

彙 報

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## GENERAL DESIGN OF THE PORT OF BANGKOK.<sup>1)</sup>

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and Harbour Association of Japan\*

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### CHAPTER I. GENERAL INTRODUCTION.

#### SECTION 1. CHARACTERISTICS AND CONDITIONS OF THE PORT OF BANGKOK.

a. **Site of the Port.** Bangkok, the capital city of Siam with a population of over 681 000 is situated on the Menam Chao Phraya approximately 35 kilometers from its mouth.

b. **Communications with the Interior of the Country.** The hinterland of the Port of Bangkok is a vast plain situated in the heart of Siam through which flows the Menam Chao Phraya with agriculture as its principal industry of which rice growing consists as a major product. This vast hinterland starting from a very flat alluvial plain gradually develops into the eastern plateau and also into the high mountainous region of the north abundantly rich in teak. Several other species of timber are widely used in the country and are also exported in considerable quantities. Siam also produces a wide range of minerals, and agricultural, forest and maritime products, however, aside from certain extent of rice mill and timber works which exist presently, there is ample opportunity for the future development of the industries for its natural products.

While the water communications between Bangkok and its hinterland may be re-

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garded as fairly satisfactory, though still capable of considerable improvement, the same cannot be said of the approaches to the port from the sea. The tributaries of the Manam Chao Phraya and the river itself, supplemented by irrigation canals, form a very close network of inland navigation, providing cheap transport for produce and goods which, owing to their small intrinsic value, could not bear the cost of more rapid but expensive means of transportation. The communications of the port with its hinterland, which are developing as a result of new drainage and reclamation

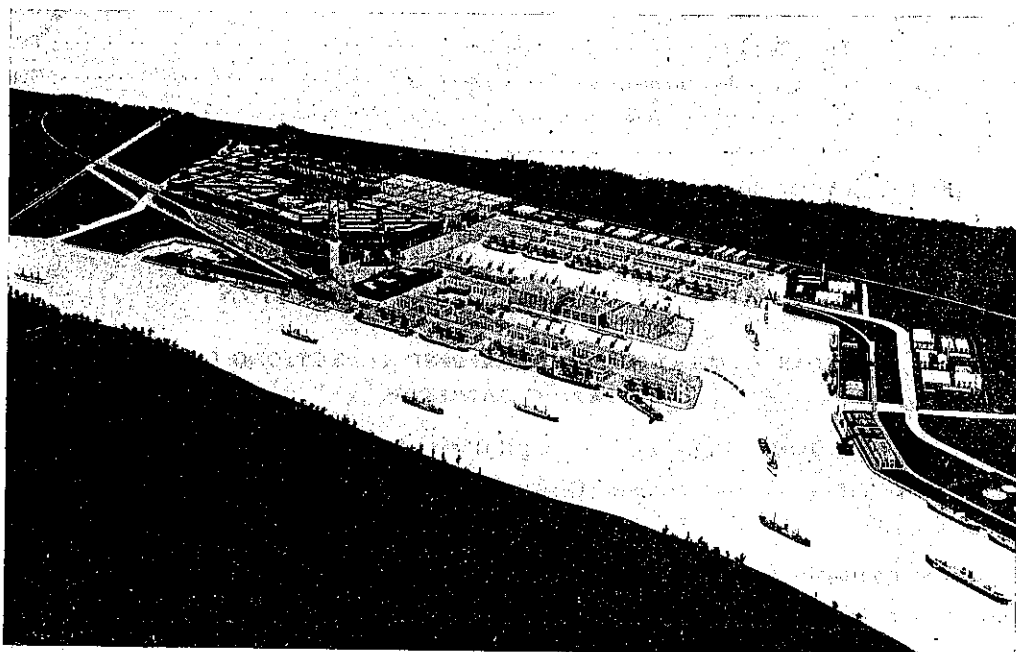


Fig. 1. Birds-eye View

canals, are completed by a railway system of about 3 000 kilometers of line which connects Bangkok with the province of Chiangmai at the northern extremity of the country and with the southern point of the peninsula, and includes two other lines, one running east and the other northeast where access to natural inland navigation is relatively small. When making new roadways, the Government's main object has been to facilitate communications with districts which have no adequate means of longdistance transportation and to connect such districts with inland waterway-system or with the railway.

