REVITALIZING WATERFRONT: The Sinking City

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REVITALIZING WATERFRONT: THE SINKING CITY

CLIFFORD SHIH

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SYRACUSE UNIVERSITY SCHOOL OF ARCHITECTURE
In 2000, our family moved to Shanghai. During the period, Shanghai was experiencing the rapid development of economics, and this also reflects on its architecture development as well. I remember my parents would take me to the Bund to view the night scenes of Lujiazui from across the Huanpu River. On the same side of the river, 52 buildings of various architectural styles such as Romanesque, Gothic, Renaissance, Baroque, Neo-Classical, Beaux-Arts, and Art Deco, built alongside and created a sophisticated architecture atmosphere. We walked along the riverside and enjoyed the highly contradiction of old city and the new city. We took the sightseeing cruise to experience the interaction with water, at that time, we could see fishing vessels fishing and cargo ships sailed along the river.
In 2012, our family has resided in Shanghai for 12 years. In this twelve years, Shanghai has experienced a rapid development of industrialization, urbanization, and economical. But this has influence the Bund. The old riverfront no longer exist; instead, the government has to build an embankment along the riverside for the consequence of rapid development. Lujiazui; on the other hand, continues to build super skyscrapers. The future tallest building, the Shanghai Tower, has cracked the surrounding surfaces. Nevertheless, sightseeing cruises and cargo vessels sail along the Huangpu River, but the fishing boats disappear. Suddenly, I question myself, where is the Shanghai I used to know?
Eco-Urbanism is a transformative style of development that will allow cities to continue to grow economically while quite literally transcending environmental constraints, obviating the need for wider societal change.

Mike Hodson & Simon Marvin
Transcendant Eco-cities or Urban Ecological Security?
Glossary

Waterfront: An area of that is next to a river, lake, or the sea. This area can usually be public space, commercial space, or residential space.

Urbanism: The process that drives people to live in cities. Cities are defined by their size, and the existence of a series of complexity traits, including such things as a central administration or government, and the segregation of people by class and/or occupation.

Ecology: The study of the detrimental effects of modern civilization on the environment, with a view toward prevention or reversal through conservation.

The Bund: A waterfront area in central Shanghai, The Bund usually refers to the buildings and wharves on this section of the road, as well as some adjacent areas. It is one of the most famous tourist destinations in Shanghai.

Biomimicry: Biomimicry is the examination of nature, its models, systems, processes, and elements to emulate or take inspiration from in order to solve human problems.

Yangtze River Delta: located in the mouth of Yangtze River, is mainly formed by the two provinces, Jiangsu and Zhejiang and the city, Shanghai.

Industrialization: a period of social and economic change that transforms a human group from an agrarian society into an industrial one. It is a part of a wider modernisation process, where social change and economic development are closely related with technological innovation.

Skyscraper: a tall, continuously habitable building of many storeys, usually designed for office and commercial use.

Underground Aquifers: an underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, or silt) from which groundwater can be extracted using a water well.
Ecological Urbanism proposes to multiply the available lines of thought on the contemporary city to include environmental and ecological concepts, while expanding traditional disciplinary and professional frameworks for describing those urban conditions.

Charles Waldheim
landscape, ecology, and other modifiers to urbanism

Ecological Urbanism is the complementary to the future urban space on the current urban condition.
Shanghai

Area: 6,219 km² (0.064% of China)
Population: 23,474,600 people
Density: 3,775 people/km²

1. Huangpu
2. Luwan
3. Xuhui
4. Changnin
5. Jing’an
6. Putuo
7. Zhabei
8. Hongkou
9. Yangpu
REVITALIZING WATERFRONT

- Transformation of the relation of Shanghai and waterfront

Clifford Shih

Primary Advisor: Julie Larson

Secondary Advisor: Yutaka Sho
Project Location

The project locates next to the Shanghai bund, in which built to prevent water flooded into the city, functions as an embankment. The project tends to propose a new method to solve the issue of water while maintain interaction with water.

Program

The programs of the project consist a water treatment plant, a port terminal, and a public space. Starting with three buildings that accommodate the programs, yet each programs require more space than a level. As a result, more programs are designed to be underground so that the project wouldn’t become a boundary between urban space and water space.
The project uses a designed module with its repetition and stacking forming the structure, this structure serves as the facade, and circulation as well.

Carving out the roof, the original box form of the project was subtracted by the spheres in order to fit with the site for the sunlight, and introducing the skylight into the project.
The entrance and exit was clearly designed to fit with the module structure so that when entering or exiting the project, people are always walking in or out to the carved-out space.

One of the main goals in this project was to clean the water from Huangpu River, and send the clean water down to underground aquifers. After the filtration process, water is sent to the aquifers from water holes. These water holes also function as vertical circulation.
Program Break Down

Even though the programs were defined on the upper level, when they go to underground level (B1, B2) these programs connect.

