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COLUMBIA UNIVERSITY GSAPP

M.S. ARCHITECTURE AND URBAN DESIGN

DESIGN PORTFOLIO

2014 - 2020

STATEMENT OF INTENT

Kevin Lynch once said, "You cannot design a city and you shouldn't design one, even you can design a house. City is a giant natural phenomenon, which is beyond our capacity of designing and our knowledge of how to change it." I understand his point that it seemed so tough to design a city owing to its complexity, but to some extent, I cannot totally agree with him. As far as I can see, in spite of the toughness, we shouldn't give up studying and discovering our cities, thus approaching the true essence of cities and urban design.What's more, just due to the complexity of a city and the great threat that a city may be confronted with when it loses control, we urban planners and designers should study and design a city--to have some degree of control on it and keep it on benign development rail. Nowadays, urban design has become a nice tool to improve spatial environment together with people's life quality and also an effective way to treat "city diseases" occurring in the process of rapid urbanization.

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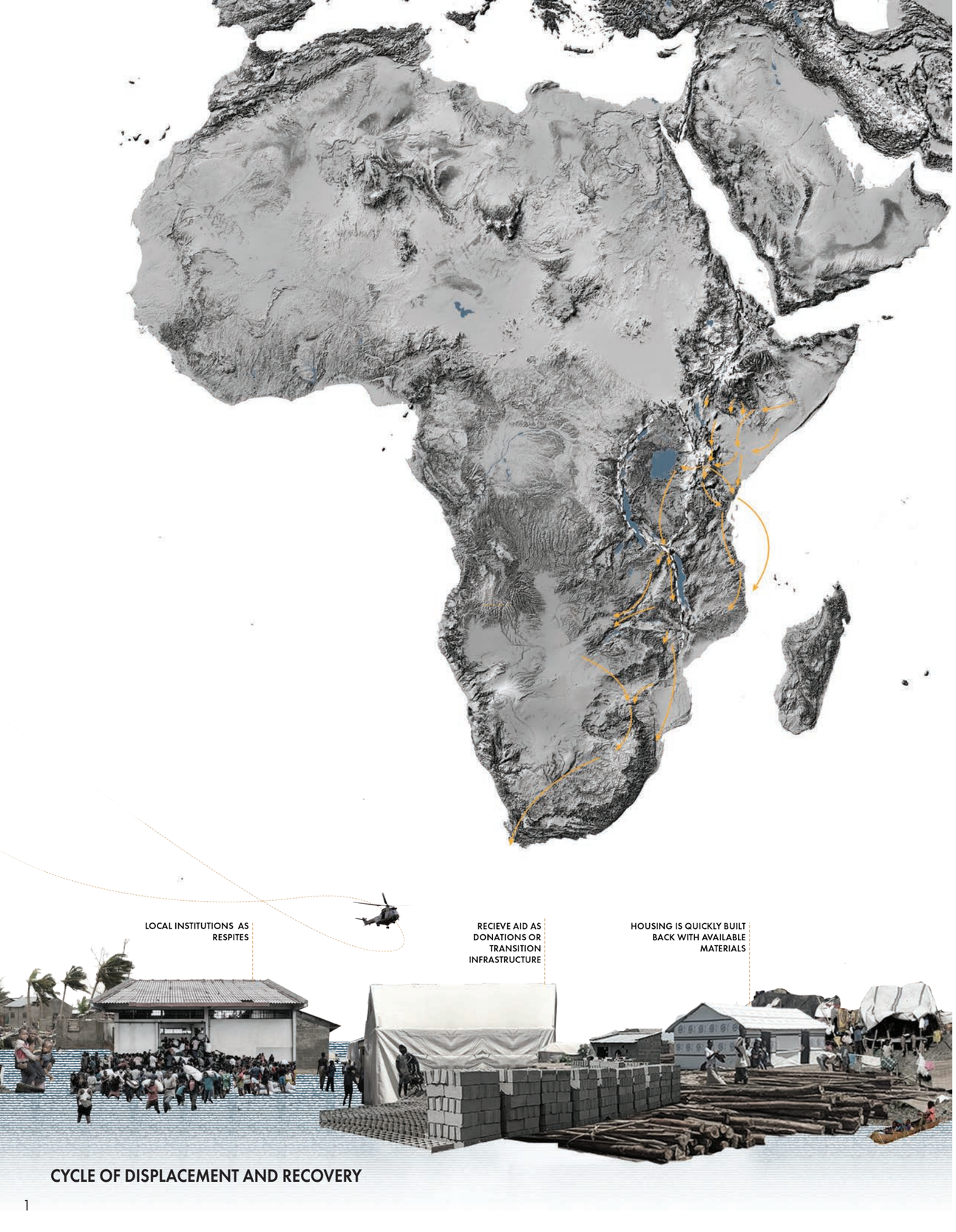


01 ALLIANCE FOR A CONSTRUCTIVE BEIRA

2020 SpringUrban Design Studio--Water Urbanism: Redesigning the Reconstruction Cycle of Beira

Instructor: Kate Orff

Site: Beira, Mozambique

Team: Wei Zhang, Yile Xu, Stuti Ganatra, Lino Caceres, Nina Lish
Role in Team: Site Survey and Analysis, Argument Development, Architectural Design, 3d Modelling, Technical Drawings and Architectural Representation

Post Cyclone Idai, limited resources and large scale damages have forced Beira citizens into a cycle of geographical and social displacement. These are snippets of the city through recent disaster recoveries. People flee to higher grounds and social infrastructures to find shelter in the emergency period and continue to seek refuge and supplies there through the recovery period. These places- schools, hospitals, and churches become locations to mobilize foreign aid through the recovery period and become reflective of the top down scheme of recovery that is a result of disaster capitalism.

Beira's urban trajectory has been determined by this vulnerability and is marked by large scale displacements due to natural disasters and political upheavals. These displacements have manifested as distinctions in materiality- The colonizers' cement city and the Mozambicans' cane city have collectively taken on a material language of emergency shelters as they recover from Cyclone Idai and Kenneth.

"Alliance for a Constructive Beira" is a framework that proposes to change the existing post-emergency reconstruction process into a more inclusive resilient one, anchoring our efforts on local social infrastructures and regional productive landscapes.

EXISTING AND PROPOSED MATERIAL SOURCING

Existing Material Sourcing
Proposed Material Sourcing
Local Institutions

CEMENT

CGI SHEETS

COCONUT

TIMBER

RICE

TIMBER

CEMENT

RICE

CEMENT BLOCKS

BAMBOO

MAIZE

COCONUT

SAND

EMERGENCY SHELTERS

RECONSTRUCTION OF SCHOOLS

RECONSTRUCTION OF HOUSES

Currently, while the emergency shelters brought in by foreign NGOs have stayed for over a year now, schools and homes are being rebuilt by materials that are destroying the local ecology without adding any real durability to the structures- timber is brought from woodlands at the outskirts and sand from the beach is traded illegally to make cement blocks. Some other materials like CGI sheets are brought in from South Africa and China. The proposed Beira's Vision 2035 would increase the demand for materials, putting under stress or completely replacing existing productive landscapes with urban development.

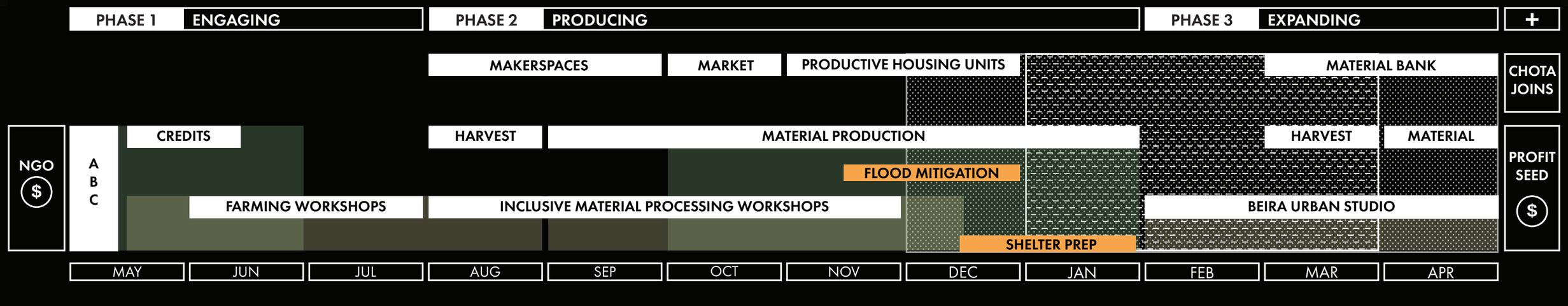
The design proposed to bring a shift to this reconstruction cycle by using agricultural residues for a new material system. This system operates at three scales- at the regional scale, city scale and neighborhood scale. The cultivation of crops like rice, maize, coconut and bamboo that are already being cultivated are proposed to be scaled up. This system can be supported by the local institutions.

REGIONAL SCALE

CITY SCALE

NEIGHBORHOOD SCALE


CROPLAND
MATERIAL BANK & MARKET
PRODUCTIVE HOUSING UNITS
MACURUNGO ELEMENTARY SCHOOL
sand soil
clay soil


PHASE 1 ENGAGING
PHASE 2 PRODUCING
PHASE 3 EXPANDING
+
MAKERSPACES
MARKET
PRODUCTIVE HOUSING UNITS
MATERIAL BANK
CHOTA JOINS
NGO $
A
B
C
CREDITS
HARVEST
MATERIAL PRODUCTION
HARVEST
MATERIAL
FLOOD MITIGATION
PROFIT SEED $
FARMING WORKSHOPS
INCLUSIVE MATERIAL PROCESSING WORKSHOPS
BEIRA URBAN STUDIO
SHELTER PREP
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR

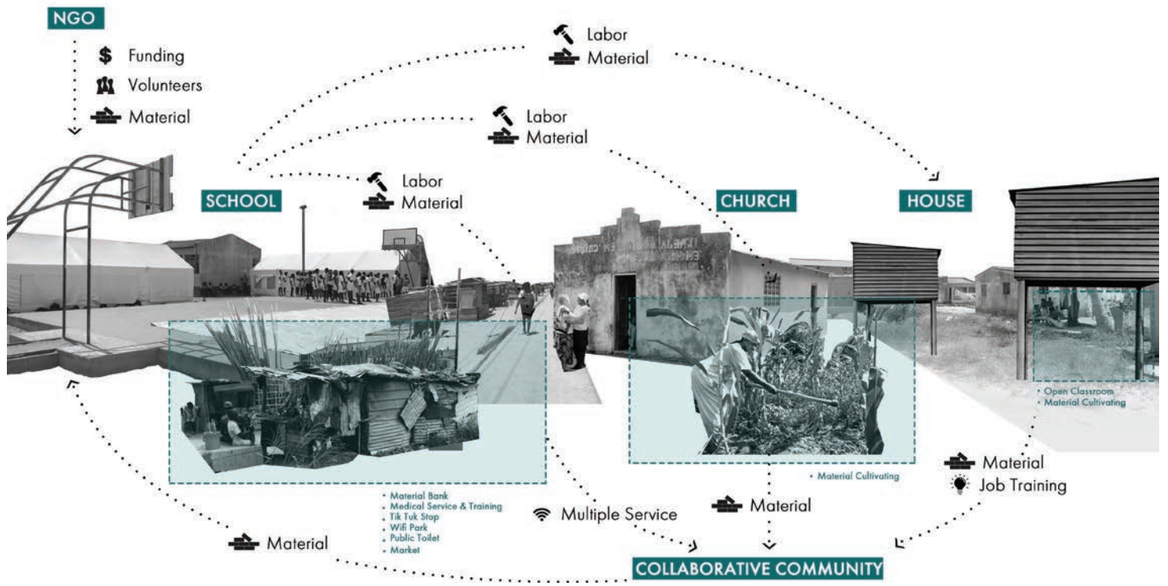
A nested implementation which recommends that multi-scalar actors redirect NGO funding and international aid for Mozambique's National Disaster Risk Reduction in partnership with Beira's Office of Reconstruction is proposed. Neighborhood Districts will organize co-ops and community members with the local institutions through Aliança para uma Beira Construtiva or ABC. This system will diversify the existing agricultural market, promoting local economies, and new job training opportunities. The open classrooms constructed by the NGOs and the community identifies new cropland and seeds the city and hinterlands. The harvested food is sold and the agricultural residues are used for building materials which increases their value. At the material bank, coconut shells and rice husk are used for aggregate in bricks, and bamboo can be used for roofing. Maize can be compressed and used as a board for furnishings.The materials are stored with tools and seeds for sale. The community will then be able to reconstruct their houses with ABC building materials to work on self-built elevated housing.

Institutions like the Macurungo Elementary School are also the first to receive recovery funds. Recovery is imported in the form of temporary shelters, re-construction material kits and basic supplies. This does not allow true stability and sustainable community growth. The first phase begins now. In order to shift to a new cycle the first ABC is established at the school, an important hub for daily life and emergency response. They will receive direct funding from NGOs, distribute microcredits and begin farming workshops.