Since the chief means of transportation in Siam has always been inland navigation, and since the building of railways, which began at the end of the last century, is involving considerable charges on successive budgets, and as road-making which commenced recently, it must be agreed that the Siam has nevertheless made remarkable

efforts to supply greater part of the country with good means of transport.

Rice which accounts for the bulk of the country's foreign trade, is as a rule disposed of in the neighbouring markets. Two thirds or the exports are sent to markets. Hongkong and Singapore whence they are transhipped to other destinations. Only a small amount of rice exported is conveyed by rail, five-sixths being carried by water-routes to Bangkok where it is milled and transported into ship for foreign markets.

Timber exports consist chiefly of teak, a high grade wood which, as regards value, ranks among the important list of export commodities. The lumber rafts are floated into Bangkok during favourable season where there are eight large saw-mills and a number of lesser establishments.

c. **Commercial Traffic of the Port of Bangkok.** The foreign trade of Siam, is handled for the most part through Bangkok, the total average annual quantity of export and import is approximately 2 500 000 tons (average tonnage for the previous 5 years). Of the total 2 500 000 tons of commercial traffic, 400 000 tons may be ascribed to import consisting of general cargo, textile goods, food-supplies, liquid fuels etc. As to the export, rice ranks first with a tonnage of 1 600 000 tons, timber with a total tonnage of 130 000 tons, and salt with a tonnage of 100 000 tons.

Maritime traffic entering the Port of Bangkok numbers on the average about 1 000 with a total tonnage of approximately 1 400 000 tons.

**Estuary of the Menam Chao Phraya.** The river is wide from Bangkok to the mouth and provides a channel of about 200 meters to 400 meters and with depth of 7 meters at low water which is adequate for ships and is easily navigated by vessels of 6 000 tons, but the estuary is obstructed by a bar at the mouth, over which the water is too shallow for ocean-going vessels. Outside the mouth proper, there is a whole series of bars and shoals consisting of deposits of muddy clay and fine sand. Between these bars there is a shallow depressions; the deepest of these, which is used as a navigable channel is 4.5 meters at high tide and the distance before it gets to a depth of 5 meters is about 15 kilometers.

By reason of inadequate depth of water between the bar, a very large ocean going vessel cannot enter and even for vessels of middle-sizes, the load has to be partially discharged at the Island of Koh Sichang with the assistance of lighters towed from Bangkok. Consequently, cargoes are largely transhipped at Koh Sichang, Hongkong or Singapore.

e. **Harbour Facilities.** On both banks of river, for a distance of 10 kilometers, there are private establishments for trade and transport; offices, stores, depots, sheds, rice-husking factories, sawmills, docks etc., and all these have been set up in a ha-

phazard manner to no general plan and without connection to railway system. The vessels are required to anchor in mid-stream, and the cargoes are discharged into the lighters. Also, the cargoes transported by rail are placed in shed or warehouses, and in case of export, they are required first to be loaded into lighters and then into steamer lying in mid-streams.

## **SECTION 2. NECESSITY FOR THE IMPROVEMENT OF ITS FACILITIES AND OPERATION.**

Siam with rich and abundant natural resources, should have possibilities for expansion of her foreign trade, particularly of the export, but for the reason stated in chapter I, the inadequacy of the maritime approaches to the Port of Bangkok, adds to the excessive cost of transport which constitutes a serious handicap to the Siamese export trade.

