

URBAN JOURNAL

VOLUME 8



URBAN JOURNAL

VOLUME 8

MAY 2022

FROM THE EDITOR

Adaptation

Thomas Wilson

After nearly a decade of abandonment, Providence's Superman Building is on the verge of being occupied once again. During the production of this journal (whose theme of the year just so happened to be adaptation), it was announced that the jewel of Providence's skyline would finally be redeveloped; this news stands out as an opportune metaphor for understanding urban life in our era. The Superman Building's redemption arc illustrates that even after periods of despair, our cities will always find ways to evolve. In my two years working on the Urban Journal, nothing has been clearer.

This year's edition of the Urban Journal is a collection of pieces grounded in urban change; this year's contributors have provided us with a set of unique perspectives on the various evolutions our cities have undergone, are currently undergoing, or may someday undergo. As you read this year's edition, it will become clear that, across all scales, urban change is constant. Even in spaces as narrow as a single street corner, our cities are continuously adapting to change, whether it be in response to forces as ominous as climate change or as communal as the Church. Beyond that, they ask us how we should consider these adaptations, both conceptually and practically.

I am especially excited by this edition's contributors because their submissions demonstrate the ability of our Urban Studies community to not only observe urban change but also impact it. Proposed in these pages are new design frameworks for concepts as broad as rivers, architectural renderings for buildings to feed communities, plans to make transit resilient, and calls to action for equitizing urban internet infrastructure. I find myself incredibly proud of the individuals who have shared their work with us, though I know their contributions to adapting the urban landscape have only just begun.

Providence, Rhode Island

Front Cover: *God's Eye on Providence* by James Dahlen

Back Cover: *Sunset Bridge* by Thomas Wilson

Edited and Designed by Thomas Wilson

Funded by the Brown University Urban Studies Program
with the generous support of the Harriet David Goldberg '56 Endowment

*Dedicated to the
Brown University
Urban Studies
Class of 2022*

TABLE OF CONTENTS

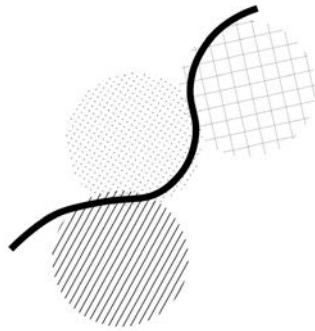
3	From the Editor <i>Thomas Wilson</i>
6	Rivers and Highways as Urban Corridors <i>Hanna Wells</i>
22	Downtown Providence from Above <i>James Dahlen</i>
26	Tracing Providence's Chinese Community Through Two Churches <i>Thomas Sze</i>
36	Climate Gentrification <i>Brian Thompson</i>
46	Documenting 14 Years of Change on One Seattle Street Corner <i>Zoe Pottinger</i>
48	Life in Public <i>Kate Harty</i>
55	Localizing A Global Network: Urban Internet Infrastructure <i>Chris Sarli</i>
66	silent / space <i>Ayana Boyd</i>
72	Farmlink Zero <i>Patrick Nasta</i>
86	An Architecture of Desire <i>Charles Alaimo</i>
88	Transit in Valparaíso, Chile <i>Jessica Luwis</i>
93	<i>Contributors</i>
94	<i>Endnotes</i>

RIVERS AND HIGHWAYS AS URBAN CORRIDORS

Reimagining their Form, Flow, and Function towards the Practice of Spatial Justice in Urban Design

Hanna Wells

This excerpt of Hanna's thesis, "Rivers and Highways as Urban Corridors: Reimagining their Form, Flow, and Function towards the Practice of Spatial Justice in Urban Design" is an analysis of the form, flow, and function of river and highway corridors in the urban environment. Chiefly inspired by Richard T. T. Forman's corridor concept, this chapter discusses river and highway corridor impacts on urban fabric through their edges, channels, capacities, and networks. In their intentional state, Hanna finds that rivers and highways represent freedom of movement and mobility. The theoretical implication of corridors is different than their practice, which is explored through case studies in the second chapter of her thesis.



A connector:

a thing which links two or more things together.
a line that weaves through a series of distinct things.

(the theoretical intent of river and highway corridor in the urban fabric)



A divider:

a line that marks the limits of an area; a bounding line.
a limit of a subject or sphere of activity.

Chapter 1: Form, Flow, and Function of Urban Corridors

I begin this chapter with a discussion of what I understand to be the constitutive connection between rivers and highways: form and flow. Both rivers and highways share characteristics in that they can be described in terms of long, meandering, continuous, narrow shapes. Flow follows this form, as their linear shape determines and facilitates the way we use rivers and highways to move people and goods. In this chapter, I will compare the morphology of rivers and highways across different scales: as form, flow, and the networks they create within the natural and built environment. I explore this connection by analyzing elements that define these forms – channels, edges, and interconnected systems – and by fleshing out the spatial similarities and differences of rivers and highways across a range of scales defined by the spatial area these corridors exist within. This multi-scalar approach allows me to demonstrate how rivers and highways interact with their environment in settings not limited to the urban landscape.

“Flows create structure, [and] structure determines flow.”¹

- Richard T. T. Forman

The long, line-like shape and arterial presence of the corridor affords them the ability to connect regions and places, on both small and large scales. Because of its distinct corridor structure, rivers and highways represent unconstrained flowing movement through and beyond urban environments. In their intended human use, the river and highway present a freedom to move and connect with different communities and places at various scales, unifying geographically disparate places. This chapter explores the distinct affordances provided by the river and highway corridor of movement and flow within built and natural environments, through respectively built and natural networks.

Despite the promises of mobility that the corridor offers, both rivers and highways are disconnected from surrounding urban patches. For example, urban rivers remain largely unintegrated into the cityscape as a natural element. The urban highway bypasses the city, selectively connecting with certain neighborhoods. Analyzing the characteristics of these corridor forms, their edge activity, function, and networks, will provide a deeper understanding of the many roles their corridor form plays within the urban environment.

My spatial analysis of rivers and highways reveals how corridors play an active role in shaping the urban matrix and how it determines movement and flow within built and natural networks. Though rivers and highways seem fixed and cemented in the urban landscape, they move, grow, and develop in accordance with human intervention. Paying attention to the edges, channels, functions, and networks reveals the impact corridors have on the surrounding urban landscape.

A comprehensive understanding of the corridor within broader urban morphology is doubly important: for one, it serves to answer questions about how humans move, flow, and interact with the urban environment, and secondly, it identifies possible points of intervention to improve flows and interactions. This chapter investigates how the corridor form influences infrastructure, and how the corridor and infrastructures are mutually constitutive as they mobilize flows around them.

FORM

A corridor is defined by channels and edges. For the purposes of the following discussion, an edge is defined by the space along the exterior of the corridor, while the channel is the area of the corridor itself. River edges and channels operate differently from those of highways. In developing a thesis around the importance of corridors in urban planning and design, it is critical that urban planners and designers understand the building blocks of environments within and around these forms. Rivers are natural corridors that predate urban development, while freeways are man-made corridors that have come to dominate cities across the country. These natural and built corridors connect through different scales of urban patches and matrices, illustrated in the corresponding figures that follow.

Chaos and Order in the City

With their curves and bends, both rivers and highways defy the way urban dwellers typically imagine and navigate our cities as a series of blocks, streets, and intersections. In planning and zoning work, cities are managed as collections of parcels, rigid zones that make up neighborhoods, and so forth. What rivers and freeways have in common is that they comprise corridors within the urban environment, slicing through orderly urban patterns, adding complexity to the mosaic of patches of the modern American city. As Forman writes, “corridors slicing through urban areas are conspicuous.”² Corridors became more prevalent in the urban landscape in the mid-twentieth century, roadway networks were intensified with freeway development.

Rivers and highways both influence and challenge modern city building and planning’s attempt to bring order and shape to urban uses. Many cities were built adjacent to rivers, as they were the purveyors of energy, transportation, and access. Planners in the United States, however, did not often integrate natural shapes into urban form, opting instead for

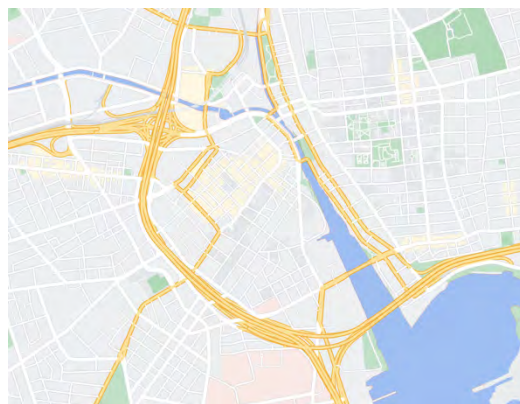


Figure 1.1: Map of downtown Providence, indicating an abrupt end of a grid-patterned city as it approaches the water. Similarly, the highway disrupts the grid pattern as well, I-95 is level with the ground in this segment.

orthogonal grid layouts. Rather than working with the natural flow of form offered by rivers, planners attempted to control and contain them. In these cases, the river does not run parallel to long avenues and urban road networks. Cities are often faced with awkward street and block patterns at the edge of a river or bay. (Figure 1.1) Roads spanning out from rivers used for human transportation “crossed the city [and] disrupted spatial arrangements... Whether considered a water system or a transportation system, rivers were always also a spatial system woven into the geographic fabric of the city.”³ Similarly, freeways are unlike the streets that indicate one’s positioning within a city: they bypass a city’s orderly gridded pattern, flying over or ducking under the built urban schema. The on- and off-ramps of highways are integrated in the city, dramatically changing the landscape.

At the same time, rivers and highways have become so spatially ingrained that they also bring order to the chaos of urban form. Historically, cities were built along rivers, and rivers shaped planning practices and the expanding economic, social, and cultural life of cities. The functionality of the river as a transporter and source of energy drove its centrality to city life. Presently, the river remains a core element of the city, now due to its aesthetic appeal.⁴ The impact of this riverine function is explored in Chapter 2.

While city streets and patches in the urban environment may aid our human experience navigating the city, rivers and highways offer an orderly spatial arrangement from different scales and perspectives. Cities were built on rivers so that humans could flow outside of urban settlements. Highways have a similar effect on modern city form, but from the perspective of a driver. Highways, as they are meticulously organized by design, are orderly to a driver; yet, a city walker has less clarity on the order they present to the city. From a human perspective, highways and rivers are much different from one another. A river traveling long stretches will appear different at various segments of the river. The landscape along the edges, the internal ecosystem, and activity on the water might indicate specific regions and climate zones. (Figure 1.2) It is especially easy for road users to discern an urban segment of a river from the rest of the patches that the river might travel through. Ex-urban highway networks, on the other hand, are nearly indistinguishable from one another: no matter what region or highway branch, the exterior landscape is almost always the same to highway users, save for the urban parts of the highway. (Figure 1.3) Here, drivers can view the city skyline and other recognizable landmarks.

Despite the similarities of corridors to “long linear patches that differ from their surroundings,”⁵ corridors vary according to the shape and function of their channel. By taking a closer look at their width and networks at various scales, the impact of sprawling corridors on everyday spaces can be better understood. Figures 1.4 through 1.11 (on page 21) present images of rivers and highways in the Pittsburgh metro area at various scales to visually support the following analyses on the corridor’s characteristics.



Figure 1.2: “I know where we are!” A flyover highway gives clear view of the distinct Pittsburgh skyline (right), and the Big Blue Bug and three smokestacks indicate Providence. Source: Google Earth



Figure 1.3: “Where are we?” Ground-level highway corridors within the metro area are indistinguishable. The image on the left is in Pittsburgh, and the right is in Providence. Source: Google Earth

Consider Figure 1.4, showing a small segment of the Allegheny River and Pennsylvania State Highway, Route 28. By isolating the river and the highway from the surrounding urban elements depicted in the aerial image, I analyze elements of form, and recognize both the similarities and differences of these corridors. Figure 1.5 shows the Allegheny River in isolation, while Figure 1.6 shows Route 28. The most obvious spatial distinction between the two is the width: the river is very wide, while the highway, though a multi-lane road that is wide to drivers, is narrower than the river. In this segment, both are relatively straight. It is no surprise that Route 28 is built in alignment with the Allegheny River, even arcing a bit with the natural shape of the river: rivers form a natural depression in the landscape that makes it easier for rail and road construction in the variable, hilly topography of Pittsburgh. “River valleys carved land transportation routes,” Castonguay and Evenden tell us, “with roads and railways running along the river’s edge.”⁶ Furthermore, industrial uses of riverfronts necessitated that railways be nearby for transport from ships inland. Such railroads, and soon road networks, often followed the trajectory of the river. Urban rivers offered readymade paths through landscapes that may have been hillier in other areas. Later road networks branch out from these original trunks, marking tangents from the parallel form highways share with the river.

Centering the same location on a larger scale, I analyze more corridor characteristics, particularly nodal points that define network systems. (Figures 1.7 through 1.9) The

Allegheny and Monongahela Rivers join to form the Ohio, and a web of highways connect to one another at this junction point as well. Rivers and highways can form patches as well, delineating one parcel of land from another. Pittsburgh’s “Golden Triangle” downtown area is an example of a patch formed both by rivers and highways: it sits at the confluence of the three rivers, and is bounded to the east by flyover highways. The highway also ends abruptly on the bottom left, as it goes through a tunnel underneath a cliff. These images also show the varying corridor widths of the river and highway, as the lanes on the highway might increase and decrease, and as the river meanders through narrow channels and larger basins.

Figures 1.10 and 1.11 both illustrate how the highway runs along the river, as it seeks the path of least resistance that has already been carved into the landscape by rivers, but also how engineers forcefully paved distinct paths through natural landscapes for the highway away from riverine space. An even more enlarged view of the river and highway systems in Pittsburgh further illustrates the difference between form in river and highway: the tension between the natural and built environments. Highways can appropriate nature according to human need, construction crews plowing through mountains to form tunnels. Some tunnels are noticeable in Figure 1.11, where the thin lines representing highways immediately stop, only to emerge again in another area of the map. Both rivers and highways are continuous forms, though it is only rivers that appear to be an endless, flowing body from this aerial perspective. Additionally, highways are able to function on a vertical scale, while rivers are limited to the topography of nature. Figures 1.10 and 1.11 illustrate the layers, bridges, and underpasses highways can form, defying nature in more ways than one to increase the efficiency of flow.

While the linear nature of rivers and highways adds a dynamic element to urban form, corridors can also effectively create boundaries, siphoning off certain parts of a city from another. The river can be an obstacle that has to be maneuvered and crossed. Historically, it has been used as a defense mechanism to protect cities and castles.⁷ The highway, similarly, is also a harsh border, with the noise and pollution and disruption to scenery pushing people away. In Pittsburgh and Providence, highways both dictate and delineate neighborhoods, splitting and isolating communities with consequences beyond the inconvenience of getting around them. I will discuss the rivers and highways as socioeconomic boundaries in Chapter 2.

Along the Edges

The linear, elongated shape of rivers and highways engages with adjacent patches and edge territories in distinct ways. Urban planner Kevin Lynch states that corridors and their edges consist of “building blocks in the process of marking firm, differentiated structures at the urban scale.”⁸ Thus, corridors are distinct building blocks in urban form, causing opportunities for unique interactions among the many patches that they pass. A corridor can mark the only point of connection between two patches that are separated by other patches. (Figure 1.12) The edges of these corridors are important points of intervention for weaving patches and corridors together, to

create an integrated urban mosaic. However, as explained in Chapter 2, these edges are underutilized.

The hardness and softness of corridor edges are important to how corridors relate to the surrounding environment. The depth and shape of the edge impact the harmony or disturbance of the corridor with adjacent patches, matrices, or other corridors.⁹ The manner in which urban rivers have historically been reinforced with concrete for flood control by engineers throughout the 20th century has hardened previously soft edges.¹⁰ Many riverfronts are still contained by concrete levees and floodwalls, significantly altering what would be their natural form. Similarly, highways are controlled conduits for movement, with hard edges—either concrete support systems or harsh barriers preventing dangerous interactions with the city, or noise pollution.¹¹ In this regard, river edges have become akin to highway edges, where these corridors are separated from the rest of the urban fabric.

While both urban rivers and highways have rigid edges that lack permeability or flexibility, there is one significant difference regarding the activity that occurs along these edges: social habitat. Urban rivers attract social life while highways deter livable communities and create hostile environments. Urban rivers, though still polluted from histories of industry, prove resilient: wildlife exists in and along these corridors. (Figure 1.13) People enjoy riverfronts, too, whether walking, fishing, or biking along them. The water of these channels is similarly enjoyed by those utilizing the channels when swimming and boating in them. Highways, on the other hand, create inhabitable edges. Wildlife is largely undetectable from highways (except for incidents of roadkill). A highway's edges are often reinforced by large walls that prevent sound from disrupting adjacent communities. Moreover, regardless of a highway's physical edges, air and particle pollution seeps into the surrounding environment, creating an invisible highway edge that radiates along the length of the corridor, cutting into communities and patches alongside its path.¹²



Figure 1.12: Map of Pittsburgh neighborhoods and regions and river corridors. The rivers touch on many regions and neighborhood patches. Source: Pittsburgh Post-Gazette



Figure 1.13: Geese make their home in the Allegheny River, despite hard, man-made edge environments. Source: Pittsburgh Post-Gazette

Edge environments are also impacted by the width of a corridor. Environments on either side of a corridor are likely to be more alike adjacent to narrow corridors, while wide corridors typically split conditions along edges, suggesting two different environments.¹³ Narrow corridors allow for close interpersonal relations, since they do not present as large an obstacle as broad corridors. Short bridges across rivers are easy to establish, often provide pedestrian access, and allow for people to move back and forth naturally. The downtown segment of the Providence River serves as a good example of this connectivity, the many bridges presenting flowing connections of patches that even a college campus (The Rhode Island School of Design) straddles on both sides of the river. A few miles south, however, the Providence River tells a different story: the east and western edges host different cultures. There are no human-scale connections possible at this point in the widening river, so South Providence and Riverside, neighborhoods at the river corridor's edges in the city of Providence and across the river in East Providence have little to no intermingling. South Providence and Riverside have two distinct identities: South Providence is a low-income, minority-majority neighborhood facing riverfront industry, while Riverside, is a middle- and upper-class white area with homes situated with riverfront access.

Regardless of the width of a highway, its edges are hostile environments that divide urban unity. Highways often mark transitional points in socioeconomic environments. Even though the multi-lane, wide portion of I-95 is sunken into the ground and there are bridges crossing the highway between downtown Providence and Providence's West End neighborhood, the highway marks a distinct split between socioeconomically and visually divided neighborhoods. There is more canopy coverage and open park space to the west of I-95, while to the east there are more fast-food chains and fewer street trees visible. Arterial roads do not necessarily have the same effect in dividing opposite edges (take for example arterial roads with strong commercial districts, with shops and amenities on two sides of the street), but this falls outside of the scope of this thesis and would be a project to explore separately.

Currently, architects and city planners are working to remove hardscapes at riverfronts that obstruct river flow and access. These efforts are a new approach aimed to increase the health of human and natural ecosystems. Several of these efforts center human activity at a wild river edge, creating park spaces. Furthermore, softening river edges can account for varying water levels, such as storm surges and rising sea level. The "Wild Mile" project is focused on softening and widening the Chicago River, allowing for more room for the water to flow.¹⁴ (Figure 1.14) This increase of transitional area, between water and land, presents a fascinating overlap between the built and natural environment. This blended, softened edge integrates humans and their activities more with the natural environment by placing space for activity on the water. Rivers with harsh, reinforced edges are inflexible, but such softened rivers will be able to "mold and respond to flows and movements" that change over time.¹⁵

While river corridors naturally possess fluidity and elasticity along their edges, highway infrastructure is intended to be static. Highway edges are harsh and



Figure 1.4: Aerial view of the Allegheny River and just north of it, Route 28.



Figure 1.5: The Allegheny River corridor, as shown in Figure 1.4, in isolation.



Figure 1.6: Route 28, as shown in Figure 1.4, in isolation. The "Golden Triangle" is the segment that is encircled by highways, left of center.



Figure 1.7: Aerial view of a section of the greater Pittsburgh metro area.



Figure 1.8: The Allegheny, Monongahela, and Ohio River corridors, converging at one point. These rivers are the same scale presented in Figure 1.7.



Figure 1.9: Highway corridors converging at multiple points. These highways are the same scale presented in Figure 1.7.



Figure 1.10: Aerial view of a section of the greater Pittsburgh metro area. The river and highway corridors are outlined in white, making the parallel and topographical relationship between the river and highway corridor clear.



Figure 1.11: Aerial view of the greater Pittsburgh metro area. The river and highway corridors are outlined in white. Two tunnels are visible.



Figure 1.14: Rendering of the Wild Mile project, softening hard river edges. Source: Wild Mile Chicago

unmoving, inflexible, and stuck in the form they were built. They do not expand and shrink according to capacity, like a soft river edge will adjust to storm surges and rising tide levels. Because highway usage is temporally heterogenous (dependent on rush hour), during much of the day and night highways are wasted

space. Design concepts that promote elasticity and soften river edges have yet to be applied to abrasive highway corridors in the urban environment. In the trend to daylight rivers, people often forget the work that goes into remediating the rivers before flora and fauna can grow healthily. Is it possible to soften the edges around an urban highway corridor? This question is explored in Chapter 3.

FLOW AND FUNCTION

The Role of Rivers and Highways

The importance of the corridor form within the urban mosaic is best understood by exploring its function. Corridors allow for movement between and among homogenous patches, connecting otherwise separate areas. In the following section, I analyze important functions of river and highway corridors in terms of their promise of freedom of movement to plants and animals, and humans, respectively. Function follows form, and as their corridor form suggests, rivers and highways are conduits of flow.¹⁶ Their function is to transport humans, animals, and goods, moving things from and through different ecologies, on both small and large scales, channeling what Forman calls "movement along their length."¹⁷ However, the origin of function for corridors differs between those in the natural and built environment. The function and use of rivers is determined by their presence as an artery in the environment. River networks were found to be useful in navigating large terrains. "River flows connect people, places, and other forms of life," as Anderson argues, "inspiring and sustaining diverse cultural beliefs, values, and ways of life."¹⁸ Their natural flow inspired people to engineer canals, extending the reach of riverine systems.¹⁹ Conversely, highways were built for a specific function, the corridor form being the best-suited form to facilitate high-speed automobility. Highways were thus developed to accommodate the increasingly central role of automobiles in the United States, and as passages between urban, suburban, and rural patches.

As flowing corridors, rivers and highways have a large impact on the dynamics of the urban environment. The city expands and shrinks as people and objects move in, between, and through the urban sphere. As Forman shows, flows are determined by the features of the city and the people moving around corridors: "An outward expanding city pushes flows outward... a larger city means bigger inward and outward flows."²⁰ A city with a large working port might attract many ships and trucks that use

connecting nodes to transport goods, and a city with a large workforce would see an influx of population during the working hours, as people use highways to get to and from work. Corridors that promote movement across large scales make the city an ill-defined region with blurry boundaries. For example, the terms “Pittsburgh” and “Greater Pittsburgh Area” are useful in research and policy, but abstract in speech without referencing maps of clear delineations. “Flows suggest the long supply and connection lines between the city center and surrounding regions and play havoc with the idea of the city boundary proper,” Castonguay and Evenden write. “Rivers facilitated the integration of outlying areas and in some cases their wholesale annexation.”²¹ Similarly, highways, and corridors in general, shorten the distance between cities and outlying areas by providing routes for direct access. Now that I’ve outlined the role of transportation in terms of flow in broad strokes, I will discuss the impact and characteristics of linear flow on the urban environment in more detail.

Navigating the Corridor

Corridors provide humans and wildlife with a shortcut, a path of least resistance through which to get to a destination. The line-like form provides opportunities of movement in a manner that bypasses an otherwise complicated grid system of transportation. Highways are to facilitate efficient flow in two directions. Traffic is arranged in such a pattern that parts of the corridor going in opposite directions do not merge into one another so that the flow is uninterrupted. Highways, as a product of human engineering, have been decisively constructed in this particularly arranged order. The natural flow of the river, meanwhile, is dictated by the slope of the land. Such flows dictate movement of plants and animals in one swift direction.