Water Circulation

The water movement in Huangpu River runs from South to North; therefore, the water pump stations are set to be at the South and the highest level. With the gravity force, the water filtration process are designed to flow from ground level into underground level.
B2 Floor Plan
Section A

1’ = 1 / 8”
Section C
Taking from the basic module with repeating on the x and y axes. We get the structure that creating floor plates as well as supporting structure for the architecture. Then we duplicate the modules to z axis in order to reinforce the vertical structure. This structure also supporting the roof; therefore, the entire project are set to be one system of structure that supporting the project.
Module as Facade
Module as Water Tank

Water Tank in the project

Water Tank in relation to module

Water Tank’s position on the module
Module as Circulation
View along Street
View to the Opening Structure
View to the Restaurant
View to the Cruise Terminal
View to the Water Treatment Plant
# TABLE OF CONTENTS

1. INTRODUCTION
   - Page 1

2. ABSTRACT
   - Page 11

3. THE CITY ABOVE THE SEA
   - Page 15

4. RADIOLARIAN
   - Page 31

5. WATER DEFICIENCY
   - Page 39

6. SOARED SINKAGE
   - Page 45

7. GLOBAL WARMING
   - Page 55

8. PRECEDENCE STUDY
   - Page 61

9. BIBIOGRAPHY
   - Page 71
Ecology

Water

Strategy Biomimetic Design

Underground Aquifers

Urban Foundation

Sea Level Rises

Ecological Urbanism
The effects of transitional water ecological situations are radically changing the way Shanghai is living. The realities of water used to be the gestation of Chinese civilization has now proved to be a threat to Shanghai. The project aims to solve the artificial waterfront development in a biomimetic way that will impact the waterfront in a natural manner. The study of this biomimetic strategy will be conceptualize and abstracted based on radiolarian, a organism of amoeboid protozoa, into an analytical study of a natural system to rethink filtrating, structuring, and spatial method on purpose of perceiving the waterfront condition.

I contend that the urban waterfronts are the places where water conflict and crises have manifested in the most cogent and attainable form. By examining and analyzing waterfront conditions, one can realize its interrelation at a local and urban condition, enabling artificial and natural forces to manifest the threat of sinking city.

A waterfront condition at the Bund, the edge of Huangpu River, Shanghai, China has manifested the sinking of Shanghai. As the process of soaring water and sinking city sprawls, the submergence deviates the spatial and structural conditions of the Bund and surrounding waterfront condition. Shanghai is strongly bond with Huangpu River. The city itself is formed by the Yangtze River, to the civilization lives near the river, to the occupying by West; nonetheless, to the most occupied ports in China. Though water is critical to Shanghai’s development, Shanghai is sinking. In reality, Shanghai is the fourth city that in the danger of sinking.

Looking through the lens of Shanghai sinking, one has an opportunity to reconsider urban development and discover a new method to react to the problem. Cities are the origins of global warming, impact on the environment, pollution, and energy, they’re all the problems that are confronted by having cities.
The two primary forces that cause the sinking are urbanization and industrialization. The government guzzles water from underground aquifers and the growth of the skyscrapers has increased the weight of the city. The underground aquifers are being use primary for the urban industrialization. On the other hand, after 1990s, Shanghai has experienced the rapid development of urbanization, which also thrusts the architecture to its limit. Skyscrapers densely spread out the entire city. While Shanghai is situated on a soft-soil based land, the skyscrapers has pressured the city downward.

Additionally, ports are paradigms for understanding the relationship between the city and the Huangpu River. Huangpu River used to be the heart of fishing vessels; however, the industrialization of the urban has replaced the cargo ships to the vessels. Currently, Shanghai has the busiest containers port. In addition, there are numerous small ports that house the cruises. Yet these ports are sightseeing purpose over traffic infrastructure.

Lastly, the severeness of water pollution has been widely known in China. Two third of China’s six sixty-two cities have a shortage of water; three fourth of the nation water is polluted; one third of the people is drinking polluted water. A study on the filtration water from the Huangpu river while these filtrated water can be used to recharge the underground aquifers.

The existing waterfront condition presents a separation between the water and urban. I propose this separation between the water and urban is an interacted space of urban and water. Waterfront constructed in this way protects the city from floating, yet a solution of creating a public space, ports, and water filtration facility will blend the separated condition. Thus, architecture exemplifies a vehicle to constitute physical and visual connection for dichotomy edge created by the waterfront in a rapid stratified urbanization and industrialization.
PROJECT FLOW

TRANSLATE

ORGIN

ISSUE

URBANIZATION

SKYSCRAPER

INDUSTRIALIZATION

UNDERGROUND AQUIFERS

CAUSE

SEA LEVEL RISES

EMBANKMENT

WATERFRONT

PORTS

INFLUENCE

WATER FILTRATION

PUBLIC SPACE
According to the Oxford American Dictionary of Current English in English Dictionaries and Thesauruses, waterfront is “the part of a town or city adjoining a river, lake, harbor, etc.”

