Towards a Floating Urbanism: Adapting to Water as a New Ground

Chris Autera
Syracuse University

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TOWARDS A FLOATING URBANISM
Adapting to Water as a New Ground
CHRIS AUTERA
Towards A Floating Urbanism: Adapting to Water as a New Ground

Chris Autera

Syracuse Architecture Class of 2019 Undergraduate Thesis

Advisory Group: Alternative Urbanism (Professors Lawrence Chua, Lawrence Davis and Mitesh Dixit)

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cmautera@syr.edu

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Introduction

Climate change offers myriad challenges to society, including a rising sea level and increasingly intense storms. Resilience to climate change, particularly the reliance on hard barriers, only protects certain areas and raises the risk of catastrophic failure. More deeply, these approaches reflect an attempt to preserve society as it exists today, denying the reality that the multi-millennia process of climate change necessitates a more profound reevaluation of how society operates. Adaptation takes this need as a given, arguing for the retrofitting of infrastructure to regular inundation when possible and the abandonment of at-risk areas when not. However, these strategies are either expensive and technically difficult over the long term or massively disruptive to communities, deeming large stretches of the world’s most densely populated coasts ultimately uninhabitable. I propose a more flexible alternative, the development of a floating infrastructure, allowing for an ongoing habitation of coastal areas while adapting to the deluge of both temporary storm surge and the long-term rise in sea level over decades and centuries. This pragmatic adaptation posits the architectural and urban question of how to reconceptualize water as a new form of ground.

New York City is selected as an urban center that is highly shaped by its waterfront and nautical history, along with the relative scarcity of land to build on. The choice of selecting a city as a site reflects the larger need for shelter from the open ocean as well as the necessity, at least in its early development, of integrated economy and infrastructure between land city and water city.

Littoral cities such as Amsterdam or Venice are largely constructed around land reclamation, and thus face their own unique challenges from climate change. However, their intimate connection to water provide a historical analogue for a water centric urban design strategy. The Netherlands represents a society that is increasingly attempting to adapt to the natural transformations of a complex water system and the interconnectedness between the layers of built infrastructure networks and human habitation. Venice reflects a society deeply integrated with water across the levels of politics, culture and economics, replicating and transforming urban typologies typical to more conventional land cities.

Floating architecture, like ships, can be prefabricated in dry docks: this would potentially limit costs while removing size limits imposed by city streets. To counter this tendency to repetitive efficiency, the structures would implement a process of self-built incremental design superimposed on a prefabricated superstructure. This would also allow communities to better shape the built environment to their needs, developing a local sense of community and character for an otherwise new and artificial neighborhood.
Thesis Prep
Climate Change

Sea level rise and increased storm severity

1. Do Nothing

2. Mitigation:
   - Shrink global economy
   - Zero carbon energy transition
   - Develop carbon sinks
   - Geoengineering

3. Resilience:
   - Hard / Artificial Barrier
   - Soft / Ecological Barrier
   - Enhanced evacuation plans

4. Adaptation:
   - Retreat from coastal areas
   - Retrofit existing infrastructure
   - Floating infrastructure
Venice
(568 ce -)
LOCATION: Venetian Lagoon (Italy)
ELEVATION: 0 - 3 Feet
ENVIRONMENT: Sheltered Saltwater Bay
MATERIAL: Wooden Piles, Limestone, Brick
POPULATION: 260,897

Tenochtitlan
(1325 ce - 1521 ce)
LOCATION: Lake Texcoco (Mexico)
ELEVATION: 7,349 Feet
ENVIRONMENT: Brackish Inland Lake
MATERIAL: Mud Filled Woven reed and Stake Fences, Stone
POPULATION (1521): 200,000 - 300,000

Amsterdam
(1275 ce -)
LOCATION: Zuiderzee Bay, Ij and Amstel Rivers (Netherlands)
ELEVATION: -7 Feet
ENVIRONMENT: Mix of Freshwater Rivers and Brackish Wetlands, Freshwater Palders
MATERIAL: Mud Filled Woven Reed and Stake Fences, Stone
POPULATION (1521): 200,000 - 300,000

MS Harmony of the Seas
(2015)
LOCATION: 18.13775 N 64.53195 W
ELEVATION: 0 Feet
ENVIRONMENT: Open Ocean
MATERIAL: Steel
POPULATION: Crew: 2,300 Passenger: 6,780