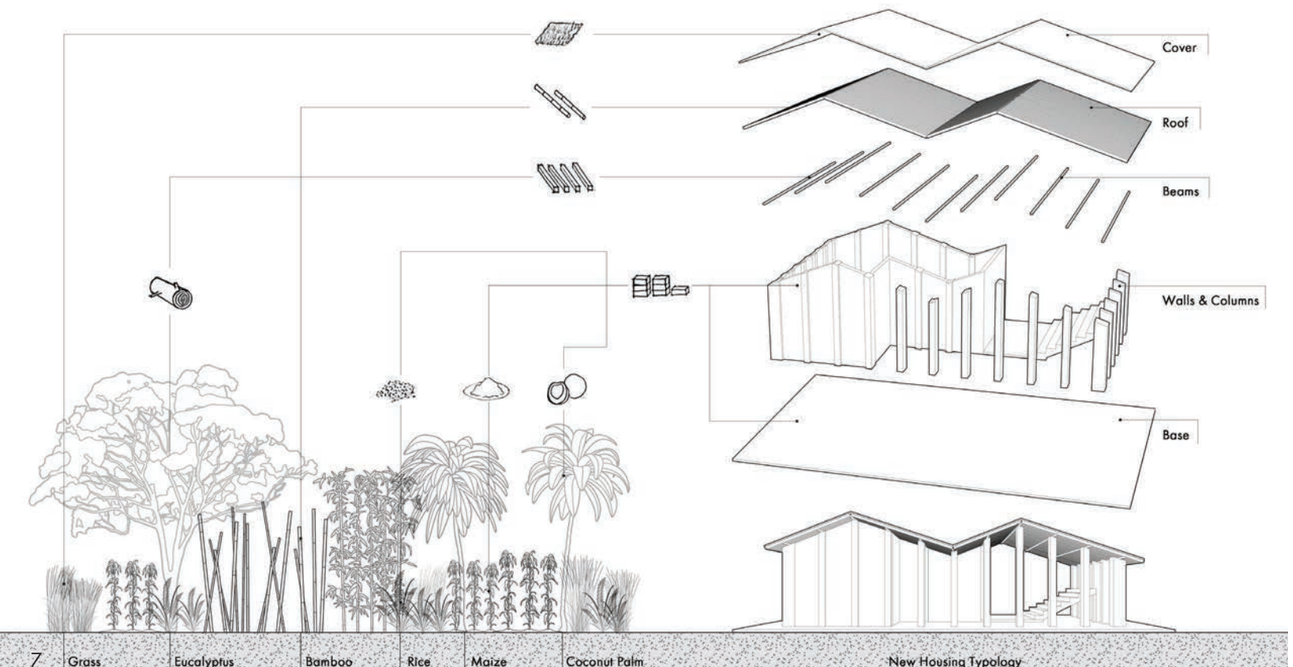
In May, GSAPP students will lead a community stakeholder meeting to establish the first ABC with UniZambeze and NGO partners. Roles for farming, tool sourcing, land scouting, and teaching are assigned and the members plan pilots in the community. Machamba Co-Ops start producing crops that qualify for the program.

The ABC runs educational farming workshops at the school in the evenings and on the weekends. Members distribute seeds and tools to community members from their library. New material methods, such as coconut shell drying are demonstrated in the courtyards of the school. Members can use credits to buy rain barrels or solar panels to bring to their homes.

PROPOSED MATERIAL FLOW



PROPOSED CONSTRUCTION TYPOLOGY



ABC HUB AT MACURUNGO ELEMENTARY SCHOOL

When reconstructing the school, the roofs are raised to improve the ventilation and brightness of the classrooms, which can also be taken off in advance when there is another cyclone. The newly built shaded infrastructures allow caregivers to safely gather. Women are key actors in the program, mom's being the most vulnerable and time constricted group, can learn material processing skills while waiting for their children at school.

After alliances are made, the new local material cycle allows us to tie surrounding structures and landscapes to the school. By multiplying the number of sites, different actors now have test sites to teach and experiment, with the aim of making the process more visible so it increases engagement. Landscape management takes protagonism in this stage, because we are talking about urban agriculture, that has to increase the districts resilience and recover degraded ecosystems.

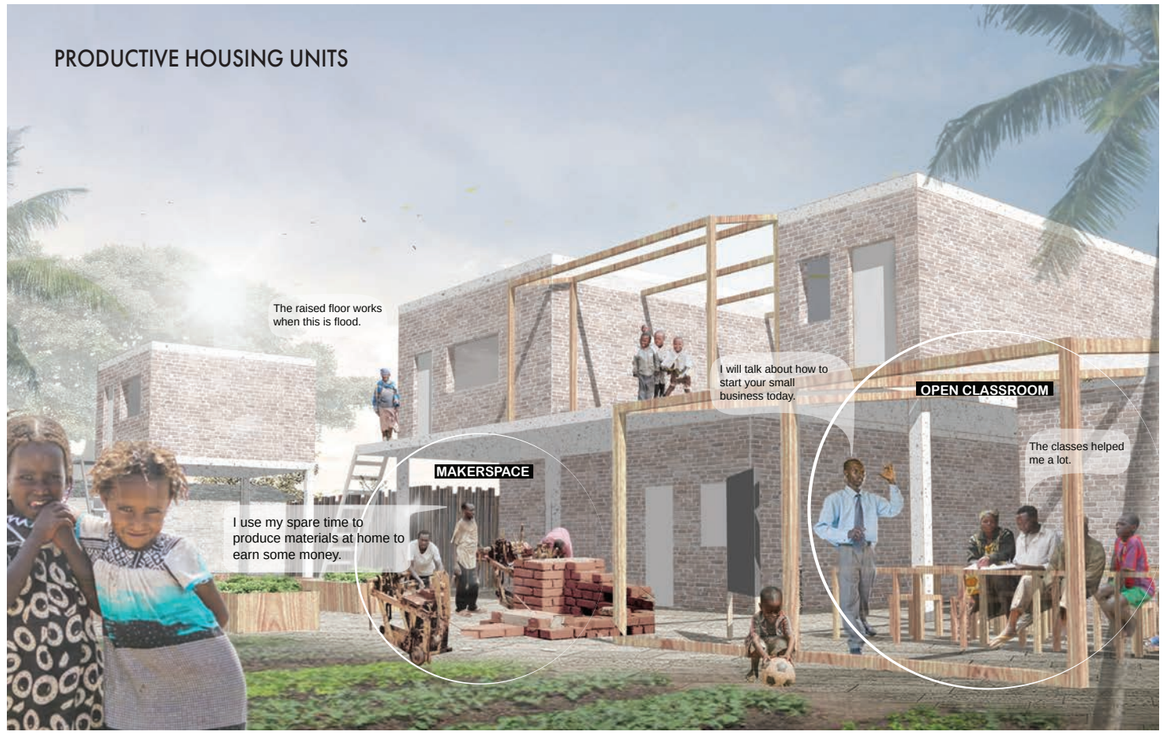
In the phase 2, machamba co-ops have started producing qualifying crops. Some small infrastructures can be converted or add other functions, such as classrooms, material processing studios and storage units. Experienced farmers can share tips on how to increase productivity and making materials by themselves. After the harvest time, locals can gather their crops and materials and go to the workshops for processing.

In the past, roofs have been ripped off and destroyed entire buildings. With this design, the roofs can be taken down from the open classrooms in the lowlands and relocate them to high ground areas for increasing sheltering capacity.

Phase 3 is expanding. The ABC collaborates with UniZambeze's Urban Studio to design and build material bank and material transformation workshops by graduates. After the second harvest season, locals bring wood, bamboo, etc. to the material bank and workshops for processing, storage and selling. These materials can be widely used in community reconstruction.

More productive housing units are developed by community members and urban studio students with raised floors that allow them to easily access the spaces such as open classrooms, makerspaces, or space for other sources of income.

In makerspaces, raw materials are processed by community members with the help of recent graduates from local high schools, under the guidance of Unizambeze Faculty, and food processing engineers, for both material production and to be sold directly to the market, diversifying the stream of revenue.



Responding to the surplus of materials produced locally, a material bank project is also carried out by the Unizambeze urban studio students. The material bank works as a unit to aggregate and store materials to be readily deployed in case of emergencies, and also as a market space for local people to sell, purchase or borrow the local-made materials.

JEN: RESIDENT OF NEWBURGH

It is hard to get access to fresh produce nearby and I have to take my car and go directly to the farm. That is time consuming and expensive

ALLEN: RESIDENT OF NEWBURGH

It has got to do with awareness. If people are aware that they can eat affordabale healthy food and also contribute to the local economy, that is when we start to create a sustainable environment.

MARIA: HIGHSCHOOL STUDENT IN NEWBURGH

We get pizzas for breakfast! We can be given more variety and healthy choices.

VIRGINIA: PROGRAM DIRECTOR AT NEWBURGH URBAN FARM AND FOOD INITIATIVE

30% of the population of Newburgh is in poverty with 45% of them being children. These are the folks who need the healthiest food so that they can continue to grow and do well in school.

LIANA: PROGRAM DIRECTOR AT NEWBURGH URBAN FARM AND FOOD INITIATIVE

Schools are opportunity spaces that can have direct relationships with the farms which can create variable pricing in the produce.

DAVE: RESIDENT OF NEWBURGH

It is not easy to buy groceries since I have to travel far. I'd rather eat at a local fastfood joint.

02 WHAT'S ON YOUR PLATE ?
FOOD AS KNOWLEDGE

2019 Fall Urban Design Studio--Corresponding to the Green New Deal: Redesigning the Food System in Hudson Valley

Instructor: Kaja Kühl

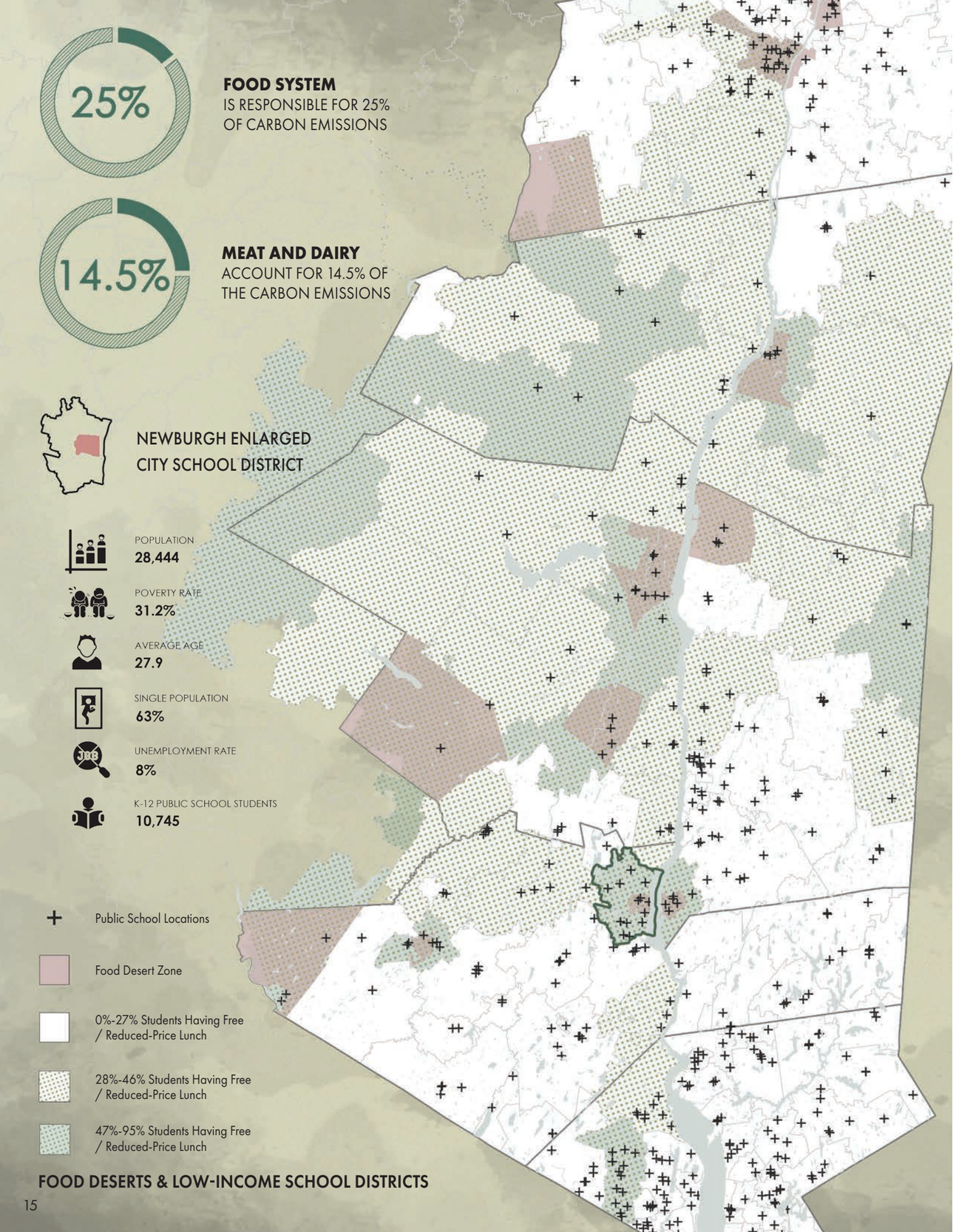
Site: Newburgh, Orange County, Hudson Valley

Team: Wei Zhang, Annie Wu, Moneerah Alajaji, Vansanth Mayilvahanan
Role in Team: Site Analysis, Argument Development, Technical Drawings and Architectural Representation

The food system is responsible for over one quarter of global carbon emissions. Lack of access to quality food creates food insecurity leading to a higher meat consumption over the Hudson Valley. Our primary focus area is the Orange County, which is one of the highest consumers of meat.

