NIHONBASHI

FINAL REPORT

GEORGIA INSTITUTE OF TECHNOLOGY
APRIL, 2022

Tokyo Smart City Studio at Nihonbashi

International Urban Design Studio - Spring 2022

Eco-Urban Lab - School of City and Regional Planning & School of Architecture
College of Design - Georgia Institute of Technology

In Collaboration With:

Global Carbon Project (GCP)
Mitsui Fudosan - University of Tokyo Smart Cities Laboratory
Graduate School of System Design and Management, Keio University
Department of Urban Engineering, School of Urban Engineering, The University of Tokyo

Acknowledgments

School of City and Regional Planning and School of Architecture
College of Design
Georgia Institute of Technology

Instructor

Perry P J Yang
Professor and Director of Eco Urban Lab

Urban Design Studio

Muhammad Arsam
Regan Buchanan
Lu Chen
Stephen Conschafter
Maddy Clowse
Sebastian Foxley
Rossana Franco-Pinilla
Mirna Garcia
Maggie Nicholson
Natalie Manitius
Tasha Snedaker
Olivia Wineski

Editor

Natalie Manitius

Studio Partners

The University of Tokyo

Akito Murayama
Associate Professor, Department of Urban Engineering, School of Engineering, The University of Tokyo, Japan

Takahiro Yoshida
Assistant Professor, Department of Urban Engineering, School of Engineering, The University of Tokyo, Japan

Keio University

Yoshiki Yamagata
Professor, Graduate School of System Design and Management, Keio University, Japan

Eri Natsume
Researcher, Graduate School of System Design and Management, Keio University, Japan

Mitsui Fudosan

Hideo Suda
Space & Environment Institute, Mitsui Fudosan Co., Ltd., Japan

Koichi Ota
Solution Partner Division, Mitsui Fudosan Co., Ltd., Japan

External Reviewers

Professor Alan Balfour

Mr. Yoshi Koshiyama

Dr. Yingying Kang

ESRI

Ms. Keera Morrish

Mr. Jason Karian

Guest Speakers

Ms. Soowan Chang

Mr. Mike Cutno

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This proposal is the output of the urban design studio of the graduate school educational program, and does not reflect the intentions of local stakeholders.

Table of Contents

Studio Context

Mission Statement

The 3C's:
carbon neutrality,
climate resiliency,
& post-Covid-19 conscious

Our studio's mission is to enhance the Nihonbashi neighborhood through:

1. Celebrating the progress and history of the neighborhood

2. Engaging stakeholders across social, cultural, and geographic distances

3. Ensuring that future development supports climate resiliency and livable and people-focused communities

4. Adding open spaces that support synergy between blue and green systems

5. Designing streetscapes and transit that makes movement enjoyable and accessible

6. Helping the neighborhood become more resilient to shocks such as Covid-19 or natural disasters

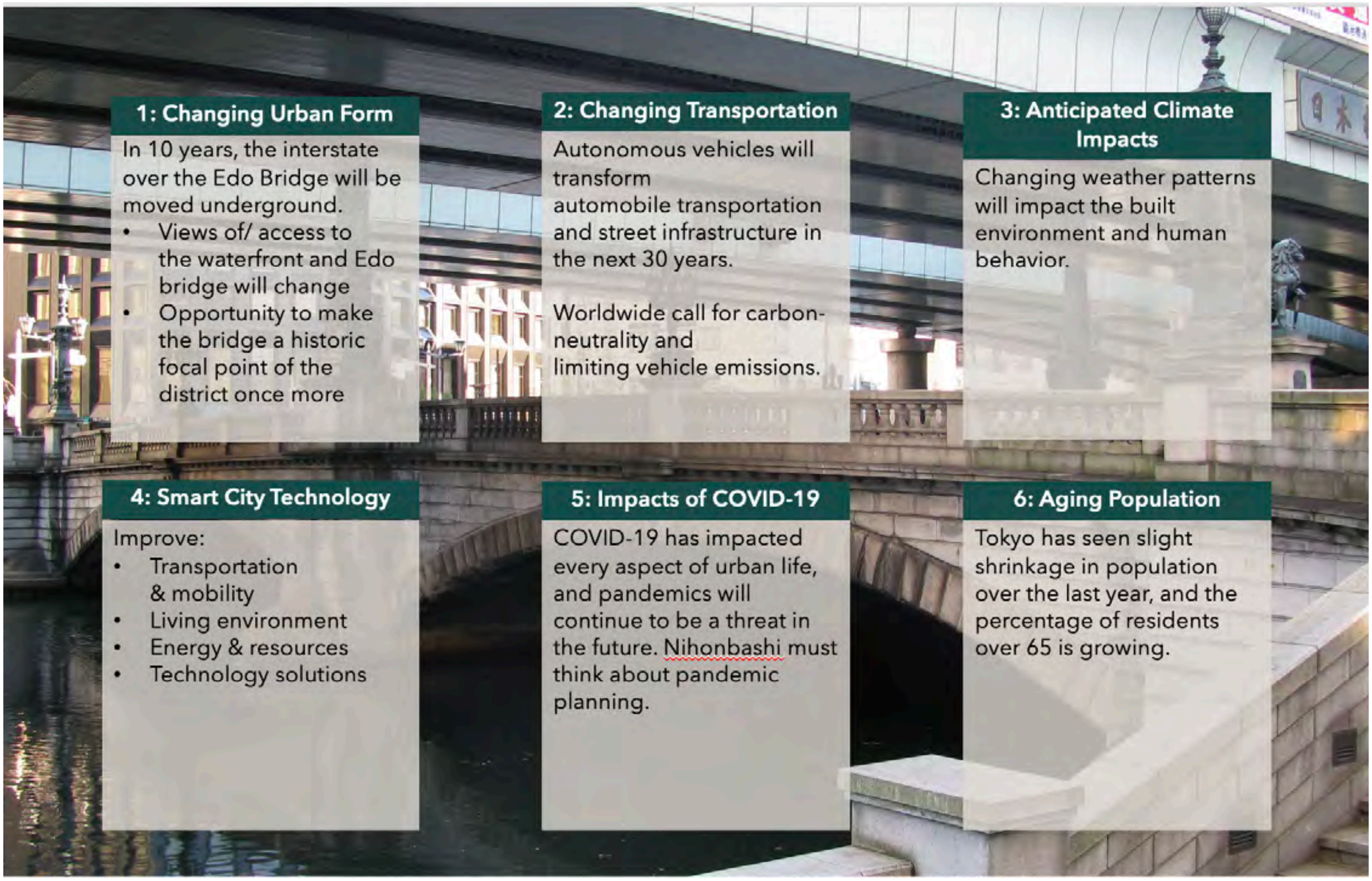
7. Anticipating trends and needs of population changes with land use

8. Harnessing smart technologies to enhance quality of life and economic opportunity, as well as our designs and processes

9. Catalyzing Tokyo's pursuit of carbon neutrality by using Nihonbashi as an example.

Projections

The following projections guided the Georgia Tech urban design studio's planning and design proposals.



Nihonbashi

History of Nihonbashi

Maggie Nicholson

Historic Nihonbashi was once swirling with water. The ancient flows of several rivers along its low, alluvial plains resulted in a canny water management strategy involving canals and bridges. These traditional water systems supported a lively exchange of goods and ideas, local and national transport, Edo Castle's security strategy, and local cultural identity. Nihonbashi's fish, produce, craft, and textile markets centered on its canal network, while its infamous Nihonbashi bridge (or "Bridge of Japan") was instrumental in cultivating Japan's national road network and postal service. The original wooden bridge was constructed with the establishment of the Tokugawa or Edo shogunate, Japan's final period of traditionalism. With the Nihonbashi Bridge as Japan's zero-mile post – the first or last station of the Tokaido - the ward naturally evolved as Tokyo's mercantile district with the constant ebb and flow of travelers.

"Nihonbashi After the Snow" (Nihonbashi Yukibare), by Hiroshige Ando. Part of the "One Hundred Famous Views of Edo"

Nihonbashi in Edo (Edo Nihonbashi) from the series "Thirty-six Views of Mount Fuji" by Katsushika Hokusai (ca. 1830 - 1832)

The Nihonbashi Bridge circa 1872. Courtesy of the Kammerhof Museum.

After the 1868 Meiji Restoration, the government renamed Edo (meaning "bay entrance") as Tokyo ("eastern capital") and relocated the emperor here from the historic capital of Kyoto. As Tokyo westernized through the late 1800s, European visitors compared the new capital to their own continent's great water city – Venice. Just as Venice exudes European cultural prowess, Nihonbashi's canal waterfront was the collective manifestation of Japanese intellectual, social, and artistic achievement built upon the island nation's customs, traditions, and way of life forever surrounded by and immersed with water.

The increasing prominence of Nihonbashi within Tokyo and within Japan solidified the ward as a national finance center. The Tokyo Stock Exchange, established in 1878, was constructed on its current Nihonbashi site in 1931. The Bank of Japan is the central bank of the nation and united the country under a common currency, the yen, in 1871. Its neo-baroque facility was constructed atop the site of a gold mint on the northern shore of the Nihonbashi River in 1896.

View across the Nihonbashi river canal towards the Bank of Japan circa 1910 (oldtokyo.com)

Looking across Ikkokubashi towards the Bank of Japan (center white structure) and Tokiwabashi (left), circa 1915 (oldtokyo.com

Streetcar passing over the Yoroibashi (Armor Bridge constructed of iron in 1872) with the Tokyo Stock Exchange building to the right, circa 1910 (oldtokyo.com)

Left: Hiroshige's ukiyo-e print with Mount Fuji (background) and Echigoya (left foreground) as landmarks. Mitsukoshi's main store in Nihonbashi circa 2000s

Top: Mitsukoshi's main store in Nihonbashi circa 2000s

However, one of the most prominent commercial endeavors to emerge from Nihonbashi started as Mitsui's Echigoya textile shop, opened in 1673 by Mitsui Takatoshi (1622-1694). By 1904, the shop had expanded business enough to re-brand as Japan's first department store, Mitsukoshi. Expanding further still, the Mitsui Company began investing in real estate holdings in 1914 targeting Nihonbashi specifically. Today, Mitsui is considered one of Japan's premier corporate holdings companies and one of the top 2,000 largest public companies in the world.

Nihonbashi's developmental history is consistently progressive, but not without setbacks. While Nihonbashi Bridge survived fires, the Great Kanto Earthquake of 1923, and the bombing of Tokyo during World War II, surrounding blocks experienced colossal destruction in all scenarios. Whereas Tokyo's wards historically fashioned a mosaic city - a patchwork of neighborhood locales shaped by their unique terrains and histories, reconstruction following these atrocities embraced increasingly more western styles of building. For Nihonbashi, the successive phases of occidental influence caused deeper and deeper ruptures with the ward's traditional water-based development. As land inheritance tax structures evolved after WWII, large parcels were subdivided for landholders to maintain affordability and new parcel typologies, such as flagpole lots, became common during selloffs.

The bridge met its ultimate demise when the elevated Metropolitan Expressway was constructed over the course of the Nihonbashi River in preparation for the 1964 Tokyo Olympics. This act was the final rupture of the ward and its residents from the historic lifeblood waterfront; the expressway megastructure sent Nihonbashi into a cultural and environmental decline with waterway economics nullified.

As greater Tokyo Bay continued to industrialize, water surface area lessened and water quality worsened. Nowadays, Tokyo is less a "water city" and more a city next to water, disconnected from its best asset. Natural coastlines and historic vistas are unrecognizable given landfill practices, sprawling industrial sites, and towering skyscrapers. Traveling up the few remaining Tokyo canals or upstream tributaries evokes romantic images of what life on the water must have been like – little traffic, quietness, brief encounters with natural greenspace and wildlife.

The Olympic legacy of elevated highways is a blessing in disguise. To avoid the cost and hassle of purchasing privately owned land parcels, Japanese transportation officials built their vehicle networks directly above rivers and canals. This allowed Nihonbashi's block structure to remain mostly intact. In 2017, Tokyo's Ministry of Land, Infrastructure, Transport, and Tourism (MLIT) set plans in motion to remove the Nihonbashi flyover following the 2020 Olympic Games, relocating the expressway as a tunnel road under the Nihonbashi River. Moving highway environmental concerns below ground seems moot by Tokyo sustainability goals compared to a complete removal, but daylighting the river provides positive outcomes, nonetheless. These include an increase in water transit fleets, improved water flow and quality, mitigation of urban heat islands, restored natural vistas, and increased access to recreational green and blue spaces.

Nihonbashi Bridge after the Great Kanto Earthquake of 1923. Nihonbashi Bridge following the 1945 Bombing of Tokyo (ca. 1946)

Nihonbashi Bridge following the 1945 Bombing of Tokyo (ca. 1946)

Construction of Metropolitan Expressway over the Nihonbashi River circa 1963 (The Japan Times)

Area Planning

Climate Policy and Green Certification

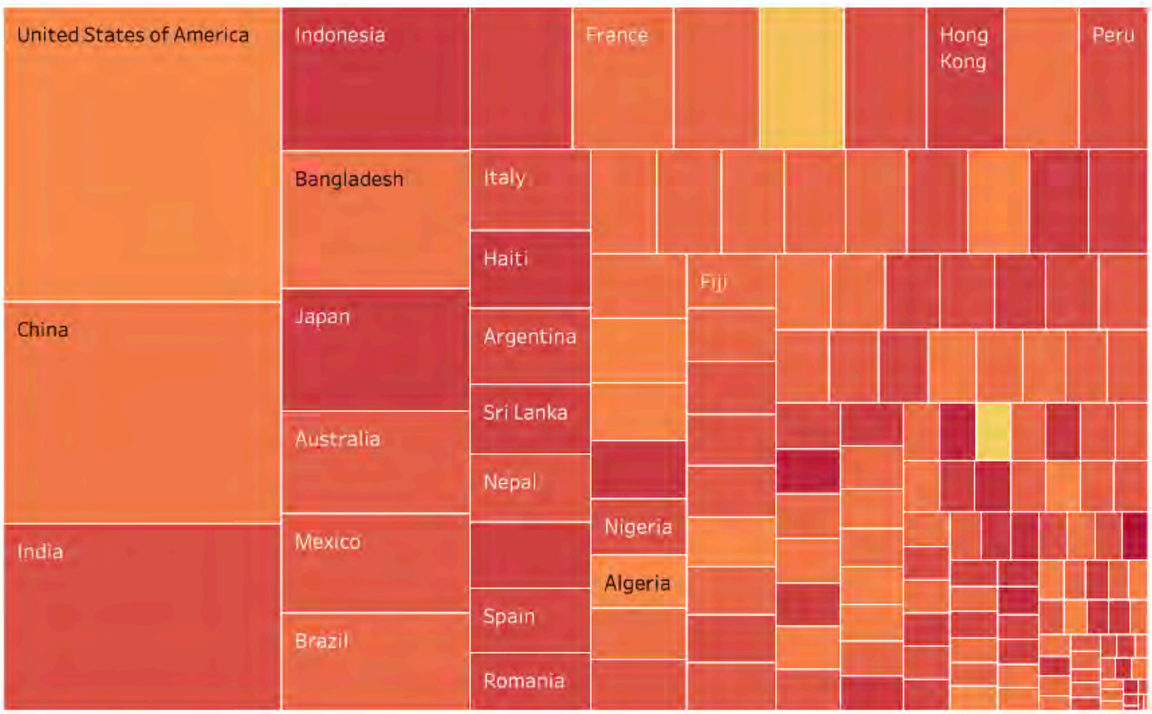
Mirna Garcia

Introduction

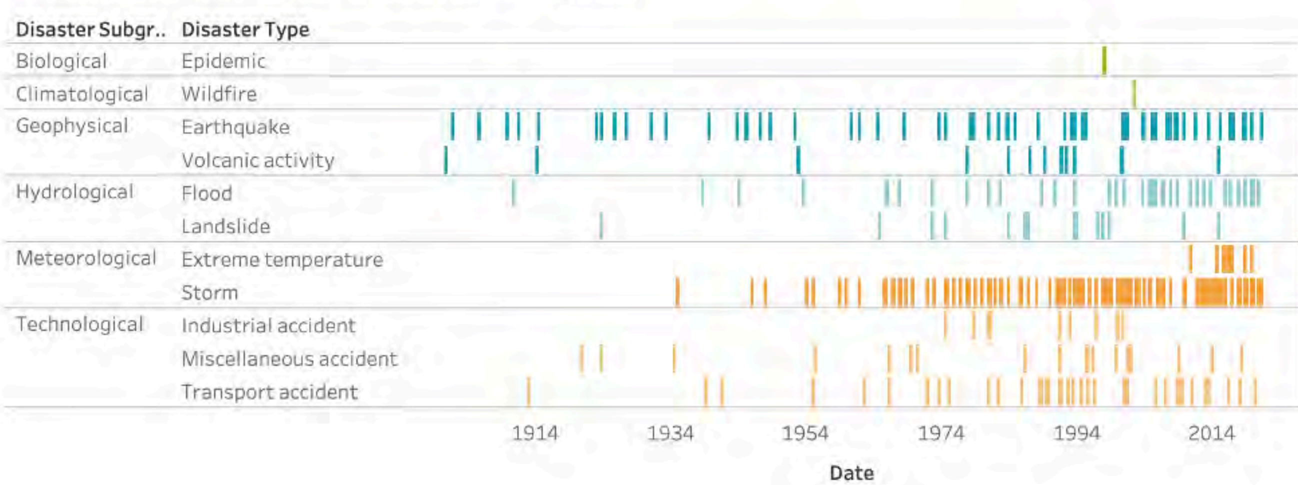
In regard to the anticipated climate change in Nihonbashi, using data from the EM-DAT international disaster database, the Natural Hazards Dataset from the National Centers for Environmental Information, and data from The Berkeley Earth Surface Temperature Study, we can see in the first visualization that Japan is ranked 5th in climate-related disasters. This visualization also shows that the darker the square, the hotter a country is-- Japan's mean annual temperature has increased by 1.0°C over the last century. The second visualization shows a timeline of natural disasters in Japan. The main culprits being earthquakes, floods, and storms. The last visualization shows the economic impacts of climate-related disasters worldwide-- flooding and extreme temperature causing economic damage in the billions.

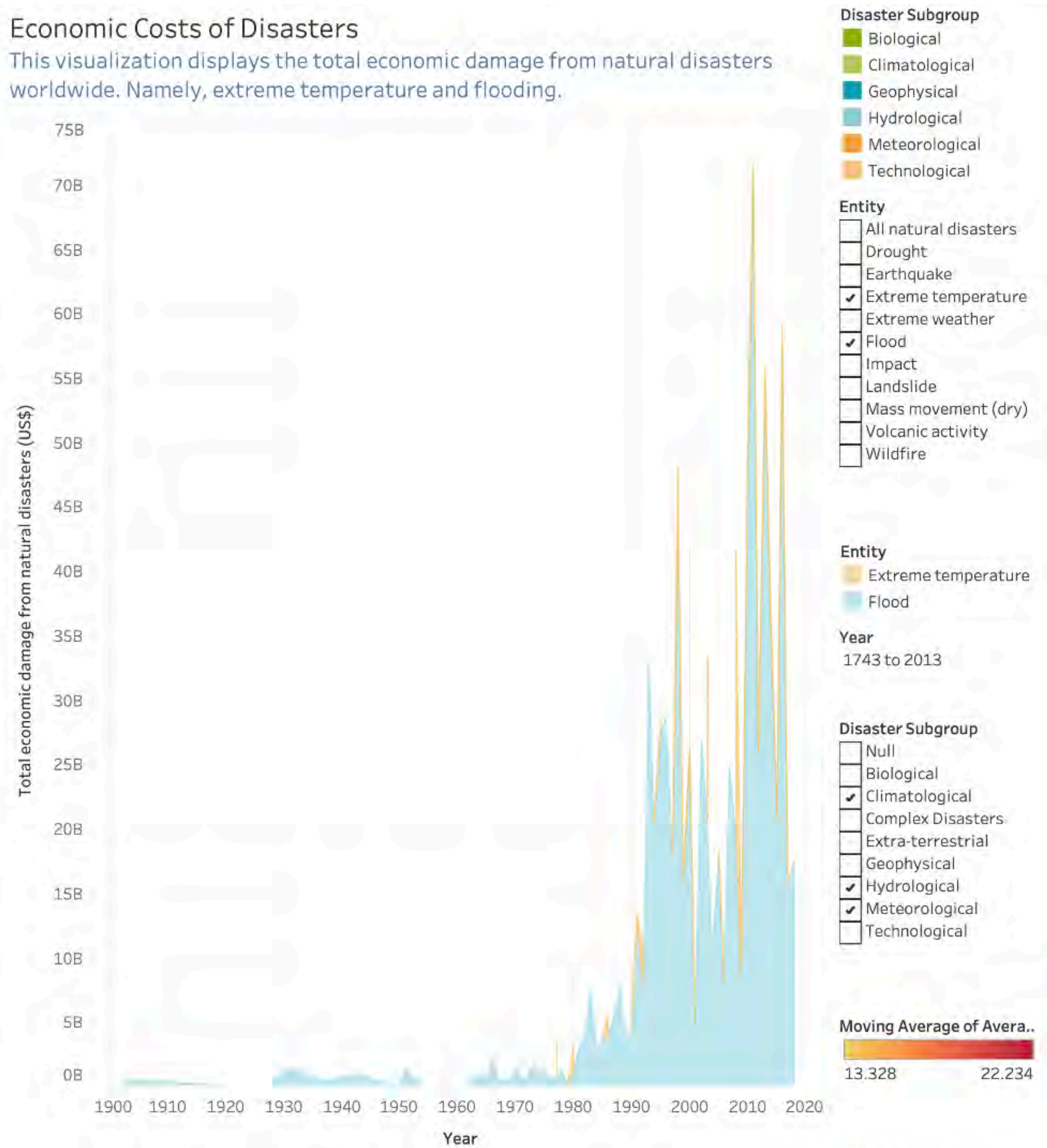
The World is Getting Hotter

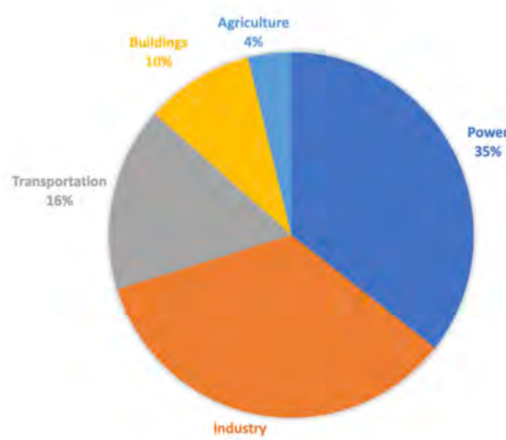
The darker the square, the hotter a country is. The bigger the square, the more climate-related disasters that have occured. Japan is ranked 5th.



A Timeline of Natural Disasters in Japan



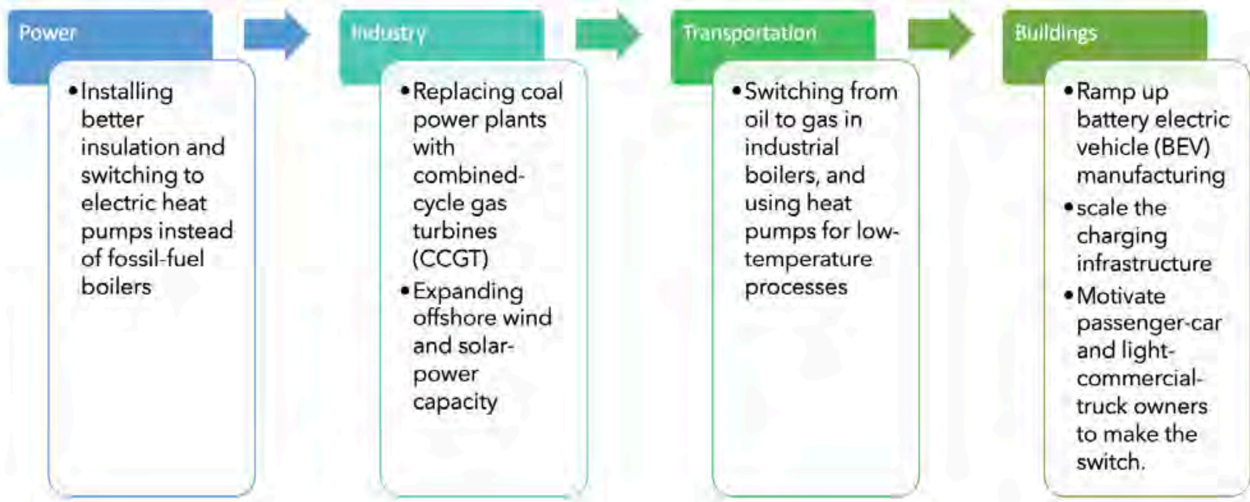




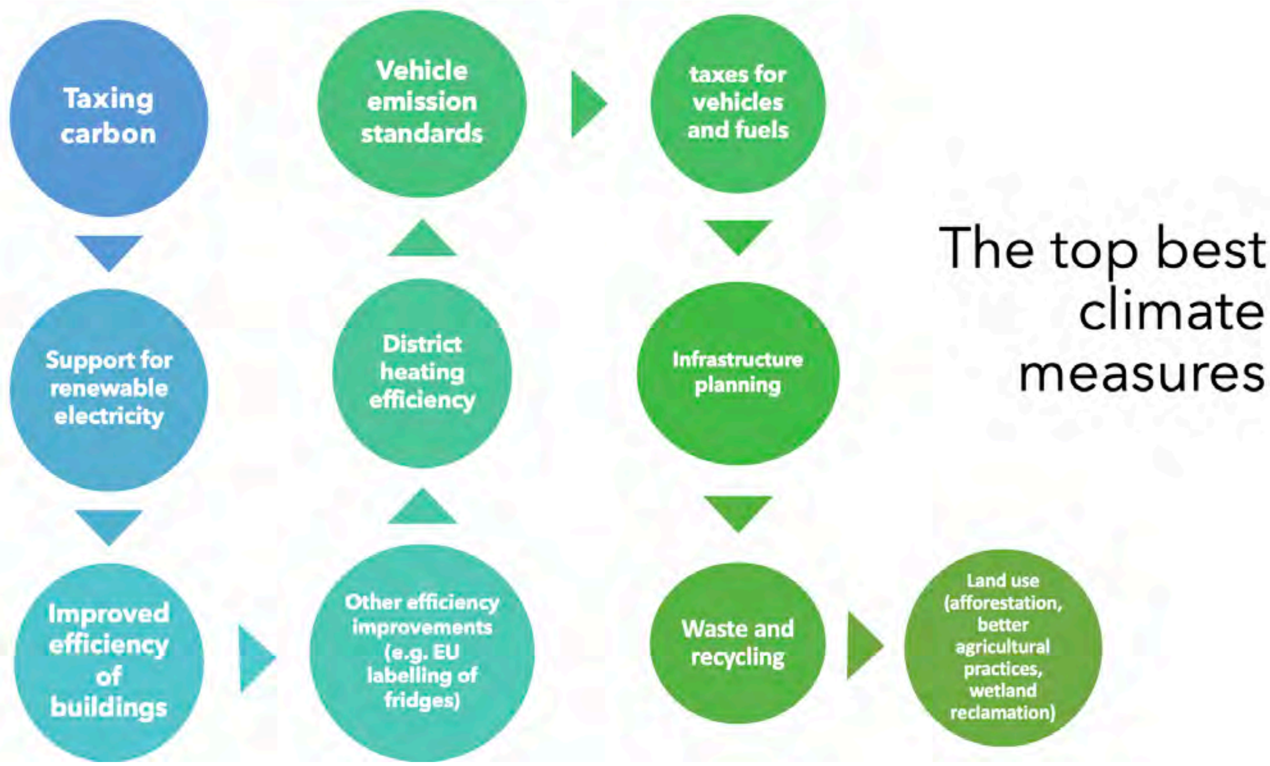
A recent report found that Japan is the sixth largest GHG emitter in the world after China, the United States, the European Union, India, and Russia (Kuwabara, Tasuku, et al., 2021). And In 2017, it emitted a net 1,230 metric megatons of carbon dioxide equivalent (MtCO2e), most of which originated from five sectors: power (37 percent), industry (36 percent), transportation (17 percent), buildings (10 percent), and agriculture (4 percent) (Kuwabara, Tasuku, et al., 2021).

A Pathway for Nihonbashi to Decarbonize

In the years ahead, Nihonbashi has many strengths to leverage on its path to net-zero. From its extensive railway infrastructure offering a viable alternative to cars to the life cycle of Japanese buildings making it easier to impose green regulations on new construction. The pathway for Nihonbashi to decarbonize its major sectors based on what seems to be most feasible and affordable are laid out here in the sectors where you find the highest emitters, from expanding offshore wind and solar-power capacity, to ramping up battery electric vehicle manufacturing (Kuwabara, Tasuku, et al., 2021).



In recent years, NGOs have identified 150 ways to save the climate in northern Europe by promoting effective climate mitigation measures in the national climate policies of 11 countries that make up the Council of Baltic Sea States. Climate policy experts from environmental NGOs in each country listed the ten best climate mitigation measures. All 10 of the top measures described have led to a drop in $CO2$ emissions in many countries. In order for Nihonbashi to reach its goal, it will be important to implement these policies or variations of the measures suggested.



The ten best climate measures. (2019, December 19). AirClim.
https://www.airclim.org/acidnews/ten-best-climate-measures

Green Certifications

Important Ecological Urbanism certifications to attain include LEED & CASBEE. LEED is a voluntary planning certification and is intended to recognize practices that meet the strategies drawn from sustainability criteria that work to reduce the impacts caused by the construction activity. The requirements of the LEED for Neighborhood Development are organized into four categories: three consist of prerequisites (mandatory for final certification) and credits associated to points for the qualification of the evaluated object, and another category called Innovation & Design Process, that has no mandatory requirements (Barcelona Urban Ecology Agency, 2012).

All LEED certification system uses the checklist methodology that, through a point system related to a list of requirements, checks whether the project complies with the requirements to get different certification standards. The graph presents the objectives and requirements of the categories that make up the certification system.

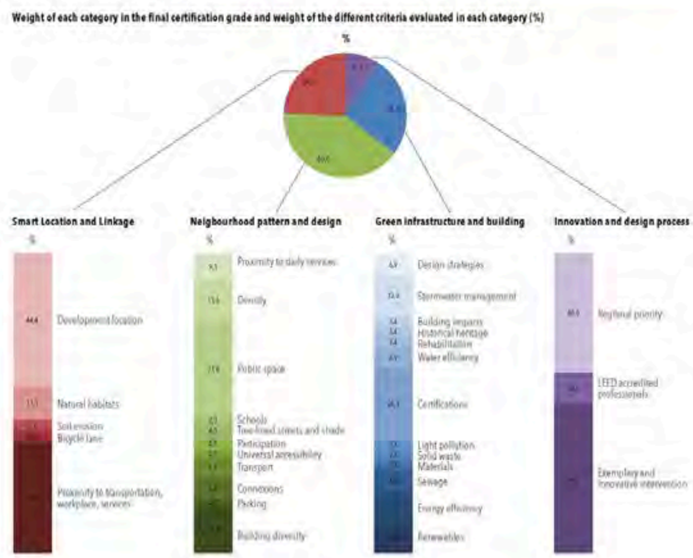
Urban Ecological Certificates

LEED for Neighborhood Development

- From 40 to 49 points: Certificate
- From 50 to 59 points: Silver
- From 60 to 79 points: Gold
- More than 80 points: Platinum

Categories	Prerequisites	Points	%
1. Smart Location & Linkage Objectives: To reduce dependence on private vehicles and health problems related to lifestyle, encouraging walking and cycling; new developments located in areas with basic infrastructure and transport; incentive of urban renewal, promoting safe spaces design and preservation of environmental quality.	5	27	24,55
2.Neighbourhood Pattern & Design Objectives: To reduce motorized travel, conservation of land and social coexistence; with compact and mixed-use developments, open and well connected, with efficient transport, safe and comfortable road design for pedestrians and cyclists, safe and comfortable public space, etc.	3	44	40,00
3.Green Infraestructure & Building Objectives: To encourage the construction and rehabilitation of buildings using design and "green" construction practices considering the historical, cultural and social memory of the area to be certified, promoting energy and water efficiency of buildings and infrastructure or preventing pollution by construction activity and usage of the area to be certified.	4	29	26,36
4.Innovation & Design Process Objectives: To recognize exemplary projects, innovative initiatives in line with the principles of green building, smart grow and new urban planning. In addition to the consideration of regional priorities and LEED accredited professional.	0	10	9,09

Table: Categories of LEED-ND evaluation system



Barcelona Urban Ecology Agency. (2012). Ecological Urbanism Certification: Urbanism Certification With Sustainability Criteria. Government of Spain.

CASBEE has been developed based on four key policies: (1) Allow evaluation of higher environmental aspects of buildings. (2) Be as simple as possible. (3) Be applicable to a wide variety of subjects and cases. (4) Consider the issues and problems specific to Japan and Asia (Barcelona Urban Ecology Agency, 2012). The evaluation parameters are organized from two basic conceptual issues: Indoor Environmental Quality of the project "Q" (Quality) and Outdoors Environmental Load "L" (Load). Both are defined as the limits of influence of the evaluated subjects: the hypothetical limit of the building and the hypothetical limit of the urban area.

CASBEE for Urban Development checks the urban environment of buildings, considering only the qualities and loads outside the building. CASBEE for Urban Development + Building also includes qualities and loads outside the buildings that make up the urban development, quality and specific loads of buildings, ie the tool brings together the considerations regarding the building and the urban environment. The requirements of the evaluation system are in total 83 and are organized into 31 subcategories, which in turn make up the six categories, three related to environmental quality and three related to the environmental impacts of development.