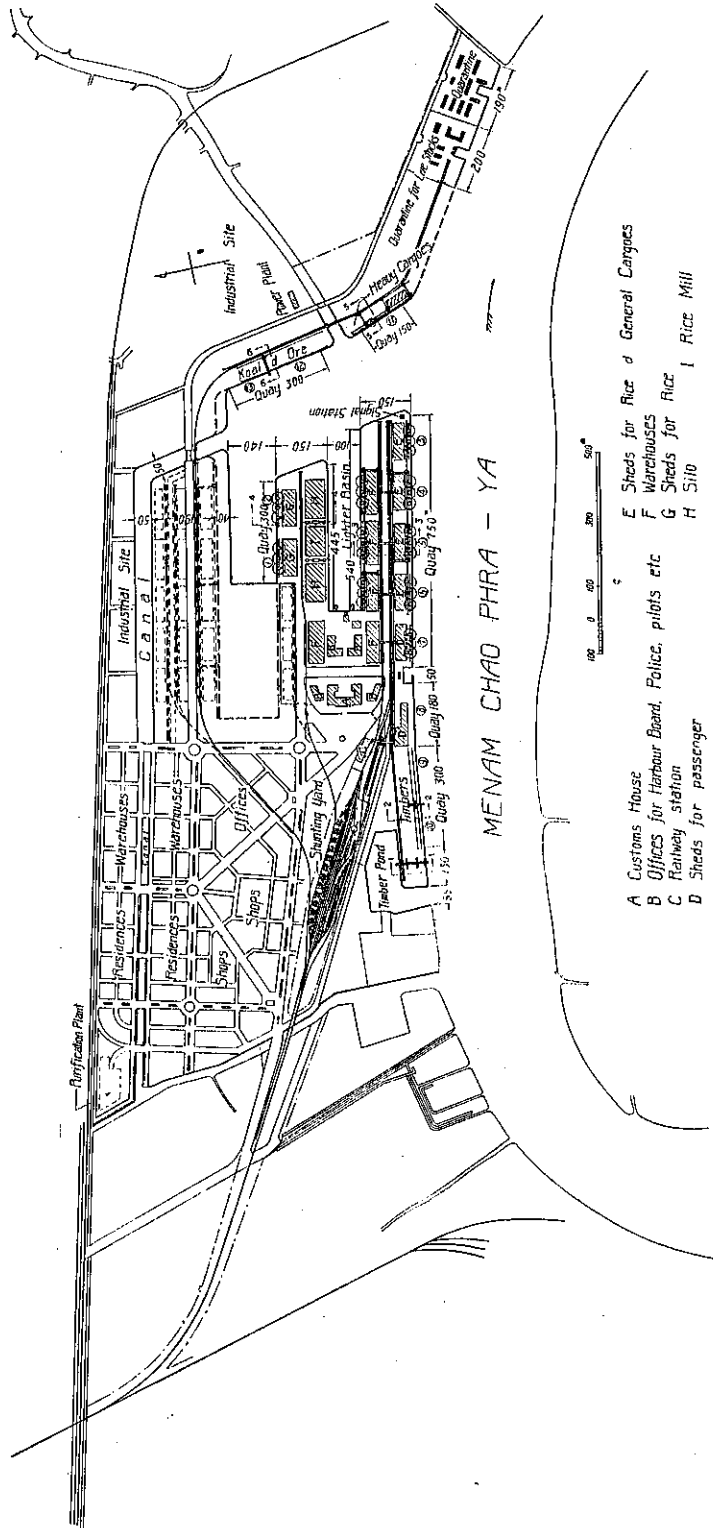
Consequently, the first step in augmenting the foreign trade is to make improvement in the maritime approaches to the port of Bangkok. With the improvement of the bar, the port should be supplemented by the construction of quays or landing-stages with all necessary equipments for a modern harbour.

Regarding the details for the improvement of the port, it will conform to the general specification presented by the Siamese Ministry of Economic Affairs, with construction of quays connected with the railway and equipped with sheds, machinery for handling goods, and public warehouses. Furthermore, special attention shall be paid to interlink inland traffic with the ocean traffic efficiently at the port of Bangkok. Thus, the building of properly equipped quays connected with railway will have the direct and immediate result of facilitating the handling of goods, and the present difficulties of handling rice, timber, import and export of cargoes should be improved as soon as possible for the successful development of her industries. Also, if the tin ore refining is to be developed, the present plan has carefully considered efficient and effective industrial site along with those for rice mills, timber mills which shall be adequately provided with land and ocean traffic so that the harbour industrialization as well can be realized to the highest standard.