River and highway flows are not only emphasized in the conductivity of their channels, but also in non-linear impacts on their surroundings. One reason why corridors are critical parts of the urban fabric is because of their ability to spread, share, and integrate patches and matrices with one another, their impact echoed beyond the corridor. Just as river and highway corridors have sprawling networks, the edges of these corridors have impacts on the neighboring environments that radiate outwardly. Forming invisible threads, they influence various patches in the urban environment. For example, a revitalized riverfront not only impacts real estate development along the edge, but it also changes the socioeconomic status of communities further from the river. A few miles downstream, the same river might still have heavy industrial, polluted uses. The flow propagated from this point may have negative effects on the surrounding urban environment. The Providence River provides a good example of such influences of flow, encroaching on the urban environment. As the Providence River has been renewed along South Water Street, particularly by the new Pedestrian Bridge, the Jewelry District has become a high-end development with plans for expansion further inland.²² A short walk south down to the Port of Providence and the river has a different effect on the environment. Here, South Providence suffers from air and noise pollution, both of which are compounded by the highway. South Providence is sandwiched between two industrial sites, bereft of public access to the waterfront other than a small point from Public Street. Clearly, the radial impact of

the Providence River is detrimental to both the adjoining edges and the surrounding community.

Capacity and Disruptions of Flow

Natural corridors are not utilized to their maximum capacity. The relationship between the visual footprint and use of river and highway corridors is inverse, offering an interesting relationship between space and use. Figures 1.8 and 1.9 show the large visual footprint that a river has on the urban realm in comparison to a highway, though this footprint does not represent their actual use. In American cities, limited numbers of people travel by boat.²³ Riverine space is underutilized, its function of mobility taken over by the highway. Instead of utilizing already existing, natural corridors for mobility, artificial systems that arguably disrupted landscapes have been built.

Disruptions in flow on rivers and highways illustrate the tensions between the natural and built environment. Human intervention has altered the form, flow, and use of corridors. Rivers have been harnessed for human need, though increasing technological advancements have altered their course in the urban geography. As Forman wrote, “Nature’s flows and movements across the land are particularly important in the urban region, partly because they are so buffeted by human activities.”²⁴ In a period of anxiety due to climate change and sea level rise, it is important to recognize natural flows that have been interrupted, and to reconfigure such systems surrounding flows. Natural patterns and flows are enmeshed with man-made patterns and flows. The power and flow of rivers have been altered over time: in Providence, for example, the Seekonk River was nearly drained of water due to the oversaturation of industrial mills along the river’s edge.²⁵ Dams and levees, among other built structures, are present in most urban rivers as well, “squeezing or narrowing the river through the city, so that the water flow is accelerated.”²⁶ (Figure 1.15) The disruptions to a river’s flow can cause severe ecological damages, including flooding that carries debris across cities. Such disruptions also have vastly negative impacts on natural wildlife, primarily the vitality of fish populations.²⁷ One important fact about the relentless nature of water remains: however humans attempt to buffet and alter riverine environments, water will flow.

Highways are prone to disruptions of flow on a regular basis, proving weaknesses of their design. When used beyond their maximum capacity, traffic jams occur at least twice a day during rush hours across the country,



Figure 1.15: A dam at Slater Mill in Pawtucket, Rhode Island. Source: iStock Images

jamming highway flow. The rigid cement infrastructure of highways is also subject to failure at times, breaking and cracking, requiring millions of dollars to repair. Constant maintenance is being done to highway systems to maintain the maximum efficient flow of transit. Clogged highways also cause massive amounts of pollution: idling cars add to already problematic emissions levels surrounding highways.²⁸ Malfunctioning highways frustrate drivers and residents of adjacent urban patches. (Figures 1.16 and 1.17)



Figure 1.16: A rush hour traffic jam preventing traffic flow. Source: Live Science



Figure 1.17: The collapse of Atlanta's I-85 interstate in 2007. Source: CNN

NETWORKS

To understand cities, Batty argues, “we must view them not simply as places in space but as systems of networks and flows.”²⁹ River and highway corridors offer wide-spanning networks, connecting far-flung places through flowing conduits. As previously discussed, the form of the corridor has a unique, continuous impact on regions beyond confined urban edges. In short, corridors have the potential to strengthen relationships between geographically distant places. In this section, I will apply the concept of networks to river and roadway systems, looking at multiple scales, highlighting the impact that regional networks have on the urban sphere via movements of flow. This discussion will include not only the formal elements of networks, but also the social, habitual, and relational networks formed by river and highway corridors.

The expanse of a corridor network is best understood at large scales. Taking a step back, these networks appear in a series of nodes. Spiraling networks increase proportionally with increases in scale. Two examples exemplify my point: Figure 1.18 demonstrates river networks through four different scales, while Figure 1.19 shows highway systems at four different scales. The scales in both figures are the same, while each window is isolated from the same aerial view from Google Earth (e.g. the top right image of Figure 1.18 is the same area on a map as the top right image of Figure 1.19).

Upon initial observation, Figures 1.18 and 1.19 pose interesting differences between rivers and highways. However, there are additional observations when considering the networks that these river and highway systems create. First, highway systems appear to form many more nodes and weave together more networks than river systems do, particularly noticeable when putting them parallel at the same scale.



Figure 1.18: Aerial view of river corridors at varying scales in the greater Pittsburgh metro area. Clockwise from top left, the scale starts small and increases.

Figure 1.19: Aerial view of highway corridors at varying scales in the greater Pittsburgh metro area. Clockwise from top left, the scale starts small and increases.

Secondly, the width, and network systems in the top right image of Figure 1.19 appear to be most akin to the network systems in the bottom right image of Figure 1.18. Highway systems mimic river networks, only on a much smaller scale.

Nodes

Understanding river and highway corridors across multiple scales can offer better insights into the important role that rivers play in unifying vast locations, specifically at their nodes of convergence. Nodes and points of confluence are sites where more than one flow merges, intensifying the activity and overlap of different ecosystems that occurs at these sites. In doing so, nodes offer great potential for vibrant ecological and social spaces.

River confluences are a natural part of its form, critical for humans and wildlife alike. Confluences offer a unique environment poised for the mixing of wildlife species. Nodes change the contents of a river, as different sediments mesh in these areas. (Figure 1.20) Nodes in rivers also change their flows: an increased volume of water may increase the velocity of the water, therefore also its capacity to carry things down the river stream.³⁰ Confluences are vital in the natural environment, since they control the “routing of flow and sediments,” stabilizing the riverine ecosystem.³¹

Nodes in river systems also mark importance for humans and civilization. Many cities were founded and built on river confluences, including Pittsburgh. Historically, humans traveling via rivers have always relied on their networks, making these confluences the sites of civilizations with immense power. Because of the unique geographic position at intersecting rivers, Pittsburgh has always been a site of strategic and commercial importance, attributing to the city’s ability to thrive since the first colonial settlement took shape.³²

Highway networks were built for human mobility and the transportation of goods and services. These networks are comprehensive, serving millions of people. Therefore,

connecting points within a highway system service people and goods to reach a wider array of places. They comprise what Reyner Banham called a “single comprehensible place, a coherent state of mind, a complex way of life.”³³ Highway networks, as shown in Figure 1.22, are sprawling. Rather than following natural topographies, they extend through urban neighborhoods, traveling to and from suburbs in all directions. Reyner Banham, who refers to the highway as the “freeway,” per California lingo, to further prove his praise of highways: the service offered by the highway is freedom to go where one wants to drive.³⁴



Figure 1.20: The confluence of the Monongahela and Allegheny Rivers into the Ohio River. Differing riverine environments and sediments account for the different colors. Source: Pittsburgh Post-Gazette



Figure 1.21: Aerial view of highway networks converging and splitting off into different directions in downtown Pittsburgh. Source: Google Earth

Highway nodes mark distinct limitations and exclusions to the access of flowing mobility. Within the urban context, highway systems have many “nodes,” which can be described as on- and off-ramps or splitting systems leading in different directions. Such nodes can be chaotic and unexpected, particularly to those unfamiliar with the route. Nodes are arranged such that they do not interfere with important elements of urban character, while at the same time, they permit mobility into distinct parts of the city. Nodes predetermine where people want to go, by making certain areas easier to access than others. Figure 1.22 shows highway nodes around the Providence area. The purple dots indicate those where the highway branches off into different routes as well as into on- and off-ramps, and the blue dots indicate where on- and off-ramps are located along the highway. The main nodal points surrounding South Providence (circled in light blue) primarily serve either the industrial port along the bay or the hospitals on the north end of the neighborhood. The highway is designed in such a way that travelers do not have to drive through South Providence while also making it so that the road is inaccessible to the South Providence community. Indeed, the highway flies over the community, leaving a visual scar on the landscape. Thus, arterial roads in South Providence running parallel to the highway, including Broad Street, Prairie Avenue, and Elmwood Street, are used only by South Providence residents, whereas the highway is used by others. The placement of nodes along the

highway corridor undermines universal and equitable access to mobility. Although nodal points on highways may seem chaotic, they are organized and arranged by design to prevent accidents and enable continuous flow. The inward and outward flowing movement of cars causes nodes to be points of intersection, their capacity changing drastically at different times of day. Unlike the natural arrangement and order of wildlife ecosystems, automobiles must follow organized networks to use highways, following a clearly defined set of rules shared with other drivers.³⁵

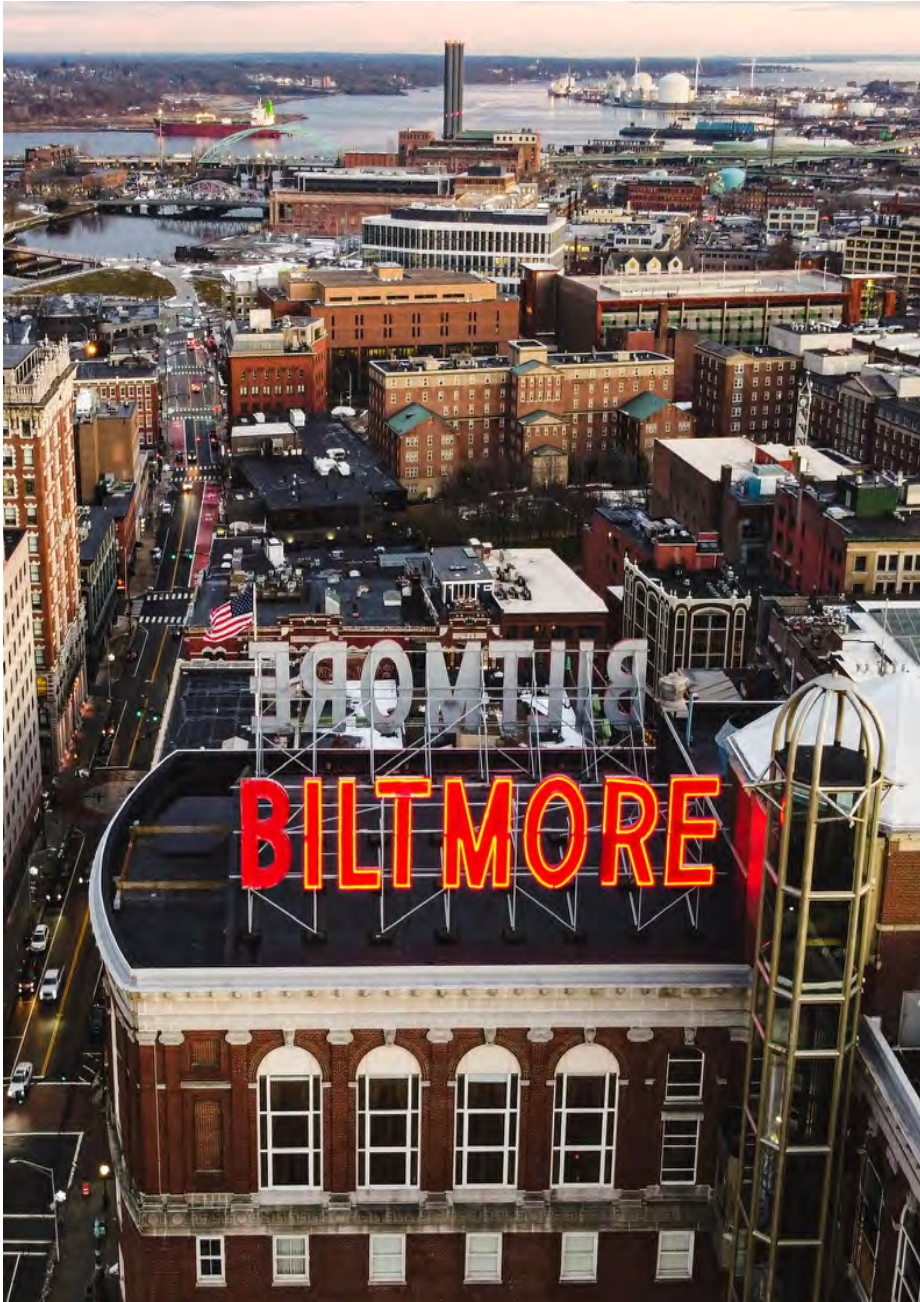


Figure 1.22: Highway nodes in the Providence area.

In sum, the form, function, and networks of urban river and highway corridors all align towards one goal: unimpeded, free flowing movement for participants of human and natural environments. As analyzed in this chapter, the corridor is a unique puzzle piece in the broader urban morphological system that affords connections, convergences, and mobility throughout its patches and matrices. While corridors have the potential to strengthen connections across geographies and peoples, they have also been shown to be problematic in the urban setting. In the following chapter, I will discuss how corridors have been detrimental to the socioeconomic health of cities as they create divisions, block movement, and highlight inequities.

DOWNTOWN PROVIDENCE FROM ABOVE

James Dahlen





TRACING PROVIDENCE'S CHINESE COMMUNITY THROUGH TWO CHURCHES

The Beneficent Congregational Church and the Chinese Christian Church of Rhode Island

Thomas Sze

Introduction and Historical Context

Known as "Chinamen," "coolies," or "celestials," Chinese immigrants came to the United States and other Western territories in search of prosperous futures promised by wealthy European traders and colonists, a situation that seemed far more opportunistic compared with encroaching, semi-colonial influences during the Opium and Sino-Japanese Wars.¹ The Chinese were considered an infinite supply of cheap labor to fill the gap left by the abolishment of slavery in 1865² and meet the demands of surging surplus capital reinvestment in the form of the booming construction and railroad industries. With the Chinese Exclusion Act of 1882, many Chinese immigrants were forced to remain in the United States and pursue "merchant" businesses, such as restaurants and laundromats, all while navigating the impossibility of reuniting with their families.³

In this context, Providence's Chinatown is often linked to the construction of a theater on Westminster Street and the demolition of a tenement house on Chapel Street, which necessitated the need for Chinese immigrant workers in 1900.⁴ By the 1920s, Providence's Chinatown only had roughly 200 people. Providence's Chinatown area, located on Empire Street, was a hub of laundromats and restaurants that catered to White Americans. During these early waves of immigration, the Chinese were looked upon with suspicion, intrigue, and often overt racism.

One particular news clipping from the Providence Journal reported in 1908 that Chinese laundrymen were "robbed, assaulted, and humiliated."⁵ Additionally, the Chinese who wanted to pursue the restaurant business were met with arbitrary opposition from the local population, who harbored racialized stereotypes, fearing that the restaurants would foster a community of gambling and opium addiction.⁶



"Chinese Element in Providence Slowly Growing." Source: *The Providence Sunday Journal*, 1908.

Eventually, the Chinese community was dispersed across the Greater Providence area and elsewhere in New England because of multiple factors. First, city authorities announced plans to widen Empire Street in 1913, which forced many Chinese to move out of Providence's original Chinatown.⁷ Additionally, economic conditions gradually improved for Chinese immigrants, who had begun to accrue capital through their various business ventures. However, beyond the hegemony of economic development as the primary driver of this history lies a lesser-known legacy, one that traces the roots of the Chinese community in Providence to the establishment of a Chinese Sunday school at the local Beneficent Congregational Church in 1879 under Rev. James Vose.



"Beneficent Congregational Sunday School, Foreign Department." Source: *The Home Guard*, April 1899.

As Min Zhou points out, most Chinese immigrants were non-religious when arriving in the United States; however, due to the difficulties navigating cultural assimilation and racial exclusion, many affiliated with religious institutions for practical support,⁸ such as learning English and building a sense of community with other Chinese. The need for ethnic enclave economies also highlights the importance of Chinatowns and Chinese-Christian communities in America as an adaptive development tactic to overcome initial disadvantages and restraints in the early stages of assimilation.⁹

Providence's Chinese community was no exception. Through oral histories and archives collected as a part of the Providence Chinatown Project, I will examine how the public situated Christianity's role in the Chinese community and recount the story of Irene Luke Hope and her family's long history in Providence (since 1917) in relation to the Beneficent Congregational Church. I will then expand on Chinese-Christian religiosity in present-day Providence through my own fieldwork at the Chinese Christian Church of Rhode Island (CCCRI), an offshoot of the original Chinese congregation at Beneficent. I hope my project will shed some light on Providence's "underground" history surrounding the Chinese community in the greater context of religiosity, identity, cultural assimilation, and the search for belonging in Greater Providence's urban landscape.

Valorization of Beneficent Congregational Church and Uncovering a Racist Past

The Beneficent Congregational Church, the second oldest church in Providence, was founded in 1743 as a separatist group of Congregationalists with Calvinist-Protestant roots.¹⁰ Located at 300 Weybosset Street, near the end of the old Chinatown, since 1836, the church has long been a contact zone of a plethora of ethnicities, including the Chinese. An April 1899 article from *The Home Guard* newspaper, for example, reported on the church's missionary work with the Chinese community:

"It must be accepted that the incoming of the Chinese to our country has opened opportunities to facilitate the Christianizing of this ancient race...The Sunday school of the Beneficent Congregational Church of Providence is one of the Christian institutions that has not neglected to open the door...instructing the Chinamen in English and the teachings of Christianity...at present, the scholars consist of Chinamen, Armenians, Greeks, and Turks, all of whom join heartily in all the services...the Armenians are a very intelligent class of men...one of the most interesting incidents, showing the sympathy of the Chinamen was their donation of \$20 towards the fund for the suffering ones in Armenia...the Chinamen having more funds, are able to do more financially than some others..."¹¹

While I do not intend to diminish the beneficial work the church has done for the Chinese community in Providence, particularly English instruction, through these excerpts from the article, it is clear how the Chinese were still treated as Others in the context of the greater racial landscape of the United States. Navigating this social position, the Chinese community was painted as an "ancient" race while still underscored as materially wealthier than other minorities. Such an ordering went hand-in-hand with Western epistemological paradigms, which sought to depict the Chinese community as deprived of adequate morals and in need of saving.

It must also be noted that this article was already a notably positive depiction of the Chinese community. Another 1887 article from *Providence and Vicinity* titled "The Chinese in Providence" concomitantly valorized the church for taking on honorable work and praised the Chinese for learning quickly under the tutelage of the church while insulting Chinese culture and fomenting negative stereotypes of calculative, drug-addicted (to opium) "Chinamen" — a poignantly ironic observation considering the nefarious role of Western institutions in the spread of opium addiction within Qing China:

"At most, any hour the observer will note 'John' attentively at work with the paraphernalia of his calling and apparently oblivious as to what is transpiring outside."

"But even then there is no cessation of business, for the ordinary form of worship is very simple and occupies about a minute."

"To learn to speak English,' he unhesitatingly replied, apparently indifferent to the religious part of the teaching."

"It was a Chinaman...He was smoking a long-stemmed opium pipe and was barely able to stand."

"The Sunday school has accomplished a deal of good for these people...the pupils have remarkably retentive memories...without a searching investigation, it would be difficult to find traces of the vices with which these people are charged."¹²

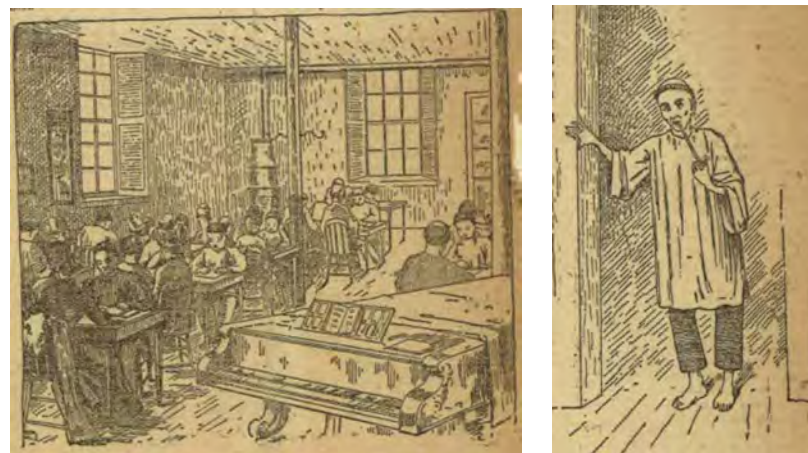


Illustration of the Chinese Sunday School at the Beneficent Congregational Church, and Illustration of an Opium-Addicted "Chinaman." Source: Providence and Vicinity, 1887.

I do not doubt the church's good intentions in educating the Chinese community in English, providing living support, and a sense of camaraderie amongst other minorities. However, I do believe that this narrative may outstrip the overall racism and institutionalized policies that necessitated the church's involvement in the first place. Although not the church's aim, the ways in which the church's work was utilized in popular prints were self-aggrandizing of Providence's public and consequently, through the generations, fostered the forgetting of a racist past. It is not surprising that these articles go hand-in-hand with supporting the United States's shifting immigration policy from an open-door policy to "gatekeeping" America from unwanted immigrants.¹³ In the context of Asian-American history in the United States, the perceived civilizing mission of the church, labeling the Chinese as "foreign," and depiction of Chinese as wealthier than other minorities corresponds seamlessly with scholarship on the racial triangulation of Asian-Americans.

Claire Jean Kim argues that, situated as Oriental Others (foreign) and a category apart from the dominant bipolar racial framework of the United States, Chinese immigrants were contradictorily and strategically triangulated between the black and white communities as alien and backward, yet industrious and apolitical.¹⁴ This dual positioning functioned as a perfect tool not only for the economic growth fueled by both industrialization and urbanization in the United States but also for the continued popularization of the narrative of a de-racialized landscape where "model" minorities could succeed under the doctrine of individualistic capital accumulation.

Irene Luke Hope's Family and the Beneficent Church

Jumping to the early 1900s, I now turn my attention to the story of Irene Luke Hope, a prominent member of the Beneficent Church from her childhood till the present. Irene Luke Hope recounts that her father Tin Cheung Luke was born in 1905 in Tais-han, Guangdong, Qing China and immigrated to Providence as a student around 1922. His father Yip Heng Luke arrived in Rhode Island in 1917 and began working at Hon Hong Restaurant on Washington Street. After his studies, Tin Cheung Luke was sent back to China to have an arranged marriage to Eng Lun Gam, who was 18 years old.

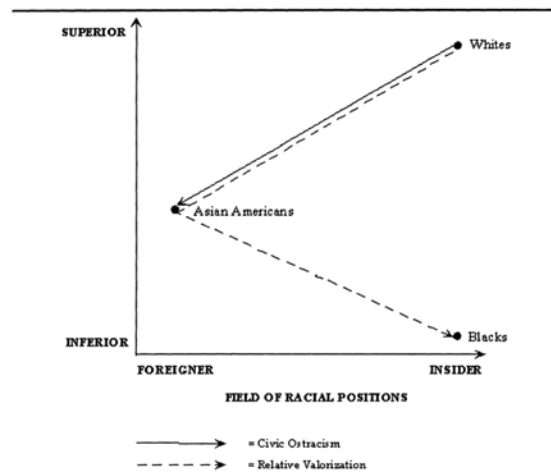


Figure 1: "Racial triangulation." Source: Claire Jean Kim, 1999.

The designation of "merchant" from working in the restaurant or laundromat business was a loophole that allowed the Chinese to travel between China and the United States, so it is probable that this allowed Tin Cheung to return to China. However, he quickly returned to the United States to work and send money home to his wife and newborn son Henry D. Luke, becoming a waiter at Port Arthur Restaurant on Weybosset Street. Before the communist revolution, where institutionalized gender equality introduced the New Marriage Law, arranged marriages were considered a widely accepted practice.