Urban Ecological Certificates

CASBEE for Urban Development

Categorias	Weight centre	Overall weight	Sub categories	Require ments
$Q_{ud}1$ Natural environment Objectives: To verify the consideration of the environmental characteristics of the place, preservation of ecological systems (soil, water and air), and to promote the quality and comfort of outdoor spaces.	0.25	0.35	5	17
$Q_{ud}2$ Proceedings of services at local level outdoor spaces Objectives: To verify the performance of development systems (supply, treatment and information), ensuring maximum efficiency and quality of services, providing comfort and security to users.	0.45	0.35	6	15
$Q_{ud}3$ Contribution to the local community Objectives: To promote the use of all local resources or the environment, the stimulus to participation and information, creating a community in harmony with the environment and with its historical, cultural and social roots.	0.30	0.30	4	8
$LR_{ud}1$ Environmental Impact Objectives: To verify actions to mitigate local disturbances and outside the project boundary, considering the treatment and design of outdoor spaces to create premises that are comfortable to the local user and are in harmony with environmental factors at local scale.	0.30	0.35	6	16
$LR_{ud}1$ social infrastructure Objectives: To promote the efficient use of infrastructure resources locally, considering techniques and systems that reduce impacts on the environment inside and outside the development.	0,45	0,35	6	14
$LR_{ud}1$ Local Environmental Management Objectives: To promote management and monitoring tools for the efficient use of resources, considering both the systems and infrastructure at local level, and checking the intervention's global impact also at local level.	0,25	0,30	4	13

Table: Categories and weights CASBEE certification

Qud 1 NATURAL ENVIRONMENT (MICROCLIMATE AND ECOSYSTEM)		
Code	**Subcategories**	**weight**
1.1	Consideration and conservation of microclimate in pedestrian areas in summer	0,35
1.2	Consideration and conservation of the land	0,20
1.3	Conservation of water resources	0,15
1.4	Conservation of natural habitats	0,10
1.5	Other considerations for the local environment	0,20

Qud 2 SERVICES INTERVENTIONS AT LOCAL SCALE		
Code	**Subcategories**	**weight**
2.1	Actions of supply and treatment systems	0,15
2.2	Actions of information systems	0,15
2.3	Actions of transport systems	0,20
2.4	Disasters and crime prevention	0,15
2.5	Daily life	0,15
2.6	Consideration for universal design	0,20

Qud 3 CONTRIBUTION TO THE LOCAL COMMUNITY (HISTORY, CULTURE, LANDSCAPE)		
Code	**Subcategories**	**Weight**
3.1	Resources use at local level	0,15
3.2	Social infrastructure	0,45
3.3	Encourage a good community	0,15
3.4	Context and urban setting	0,25

Lud 1 ENVIRONMENTAL IMPACTS (MICROCLIMATES, FAÇADES AND LANDSCAPE)		
Code	**Subcategories**	**weight**
1.1	Reduction of heat impact in outdoor spaces in summer	0,30
1.2	Mitigation of the geological impact outside the local level	0,15
1.3	Prevention of air pollution outside the local level	0,10
1.4	Prevention of noise, vibrations and odours outside the local level	0,10
1.5	Wind hazard mitigation and obstruction of sunlight	0,25
1.6	Mitigation of the impact of local lighting	0,10

Lud 2 SOCIAL INFRASTRUCTURE		
Code	**Subcategories**	**weight**
2.1	Reduction of the heat impact in outdoor spaces in summer	0,19
2.2	Reduction of the flushing of rainwater	0,09
2.3	Reduction of the burden of wastewater and graywater treatment	0,09
2.4	Reduction of the burden of solid waste management	0,17
2.5	Reduction of the burden of traffic	0,26
2.6	Effective use of local energy	0,26

Lud 3 ENVIRONMENTAL MANAGEMENT AT LOCAL SCALE		
Code	**Subcategories**	**weight**
3.1	Consideration of global warming	0,25
3.2	Environmentally responsible building management	0,35
3.3	Regional transportation planning	0,15
3.4	Monitoring and management systems	0,25

Table: Lud3 category requirements

Smart City Technology

Maddy Clowse

Introduction

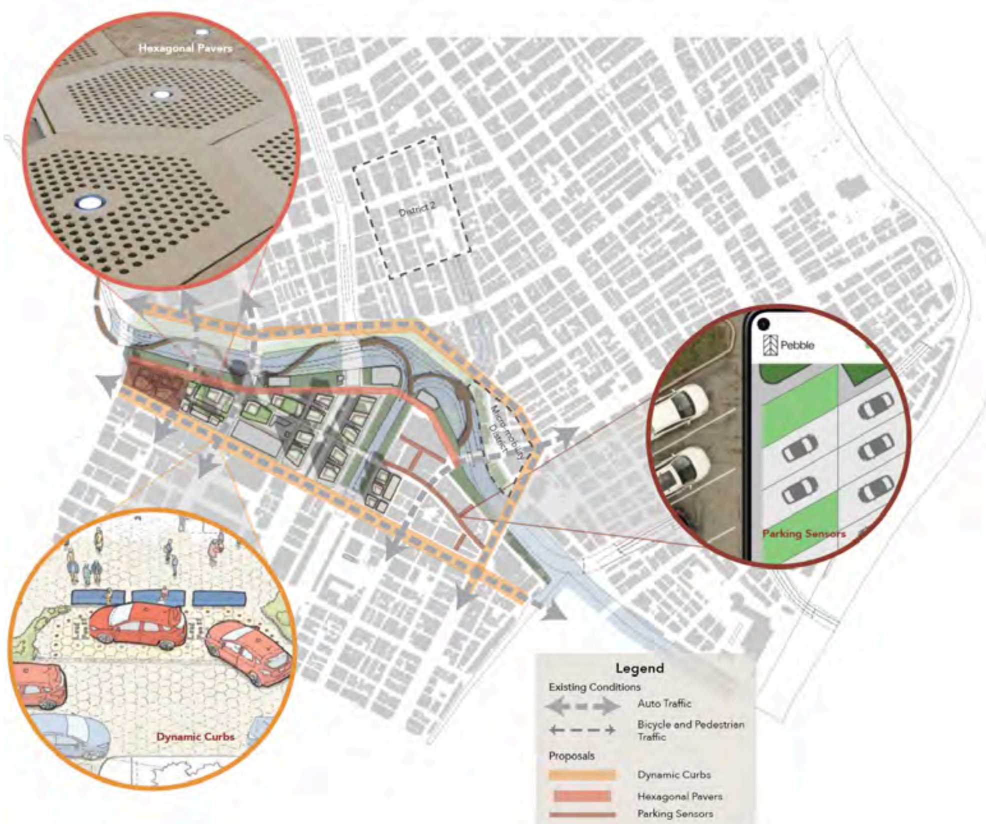
When thinking about Nihonbashi's needs and potential for smart technology implementation, there are many areas in which technology could enhance planning and design. However, because of the district's carbon neutrality and climate resilience goals, targeting transportation improvements and bicycle/pedestrian infrastructure would be the most effective way to use smart technology to encourage less driving and decrease carbon emissions and increase general quality of life. Particularly along the Waterfront proposal, there is emphasis surrounding maintaining the street grid, activating the riverfront, and encouraging pedestrian movement through the area, so this proposal will focus on this district to demonstrate the potential of smart technology.

Smart Technology: Pedestrian Improvements

There have been many improvements via smart technology that impact the experience of the pedestrian. "Smart sidewalks" are a new concept, and they use sensor technology to capture the flow of foot traffic on the sidewalk. This type of data collection is preferred, as it does not require video cameras or any identifiable personal information. Pavegen is a company that developed sidewalk energy generation technology through panels that generate power when a footprint compresses the boards. Each step generates between 2 and 4 joules, which is stored in batteries. Streetlights can also be connected to a smart grid, and sensors can be used to turn them on and off based on the sound of footsteps nearby. They can also be used to surveil traffic patterns, or even connect people to emergency services if needed. This connectivity can also save Nihonbashi energy and money, as street lighting can be up to 40% of a city's energy bills, so this would cause huge cost savings. Finally, smart street crossings were developed by a firm in Poland. Called SmartPass, the system increases safety of pedestrians on the road crossing, by informing approaching vehicles about the presence of pedestrians. Not only does the whole crossing light up when someone approaches, but it alters the surrounding streetlights to stop traffic as someone is trying to cross the street. Here are some examples of areas that each of these improvements could be implemented.

Smart Technology: Transportation

In targeting transportation, smart technology has been used to help with an array of issues, including parking. We hope Nihonbashi will implement car free zones and reduce vehicles on the road, parking will remain a part of the urban fabric for a while. The use of sensors in parking spaces would help streamline the parking process. In Los Angeles, drivers in a 15-block district drove an extra 950,000 miles and produced 730 tons of carbon dioxide in search of parking. In order to quell these emissions, parking sensors would allow users to see where available spots are in real time in Nihonbashi, as well as reserve them. The sensors were introduced through Sidewalk Labs, and they are connected to an app called "Pebble", which shows drivers where spots are available in an area in real time. Specifically, in this proposal we wanted to keep parking at a minimum and focus on other transit options, so parking should largely be underground and on a few arterial roads on the outskirts of the district. Dynamic curbs are another parking and transportation tool. Introduced for the Sidewalk Toronto project with Google, dynamic curbs use lights instead of physical curbs to illustrate the street boundary. These lights can move throughout the street, to widen or narrow the roadway or even make an area pedestrian-only. Dynamic curbs would be a strong tool to begin to lessen Nihonbashi's car use. Finally, through the Sidewalk Toronto proposal, they proposed these hexagonal street pavers, which can be easily removed and reconfigured as demands change. These are installed in tandem with dynamic curb technology. These pavers are typically made of wood for driving, which makes them absorb less heat and allow for drainage. They can also be changed based on use, so they can widen or narrow a road, reserve space for pedestrians, or remove the street altogether. They contain many holes on their surface as well, which allows for easy installation of bike racks, street signs, or even a basketball hoop.



Data Management

At the core of smart technology implementation is data. Smart technology reacts to real-time demands, which means there must be some form of surveillance to understand what those demands are – typically in the form of video cameras, sensors, or mobile phone tracking. This is the most debated piece of smart technology, since using mass surveillance technology can easily cross the line into invasive and open the potential for personal data misuse by companies or governments. Therefore, it is vital to have strong data use and storage policies. Specifically, data should be stored in various locations, so it is decentralized, which would protect mass data exposure if there were to be a hack. Additionally, residents in the smart district should understand in simple terms how their data is being collected, stored, and used. Finally, residents should also be able to use their data and have access to it through the company or government that is storing it. In the future, the district should develop a data management plan, to ensure

Car-Free Districts

Regan Buchanan

Introduction

In response to our goals of carbon-neutrality, covid-preparedness, and climate change action, one of our proposals is enacting car-free districts in specific points of Nihonbashi. To achieve carbon-neutrality specifically, Nihonbashi will have to take a critical look at its use of personal vehicle travel and make significant changes. Car-free districts have many benefits, including an increase in pedestrian and cyclist safety, reduction in air or noise pollution, and improved street aesthetics. In this proposal, we will discuss the history of roads in Nihonbashi, inspirations to go car-free from other global cities, implementation plans, and design proposals.

Nihonbashi Circa 1922

Nihonbashi Circa 1963

History

Nihonbashi is a successful and prominent district in Tokyo for many reasons, but a key piece of its development revolves around the five roads that begin in the district and connect to all distant corners of Japan. In 1604, the Shogunate constructed these five roads, essentially determining Nihonbashi's destiny to be the center of Japan's transportation network. Flash forward to 1922 (in first image above), Nihonbashi's roads were bustling centers of multi-modal transportation featuring transit, pedestrians, and cyclists alike. However, in 1963, in preparation for the Olympics, the five essential roads were turned into to highways for cars. When proposing a car-free Nihonbashi, at first glance it may seem that we are ignoring the district's history of being the center of Japan's transportation because we are suggesting that car travel be limited. It is, in fact, quite the opposite; we are urging a return to and celebration of Nihonbashi's origins by suggesting roads that can be used and enjoyed by everyone. Let's go back to 1922 when the roads were thriving community spaces for exchange and travel.

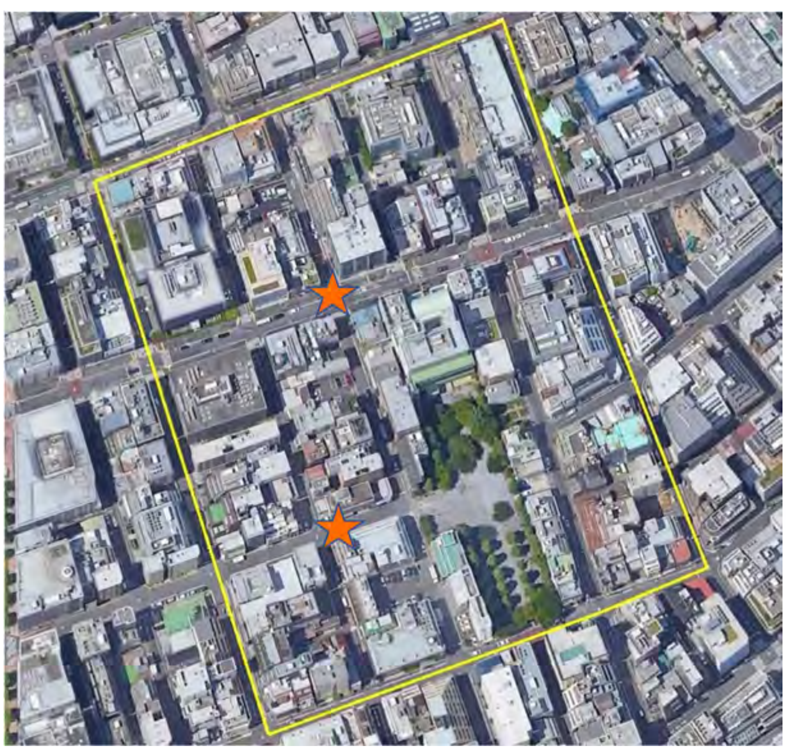
Implementation Plan

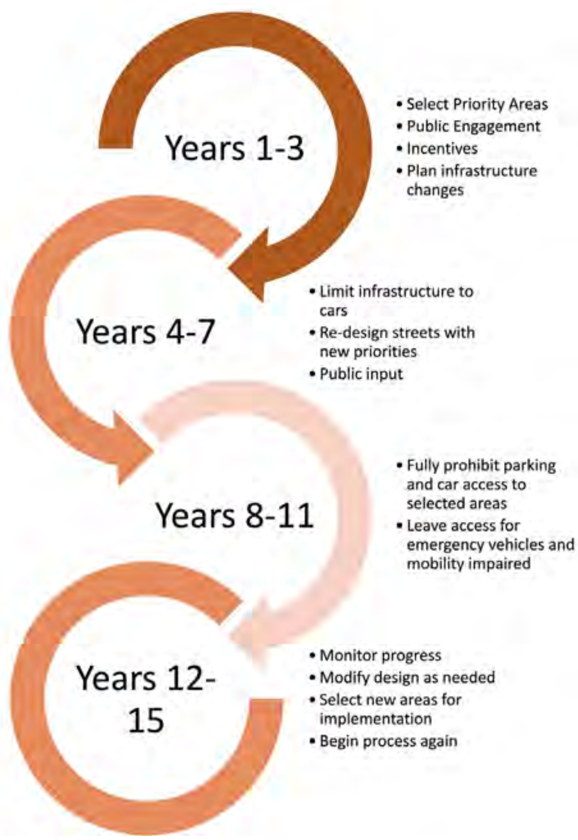
The first step for this project was to research other global cities that are making efforts to go car-free and gather best practices from their work. Many cities are currently attempting to limit or eliminate car traffic entirely, and their efforts can be boiled down to three basic strategies. The first is to encourage residents to be car free. Cities are achieving this mission by hosting community events, raising public awareness, and celebrating multi-modal transportation options. The goal is to get residents excited about the opportunity to reduce their travel in cars. The second strategy is to suggest going car-free. Suggesting is stronger than encouraging, with governments working to reduce street access for cars, reduce parking, or add congestion taxes. In this way, governments are not prohibiting travel in cars, but they are making it more inconvenient and costly to travel this way, which also pushes residents to use other modes. Finally, governments can require a car-free zone. This stage entails fully prohibiting cars on selected spaces and re-designing roads to reflect the new uses. These stages should happen in a procession but can certainly overlap. The goal is to have an incremental approach that allows space for public feedback and support.

After compiling the various strategies from peer cities, we can break the three stages of encourage, suggest, and require into a 15-year plan for implementing a car-free district. Again, the goal is an incrementalist approach with time for reflection, redirection, and public feedback.

Scope of Implementation

In examining architectural proposals for the redevelopment of District 2, it was determined that District 2 would be a suitable candidate for the first car-free district trial. Specifically, the streets in the image below will be the sites for our implementation plans.



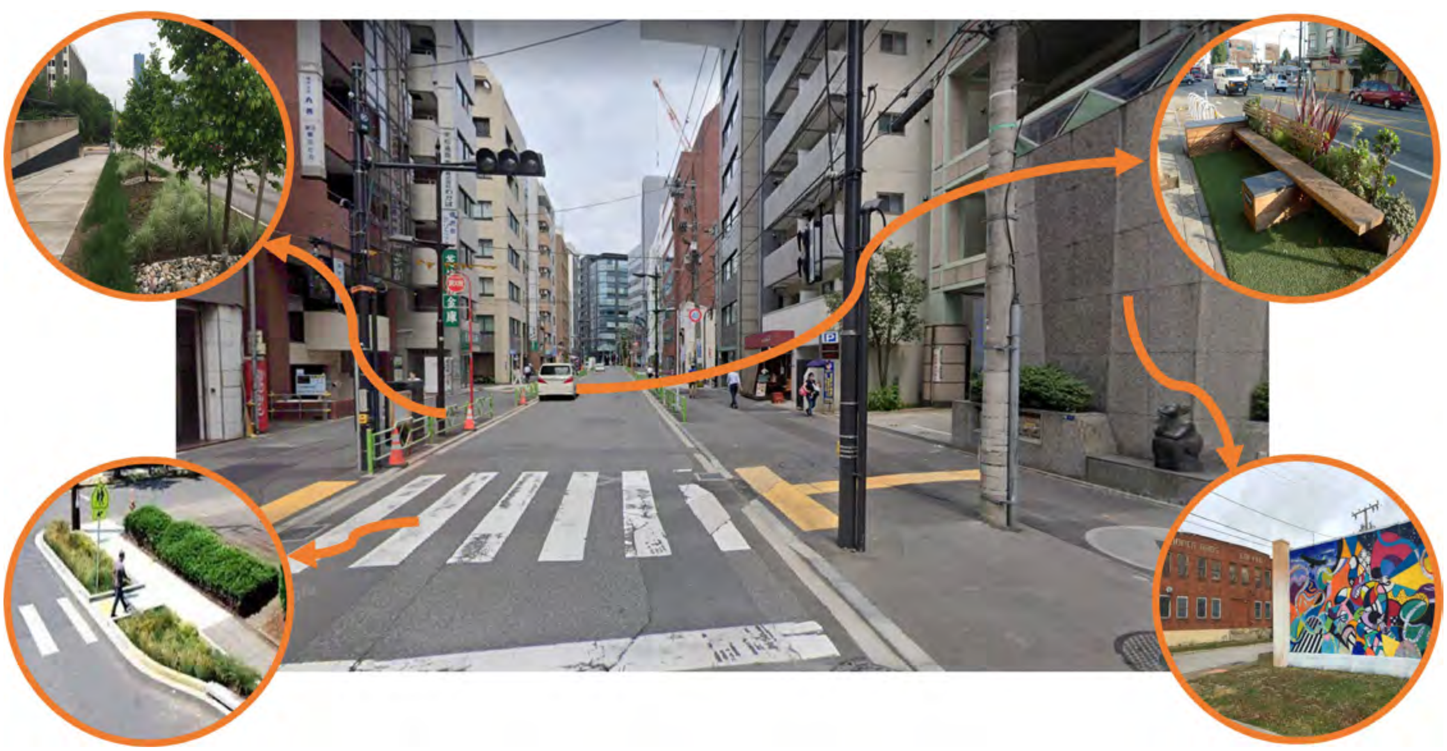


Years 1-3

For the first four years of the project, public awareness and engagement will be the focus of the project. Specifically around the re-design of Horidome Children's Park, community events and listening sessions could be held on the narrow access street and in the park to prepare and excite residents for the incoming changes. The access street is already limited to through traffic, making it a perfect launching point for a car-free district.

Years 4-7

The second phase of the implementation looks at the wider road to the north of the children's park. This road is suitable for the car-free implementation because it is close to green space, it is around a decent amount of mixed uses, and it already has infrastructure that reflects and supports high pedestrian traffic. In this portion of the plan, the street could undergo several aesthetic re-designs to limit car traffic and make the space more amenable to micro-mobility travelers.



Years 8-11

The third phase of the implementation looks at closing the road off to car traffic, except for emergency vehicles and disability services vehicles. To provide for those uses, a lane will remain available, but could be painted green like the renderings below.

Years 12-15

Finally, for the final phase of implementation, there must be time for reflection and public feedback. Upon reflection, successes and failures of the project will be noted for the next car-free implementation area.

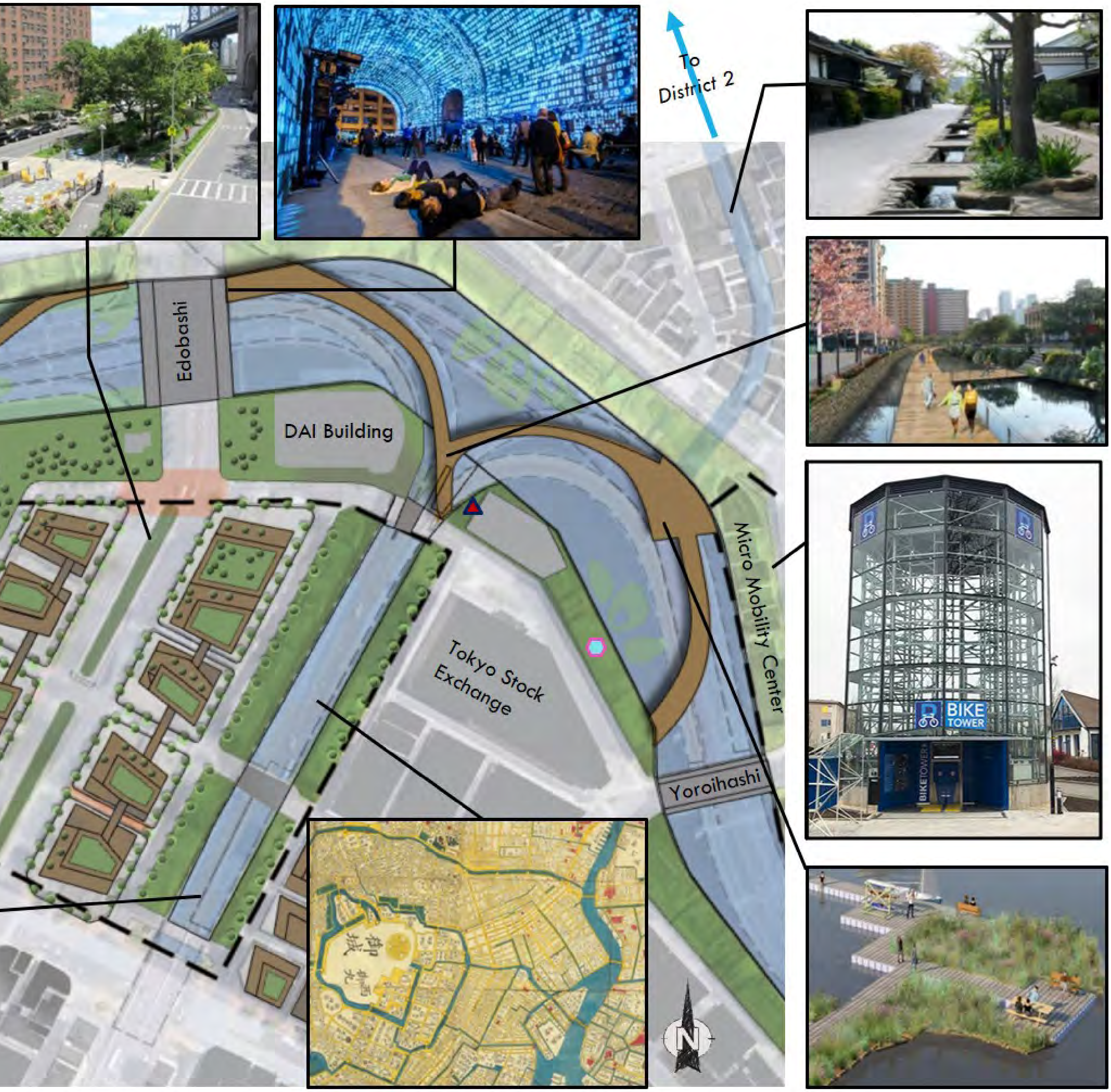
Waterfront Design

Waterfront Redesign

Maggie Nicholson

Since Nihonbashi Bridge is the historical zero-mile post of Japan, our studio's master plan is anchored by this feature and its prominence along the riverfront once the elevated expressway is removed. We aim to bridge Nihonbashi's past and future through cultural-based designs, activation, and programming along this central water course to make the district a leading example in the achievement of Tokyo's 2040 and eSG sustainability goals. We believe that broader access to water can be a driver of systematic social, cultural, and environmental change. There are three guiding elements in this riverfront plan: the recreated canal form, dedicated pedestrian and bicycle paths through green and blue spaces (cultural corridors), and a digital park under the Edo Bridge.

Base map credit: S. Conshafter.


To District 2
Edobashi
DAI Building
Tokyo Stock Exchange
Micro Mobility Center
Yoroihashi
BIKE TOWER

Recreated Canal Form

As an island nation, Japan has depended on the ocean for prosperity, yet it also lives in opposition to its powerful forces. In a civic sense, the larger relevance of water – the good and the bad - has been lost, blocked from view and out of reach with seawalls and flood gates, capped and buried underground, or pushed further away with landfill in Tokyo Bay. The elevated Metropolitan Expressway within Nihonbashi contributed to this disconnect. Its construction filled several historic canals and has hidden the Nihonbashi River from view for nearly 60 years. Upon its removal, waterfront placemaking will be key to reconnecting citizens with these blue spaces and to the heritage of the district. In today's "experience economy", cities must orchestrate memorable events for their citizens, so that memory itself becomes the part of their urban experience. Emotional and biophilic connections are re-established in Nihonbashi through the revitalization of its canals and rivers, their flows to greater Tokyo Bay, and their evolving role in a future water world.

Nihonbashi's historic canal form is culturally valuable in its usage of oku, or the inner-outer dichotomy of traditional Japanese space. This theory was popularized by Japanese architect Fumihiko Maki and insinuates more private and intimate uses and feelings for inner spaces compared to outer spaces. This is seen in the rings of canals surrounding Edo Castle as well as Tokyo's street hierarchy. The theory has both spatial and psychological configurations, which have the power to restore the balance between Nihonbashi's built environment and natural elements as well as its role within greater Tokyo.

Map of Nihonbashi from 1863

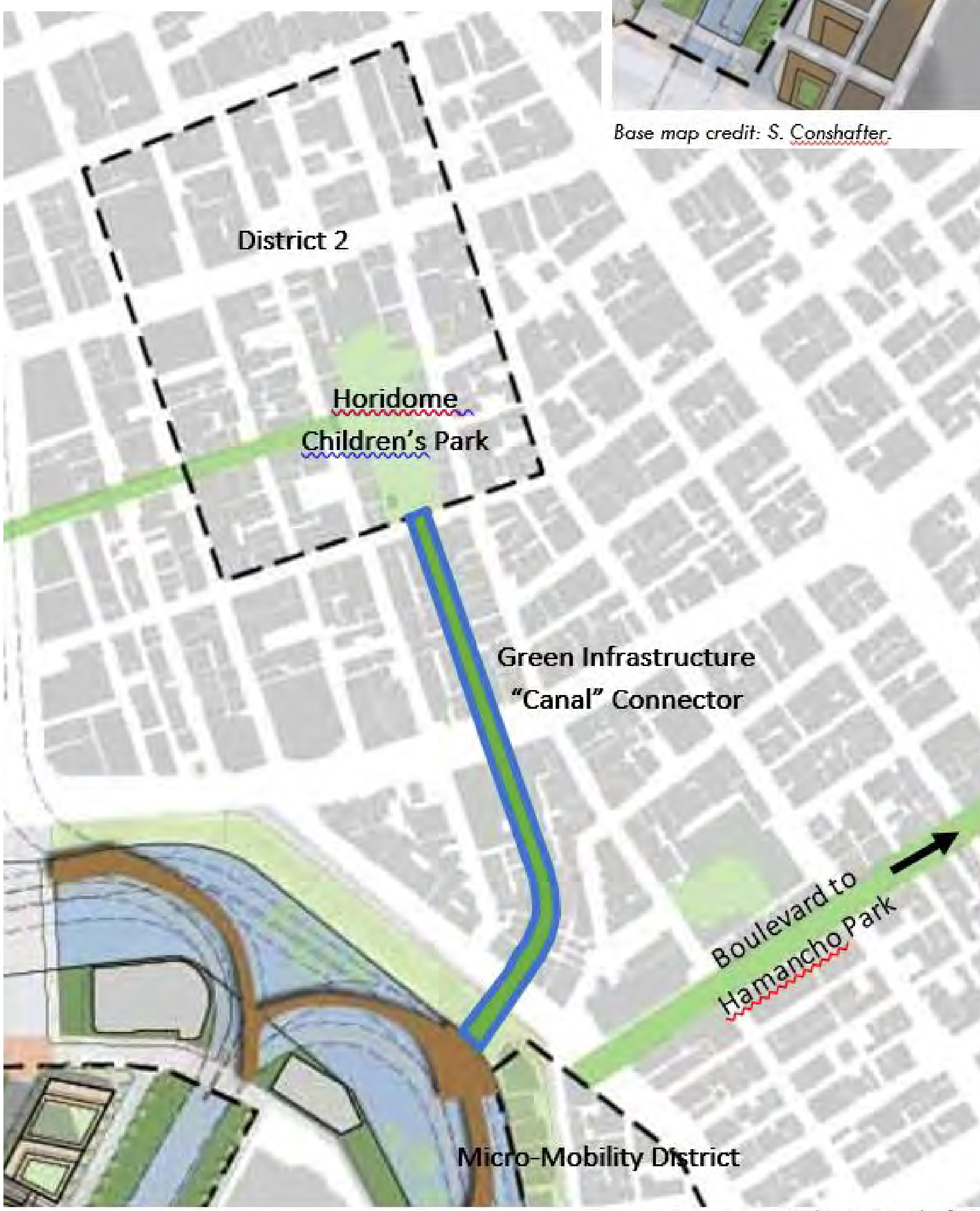
A large canal perpendicular to the river's south bank is targeted for daylighting in our plan. This will inject blue and green space into Nihonbashi's commercial heat island core. Should surrounding office buildings be converted to residential units, future residents will now have nearby access to recreation and beautiful canal scenes. This canal is also large enough to support water taxis, thereby expanding river transit and enhancing a historic transportation network for a sustainable future city.

While the presence of water is important in this design strategy, it can take a variety of forms. For example, the "canal" connection between the riverfront's north bank and District 2 is just wider than a vehicle. Instead of recreating an actual canal here, the historic form can be mimicked with a car-free zone lined with green infrastructure and vertical greening. The green infrastructure can retain stormwater, making temporary water features before infiltration. This human-scale experiential path amplifies the intimacy found in traditional Tokyo alleyways while working with the space constraints.

Base map credit: S. Conshafter.

Above: South Bank Canal

Left: District Two "canal" connector of green infrastructure



Base map credit: S. Conshafter.

Green Cultural Corridors

Tokyo's eSG goals prioritize human-centered, walkable spaces surrounded by greenery and water rich in biodiversity. Our green cultural corridors strategy does just this. Using elevated boardwalks, a system of pedestrian and bicycle paths weaves over water and through new linear riverfront parks. The new greenspaces remove impervious surface cover, creating infiltration opportunities that address both upstream (watershed) and downstream (Tokyo Bay and storm surge) water threats. Many historic buildings, landmarks, and shrines are located near the riverfront and the boardwalk-path system supports connectivity between all. It is anchored on each end by micro-mobility hubs – the existing Tokiwabashi bicycle parking hub and a newly proposed micro-mobility district near the Koamicho Children's Park.

A broader network of boulevards can also be incrementally introduced building off the boardwalk form. Strategic routes for this strategy include:

1. Amazakeyokocho Street to connect Hamancho Park to the Nihonbashi riverfront.

2. Eitai-dori Avenue from the Tokyo Station tracks to the Kamejima River. This avenue is where the renewed canal ends, so it would be a strong intersection.

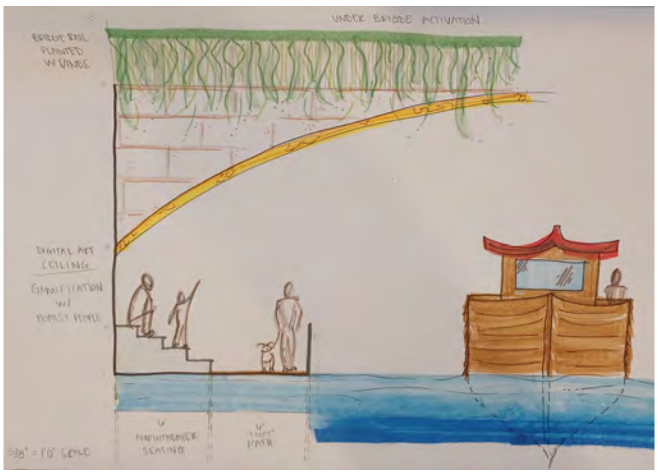
3. The approach to and over the Edo Bridge.

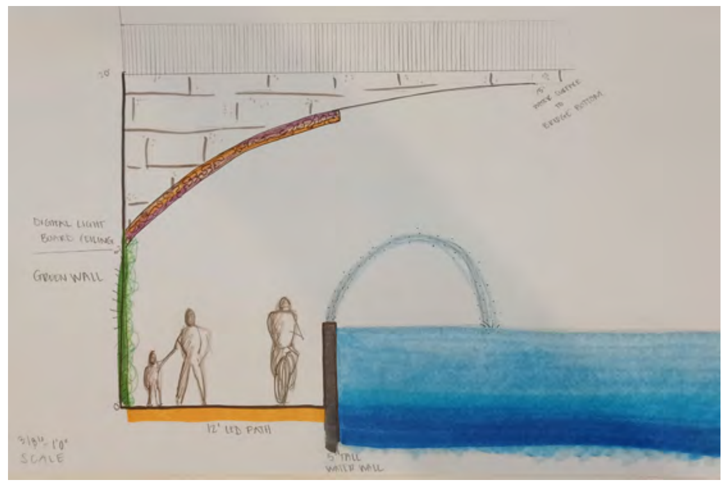
Cultural experiences and public art must be integrated along these cultural corridors to create stimulating visual interest. A unique cultural facet of the over water boardwalk component is the utilization of existing expressway pillars. This is a cost-savings measure as well as a wabi-sabi outlook on a hard urban lesson learned – vehicle prioritization is no longer considered progress; riverfront revitalization is. Further cost savings can be achieved over the long-term if kinetic pavers are used for boardwalk construction, which harnesses the power of a footstep to generate off-grid electricity. Perhaps to power the digital displays in our next riverfront strategy.