## **CHAPTER II. THE DESCRIPTION OF THE PROJECT.**

### **SECTION I. TECHNICAL MEASURES FOR IMPROVING THE FACILITIES AND OPERATION OF THE PORT OF BANGKOK.**

a. **Tonnage of the Vessels entering the Port.** In order to avoid transshipment at Hongkong and Singapore and to efficiently handle the vessels, the port must be so constructed as to handle vessels of not less than 6 000 gross tons. On the other hand,



- A Customs House
- B Offices for Harbour Board, Police, pilots etc
- C Railway station
- D Sheds for passenger
- E Sheds for Rice & General Cargoes
- F Warehouses
- G Sheds for Rice
- H SIB
- I Rice Mill

Fig. 2. General Plan.

as the estuary between the mouth to the port has a depth of about 7 meters, hence by increasing the depth of the bar to 6.5 meters and using the tide, it will be possible to handle the vessel of 6 000 tons. Consequently, in this plan, the main quays were also considered with this in view.

**b. Location of Berths.** There are two plans for the arrangement of main quays as also mentioned in the Report of the League of Nations, one of which is to utilize the existing banks of the river, and the other, is to provide for several docks.

First, comparing from the point of handling of the vessel, the first plan requires a complete turning of the vessel in mid-stream which may cause difficult operation during flood season, nevertheless, even for the second plan, it will be impossible to avoid a side current at the moment when the vessel enters or leaves the docks. As the width of the river at the site of the harbour is approximately 400 meters, and also the maximum current is 1.5 meters per second, there should be no difficulty in consideration of the condition of tidal current existing at the harbour of Moji, in Japan, where we find a velocity of 2 to 2.5 meters, especially with the use of tugs.

Secondary, from the point of maintaining the depth of the harbour, it will be very easy to hold the depth of 8 meters as the part of the river where the port is to be constructed lies in a concave bank, however, the second plan will have the disadvantage of continuously dredging the docks as the fine materials shall be carried into the docks by the natural flow of the river, especially, in view of the high percentage of fine materials carried in suspension which will settle.

Furthermore, the first plan will not require special dredging which will reduce the cost of making the quays, and that the arrival and departure of the vessels can be controlled much more easily. Also, if several slips are to be dug in it will cause difficulty in simplifying the terminal railway line connecting to the quays, and by reason of various other disadvantageous conditions for the second plan, the main berths were laid out as shown in the drawing submitted.

**c. Necessity and Uses of the Docks.** The position of the port designated in the General Specification calls for construction within the width of approximately 1 000 meters. Hence, if only the bank is to be utilized for berths, then the area lying back of the bank can only be utilized to a very small extent. Hence, it is necessary to provide docks as shown in the drawing, excavation for which can be used to raise the level of the bank which is at present lying relatively low. These docks, one of which shall be used to take care of the lighters and small vessels and the other shall be used for large ships fully protected from the current of the main river. Thus, the

formation of these docks will greatly increase the area lying behind the bank and also provides facilities for future extensions.

## SECTION 2. GENERAL OUTLINE OF THE PROJECT.

In accordance with the three fundamental principles, mentioned above, we have worked out the harbour project with a firm belief. The general outline is summarized in this section, and the details will be described in the following chapters.

a. **Construction of a New Dock.** The entrance to the proposed dock is located in the neighbourhood of the confluence of the Chong Phra Khanong and the Menam Chao Phraya, which is situated in the south eastern corner of the specified area, and an inverted L-shaped basin is to be excavated as shown in the plan. The width of the entrance is 250 meters, and the dock makes an angle of about  $70^\circ$  with the center line of the river as measured facing towards the upper stream in order to facilitate the entry of inbound ships and to modify the direct onrush of violent flood waters into the dock as much as possible. Furthermore, the width of a part of the interior is enlarged to 300 meters so as to make it a turning basin for large ships.

