of the proposal are to blur the clear boundary between Morningside Height and Harlem, address the park’s accessibility, and provide a variety of programs that allow meaningful and inspiring interactions.

Gradual social-scape tries to answer questions like how do we heal the apparent fracture between Morningside Height and Harlem? How do we make better use of the topography to bring people together? How do we create visual and physical connections that enable social interactions?
The magnitude of cultural & social events around Morningside Park

The thousand steps of Morningside Park
How to rethink the topography?

How to rethink the program?
Hand-drawing | 3 sections of the intervention
Models of intervention | how can ramps replace the stairs?

Models of intervention | who knows what the pond is there for?
Models of intervention | a new public market and outdoor movie theater
THE IMPACT OF THE FRENCH PROTECTORATE ON CASABLANCA AND ITS SOCIETY

INTRODUCTION

When visiting Casablanca today, one cannot fail to notice the French urban and architectural legacy that both blends and conflicts with the traditional urban and social fabric. Professor Hassan Radoine described this pattern as “an urban duality that has its own melody”.

Although the last of France’s colonial acquisitions (conquered and made a protectorate in 1912 until 1956), Morocco was amongst the few places where architects and planners “engaged their talents in the decision-making processes for exploiting natural resources and social conditions”. As Resident Général de France au Maroc, Louis Hubert Lyautey had a major impact in reshaping the country and reevaluating the economic, political and social importances of each existing city. This way Lyautey named Casablanca, then a chaotic-yet flourishing-urban center, the economic capital of Morocco. With that came a number of planning interventions that Lyautey led in order to increase the international presence of Casablanca, provide adequate public and administrative buildings, and promote an optimized circulation network that would cover most of the country. This paper focuses on the expansion of Casablanca throughout the Protectorate period and how different actors contributed to its development. Throughout the paper, it will be evident that Casablanca provided the ideal opportunity for French and other Western architects/planners to experiment new designs at all scales, from new urban layouts to specific residential typologies.

First, this paper will go over the conditions of Morocco and Casablanca pre-protectorate as well as Lyautey’s intentions when arriving in Morocco. Second, we will discuss the major urban changes that happened at the beginning of the protectorate in order to make Casablanca a stronger urban center that reflected the power of French colonizers. Finally, this paper will cover the late addition of a new Medina in Casablanca in order to respond to the overwhelming need for Moroccan housing in Casablanca.

CONCLUSION

While General Lyautey heavily focused on ensuring that Morocco maintained its identity, the French Protectorate had an undeniable large impact on the local culture and lifestyle. The decolonization of Morocco left local populations with a substantial urban infrastructure that continued to encourage segregation and social hierarchy. In Casablanca, European quarters were taken over by wealthy Moroccan families while the old Medina were dedicated to the poor communities. These Medinas were no longer seen as the centers of the urban life, but rather only a residential neighborhood within a bigger city. Hassan Radoine referred to Moroccan cities as “bipolar” as he emphasized that they “have been handicapped by the heterogeneous components forming them”. Moreover, the centralization of power and economy into Casablanca and Rabat led to a clear deterioration of the inland historic cities that “lost their raison d’être” as their functional side was abandoned by Lyautey to “make them exotic tourist resorts”. After independence, Moroccan planners neglected to see the Medinas as a rich heritage from Morocco’s past, leading to their rapid deterioration between the 1950s and the 1980s. As Historian Philip Naylor noted, “decolonization denied much more than the liberation of Europeans. It meant dealing with imported ideologies and reconciling modernization with liberation. To Moroccans, decolonization also involved consequential questions of personal as well as national identity. Nagging questions remained: did the decolonization clearly end the French influence on Morocco’s architecture, planning, and culture? Was post-colonial Moroccan man somehow still colonized?

BIBLIOGRAPHY


NAYLOR, Philip C., North Africa: a history from antiquity to the present, Austin, University of Texas Press, 2015, pp 141-167.


Decades of disinvestment into the regional transportation system has led to intense transit based inequities across the Hudson Valley. In order to transform the accessibility of the valley's west shore, this proposal looks at reactivating the historic western shore passenger rail line to reconnect cities that are now disconnected. This regional rail service would create a permeable transportation network, reduce the locals' carbon emissions through transitioning away from a car based region and regenerate local economies and foster opportunity through transit oriented development.