The Luke family had their first contact with the Beneficent Church in the 1930s when missionaries ventured to Port Arthur's for Chinese food. With his wife and son already being practicing Christians in China, Ting Cheung Luke talked to the missionaries about bringing his family to Beneficent. This part of the Luke family's story emphasizes the transnational nature of Christianity throughout China's history and eschews the notion of immigrants having no conception of Christian values. In fact, Christianity in China traces its official roots to the Tang dynasty in 635 AD.¹⁵

Thankfully, Irene's mom and older brother traveled on the last ship to leave Hong Kong before the Second-Sino Japanese War broke out, arriving in Seattle first before reuniting in Providence. Irene would be born in a small rented apartment above a linoleum store on upper Weybosset street, next to the Beneficent Church. As an active member of the church, a young Irene would join the Round Top Choristers and the Lowell Mason Youth Choir, noting that she met kind church-goers who would take her on trips to the beach, teach her how to sing, and play the piano. Eventually, she would be confirmed at the church at twelve.

In her personal narrative, Irene recounts the diverse nature of the church and that the Beneficent members taught her by example to "accept all people and to get along with one another" while explaining how the youth fellowships would take trips to learn about other religions and cultures: "the Beneficent congregation was welcoming, and the Chinese, especially the children all felt accepted and became fully involved with

the life of the church." She also describes the multiethnic nature of the church as a place that sponsored refugee families from Poland, Russia, Egypt, Italy, Vietnam, and Cambodia and made her "feel very comfortable, welcomed, accepted, and loved." To practice their values of inclusivity, the church also regularly held international festivals with foods, displays of indigenous goods, and music, which was opened up to the whole community.

Mirroring her progression through the church, Irene details her experiences with Chinese food heritage, beginning to work at her family's restaurant Luke's on Eddy Street when she was twelve. This restaurant was one of the few family-run "anchor restaurants" that could accommodate banquets and large functions for the Chinese community while serving dishes popular with White clients such as chop suey and chow mein. As Quinton Huang points out, "life revolved around the restaurant business, as restaurant workers had to work 12-13 hours, six days a week."¹⁶ It was not uncommon for the whole family to be employed in the restaurant business, which assumed a multiplicity of roles within the Chinese community as hubs of intergenerational sociality, entertainment, and Chinese cultural practice. The Beneficent Church was very much related to such restaurants as both Charlie Chin (another member of the choir and son of another Chinese restaurateur) and Irene recounted going to choir rehearsals on Saturdays and Sundays and rushing to work at the restaurants in the afternoons. The association between food heritage and the Chinese-Christian community continues to the present. As Irene notes, "food is still a focus. Chinese New Year is an annual celebration that involves cooking at BCC."

Irene would go on to join the Adult Choir, where she would meet her husband Walter Hope, whom she married in 1961. She would also assume many leadership positions in the church, such as being the first female junior deacon at Beneficent, Church President from 1984-1990, and first female member of the Beneficent society, paving the way for gender representation within the church. Her children all grew up in the church as well and were very active in Sunday school, youth groups, and choir. Reflecting on her long professional career, Irene remains thankful for "Beneficent's role in [her family's] lives in teaching faith, values, and work ethic." When asked, "what keeps you at BCC?" Irene replied, "the diversity of the congregation and BCC has always been a welcoming church."

An Offshoot: The Chinese Christian Church of Rhode Island

During the 1950s and 1960s, Chinese immigration grew enormously due to the surge of immigrants from Hong Kong and Taiwan, many of whom were fleeing political instability due to the greater socio-political effects of the establishment of the People's Republic of China.¹⁷ Notable was the growth in the females in the Chinese diaspora, made possible by the repeal of the Chinese Exclusion Act, which barred the admission of Chinese immigrants' wives to the United States.¹⁸ Providence also saw an uptick in Chinese immigration, with the official Chinese population in Rhode Island growing from 257 in 1940 to 1093 in 1970.¹⁹ As a result of this influx in immigration, the Beneficent Church saw Chinese members increase more than twofold, leading to the creation of a Chinese-speaking congregation.

In a church-sanctioned interview in 2016 focused on Beneficent Congregational Church's celebration of the Lunar New Year, Irene was asked about the fragmentation of the Chinese worshipping congregation at the Beneficent Church that once held ser-

vices in Cantonese during the regular worship hour in a different area of the church. Irene noted that while the two congregations would get together during Christmas and Easter celebrations and bilingual services, there were tensions in religious interpretations, with the Chinese speakers being more evangelical and taking the Bible very literally and the English speakers generally being more liberal in their interpretation of the Bible. With the leader of Beneficent Church's Chinese congregation leaving for a new job in Arizona, many Chinese members ultimately left and joined the Chinese Christian Church of Rhode Island (CCCRI), which was founded in 1977 as a grass-roots offshoot of the Beneficent Church.

The CCCRI, much like its predecessor once was, is split into two congregations: the English-speaking Citylight group and the original Chinese-speaking group. The Citylight congregation is notable for its diversity in terms of race, age, and culture — there were quite a few Southeast Asian families, children with their parents, one Black family, and a myriad of Chinese-American families who mainly speak English. There were also quite a few older biracial couples and single elderly from the assisted living space near the church. It seemed like, in line with the original inclusivity of Beneficent, the Citylight community was a unique contact zone of different cultures and living arrangements. One of the youth service leaders admitted that the Citylight community has struggled with diversity in terms of race (predominantly Chinese) while explaining that the church was a 'Family Church.'

If the Citylight service was a transnationally Asian, familial microcosm of the Greater Providence community, the Chinese service catered to elderly Chinese, new immigrant families, and students from China. The service was conducted in Mandarin with Chinese subtitles for other dialect speakers. The separation between the Citylight and Chinese service may have been borne out of a necessity to serve the Greater Providence community and inter-generational Chinese-American families. However, I also see the categorization acting as a way of allowing a split in liberal and conservative interpretations of biblical ideology. This is an interesting similarity with the original split between the Chinese and English congregations at Beneficent. Indeed, a church-goer mentioned that the Chinese congregation was seen as more conservative than the Citylight congregation: "it's the same theology, but the people are what make each congregation slightly different...with different interpretations." Similar to the original Beneficent congregations, the two services hold joint services three to four times a year for unity on occasions of importance, and it was reported that the after-service lunches were contact points for the respective communities.

It should also be noted that the Chinese service was initially conducted in Cantonese as most church-goers were from Hong Kong. Over the years, the children of that generation created the Citylight English service. Meanwhile, the astronomical influx of immigration from mainland China has warranted Mandarin as the official language for the Chinese service.

By interacting with two congregation members (a husband and wife), I was able to go on an informal walking tour of the Church's impressive facilities. There are two separate altars for the Citylight service and the Chinese-speaking service, the Chinese one being larger as they have more attendees. Next to the altars, there is a small traditional Chinese-themed lounge where the elderly rest and talk while enjoying the view of the Blackstone River. Meanwhile, the facility's rear houses a Nursery Room, various

Sunday School classrooms for different ages, and a youth game room. I learned from one of the members that two Chinese Schools (one operated by the church and one that rents from the church) use these classrooms throughout the week. Similar to Beneficent, celebrating culture is an important part of being a member of the church. As such, the church holds Chinese New Year festivities, Dragon Boat racing, and various food heritage initiatives. There is also a large gymnasium with a wok kitchen where after-service lunch is served and youth can play badminton and basketball.

Externally, the church has an attached assisted living space for elderly folk who are primarily church-goers. In addition, students from RISD constructed a community garden for church members to plant vegetables and fruit for use in the weekly after-service lunches. The YMCA, which often collaborates with the youth groups on community service initiatives, also rents a small space in the back and shares usage of the gymnasium to host their programming. Interestingly, the church is spatially oriented around the family nucleus, with each space serving an important role for mothers, fathers, children, and the elderly. At a time when medical costs have been rising for decades, it is comforting to know Chinese values of taking care of the elderly are a part of the CCCRI community.



Lunch served after the service. (November, 2021).

As within Irene's narrative, food heritage is an essential part of the Chinese community at CCCRI. Despite the regional variations within China, the age difference between generations, the racial diversity, and the split between the Citylight and Chinese congregations, the after-service lunch appears to be an aggregating event. I overheard one family speaking Cantonese and Mandarin to their children, with their children responding in English, epitomizing the cultural hybridity within the space. The food is cooked by a rotating volunteer group from the Chinese congregation and serves about 300 people every week.

During lunch, the youth fellowship group held a performance where they sang pop tunes with Christian lyrics and performed a traditional Chinese dance, exemplifying the in-between identity and a respect for traditional Chinese culture the church fosters for its youth community. Another first-time visitor sat next to me and explained he was excited to join the church because he is Hispanic and Chinese but felt distant

from his Chinese heritage. He felt the church could offer him a unique opportunity to learn the Chinese language and culture while furthering his love of Christianity. There were also a few biracial families partaking in the lunch. These insights reveal the potential of events organized around food heritage to forge cross-cultural contact, camaraderie, and ethnic identity solidification.

Concluding Discussions and Broader Connections

The Beneficent Congregational Church was a cultural contact zone that afforded minorities, including the Chinese in Providence, a sense of belonging and community as an ethnic enclave amongst a triangulated racialized landscape, where Asians were often portrayed as Oriental and Othered.

Irene Luke Hope's family story demonstrates both the tenacity of the Chinese-American community in Providence and the church's primacy in Providence's Chinese-American community as a didactic and cultural space that fostered both English language learning and the continuation of Chinese cultural practice. Physically, the church's proximity to the old Providence Chinatown afforded many opportunities for contact between the church and the burgeoning Chinese-owned businesses around the area, especially the restaurant businesses. Sharing and respecting cultural differences through food heritage, international festivals, and linguistic incorporation exemplifies the church's strong commitment to diversity.

Despite the church's good intentions, however, the public valorized the work of the church and subsequently erased and belittled the struggles of the Chinese immigrant community. Early reporting on the church's inclusion of Chinese immigrants poignantly displays the roots of racially charged tropes that figure prominently in the American psyche. Notably, "Chinamen" were depicted as from a "backward" race while being financially superior to other minorities. They were also described as being anonymous, opium-addicted "John's," overly industrious, and merely concerned with monetary ends.

The duality between benevolent Christian leaders and the racist public also speaks to the greater situation of social precarity and unpredictable discrimination the Chinese community faced on a daily basis — never sure who to trust or when the next racially charged slur would be hurled at them. As Erica Lee argues, "the Chinese [even American-born] lived in a state of anxiety, suffering from a psychology of fear and becoming segregated and marginalized from mainstream society"²⁰ due to exclusionary policy and state-sanctioned scrutiny of the community.

Meanwhile, at a time when anti-Asian hate crimes continue to be a national concern, the CCCRI endures as a modern ethnic enclave that fosters a sense of identity and community for the Chinese community in Greater Providence. While the CCCRI is bifurcated between the Chinese and Citylight congregations, which is perhaps symptomatic of the inherent condition of in-betweenness for Asian immigrants in the United States, there are spaces and practices the church has created and continued that are conducive to fostering a sense of place and identity for the intergenerational Chinese diaspora. Namely, Chinese language and culture instruction go hand in hand with religiosity and the after-service lunch utilizes food heritage to connect generations and unite conflicting Chinese identities (Taiwan, Hong Kong, Regions in China) while also serving as a potential contact zone for biracial as well as non-Chinese

Greater Providence residents and the Chinese-Christian community.

Chinatown's businesses may have long been reoriented to fit the needs of Providence's gentrifying landscape, Luke's is now occupied by a hip "bar-nightclub" the Salon, but Irene's personal stories reinforce the importance of preserving and incorporating vernacular landscapes into the public's memory and future. Remembering and including everyday elements of Chinatown into Providence's present landscape remains an untapped opportunity for building a sense of civic identity and shared history²¹ amongst the Chinese community of Rhode Island, no matter the affiliated religious institution. It may also challenge the parochial preservation landscape of Providence which continues to be inundated with American Revolutionary figures and the colonial past while amnesic of its exclusionary and racist past.



A photo of the Luke's facade superimposed on its former location in the Smith Building. Current street view photo from Google.²²

Acknowledgments

I want to acknowledge the excellent archival work done by lead curators Angela Yuyan Feng (Brown Ph.D. Candidate in American Studies) and Julieanne Fontana (Brown MA'18 in Public Humanities) for the Providence's Chinatown project as well as the scholarship of John Eng-Wong who contributed greatly to the project. Angela granted me access to the project's database, which had plenty of archival material, including Irene's interviews, to help me uncover essential information for my article. I also want to thank the Chinese Christian Church of Rhode Island for being so welcoming and allowing me to participate in church activities for an afternoon. In addition, Professor Emeritus Robert George Lee was very helpful in guiding my research direction and providing a general overview of the history of Chinese in Providence. Professor Lauren Yapp was also very supportive of my research project and provided invaluable feedback.

CLIMATE GENTRIFICATION

Climate Change, Ecological Resilience, and Price Appreciation in the Real Estate Markets of Boston and New York

Brian Thompson

Part I: Climate Change and the Urban Landscape

The United Nations released their revised World Urbanization Prospects in 2018, using demographic modeling to estimate current statistics on urbanization. According to the report, 82% of the North American population now reside in urban areas. Since 1950, the urban population of the world has grown from 751 million to over 4.2 billion.¹ Based on this rapid acceleration in rural-to-urban migration, it is more important than ever to focus on sustaining urban communities. According to the United States Department of Commerce, over 40% of Americans live within 100 km of the coastline.² As urbanization increases, the share of the population living in coastal communities will continue to increase. Simultaneously, climate change — accelerated by fossil fuels and land use in commercial agriculture, manufacturing, and transportation — has placed these communities in the crosshairs of an environmental crisis. The National Aeronautics and Space Administration (NASA) uses satellite technology and landscape surveying to measure early signs of climate change on Earth; based on the most recent calculations, Earth's polar region is melting at a rate of over 200 billion tons per year. As a result, sea levels have risen in the last two decades alone at a rate of over two times that of the last century.³



Figure 1. Rendered plans for the New York Center for Climate Solutions, proposed to be constructed on Governors Island, to promote citywide resiliency and environmental scholarship. Source: WXY Architecture/Design.

Given these trends, urban centers across the world have begun to visualize the impact of climate disaster. Aside from rising sea levels, which leaves coastal communities vulnerable to flooding, global warming has led to an increasing number of extreme temperature events and record-intensity natural disasters.⁴ Maps of potential sea rise scenarios based on scientific evidence show that some of the largest downtown regions on the East Coast (e.g., New York, Boston) of the United States would be completely submerged. Therefore, as economic activities and urban population growth

increasingly strain the environment, the field of urban ecologyⁱ has come to focus on sustaining the resources essential to urban life. William Rees, Professor Emeritus at the University of British Columbia, quantifies the importance of mitigating impacts on the environment in his development of ecological footprint analysis. Under the laws of thermodynamics, Rees finds that most cities are running an ecological deficit, exporting more waste to the periphery than managed within city lines.⁵ To remedy this, urban professionals have collaborated in multidisciplinary ways, designing innovative solutions for the resilient city of the future. The next section explicitly takes on these urban challenges, centered on climate change and ecology, within the greater urban ecology literature. One of the most promising measures being taken to protect cities from climate disaster is the concept of ecological resilience, which makes design recommendations centered on using the natural landscape to expand green spaces in coastline communities that serve to reduce damage to the built environment. These practices have been explored in cities across the United States and have led to ambitious proposals for the implementation of America's first climate-resilient cities within the next decade (see Figure 1).⁶

As coastal resilience makes its way into governance and urban design across the country, this research promotes a socio-ecological approach to draw conclusions on how the resilient city may shift demographics and exacerbate wealth inequality. Over the past decade, there has been a body of research in environmental gentrificationⁱⁱ observing drastic disparities in accessibility to parks and green spaces, often tied to urban sustainability demanding price premiums. This has paved the way for climate refugee concerns, as low-income and minority urban communities will face the effects of climate change disproportionately. In that sense, the elements of environmental gentrification have been applied to an emerging theory known as climate gentrificationⁱⁱⁱ. Although the media has popularized the term, there is only limited academic research on this topic. In order to prepare for the environmental challenges threatening an increasingly urbanized world — and draw conclusions on how the implementation of resilient infrastructure in the built environment might impact urban inequality — this theory will be studied from a critical spatial lens.

Part II: The Emerging Theory of Climate Gentrification

As mentioned, ecological resilience is an emerging paradigm that focuses on designing cities that adjust to climate disasters before damaging infrastructure and human life. Steward Pickett, Senior Scientist at the Cary Institute of Ecosystem Studies, pioneered this practice in Building Research and Information. As innovative coastal architecture to protect cities from sea level rise has shown promising results, design competitions and city governments across the United States have released concrete resiliency designs.⁷ Notably, in New York, the 2010 "Rising Currents" exhibit at the Museum of Modern Art (MoMA) reimagined Lower Manhattan by proposing natural landscape projects to reciprocate and protect streets from flooding (see Figure 2).

i Urban Ecology: The branch of urban planning that is concerned with the relationship between humans and the urban environment, incorporating the additional environmental layers of a densely populated ecosystem.

ii Environmental Gentrification: The process by which sustainability & renewal projects (e.g., parks, green space, green buildings) leads to real estate price increases and the displacement of low-income residents.

iii Climate Gentrification: An emerging concept in urban studies proposing that property values in areas of lower risk to climate change (e.g., flooding, natural disaster) will see greater price appreciation.



Figure 3. The 2010 “Rising Currents” Exhibition, as seen in the Museum of Modern Art. Source: Musuem of Modern Art.

From this exhibit came several competitions that further reimagined the city. DLAND Studio, a landscape architecture firm based in New York, released “A New Urban Ground”, which would create public parks at the edge of Manhattan (Battery Park) that act as surge protection in times of weather events (see Figure 3).

While these resiliency projects are essential to urban ecological health and protection against rising seas, the subsequent changes to the surrounding built environment(s) have led scholars to be concerned with gentrification and equity. Melissa Checker, Professor of Urban Studies at Queens College, conducted ethnographic research published in *City & Society* that demonstrates the socio-ecological repercussions of sustainable urbanism. Within this research, Checker studies Harlem, a historically low-income community of NYC, concluding that these projects, which increase access to green spaces, often lead to gentrification through property price rise.⁸ In that sense, the notion of sustainability has become heavily commodified, synonymous with profitable commercial real estate development. From these disparities in environmental quality, Checker coined the term environmental gentrification. Since then, there has been a surge in literature on the topic. Dr. Winifred Curran, an urban geographer at DePaul University, published the book *Just Green Enough* (2018) and focused on Brooklyn. In agreement with Checker, there have been clear correlations between environmental protection plans within urban design and price increases in those neighborhoods.⁹ While this literature has predominantly focused on sustainable urban infrastructure (e.g., public parks, landscape, green space), the implementation of coastal resiliency initiatives has raised concerns due to its similarities. In the United States, the poverty rate for those residing in urban areas remains the highest at 16%.¹⁰ As low-income communities continue to bear the climate change burden, scholars have shifted to focus on how to adapt to inevitable changes.



Figure 4. The plans for “New Urban Ground” by DLAND Studio, which promotes using the landscape as a method of flood protection. Source: DLand Studio.

Building from the dialogue surrounding environmental gentrification, the combination of these processes with resilient design has led to the emergence of climate gentrification theory. Dr. Jesse Keenan published the first evidence of this theory at the Harvard Graduate School of Design (GSD), published in *Environmental Research Letters*. By analyzing real estate markets and socioeconomics in Miami-Dade County, Keenan found empirical evidence that consumer preferences have shifted towards low-risk geography, or neighborhoods better situated to combat sea level rise.¹¹ This was often seen in the displacement of residents in high elevation areas, as that real estate has increased in value due to lower flood risks. On the other hand, displacement of residents in coastal neighborhoods was catalyzed by the implementation of resilient design proposals that demanded higher prices. Aside from Keenan, the body of research on climate gentrification has been limited. Keenan calls for case studies in additional cities to better understand how these proposals may systematically limit equity or lead to gentrification.

Dr. Isabelle Anguelovski, Director of the Barcelona Lab for Urban Environmental Justice and Sustainability (BCNUEJ), combines the gentrification patterns identified by Checker with the climate change theories pioneered by Keenan in a recent report on the literature. From these findings, Anguelovski expresses concerns that resiliency and adaptation negatively impact low-income communities.¹² Given the need to focus on equity, Anguelovski highlights that literature in this emerging field of climate gentrification has failed to analyze displacement, stating, “quantitative/spatial analyses need to establish who is moving to new greened and protected areas and who is being displaced to neighborhoods with few environmental safeguards,” in her research recommendations.¹³ These research priorities are of particular importance to closing the gaps expressed by Keenan. Therefore, to further the climate gentrification theory, focusing on the spatial changes occurring from adaptation is most pressing. As Checker shows in the ethnographic study of policy proposals, the inequitable outcomes begin with city politics. Carolyn Kousky, Executive Director at the Wharton Risk Center at the University of Pennsylvania, recently published the book *Blueprint for Coastal Adaptation: Uniting Design, Economics, and Policy* (2021) with a team of experts across these fields. Aside from advocating for resilient design, Kousky emphasizes that equity needs to be further understood. To meet the goals defined by these initiatives, it is essential that all facets of the planning and implementation process distribute the environmental benefits equally across vulnerable populations.¹⁴ Based on these recommendations, the case method prioritized by Keenan, and the spatial method prioritized by Anguelovski, this research will focus on examining equity and consumer expectations through the spatial application of policies and resiliency proposals in cities that have seen the greatest climate change threats.

Part III: Case Study and Research Methods

In this analysis, Boston and New York will serve as the most critical cities to study in the context of climate gentrification. Aside from Miami and South Florida, climate change predictions from NASA show that Boston and New York remain the most at risk from rising sea levels.¹⁵ Both cities lie in the Northeast Corridor of the United States, an area that is home to over 50 million residents. According to Dr. Richard Florida, Head of the Martin Prosperity Institute at the University of Toronto, this region is also the world’s largest by economic output.¹⁶ Given the widespread social, political, and economic devastation that would follow climate disaster, the progressive governments of both cities have been at the forefront of urban resiliency. In Boston, this

has culminated into the Resilient Harbor Plan and Imagine Boston 2030; in New York, these initiatives have been proposed across several targeted borough-wide resiliency projects. With respect to the literature, Anguelovski prioritizes future analyses of East Boston, which has seen significant indicators of gentrification over the past decade.¹⁷ Given the situation of both Boston and New York as places at the forefront of climate adaptation in the United States, these cities serve as the best subjects.

The research will be conducted by completing a critical study of policy proposals, and spatial analyses of enacted projects, in each city. For each proposal, qualitative research will determine the extent to which equity is addressed in the initial planning procedures. Bearing this in mind, the limitations of these proposals will be analyzed by layering empirical data¹⁸ (e.g., home price appreciation, median household income, etc.) onto their corresponding geographic area:

- **Gentrification:** Property Price Appreciation
- **Income Level:** Median Household Income
- **Geographic Risk:** Proximity to Shoreline
- **Resiliency:** Policy and Urban Planning Proposals

After the maps are completed, the research will present evidence of climate gentrification. Based on the Keenan's conclusions, this is defined as (i.) high rates of price appreciation in neighborhoods outside of the waterfront (natural low risk), or (ii.) high rates of price appreciation in coastal neighborhoods with coastal resiliency projects (constructed low risk). These rendered maps will provide the most accurate representation of consumer real estate trends over time.

Part IV: Research and Analysis

Evidence of Climate Gentrification in Boston

The City of Boston has spearheaded efforts to enact climate resiliency through the 2018 Resilient Boston Harbor Plan and Imagine Boston 2030. Each proposal aims to make drastic changes to the built environment by reimagining the 50-mile coast of Boston Harbor. To implement these projects, Boston has collaborated with SCAPE, a landscape architecture firm based in New York, to create comprehensive design plans (see Figure 4).¹⁹ Within Boston, the majority of resiliency projects have been concentrated on the Boston Waterfront and East Boston. In each proposal, equity is addressed and handled by the city government of Boston. However, there has been contestation with the residents in East Boston due to drastic property price increases.



Figure 4. The architecture firm SCAPE has collaborated with the City of Boston to plan for the Resilient Boston Harbor Initiative. The proposal intends to increase open green spaces across the shoreline and elevate the landscape. Source: SCAPE.