Prelude Floating Natural Gas Platform (FLNG)
(2017)
LOCATION: 13° 47.2´S 123° 19.0´ E
ELEVATION: 0 Feet
ENVIRONMENT: Open Ocean
MATERIAL: Steel
POPULATION: 240

Caspian Offshore Accommodation Barge (Sea-500)
(2015)
LOCATION: Various
ELEVATION: 0 Feet
ENVIRONMENT: Open Ocean
MATERIAL: Steel
POPULATION: 353
San Francisco: Inhabiting the Quake

Plan for Tokyo Bay

Shard House, San Francisco: Inhabiting the Quake (Lebbeus Woods 1995)

LOCATION: San Francisco Bay, California
ELEVATION: sea level
MATERIAL: Scavanged steel and existing dock pilings

Lagos Shanty Megastructures

LOCATION: Lagos, Nigeria
ELEVATION: sea level
MATERIAL: Scavanged steel sheeting and existing urban fabric

Lagos Shanty Megastructures (Kenzo Tange 1960)

LOCATION: Tokyo, Japan
ELEVATION: sea level
MATERIAL: Steel Reinforced Concrete

Noah’s Ark

(Yahweh and Noah (Architect of Record) 4th Century BC)

LOCATION: Mount Ararat
ELEVATION: 16,854 ft
MATERIAL: Gopher Wood

Walking City

(Walking City (Ron Herron, 1964)

LOCATION: Global
ELEVATION: Global
MATERIAL: Steel

Periscoping access tubes allow entrance from ground level into host cities and other walking city modules.

Long steel legs and wheels allow for traversal of rugged terrain of post-apocalyptic land and sea.

Office blocks suspended from grounded concrete piers.

Large terraces provide public pedestrian space and room for raised vegetation.

Multilevel highways form the spine of the residential structures, interconnecting them to the larger urban context.

Gondolas provide an alternative to the interminable congestion of downtown Lagos surface traffic.

Raised pedestrian paths provide parks separated from ground level pollution and offer resilience to flooding.
Collage 1: Fortress New York
FORTRESS NEW YORK

A closed coast creates conditions for catastrophic failure. Combined with the failure to seriously mitigate climate change, both hard and soft resiliency will eventually become inadequate in the face of inexorably rising seas.

“Everyone thought it would happen gradually, and out in the boroughs it did. But they had built a surge wall about a hundred years before... You could lose your balance if you looked at both sides at once. It kind of made you sick to your stomach. Because the water was higher than the land... That day is why they’ll never polder the harbor. I don’t know why people even talk about that. Dam the Narrows and Hell Gate, pump the Hudson into the sea—it’s crazy. Something breaks and boom, it would all go under again. Including Brooklyn and Queens and the Bronx. I can’t even imagine how many people would get killed.”

-New York 2140

FLOAT BLOCK

Re-imagining Koolhaas’s New York for an aquatic future, the urban substrate of asphalt is replaced with water. This intensifies radical cross-pollination of contrasting adjacent programs.

“Manhattanism is the one urbanistic ideology that has fed, from its conception, on the splendors and miseries of the metropolitan condition - hyper-density - without once losing faith in it as the basis for a desirable modern culture. Manhattan’s architecture is a paradigm for the exploitation of congestion.”

-Delirious New York

INCREMEN-TAL PERFAB

Prefabrication fosters inexpensive mass produced floating architecture. The concept of incremental housing and bottom up design development allows for flexible use across regions, responding to the specific needs of its inhabitants and empowering communities to shape their built environment.

‘When dwellers control the major decisions and are free to make their own contribution to the design, construction or management of their housing, both the process and the environment produced stimulate individual and social well-being’.

-The Autonomous City


Picturesque Atlantis

“Sun blazed off canals and made the rank-and-file forest of buildings look like rows of standing stones in some half-sunk Avalon. Black pillars drowned to the knees, it was a surreal sight: there was no coming to terms with it, it never ceased to look bizarre, even though she had lived in it all her life. What a fate. A somewhat glorious fate.”

—New York 2140

Imagining Manhattan as a picturesque ruin, submerged by storms but now serene in its transformation. After all the devastation, its inhabitants sail the avenues of the same city, utterly changed.