The shore 1 230 meters in length along the main river in the upper stream, the north shore of the inner basin 300 meters long and the east side of the dock 450 meters in length, are to be used as quays for large ships, and in addition, small quays for inland navigation are to be constructed in both shores of the outer basin. The depths of water below low-water-level shall be 8 meters in the dock and 4.5 meters in the basin for inland navigation, respectively.

Various accommodations accompanying the above mentioned dock shall be laid as follows. In addition, a canal from 50 meters to 30 meters in width is to be excavated along the periphery of the specified area in order to facilitate the navigation of lighters.

### b. Locations for Various Accommodations.

(1) **Custom House Zone:** The most parts of the quays will lie along the piers and the bank of the Menam Chao Phraya River, and the foot of pier will be located almost in the center of the entire area and will occupy a most important position of the port so that the custom house building and various other government offices shall be built here in order to make the place as the center of administration and management, and the whole neighbourhood shall be allotted as customs zone.

(2) **Zone for Handling Passengers and General Cargoes:** The bank adjacent to the customs house shall be used for passengers as well as for general cargoes as it is most convenient so far as the traffic is concerned.

(3) **Zone for Handling the Rice:** The land traffic in the pier area will be con-

venient, and in addition, there shall be provided a lighter basin between two piers so that the connection with inland navigation will become effective. Hence, this zone shall be used for handling the rice, which is the greatest cargo of this harbour.

(4) Zone for Handling Timbers. Timbers are floated down the river chiefly in the form of rafts and occupy considerable surface area of the river. So that a portion in the upper stream for timber zone shall be selected in order that there will be no interference with the navigation of inbound ships as far as possible.

(5) Zone for Handling Heavy Cargoes, Coal and Minerals: The zone for the heavy cargo shall be placed in the specified location, and zone for handling the coal and tin-ores shall be provided in the east of the dock which shall be situated near the proposed industrial zone.

(6) Zone for Dangerous Cargoes: The zone for dangerous cargoes shall be established in the lower stream near the location for heavy cargoes.

(7) Zone for Private Offices and Stores: The area in the west of the customs zone, where the traffic is very convenient and which is situated towards the city of Bangkok, shall be selected for the purpose.

(8) Residential District: The residential district shall be set up in the north-eastern part which is the most quiet place in the whole harbour area.

(9) Industrial Zone: Since it is considered that the industrial development is a requisite condition for the progress of the port, it is proper to select the whole area in the rear of the quay in the east side of the dock, and in the neighbourhood of the canal.

(10) Quarantine: The location in the extreme east of the harbour area which is remotest from the city proper shall be selected for quarantine.

### CHAPTER III. QUAY ACCOMMODATIONS.

#### SECTION 1. FACILITIES FOR PASSENGERS.

A location convenient for connecting the railroad, and custom house shall be selected for passengers, and the 7th and 8th berths on the bank of the Menam Chao Phraya shall be used. The two passenger sheds shall be provided, using the second floors as passages for passengers, luggage inspection office, customs detached office and waiting rooms. The first floors shall be used for the handling of cargo and other miscellaneous goods. A passenger station shall be constructed in the rear of the sheds, an overbridge shall be used for the connection, and an open space with motor car parking zone shall be provided for in front of the station.



