Glacial Indifference:
The Failure and Future of Seattle

Scott Simpson

A thesis
submitted in partial fulfillment of the
requirements for the degree of

Master of Architecture

University of Washington
2017

Committee:
David Miller
Gundula Proksch

Program Authorized to Offer Degree:
Architecture

University of Washington

Abstract

Glacial Indifference:
The Failure and Future of Seattle

Scott Simpson

The future of Seattle is projected to be a bleak reality due to unhindered climate change and massive population growth. The buildable landmasses of Seattle will slowly become submerged leaving many residents to flee and seek higher ground, or adapt. This thesis aims to examine the condition of Seattle in the year 2217 and how a futurist approach to the development of the city is required to continue healthy growth.

Architecture groups such as the Metabolists and Archigram faced similar issues during the 1960s as the field of architecture fell short in dealing with the cultural and infrastructural issues of the time. Their responses required city development to be approach in a different manner, through large scale interventions where conventional building methods were not enough. The projects these groups produced depicted a Utopian future where cites adopted the characteristics of machines through master planning as a means to adapt to change.

This thesis proposes that Seattle adopt a new approach to building and extend the city beyond solid ground, into the air and water, through a massive infrastructural intervention. Vertical pylons will be installed throughout the city in flood prone areas and allow a new type of development to exist in a floating and suspended cityscape. These new typologies of Seattle will be floating, tethered to pre-existing buildings, or suspended above the street level. A futurist approach is necessary when examining the future of Seattle so it may continue to thrive despite rising tides and overpopulation ravaging the city.

GLACIAL INDIFFER-ENCE: The Failure and Future of Seattle

A Thesis by Scott Simpson

TABLE OF CONTENTS

CHAPTER 1: Introduction i

CHAPTER 2: Catalyst 1

1.1- Sea Level Rise 1

1.2- Effects on Seattle 2

1.3- Infrastructural Follies 4

1.4- Future Requirements 4

CHAPTER 3: Framework 6

2.1- Visionary Requirements 6

2.2- Metabolists 7

2.3- Archigram 10

2.4- Futurist Thought 12

CHAPTER 4: Precedents 13

3.1- Marine City 14

3.2- Plug In City 17

3.3- Lilypad 20

CHAPTER 5: Proposal 23

4.1- Z-Axis 24

4.2- Investigation through Modelling 25

4.3- Initial Design Concept 37

4.4- Typologies 39

4.5- Sprawl 41

4.6- Infill 45

4.7-Assemblage and Connectivity 49

4.8- Floating Spaces 51

4.9- Regulated Expansion 55

CHAPTER 6: Conclusion 57

Endnotes 58

Figures 59

References 60

Chapter 1:

INTRODUCTION

From Seattle's newest waterfront properties on First Hill, the view towards the Puget Sound is bleak. Desolate waterways stretch from Georgetown to Pioneer Square, leaving a macabre Venice that has been left to ruin. Aquatic channels formed over the past century have submerged the low-lying streets and alleyways. Buildings have been enveloped by the water making them appear like floating boxes jutting out of the seascape. The seaports have been pushed inland forcing ships to weave through the abandoned downtown area, passing by the Columbia Center and Smith Tower whose ground-level entrances now provide shelter for sea life and on occasion, recreational divers. It is hard to come to terms with this reality of Seattle, but without proper acknowledgment of the planets' climate crisis and a better understanding of architecture's role as a catalyst for change, this outcome may be inevitable.

This vision of a future Seattle flooded by rising sea levels is becoming more possible due to the increasing impact of climate change. The built environment has typically responded to this threat in one of three manners: to fortify, to abandon, or to seek higher ground. However, these options oppose the change when the solution is through environmental adaptation that would be able to provide shelter and resist damage to life and resources. The architecture of the city must be able to adapt to the various stimuli of growth and change.

This type of approach is exemplified by the avante garde proposals of modern architects working in the 1950s and 60s in Japan and England. It is in this work, by groups like Archigram and the Metabolist Movement, that we can see visions for the future that examine solutions to overpopulation, transportation, and the flaws of their contemporary societies. The work of the Metabolists in Japan and of Archigram in England can serve as a model for imaginative futuristic solutions to dire threats against the livelihood of urban environments. These projects and approaches realize that modern rational does not adequately address the type of catalyst presented to us and therefore requires drastic thought. They sought organic proposals to address population growth and transportation issues of the city in a post World War II era. These radical proposals, whether implemented or not, change the way architecture is perceived. They lay the foundation for research and development by challenging designers to stray from the status quo and explore potential solutions to pragmatic issues. Their vision of architecture as a living organic being with a "metabolism" still has relevance today, in the face of new threats to our urban existence.

This thesis plans on approaching the conditions of Seattle through a similar gaze as these architects and collaborations. Seattle is one coastal city that will have to deal with flooding from climate change head on. The city is faced with the imminent condition of doubling, or tripling its inhabitants who over time. With coastal flooding, entire stretches of the city will become inhabitable. Roads and highways near the coast will be rendered useless, communities will be uprooted, forced from their homes by the encroaching tides. The city will need to establish a new type of growth, one that can adapt to the needs of the city while acknowledging the grim state it may be left in due to climate change. This thesis argues for an adaptable and organic architecture that responds to the inevitable changes that the city of Seattle will experience.

Therefore this proposal is to approach Seattle through a series of infrastructural interventions. Much like the Metabolists and Archigram, the solution to Seattle's future relies on architecture as a flexible and adaptable medium. The Utopian lessons from these groups design proposals identify a need for such architecture when faced with such catalyst, and also reveal where theory may have fallen short in an obsession with modularity and master planning. This proposed design must not just avoid destruction and mitigate damage, but adapt to the changing environment by taking advantage of the city's existing structure and natural setting.

Fig. 1- Seattle Waterfront, 2037

Fig. 2- SODO, 2217

Chapter 2:

CATALYST

Though the earth's climate has varied throughout its history, scientific evidence confirms that more drastic changes have been occurring since the mid 20th century.[1] Industry and human presence, through consumption and competition has opened a hole in the ozone layer causing temperatures to rise around the globe. Efforts have been initiated to halt the human activities causing this damage. But the effects on the earth's atmosphere and environment are irreversible. More severe weather patterns, temperature fluctuations and soil erosion will all contribute to the most catastrophic consequence- the rise in sea levels. And the earth's temperature steadily rises melting the arctic and antarctic ice caps, this rise will intensify.

SEA LEVEL RISE

According to climate research conducted by NASA, "The global sea level has risen by about 8 inches since reliable record keeping began in 1880. It is projected to rise another 1 to 4 feet by 2100".[2] However, this rise will not stop in 2100 because ocean temperatures take longer to react than the conditions of the earth's surface. "Ocean waters will therefore continue to warm and sea level will continue to rise for many centuries at rates equal to or higher than that of the current century".[3] A further projection estimates that in a

few centuries, the polar ice caps may be completely dissolved causing the sea level to rise up 60 meters, engulfing many of the United State's coastal cities especially in the South-East. (Fig. 4) In his book, Utopia Forever, Matthias Bottger observes:

> The possible impact on coastal systems, due to the rise in sea levels, are various and frightening: ranging from coastal erosion, higher storm-surge flooding, inhibition of primary production processes, increase in coastal inundation, increased loss of property and coastal habitats, increased flood risk and potential loss of life, loss of cultural resources and lowered land values, and loss of tourism, recreation and transportation functions.[4]

The effects of rising sea levels on the urban environment are already evident locally. Today the city of Seattle experiences six times more observed days of nuisance flooding, meaning between 0.5 and 1 meter, than it did in the 1960s.[5] According to climate expert, Dr. Benjamin Strauss, the likelihood that the city will experience more extreme coastal flooding is projected to increase by 68% by 2030 alone.[6] And as sea levels continue to rise flooding will only cause greater devastation. More than $5 billion in property and tens of thousands of people currently inhabit these already flood-prone areas.[7] (Fig. 2)

Fig. 3- Interbay and Magnolia, 4017

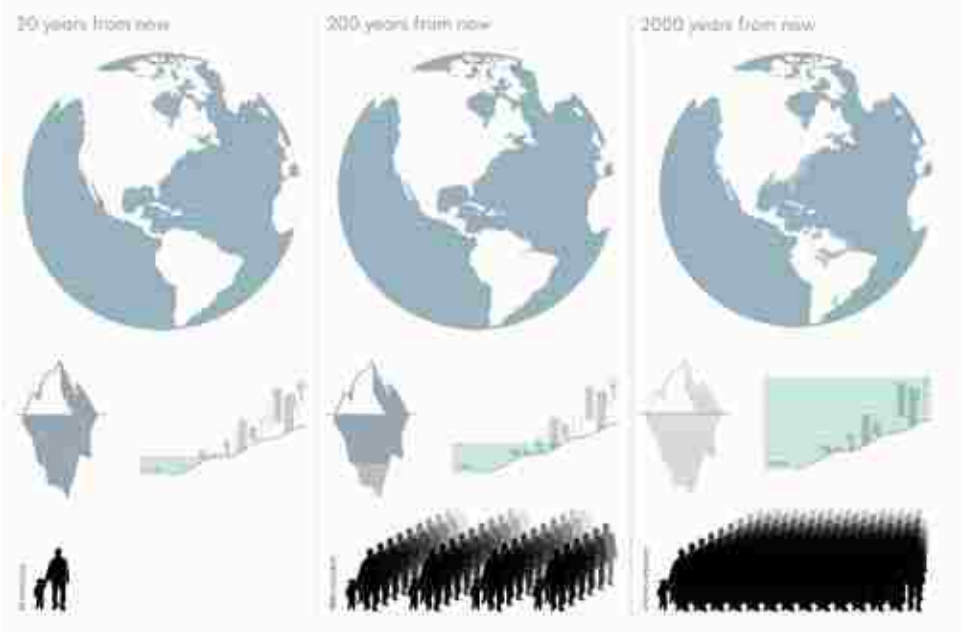

Fig. 4- Glacial Melt vs. Flooding

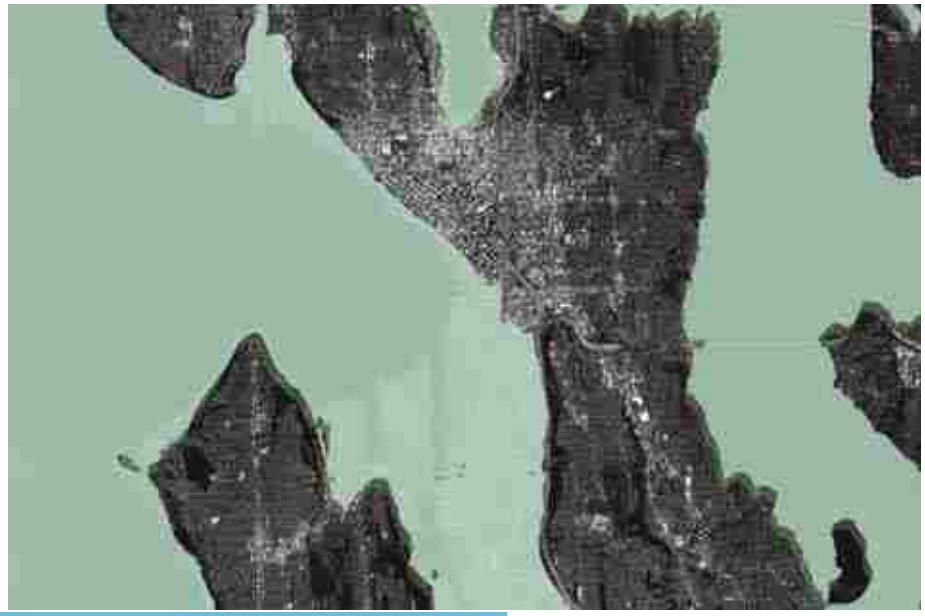

Fig. 5- Map of Seattle in 2217

EFFECTS ON SEATTLE

This condition, paired with the fact that Seattle sits in a seismic zone of high activity suggests a catastrophic outcome for those inhabiting the Puget Sound area. Some residents of Seattle, the steep rise in elevation from sea level may protect major portions of the city from flooding. However, though, "Seattle may survive, but elements of the city's economic and cultural backbone—winter recreation, the salmon industry, the shellfish industry—could disintegrate. But while the urban fabric may withstand the flood, elements of Seattle's economic and cultural identity will be effected. As reporter Sydney Brownstone argues: "'everything' you think of when you think of Seattle might have to change".[8]

In addition to rising tides encroaching on an ever dwindling landmass, Seattle also has the condition of seeing an explosion in population growth and density over the past decade which is projected to continue into the future. This population explosion occurs in a city of less than 750,000 people and is expected to grow to over 1.4 million by 2040 alone.[9] (Fig. 4) As new residents come to the city they will be increasingly met by a vertical Seattle, as expansion upwards increases as the landmass

Single family homes will are projected to become a typology of the past as the need for space outlasts the desire to keep lawns and side alleys. As areas of the city like Capitol Hill, Downtown, and Queen Anne continue to densify, the population will sprawl to

neighboring areas. These primarily low-lying and industrial areas like SODO and Georgetown, primarily industrial and low-lying, will see an influx in residents looking for an affordable future. Growth in these neighborhoods will provide a temporary solution to combat the issue of overpopulation. However these areas are the most threatened by the effects of climate change. Past approaches to accommodate urban expansion and population growth will no longer be valid options and may put residents at risk.