Collage 5: Dry Dock
Collage 5: Dry Dock

Dry Dock

Le Corbusier emulation of the ocean liner is maximized, with Unité d’Habitation sited on a barge that can be towed by a tugboat. Realizing its goal of fulfilling modernist utility and universality.

Connected modules could form structure of very large area. Such constructions could help, perhaps in an overly literal sense, help transform the East River into the Central Park of the 21st Century.

Taller structures permanently moored, forming an extension of new urban landscape.

Kenzo Tange’s Plan for Tokyo Bay interweaves with the fabric of the Williamsburg Bridge. The suspension bridge naturally being one of the more resilient structures owing to its great height.

Repurposing of the Brooklyn Navy Yard from shipbuilding to the construction of floating architecture. The potential of prefabricated structure is unfettered from the size of a truck bed, only constrained by the width of a drydock and the height of the lowest bridge, it can be an apartment block or a city park.

The Egyptian Obelisk is one of the earliest examples of prefabricated architecture floated on water.

MVROV’s Silodam, already invoking the harbor character of the easily made shipping container, is reconstructed in a drydock, maximizing its prefabricated potential and nautical character.
Float In
Plug In

"Often likened to insects, these mobile pods would be able to roam the globe, containing all of the services they needed to survive, as well as the ability to plug in to the resources of whatever location they happened to be in. They could strike out on their own or combine and recombine with other pod cities in an endless game of musical chairs of place and community... it could be anything that was needed. It could walk itself to a rural area if safety and distance were called for, it could combine with other walking pods and form larger communities, or, it could even join up with a major metropolis."

-Allison McNearney

With water as the new ground, architecture is no longer constrained to a static location. With this flexibility, architecture can better serve the particular needs of coastal areas around the world: whether a temporary event space or a permanent augmentation to existing infrastructure. The unlocking of new Real Estate provides flexibility to cities with scarce land available.

Thesis
Site Analysis: 10 Foot Zones and Bathymetry

- 0' Mean Low Water Level
- -10' to -20'
- -30'
- +10'

The Big West 57th Street
East 42nd Street
Brooklyn Bridge (127')
Manhattan Bridge (134')
Williamsburg Bridge (133')
Queensboro Bridge (131')
RFK Bridge (138')
Hell Gate Bridge (134')
Roosevelt Island Bridge (40 - 99')
Wards Bridge (55-136')
TriBoro Bridge (54-136')
Willis Avenue Bridge (25+')
3rd Avenue Bridge (27+')
Park Avenue Bridge (25 - 135')
Madison Avenue Bridge (25+')
145th Street Bridge (30+')
Kisker Island Bridge (52')

East River
Harlem River
East River
Newtown Creek
Pulaski Bridge (39')
Greenpoint Bridge (30')
Kosciusko Bridge (125')
Hudson River
Hudson Bay

Bathymetry and Bridge information based on NOAA Office of Coast Survey
Flood projections based on Surging Seas Risk Zone Map
Site Analysis: 10 Foot Zones and Bathymetry

0' Mean Low Water Level
-10'
-20'
-30'
+10'

The Big U
West 57th Street
East 42nd Street
Brooklyn Bridge (127')
Manhattan Bridge (134')
Williamsburg Bridge (133')
Queensboro Bridge (131')
RFK Bridge (138')
Hell Gate Bridge (134')
Roosevelt Island Bridge (40-99')
Wards Bridge (55-136')
TriBoro Bridge (54-136')
Wellesley Avenue Bridge (25+')
3rd Avenue Bridge (27+')
Park Avenue Bridge (25-135')
Madison Avenue Bridge (25+')
145th Street Bridge (30+')

Flood Projections based on Surging Seas Risk Zone Map
Site Analysis: Potential Sites and East River Bridge Analyses

Lawrence Point:
Heavy Industry / Light Industry / Residential

East Harlem:
Residential / Commercial / Transportation

Hunter's Point:
Light Industry / Heavy Industry / Residential / Parkland

Brooklyn Navy Yard:
Heavy Industry / Light Industry / Residential / Parkland

Minimum Channel Depth: 15'

Bridge Clearance along East and Harlem Rivers

Bridge Clearances:
- Williamsburg Bridge
- Pulaski Bridge
- Greenpoint Avenue Bridge

Site Analysis: Potential Sites and East River Bridge Analyses
Financial District

Movable barriers convert streets to pedestrian zones while allowing access for delivery vehicles.

