

Yangshan Island Deep-Water Port Project, Shanghai, China

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ABSTRACT

Shanghai was designed as the center of marine shipping in China. Shanghai is located at east of China and on the verge of the East China Sea. In addition, The Yangzi River and Qiantang River are surrounding the city and access to the sea here. The Huangpu River crosses the city center and has been called the mother river of Shanghai. Lots of ports and terminals were operating on the river.

After near 30 years fast development, Shanghai has become largest port in China. Since 2000, the major ports and terminals on Huangpu River had been required to move to farther places because of the development and the increased value of the land in the city center. The governments of China and Shanghai tried to build the largest shipping center in shanghai. In 2005, the capability of the cargo traffic stagnated. The demand of more ports and terminals were showed. Unfortunately, due to the limitation of the geometry of the city and surround area, it was not possible to build the ports to fit the requirements of the large containers vessels and tanker vessels.

In 2002, a new port project, Yangshan island Deep Water port were launched. Actually, Yangshan Island is not geographically located in Shanghai. The island is around 30 km from the closest spot of Shanghai. Obviously, the transportation from the island and Shanghai was one of the major problems. In addition, in order to increase the capability of the marine shipping traffic, the port was design to host the huge shipping, i.e. 200,000 tones tankers and 10,000 TEU container ships.

Currently, the initial three phase construction project has been completed. In 2008, Shanghai successfully became the largest marine shipping center of the world. A 32.5 km bridge was built on the sea to connect Shanghai and Yangshan Island.

1.0 INTRODUCTION

Shanghai is located at east of China and on the verge of the East China Sea. The Yangzi River and Qiantang River are surrounding the city and access to the sea here. Because of the importance of its geographical locations, the city became one of the busiest ports since 200 years ago when the city was formed. Especially in the recent two decades, the demand of goods import and output from Shanghai increased rapidly. The equipment and berths of existing ports and terminals limited the goods handling capacity. Unfortunately, because of the urbanization process and fast increasing population in Shanghai, it was impossible to find a new site to build or extend new ports or terminals. The map below shows the location of Shanghai. The city of Shanghai is marked as pink.

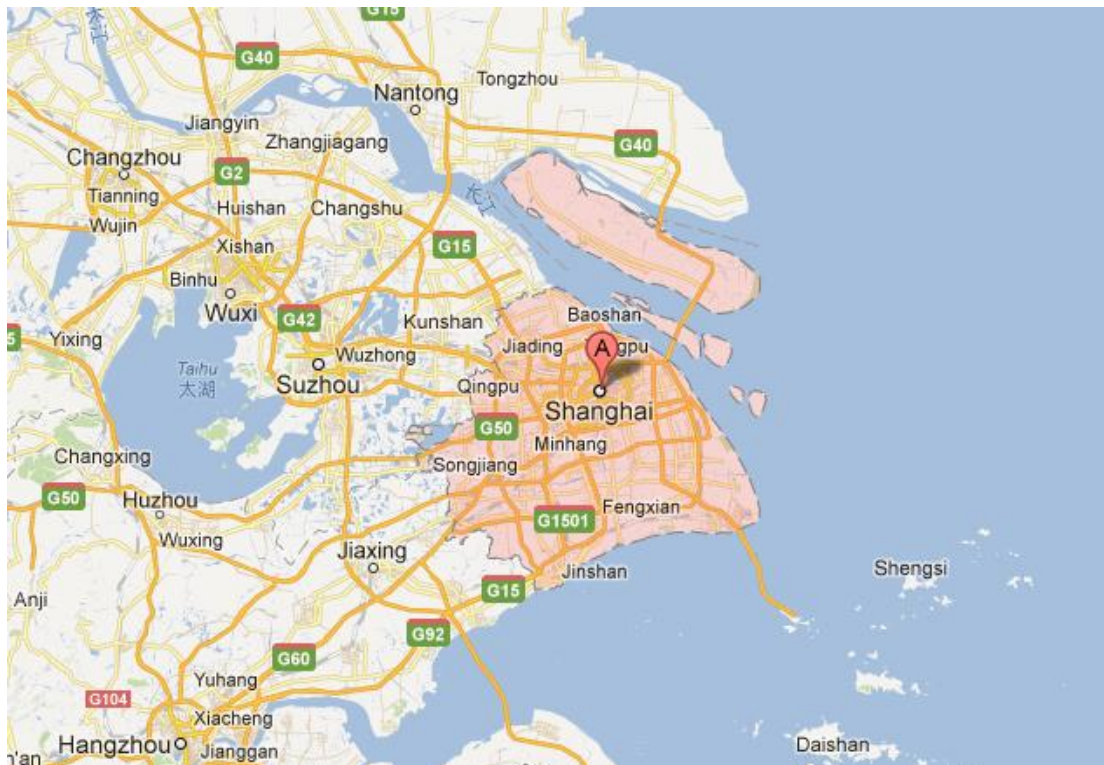


Figure 1 Google Map of Shanghai and surrounding area

After 6 years research and discussion, in 2001, Shanghai decided to start a new project Yangshan Deep Water Port. The site location is actually belong to Zhejiang Province, which is South to Shanghai. The site is a combination of several small islands, including Da Yangshan Island and Xiao Yangshan Island. the distance between the site and the closest spot in Shanghai is around 32 km.