This proposal aims to establish a sequence of mobility hubs along the rail line that would serve as a critical connection between several transportation systems creating a more cohesive and equitable metropolitan system.

The Newburgh hub transforms the surrounding urban-scape to encourage the use of more sustainable transportation systems. By favoring public transit and human powered modes of transportation, the design of the Newburgh hub serves as a guide for communities in transportation transition.
Populations along the Hudson river
Population poverty along the Hudson river
Existing railway on the east side of the river
Highway tolls on the west side of the river & bridges
Creating of mobility hubs

4 mobility hubs along the Hudson River:
- Newburgh
- Saugerties
- Albany
- Haverstraw
Socio-economic impact of the intervention

Dylan
Newburgh to Albany

Dylan, like other governmental workers, works between NYC and Albany. He just purchased a home in Newburgh as it is conveniently located between both New York City and Albany and he can continue to work hybridly from home and in both places.

**Existing commute**
- Personal car: 1 hour 27 minutes, $18.96 ($4.75 tolls), 0.03 tons of CO2e
- Public transit: 3 hours 12 minutes, $37, 0.01 tons of CO2e

**New commute**
- 42 minutes (via express train), $14, 0.00 tons of CO2e

Linda & Larry
Newburgh to New York

Since they retired in 2010, Linda and Larry live in Newburgh to be more connected to nature and live in a less stress intensive environment. They often commute to NYC to see their kids and take care of their grandchildren.

**Existing commute**
- Personal car: 1 hour 36 minutes, $12.91 + parking, 0.05 tons of CO2e
- Public transit: 2 hours 26 minutes, $24, 0.00 tons of CO2e

**New commute**
- 55 minutes (via express train), $10, 0.00 tons of CO2e

Martha
Walden to Newark

Martha is a freelance consultant from Walden. Martha has clients all over the US, which requires her to constantly travel within the state and across the US. She usually drives to Newark and leaves her car at a parking there.

**Existing commute**
- Personal car: 1 hour 17 minutes, $15.59, 0.02 tons of CO2e
- Public transit: 2 hours 57 minutes, $24.50, 0.00 tons of CO2e

**New commute**
- 1 hour 10 minutes (via express train), $12, 0.00 tons of CO2e

145 miles
30,000+ jobs
72.5 billion
32 new stations

Proposal’s socio-economic benefits

Socio-economic impact of the intervention

Proposal’s socio-economic benefits

145 miles
30,000+ jobs
72.5 billion
32 new stations

Proposal’s socio-economic benefits
In an effort to expand the system and increase network capacity, the toolkit depicts optimal conditions for urban transformations relating to mobility. These conditions aim to shift car-centric infrastructure to pedestrian-centered spaces.
01 | Current use

02 | Road Reconfiguration

03 | Resiliency & Landscape revitalization

04 | Protected view & Broadway continuity

05 | Mobility Hub Layout

06 | Permeability, Active Living

07 | Pedestrian walkway to the water level

08 | Development invill on both sides of the hub
Site plan of the Newburg transportation hub
View from broadway towards the east | physical model photograph

Lateral view of project | physical model photograph

East-west section through the Newburgh Mobility hub showing the connection to the water
THE MEDINA OF TUNIS between cultural continuity & neocolonial globalization

Fall 2022, GSAPP at Columbia University

As a means of enriching the local Tunisian culture, this project claims the property of either the street or rooftop of a network of cultural centers and educational institutions. These spaces either exist in ruined condition, with a lack of maintenance and/or localized social activity, given that they are separate from the interstitial spaces used by residents. This project also claims the object of the medersa — those that have been abandoned and left obsolete post colonization.

With the intention of providing a charitable resource for the indigenous local community, the project aims to create a cultural translation between Medina craftspeople and Tunisian students/graduates, by subverting the occupation of streets and roofs to celebrate the people’s culture through making and fabricating. In a similar manner, the project’s claim of appropriated medersas gives agency back to the people of Tunis to decide how to treat the space — promoting a fluid functionality as a means of embracing Tunis’ cultural heritage through spoken word, music, dance, and social gathering events.