Many coastal and riparian human settlements owe their origin and prosperity to water transport and trade. From ancient times until recent decades, such urban settlements and their ports were commonly intimately related in both functional and spatial terms.

Waterfront is a space transition, functioning as a connection or separation or metaphorically waterfront is a boundary. Waterfront is lying within one’s ideology, often resulting with the creation of a physical barrier.

The word ‘waterfront’ has been used in many places without an evident definition, probably because the authors assume that the meaning of the word itself is clear – that is, the land fronting on the water. At the same time, several other terms are used in place of ‘waterfront’ to refer to all or part of this particular region. Such terms include city port, harborfront and river edge.

On the other hand, United States federal Coastal Zone Management Act gave a much clear definition. The CZMA defines the term urban waterfront or port as: “any developed area that is densely populated and is being used for, or has been used for, urban residential, recreational, commercial, shipping, or industrial purposes”.

The extent of waterfront districts may be self-evident because they are contained between reaches of relatively homogeneous land uses, such as housing, large-scale industrial plants or waterfront parks. In other cases, the boundaries may be vague, particularly where long reaches of industrial waterfront have been abandoned and only a small part abuts a commercial centre or residential neighborhood, which might form the nucleus for revitalization planning efforts.
THE CITY ABOVE THE WATER

- History of Shanghai
The two Chinese characters in the city’s name are ‘上’ (“above”) and ‘海’ (“sea”), together meaning “above the sea”. The first discovery of the name came around the Song Dynasty at 1000’s, at which time there was already a river convergence and a town with this name in the area. There are disputes as to exactly how the name should be interpreted, yet the historians of Chinese history have discovered that Shanghai was truly on the sea; consequently the origin of the name, during the Tang Dynasty.

“Shanghai is a developing international city where East meet West; a meeting ground where the juxtaposition of different religious beliefs, life styles, languages, and architectural styles forms the city’s main characteristic.”

--- Liu Yuxing, Kang Man
Waterfront public space is created and used by people. Human being is the main role in such a space. It is the interaction of people with this immediate environment that gives it characteristics distinct from those of the surrounding areas. Physical forms of city, including man-made elements such as architectures, streets, plazas, to natural elements such as greenery, water-body, mountain, etc. provide places and settings for interactions in an urban spatial environment. Simultaneously, the various regulations, customs, historic heritage, cultural traditions that exist in a city together with modern technology compose the spiritual backgrounds of urban environment.

The role of waterfront has changed with the passage of time. Once, the waterfront had been the centre of urban life, it then lost its predominance, and now it is taken away from industries and returned back to the people. In retrospect to the main changes of waterfront in city centre, it is concluded that social-economic factors together with technological-industrial factors make and accelerate the process.

Society and Economics

The first transition came about with social and economic development. The enlargement of urban scale is the direct effect of population growth and economy increment. When cities were still small, the waterfront had a major role to play in industrial production, daily life and day to day running of the city. However, with the expansion of the region, economy and population, the centre of city may be moved further inland. In each city, the waterfront was the different demesne of land use; in cities such as London, it was the administrative bodies in some part; in Tokyo, it was mainly production industries and in Barcelona it was in some waterfronts which people used in their everyday lives.


--- Lynch Kevin
**Transportation**

The second transition occurred along with reforms in transportation techniques. At the time when the only method of transportation over land was to use animals, water transport maintained its supremacy over all other types. However, the appearance of railroading the 19th century, followed by motor cars at the beginning of the 20th century, brought about a relative decline in the authority of water transportation and the priority of the waterfront, which at that time gave to production activities. Then with the appearance of the airplane on the transport scene in the middle of this century, this decline became even more marked. Another important technological and logistical changes are the increase in vessel size and the development of new cargo handling methods in the past 30 years, which led to the abandoned of small ports and the building of large modern ports with very deep harbors.

**Industrialization**

The third change was brought about with transitions in the industry itself. The key form of industry moved away from iron and steel or chemical industries, which rely on the existence of a seaport or harbor of some kind, towards electrical and machine industries which can be located near land ports and interchanges of motorways or railroads. Moreover, with the profitable electronics industry taking a prominent positioning industry as a whole, the preferred location for an industrial centre of such a nature was in the vicinity of an airport. As a result, the role which the waterfront played in the city was compelled to change.
China, in the history of the five-thousand-year development, the civilization is bred by the three rivers to originate, the Huang River, the Yangtze River, and the Pearl River. The three rivers formed the river deltas, and these three deltas become the financial center of Chinese economics development.