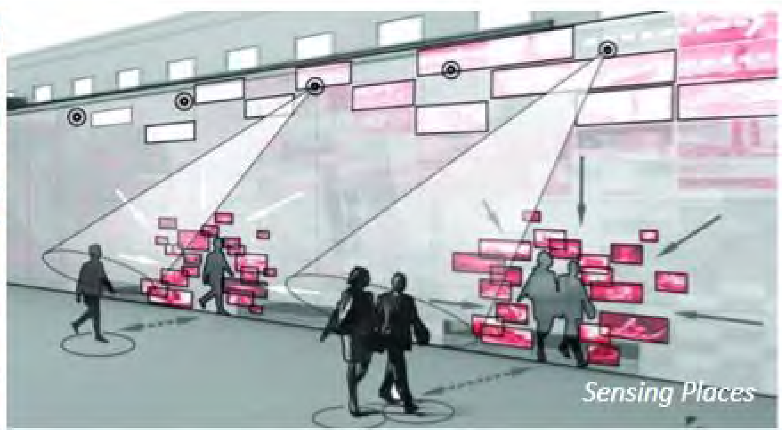
Base map credit: S. Conshafter.

Digital Park Under Edo Bridge

This detail of the master plan restores a lost connection to the water of the Nihonbashi River. Targeting the Edo Bridge because of its proximity to the historic Nihonbashi Bridge, this under-bridge placemaking strategy reconciles old with new, history with modernity; it plays on the themes of above-below, inner-outer, memory-imagination, tactile-ephemeral, and technological-natural spaces. The green cultural corridor boardwalks deliver users under the bridge and close to the water's surface. Virtual reality ceilings and walls create engagement space, literally plugging passersby into Nihonbashi's evolving story. Pedestrians, water taxi riders, and bicyclists can experience themselves along the river during the traditional Edo Period and imagine futuristic Nihonbashi. These digital tools can also impart local historical facts, share best practices individuals can implement to do their part to help Tokyo achieve its 2040 and eSG sustainability goals, provide wayfinding for tourists, and support a city-wide emergency notification system.







Alternative Timelines: Vertical Forest | Historic Grid

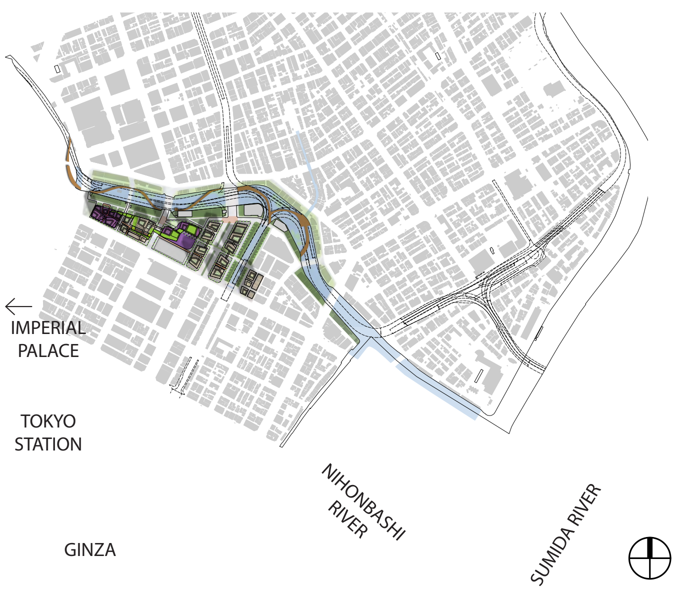
Nihonbashi is the historic center of Tokyo and the "kilometer zero" point for all of Japan. Though the area has seen massive changes over time, in terms of war and redevelopment, it largely retains a grid of streets and alleys that recall the Edo-era architectural fabric. Though presented with positive changes, such as the removal of the Nihonbashi expressway, the neighborhood faces challenges in the form of redevelopment, COVID lifestyle changes, demographics, and climate change. New development underway is increasingly subsuming the historic street grid, replacing it with massive office towers. Such development is "business as usual" in a world that desperately requires new thinking.

There could have been another way.

I propose an alternative timeline where Nihonbashi is redeveloped in a manner that preserves the historic street networks, captures and negates carbon emissions, and creates a livable neighborhood for the people of Tokyo. Hybrid timber towers are already under development in Tokyo and offer a strategy to capture carbon, while integrating the district with other sustainable strategies. Thinner, residential towers, integrated into pedestrian alleys and parks, can add street life and residents to this waterfront district. Office and commercial space can be integrated into the podiums and also withing "work-from-home" spaces within the towers.

Nihonbashi and Japan deserve a new way of thinking to address the challenges that lie ahead in a rapidly changing world.

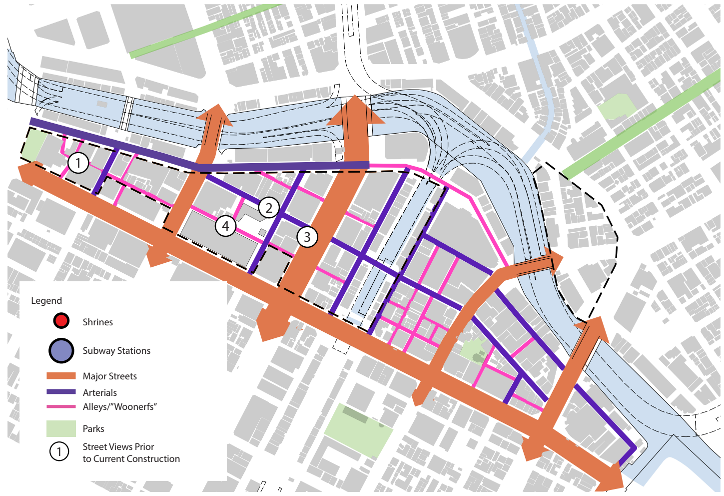
SITE CONTEXT: NIHONBASHI



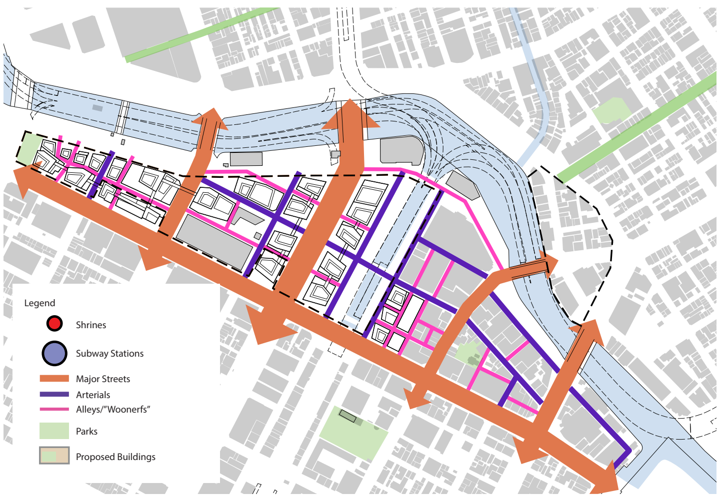
NIHONBASHI STREET AT THE INTERSECTION OF HONSHIROGANE-CHŌ STREET (CA. 1805). SOURCE: MUSEUM OF EAST ASIAN ART, IDENT.NR. 2002-17.

History & Proposed Plans:

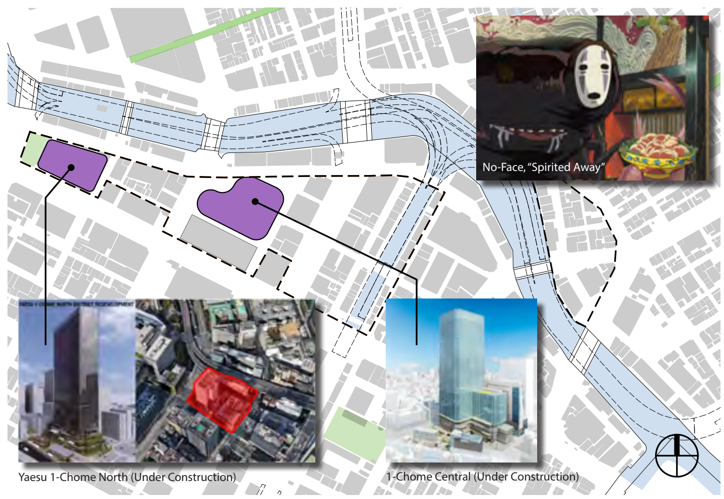
Historic Grid: Retained for Centuries (1892 Map)



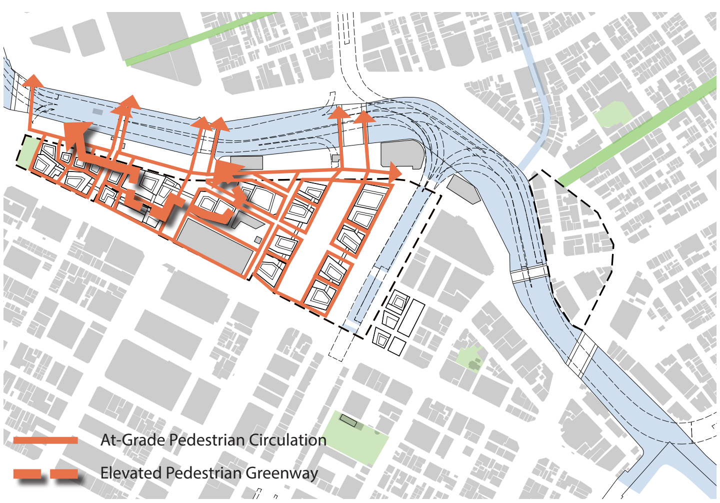
Existing Conditions: A Network of Historic Alleyways



Proposed Plan: Save the Grid!



Current Timeline: Consuming the Grid



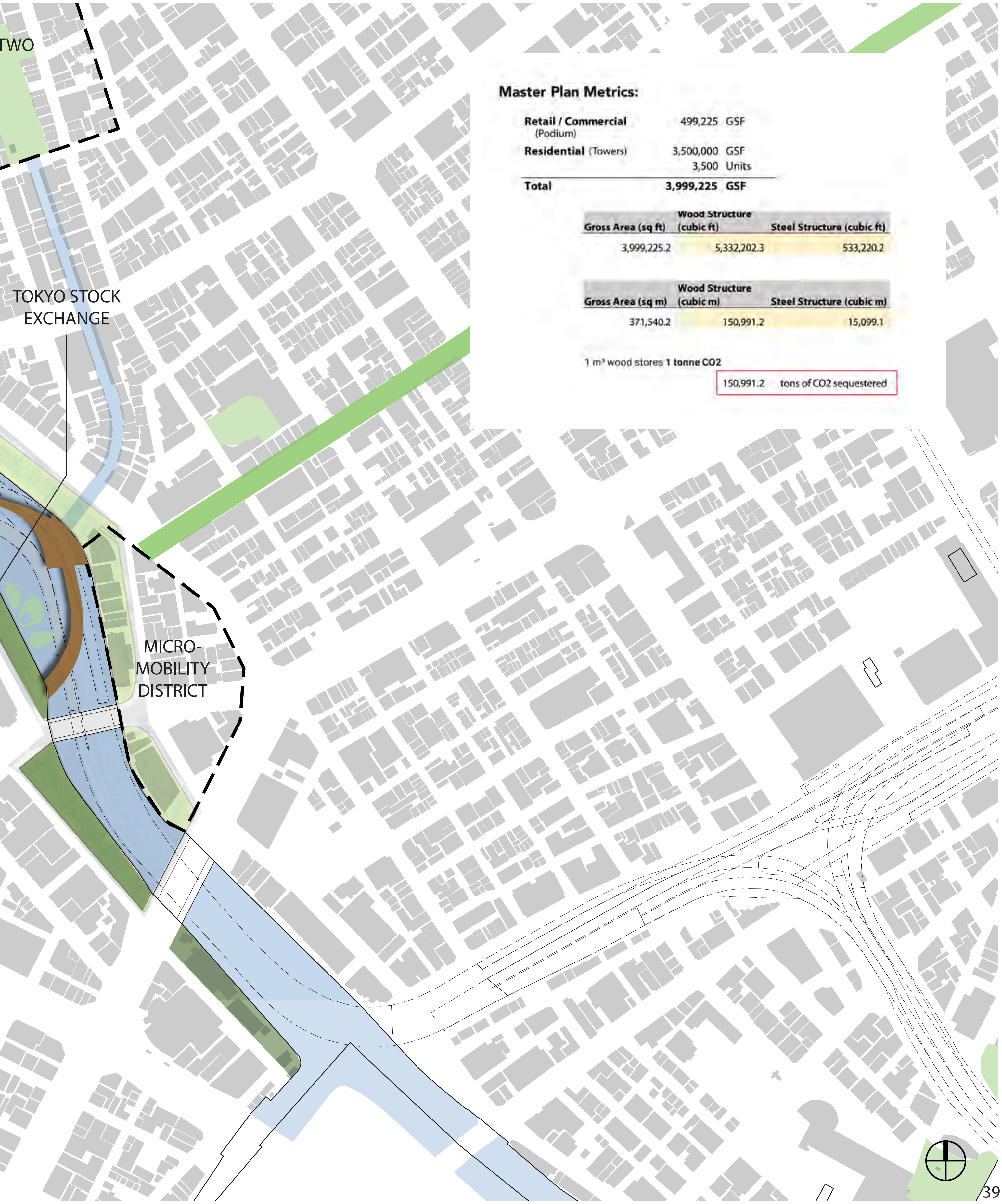
Pedestrian Realm: Multiple Levels

FAR / Density: Thinner Timber Towers

Vanished: In Memoriam of a Historic Grid

The above images from Google Earth Street View show pictures of historic alleyways (and their businesses). These alleyways are now gone - under construction for new office-focused mega-development has wiped away these historic streets. The streets are the only memory of this historic center of Japan. Real estate owners should understand the importance of being a steward for the area - they should preserve the historic grid, the soul of Nihonbashi, and develop buildings that respect history while building in a more sustainable manner.

ILLUSTRATIVE SITE PLAN: PROTECT THE SOUL OF NIHONBASHI & THE FUTURE OF THE PLANET



Master Plan Metrics:

Retail / Commercial (Podium)	499,225	GSF
Residential (Towers)	3,500,000	GSF
	3,500	Units
Total	**3,999,225**	**GSF**

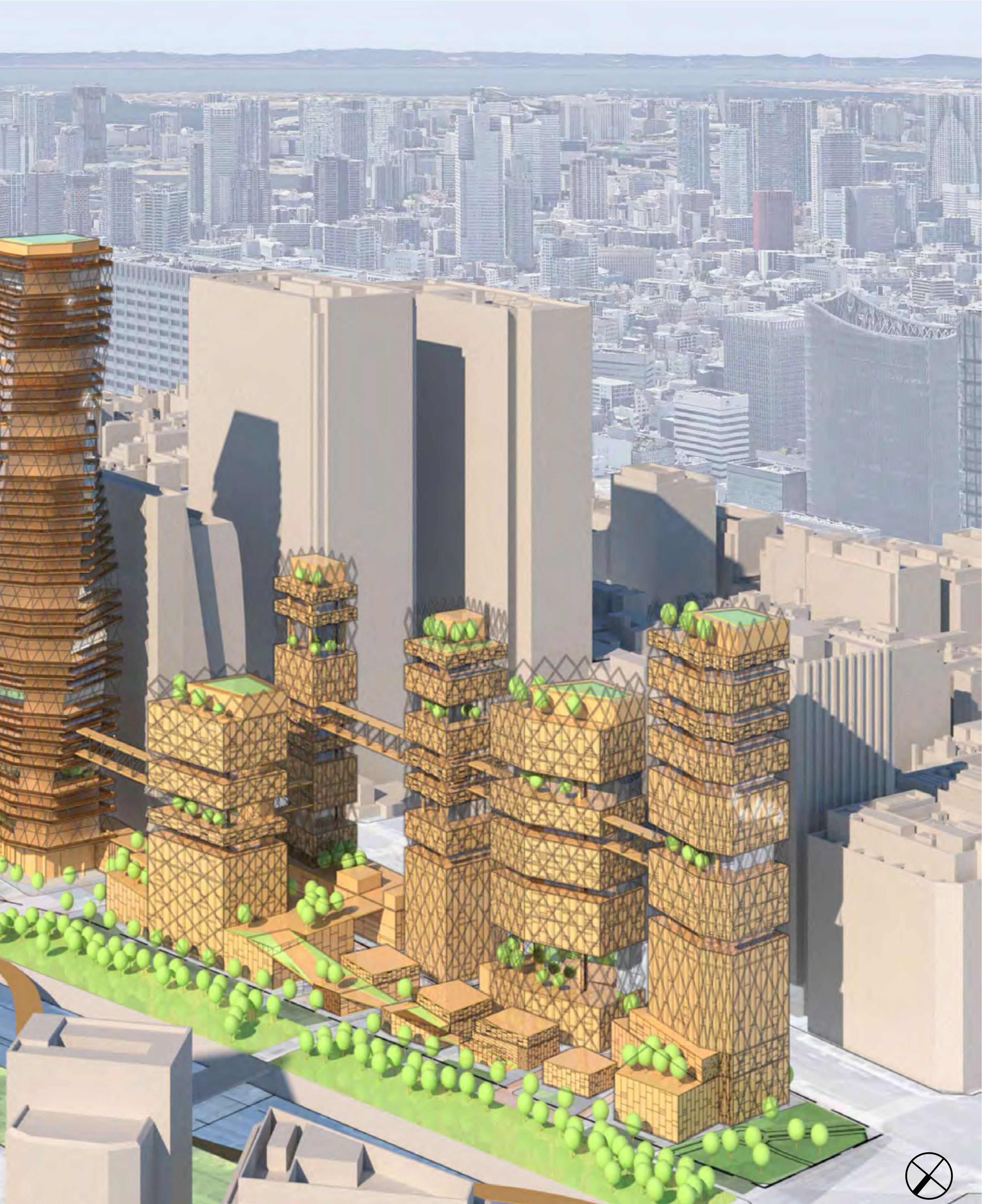
Gross Area (sq ft)	Wood Structure (cubic ft)	Steel Structure (cubic ft)
3,999,225.2	5,332,202.3	533,220.2

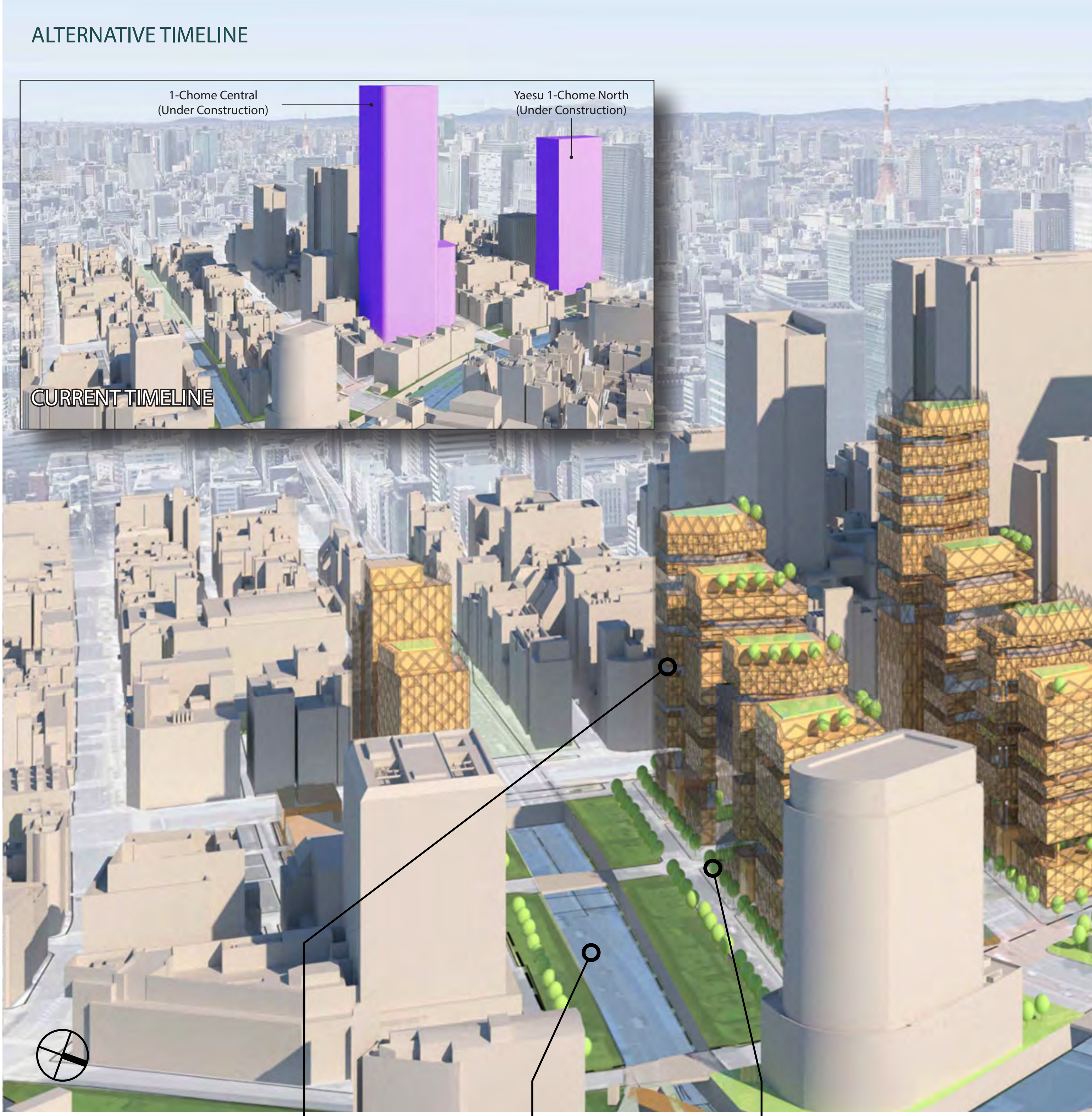
Gross Area (sq m)	Wood Structure (cubic m)	Steel Structure (cubic m)
371,540.2	150,991.2	15,099.1

1 m^3 wood stores **1 tonne CO2**

150,991.2 tons of CO2 sequestered


ALTERNATIVE TIMELINE
1-Chome Central
(Under Construction)
Yaesu 1-Chome North
(Under Construction)
CURRENT TIMELINE
NIHONBASHI
BRIDGE





Master Plan Strategies:

BUILDING AIRFLOW

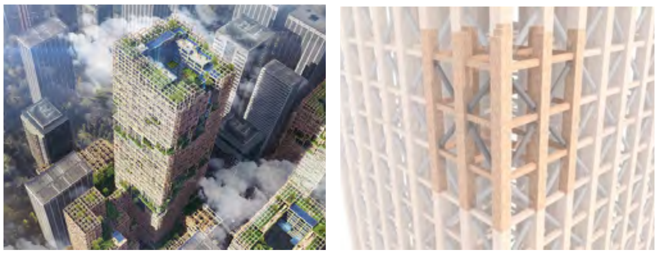
HISTORIC CANALS

HISTORIC GRID


NIHONBASHI BRIDGE
DAYLIGHTING THE RIVER
RIVERFRONT EXPERIENCES
PUBLIC SPACES / PROMENADE
HYBRID TIMBER TOWERS

Architectural Strategies for an Alternative Future:

1 REDUCE & SEQUESTER



W350 Project - by Nikken Sekkei
9:1 ratio of wood to steel

Mitsui Fudosan and Takenaka Corporation's 17-story, 280,000 GSF hybrid mass timber building

Kengo Kuma mass timber residential building

2 REUSE & RESTORE

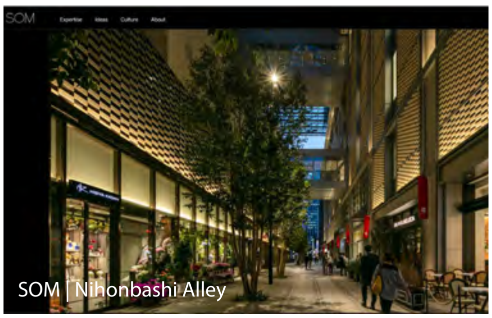
The Edith Green-Wendell Wyatt (EGWW) Federal Building

Sydney, 3XN's 50-story Quay Quarter Tower (1) incorporates a 45-story 1970s office tower (2)

Restore waterfront, provide new permeable open spaces and new waterfront habitats (Copenhagen Floating Islands / Marshall Blecher Studio Fokstrot)

③ REMEMBER


Sino-Ocean Taikoo Li Chengdu | Oval Partnership


SOM | Nihonbashi Alley


Henning Larsen | Toronto

New development should retain the historic block and alley structure of Nihonbashi; allowing for historic businesses to occupy space in new buildings - and providing a pedestrian-friendly experience

Urban Modeling

Urban Performance Modeling

Olivia Wineski

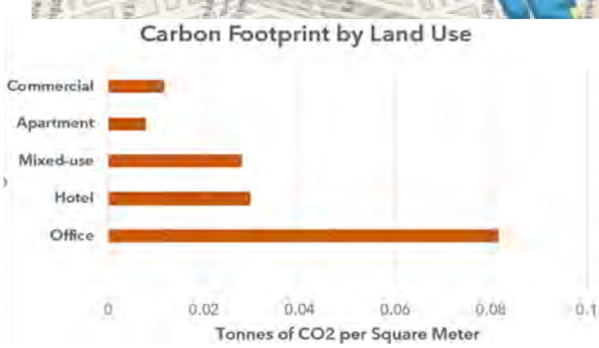
Project Overview

This project is meant to increase resiliency within the district of Nihonbashi in the face of climate change and the COVID-19 pandemic by harnessing the use of smart technologies to analyze the performance of potential redevelopment projects that will further Tokyo's pursuit of carbon neutrality.

With Tokyo's goal of carbon neutrality in mind, this project attempted to understand what factors influence the performance of a development and the potential impacts it will have on its surrounding environment. By utilizing smart technologies to create metrics based on the development's land use patterns, the waterfront performance analysis was able to identify how occupant behavior influences the resiliency of a building and its surrounding area in the face of a warming climate.

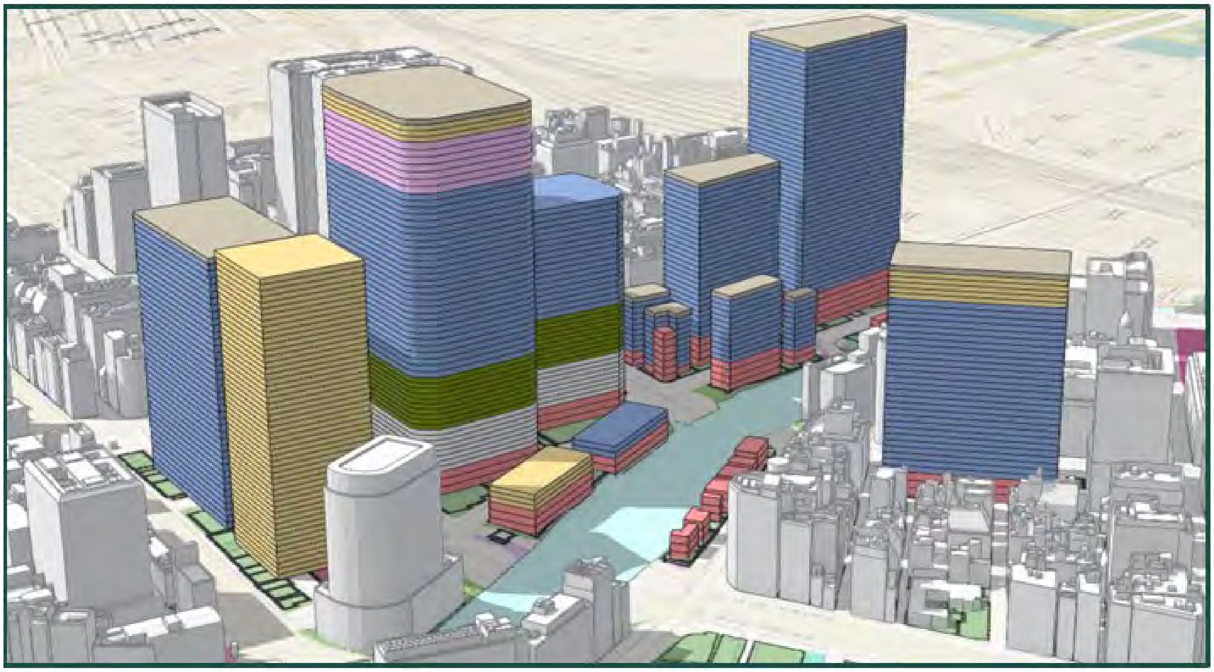
Using an application within the ESRI products called ArcUrban, build outs of the Georgia Tech and Mitsui Fudosan waterfront development proposals were created to understand how their respective land uses would interact with a waterfront that will be activated after the interstate removal. The metrics each build out created provide a better understanding of the efficiency of each proposal and serve as a guide for future developers when considering which land uses most align with Tokyo's goal of carbon neutrality and climate resiliency.

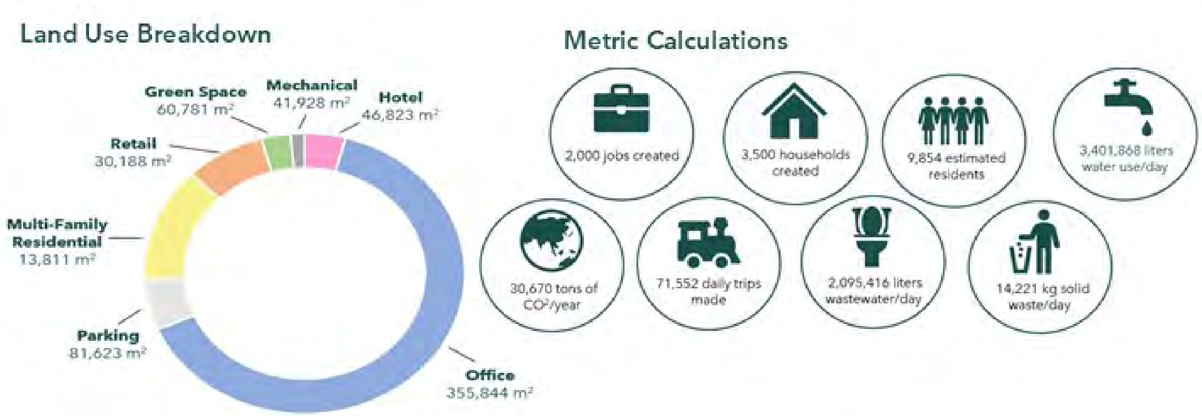
Before the build outs of each proposal was created, establishing an understanding on how occupant behavior and land use impacts the carbon footprint of a building was important.



General observations show that most of Nihonbashi's carbon emissions occur along the waterfront and in District One, which is made up predominantly of office buildings. A breakdown of what land use is responsible for the most CO2 per square meter show that office buildings are the largest contributor at almost .09 tonnes of CO2 per square meter. This is mainly contributed to the fact that most office buildings have data sectors that must be maintained at a certain temperature to prevent overheating or energy failure. This, in addition to the general energy demands that come with maintaining an office building make the carbon footprint of office buildings much larger compared to other building uses (IPCC, 2014)

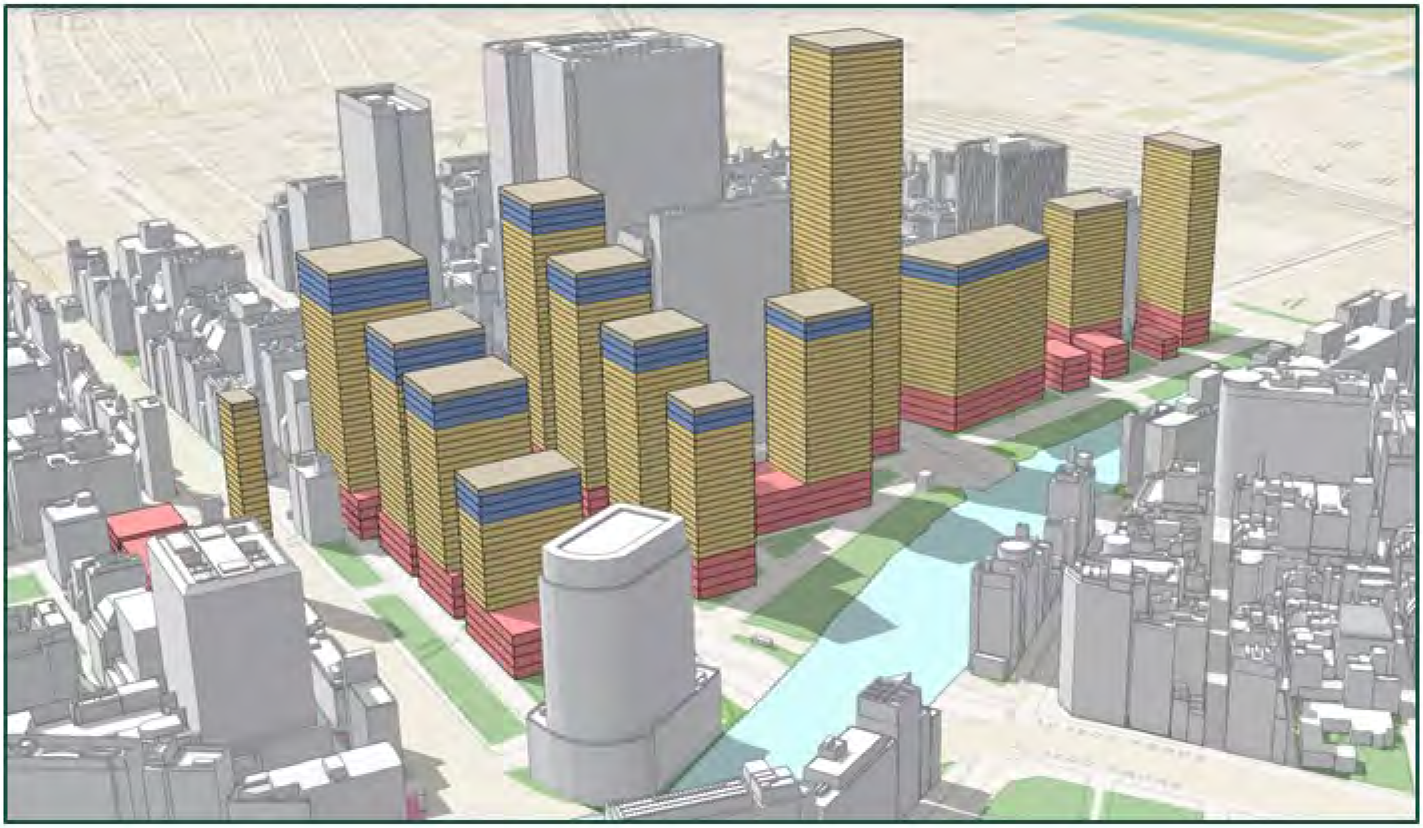
With clear indications and research showing the correlation between building use and carbon footprints, COVID-19 represented a rare opportunity to capitalize on changing work environments to reshape the built environment as it shifted away from a high demand for traditional workspaces. Additionally, with Tokyo's goal of reaching net carbon net neutrality by 2050, massive changes would need to be made to the infrastructure of Tokyo to reach this goal.