In both cases, the project aims to bring these interstitial spaces and medersas to develop a network of local cultural experiences, organized and developed primarily through the input of local users, in order to avoid a linear experience and embrace the fragmentation that the colonial history produced.

Imagined future
• The medina of Tunis is recognized as one of the leading centers of craftsmanship.
• Right at the intersection between preservation and modernization. The medina is a perfect example of catalyst infrastructure that promotes the development of arts and culture within the local community and beyond, regardless of social status, race and religion.
• Since its inauguration, a number of public workshops opened within the medina and beyond. The other MENA countries took example of this success and have started their own workshop network.
The lost craftsmanship of chia making

The lost craftsmanship of wood carving

The lost craftsmanship of metal engraving

The lost craftsmanship of mosaic making
01 | Post-colonial Tunis - arts and crafts leave the medina for new modern infrastructures

02 | How can the arts and craftsmanship return to the medina of Tunis?

03 | How can the creation of main craftsmanship workshops empower others to do the same?

04 | How can all these new workshops be connected through a more accessible pathway?
Wood and metal workshops | section

Main entrance of the crafts network | section

Connection between metal workshop & local shops

Connection between wood workshop & local mosques

Wood and metal workshops | section

Wood & metal workshops | lower level
Civic spaces and identities are not restricted to physical structures or buildings, but can exist in a variety of forms, including objects, time and measurability. The civic-ness of a space or identity can be assessed at the scale of the human experience and the various interactions that occur within it. Makola market, a critical part of Accra's economy, is the second largest informal market in the world. Trading within its boundaries, the market is home to a diverse array of vendors, selling everything from fresh produce to textiles, clothing and crafts. The government's attempts to construct large scale infrastructure for the market are facing opposition from the local population, indicating that a top-down approach might not be the most effective strategy for the development of the space. Given this understanding, how can we design for a segment of the society that lives with the temporality of everyday life? How can we create a sense of ownership over space and provide agency to individuals who want to have an identity within the common collective?

It is essential to the hypothesis that we design for stakeholders that face the brunt of the social hierarchy and support their needs in a way that allows them to feel empowered when they leave their homes. The aim is not to establish and heighten the stratification that exists today, but to offer opportunities for improving conditions for traders, and supplement that with developing organizational schemes that coordinate the provision, maintenance and use of the intervention. Our objective is to address the intricacies present in Accra by incorporating trust, impermanence, adaptability and security into the approach and creating prototypes that can be duplicated and scaled beyond the boundaries of problem solving frameworks.
The evolution of Makola Market through collages
Analysis of current market density

Sections showing existing conditions and appropriation of spaces
Taxonomy of strategies to bring infrastructure to the Makola Market
Where to find materials to make your own cart?
Process of making our own cart
If we can make it with waste materials we find around Columbia University, they can make it with materials they find around Accra!

cart made of

98% recycled/diverted from landfill material
70% desassembleable

Photos of catalogue that shows a taxonomy of objects and spaces that are being appropriated by the locals

Final review held outside on Columbia Campus

Fully functional cart retracted
Daylight though a day | June 21st

Noon Prayer | High Sun
Physical Model | Noon Prayer

Physical Model | End of Day Prayer
The UpGrid brings an innovative approach to manufacturing and construction of a mass timber system that not only offers flexibility and scalability, but aims to upscale construction materials and reduce demolition waste.

The UpGrid seeks to design affordable housing that relies on a prefabricated 2D and 3D systems that can easily be assembled, disassembled, and reassembled. The main assemblies are made out of mass timber in order to reduce the system’s embodied carbon. Closely working with developers, manufacturers and designers allow for a fully predicted kit of parts which can be assembled on site and deassembled at the end of the building’s lifecycle. The UpGrid is sensitive to context height, neighborhood necessities and green space accessibility. Located in one of the financially vulnerable areas of the Bronx, this project offers a variety of studios, one, two and three bedroom apartments to accommodate all family sizes and intergenerational cohabitation. It seeks to introduce means which could enhance the wellness and health of its inhabitants by providing community spaces throughout the ground floor and rooftop of the two main buildings. The green spaces feed into these programmatic ideas accessible to the whole neighborhood while the green terrace offers inhabitants a more private experience within the community which is also driven by wellness.

