Abstract

Taipei port is a new port located at on the south bank of Dan-shui river mouth. It was a domestic harbour constructed for transporting aggregate from East Taiwan to North Taiwan originally. Due to the Keelung port can't satisfy the requirement of berthing mainline container ships, so a lot of import & export containers should be transported to Kaohsiung port that cause a heavy loading of inland road system. For solving this issue, Taipei port was expanded and promoted to an international auxiliary port of Keelung port in 1997. Taipei port is planned to have diversified functions, and it is operated as a “landlord port”, all the operation facilities is invested and operated by private sectors except infrastructures. The whole port area is reclaimed offshore by dredging material of port and discarded soil of Taipei metropolis, so the environmental impact can be reduced to minimum. Taipei port would keep the liberalization and privatization of operation conditions, and this port would be the biggest international port in North Taiwan in the future.

1 Introduction

Taipei port locates on the south bank of Dan-shui river mouth in Ba-li of Taipei County, the location of Taipei port is shown in figure 1. It was a domestic harbour constructed for transporting aggregate from East Taiwan to North Taiwan originally. Based on the transportation demand of North Taiwan, Taipei Port was promoted to an international auxiliary port of Keelung harbour by Executive Yuan in 1997.

Taipei port is close to the Taipei metropolis, which is the national political and economical centre and the main domestic cargo sources also. Taipei port neighbours upon Mainland China and East Asian economical rings, and locate on the shipping route of Far East to North America and Europe. Therefore, it is very suitable to be developed as an international container port for mainline ships and cross-strait transportation.
2 Master Plan of Taipei Port

The master plan of Taipei port is shown in figure 2. The considerations of this layout are based on the predictive throughput and other concerns, such as the actual demand of operation and the marketing demand. This port can strengthen the competitive ability and has reserved sufficient space for future development.
2-1 Development Orientations

a. The auxiliary international port of Keelung harbour;
b. The main container port for mainlines in North Taiwan;
c. The major port for bulk import;
d. A port with free trade zone.

2-2 Planning Tactics

a. The development of Taipei port must consider the issue of the maintenance requirement of approach channel due to coastal sedimentation.
b. All the port area will be obtained by reclamation offshore to prevent levying private land and reserve the coastal zone for public. All the dredging material of channel, turning basin, basin, berth, and water area maintenance would be used for land reclamation of port area.
c. The landlord operation mode is proposed for Taipei port, the infrastructure as outer breakwater, road systems, and utilities would be invested by port authority, and the major operation facilities would be invested by private sectors.
d. For decreasing the inland transportation of container between North and South Taiwan, modern container terminals would be planned in order to accommodate the mainline container ships.
e. The functions of Taipei port would satisfy the import demand of bulk cargo and
break cargo in North Taiwan.
f. For accommodating the discarded soil of Taipei metropolis, an offshore area would be planned in order to solve the environmental issues of dumping discarding soil and increase the port area for future development.
g. For increasing the competitive ability, Taipei port would supply enough space for free trade zone.
h. Diversified functions are expected for Taipei port. A lot of space will be reserve for marina, coastal recreation zone for public, power station, etc.

2-3 Predicted Throughputs

<table>
<thead>
<tr>
<th>Cargo</th>
<th>Year</th>
<th>2007</th>
<th>2011</th>
<th>2016</th>
<th>2021</th>
<th>2026</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical liquid bulk</td>
<td></td>
<td>200</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
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<tr>
<td>Cement</td>
<td></td>
<td>900</td>
<td>1,730</td>
<td>1,680</td>
<td>1,610</td>
<td>1,540</td>
</tr>
<tr>
<td>Coal</td>
<td></td>
<td>0</td>
<td>1,000</td>
<td>1,000</td>
<td>11,500</td>
<td>13,600</td>
</tr>
<tr>
<td>Aggregate</td>
<td></td>
<td>7,200</td>
<td>7,400</td>
<td>8,200</td>
<td>9,000</td>
<td>9,900</td>
</tr>
<tr>
<td>Fuel</td>
<td></td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
<td>3,000</td>
</tr>
<tr>
<td>General cargo</td>
<td></td>
<td>1,400</td>
<td>4,320</td>
<td>4,650</td>
<td>4,970</td>
<td>5,280</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>12,700</td>
<td>17,700</td>
<td>18,780</td>
<td>30,330</td>
<td>33,570</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cargo</th>
<th>Year</th>
<th>2007</th>
<th>2011</th>
<th>2016</th>
<th>2021</th>
<th>2026</th>
</tr>
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<tbody>
<tr>
<td>Import &amp; export</td>
<td></td>
<td>0</td>
<td>710</td>
<td>1,390</td>
<td>2,140</td>
<td>2,400</td>
</tr>
<tr>
<td>Transshipment</td>
<td></td>
<td>0</td>
<td>490</td>
<td>960</td>
<td>1,610</td>
<td>1,800</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>0</td>
<td>1,200</td>
<td>2,350</td>
<td>3,750</td>
<td>4,200</td>
</tr>
</tbody>
</table>

