



Analysis on the Interaction Between Ocean and Urban Construction from the Perspective of Sustainable Development

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Abstract: The ocean is closely related to the development of cities. It makes the value of urban land increased, but also causes damage to the city, whereas urban construction mainly plays a negative role in the ocean, manifested as destroying the marine natural environment. In recent years, more and more cities pay attention to the interaction between ocean and urban construction, and begin to put the concept of sustainable development into urban construction projects to protect the marine environment.

Keywords: ocean, urban construction, sustainable development, interaction

1. Foreword

Water is the source of life, the cradle of human civilization, and also an important factor in urban development. From the perspective of environmental elements, the ocean is a type of water elements, which also involves biological elements, soil elements, climate elements, etc.

The ocean is closely related to the development of the city, and the livelihood of more than 3 billion people worldwide depends on multiple organisms from the ocean and the coast. The ocean and the urban construction environment mutually influence and interact with each other. Marine cities have unique geographical conditions and landscape resources, and also face natural disasters such as tsunami and typhoon. The ocean can also be affected by a range of environmental problems arising from the city.

At present, foreign scholars have had a relatively complete theory and many successful cases in the research and practice of the urban waterfront area. However, the research on waterfront areas in China mostly focuses on inland water bodies, and less discusses the relationship between Marine environment and city. However, the coastal area has gathered more population, and the urbanization process is rapid. Since the 21st century, there is a trend of population growth in coastal cities. In 2005, the coastal urban belt consisting of 24 cities absorbed about 37% of the country's floating population.[1] In 2007, China's eastern coastal areas of 916,000km² (about 9.5% of the whole country's land) of land concentrated 36.5% of the country's total population.[2] Similar trends can be found in many other parts of the world.

Marine sustainability is closely related to the construction of coastal cities, and their relationship affects people's well-being. This paper will reveal the relationship between ocean and urban construction, and explore how the concept of sustainable development coordinate the relationship between ocean and urban construction through urban planning and design.

2. The role of the ocean on the urban construction

The role of the ocean on the urban construction has two sides, including positive and negative effects.

2.1 Positive effects

The ocean makes the coastal cities have unique geographical conditions and greatly enhance land value. Urban coastal areas generally arrange urban leading industries to drive rapid development. For example, the Qianhai area of Shenzhen is closely linked with Guangdong-Hong Kong-Macao Greater Bay Area, and it plans to arrange a large amount of commercial land, mainly developing headquarters economy and information industry, which is building another city center of Shenzhen. Another example is Ningbo and Zhoushan. Their coastlines are tortuous, with fishing and shipping as the leading industries, so as to lead the regional development.

Moreover, the ocean provides good landscape resources and open space for the city. Coastal areas can make use of this characteristic to arrange the urban pattern, to create a unique skyline and beautiful civic parks. The coastal buildings can also have a better landscape vision.

2.2 Negative effects

Marine environments can also cause cities to face the negative effects of extreme weather and natural disasters. Frequent natural disasters, include tsunamis, typhoons, earthquakes and floods, will hinder urban construction, cause damage to urban environment, cause economic losses, and even endanger the lives of citizens.

Take tsunamis for an example. There are about 260 destructive tsunamis recorded around the world, with an average of about once in 6-7 years. According to the news report, the major Indian Ocean tsunami on December 26,2004, reached a wide range of six time zones. A total of 238,945 people in the worst-hit Indonesia, died or disappeared. The number of victims worldwide reached 292,206.

3. The role of urban construction on the ocean

The impact of urban construction on the ocean is basically a negative impact, reflected in the damage to the ocean, mainly including the destruction of coastal wetlands, large-scale reclamation and development, coastal water pollution, etc.

3.1 Destroy coastal wetlands

According to the definition of intertidal zones, the vast majority of natural coastal shorelines fall in the category of wetlands, including mainly rocky shores, sandy beaches, mangroves, and shallow coral reefs.[3] It is an important habitat for waterfowl, and also a place for fish, shrimp, crabs, and shellfish to grow and breed. However, these ecologically valuable wetlands are constantly disappearing, due to improper urban development.