Upon looking at the effects of these efforts from a spatial perspective, there is clear evidence of climate gentrification in several neighborhoods, as depicted in the map (see Figure 5). In the map, areas shaded in blue correspond to the highest risks of flooding. Adjacent to these areas are several pockets of high property price appreciation (gentrification) as shaded in orange. Looking at South Boston and the South End, there is some indication of climate gentrification due to the real estate trends demonstrating a shift in preferences towards higher elevations. On the other hand, historically high-income communities (such as Back Bay) have remained constant. While this could stem from several variables, this is concerning due to the possibility of displacement within the neighborhoods associated with historically low-income residents. Without affordable housing, the displacement of low-income communities to high-risk areas exacerbates inequality.

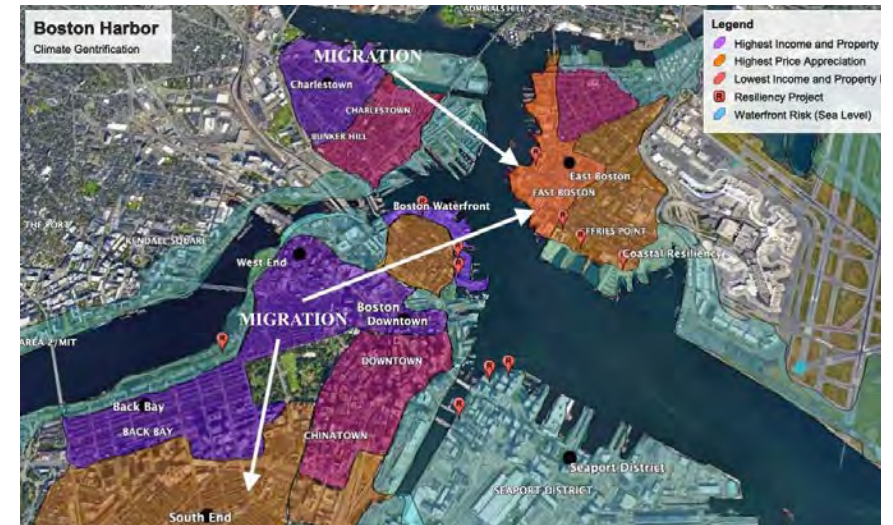


Figure 5. The rendered data on Boston reveals evidence of climate gentrification in East Boston and inland towards the South End. In East Boston, plans to elevate the waterfront and construct green spaces have drawn residents from elsewhere in the city willing to pay a premium for new construction. In the South End, gentrification has been seen as residents from the waterfront and downtown seek more affordable options with less risk of flooding.

Across the harbor, in East Boston, efforts to rapidly transform the coastline of the neighborhood has led to the observation of climate gentrification in the opposite direction. In Boston's plans to increase resiliency along the harbor, East Boston has seen the greatest changes to the built environment in the entire city. Consequently, while the cases of South Boston and the South End demonstrate price appreciation based on natural geography, the gentrification of East Boston correlates to the establishment of new adaptive coastal communities. Due to the protection that climate resiliency offers, the proximity to waterfront real estate remains a luxury amenity, channeled through the market for sustainability. In East Boston, property prices and rents in the past five years have skyrocketed. As shown in the map, this is spatially relative to a low-income community (shaded in pink). Boston has expanded the resiliency of the neighborhood through these methods in elevated parks and green spaces as part of the citywide plans (see Figure 6). At the same time, the Boston Waterfront has undergone similar changes with the difference of being a historically high-income neighborhood. As the existing real estate is protected from floods and climate change,

the displacement of low-income residents within the downtown region is facilitated by additional movement towards East Boston and other low-income communities. Therefore, these spatial analyses provide a narrative of climate gentrification by illustrating contested resilient spaces of concern in East Boston, South Boston, and the South End.



Figure 6. Resiliency plans in Boston intend to construct elevated parks in East Boston, drastically changing the waterfront adjacent to Boston Logan International Airport. Source: Stoss Landscape Urbanism.

Evidence of Climate Gentrification in New York

In New York, climate resiliency initiatives are managed by the Mayor’s Office of Climate Resiliency. In recent years, the city has outlined several initiatives to transform the most vulnerable coastal neighborhoods of Manhattan and Brooklyn. Most notably, the Lower Manhattan Coastal Resiliency Project (LMCR) allocated \$500 million to increase resiliency through landscape design in Downtown Manhattan, and the East Side Coastal Resiliency Project (ESCR) allocated \$1.45 billion to increase protection in East Manhattan, predominantly composed of neighborhoods such as the Lower East Side and East Village.²⁰ In contrast to the policy proposals of Boston, New York has implemented the Resilient Neighborhoods Initiative (launched in 2013) to integrate stakeholders through outreach to residents. This initiative will theoretically lead to more equitable outcomes through the consideration of residents prior to policy-making, as recommended by Checker. However, these projects have been faced with opposition; East River Park Action, an activist group of Lower East Side residents, expressed concern with the plan after its enactment in 2019. One member, Harriet Hirshon, stated, “this is much more about paving the way for gentrifying further the Lower East Side than it is about flood protection,” in an article for Spectrum News.²¹ With construction is underway, these concerns have been echoed by grassroots organizations in Brooklyn, which has recently seen both the Red Hook Coastal Resiliency and Sunset Park Coastal Resiliency projects begin to transform the waterfront.²² Although the climate plans in New York may seem to reflect a greater emphasis on equity than in Boston on the surface, the spatial analysis reveals signs of climate gentrification. This is especially true in the Lower East Side and Brooklyn, which have seen the highest rates of price appreciation in the past decade. Largely due to the drastic differences in wealth between the boroughs, the case of Brooklyn

is particularly significant. As in the low-risk neighborhoods of Boston, the inland properties of Brooklyn have seen unprecedented changes in prices (shaded in purple). Shown in the map of Manhattan (see Figure 7), the greatest levels of price appreciation can be found in the coastal neighborhoods of the East Village, Lower East Side, and Financial District. To the North lies historically high-income neighborhoods, which has left most middle-income and low-income residents to choose between these coastal communities and Brooklyn. These neighborhoods have seen shifts due to the ECSR and LMCR projects over the past years.



Figure 7. The rendered data on Manhattan aligns with existing trends of movement and affordability in the most densely populated borough of the city. While the East Side Coastal Resiliency and Lower Manhattan Coastal Resiliency projects have opened construction plans for new and high-end green real estate, demand from high-income residents has raised property prices. As Manhattan becomes increasingly unaffordable, families have looked towards neighborhoods such as Williamsburg in Brooklyn. This has exacerbated the need for affordable housing in New York.

Like East Boston, the implementation of elevation and green space in these contested coastal communities has led to displacement as high-end waterfront neighborhoods are constructed. In Manhattan, the access to affordable real estate and rents has been diminished. However, while the case of Manhattan is parallel to Boston, the coastal neighborhoods of Brooklyn have seen more concerning signs of climate gentrification because of existing movement from Manhattan (see Figure 8). The neighborhoods of Red Hook and Sunset Park provide the clearest evidence towards climate gentrification theory. In conjunction with displacement from Manhattan, the real estate market along the coast of Brooklyn has rapidly changed. In Red Hook, the median home price has increased 141% from \$680,583 in 2012 to \$1,643,110 in 2017.²³ As these neighborhoods become unaffordable, the further displacement of residents into Brooklyn could lead to inequity across the entire borough; if this were to occur, affordable housing in New York would be left to peripheral boroughs without the planning of Manhattan and Brooklyn. Therefore, the threat of climate change must integrate existing trends that may magnify the displacement.

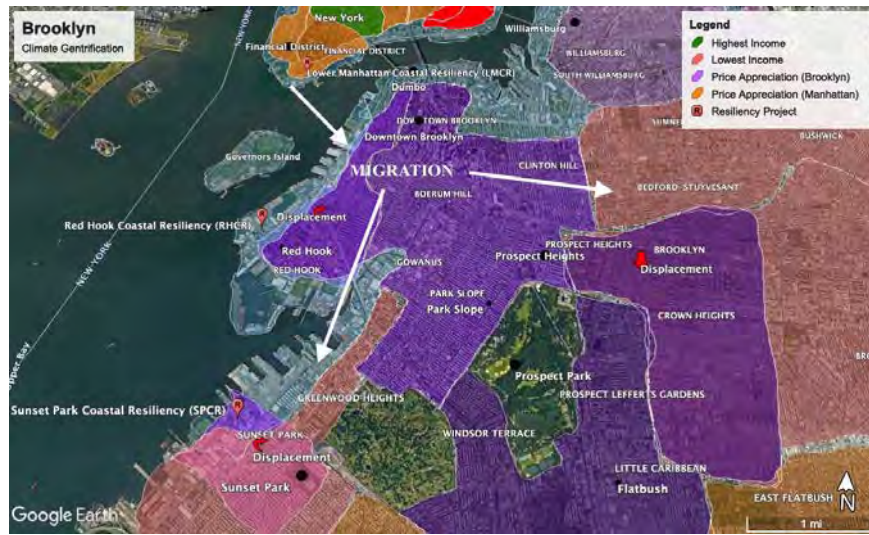


Figure 8. While the residents of Brooklyn have felt the impacts of gentrification from families migrating from Manhattan over the past decade, the continued appreciation from climate resiliency has put strains on historically affordable neighborhoods such as Bushwick. Further into the borough, plans to transform Red Hook and Sunset Park have opened opportunities for lucrative commercial real estate development alongside lower risks of coastal flooding.

Part V: Potential Solutions and Research Recommendations

Based on the spatial analysis of Boston and New York, it is urgent for urban planners and municipal leaders in both cities must consider climate change as a gentrifying force. In Boston, there are several emerging indicators of climate gentrification as depicted in the analysis above. In particular, the neighborhood of East Boston is concerning due to the large nature of displacement and price increases over the past decade. In New York, while resiliency projects across Lower Manhattan stands as agents of protection against sea level rise, affordability in historically low-income neighborhoods such as the Lower East Side has become limited. In effect, the gentrification of low-risk neighborhoods in Brooklyn has been accelerated. Within Brooklyn, the cases of Red Hook and Sunset Park further illustrate these conclusions. In most cases, these processes fail to align with the inclusive objectives of resilience policy plans in both cities. The question, therefore, becomes: what initiatives must be enacted to prevent indirectly exposing low-income communities to the disproportional burden of climate gentrification (and climate change)?

Situating these findings into the greater literature, the cases of both Boston and New York echo the findings of Dr. Keenan in Miami. However, while Keenan establishes a diagnostic understanding of climate gentrification theory, this research builds upon the theory to correlate adaptation and resiliency with increased vulnerability among those communities most at-risk of gentrification. From an equity standpoint, the findings of this paper align with the recommendations posed by Anguelovski in the Journal of Planning Education and Research. Anguelovski raises concerns that planning proposals in cities across the Global North fail to account for comprehensive inclusion while transforming resiliency into economic development. Likewise, the spatial indications of this paper align with policy that protects the elite at the expense

of the urban poor. To create more effective policy, politicians must consistently evaluate who these resiliency projects are helping. In doing so, policies that pave the way for cities to adapt to a rising waterfront should come with targeted incentives to build affordable housing. For example, despite feasibility concerns, recent proposals to extend Manhattan by Dr. Jason Barr, Professor at Rutgers University, demonstrate options that might offset the displacement from resiliency given proper incentives to do so (see Figure 9).²⁴

As climate gentrification is inevitably situated within environmental gentrification, we see that the arguments raised by Checker demonstrate how a lack of understanding of equity at the onset of the planning process leads to negative outcomes once policy is enacted. In order to place justice into the plan for resilient cities, input from the residents of communities that must undergo drastic change to the built environment should be of utmost importance. From this sense, future plans in the cities of Boston and New York should increase funding for programs such as the Resilient Neighborhoods Initiative. In addition, partnering with dissenting community organizations by holding forums will lead to more adaptive outcomes for everyone. Outside of these cities, future research should continue to highlight the use of spatial analysis methods rather than the rhetoric of political planning. This research shows that the issue of climate change is, at the core, one of ethnography and locality as much as it is planning and science. Further case studies will aid in the solidification of climate gentrification theory and provide a better understanding of how the real estate market is impacted by resiliency pathways. In the absence of these proposals, the challenge of combating sea level rise will devastate the most vulnerable coastal communities. Alternatively, under these proposals, and with further contributions to the literature, the future city can be democratized by by creating resilient forms that protect all residents of the urban environment from climate change.

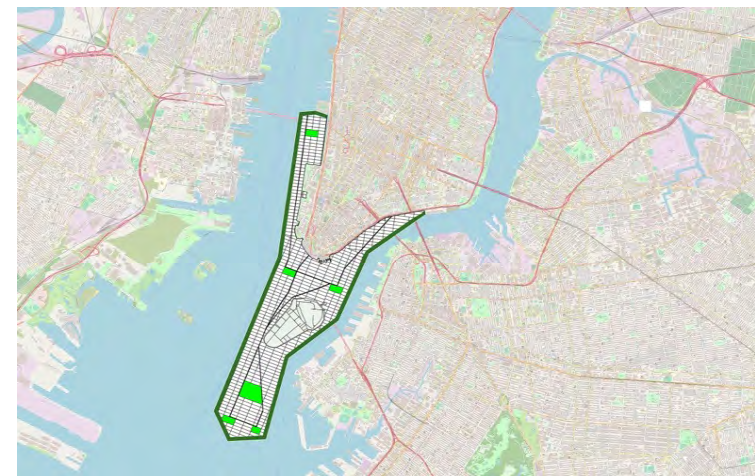


Figure 9. Dr. Jason Barr, Professor of Economics at Rutgers University, recently proposed “New Mannahatta”, an extension of Manhattan constructed through landfill with the potential to create more units of housing than the Upper West Side. Source: The New York Times

DOCUMENTING CHANGE ON ONE SEATTLE STREET CORNER

A Right of Way Analysis of 34th Street & Union Spanning 14 Years

Zoe Pottinger

This piece is a visual exploration project, originally created for URBAN 1870T: "Transportation, An Urban Planning Perspective," aimed at exploring the evolution of right-of-way in a place close to the author's home and my heart. This intersection, E. Union St. and 34th Ave, is the central intersection in her neighborhood, marked notably as the end of E. Union as a major arterial street. This work was done with a fine comb, examining small and large changes to the right of way over time. Zoe hopes that viewers who are unfamiliar with the location might find additional changes as well, coming with a fresh perspective. Through this poster, Zoe aims to evoke in viewers both a sense of this intersection and its growth over the years.

Each of these numbers aligns with a callout on the Right of Way Observation:

1. Wires for Trolley Buses, unchanged since at least 2007
2. Curb cut for parking lot
3. Bicycle rack
4. Curb cut for pedestrians
5. No striping for this segment of Union St, the first segment of the street after it ends as an arterial and transitions into residential
6. Back-in angle parking, unchanged since at least 2007
7. Mailbox, unchanged since at least 2007
8. School speed limit sign updated with flashing light element
9. Yellow and red striping to indicate bus stop area
10. First instance of stop lines at the intersection
11. Bus shelter updated with rounded roof
12. First instance of sharrows
13. New public seating/art installation
14. New city bicycle trail signage installed
15. Curb cuts updated with yellow paint for increased visibility
16. Restaurant changes ownership and adds a bench for patrons
17. Restaurant updates outdoor dining infrastructure
18. Bicycle users turning onto Union St.
19. Adirondack chairs added by unknown patron next to bus stop with limited seating
20. Public garbage and recycling bins updated with closed lids
21. New speed limit signage
22. Street signs updated to reflect location in official Historic Central Area Arts & Cultural District, including E. Union St. being named for the late local Black theater pioneer Douglas Q. Barnett



LIFE IN PUBLIC

Understanding the Role of Parks in New York City's Public Realm

Kate Harty

I've lived in New York City all my life, so I've never had the experience of a tourist, but I've heard that many people feel like New York City is dirty, that there are too many buildings, that it feels crowded and claustrophobic. Parks and increased green space seem like the obvious remedy to this problem. However, much more than people's desire to escape from the crush of crowds and buildings is at stake in the business of urban parks. In the 19th-century, Central Park became New York's first park, and in some ways, America's first real park. The park ushered in new ideas about what it meant to live in a city. Cities might be associated with constant work and industrialization but parks are places of pleasure and nature. Cities cram lots of people together into too small a space, but parks can be a place to find solace. This apparent contradiction is what makes the question of urban parks so significant. Every new park must ask questions about its purpose – who it is meant to serve. In this essay, I seek to understand the purpose of parks in New York City. The literature about urban parks is vast, even when such an inquiry is geographically limited. Tracing the history of city parks from the 19th-century to the present is a useful way to contextualize a set of contemporary questions, about sustainability, funding, and urban life. Then, two case studies of recent parks help illuminate the steps towards a more sustainable future that many new parks are taking, while also highlighting concerns about the growing role of the private sector in public projects. Ultimately, this paper interrogates why and how cities can continue to prioritize the public realm through urban parks.

In her book, *The Politics of Park Design*, Galen Cranz traces the development of parks through four distinct eras: the pleasure ground, the reform ground, recreation facilities, and open spaces. Pleasure grounds, the parks of the late 19th-century, were designed to provide an escape from industrialized urban life. They promoted refined pastimes like strolling and picnicking as alternatives to uncivilized activities like drinking and gambling.¹ Reform parks emerged at the beginning of the 20th-century and were smaller, more local parks that were specifically intended for children. Reform parks were meant to increase the health and social skills of children, especially working-class immigrants.² Recreation facilities, from the middle of the 20th-century, built on the work of reform parks, but standardized them into complexes of stadiums and asphalt courts. These facilities were mainly located in suburban areas and served middle-class families.³ Finally, the Open Space System emerged in the 1960s and promoted a less uniform system of parks and recreation. Parks in this era were located organically in their surroundings and were often quite small as each space was meant to be connected into a larger network.⁴ Cranz also identifies some consistent components of the history of parks, including a decline in the number of social functions to which a park contributes, the use of parks as a mechanism of control, and the evolution of one park type into another.⁵ Cranz offers several critiques of park design. She argues that because there is such support for the general idea of a park, there is a lack of rigorous policy debate about the exact function a park should serve.⁶ She also contends that despite the changing types of parks, there has been little progression in the actual ideologies associated with park development. She holds that "park thinking had never really questioned, or engaged critically with, the drive for short term profits associated with a capitalist social organization, or the urban realities resulting

from it."⁷ In a subsequent article, "Defining the Sustainable Park: a Fifth Model for Urban Parks," Cranz, along with Michael Boland, reexamine Cranz's thesis from *The Politics of Park Design* to propose a new type of park ideology: the sustainable park. They describe several characteristics of a sustainable park that distinguishes them from previous models.⁸ These include the use of native plants, the restoration of natural systems, sustainable waste management, and maintenance strategies, and more.⁹ They also write how public-private partnerships may function as a form of community stewardship and "one kind of social structure whereby the community may directly support urban parks."¹⁰

In "Why Urban Parks: a Matter of Equity," Heath Schenker also discusses the history of parks as an institution, from aristocratic leisure spaces to a worker's respite from industrialization. She considers Central Park as a case study, noting that "Olmsted believed that it was the duty of members of the 'new aristocracy' in the United States (by which he meant educated, powerful, self-made men of means) to bring a certain level of 'civilization' to the masses, thereby strengthening the whole political system."¹¹ Schenker describes how parks flourished under both representative democracies like the United States and non-democratic empires like France under Napoleon III and highlights how both of these regimes used parks as a tool to promote "basic rights and equity."¹² This political use of parks reinforces Cranz's belief that parks are seen as a vague mode of promoting good, inviting little rigorous debate. She also writes how the urban bourgeoisie supported the creation of new parks because of their economic value since they made a city more attractive to investors and tourists. Schenker concludes by saying that "the equity values that were embedded in these parks in the 19th-century are still intrinsic to them today, although obscured by nearly two centuries of habit and imitation."¹³

Furthering the idea of parks as a political tool, Alvaro Sevilla-Buitrago discusses in "Gramsci and Foucault in Central Park: Environmental Hegemonies, Pedagogical Spaces and Integral State Formations" how urban parks have been used as technologies of bourgeois control, using Central Park as a case study. He notes that parks are a way that the state and the bourgeoisie projected regulation over the lives and lifestyles of the working class. He also unpacks the pedagogical work of parks in organizing desires and instilling a sense of channeled freedom.¹⁴ Using Gramsci's and Foucault's modes of analysis and theories about power and control, he analyzes Central Park as a site of bourgeois hegemony. The park could police the types of pleasurable experiences that its users were permitted to have. For example, strolling was acceptable; drinking and partying were not. Olmsted explicitly designed the park to subtly encourage its users, especially those belonging to the popular class, to reflect on their behavior and act in accordance with polite norms. Since the park was created with the goal of interclass interaction, the working class could watch the elites practice polite behavior and then mimic their actions.¹⁵ The type of democracy that Olmsted sought to promote in his park was limited, one in which people's interactions, especially across classes, were highly scripted. Public space might be open to everyone, but typical power dynamics remained intact.

John Beardsley begins his article "Conflict and Erosion: The Contemporary Public Life of Large Parks" by identifying a lack of publicness as a problem specific to large parks. He notes that large parks are notoriously complex and difficult to maintain, leading governmental authorities to delegate at least some control to private entities, which

have the capacity for greater focus and are often better funded.¹⁶ He discusses other ways in which the public and private become blurred in parks as well. Private enterprises might take over the management of spaces that were entirely public, leading to new regulations on their use.¹⁷ He argues that while public space generally has become increasingly privatized, parks remain a place which exist largely in the public realm, and allow for almost entirely public, unregulated actions.¹⁸ Some of the details that Beardsley includes about the impact of private management in parks are particularly illustrative of the shrinking public presence in greenspace management. He describes how public spending in parks dropped significantly in the late 20th-century, declining 31% in New York City. Beardsley also points to the fact that parks are increasingly expected to be essentially self-funded, through concessions, corporate events, and other fees. Simultaneously, Beardsley recognizes that these practices can be financially sustainable, especially when the funds are redirected into park maintenance, while also critiquing the public sector for ceding responsibility to private enterprises which have their own priorities. In doing so, he calls for a reclamation of parks “as part of our essential urban infrastructure, as key features in functioning urban social systems.”¹⁹ Beardsley concludes by reiterating the role that parks can play in supporting democracy, and encouraging organic interactions, necessary debate, and greater tolerance.

Nina-Marie Lister brings an ecological lens to urban parks in her article “Sustainable Large Parks: Ecological Design or Designer Ecology?” One useful term that Lister brings into discussion is adaptive ecological design. She describes how in the modern era, cities have less land available for higher prices, which means that the demands on new parks are higher than ever: they must be financially sustainable, that is, revenue-generating; appealing to a mass audience; and, of course, they must take into account ecological concerns and resilience.²⁰ She critiques the view that ecosystems develop into a particular stable state, in which a perfect balance of biodiversity is maintained. Instead, she writes how it is normal for the natural world to be unstable, and change suddenly, in extreme and brutal ways. She argues it is a major shortcoming that most parks are not designed for these changes.²¹ She notes that many designers rely on a sense of scientific certainty, which is antithetical to the unpredictabilities of nature, and that instead of enforcing a false sense of order onto ecosystems, designers would find more success in accepting change and adopting flexible methods.²² Lister also offers a critique of top-down, institutionalized planning, and instead articulates a method which, in addition to being more attuned to an area’s everchanging ecology, depends on the local residents to make their own choices about the design and management of parks. This increases civic engagement, requiring the planner to act more as a facilitator and less of an absolute authority.²³

In “Parks and the Private Purse,” Ernest Beck interrogates the role of public-private partnerships in the financing of new city parks. Beck describes the increasing role of the private sector in parks as a change from the 19th-century policies of hands-on, large public investments, as in the example of Central Park. Like many other sources, Beck traces the role of the private sector to the Central Park Conservancy, and notes how the group has been successful in raising private funds to maintain and restore the park.²⁴ Several supporters of the public-private model claim that the money for public investment is not there, and private enterprise can step in and directly support the project. In response, Beck incorporates several critiques of the public-private model. He writes that the private sector investments are often dependent on real es-

tate, meaning that funding is often dependent on the market and far from secure. He also quotes the designer Michael Sorkin, who argues that the private sector fails to equally distribute services and resources and that there is no economic incentive for them to invest in lower-income communities.²⁵

From these authors, there are some fairly consistent themes which can be applied to a few case studies. The questions of what parks are for and how they accomplish their functions are at the center of this literature. Are parks places which seek to mask social conflict and exert control, as Sevilla-Buitrago and Schenker suggest about Central Park? Or, as Beardsley argues, are they sites of necessary and productive conflict? Another persistent question is about the value of public-private partnerships, and, more broadly, the roles of the public and private sectors in the development and management of urban parks. Cranz and Boland propose that public-private partnerships can be a method of facilitating community engagement, while Beck critiques such reliance on the private sphere as allowing private developers to neglect lower-income communities. Lastly, there is a question about redefining and applying sustainable models to new urban parks. Cranz and Boland attempt to define what a sustainable park means and Lister brings their analysis further to calls for a model of sustainability that is flexible and takes into account the volatility of natural systems and the needs of the surrounding community.