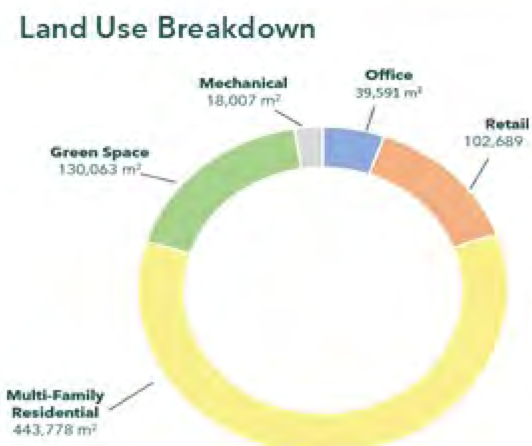


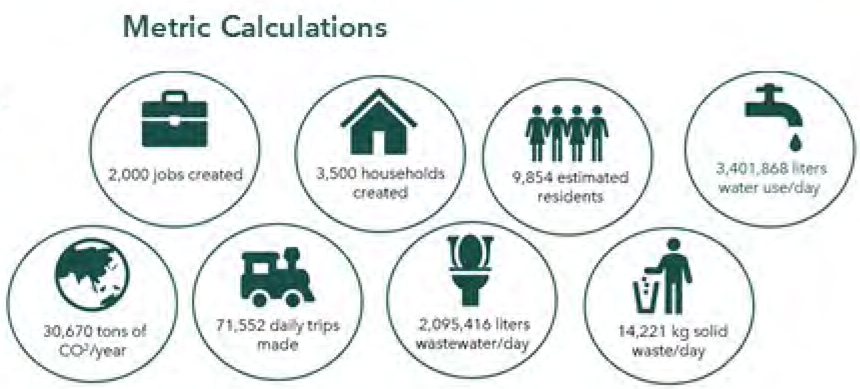


Mitsui Fudosan Proposal

With their proposal being developed prior to the pandemic, the Mitsui redevelopment proposal does not consider a decreased need for traditional office space as telecommuting becomes more prominent. With the vast majority of the Mitsui proposal comprised of office buildings, it is likely that much of this space will be severely underutilized. Furthermore, the carbon emissions associated with its main building use do not align with Tokyo's carbon net neutrality goal of 2050. While their plan does incorporate a fair amount of green space creation that coincides with the activation of the waterfront, most of this green space is comprised in the form of outdoor terraces within the office buildings, which severely limits the accessibility of these green spaces to residents who don't work in the office buildings.







Georgia Tech Proposal

The Georgia Tech proposal presents a stark contrast to the Mitsui proposal. Georgia Tech proposal recognizes the shift in the need for traditional workspaces due to COVID and instead incorporates mostly mixed-used developments that create a livable city center. As shown earlier, mixed-use developments have a much lower carbon footprint than office buildings, which will help contribute to Tokyo's carbon neutrality goals while also revitalizing the waterfront in ways that strictly office buildings could not. By incorporating more green space along the river rather than in courtyards inside the buildings, Georgia Tech's plan makes green space much more accessible and enjoyable for all residents and visitors. This plan also recognizes Nihonbashi's history as a business district by maintaining office space within each of the buildings, just not to the same degree as the Mitsui proposal. Compared to the Mitsui plan, the much smaller floorplates of the Georgia Tech plan allow for much greater access to natural light, which will significantly lower energy demands for the district. The smaller floorplans of the Georgia Tech proposal will also allow Nihonbashi to retrofit these spaces back into office buildings much easier than a larger floor plan should the work force transition back to mainly in person.

	Jobs Created	Households Created	Estimated Residents	L of Water Used/Day	Tons of CO^2/Yr	Daily Trips Made	L of Waste Water/Day	Kg of Solid Waste/Day
Georgia Tech	2,000	3,500	9,854	3,401,868	30,670	71,552	2,095,416	14,221
Mitsui	27,500	2,500	4,367	4,772,525	84,995	138,368	2,940,185	24,253

ArcUrban Metrics

With the build out of each proposal within ArcUrban, several metrics are created that allow for a greater understanding of the proposal performance. These metrics are created based off a formula built into ArcUrban that is based on the respective building use, total populations, and net area of each building. Each of these metrics provides a comparative analysis into the impacts each proposal will impose on its surrounding environment. The four metrics of interest in this study were jobs created, estimated residents, tons of CO2 emitted per year, and the daily trips made. The Georgia Tech proposal accounts for more than double the number of estimated residents as compared to the Mitsui proposal. This number is mainly due to the higher number of mixed-residential units in the Tech proposal compared to Mitsui's.

However, despite accounting for twice the estimated number of residents, the Tech proposal will only emit almost a third of Mitsui's total carbon emissions per year. This metric relates to the differences between office and mix-used buildings and their respective carbon emissions per square meter. Tech's plan, which is predominantly mixed-use developments, would help to drastically lower Nihonbashi's total carbon footprint if implemented.

The second metric worth pointing out is the jobs created and the stark differences between the two proposals. A limitation of ArcUrban is that it cannot account for remote work, only work that is present in the office. So while it may look like Georgia Tech's proposal will take away jobs from the business district of Nihonbashi, this is not actually the case. It is likely that the Georgia Tech proposal will maintain the same number of jobs that exist already within the district, but most of those jobs will be through a work-from-home situation and thus will not take up office space within the waterfront district.

The last metric to highlight is the daily trips made into the waterfront district for each respective proposal. As you can see the Georgia Tech proposal is almost half of the daily number of trips compared to the Mitsui proposal. This can be contributed to the fact that mixed-use building developments will reduce massive commuting flows into the district that will have a two-fold impact—one being that it will reduce overall emissions and the second being that less traffic within the district will reduce air pollution produced by vehicular traffic that will improve overall quality of life for residents within the area.

Conclusion

The results of this performance and energy analysis are meant to serve as recommendations for future redevelopers to incorporate more mixed-use developments and alternative energy sources into Nihonbashi as revitalization projects continue throughout the district. As we have shown, the benefits of mixed-use developments are two-fold – 1) mixed-use developments will increase density of activity patterns throughout Nihonbashi by changing land use patterns; and 2) will decrease overall carbon emissions throughout Nihonbashi due to lower energy demands associated with mixed-use developments compared to office buildings.

Waterfront Energy Modeling

Natalie Manitius

Urban Energy Overview

As we know, cities are high consumers of energy. Cities house 50% of the world's population by are responsible for 75% of the global energy demand (UNEP, n.d.) . However, although cities are such high consumers, the per capita energy demand of urban areas is often lower than rural areas due to concentrations of populations and infrastructure. In fact, Tokyo's per capita energy demand is lower than many of the world's other global cities. This is largely in part to the high population density. Other factors also influence urban energy demand including building design, material and use, urban form, transportation networks, and infrastructure networks. Redevelopment opportunities, like in Nihonbashi, create opportunity to reduce energy demand through design.

Waterfront Energy Modeling

The goal of this analysis was to compare the energy demand of three different scenarios: the existing buildings, the Mitsui Fudosan proposal, and the Georgia Tech proposal. Examining the results will provide insights into how demand varies based on building use, and can inform energy supply planning and policies for Nihonbashi.

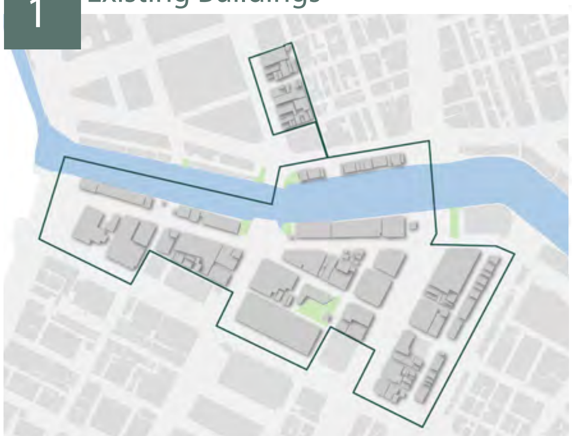
In order to model energy demand, we used Japanese data on annual electricity demand by building use, provided by Dr. Yoshida at the University of Tokyo.

Japanese Electricity Demand by Use

	Office(std)	Office (w/ OA)	Hospital	Hotel	Shop	Sports Facility	Residence
Electricity Demand (kWh/m^2y)	156	189	170	200	226	250	21

Three Scenarios

1 Existing Buildings



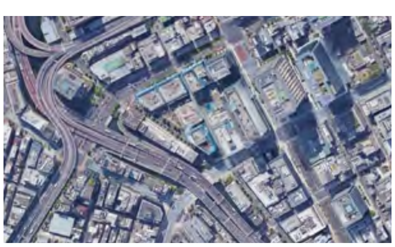
Existing Buildings

Use	Floor Area (square meters)	Percent of Total Floor Area	Electricity Demand (kWh/y)	Percent of Electricity Demand
Residential	14,165	3%	297,463	0.43%
Office	360,542	84%	56,244,514	82%
Commercial	52,916	12%	11,958,929	17%
Hotel	-	0%	-	0%
Total	427,622	100%	68,500,906	100%

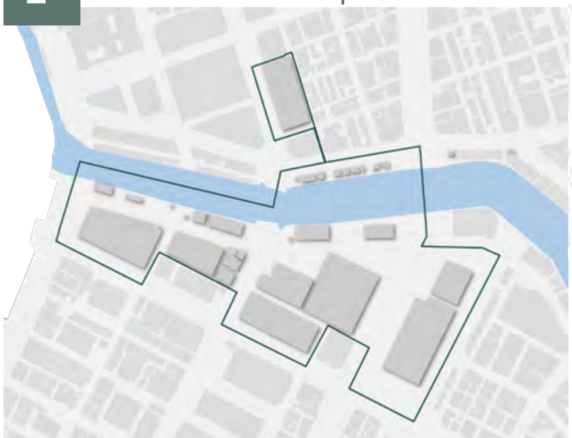
Annual Electricity Demand Per Square Meter:

160 KWh/m²

The existing buildings have a high floor area of office space, which comprises 84% of the total floor area. This is reflected in the high percentage of energy demand driven by office space.



2 Mitsui Fudosan Proposal



Mitsui Fudosan Proposal				
Use	Floor Area (square meters)	Percent of Total Floor Area	Electricity Demand (kWh/y)	Percent of Electricity Demand
Residential	13,811	3%	290,035	0.40%
Office	355,844	79%	55,511,604	77%
Commercial	30,188	7%	6,822,466	9%
Hotel	46,823	10%	9,364,548	13%
Total	447,729	100%	71,988,654	100%

Annual Electricity Demand Per Square Meter:

161 KWh/m²

The Mitsui Fudosan proposal is very similar to the existing conditions and can be considered a continuation of a "business-as-usual" mentality. Office space, an energy intensive use, remains a significant percentage of the proposed land use. The annual electricity demand per square meter remains consistent with the energy use of existing buildings. The proposal is not effective in lowering energy demand.

This proposal was developed before the Covid-19 pandemic, which has drastically impacted central business districts and the demand for office space. Demand is declining, and concerns of an oversupply of office space in Tokyo have been circling for years. This, in combination with the energy intensive demand of office space, would suggest that Mitsui Fudosan should reconsider its high reliance on offices in its development.

3 Georgia Tech Proposal

GA Tech Proposal				
Use	Floor Area (square meters)	Percent of Total Floor Area	Electricity Demand (kWh/y)	Percent of Electricity Demand
Residential	443,778	76%	9,319,329	24%
Office	39,591	7%	6,176,232	16%
Commercial	102,689	18%	23,207,748	60%
Hotel	-	0%	-	0%
Total	586,058	100%	38,703,309	100%

Annual Electricity Demand Per Square Meter:

66 KWh/m²

The Georgia Tech proposal uses 59% less electricity demand per square meter than Mitsui Fudosan's proposal. Georgia Tech's proposal has more floor are than both other scenarios but requires drastically less energy. Land use affects energy demand. Mixed-use and increased residential space can lower energy demand, as shown through this proposal.

Beyond lower energy demand, mixed-use spaces also increase resilience to shocks like the pandemic, by maintaining a high residential base. They also work to create more livable spaces in the center of cities like Tokyo.

District Energy for Carbon Reduction

Natalie Manitius

The comprehensive redevelopment of the waterfront presents an opportunity to develop a district wide micro-grid that will contribute to energy resilience and emissions reduction goals. Locally produced energy will be able to provide a stable supply of energy through distributed co-generation systems and solar panels. A sustained connection to the Tokyo grid will be able to supply supplemental power. The district energy system will drastically reduce emissions through efficiency improvements and the incorporation of renewable energy. Further efforts to decrease energy demand, improve efficiencies, and create power storage through design and amenities will support the district in achieving carbon neutrality.

Proposed Energy Supply

Energy	Percentage	Annual kwH
Grid	15%	5,805,496
Solar	15%	5,805,496
Cogeneration	70%	27,092,316
Total	100%	38,703,309

Solar Power

Panels Required: 1,313

Space Required: 2,100 m²

Energy Per Panel: 4,422 KWh/y

Carbon Offset: 2,227 T CO2eq

Assumption: Each panel produces 0.18 kWh of energy and requires 1.6m²

Emissions

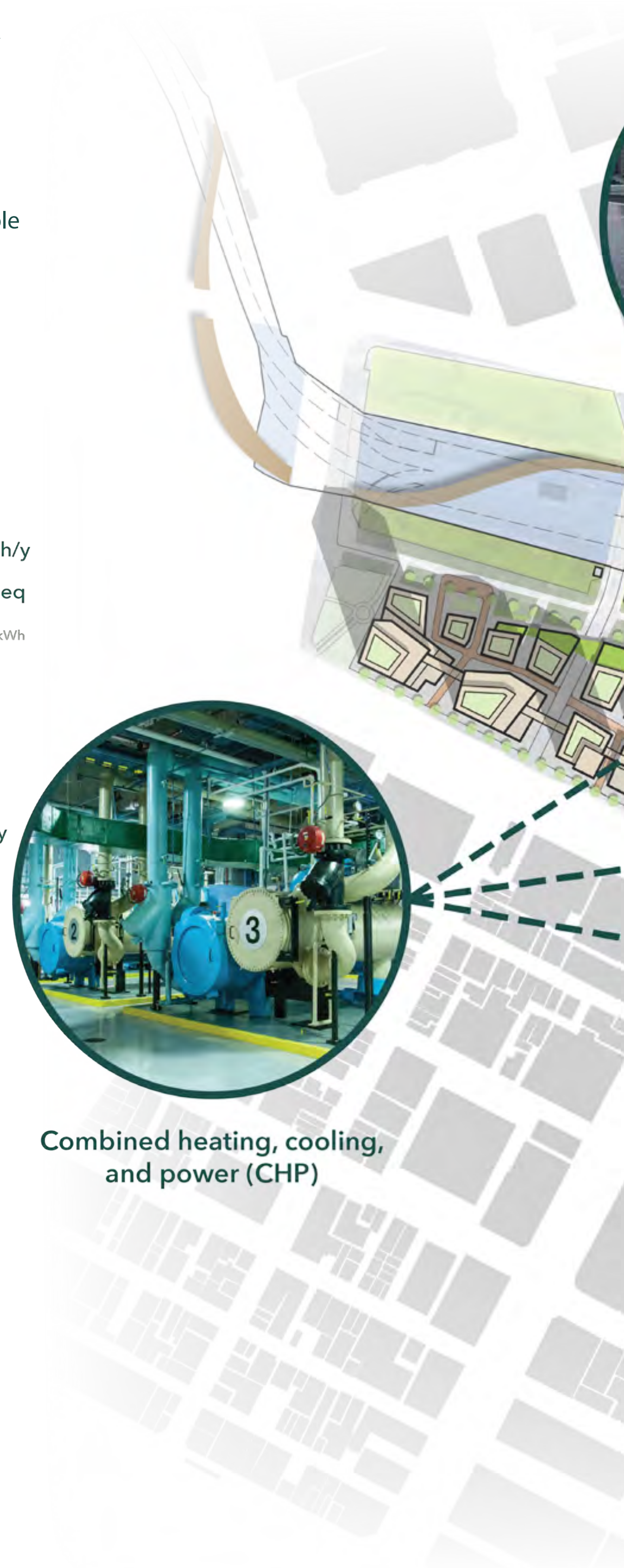
Energy	Annual Tonnes CO2eq
Grid	4,601
Solar	-2,227
Cogeneration	15,028
Total	17,401

Co-generation

Co-generation Plants: 3

Energy Supply: 5,805 MW/y

Carbon Reduction: 30%



Combined heating, cooling, and power (CHP)

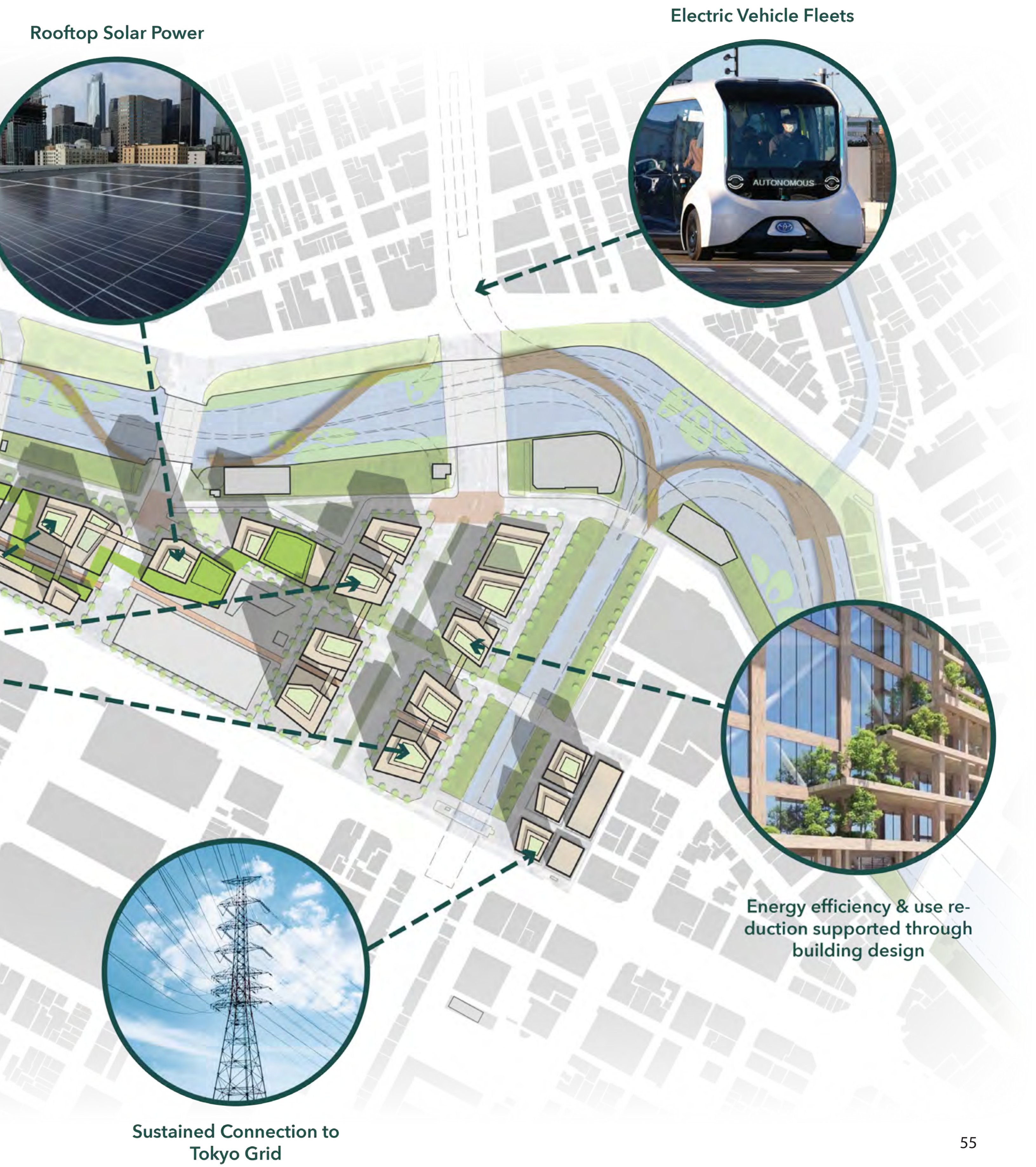
Annual Emissions without CHP & Solar

30,670 Tonnes of CO2eq

Annual Emissions with CHP & Solar

17,401 Tonnes of CO2eq

Proposed energy supply reduces emissions by 43%


Rooftop Solar Power
Electric Vehicle Fleets
AUTONOMOUS
Energy efficiency & use re-
duction supported through
building design
Sustained Connection to
Tokyo Grid

Urban Climate

Smart Cities Granular Urban Metrics

Steven Gonzales

Notably missing from the Nihonbashi Revitalization Plan (2019) are considerations towards climate challenges that affect Tokyo in the coming years. Identifying these climate challenges, also known as climate vulnerabilities, is necessary in creating resilient and well-planned communities. Assessing climate vulnerabilities requires consideration of social, economic, and environmental factors that exist in a region–a sustainability-oriented framework (Miola et al., 2015). Climate vulnerabilities cover a range of phenomena, from flooding to urban heat to energy burden and food insecurity. We present in this report a justification for the undertaking of a heat vulnerability assessment in the Nihonbashi neighborhood. Given the scale of our analysis, we developed and implemented a specialized research design to present our assessment of urban heat vulnerability at a neighborhood scale.

Research Design

We present the following research questions for the Nihonbashi study areas:
1. How can you transform ArcGIS Urban's metrics for granular smart cities analysis?
2. How can we use granular smart cities metrics tool to address the following questions:
a. Do residents in our study area have access to adequate access to urban greenspaces?
b. How vulnerable are our neighborhood study areas to the heat island effect?

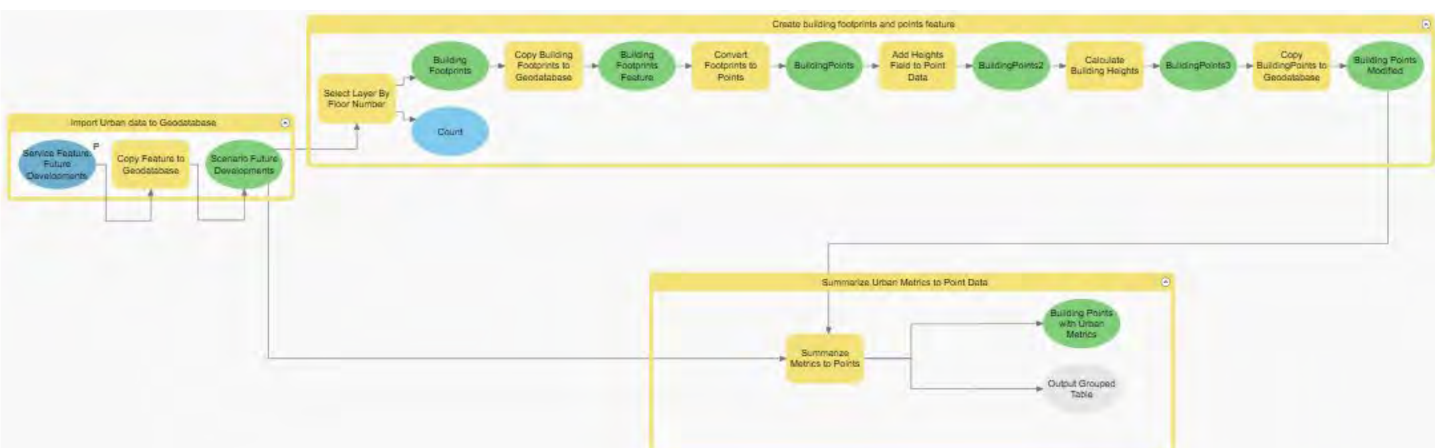
This chapter presents two separate methodologies that are linked to each other for our analysis. First, is a methodology for the development of a custom, Smart Cities Granular Urban Metrics (SCGUM) tool using the ESRI ArcGIS ecosystem (Pro, Online, and Urban). Next, is an application of the SCGUM tool to the first portion of a heat vulnerability assessment: a building-level analysis of greenspace accessibility in District 1. The tool is used to model three scenarios: present day (Scenario 1), the Mitsui Fudosan development proposal (Scenario 2), and the Georgia Tech Studio proposal (Scenario 3).

Developing the SCGUM Tool

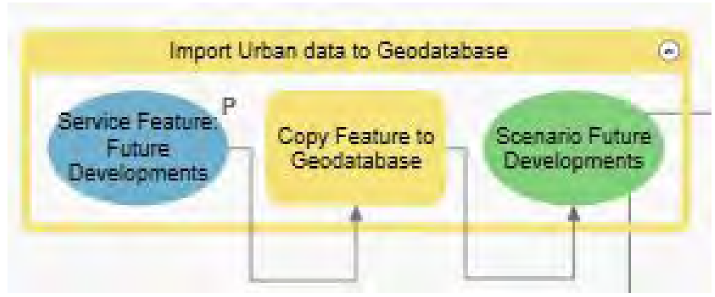
The ESRI ecosystem allows for the creation of custom tools to expedite workflows and automate tasks. The team created a custom tool, the SCGUM tool, to expedite the import of ArcGIS Urban data, process the data, and create outputs which allow analysis to be conducted at the most granular level possible. Polygon and point feature data are created for each building in a proposed scenario. The tool's deployment does require some items to be created beforehand. These include establishing licensing to the ESRI software in addition to the creation of ArcGIS Urban infrastructure, plans, scenario, and metrics.

The Smart Cities Granular Urban Metrics (SCGUM) is an ArcGIS custom tool that facilitates the manipulation of ArcGIS Urban data into an output which can be used to conduct analysis at a granular level. The tool was created for public consumption where users can insert simple commands to select the desired data to download and where to save the data. The tool is intended to fit into any type of workflow, either as a stand alone tool or within a workflow involving ArcGIS Urban data. The end products created by the tool can be used to create new analysis or implemented into an existing analysis to measure the impact of the proposed Urban development at a high level of detail.

The tool has three components which work in sequential order: data importation, creation of base data, and summation of metrics data. The first step prompts a user to select the ArcGIS Urban which they desire to import in ArcGIS Pro. The second step creates base polygon features needed to perform future analysis either within the toolbox or outside the toolbox. The last step summarizes the Urban metrics data into point features.

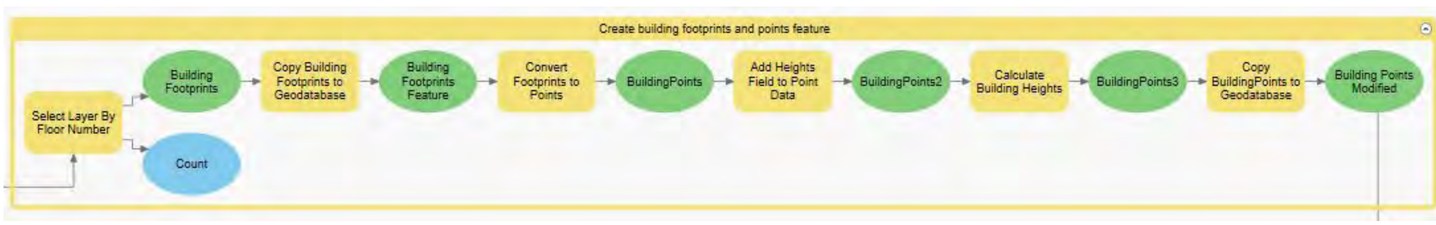


The tool was created within the Model Builder module within ArcGIS Pro. The Model Builder module allows the tool to take advantage of the ArcGIS ecosystem. This includes the ability of the tool to directly access ArcGIS Urban data through the ArcGIS Online portal. The tool also takes advantage of the ESRI data infrastructure by leveraging geodatabases to protect and preserve data. Lastly, the Model Builder module allows users to modify the process flow to fit their needs. Users familiar with Model Builder can change specific functions within the tool to further customize data to their needs.



The two prerequisites which need to be completed before applying the tool are obtaining adequate ESRI licensing and a build-out of an ArcGIS Urban plan and scenario. It is crucial for a user to obtain adequate licensing and access to ESRI software. This includes the ArcGIS Pro, ArcGIS Online, and ArcGIS Urban software. The tool uses specific action items which are proprietary to the ESRI software environment. Inability to obtain licensing access may lead to errors in the deployment of the tool. The other crucial component which needs to be completed is the build-out of an ArcGIS Urban plan, scenario, and metrics. The ArcGIS Urban "plan" acts as a localized container which holds one or more scenarios built by the user. ArcGIS Urban metrics established by the user are tied to the scenarios. The end product of a full build out of ArcGIS Urban culminates in a service feature of the proposed future scenario. This service feature is a polygon feature which has the floor plates of the proposed development. These floor plates are enriched with the metrics data established. It is these floor plates which the tool extracts and manipulates.

The first step of the tool's process flow is the importation of urban data to the local geodatabase. The purpose of the first step is to preserve the data integrity by creating a copy of the original data. The tool prompts users to select the service feature of the future development within ArcGIS Urban. A user will need to navigate to the appropriate ArcGIS Online group, the appropriate ArcGIS Urban scenario, and then select the future development service feature. The tool will also prompt the user where they desire to save a copy of the future development service layer. It is recommended that the data be saved within a dataset within a geodatabase. All of this is done using the Copy Feature tool.



The second step in the process is the creation of building footprints and point features (Figure 5). The purpose of this step is to create baseline data which the user has at their disposal. Using the future development feature, the tool uses Select by Layer function to select the 1st floor of every building and creates a copy of it. The Copy Feature function saves the selection as Building Footprints. The Convert Feature to Points function converts the footprints polygons to points. The Add Field function creates a new field called "building height" while the Calculate function inserts 100,000 for the default height. The Copy Feature then creates saves the point data as "Building Points".

The third step in the process is the summation of Urban metrics (Figure 6). The purpose of this step is to extract and sum the Urban metrics data which then can be used to carry out additional analysis. The Summarize Within function combines the original Future Development feature with the BuildingPoints feature. The function uses the building points "building height" to capture the data within the individual floor plates above it. The function is set-up to sum all the attributes (or Urban metrics) in each floor plate above the point. The final product is the "Building Points with Urban Metrics" feature.

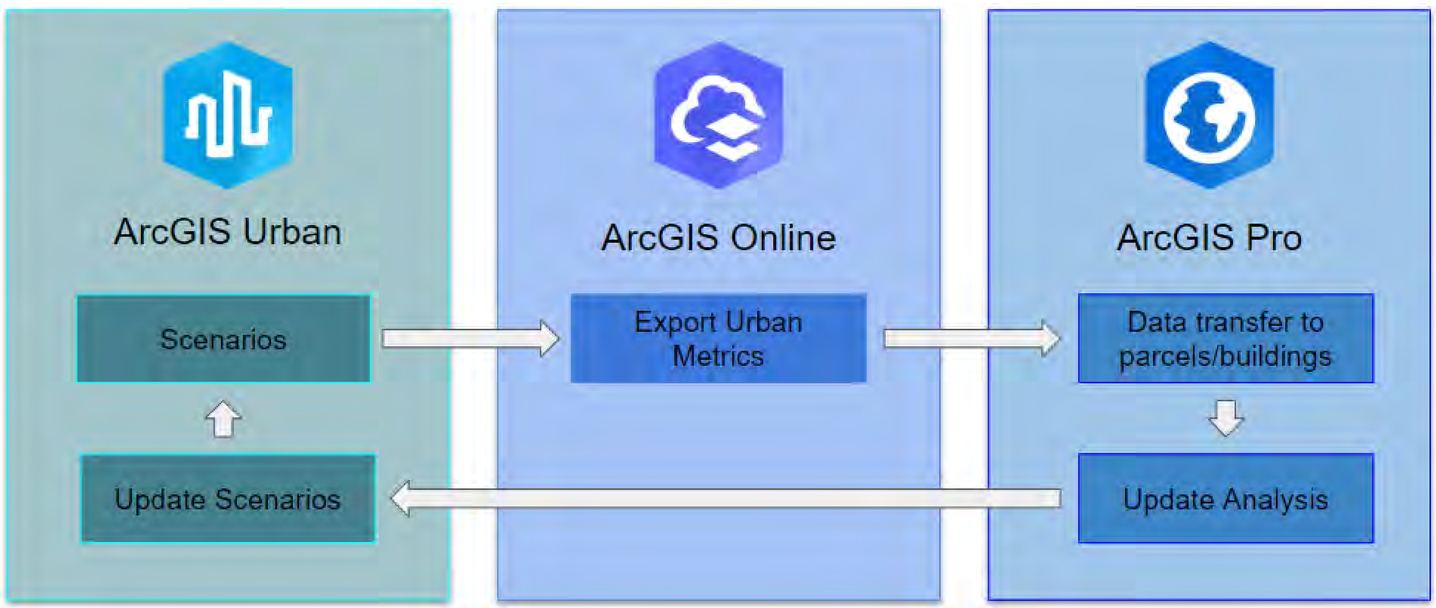
Developing the SCGUM Tool

The end product of the SCGUM tool creates point and polygon features which users can leverage for granular analysis of development scenarios. The most important aspect of the created data are the metric values which exist within the feature's attribute table. An example of a granular analysis is a kernel density to identify concentrations of residents within a development scenario. Another example is a closest facility network analysis to identify the closest park to proposed buildings in the development scenario. The team used the ArcGIS Urban development scenario to test the tool and perform a green space proximity analysis.

As with any tool, there are imperfections and issues. The tool was designed specifically to extract ArcGIS Urban data and create footprint and point features. In applying the tool, the team was exposed to additional items which were needed to proceed with certain analytics. To compound the issue, some of these data points were created manually due to time constraints and lack of resources to automate such tasks. One of these hurdles was the creation of street grid networks and the subsequent network analysis. The team had to create custom street grid networks for each proposed development scenario. Each new grid network was used to create a unique network analysis which unlocked the ability to perform a green space proximity analysis.