2-4 Maximum Size of Calling Ships

The planned maximum size of calling ship was 8,000TEU for container ship and 80,000DWT for bulk carrier originally. For satisfying the trend of marine marketing development, strengthening the competitive ability, and to fulfil the demand for coal handling system of thermal power plant in Taipei port, the planned maximum size of calling ships is revised as shown in following table finally.
<table>
<thead>
<tr>
<th>Cargo</th>
<th>Ship Size</th>
<th>Capacity</th>
<th>Length (m)</th>
<th>Breadth (m)</th>
<th>Draft (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container</td>
<td>Short-tern</td>
<td>10,000TEU</td>
<td>350</td>
<td>52.0</td>
<td>14.0</td>
</tr>
<tr>
<td></td>
<td>Long-tern</td>
<td>15,000TEU</td>
<td>400</td>
<td>69.0</td>
<td>15.0</td>
</tr>
<tr>
<td>Coal</td>
<td>Short-tern</td>
<td>80000DWT</td>
<td>265</td>
<td>38.0</td>
<td>14.0</td>
</tr>
<tr>
<td></td>
<td>Long-tern</td>
<td>150,000DWT</td>
<td>300</td>
<td>45.0</td>
<td>17.0</td>
</tr>
<tr>
<td>Liquid Bulk</td>
<td>Panamax</td>
<td>50,000DWT</td>
<td>230</td>
<td>32.0</td>
<td>12.0</td>
</tr>
<tr>
<td>General</td>
<td>Handy-Size</td>
<td>30,000DWT</td>
<td>190</td>
<td>27.0</td>
<td>11.0</td>
</tr>
<tr>
<td>Automobile</td>
<td>Post-Panama</td>
<td>65,000GT</td>
<td>215</td>
<td>35.5</td>
<td>11.5</td>
</tr>
</tbody>
</table>

2-5 Planning of Harbour Facilities

a. The planned outer breakwaters of Taipei port are shown in figure 2, including the north outer breakwater which will be extended with a total length of 9,163m, and 1,550m south outer breakwater which is under construction. In addition, there will be a new south outer breakwater with a length of 1,250m in future, and one breakwater 528m long for protecting the basin of pleasure-craft.

b. To accommodate the maximum size of ships and to increase the calmness of outer port, the width of entrance and approach channel will be 400~525m with a depth of CD.-19~21m. The width of inner channel will be 300m with a depth of CD.-16~17m. Three turning basins with diameter 720m, 900m, 900m are planned with a depth of CD.-16m, CD.-17m, CD.-19m respectively.

2-6 Planning of Wharfs

2-6-1 East Wharf Area (layout is shown in figure 3)

a. Terminal No. 1 for General and Bulk Cargo (wharf E13 ~ E16)

b. Four berths for general cargo and bulk cargo with a total length of 1,230m and an area of 4.9 Ha have been rented to a private company for a multi-function terminal to unloading and transiting aggregate, coal, and fuel mainly.

c. Terminal No. 2 for General and Bulk Cargo (wharf E10 ~ E12)

d. Three berths for general cargo and bulk cargo with a total length of 690m and an area of 10.0 Ha would be opened for private investor in the future. This terminal will be multi-function for handling aggregate, coal, cement, break cargo, etc.