These questions feed into a set of case studies comprising two recent waterfront parks in New York City: the Little Island at Pier 55 and Brooklyn Bridge Park. These two projects are significant because they were both built in the past twenty years, offering important insights into the new politics of park construction. In a city that is increasingly strapped for space, expanding onto the waterfront, and replacing decaying piers with new parks seems like an obvious move. Despite the apparent benefits that characterize the creation of these parks, a more informed analysis is necessary. There are several questions to be asked about Brooklyn Bridge Park. How did the plan for the park come to be? Who were the major actors and stakeholders involved in the park’s development and construction? Was the park created in the model of older New York City parks, or was it a new model of an urban park? And, lastly, how was the park funded? The Brooklyn waterfront had been a major port and shipping center in the nineteenth and early twentieth centuries, but by the 1980s, the piers had fallen into disuse.²⁶ But plans for development along the East River stirred up debate among a variety of stakeholders. The Port Authority, which had operated the piers, was looking to offload the land to private developers who were likewise eager to capitalize on the site’s prime location and iconic views of the Manhattan skyline.²⁷ These groups were from the beginning in conflict with the Brooklyn Heights Association (BHA), a community activist group which already had a long history of opposing projects that they considered detrimental to the neighborhood.²⁸ The conflict would only escalate through the next several decades, as other governmental and private organizations became involved. Throughout this period, different mayoral and gubernatorial administrations would bring additional perspectives and issues to the project, and the longstanding tensions between city and state authorities would prove an ongoing challenge. The disagreements over the nature of the development, and the related problem of funding and management, became the two major sticking points in the making of what became Brooklyn Bridge Park.

For the private developers involved in the project, the original plan involved residential and commercial structures, which the BHA quickly opposed, contending that tall buildings would block the view from the Brooklyn Heights Promenade, and countered with a proposal for a public waterfront park. The Port Authority prioritized converting the crumbling piers into a revenue-generating enterprise, while various elected officials were at once attracted to the possibility of putting their names on a major public works project but also hesitant to commit to the controversial venture.²⁹ Debates over the park's financial situation continued as well, with some in the real estate sector advocating for private management, funded by hotels, restaurants, and other businesses in the park. They also posited that privatization might curtail much of the political fighting that had plagued the project since the beginning.³⁰ Others, especially local activists like those involved with the BHA, were concerned about the impact of privatization on the park and preferred the oversight of a public agency.³¹ Eventually, funding was secured for the park through a variety of public and private organizations, and the landscape architecture firm Michael Van Valkenburgh Associates was contracted to begin construction officially in 2007.

What kind of park is Brooklyn Bridge Park? In many ways, it successfully incorporates many of the characteristics of a new sustainable park that Cranz and Boland list in their description of the type. Many of the plants are native to the area and also work as part of the park's irrigation system.³² The waterfront nature of the park meant that the designers encountered problems specific to the site, from both an ecological and a design standpoint. The architects wanted to highlight the connection to the waterfront through floating walkways, but they also had to avoid creating too much shade over the water, at risk of harming the aquatic ecosystems.

Beyond its physical design, Brooklyn Bridge Park also engaged with questions about the role of new parks in New York City. Given the contentious debates over the park's financing, it is worth returning to John Beardsley's concerns about whether or not the government is still interested in funding and managing large parks for the general good; whether it has ceded too much responsibility to the private sector. One particular event in 2016, when some residents of Brooklyn Heights made racially charged complaints about the users of the park's basketball court and demanded that they be replaced with tennis courts, brings us to Sevilla-Buitrago's analysis of how parks and infrastructure might be used to control behavior, and in this case, the type of person who is welcome in a park.³⁴ This example also intersects with Lister's conviction that because of their size and enormous draw, large parks must engage with a variety of viewpoints beyond those in the immediate surrounding.

The model of Brooklyn Bridge Park proves insightful in examining an even more recent park, The Little Island at Pier 55, another waterfront park where development seemed equally fraught. Primarily financed by billionaire businessman Barry Diller and his wife, fashion designer Diane Von Furstenberg, the project opened in May 2021 to significant fanfare and criticism. The project began in 2012, a few years after the first sections of Brooklyn Bridge Park opened, and the same year that Hurricane Sandy hit New York and devastated much of the city's waterfront infrastructure. Diller, who has long invested in various New York City-based public works projects, including the High Line, agreed to contribute one hundred and thirty million dollars to convert the collapsing piers into a park and support maintenance on the site for two decades following. Public funds would cover the remaining forty million.³⁵

With funding secured, the park had seemingly breezed past the obstacle which had stalled Brooklyn Bridge Park for decades. Then came the lawsuits, with complaints coming from the City Club of New York but primarily funded by real estate mogul Douglas Durst.³⁶ Construction costs ballooned to almost two hundred and fifty million dollars, and Diller backed out of the project, rendering it dead until Governor Andrew Cuomo struck a last-minute deal with the City Club to protect the Hudson River's marine life, allowing the project to continue.³⁶ Diller, now backed by Cuomo and allied with the Hudson River Trust, the public-private organization which manages the parks along Manhattan's western waterfront, ultimately committed three hundred and eighty million dollars to the park.³⁸

The question stands: how should New Yorkers, or anyone else who cares about public infrastructure and green space, respond to the park? For a city that was hit hard by the coronavirus pandemic, it seemed like a gift for vaccinated New Yorkers to finally step out into their city and explore a beautiful new space. But it is also hard to avoid thinking about how this project came to be, and all of the backroom deals and billionaire politics that eventually created it. The website for the Hudson River Trust states that it "operate[s] on a premise of financial self-sufficiency... funding for new construction, known as capital funding, has historically come primarily from state, city and federal appropriations and grants, though private funds are increasingly important" (emphasis added).³⁹ Such a statement reads almost euphemistically, in light of how much the public sector has stepped back from funding major projects. The consequences of private involvement are already clear. Entrance to the park requires a ticket, which, though it is free, nevertheless restricts access to what is supposed to be a public space for everyone. Pricey concession stands and fees to see performances in the park further add to the site's sense of exclusivity. The Little Island is a new sort of park and it may well incorporate many sustainable features, but its more important contribution to the new age of parks is its prioritization of private investment and priorities over public life.

From the beginning, both Brooklyn Bridge Park and The Little Island have had more in common than just dealing with the unique challenges of building on a waterfront. As major projects in a large, diverse, and frequently divided city, development was bound to be contentious. These two case studies reveal how finances are one of the most significant factors in the development of new parks, and how the private sector is increasingly involved as the government steps back.

The negative influences of private development make the days of massive public investment appear like a distant and idealized past. While the ideologies of environmental hegemony do not need to see a 21st-century resurgence, Olmstead and others at least had a fully realized vision of life in public. What New York City needs is a reconceptualization of public space, and what it means to prioritize the public realm. That has to mean that the public sector begins to treat new development seriously, even large projects which seem to have dauntingly high price tags. This requires a certain amount of political peace and cooperation that is almost unimaginable in New York City, given the constant battles between the state and local governments. It also means that New Yorkers will have to rethink what it means to live in a city and recommit to the experience of living with others. The coronavirus pandemic has obviously impacted almost every facet of life, and one of its consequences has been the move towards remote work, virtual interaction, and a general retreat into the safe indoors.

Privacy, rather than public life, seems to be the new normal, even in cities. One new project in New York is a particularly interesting place to watch as a potential sign of the new future of big parks. Ground broke on Freshkills Park in Staten Island almost a decade before the opening of Brooklyn Bridge Park, long before anyone had even conceived of The Little Island, though the park is not meant to open until 2036. The park is meant to reclaim what was once the largest landfill in the world, by allowing native flora and fauna to grow over the area over the course of over three decades.⁴⁰ Freshkills will be the largest park to open in New York City in over a century, and though its past as a landfill serves as a constant reminder of how much the city consumes, and discards, its future can be a place where New Yorkers come to be with nature, and with each other.

Ultimately, Brooklyn Bridge Park, The Little Island, and Freshkills are indications of the new direction that parks are taking in the 21st-century. Some of these changes are favorable, especially the move towards increased awareness of and sensitivity towards the environment and ecological systems. Parks are more and more designed for the present and the future, though the growing discussion about the need for resiliency planning in terms of not stasis but flexibility and adaptability is a much-needed intervention. Beyond design, the history of these parks could also indicate the number of obstacles that delay or prevent entirely the construction of new parks, from financial troubles, to political maneuvering, to community backlash. These parks invoke questions about the role that public life will play in our future and whether private enterprise or public investment is the best way to create the richest, most democratic spaces.



Little Island. Source: Amr Alfiky, The New York Times.

LOCALIZING A GLOBAL NETWORK: URBAN INTERNET INFRASTRUCTURE

NYC Mesh and Local Efforts to Connect Urbanites

Chris Sarli

Thesis Abstract

The Internet is increasingly important to urban life, but Internet service in American cities is overpriced and slower than it should be. Even though it is technically possible to allocate high quality connections to all those who want one, significant populations are stuck with very poor connections or lack a connection altogether, an inequity that reinforces gaps in access to healthcare, education, and employment. This thesis examines the extent of this urban digital divide and explores the policies and (lack of) regulation that have allowed it to worsen. It also covers efforts to overcome these issues and the challenges opponents of the status quo face. In that vein, this thesis stresses not just the importance of providing connections, but also considers the implications of how those connections are provided, with an eye towards the role of local political power in infrastructure and grassroots participation.

The following is an excerpt from a chapter of the thesis that focuses on bottom-up efforts to reform urban Internet connectivity in cities. In the chapter, I introduce the term “Community Network Projects” (CNPs). CNPs, for the purposes of this thesis, are non-governmental, non-commercial, non-institutional (specifically not attached to universities or schools) entities that attempt to deliver Internet service to community members. They may accomplish this through any number of mechanisms, from collectively purchasing service in order to obtain a lower rate to planning, installing, and maintaining their own network hardware. This excerpt focuses on a single CNP—NYC Mesh.

NYC Mesh

NYC Mesh is one of the larger and more well-known CNPs in the United States. As its name suggests, the group is based in New York City, and serves as an excellent study in both the technical and human considerations in building a grassroots network. “NYC Mesh” has a dual meaning—it refers to both a physical network (consisting mainly of rooftop antennas and off-the-shelf consumer-grade wireless access points) and the community of volunteers who build and maintain that network. Despite their close involvement with the physical network, the members of the *organization* NYC Mesh are the chief proponents of this distinction. They underscore that with their network, unlike the physical Bell System of yore, which was effectively inseparable from its parent company, AT&T, the network doesn’t belong to any one entity. It is through the consensus, not the command, of the community that the physical network is operated.

Both physically and organizationally, the project began at d.b.a., a bar at 41 1st Avenue, in Manhattan’s East Village.¹ Despite its formation in the early 2010s—a period of acute gentrification—from its earliest inceptions the project appears to embody at least part of the counterculture ethos that defined the neighborhood decades earlier. On their website,² in press appearances,³ in community presentations,⁴ and in conversation,⁵ NYC Mesh volunteers are unapologetic in describing their mistrust

of incumbent Internet Service Providers (ISPs), clarifying that while they do indeed provide Internet service to New Yorkers, the fact that they connect users directly to an Internet Exchange Point (IXP)⁶ with a minimal of intermediary networking and have strict policies regarding privacy and net neutrality means that they really can't be lumped in with the incumbents they oppose ("the telecom oligopoly in New York of Verizon, Optimum and Spectrum."⁷)

While the network has grown to thousands of users who possess a wide range of viewpoints and technical expertise, "early supporters were mostly tech-liberationist types,"⁸ and this thread is still clearly visible in the core of the organization.

Nuts and Bolts of Mesh Infrastructure: "Guerrilla Wi-Fi"

At present there are 985 NYC Mesh installations and more than 4,500 individuals signed up for the organization's online communication tool. From donations, the organization pays a few thousand dollars in monthly rental fees for strategic antenna location on some tall buildings, and for the ability to "peer" with other networks in IXPs (which is how most Internet traffic flows into and out of the NYC Mesh network). Several volunteers are software developers and network engineers, so the organization has effectively no labor costs in this area. Good NYC Mesh connections can provide symmetric speeds in the several-hundred megabit per second range.

Because members of the organization own their own equipment, there *is* an up-front cost to joining. On average, the equipment for one building costs \$240, and the organization asks that if you request installation help from a group of volunteers, you put up \$50 for transportation expenses and incidental costs (though they are happy to have you perform your own installation), for a total of \$290. NYC Mesh does offer need-based subsidies (\$160 subsidized for equipment and installation) and installment plans for the equipment, and also encourages groups of neighbors to invest together, amortizing the constant cost amongst them. There is no required monthly payment, however the organization does suggest a monthly donation of \$20 to those who can afford it (which goes toward various expenses and subsidies).⁹

In its "Master Plan," the organization expresses that it would like to grow to the scale such that it can provide a high-quality connection to every building in the five boroughs. NYC Mesh has received grant funding from the Internet Society and Mozilla, both technology-oriented nonprofits, and is legally a subsidiary of the Internet Society Chapter of New York, in an arrangement designed to give NYC Mesh autonomy but also legal protection from some liability.

In and Of the City

The title of a 2021 profile of Daniel Heredia, an active NYC Mesh volunteer, and of NYC Mesh itself in *The New York Times* includes the term "Guerrilla Wi-Fi." While the piece touches upon the digital divide in general and New York-specific issues (such as Verizon's unsatisfactory fiber installation, discussed in an earlier section), it also follows Heredia as he traipses across a rooftop in Brownsville, Brooklyn, crimping cables, aligning antennas, and running speed tests as he leads an installation. While firm in their opposition to the "telecom oligarchy," volunteers tend to be pleasant and softly spoken people,¹⁰ and as an organization have developed clearly thought-out strategies for long-term growth and sustainability. Still, "guerrilla" is an apt term.

Incumbent ISPs provide a *service*, where a monthly fee paid to a telecom giant buys an installation, preconfigured networking equipment, and a terrible customer support system that is the only real mechanism for troubleshooting issues. The mass-market option, for better or worse, is a neatly packaged offering that is only identifiable by a corporate-branded router and local Wi-Fi network name. NYC Mesh also strives to offer a similar turnkey *service* for those who want or need it, but as a product of being a participatory, volunteer operation, it daylights the complexities of network engineering and installation typically discussed only internally at ISPs and implemented by specialized installers. The methods and technologies they use are, for the most part, the same as those used by ISPs—after all, the Internet is defined in technical, non-proprietary terms. Though large ISPs provide most of the service, NYC Mesh can do the same, and this means that it must deal in the technical, physical bones of network infrastructure.

The extent to which the organization deals in what may be considered the "nitty-gritty" is suggested by the detail of NYC Mesh's extensive documentation.¹¹ A linked slide presentation, which aims to provide an overview of the typical installation process and train volunteers with the requisite technical skills, is 105 slides long.¹² The presentation provides an overview of the group's workflow, including how it uses Slack, a popular online communication tool, and osTicket, the ticket system it uses to track installation requests.

As becomes clear early in the installation presentation, much of the process of deploying a CNP has just as much to do with the geography of the city and the types of buildings within it as it does to networking protocols. One of the first steps for anyone wishing to acquire a connection is to capture a panorama photo (usually from a rooftop, but occasionally out of a window). The reason for this photo is to establish potential Line-of-Sight (LOS) to other nodes in the network. Most connections in NYC Mesh are made wirelessly, with antennas transmitting signals over the city below. NYC Mesh can set up these antennas on rooftops dotting the city.

While NYC Mesh provides an online tool (see Figure 1 for an example) that uses a 3-dimensional model of the city to attempt to map nodes that a building may have a LOS to,¹³ a panorama is often the best way to verify these findings and account for nuances (like trees, chimneys, water towers, or other networking equipment) or new buildings that may not be captured in the model. To prevent future frustrations, NYC Mesh asks that LOS is verified before the group dispatches schedules an installation team.¹⁴

Once LOS has been confirmed and an installation scheduled, a volunteer will self-select as a leader for the installation. The aforementioned slide deck disclaims that these installation leaders are responsible for assembling the required equipment and provides checklists that leaders should use. The equipment favored by NYC Mesh are reasonably cheap, unremarkable, off-the-shelf options.

Actual installation instruction ranges from the technical IT necessities to "tips of the trade" to policies and suggestions on etiquette and safety. On the technical side, there are illustrative diagrams of typical NYC Mesh setups (see Figure 2), instructions on how to attach or "crimp" RJ45 connectors onto the ends of Ethernet cables needed to connect, tutorials on how to install needed firmware and configure the antennas, tips

on which drill bits to use on roofs, and links to lists of subway stations with elevators (to make it easier to move equipment to the installation site, especially if installers don't have the "stair-climbing" hand trucks NYC Mesh veterans recommend).

Beyond the technical acts of creating a new network connection, NYC Mesh values installations as a form of "camaraderie and community-building."¹⁵ After all, installers work on a volunteer basis, and in lieu of formal compensation, the hope is that installers feel rewarded by simply helping their fellow New Yorkers when they "See the joy on a new member's face when they get connected!"¹⁶ Much in the same way people find tending community gardens or participating in neighborhood cleanups, the hope is that installers may find the acts of climbing on top of rooftops, aligning antennas, drilling holes, and crimping cables to be a similarly welcome and fulfilling break from the typical. Indeed, the technical act of "connecting to the network" is often purposefully conflated with the social act of "joining the community." Hall, in presentations, has said "by joining, you are now part of our network. We're not like an ISP where we're giving you things, you become part of our network."¹⁷

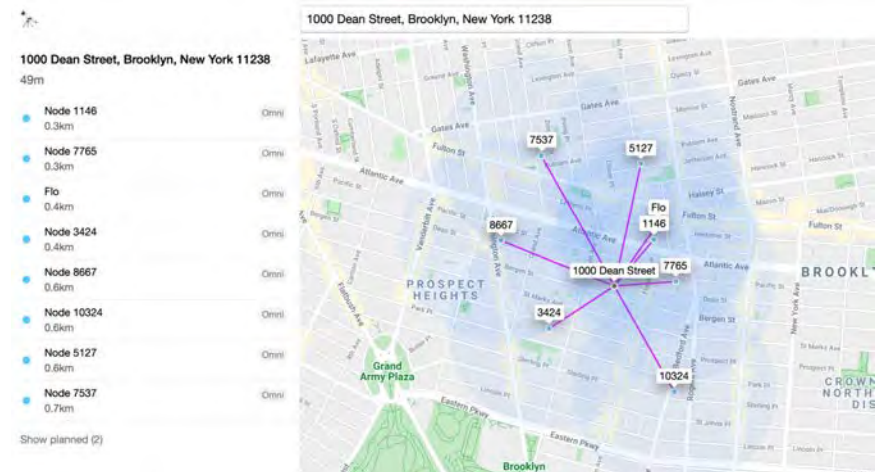


Figure 1: NYC Mesh's Line-of-Sight tool, for address 1000 Dean Street, Brooklyn, New York 11238.

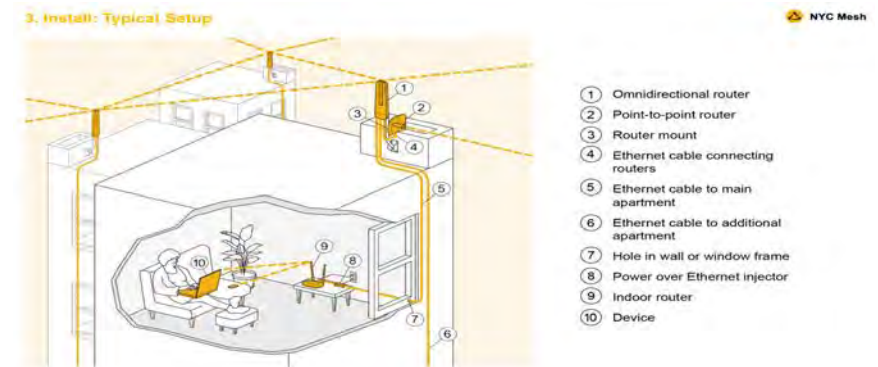


Figure 2: Slide 41 of NYC Mesh's installations slide deck,¹⁸ showing the component of a typical installation of NYC Mesh.

Installers for incumbent ISPs are clearly employees, so the social interactions between them and the owners or occupants of the buildings they perform work for are relatively clearly defined by the contracted transaction arranged by the company. Installers show up with identification cards, in trucks with company logos, often with company-branded equipment. They have an official "look." NYC Mesh install volunteers, on the other hand, arrive as a group of people who may be friends with one another or complete strangers. They don't have uniforms, equipment vans, or any sort of official licensure certificate. Whereas the official nature of professional installers offers guardrails on what is and is not acceptable behavior on the part of the installer and the resident, those guidelines are largely murky, given that volunteers and residents are drawn from one of the most culturally diverse cities in the world, that volunteers aren't paid (the \$50 surcharge is meant to cover install leaders' expenses, not serve as compensation), and that residents may not fully understand what the installers are doing. The organization has put together an "etiquette guide,"¹⁹ which at a high level reminds volunteer installers:

"As a volunteer installer, you are the public face of NYC Mesh! [sic] Courtesy, respect, friendliness and professionalism will give new members a great first impression of our organization and will encourage them to become active contributors to our community."

Specific recommendations range the gamut. Before the install, installers should check the weather forecast, get in touch with others working on the install, and check for public transit delays (if this is how they are getting to the install site). While at the site, they should be mindful of potential cultural and social differences, including "attitudes towards physical contact," wearing outdoor footwear indoors,²⁰ language barriers, and differences in physical abilities that may impact who participates in the install and in what capacity. While installers should respect an installee's privacy, installers are encouraged to ask for the location of the bathroom when they arrive in case, they need to use it during the install.

Though it goes without saying that NYC Mesh (the group) wants its volunteers to have a positive experience, it is also realistic about potential risks, most of which surround working on rooftops. The organization's documentation includes an entire section on-site safety,²¹ covering topics from fall hazards to electrical shocks to asbestos. The lack of formal, authorized training and licensure is a point of difference from the services offered by incumbent ISPs. Installers working for Spectrum or Verizon "often have safety protocols that are more stringent than" NYC Mesh's²² and generally have a different concept of liability. Rob Johnson, a volunteer with NYC Mesh, describes this as a fundamental tension between "long term visions of a professionally supported mesh and an amateur [sic] one."²³

By no means is participation in NYC Mesh an extremely dangerous activity but the *small* amount of risk it requires members to take earns it the "guerrilla" qualification. NYC Mesh proposes a community network, where members own their equipment. The donation of time and assumption of that small liability for participation validates the social contract members make with the rest of the NYC Mesh community. Rather than being passive consumers of Internet service, their independent and individually insignificant actions disrupt that status quo. In a small way, under this model participants embrace the ethos of decentralization inherent to the Internet itself.

NYC Mesh Deployment

This subsection first seeks to highlight the current buildout of the NYC Mesh network and contrast that with national trends in broadband access, and then discuss how the organization is targeting expansions both based on the network's infrastructural requirements and the desire to lessen the digital divide by serving certain populations.

Current Buildout

Given the organic, piecemeal manner in which NYC Mesh expands, it has not yet reached its goal of covering the entire city. As mentioned, the organization ultimately hopes to cover the entire City, but most of its current members live in (and thus the organization's activity as a whole centers in) a southeastern portion of Manhattan (roughly bounded by the Brooklyn Bridge to the south, Broadway to the west, and 14th Street to the north) and in several neighborhoods in Brooklyn. The organization collects only what it considers the bare minimum of information needed to function (new members need to provide a name and email address), but this includes the location of each node. This information is needed, and ultimately public, because one of the core tenets of the network is that others can connect to it and therefore need to know the locations of existing nodes.