Not only does this project seeks to expand on the notions of design for flexibility and deconstruction, it pushes the boundaries of what co-living and design for social empowerment means.
Circulation
Option 01 | The knuckle
Option 02 | The back to back
Option 03 | The egg yolk

Wet cores
Living areas

Zones layout on grid
Site plan

Zones layout on grid

Circulation
Wet cores
Living areas

Business plan | design for disassembly and reuse
Components

- Slabs
- Envelope
- Interior partitions
- 3D modules

Units floor plans & components

- 1 bedroom apartment
- 2 bedrooms apartment
- 3 bedrooms duplex
- 2 bedrooms duplex
Construction process

Components details & assembly
Integration of mechanical system
South elevation

Sun exposure on south facade

Overall materiality and tectonic

Insulation continuity through balcony condition

Terracotta detail

West elevation
South west view

3D Printed model of preliminary massing
THE INTRODUCTION OF AIR CONDITIONING IN AMERICAN ARCHITECTURE

History & theory - Architecture+ Development

Reinhold Martin

Introduction

Today, air-conditioning accounts for five percent of the total electricity demand of the United States, and for twenty percent of the electricity demand of buildings around the world (based on the International Energy Agency). These figures validate that air-conditioning systems can be seen as one of the most dangerous technologies of our time, having "one of the costliest effects of global warming". Yet, since their invention, heating, ventilation and cooling systems are among the more poorly understood innovations by architects. For the American architecture historian Joseph M. Siry, this issue can be connected to the lack of representation of air-conditioning systems in architectural records and in modernism historiography. For him, "modernist architectural culture has long stressed creative genius, when even the most celebrated architects increasingly worked in teams of architects, engineers, suppliers, contractors and clients." Through these collaborations, architects saw the potential for a new architecture style that represents a "more inclusive expression of modern functionality". Therefore, as the different case studies of this paper inferred, modernist buildings transformed from being breathing machines that used passive and natural ventilation strategies to independent machines that worked separately from the outside environment utilizing heavy machinery and electrification. In its technological evolution throughout the years, air-conditioning started with the desire to address what was perceived as general ignorance among architects about the scope and implications of the problems, where "energy costs, although always of concern, had been secondary to issues of productivity and comfort". For Salvatore Basile, he sees the technology as being "abused by many users", to the point where "some experts see air-conditioning as a grievous fault of an invention, one that should disappear from the world's day to day existence as a business aid, a therapy, and a plain necessity". For him, air-conditioning has "saved countless lives… while causing countless deaths". In the built environment, the introduction of air-conditioning since the end of the nineteenth century redefined the discipline of architecture, "its boundaries and its professional concerns". Referring to the man-made environment as "central to many fictional accounts of an advanced society that reached beyond its natural and primitive beginnings", Rosalyn Williams criticizes the intersections between technology and art, analyzes the then new collaborations between architects, engineers, equipment manufacturers and clients, and describes the integration/adaptation of mechanical heating, cooling and ventilation required all stakeholders from architects to engineers, equipment manufacturers and clients to thoroughly work together to fully integrate new technologies into building structures.

Figure 4 (left). Diagram showing the air system applied to the Grauman's Metropolitan Theater (image source: Siry, Joseph M. Air-Conditioning in Modern American Architecture: 1890–1940. The Architectural History Series. 2009. The Architecture of the Well-Tempered Environment)

In fact, "modernist architectural culture has long stressed creative genius, when even the most celebrated architects increasingly worked in teams of architects, engineers, suppliers, contractors and clients." Through these collaborations, architects saw the potential for a new architecture style that represents a "more inclusive expression of modern functionality". Therefore, as the different case studies of this paper inferred, modernist buildings transformed from being breathing machines that used passive and natural ventilation strategies to independent machines that worked separately from the outside environment utilizing heavy machinery and electrification. In its technological evolution throughout the years, air-conditioning started with the desire to run industrial factories year round, and developed into rectifying the environmental conditions that complex modernist architectural features generated.