INFRASTRUCTURAL FOLLIES

While the current development in Seattle remains focused on finding solutions to overpopulation by expanding upward and outward, little seems to be done to prepare for the long term effects of climate change. However, in the past decade some progress has been made in adapting existing infrastructure to combat flooding. Recently completed in 2016, the Evergreen Point Bridge (commonly known as the SR 520 Bridge) has been deemed the largest floating bridge of its kind in the world. This bridge can raise to adapt to rises in water levels and be widened over time by adding additional lanes to account for a growing need of infrastructure in the city. In contrast is the recent development of the Alaskan Way Viaduct that runs along the coast of Seattle and the Puget Sound. This Viaduct, once elevated above the downtown and industrial districts, has now been moved underground in order to provide residents and visitors of the city with an unobstructed view of the Sound. However in doing so, this highway will now sit below sea level illuminating a serious oversight that does not address the potential of rising flood waters. On the topic of a possible tsunami further effecting the tunnel, Steven Kramer, a geotechnical-engineering professor at the University of Washington jokingly concludes that, "The tunnel would probably be the least of our concerns at that point. The tunnel would likely be in much better shape than the structures over it... Such an event might occur every 23,000 to 60,000 years."[10] However, the WSDOT analysis done by Parsons Brinckerhoff does not factor in climate change.[11] As evidence mounts that climate change will effectively cause the sea level to rise, it is hard to justify the tunnel as anything beyond temporary solution in Seattle's future development.

FUTURE REQUIREMENTS

Seattle is being left with a quandary in facing an increasing population and decreasing landmass. The rapid development of the city is shortsighted as billions of dollars are being invested into areas that may be submerged within the next century. Insufficient attention has been given to the imminent impact of climate change on the city, as urban development continues to focus on immediate social needs and financial gains. The effects of climate change and increase in sea levels must be directly confronted by those involved in the built environment. These imminent threats are catalysts for change, calling

for an architecture that is flexible and adaptable, able to adapt to any changes. This approach allows for the possibilities of architecture can be pushed and theorized, providing an imaginative alternative to the modern perception of growth in Seattle, because the potential future of the city as a sea of islands offers an opportunity to develop an imaginative alternative to the current building model, an architecture that seeks to innovate rather than await razing.

Chapter 3:

Framework

A responsive architecture is necessary to deal with such catalysts. This thesis calls for an architecture that is more responsive to these environmental catalysts. It must be flexible enough to take into account scenarios even further into the future. And though a traditional pragmatic proposal can alleviate current challenge, this approach tends to negate a greater vision of the designs future.

VISIONARY APPROACH

According to a study done by Jennifer O'Connor entitled Survey on Actual Service Lives for North American Buildings, "Only one-third of the concrete buildings lasted more than 50 years... Furthermore 80% of the steel buildings fell below the 50-year mark, and half of those were no more than 25 years old."[12] But their relatively temporary status in terms of their physical and functional use is rarely acknowledged. The current approach to building in a city like Seattle has failed to address the impeding effects of rising sea levels. Climate change and overpopulation are inadequately countered in Seattle by an influx of housing cobbled together by developers looking for a quick financial turn around. However, avant garde modern architects directly confronted similar concerns in facing the issues involved with the reconstruction of cities in the post World War II era. With an exploding population and shrinking landmass, the

Fig. 6- Kenzo Tange and the Tokyo Bay Proposal
(google.sk)

Fig. 7- Tokyo 1960
(quora.com)

works of groups like the Metabolists and Archigram become more apt as they do not just propose new types of development, but rather analyze the trajectory of architecture and provide alternatives to better deal with the catalysts that evoke greater change, whether it is from a social standpoint or environmental approach. The radical visions of future cities by the Metabolists in Japan provide a model for an organic architecture that looks forward rather than back.

METABOLISTS

Metabolism was a movement in modern architecture that originated in Japan during the 1960's. The Metabolist movement rose out of Japan during a post war era in the 1960's. The destruction of cities in the World War II period inspired a group of architects, led by professor Kenzo Tange, to reexamine the infrastructure of Tokyo. Lead by professor Tange the Metabolists composed of Kisho Kurokawa, Kiyonori Kikutake, Fumihiko Maki, and others, began to look at their own city in a new light. As Zhongjie Lin, a Metabolist scholar, explains, "The cities expanded into the surrounding countryside with reckless speed, they lost the coherent structure of a healthy organism. The Metabolists looked at these monstrous and untidy cities as cancers in the society".[13] The Metabolists argued for an understanding of cities and buildings as living organisms that experience "metabolic cycles". These cycles acknowledge the lifespan of the built environment as components degrade and require replacement. In response to

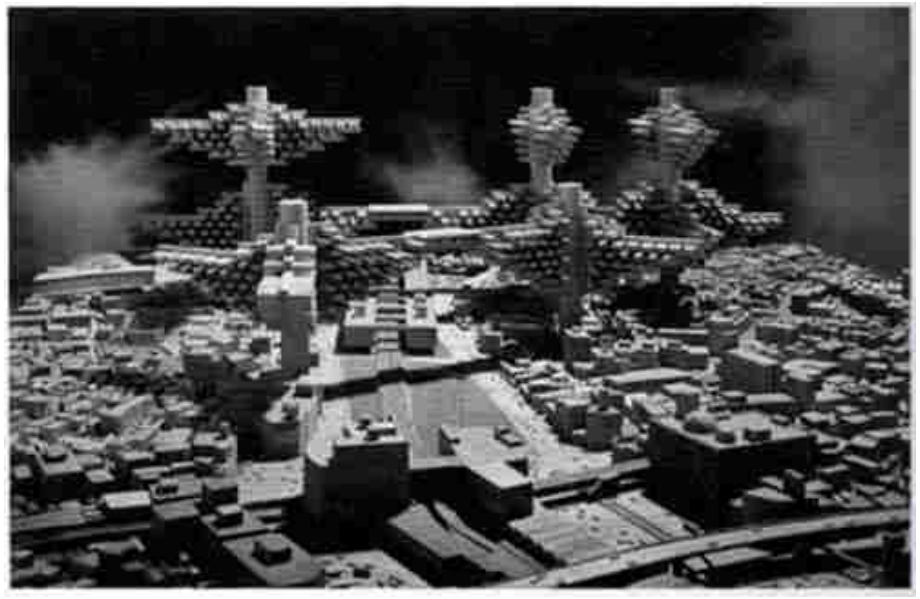

Fig. 8- Tower Shaped City, 1961
(Estudio Quagliata Arquitectura)

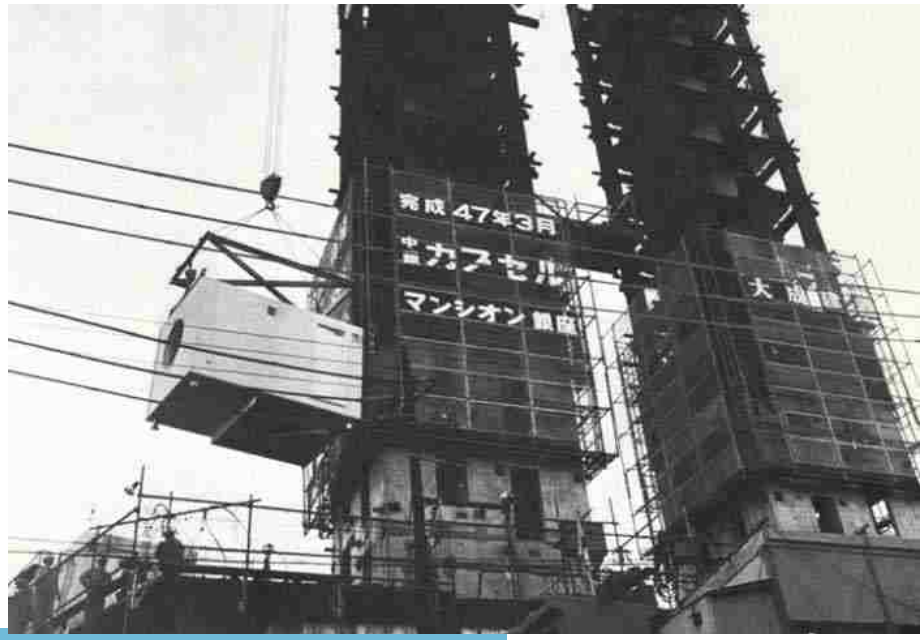

Fig. 9- Nakagin Capsule Hotel Construction
(MoreAEDesign Wordpress)

unprecedented expansion and population growth they proposed designs that could organically adapt to the changing conditions around them. In their re-conception of the essential nature of building as an ephemeral construct, Tange and his students addressed the need for a "social transformation" through architecture.

This transformation involved a reorganization and conception of space within the city exploring futuristic solutions such as floating housing developments and capsulized living. Metabolism became an outlet to speculate about developmental urbanism. As Simon Sadler observes: "The Metabolists wanted to dissolve the large cities and replace them with urban clusters, which would form a regional network or a linear urban system. The difference between city and country would no longer exist".[14] As these clusters, modular in nature, began to outgrow their limit a new unit would create itself, dividing like a cell. This approach countered the density and sprawl of Tokyo at the time by proposing independently functioning communities. Lin identifies that these communities would maintain the social values of the era, "such as democracy, egalitarianism, liberation from land and freedom of movement... With a conceptualized urban organization featuring hierarchy, centralized administration and regimentation".[15] Many proposals made by the Metabolists had strong underlying ties to Utopian architecture and establishing a grand order to the lives of inhabitants. (Fig. 8)

The Utopian goals of the Metabolists led them to envision a complete transformation of Japanese society where architecture

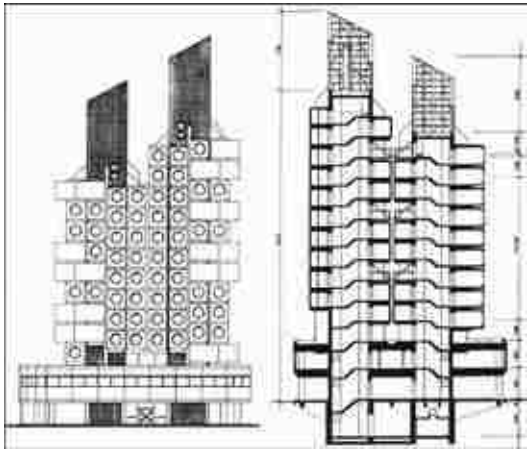

Fig. 10- Nakagin Capsule Hotel Drawings
(Kisho Kurokawa)

Fig. 11- Nakagin Capsule Hotel Interior
(ArchEyes)

established a new relationship between individual and society. But their grand visions of massive superstructures with replaceable housing cells, or capsules, failed to meet the intimate needs of its users. Capsulized existence became very tiring, a condition only realized through inhabitation. One of the only built projects, Kisho Kurokawa's Nakagin Capsule Tower in Tokyo consists of over 130 prefabricated individual units attached to two tall concrete cores. Due to the cost of maintenance and uncomfortable living conditions caused by asbestos and degrading pipes, very few residents remain. According to Ana Soares of Failed Architecture, after the pipes began to erode,"... many of the capsules were thus unusable, rotting from the inside. Moreover, the renovation works were done without much care: doors were sawn into so as to pass and connect the new pipes. It seems that with every repair, the building is falls further into disrepair."[16]

This shows the shortsighted nature of Utopian architecture the Nakagin Tower reveals the danger in finding a perfect all-encompassing solution to society's larger problems leads to the neglect of the individual needs of the human users. Kurokawa's initial idea of having the capsules maintained and cycled was short lived as the mechanical systems of the building failed. The approach to social architecture is not to find a perfect solution, as "Utopia is more dysfunctional than functional. Failure is written into its DNA. How could anything so pure and so all-encompassing ever be taken seriously as a realistic blueprint for the future?"[17] But the Metabolist movement does provide many important lessons regarding the need of

Fig. 12- Members of Archigram
(ArchDaily)

Fig. 13- City of Archigram Projects
(Archigram)

architecture to directly confront the catalysts of environmental change that are reshaping the identity of the city. During the same time, on the other side of the globe, a group of modern architects formed to address the radical changes they saw in their city of London, England. The work of Archigram provides another model of how architecture can aspire to challenge conventions and tackle the future of society.

ARCHIGRAM

In 1960, a group of students based at the Architectural Association School of Architecture in London began proposing radical notions of how technological and social advancements should be reflected in "modern architecture" Archigram was comprised of six men (Warren Chalk, Peter Cook, Dennis Crompton, David Greene, Ron Herron, and Michael Webb). According to Simon Sadler, the group was, "...an outburst against the crap going up in London, against the attitude of a continuing European tradition of well mannered but gutless architecture that had absorbed the label 'Modern', but had betrayed most of the philosophies of the earliest 'Modern'".[18] They felt the architecture of their time was dead on arrival. England and the rest of Europe was experiencing a period of sterile and uninspired architecture that merely seemed to replicate design of the past. The celebration of everything new by Archigram opposed the day-to-day architectural education and practice. They would not be confined to an office or a standard work week, but rather explored architecture

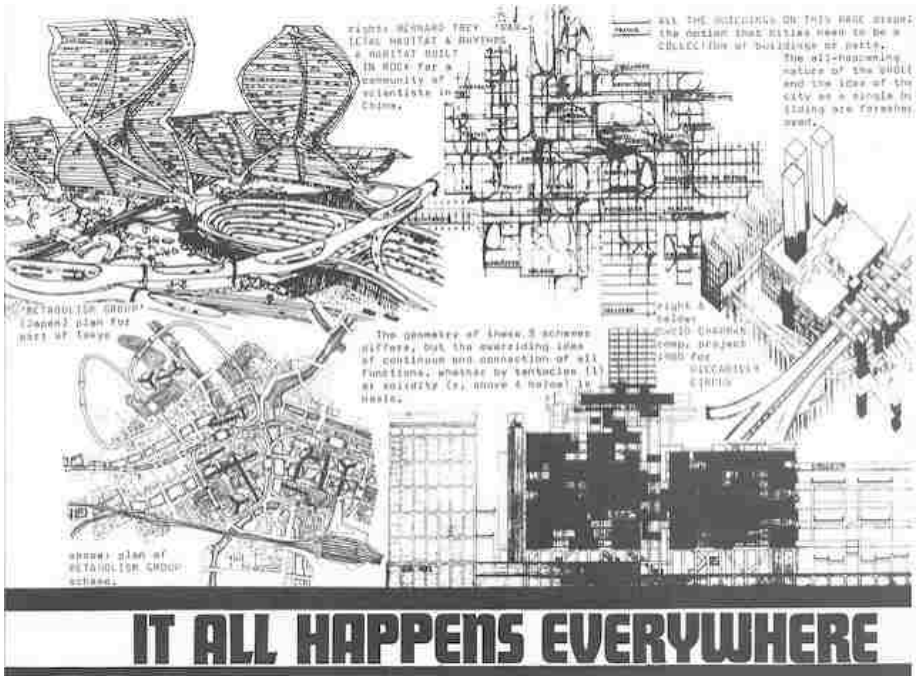

Fig. 14- Page from Archigram Magazine (Archigram)

through depictions in various media, particularly a self published magazine. While architectural students and practitioners created realistic proposals, described in section and elevation, Archigram aimed to capitalize on fanciful imagery and futuristic forms to question architecture's role in society and it's responsibility to adapt to change overtime.