Given that relatively few (compared to the population of the city as a whole) use NYC Mesh, and because as mentioned above the organization collects a minimum of information from these members, there are not statistically rigorous and defensible measures of the demographics of the user base. One approach that provides some very limited insight is to perform an analysis on the relative wealth of the surroundings of each Mesh installation. Based on pre-pandemic (2019) American Community Survey data, the median incomes of the block groups containing the 927 nodes represented in the above-used NYC Mesh dataset have an average of \$71,764.61, with a standard deviation of \$34,780.36. Again, while this mode of analysis is inherently limited, Figure 3, which is based on such analysis, suggests that NYC Mesh's installations tend to be in a more economically representative sample of the city, especially when compared to the stark divides seen in Baltimore's infrastructure deployments [discussed in previous chapters].

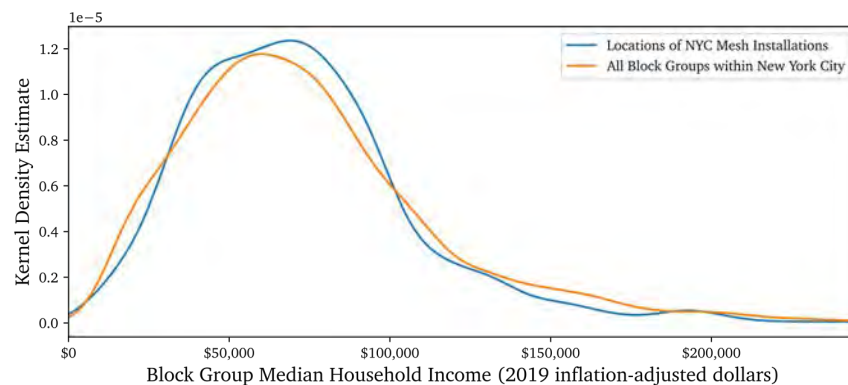


Figure 3: A Kernel Density Estimation plot drawn from two sets of ACS 5-Year median annual household income (in 2019 inflation-adjusted dollars) estimates (ACS detail variable B19013_001E²⁴): one set of the block groups containing each instance of a NYC Mesh installation and another set for each block group in the city. Note, this analysis suggests that NYC Mesh's installations are geographically located in areas that are economically representative of the city.

Targeting Buildings

Under ideal circumstances, the time investment to install and maintain a node is minimal. As the NYC Mesh network has grown beyond its origins, therefore, the already-connected volunteers who spearhead the organization are investing their time not just for the benefit of their own connections, but for the shape of the system. Given that they are a group of volunteers, they have relatively few resources compared to those needed to realize the full mission of covering the city, so focus and prioritization are needed. A one-page flyer describing NYC Mesh's priorities notes that "To expand network access, NYC Mesh identifies strategically-located buildings to function as local hubs to which a surrounding community may connect."²⁵ Strategy, in this case, is very much concerned with the urban topography—the organization seeks to identify tall structures that can act as hubs, to bring a high-quality connection into a previously unconnected building:

Tall structures are the only way we can expand the wireless mesh. This is by far our biggest priority. There are a few different types in the city and we need to try them all- NYCHA [New York City Housing Authority] buildings, skyscrapers, churches, schools, libraries, existing antenna masts and building coops. We need specific presentations and handouts for each of these types of structures. We are currently approaching libraries and churches. We need to build presentations for coop boards and others.

Once we have a tall structure in a neighborhood, we can link to apartment building rooftops.²⁶

Targeting Populations

Increasingly, NYC Mesh has made a concerted effort to target growth towards underserved communities.²⁷ If a private developer is willing to pay to wire a new building, the organization is more than happy to help connect the building to the NYC Mesh network. But when targeting rooftops and community partnerships, the organization has been prioritizing neighborhoods most in need (there was a specific push to bring service to Brownsville, for example).

While NYC Mesh has primarily realized its network in connecting members' dwellings, the organization has not been limited by those spaces, and has expanded to businesses, community gardens, and public housing complexes. As alluded to, businesses (such as d.b.a.) can be connected to the network in much the same way that members' apartments are. There have also been efforts to promote connectivity through NYC Mesh in public spaces. The 11th Street Community Garden, for example, proudly displays a laminated sign proclaiming "We have free Wifi" and "Provided by nycmesh.net" near its front gate (see Figure 4). Especially for those New Yorkers who lack large cellular data plans or devices, such an installation provides a point of public access not tied to a retail business (a Coffee Shop, where one may be obligated to make a purchase) or subscription.

NYC Mesh, the organization, has also made attempts to work with large landlords and building owners, including, notably, the New York City Housing Authority (NYCHA). One realization of this effort has been the network's Saratoga Hub. The hub equipment is located on top of the NYCHA-owned building at 33 Saratoga Avenue, near the Eastern Avenue of the Bedford--Stuyvesant section of Brooklyn. The building is the tallest in its immediate area, and the panorama taken from its rooftop indicates that much of its surroundings have clear lines of sight to the Hub's antennas.



Figure 4: Laminated signs (including one proclaiming free wireless Internet access provided through NYC Mesh) at the entrance to the 11th Street Community Garden in the Alphabet City neighborhood of Manhattan.

The installation, in addition to the needed basics for establishing a signal with peer nodes, includes several wireless access points installed throughout the building. Rather than requiring each resident to request an installation, the building-scale approach provides what appears to be a “free” Wi-fi network throughout the building that residents can use or ignore, without any need to individually contact the organization, an incumbent ISP, or NYCHA. Unlike in the case of a traditional installation on a managed building, the system’s technical documentation is published and freely available—on its website, NYC Mesh lists the hardware used, details the approach installers took to mounting the wireless access points (which act as the true “last miles” by providing the signals residents connect to on each floor), and includes images of the installation and technical diagrams

As shown in Figure 5, the Hub largely lives up to its purpose, providing connections to other nodes both in its immediate vicinity and somewhat farther away. In addition to the access points, it provides for building residents and the public access available at Halsey Street station, the installation also serves “large areas of the Bedford Stuyvesant and Bushwick neighborhoods.”²⁸

Beyond providing access inside the building and functioning to expand the network, the installation was also used to provide free, unmetered Wi-Fi access at a nearby park and on the platforms of the Halsey Street station,²⁹ which is served by the New York City Subway’s J train.

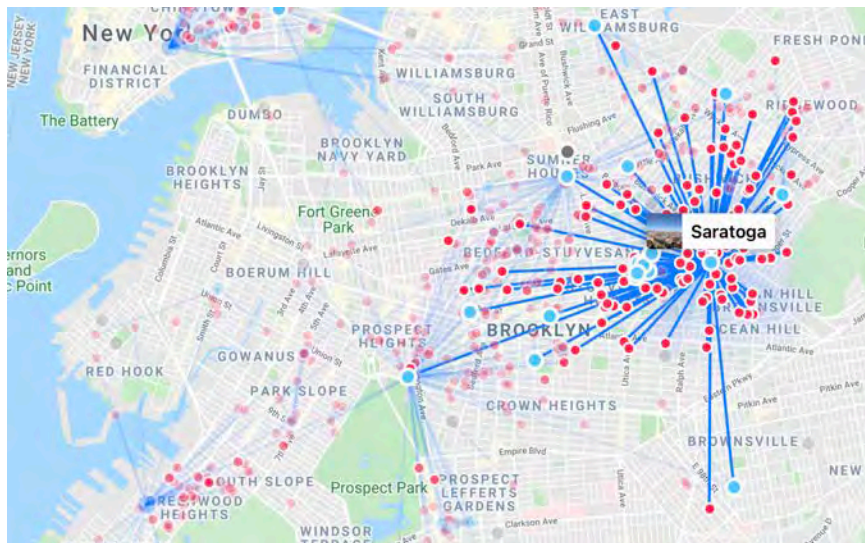


Figure 5: NYC Mesh’s node map, showing other nodes connected to the Saratoga Hub.³⁰

However, more so than with relatively small and old buildings, buildings that are large, new, and/or professionally managed tend to pose challenges for installers. The buildings are less likely to have easy rooftop access or easy install points for the necessary equipment, or, if they do but such access is guarded by lock and key, the building owner may be wary of potentially liability they may face for allowing the informal, unaccredited installers traipse around.³¹ But, if building *owners* themselves ask the organization to connect it, once completed the installation (including all equipment and wiring) is owned by the building owner (rather than by an incumbent ISP).³² Connections, of course, can be made wirelessly, but the organization can also arrange for a fiber optic connection to be made if the owner is willing to foot the installation cost and contract with an installer.³³ In addition to the Saratoga Hub, by mid-2019 NYC Mesh touted large building installations at the RiseBoro Youth Center in Bushwick, Brooklyn, the old Domino Sugar Refinery along the East River, and the Hotel on Rivington (a modern, relatively tall building surrounded by comparatively historic buildings on the Lower East Side) and had plans to expand to more NYCHA buildings as well.³⁴

Implicit Hierarchy

A Master Plan Beyond Profit and Growth

As much as can be said about an organization that is inherently somewhat informal and ad-hoc, it appears that the core membership of the NYC Mesh organization truly are well-intentioned, hardworking volunteers endeavoring to improve the lives of their fellow New Yorkers. Though no organization can be perfect, NYC Mesh has attempted to bake into its culture elements that will safeguard against organizational corruption.

At a purely academic level, one may be tempted to ponder whether Robert Michel’s “Iron Law of Oligarchy” may be exemplified or disproven by NYC Mesh. The oft-debated rule that “whoever says organization, says oligarchy” is refined into three claims: complex situations and systems require administration, begetting bureaucracy; that bureaucracy creates competition amongst bureaucrats, and the most effective naturally assume more power; power corrupts, and the organization supporting the bureaucracy develops a survival instinct (sometimes at peril of its original mission).³⁵ As discussed, organizers of NYC Mesh are transparent in the fact that the organization’s “master plan” envisions a network that covers the entirety of the city, and in other presentations representatives of the organization have made reference to Metcalfe’s law: “the value of a telecommunications network is proportional to the square of the number of connected users of the system (n^2n^2).”³⁶ Metcalfe’s law was traditionally been viewed more as a “rule of thumb” and framed in terms of monetary value to users,³⁷ but with the goal of connectivity, and especially resiliency (recall, in a more ideal mesh, each node is connected to many other nodes, so the loss of one or many for any reason does not have any impacts on the rest of the network), it is not hard to see how members increasingly benefit when others join the mesh.³⁸

NYC Mesh’s technical designs continue to be designed in the hopes of realizing the master plan, and the robust technologies which the network is based on can easily handle the scale of a city (after all, they are fundamentally the same technologies that constitute the Internet, which successfully operates at global scale). But while the technological challenges can be brushed aside, human factors cannot be. For its roughly 1,000 nodes, NYC Mesh’s Slack communication tool has more than 5,000

registered members, and the support chat generally gets at least a few requests per day. A small and informal team of dedicated and knowledgeable volunteers can generally resolve issues as they arise but functioning as technical support for the entirety of New York would require not only more volunteers, but also significantly more complicated triaging mechanisms. While a few installers climbing on top of buildings is unlikely to garner many issues, scaling this up would likely attract liability concerns and other purely bureaucratic necessities. While the absolutist nature of Michel's proclamations is the subject of likely unresolvable academic debate, that this pattern *frequently* if not *always* occurs to some degree within organizations is typically accepted as fact. NYC Mesh presents an opportunity to theorize about the interplay between these two theoretical laws: does the satisfaction of Metcalfe's in the *network* force the *organization* to conform to Michel's? This question is intended as rhetorical. As NYC Mesh continues to expand, the way it thinks about and manages inevitable growing pains and the organization's role serves as an interesting case study for how, in an urban context, utility infrastructure can relate to the communities it serves beyond the impersonal delivery of incumbent ISPs.

Much of the aforementioned "master plan" relies on the installation of several new hubs throughout the city, acting as key connection points for their surrounding neighborhoods (à la the hub at 33 Saratoga Avenue, discussed earlier. This is partially due to the mechanics of mesh networking—the potential for obstruction and long distances makes city-wide nodes infeasible. But there are other reasons to emphasize a neighborhood (or multi-neighborhood) hub model: "The populations are different, different local leaders... there's different local issues."³⁹ The organization, in the master plan, indicates that working within existing communities and involving residents of the neighborhoods they install in are parts of their plans:

... You can hire different people in the neighborhood to do different things, but, when we need to be neighborhood-localized as well as across the whole city. I think that's really the only way we can grow the neighborhood successfully without having to either, you know, lay down rules from the top down, or only be concentrated in a small neighborhood. Therefore we need to adapt to something that's kind of country-wide in nature, but adapt it for New York City where we have the density so we don't have to have a, you know, one connection across a hundred miles, we can have several connections across many blocks that are diverse in their neighborhoods.⁴⁰

In an attempt to grow neighborhoods which have few social connections to existing mesh members, the organization targets installs. Sometimes these are directed towards specific, tall residential buildings (like the Saratoga Hub), but often the highest and most strategic installations are religious rather than residential, as noted by an outreach flier specifically created aimed at facilitate installations at these sites: "To reach our goal we need to install our small routers in tall structures in each neighborhood. Often the tallest structure is a church, and all over the world churches have been helping these community networks."⁴¹ Existing and new members, of course, are encouraged to promote the network to their friends and neighbors, and many do. The organization provides multilingual pamphlets that have basic information about the network to further facilitate this.

In the past, there have been occasions where the organization has worked with a neighborhood group to coordinate multiple installs in a small area. Reflecting on the experience of working with the 700 Jefferson Avenue Block Association, a group based in Bedford Stuyvesant, Brooklyn, a volunteer NYC Mesh installer noted that such an arrangement had direct positive impact on the individual members who were connected, and also produced a more stable network (from a technical perspective) and formed a basis for future expansions and volunteers:

This install was particularly special because for the first time we were not only connecting block residents to Saratoga Village but to each other, forming a more resilient mesh network. Now, if one antenna on the block went down, neighbors could still connect to the internet through another.

... [Kiki, Eugene, George, and Miriam are all members connected during this installation process.]

Unlike Kiki and Eugene, who had upgraded their cable plan before getting frustrated and reaching out to NYC Mesh, George and Miriam had opted for the most basic plan. When they showed me the speeds they were getting my jaw dropped. Less than 2 Mbps down, which wasn't even enough to stream music let alone watch a movie or make a phone call! When we connected them to NYC Mesh, our first speed test yielded 51 Mbps down, more than 25 times the speed of their existing connection. You can see how happy they were when they posed for a photo with the antennas they share with Kiki and Eugene.

... Last month, Kiki invited us back again to set up a table at the annual 700 Jefferson Avenue block party. It was a blast—we met a lot of new block residents, handed out pamphlets explaining how the Mesh works, showed young people how to put an antenna together and chowed down on some delicious barbecue. And because our rooftop antennas broadcast public WiFi to the street, we were also able to help new people sign up for a volunteer-led install.⁴²

Such a success, where an entire community buys in (to some extent) to NYC Mesh's model, is an early endorsement of the master plan's emphasis on neighborhood-level investment and stewardship. While not replicated on a wide scale, such an event is evidence that a certain symbiosis is possible. On one hand, the network, viewed as an entity itself, has a goal of maximizing connectivity and thus of growing. A neighborhood makes an initially moderate (installation) and small ongoing (maintenance) investment which allows the network to expand and provides a basis for even more expansion in the future. In return, individuals reap the benefits of that connectivity. More than that, though, a *community's* participation in NYC Mesh has the potential to benefit that community as an entity—it requires cooperation and familiarity between neighbors, and a degree of camaraderie between a geographically diverse group of volunteer installers and the members they help. While cyberspace is often accused of poaching social interaction from the streets and giving neighbors fewer reasons to be neighborly, NYC Mesh makes the physicality of the Internet tangible, and has the potential to strengthen "offline" social networks by involving participants in the construction of the infrastructure that delivers online social networks to their homes.

Though the NYC Mesh organization is very much one built around and in service of technology that is almost definitionally impersonal, these sorts of interactions paint it as a community of individuals in the same way the network is composed of nearly

a thousand nodes. Such interactions are as varied as the volunteers. Contrast, for example, the outreach undertaken with the 700 Jefferson Avenue Block Association with a message posted by an individual calling themselves “nicolas equis” on the organization’s Slack communication tool:

hey comrades! we are helping maintain ownership of a 3-story brownstone that has been in the family since 1951!

they were the first black family on the block in crown heights. they have been fighting against deed theft and, more recently, eviction for 5 years.

they are currently back in the home but need to re-nest since the illegitimate slumlord threw all their things out, personal belongings, family history and all.

they currently do not have wifi and I was wondering if yall would be interested in helping them set up mesh, possibly donating some material or helping us raise money for it?

solidarity,
nico - Brooklyn Eviction Defense⁴³

In a threaded conversation, a volunteer exchanged messages with the poster, clarifying some details and discussing what may be possible. Within a day of the original post, two other members added their support, saying that they lived close to the site and would be willing to help with an installation.

Balancing Organizational Needs

Coordinators of NYC Mesh would likely argue that the organization is as decentralized as is practical. Hall, a self-described introvert, has written that “for some reason most of us are softly spoken, and louder people may have trouble fitting in. (Is this the opposite of most organizations?)”⁴⁴ They are aware that because there are no real roles or titles in the organization, technical know-how and tradition can lead to the development of an “implicit hierarchy,” which they are wary of. Though the network has scaled to thousands of participants, there are still a relatively small number of individuals actively involved in the growth and coordination of the network (a few hundred at most), so issues of scale may not have fully developed yet.

In a posting on the NYC Mesh website titled “Protecting the Mesh,”⁴⁵ one member outlines some of the issues that have proven inevitable in a decentralized, free network. Some of these issues are largely technical—“misbehaving or misconfigured equipment disrupting connectivity for others or spamming log files slowing support functions”—while others have more to do with the human aspects of a volunteer-run network. These fall into a few categories: a member may simply be maxing out the connection of one node (usually through file-sharing or torrenting), causing issues for nearby nodes; someone may be using the network for spam or other forms of abuse; or a member may not be honoring the Network Commons License that they implicitly agree to by using NYC Mesh (specifically, they may not be responding to requests from the organization or other potential members to use *their* node to further extend the network to another).

The current strategies to deal with these challenges vary. A core team of self-selecting volunteers who are sufficiently technically adept monitor the status of the network

and reach out the members who may be using inordinate amounts of bandwidth on a regular basis (to the detriment of others) or who have misbehaving equipment. Automated abuse and copyright infringement reports of someone using the network are logged publicly and automatically in the organization’s Slack communication tool, but because the organization does not track the details member activity on the network, “there is simply no mechanism for investigating which member has caused a DMCA alert or spam filter to be triggered.”⁴⁶

In extreme cases where the Network Commons License is violated, the contract does provide the organization an out from its otherwise impartial connectivity, allowing it to temporarily disconnect a misbehaving node: “*The network must allow access to any willing participant, except when doing so would jeopardize the proper functioning of the network.*” Such an extreme does represent a cession of the completely pure, ideal network, and could arguably be seen as the basis for the rise of oligarchical power within the organization that, in practice if not by fiat, controls the network. Yet, an ideal network is merely theoretical, as connectivity between individuals is ultimately subject to the fallacies of human nature.

As NYC Mesh continues to expand in pursuit of city-wide connectivity, the network will likely act as a positive force in the lives of thousands of New Yorkers by strengthening neighborhood ties, creating new digital and non-digital connections between them, and, of course, providing affordable home Internet service. But it would be naive to assume that with that increase of good would not come some additional abuse. For as much as the good as can come from decentralized, neighborhood-based organization, the bad must often be dealt with in a somewhat centralized manner, not just in mesh networks but in institutions of all shapes and sizes. How NYC Mesh, an organization inherently skeptical of control, will handle balancing these factors will likely continue to evolve. At present, however, there is no evidence that the organization and the volunteers that run it act as anything but benevolent stewards of the network. An academic debate over the satisfaction of Michel’s Law notwithstanding, the strong internal culture (with remaining strains of “techno-liberationist”) that NYC Mesh retains and the constantly changing cast of volunteers it attracts will likely act as some insulation against the deterioration of its core values. At any rate, it undeniably achieves lower prices and greater connectivity (of all types) than the incumbent ISPs it defiantly taunts and challenges.

silent / space
Ayana Boyd





FARMLINK ZERO

Growing Food Sovereignty Through Urban Agritecture in Providence, Rhode Island

Patrick Nasta



Figure 1: Exterior Rendering – Ground View

I. Introduction

The history of the charitable food space is one fraught with hardship, class conflict, and socioeconomic struggle. Despite these problems, urban agriculture has become a promising solution. However, the path forward is not the way of food pantries and community gardens, although it is not to say that those things do not play a vital role in feeding millions of people across the country. The future—of farming, of food banks, and of Farmlink—is in agritecture: the art of folding urban agricultural methods directly into the built environment through innovative, sustainable architecture. To this end, the goals of my honors architecture thesis are threefold: design a national headquarters for The Farmlink Project, build a monument to urban agritecture and vertical farming, and create a building that is completely self-sustaining according to the Living Building Challenge. Thus, *Farmlink Zero* was born

II. Background: The Farmlink Project

As the title suggests, the primary function of this building is to serve as headquarters for The Farmlink Project and a representation of their mission. There is enough food grown around the world to feed every person on the planet, yet over one-third of it is thrown away or goes unused. This non-profit, founded in April of 2020 in response to the COVID-19 pandemic, finds and rescues surplus produce across the country—mainly from large-scale farming operations—and transports it to food banks in need.



Figure 2: Farmlink Dealflow Graphic Image Source: The Farmlink Project

A. Transformation and Growth of The Farmlink Project

When I joined the organization a few months after its founding, Farmlink was a small start-up of scrappy college students coordinating deliveries in big growing areas like California, New York, and Wisconsin. Now, two years later, The Farmlink Project employs hundreds of people around the country from all different backgrounds, and the organization has just surpassed its 60 millionth pound of food rescued and delivered to food banks in 48 states. We have raised millions of dollars through innovative, grassroots fundraising to put towards paying farmers, food bank employees, and truckers; built a custom platform for sourcing, transporting, and delivering food; and continue to move millions of pounds more in an effort to stem food insecurity. As a fully remote organization, many of us have never even met most of our coworkers in the months and years that we have been working together. To honor the growth of this non-profit and build a proper space for this team to work, my thesis design project is an attempt at creating a monument to the mission, where all members of The Farmlink Project can gather in person and work to rescue food from one central hub.

B. Farmlink Zero as The Farmlink Project's Headquarters

The design itself is fairly straightforward: Farmlink Zero is defined by the massive central canyon that splits the building nearly in two. While the first two floors are fully bisected, allowing people to pass through the central avenue, the upper floors are connected as the canyon cut-out is pulled toward the center of the building. This abstract, gracefully curving accent wall is intended to severely contrast with the rigidity of Providence's surrounding architecture and draw the eye towards the building and the organization that works in it. With The Farmlink Project office space occupying the top floor, the remainder of the building serves to showcase Farmlink's mission, and there is no better way to do that than by growing and serving our own sustainable produce. The first two floors are far more public than the rest of the space, with a café, lounge, and "Farmlink to Table" restaurant fueled by the organic produce grown on the floors above. Anything not served to patrons or donated to local food pantries can then be sold as part of a Farmlink CSA, short for Community Supported Agriculture, or a crop sharing program that would spread fresh produce across Providence. The next four floors of indoor vertical farm space will efficiently produce

small-batch organic produce like lettuce, mixed greens, tomatoes, cucumbers, etc. The rooftop terrace serves as an open space where employees can get fresh air, grow their own food in the employee garden, and interact with the surrounding greenery. The building also sits next to Gaia's beautiful 2018 mural *Still Here*, showing the indigenous heritage of Providence. It depicts Lynsea Montanari, a member of the Narragansett tribe, holding a picture of Princess Redwing, a Narragansett and Wampanoag elder, surrounded by native flora and fauna. The final component of Farmlink Zero's design is the surrounding green landscape, trees, and picnic tables that will be scattered in front of the mural, covering over the dirty parking lot that currently occupies the space and giving the Narragansett women a brand-new community garden to watch over. This headquarters building aims to bring awareness and attention to the food space and stand as a constant reminder of the organization and our mission, all while we work to continue moving surplus produce and serve the community. However, in order to fully understand how this works, it is first necessary to explore the ways in which urban agriculture and vacancy reclamation such as this can have a vital impact on alleviating food insecurity and restoring community.