The river deltas formed at the mouth of each river, where the river flows into a sea. Deltas are formed from the deposition of the residue carried by the river as the flow leaves the mouth of the river.
Yangtze River Delta, located in the mouth of Yangtze River, is mainly formed by the two provinces, Jiangsu and Zhejiang, and the city, Shanghai. The Yangtze Delta has a marine monsoon subtropical climate, with hot and humid summers, cool and dry winters, and warm spring and fall. Winter temperatures can drop as low as -10°C (a record), however, and even in springtime, large temperature fluctuations can occur.
In 1850, most of the development in Shanghai exists in the heart of city and along the water. Few towns exist in the suburban area.

In 1910, the treaty of Nanjing opened up the port of Shanghai, Western development took over the waterfront area. After the invasion of West, rural moved to urban, especially to the waterfront.

In 1990, the development of the Puxi, western part of Shanghai city, had been too crowded; as a result, the development started to move to Pudong.

In 2010, Puxi and Pudong both develop to near its limit, the development started to spread out along the river.
Before 1843, the Bund was still a piece of island.

The Bund, in the 1880s, the old trackers’ road had turned into a broad boulevard. Despite the traditional Chinese architecture, the western style house towered along the roadside.

Art Deco style architecture started to appear on the Bund in 1910s; hence, started on the Bund the construction of the “World’s Architecture Exhibition.”

The Bund in the 2005, the thread of sea level rise up and the sinking of Shanghai caused the waterfront to be built into an embankment; however, the linkage between the water and the urban has broken.

RELATIONSHIP TO WATERFRONT

THE CHANGE OF WATERFRONT CONDITION
Site Plan: Shanghai

The current condition of waterfront

Section A
Section B
Section C
Section D
The Bund is one of the most recognizable architectural symbols of Shanghai. The word 'bund' derives from an Anglo-Indian word for an embankment along a muddy waterfront and that is what it was in the beginning. When the first British company opened an office there in 1846, the bund became the epitome of elegance during Shanghai’s history as a city of trade. Now many attractive new constructions have been erected in addition to the historical buildings. A 771-metre long retaining wall for flood control was built in the bund, paved with colorful tiles and dotted with flower beds and European-style garden lights. Atop the wall is a spacious walkway for sightseeing. It is a good place for a leisurely stroll and a view of the Huangpu River.

The Bund, which extends from Jinling Road in the south to the Waibaidu Bridge over the Suzhou Creek in the north, is on the western bank of the 114 kilometer long Huangpu River, a tributary of the Yangtze River.

Society and Economics

The stretch along Shanghai’s Huangpu River was a major trading port during the 19th century that later developed into an important East Asian financial hub. Extensive foreign investment from France, England, and the United States led to the creation of a row of grand, Western-style buildings along the embankment, mostly trading or banking houses that reflect a myriad of architectural designs, from baroque to art deco. The riverfront stretch is one of Shanghai’s most popular tourist attractions and looks directly onto the Pudong, the city’s new thriving, ultramodern financial heart, which includes several of the world’s tallest buildings, including the Shanghai World Financial Center, and Jin Mao Tower.

“Shanghai will be to the 21st century what New York was to the 20th century. It’s really emerging as one of the most important urban concentrations in the world — as a financial center, as a business center, as a cultural center. So, to be able to participate in the transformation of one of its most important historic sections is certainly a great challenge and a desirable role to play.”

--- Alex Krieger
Current Condition

The current Shanghai Bund is designed by the CKS Architects, which the architects proposed a connection between the old and the new Shanghai. On the Puxi side, you have 1930s banks and institutional buildings. On the Pudong side, you have 21st century skyscrapers. A promenade atop a levee and 10-lane highway separates the riverfront from the city; the city’s effort to relocate the highway underground provided the opportunity for the redevelopment. The project also proposes connections between the existing promenade, the city, and the waterfront through bridges, landscaping, and a new boulevard with a wide median. Reducing on-grade traffic to four lanes will create a better pedestrian experience. Aesthetically deficient underpasses will be replaced by more urbane street crossings along the boulevard.
SITE ANALYSIS

SHIPS LOCATION

TRAFFIC TO CROSS RIVER

- Cargo Ships
- Cruises
- Fishing Vessels
- City Metro System
- Underwater Tunnel
- Sightseeing Tunnel
SITE ANALYSIS

PUBLIC SPACE

WORLD’S ARCHITECTURE EXHIBITION

- Public Space
- The Bund Architecture
Old Walled City

Skyscraper

Old Walled City

Skyscraper > 250’
BIOMIMETIC SOLUTION
- RADIOLARIAN
The field of architecture is at a critical point in history with regards to reducing its impact on the natural environment. To truly minimize a building’s impact it needs to interact more holistically with its surroundings instead of just singular fixes that focus on one issue like less pollution. The lessons learned from natural ecology can be functional to architecture to lessen its environmental impact, and the critical point is how could the significant development of the modern technology help to construct an architecture that will behave like an natural object.

