Ministry of Fisheries and Agriculture
Seychelles Fishing Authority
Republic of Seychelles

PREPARATORY SURVEY REPORT ON THE PROJECT FOR THE CONSTRUCTION OF ARTISANAL FISHERIES FACILITIES IN MAHE ISLAND, PHASE 2 IN THE REPUBLIC OF SEYCHELLES

FEBRUARY 2016

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

OAFIC CO., LTD.
ECOH CORPORATION

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to OAFIC Co., LTD. & ECOH Corporation. The survey team held a series of discussions with the officials concerned of the Government of Republic of Seychelles, and conducted field investigations. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Seychelles for their close cooperation extended to the survey team.

February 2016

Mr. Makoto Kitanaka
Director General,
Rural Development Department
Japan International Cooperation Agency

SUMMARY

1. Country Profile

The Republic of Seychelles (hereinafter "Seychelles") has a population of about 91,000 (2014: World Bank) and a total land area of 460 km^2 spread around 115 islands. The country has a total coastline of about 491 km. Its exclusive economic zone (EEZ) of about 1.37 million km^2 includes the Mahé Plateau and the Amirantes Plateau, which offer suitable fishing grounds for coastal fisheries.

Seychelles has a marine tropical climate, average temperatures are stable at 27°C throughout the year, and average humidity is high at about 80%. The year is broadly divided into two seasons, May to October being a dry season under the influence of the southeast monsoon and November to April a rainy season under the influence of the northwest monsoon. Rainfall is plentiful; average annual precipitation is more than 2,500mm, nearly three times the global average of 900mm and 1.5 times the Japanese average of 1,700mm. Cyclones have relatively little impact.

Seychelles enjoys a relatively high socio-economic status compared to other African nations; in 2014, for example, the per capita GNI was US$13,990 (World Bank) and the country was ranked 71st out of 187 countries in the UNDP Human Development Index. On the other hand, the economy is dependent on tourism and fisheries, and the status of Seychelles as an island nation makes it susceptible to the impact of climate change and other fluctuation in the natural environment. This in turn causes high levels of economic and environmental fragility. To combat these negative aspects, the government of Seychelles is striving to promote fisheries, agriculture and small-scale industries.

The breakdown of GDP by industry comprises primary industries (3%), secondary industries (27%) and tertiary industries (70%). The principal industries are tourism and fisheries, with primary focus on tuna fishing. Tourism, in particular, employs around 30% of the working population and generates around 70% of foreign currency income. However, because this dependence on tourism is susceptible to the impact of international and other situations, the government is striving to promote fisheries, agriculture and small-scale industries. Partly due to a slump in tourism following the 9/11 attacks on the USA in 2001, the real GDP growth rate stagnated at 6.0% in 2013 and 3.0% in 2014, while in 2014 outstanding foreign debt reached 1,720 million US$. The value of exports in 2014 was 596 million US$, the principal exports being canned tuna (68%), frozen fish (13.2%) and cements (5%). Imports totaled 1,024 million US$; the main imports were foods and livestock, fuel, and transport machinery. The trade balance is massively in the red, and the Seychelles government aims to improve self-sufficiency in daily commodities and food in order to reduce imports.

2. Background of the Project

The principal industries of Seychelles are tourism and fisheries (coastal-offshore fisheries and tuna processing). In particular, the fisheries industry accounts for 48% of the country's exports and 10% of its labor force in regular employment, thus making a huge contribution to the national economy.

In its "Seychelles Strategy 2017" national development plan (2007-2017), the Seychelles government cites the target of doubling GDP and identifies the economy's two mainstays of tourism and fisheries as priority sectors for the future. The Strategy also sets the target of making Seychelles a principal center for fishery processing in the Indian Ocean, particularly given that the headquarters of the Indian Ocean Tuna Commission are located in the country. Meanwhile, the government's "Fisheries Policy" (2005) outlines its policy in the fisheries sector. Here, promoting the development of sustainable fisheries through measures such as developing new fishing ports and improving the infrastructure of existing fishing ports is cited as a matter of priority importance.

Currently, annual fishery catches in Seychelles amount to about 270,000 tons, of which catches from artisanal or small-scale fisheries account for 4,135 tons. Catches by artisanal fisheries are mainly landed at Port Victoria on Mahé Island, location of the capital Victoria, and these catches are increasing year by year (2011: 1,087.3 tons, 2013: 1,260.8 tons; source: Seychelles Fishing Authority Annual Report (2013)). This has led to congestion inside Port Victoria, lost catches due to a decline in landing efficiency, and a decrease in the safety of moored vessels. It has also caused problems such as declining freshness owing to catches exceeding the capacity of refrigeration facilities. However, there is no room to expand Port Victoria, as the fishing port is sandwiched between the buildings of fishery processing companies, while multipurpose fishery offices stand behind the port and Hodoul Island faces the quay. As a result, there are calls for other fishing ports in the country to be developed or expanded with some urgency.

The Providence district, the target area of this Project, is located some 5km south of Victoria. In view of its location, it is being proactively developed as a new industrial district, and there are progressive moves to build fishery processing facilities and lease land to investors who will use fishery processing plants as investment targets in future. In 2008, a new fishing port together with fishery-related facilities were developed in the Providence district under the Grant Aid Project for the Construction of Fishery Facilities and Supply of Equipment (hereinafter "Phase 1"). The number of fishing boats based at Providence Port (including those transferring from Port Victoria) increased from 23 in 2011 to 49 in 2014, and this number is expected to rise to 80 in 2018. However, the country's fisheries sector is segmented into subdivisions including corporate fisheries, artisanal fisheries and

aquaculture, and investment in corporate fisheries (mainly tuna fishing, where foreign capital investment is easier to obtain) has been earmarked as a priority target in annual fishery negotiations with the EU. As a result, any further development of fishery facilities and others in Providence Port, a port designed for artisanal fisheries, would be difficult owing to budgetary constraints. Moreover, although a fishing port together with fishery-related facilities were developed in Phase 1, the number of fishing boats using the port is expected to keep increasing in future. To cope with this, the facilities required for fishery activity in the port (e.g. quays, aprons, landing sheds, water and power supply equipment, ice making facilities) need to be expanded.

Given this situation, expanding and developing Providence Port and strengthening its functions will be essential to secure smooth and efficient fish landings in the port, thus contributing to the further promotion of fisheries in Seychelles.

3. Contents of the Project

In response to these requirements, the Government of Japan decided to conduct preparatory surveys, and dispatched the following survey teams to the local area for this purpose.

- Preparatory survey 1: March 7 - April 5, 2015
- Preparatory survey 2: May 19 -July 17, 2015
- Outline explanation survey: November 25 - December 5, 2015

This Grant Aid project was designed on the basis of a request from the Seychelles government and the results of local surveys and discussions. The ultimate purpose of the project was to help the Seychelles government implement its Fisheries Development Plan, which highlights fisheries as an important industry for developing the national economy and has the target of "promoting sustainable and responsible development of fisheries". Specific goals were to develop quays No.1 and No.2 (including aprons, 212m), develop access roads and U-turn paving (1,879m^2), and install mooring buoys as civil engineering facilities, and to provide Soft components contributing to an improvement in facility maintenance technology. These targeted an ice making building (daily output 10 tons) and fish landing sheds (20.4m×7m) as architectural facilities, as well as various infrastructure(street lighting, water and power supply), access roads and ice making equipment. In this way, steps would be taken to ease congestion inside Providence and Victoria fishing ports caused by a marked increase in fishing boats and up scaling of ports, and to ensure a stable supply of ice. The Seychelles request also included the components of "developing quay No. 3, quay No. 4, and breakwaters" and "reclaiming the hinterland", but it was decided that these would be outside the scope of the project as they were judged premature in terms of cost effectiveness. The facilities subject to the aid are shown below.

4. Project Duration, Estimated Project Costs

(1) Duration

If this Project is implemented with Grant Aid from Japan, a total of approximately 26 months will be required for the entire process, consisting of approximately 8 months for implementation design and 18 months for construction work.

(2) Estimated Project Costs

The project cost beard by Government of Seychells is estimated to 48 million yen. As support for artisanal fishermen, partial subsidies have been secured for the operation of fishing port facilities. Therefore, the balance of operation and maintenance costs obtained through the expansion of Providence Fishing Port facilities after the implementation of this Project is estimated to be 2,465,000 Seychelles rupees (SCR) per annum. Implementing agency, Seychelles Fishing Authority (SFA), commitment on future maintenance and facility upgrades has been obtained from the Ministry of Finance, Trade and Blue Economy (MFTBE), and the soundness of funding for the operation and maintenance of Providence Fishing Port will be secured.

5. Project Evaluation

(1) Relevance

This Project will contribute to meeting the upper level plan targets cited in the Seychelles Fisheries Development Plan, namely “making sustainable use of resources”, “creating employment”, “acquiring foreign currency” and “food safety”. Given the increase in vessels using Providence Fishing Port, the goals of this Project were to improve the working environment for artisanal fishermen who use Victoria and Providence as activity bases, increase the efficiency of operations and increase output volumes by small and medium artisanal fishing boats, and to achieve operational efficiency and improvement inside fishing ports. These goals were to be achieved by expanding and developing the facilities needed for appropriate fishing activities. Moreover, as well as helping to resolve these issues, the Project also aimed to improve convenience and safety inside the fishing port, as well as the hygiene of fresh fishery produce distributed in the area.

The following effects are expected from this Project.

(2) Effectiveness

Quantitative effects arising from this Project may be ascertained in terms of the congestion rate of the expanded quays, the volume of fish catches landed at Providence Fishing Port, and the quantity of ice sold to fishermen at Providence Fishing Port.

Quantitative effects

Indicator	**Reference value** (Actual figure for 2015)	**Target value (2021)** (Three years after Project completion)
Quay congestion rate* (%)	191	100
Fish catch landing volume (tons/year)	150	292
Ice sold at the fishing port (tons/month)	125	375

*Quay congestion rate (Target value)= Number of vessels using quay/ Designed number for mooring vessels.

The expected outcomes for quantitative effects arising from the input of this Project are as follows.

(i) The work efficiency of fishers is improved through the implementation of port regulations.

(ii) The safety of vessels and fishers at Providence/ Victoria ports are improved through reducing the congestion.

(iii) The optimum supply of ice for fishers is ensured through enhancing the operation and management of ice making facility.

(iv) The quality of fish product is improved through enhancing the port operation such as the use of ice making facility and landing shed.

Based on the above, this Project is judged to be highly relevant and also to promise ample effectiveness, since besides the contribution to fishery operators who use the fishing port, a knock-on effect to fisheries in the local community can also be expected.

THE PROJECT FOR THE CONSTRUCTION OF ARTISANAL FISHERIES FACILITIES IN MAHE ISLAND, PHASE 2

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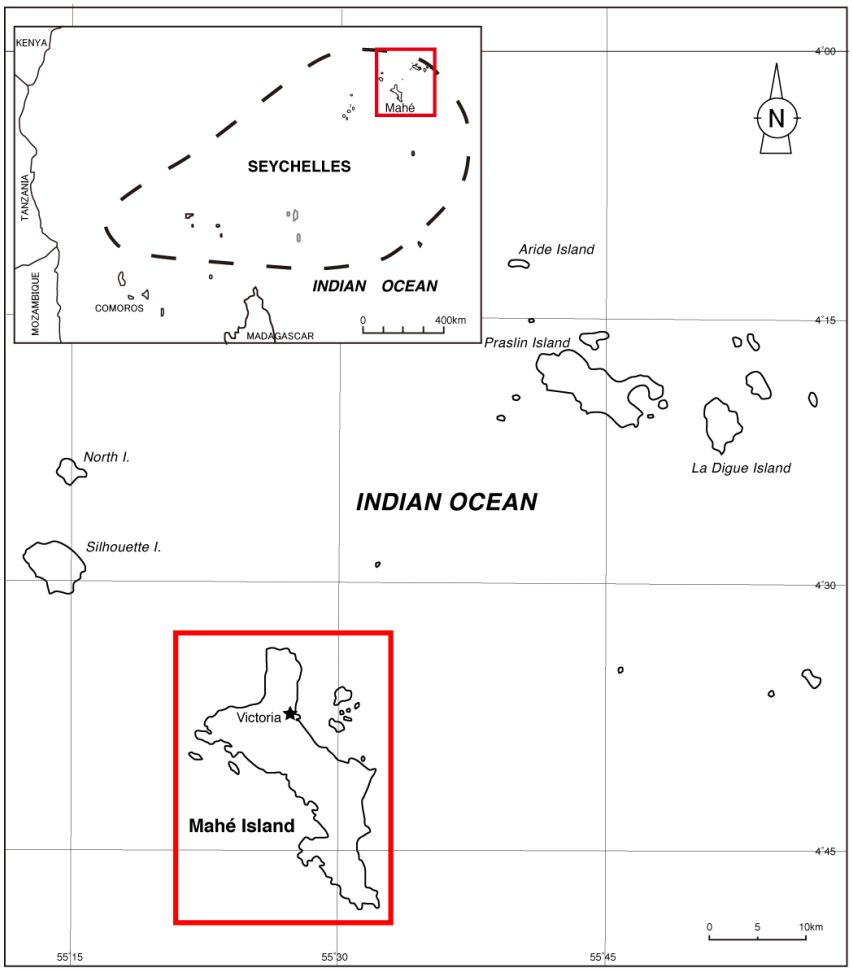
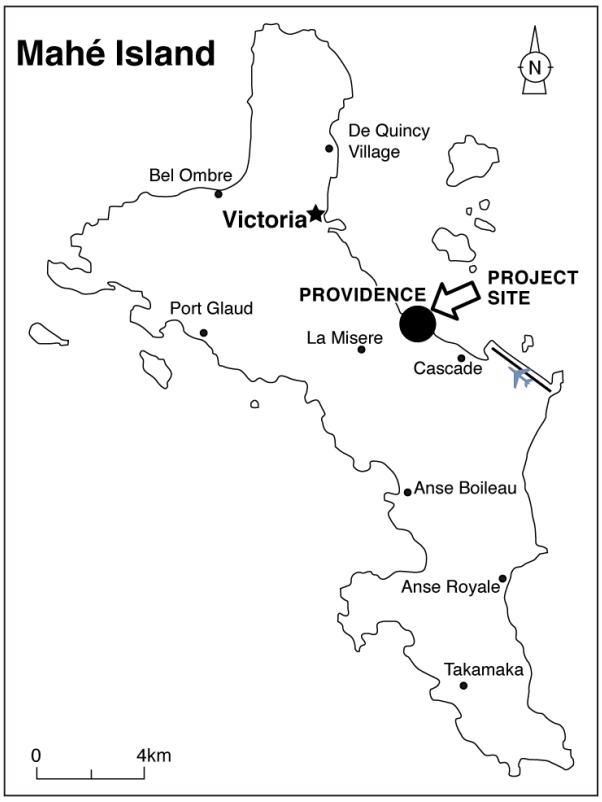
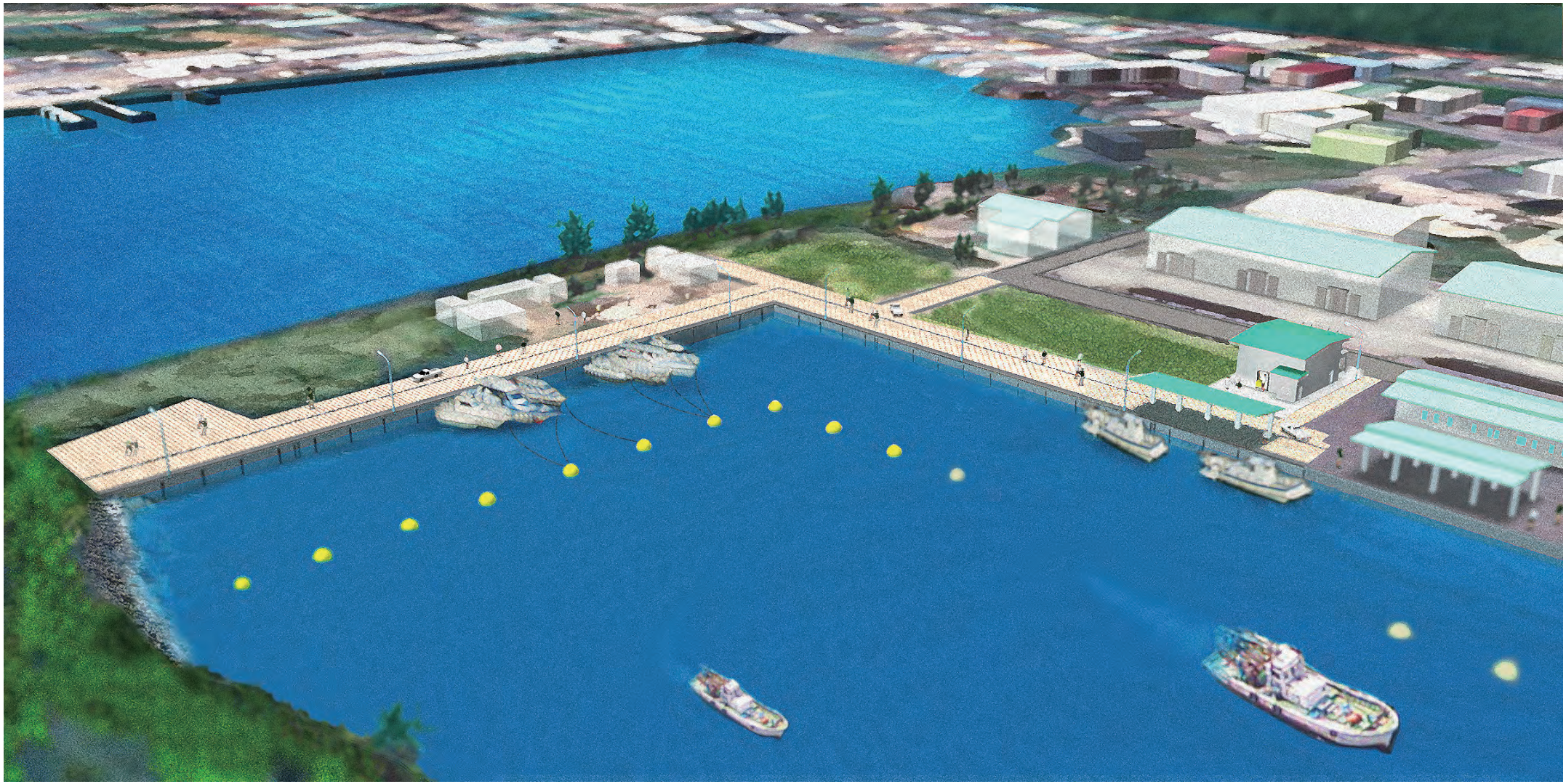