To go back to the environmental impact issue described in the introduction of this paper, one can understand how the notions of energy intensity and global warming were not considered throughout the first half of the twentieth century, when air-conditioning was exponentially growing. In fact, up until the 1960s, the little energy demand that described the use of air-conditioning systems in buildings barely touched on its massive energy demand. In the conclusion of his book, Siry seems to agree with the "many articles [that] sought to address what was perceived as general ignorance among architects about the scope and implications of the problems", where "energy costs, although always of concern, had been secondary to issues of productivity and comfort". For Salvatore Basile, he sees the technology as being "abused by many users", to the point where "some experts see air-conditioning as a grievous fault of an invention, one that should disappear from the face of the Earth for the good of the planet". In Air conditioning is not the enemy, Gernot Wagner believes that "the solution must involve all of us, for that to happen we'll need appropriate policies at the city, state and federal levels: everything from building codes to energy efficiency appliance standards to caps or taxes on carbon pollution". The reality is that human kind has adopted air-conditioning systems to a level that is not retractable. The mass production of air-conditioners and their worldwide integration into buildings today is out of control and it would be unimaginable to stop this spread. Just as an example, fifty million air-conditioners are sold yearly in China since 2010; Mumbai's metropolitan's energy demand for cooling in 2009 was the equivalent of a quarter of the United States' total energy demand. Ski Dubai and the soon to be built winter Olympics resort in the middle of the Saudi desert are two examples that demonstrate how far humanity has gone when uncontrolably implementing cooling strategies in the architectural realm. It is certain that cooling systems are needed across the world for the survival of billions of people, the question remains - how can we limit its use to the bare necessities?
SOMEONE SAID PASSIVE HOUSE?
Analysis of materials extraction and processes
Tech & Visual Seminar | GSAPP | Tommy Sheperdottter

Vancouver, British Columbia, is aspiring to be the “greenest city in the world.” To do so, the City uses its extended building portfolio to change the construction market and lead by example. The analytical project was targeting a number of green building certifications: passive house, net-zero carbon in design as defined by the CaGAA, and LEED v4.1.2 Gold.

Project challenges:
Acting as a cooling center and a post-disaster building, the structural capacity and the mechanical systems thought of for this project were unique in complexity. Vancouver is exposed to important seismic activity, which led the project team to design very deep foundation footings (close to 1.5m deep) poured concrete foundation under the floor slabs and core engineered structural systems throughout the building. As for the mechanical system, the design team opted to go with an extensive geothermal system supplied by district heating plants and highly efficient VAV systems to achieve the stringent passive house requirements.

Project design:
The design of the project was primarily driven by its function as a firewall. With a turnout time of 55s for the firefighters to lay water, ready to use, the layout of the project needed to be compact and efficient. Another key aspect that affected the design was the construction of a temporary firewall on site while the entire core was de-mobilized and the new core built.

System analysis:
This study analyzes the environmental impact of some of the materials used in the construction of the firewall. It covers the building’s envelope assemblies, its floor and roof, its structure, and its photovoltaic system. The mechanical systems, electrical systems (other than HVAC), and finishes were not assessed for in this analysis. This analysis is based on the manufacturer’s list received in sleep drawings during the building construction.

Results:
The first section looks at the location of extraction and manufacturing of each building material. For some materials, like wood insulation, Environmental Product Declaration forms availability for the place of extraction of the raw materials, but most manufacturers still lack transparency when it comes to material sourcing.

Along with the location map are a grid cleanliness analysis and a list of processes that support how the environmental footprint of a material can greatly depend on the local grid of its production facility. Most of the lower information was extracted from governmental websites and Asymetrix.

The second section analyses the quantity of each material in the building. This portion shows the production of these materials and the cost of extraction. The data is current, mainly due to the very thick foundation needed in this post-disaster project.