“Biomimicry design methodology can serve as a guide to help innovators use biomimicry to biologize a challenge, query the natural world for inspiration, then evaluate to ensure that the final design mimics nature at all levels—form, process, and ecosystem.”

---Biomimicry Institute

ANTONI GAUDI’S SAGRADA FAMILIA

RADIOLARIAN
DESIGN STRATEGY

DESIGN VEHICLE

PROBLEM

METHODOLOGY

SOLUTION

POLLUTION

FILTRATION

FILTRATION

FOUNDATION

STRUCTURAL SYSTEM

ADAPTION

SPATIAL RELATIONSHIP

INNER & OUTER CELLS

SPACE ORGANIZATION
Radiolarians are amoeboid protozoa that produce intricate mineral skeletons, typically with a central capsule dividing the cell into inner and outer portions, called endoplasm and ectoplasm. They are found as zooplankton throughout the ocean, and their skeletal remains cover large portions of the ocean bottom as radiolarian ooze. The size of a radiolarian is quite small, 0.1mm -0.2 mm.

The skeletal part supports the cell body of the radiolarian and protects the central capsule. The skeleton provides the organism with a relatively large volume to protect it against predators. In order to reduce the energy needed to move in the water, the density of the complete organism is optimized to be approximately the same as the density of the water surrounding it.

Density of water

\[+80 \, ^\circ F = 0.996 \, \text{g/cm}^3\]
\[+40 \, ^\circ F = 1 \, \text{g/cm}^3\]
\[+32 \, ^\circ F = 0.999 \, \text{g/cm}^3\]
**Depiction**

**Radiolarian**

**Envelop**

Shape, function, context response, energy performance, structure, filtration, physical protection, boundary

**Facade**

Frontality, face, orientation, repetition, decorated, patterns, composition, representation

**Skin**

Materiality, patterns, transparency, opacity, skeleton, density, layer

**Surface**

Hierarchy, scale, articulation, continuity, geometry, intelligence, Dynamic,
Analysis

Problem: Boundary

Current Condition

Proposed Solution
The design strategy of the project which adopts the study of radiolarians then the design aims to solve the current site issue that how to create a hybrid space in between the artificial urban space and the natural Huangpu River. The characteristic of radiolarians which contain of inner and outer cells and several spines grow on the inner cell. The idea of how to biomimetic not only the shape but also the function of the radiolarians become the primary starting point.
STURCTURE ANALYSIS
WATER DEFICIENCY
- Underground Aquifers
Even though water has always been the leading force of the development of China, water has turned into a threat. Based on the statistics from World Resources Institute, of the 640 major cities in China, more than 420 cities face water shortages. Of the 1,500 rivers, 75% of the rivers are polluted, of the 1.3 billions of population, 1/3 of the citizens are drinking polluted water. Besides the issue with polluted water, the shortage of underground aquifiers is another critical issue as well. Underground Aquifers in China is being used primary for 1) agriculture and commercial (70%), 2) industry (20%), and lastly 3) domestic uses. (10%) Beijing’s Geological Environmental Monitoring Institute

Water is life’s mater and matrix, mother and medium. There is no life without water.

--- Albert Szent-Gyorgyi
GLOBAL WATER SITUATION

ACCESS TO WATER AND SANITATION

WATER USAGE

USA Canada 90%
Australia Japan 80%
Russia 70%
Mexico 60%
Brazil 50%
China 35%
India 30%
Ethiopia 15%

China 21%
India 19%
Brazil 15%
USA 8%
Mexico 7%
Italy 6%
France 5%
Germany 4%
Thailand 4%
No country in history has emerged as a major industrial power without creating a legacy of environmental damage that can take decades and big dollops of public wealth to undo.

But just as the speed and scale of China’s rise as an economic power have no clear parallel in history, so its pollution problem has shattered all precedents. Environmental degradation is now so severe, with such stark domestic and international repercussions, that pollution poses not only a major long-term burden on the Chinese public but also an acute political challenge to the ruling Communist Party.

Public health is reeling. Pollution has made cancer China’s leading cause of death, the Ministry of Health says. Ambient air pollution alone is blamed for hundreds of thousands of deaths each year. Nearly 500 million people lack access to safe drinking water.
WATER FILTRATION

ACTIVE STRATEGY

Pros
- Low construction cost
- Occupies small area
- Relatively low odor
- Removes a high percent of BOD

Cons
- High operating cost (air pumps)
- High energy expenses for oxygen demand

PASSIVE STRATEGY

Pros
- Inexpensive to construct and operate
- Tolerate both great and small volumes of water
- Effective, reliable and ecologically sound
- Provide habitat for wildlife

Cons
- Require a larger land area
- If improperly designed and implemented, expose the odor of the waste stream
HYBRID STRATEGY

PRE AND PRIMARY TREATMENT: ACTIVE SYSTEM
SECONDARY TREATMENT: PASSIVE SYSTEM
SOARED SINKAGE
- URBAN STRUCTURE
SECTION 5

After the First Opium War in 1842, Chinese surrendered and signed the Treaty of Nanking. The government opened the five ports/cities along the coast, Shanghai, Canton, Ningpo, Fuchow, and Amoy. After the port opening, Shanghai began its industrialization, and this led to Shanghai’s urbanization.