The SCGUM tool has tremendous opportunity to be expanded and modified. As stated earlier, the tool can easily be transformed into a python script. This requires additional coding to allow for user input and to call certain packages. The python script also offers the opportunity to replicate the process flow using non-proprietary tools (such as using QGIS).

The tool can be used as a stand alone tool but it was intentionally built to bridge existing gaps within the ESRI ecosystem. Figure 7 shows the application of the tool within a greater process flow involving ArcGIS Urban, ArcGIS Online, and ArcGIS Pro. Starting on the far left, the creation of a ArcGIS Urban development scenario is required. ArcGIS Urban data is stored in ArcGIS Online and thus available to extract in ArcGIS Pro. The tool is then implemented at this stage: creating building footprints and points which contain metrics data from the development scenario. A user can then either create new analysis or leverage the created data to update their analytics. Results from the analysis, whether it be green space proximity, drive time analysis, shadow coverage, or Urban Heat Index values, can be used to inform planner, designers, and architects on changes to the development scenario. The core to the process flow is the ability to create the data needed to drive a data-driven analysis of the development scenario outputs.

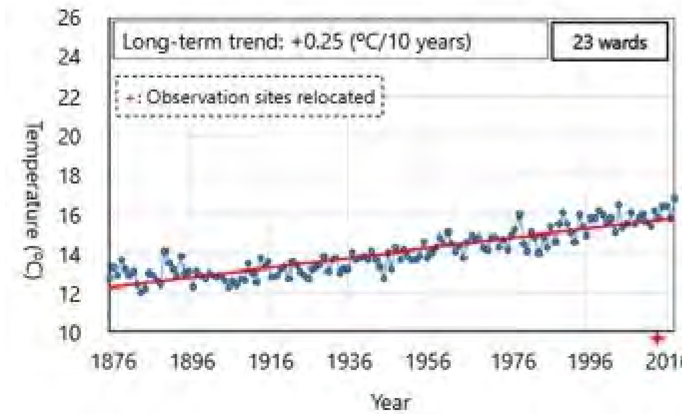


Urban Heat and Green Space Accessibility

Steven Aceto and Yasamin Khorashahi

Urban Heat Island Effect

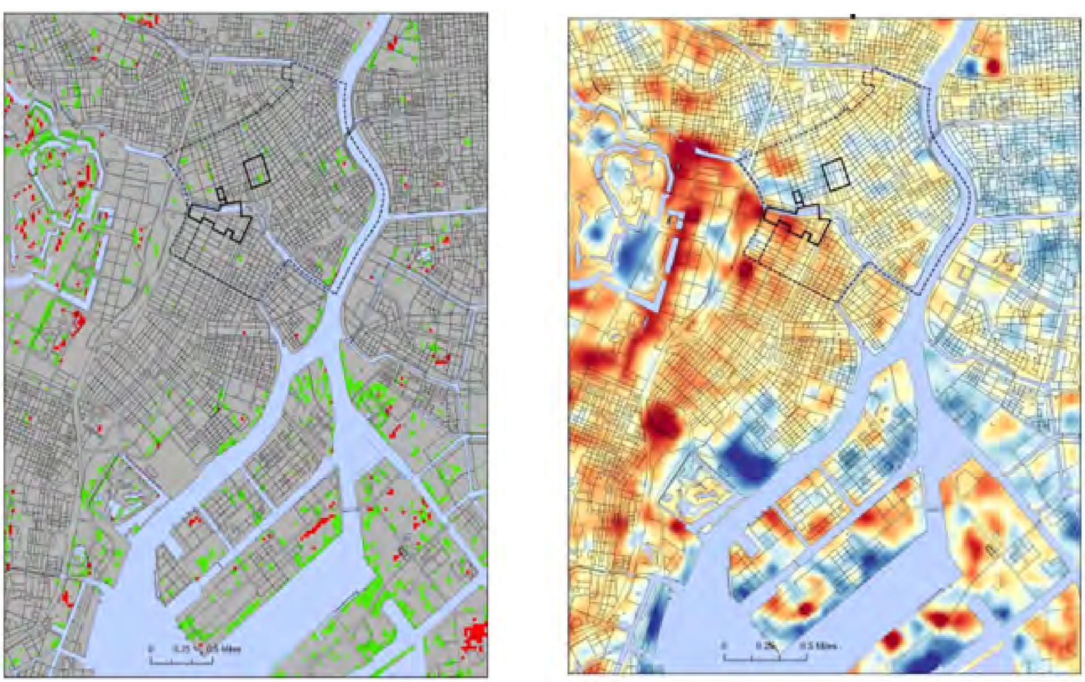
The Urban Heat Island (UHI) effect is a well-studied phenomenon in urban planning, environmental management, and geography. The U.S. Environmental Protection Agency defines urban heat islands (UHI) as urbanized areas that experience higher temperatures than outlying areas (U.S. Environmental Protection Agency, 2022). This positive temperature difference is caused by a number of factors, including urban geometry and its effects on airflow and solar radiation, material properties of built environments, anthropogenic heat (heat generated from human activities), general weather and geography in a region, and the reduction of natural landscapes in an area. Solutions to the urban heat island effect often include a reduction of the impact of one or a combination of these factors.



Tokyo Metropolitan Government. (2019). Tokyo climate change adaptation policy.

It is well documented that the urban climate of Tokyo, Japan is susceptible to the urban heat island effect. Literature indicates that research of UHI in Japan originated in the 1980s in physical science disciplines, and proliferated through engineering, environmental, and energy fields before becoming a policy-oriented issue at the turn of the century (Yamamoto, 2006). Documentation of UHI in Japan Studies on the mitigation of Urban Heat Island, particularly in Tokyo, present a number of solutions towards UHI mitigation, including creating wind paths to lower temperatures (Akashi, 2008), groundwater use as a heat sink (Nakayama & Hashimoto, 2011), and urban energy conservation (Kikegawa et al., 2004). Existing studies of urban heat in Japan are often small in scale, encompassing entire cities or urban regions (Saitoh et al., 1996; Takahashi et al., 2009; Matsuo & Tanaka, 2014) rather than a single neighborhood, and few if any provide parcel-level analysis. Urban Heat Island mitigation continues to be a key climate policy focus for the city, as the Tokyo Metropolitan Government has identified a 0.25 degree Celsius increase in Tokyo's annual average temperature in the long term (2019).

The primary determinant for urban heat island in cities is the lack of natural features as a result of the built environment. Evapotranspiration from vegetation is a primary cooling mechanism for atmospheric heat and the urban tree canopy creates a shady environment for pedestrians and even cools building facades (Dimuodi & Niklopoulo, 2003). The relationship between urban heat and urban greenspace goes both ways, as UHIs negatively affect the biodiversity of urban landscapes but increasing urban greenery is necessary to reduce the UHI effect (Oishi, 2019). Along with alleviating the UHI effect, increase prevalence of urban greenspace leads to positive health outcomes in communities. Greenspaces are negatively correlated with urban mortality rates resulting from UHI (Dang et al., 2018); mortality rates decrease as square meters of greenspace in an urban area increase.


Left: Change in green space in and around Nihonbashi using NDVI (2000-2020)
Right: Land surface temperature in and around Nihonbashi (2020)

To better understand the need for a heat vulnerability assessment in Nihonbashi, it is first necessary to establish baselines of urban greenspace and land surface temperature in the neighborhood and surrounding areas. For this preliminary analysis, we utilized Landsat 7 and 8 imageries from the U.S. Geological Survey (2000, 2020). For the urban greenspace analysis, we utilized Normalized Difference Vegetation Index (NDVI). Satellite maps of vegetation show the density of plant growth over the entire globe. Very low values of NDVI (0.1 and below) correspond to barren areas of rock, sand, or snow. Moderate values represent shrub and grassland (0.2 to 0.3), while high values indicate temperate and tropical rainforests (0.6 to 0.8). An in-depth methodology for calculations towards green space analysis is presented in the Appendix of this report. From our preliminary analysis of greenspaces, we note that there has been an overall increase in green spaces in Districts 1 and 2. Trends in green space development in Tokyo show an increase in greenspace along the waterfront, although this is yet to become prevalent in Nihonbashi. District 1, the Waterfront district, has significantly less greenspace and proximity to green space as compared to District 2. Figure 9 shows the change in greenspace in Nihonbashi and surrounding areas from 2000 to 2020.

Next, used the same satellite imagery to assess land surface temperature in Districts 1 and 2. We find that the Waterfront district faces greater surface temperatures than the Neighborhood district. Figure 10 shows land surface temperature in Nihonbashi and the surrounding areas. Darker red areas are hotter and bluer areas are cooler than the mean temperature.

Green Space Scenario Modeling

Our next steps were to exhibit the possibilities of our tool, and decided to perform a brief green space analysis of the study area, hoping to show clear visualizations contrasting the three unique scenarios of the proposed developments of the area.
Using the SCGUM tool chose to evaluate three different sizes of green spaces to determine proximity and accesibility to green space in the Nihonbashi Waterfront District.:

> Small green spaces, greater than 1000 m2, are spaces such as gardens and squares, and are areas that offer a daily contact of the citizen with green spaces. They provide coverage for daily recreational needs of and to those citizens who have limited mobility: elderly people, children. They must be within a distance of 300 meters (less than 5 minute’s walk; daily walk).
>
> Medium green spaces, greater than 35,000 m2 (3.5 ha), are spaces corresponding to urban parks that guarantee different entertainment possibilities and present some uniqueness in relation to their historical character. They must be within a distance of 750 meters.
>
> Large green spaces, greater than 100,000 m2 (10 hectares), correspond mostly to parks or green rings of cities. They are free areas integrated in the natural environment. They are often assigned a restorative and landscape purpose. They must be within a distance of 4 kilometers (travel by public transport or cycling).

Our next steps were to exhibit the possibilities of our tool, and decided to perform a brief green space analysis of the study area, hoping to show clear visualizations contrasting the three unique scenarios of the proposed developments of the area.

Using the SCGUM tool chose t his initial analysis is simple enough; categorize each of nearby 115 parks into the three size categories, then determine the distance each of the green spaces offered to the districts within the study area. Through this rough initial framework, we took away important notes:

Small park coverage is insufficient for the waterfront district of the study area, and there are three small parks in the nearby area that could potential server this spaces; Sakamotoch Park (5188 m2), Tokyo Torch Park (4417 m2), and Horidome Park, (3757 m2) the last of which located within the neighborhood district.

Medium park coverage is not sufficient in either of the two districts, but the construction of a green space of more than 35,000 m2 is outside the scope of the current project framework.

Large Park coverage for both of the districts is sufficient; 4 kilometers allows large parks to be located further away from urban cores, however the book does suggest ensuring robust public transit options for equitable access. The Japanese rail network is more than sufficient to meet this goal.

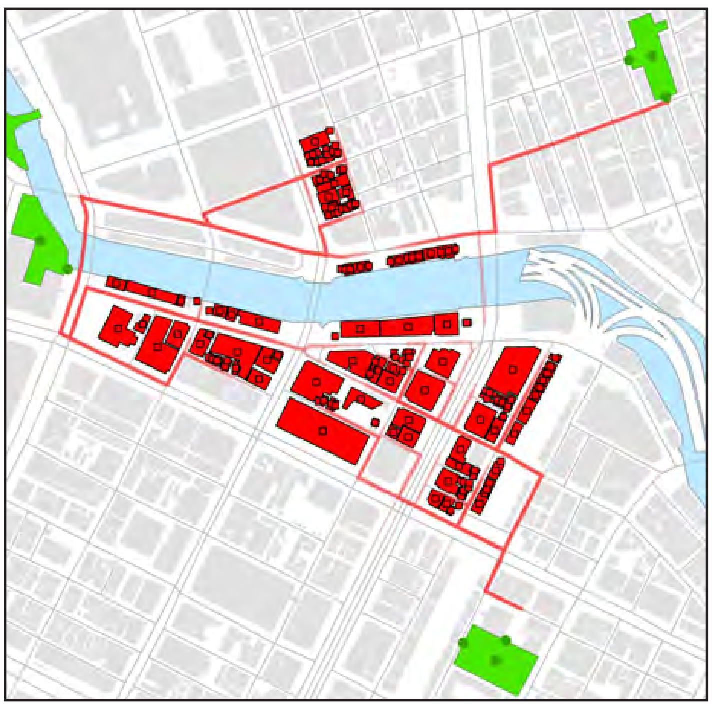
Using these takeaways, we determined the best course of action to be a more in-depth analysis of small parks in the waterfront district, District 1. These smaller green spaces "provide coverage for daily recreational needs of and to those citizens who have limited mobility," and are within the scope of this project. The addition of these parks sized between 1,000 and 35,000 m2 allows for creative placements without having to schedule expansive redevelopments.

After inputting the locations of the current building footprints and greenspace locations, as well as the modern-day pedestrian network, we were able to better understand and visualize this district's current small park access. This scenario of current-day Nihonbashi conditions is designated as Scenario A. The network analysis can be seen in Figure 14, where the red polygons are the current buildings, green polygons are the current closest green spaces, and the red paths are the pedestrian networks from the buildings to these small green spaces.

This analysis of the current-day scenario resulted in a lackluster average path length of 387 meters, with a maximum path of 526 meters and only 27 of the 136 buildings having a path less than 300 meters, resulting in a 19.8% small green space connectivity ratio. Additionally, this analysis highlights that this scenario features a high number of smaller buildings, producing a high number of unique paths to nearby greenspaces. This can be a red flag for potential pedestrian funding, as activating a higher number of paths for optimal pedestrian experiences can take years to implement.

Our next scenario analyzed the proposed development from the Japanese developer Mitsui Fudosan, as shown in Figure 15. The yellow polygons are the proposed structures, the green polygones the nearby small parks, and the yellow lines are the pedestrian networks from the buildings to these small green spaces.

The analysis of this scenario results in similar numbers to the current-day proposal, as many of the proposed buildings are amalgamations of the modern-day structures. This, paired with no new green spaces introduced, results in a similar average walk distance of 391 meters and a maximum of 523 meters. Only 5 of the 32 new buildings lie within a 300 meter walk to a small green space, or a 15.6% small green space connectivity ratio. This shows that even proper development and consolidation of smaller systems may not always have a substantial impact on the root causes of some complex societal and health issues.



Scenario A: Current District

Mean: 387m

27/136 Buildings within 300m Buffer

= 19.8% Greenspace Connectivity

(left)

Scenario B: Mitsui Proposal

Mean: 391m

5/32 Buildings within 300m Buffer

= 15.6% Greenspace Connectivity

(right)

Our third and final scenario, scenario C, analyzed the proposed development from the Georgia Tech Master of City and Regional Planning Second Year Studio, as shown in Figure 16. The purple polygons are the proposed structures, the green polygones the nearby small parks, and the purple lines are the pedestrian networks from the buildings to these small green spaces.

This proposal vastly cuts down on the total walking distance from the buildings to green spaces through the introduction of nine new small green spaces paired with a similar consolidation strategy as scenario B. The average walked distance is only 99 meters, with a maximum of 187 meters. This proposal boasts a perfect 20 of the 20 buildings within the 300 meter buffer, resulting in a 100% small green space connectivity ratio. This addition of green spaces helps reintroduce green and natural elements to more community members and reduce urban heat threats as well as helping improve community rain and flood resilience with more porous surfaces, which are becoming increasingly important in coastal urban communities such as this specific study area district. In addition, the location of the green spaces right on the waterfront can help offer a unique pedestrian green space experience akin to Chicago's waterfront park network or Seoul's Cheonggye Creek, tying in the character of the river back to the communal culture. A summary chart of the findings of these analyses can be found in Figure 17, an illustrative table highlighting the impressive improvement offered by scenario C.

Limitations and Discussion

The scale and scope of this community-level analysis is incredibly important, and a great example of the true power of our developing tool. Once locations of buildings and greenspaces as well as the pedestrian networks are known, one can determine the level of connectivity the region has, helping put hard numbers to the usually subjective "greenspace access." The same process of data collection and analysis can be used with countless other frameworks outlined in this book or by governing bodies, helping streamline the visualization of urban sustainability indicators.

A primary limitation of this study was the scope and scale of the analysis. Because the SCGUM tool analyzes metrics at the building-level, we needed to limit the scope of our study to a single study area, the Nihonbashi Waterfront District. The project was also developed and executed over a limited timeline, which narrowed the scope of analysis to just the greenspace analysis.

Based on these limitations, we suggest future study towards the development of a Building Façade Thermal Index using high-resolution satellite imagery from the Ministry of Land, Infrastructure, Transport, and Tourism's PLATEU project. We propose the adaptation of deep learning techniques to assess and classify building façade imagery based on the thermal properties of the building material (Koo et all., 2022). To determine thermal properties of building materials, we look to existing reviews and guidelines for green building at the international scale (Johra, 2021; Asia Business Council, 2007; Ministry of Economy, Trade and Industry, 2018). Once satellite imagery has been assessed, it will be input into the SCGUM tool to analyze the effects of building façade on radiant heat at the microscale. This building heat analysis will be combined with the greenspace analysis presented in this report, as well as a general review of social determinants of urban heat vulnerability to produce a comprehensive heat vulnerability assessment for the Nihonbashi Waterfront District. This methodology can be then adopted to analyze all of Nihonbashi.

Data Analytics

Activity Big Data Driven Smart City Planning

Lu Chen

This research is to understand Nihonbashi's city context and depict residents' lifestyles by analyzing and mapping urban activity patterns. Furthermore, to propose data-driven planning tactics that support our 3C missions. Activity big data analyses would answer the following questions:

- How do people live in Nihonbashi: when and where do Activities Happen?
- How can we infer the activity patterns of people from big data analysis?
- How can the activity pattern research contribute to better city development and policies?

Acknowledge:
GPS data and web-scraped methodology from Tutorials offered by Dr. Takahiro Yoshida, The University of Tokyo.

Big Data Used in the Research

GPS Data

About the GPS Data

- Each GPS data point shows a person's location at the time.
- Date of the data: it is a Saturday's GPS data in Nihonbashi.
- Data size: over 120k rows.

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string	time	float	float
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a9da5b52-0411-456e-a4f1-23e1f95457af	11:38:00	35.6806	139.77031
fa37c01c-c142-4703-a683-3a8c757084a4	12:08:00	35.69467	139.77991
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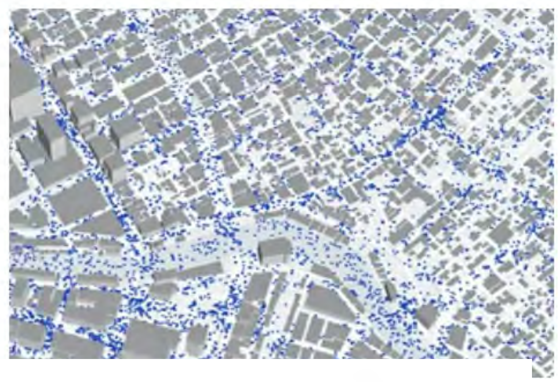
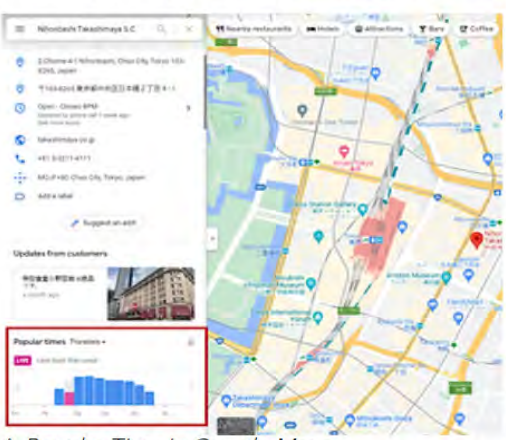


Google's Popular Time data

About the Popular Time Data

- Google's Popular time: It is provided by Google Maps, which shows the portion of activity within the day of each POI (Points of Interests).
- Data source: The data is web-scraped from Google Maps Platform by API and Python.
- Date of the data: it is a Friday and a Saturday's data in Nihonbashi.
- Data size: Popular time data of 338 POIs in the district.



^ *Popular Time in Google Maps*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^ *Popular Time data scraped by Python*

^ *Popular time data in the week of a POI*

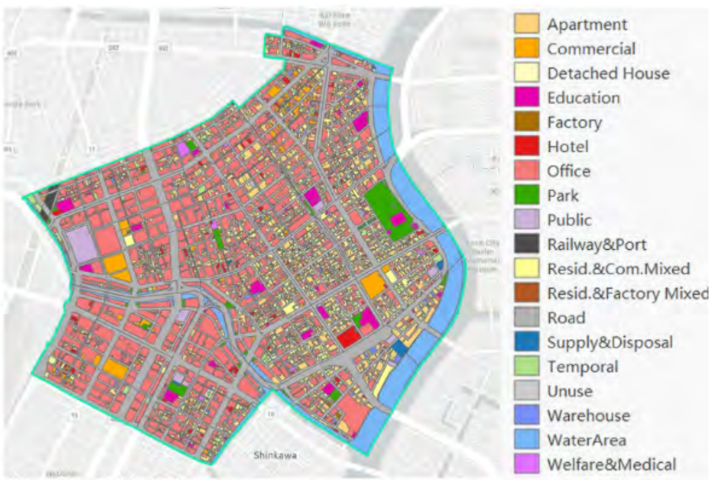
Activity Patterns and Planning Tactics

"Working City": Most activities happened on the roads or in the offices during the working hours.

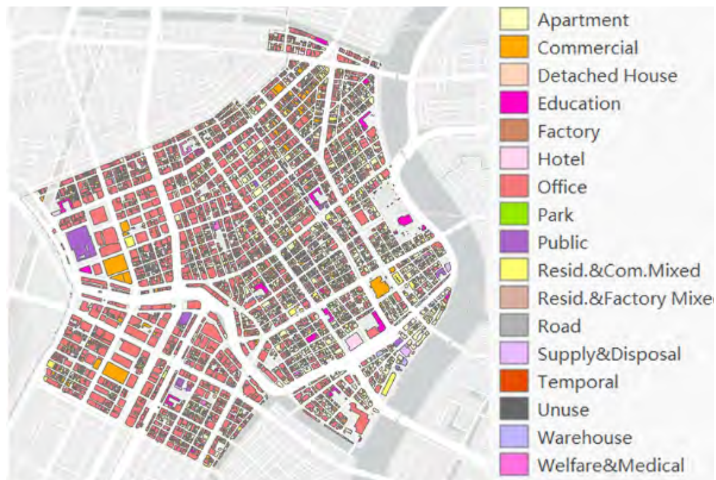
- Most activities happened during working hours, from 9am – 7pm.

"Commuting City": A large amount of commuting population causes activity peak.

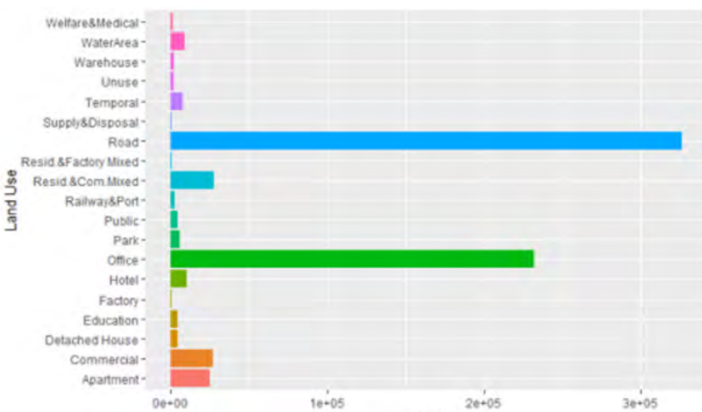
- Most activities happened on the roads or in the offices, which indicated busy traffic and a large group of people came to work even its weekend.
- Relatively homogeneous space types: the district is dominated by red blocks, which represents offices.
- Lack of greening and public open spaces.



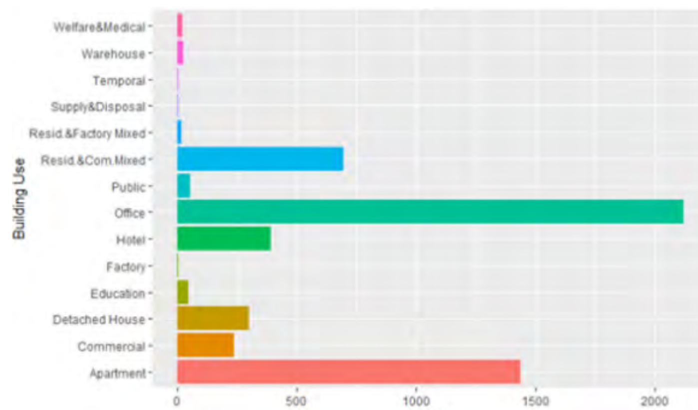
^ *Land Use Map of Nihonbashi*



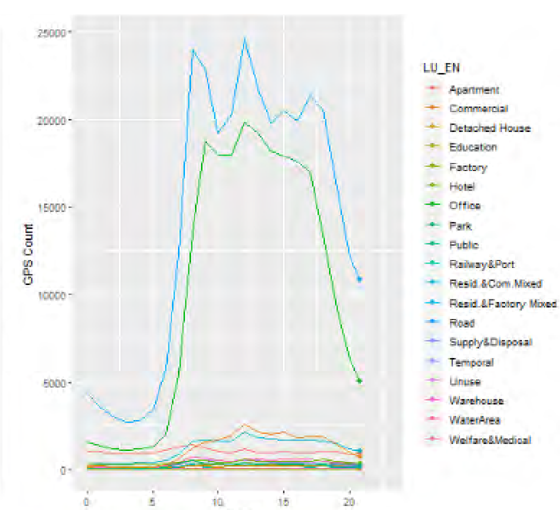
^ *Building Use Map of Nihonbashi*



^ *Total GPS Count in Each Land Use*



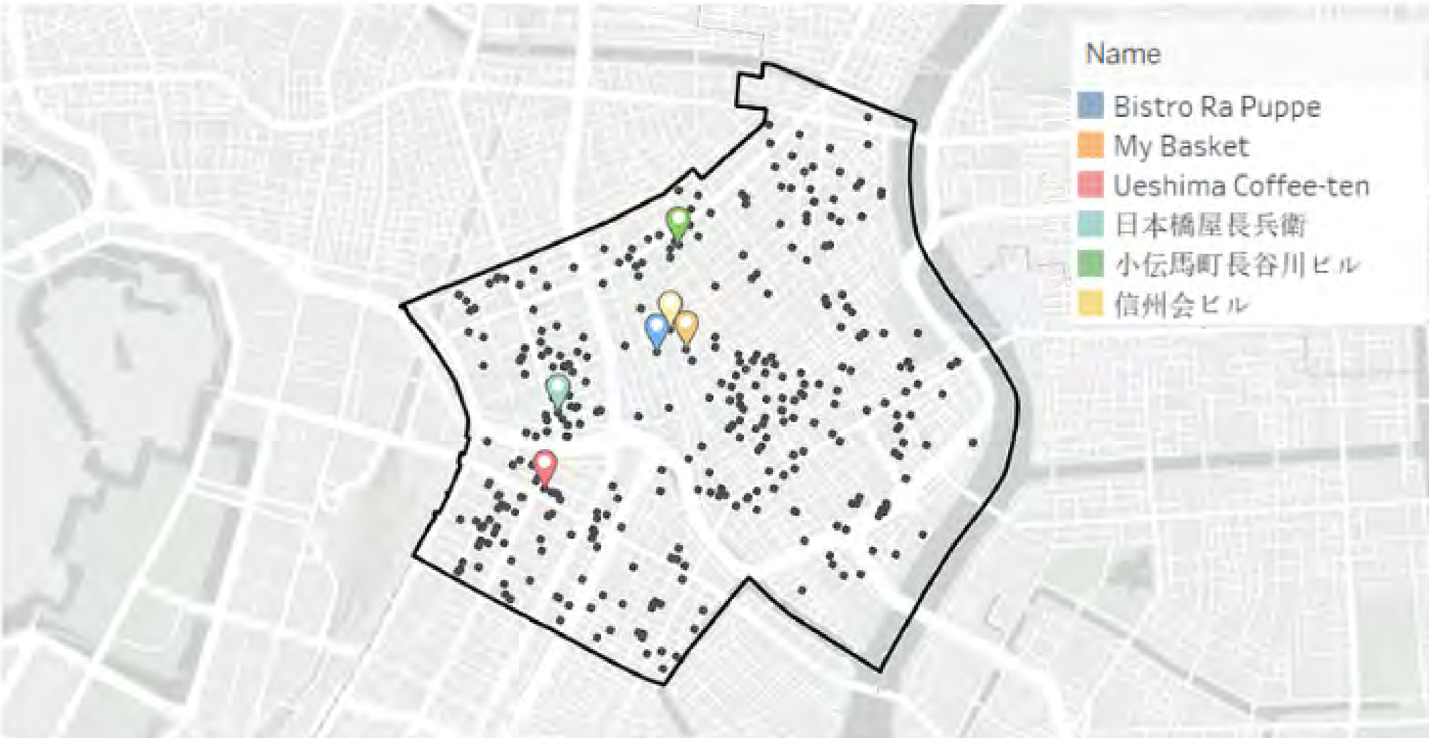
^ *Total GPS Count in Each Building Use*



^ *GPS Count in Each Land Use within 2*

^ *GPS Count in Each Building Use within 24 hours*

I took six POIs in the district as samples to look into their popular times in Friday and Saturday.
Each of them has different types: restaurant, grocery store, cafe, shop, office.