The embodied carbon calculation was primarily done through Athena with some data extrapolated from Arup Greenlab. The carbon equivalence calculations were done using the United States Environmental Protection Agency’s online Greenhouse Gas Equivalents calculator.

Conclusion:
One can question the need to have a Passive House considering how clean the BC grid is. The amount of insulation added to the walls and the floors greatly impacted the final embodied carbon calculation.

The amount of concrete used in this project is undoubtedly excessive. More environmentally-friendly alternatives to concrete should be thought of for structurally challenging buildings like this firewall.

The PV system has a higher embodied carbon than the foundation of the building. However, “clean” is the electricity generated by this array! Considering the cleanliness of the BC grid and its overall reliability, it is essential to reconsider the need to have extensive solar arrays on buildings like this one.

% of clean grid
THE XR SCHOOL
Fall 2021, GSAPP at Columbia University

Looking at the important role the old PS64 played in the lower east side of Manhattan, this rehabilitation of PS64 looked at, first and foremost, giving the building back to its community. Between the 1960s and the 1980s, PS64 was an escape from reality to the lower east side community. It was used as a playground, as an artist's studio, and as an exhibition space. It was heavily used by the local minorities to come together, feel safe and empowered. In the early 1990s, the school was locked by the local government and is since falling into ruins.

That’s why, the XR Centre provides more than a school. This project looks at what the future of public school can hold. What if schools were more than just educational for kids? What if schools were community centers that bring different generations together? While grandparents are reading at the library, parents can go to the gym and kids to class. In the evening, they can all enjoy concerts together and play in the rooftop playground. To get to this level of comfort and enjoyment, the design development of this project relied heavily on a set of guidelines that respond to notions of personal development, empowerment, safety, accessibility, community resilience, energy efficiency and low embodied carbon, indoor air quality etc. The program throughout the building is fluid which allows it to remain vibrant past school hours.

What if schools were much more than just classrooms? How can we design buildings that serve more than one purpose? How can we start thinking about multigenerational buildings?

Program analysis - proximities and adjacencies

Environmental qualities

Lobby & social spaces

Plants & areas

Classrooms & labs

Library

Amphitheater

Gymnasium

Art spaces

Community kitchen

Multipurpose rooms

Admin

Gallery

Necessary
Desirable
Non-essential
Social Impact

Environmental Sustainability

Offer space for meaningful and chance experiences
Provide a diversity of programs
Offer visual connections between different indoor spaces
Provide an inviting and welcoming environment for everyone
Support people in expressing themselves
Encourage Lingering
Meaningful participation
Provide a diversity in uses and ways to be
Provide opportunities to take ownership
Perceived and actual safety for all
Visibility and shared monitoring
Minimize barriers for a more accessible and inclusive space
Easy to navigate with effective signage, color codes, and visual permeability
Integrate the building with the local context (program, access etc)
Adapt to local needs
Foster stewardship and sense of purpose
Offer a vibrant place for all to enjoy
Promote active living to access the building and move throughout the building
Connection to nature and natural light
Foster dense social networks
Engages our senses
Provide catered spaces for different moods and tempers
Provide a playful design for both children and adults
Catalyze social mixing
Provide spaces for creation and collaboration

Low Carbon Building (Operational)

Low Embodied Carbon

Water Efficiency

Low Environmental Quality

Indoor Air Quality

Indoor Embodied Carbon

Indoor Environmental Quality

Efficient Energy Use

Low Energy Consumption

Optimized operation

Optimized window to wall ratio

Use of passive heating/cooling strategies

Use of renewable energy

Use of low embodied carbon

Use of low toxicity materials

Optimized envelope performance

Optimized mechanical system

Optimized water efficiency

Optimized indoor air quality

Optimized system performance

Optimized wet spaces layout

Rainwater collection and reuse

Reuse of gray water

Reuse of existing structure

Use of recycled materials

Use of low embodied carbon materials for additional structure

Use of natural ventilation when possible

Controlled glare

Opportunities to control light, temperature, and air movement

Design guidelines that guided the development of the XR School
Iteration 01 | Make it a community center first!

Iteration 02 | Make it a school first!

Iteration 03 | The Vis-a-vis

Iteration 04 | Let’s all be together!