During this period of industrialization, most of the development happened along the waterfront of city center - Puxi. The industrialization is not the only Western influences, the style of Art Deco heavily impact the traditional Shanghaiese architecture, linong and shikumen, as well. More and more high rise buildings were built, yet the rapid development of skyscraper won’t come in until the 1990s. However, as the city passionate builds numerous skyscrapers, city itself hasn’t realized the consequence.

“IN THE PAST TWENTY FIVE YEARS, [CHINA] DID AN INCREDIBLE THING ... ONE COUNTRY WITH THREE TO FIVE THOUSAND YEARS OF HISTORY, WITH SUCH RICH CULTURAL AND TRADITIONAL THINGS ... MADE A BIG DECISION TO DEMOLISH IT. NINETY PERCENT, JUST IN THE PAST TWENTY-FIVE YEARS. THEY DO THIS AND THEN BUILD SOME NEW THINGS; THEY COPY FROM ALL OVER THE WORLD ... IT IS THE PROFESSIONAL URBAN PLANNER AND ARCHITECT WHO DID THIS DISASTER. THEY DO THIS WITH THE GOVERNMENT TOGETHER. AND SO I THINK MAYBE WE NEED ANOTHER KIND OF ARCHITECT.”

--- “GEOMETRY AND NARRATIVE OF NATURAL FORM”  WANG SHU
As the development of Shanghai, urbanization has articulated the help from industrialization. The government loosens the restriction of migration in Shanghai as part of central strategies of urbanization. The excess rural labor forces flow into Shanghai for more income and better future for their posterity. Shanghai, as the most international and globalized city in China, attracts millions of migrants every year. Migrants in Shanghai become essential for urban developments. Today, one third of the migration formed up the Shanghai population. For a better rent and opportunity, amounts of them choose to live in the city center, where the traditional settlement of migrants, creating a high density urban center.

**POPULATION DISTRIBUTION**

**DENSITY MAP**

- **PUDONG**: 504.43
- **BAOSHAN**: 1,904.85
- **JIADING**: 150.6
- **JIANGXIANG**: 1,582.4
- **NANHUI**: 703.72
- **FENGFANG**: 1,083.46
- **CHANGNING**: 690.57
- **JING’AN**: 246.79
- **HUANGPU**: 429.89
- **LUWAN**: 248.78
- **QINGPUDONG**: 1,081.02
- **MINGHANG**: 2,429.37

**3,775 people/km²**
As the process of the urbanization, most of the developments happened in the Puxi and along the Huangpu River. The whole developments make the city become too dense; as a result, the traditional horizontal development becomes vertical. The skyscrapers started to take place in most of the place. After the 1990’s, government opened up Pudong for foreign investors. None of the districts in Puxi has more skyscrapers in Pudong. Yet the result of building all around the Huangpu River has made the city becomes too heavy.
“Reform and openness were essential to China’s modernization”

-- Xiaoping Deng

Before 1978, Chinese market has been holding a boundary between itself and the rest of the world. However, the initiative of free market system facilitated the trade with foreign capitals, opening the boundary for investors and foreign businesses. Nevertheless, Shanghai has been left out for the great leap development in 1980s, when cities such as Beijing, Shenzhen, and Guangzhou rapidly developed and modernized. Though Deng initiated the hybrid economic system, “socialist market economy”, to interact with other countries, Shanghai did not benefit from the new economic system, as if it was penalized for its bourgeois history. After Deng’s visit in 1990, he decided to reconstruct the Puxi and develop Pudong. Shanghai started rushing into the boundary of modernization and urbanization.

In 1992, government released the policy of land privatization, encouraging the private real estate to invest capital in the market. Since 1992, the urban development of Shanghai has accelerated. At the same time, Shanghai started to experience enormous increase in migration. Restriction on the entry of rural migrants is loose as Shanghai needed labor forces to construct its new global image. Thus, residential towers emerged as profit machines and were multiplied in the urban centers. Under the name of gentrification, private investors started to engage with urban forms, extruding the scale of Shanghai and a three dimensional boundary that poor people could not reach.
Magnificent skyline in Shanghai, BUT what's the problem behind this massive volumetric skyscraper?

In May 2012, a lady failed through from the road into this 20 ft sinkhole in Pudong.