Inspiring hypothetical projects by Archigram like Walking Cities, debuted in 1964, (Fig. 13) were documented in their self titled publication.. Walking Cities is a proposal for mobile robotic mega-structures that could roam freely over land and water, aimed for flexibility and freedom in future settlements. Though an impractical proposal for the time, this design opened many people's eyes to what architecture could be and how radical the future be perceived in a radically different way. Archigram focused less on the physical mechanics of the buildings they proposed and more on their impact on society. Consumerism, density, and social interaction were frequent topics in their publication.. Archigram was not concerned with pragmatic solutions to problems, but rather society's interactions with space. The lack of focus on the physical manifestation provided a sense of freedom that allowed ideas to grow and develop without the need to acknowledge many real-world constraints like time, feasibility, even the laws of physics at times. Metabolists did not face the same luxury as overpopulation and sprawl were very real and pressing issues in their society.

Nevertheless there is much overlap in the goals and details of the proposals of the Metabolists in Japan and of Archigram in London. For example, both groups became highly enveloped with sub-systems in their designs. For the Metabolists, this was evident in the construction techniques of their capsule proposals, to rapidly construct affordable and enjoyable spaces. Modular boxes were arranged around central cores illustrated a strive for efficiency through hierarchical form. These individual units were intended to serve a multitude of purposes such as residences, shops, restaurants, bars and other functions tied to a central core of vertical circulation. Archigram took this notion of systems further through their work; as seen in projects like the Plug-In City or Computer City. In these projects, we begin to see an exploration of movable mega structures constructed of tubular systems that could transport inhabitants to different areas.. The building systems the Metabolists and Archigram challenged the idea of architecture as a static, fixed entity. Their proposals for mobile urban infrastructure adapted and changed to meet the needs of their users and disregarded contemporary notions of what modern architecture was. The catalysts for their projects required a radical rethinking of the role of architecture and building, running parallel to the situation experienced in present day Seattle.

Chapter 4:

Precedents

The precedents chosen for this analysis all operate through a systemic hierarchy of space to allow adaptation. Modulation and connectivity are driving forces in understanding mega-structures. By allowing structure to be replicated, a natural urban growth occurs as these cities expand into patterns beyond the conventional two dimensional grid. Each project is a reactionary response to the environmental stimuli experienced by the city; simultaneously combating issues like density, inefficiency, and relocation. It is not enough for these projects to simply find a solution to the problems faced, but they aim to expand the field of architecture to a scale beyond what people of the time could conceive of. These projects are not faultless, but provide the opportunity to examine the successes and failures of Utopian ideals when planning for the future. For these projects, it is not about finding a solution, but rather to create a grand vision based on responding to an immediate catalyst through fantastical thought, and furthermore allowing this vision to manifest itself in infrastructural interventions in an effort to support health growth for all who inhabit it.

Fig. 15- Kikutake Kiyonori exhibiting his work
(Places Journal)

MARINE CITY

The unbuilt Marine City 1963 by Kikutake Kiyonori (Fig. 15) was one of the strongest proposals of the Metabolist Movement. This project based on a previous proposal exhibited at the World Design Conference 1960 in Tokyo. From his initial sketches, it is evident that Kiyonori took a 3-step process in his design: ka, kata, katachi. Translated, this approach represents the understanding of social needs, prototyping through a systematic approach with technology, which in turn results in a final form.[19] While earlier versions of the project grouped the facilities (public spaces and mechanical systems) on a single loop platform for all of the surrounding buildings to utilize, but with this further developed proposal, each tower contained its own facilities, operating independently of each other. Peter Cook argues that, "This approach resulted in a much clearer expression of the Metabolism notion of growth and change and its analogy with biological systems".[20] Towers occupied floating pads that were anchored to the sea floor. In response to criticism of earlier versions Kiyonori opted to create sturdier towers in order to handle heavier seas. Later revisions also incorporated a three dimensional system of circulation between the towers themselves.

Kiyonori's proposal embodies the main tenets of Metabolist thought as these clustering mega-structure adapt to expansion and employ a construction method rooted in a "metabolic cycle". He implements a series of capsules that protrude from the individual

towers on all sides. Each tower is connected to a ground level platform, floating at sea level. These platforms are then connected creating a web of circulation without any type of centralization to the overall complex. This proposal aligns with the Metabolists' aim of dissecting the city into smaller, manageable clusters.

However as with the Nakagin Tower in Tokyo, it is the use of the modular capsule that causes this project to fall short. Though any multitude of services or uses could fill each capsule, the regimented form and size limits the program within. (Fig. 16) These spaces lack the ability adapt or change. If the population exceeds the limit of the tower, the solution is to simply add more capsules. This does not alleviate the root of the problem, but the fixed sterility of the individual spaces remains, human comfort sacrificed in the aim of larger Utopian ideals.

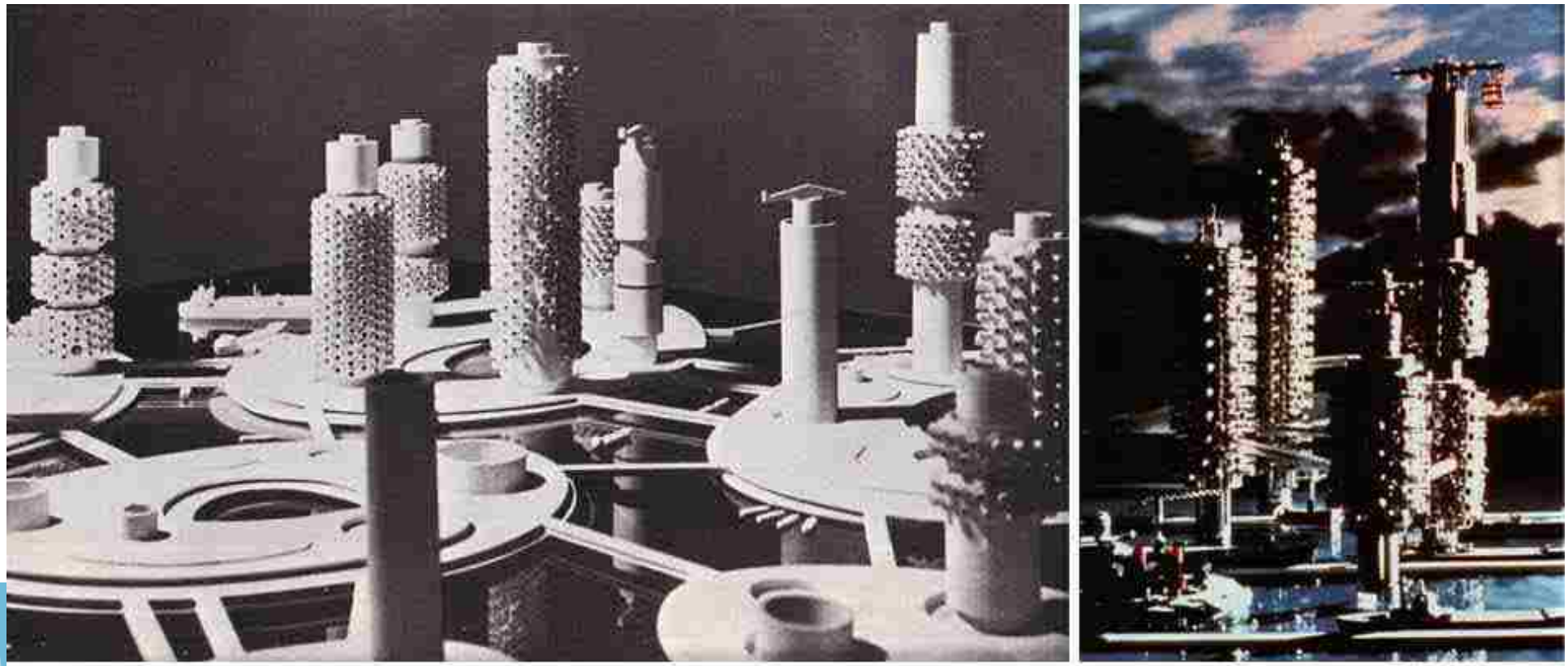

Fig. 16- Marine City Images
(Kikutake Kiyonori)

Fig. 17- Marine City Model
(Kikutake Kiyonori)

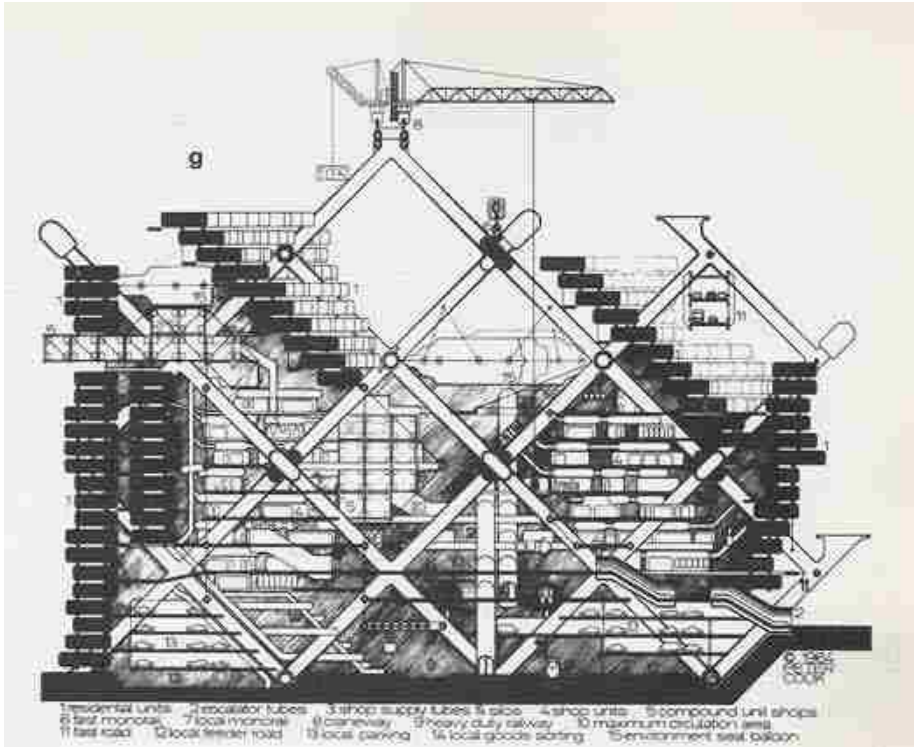

Fig. 18- Plug-In City Construction
(Archigram)

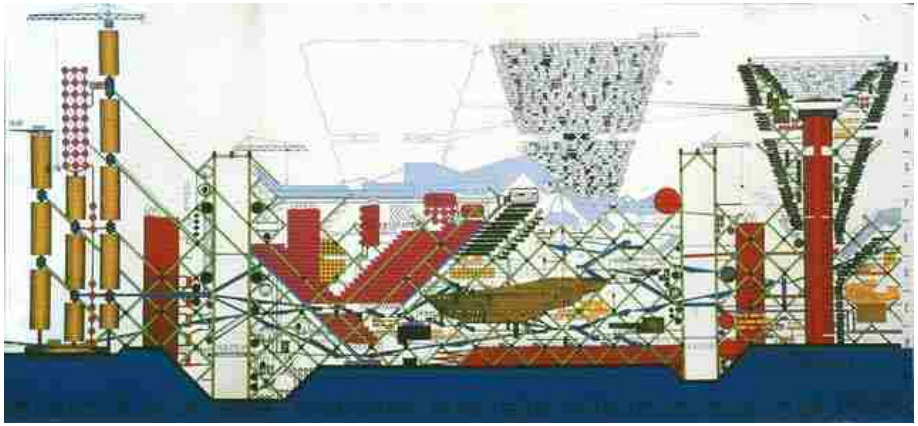

Fig. 19- Plug-In City Section
(Archigram)

PLUG-IN CITY

The Plug-In City by Peter Cook of Archigram shares similar motifs to Kiyonori's mega-structure, but aims to be much more adaptable and responsive to its inhabitants. "The Plug-In City (Fig. 18) is set up by applying a large scale network-structure, containing access ways and essential services to any terrain. Into this network are placed units which cater for all needs".[21] The Plug-In City provides a concept of construction in which a series of cranes are equally important to the proposal as the capsulized units themselves. These cranes, attached to a train at the apex of the complex maneuver units around to address the individual needs of spaces. Instead of relying on a central building core, these units can be placed in countless arrangements to deal with any differentiation in terrain or use through the years. Each component of the mega structure is characterized by levels of permanence related to its function? Roads and car silos can last up to 20 years before their replacement part is craned in, while spaces like bathrooms and living rooms can range from 3-8 years before they are replaced.[22] Circulation corridors connect spaces as the sprawl of the mega structure expands to overtake the English countryside.

Plug-In City provides a lesson in infrastructure that seems to be overlooked in many Metabolist proposals. Simply providing a capsule tower is not enough to create a community, as there must be infrastructure. By incorporating infrastructure, the project goes beyond the basic provision of grouped units to form a community.