Iteration 01 | straight ramp | outcome: too steep

Iteration 02 | angled floor slabs | outcome: carbon intensive

Iteration 03 | raise one wing of the H building | outcome: structurally complex

Iteration 04 | undulating ramps for greater length and less steepness

Iterative process for program layout

Iterative process for accessible circulation
Floor plan level 2

Accessibility & inclusivity strategies

- Universal bathrooms
- Adjustable furniture
- Sliding doors for accessibility
- Wide ramps
- Round corners for visually impaired people
Floor plan level 4

Low embodied carbon strategy | Reuse of existing structure

- Added structure
- Existing structure
- On-site reused structure
Section through the west wing showing the diversity of programs and uses
Detailed environmental sustainability diagram
THE WEB
Spring 2022, GSAPP at Columbia University

Location: New York, NY
Tutor: Laurie Hawkinson
Galia Salomonoff

Collaborators:

Contribution: Teachers’ Assistant

Designed and constructed by students in the Spring 2022 seminar “The Outside Project”, WEB is a temporary pavilion consisting of an inflatable structure and a collection of custom furniture installed at Columbia University’s Avery Plaza. Anchored using a network of ropes and carabiners attached to adjacent buildings and weighted ballasts in each of its seven feet, WEB sustains its voluptuous form with the help of four blowers, constantly blowing air throughout the structure. The formal configuration elucidates a strong contrast between the campus’s existing fabric and its new inflatable counterpart. WEB is an immersive installation that invites its participants to be introspective about architectural possibilities.
Deformation of the inflatable with 60km/h winds
Designed and constructed by students in the Spring 2021 seminar “The Outside Project”, SPOT celebrates the safe reunion of students and faculty on campus opening on April 29, 2021 for the Columbia GSAPP Commencement Ceremony. There were two principal components to completing SPOT: the inflatable canopy and hybrid digital/in-person programming.

In the sky, anchored by four steel beams in Avery and Fayerweather Halls and four anchor points, a 600 pound inflatable canopy fabricated by areacubica hovers above Avery Plaza. During construction, students installed LED lights within the inflatable to establish an omnipresent glow below the canopy at night. LEDs are powered via solar panels located at the base of the pavilion.

**Location**
New York, NY

**Tutor**
Laurie Hawkinson
Galia Solonominoff

**Collaborators**
Eleanor Girle, Jiyong Chun, Marie Christine Dimitri, Anays Gonzalez Sanchez, Lin Hou, Nanja Jiang, Blake Kern, Cecile Kim, Kim Langat, Kassandra Lee, Xinyi Qu, Vera Montare Savory, Tristan Schendel, Lauren Scott, Kaeli Alika Streeter, Taylor Urbshott, Xindi Wang, Eunjin Yoo, and Elie Zeinoun

**Contribution**
Design development and construction

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**Building technology**
**Empowerment**
**Enjoyment**
**Social & cultural life**
LIFE CYCLE ANALYSIS OF ECOLODGE
an undergrad “net-zero” project
Tech Seminar | GSAPP | David Benjamin

How can a retaining wall contribute to 27% embodied carbon footprint? A design decision as simple as adding a retaining wall in one of my green projects of undergrad cost much more than I had ever imagined...

Carbon emissions per building component [kgCO2e]
My work over the past three years has focused on **gaining a deeper understanding about the environmental and social footprint of architecture**. Through their creativity, architects have the agency to design places that have lasting impact on people and the planet. Unfortunately, it is common in our profession to **overlook the unintended negative consequences** of our designs. It is essential, going forward, to consider the **embodied labor, energy, carbon, and justice of architecture**. Seeing how our industry is a major contributor to the current climate crisis, providing **alternatives to nondescript globalized architecture** and brute force engineering is crucial. It requires a new understanding of the constituents of sustainable environment and the ways in which architecture can contribute to its support. I believe that it is the responsibility of architects to educate themselves on the **quantitative and qualitative data** surrounding the environmental and social impacts of architecture and to use this knowledge to build adaptable and resilient buildings that **respond to the needs, culture and climate of their surroundings and communities**.