A crack happens around the Shanghai World Financial Center, Jin Mao Tower, and the under constructing Shanghai Tower.
In the recent Shanghai development; instead of the horizontal urban development, Shanghai has moved into the mass vertical development era. There are around 150 skyscrapers higher than 250’, yet among most of the skyscrapers in Shanghai, 40 percent of the skyscrapers build along the Huangpu River. Consequently, this becomes the primary force to cause the land to sinks and cracks.
Shanghai, one of the most densely-populated cities in the world, is believed to be sinking at an average rate of 1.4 inches a year, putting pressure on underground pedestrian and railway tunnels and building foundations. Subsidence can lead to the collapse of tunnels and nearby buildings or even the whole city.

Shanghai, like several other coastal cities in China, is built on marshy soil, making it vulnerable to sinking. The pumping of groundwater to cater for a massive, growing population has been a significant contributor to subsidence. The problem has been exacerbated by the country’s decades-long building boom amid rapid urbanization.
SOARED SINKAGE
- SEA LEVEL RISES
SECTION 7

Sea levels around the world are rising. Current sea-level increase potentially affects human populations those living in coastal areas and on islands and the natural environment ecosystems.

Two main factors contributed to observed sea level rise. The first is temperature changes: as ocean water warms, it expands. The second is from the contribution of increased melting of the land-based ice. The major store of water on land is found in glaciers and ice sheets.

Sea levels rise is the other issue that Chinese are facing. As one of the highest carbon dioxide producing country, it tightly affects its coastal city. Shanghai, the most impacted city by the sea level rises, has to build an embankment on purpose of preventing water flooded in.

“As many know, the Chinese expression for “crisis” consists of two characters side by side. The first is the symbol for “danger,” the second the symbol for “opportunity.”

--- “An Inconvenient Truth” Al Gore
CUASE OF SEA LEVEL RISES

WHICH CITIES WILL FLOOD WHEN?

<table>
<thead>
<tr>
<th>YEARS</th>
<th>SEA LEVEL</th>
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<tr>
<td>8000</td>
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<tr>
<td>1000</td>
<td>60 FT</td>
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<tr>
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<td></td>
</tr>
<tr>
<td>400</td>
<td>18 FT</td>
</tr>
<tr>
<td>45</td>
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<tr>
<td>300</td>
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<tr>
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<td>100</td>
<td>3 FT</td>
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<td></td>
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</table>

TOTAL CONTRIBUTIONS

<table>
<thead>
<tr>
<th>TOTAL</th>
<th>CONTRIBUTIONS</th>
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<tbody>
<tr>
<td>South Pole</td>
<td>180 FT</td>
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<tr>
<td>Greenland</td>
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<tr>
<td>West Arctic</td>
<td>18 FT</td>
</tr>
<tr>
<td>Heating ocean expanding</td>
<td>3 FT per year</td>
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<tr>
<td>Already happened</td>
<td>.3~.6 FT</td>
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DATA FROM IPCC, SEA LEVEL EXPLORER
Sea level rise might not be so bad in places where the land is rising... i.e. land located on a fault.

But it will be really bad in places where the land is also sinking... i.e. Shanghai, NYC.
CAUSE OF SEA LEVEL RISES

influences on Shanghai

First- After 1990’s, skyscraper emerged.

Second- The numbers of the skyscraper cause city becomes too heavy.

Third- Overuse of the underground aquifers cause the city to sink.

Fourth- Sea level rises.

Fifth- To prevent water flooded in, city built an embankment.

Sixth- What can we do to recreate the interaction yet blended the current boundary.
Climate change is causing the sea level rises worldwide. Although the sea level rises is growing the length of a rice grain in recent year, yet the city itself has had to spend billions of dollars into reconstructing infrastructure to prevent the water flood.

Shanghai has been benefit from its location on the Yangtze River Delta of becoming one of world’s biggest financial and transporting hub; however, it has also finds itself in danger because of global climate changes. During the past decades, Shanghai has experienced more extreme weather, missed rain in the wet season.

Besides the extreme weather, Shanghai’s biggest concern is the slow, steadily growing threat that comes from the sea level rise. Higher tides are washing away the precious delta soil upon which the city’s foundations are built, and water supplies are becoming more tainted as seawater intrudes more deeply into the fresh water of the Yangtze River.

What stands between Shanghai and drowning is an average 15 feet of land. Construction of thousands of high-rise buildings, combined with the pumping of groundwater, is making the soil subside. The removal of groundwater is now under tighter controls, and water is actually being pumped back to wells, Shanghai is on the edge of finding every method to prevent city from sinking.
PRECEDENCE STUDY
- WATERFRONT | PORT | FILTRATION FACILITY
«When public spaces are successful [...] they will increase opportunities to participate in communal activity. This fellowship in the open nurtures the growth of public life, which is stunted by the social isolation of ghettos and suburbs. In the parks, plazas, markets, waterfronts, and natural areas of our cities, people from different cultural groups can come together in a supportive context of mutual enjoyment. As these experiences are repeated, public spaces become vessels to carry positive communal meanings.»