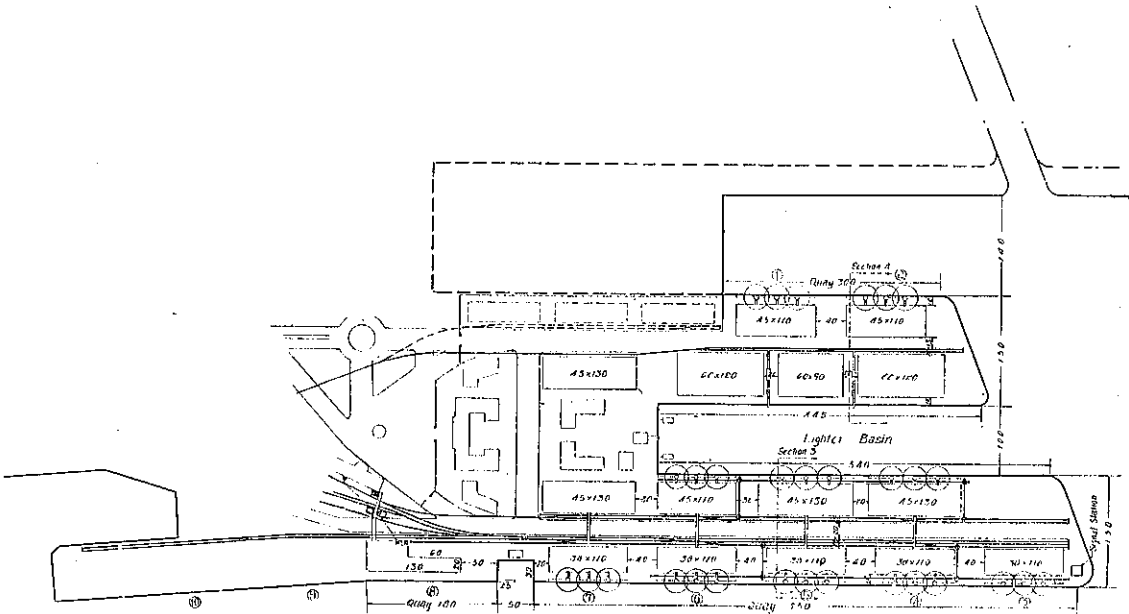


Fig. 3. Plan of Quay.

## SECTION 2. EQUIPMENTS AND FACILITIES FOR HANDLING THE RICE AND GENERAL CARGOES.

Berths No. 3 to No. 6 along the bank of the river shall be used for handling the rice and general cargoes. An apron 12 meters in width, (here an apron traffic line shall be provided for which shall connect with the main line with a turn table), a row of sheds 38 meters in width, 3 railway sidings, a road 20 meters in width, two railway sidings and a warehouse 45 meters wide shall be laid out in order to facilitate the connection between the land and the water. In addition, the above three warehouses exclusive of warehouse for berth No. 3, face directly to the lighter basin and the connection with inland navigation shall also be made possible. The warehouses and sheds shall be all two storied. The lower stories of sheds shall be used for inspection and sorting of freights or for short period storage, and the usefulness of quays will be increased immensely if the goods are stored in the upper store for relatively long period.

No. 1 and No. 2 berths on the north pier shall be used exclusively for handling the rice and the width of piers shall be 150 meters. Two railway sidings and a road shall be laid down in the center. Two silos shall be built on the side of lighter basin and a rice mill shall be constructed between them. Furthermore, two loading sheds of two stories shall be built in the 1st and 2nd berths on the north side of the pier.

Thus, the paddy rice carried in by railways and lighters can be immediately sucked up and stored in the silos milled properly in the rice mill, and then exported through the loading shed. Thus, the cargo handling will become very efficient due to the systematic manipulation.

**SECTION 3. EQUIPMENTS FOR HANDLING THE TIMBERS.**

Berths No. 9 and No. 10 in the upper stream of the river bank shall be used for handling the timbers, and a timber pond of about 28 000 square meters shall be excavated. Space between the berths and pond of about 75 meters in width shall be provided for timber yard and saw-mill. For connection with land, a belt line railway and a road shall be constructed and cranes for cargo handling shall be provided.