Location Map

Perspective



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Abbreviations

ABBREVIATIONS	LONG FORM
[Relating Organizations]	
DBS	Development Bank of Seychelles
FBOA	Fishing Boat Owners Association
JICA	Japan International Cooperation Agency
MENR	Ministry of Energy and National Resources
MEECC	Ministry of Environment Energy and Climate Change
MFTBE	Ministry of Finance, Trade and the Blue Economy
MFA	Ministry of Fisheries and Agriculture
NMS	National Meteorological Services
PUC	Public Utilities Corporation
SAA	Seychelles Agriculture Agency
SBS	Seychelles Bureau of Standards
SFA	Seychelles Fishing Authority
SMSA	Seychelles Maritime Safety Administration
SMB	Seychelles Marketing Board
SPA	Seychelles Port Authority
[Other Organizations]	
AfDB	African Development Bank
EU	European Union
IFAD	International Fund for Agricultural Development
IMO	International Maritime Organization
IMF	International Monetary Fund
UNDP	United Nations Development Programme
USGS	United States Geological Survey
[Type of Vessels]	
LAV	Lavenir Boat
LEC	Leconomi Boat
LL	Longline Vessel
MM	Mini Mahé Boat
SCH	Schooner Boat
SEA	Sea Cucumber Boat
WH	Whalers Vessel
[Others]	
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
EEZ	Exclusive Economic Zone

HFC	Hydro-fluorocarbon
SS	Suspended Solid
A/P	Approval to Pay
B/A	Banking Arrangement
NGO	Non-Government Organization
OFCF	Overseas Fishery Cooperation Foundation of Japan
BS	British Standards
E/N	Exchange Notes
EIA	Environmental Impact Assessment
FPA	Fisheries Partnership Agreement
G/A	Grant Agreement
GDP	Gross Domestic Product
GNI	Gross National Income
H.W.L.	High Water Level
IEE	Initial Environmental Examination
L.W.L.	Low Water Level
M/D	Minuets of Discussion
MT	Metric Ton
RC	Reinforce Concrete
SCR	Seychelles Rupee

Chapter 1 Background of the Project

1 Background of the Project

1-1 Background

The Republic of Seychelles (hereafter Seychelles) is an archipelago in the Indian Ocean. The 115-island country, whose capital is Victoria, lies 1,500 kilometers east of mainland Southeast Africa. Seychelles, with a population of about 91,000, has the smallest population of any independent African state. The Gross Domestic Product (GDP) in Seychelles expanded 2.80 percent in 2014 from the previous year. The country is known for its upmarket tourism and offshore financial center. In recent years, to make the economy less dependent on tourism, Seychelles promoted the development of fishing industries. It has a surface area of 455 km^2 but an Exclusive Economic Zone (EEZ) of 1.37 million km^2. Seychelles is a stable democracy with presidential and parliamentary elections held every five years. The country ranks high in Africa in terms of human development (HDI was 0.756 in 2014) and ranks second in Africa in terms of income (GNI per capita was $ 13,990 in 2015: World bank). Millennium Development Goals have accomplish, despite overseas development aid has decreased substantially in the past few years.

The fisheries industry is important in Seychelles contributing 8%to GDP, but this sector continues to be adversely affected by fluctuations in fish stocks and the threat of Somali pirates. Seychelles economy being a small island state remains highly vulnerable to global economic downturns, especially in the tourism market and the price of essential commodities (oil and food).

(1) Sectional issues

The Seychelles government has highlighted fisheries as the most important industry for developing the national economy. It formulated a fisheries policy in 2005 and is currently promoting the sustainable and responsible development of fisheries. Victoria Fishing Port is mainly a focus for small-and medium-scale fisheries, for which various facilities including quays and fish landing sites were developed with Japanese grant aid for fisheries in 1997. Since then, the quays have become very congested owing to an increase in the number of boats using them. This has led in turn to a loss of freshness in fish catches and a decline in the safety of boat mooring, due to a deterioration in landing efficiency. Meanwhile, Bel Ombre Fishing Port is the second fishing port after Victoria, and the Seychelles government is currently engaged in a project to expand and develop the port. However, due to the underdevelopment of ice making facilities, the main fishing boats land their catches and moor at Victoria Fishing Port, adding to the congestion there.

To combat this, the Seychelles government planned to develop fishing port facilities for the new industrial district in Providence and an ice making facility for Bel Ombre Fishing Port (the

secondary fish landing site), and asked Japan for grant aid to implement this Project. The ultimate aim was to ease congestion in Victoria Fishing Port, as well as promoting small-scale fisheries in the two districts.

Providence Fishing Port was built with grant aid from Japan at the same time as Bel Ombre Fishing Port, with the aim of easing congestion in Victoria Fishing Port. It was completed in February 2010. After Providence Fishing Port was opened, the average number of boats moored at Victoria Fishing Port each day temporarily decreased and the effects of the project were confirmed.

Fishery processing facilities are under construction in the area around Providence Fishing Port, thanks to support from the EU and elsewhere. As a result of this, however, both the number of fishing boats based at the port (including those transferring from Port Victoria) and their average monthly fishing operations have increased. In future, it will be absolutely essential to strengthen the functions of the fishing port through expansion and development, in order to further promote fisheries in the Seychelles by securing smooth and efficient fish landings at the port.

Recently, Seychelles government have been conducted promotion of artisanal fisheries sector by exempting GST and trade tax, financial support through Development Bank of Seychelles (DBS), and providing subsidy to fuels and ice for artisanal fishing activity. Accordingly, artisanal fishing vessels were growing in number of vessels as well as in the size, enhancing congestion for landing and mooring in the port. Thus construction of new fishing quay and fisheries related facilities in Providence fishing port was key step toward the decentralization of operation away from Victoria fishing port and to create interest in further investment of this sector.

(2) Enumeration of problems and issues with Victoria Fishing Port

Victoria Fishing Port is used as a fish landing port by many small and medium fishing boats, on account of its location in the capital and its proximity to Victoria Central Market. The problems shown below have been found.

1) Issues from infrastructural aspect

i) Partly due to the increasing size of fishing boats, mooring areas inside the port are becoming overcrowded.

ii) As well as the overcrowding inside the fishing port, the method of facility use planned on the basis of movement lines is not consistent with the purpose.

iii) Traffic congestion toward the market is becoming normal.

iv) There are physical constraints on the expansion of the fishing port.

2) Issues from technical aspect

i) The volume of ice procured for use by fishing boats is inadequate, and this is affecting fishing activity.

ii) Guidance on facility use (operation) is not sufficiently rigorous.

iii) No fees are levied from fishermen for the use of harbor facilities.

(3) Enumeration of problems and issues with Providence Fishing Port

After Victoria, Providence Fishing Port is the second largest fish landing port. It is most often used mainly as a mooring base for fishing boats, and is also used as a port where ice sold by the SFA can be obtained. In particular, 90% of domestically caught sea cucumbers are landed at Providence Fishing Port, where they are processed for export in private-sector factories scattered near the port. The construction of fishery processing facilities at Providence Fishing Port is in progress. There are expectations of its role as a fish landing port capable of supplying raw materials to fishery processing plants, due to its positioning as a mooring port planned in Phase 1.

1) Issues from infrastructural aspect

i) The number of fishing boats moored inside Providence Fishing Port has increased to twice the designed plan, and with the increasing size of fishing boats, there is not enough quay space available for safe mooring.

ii) With the congestion inside the port, the method of facility use is not consistent with the purpose.

iii) There are not enough awning facilities for fishing preparation and landing work undertaken during the day in equatorial conditions.

2) Issues from technical aspect

i) The volume of ice procured is inadequate, and this is affecting activity by fishing boats.

ii) Guidance on facility use (operation) is not sufficiently rigorous.

iii) No fees are levied from fishermen for the use of facilities.

1-2 Natural conditions

(1) Temperature, Daylight, Rainfall, Humidity and Wind

Meteorological data in this study were collected from Natural Meteorological Services in the Seychelles International Airport. Summary data of natural condition (Temperature, Daylight, Rainfall, Humidity, and Wind) of past 42 years are shown in the Table 1-2(1).

Seychelles has a marine tropical climate, average temperatures are stable at 27°C throughout the year, and average humidity is high at about 80%. The year is broadly divided into two seasons, May to October being a dry season under the influence of the southeast monsoon and November to April a rainy season under the influence of the northwest monsoon. Rainfall is plentiful; average annual precipitation is more than 2,500mm, nearly three times the global average of 900mm and 1.5 times the Japanese average of 1,700mm. The oceanic condition becomes rough with mean wind speed exceeding 10 knots during dry season specially from June to September, consequently this causes low season for the fishing activities. As Seychelles is located outer zone of tropical cyclone zone resulting Cyclones have relatively little impact.

Table 1-2(1) Meteorological Data (1972-2013)

Item	unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average	Total
Mean Temperture	℃	26.9	27.5	27.9	28.2	28.0	26.8	26.1	26.1	26.6	26.9	27.0	27.0	27.1	
Monthry Sunshine	h	155.1	176.1	212.5	234.3	255.2	223.1	233.4	232.5	216.9	222.9	204.2	174.9	211.8	2541.0
Daily Sunshine	h	5.0	6.2	6.9	7.8	8.2	7.6	7.5	7.5	7.2	7.2	6.8	5.7	7.0	
Mean Rainfall	mm	408.3	264.5	192.5	190.3	137.9	97.2	78.1	110.6	149.7	202.7	201.5	298.6	194.3	2331.8
Season		**Rainy Season**				Dry Season						**Rainy Season**			
Mean Humidity	%	82	80	79	80	78	79	80	79	79	79	80	81	79.7	
Mean Wind	kts	6.2	6.4	5.4	5.0	7.9	10.5	11.3	12.1	11.3	7.9	5.6	5.7	8.0	
Fishing Season							**Low Season**								
Sea Cucumber								**Close Season**							
Gust	kts	57	55	61	51	53	51	61	50	48	50	59	56	54.3	

Source: Seychelles National Meteorological Services

(2) Topographic and Bathymetric Survey

The result of topographic and bathymetric surveys implemented (as of March 2015) during this survey are shown in Figure 1-2(1). As the highlight of survey result of those periods, the bottom topography studies showed not much changes comparing with previous survey conducted in Phase 1 (2006).

Bottom cross-section of existing breakwater in the back of bays are shown in Figure 1-2(2). The building structures of the fish-processing factory to temporary quay and jetty have been constructed as described in figure as B-B section. As consequence, those building structures are closely devoted to the project site.

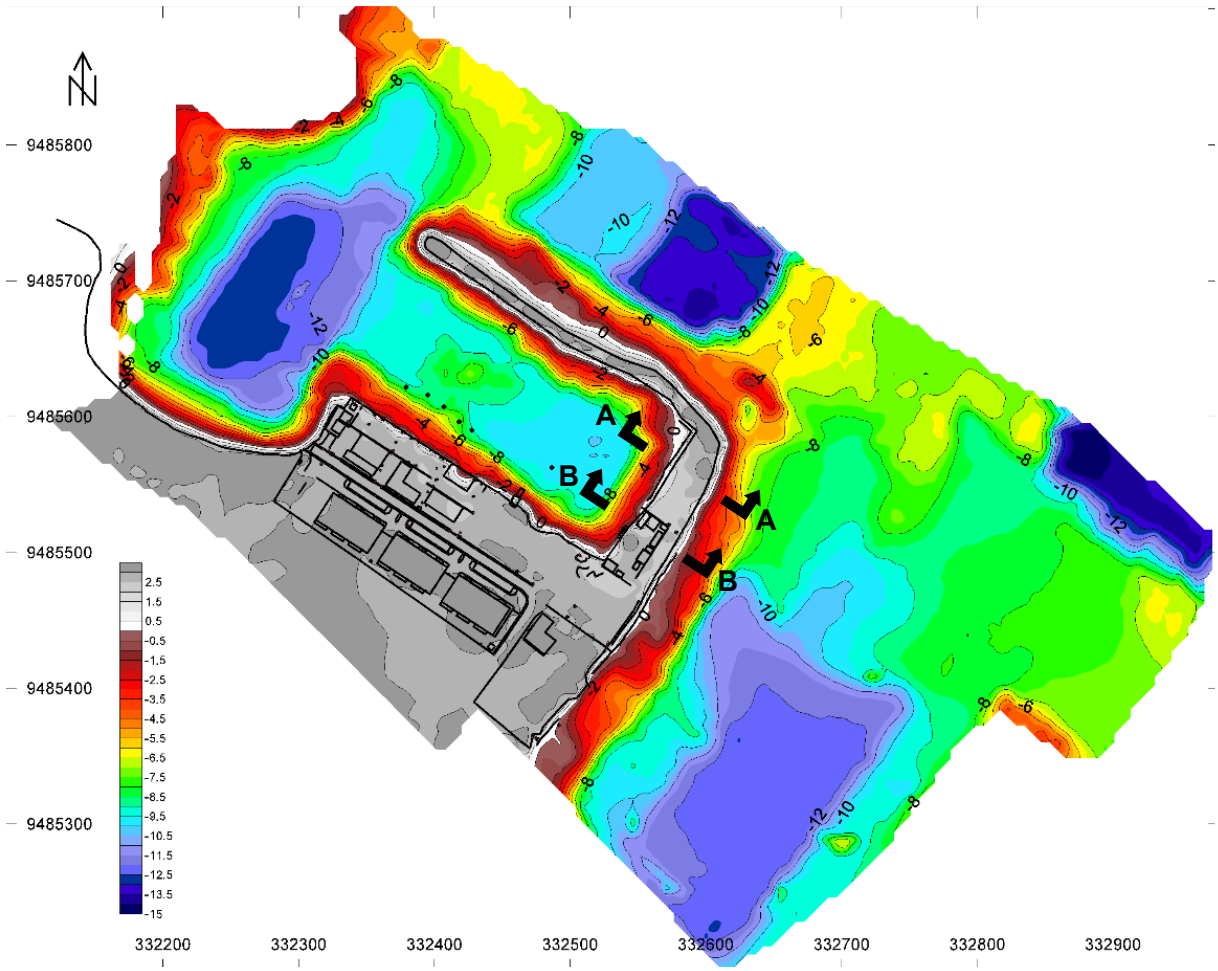


Figure 1-2(1) Topographic and Bathymetric Surveys result (March 2015)

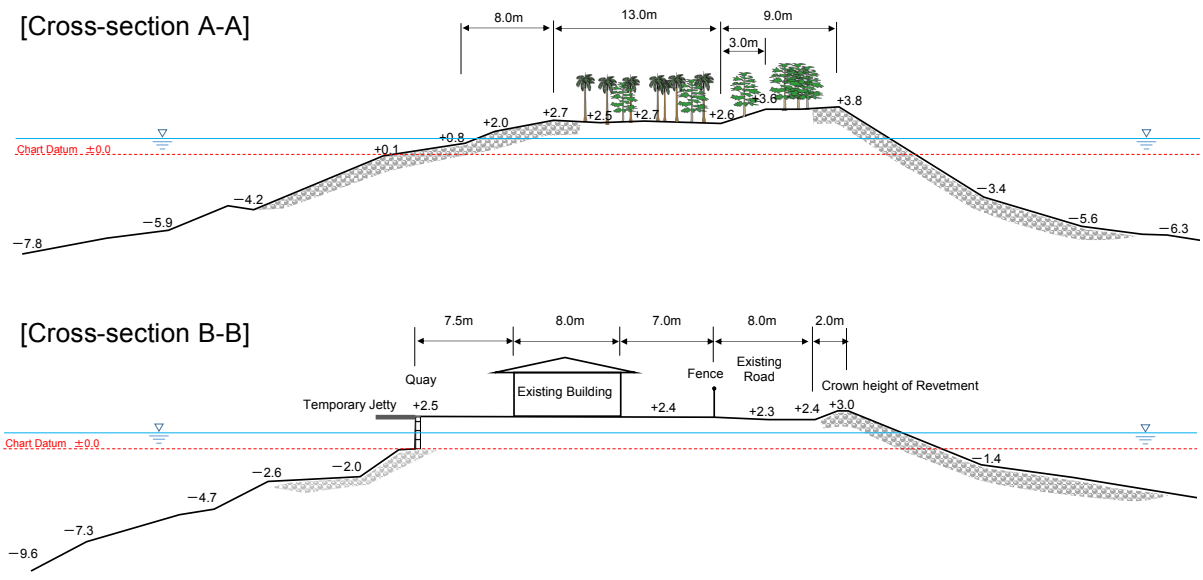


Figure 1-2(2) Cross Section diagram of Breakwater (March, 2015)

(3) Soil Conditions

Phase 1 conducted the soil investigation of the Project site in January 2006. The basic structures of Quay No. 1 have been studied from this result, which were requested from the recipient country. During this survey, sets of two soil investigations were conducted to confirm current soil condition of Quay No.2. Samples from this investigation were collected, and studied result are shown in Figure 1-2(3), and borehole logs of Phase 1 are shown in Figure 1-2(4) together with comparison of this study result in Figure 1-2(5), respectively.