--- Francis Carr, Rivlin and Stone

“Our proposal for the project start by declaring the site as an open public space and proposes to have the roof of the building as an open plaza, continuous with the surface of Yamashita Park as well as Akaranega Park. The project is then generated from a circulation diagram that aspires to eliminate the linear structure characteristic of piers, and the directionality of the circulation.”

--- Foreign Office Architects

“(...) An environmentally sensitive design that integrates landscape, infrastructure and striking architecture within a public park.”

--- Metropolitan Home, Raul Barrenche, May 2006

“An inverted metal water droplet abstractly expresses a water-purification plant’s processes.”

--- Metalmag, September, 2006
WATERFRONT PUBLIC SPACE

Olympic Sculpture Park / Weiss Manfredi

Concept

The geometrically rectangular site is designed into a “Z” shaped platform to maximize views within the site and to provide a indirect path along which sculpture can be positioned on purpose of taking full advantages of the travel experience. The delicate shape of the path is in response to the historical industrial site and profoundly reinforced retaining structure supporting the public space below.
The race street pier is the first waterfront public space in Philadelphia on the central Delaware riverfront. The waterfront is intended to reconnect the city to the river and motivates the public to help realize the larger City initiative to transform its underutilized waterfront.

The design started with the clear concept that the connection between the urban and waterfront. The actual design started with a slice and separate into upper and lower level for different usage. Upper level is used to create connection with the surrounding view, yet lower level is used to create water activities.

**Source:** Designboom
WATERFRONT PUBLIC SPACE

Multi Mill / NL Architects

The project aims to produce an distinctive experience on the Port of Amsterdam with a sophisticated design configuration that allow multiple activities. This public space is situated on the Haparandada near the IJ River, the flexible and variable base will accommodate different forms of art such as film, fashion, sculpture, dance, etc. The goal of the project by the architect, “The versatility of the assignment is the ultimate challenge for Architecture: how can one single spatial given host all these functionalities in a credible way?”
PORT

Helsinki South Harbor Proposal | Macyausk Research & Design

This Helsinki’s new South Harbor proposal, designed by Macyausk Research & Design, is envisioned as the iconic gateway into the heart of the city that serves its tourists and travelers aesthetically and effectively. Its strong urban connection between the waterfront and the city has been simplified to efficiently activate Helsinki’s South Harbor.

Programmatically the required terminals have been concentrated into one fluid and pristine envelope. The museum, tourist center, and market place have been redesigned to respond to its contextual adjacencies while remaining within the language set forth by the terminal.
PORT

Yokohama International Port Terminal / Foreign Office Architects

The initial idea of Yokohama International Port Terminal describe by architect, “Our proposal for the project start by declaring the site as an open public space and proposes to have the roof of the building as an open plaza, continuous with the surface of Yamashita Park as well as Akaranega Park. The project is then generated from a circulation diagram that aspires to eliminate the linear structure characteristic of piers, and the directionality of the circulation.”
The Shanghai Port International Cruise Terminal encompasses a massive 630 thousand square foot site. It locates underneath an existing public park that forms its roof, thus conserving precious land for green, public use. Below rests a vast, underground, three-level public space lit by a unique, earth form bridge forming a gateway to the city.

Finally, a 260 foot-long glass observation bubble floats on steel legs above the park, providing spectacular city views and an arena for public functions like cultural openings and photo shoots. The terminal is passively cooled by river water, in which it is fully absorbed with a system of double walls at its boundary, precooling the ventilation.

Source: ArchDaily
WATER FILTRATION TREATMENT FACILITY

Whitney Water Purification Facility and Park / Steven Holl Architects

The overall design of the park is comprised of six sectors, analogs of the six processes of water treatment in the new underground facility below. The park’s “micro to macro” reinterpretation results in the unanticipated, challenging conventional material spatial configuration. In the zone equivalent to rapid mixing and high turbulence, agitated grass mounds are penetrated by little streams. Hints of the plant below rise up in stainless steel “slices.” The administration building is formed as a stainless steel sliver rising like liquid from below. This building orients the public education entrance and is flanked by entrance ways on both sides.
WATER FILTRATION TREATMENT FACILITY

Kyiv Urban Wildlife Park / Katya Larina, Yevgeniya Pozigun, Irina Klibull, Roman Pomazan

The overall design of the park is comprised of three strategies. The first strategy proposes a development of green infrastructure: water cleaning system, reclamation of the polluted water bed and bio-fuel production. The second part of the strategy aims to convert Kyiv islands into the center of the Research-Educational network of the Dnieper’s river ecological corridor. Third part is focused on redevelopment and densification of the already existing parts of site aiming to bring a new high quality of public and cultural environment to the context.
**BIBLIOGRAPHY**