**SECTION 4. CARGOES IN BULK, HEAVY CARGOES AND EQUIPMENTS FOR FACTORIES.**

In the east side of the dock, berth No. 11 shall be used for heavy cargoes while

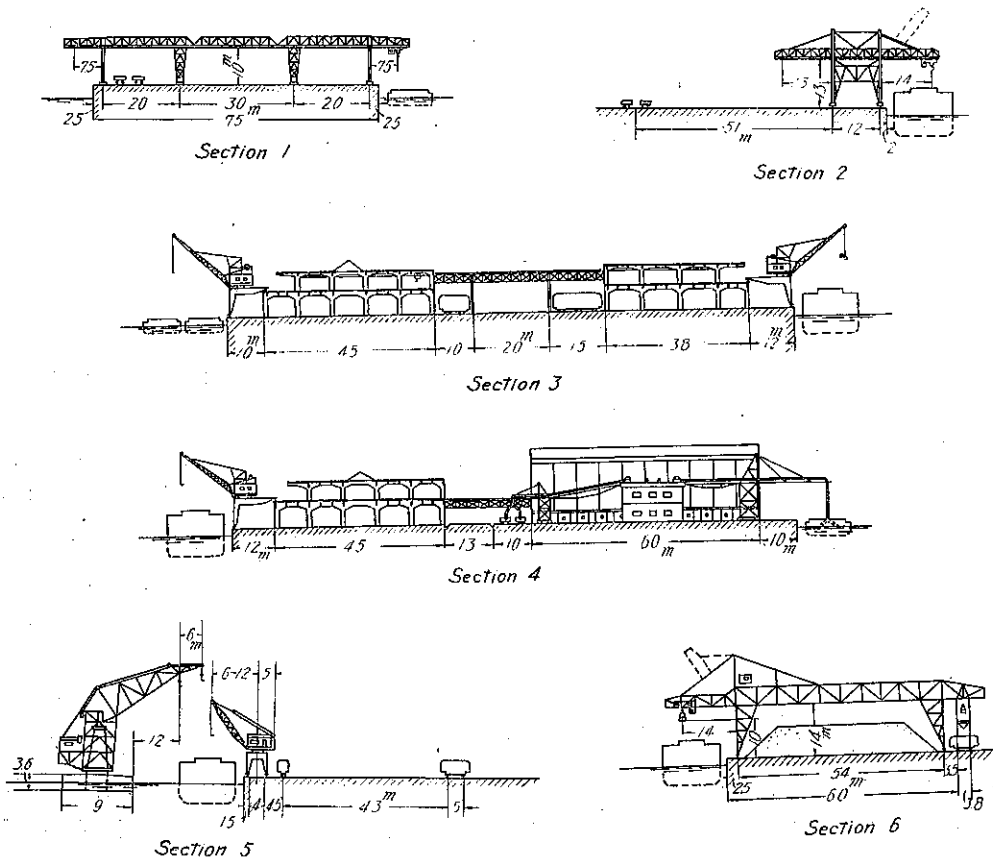


Fig. 4. Cross Section of Quay.

the berths No. 12 and No. 13 for cargoes in bulk and factories. A spacious ground in the rear of these berths shall be allotted for open space and factories provided with railway sidings. Floating cranes and portal cranes for handling heavy cargoes and transporters for cargoes in bulk shall be equipped.

#### SECTION 5. EQUIPMENT FOR OFFICIAL BOATS.

Landing stages, slips and boat houses are to be built in the end of the outer basin; and between berths No. 7 and No. 8 a basin 50 meters in length and 30 meters in width for small boats will be constructed with landing stages for the use of the official boats.

### CHAPTER IV. LAND TRAFFIC ACCOMMODATIONS.

#### SECTION 1. RAILWAY.

The belt line railway shall branch out from the position indicated in the specifications, and a sorting yard shall be constructed having a capacity in excess of 2 000 000 tons per year, and a group of sidings shall be laid out necessary for classification and storage of the freight cars. Side tracks from the sorting yard to each quay, warehouse, shed, open space and factory shall be completed in order to facilitate the land and water connections. Especially, the track which runs to the rear of the passenger shed shall be laid out so that it can connect with the main track directly and a station shall be constructed for the convenience of passengers.

#### SECTION 2. ROADWAYS.

In the specified area, a network of roads shall be well laid out in order to make the connection between each zone closer together. Two main roads, of which the one connects with the customs zone, and the other connects with the northern district shall be constructed, with a width of about 25 to 30 meters and at places shall have a green belt in the center. From these main roads, paved roads shall be branched out to each quay.