As the result, following characteristics of soil structures are summarized:

a) Comparatively good filling materials having more than 10 N values are used from surface to -3m depths.

b) Crude density with very loose coral sand and a muddy soil (classified as silt) are found from depth of -3m to -10m having 0 to 12 in N-value. The soil condition of the depth exceeding of -10m become "very soft", with N value of 0 to 3.

Soil condition becomes relatively stable in deeper than -20m with N value of above 10. According to the hearing survey to the local company, a bearing stratum of granite is sited at a depth of -30m.

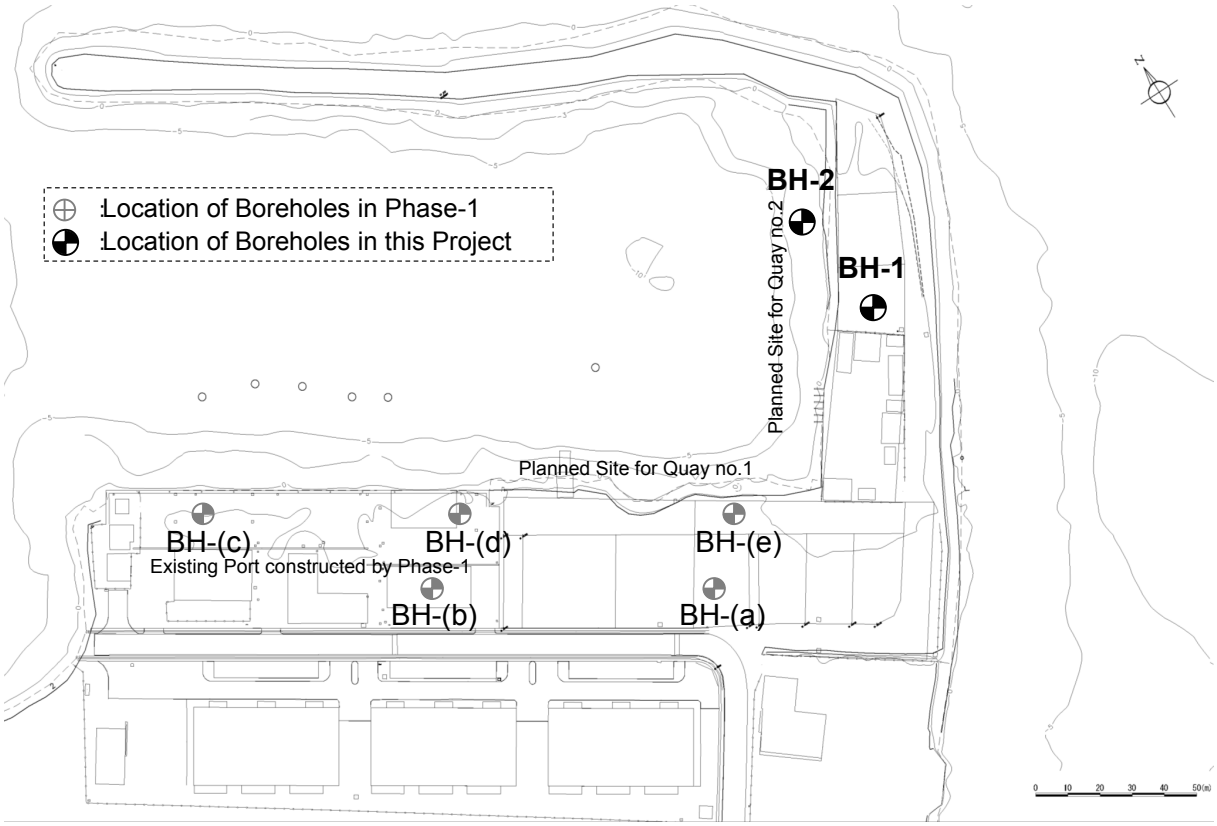
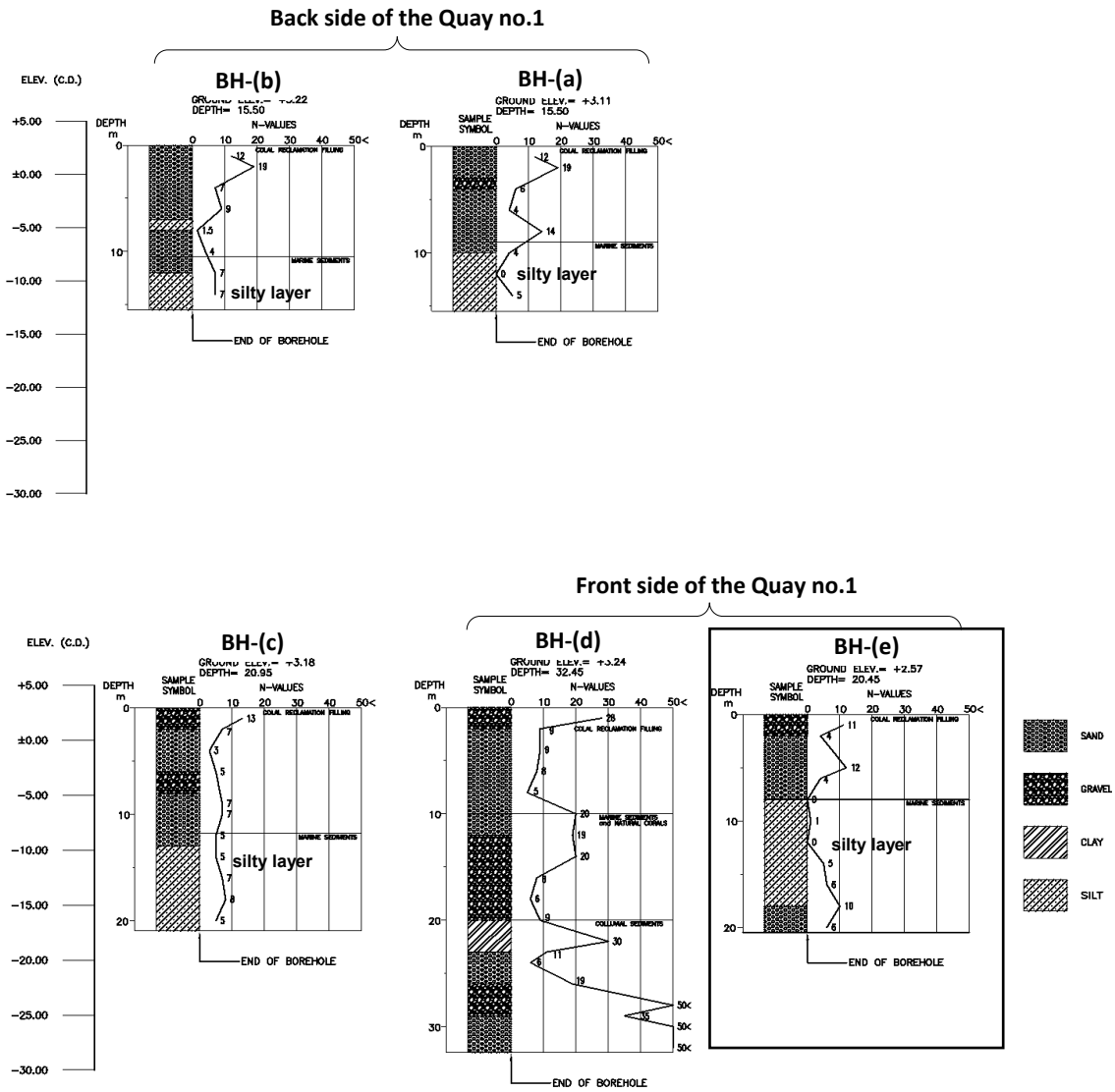


Figure 1-2(3) Boreholes survey position



Source: "Basic design study report on the project for the construction of fishery facilities and supply of equipment in the Republic of Seychelles" (issued in 2006)

Figure 1-2(4) Result from Soil Investigation (January 2006)

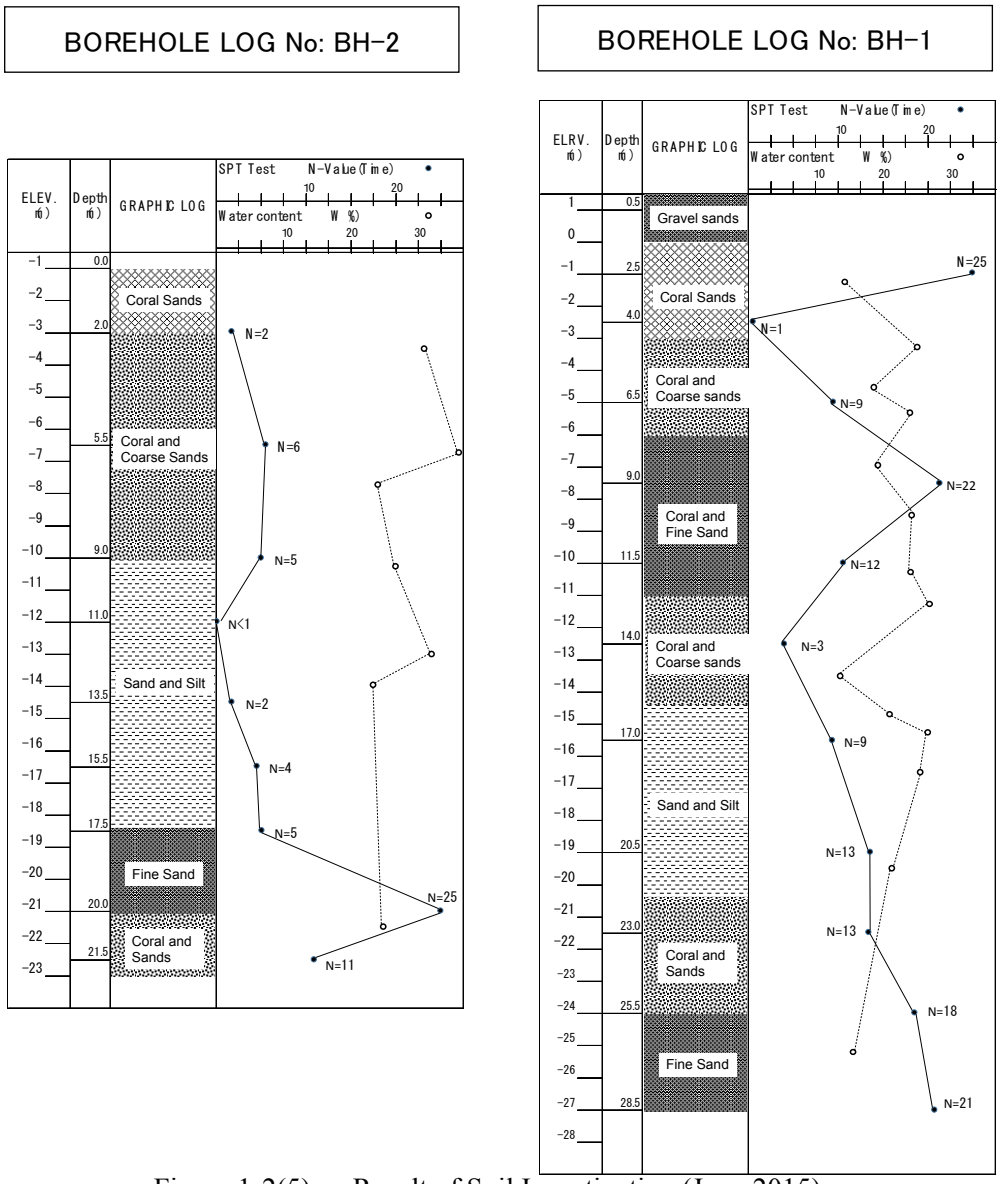


Figure 1-2(5) Result of Soil Investigation (June 2015)

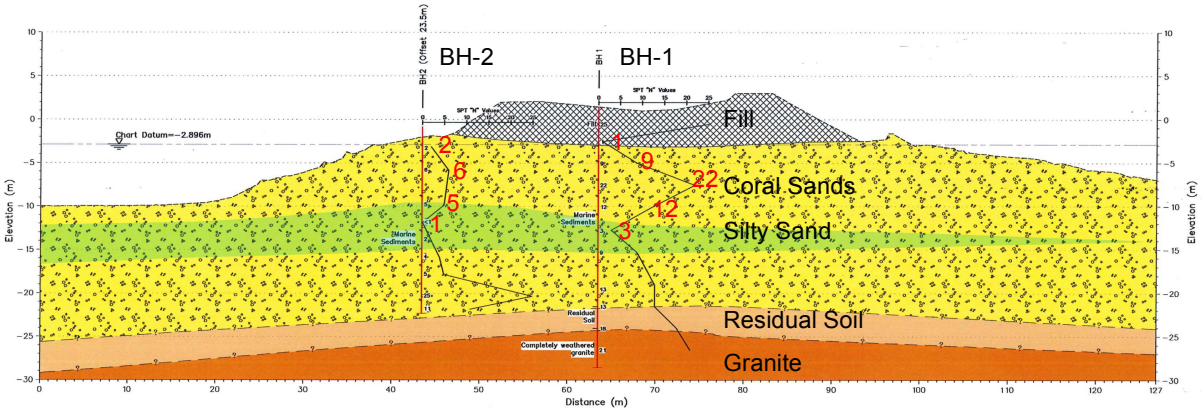


Figure 1-2(6) Soil structure of the project site

(4) Water Quality Survey

Water samples were collected from four positions selected to similar position as Phase 1 as shown in Figure 1-2(7). The analyzed results are shown in Table 1-2(2) and 1-2(3). In this survery, water samples are analyzed by Seychelles Bureau of Standards (SBS), which is a public inspection organization in Seychelles to conducts chemical and biological water analysis. An analyzed result obtained in this survey passed the parameter of water quality standards in the Seychelles and Japan.

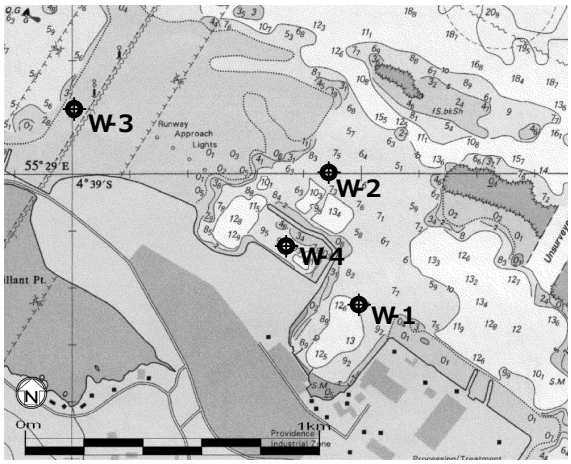


Figure 1-2(7) Sampling position for Water Quality Survey

Table 1-2(2) Water quality parameter in Phase 1 (2006)

Test	Standard Value				W-1		W-2		W-3		W-4	
	Seychelles	Japan Type A)	Japan Type B)	Japan Type C)	ebb	flood	ebb	flood	ebb	flood	ebb	flood
Dissolve Oxygen (DO)	—	7.5mg/l or more	5mg/l or more	2mg/l or more	-	7.69	-	8.68	-	8.92	-	8.56
Chemical Oxygen Demand (COD)	80mg/l or less	2mg/l or less	5mg/l or less	8mg/l or less	2	1.4	1.4	1.2	1.2	1.3	1.8	1.6
Suspended Solid (SS)	30mg/l or less	25mg or less	25mg or less	50mg or less	15	22	22	17	12	10	<3	5
n-hexane Extracts	—	0	0	—	8	4	5	6	<4	<4	<4	-
Total Coliform (cfu/100ml)	500 or less	1,000 or less	—	—	50	80	150	250	98	300	65	72

Notes : - Observational day
ebb : 23/1/2006 11:30
flood : 23/1/2006 16:30

Type A: Fishery 1st Class
Type B: Fishery 2nd Class
Type C: Environmental Conservation

Table 1-2(3) Water quality parameter (2015) -1

Test	Standard Value				W-1		W-2		W-3		W-4	
	Seychelles	Japan (Type A)	Japan (Type B)	Japan (Type C)	ebb	flood	ebb	flood	ebb	flood	ebb	flood
Salinity (ppt)	–	33～37ppt			34.6	34.4	34.8	34.9	34.1	34.5	34.8	34.8
pH	5.5-8.5	7.8～8.3	7.8～8.3	7.0～8.3	6.09	8.06	7.69	8.07	7.92	8.11	7.99	8.12
Suspended Solid (SS)	30mg/l or less	25mg/l or less	25mg/l or less	50mg/l or less	＜1	＜1	＜1	＜1	＜1	＜1	＜1	＜1
Turbidity (FAU)	–	–	–	–	＜1	＜1	＜1	＜1	＜1	＜1	＜1	＜1
Total Coliform (cfu/100ml)	500 or less	1,000 or less	–	–	0	0	0	0	0	0	＜4	5

Notes : - Observational day
ebb : 23/3/2015 10:30
flood : 23/3/2006 15:30
- ppt :permillage
Type A: Fishery 1st Class
Type B: Fishery 2nd Class
Type C: Environmental Conservation

Table 1-2(4) Water quality parameter (2015)

Test	Standard Value				Location of Water Sampls					Average
	Seychelles	Japan (Type A)	Japan (Type B)	Japan (Type C)	Existing Quay	Candidate site for Quay no.1	Candidate site for Quay no.2	Candidate site for Quay no.3	Outside the Port	
Dissolved Oxygen (DO)	-	7.5mg/l or more	5.0mg/l or more	2.0mg/l or more	5.5 <	6.0 <	5.5 <	6.5 <	6.5 <	6
Chemical Oxygen Demand (COD)	-	2mg/l or less	5mg/l or less	8mg/l or less	4.0 mg/l	3.0 mg/l	2.0 mg/l	3.0 mg/l	3.0 mg/l	3.0 mg/l

Notes : - Observational day: 28/11/2015 11:00
Type A: Fishery 1st Class
Type B: Fishery 2nd Class
Type C: Environmental Conservation

(5) Sediment Conditions

Under water sediment of the project area was determined to confirm current condition by divers. The surveyed areas of sea bottom are shown in Figure 1-2(8), and the features of the sediment conditions are described as below.