Despite having many farms, fresh produce in these counties are not widely available due to their high production costs and logistics. Lack of nutritious food, easy access to fast food joints and cheap prices of meat, create an unsustainable food cycle. These issues magnify significantly in areas like Newburgh, which has a diverse young population with school children making up for a third of the population.

Therefore, there is a need to restructure the food system to reduce significant carbon emissions by providing access to quality food, changing the current meaty diet and creating awareness by educating the children for the future.



FOOD DESERTS & LOW-INCOME SCHOOL DISTRICTS

One of the primary goals of the green new deal is to reduce carbon emissions. To begin with, the food system is responsible for over 25% of the global carbon emissions out which meat and dairy contribute to around 15%.

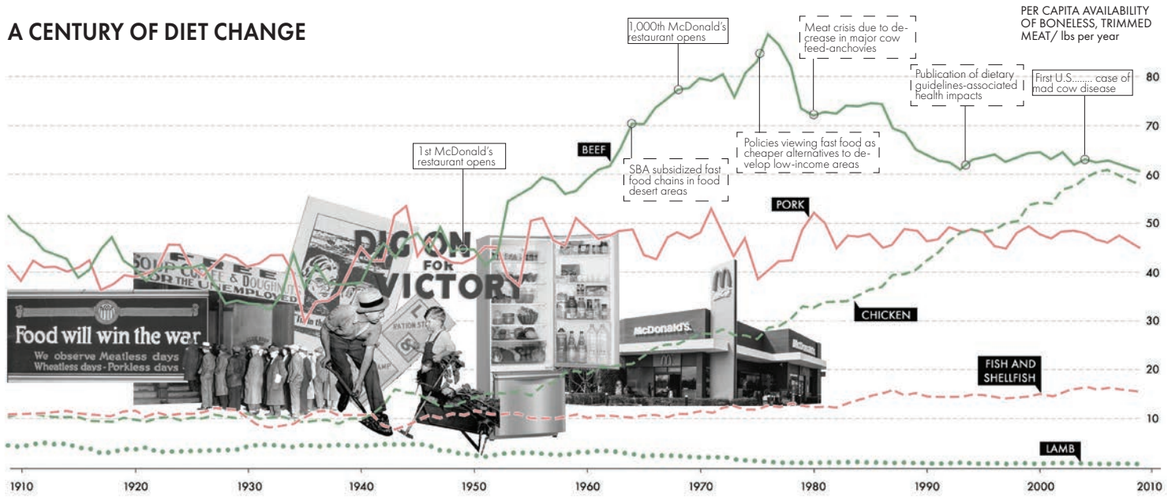
Food accessibility and logistics play important roles in the consumption of food and the carbon emissions related to food consumption. In our area of focus, the Hudson valley, there is a huge issue of food insecurity. As you can see, all the dark areas represent food deserts, which are areas with low accessibility to fresh food. Coincidentally, these food deserts are also located in the school districts with the lowest average household income in the valley. So there is a need to restructure the food system to reduce carbon emissions by providing access to quality food. And through our design we are providing the opportunity for people to transform their current diet and eating culture into a healthier and a more environmentally-friendly one.

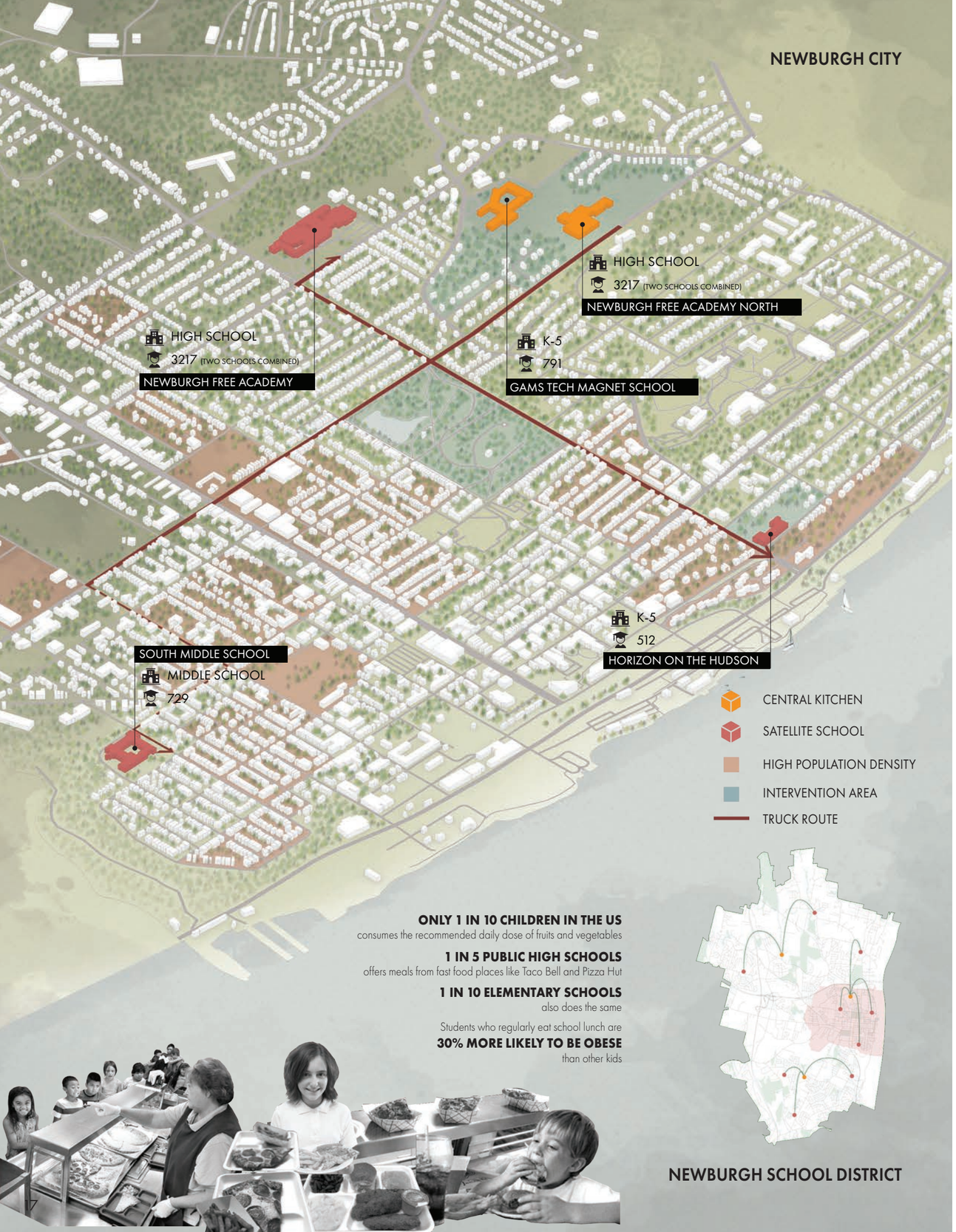
Our area of focus is the Newburgh School District -- one of the overlapping areas of food deserts and low income school districts. It has one of the highest poverty rates in the valley with a median age of 28 which is much lower than the valley's average. Further there is a huge single population living with an unemployment rate of 8% and a large population of public school students suffering from food insecurity.

Just to test the possibility of transforming people's eating culture, we studied the food trend over the years in the U.S. and understood that there is a possibility to guide people's diet. For instance, food stamps and victory gardens were used as policies to control people's meat consumption during the world war. However, right after the world war, the Small Business Act subsidized fast food chains in food desert areas as they saw that as an opportunity to improve the economic conditions of those areas. Owing to this there was an increase in meat consumption in the 70s. But after the 70s dietary guidelines were used to encourage people to consume more fruit and vegetables instead of meat. The meat consumption now is at a constant but more impactful on the climate.

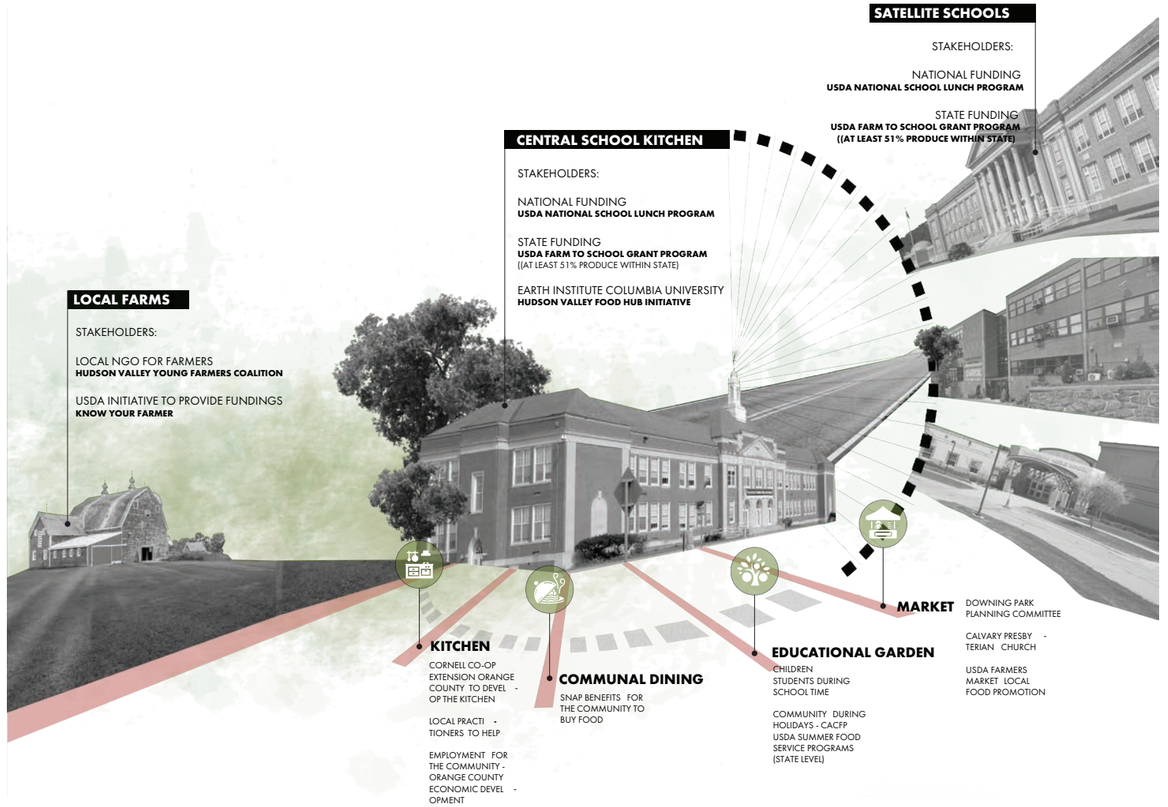
We realized that schools could be used as opportunities to bring a change since only 1 in 10 US children consume the recommended dose of vegetables and fruits and students who have school lunches are 30% more likely to be obese. In the Newburgh School District, public schools provide students with USDA subsidized lunches which are low-quality fast food like pizza and chicken nuggets. The main issue is the huge lack of kitchen infrastructure to provide healthy fresh food to students. Finally, we view children as the future generation and the catalyst to educate the whole society about the concept of eating healthier and environmentally-friendly.

A CENTURY OF DIET CHANGE





SYSTEM RECONSTRUCTION



The Newburgh Enlarged School District has 13 public schools. Our larger intervention is to create connections among these schools with a hierarchy of different functions. There are three central kitchens attached to schools to prepare and serve food to the students in these other satellite schools and the community around each school.

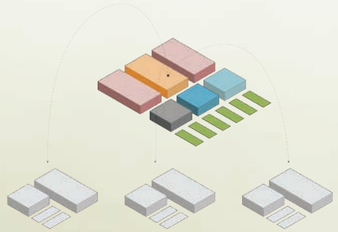
Within the city of Newburgh there are 5 public schools. Newburgh Free Academy (NFA) is designated as the central kitchen because of its proximity to the 9w route and the current urban farm program in Downing Park, and the availability of space around it for a larger kitchen infrastructure. The rest of the schools in the city are all satellite schools among which Horizon on the Hudson Magnet School (HOH) is located in a densely populated area so it forms an ideal location to not only serve students but also the surrounding community.