Movable cranes shift and alter the form of the structure allowing new types of spaces and spatial relationships to be constructed. (Fig. 20) Plug-In City aims to break up the monotony of daily life by constantly surprising its inhabitants through a responsive architecture. The Plug-In City maintains Utopian characteristics through order and hierarchy, but ultimately identifies itself as a “Living Machine.” The Plug-In City seeks to be a “living machine” that like its residents changes and adapts over the years.

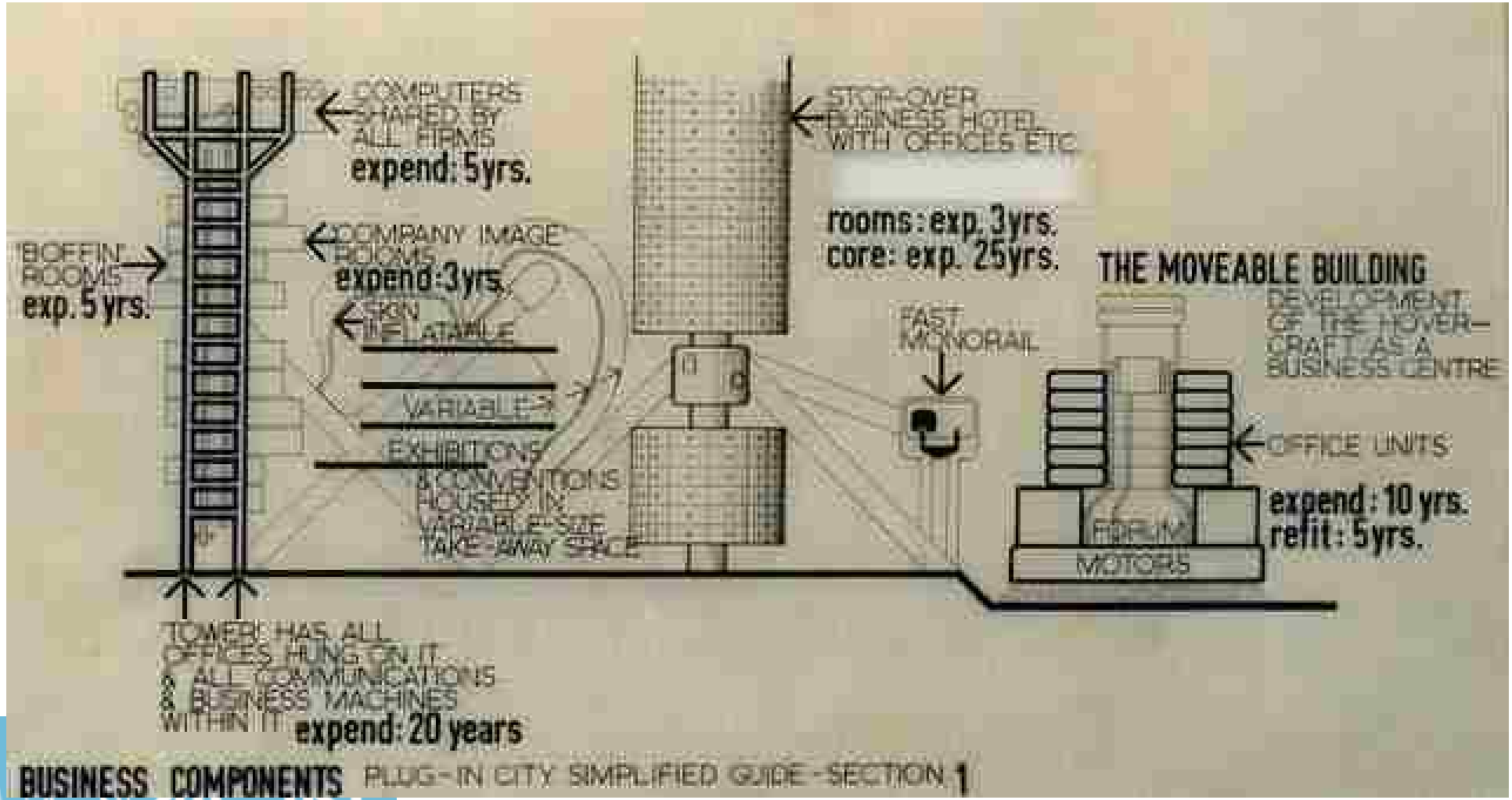

Fig. 20- Building Life Span (Archigram)

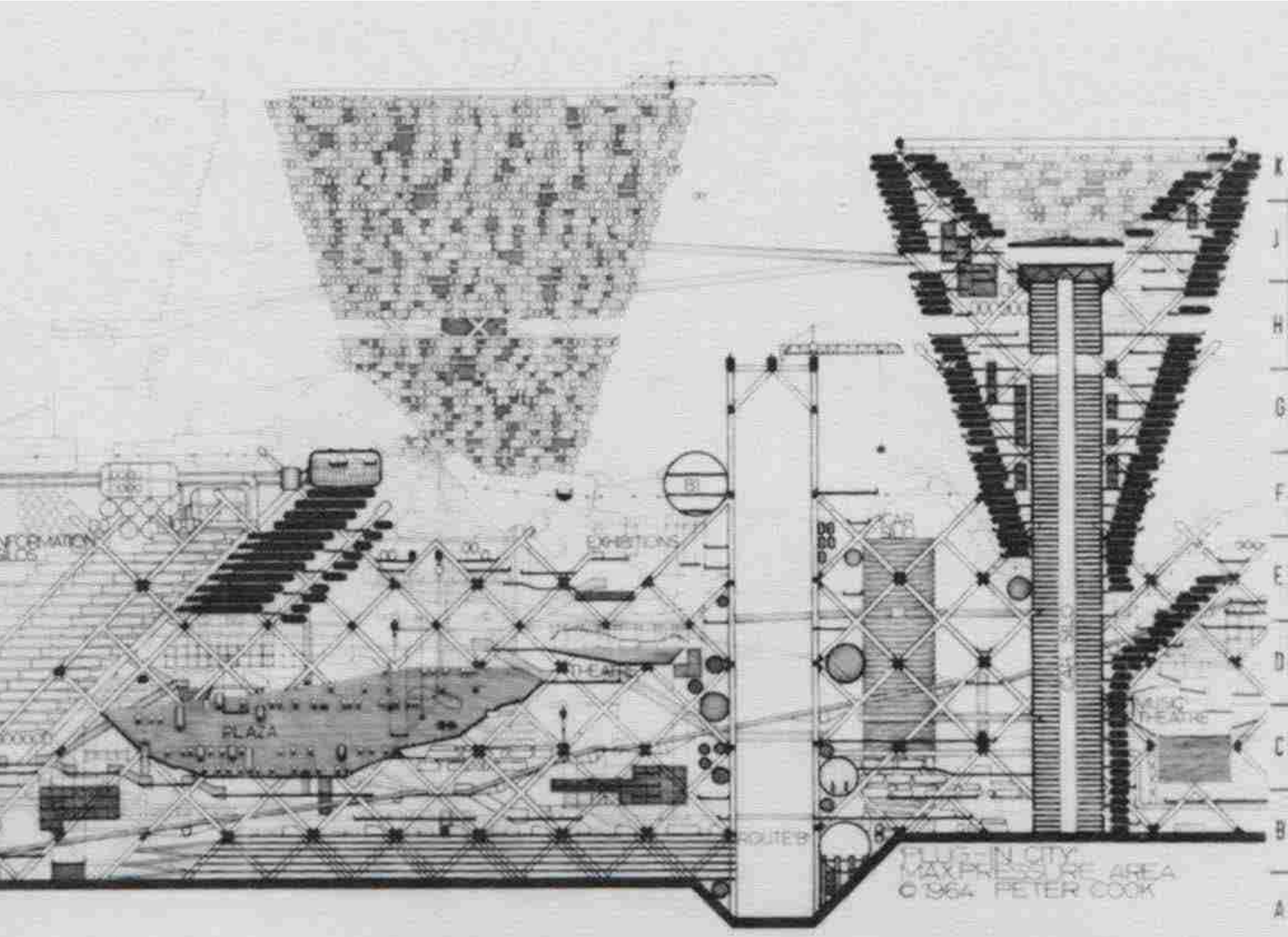

Fig. 21- Plug-In City Detail
(Archigram Wordpress)

Fig. 22- Multiple Lilypad Iterations
(Vincent Callebaut)

LILYPAD

In contrast to these historical proposals, the final precedent demonstrates the continuing relevance of Utopian ideals. Envisioned for 2100, the Lilypad: A Floating Ecopolis for Climate Refugees by Vincent Callebaut depicts a fully autonomous floating complex able to house up to 50,000 people. (Fig. 22) Designed in 2008, there are two primary goals this project aims to accomplish: to increase sustainability of developed nations by creating offshore energy collection, and to provide haven for climate refugees or people forced from their land due to the effects of climate change. As Callebaut describes the project as, "...a true amphibian half aquatic and half terrestrial city, inviting the biodiversity to develop its fauna and flora around a central lagoon of soft water collecting and purifying the rain waters".[23] Each floating structure utilizes its surroundings to produce energy through solar, thermal, wind, hydraulic, tidal, and osmotic means.[24] The structures themselves are covered by plantings and hanging gardens that enclose public spaces, sheltering them from the elements. Residents can live above or below sea level and experience such amenities as shopping districts and restaurants, movie theaters and sports courts. Completely independent of life on the mainland, these structures can

be moved around the world, anchoring wherever the residence deem acceptable.

Lilypad addresses needs that the Metabolists and Archigram

Fig. 23- Lilypad Perspective Elevation
(Vincent Callebaut)

have overlooked in their past proposals in pursuit of systematic order, striving for structural efficiency and social organization. By acknowledging the resource rich character of the site to power itself, true autonomy can be achieved, something Callebaut's predecessors did not concern themselves with. However, only housing 50,000 people creates more of a large neighborhood that a mega structure and this type of isolation can be detrimental to the mental health of the Lilypad inhabitants. Without connective ties between complexes or to the mainland itself, the Lilypad can be seen as nothing more than an autonomous cruise ship. (Fig. 23) The lack of infrastructure inhibits further expansion as each floating "island" operates independently as unconnected nodes.. They cannot grow to adapt to population growth as a maximum capacity can be reached before an addition structure is required. To truly be a conceivable alternative to traditional development, these individual islands are lacking an overarching vision as a mega structure. They remain the same size and cannot adapt to growth. If the population does increase, an entire new complex must be constructed. So as the Lilypad excels as an individual node, it lacks the relationship to its surroundings that would make it a successful response.

Explained in Utopia Forever, it is understood that there are only a few approaches cities can take to handle the effects of flooding: to fortify, to abandon, or move to higher ground.[25] These cases studies demonstrate that there is an alternative option: to adapt. Each of these projects responds to a distinctive catalyst, whether it is environmental or man made. That is a consideration of the needs of individual residents in relation to the larger infrastructure and by learning from and adapting to the changing environment.

Fig. 24- Lilypads at Night
(Vincent Callebaut)

Chapter 5:

Proposal

This proposal employs an infrastructure of vertical pylons throughout low lying, flood prone areas, specifically SODO and Pioneer Square. These pylons, extending from bedrock to their vertical limits of the era's technology, begin to outline an expansion of the city, remaining as the city becomes further engulfed by the surrounding bodies of water. Acting as stable, structural nodes for development, three new building typologies emerge: suspended, floating-anchored, and floating-tethered. These structures begin to infill the city streets; utilizing space between and above the existing city. They are woven into the urban fabric as circulation tubes connect new spaces to old, forming a web of walkways that pull pedestrians through the layers of space. A once two dimensional city grid becomes a maze of passageways extending in every direction. Each typology possess the ability to react to its external stimuli. As sea level rises, these new structures dynamically respond. The floating iterations remain on the surface of the the ever expanding Puget Sound, while the suspended units slide up the pylons, making room for structures below. This allows for healthy expansion as the Seattle grows and densifies.

Z-AXIS

The initial investigation in this thesis starts with identifying the z-axis, or altitude, as a key factor in the development of the city. As the waterline rises, these layered spaces begin to change. If understood three dimensionally, the x and y coordinates of the city remain static, they are understood as land or water depending on when they are examined. The z-axis experience the most constant change over time. By understanding the change in z-axis as a stable, driving force, new approaches to construction can be developed.