- Sediment surrounding revetment in the port is mainly composed of boulder stones, bleaching coral clots at around foot of slope in rubble mound revetment.
- Sediment condition from the foot of revetment slope to the center of port is composed of coral sand and silt, which is covered with soft surface layer. The particle size-analysis conducted in Phase 1 shows, majority of in-port sediment are composed of “sandy silt” with minor sand.
- Boulder stones and bleaching coral clots are scattered about foot of slope in rubble mound revetment with sediment condition of outer port. Waterweed was confirmed in spreading area.

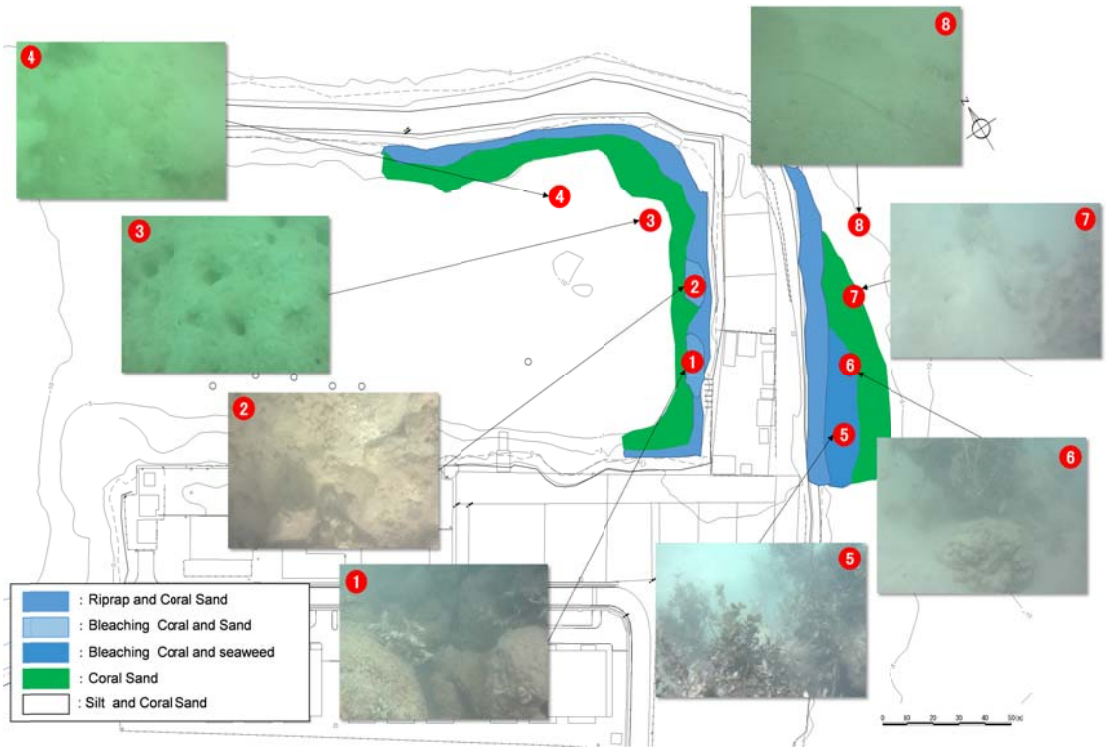


Figure 1-2(8) Sediment Conditions

(6) Construction Material

Different types of granite can be obtained throughout islands in Seychelles. The geologically characteristic of this area, the basic rock stratum is mainly composed of granites. The sand and gravel are fundamental materials used during the construction. The material analysis by Phase 1 is shown in Table 1-2(5), which is to refer in the Project.

In addition to above, the landfilling works are implemented in the country. This works utilized dredged sands collected from 7km offshore of the airport to piling work in Zone-14 construction in north of the Victoria fishing port.

Table 1-2(5) Material analysis by Phase 1

Item	Test	Result
FINES	Moisture Content	2.7%
	Specific Gravity	2.47t/m^3
GRAVEL	Density Test	Bulk density 2.19t/m^3
		Dry density 2.13t/m^3
		Compacted Unit Mass 2,160kg/m^3
GRANITE－Grey	Strength Test	16.6MPa
	Specific Gravity	2.75t/m^3
GRANITE－Black	Strength Test	18.3MPa
	Specific Gravity	2.96t/m^3
GRANITE－White	Strength Test	7.7MPa
	Specific Gravity	2.65t/m^3

(7) Earthquake

Centennial records (after the year of 1900 to present) of earthquake data was collected from United States Geological Survey's (USGS) for the Indian Ocean, including the Seychelles, are shown in Figure 1-2(9).

As the result, majorities of previous earthquakes were struck near the Carlsberg ridge, which is located at the boarder of Indian Plate and African Plate. The biggest earthquake struck was consisted with magnitude 7.6 in July 2003, in which maximum ground acceleration speed was calculated to 0.5 to 1.0 Gal. This calculation is estimated from following formula, accordance with the distance from the seismic center (1000km from the Seychelles). Which can achieve the impact by the earthquake is relatively very small.

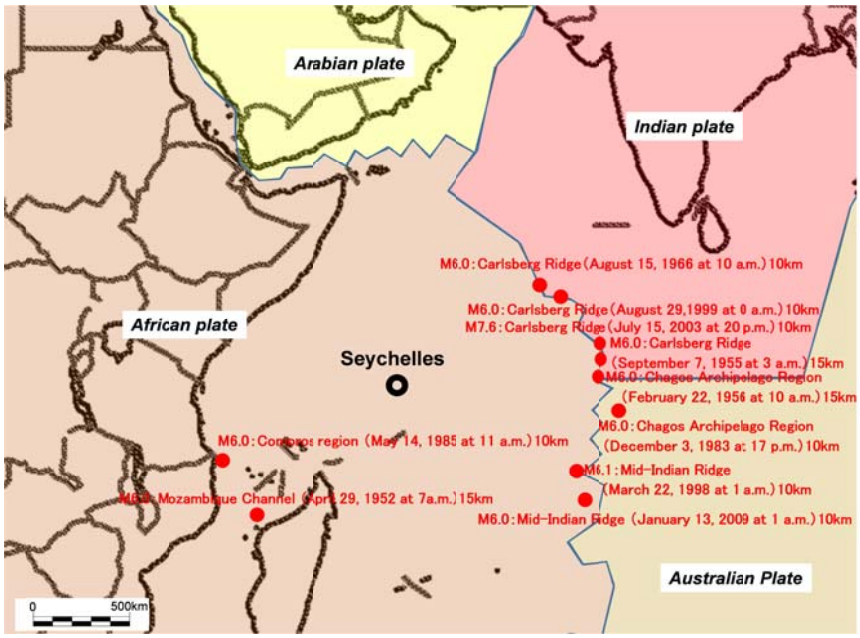
$$\log_{10} A_{SMAC} = 0.53M - \log_{10}(X = 0.0062 \times 10^{0.53M}) - 0.00169X + 0.524$$

A_{SMAC} ; peak bedrock acceleration measured by a SMAC-type strong motion seismograph (Gal)

M ; Magnitude of earthquake

X ; fault distance(km)

Source: "Standard Design Methods on Fisheries Infrastructures (National Association of Fisheries Infrastructure) "



Source: USGS (1900 to 2015)

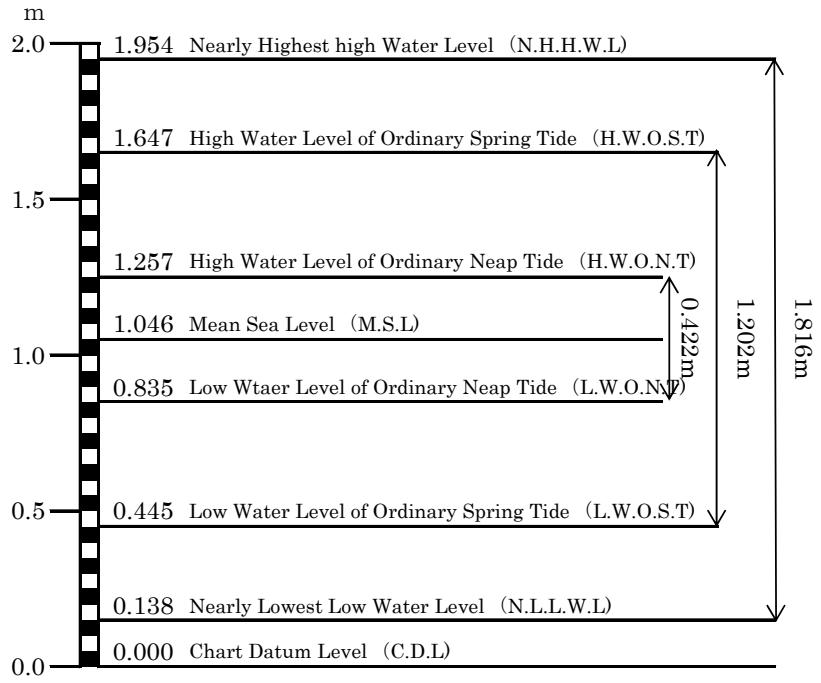
Figure 1-2(9) Earthquake Record around the Seychelles

(8) Sea Conditions

1) Tide level

Tide level of the Providence Fishing Port is considered to be the similar to Phase 1 as shown in

Figure1-2 (10), since only five years have been passed after establishment of fishing port facilities.



Source: "Basic design study report on the project for the construction of fishery facilities and supply of equipment in the Republic of Seychelles" (issued in 2006)

Figure 1-2(10) Tide Table of Providence Fishing Port

2) Wave level

(a) Standard wave level

In Phase 1, wave height, period and the direction were studied for 23 days at 300m offshore of the Providence Fishing Port. As the result, maximum height of significant wave ($H_{1/3}$) was estimated to 0.56n and the period ($T_{1/3}$) was 5.6s with predominant of ENE wave-direction.

In the Seychelles, a continuous and periodical wave levels are not monitory collected. In this survey, a wave prediction was studied based on the wave generated in West Indian Ocean wind data (2002 to 2006) collected from Japan Meteorological Agency as shown in Table 1-2(6). In addition, verification was made by the calculation of wave levels of mouth of the Providence Fishing Port using wave deformation calculation. The analysis results of wave prediction are shown in Table 1-2(7) and 1-2(8). Accordingly, standard wave levels are estimated to ENE direction (N62.8°E to N63.9°E) as dominant, and the wave-generating ratio is calculated to the wave height of less than 25cm, 50cm and 70cm are 35%, 65% and 85 % respectively. Accordingly, the Providence fishing port is predicted as "relatively calm" water area. As to now, the occurrence ratio with the area of 5s to 9s .

Similar result has been obtained from data from Phase 1, this study and wave prediction calculation using wind data collected from Japan Meteorological as "highly credible".

Table 1-2(6) Wind Direction and Frequency (2002 to 2006)

YEARLY

Direction / U(m/s)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW		Total
0.0 - 0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.1 - 2.5	67	52	66	67	103	94	99	84	64	62	70	71	107	78	66	80	6	1236
	0.92	0.71	0.90	0.92	1.41	1.29	1.36	1.15	0.88	0.85	0.96	0.97	1.46	1.07	0.90	1.10	0.08	16.92
2.5 - 5.0	119	84	67	72	118	199	236	196	121	88	87	125	215	246	223	159	0	2355
	1.63	1.15	0.92	0.99	1.62	2.72	3.23	2.68	1.66	1.20	1.19	1.71	2.94	3.37	3.05	2.18	0.00	32.24
5.0 - 7.5	76	18	13	3	36	188	533	566	170	35	23	38	96	149	114	111	0	2169
	1.04	0.25	0.18	0.04	0.49	2.57	7.30	7.75	2.33	0.48	0.31	0.52	1.31	2.04	1.56	1.52	0.00	29.70
7.5 - 10.0	11	2	0	1	0	57	544	594	104	3	0	2	11	25	25	13	0	1392
	0.15	0.03	0.00	0.01	0.00	0.78	7.45	8.13	1.42	0.04	0.00	0.03	0.15	0.34	0.34	0.18	0.00	19.06
10.0 - 12.5	0	0	0	0	1	1	50	75	14	0	0	0	0	3	2	3	0	149
	0.00	0.00	0.00	0.00	0.01	0.01	0.68	1.03	0.19	0.00	0.00	0.00	0.00	0.04	0.03	0.04	0.00	2.04
12.5 - 15.0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3
	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
15.0 - 17.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17.5 - 20.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20.0 - 22.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22.5 - 25.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25.0 - 27.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27.5 - 30.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30.0 - 100.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	273	156	146	143	258	539	1465	1515	473	188	180	236	429	501	430	366	6	7304
	3.7	2.1	2.0	2.0	3.5	7.4	20.1	20.7	6.5	2.6	2.5	3.2	5.9	6.9	5.9	5.0	0.1	100.0

Upper : Number of contents
Lower : Percentage of occurrence

Source: Data Base of Japan Meteorological Agency for 2002 to 2006

Table 1-2(7) Frequency from Wave direction and Heigh (2002 to 2006)

Wave D. N – E/W	CALM	2.1W	0.2W	2.8E	62.8E	63.3E	63.9E	64.1E	TOTAL
WAVE HEIGHT (M)									
CALM	2036 5.8	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	2036 5.8
0.00 – 0.25	0 .0	337 1.0	861 2.5	530 1.5	1285 3.7	3709 10.6	2498 7.1	1136 3.2	10356 29.5
0.25 – 0.50	0 .0	625 1.8	1362 3.9	452 1.3	1589 4.5	3586 10.2	1743 5.0	826 2.4	10183 29.0
0.50 – 0.75	0 .0	387 1.1	454 1.3	10 .0	1117 3.2	3307 9.4	1719 4.9	295 .8	7289 20.8
0.75 – 1.00	0 .0	110 .3	56 .2	10 .0	1114 3.2	2522 7.2	384 1.1	6 .0	4202 12.0
1.00 – 1.25	0 .0	27 .1	25 .1	0 .0	338 1.0	550 1.6	1 .0	0 .0	941 2.7
1.25 – 1.50	0 .0	20 .1	2 .0	0 .0	27 .1	1 .0	0 .0	0 .0	50 .1
1.50 – 1.75	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
1.75 – 2.00	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
2.00 – 2.50	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
2.50 – 3.00	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
3.00 –	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
TOTAL	2036 5.8	1506 4.3	2760 7.9	1002 2.9	5470 15.6	13675 39.0	6345 18.1	2263 6.5	35057 100.0

Table 1-2(8) Frequency from Height and Period (2002 to 2006)

WAVE PERIOD(S)	CALM	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-	TOTAL
WAVE HEIGHT(M)																		
CALM	0 .0	0 .0	0 .0	0 .0	0 .0	316 .9	1090 3.1	277 .8	300 .9	53 .2	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	2036 5.8
0.00 - 0.25	0 .0	0 .0	0 .0	0 .0	0 .0	68 .2	503 1.4	2494 7.1	4479 12.8	2393 6.8	314 .9	105 .3	0 .0	0 .0	0 .0	0 .0	0 .0	10356 29.5
0.25 - 0.50	0 .0	0 .0	0 .0	0 .0	0 .0	119 .3	1449 4.1	3347 9.5	3248 9.3	1569 4.5	389 1.1	62 .2	0 .0	0 .0	0 .0	0 .0	0 .0	10183 29.0
0.50 - 0.75	0 .0	0 .0	0 .0	0 .0	0 .0	38 .1	959 2.7	3807 10.9	1624 4.6	644 1.8	189 .5	28 .1	0 .0	0 .0	0 .0	0 .0	0 .0	7289 20.8
0.75 - 1.00	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	156 .4	1883 5.4	1791 5.1	369 1.1	3 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	4202 12.0
1.00 - 1.25	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	28 .1	238 .7	571 1.6	104 .3	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	941 2.7
1.25 - 1.50	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	1 .0	22 .1	27 .1	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	50 .1
1.50 - 1.75	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
1.75 - 2.00	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
2.00 - 2.50	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
2.50 - 3.00	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
3.00 -	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
TOTAL	0 .0	0 .0	0 .0	0 .0	0 .0	541 1.5	4186 11.9	12068 34.4	12040 34.3	5132 14.6	895 2.6	195 .6	0 .0	0 .0	0 .0	0 .0	0 .0	35057 100.0

(b) Severe Wave condition (Design Wave level)

The design condition and parameter under the severe wave condition is set with accordance with Phase 1. In Phase 1, the scale of incident wave in front of the Providence Fishing Port was estimated by wave deformation analysis in shallow water area, after the wave prediction of offshore wave in Seychelles. This wave prediction is calculated from data of cyclone (center atmospheric pressure, radius and route of cyclone) considered to have impact to Seychelles in the past. The scales of offshore waves in Seychelles and incident waves in front of Providence Fishing Port are shown in Table 1-2(9).

Table 1-2(9) Wave parameter in Severe Condition

Offshore wave		Incident wave at Providence Fishing Port	
Wave height (H_0)	6.0m	Incident wave height (H_0')	2.64m
Wave period (T_0)	12.0sec	Wave period (T)	12.0sec
Wave direction	ESE	Incident wave direction	N53.2°E

Designing parameter of wave were set H (design wave height) as 2.85m (significant wave) against 2.64m incident wave using calculation formula as below as a result, H/H0' =1.08 were preferred from Figure 1-2(11).