The issue of food accessibility is attributed to the expensive local farm produce. Our idea is to connect local farms directly to schools as central kitchens. That way, the schools would be an anchor buyer and the farmers don't need to worry about selling their produce. Since the schools need a large amount of produce and no single farm can produce so much, we could connect a number of local farms to the central kitchens making them also function as aggregation centers. Moreover, the schools would also host a number of programs ranging from a shared use kitchen, community dining, learning gardens and a market space. As much as it is about providing healthy food, our goal is also to create awareness among the community and educate them about healthy food consumption.

Now coming to our design proposal, Our first intervention is transforming the space in between NFA and the Gamstech Magnet School as the central kitchen. The site is located in a contour area with the NFA at the top and the Gamstech at the bottom.

CENTRAL KITCHEN

NEWBURGH FREE ACADEMY & GAMS TECH MAGNET SCHOOL



DINING SPACE
CENTRAL KITCHEN
LEARNING GARDEN
WET STORAGE
DRY STORAGE
PACKAGING SPACE

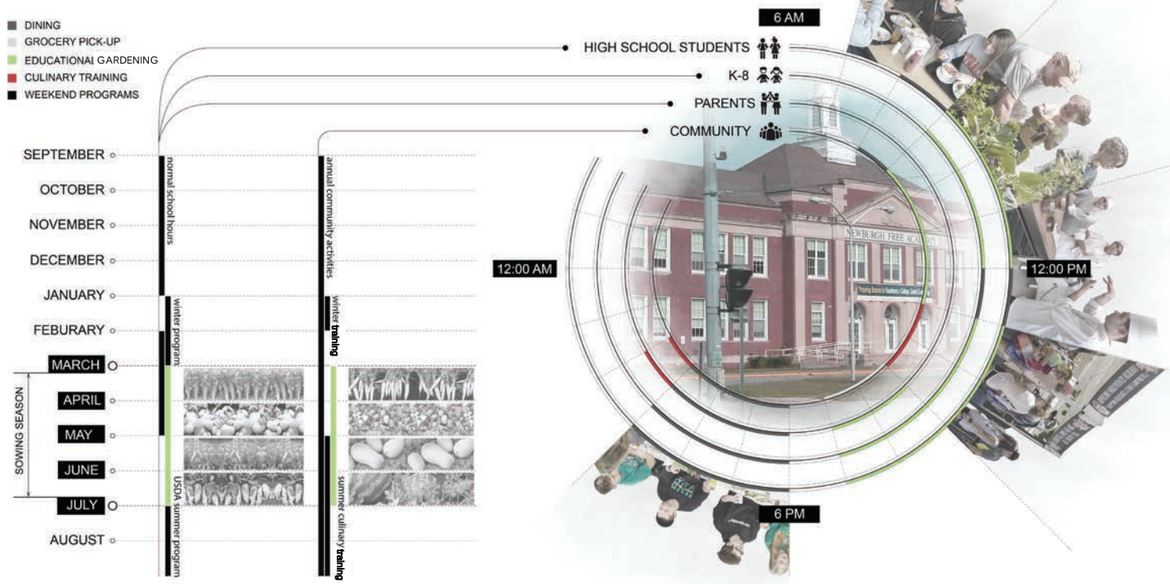
HEALTH LIBRARY
MARKET/GARDEN
WELCOME CENTER
MULTI-FUNCTION DINING HALL
MULTI-FUNCTION DINING HALL
WALK-IN STORAGE
COMMUNITY DINING
K-5 DINING
CORRIDOR
LEARNING GARDEN
FOOD LAB
ENTRANCE
LEARNING GARDEN
COMMUNITY GARDEN
GROCERY MARKET
GREEN ROOF
GREEN ROOF
UNLOADING AREA
COMMUNITY GARDEN
COMMUNITY ENTRANCE
DRIVE-THROUGH GROCERY STORE
LEARNING GARDEN
COMMUNITY ENTRANCE

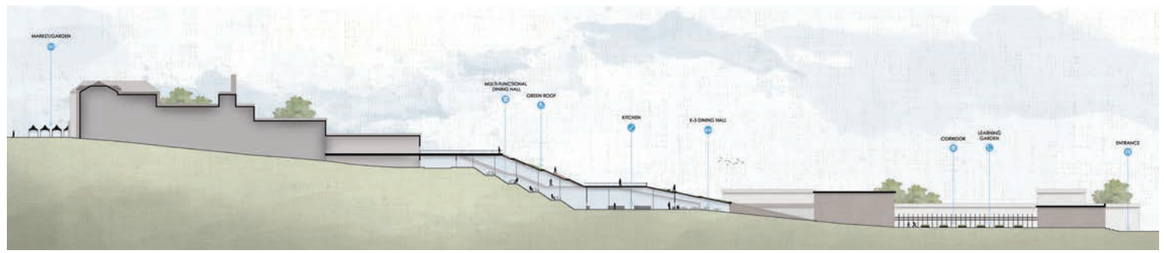
COMMUNITY CIRCULATION
STUDENT CIRCULATION
TRUCK CIRCULATION

We took advantage of the topography to design a structure connecting two schools. The main idea of the design is to create experiential space for users to be able to engage with the various food processes. So we located the kitchen centrally surrounded by the dining space. That way, the students and community are able to observe the cooking process in the kitchen while they are eating. There is a walk-through storage space on the way to the dining space. It is located together with the greenhouse inside and learning gardens outside to enhance the experience of students and the community. There is also a drive through market space where parents can buy food when they come to pick up and drop off their kids. We also designate a separate circulation space for the truck service to serve the kitchen without hindering the school activities. The following section shows the design intervention sandwiched between the two schools.

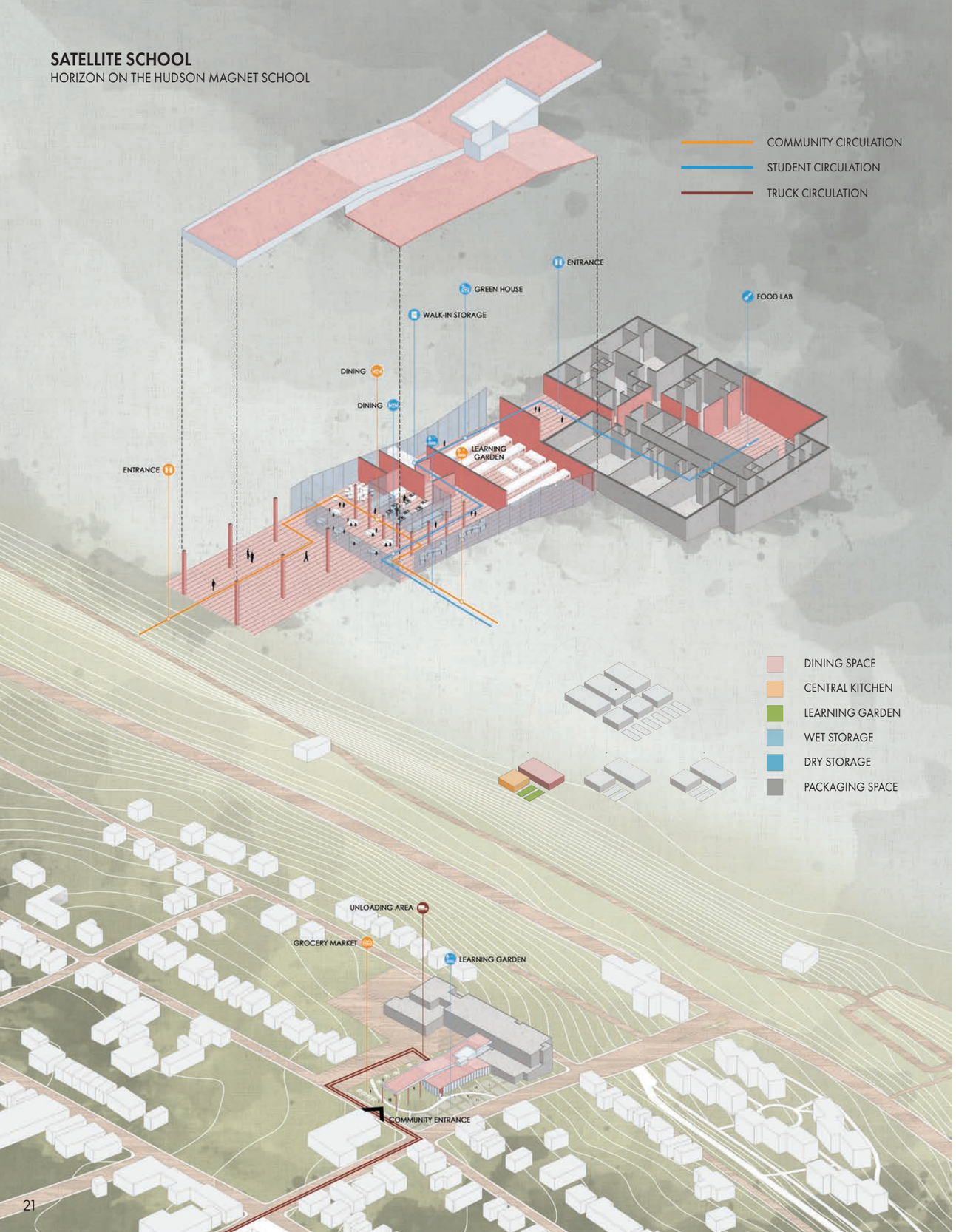
Since the schools don't function during the summer and winter breaks and also during the weekends and the post-school hours in the evening, we want to understand how the spaces function during different times of the day, week and year. For example, the dining space would be used by the students during the school hours, and during the after hours the community could use them for dining. Similarly the kitchen space could be used as a multi-function cooking space and also a teaching kitchen to enable the community to cook healthier. And during the summer and winter breaks, when the schools are closed, summer and winter food service programs can be conducted and volunteering garden activities can be carried out.