e. Terminal No. 3 for General and Bulk Cargo (wharf E01 ~ E03)

f. Wharf E01 ~ E03 is operated for unloading aggregate currently. These three berths with a total length of 554m and an area of 13.1 Ha is proposed to rebuild by private sectors for multiple functions. It is expected and promoted that the whole area can be developed for free trade zone in order to increase the efficiency of overall operation.
g. Wharf E04 is planned for passenger terminal.

h. Wharf E05 ~ E09 is planned for berthing tugs and small crafts.

i. Temporary Petroleum Unloading Wharfs

To fulfil the fuel import demand of North Taiwan, four berths is planned for unloading fuel and liquid chemical temporarily, these wharfs include wharf E03 ~ E05, and E15. All of these wharfs will be relocated to outer port to assure the safety of harbour centre area and the resident area adjacent to Taipei port.

j. Logistics Park for the Components of Car

The whole area has been rented to private companies to invest a special automobile logistics park jointly, which is also the first successful case of the operation for the free trade zone in Taiwan.

k. Port Administration Area

l. Special Zone for Coast Guard

2-6-2 North Wharf Area (layout is shown in figure 4)

a. Wharf N01 ~ N02

Two berths with a total length of 602m are planned for handling general cargo.

b. Container Terminal No. 1 (wharf N03 ~ N09)

Container terminal No. 1 includes seven deep berths with a total length of
2,368m and an area of 113 ha. The development of this terminal was tendered as a BOT project, and this terminal is under construction. Considering the limited area for container yard, the storage area of N4-2~N9-2 will be rented to the operator of Container Terminal No.1 after the completion of the reclamation work.

c. Offshore Logistics Park

The development area for logistics park is located in the water area outside the existing north breakwater from 1k+710 to 5k+263, the existing depth of this area is CD.-10m ~ CD.-20m. The area of this park will be 348.3 Ha, and the volume of required reclamation material is 71.72 million m³. The discarded soil come from Taipei metropolis will be used for filling. Except the windbreak area with a width of 200m inside the outer breakwater, there should be 17 areas for business usage, and 2 areas reserved for administration usage. The road system inside this park will be smoothly, the width of roads will be 25m~40m.

The schedule of the availability of filling materials can not be totally controlled at this moment. Furthermore, a huge quantity of filling materials is required due to the considerable water depth in this reclamation area, so it would take a very long time to complete the reclamation works. Therefore, it is difficult to plan the usage of this area at this moment; this area is classified as the future development area.

Figure 4
d. Future Development Area

There are still eight berths with a total length of 2,668m in north wharf area. The usage of these berths will be adjusted by the actual demand in the future. Basically, the area behind apron will be planned as free trade zone or container stacking yard in priority. However, the actual usage of these berths will be finalized stage by stage according to the marketing demand in the future.

2-6-3 South Wharf Area (layout is shown in figure 5)

a. Container Terminal No. 2 (wharf S01 ~ S08)

There are eight berths with a total length of 2,630m planned for container terminal in south wharf area. The width of this area is 800m, and the area is 114.0 Ha. Wharf S01~S03 is planned as feeder berths, and the container ship of mainline will berth at wharf S04~S08. This terminal would be invested and operated by private companies in the future.

b. Special Zone for Military

A preliminary planning for special zone for military is considered, but a feasibility study should be carried out in the future.

c. Power Plant Special Zone

Due to the power demand in North Taiwan and installed infrastructure of Taipei port, a thermal power station is proposed in Taipei port. This project is under negotiating
between Port Authority and Taiwan Power Company (TPC). A preliminary study had been completed for this project. The maximum coal carriers will be 150,000 DWT, and the annual unloading volume of coal will be 12.6 million ton for six coal-fired generating sets with 800,000 KW capacity each. Based on the estimated development schedule, the commencement of operation of Taipei Power Station will be year 2018.