^ *The locations of six sample POIs in the district*

^ Names, types and *Popular time of the samples*

Quasi-real-time Energy Demand Estimate

Methodology Reference: Optimization of local microgrid model for energy sharing considering daily variation in supply and demand, Daisuke Murakami, Yoshiki Ya Takahiro Yoshida

- Improve accuracy on traditional energy demand models: the unit is the average rate estimated by a sampling survey and does consider individual, real-time activity.
- Caculation Formula:

Energy demand =

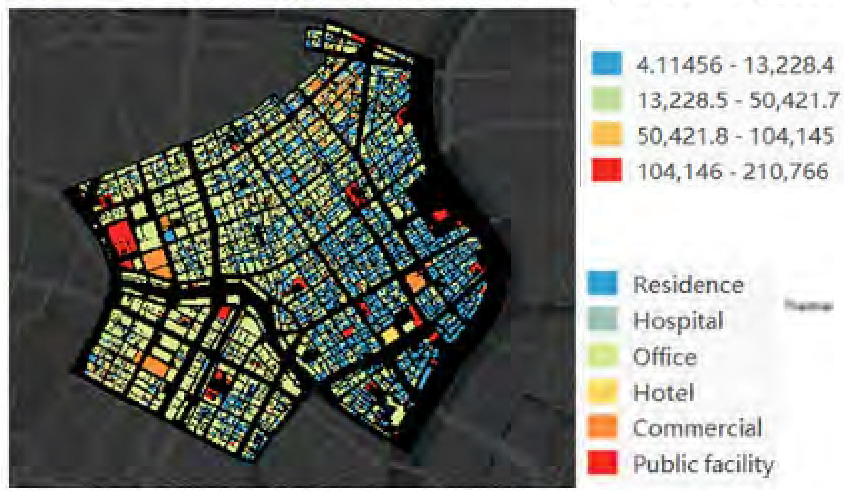
[The basic unit consumption in the h-th hour in u-th use]

× [Total floor area of the i-th building]

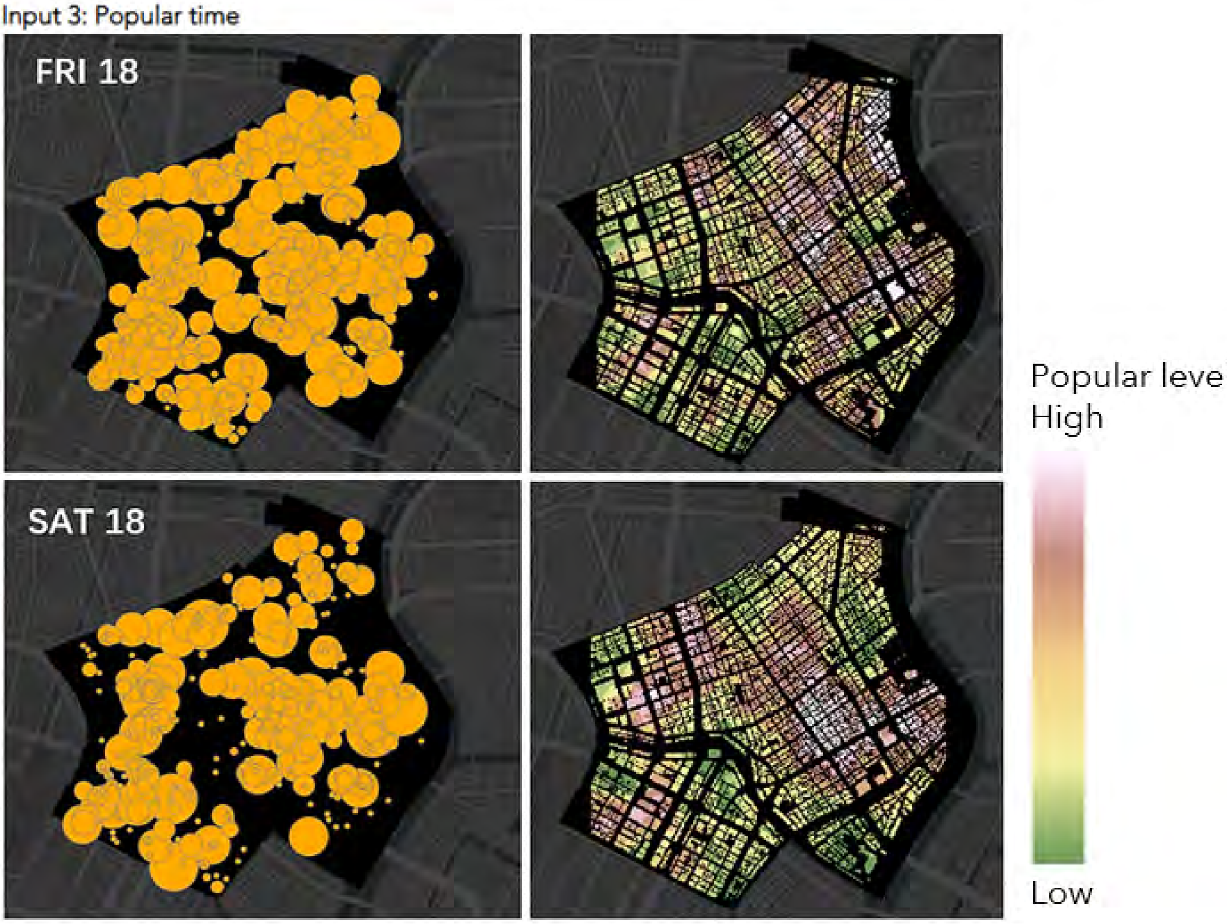
× [Populartime (activity) of the i-th building in h-th hour]

Input 1: Total Floor Area

Input 2: Average Energy Consumption According to Building Use



Input 3: Popular time



Energy Demand Estimate in District 1

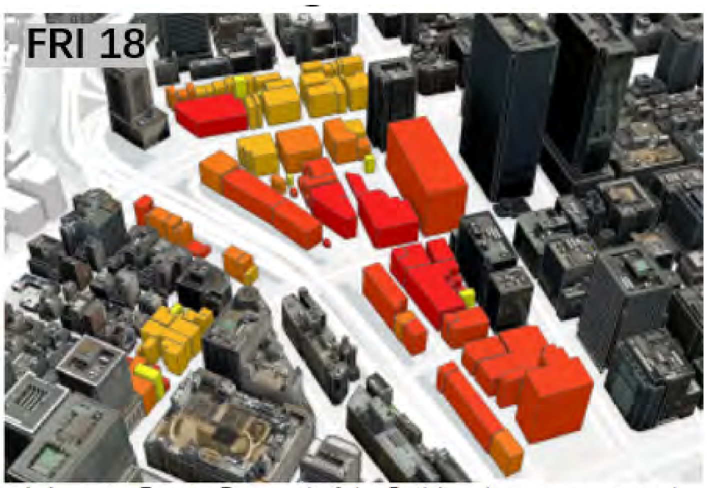
Energy Demand on FRI 18:00

^ Energy Demand for FRI 18:00

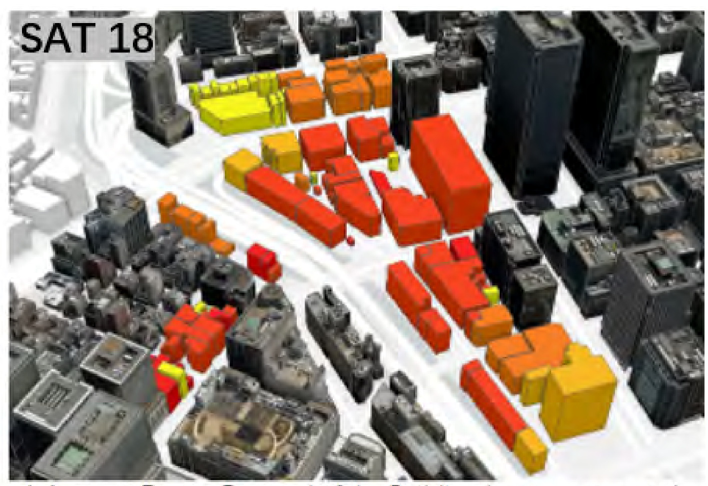
Energy Demand on SAT 18:00

^ Energy Demand for SAT 18:00

Existing Buildings

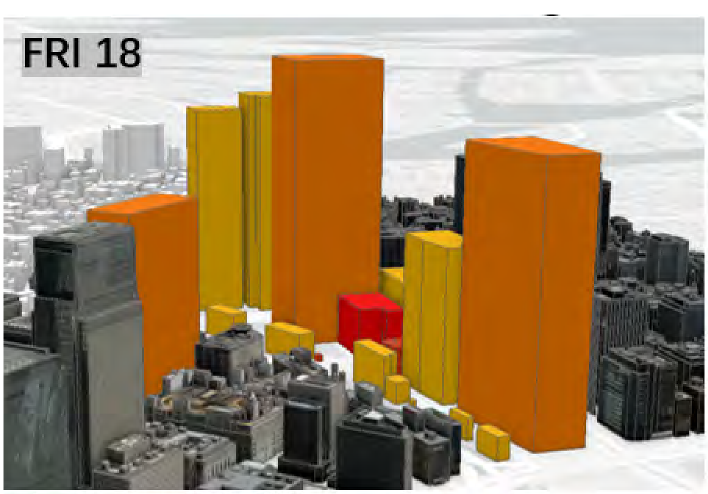


^ Average Energy Demand of the Building (per square meter)

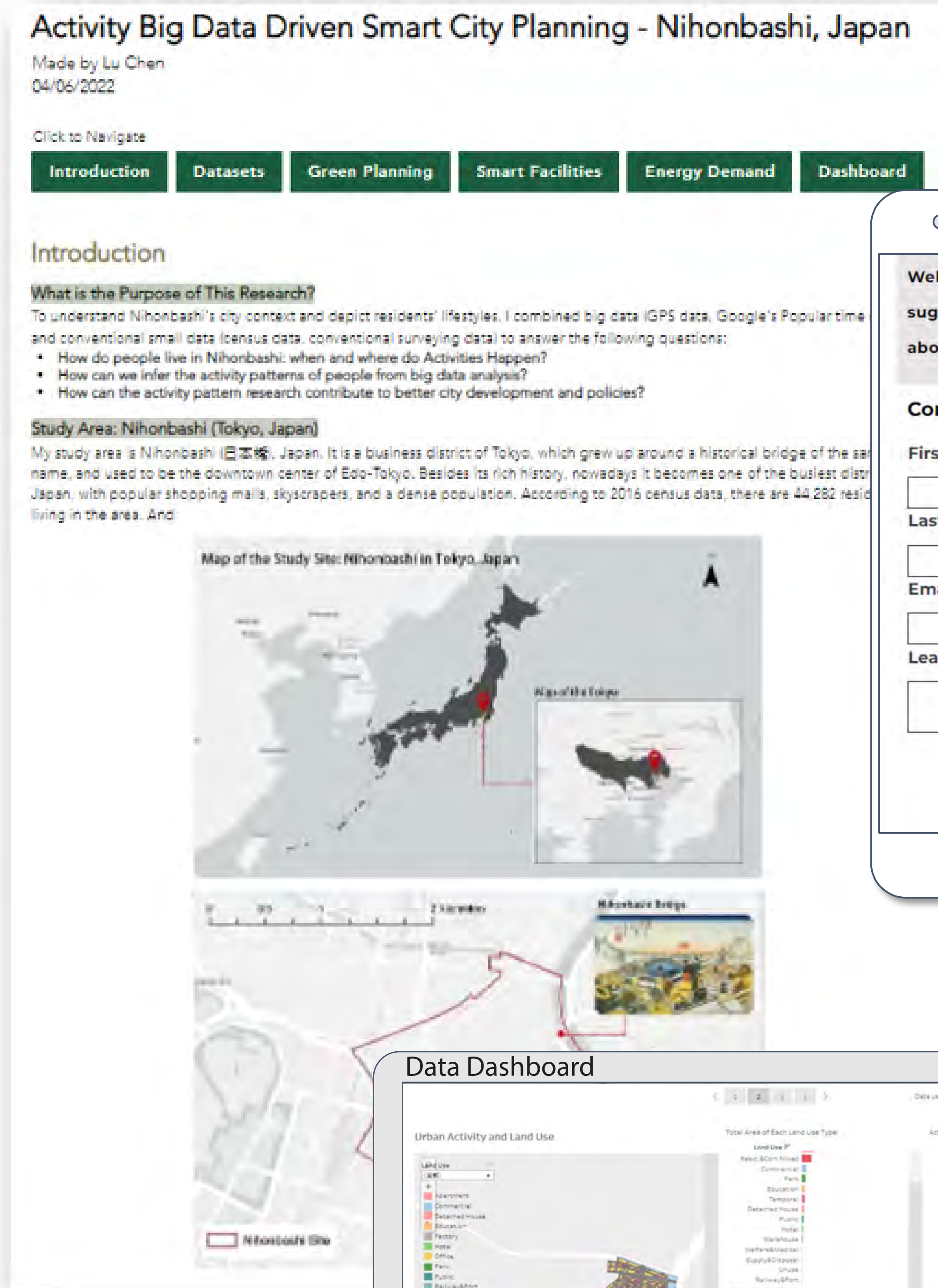


^ Average Energy Demand of the Building (per square meter)

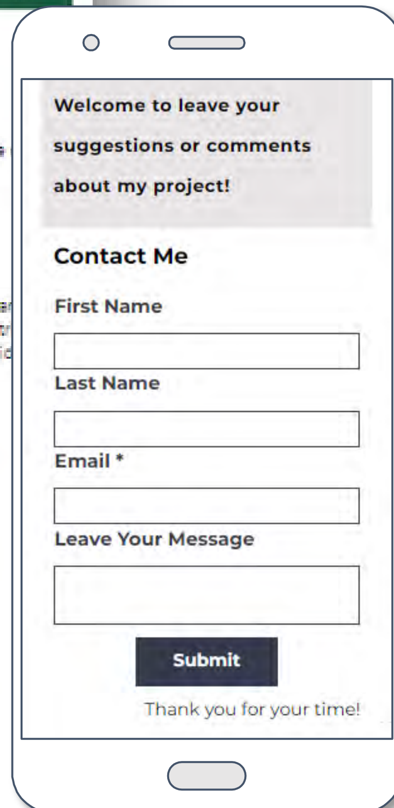
Planned Buildings



Community Engagement Approaches



Project Website



Mobile Web Page

Data Dashboard

Policy for Density that Supports Waterfront Re-Design

Muhammad Arsam

The waterfront re-design proposed by our studio embodies may of the policies laid out earlier; it maintains the existing road network as much as possible, gives buildings wide berth between each other to maintain sunlight and neighborhood walkability and supports constructing more green infrastructure in the form of parks. Additionally, we are also proposing a construction bonus, possibly in the form of tax credits, as an incentive to whoever builds structures that are at least somewhat publicly accessible on the waterfront. This will ensure density, human-scalability and allow the formation of a robust atmosphere on the waterfront.

The major problem this proposal is attempting to address is the discrepancies in Nihonbashi's current land use plans and to implement a zoning policy that is more open to robust forms of activity and engagement in the area. As discussed earlier, Nihonbashi as a neighborhood mostly attracts workers from outside of its boundaries and fails to generate its own internal traffic. Our policies, taken as a sum, introduce higher vertical density will spur a new wave of residential development, which will be followed by more commercial development within the area of Nihonbashi itself. Hence, we hope to develop a neighborhood that attracts and retains a bigger population. Our proposals also encourage more walkable designs and biking as a form of commuting.

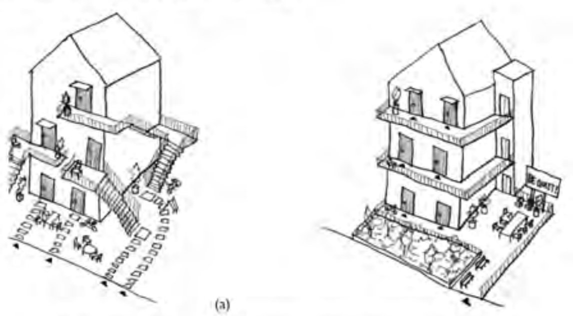
Nihonbashi Patterns of Activity

Overall Activity (811,640 points)

Night Activity (6 pm to 6 am, 217,024 points)

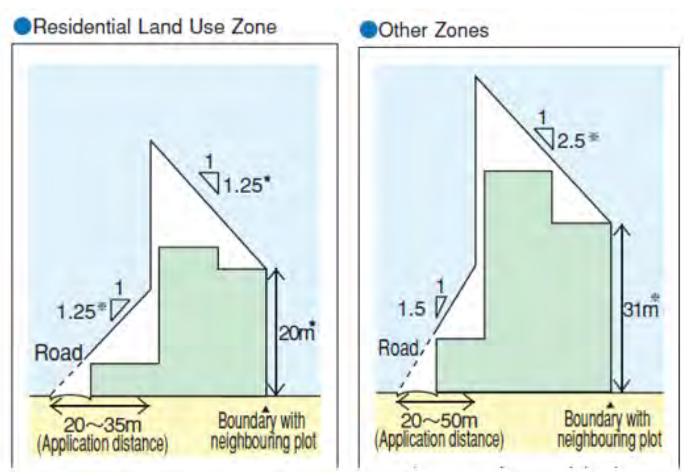
Day Activity (6 am to 6 pm, 594,616 points)

Public-private interaction in low-rise, high-density Tokyo



(a) (b)

Fugure 5. (a) Row-house/Apartments without common use area;
(b) Communal Housing/Dormitory/Apartments with common use area



District Two

Greening The District

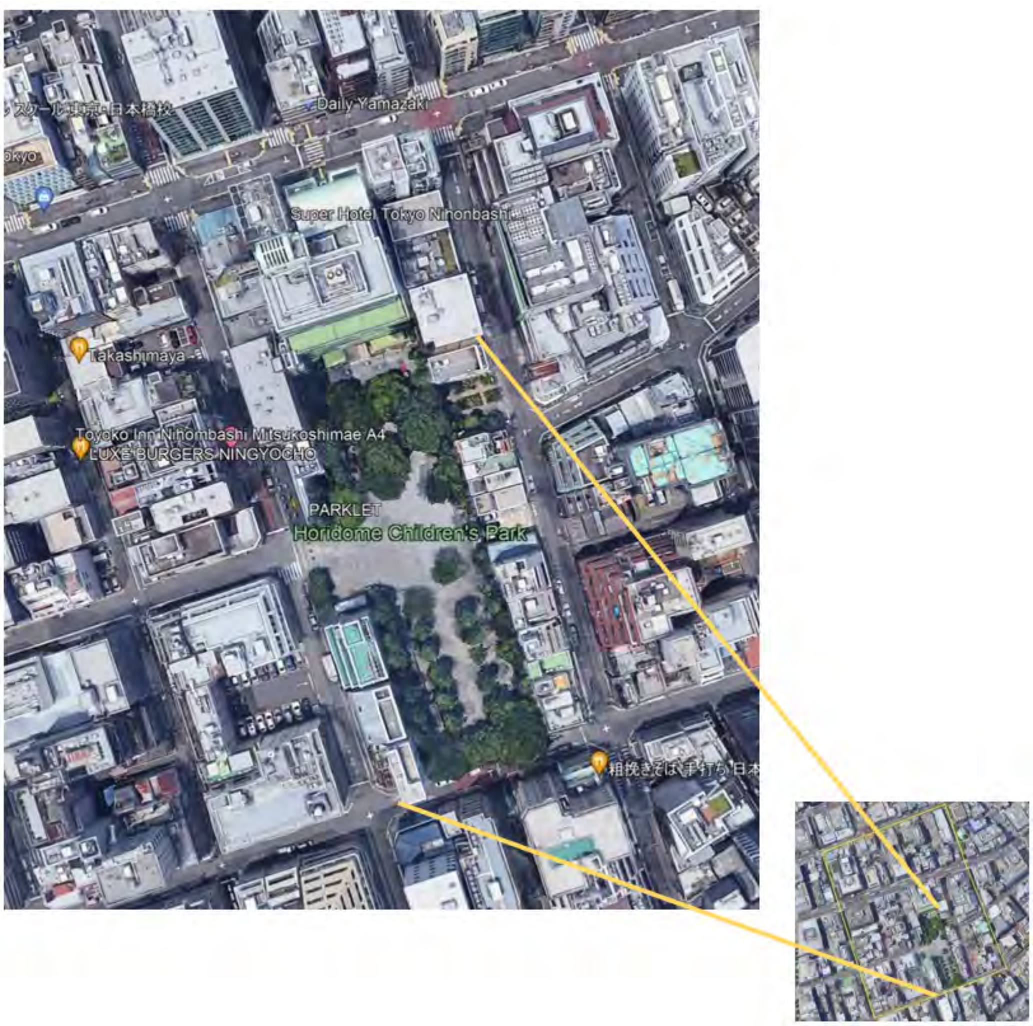
Rossana Franco-Pinilla

District two is a smaller scale district populated mainly with older office buildings. This district as much of the rest of its surroundings is densely populated with closely built buildings on small parcels. Resulting in an almost "stitched-together" look and feel rather than a cohesive design. Within the district is located Horidome Children's Park which is supposed to be a nice green children's park. Unfortunately this park is mostly concrete covered with a small children's jungle gym resulting in a seemingly missed opportunity.
As this park seems so gloomy in its scale and possibilities, this was the generator to begin the "Greening the District" proposal. In this proposal, the aim is to firstly create a better look and feel to Horidome Children's Park which will influence adding greenery and open spaces to the surrounding portions of the district. In opening up the blocks this allows for better walkability and "breathability" to the district amongst such a dense city.
Horidome Children's Park historically is where one of the Nihonbashi canals ended so this proposal not only aims to revitalize Horidome Children's Park but to also commemorate the historic trail of the canal that is now a street while still creating an incredible new and revitalized Horidome Children's park.
The district is already densely packed but with low to mid-rise buildings, allowing for the opportunity to rebuild higher, more sustainable buildings whilst still maintaining the same proportions as before just built up instead of horizontally.

Greening The District
Current Horidome Children's Park Conditions





Greening The District

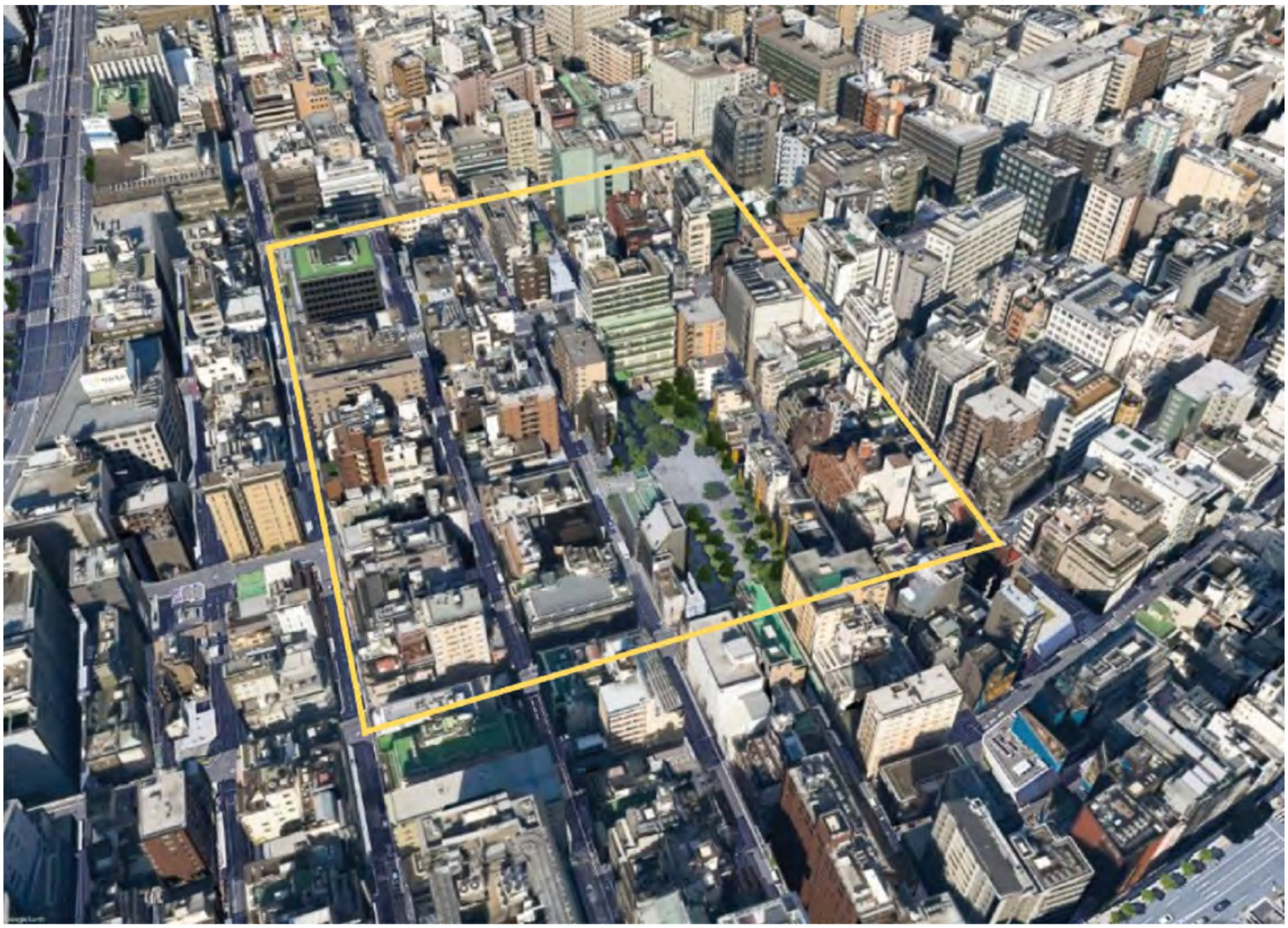
Historic Canal Extension into Horidome Park

Existing Plan

Proposed Plan

Buildings To Remain:
- Shrines
- Historic Buildings
- Buildings to Retrofit

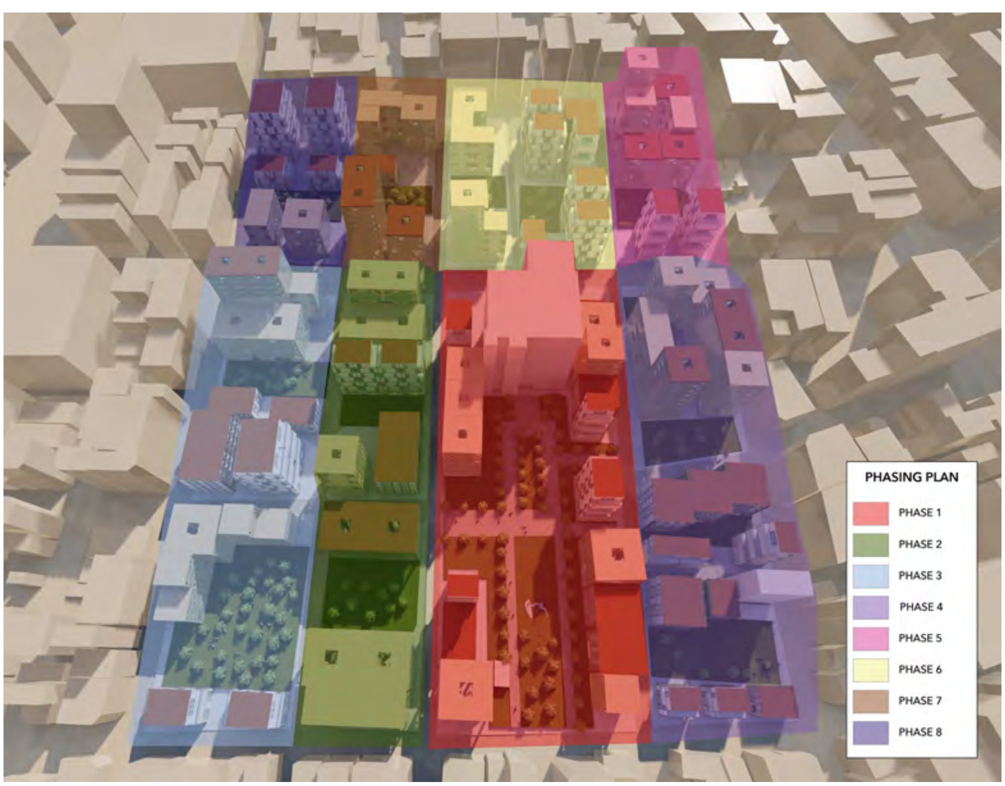
Existing Aerial



Proposed Aerial Render

Greenery Pathway Diagram

Preliminary Phasing Plan

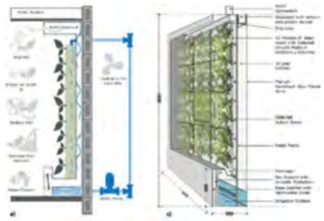



Proposed Land Use Categories
Education
Welfare & Medical
Office
Office Commercial Mix
Residential Commercial Mix
Hotel
Detached House
Apartment
Park / Green Space
Horidome Park
Shusse Inari Shrine & Iwashiro Inari Shrine


Existing Land Use Categories
Public
Education
Welfare & Medical
Office
Commercial
Residential Commercial Mix
Hotel
Detached House
Apartment
Residential Factory Mix
Warehouse
Temporal
Park
Unused
Horidome Park

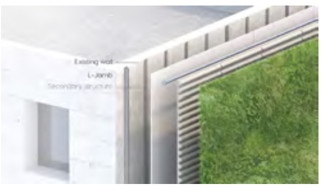
Material Palette

Green Pavers to Use



New Green Wall
System

Smart / Tinted Glass

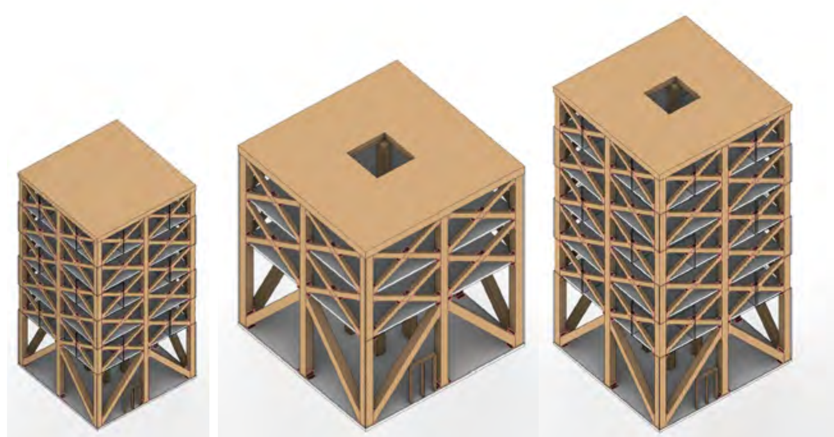


Green Wall System for
Existing Structures

Possible Local Wood

Prototypes

Commercial Buildings

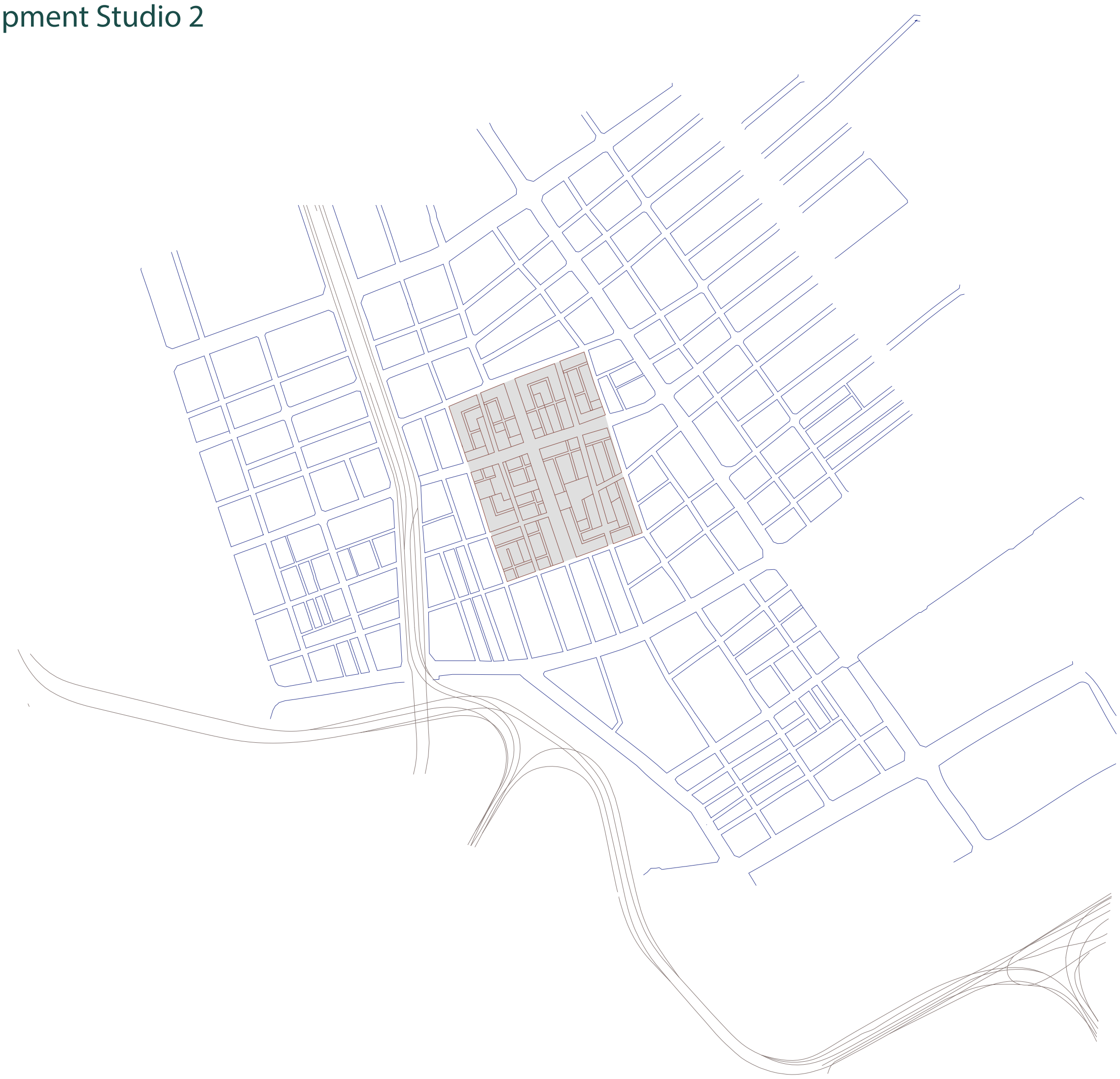


Residential Buildings

Proposed District Two

Eco District: One-Minute City

Research and Development Studio 2
Smart City Tokyo
Professor Perry Yang
Tasha Snedaker
Spring 2022



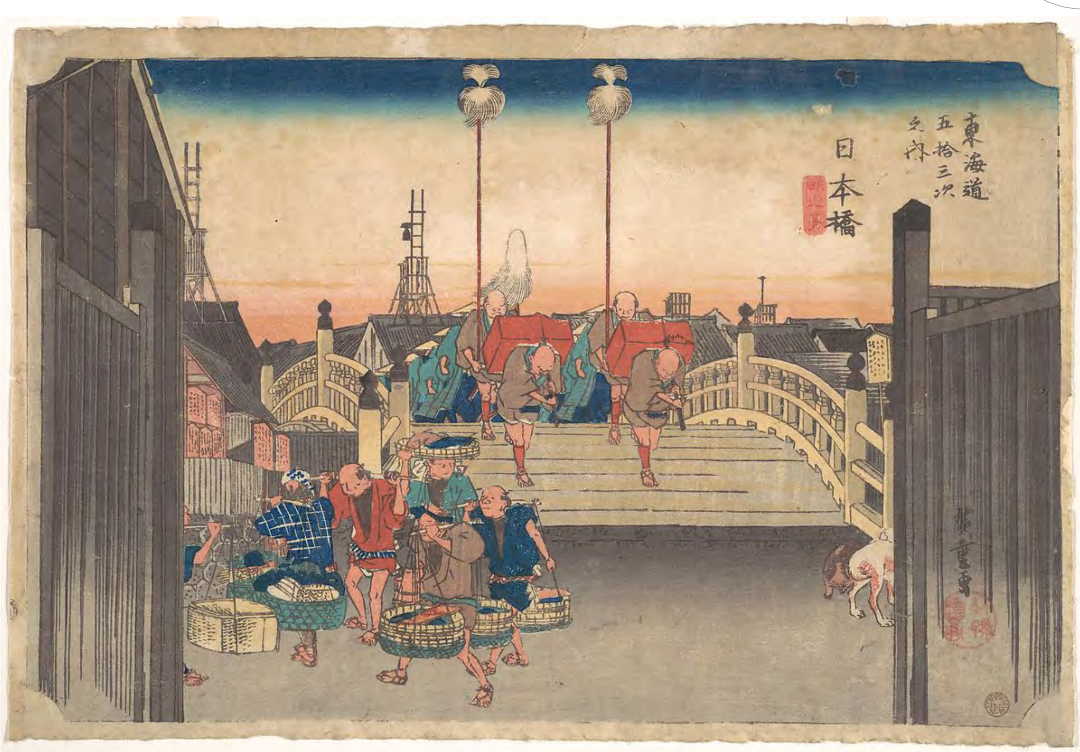


figure 1

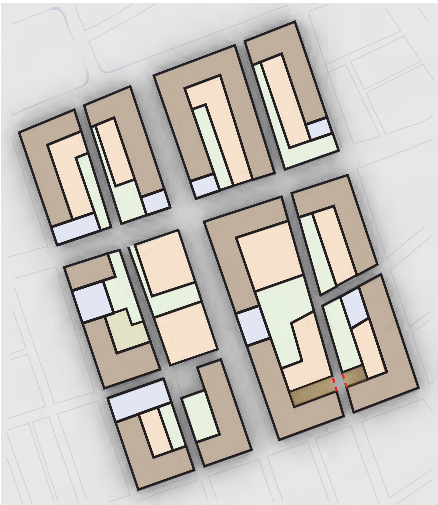
PROPOSAL FOR LESSENING GREENHOUSE GASES

Nihonbashi, located in Chuo City, Tokyo, Japan, and the center of old Edo Tokyo, has become an area of high carbon and low community. The studio's intent was to address these issues and Tokyo's zero carbon goal. This project proposes an Eco-District: One-Minute City concept that is intended to have the ability to be duplicated throughout Tokyo and allow for the return to a more harmonious and balanced way of life The key proposition of this project is to create a multi-layered, mixed-use space that includes community areas, recycling, walk-ability, connectivity to neighbors, kids areas, garden spaces in each living unit, and maximum amount of daylighting in each space. There are also third spaces and the idea of having the buildings connected by bridges is that it can allow for quick and safe passage to a friend and allow for more community amongst those that wouldn't normally be able to run into someone, like the elderly.

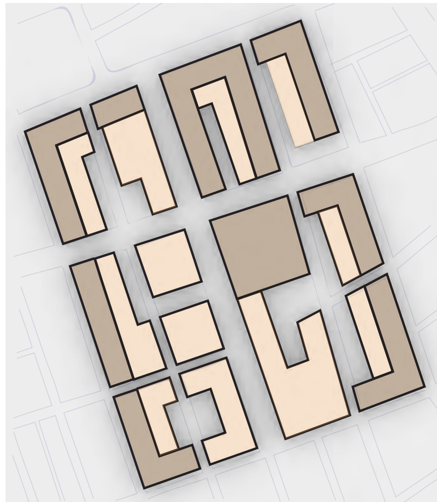
The design started with looking at the machiya, the Japanese shop house design, which is long like an eel's bed, or a 'unagi-no-nedoko'. It is an homage to the Edo period's form of mercantile architecture that emphasized a narrow street-facing front, and resulted in a longer building extending to the back or center of the block. Space was limited and was used efficiently. The proposal takes the machiya styled apartments and follows the tatami mat room measurement style, from the Edo period. This then led to a conglomeration of stacked machiya-like apartments that were then arranged fit into buildings. The buildings were organized so that the first few floors would contain primarily street-faced retail and open office and residential on the remaining floors.