DAILY & SEASONAL PROGRAMS

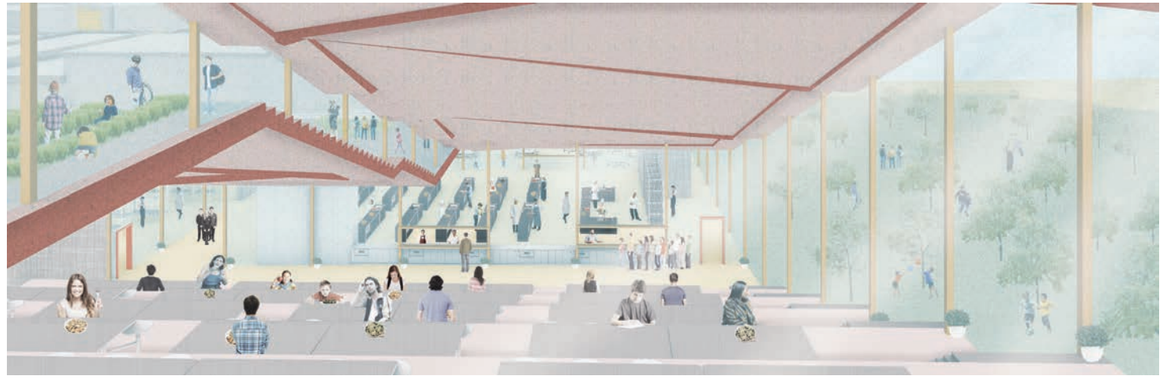




SATELLITE SCHOOL
HORIZON ON THE HUDSON MAGNET SCHOOL



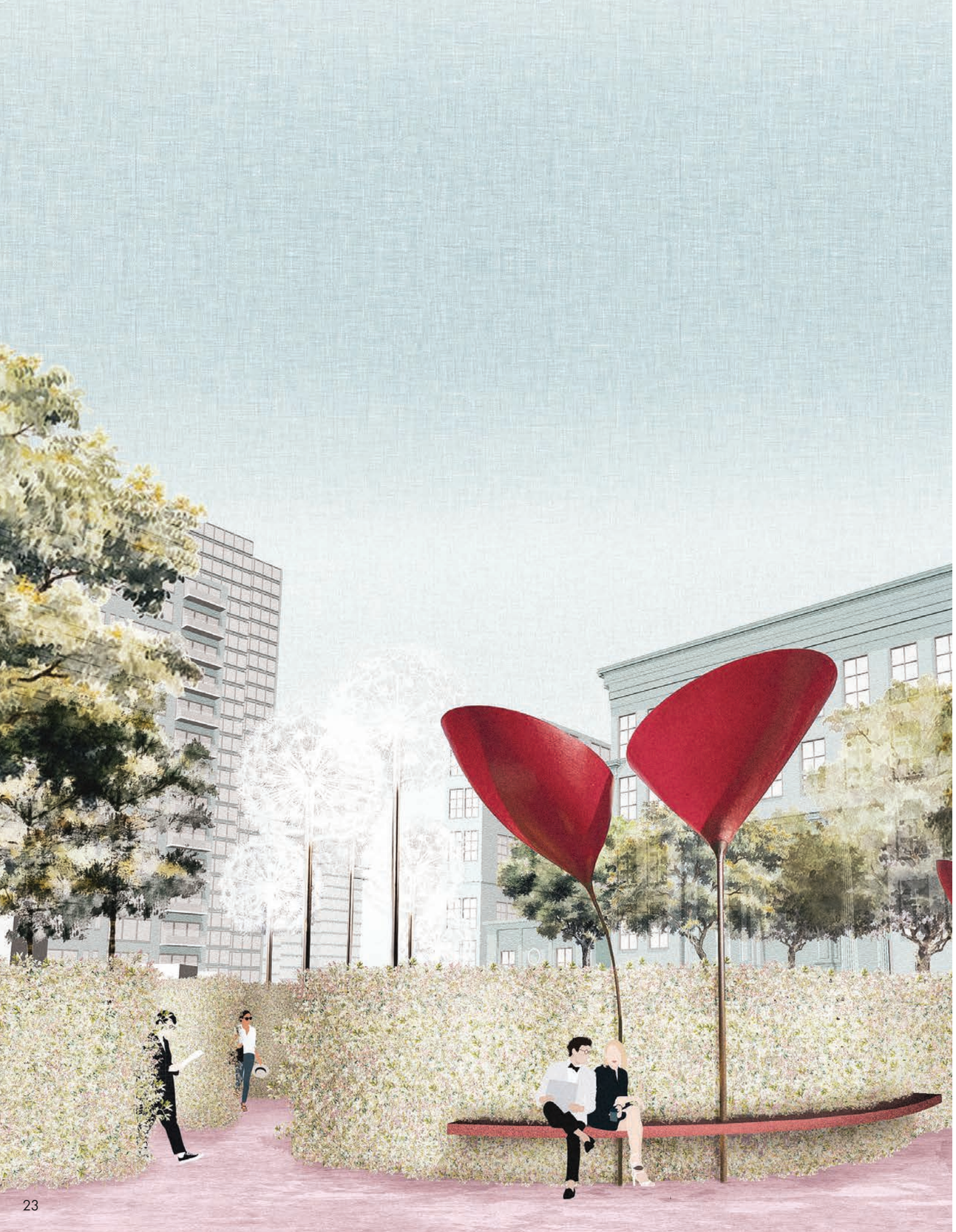
MULTI-FUNCTION DINING HALL



STUDENT DINING AT NOON

GROCERY MARKET

The HOH is a satellite school which receives freshly prepared food from the NFA. Such satellite schools are designed to have a smaller kitchen mainly for educational and training purposes together with multi-function dining space, learning gardens and market space similar to central kitchens.



03 LOVE ISLAND CITY

2019 Summer Urban Design Studio--
Redesigning the Public Space for Single Population

Instructor: Tricia Martin, Nans Voron

Site: Long Island City, New York, NY

Team: Wei Zhang, German Bahamon, Stuti Ganatra
Role in Team: Site Analysis, Argument Development,
Technical Drawings and Architectural Representation

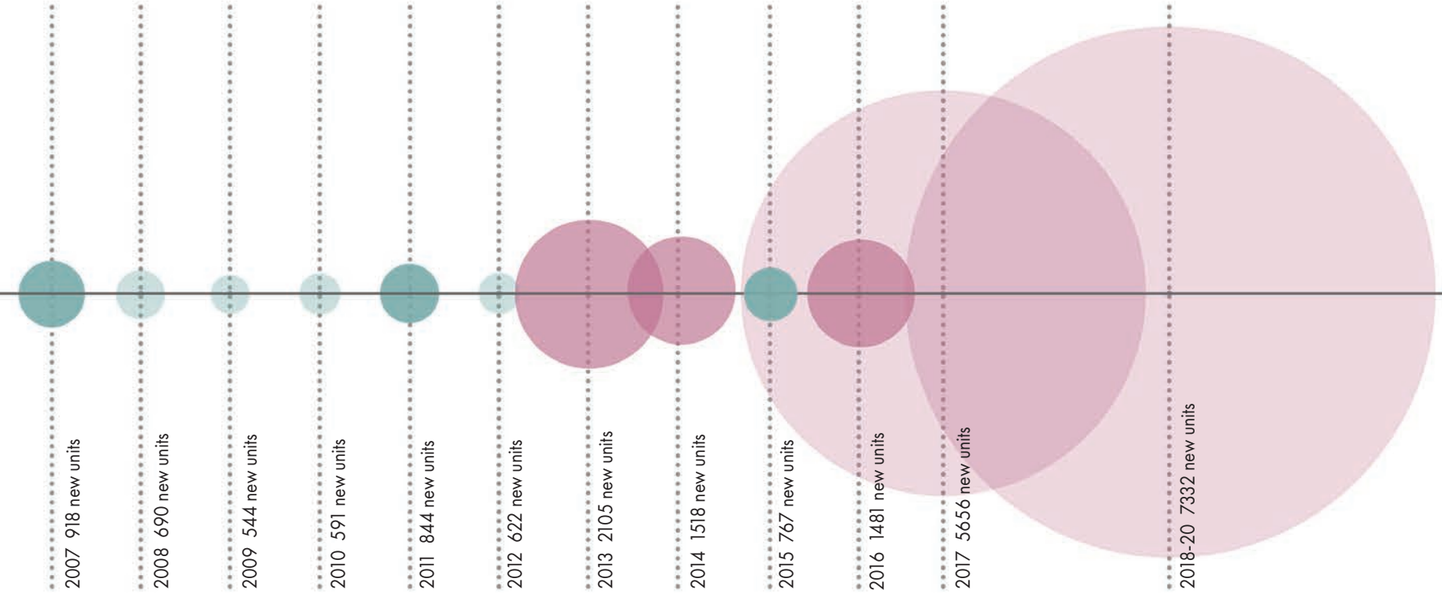
When we think about the way our cities grow, we think about real estate, about politics, about economic growth, but not necessarily about people - who they are and how they might interact not just with the built environment, but also how urban design drives interaction between people.

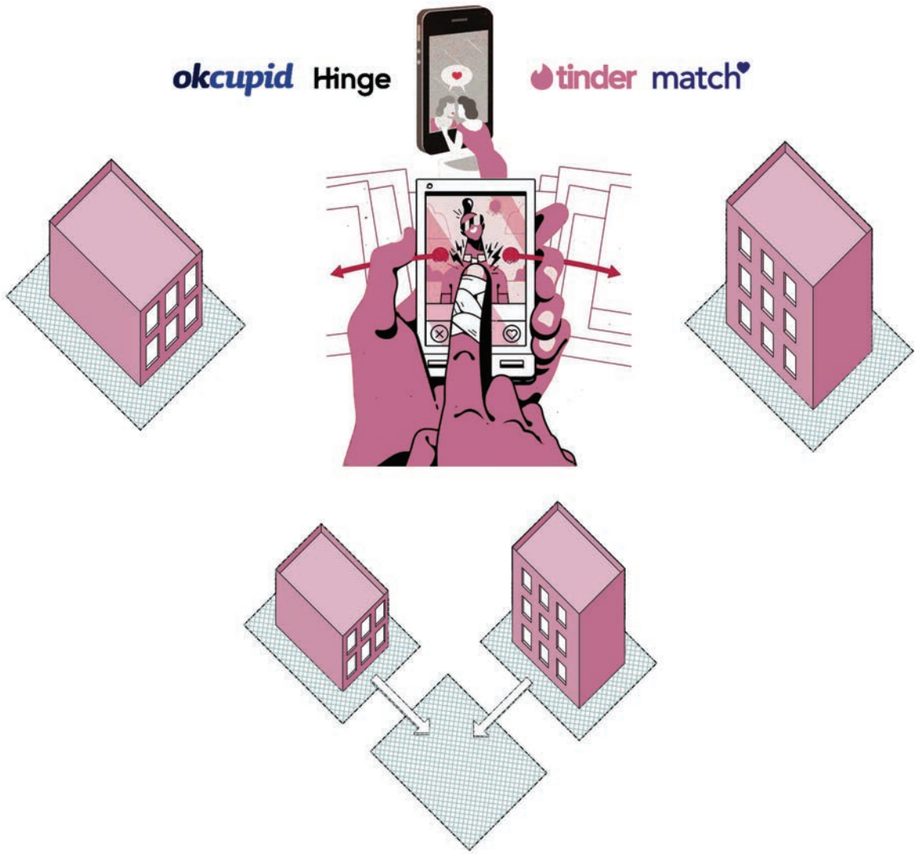
Love island city is a speculation on how public spaces can be improved in rapidly growing cities to cater to the predominant demographic of young, single millennials in Long Island City. Underused spaces around frequently visited places are identified for the interventions. Various levels of intimacies are achieved in these spaces by introducing a series of objects that trigger or reinforce social interactions. The result is a series of spots carved into existing fabric of the city holding opportunities for encounters and moments that one may experience with someone else in the hustle of everyday life.

DEVELOPMENT GROWTH IN LIC

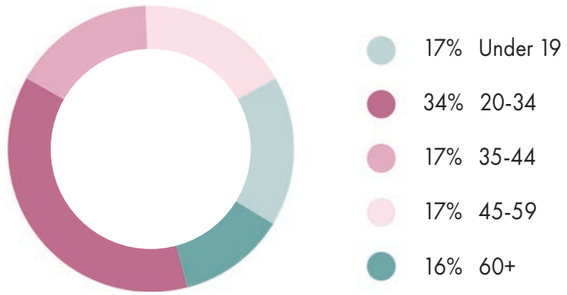
QUEENS OWES ITS RESTLESS SKYLINE TO THE BOOM OF RESIDENTIAL TOWERS IN LONG ISLAND CITY, THE **'FASTEST GROWING NEIGHBORHOOD IN THE COUNTRY'**

NEW BUILDINGS FROM 2010-2020	**109**
PROJECTED POPULATION BY 2020	**100,000**
INCREASE IN RESIDENTIAL RENTAL PRICES	**4.7%**

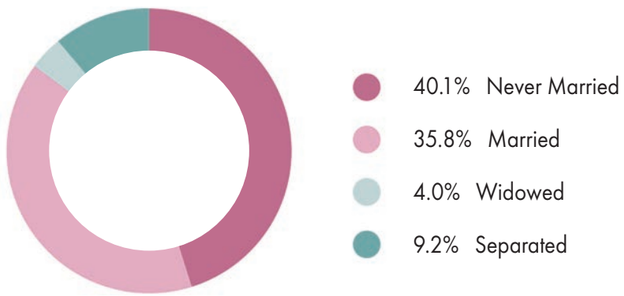




AGE DISTRIBUTION



MARITAL STATUS



When we think about the way our cities grow, we think about real estate, about politics, about economic growth, but not necessarily about people - who they are and how they might interact not just with the built environment, but also how urban design drives interaction between people. So we set out to ask this question about how much the built environment of the city affects the social realm.

In a development driven city, can we carve out spaces in the public realm for the people who live there?

How much does the city affect the social realm?

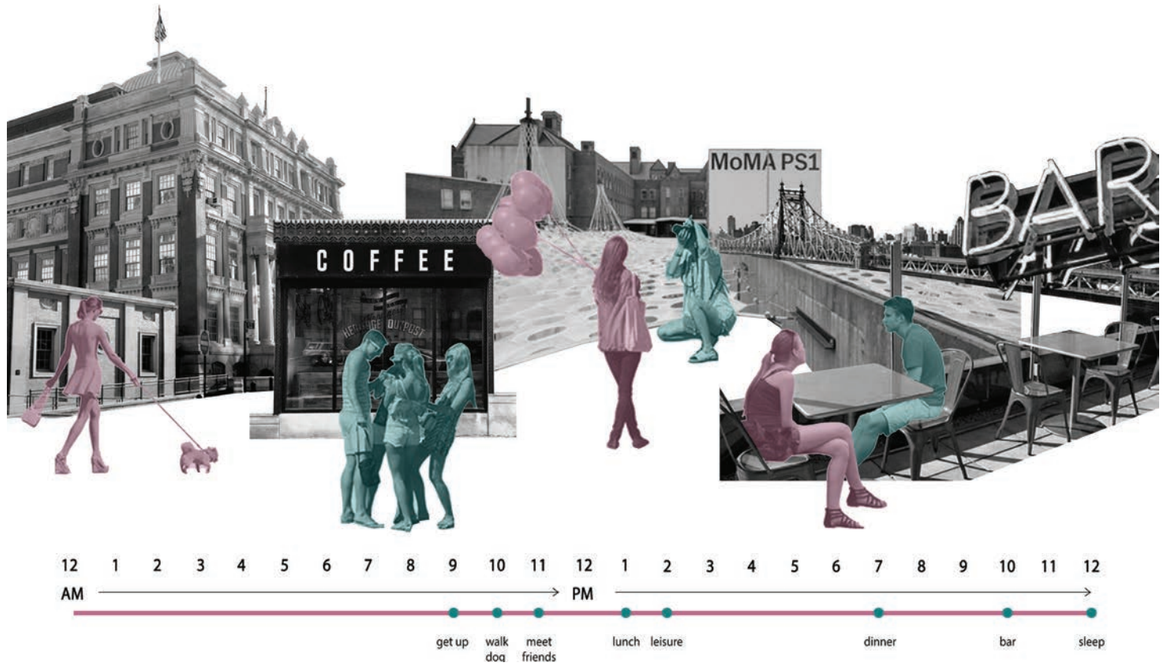
Have you ever thought if your city is making you single?