For accommodating 150,000 DWT coal carriers, a calm water area with sufficient space is required, and a huge reclamation works should be carried out for the required land of power plant. Therefore, TPC proposes to invest and construct the extension portion of north outer breakwater (sta. 5k+263~9k+163) and new south outer breakwater by them self in advance. Two berths for coal unloading, revetment with a length of 5,076m for land reclamation, land reclamation works for power station, dredging for outer channel and outer turning basin, and breakwater for pleasure-craft basin would be also carried out by TPC.

d. Coastal Recreation Zone

To reserve right of the coastal zone for public use, an isolation channel is planned between existing coast and port area in order to maintain a near-shore recreation zone. Keelung Harbour Bureau will carry out a beautifying work for coast area between the old south breakwater and new south breakwater. Taipei County Government will handle the planning and developing works between the area outside the port district and West Coastal Highway.

e. Pleasure-Craft Basin (Marina)

A pleasure-craft basin in the southern area is planned for investing and operating a yacht harbour by private sectors. The western S16-3 area with an area of 12.39Ha can be installed yacht club, parking area, yacht parking area, maintenance shop, etc.

2-6-4 Boundary of Port District

The boundary of Taipei port district is shown in figure 2, the total area for Taipei port is 3,102 ha approximately.

2-6-5 Connecting Traffic System (route is shown in figure 6)

The existing connecting road of Taipei port is Provincial Road No.15 via the 50m-wide Zhong-hua Road. The related construction plans of connecting road system are as follows:

a. The completion date of Phase II connecting road construction will be May 2007.

b. The estimated completion date of the widening work of West Coastal Highway from Ba-li to Lin-kou (12k~19k) will be in June 2008.

c. The estimated completion date of East-West Expressway from Ba-li to Wu-gu will be in March 2008.
d. The estimated completion date of the improvement work of Wu-gu interchange system of national free way will be in March 2009.

Figure 6
3. Phase Development Plan and Operation & Management Mode

3-1 Phase Development Plan

Phase development plan of Taipei port is shown in figure 7. The different phases are defined by different colour. The phase development schedule is shown in following table.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Period</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed</td>
<td>Jan. 1993 ~ Dec. 2006</td>
<td>14 years</td>
</tr>
<tr>
<td>Phase 1</td>
<td>Jan. 2007 ~ Dec. 2011</td>
<td>5 years</td>
</tr>
<tr>
<td>Phase 2</td>
<td>Jan. 2012 ~ Dec. 2016</td>
<td>5 years</td>
</tr>
<tr>
<td>Phase 3</td>
<td>After Jan. 2017</td>
<td></td>
</tr>
</tbody>
</table>

3-2 Operation and Management Model

The most important strategies of developing an efficient and beneficial port are how to bring non-governmental capital and management vitality of private sectors. The landlord operation mode and privatization would be the key to strengthen the capability of competition. Nowadays, the world first 10 container ports’ management system is always conducted by separating “port management” from “port operation”.
After being promoted to international commercial port, the management mode of Taipei port is operated as “landlord port”, and most of operation facilities is privatized in practice. Not only stevedoring, storage, wharf affairs have already been open to private corporation, but also the investment and operation of General and Bulk Cargo Terminals & container terminals would be open to private sectors by areas. Keelung Harbour Bureau will not intervene in management and strictly play the role of a port manager only.

Consequently, Taipei port has caught on the steps of operation and management of modern ports, and satisfies the expectation and need of ships’ or cargos’ owners. However, the development goal of Taipei port is to conduct the mode of “landlord port”, and to keep the liberalization and privatization of operation conditions.

4. Existing Conditions of Taipei Port

4-1 Existing Port Facilities

Present development situations of Taipei port are shown in figure 2.

4-1-1 Existing Harbour Facilities

a. The total length of north outer breakwater is 5,263.2m; north inner breakwater is 463.77m long, south outer breakwater is 1,050m long and south inner breakwater is 290m long.

b. The existing approach channel is 200m wide, and -12m deep; the diameter and depth of existing turning basin is 500m and -12m.

c. Three tug boats with 1,600HP, 2,800HP and 3,200HP had been rented out to non-government enterprise for commerce. Otherwise, one pilot boat and one multipurpose ship is managed by Keelung Harbour Bureau now.