### CHAPTER V. BUILDINGS.

#### SECTION 1. ADMINISTRATION BUILDINGS.

Center of the customs zone, shall be selected for this buildings; the associated office of the entire Customs Department, and Customs Offices of Bangkok shall be made as the center. The offices for harbour board, the harbour police, pilots and immigration

shall be laid out around the Union Building in order to facilitate the harbour administration. Luggage Inspection Office and Guide Office shall be located in the upper story of the passenger shed for the convenience of travellers, and also inspection office for cargoes shall be provided in the first floor of each shed. The necessary provision of fenced area for inspection and control of customs will be made as shown in drawings.

#### SECTION 2. QUARANTINE, LIVE STOCK QUARANTINE, ETC.

Buildings for these offices and stations shall be built as far remote as possible so that the portion lying in the extreme east of the specified area can be allotted and a road shall be provided for connection.

#### SECTION 3. RESIDENTIAL DISTRICT.

The region along the canal in the northeast of the specified area shall be selected as a residential district and lodging houses for the crew and labourers. It comes near the purification plant of water supply system in the west, and a pleasant residential district shall be planned by providing small green areas.

### CHAPTER VI. MACHINERY AND OTHER ACCOMMODATIONS.

#### SECTION 1. THE MACHINERY,

The latest types of cranes and conveyors using the electric power shall be equipped in order to save the manual labour and to increase the efficiency of cargo handling in the harbour area. The chief machineries are enumerated in the following;

- |    |   |  |
|----|---|--|
| 15 | 3-ton semi-portal horizontal luffing cranes . . . . . | for handling the rice.                       |
| 15 | 2-ton luffing cranes . . . . .                        | for loading and unloading general cargoes.   |
| 4  | 1-ton telfers . . . . .                               | for connection between sheds and warehouses. |
| 4  | 60-ton per hour pneumatic elevators . . . . .         | for unloading paddy rice.                    |
| 2  | 60-ton per hour belt conveyors . . . . .              | for handling rice.                           |
| 1  | 3-ton timber . . . . .                                | for handling timbers.                        |
| 1  | 1-ton telfer for timber . . . . .                     | for hoisting timbers from river at pond.     |
| 1  | 15-ton wharf crane . . . . .                          | for unloading heavy cargoes.                 |
| 1  | 50-ton floating crane . . . . .                       | ” ” ” ”                                      |
| 1  | 50-ton per hour bridge transporter . . . . .          | for handling cargoes in bulk.                |



## CHAPTER VII. CONCLUSIONS.

When the aforementioned appliances and accommodations are fully set up, it is possible to moor 13 large sized ships at a time, and the cargo handling shall be facilitated and speeded up due to the fully equipped loading and unloading machineries, sheds and warehouses. Connections with all parts of the country with the new harbour shall be made closer by means of railways, highways and navigable channels so that the cargo transportation shall be remarkably facilitated. Moreover, the connections between silos, rice mill and loading sheds with railways and lighters shall be made complete, and the efficiency of cargo handling shall become especially high because mechanical equipments such as suction elevators, conveyors and wharf cranes shall be made use of, and thus it is expected that the quality of the rice will be decidedly improved and the price will be made more reasonable so that the Siamese rice will consequently become more renowned.

Again, the teak timber, which is known the world over, will be exported with more profits on account of the harbour accommodations and efficient saw-mill.

The harbour industrial zone, which will enjoy advantageous conditions for transporting raw materials besides rice milling and timber milling, will play an important roll as a forerunner of the Siamese industries which will grow eventually.

According to the project, the total length of the quay shall be 1 980 meters in length and the capacity of load handling shall be at least 3 000 000 tons per annum, and the construction cost shall be approximately 25 000 000 bath; and it shall be fully equipped regarding the interior navigation as well as the foreign trade. Again, the harbour possesses an essence for industrial harbour development as well as a commercial port.

In case the proposed facilities shall not be adequate in future due to the development of the harbour, there can be provided a space for constructing wharves 1 320 meters in length which can moor 4 large-sized vessels and 6 medium-sized ships, and the cargo handling capacity shall thereby be increased by 2 000 000 tons.

Last, but not the least, let us hope that the project may be actually undertaken, and earnestly desire the realization of the estuary improvement in the near future in order to fully show the wonderful capacities as a modern harbour.

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