Take mangroves, for example, where 35% have disappeared since the 1950s. Nearly 50% of mangroves in China's population have also disappeared, from 42,001.0 hm² in the 1950s and decreased to 22,024.9 hm² in 2000.[4]

3.2 Large-scale land reclamation and development

In order to meet the contradiction between the tight supply and demand of land, some coastal cities have implemented large-scale reclamation activities. Since 2002, the reclaimed land area with a sea area use right certificate alone has reached 163,000 hm² in China (about 1hm² each year).[5] Due to the good location and the high cost of land reclamation, some coastal areas have adopted high-intensity development models to obtain benefits. For example, the building density and plot ratio of coastal areas in Hong Kong and Tokyo Bay of Japan have reached a high level.

Mass reclamation and high-intensity development have affected the environment in the coastal area. (1) The reclamation project has changed the hydrodynamic conditions of the bay, affected the water exchange in the bay, and also caused the changes of silt flushing and pollutant migration rules[6]. (2) High-intensity development makes the heat island effect in coastal areas obvious, according to two scholars called Fojio Kimura and Saun ji Takahashi from the Tsukuba Meteorological Institute. They demonstrated that climate change in the Tokyo Bay landfill proved that at 20% building coverage, the temperature in the coastal areas is 3 °C higher in summer evenings than in other areas[7]. (3) Artificial coastal areas replaced the coastal wetlands, and had a negative impact on the ecological structure. In port areas such as Tokyo and Osaka, Japan, due to a large number of coastline replaced by vertical buildings, many coastal creatures almost completely disappeared[8].

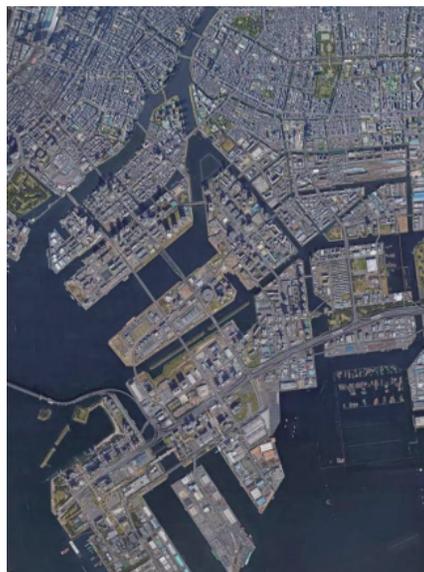


Figure 1. Satellite view of Tokyo Bay



Figure 2. Aerial view of Tokyo Bay

3.3 The pollution of sea water

In the early stage of industrial development, many factories and fossil enterprises were located in the coastal areas such as Shandong, Zhejiang, Fujian and Guangdong, taking into account the advantages of transportation, water intake and emissions. The industrial wastewater and solid waste of these plants is directly discharged into the sea without treatment, which will have an irreversible negative impact on the ocean. According to the report, the marine environment at the estuary sewage site is too poor, so that many marine protozoa have extincted. [9]

Coastal tourism industry also causes marine pollution to some extent. Coastal tourism industry reflects that many bathing beaches often float with oily attachments, making a large number of seaweed growth. Visitors will also leave solid waste on the beach or in the ocean, causing solid waste pollution.

4. Practice of sustainable development planning

Sustainable Development refers to the development that meets the needs of the present people and does no harm to the ability of future generations to meet their needs. In 2021, the United Nations identified 17 targets for Sustainable Development, the 14th of which is "protection and sustainable utilization of Marine and Marine resources", with 10 specific goals for reducing marine pollution, strengthening capacity against disasters, and protecting coastal and marine areas. In recent years, more and more coastal cities begin to apply the concept of Sustainable Development to the actual urban construction projects. The practical directions mainly include the following four points.

4.1 Develop sustainable development strategies

In order to clarify the Sustainable Development goals and deepen the realization, some urban designs will formulate Sustainable Development strategies in the design process to strengthen the awareness of marine environment protection. Take the urban design of Prince Bay in Shenzhen as an example. To begin with, it made a background study on eight directions of sustainable development, such as land use, air quality, energy management and so on. Based on this, it formulated a Framework to guide urban construction, and controlled ecological factors, including water, energy, carbon, etc, through a series of indicators. Through these ways, it expects to practice the theory of sustainable development at the strategic level.