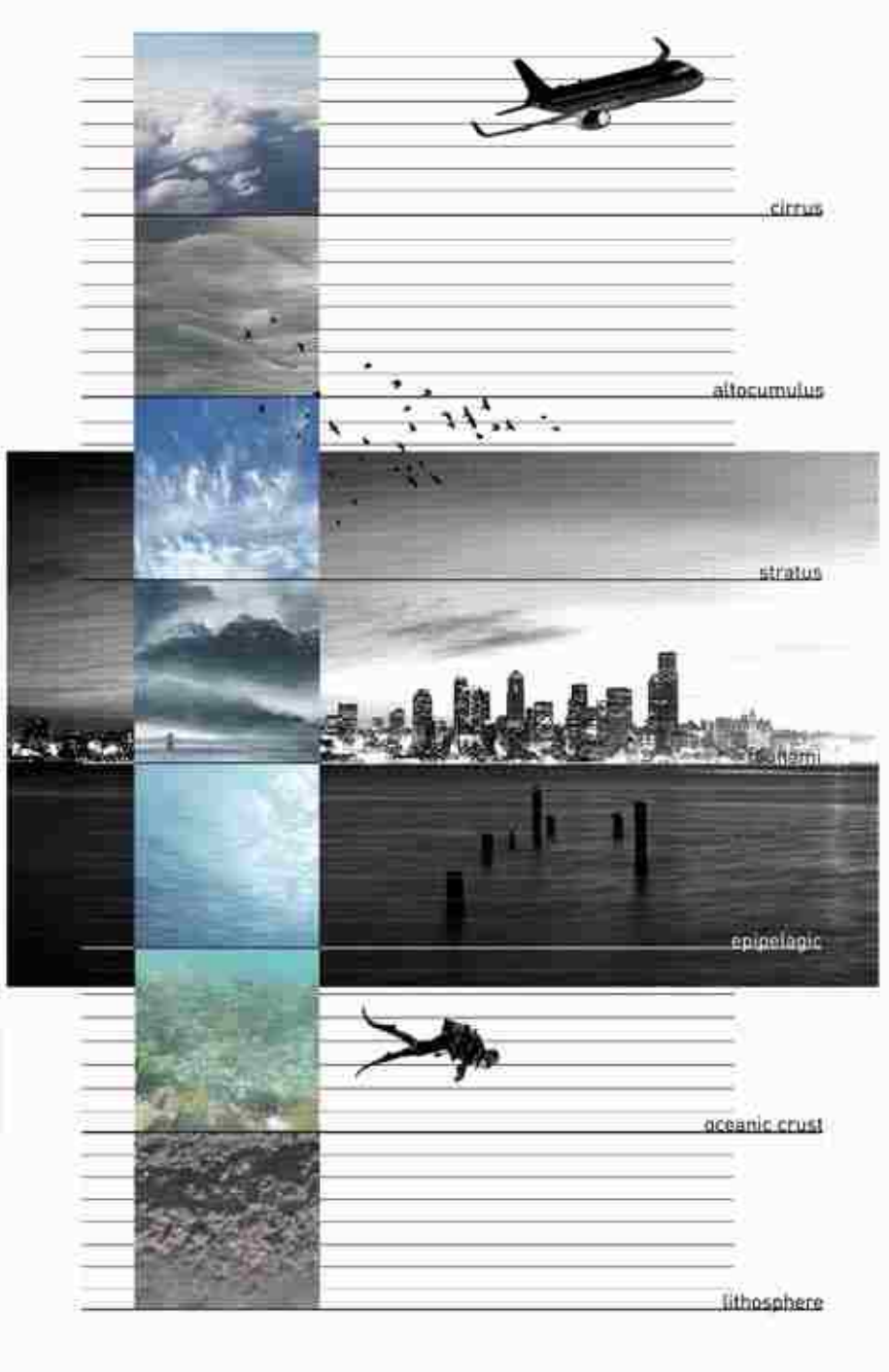

Fig. 25- Z-Axis Investigation

INVESTIGATION THROUGH MODELLING AND COLLAGE

Similar to the Metabolists and Archigram, physical modelling and collage become useful tools to understanding the future. Though rendered scenes provide a clear depiction of how the future may operate, conceptual models and collages allow for greater interpretation of how these future systems work. Instead of being fixed in two dimensions like a drawing, models can be experienced from any angle, providing greater depth to a concept. These investigations through materials and composition reveal the inital foundation for this thesis as they are the most vague interpretations of the future and allow for a final proposal to be distilled.

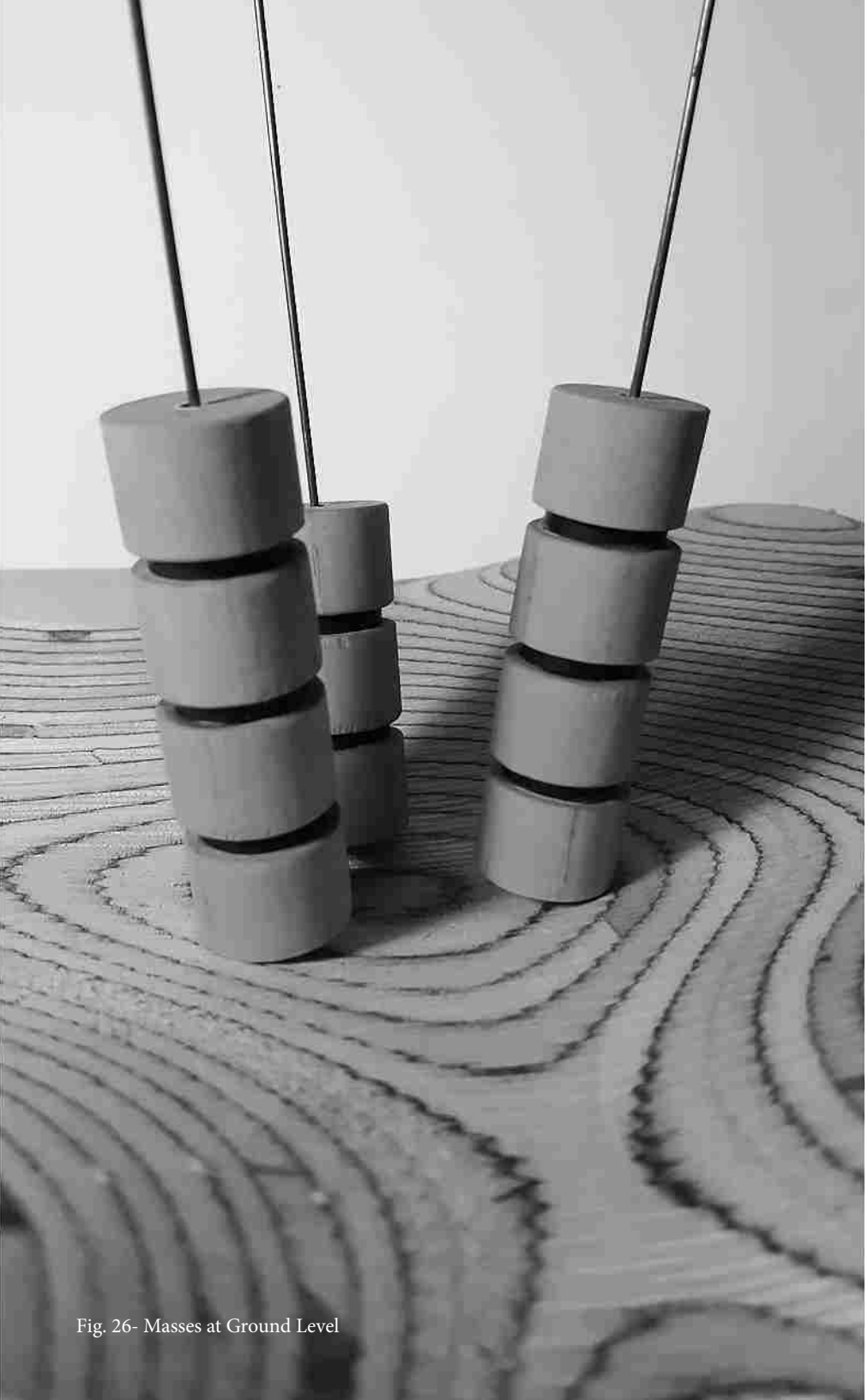

Fig. 26- Masses at Ground Level

VERTICAL REFUGE

The initial concept investigation was derived from the simple need to flow along the z-axis. Cylindrical forms would be able to move along single structural members and then fasten themselves in place. This movement is a response to external stimuli. The wooden forms are guided up the vertical members by hand showing a similar reaction if the force of water were acting on the masses, allowing them to rise and remain at the top of the surface. The location of these elements remains relatively static in plan, as this is a condition that would not change if the surface was altered. Where movement in the x and y-axis is experienced reveals the structural character of this model; that single unbraced supports stress with the weight of a heavy mass and therefore cannot solely support structure.

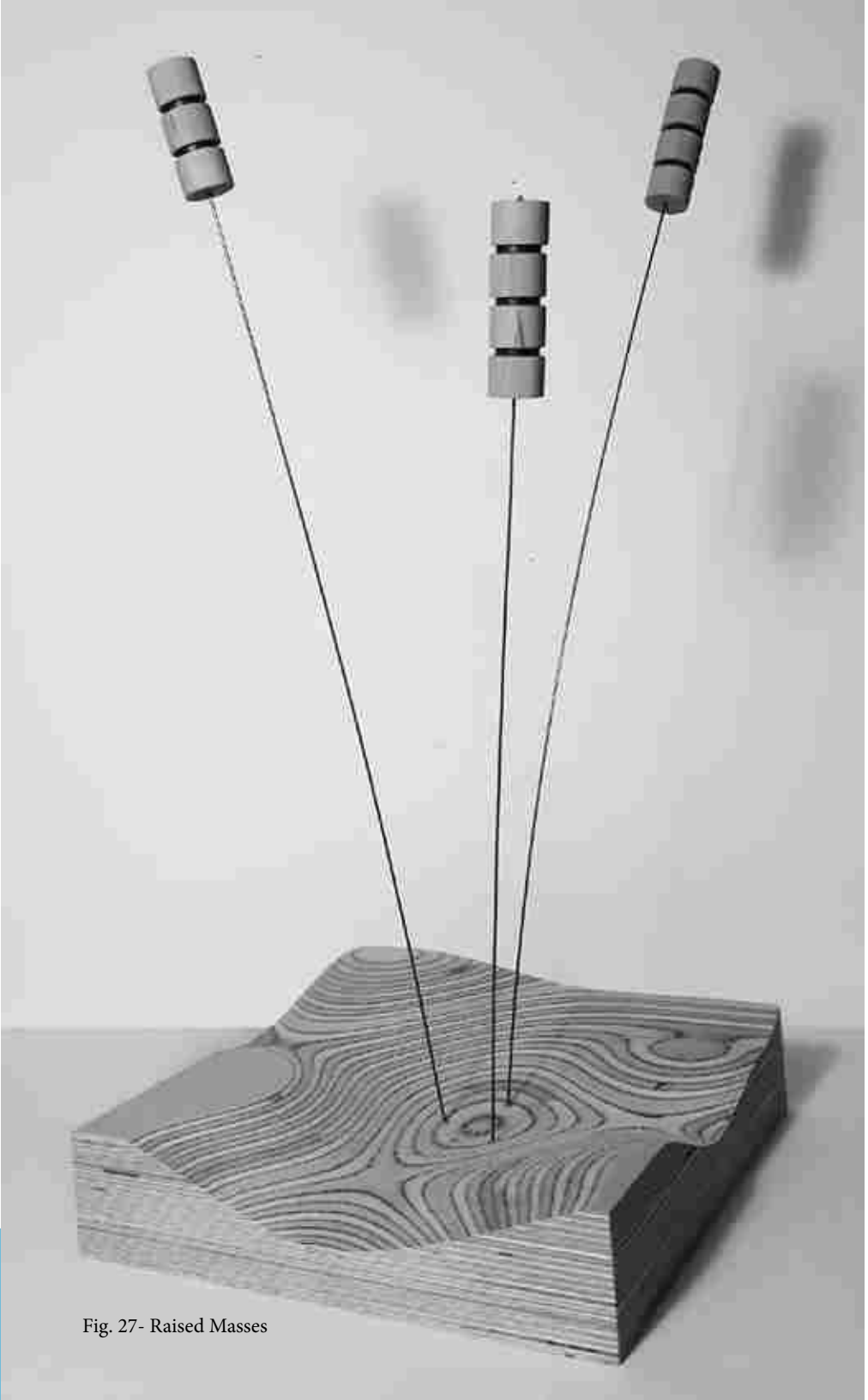

Fig. 27- Raised Masses

Fig. 28- Floating Farms

FLOATING FARMS

This investigation examines the layers of Seattle as low lying areas become submerged. Understood in section, the relationship between the old and new built environments is revealed. The historic buildings become buried, rendered useless. A solid volume of plaster fills in the space around these masses creating a new, stable, workable plane for construction. The motif of vertical structure is apparent in this iteration as well. These vertical elements connect the new building typologies resting on the surface to the lower portion of the model, anchored into the base. Flowers, grasses, and mushrooms are encased in resin at different heights, a representation of how food production may develop beyond our conventional means. In this strategy, the city clearly builds itself upon previous conditions and iterations. The structure of this model relies on a strong relationship between these horizontal layers and the vertical elements that connect them.