III. The Charitable Food Space

The charitable food space is a long-standing and complex arena in which The Farmlink Project is a relatively new player. In order to best serve the communities in which we work, it is crucial that we understand the nuances of food insecurity and food sovereignty as best we can.

A. COVID-19's Effects on Hunger and Food Insecurity

As a result of the COVID-19 pandemic, U.S. citizens experienced a 36 percent increase in food insecurity:¹ Adult usage of the charitable food system has risen by 50 percent over the last two years, from 13.2 percent to 19.7 percent, which means that one in five adults have experienced food insecurity during the pandemic.² In addition, Black and Hispanic adults, along with other minority groups such as single-parents, people with disabilities, and immigrants, accessed charitable food resources three times more often than white adults. It is not a simple matter of just rescuing food or donating money, but rather understanding systemic problems in food access and policy spurred by race, culture, and socioeconomic status.

B. Governmental Barriers to Food Security

COVID-19 is not the only thing exacerbating food insecurity across the country. The federal government controls the food system with a firm economic focus, which prevents citizens from getting involved and having their voices heard. The individual stakeholder quite literally has no legal right to food, no legal power to shape the food system, and a government that refuses to effectively acknowledge the moral, cultural, and health concerns associated with their policy. While cutting out the middlemen and forming a tight bond between government and producer is great for the economy, the lack of individual input or perspective severely hinders the effectiveness of federal policy. There is evidently a vast and tremendously fluctuating number of issues in our modern national food system; one blanket federal policy is insufficient for covering all of these regions.³ By granting local stakeholders the legal and moral responsibility to have a say in their own food policy, the problems that ail their various communities will be better addressed. In discussing the Federal Farm Bill, Johnson and Monke, two policy specialists for the Congressional Research Service, focus on the economic insufficiencies of the new act. The bill shows that over five years, 500 billion dollars

has been allocated to federal food programs including commodities, insurance, trade, development, research, horticulture, etc. However, an astounding 80 percent of those funds will go towards nutrition, like the Supplemental Nutrition Assistance Program (SNAP) and similar initiatives.⁴ This means that the government is pouring almost 400 billion dollars into feeding its people, but without a local perspective. These funds are being badly misappropriated because they fail to address the root issue. Furthermore, federal policy encourages overproduction and overconsumption of unhealthy food, and labor laws disproportionately exploit those who work in the farm and food service industry.⁵ All in all, regional and local oversight is absolutely required for the effective implementation of federal food policy. It does not mean that the government needs to or should be completely hands-off, but it does mean that they need to take into consideration the cultural, economic, and health needs of the people who are struggling to eat healthy, appropriate foods, despite the 400 billion dollars in food aid they are ineffectively receiving.

C. Systemic and Historical Barriers to Food Security

Perhaps the biggest contributor to food insecurity, however, is lack of access, especially among marginalized groups and minorities. These injustices are not new either; they are direct remnants of slavery and a system of oppression that continues to have ramifications today. Many Black Americans, having escaped the generational hardships of the South to seek justice in the northern states, were instead met with thinly veiled political repression in the form of redlining and the Fair Housing Acts.⁶ Historically Black and Hispanic communities were steamrolled, decimated, and turned over to make room for wealthier white residents, while minority tenants were forced into public housing projects like Stuyvesant Town in New York, where living conditions quickly declined because of willful governmental neglect. Minority homeownership plummeted as a result to levels that have still not risen to this day, even 75 years later. Since being forced into ghettoized communities, a number of factors such as poor health conditions, lack of education, violence, decreased economic opportunity, and of course, lack of healthy food options continue to plague residents who are dug deeper and deeper into a social hole.⁷ With no infrastructure or government funding in place to remedy the food sovereignty situation, minority communities are forced to rely on unhealthy options like corner stores and fast-food chains instead of local grocery stores. Other marginalized communities of low-income and overweight people also face discrimination at the hands of the federal government and policy that is more concerned with financial gain than it is with the welfare of its people. The Rhode Island Community Food Bank states that proposed cuts in SNAP benefits will have 11,000 Rhode Islanders going hungry and cause a vast increase in reliance on food banks, which are often underfunded and ill-equipped to handle the multitudes of people needing food services. Additionally, approximately half of the surveyed population, thousands of people, had to choose between paying the utility bill or their rent or putting enough food on the table to eat.⁸ It is a problem of government policy that refuses to acknowledge those who need access and support the most.

D. Urban Agriculture: Examples, Issues, and Potential for the Future

Nevertheless, despite these rampant problems in the food space, there is a light at the end of the tunnel: urban agriculture. Urban agriculture has existed in a multitude of forms since the dawn of farming thousands of years ago. However, in today's globalized economy, urban farming has taken on a new role in contributing to the

food security of communities across the United States. From community gardens to large-scale industrial operations, urban agriculture has grown into a sizable practice. Nevertheless, food insecurity rates have continued to rise for the last five years, a concerning statistic given the steady national growth in food assistance and crop production.⁹ So why do people continue to go hungry despite consistent growth across the food sector? Feeding America, a nationwide conglomerate of non-profit food banks, reports that only 29 out of 200 food banks in their network utilize urban farming as a means of increasing their offerings.¹⁰ With urban agriculture on the rise, it is evident that independent practice will not be enough to stamp out hunger; only through consistency and thoroughness will these modern farming techniques be implemented in order to decrease these stagnant food insecurity rates. Especially in the face of the COVID-19 pandemic, urban agriculture is becoming more important than ever. For many Americans, even *getting* to the grocery store can be an expensive and challenging task.¹¹ Encouraging urban agriculture in areas threatened by the pandemic can cut down on those commutes, increase education, build important life skills, generate income, and create safe spaces for community engagement. Access to culturally appropriate, fresh, healthy produce is an enormous factor in overcoming larger societal disparities in health and income levels. However, that is not to say that urban farming will magically solve one of the United States' greatest troubles.

A look into Philadelphia's long history of urban farming in the 1990s will detail the vast social and political hurdles that growers had to navigate. With so many vacant lots, green reclamation projects became a major focus of the government, but it quickly became apparent that community actors and policymakers held clashing aspirations for the unclaimed spaces. Revitalization through gardens was an easy way that community members could be encouraged to prevent trash build-up and crime in their neighborhoods, as well as beautify their city blocks. Youth gardening programs kept kids off the streets, improved their mental health, taught them economics, and improved healthy food access for all. However, what the people saw as permanent growing sites, the government saw as temporary greenery to encourage new development.¹² This new development would of course target lower-income minority neighborhoods of Black and Hispanic people, leading to rampant gentrification throughout Philadelphia. In addition, the government's hands-off approach to their own community gardening initiative created a slew of other problems. By leaving it up to the people and providing no direct support, farmers lacked water sources and, most importantly, land ownership. Bureaucratic convolusion and political confusion made securing land ownership over these reclaimed vacant lots virtually impossible, and "guerilla gardening" became more of a problem than a solution as developers moved in.¹³

While essential, food banks and community gardens are not enough to create food sovereignty.¹⁴ A Texas State University study found that non-gardening community members benefit from increased food production but fail to receive the social benefits that urban agriculture champions.¹⁵ The practice is further constrained by insufficient access to land, water, soil, and money, which are the driving forces behind any efficient farming production. Essentially, it is a time- and labor-intensive practice that requires specialized knowledge in order to work properly. However, some farmers are not measuring their success on economic prosperity, but rather land reclaimed, communities greened, and people involved. Community gardens cannot solve food security on their own, but they are an important mediary step that can help educate

communities and begin the process of healthy food access.

Despite the challenges of urban farming and many food banks' inability to spend the necessary funds on costly setups, the future is bright. While still expensive, vertical farming and hydroponics have been consistently growing, promising "large amounts of food in a small footprint" and a pivotal shift in the food space.¹⁶ Will Allen's farming organization Growing Power, for example, helped flood Milwaukee with healthy foods, revitalize the community, and still make a profit, all by using hydroponic urban agriculture. His food garden pop-ups were proven to decrease crime and drug use and absorb unused patches of urban jungle to be converted into fertile, green, growing land.¹⁷ As the technology advances and prices decrease, many charitable food organizations will likely be more willing to grow their own food and adapt vertical farming into their organizations. Universities also have an important role to play in growing urban agriculture. As Mark Winne, co-founder of the Community Food Security Coalition, puts it, "campus food systems are connected with those of the communities where they reside, the states they serve, the nation, and the world."¹⁸ With the financial resources, volunteer manpower, and knowledge base required to contribute effectively to increasing food security, student groups have a duty to bridge the gap between universities and the communities they exist within.¹⁹ No, vertical farms will not feed entire cities, but at the very least they will bring fresh, healthy produce into urban areas, show people exactly where their food is coming from, and serve as a constant reminder of how agriculture can be used to incorporate farming into the very fabric of the city. The benefits of urban agriculture far outweigh the factors that prevent it from being utilized effectively. Given sufficient time, resources, and organization, countless urban farming systems can be implemented into communities in order to benefit the people that live within them. This is precisely where *Farmlink Zero* steps onto the scene. Urban agriculture is destined to be confined to the skyscraper, and vertical farming will be the key to solving the food sovereignty crisis. It is clearly not as simple as just dropping a supermarket into the middle of a food desert. Rather, a well-organized, well-funded, sociopolitical movement needs to flood at-risk communities with the funding, manpower, and infrastructure required to create their own healthy foods and sustain their own food sovereignty. Even something as simple as turning every roof in every city from now forward into a green site for urban agriculture would decrease our solar heat gain, energy usage, and carbon footprint tremendously.²⁰ Increasing urban agriculture through new architectural development not only supports the labor market but also brings in individual stakeholders and community members and encourages them to get involved in the creation of their local food policy and food systems. When pandemics hit, supply chains break down, and oil prices skyrocket, it is more important than ever before to have efficient and resilient local food systems in place *before* they are desperately needed.²¹ Using a circular hub-and-spoke model that connects communities at the center, vertical farms like *Farmlink Zero* can be created that sustain themselves and generate healthy, culturally appropriate food for the locals, by the locals.

IV. Creating a Living Building

Farmlink Zero cannot become a monument to The Farmlink Project and urban agriculture if it does not resonate with the mission and stand for what the people inside it believe. The Living Building Challenge is an initiative created by the International Living Future Institute, an organization advocating for the growth of

green architecture, in an effort to incorporate sustainable design methods into both new and existing buildings worldwide. With an emphasis on regenerative building, the program comprises seven performance “Petals,” including Place, Water, Energy, Health + Happiness, Materials, Equity, and Beauty. These petals are then subdivided into 20 total “imperatives” that further inform the strict regulations that define a true “Living Building,” or a building that gives back more to the Earth than it takes.

They also have a vast collection of case studies that helped me better understand how these green solutions can be implemented into the built environment. Drawing inspiration from the Josey Pavilion, Bertschi Science Wing, and the Phipps Center, I found imperative design strategies that I could incorporate into *Farmlink Zero*. The Living Building Challenge runs on three basic principles: Since Farmlink’s headquarters is a new structure, it would be required to check all 20 imperatives, all seven petals must be *holistically* reviewed, and only *actual* performance data can be used to judge the distinction. Nevertheless, utilizing historical census and survey data on the energy, electricity, and water usage of similarly sized administrative, agricultural, and food processing structures, I calculated estimates of *Farmlink Zero*’s



Figure 3: The Seven Petals of the Living Building Challenge
Image Source: International Living Future Institute

anticipated environmental footprint. This allowed me to then retrofit the design and incorporate eco-friendly architectural techniques that would offset this footprint. All in all, my third goal in the creation of this building was to design a true “Living Building,” and with these considerations in mind and after substantial research, I believe that this project has the potential to become one.

A. Living Building Goals: Place, Health + Happiness, Equity, and Beauty

Four of the petals prove to be significantly easier to work towards than the other three: Place, Health + Happiness, Equity, and Beauty. “Place” focuses on ecology, urban agriculture, and human-scaled living, which is easily achieved. My design reclaims two parking lots in exchange for beautiful, ecological rain gardens; creates a large, outdoor gathering space for community members; and contributes far more than the

required 5 percent of its square footage towards growing food. The sensory, green environment also completes the Health & Happiness petal, which mandates access to nature and daylight views. The employee rooftop garden will go a long way towards the improvement of work-life and the environment of the office is full of greenery and natural light. Equity and Beauty are also simple design choices. These petals are achieved by not blocking any existing facades from light autonomy and delivering accessible, equitable access to every part of the building, as well as by adding plants, moss walls, and a magnificent wood accent wall to beautify the space. However, I focused the greater part of my attention on the three remaining petals—Water, Energy, and Materials— which had the three most difficult accompanying goals that gave the building its name: zero net energy, zero net carbon, and zero net water. In attempting to generate more energy than is used, capture and treat all water on-site, and use healthy, carbon-neutral materials, *Farmlink Zero* was born.

B. Living Building Goals: Energy

The Energy petal proved to be without doubt the hardest initiative to attempt to achieve, simply due to the enormous proposed output of Farmlink’s headquarter building. Using the Energy Information Administration’s 2012 Commercial Buildings Energy Consumption Survey, I estimated that the 4,000 square feet of office space at the top of the building would use roughly 38,400 kWh of energy, followed by an additional 204,800 kWh consumed by the two public floors on the bottom.²² Finally, the approximately 10,000 square foot vertical farm would require 65,300 kWh to continuously grow romaine lettuce at full capacity, based on estimates from vertical farming pioneer iFarm.²³ The first step to offsetting this energy consumption was to add solar panels to the south face of the design. I selected a new location just across the river that would expose more of the facade to sunlight and oriented the building in such a way to maximize exposure time.

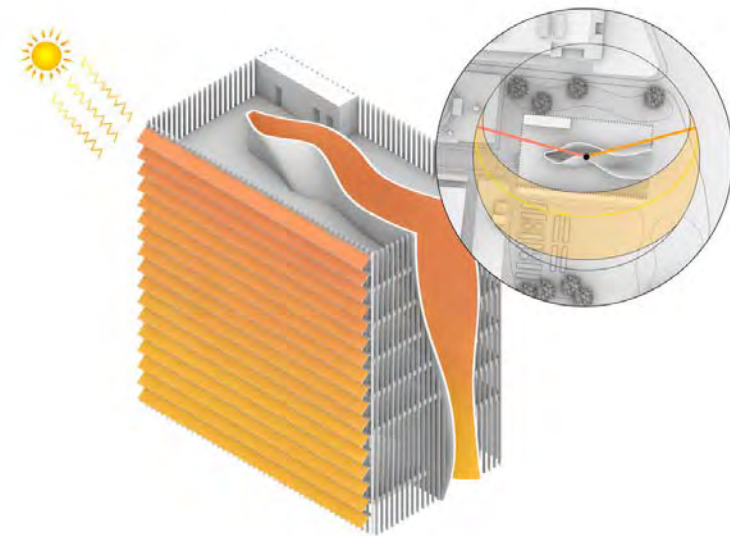


Figure 4: Sun Orientation Site Diagram

I then added 221 Trina Solar Vortex panels, each with a 670 W capacity and 21.6 percent efficiency. Using a public database on turbine generation, I determined the optimal year-round panel angle to be 42 degrees, and with Providence receiving 4.6 hours of optimal sunlight each day calculated a total energy generation of 190,944 kWh a year.²⁴ While these panels could cover more than half of *Farmlink Zero's* 308,500 kWh energy consumption, there remains 117,556 kWh unaccounted for. Luckily, this enormous energy consumption is based on average building technology, and by incorporating more sustainable and efficient methods the energy consumption can be cut drastically.

Firstly, I ruled out dynamic shading as a mechanism that would disrupt the inherent nature of the building as I designed it. *Farmlink Zero* instead uses fixed vertical fins as a means of shading and filtering light coming through the facade throughout the day; depending on the orientation, these can reduce energy cooling costs by anywhere from 23 to 89 percent.²⁵ I also decided to use argon-filled, triple-pane windows with a double low-e coating.

Code	Description	U-Value	R-Value	Solar Heat Gain	Visible Light Transmittance	
Clear	Dual	Dual pane, clear glass, no coatings	0.480	2.084	0.760	81%
Clear	Tri	Triple pane, clear glass, no coatings	0.310	3.226	0.685	74%
LOW-E	HS1-C180	Dual pane, one Low-E coating, Argon	0.260	3.846	0.685	79%
LOW-E	HS2-C180	Triple pane, one Low-E coating, Argon	0.184	5.433	0.615	72%
LOW-E	HS3-C180	Triple pane, two Low-E coatings, Argon	0.133	7.521	0.560	70%
SUNSTOP	HS4-C270	Dual pane, one SunStop coating, Argon	0.248	4.033	0.367	70%
SUNSTOP	HS5-C270	Triple pane, one SunStop coating, Argon	0.186	5.377	0.338	63
SUNSTOP	HS6-C270	Triple pane, two SunStop coating, Argon	0.124	8.065	0.310	54
SYSTEM V	HS1V-C180/189	Dual pane, two Low-E coatings, Argon	0.209	4.783	0.623	77
SYSTEM V	HS4V-C270/189	Dual pane, one Low E & one SunStop coating, Argon	0.200	4.998	0.361	69

Figure 5: Glass Performance Chart Image Source: All Weather Windows

With an R-value of 7.521, U-value of 0.133, Solar Heat Gain Coefficient of 0.560, and Visible Transmittance of 70 percent, these windows have the optimal combination of insulation and resistance to solar heat gain, while still allowing for maximum daylight autonomy. At times when daylight is not sufficient, a fully automated lighting control system will activate recessed LED lighting in public spaces outside of the growing area, reducing lighting consumption by over 50 percent when compared to CFLs or fluorescents that operate by manual control.²⁶ Finally, energy consumption will be drastically reduced through the implementation of a variable refrigerant flow heat pump system with closed-loop water-to-water ground source heat pump. The Environmental Protection Agency calls geothermal heat pumps “the most energy-efficient, environmentally clean, and cost-effective systems for heating and cooling,”

and this system is estimated to reduce energy consumption by 65 percent or more.²⁷ *Farmlink Zero* also features a natural solar chimney in the form of its wooden “canyon” wall oriented for near-optimal solar heat gain. When heated each morning by the rising sun, the heat-absorbing wood canyon will provide “buoyancy-driven natural ventilation and significantly lower the building’s cooling loads” by over 68 percent, according to research done by the Harvard GSD ResilientHub design team. With Providence weather reaching below freezing temperatures, the exterior air can also be used to chill water for use in maintaining the vertical farm’s internal conditions, avoiding the need for electrical equipment such as a compressor.

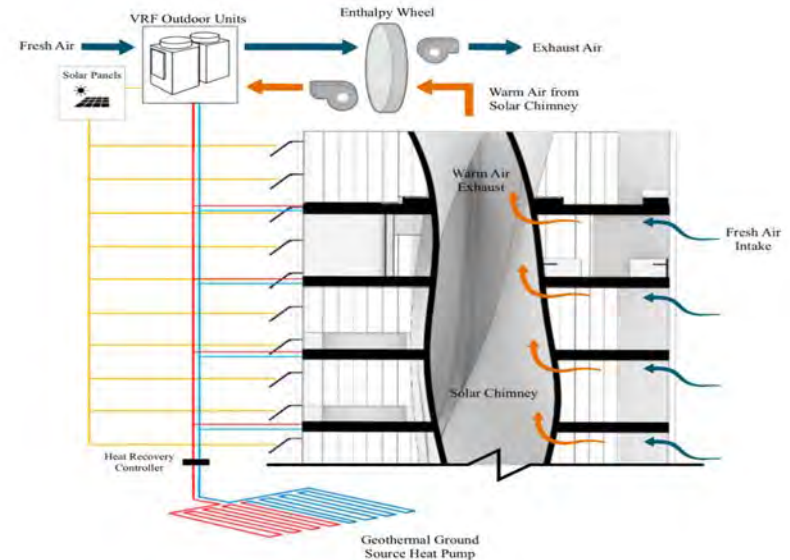


Figure 6: Heating, Ventilation, & Cooling Diagram

Although it is impossible to accurately predict the energy output of the building and an external solar farm will likely be needed to fully offset its energy usage, there is no doubt that design steps have been taken to significantly reduce energy consumption and turn *Farmlink Zero* into a sustainable energy provider of its own.

C. Living Building Goals: Materials

The Living Building Challenge is perhaps best represented to the viewer through the use of sustainable materials. The Josey Pavilion described its material goals as using “as few materials as possible” and using “materials in as natural a state as possible.”

Of course, the original design for *Farmlink Zero* used only glass, steel, concrete, and wood, but after doing more research it is clear that two of these materials will not come close to meeting the standards of a true Living Building. The Climate Adaptation Platform estimates that steel and concrete contain over 70 percent of a building’s carbon footprint; by eliminating these materials, we can get increasingly closer to net-zero embodied carbon in our buildings. Moreover, using a simple online carbon

footprint calculator, it can be estimated that an eight-story steel-frame building with concrete floors will release almost 1,000 metric tons of carbon into the atmosphere. Following the lead of the Phipps Center, Portland cement can be replaced with recycled fly ash, a waste product of combustion, in order to take much of the carbon out of the concrete and keep the ash out of a landfill.



Figure 7: Dixon Water Foundation Josey Pavilion, Interior Perspective
Image Source: International Living Futures Institute



Figure 8: Phipps Center for Sustainable Landscapes Image Source: International Living Futures Institute

Although there is currently no carbon-neutral alternative for steel, using high-recycled content steel instead of virgin steel can decrease its embodied carbon by over five times. In addition, using recycled materials, sourcing wood and stone locally, and endorsing environmentally beneficial waste systems will also help the building check off the imperatives within the Materials petal. Further, the American Institute of Architects (AIA) recommends the use of raw concrete ceilings and floors, rather than using carbon-intensive vinyl or finishing polishes.²⁸ Other methods include avoiding aluminum, plastics, and foams, which is why blown-in cellulose insulation will be used in the wood frame accent wall. Cellulose is not only low cost and low embodied

carbon but also has a high R-value that will help keep energy usage down.

Following the guide of the Living Building Red List, hazardous materials will not be used in construction; PVC piping will be replaced with high-density polyethylene and only halogenated flame retardant-free electrical wire insulation will be used in the building. The wood accent wall and cellulose insulation will greatly help in carbon sequestration, and although any steel used in the building will still embody the highest amount of carbon, this can be offset with one of The Farmlink Project’s most promising initiatives: Carbonlink. Through this program, customers purchase carbon credits, worth 1 ton of carbon dioxide each, which are then used to fund projects that reduce emissions and improve the food system. By using Carbonlink, all of the carbon embodied in *Farmlink Zero* after these reductive measures are taken can be offset through the purchasing of carbon credits and removed from the environment by our partners.

D. Living Building Goals: Water

Lastly, I explored how to achieve net-zero water usage in The Farmlink Project headquarters. Again using the EIA’s Energy Consumption Survey, I estimated that the water consumption of the office and restaurant spaces would be around 240,000 gallons a year.²⁹

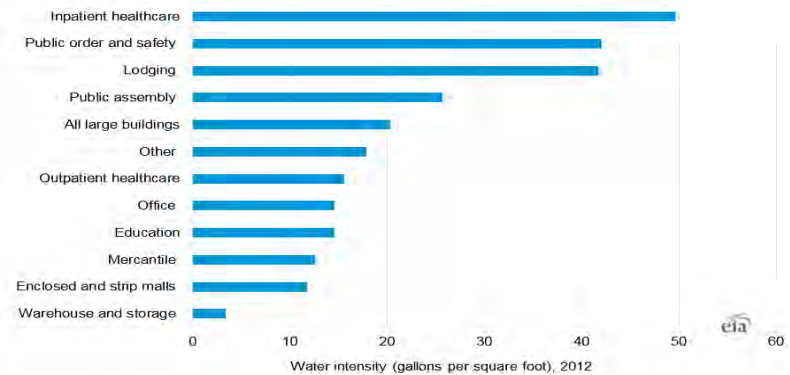


Figure 9: 2012 Water Usage among Commercial Buildings Image Source: U.S. Energy Information Administration Energy Consumption Survey

Moreover, a 1,000 square meter vertical farm producing 2.5 tons of lettuce a month would require approximately 194,774 additional gallons to sustainably operate. However, iFarm has developed an automated nutrient solution replacement system that can recycle used water within the farm and decrease consumption by over 80 percent.³⁰

Agricultural reuse can only lessen an urban farm’s consumption by so much, and that is exactly where green water infrastructure can be implemented right on-site. With the rooftop and surrounding landscape forming a rainwater collection area of over 12,000 square feet and an underground water storage and filtration system, *Farmlink Zero* can account for 366,324 gallons of water a year based on Providence’s average annual rainfall of 49 inches. Filling the site—and the adjacent parking lots—with even

more green water infrastructure like rain gardens, bioswales, and permeable pavers more than doubled the building's water collection area. This water can then be pulled from the aquifers to completely run every sink, toilet, irrigation system, and once permitted, potable water fountain, in the entire building.