This report will discuss two major or most important engineering challenges involved in the project.

2.0 PROJECT PLAN

In the research and discussion procedure, about 200 related institute and research center and 6000 researchers and scientists joined research, preparation, and design the new site. When finished, Shanghai will have the largest container capacity city in the world. Shanghai also will have the largest oil and gas traffic capacity in the Far East.

The project was divided into three construction period and was expected to fully complete in 2020. The total area of site will be 25 km². The total investment is ¥70 billion Chinese Yuan, which is around \$15 billion CND The ports will provide 50 deep water berths for container ships, and the annual loading capacity will be 15 million TEU. In addition, the site also has oil and gas tanker ship loading zone, which had been finished in 2009.

The map below shows the original islands of the site.



Figure 2 Google Map of Yangshan Island

3.0 PROJECT CHALLENGES

As expected, there were thousands challenges related to this project. The challenge is not only in the engineering difficulty, but also in the environment affect, economic problem and others. In these report, only two major engineering challenges will be discussed.

The first one is the connection between the site and main land of China. As showed in map above, the closest distance from main land of China is more than 30 km. This water area is important shipping lane for other ports near Qiantang River. The problem was highly related to the successful of the whole project. Obviously, if the challenge cannot be overcome, the new port will become useless.

The second challenge is to grow the land area from the ocean. The selected islands did not provide enough space to such a big project. For a high container transmit port, it would require a huge space as the terminal. In addition, the project site is far away from the main land. As a result, the support facilities, such as power plant, water plant, and living area, would require to setup on site.

4.0 CHALLENGES SOLUTION

After the 6 years design process, the final decision of the project plan was made by the Chinese government and the city of Shanghai. In the plan, a bridge was design to handle the transportation to Shanghai. A pipeline would be installed along the bridge to transmit the oil and gas product. The project also would require growing about 8 km² from ocean and combining the small islands to a big site.

4.1 Bridge and Pipeline

In the final plan of the Yangshan Deep Water Port, a 32.5 km long bridge would be built to connect the port and Shanghai. The master of bridge designer, Yuanpei Lin, is the principle designer to charge this sub-project. The bridge was named as Donghai (East Sea) Bridge.

Donghai Bridge project started on June 26, 2002. The total construction period was 35 months. On May 25, 2006, the major structure constructions were completed. The bridge is 32.5 km long and 31.5 m wide. It can handle six lines at a design driving speed of 80 km/hr.



Figure 3 East Sea Bridge

In order to avoid block the shipping line, in the middle of the bridge, there is a main navigation hole. This hole is about 40 meters clear height from water surface. The ships, up to around 10000 tons can access this hole safely. The bridge also has two other holes for passing ship size of 1000 tons and 500 tons. Any other huge ships have to make a detour trip to travel though this area.

Furthermore, a wind energy plant was design to setup on the bridge to save the space on the island. This plant can provide 100,000 Kw/hr electricity power. It can solve the energy shortage on the islands.



Figure 4 East Sea Bridge

4.1 Land Growth

To extend the original islands and combine these islands together was one more big challenge for the whole project. Land reclamation from ocean was the only possible way to achieve this. The total area would be 8 km^2 . The construction would also be divided into three steps. In the surround area, the average water depth in that area is -12 m. Hence, the required volume of the soil was incredible huge.

The first construction period was finished in 2004. The maximum water depth in this construction period was 39 m. 60 % of the water depth is more than 15 m. In the period, the total land extended is $1,250,000 \text{ m}^2$. The total soil used is around $25,000,000 \text{ m}^3$. The total period cost one and half year to finish. All the soil for this project was collected from the seabed nearby.

The second construction period was also finished in 2009. The total usable land space was extend to 5.9 km^2 . The third construction period was expected to be finished in 2020. At that time, the total area would be 8 km^2 . The total soil used was estimated as $100,000,000 \text{ m}^3$.

5.0 CONCLUSION

In conclusion, the Yangshan Deep Water Port had thousands of challenges in different area. There are some other problems to be solved. For example, the deep water port is physically belonging

to Zhejiang province, but it is managed and operated by the city of Shanghai currently. The investment was also provided by Shanghai. The scientists, designers, researchers and other professionals spent their experience to overcome these challenges. The growth land procedure had been completed in 2004. The East Sea Bridge had been built in 2005. The first and second construction period had been achieved in 2005 and 2006. The port started to operate in 2005 when the first construction period finished.

6.0 REFERENCE

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