Fig. 29- Resin Detail

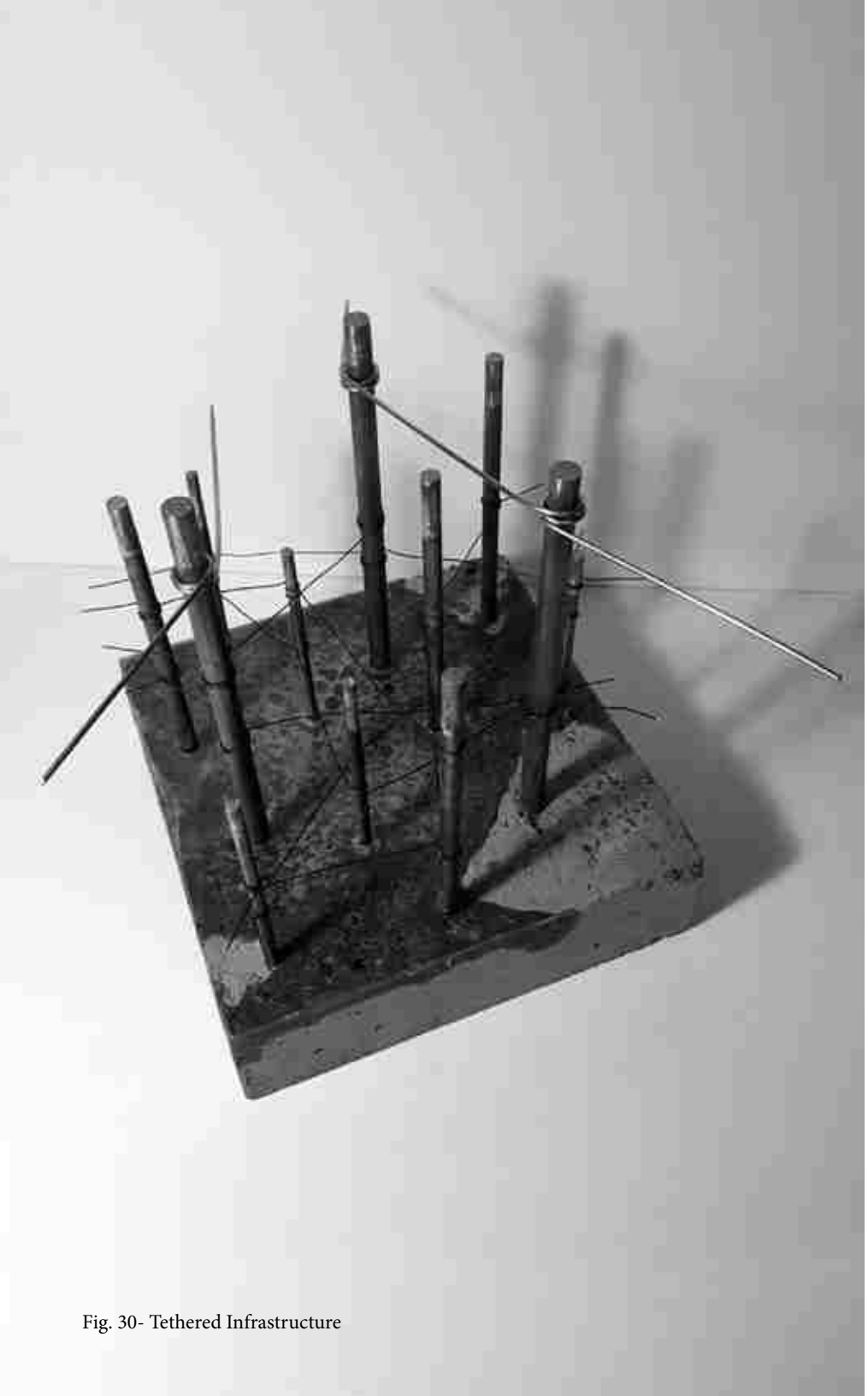

Fig. 30- Tethered Infrastructure

TETHERED INFRASTRUCTURE

Bound together in space, this third investigation looks at the vertical structural elements and their relationship to one another. Various diameters of metal rod create a visual hierarchy throughout the model. These elements allow a network to be formed off of the surface that depicts an effort to adapt to an irregular and unusable ground. Thinner rods are placed more frequently and have been cut shorter to allow lower connections to be formed. The larger rods are woven into the pattern connected to the surrounding components as well as creating their own, unique support structure embodied in brass. These are placed in an effort to establish an understanding of local and regional systems: structure and transportation and how a network can exist above the ground plane.

Fig. 31- Model Detail

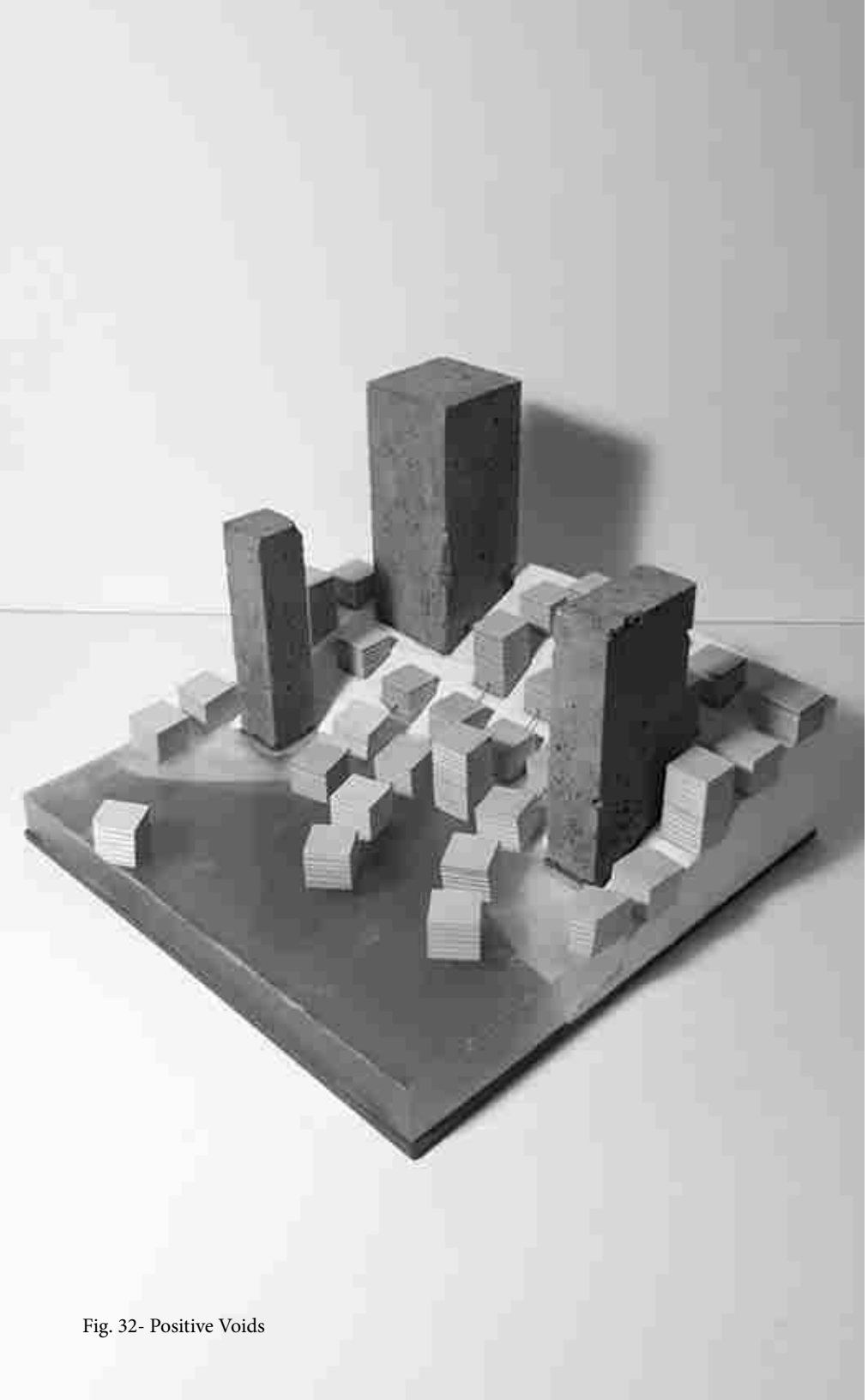

Fig. 32- Positive Voids

POSITIVE VOIDS

The final investigation is a representation of infill and adaptation. Rectangular concrete volumes are nestled into a plaster mass. In a more literal translation, these can be understood as the historic elements of the city. New components of plywood begin to fill the voids between these concrete masses, continuing to establish a recognizable grid. This grid becomes more free form as it extends from plaster to glycerin. However, where the historic masses become submerged, the new interventions rise to the surface unimpeded. The concrete is static in the model, fixed in place and unwilling to change as the wooden cubes freely shift back and forth, tethered together and anchored back into the plaster. To remain dynamic among static elements, these new forms must operate in a different manner or they too may be lost in time.

Fig. 33- Floating Masses Detail

Fig. 34- Interuppted Sprawl

INTERUPPTED SPRAWL

This is a representation of the relationship between floating masses and a vertical infrastructure. It begins to depict the characteristics of an urban fabric that allow for movement and growth. Metal rods extend from rock through water and support a connective structure above the floating masses below. The successful integration of these two elements into a cityscape is crucial in this proposal.

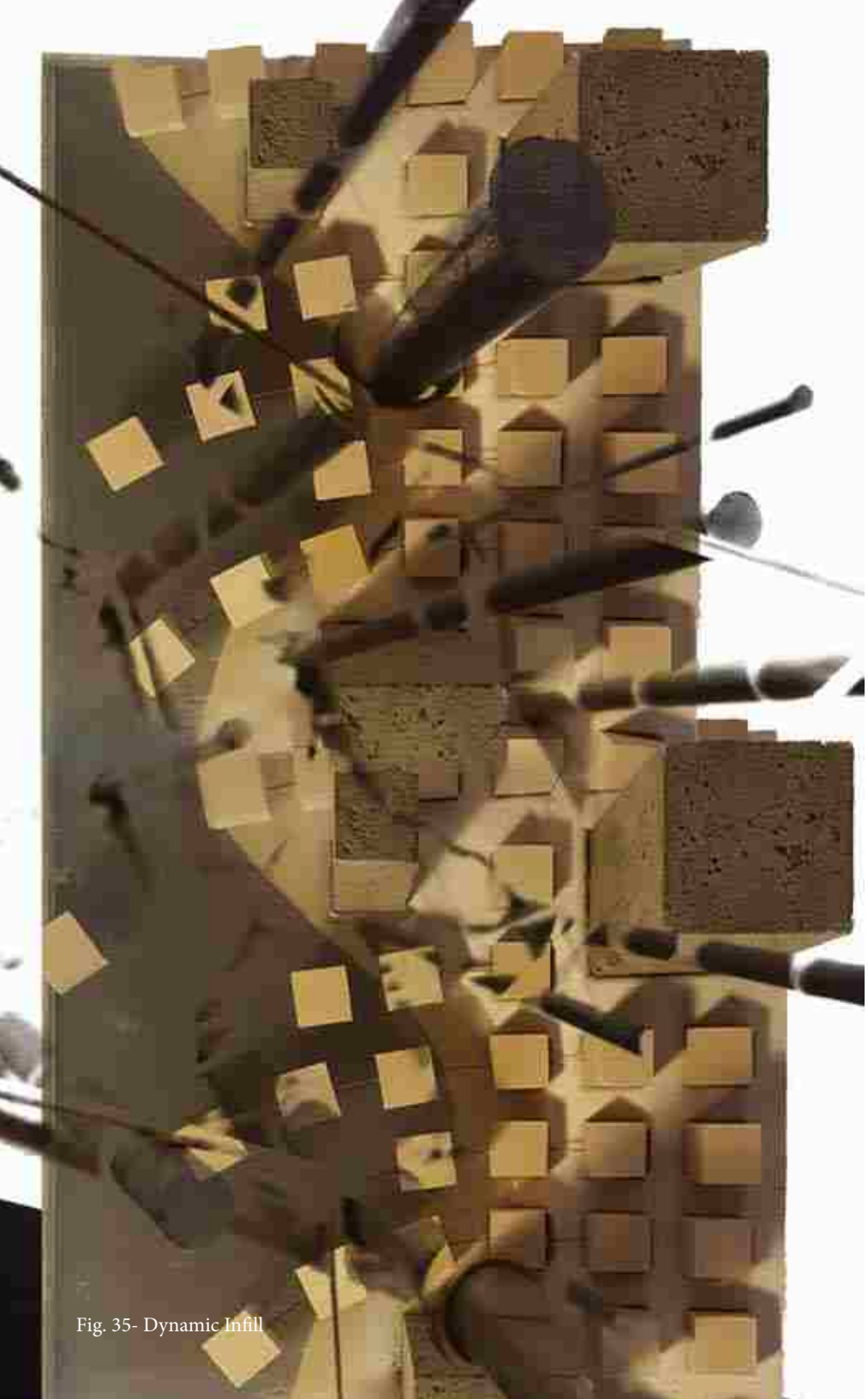

Fig. 35- Dynamic Infill

DYNAMIC INFILL

Depicted from an aerial vantage point, we see multiple elements combine and begin to establish a structural hierarchy. The concrete masses remain uninterrupted as metal rods root themselves in the surrounding land and water. Wooden masses are forced to adjust and adapt to these components and their structural organization is forced to break from the conventional grid in order to adapt to their new surroundings.

Fig. 36- Vertical Field

VERTICAL FIELD

The final investigation looks at vertical layering and how these elements interact in space. Wooden supports appear to stretch out of the ground a rise through the buried buildings into a field of volumes above. Layering these volumes creates depth and highlights the negative space between them. The aim was to create a vision of density without overcrowding the composition. How these volumes interact in space begins to establish a new type of connectivity by offsetting a single plane.

INITIAL DESIGN CONCEPT

The initial design for this proposal stems from the reuse of the existing cityscape of Seattle. Massive pylons would be placed at the corners of city blocks and buildings. They would be anchored into the neighboring building's structure and extend into the sky. This would provide a stable infrastructure for parasitic modules to attach themselves and extend the usable space of the building out over the streets and neighboring structures. Exoskeletons may be required for these modules in order to adequately support the weight of the floors and spaces within. The pylons would be embedded deep into the bedrock and their foundations would eventually be submerged by the rising tides. However, because a mag-lev system would be integrated into their structure. The parasitic modules would be able to slide up the pylons and out of harms way in the case of flooding or tsunami. As new space would be required to deal with the city's growing population and density, more modules would be able to be built and attached while the old ones would simply move up the pylons in order to make room. This allows the city to grow exponentially while not requiring any more land mass than what previously exists. Seattle would be able to deal with expansion by utilizing the space inbetween and above existing buildings.