LIC has been called the fastest growing neighborhood in the country. Residential units in LIC have multiplied at a rapid rate since 2010. 109 new buildings will been built from 2010 to 2020, projecting a population of about a hundred thousand people. What's common among these new buildings, apart from the waterfront view and amenities, is that they're being rented out by millennials - 64% of the current population in LIC is those aging from 20 to 34. And 65% of the population has either never been married, separated or widowed.

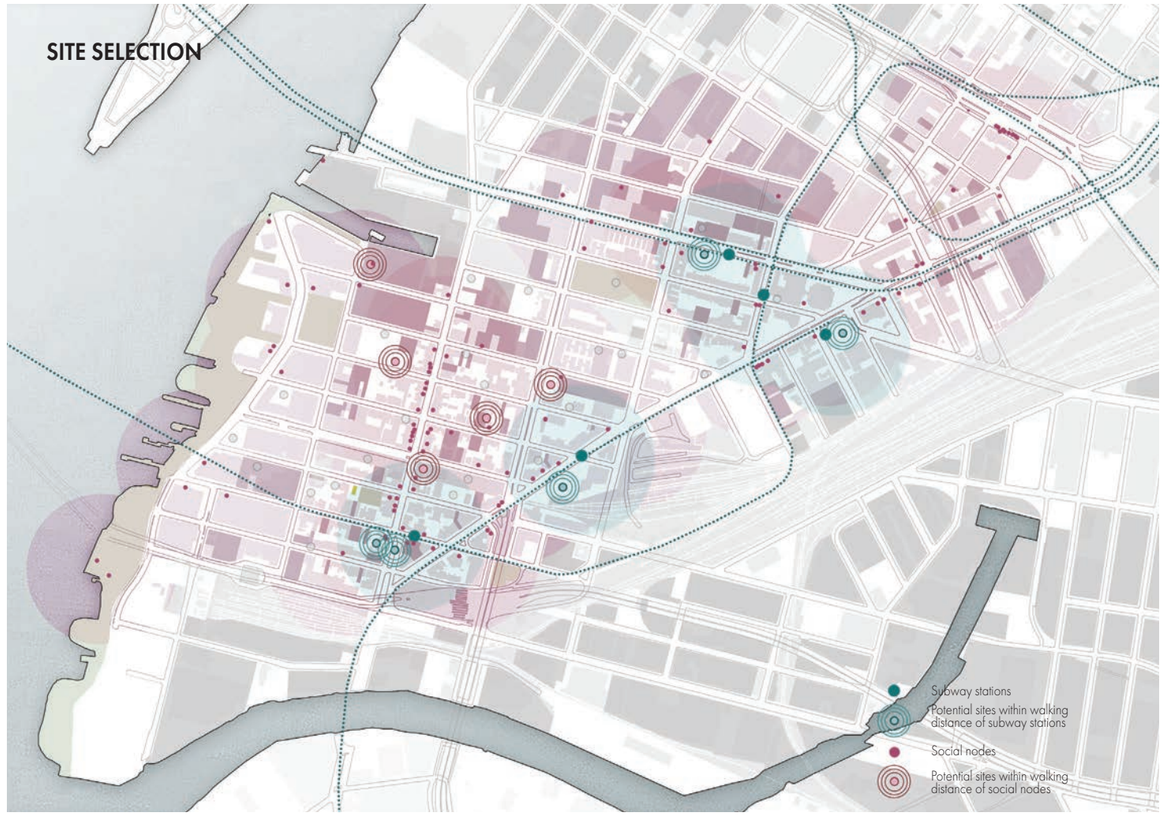
These millennials, people of our age, spend most of their day immersed in the virtual world, losing touch with the real world around them. One of the reasons why that might be happening is that the physical public realm in the city offers nothing to them - and while the private residential sector keeps growing, the city is left with inadequate, hostile public spaces.

WEEKDAY ROUTINE

WEEKEND ROUTINE



SITE SELECTION

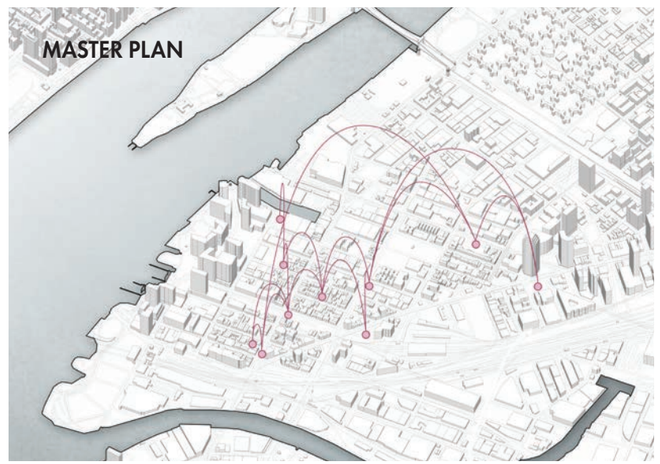


So we set out to find if we can improve the public spaces in the city to trigger interaction between singles. The first step to doing that was to understand their lifestyles in relation to the city - what they do and where they go as a part of their weekday and weekend routine and identify spatial and programmatic gaps where we can intervene. These spatial gaps are either the underused spaces, parking or vacant lots, sidewalks, or spaces with temporary programs.

For example, on a regular weekday, they wake up, take their dogs out for a walk, take the subway to their work place, since most of them work in Manhattan. So we looked at the major subways stations around the new developments, and potential spots within walking distances of the stations.

On a weekend, we found out that they visit bars, restaurants, cinemas, art galleries or fitness centers. So we looked at the underused spaces within walking distances around those spots. And then we mapped out the potential sites based on their proximity to the spaces that they visit everyday. Some of these are around subway stations, others are around frequently visited social nodes.

TYPES OF POTENTIAL SITES



INTERACTIVE MOMENTS AND DESIGN CATALOG

ENCOUNTER

FIRST DATE

INTIMATE DATE

GROUP HANGOUT

VISIBILITY
PROXIMITY
TIME
PROGRAM

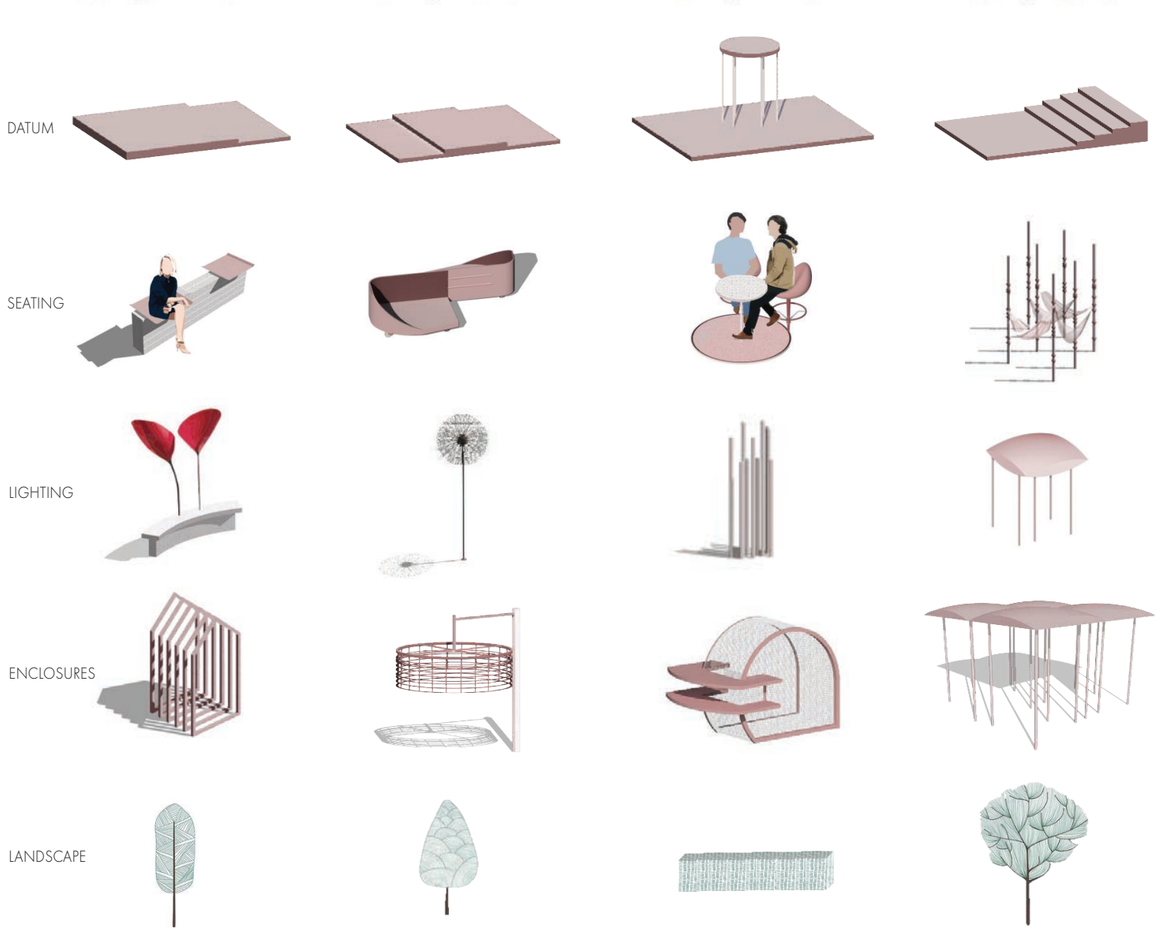
DATUM

SEATING

LIGHTING

ENCLOSURES

LANDSCAPE

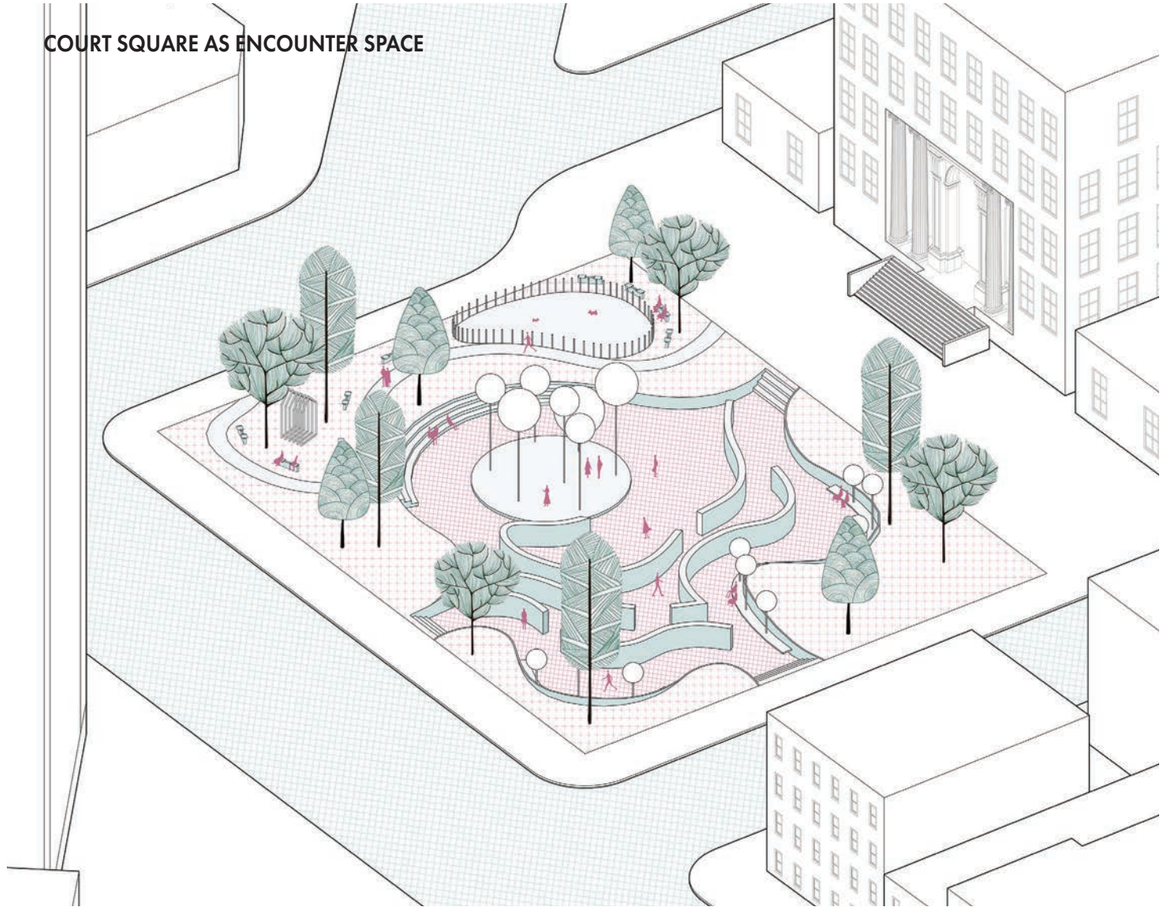


Once we had identified the potential sites, we tried to build categories of the spatial qualities of these sites - so we divided them in four basic categories based on the level of intimacies we wanted to achieve. The first one is encounter by chance - where one spends a short amount of time in a densely populated space and requires strong conversation starters. The second one is first date, where two people might decide to go out around a bar or a restaurant with some visibility for safety purpose and with more subtle conversation starters. The third one is a more intimate date, when the two people have grown closer to each other and might seek more privacy than the first two stages. The space varies in scale, ranging from a goodbye spot where they spend a minute, to a sunset spot where they could spend maybe an hour. The fourth one is for the situation when one has decided to introduce their dates to their friends - so it becomes a space for small groups, with more playful activities.