4.2 Control development scale

Some coastal urban design meetings will set the upper limit on the scale of development and construction to avoid the excessive development of coastal areas from affecting the marine ecological environment. The urban design of southwest Brooklyn adopts the triple bottom line (TBL) tool to practice the sustainable development theory, considering the economic, social and environmental aspects, and evaluates the development of three different densities, so as to determine the site development area of 450,000 square feet. Under this scale of development, this area can maximize economic benefits, social equity and ecological sustainability. [1]

4.3 Delimit the reserve

Delimiting marine protection areas for Marine ecological sensitive areas is also a form of sustainable development practice. The red line for Marine ecological protection is defined in the "Three Line and one Order" ecological environment

zoning control Plan issued by Qingdao City. At the same time, a "1 + 146 + 63" ecological and environmental access list system has been established, including 63 marine environmental control units. These are divided into different control units according to the characteristics of different sea areas, so as to implement precise measures for marine ecological environment protection, and to build a marine central city suitable for living and working. [2]

4.4 Disaster prevention projects

In order to reduce the impact of natural disasters caused by the ocean, some coastal cities pay attention to the construction of disaster prevention projects. For example, Hamburg Port New Town adopts a variety of design methods to resist the flood, which have become some of the urban constructions that the native people are proud of. The main measures include: (1) wharf: the floating wharf can move up and down with the water level; (2) waterfront: embankment walking/cycling path is 4-5.5m above sea level, and creates public relations space combined with green space; (3) streets: built on the waterproof foundation of about 7.5-8m above the sea level; (4) buildings: their waterproof gate is installed on the coastal side, and temporarily closed by flood to achieve the flood control effect.



Figure 3. Floating piers on the water in Hamburg Port



Figure 4. One of the open space next to the waterfront of Hamburg Port



Figure 5. The buildings on Hamburg Port Street



Figure 6. The buildings beside the waterfront of Hamburg Port

5. Conclusion

5.1 The interaction between ocean and urban construction

The ocean has both positive and negative effects on urban environment; whereas the urban construction mainly has negative effects on the ocean. We can also find that there is a certain connection between these effects. For example, the coastal wetland is capable of preventing wind and eliminating waves, protecting embankments, promoting land construction with silt, purifying the environment, improving ecological conditions, etc. Its reduction will greatly reduce the coastal biodiversity, but also make it difficult for cities to withstand typhoons, tsunami and other natural disasters, and increase the negative effect of the ocean on the urban construction.

Therefore, it is necessary for cities to change the urban development mode that simply pursues economic benefits, and

adopt a sustainable development mode, so as to better avoid the negative impact of the ocean, and form a symbiotic relationship with the ocean.

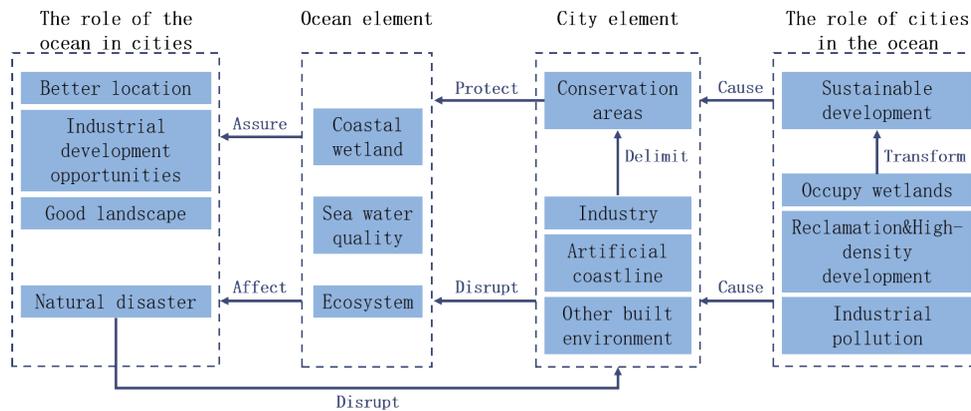


Figure 7. Schematic diagram of ocean-city interactions

5.2 How to develop sustainably for coastal cities

In recent years, the concept of sustainable development has been reflected in the urban construction in more and more coastal areas, and has achieved certain results. These successful cases are worth learning from. At the same time, planners can also notice that marine sustainable development should not only be reflected in local urban design, but also be incorporated into the overall urban development strategy, so that marine sustainable development can be implemented in all planning and design scales. Based on this, the ocean should be more easily coordinated with rivers, lakes and other inland water systems, make overall planning and formulate water protection strategies, and create an urban pattern of "mountain" - "river" - "sea".

The earth belongs to all mankind, and the ocean also belongs to all mankind. When most of the coastal cities apply the concept of sustainable development to the urban development and construction, can we share a beautiful and pure ocean.

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