Depth h： 9.0m+1.45m (H.W.L)＝10.45m

Equivalent deep water wave height Ho'： 2.64m

Offshore wave length Lo： 1.56 x To^2＝224.6m

Slope of sea bottom： 1:30

Ho'/Lo： 2.64/224.6＝0.012

h/Ho'： 10.45/2.64＝3.96

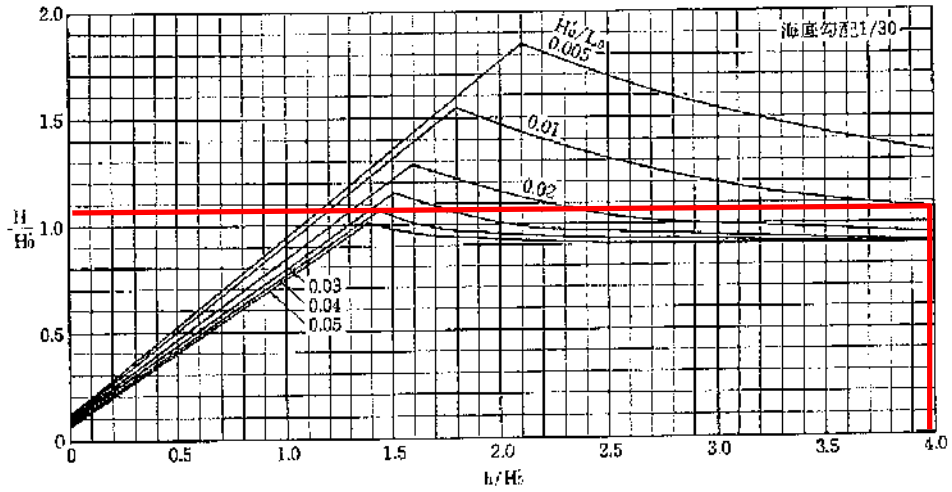


Figure 1-2(11) Wave Height Change by Water Depth

(c) Tidal Current level

Tidal current parameters prepared in Phase 1 were used for designing due to less time span since Phase 1 survey. In this survey, topographical change was not observed since phase 1. The result from Phase 1 shows, the tidal current in front of Providence Fishing Port is stable to NW direction regardless flood or ebb tide, and the mean flow velocity was slow with approximately 6 meters per minute.

Accordingly, in this survey, additional hearing from fishermen was made, suggesting the tidal current level in northwest monsoon season is NW direction, on the other hands, southeast monsoon season is SE direction.

(d) Littoral Drift level

Marin chart of Providence Fishing Port in 1994 are shown in Figure 1-2(12).

In the middle of 1990s, the Providence area including the Providence Fishing Port was constructed with an earth filling to offshore sides. In this area of Victoria to international airport along with old road, shoreline was fundamentally established, consisting the mangroves and tidal flat were formed. Several rivers run into the tidal flat among reclaimed land and old road. The lengths of these rivers are short, and the supply of sand is considered to be small since the Mahé Island is formed with the granite island. In addition, as offshore of the Providence area are surrounded by shallow waters with Au Cerf Island and coral reefs, the terrain structures are protected to be affected by direct waves from outer sea.

The marine chart of 1994 shows the outline of Providence Fishing Port and comparing with the result of presented by bottom sounding (refer to Figure 1-2(1)). Even after 15 years have passed, considerable change is not observed on the coast topography and water depth.

With the above mentioned, it is inferable that phenomenon and impacts of sedimentation or erosion by littoral drift around the project site are “minor”. However, as the change like long term shoaling cannot be avoided, it is necessary to be maintaining with dredging work inside of the port by the Government of Seychelles.

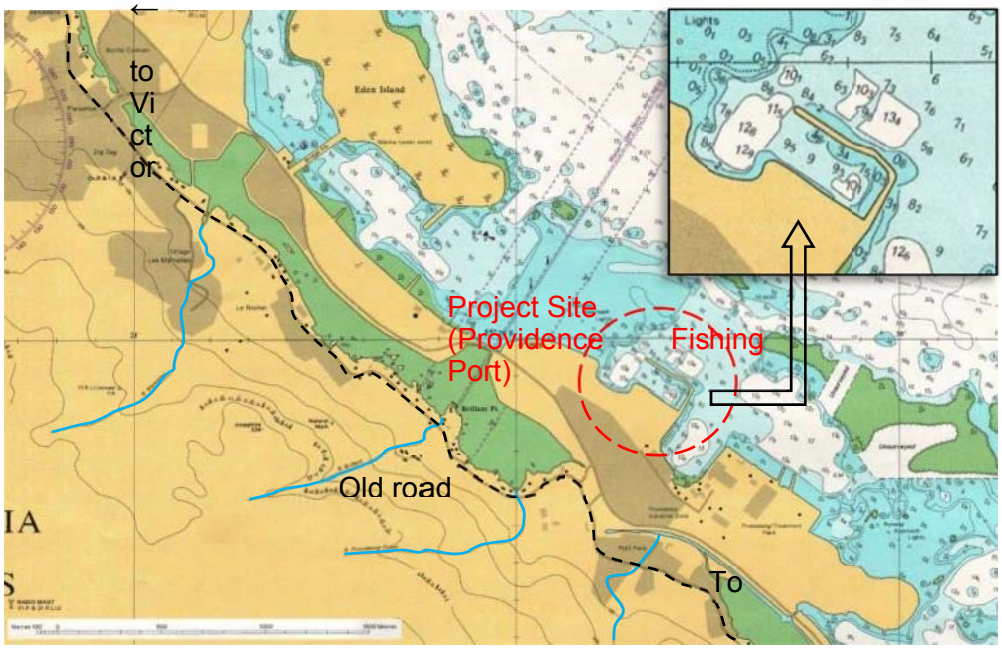


Figure 1-2(12) Marine Chart around Providence district surveyed in 1994

(e) In-Port Calmness analysis

In-port calmness analysis was studied for requested quays as shown in Appendix 6.2. As a result of this study, present in-port calmness is considerate as “very high”.

During the survey, hearing studies were made to Fishermen and Fishing boats owners, regarding to the In-port calmness, however, no objection was raised regarding to the current in-port wave and its calmness of the Providence Fishing Port.

1-3 Environmental Social Consideration

(1) Outline of project-related components that could have environmental or social impacts

The main soft components requested in this Project are to expand and develop “berthing quays” and to develop “ice making facilities”. Project-related soft components that could have environmental or social impacts are as follows.

(i) Berthing quays

Expanding the berthing quays may necessitate construction work inside the existing harbor. If landscaping and construction work are carried out, impacts inside the existing harbor are anticipated. In particular, the water could become polluted when steel sheet piles are driven in during construction.

(ii) Ice making facilities

Developing ice making facilities may necessitate construction work behind the quays. If development and construction work go ahead, impacts inside the harbor (including land areas) are anticipated. In particular, although there are no residences or similar nearby, an impact is expected to arise from the traffic of construction vehicles.

Particularly noteworthy points in connection with environmental and social consideration are summarized below.

・Lease agreement land adjacent to scheduled land sites

Of the requested quays, land behind Quay 2 was leased out in 2012. It is currently being used as a materials storage yard, among others, by a private company involved in construction. The company has also built a small jetty at its own expense, for temporary mooring of a boat it is due to own from around March 15th, 2015. The jetty is not located on the leased land and therefore constitutes illegal occupation. If the construction work at Quay 2 is approved, the SFA will need to remove the jetty and pay compensation by means of a reacquisition price before starting construction.

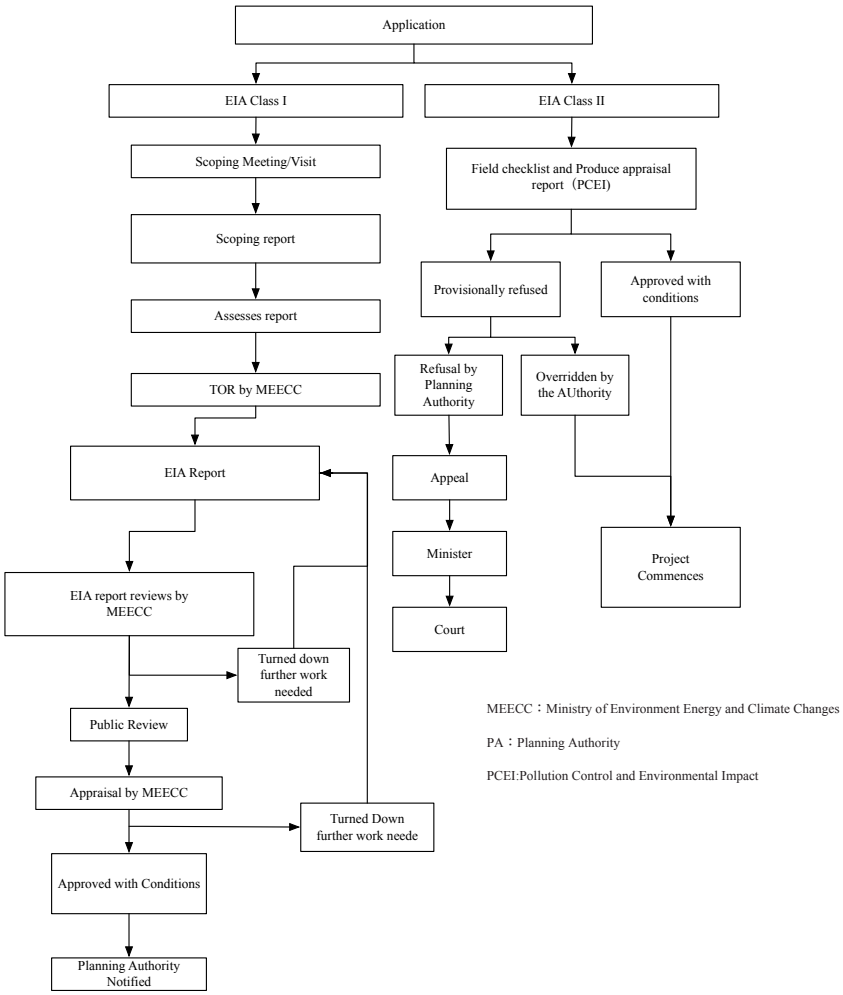
The lease agreement land will not be impeded by construction work under present circumstances. However, the SFA may need to secure alternative land at a future planning stage. As for the removal of the jetty, meanwhile, the private construction-related company has confirmed and agreed to the removal at a Meeting of Stakeholders, and orally in the subsequent interview survey.

・Garbage disposal and wastewater management

The SFA entrusts the management of garbage disposal at Providence Fishing Port to a private company, and pays a monthly fee of 750 SCR for this service. Garbage is collected three times a week. Wastewater is channeled through sewage pipes to a sewage treatment plant on Mahe Island, and will thus cause no impact on the surrounding sea area.

(2) Environmental Impact Assessment relating to Construction Works

The EIA procedures, as required by the Environmental Protection (Impact Assessment) Regulations (1996) under the Environmental Protection Act 9 (1994), is a pre-requisite for gaining Environmental Authorization from the Ministry of Environment, Energy and Climate Change (MEECC) for the proposed project. EIA approval process is shown in Figure1-3(1).



Source：MEECC

Figure 1-3(1) EIA Approval Process

Implementation agency (SFA) is to submit an application of Environmental Authorization for development project to Division Environment Assessment and permit section of MEECC.

1) SFA submit EIA application form to Division Environment Assessment and permit section
2) Preparation and Submission of EIA result of EIA Class II survey
3) Review of EIA result by Ministry of Environment, Climate change and Energy (MECCE)
4) EIA appraise by appraisal committee
5) Submission of Environmental Authorization by Ministry of Environment, Energy and Climate change

It is expected that the final approval of ESIA by Ministry of Environment, Energy, and Climate change will be obtained by February 2016. MEECC appraises the EIA report and issue the Environmental Authorization (EA).

This project is extension of Phase 1. Thus, automatically categorized to Class II accordance to previous studies. MEECC are to studies necessary information from related agencies and to request for additional survey to SFA, as necessary.

(3) EIA Approval Schedule

Under Schedule of the Environmental Protection (Impact Assessment) Regulations (1996), of the above-mentioned Act, the desired level of development, its proposed activities and concept comprises activities, which in accordance with Regulation 3(1) of the same regulations are projects or activities requiring EA. Accordingly, three to four month are required to obtaining Class 2 as shown in Table 1-3.

Table 1-3 Approval schedule of EIA

Steps	Approximate time
Scoping meeting with the Department of Environment	2-3 days
Undertake scoping study & prepare report	15-30 days
Upon submission of scoping report the ministry provides the detailed Terms of Reference to the EIA Consultant	14 days
EIA Class 2 is undertaken on the basis of the Terms of Reference	1-2 months
Specialist Studies (may or may not be required) depending on the type of project.	Variable
EIA Class 2 is submitted to the developer for review	14 days
EIA Class 2 is submitted for internal review	21 days
EIA Class 2 is submitted for public review	7 days
EIA Class 2 undergoes final appraisal and client presented with/without environmental authorization	
Total Approximate Time	2−3 months

1-4 Other Matters (Global Issues, etc.)

With regard to global issues, this Project is linked to eradicating poverty and environmental and climate change, among others. In terms of eradicating poverty, it will be effective in improving domestic food self-sufficiency by developing the fisheries sector and stimulating economic activity by promoting trade, with key focus on sustainable development. Based on this awareness, it is an important task from the viewpoint of achieving a stable supply of valuable protein sources for the people from the limited natural environment of an island nation.

When formulating the aims and plan of the basic design in terms of equipment, care was taken to study equipment specifications that would contribute to more effective and efficient fishery activity with consideration given to environmental impact, as well as selecting machinery with high levels of mobility. Implementing this Project is expected to increase the effectiveness of operations needed for fishery activity.

Use of refrigerants in ice making facilities and regulation on use

In the Seychelles, R-22 (a freon gas) and ammonia are commonly used as refrigerants for ice making and refrigerating equipment. Freon gases are used in 5 out of 7 existing ice making facilities. Ammonia is used in the ice making equipment newly installed under Phase 1 in FY2010. New refrigerants (HFC types: ozone depletion coefficient 0.0) are used as substitutes for regulated refrigerants in motor vehicles and general purpose air-conditioners, etc., but not in ice making and refrigerating equipment. In countries around the world, various regulations are being imposed on production volumes, import and export volumes, and use of R-22 as a refrigerant constituting an ozone layer depleting substance. Ozone layer depleting refrigerants are broadly divided into CFCs (coefficient l.0) and HCFCs (coefficient 0.055) depending on their ozone depletion coefficient, and R-22 is one of the HCFCs that has less impact. In Japan, R-22 consumption has been reduced in stages since 1996, based on actual consumption in FY1989 as a reference amount; the predetermined regulation schedule aims to reduce it to zero from 2020 onwards. As an exception, however, production up to a maximum of 0.5% of the consumption reference amount has been permitted up to 2029, when replenishing refrigerants for ice making and refrigerating equipment, etc. On the other hand, because there is no regulation on the manufacture, installation and operation of ice making and refrigerating equipment using R-22, new products are still being manufactured and installed.

In the Seychelles, R-22 is not produced and the whole volume is imported, but the Environment Ministry plans to reduce it in stages, based on the import volume in FY2020 as the maximum reference amount.

Chapter 2 Contents of the Project

2 Contents of the Project

2-1 Basic Concept of the Project

Providence Fishing Port was built at the same time as Bel Ombre Fishing Port using grant aid from Japan, with the aim of easing congestion at Victoria Fishing Port. The port was completed in February 2010. The effects of the project were confirmed, in that the average daily number of fishing boats mooring at Victoria Fishing Port decreased after the opening of Providence Fishing Port.

Since then, the number of fishing boats based at Providence Fishing Port has grown year by year, and an increase in the size of fishing boats has also been observed. In line with this, the volumes of fish landings by small and medium fishing boats have also grown (500-1,000 tons per annum). In 2012, two years after Providence Fishing Port was opened, the average daily number of fishing boats mooring there (23 boats) reached twice the number in the original plan (12 boats), making the port cramped. This trend was caused by an increase both in the number of fishing boats in the Seychelles and in the number of fishery processing plants around Providence Fishing Port.

With further increases expected in the number of boats using Providence Fishing Port, the aim of this Project is to improve the working environment for artisanal fishermen who use Victoria and Providence as activity bases. This will be done by expanding and developing the facilities needed for fishery activity in the port (quays, aprons, landing sheds, water and power supply equipment, ice making facilities, etc.).

Additional numbers of fishing vessels are expected to increase for development of fish processing factory in the area. Accordingly, Seychelles government requested Japanese Government, “THE PROJECT FOR THE CONSTRUCTION OF ARTISANAL FISHERIES FACILITIES IN MAHE ISLAND, PHASE 2" (herein after "the Project") for sustainable development of fishery sector in Seychelles. Basic outline of the project are shown in Table 2-1(1).

(1) Overall Goal of the Project

The Project is improvement of fisheries infrastructures to promote the fisheries sector, one of the country’s main industries, and contribute to the development of the national economy.

(2) Project Goal

The objective of the Project is to extend existing quays and expansion of fisheries facilities in Providence fishing port by securement of mooring quays for increased fishing vessels, with aiming to improve quality of fish products and port operation through fishing activities accordance with demand fluctuation, thereby contributing to the fisheries industries comprise of fish process sector.