To aid these moments, as we have called them, we broke down the spatial requirements into components of a public space - datum or ground line, planting, benches, enclosures, seating etc. Some of these objects have been designed in a way to almost insist that two strangers interact - for example, a bench that glows when two people sit on it. In this way, the city not only triggers interaction, but becomes an active participant in the social realm of the city.

So we decided to choose three of the potential sites.

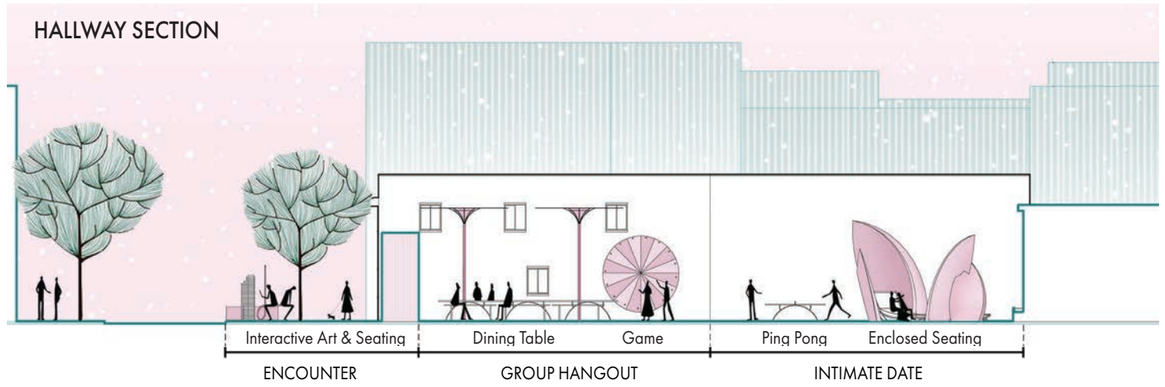
COURT SQUARE AS ENCOUNTER SPACE



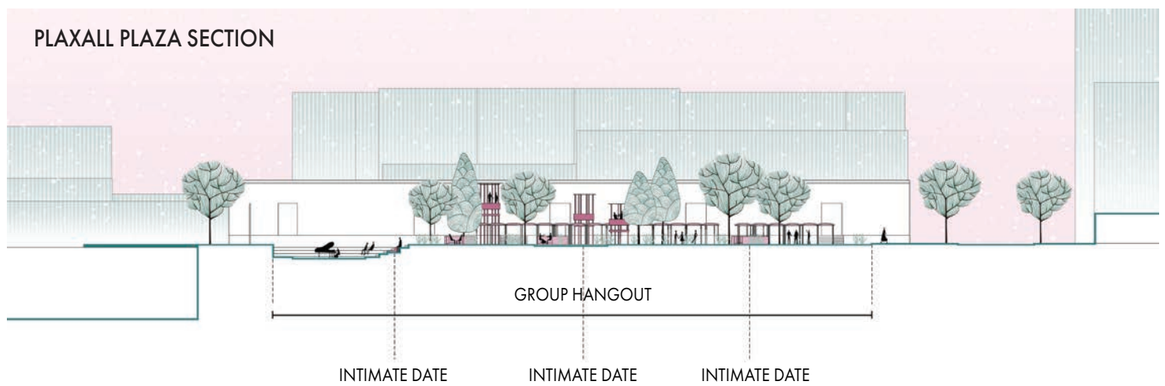
Court Square was designed as a space for encounter mainly because it is a place where a large volume of people pass by every day due to its proximity to the subway stations connecting LIC and Manhattan. Beautiful lightings in the center are used to attract people in. The maze is lower than the ground line so that it creates the semi-private space where people can enjoy the private atmosphere but also can be observed for safety purpose. Some triggers are designed to start people's interaction. For example, the lights on the central interactive platform will become lighter if more people step onto the platform. There are also specially designed benches of which the two seats will slide near to each other when there are two people sitting on it.

COURT SQUARE SECTION

HALLWAY SECTION



PLAXALL PLAZA SECTION



HALLWAY OUTSIDE VIEW

HALLWAY INSIDE VIEW

There are a lot of interstitial spaces in LIC being underused and this is a prototype designed to serve the young population. Attached to restaurants and bars, interactive installations will be used outside on the street to attract people in. Different spaces are designed here, ranging from public space for group hanging out to private space for couples to have more intimate date.

PLAXALL PLAZA AS GROUP HANGOUT SPACE

The Plaxall Plaza used to be a popular market space near the water, so we consider it to have more potential to serve the young population in LIC. The market space still exists while people can enjoy outdoor movies in the sunken plaza. People can also seek more intimate experience in those towers and appreciate the beautiful sunset.

04 BIRD COLLISION IN URBAN AREA

2019 Fall--Analyzing Bird Collision Factors in Urban Area with ArcGIS

Instructor: Leah Meisterlin

Site: Toronto

Team: Wei Zhang, Yile Xu, Youqiao Wu
Role in Team: Research Topic Development, ArcGIS Analysis and Report Composing

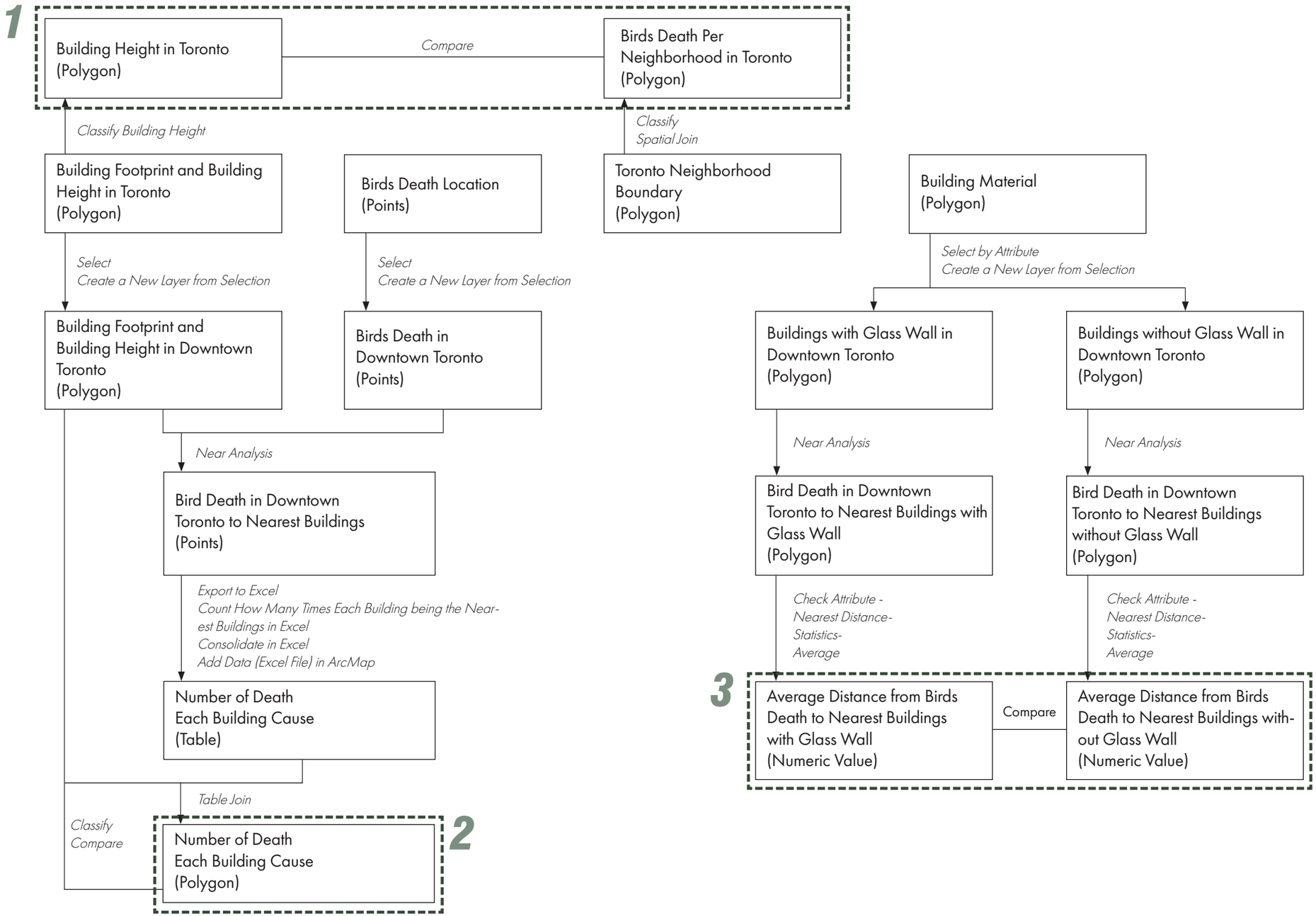
While the loss of habitat is the major issue causing the decline of bird populations, those man-made structures that make up modern city skylines and take up avian air space also present serious hazards for birds. In North America, collisions with human made structures are the second biggest threat to bird populations apart from habitat loss. It is estimated that more than 1.5 billion birds are killed annually across North America as a direct result of human actions. This does not include impacts of habitat destruction from deforestation, agriculture, urban sprawl, the effects of climate change and invasive species. This study aims to identify what kinds of buildings in the city are the bird killers, as well as what specific elements of the buildings contribute most to the collision of birds, thereby instructing the location and design of those threatening structures.

METHODOLOGY

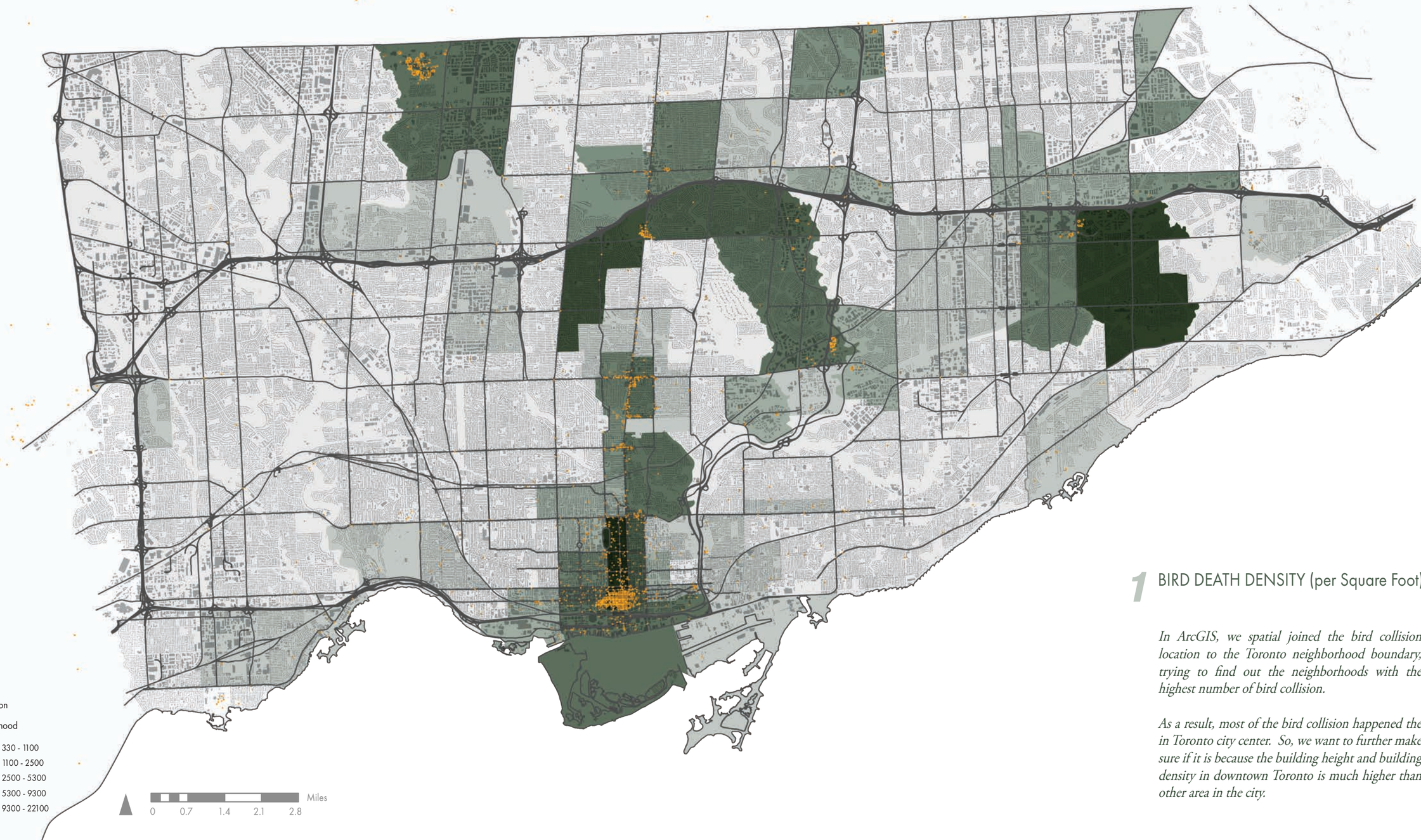
1 *At a larger scale, do death of birds and skyscrapers cluster at the same area in the city of Toronto?*

2 *In downtown Toronto, is bird death highly related with building height?*

3 *In downtown Toronto, is bird death related with building material?*



CITY SCALE ANALYSIS



1 BIRD DEATH DENSITY (per Square Foot)

In ArcGIS, we spatial joined the bird collision location to the Toronto neighborhood boundary, trying to find out the neighborhoods with the highest number of bird collision.