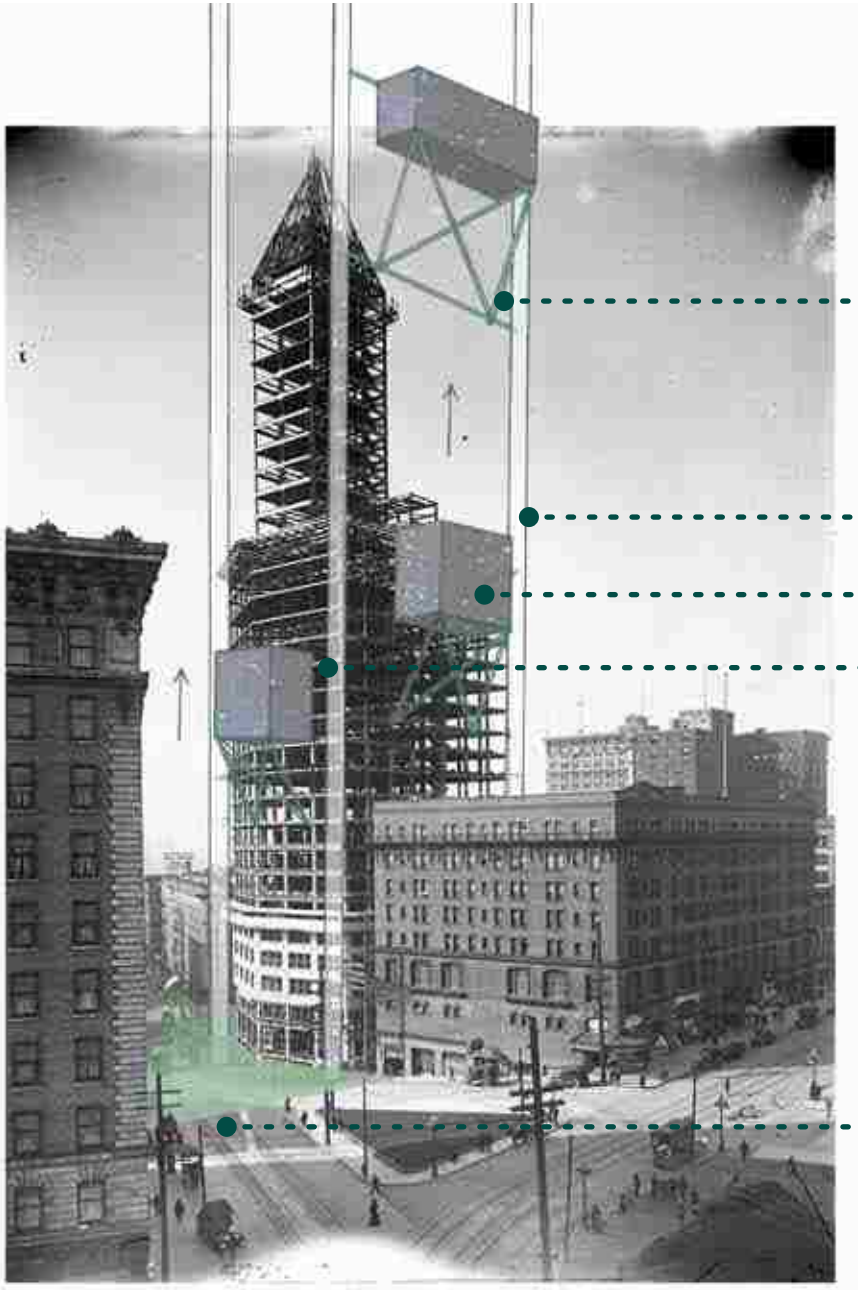

Fig. 37- Initial Design Concept

From the initial design concept, three iterations of building structure emerge. Each responds to its surround condition and can be deployable in different areas of submerged Seattle. These typologies share characteristics but operate independently of each other.

Much like the floating homes seen in contemporary Seattle, the Floating-Anchored and Floating-Tethered typologies operate in a similar manner. They remain on top of the water's surface no matter the level, allowing for them to adapt to change over time. The Floating-Anchored typology would be imployed in deeper waters or where the pylon infrastructure has not been put in place. Where there are pylons, the Floating-Tethered typology anchors itself to the infrastructure. This is a more permanent solution as this typology will be less effected by currents than its anchored counterpart. The third typology is Suspended. These spaces will inhabit much of the downtown area where space is tighter and allows for less movement. A mass will be suspended between pylons and can be adjusted in place by crane or mag-lev system. This typology is incredibly useful for tackling the lack of density in the city as it utilizes the void space between buildings. All of these typologies are designed to adapt to their surroundings and can be moved and reoriented if needed.

Fig. 38- Typologies

SPRAWL

Urban sprawl is a familar concept in city development and planning. As an urban environment grows, there are few directions it can spread in. This series of images hypothesizes the product of sprawl within this future vision of Seattle.

Depicted is an aerial view of downtown Seattle. The water level has risen and continues to creep up the hills, engulfing the land mass it comes in contact with. This already dense area may experience the most change as the growth of the city must adapt to its environment.

Transportation tubes, shown in white, create a web of circulation around the area. Larger tubes are used to break up these newly developed areas into larger, super blocks. Within these super blocks are a combination of Floating-Anchored, Floating-Tethered, and Suspended typologies. These spaces become connected to each through smaller transportation tubes that break off of the larger, regional ones. This organization allows enough freedom for the natural development of the city, but begins to establish an understandable hierarchy of space. By the final phase, the once useless, submerged landmasses become viable areas for development and as more residents enter Seattle, the city can expand through multiple dimensions of growth.

Fig. 39- Sprawl Phase One

Fig. 40- Sprawl Phase Two

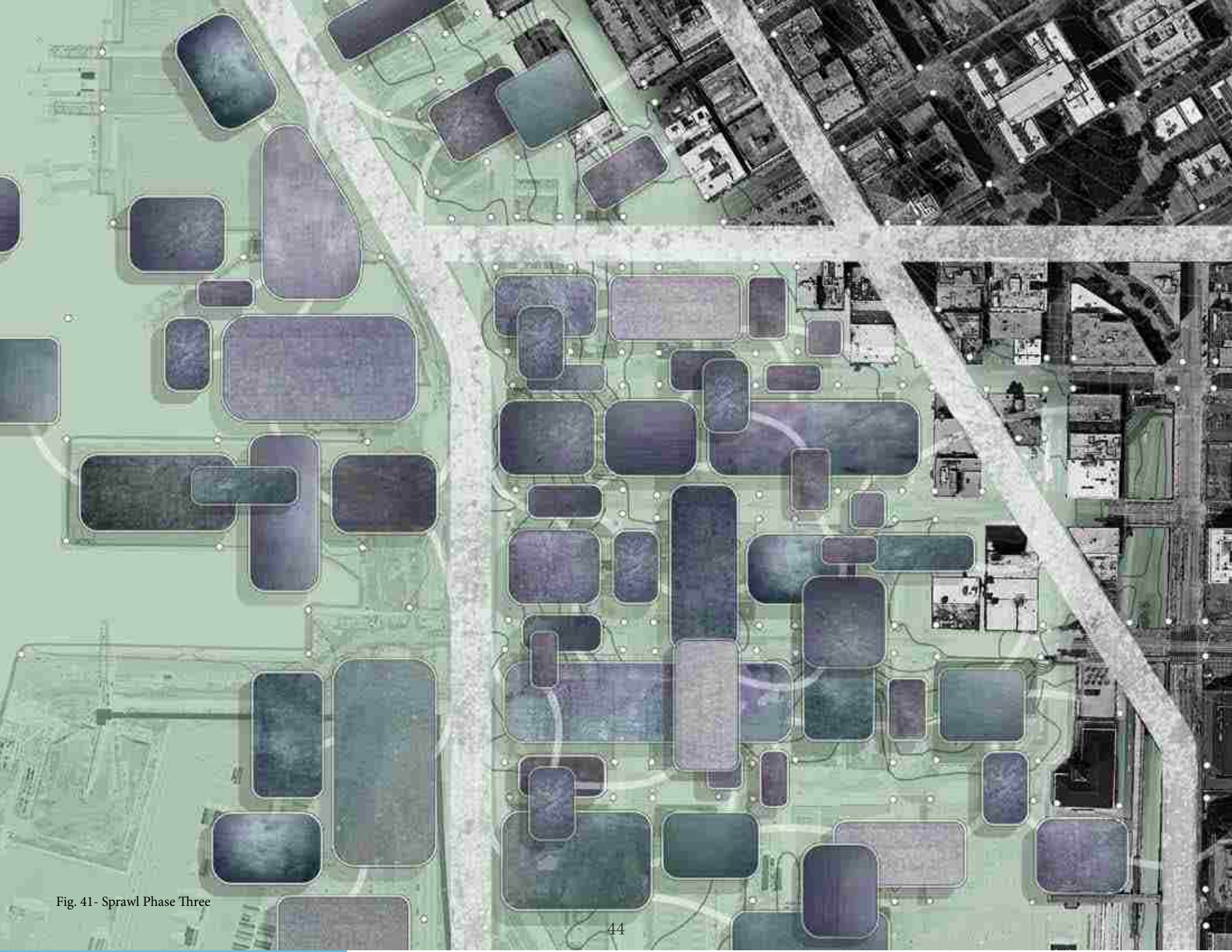

Fig. 41- Sprawl Phase Three

As the buildable ground plane becomes submerged, the city will continue to expand over the water and within space between buildings. New structures will infill the voids of the city from the waters surface to the sky. Rather than constructing a single, massive vertical volume, these spaces would be smaller to allow for more structures to exist around them. The structural and spatial relationships within the city will become more complex than what is experienced in contemporary Seattle and a two dimensional city scape will envelope the third dimension.

This development provides new possibilities for open public space to exist at multiple building heights. Parks and greenways will fill the voids between buildings providing havens from the growing density of the city. Explained later in this chapter, these spaces will have the ability to be moved and rearranged to meet the needs of the city.

Transportation tunnels would be suspended and integrated into this urban landscape. By raising the transit lines off the ground, they will continue to operate no matter what the water level is at. This approach could also be taken in areas that do not have the pylon infrastructure installed by allowing this transportation tubes to float on the waters surface. Through these means, the circulatory system remains viable regardless of what the characteristics of the ground plane are.

Fig. 42- Infill Phase One

Fig. 43- Infill Phase Two

Fig. 44- Infill Phase Three

A new construction strategy is required in this proposal. Instead of having buildings constructed in space, prefabrication will become standardized. This image illustrates the condition of volumes being constructed off site, floated to their destination, and raised into place by crane. This process will minimize the installation period and allow for massive city expansions to occur in a relatively short time period. Specifications from a building's final location will be used to construct the volumes allowing for greater customization and detailing as the ground plane will no longer be a stable surface to work on. This process also allows for building masses to be moved and reorganized throughout the city. If a company were to expand, a new volume may be brought in and connected to it instead of the contemporary approach of moving the entire company from a smaller to larger structure.

With these volumes in place, pedestrian tunnels may be put in place to connect these spaces. In areas where the ground plane is submerged, these tubes will act as sidewalks. However, unlike traditional sidewalks, these interventions have the ability to be moved to different levels throughout the built environment creating a more complex and interesting experience as a pedestrian. The placement of these tubes may depend on the internal activities of the buildings, whether they be work spaces, restaurants, or retail stores, continually adapting to the spatial needs of the city.

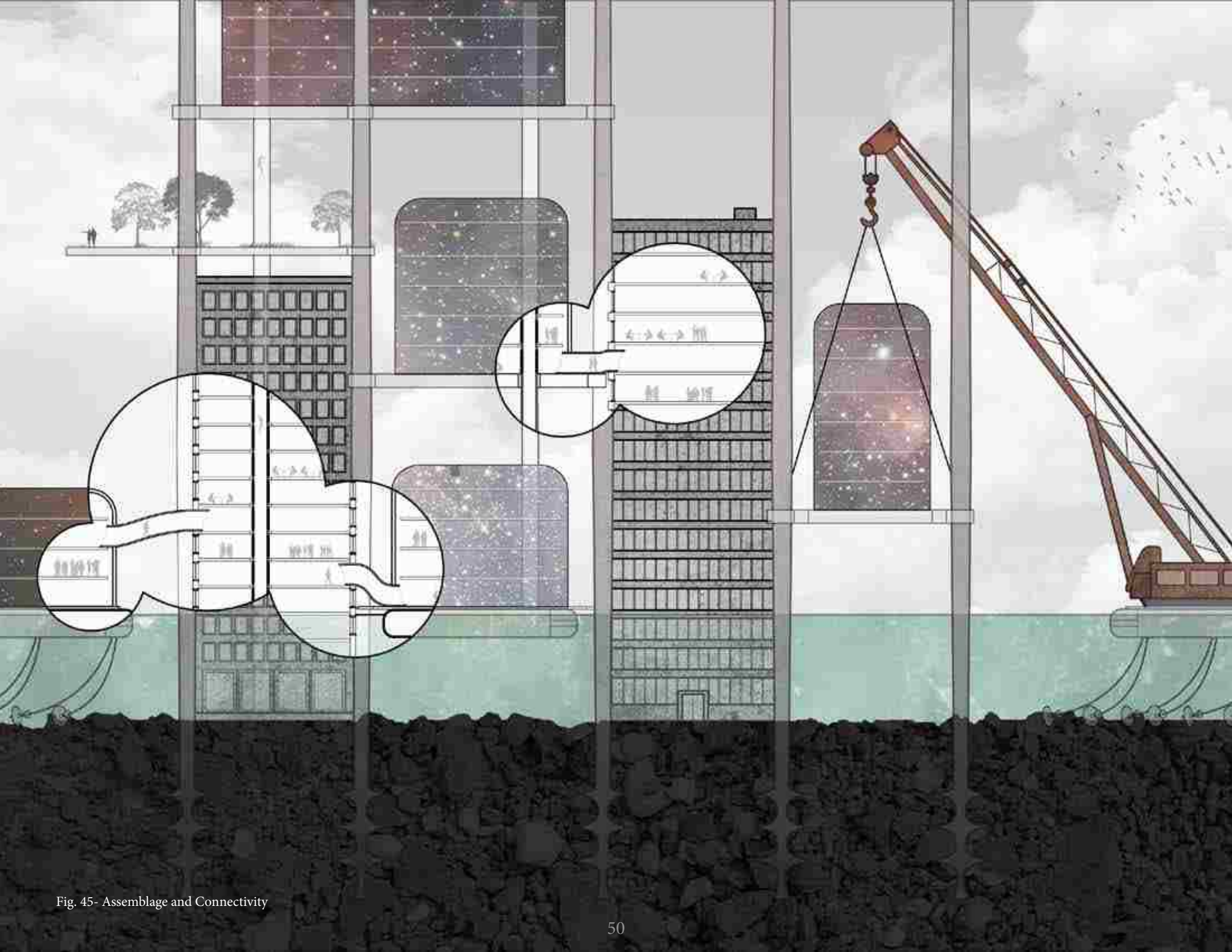

Fig. 45- Assemblage and Connectivity

The perceived character of the city can be understood as a field of floating spaces. Although height and placement of these spaces may be regulated, it is essential to understand that activating the use of vertical space within a city may drastically alter its current character by providing a greater depth of connectivity.