Table 2-1(1) Basic concepts of the project

Fishing port (Status)	Issues	Issues to be solved	Components in the project
Victoria Fishing port (Largest fishing port in Mahé Island)	Mooring vessel congestion created by increase of number and size of fishing vessels	Reduction of fishing vessels moored in Victoria fishing port	• Extension of quays • Installation of ice-making facility
	Operation and usage of quay is handled by user (fisherman)	Port operation	• Improvement of port operation
	Lack of the ice for fishing activities	Increase of ice production	• Installation of ice-making facility
	Traffic congestions behind the port	Reduce vehicle access to the Victoria fishing port	• Extension of quays
Providence Fishing port (Landing site for sea cucumber, Mooring port for artisanal fishing vessels)	Lack of mooring space caused by increase of number and size of vessel	Increase number of mooring vessels in Providence FP	• Extension of quays
	Operation and usage of quay is handled by user (fisherman)	Port operation	• Improvement of port operation
	Lack of ice, resulting loss of fishing activities	Increase of ice production	• Installation of ice-making facility
	Lack of maintenance and operational staff for ice-making facility	Maintenance and operation Training for ice-making facility	• Installation of ice-making families and improvement of operation staff
	No sunshade in the port resulting difficult environment to work.	Improve of working environment	• Installation of landing shed
	Increase of fish processing factory	Improve of working environment	• Installation of landing shed

(3) Outline of the Project

In order to achieve the above goal, the project will extend quays, and construction of fisheries related facilities such as the ice-making facility, the landing shed and other necessary incidental facilities in Providence fishing port. Those facilities should reduce the number of mooring vessels in Port Victoria. In addition, an extension of the quay with additional landing sheds in Providence fishing port could also improve working environment by improvement of safety during unloading of fish products under the extreme hot climate of Seychelles.

1) Victoria fishing port:
   a) Usage of quays shall be design with confirmation of current vessel flow lines; access from departure and arrival of vessels shall be carefully studied. It is highly required to prepare plan to be used as public quays.
   b) Decentralization of vessel operation from Port Victoria to Providence fishing port should be planned for excess number of vessels designed from Phase 1.

2) Providence fishing port(Project site):
   a) Usage of quays is to design accordance with confirmation with current vessel flow lines; departure and arrival of vessels shall be carefully studied. It is highly required to prepare a plan to be used as public quays.
   b) Decentralization of vessel operation from Port Victoria to Providence fishing port should

planned for excess number of vessels designed from Phase 1. Sea-cucumber harvesting vessels should be relocating with higher priority to Providence fishing port.

c) The back area of quays is limited, and public access must be reserved for the land area to quays. It is necessary to avoid privatize occupation use of the public quay.

(4) Counter parts organization

a) Supervising agency： Ministry of Fisheries and Agriculture
b) Implementation agency: Seychelles Fishing Authority (SFA)
c) Project Management： Seychelles Fishing Authority (SFA)

(5) Input of the Project

1) Japan side

a) Quay No.1
b) Quay No.2
c) Quay Surfacing (Interlocking Block, Apron, Road)
d) Water supply system within the Project site
e) Power supply system within the Project site
f) Lamppost
g) Water drainage system within the Project site
h) Landing shed
i) Ice making machine (Plate ice) with Ice storage
j) Anchoring Buoys
k) Soft Component (technical assistance) for Operation and maintenance of ICE making facility

2) Seychelles side

a) Implementation of Environmental impact assessment
b) Secure of temporary yard
c) Site clearance
d) Construction of access road
e) Two technical staffs for ice plant operation (Soft Components)
f) Operation and maintenance of facilities and equipment
g) Banking arrangement fees

2-1-1 Requested contents of Japanese Assistance

At the preparatory survey stage (March to November 2015), discussions were held with the SFA to confirm priority levels for the requested components and their necessity. On the relevance of the request content submitted by the Seychelles side, comprehensive priority levels based on necessity, urgency, operation and maintenance, etc., were evaluated in three stages (A, B, C), and the content of each was studied together with the Seychelles side.

Table 2-1(2) shows changes in the items requested by the Seychelles in 2013 and the priority levels of components obtained through discussion.

AFTER discussing the request content, it was decided that priority level A would comprise the components subject to this plan. Details of the study of request contents for each component are as shown

Table 2-1(2) Changes of contents of request and Priority

No.	Requested components (2013)	Re-requested components after discussion (2015)	Priority
1	Quay No.1, No. 2 (Length: total 216 meter)	Quay No.1	A
		Quay No.2	A
2	Quay No.3(Length: 112 meters) and Quay No.4 (Length 84.5 meters) Breakwater (50 meters) Back filling (38,700 cubic meters)	Quay No.3	B
		Quay No.4 (length 84 meters) Breakwater (50 meters) Back filling (38,700 cubic meters)	B
3	Quay surfacing (13 meter) behind Quay No.1	Quay Surfacing (Interlocking Block, Apron, Road)	A
4	Mooring (Anchoring) buoys (3 set)	Anchoring Buoys	A
5	Electrical installation and lightning, water and rainwater collection, and drainage	Water supply system within the Project site	A
		Power supply system within the Project site	A
		Lamppost	A
		Water drainage system within the Project site	A
6	30 meter length Landing shed (Quay No.1)	Landing shed	A
7	Ice-making facility (10 tons per day)	Ice making machine (Plate ice) Ice storage	A
8		Soft Component (technical assistance) for Operation and maintenance of Ice making facility	A

Remark: Priority A: High requirement from necessity, and emergency
Priority B: High requirement but low emergency
Priority C: Low priority from emergency and necessity.

(1) Construction of Quay No.1 and No.2

The number of fishing boats currently using Providence Fishing Port has risen to 49, more than twice the 24 boats in the Phase 1 plan. The number of fishing boats moored in the port has also nearly

doubled from 12 in the Phase 1 plan to 23, and together with the increasing size of fishing boats using the port facilities, this is causing congestion inside the port. Moreover, because the existing port is used by numerous sea cucumber boats, the average of 23 moored boats sometimes increases to about 40 during the July-September off-season, the year end, and at other times. Facility plans are underway for fishery processing plants to be built on land behind the planned area, and together with the construction of these plants, the introduction of around 20 new fishing boats is being considered. Of these, 11 have already been bought and are being built. Meanwhile, the increased number and size of fishing boats using port facilities are also causing congestion inside Victoria Fishing Port. Therefore, if around 20 fishing boats using Victoria Fishing Port could be transferred to the planned site at Providence, the implementation of this plan could be expected to contribute to the efficient and safe operation of Victoria Fishing Port.

Based on the above background, Providence Fishing Port is expected to accommodate around 40 boats (nearly 3.5 times the number of 12 boats moored at the time of the Phase 1 plan) in the near future. As such, the development of new quays is a matter of urgency, and both necessity and urgency are high.

Furthermore, if a quay extension measuring about 3.5 times the length of the mooring quays developed in Phase 1 (60m) were to be planned, a total of about 210m (= 60m×3.5) could be secured for Quays 1 and 2 combined. The relevance of this development is therefore also recognized and its effectiveness is also judged to be high.

(2) Construction of Quay No.3 and No.4, Breakwater and Backfilling Works

A further increase in fishing boats can be anticipated in future if the operation of fishery processing plants on land behind the planned site becomes lively. In this case, there would be an understandable need to develop Quays 3 and 4. When considered in terms of the urgency of easing congestion for current mooring, however, it is thought that this can be addressed sufficiently by developing and extending Quays 1 and 2 alone, and developing Quays 3 and 4 is judged premature.

On the development and extension of the breakwater accompanying the development of Quay 4, the maximum wave height conditions to facilitate safe mooring were studied using tranquility analysis at a maximum height of 30cm. As a result, although the request was for a breakwater extension of 50m (breakwater wall 30m + breakwater 20m), development of about 100m (breakwater wall 30m + breakwater 70m) is thought necessary to ensure a proper capacity utilization ratio for moored fishing boats. Therefore, the breakwater development accompanying the development of Quay 4 is not only of low urgency but is also expected to require an enormous project cost, and is thus judged to have low relevance from the viewpoint of cost-effectiveness.

With the above result, the component regarding to “Construction of Quay No.3 and No.4, construction of Breakwater and Backfilling” will be outside the scope of this Project.

(3) Construction of Apron behind Quay No.1

The aprons behind the quays are used for preparation and landing work, and also as parking spaces for vehicular access and temporary storage spaces for fishing gear, ice, etc. As such, it is essential that the aprons should also be developed. This applies not only to Quay 1 but also to Quay 2.

Generally, aprons behind mooring quays and landing quays should be at least 10m wide, and in fact, the client government has requested a width of 15m. However, a space of only about 13m can be secured, as it is sandwiched between the quays and fishery processing land behind them, owing to constraints of land use in the planned site.

Moreover, plans to develop fishery processing facilities on land behind the aprons are being advanced by private investors. Therefore, as well as developing aprons, this land is to be earmarked as “roads” to facilitate free access by motor vehicles. This will serve to avoid exclusive use of quays and aprons by fishery processing companies at the back and to ensure their public nature, so that people involved with fisheries can use them equally.

In view of the above, it is essential that a space of 13m behind Quays 1 and 2 be developed as aprons and roads, with a view to guaranteeing their functionality and public nature. This is therefore judged to be a soft component with high levels of urgency and relevance, as with the development of Quays 1 and 2.

(4) Installation of Mooring Buoys

To minimize the need for quay extensions, the head-on method(tandem-mooring method) will be used for fishing boats moored at the mooring quay. The main purpose of the mooring buoys will be to prevent fishing boats that are moored head-on from drifting in the mooring area due to wind, current, waves, etc., and thus to ensure safe mooring. They will also serve to fix the mooring position of boats and prevent them from being damaged through violent impacts with adjacent fishing boats, quays, etc.

The method of mooring using mooring buoys has been adopted not only in the existing Providence Fishing Port but also in Victoria Fishing Port. Thus, head-on mooring using mooring buoys is judged to have high levels of necessity and effectiveness in terms of safety and functionality, as a countermeasure against the strong winds that occasionally visit the Seychelles.

(5) Electrical installation, water drainage system

1) Electric supply system within the Project site

Many fishing boats have to operate generators, as they still need power on board when moored. But to minimize the cost of running generators, fishermen use extension cables to take power from outlets in the fishermen's gear storage building, which is owned or leased by the fishermen themselves on the existing quay. The number of fishing boats undertaking fishing preparation work on Quays 1 and 2 after development in this Project is expected to increase. Therefore, shore power supply equipment must be installed in order to supply boats with the power they need from power sources on shore when their own generators have been stopped. Street lighting must also be installed to ensure the safety of fishing preparation and vehicle traffic on quay aprons and access roads at night.

2) Water supply and drainage system within the Project site

Water supply facilities are basic infrastructure for fishing boats in fishing port facilities, and are vital for providing the water supply needed by all fishing boats when they go fishing. Drainage facilities using rainwater traps will also need to be installed, to cope with the abundance of rainfall in the Seychelles.

(6) Landing shed

Hygiene is essential for facilities used to land marine produce. Landing sheds were already installed in Phase 1, but because the planned number of boats using the facilities has already been exceeded, they are in a state of saturation. In addition, more processing plants are to be built in the area around Providence Fishing Port, and the number of boats landing fish will therefore also increase. Landing work by artisanal fishing boats is expected to be concentrated between early morning and midday. Therefore, more landing shed facilities need to be developed to enable them to land fresh fish and shellfish in the limited time available.

(7) Ice-making facility

Longline fishing boats, which account for the majority of semi-industrial fishing boats, are either owned by fishery companies or are exclusively used by them through agreements with the boat owners. This means that the ice they need for fishing operations can be supplied by fishery companies. The total daily output of ice produced by fishery companies and the SFA at Providence and Victoria Fishing Ports is around 35 tons, which is not enough to meet demand at peak fishing times. When fishing on successive days, in particular, longline and many other fishing boats are unable to depart as soon as they would wish, as they have to wait for ice to be supplied. Artisanal fishing boats have particular difficulty in procuring ice, as they only buy a little at a time and, as mentioned above,

fishery companies prioritize the supply to longline fishing boats as their large-volume buyers, and do not sell to fishing boats buying in small volumes. In this Project, therefore, it is judged necessary to develop ice making facilities for artisanal fishing boats that have difficulty in procuring ice.

(8) Soft Components

In view of the following issues and situations, consideration will be given to implementing Soft Components related to ice making facilities at Providence Fishing Port.

a) The Seychelles side has requested the implementation of soft components in connection with ice making facilities.
b) Considering that the Seychelles side has no notable track record of operating ice making facilities, guidance and support in soft aspects related to the operation and maintenance of these facilities will be needed.

2-2 Outline Design of the Requested Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Basic Policies for Civil Facility

(1) Basic Policy of Construction Plan

Project target is to contribute to the fishery's development of Seychelles keeping quality of fishery products under the smooth, safe and effective landing works corresponding with increasing mooring vessels and landing demand in Providence fishing port.

One of the construction concepts of Providence fishing port prepared at the time of Phase 1 was the congestion mitigation of the port, which became saturated. Basic policy of civil facility construction in this project is to resolve the congestion caused by an increase of fishing vessels and its growing in size not only in the Providence fishing port but also including Victoria fishing port, which framework are parallel to the previous project toward goal achievement.

Basic policies for civil facilities in this project are described below.

【Basic thoughts on civil facilities in this project】

1. Port Victoria (Victoria fishing port)

- Reallocation of function to meet the aim of accessibility to be used as public quays, reviewing flow line and reorganize current utilization of the quay mooring.
- The possibility to relocate fishing vessels, which have increased in number and grown in size to Providence fishing port as the mitigation method of congestion for the mooring fishing vessels in the existing port shall be studied.

2. Providence Fishing Port (Project Site)

(a) Quay Construction

- Reallocation of function to meet the aim to be desired to use as the public quays reviewing flow line plan including quay location constructed at Phase 1 accordance with current congested status.
- Necessary length of landing quay and mooring quay shall be studied aiming not only the resolve of congestion by the number of fishing vessels, which presumably doubled, and grown in size. In addition to the congestion, mitigation of Port Victoria was increase of fishing vessels by the construction of fishery processing facility near future.
- Normal line and the cross section structure of quay are to design to coordinate with the existing quay normal line, bottom topography and ground condition with the aspects of usage with economical views. Especially, area around border with private land where

already used on the existing normal line of revetment has to be taken care without any impact by quay structures.

- In a view of safety and operation, items such as fenders, bollards, mooring rings, ladders and mooring buoys are going to be installed as the ancillary facilities in the quays.

(b) Construction of Apron and Access way

- Avoiding quays occupation by fishery processing facilities, which are planned separately behind the planning quays, access way is planned behind the apron so that everyone can equally access to quays as the public quays.

(c) Restriction of Fishing Vessels

- As the existing port is closed water area with horseshoe shape, proper operation in the port water area shall be prepared making restrictions on fishing vessels in order to secure safe ship maneuvering basin.

(2) Policy on Scale Setup

Scale of civil facilities in Providence fishing port is depended on the construction quay length to be fixed by the number of design vessels and the number of fishing vessels shall be fixed as the basic number with the following three point of views. Quay scale should be adjusted from the result of base line survey and mooring status survey. For designing, vessels shall fix the necessary length dividing into landing quay and mooring quay (for preparation and resting) and construction of Quay No.1 and No.2.

The scale length of apron and access way to be constructed behind quays shall be planned to secure the bare essential breadth considering current land utilization restrictions.

【Policy on basic number of vessel】

1. Number of vessels to relocate to Providence from Victoria

In order to determine the congestion rate caused from current mooring water area or section is more congested by increased number of vessels and growing in its size, “Basic Framework” showing the number of vessels and the clarification for boundary by use of quay function is to be designed.

The number of vessels differs between the plan of mooring vessels fixed by the above “Basic Framework” and present average number of mooring vessels is to include into the designing of vessels number treated as relocation vessels to Providence fishing port (project site).

2. Increased number of vessels using Providence fishing port

In Providence fishing port, the number of vessels using and mooring the port after

completion of Phase 1 was doubled. Necessary length of quay is doubled in accordance with number of vessels for its landing and mooring quays. And, as growing in size of vessels is accelerated by an increase of middle to large size vessels such as Schooners (SC), Long Liners (LL) or others as the actual dimension of targeted vessels to use the port, the necessary length of quays shall be calculated based on the current vessel size.

3. Increase number of new fishing vessels by construction of fishery processing facilities

Nineteen fishing vessels are newly introduced by fishery processing facilities planning to be operated behind Providence fishing port by investors. The construction of fishery processing facilities behind project site is constructed after the completion of this project. However, some of the investors have been constructed those vessels and moored around Victoria fishing port. Currently, ten fishing vessels have already procured by investors.

Accordingly, the number of the new fishing vessels, which had been procured by the investor of fishery processing facilities, shall be counted into this project.

(3) Policy on Facility Location

Target facilities for civil works are quays, apron and access ways. Building construction facilities work is ice-making facility and landing shed. Providence fishing port where the Project site has some constraints not only the problem of existing use but already utilized the land for fishery processing facilities and contracted for the land use.

Because of these factors, the location plan of targeted facilities shall be selected carefully not only to link of existing facilities but also to securement of access time of construction works and their operation as followings.

1) Layout of Quay

a) Facility layout shall be planned with consideration of flow lines of fishing vessels. The quay is to be separated by function, the landing quay and the mooring quay. The new-landing quay shall be constructed next to the existing landing quay so as to unite effectiveness.

b) Normal line of Quay No.1 shall be in alignment with the existing quay considering convenience of mooring of fishing vessels.

c) Concerning the formal line of Quay No.2, an economical facility layout shall be planned adjusting various points including related water depth with the existing leased area.

d) Facility layout of Quay No.2 shall also consider the formal line layout of Quay No.3, which will be most probably constructed in the future.

2) Layout of Apron

Minimum but necessary breadth length shall be secured as the space for preparation work for fishing and car parking behind Quay No.1 and No.2.

The layout requires retaining continuity with the apron behind the existing quay.

3) Layout of Access way

a) Necessary minimum breadth behind apron shall be secured so that free access can be made from hinterland to quays.

b) Access way shall be planned considering the accessibility from main road and enabling linkage with land facilities.

c) The access way is to design in a prospect of future construction of loop road behind Quay 2 by the Government of recipient country. And, before the construction of loop road, as the road front edge portion shall be dead end, the function to turn around shall be constructed at the front edge.

d) The road shall secure space that both construction vehicles and public vehicles can be trafficable when Quay No.2 is constructed.