As a result, most of the bird collision happened the in Toronto city center. So, we want to further make sure if it is because the building height and building density in downtown Toronto is much higher than other area in the city.

ZOOM-IN AREA

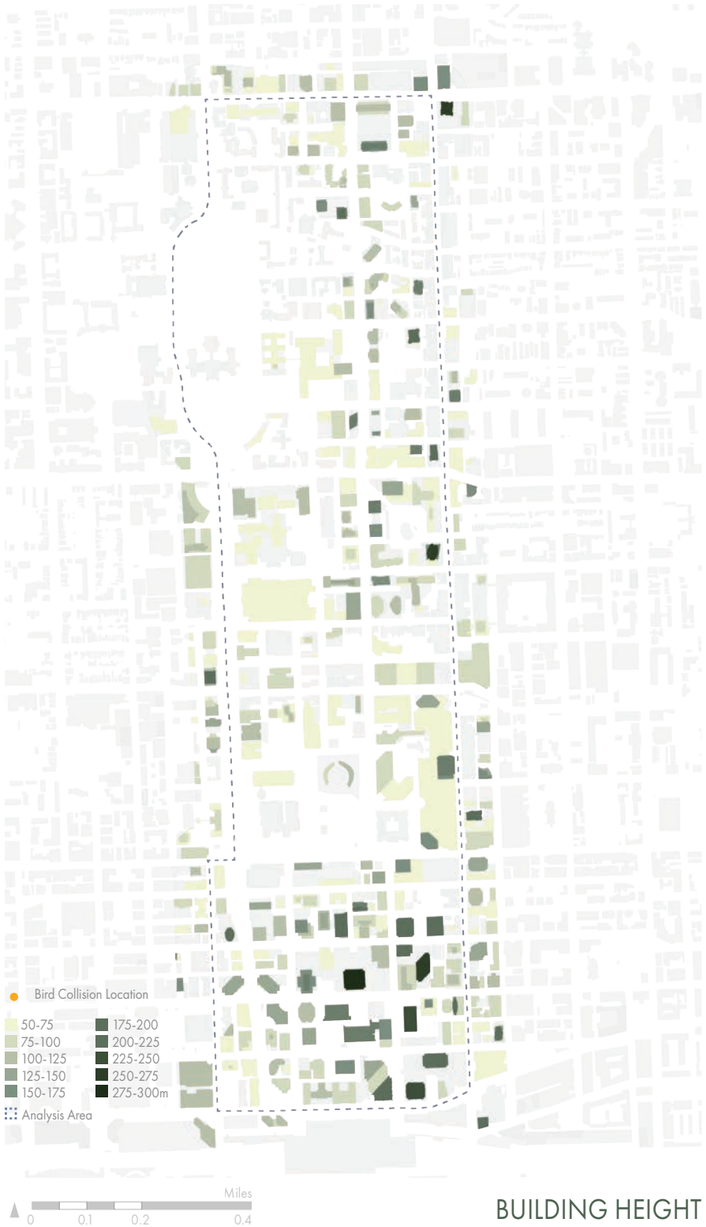
LIMITATION

However, we are skeptical about the bird death data source. Since the correlation between population density and the number of bird death reports is too relative. We wonder if it is because more people live in the high density area, there are more volunteers reported the bird death to this organization? In order to exclude the element of population density, we zoomed in to the downtown Toronto with a relatively even population density.

FINDING ANALYSIS

Zoom in to downtown Toronto

- BUILDING HEIGHT
- BUILDING MATERIAL
- TREE LOCATIONS

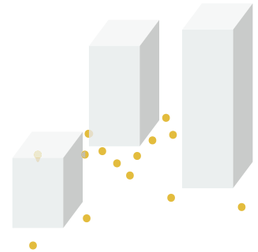


BUILDING HEIGHT

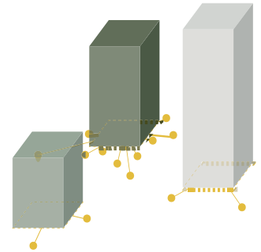
NUMBER OF DEATH EACH BUILDING CAUSE

BUILDING HEIGHT

Find the nearest building of each death point

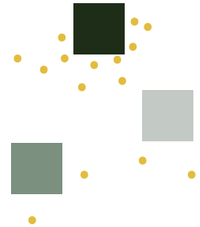


Aggregate the number of being the nearest building for each building



Darker the building is, more death near it.

The tallest building is not the nearest building to death points.



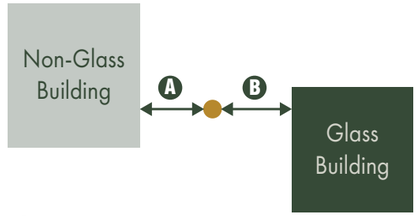
BUILDING HEIGHT IS NOT THE MAJOR KILLER ELEMENT

We ranked the buildings over 50 meters in height to short, and added the data of bird collision. According to this map, we can see there is no absolute positive correlation between the height of buildings and the number of bird collision.

If building height is not the main reason for bird collison, what is that? Having looked at those bird killers on Google Street View, we found that they are mostly glass-made, highly reflective buildings.

BUILDING MATERIAL

GLASS BUILDINGS & BIRD DEATH



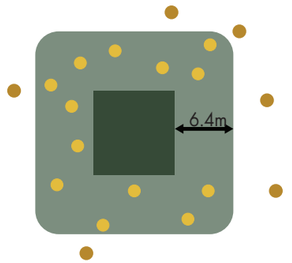
A

58.7 m Distance To Nearest Non-Glass Building

B

6.4 m Distance To Nearest Glass Building

82.5% Collision are in the buffer zone of glass building

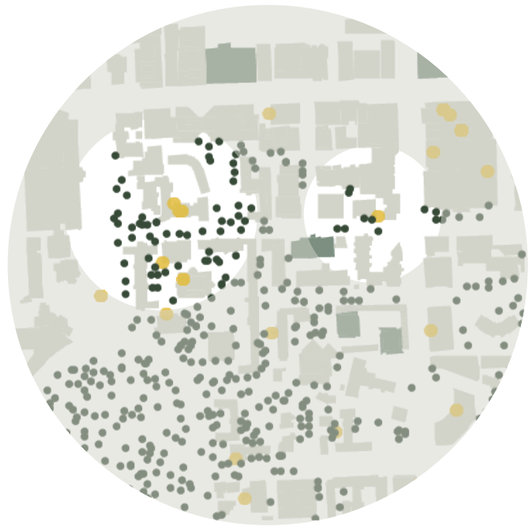


EXCEPTIONS?

Since birds cannot distinguish the real sky and the glass walls that reflect the sky. Thus, most of birds dead near to tall glass buildings. However, there are still some exceptions. In some places without any tall glass building, the number of bird collision is still concentrated and large.

TREE DENSITY & MIRROR EFFECTS

TREE DENSITY AND REFLECTION



Trees which near glass building can mislead birds' flying route.

CONCLUSION

According to the study, there are various threatening elements that can cause bird death of collision.

Building height and density are to some extent related to bird collisions. However, they are not the main element.

What matters most is whether the buildings have reflective glass curtain walls. Since birds perceive glass to be unobstructed passageway and fly towards the glass with no awareness of an obstacle.

Moreover, bird collisions are more likely to happen when trees and glass buildings coexist. The reason is that architectural glass reflects the sky, clouds, or nearby trees and vegetation, reproducing habitat familiar and attractive to birds.

Understanding the conditions that contribute to bird collisions with buildings is only the first step we can do towards planning bird-safe environments. According to the study, more and more actions such as building construction guidelines can be taken to protect birds life.

APPENDIX

DATA SOURCE

Birds Deaths Map
Bird Safe Organization, "Global Bird Collision Mapper" https://birdmapper.org/app/

Building Footprint map in Toronto
Toronto City Planning, "3D Massing", https://open.toronto.ca/dataset/3d-massing/

Toronto Neighborhood Boundary
Toronto City Planning, "Boundary of Neighborhood", https://open.toronto.ca/dataset/neighborhoods/

Toronto Physical location of trees
Toronto City Planning, "Physical location of trees", https://open.toronto.ca/dataset/physical-location-of-trees/

Building Material and Color
Open Street Map, https://www.openstreetmap.org/export#map=17/43.64720/-79.38123

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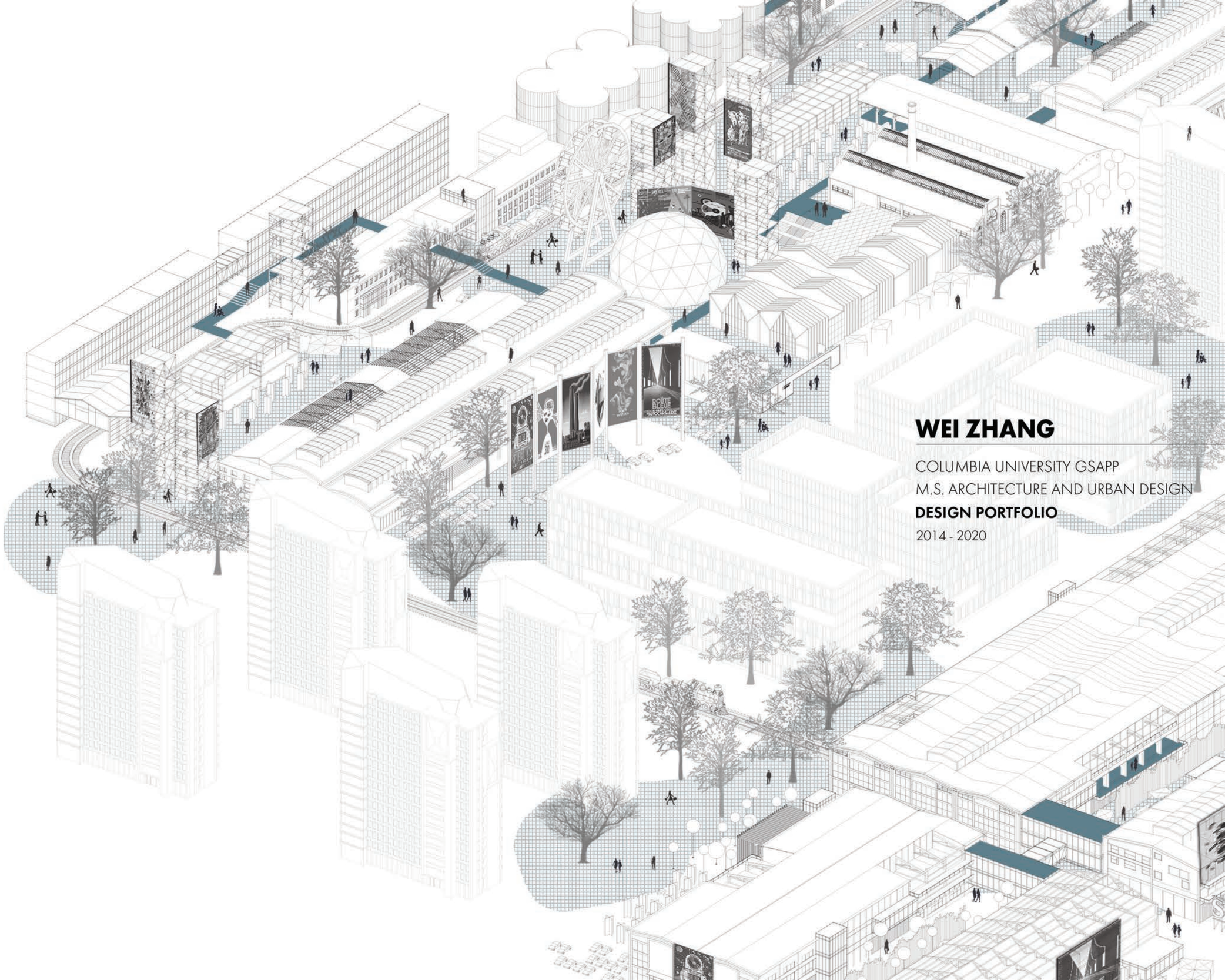

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M.S. ARCHITECTURE AND URBAN DESIGN

DESIGN PORTFOLIO

2014 - 2020