The benefits of having a one-minute city is that the people living in that superblock can reach what they need within a minute. Shopping, eating, socializing, health and medicine, laundry, and other items can be found within a very short period and without a car. This reduction of the use of cars is in direct relation to the increase in green house gas accumulation, and the heating of the earth. The minute city won't have everything people need but what they need most.

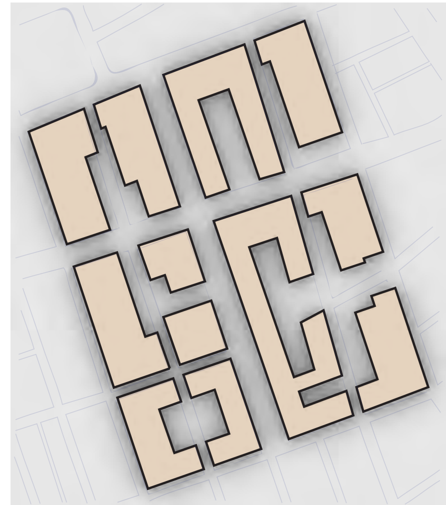
ZONING



GROUND FLOOR

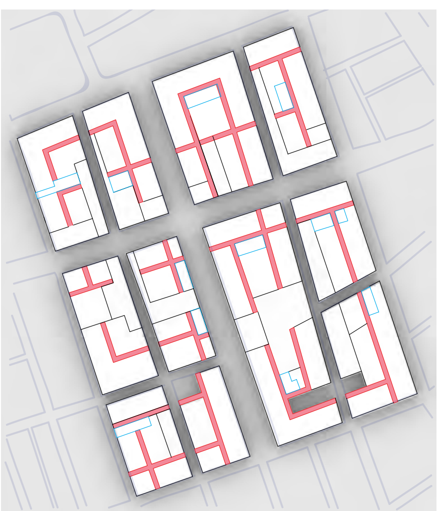


TYPICAL RETAIL / OFFICE FLOOR

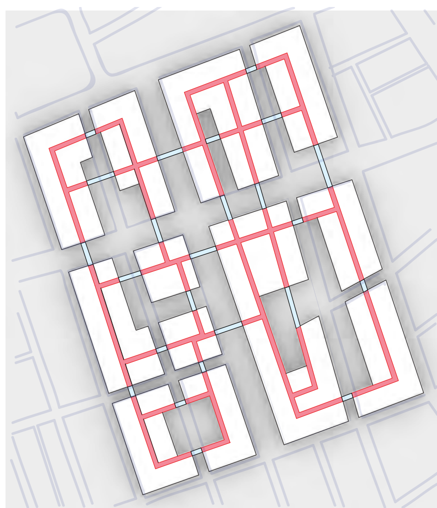


TYPICAL RESIDENTIAL FLOOR

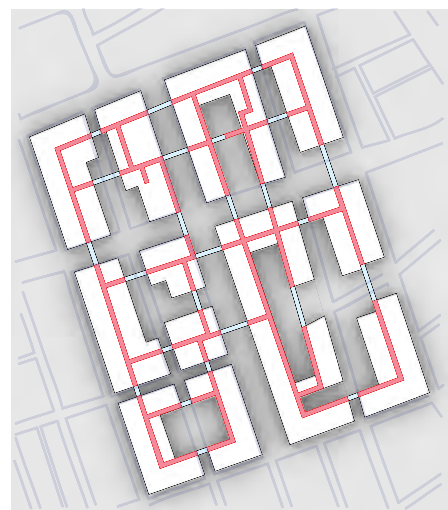
CIRCULATION



GROUND FLOOR

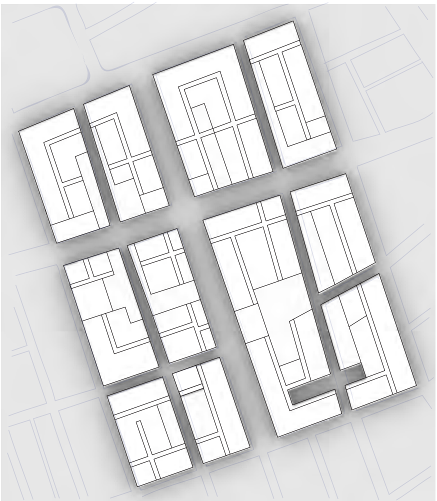


TYPICAL RETAIL / OFFICE FLOOR

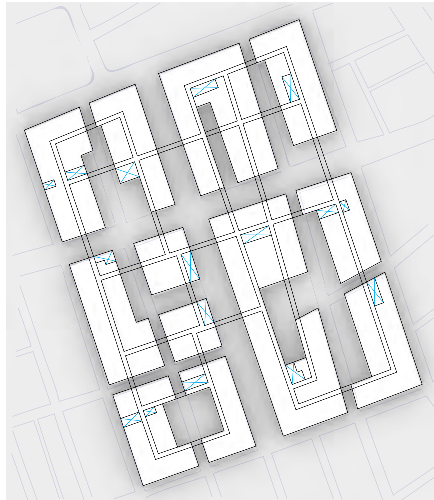


TYPICAL RESIDENTIAL FLOOR

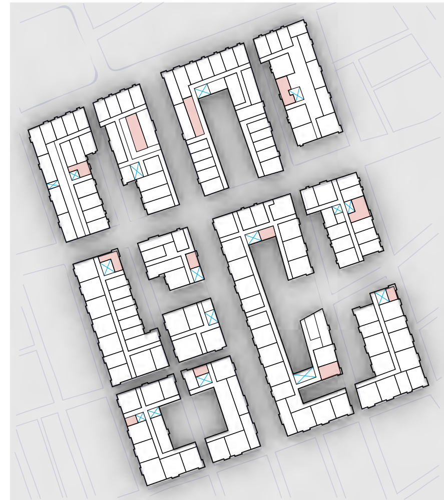
PLANS



GROUND FLOOR

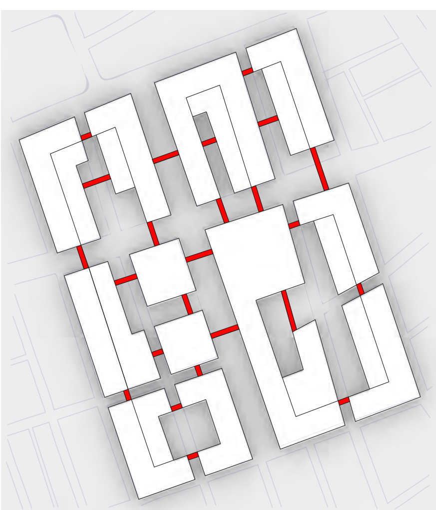


TYPICAL RETAIL / OFFICE FLOOR

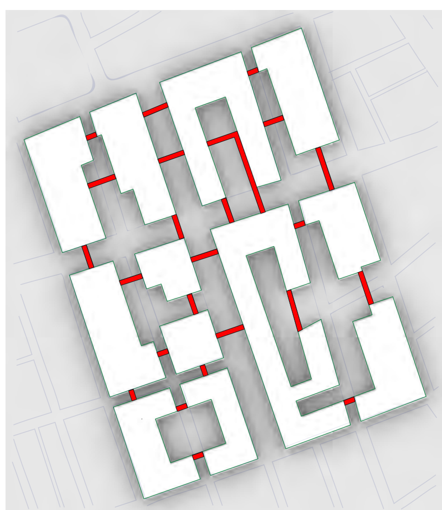


TYPICAL RESIDENTIAL FLOOR

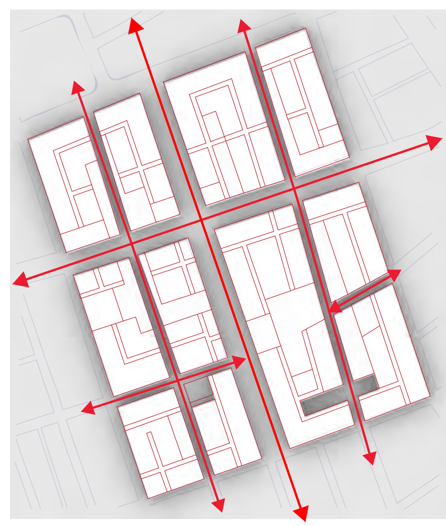
BRIDGES & STREET CIRCULATION



GROUND FLOOR



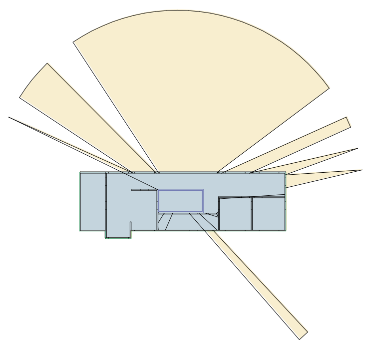
TYPICAL RETAIL / OFFICE FLOOR

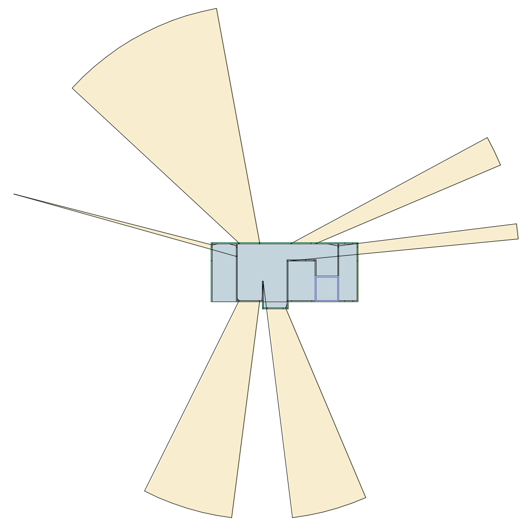


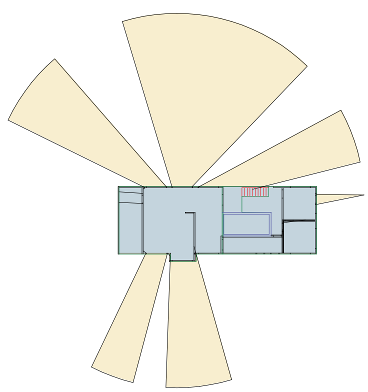
TYPICAL RESIDENTIAL FLOOR

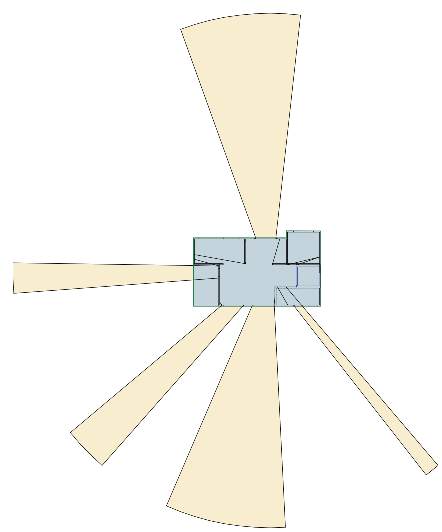
TWO ADJACENT BUILDINGS' FLOOR PLANS

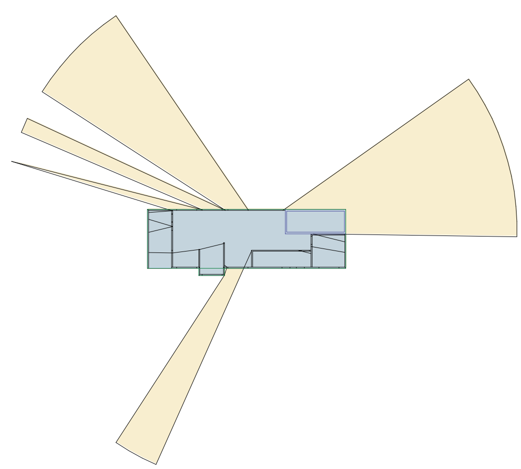
APARTMENT EXAMPLES WITH DAYLIGHTING AND VISIBILITY



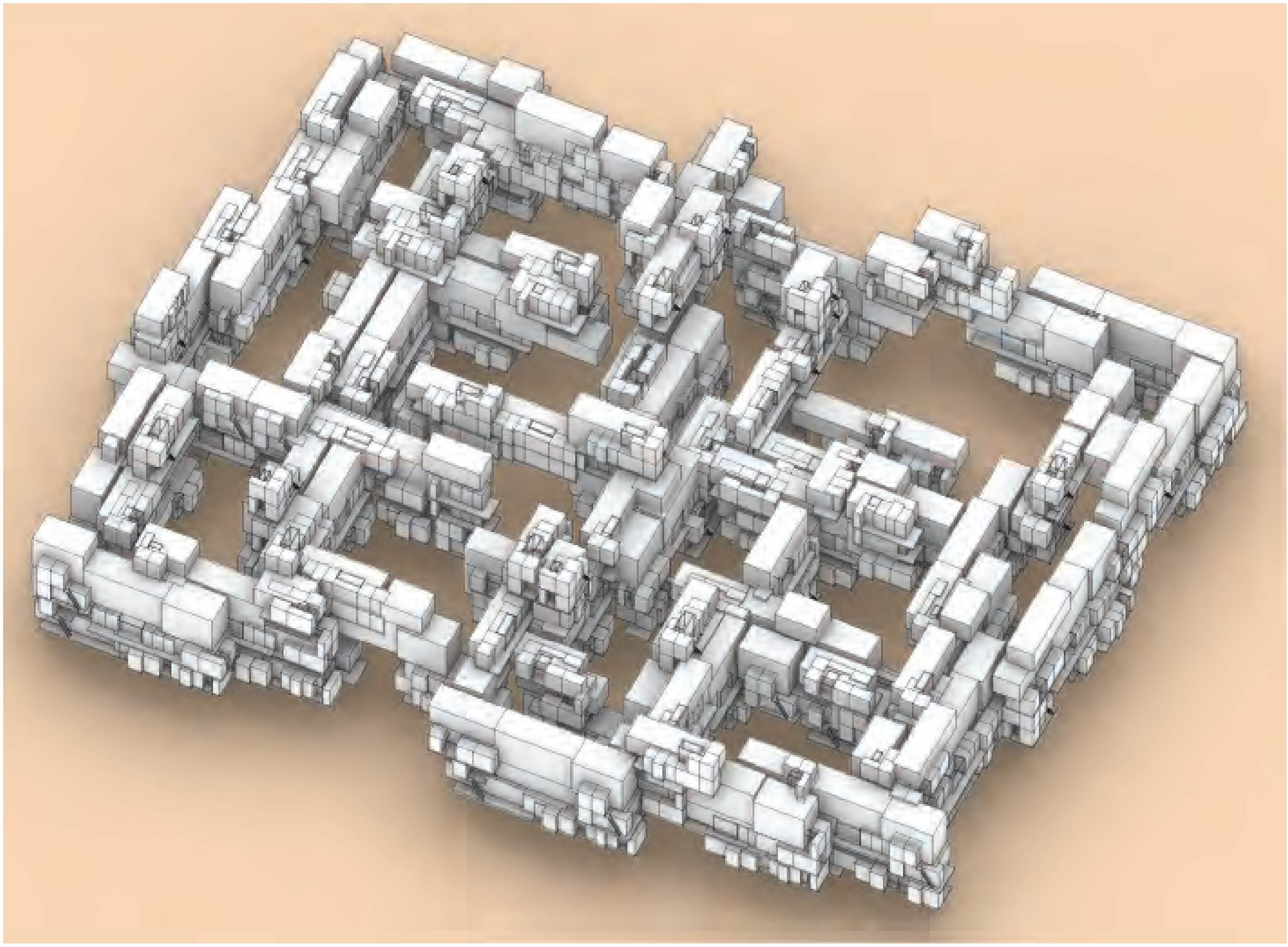








METABOLISM MASSING STUDY



EXAMPLES OF HEIAN AND EDO PERIOD MACHIYA

figure 2

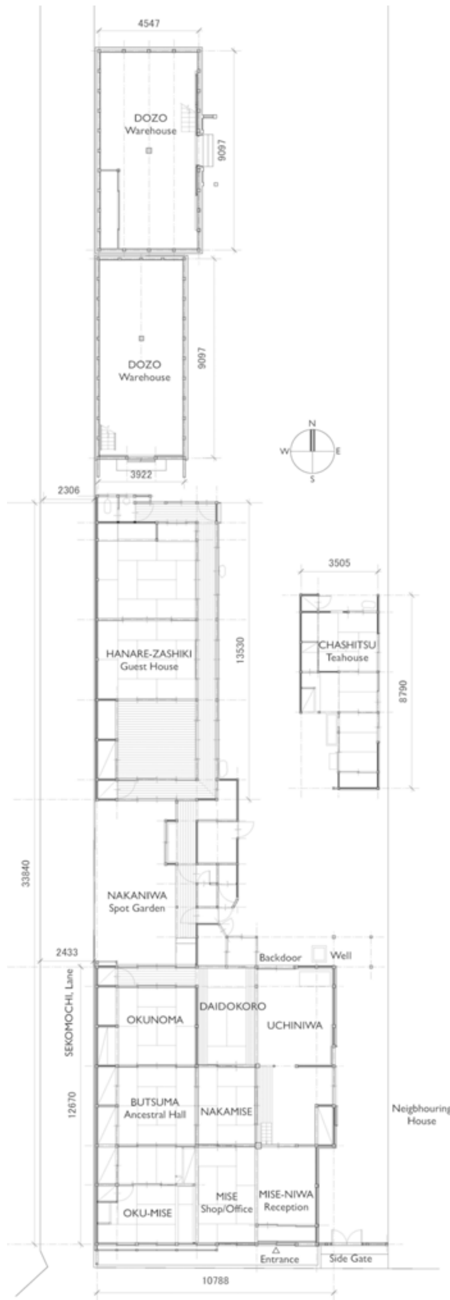
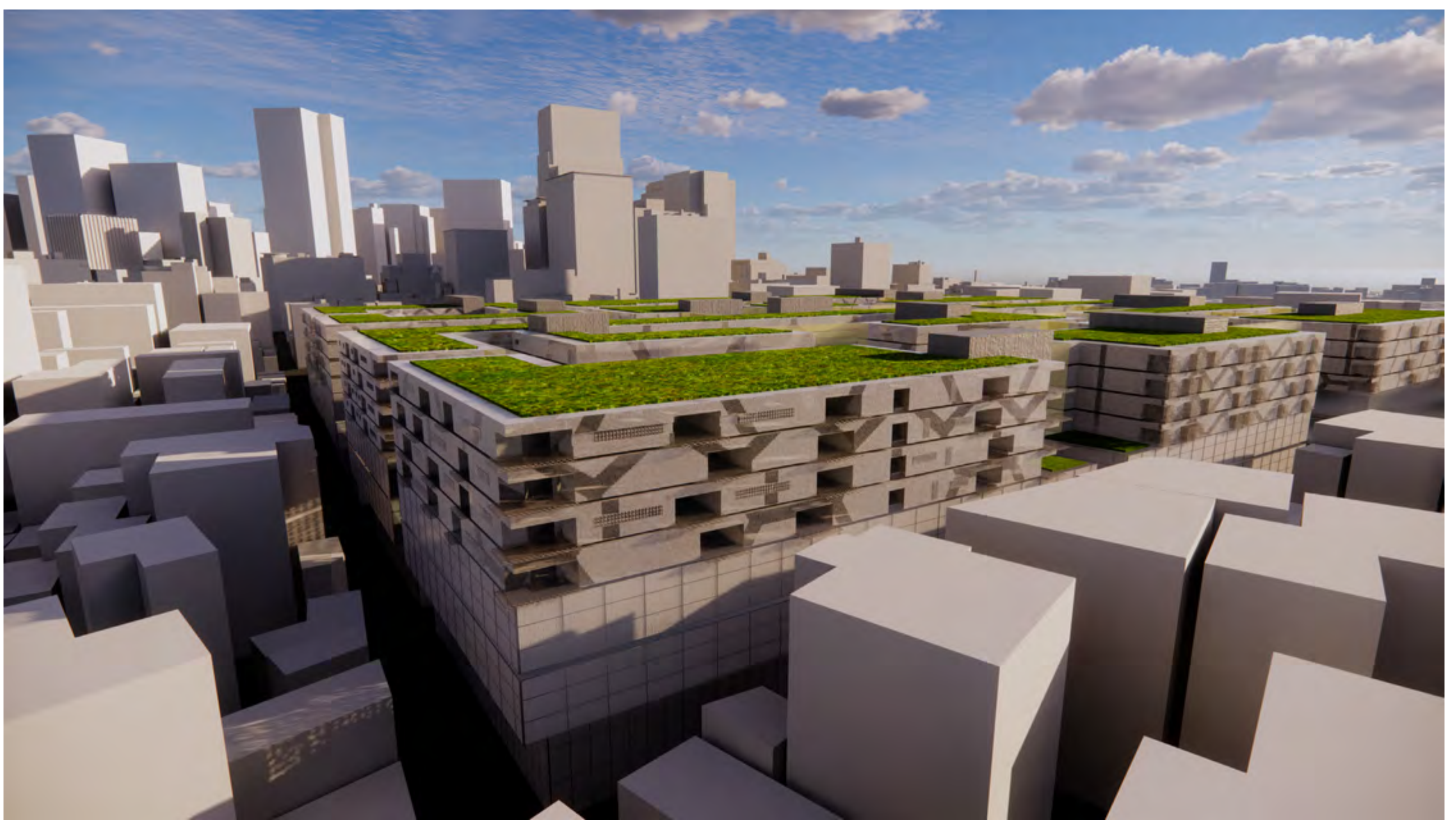


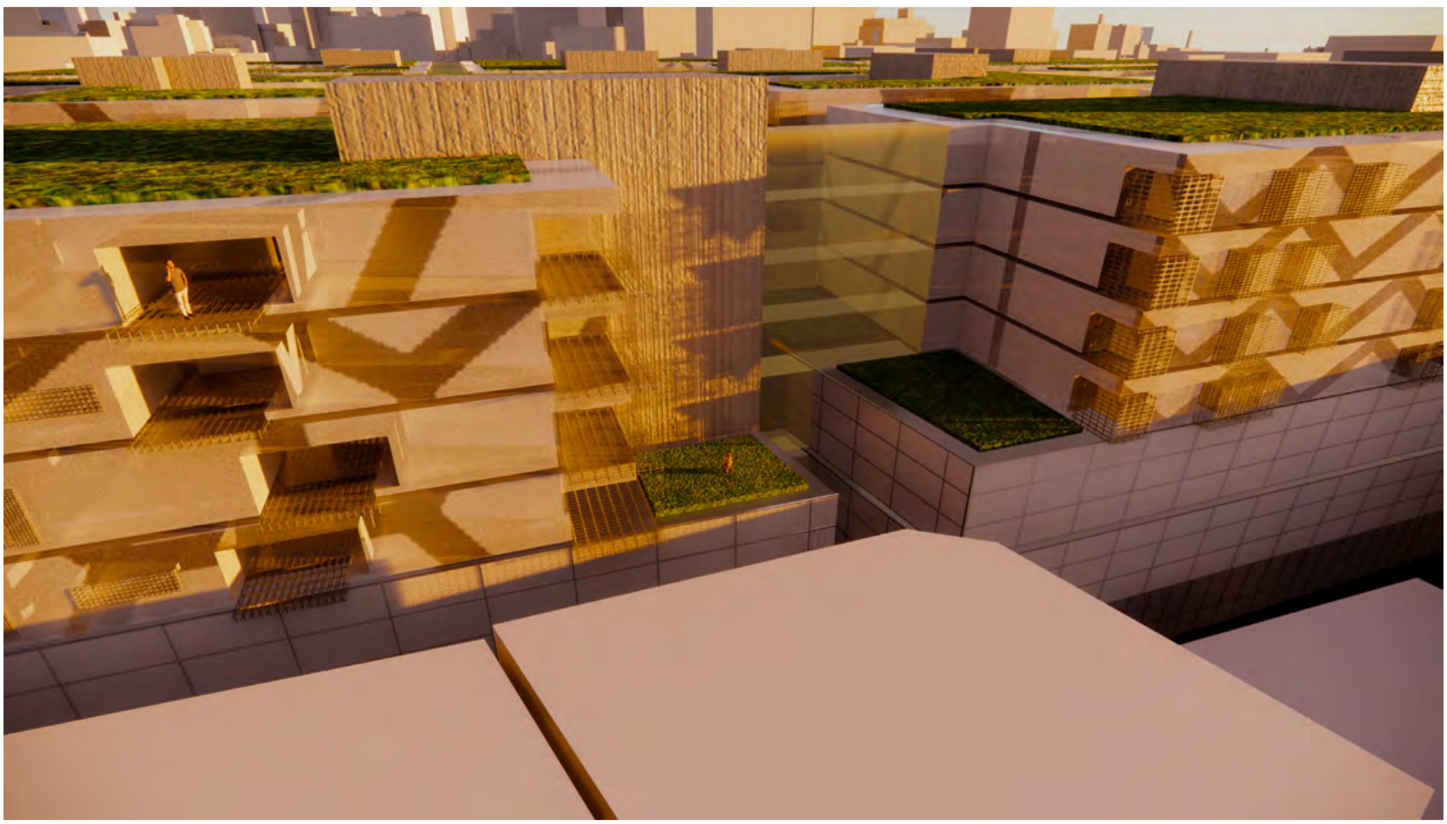
figure 3

PERSPECTIVES

GREEN ROOFING



VARYING MATERIALITY



GARDEN TERRACES

PERSPECTIVE AND PRECEDENTS


figure 4


figure 5

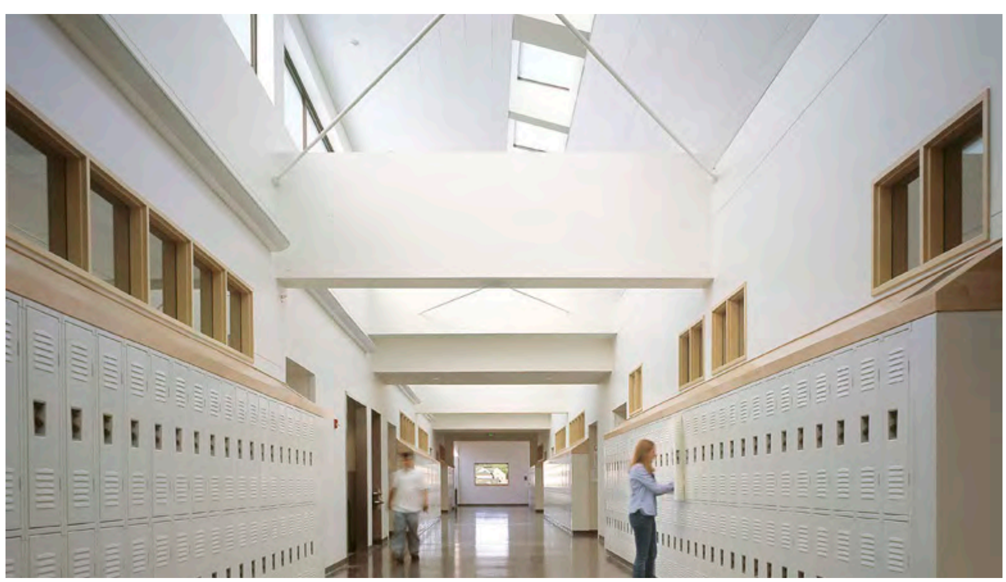


figure 6

figure 7

figure 8

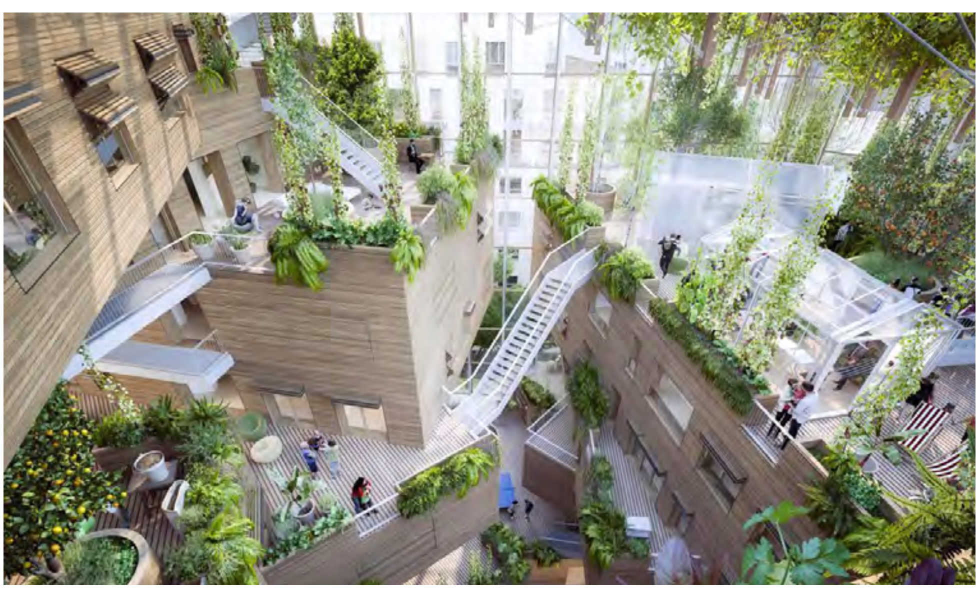


figure 9

CREDITS

figure 1:
Stations One: Morning View of Nihonbashi
ca. 1833–34
Utagawa Hiroshige
https://www.metmuseum.org/art/collection/search/36922

figure 2:
Kyo-Machiya Floorplan (typical)
Published: Jul 22, 2020
by Moon-Shadow-1985
https://www.deviantart.com/moon-shadow-1985/art/Kyo-Machiya-Floorplan-typical-849589643

figure 3:
Erik Olsen
@HardFastAndFree
10:56 AM · Jun 20, 2020·Twitter Web App
https://twitter.com/HardFastAndFree/status/1274355369616302080

figure 4:
“Experience “Live Like a Local” staying in Kyo-machiya”
https://www.tabido.jp/en-us/article/919/
TABIDO Last Updated : 2019.2.20

figure 5:
Food Roof Farm
Urban Harvest STL
https://www.urbanharveststl.org/food-roof-farm

figure 6:
Clackamas High School
Boora Architects
Clackamas, Oregon, United States
Credit: Michael Matthers

figure 7:
https://tooledesign.com/expertise/multimodal-transportation-plans/

figure 8:
“Rooftop Farming is Getting Off the Ground”
https://www.npr.org/sections/thesalt/2013/09/24/225745012/why-aren-t-there-more-rooftop-farms
September 25, 2013
10:48 AM ET
Eliza Barclay

figure 9:
MVRDV Architects
https://www.mvrdv.nl/themes/6/sustainability
proposal for La Serre d’Issy in Paris

Urban Design I

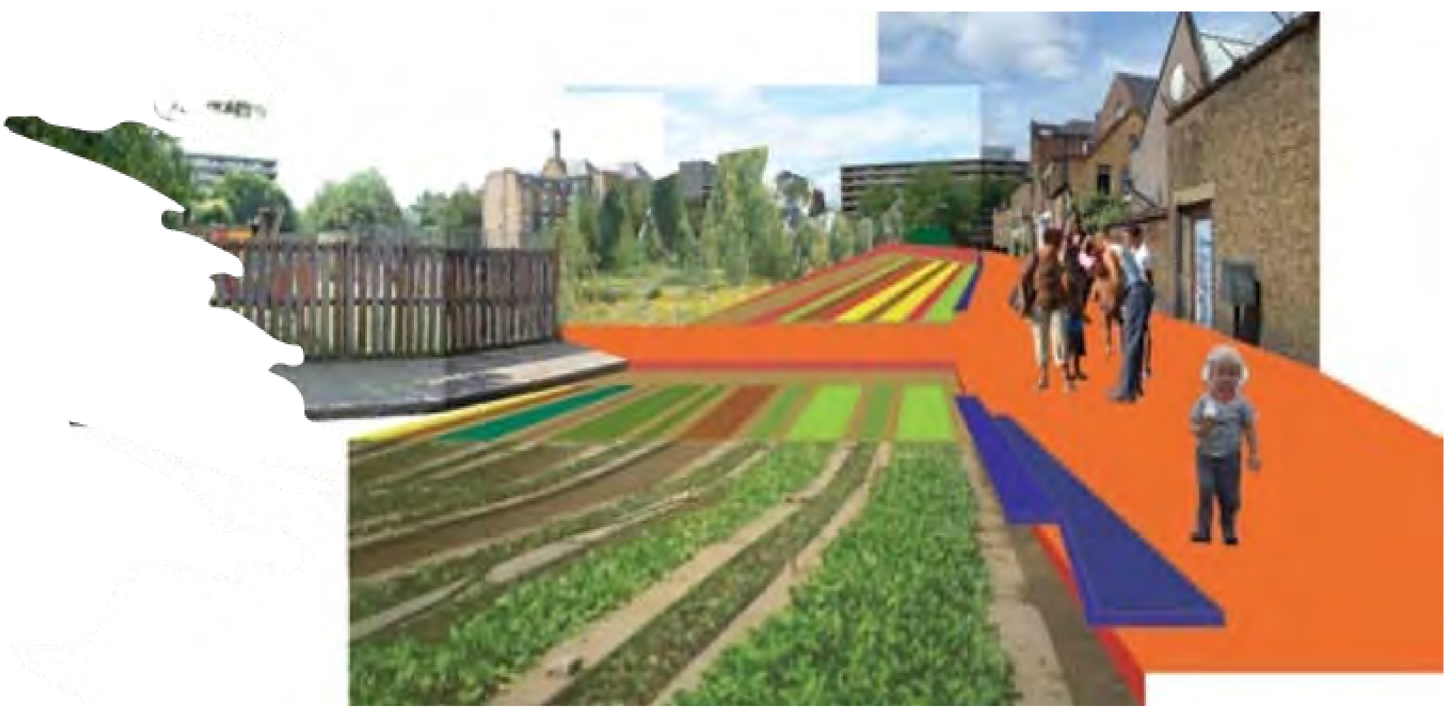
Continuous Productive Urban Landscape

By Usha Menon, Athulya

Despite being a highly industrialized country, one-third of Japan's agricultural output is generated by urban agriculture. Source of fresh and safe products, including organic and low-chemical crops, that are increasingly demanded by urban consumers. In Tokyo, one of the largest and most congested cities in the world, among the intricate networks of railways, roads, buildings and power wires, local agriculture produces enough vegetables to potentially feed almost 700,000 city dwellers.