(4) Policy for facility structure

1) Policy for quay structure

a) Quay structure having an advantage of construction and economic efficiency are to be analyzed based on the bottom soil condition and the result from bathymetric survey.

b) As the land-use behind Quay No.2 is made by fishery processing company, the quay structure itself shall not have an impact on the existing fishery processing and the existing buildings.

c) As Providence fishing port is closed water area with horseshoe shape, in order to confirm the amplified reflection ratio in the port generated by more construction of vertical quay structures, the analysis of port tranquility is studied.

d) The quay crown height shall be designed with a view of the heights of the existing quays, locality and free board height of design vessels.

e) The design plan of water depth for quay shall be estimated from maximum draft length of the existing fishing vessel.

2) Policy on pavement structure of Apron and Access way

a) In order to retain likeness with the existing apron and road, the pavement by inter-rocking blocks shall be adopted as same as the existing structure.

b) Apron pavement of landing facility shall be concrete pavement same as the existing facility, and the floor surface are finished with highly volatile synthetic resin.

(5) Policy on Design Standard

As there are no design standards for the civil facilities related port, harbor and fishing port in Seychelles, following Japan's design standards shall be applied.

a) Guide for Fishing Port Plan (National Association of Fisheries Infrastructure)
b) Companion for Design on Fisheries Infrastructures (National Association of Fisheries Infrastructure)
c) Technical Standards and Commentaries for Port and Harbor Facilities in Japan (Japan Port and Harbor Association)

(6) Policy on Natural Condition

1) Weather Condition

a) Season of Seychelles is mainly divided by the rainy and dry seasons. The impact of cyclones is very low.
b) Average temperature is 27°C through a year round and the maximum temperature is 30°C which is stable. The impact to construction works is very small.
c) Precipitation is estimated to 2,500mm in annual average and as rainfall with more than 10 mm/day. Accordingly, impact to construction works is estimated to 57.6 days/year. From this result, special attention is required for an extra construction period for outside work, which should be, include for the planning of the project.

2) Oceanographic Condition

a) Tide level: In the Project, same tide level applied in Phase 1 will be use.

H.W.L：+1.65m, L.W.L + 0.45m

b) Wave design: Wave in front of the existing breakwater shall be H_0'= 2.85m, period T_0'= 12sec. And, wave acting to quays shall be analyzed by confirming the port tranquility analysis for its inner port reflected waves.
c) As tidal current is analyzed 6 m min^{-1}, which is very slow. This tidal current will not be included into design as same included in the previous project.

3) Soil Condition

In the past, the project site was buried by coral sand with bottom silt in 1991 to 1995. The result of soil investigation in Quay No.2, characteristic of soil is relatively softer and loose as the soil sample Quay No.1 determined in the previous project. Soil condition to be applied to the design condition shall be set out as follows:

N Value： N = 3

Cohesion： C = 0

Inner Friction Angle： $\varphi = 25°$

4) Seismic Force

In the past, the earthquakes of magnitude 6.0 to 7.6 attacked intensively near Carlsberg oceanic ridge in the Indian Ocean including Seychelles. The distance is 1,000km away from Seychelles and the maximum base speed of acceleration is presumed as 0.5 to 1.0 Gal. Therefore, seismic factor will not take into consideration for design of civil structures.

(7) Policy on Social Environmental Condition

a) Designing of area behind construction of quays is to comprise with land use limitation, since existing fishery-processing company holds lease contract. Accordingly, the breadth of apron of roads behind quays shall be design as 13m.
b) Designing of area behind the construction of quay No.2 is to comprise with used by fishery processing company, not only selecting from economical point of view from construction, the water depth is to design with consideration of the impact to the existing fishery processing company.
c) During construction works, the project areas are to design to control as restricted area from safety reasons. However, the existing ports are planned to be actively function during this period, accordingly the structural selection is to be designed to reduce area for the use as temporary yard during construction periods.

(8) Policy on Construction Method

a) Construction of Quay No. 2, it is necessary to secure two access ways, first is in the front of the fishery processing facility and second is behind the existing fishery processing factory. This area has been occupied already, and will be the obstacles against construction works of Japanese side. During the construction of front of fishery processing facility, a land behind fishery processing facility shall be utilized as the access way.
b) Arrangement of traffic controllers highly required for the safety of constriction area. Specially, the security controller must be placed near the existing port to direct working vehicles.
c) Silt fence shall be installed during construction period to protect water area of Quay No.1 and 2. Water quality must be monitor for environmental protection.
d) As Providence fishing port is located closer to Seychelles International Airport, construction machineries used during construction shall limit of the height of less than 25m.

(9) Policy on Construction and Procurement Condition

a) Seychelles produces stone and ready-mixed concrete to be used in fundamental civil

materials for the construction works and the stable procurement is possible.

b) High quality construction materials, such as steel products (sheet piles, reinforcing bars) are designed to procure in Japan for securement of quality.

c) As quay construction works using steel sheet piles requires special operation by well-experienced workers, construction machineries, its operators and divers shall be employed to ensure the safety from Japan.

2-2-1-2 Basic Policy for Building Facilities and Equipment

(1) Basic Policy

Production capacity of ice machine is calculated to cover the shortage of difference between daily production in both Providence and Victoria fishing ports, with accordance of demand ice from capacity of artisanal fishing vessels. Basic designing concept of the ice-making facility shall follow the concept from existing facilities, which was installed by Phase 1.

1) Policy on construction of ice-making unit and ice-storage

An adequate scale of providing ice-making machines necessary for complementing the lack of ice supply to artisanal fishing vessels in Providence fishing port and Port Victoria shall be determined. Building facilities shall be designed in order to prevent confusion in the flow of ice, flow of fishermen and flow of fish products as follows.

Figure 2-2-1(1) suggests original partition plan of the lease area of the Project in providence fishing port prepared by Seychelles government. Leasing contract for a piece of land had been agreed with a private investor and SFA, and the land Section-3 was kept for ice-making facility for this project. Section 3 is located side by side to Section 1 and section 2, southeast from current administration building constructed in Phase 1.

Two access roads as shown as R1 and R2 in Figure 2-2-1(1), were originally integrated in design prepared by Seychelles side. After discussion with SFA, that access road is to include in design with review on following criteria.

- Maintenance of ice making facility
- Ice transporting route (flow line) and distance from Ice making facility to the fishing vessel,
- Distance from ice-making facility to administration building.

In addition to above, followings are to be reviewed for the design.

- Improve accessibility to Quay No.1 for ice supply to vessels
- Distance to Quay No.2 is shorter with figure 2-2-1(1), nevertheless supply transportation can be done by a vehicle.

As a result, location of ice-making facility is to transfer toward next to R1 access road, and then section-1 and 2 are to be relocated toward one block southeast as shown in Figure 2-2-1(2)

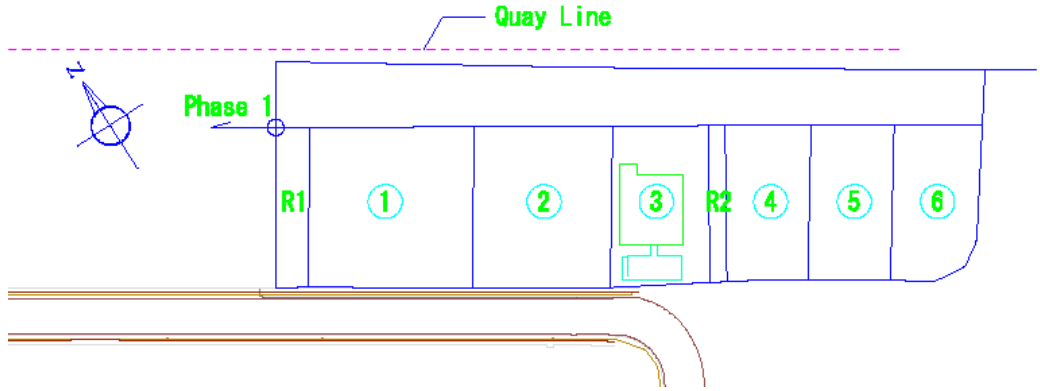


Figure 2-2-1(1) Land section plan prepared by Government of Seychelles

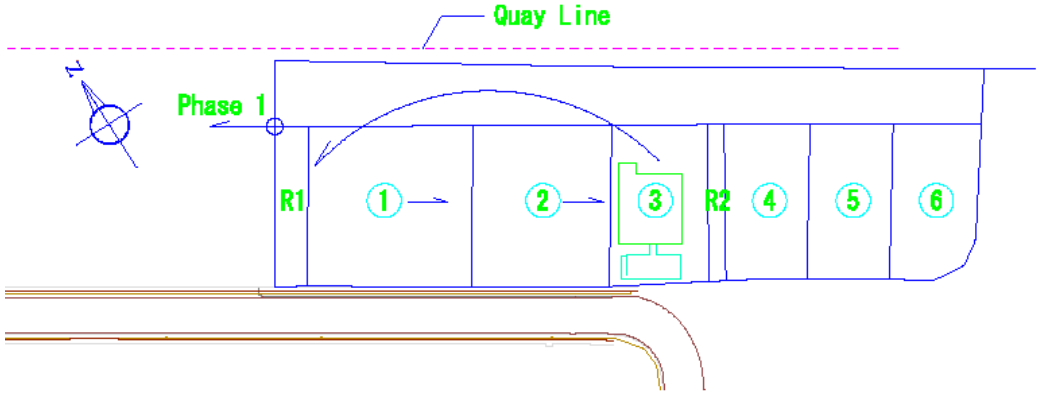


Figure 2-2-1(2) Alternative land section plan for Providence fishing port

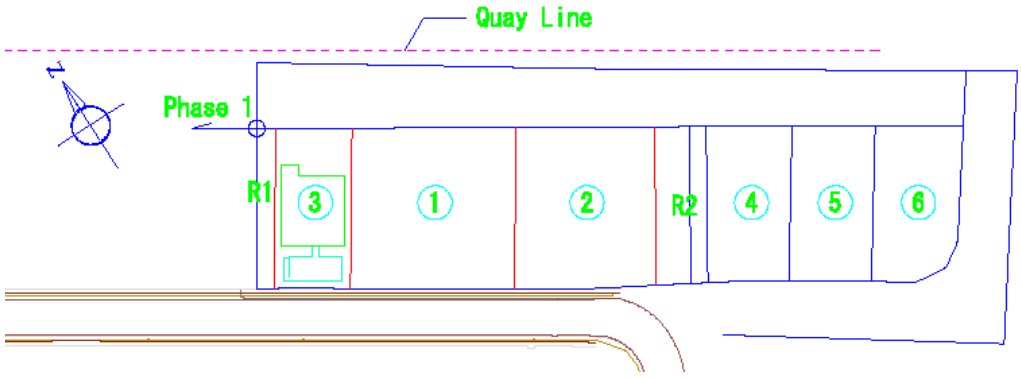


Figure 2-2-1(3) Location plan for ice making facility

a) Type of the Ice

Generally, ice plants are usually classified by the type of ice they produce. In

Providence fishing port, type of the ice is selected to design from three main ice types, which are block ice plants, flake ice plants, plate ice plants. The plate ice type is mostly used in Seychelles, while flake ice is rarely produced and block ice is not manufactured for artisanal fishing sector. The plate ice have both characteristics of flake and block ice which are suitable to use for fishing vessels consisting ice storage and having fishing trip with one day to two week period. These types of ice have good heat transfer efficiency to use for artisanal fisheries to load their catch in fish storages and to store on board. Therefor, fisherman raise strong request of plate ice in Seychelles. In addition, the process of producing plate ice is fully automated compare to the block ice from easy operation and maintenance, which can initiate reduction of production costs. Considering the current status and requirement of ice in artisanal fisheries sector, plate type of ice units are to be selected by the project.

b) Selection of Refrigerant

Chemicals used as refrigerants, known as chlorofluorocarbons (CFCs), are known to have adverse effects on the earth's stratospheric ozone layer. As a consequence, international efforts are being made to phase out most of the CFCs or halogenated hydrocarbons from commercial use. A number of more environmentally acceptable alternatives are being proposed, such as R-22, R-502, ammonia. With regard to the refrigerants most widely used in fisheries, R-22, R-502 and ammonia are the leading products. However, with the ban on CFCs in developed countries, most of the existing refrigeration plants using CFCs will be facing serious problems.

R-22 is not produced in Seychelles and the country imports the total sum of it demands. The Ministry of Environment and Energy and Climate Change allows import of the coolant up to 2040, setting the import amount as of fiscal 2020 as the limit, instead of taking phased reduction measure.

- Import of R-22 ban as from January 2018
- Phase-out compliance as from January 2020

On the other hand, ice machine using ammonia as refrigerant has been installed by Phase 1 and managed to operate by SFA in Providence fishing port and Bel Ombre fishing port. Currently ammonia is the main alternative refrigerant for CFCs used commercially for large-to medium size ice plants, with the advantage that this chemical has no detrimental effect on the ozone layer. Although ammonia is considered toxic and corrosive, with a sharp odor and irritating properties also serve as a warning when leaks. It is rated as being

dangerous, or capable of producing serious damages to humans at low concentrations for exposures of a few to 30 minutes. Therefore, there are health hazards associated with the use of ammonia and skilled labor is required to operate and maintain ammonia refrigeration plants.

Ammonia refrigerant is not produce in Seychelles, for this reason SFA have been purchasing directly from abroad and import from overseas. SFA have constructed connection with distributors and established operating facility since Phase 1. Therefor, engineer staffs and maintenance personnel of SFA are well experience in handling in one-way or another.

Seychelles government, as an island country, requested ice-making facility using eco-friendly refrigerant provided by the project as a long-term perspective. However, the level of technical engineers for refrigeration equipment in Seychelles is not sufficient.

c) Composition of Ice-making Facility

Plate ice machine is automatically operated to produce ice. Water is frozen on one face of a vertical refrigerated plate, and the sheet of ice is released by running hot gases on the other side of the plate. The size of ice particle is variable, but each unit has it own optimum thickness. The plates are usually mounted in banks, often above the refrigeration machinery, to form a self contained unit. A gas for defrosting has to be heated as necessary. Like most icemakers the plate ice machine will operate unattended on an automatic timing cycle.

Ice-making unit is basically composed from compressor, condenser and ice plate units. A condenser (heat exchanger) is generally placed outside in order to increase their efficiency. Installation spaces required for main unit of ice-making facility for the compressor and maintenance space are approximately equal size to the ice storage room. The design of ice-storage is composed with the prefabricated heat-protection panels, to protect machinery from the coastal environment such as sea breeze and rainfall. It is necessary to design with a wall around facility for good maintenance for a longer-term.

2) Policy on construction of connecting road

Many of the large vehicles are expected to access through the connecting road for the transportation of fish catches and ice by the extension of the port. By relocating the ice-making facility as shown in Figure 2-2-1(3), length of a connecting road R1 is estimated to be 3 meters. This enables widening the width to 9 meters by extending the existing of 6 meters with the connecting road.

3) Policy on construction of landing shed

Landing shed shall be planned with roof and leveled flat floor to provide a sunshade for rain protection necessary during unloading of fish products from artisanal fishing vessels under sanitary condition. As landing activity take place during nighttime and early morning, a lighting fixtures are necessary and shall be installed. In addition, water-supplying facilities are required to keep landing shed hygienic and clean condition. Landing shed is to be constructed within the area of the current project area as for consideration of the methods of construction. The wall does not exist, and the structural configuration is only roof for the landing shed. As a consequence, the negative pressure of the directions is also studied, in addition to equilateral pressure by the wind for the roof. This project is extension of Phase 1, and an available land is limited to use for the landing shed. Therefore, use of the one pillar structure to support a roof for landing shed is selected to design under available land with effectiveness. Moreover, structural design is made to keep flexibility to a roof bolster by installation of the steel beam and reinforced concrete structure for pillar.

4) Policies for building structure

Ice-making facility are planned to use RC foundation and steel structure as superstructure to construct a lighter frame. Comparing to the reinforcement concrete, total weight of building can be reduced by use of steel structure and finishes material can be prepared with lighter weight materials. Exterior wall is designed with horizontal installing material needing vertical furring strips, and to make deflection of furring strips as small as possible. Horizontal girder shall be installed at half of maximum height of the building. Rustproofing by salty air is undertaken by use of fascia board and soffit board installed to prevent steel structure contact with outside air containing salt and outside stage for evaporative condenser which is designed with galvanized steel structure against damage.

Landing shed has only roof panel without wall, so not only positive pressure but also negative pressure working the roof pulling away shall be considered. In Phase 1, installation of two columns had been used to hold roof, but in this Project, available depth-length is limited to 7 m to support roof with one column. As consequence, a landing shed was prepared to design with support a roof using steel girder having flexibility with the column made of reinforced concrete.

5) Concept of Design Standards

Design of building facilities shall comply with building standards in Seychelles, which are prepared based on the British Standards. On the other hand, Seychelles depends on import for a reinforcing rod and the steel frame of the building material. Therefore, the supplies of the steels are planned to uses a Japanese standard in consideration with technology such as the reliability of

materials and processing technique. In addition, for building utilities, Japanese standard is to be applied.

6) Concept of Natural Conditions

a) Seismic Load

According to the data of an earthquake generated in the past, the earthquake is intensively stroked in the area, approximately 1,000km away from Seychelles. As consequence, seismic factor is not taken into consideration to structural calculation.

b) Wind Load

Category and wind pressure is calculated to design from maximum wind velocity of 32m and no obstruction around buildings were found. Accordingly, structural calculation is set to category 1. It is necessary to design facilities with construct adjacent to the coastline, and wind directly interrupts those facilities.

c) Endurance strength of the foundation

Subsoil condition has been confirmed to 13 tons/m^2 by the borehole test and plate-bearing test during Phase 1. Ice-making facility for this project is positioned to testing point of this borehole test.

Approximately ten years has passed from previous examination, and endurance strength of the foundation may change to increase by the un-constructed condition and non-utilize of land. 13 tons/m^2 is used to design endurance strength for facilities.