Corner tower massing helps formally define city block bounding box.

Monolithic block massing versus fragmented infill.

Semi-Public
Semi-Private

Alcoves provide transitional space from public to communal and communal to private.

Commercial massing hold the corners of residential blocks.

Multiple levels provide dynamic rhythm to street front. Raised Landing

Full Stoop
Depressed Landing

Stoop acts as collective urban porch and helps provide “Eyes on the street”.

Towers anchor block corners with low-rise midblock infill.

Large office towers combined with smaller residential and commercial infill fabric.

Commercial meaning hold the corners of residential blocks.

Commercial provide transitional space from public to commercial and communal to private.

Multiple levels provide dynamic rhythm to street front.

Precedent Analysis: New York City Block Typology Analysis
Linear residential and industrial fabric along urban infrastructure spine.

Houseboats encrusted along urban block edge.

Narrow lot width maximizes individual access to waterfront.

Elevated block corners raise bridge spans to allow boat traffic while facilitating water access at mid-block.

Monumental public square framed by interplay of commercial, private and cultural institutions.

Uniform screen applies order to varied massing of offices, shops and cultural institutions.

Constricted alleys provide sense of communal privacy to ostensibly public pathways.

Engagement with waterfront along public / private / and semi-public spaces.

1. Inner Residential courtyard
2. Outer Ferry Courtyard
3. Ferry Pier

Footbridge as active surface for civic and commercial activities.

Precedent Analysis: European City Block Typology Analysis
Historic Aquatic Precedents

**MS KINGSHOLM**
- Built: 1928
- Designed by: Blohm + Voss
- 1428 Passengers

**Unité d’Habitation**
- Designed by: Le Corbusier
- Built: 1952
- Location: Marseille, France
- 1600 Residents

**Triton City**
- Designed by: Buckminster Fuller
- Built: 1960s
- Location: Tokyo Bay, Japan
- 5000 Residents

**New Grounds**

**Vernacular Translation**

**Module**

**Cell Biology** Parasitic Module Core and Branch

**Historic Aquatic Precedents**

**International Modernism**

**Metabolism**

**Historic Japanese Idioms**

**Land Scarcity**

**Tsunamis**

**Earthquake**

**Fire and Atomic Bombings**

**Ecological Preservation**

**Historic Japanese Challenges**

**Detach From Ground:**
- Into the Sea
- Into the Air

**Detach From Ground:**
- Into the Sea
- Into the Air
Float Block: Micro Design Precedents
Float Block: 1. Transverse Section 2. Residential Unit 3. Micro Urban Condition
Floatblock: Incremental Development of Atriums

INDUSTRIAL

CARNIVAL

FOREST

ART HOUSE
Urban Design Callouts: 1. Interblock Connections 2. Connection to Dryline 3. Connection Flooded District
Urban Design: Looking southeast towards Brooklyn
Urban Design: Looking west towards Manhattan
Urban Design: Looking west towards Manhattan
- The project was presented as a narrow snapshot of floating urbanism at a “mature” development level, alternatively:
  1. How could origins have been explored more, i.e., Dry-dock construction system, initial implementation and relationship to coastline, transition pre and post major flooding.
  2. More interestingly, what does floating urbanism look like over multiple human generations (or building module generations, how are they decommissioned? Artificial reefs, permanently docked, continuously patched? What’s the life span of a float block?) How long until habitation of artificial ground becomes socially “normal” for its tenets.

- To what degree must these structures that act as both singular discreet architecture and plural blended urbanism cater to the heightened fragility of inhabitants? Is this fragility heightened by the chaotic impact of severe climate change?

- What about leaving NYC, or even just moving up or down the east River? How do blocks rearrange over time?

- How would more specialized floating cultural institutions develop? I.e. theatre districts, art museums etc.

- How do blocks form individual identities communal identities? What is the value of inter block rivalries vs. the necessity of large scale rivalries? Should each block be self sufficient or interdependent because of the distribution of essential infrastructure? How does the design of inter-block connection facilitate these relationships?

- How does this subvert earlier relationships to parkland and water in the 19th and 20th century?
References:


Purdy, Jedediah. “*The Unequal Distribution of Catastrophe in North Carolina.*” The New Yorker, September 18, 2018.