Horidome park	Hotels with potential roof spaces for events and agriculture
Office Units with potential roof spaces	Hospital
Residential units with potential private garden and balcony spaces	Potential open spaces for CPULs currently surface parking

CPUL is a strategy for the coherent integration of urban agriculture into urban space planning. Coined by prolific architects and natural urbanism advocates, Andre Viljoen and Katrin Bohn. (Below) Munton Road, London, before and after implementing a CPUL. In this proposal, the road, which is lightly used by vehicles, would be converted into an urban agricultural field surrounded by cycle and pedestrian ways. From Bohn&Viljoen Architects.



CPUL for an Everyday City-Nihonbashi, Tokyo

Green loop connecting site A-2 to existing open spaces through CPUL

C -Connects open spaces;urban land to new infrastructure

P -Uses open spaces;through urban agriculture, economically, environmentally and socially.

U -Happens inside, the green field stays green,brownfield site becomes green.

L -Landscape of spatial and visual qualities of the urban and rural.

CPUL could transport and supply:

PRIMARIES: air, Wildlife, Water retention, Soil,Pollination

PEOPLE:To compliment and as alternative to road and cars.

SPATIAL COHERENCE: Closeness to nature

CULTURAL COHERENCE:Constant offer to encounter & communicate.

FOOD LIFECYCLE: Production-retail-consumption-recycle

Design interventions at a

URBAN

Parks

Systems
Lighting
Floor Area
Potential Yield

Boulevards

Systems
Lighting
Floor Area
Potential Yield

Park Benches

Systems
Lighting
Floor Area
Potential Yield

BUILDING - INTERIOR

Ceiling

Systems
Lighting
Floor Area
Potential Yield

Window

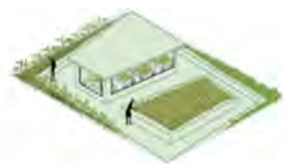
Systems
Lighting
Floor Area
Potential Yield

an urban and building scale

BUILDING - DEVELOPMENT

Facade

Systems
Lighting
Floor Area
Potential Yield



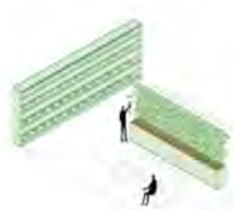
Roof

Systems
Lighting
Floor Area
Potential Yield

Balcony and corridor

Systems
Lighting
Floor Area
Potential Yield

BUILDING - INTERIOR



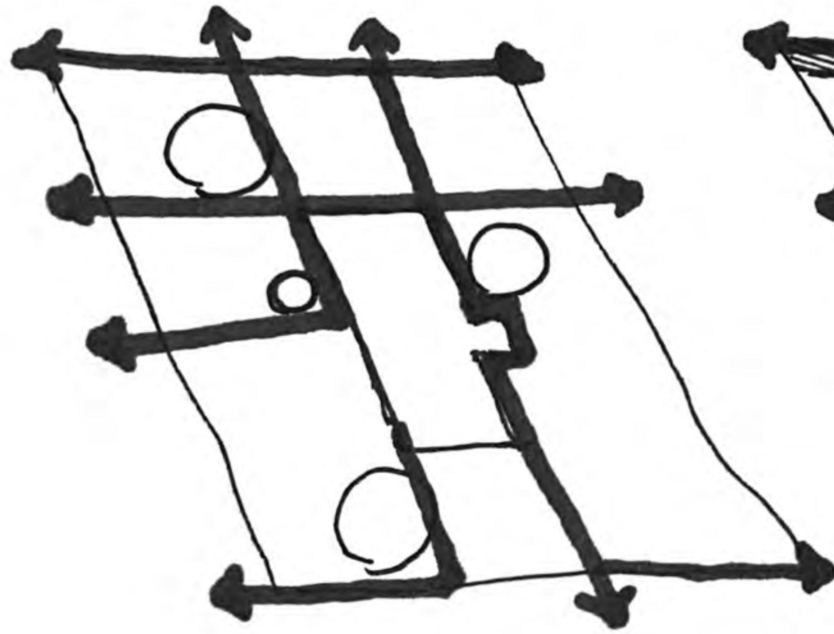
Furniture

Systems
Lighting
Floor Area
Potential Yield

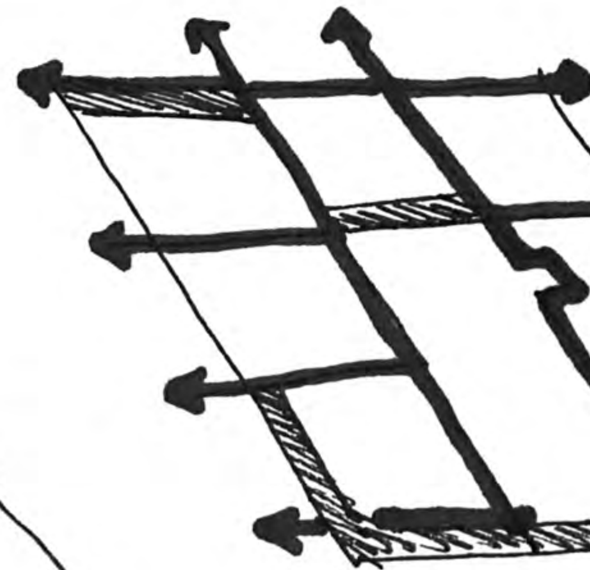
Feature Piece

Systems
Lighting
Floor Area
Potential Yield

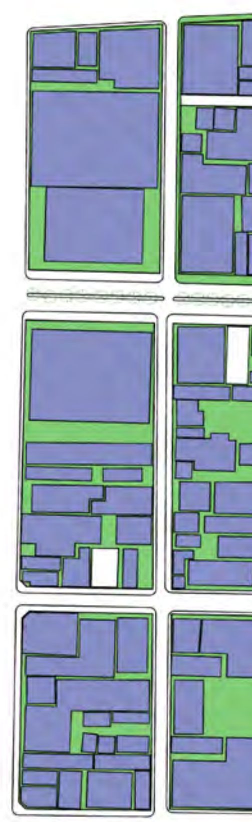
PUBLIC REALM FRAMEWORK STRATEGY

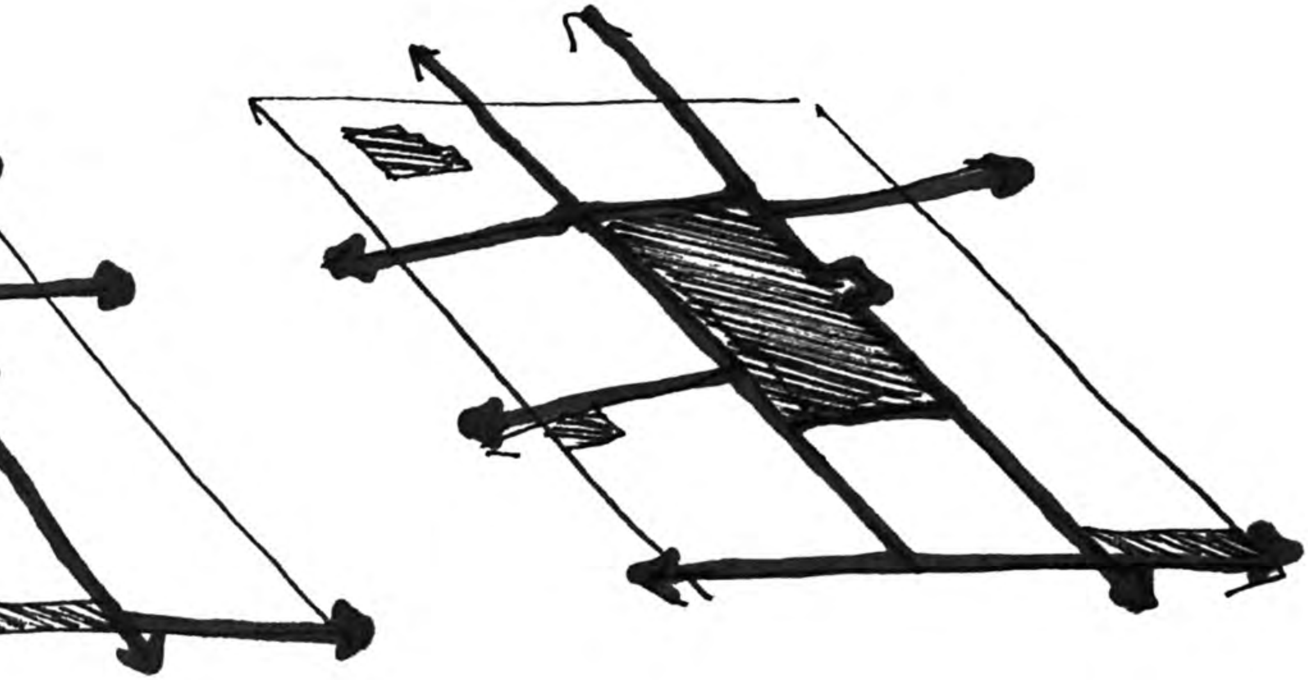


Identifying potential spaces for food related programs



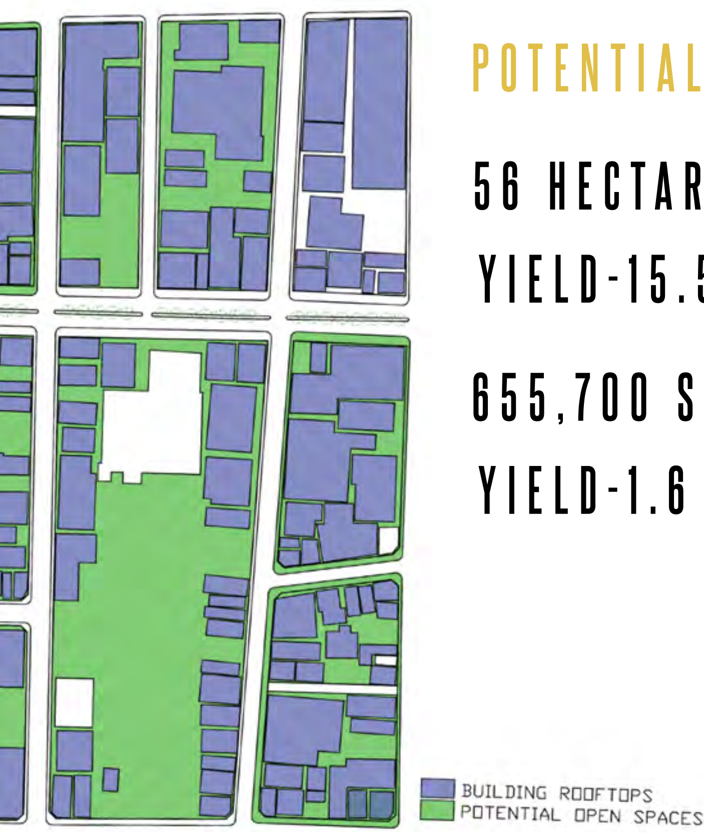
Identifying pot
and commercial





ential spaces for retail
l spaces

Community facilties to build a
strong connection between
the ecological functions.



POTENTIAL YIELD FROM NEIGHBORHOOD BLOCK

56 HECTARES OF OPEN SPACES

YIELD-15.5 TONNES

655,700 SQ.FT ROOF TOP AREA

YIELD-1.6 TONNES

Ecological Urban Design

Compiled by Priyanka Shyamal Adhikari

A. FIXING OFF-STREET PARKING (NIHONBASHI DISTRICT TWO) USING GREEN INFRASTRUCTURE METRIC

EXISTING ISSUES:


KEY MAP

DEAD PARKING LOTS AND BUILDING REARS FACING MAIN STREETS.

KEY PROBLEMS:

Large swathes of hardscape, absence of green interventions increases urban heat island effect.
Absence of connectivity with abutting streets.

INTEGRATION OF GREEN INFRASTRUCTURE METRIC TO EXPLAIN REMEDIATION STRATEGIES:

Integration of Permeable Pavers

Ecosystem Benefits: Reduces stormwater runoff, reduces heat island, reduces flooding and erosion.
Economic Benefits: Saves money on water management
Community Benefits: Enhances urban streetscape.

Downspout Disconnection- Preventing sewer system overflows, redirecting runoff to rain barrels/ cisterns- reuse water for landscape and other uses.

Ecosystem Benefits: Reduces stormwater runoff.
Economic Benefits: Saves money on water management
Community Benefits: Enhances urban streetscape.

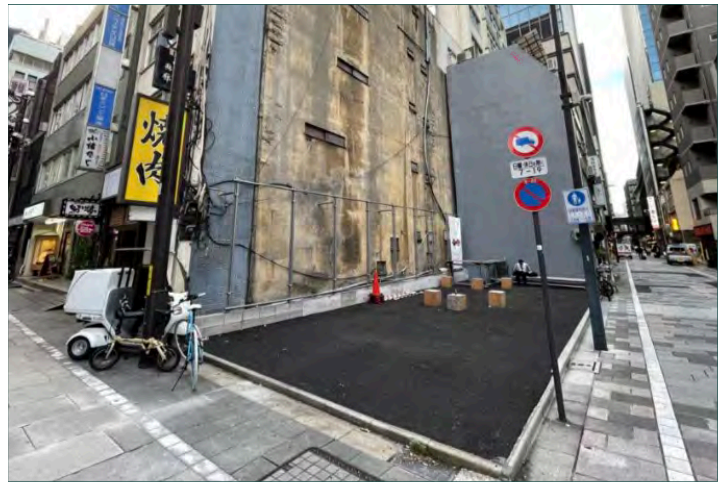
Reconfigure Parking (planters for Bio-Retention, partial infiltration), Use of Native plants

Ecosystem Benefits: Reduces stormwater runoff. Reduces flooding and erosion, reduces CO_2, Cleans the air.
Economic Benefits: Saves money on water management
Community Benefits: Enhances urban streetscape.

B. RETHINKING BUILDING FRONTS TO INTEGRATE LANDSCAPE ECOLOGICAL INTERVENTIONS

EXISTING ISSUES:

POTENTIAL DEVELOPMENT AREAS

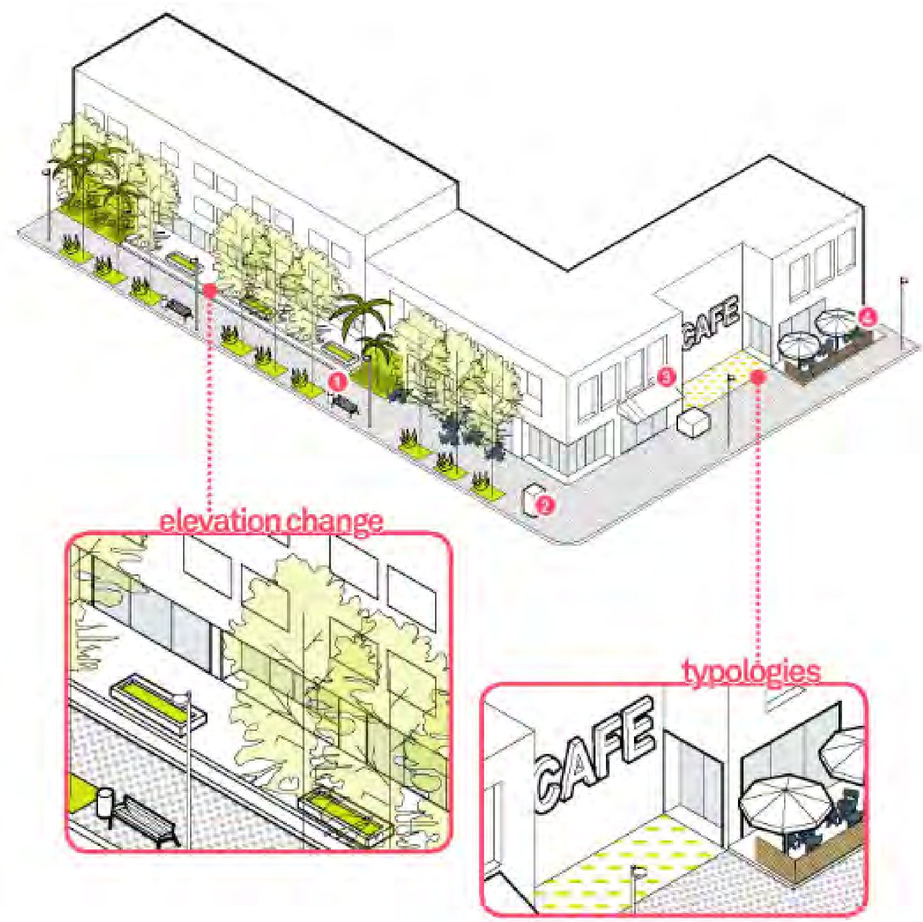


POTENTIAL DEVELOPMENT AREAS

KEY PROBLEMS:

Open space surrounding skyscrapers.
Presence of many undeveloped temporary open spaces.

INTEGRATION OF GREEN INFRASTRUCTURE METRIC TO EXPLAIN REMEDIATION STRATEGIES:



Source: Coastal Florida Design and Construction Manual

Architecture connects the public realm with the Private realm.

Access and openings shape this connection and add to the identity and experience of the pedestrians.

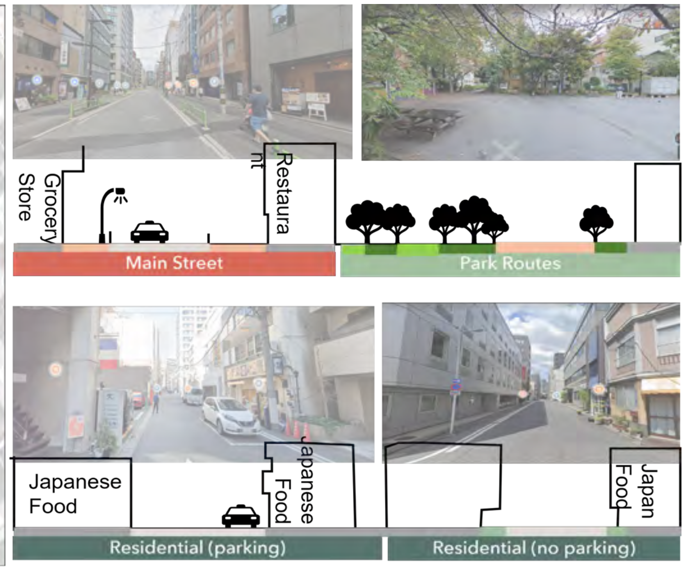
Elevational changes as a result of designing for flood events can alter this connection and should be done without losing the connection.

Frontage typologies should reflect the Place
And Identity while being appropriate for the immediate public realm.

1. Manage Stormwater and Urban Runoff: Bio Retention Planters, Street Trees and Living Infrastructure.
2. Reducing Clutter in ROW while enabling access: Integration of utilities, infrastructure integrated into building frontages through Alcoves and Setbacks.
3. Shading Devices: Overhangs, Trees, Shading Devices that add to the identity of the place.
4. Seatings, Cafes: Connections to the public realm.

Street Renewal Strategies in the Post-Pandemic Era

By Yan Xie

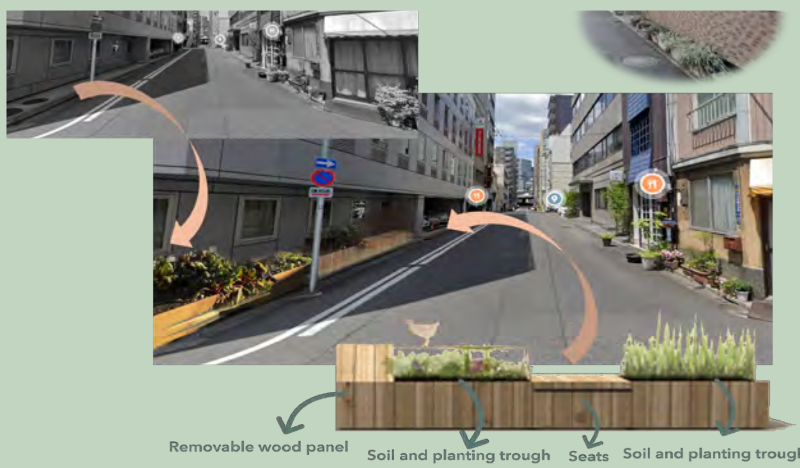


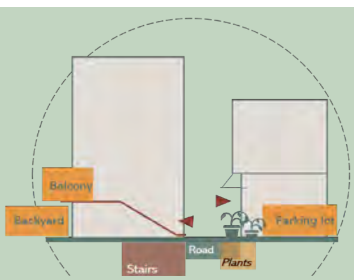
Existing Streets

The existing streets were categorized into three class: main street, residential road and park routes. The main street has a narrow walkside less than 3 meters while residential roads are narrow and shared by pedestrian and cars. The park routes, however, have a large area of concrete ground without boundaries. Since the neighborhood was transformed by commercial offices, it was not residential friendly in scale. Three strategies are used to make better use of the space, activate streets and help commuters keep safe during the outbreak.

The store was filled with potted plants at the entrance. Those potted plants, and the agriculture module which combined with street furniture, are part of the CPULs landscape system. They will be embedded along the residential road to increased entrance depth visually, and also activate the space.

Strategy 1 Discrete and Activated Residential Roads





Local Japanese restaurants are located on narrow roads with no outdoor dining space. Outdoor dining strategies in the post-pandemic era utilize the existing small, fragmented outdoor spaces. Place residential road grade outdoor furniture in the parking lot, open terrace or backyard.

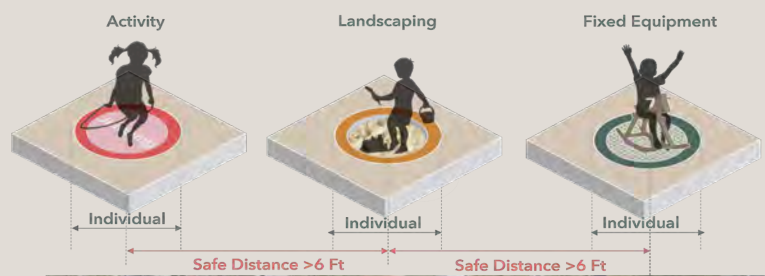
Strategy 2

Strategy 2 Dynamic and Lively Main Street

The Main Street used to be a busy pedestrian street.Since the outbreak, there are fewer commuters. Some movable smart street furniture could add vibrancy, but help people keep a safe distance. Install sensors underneath the sidewalks to collect pedestrian data and redefine the sidewalk boundary based on the amount of traffic. The street could also manipulate the furniture and move them to safe places.

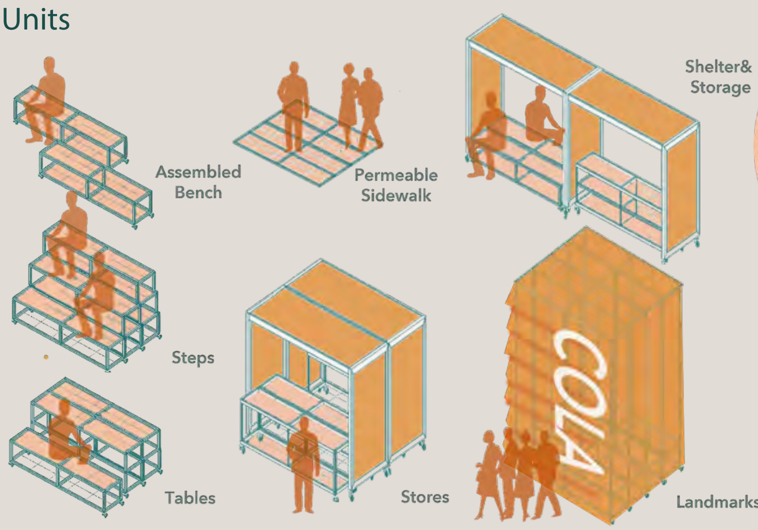
Strategy 3

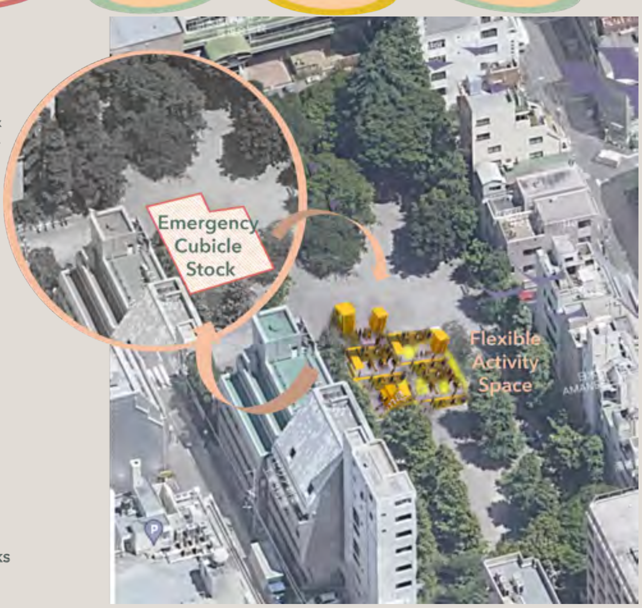
Strategy 3 Flexible and Fixed Park Spaces



Flexible spaces are made of single units which can be assembled to provide functions, including rest,dining, movies, etc. The units can be removed at any time to leave large open spaces where temporary cubicle wards can be built to meet the needs of a sudden epidemic. The "islands of activity" is site where Individual devices or activities are fixed on an "island" restricted by panting or landscaping and distanced from other. It is a playground for children when they cannot gather.

Units





Urban Design II

Landscape Urbanism at Play

By : Riya Shah,Devaki Kesh, Umar Dar

Nihonbashi (a literal translation of Japan bridge) refers to a hyperactive commercial area known for its 17th-century bridge. Nihonbashi was at the center of Edo-Tokyo and connected five major roads that improved the connectivity of Japan. As a result, Nihonbashi received an influx of people and products due to the excellent connectivity to the area. One could truly experience the essence of Japan here. The closure of one of the prominent business brands in the late 90s led to the decline of Nihonbashi as the financial district of the country. This led to a downfall in Nihonbashi visitors and over time the area lost its popular vibrancy.
Mitsui Fudosan, an influential real estate agency with roots in Nihonbashi recognized this pitfall in the neighborhood and initiated the Nihonbashi Revitalization Plan. The plan aims to revive and retain the traditional and cultural fabric of Nihonbashi and aims to also retrofit existing projects to provide for a better tomorrow. The first phase of the project was completed in 2004 when the company developed mixed-used and diverse establishments that restored the lost footfall in the region. The second phase of the project is currently underway where the expressway running over Nihonbashi will be shifted underground opening avenues to revitalize activities along the waterfront.

The project's phase 2 (currently underway) has four objectives:
1.Creating Business Clusters: Invite and foster the life sciences and other growth realms
2.Neighborhood Renaissance: Develop mixed-use buildings and make streets more appealing.
3.In Harmony with the Community: Foster the vitality of local communities
4.Reviving the Aqua polis: Revitalize the waterways for a more attractive waterscape

Three-Fold Urban Design Framework: The design is approached through a three-fold design framework that lays down the Urban Design Guidelines, Urban Design Framework and Design proposal.

INTENT:
How can we socially reorient a city that has turned its back on the water through urban design frameworks?

Urban Design Guidelines

NEIGHBOURHOOD CHARACTER

Each site and neighborhood are unique and has different existing characteristics. The Place Types provide a planned vision for each area, but attention should also be paid to the existing features on the site and how they can contribute to the unique identity for the area and create a sense of place.

1.Strategically locate new parks, pathways, and open spaces in central locations, adjacent to natural heritage features, at corners, view termini and adjacent to community facilities to form focal points and provide views throughout the neighborhood.
2.Provide a cohesive and complementary architectural style throughout new development. Architectural style and form do not need to be the same but should be compatible to create a sense of place.
3.Consider the design of streetscapes, setbacks, façade rhythm, architectural datum lines, and landscaping, to contribute to the unique character of the neighborhood for new or infill development.

BUILDING MATERIALS

A diversity of materials in new development will help to visually break up massing, reduce visual bulk, and add interest to the building design. Articulation is a horizontal change (recesses and projections) in building place that helps to break up the length of long buildings.

1.Provide recesses and projections that are a minimum of 1m deep. Relate articulation to the rhythm of interior units where possible. Heavier materials should be projected out from lighter materials.
2.Where there is a horizontal material change, aim to include a slight articulation change to resolve the transition.
3.Recesses and projections should be a minimum 0.3 meters deep to be noticeable. Relate articulation to the rhythm of interior units where possible.
4.Heavier materials should be located lower on the building.
5.Only provide parapets where they relate to a projection in the façade, or a change in material.
6.Utilize transparent glass and glazing to break up the mass of the building, activate the streetscape and provide passive surveillance for commercial, residential, office, and institutional uses.

BUILDING LOCATION

Locate buildings to frame the public realm and create usable amenity space on site .

1. Locate buildings close to the highest order street to create a comfortable pedestrian environment.
2. On corner properties, locate the building at the corner.
3.Locate buildings in line with existing adjacent buildings that are not anticipated to change.
4. Within new development, provide a 1-to-2-meter setback to avoid encroachment of footings, canopies, and signage.
5.Orient buildings with their long axis parallel to the streetscape to provide a continuous street wall.
6. Development adjacent to parks, pathways and POPS should be oriented to and frame the open space.

PARKS

The inclusion of each public space in the design of neighborhoods and new developments provides a place to meet and gather, create connections, and establish the character and sense of place for the surrounding area.

1.Locate public spaces centrally within new neighborhoods, bounded by public streets, to form a focal point. Design new neighborhoods to have 50% of the perimeter of a park bounded by public streets.
2.Locate public open space adjacent to natural features, at corners, view termini and adjacent to community facilities.
3.Locate plazas at the corners of new development to serve as an extension of the public sidewalk.
4.Introduce civic spaces to dense existing neighborhoods by providing a more urban, hardscape space for events and gathering.

Urban Design Framework

TRANSIT AND CONNECTIVITY:
Main streets for the integration of bike lanes, wider pedestrian paths, and central median bioswales.

GREEN SPACES & CONNECTIVITY:
A slow street connects the Himacho Park to the north-east of our site, in order to create better pedestrian connectivity across green spaces.

WATER TRANSIT:
Introduction of water transit stops as a means of facilitating alternate modes of public transit that

SITE SELECTION:
Introduction of water transit stops as a means of facilitating alternate modes of public transit that utilizes the river as connecting element in the city rather than a disconnect.

Urban Design Strategies

Green Streetscapes

Opportunity Nodes

Waterways Network

Urban Farming

Urban Squares

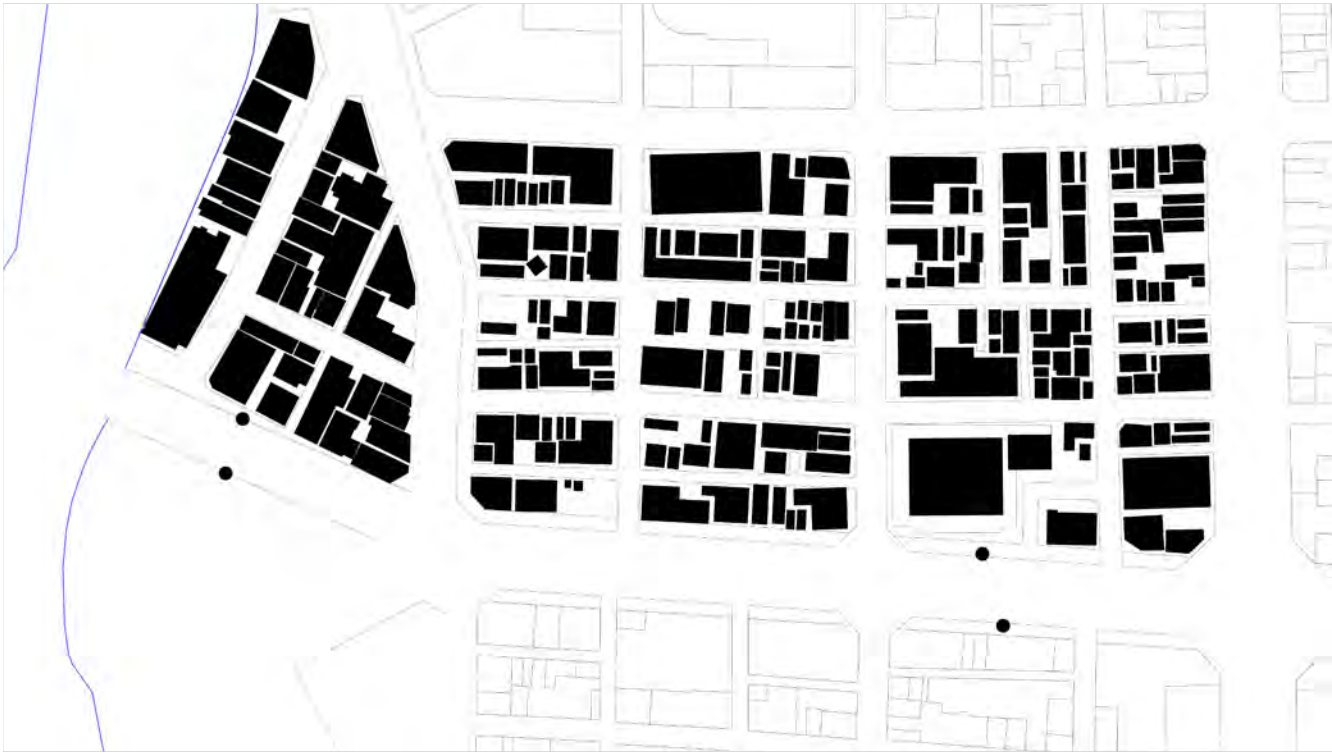
Activating Waterfront

Urban Design Proposal

Existing Urban Fabric

Proposal Plan

Block level Analysis



Existing Figure Ground

Proposed Figure Ground

Block level Analysis

Existing Land Use Plan

Proposed Land Use Plan

Residential
Commerical
Historical Importance
Amenities
Mixed-Use

Block level Design Proposal

Proposed Block Axonometric

Residential   Amenities   Commerical   Mixed-Use   Historical Importance

LEGEND :

1. Stilts - Public zones
2. Bike lane x Pathways
3. Public Park
4. Water Jetty
5. Slow Street
6. Bioswale x Public Amenity
7. Urban green plaza

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