Unlike the contemporary city, these new buildings will not be anchored into the ground, but rather will utilize vertical and horizontal transit tubes to tether these spaces together. By allowing these transit tubes to move and attach to different areas of the city, the contemporary two dimension grid of the city becomes insufficient to handle the needs of movement throughout the urban environment. A single ground plane no longer exists as a maze of tubes and tunnels become standardized circulatory means.

Aspects of the historic city may remain if unaffected by the rising water level and new development. These historic buildings will be integrated into the new vision of the city as transportation tubes are attached at varying levels. The city will merge old with new and create a dynamic, three dimensional cityscape for the future residents of Seattle to inhabit.

Fig. 46- Floating Spaces

Life within the city will change, although the general character of downtown density will remain. However, in this proposal residents at higher levels will have the ability to move throughout the city without needing to travel down to a ground level. This will change how different uses of the city are organized. Parks may be connected to shops and restaurants on different planes, offices and residences can be directly adjoined. These new types of relationships will not only connect, but also divide parts of the city. Certain buildings may become inaccessible to the standard resident if required for security. Banks and laboratories may detach their transportation tunnels, inhibiting access by the public.

Accessibility may change throughout the day as well. During the day, transit tubes may connect businesses and residences while at night these tubes may concentrate in areas with entertainment and thriving night life. Tubes and tunnels may be rerouted if nessary to avoid situations like accidents and construction. This dynamic approach to circulation will allow the city to operate as a machine. Seattle will constantly adapt and change, keeping up with the needs of the residents and city itself.

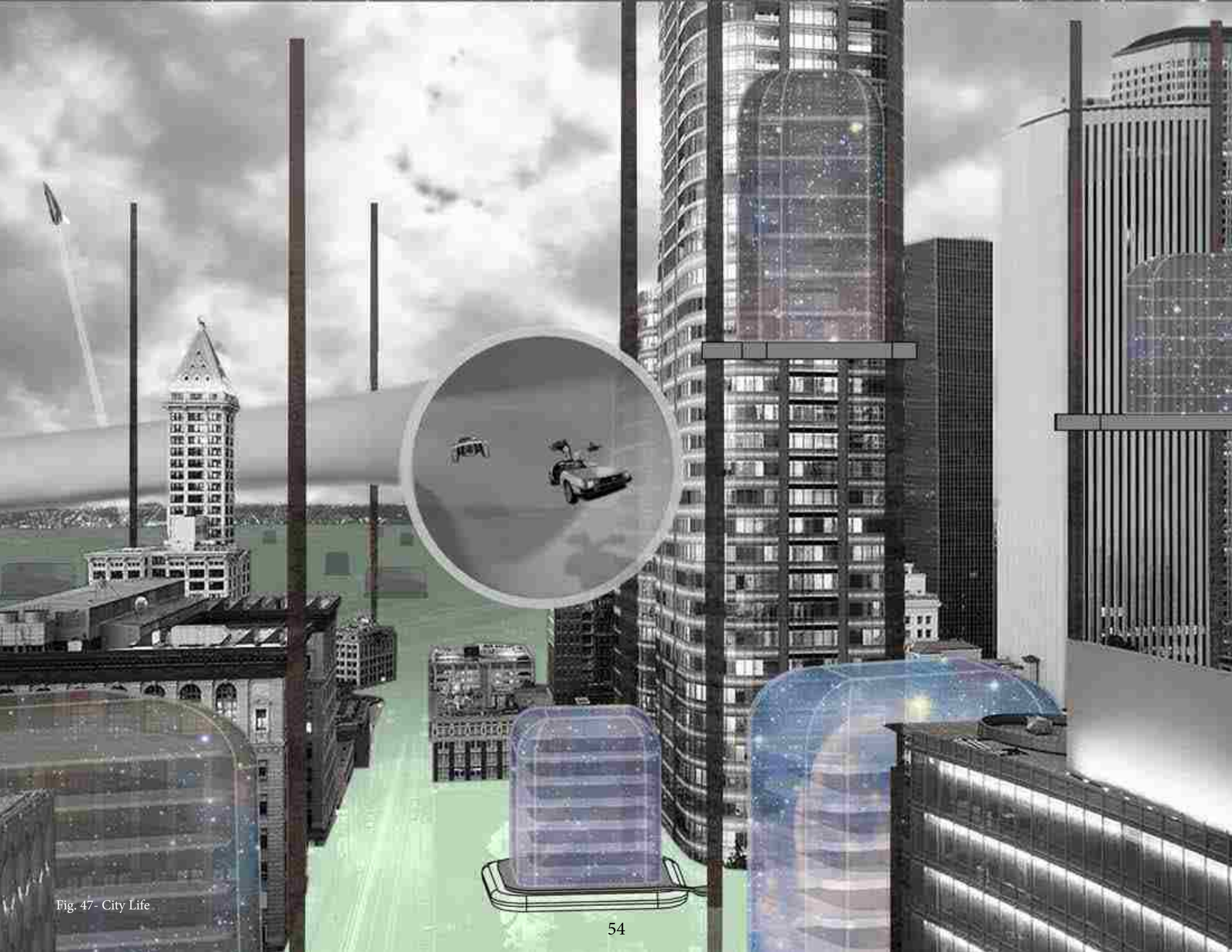

Fig. 47- City Life

REGULATED EXPANSION

The growth of the city may be regulated through typology zoning. This process would identify the need for permanence with certain programs and allow these essential functions to be tethered to the pylon infrastructure. This regulation could also hold greater socio-economic impact as well.

Closer to the city center, the pylon infrastructure would be abundant. In this area density would be most concentrated. Suspended buildings near the top of the pylons would be the most desirable as their views of the surrounding landscape remain unhindered. This is a similar condition we see today in Seattle as penthouses and high rises house more wealthy residents of the city. Average people would live in lower masses or be force out of the downtown district.

Further out from the city center, the pylon infrastructure will continue, spreading out into submerged SODO which is now apart of the Puget Sound. In these areas, pylons may be scarce, so the Floating-Tethered typology may be dominant. This typology maintains a level of permanence and alludes to an organizational strategy for community.

Beyond these pylons, the Floating-Anchored typology will be most abundant. These buildings float freely, anchored to the sea floor and allow for less zoning restrictions to apply. Here, lower income families may find haven and being to develop their own types of communities, freely moving around and reorganizing to suit their needs.

Fig. 48- Regulated Expansion

Chapter 6:

CONCLUSION

The future of Seattle continuation lies in the city's ability to adapt to factors such as rising tides and overpopulation. Such issues require a futurist approach to inspire realistic, practical solutions, to these problems. Much like the Metabolists and Archigram, we are faced with development that is short-sighted and does not address the growing needs of the built environment.

This thesis identifies these issues and proposes a fantastical solution. However, unlike the Metabolists and Archigram, the city is not viewed as a machine, but as an intergrated part in the natural environment by acknowledging the changing conditions of the site. By constructing a future Seattle within these void spaces: on the water, between and above existing buildings, the city can continue to thrive and change in all directions.

The notion that circulation through the city will exist on a single plane is outdated. New relationships between spaces will exist within a three dimensional gaze . The built environment will have much more influence on the daily lives of Seattle's citizens as this proposed intervention will be the driving force behind Seattle's growth and development. The city is unprepared for the future. This thesis proposes a future that allows Seattle to react and adapt to the stimuli acting upon it.

Through this design process it has become apparent that these interventions will have a drastic effect on the character of the city. Hilltops and solid ground foundations will only be affordable for the wealthy. The city will grow and spread into the Puget Sound as affordable space is needed. Low income areas will be reminiscent of Seattle's historic shanty towns as aquatic communities begin to form and develop. A new city will emerge from the water and become woven into Seattle like an appendage.

Through this research, it has become apparent that we can only speculate about the future, that there is so much out of our control that the only way to fathom its reality is to focus on small portions. These characteristics of a future city are derived from what we know now and what can be perceived to develop. However, there are certain realties that hold true such as climate change and overpopulation that begin to create the framework of the future. This proposal is not to find a single perfect solution, but rather to provoke a conversation about the future of Seattle and what solutions may be possible.

ENDNOTES

1. NASA. climate.nasa.gov pp. 2

2. NASA. climate.nasa.gov pp. 2

3. NASA. climate.nasa.gov pp. 3

4. Bottger, Matthias. Utopia Forever. pp. 61

5. Tompkins, Forbes. Rising Tides in the United States. pp. 2

6. Strauss, Dr. Benjamin. Puget Sound Epicenter of Sea Level Rise Exposure in Washington State pp.3

7. Strauss, Dr. Benjamin. Puget Sound Epicenter of Sea Level Rise Exposure in Washington State pp.4

8. Brownstone, Sydney. What Seattle Will Look Like After 2050. pp. 1

9. Seattle Office of Planning and Community Development. Population and Household Statistics pp. 3

10. Lindblom, Mike. Hwy 99 Tunnel would be Prepared for Potential Disasters pp.1

11. Lindblom, Mike. Hwy 99 Tunnel would be Prepared for Potential Disasters pp.2

12. O'Connor, Jennifer. Survey on Actual Service Lives for North American Buildings. pp. 12

13. Lin, Zhongjie. Kenzo Tange and the Metabolist Movement pp. 25

14. Lin, Zhongjie. Kenzo Tange and the Metabolist Movement pp. 26

15. Lin, Zhongjie. Kenzo Tange and the Metabolist Movement pp. 32

16. Soares, Ana. A Year in the Metabolist Future of 1972 pp. 2

17. Bottger, Matthias. Utopia Forever. pp. 62

18. Sadler, Simon. Archigram: Architecture Without Architecture. pp. 11

19. Mori Art Museum. Metabolism: The City of the Future. pp. 1

20. Cook, Peter. Archigram. pp. 7

21. Cook, Peter. Archigram. pp. 15

22. Cook, Peter. Archigram. pp. 16

23. Callebaut, Vincent. Lilypad. pp. 2

24. Callebaut, Vincent. Lilypad. pp. 2

25. Bottger, Matthias. Utopia Forever. pp. 62

FIGURES

1. Seattle Waterfront, 2037
2. SODO, 2217
3. Interbay and Magnolia, 4017
4. Glacial Melt vs. Flooding
5. Map of Seattle, 2217
6. Kenzo Tange and the Tokyo Bay Proposal
7. Tokyo 1960
8. Tower Shaped City, 1961
9. Nakagin Capsule Hotel Construction
10. Nakagin Capsule Hotel Drawings
11. Nakagin Capsule Hotel Interior
12. Members of Archigram
13. City of Archigram Projects
14. Page from Archigram Magazine
15. Kikutake Kiyonori Exhibiting his Work
16. Marine City Images
17. Marine City Model
18. Plug-In City Construction
19. Plug-In City Section
20. Building Life Span
21. Plug-In City Detail
22. Multiple Lilypad Iterations
23. Lilypad Perspective Elevation
24. Lilypads at Night
25. Z-Axis Investigation
26. Masses at Ground Level
27. Raised Masses
28. Floating Farms
29. Resin Detail
30. Tethered Infrastructure
31. Model Detail
32. Positive Voids
33. Floating Masses Detail
34. Interuppted Sprawl
35. Dynamic Infill
36. Vertical Field
37. Initial Design Concept
38. Typologies
39. Sprawl Phase One
40. Sprawl Phase Two
41. Sprawl Phase Three
42. Infill Phase One
43. Infill Phase Two
44. Infill Phase Three
45. Assemblage and Connectivity
46. Floating Spaces
47. City Life
48. Regulated Expansion

REFERENCES

Branum, Jamey and Jonmarc Ross. *Rising Tides*. Museum of the City. http://www.museumofthecity.org/project/rising-tides-and-sinking-cities/.

Bottger, Matthias. Utopia Forever: Visions of Architecture and Urbanism. Gestalten, 2011. pg. 61, 62.

Brownstone, Sydney. *What Seattle Will Look Like After 2050 If We Don't Get Real About Climate Change*. The Stranger. June 2015.

Callebaut, Vincent. *Lilypad*. http://vincent.callebaut.org/object/080523_lilypad/lilypad/projects.

Cook, Peter. Archigram. Studio Vista Publishers, London. 1972.

Lin, Zhongjie. Kenzo Tange and the Metabolist Movement: Urban Utopias of Modern Japan. Routledge, March 2010. pg. 70, 74.

Lindblom, Mike. http://www.seattletimes.com/seattle-news/hwy-99-tunnel-would-be-prepared-for-potential-disasters/. Seattle Times. Feb 12 2011.

Mori Art Museum. *Metabolism: The City of the Future*. 2012.

NASA. https://climate.nasa.gov/vital-signs/sea-level/. March 2017. Visited May2017.

O'Connor, Jennifer. *Survey on actual service lives for North American buildings*. Presented at Woodframe Housing Durability and Disaster Issues conference, Las Vegas, October 2004

Sadler, Simon. Archigram. Architecture Without Architecture. MIT Press, 2005. pg. 11

Seattle Office of Planning and Community Development. *Population and Household Statistics*. http://www.seattle.gov/opcd/population-and-demographics/about-seattle

Soares, Ana and Filipe Magalhaes. *A Year in the Metabolist Future of 1972*. https://www.failedarchitecture.com/nakagin/

Strauss, Dr. Benjamin. *Puget Sound Epicenter of Sea Level Rise Exposure in Washington State*. Climate Central. http://www.climatecentral.org/pdfs/SLR-WAPressRelease.pdf.

Tompkins, Forbes. *Rising Tides in the United States*. World Resources Institute. http://www.wri.org/sites/default/files/15_Info_Rising_Tides_0.png