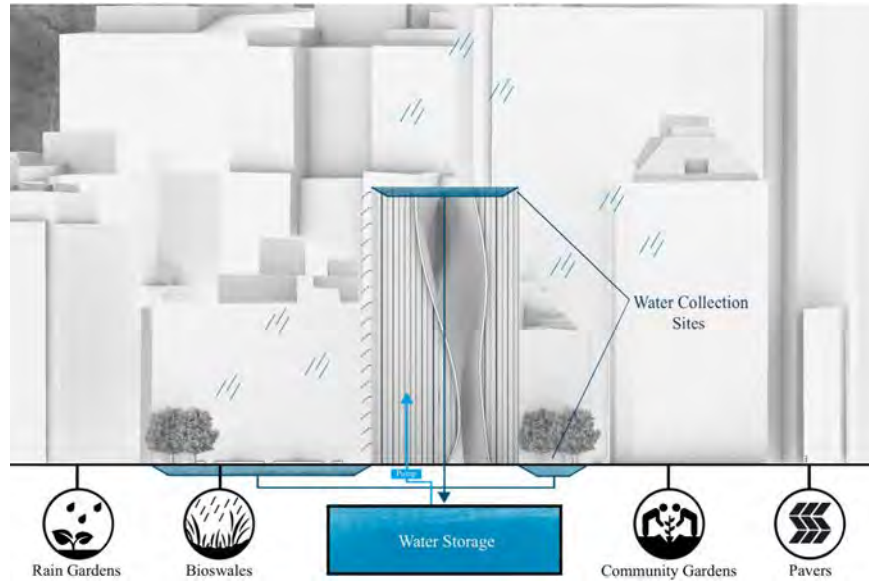
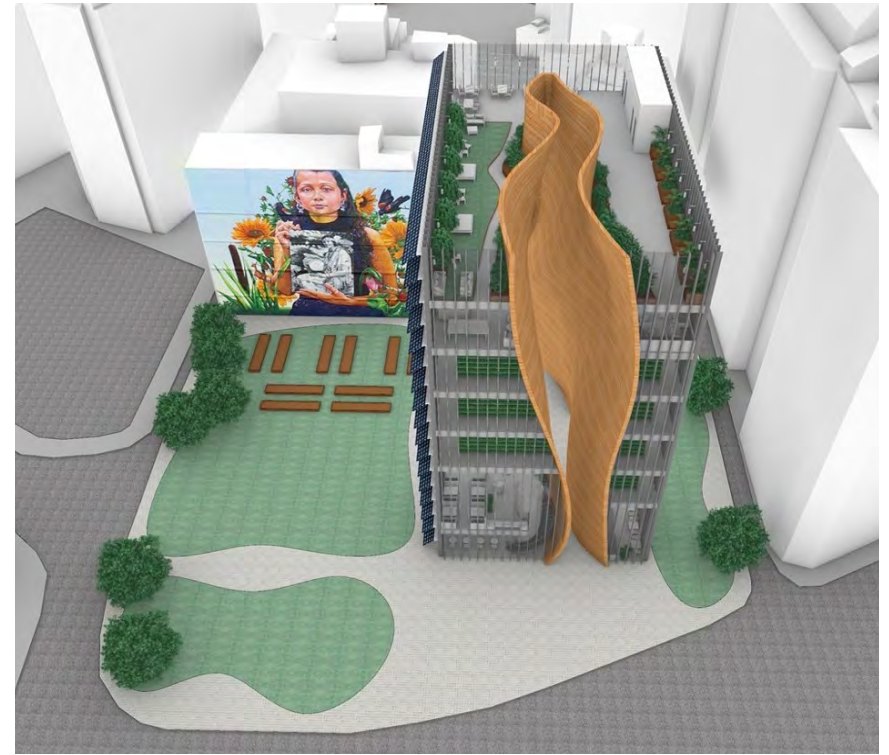


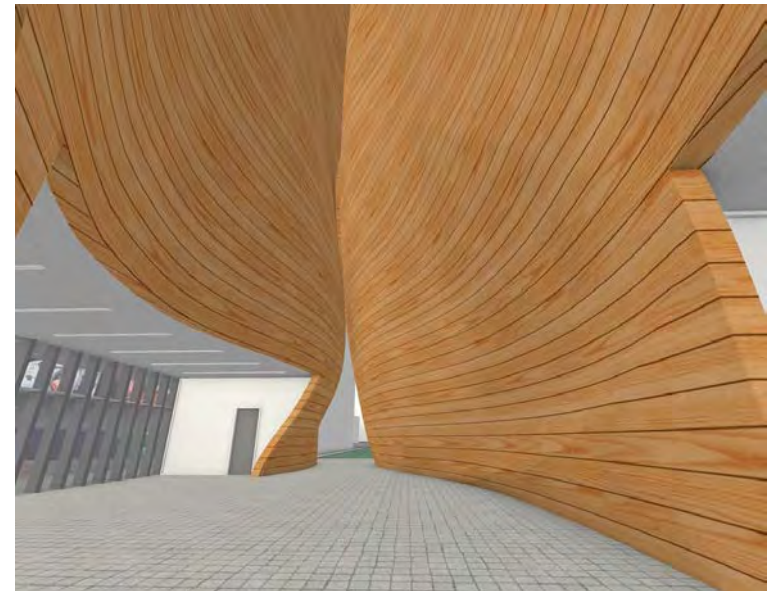
Figure 10: Water Flow Diagram

V. Conclusion

Ultimately, this research was a deep dive into the world of highly efficient sustainable building as I attempted to implement eco-friendly systems and strategies into my own design thesis for a Farmlink headquarters. Luckily, rainy Providence makes net-zero water usage an easy adjustment. Otherwise, perhaps the building has to dip into an off-site solar network to completely power its energy-heavy systems or purchase extra carbon credits in order to offset the unavoidable usage of steel in such a design. Although it is naturally difficult to say with complete certainty, based on this research I am confident that the building could eventually achieve net-zero energy efficiency, net-zero embodied carbon, net-zero water usage, and a Living Building designation without compromising the integrity of the design. In doing so, *Farmlink Zero* is intended to be as alive as the plants within it. It stands as a representation of The Farmlink Project, its national mission to end food insecurity, and the potential of agriculture and vertical farming to build food sovereignty in diverse communities across the country.



Exterior Render: Sky View



Exterior Render: Ground Level Canyon View

AN ARCHITECTURE OF DESIRE

The Opening of Moynihan Train Hall

Charles Alaimo

On New Year's Morning of 2021, the new Daniel Patrick Moynihan Train Hall opened in midtown Manhattan, unexpectedly on budget and ahead of schedule. The project repurposed an old Post Office building into an expansion for major rail hub Pennsylvania Station. The train hall was received positively by the public, even though its completion made limited progress towards reducing Penn Station's congestion. NYT architecture critic Michael Kimmelman wrote an especially positive article about Moynihan Hall, despite its limited infrastructural impact.¹ His review is emblematic of a poetic attitude toward Moynihan: at its opening, the public of New York viewed the station's actual technical function as less important than its role in constructing a discourse of renewal, modernity, and progress. The station's opening thus exemplifies anthropologist Brian Larkin's conception of infrastructural discourse as aesthetic address. Moynihan also follows Larkin's view of infrastructure projects generally as operating on the level of "fantasy and desire."²

Onlookers and critics praised Moynihan's design and completion; many nearby residents ventured out of quarantine just to explore the new concourse. One such observer, Steven Sandberg, said, "It's perfect, it's beautiful, especially for a train station."³ The train hall boasts what *Architectural Record* calls "An ambitious public art program," including stained-glass panels by Kehinde Wiley, the presidential portraitist for Barack Obama.⁴ Kimmelman called the architecture "modern, sober, and solid."⁵

However, the generally positive reception of Moynihan Hall conceals a confusing reality—the train hall doesn't actually improve most people's commutes. The project's original stated goal was to decongest the outdated facilities at Penn Station, which was operating far over capacity. Pre-pandemic, Penn Station had 650,000 riders a day, despite being designed to service only 200,000.⁶ On the surface, it seems that opening a new train hall could relieve the overcrowding. But Moynihan overwhelmingly services Amtrak riders, which make up only 5% of Penn Station ridership. Journalist Christina Goldbaum reports that the plan leaves "subway riders, who tend to be less affluent than Amtrak users ... to the bowels of Penn Station."⁷ By only providing Amtrak service, the addition of Moynihan to the New York City public transit network fails to address Penn Station's lack of capacity. It primarily services a wealthy minority. For a cost of \$1.7 billion, the opening of Moynihan Hall inadequately accomplishes its goal as part of an infrastructural system.

So if this is the case, why do so many of the citizens of New York City view the project in a positive light? Applying some of the concepts discussed in Larkin's article "The Politics and Poetics of Infrastructure" helps make sense of this apparent oversight. Larkin analyses infrastructures as speech acts in the poetic mode of address. Larkin states, "What distinguishes the poetic is when a speech act is organized according to the material qualities of the signifier itself rather than to its referential meaning."⁸ In this view, the appearance of an infrastructure becomes its primary function, rather than the technical purpose which it is nominally supposed to fulfill. This semiotic framework emphasizes how a building like Moynihan Train Hall exists not solely as a means of moving people from one place to another more efficiently—it also com-

municates all sorts of information to its passengers just by being there. Rather than seeing aesthetics as an issue of form versus function, Larkin's insight is that form is a function, one of many that an infrastructure fulfills. And infrastructure in the poetic mode fulfills form as its primary function, before anything else.

One ethnographic example of infrastructure as a poetic address is the article "This Is Not A Pipe: The Treacheries of Indigenous Housing" by Tess Lea and Paul Pholeros. Lea and Pholeros describe aboriginal housing provided by the Australian government. From the outside or on a bureaucrat's spreadsheet, these houses check every box: they have heating elements and roofs and pipes, all the components needed for a working house. But the pipes are not connected to any actual sewage network, and the materials for the houses are cheap. The actual technical function of the housing is ignored, because providing shelter was never the point. Larkin, commenting on the article, says, "Pipes, in this sense, turn out not to be about pipes but about their production as a representational form that allows reports to be written, budgets to be satisfied, and sponsors to be mollified."⁹ Lea and Pholeros write, "The sign of the material house is an illusion when no system of institutionalized expectation is in place to connect the physical structure (house) and the range of functions it is assumed to be able to provide."¹⁰ Instead, the houses fulfill a poetic function; they make the government look like it is doing its job. The primary purpose of the infrastructure is to manufacture an appearance.

This fits with the way people talk about the opening of Moynihan Hall: material concerns about ridership and effectiveness are buried in a tone of idealism and hope. It's not as if Kimmelman isn't aware of the problems with Moynihan's transit system; he spends a significant portion of the article discussing them. They just seem secondary to the point of the project. He states, "Moynihan provides a welcoming new front door and doubles down on the future of train travel. It sends a message."¹¹ Kimmelman sees Moynihan Hall as the start of something, a symbol of promise—of renewal after the COVID-19 pandemic, or simply as a rare completion of a real public works project in an era of stagnation. The failure of the new train hall to actually provide more transportation is forgivable, because the real purpose of the train hall is aesthetic: to catalyze a larger campaign and bring hope to the city.

Kimmelman seems affected by the same majestic conception of infrastructure that Larkin describes earlier in his article: that it can be "an excessive fantastic object that generates desire and awe in autonomy of its technical function." Larkin sees infrastructure as bound up in all sorts of ideals of modernity and the Enlightenment. He says, "Roads and railways are not just technical objects ... but also operate on the level of fantasy and desire. They encode the dreams of individuals and societies and are the vehicles whereby those fantasies are transmitted and made emotionally real."¹² It is this insight that seems to ultimately explain Kimmelman's unconcern with the practicalities of Moynihan's operation. He prioritizes the aesthetic and poetic functions of the train hall because there are so many other dynamics tied up in his conception of it. Moynihan is so much more than a building or a means of transit. It is a representation of the city's dreams and future. One woman, at the opening, called it "An icon of the city, already."¹³ Viewed this way, the public's optimism is not about ignoring the inefficiency and stagnation which Moynihan leaves unsolved. It is instead a powerful statement of New York's resilience and a vision of hope. Like Kimmelman says in his review, "Symbols matter, after all."¹⁴

TRANSIT IN VALPARAÍSO, CHILE

Environmentally-focused Retrofits of Public Transport Options

Jessica Luwis



View of Valparaíso from Cerro Artillería. Source: CAA Magazine

Valparaíso, Chile is not a bikeable city. The only flat area of the metropolis is its sea-level port and downtown business district called el plano -- almost the entire residential population lives among 42 steep, winding hills that spring up from the bay in a crescent formation. Valparaíso's social and cultural identity is intrinsically linked to its dramatic topography and the transit solutions locals have developed to traverse its challenging terrain. Historically a walker's city, Valparaíso's growth into the second largest metropolitan area in Chile was largely made possible by the introduction of funicular elevators, minibuses, and a local commuter rail track. Despite the successes of these key modes of transportation, the city now faces the task of improving each transit option's sustainability and efficiency for the coming pressures of climate change, which will be exacerbated in the coastal nation of Chile. Updating the region's three central transit modes with a combination of existing renewable fuel technologies, hill-oriented transit innovations, and modern rail infrastructure will help Valparaíso significantly improve city-wide environmental sustainability, as well as transportation efficiency and equity.

Funicular Elevators (Ascensores)

Current System:

The ascensores, or funicular rail elevators, of Valparaíso have historically provided crucial access to its hilly neighborhoods and served as iconic symbols of the city's growth and economic advancement.¹ Early on, most residents traveled on foot between their homes in the hills and their sea-level jobs in el plano. However, this became increasingly infeasible as the lower hills reached residential capacity and the city expanded further upwards, prompting the installation of funicular elevators to move people more efficiently up the steep slopes to their homes.² The ascensores acted as gateways to otherwise inaccessible neighborhoods, tying the area's local identity and pride to its natural topography.³ Though there were once about 30 funiculars around the city, only 15 remain in operation today due to a period of pop-

ulation decline during the early 1900s and the rise of internal combustion engine (ICE) vehicles.⁴ Because of their historic nature, most of the ascensores are located in early-populated low/middle tier hills, leaving residents of the younger, higher hills dependent on fossil-fuel-powered vehicles to travel to and from the central port area. Still, the remaining elevators continue to see heavy use from commuters and tourists in key locations throughout the city.⁵

Most of the ascensores now run off electricity, and some use hydraulic pump systems to raise and lower the rail cars.⁶ Despite utilizing counterweights, these funiculars require motors to overcome any difference in weight between their two oppositely oriented cars and to account for friction.⁷ In 2015, Chile still sourced 58% of its electricity from fossil fuel combustion and imported most of its power supply from abroad,⁸ which suggests the ascensores likely rely significantly on nonrenewable energy.

Suggested Initiatives:

Taking inspiration from a 665m long funicular in Leghorn, Italy that has operated on photovoltaic energy since 2000, Valparaíso could install PV panels on the station buildings and/or on the funicular cars themselves to reduce reliance on the fossil-fuel-powered grid. As the two cities lie at similar distances from the equator, they receive roughly the same amount of sunlight annually, which suggests that PV-powered funiculars would run successfully in Valparaíso.⁹ Given the region's electricity origins, converting the ascensores to solar power would offer a more sustainable and locally-sourced fuel solution.

To address the elevators' limited range, the city could also introduce a gondola system. With proven success in several other South American cities, gondolas are a safe and sustainable alternative to overcome the challenges of transit in mountainous or hilly terrain.¹⁰ Running more efficiently than automobiles, they reduce traffic congestion and use less energy per passenger -- only about 0.1 kWh/passenger km compared to an average cars' use of around 0.35-0.47 kWh/passenger km.¹¹ Compared to more elaborate infrastructure modes, gondolas have shorter construction times and cause less disruption to en-route neighborhoods -- fitting for Valparaíso's compact, winding streets.¹²



Ascensor Baron. Source: Arturo Villegas

While the city's active ascensores have a unique functionality that would be difficult to replicate because of their historical integration with the urban landscape, a modern gondola would actually complement them; the two vertically-oriented transit systems would work in tandem to reduce reliance on ICE vehicles to travel between Valparaíso's highest hills and downtown. A gondola would provide a more direct and efficient route for commuters, and even if upper-hill residents would need to commute laterally via ICE vehicles to arrive at gondola stations, those shorter, horizontal trips would require fewer energy-intensive altitude changes than a car/bus trip downtown.¹³

Minibuses (Micros)

Current System:

Both within hills and between the residential and commercial districts, minibuses (locally monikered micros) are an exceedingly popular transit choice for many Valparaíso residents. Though many who happen to live/work within convenience of a funicular do still ride the ascensores on a daily basis, micros carry far more passengers and are typically the masses' go-to mode of transportation, servicing nearly every corner of the city. Each micro holds 15-20 people, and even car owners often opt to commute via minibus since historic Valparaíso has little downtown parking.¹⁴ While the micro system is expansive, services are inconsistent between stops, which are spread across winding residential areas. This results in sometimes inefficient, redundant or underserved routes.¹⁵ Additionally, despite their charm and speed, Valparaíso's aging minibuses combust fossil fuels in outdated, wasteful engines.¹⁶

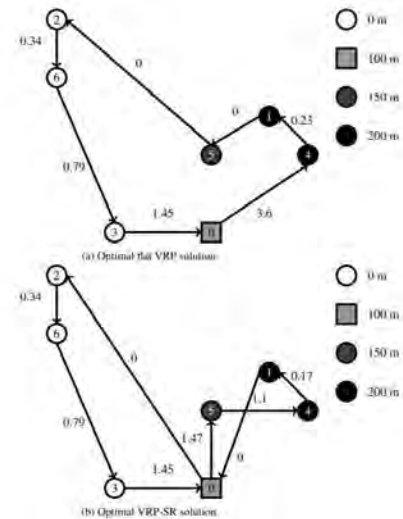


A Valparaíso minibus climbing one of the city's hills. Source: Chekeitha Gray

Suggested Initiatives:

Since micros are so widely relied-upon as the only form of public transit nimble and plentiful enough to effectively service all of Valparaíso's narrow, exceedingly steep, and sometimes cobblestoned streets, eliminating them altogether to be replaced with a more innovative alternative would be an unnecessary and fairly unrealistic course of action. Instead, Valparaíso could reform the minibus system through embracing natural gas as a fuel source and introducing fuel-efficient route planning specifically designed for hilly terrain.

Given that the micros run predictable, closed-loop routes within the city, they are an ideal transit mode to convert to compressed natural gas fueling. Natural gas burns cleaner than fossil fuels, but a lack of refill stations typically limits the range of gas-powered vehicles.¹⁷ However, closed-loop minibuses that almost never significantly deviate from predetermined routes could comfortably rely on natural gas, provided a few strategically located refilling stations. Micros are large and heavy enough that converting them to 100% battery-electric power would be challenging and extremely expensive, but this size also makes them well-equipped to carry fuel tanks of natural gas, unlike personal automobiles.¹⁸



Ideal minibus route for flat terrain vs. ideal route for Valparaíso's terrain. Source: Brunner et al.

Additionally, the micros could lower fuel consumption and operational costs by re-orienting routes around the city's altitude changes instead of continuing to use standard efficiency route planning designed for flat areas. According to a study from the Pontificia Universidad Católica de Chile, splitting what is currently a single micro route into two trips to strategically reduce the weight each vehicle carries uphill could reduce overall fuel consumption. Hill-oriented routes would cluster riders within shared altitude ranges and avoid sudden altitude changes while fully loaded. Serving high-altitude customers while the micros are emptier will increase the distance each one travels, but also reduce fuel consumption enough to counteract that incrementation. The reduction in fuel costs will outweigh the increased costs associated with traveling slightly greater total distances with average operating cost savings of 3.6% and maximum savings up to 13.2%. This study indicates that switching to terrain-focused route planning that reduces fuel consumption would be not just financially feasible, but more sustainable -- the change would bring both environmental and economic benefits to Valparaíso.¹⁹

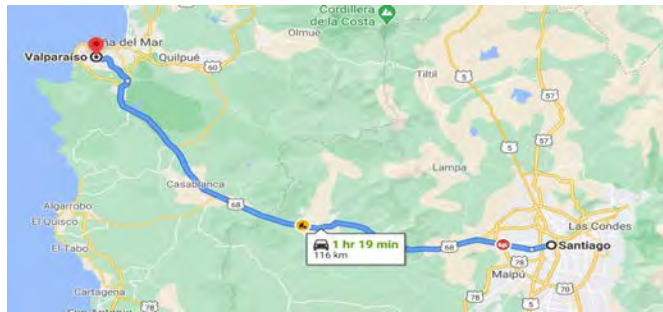
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Commuter and Intercity Trains

Current System:

A metro commuter rail line with 20 stops currently runs along the Chilean coast in the Valparaíso region, linking the city to nearby Viña del Mar, Quilpué, Villa Alemana, and Limache. Electric trains pass through the stations every 3-12 minutes depending on the time of day and had 19.5 million riders in 2017.²⁰ The success of the sustainable and reliable intercity metro has sparked several studies into potential expansion projects sponsored by the regional government and prompted discussions of creating a longer high-speed rail route from Valparaíso to the capital city of Santiago, which could link directly to the coastal metro.²¹

It currently takes 1.5-2 hours to drive between the major port city of Valparaíso and the national capital of Santiago, with up to 100,00 automobile trips made along the route each day.²² Though there used to be a small freight and passenger rail line between the two cities, it closed to the public in 1987 and freight shipments through the rail corridor are now effectively nonexistent.²³ The former line took an indirect path which avoided steep gradients through the mountains, but consequently had limited financial returns and encroached on the natural environment more than a comparatively linear route would.²⁴



Driving route between Valparaíso and Santiago. Source: Google Maps

Suggested Initiatives:

A new, more direct high-speed freight and passenger rail line linking Valparaíso to Santiago could facilitate a more efficient transfer of imports/exports within the most highly populated area of the nation while dramatically reducing emissions. The train's superior efficiency would incentivize commuters to stop driving between Santiago and Valparaíso and could even further reduce the need for car ownership if directly linked to Valparaíso's existing commuter rail at a central station, allowing direct passenger transfer. An engineering firm from Santiago and China Railway Group Limited have together proposed a bid for the construction contract to build such a high-speed train.²⁵ As the top importer to Chile and the number two recipient of Chilean exports, China has a lot to gain from faster, more sustainable, and more cost-effective freight shipment in the Valparaíso-Santiago region.²⁶ Though the project is still in the proposal phase, the businesses' investment interest demonstrates that a low-emission high-speed rail route could catalyze greener trade and development in the region at a low cost to local taxpayers.



Proposed rail routes between Valparaíso and Santiago. Source: BNamericas

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ACKNOWLEDGMENTS

Special thanks are in order for Kenneth Wong, Sandy Zipp, Lauren Yapp, Matthew Roth, and Suzanne Brough for supporting this year's edition of the Urban Journal; without their efforts, none of this would have been possible.

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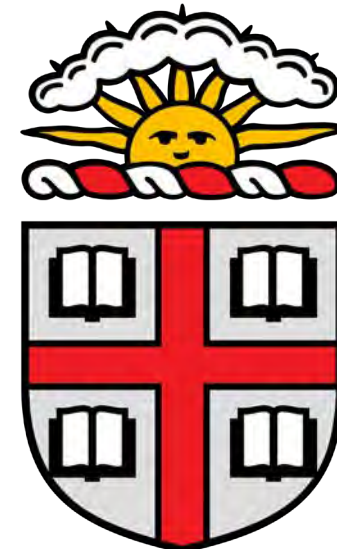
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