4-1-2 Existing Wharf Facilities

a. There are East Wharf Area and North Wharf Area currently, which are invested and operated by private companies in principle.

b. Wharf E01~E03 is public wharf for unloading aggregate currently, but it would be removed to general and bulk cargo terminal No.1 in the future.

c. Wharf E04~E05 is liquid chemical terminal currently.

d. Wharf E05 is a public wharf for passenger terminal.

e. Wharf E06~E09 is occupied by tug boats, small crafts, construction boats currently.

f. The investment projects of government and private sectors are listed as follows:

(a) B.O.T. Project of Container Terminal No. 1
Taipei Port Container Terminal Corporation consists of Evergreen group, Wan-Hai group, and Yang-Ming line. This terminal is invested in the way of BOT. The main investment items include dredging and reclamation, construction of wharf N02 for general cargo, construction wharf N03~N09 and container yard, installation of container handling equipment. The total area is 110Ha approximately. The total investment is estimated up to 20.36 billion NTD, and the concession period is 50 years. The perspective drawing of the Container Terminal No. 1 is shown in figure 9.

This terminal is under construction. If the connecting road system can be completed on time, the commencement date will be estimated before March 2008.

(b) General and Bulk Cargo Terminal No.1

An investment Contract had been signed for renting existing wharf E13~E15 and investing wharf E16 for general and bulk cargo.

Airtight storage facilities in the storage yard also contain in the Contract. The annual handling throughput of aggregate and coal should be no less than 3.6 million ton and 1.0 million ton respectively.

(c) General and Bulk Cargo Terminal 2

The investment items of the terminal include construction of wharf E10~E12, reclamation of new land for the terminal, installation of automatic ship unloaders and airtight storage facilities, etc. The berths and cargo stevedoring and storing affairs are open to any company. Under the agreement of Ministry Transportation and Communication, this project will be conducted based on BOT procedure. Keelung Harbour Bureau is executing invitation of public tender at present.

(d) Coast Guard plans to build a base in Taipei port, and it is approved by Government. The base is located in the area of wharf E17~E20.

4-2 Achievement Records of Operation

The throughput in year 2005 is up to 9.73 million ton, and consists of 6.88 million ton of aggregate, 2.45 million ton of liquid cargo, and 0.4 million ton of general cargo containing 6,240 cars. The throughput and the calling number of ships in 2000~2005 are shown in following table; average growing rate is 34%. Furthermore, the throughput in January ~ July 2006 is 7.69 million ton.
The business revenue of Taipei port is 4.03 hundred million NTD in year 2005; it is consisted of operational income (54%) and realty rent (46%). The operation income and rent in 1999~2005 are shown in following table.

5 Conclusions

The advantages and opportunities of future development of Taipei port are evaluated as follows:

5-1 Advantages

a. Taipei port is located in the central of administrative and financial region of Taiwan, and its hinterland has the biggest market of Import and export
containers. The geographic location is beneficial to obtain the transhipment container from the southeast region of China.

b. The port facilities can accommodate 10,000～15,000TEU Container Ships safely in future, so the mainline container ship can be attracted to use Taipei port.

c. Taipei port is the first landlord port in Taiwan, the port complies with the trend of modern operation and the market's expectation, and so the port has the superiority of competition.

d. Container Terminal No.1 is invested by three big shipping companies. The design capacity of handling container will be 4.0 million TEU, and excellent business capability and shipping route dispatch of operator can obtain a stable cargo source. Based on the successful operation of import and export container, this terminal can attract more shipping company’s interest, so that it is beneficial to gain more business of transhipment containers.

6-2 Opportunities

a. Taipei port is an artificial port, so that there is no restriction on boundary condition. The water area can be deepened according to the demand of shipping marketing. It has potential and full of opportunities to be a world-class container port.

b. If the project of thermal power station in Taipei port is approved by Government, the infrastructure of final stage can be accomplished in advance. It is beneficial to enhance the potential of long-term business.

c. The increase of throughput and revenue is very stable in the past years. The container terminal No.1 is under construction and it would start to operate by the end of 2008. Based on virtuous circle of port operation, the business of Taipei port would be promoted by clustering effect and economic growth in future.

d. If the urban planning of special zone for Taipei port can be executed in future, it will assist the development of Taipei port and the industries development in special zone.

7 References

Institute of Transportation MOTC. Integral Development Plan of Taiwan’s Commercial Ports, 2006.


Taipei Port Container Terminal Corporation. BOT Investment Plan of Taipei Port Container Terminal, 2002.

Keelung Harbour Bureau. Environmental Impact Assessment of Taipei Port