7) Policy on Construction and Procurement condition

Construction materials that originate from Seychelles are limited to ready-mixed concrete, rubbles, and the timber. In addition, the materials need maintenance, such as lighting equipment, an air conditioner; those items should give higher priority to procure locally. However, high quality materials are required such as salt tolerance steel, water tanks, roof materials which should be procured from Japan.

Many construction materials are purchased by dealers, to import and distribute a variety of construction materials from other countries across the glove. The import counterparts include neighboring nations in continents and China, which unfortunately having low guarantee on a quality of materials. Likewise, the inventory level fluctuates, making difficult to constantly procure a correct quantity of materials compliant with the international specification at right timing. Taking those into consideration, it is noteworthy to confirm the specification, quantities, turnaround time, and other important factors when procuring materials with predetermined specifications, so as to ensure that there will be no discrepancy with the construction

arrangement.

8) Concept on utilization of local contractor

There are a three or more construction companies in Seychelles, including general construction companies of conglomerates with 100 or more employees and middle-sized companies with dozen of employees. There is a company, which has an experience to construct hotel buildings in Seychelles for general building construction. Therefore, it will be possible to work for construction under the instruction and guidance as local subcontractor. However, installation of ice-making facility and the roofing material are to import from Japan. The roofing work is necessary to be conducted by a skilled expert from Japan in order to prevent from rain leaking. Installation of Ice-making shall also need to be conducted by Japanese technical experts.

9) Concept to social environment

Population of Seychelles is just above 90,000 and the domestic construction market is accordingly limited, most construction materials and equipment are imported. As a result, the inventory of products of the same specification and size is scarce and the product quality differs among countries of origin. Consequently, when procuring construction materials and equipment in Seychelles it s important to pay attention the inventory shipment and delivery time. Furthermore, a labor force population is also small as around 40,000 and hence the number of engineers and skilled workers are also limited. These must also take into consideration in managing the construction schedules so as to prevent any delay in the implementation and completion of the works.

10) Concept on operation maintenance cost of the implementation agencies

a) Operation and the maintenance shall be planned based on the achievements, which SFA has experienced through Phase 1. The operation of the ice making facility needs additional technical staffs specialized in ammonia refrigerant ice plant.
b) The SFA must consider to prepare independent accounting system for the sustainable management of fishing port, SFA should well noted to attempt the continuous management of the Providence fishing port
c) Sustainable management of ice-making facility shall be prepared for economical operation

11) Soft Component

Soft Component activity is to intend to solve the following issues with respect to the ice-making facility in the Providence fishing port.

a) Seychelles government requested for Soft Components to assist technical assistance for ice-making facility.

b) The operation and maintenance performance of the ice making facility that uses ammonia refrigerant has been not correctly functioned. Support for ice-making technology in operation and maintenance of ice-making facility is highly necessary.
c) Long and mid term maintenance plan is necessary to prepare for sustainable operation for ice-making facility. Technical support is required as the Soft Component.

2-2-2 Basic Plan (Construction Plan)

2-2-2-1 Civil Facilities

(1) Basic quantities parameter for the civil facilities

Estimation of project scale of civil facilities shall be based on the necessary quay length which is determined by the actual operating condition such as the number of fishing vessels, the sizes of fishing vessels, hours of quay use. The number of fishing vessels and their sizes related with the Project for the Construction of Fisheries Facilities at Providence, Zone 6 (hereafter "The Project") shall be estimated with the following three basic concept on the policy.

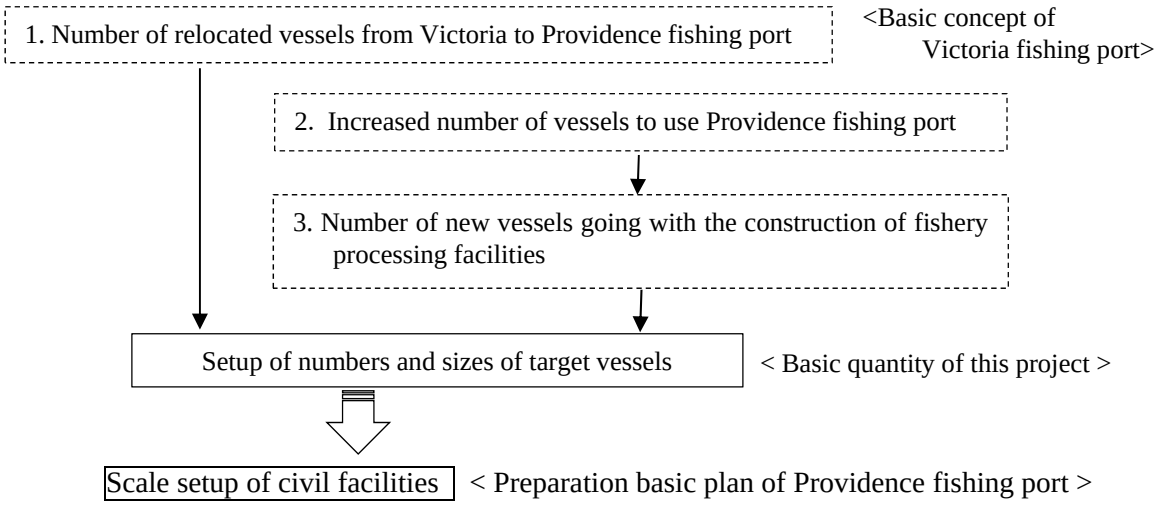


Figure 2-2-2(1) Scale estimation in the Project

1) Relocation Plan of fishing vessels from Victoria fishing port to Providence fishing port (Basic concept of Victoria Fishing Port)

(a) Prospect of Basic Framework

The number of mooring vessels and their sizes in this fishing port from the time of planning (1997) to present (2015) increased to 54 numbers from 40 which was the planned number of mooring vessels as shown in Table 2-2-2(1) and the average length of vessels was grown to approximately 13m from 9m. The current Victoria fishing port has physically no space to expand due to the leasing contract with the investor. Therefore, landing at the quay always face triple or four-hold alongside mooring, making congestion from these background. As consequence, it is necessary to control the number of fishing vessels using the Port in order to attain safe and effective fishing port operation as public quay. Basic framework of Victoria

fishing port aiming quay congestion mitigation and operationally potential number of fishing vessels to moor both of which shall be included estimation.

Table 2-2-2(1) Number of fishing vessels in Victoria port (number of mooring vessels) and Vessels size

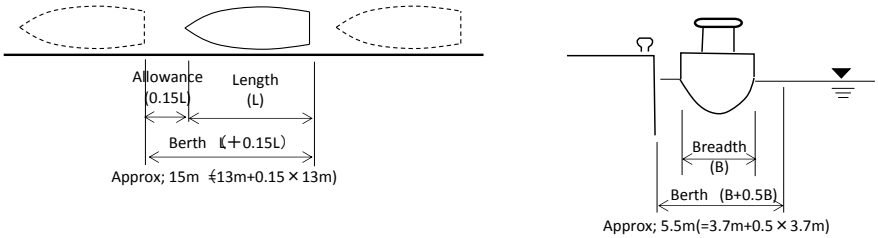
Vessel / Year	Small fishing boat	Middle fishing vessel	Semi-industrial	**Total**
1997	4	33	3	**40**
(Original Plan)	L=5m, B=2m	L=9m, B=3.5m	L=15m, B=5m	**L=9m, B=3.5m**
2015	2	42	10	**54**
(Present)	L=7.5m, B=2.2m	L=11.8m, B=3.5m	L=17m, B=5m	**L=13m, B=3.7m**

(Remark) Data in 1997: original setup number of vessels in Victoria fishing port
Data in 2015：Number of vessels according to the mooring survey executed by this project study
L：Length of vessels, B：Breadth of vessels

(b) Estimation of Occupied Water Area for one vessel

There are "Alongside mooring" for landing quay and "Tandem mooring" aiming the preparation and resting quay as mooring method. Based on the average vessel sizes moored in Victoria fishing port, occupied water area for one vessel is calculated to 15m x 5.5m by "alongside mooring" and 5.5m x 27m by "tandem mooring" as shown in Figure 2-2-2(2).

【Alongside mooring】: Landing quay



【Tandem mooring】: Mooring quay

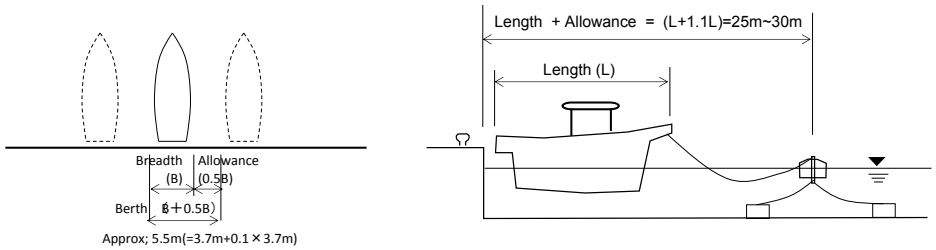


Figure 2-2-2(2) Occupied water area for fishing vessels in the alongside mooring and tandem mooring (Victoria fishing port)

(c) Functional Plan for Quay Use

There are three routes for flow lines of the fish product from connecting water areas and land areas in Victoria fishing port. One flow line is routing to public area, and two routes are routing to a private fishery processing company's area. From the existing quay use of fishing vessel and the existing flow lines, the functional demarcation are shown in Figure 2-2-2(3).

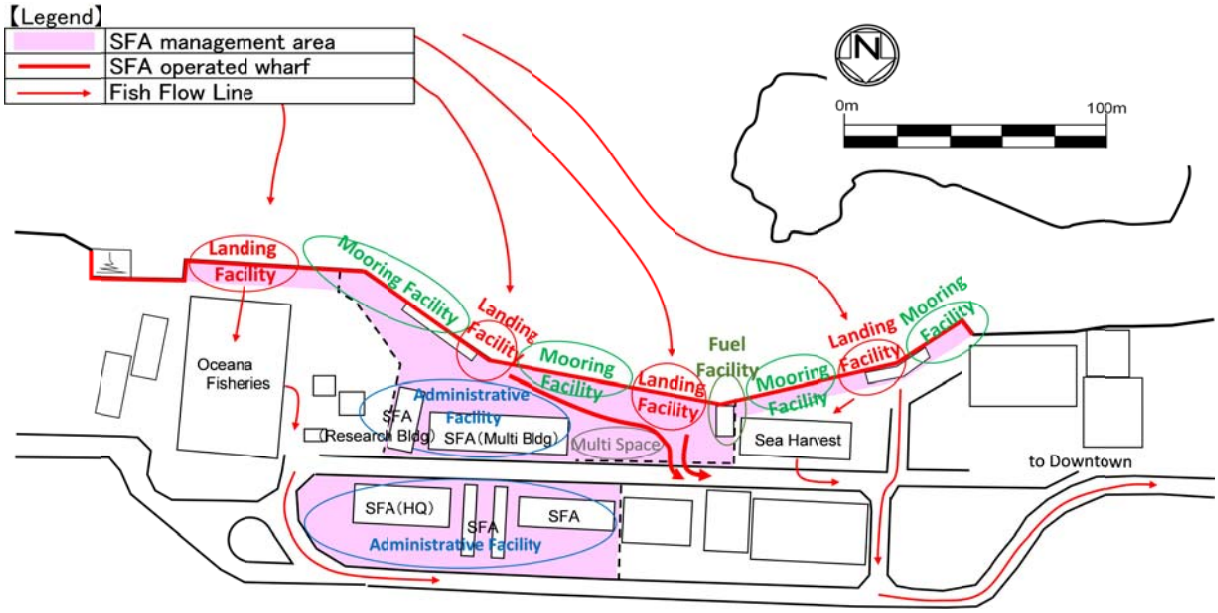


Figure 2-2-2(3) Function Plan for Quay Use in Victoria fishing port

(d) Basic Framework of Victoria fishing port

Basic framework is to design reduction of vessel congestion as shown in Figure 2-2-2(5). The Basic framework is design with consideration of previously described plan as mentioned in above "(b) Estimation of Occupied Water Area for one vessel" and "(c) Functional Plan for Quay Use". As the result, outlook of 14 vessels (=54-40) out of 54 vessels moored in Victoria had to relocate to other areas, including Providence fishing port as shown in Figure 2-2-2 (4).

Present: 54 vessels mooring.

(Remark) 4 out of 54 are owned by fishery processing company behind the port.

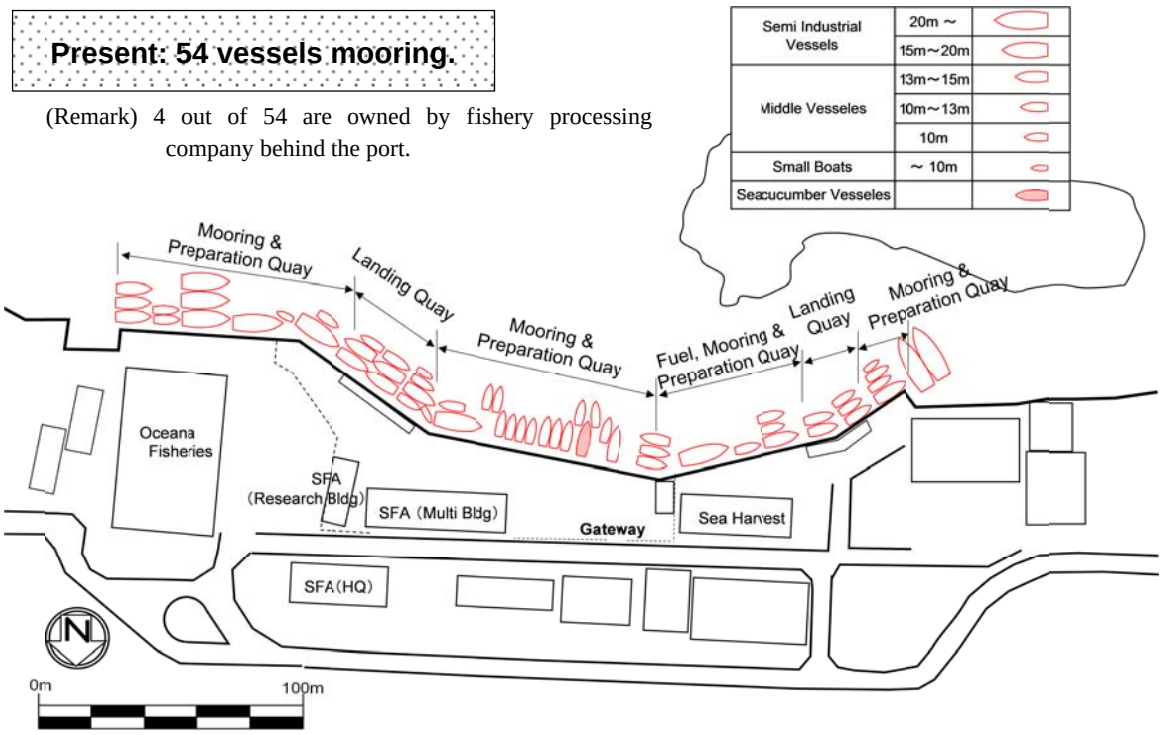


Figure 2-2-2(4) Mooring situation in average in Victoria fishing port (Present)

Prospect: 40 vessels Mooring

····· 14(=54 (present) – 40(prospect))are plan to relocated to other port

(remark[1]) 4 out of 14 are owned by fishery processing company located behind Providence fishing port
(remark[2]) Vessel figures are converted based on the average LOA and Breadth.

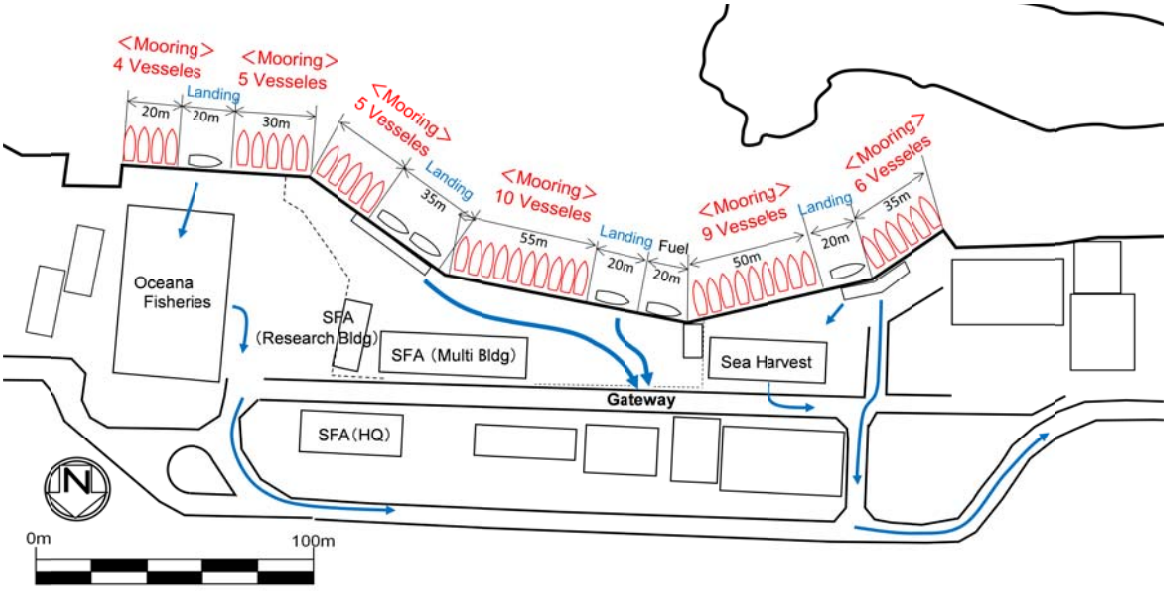


Figure 2-2-2(5) Basic Framework of Victoria fishing port (Quay Use Demarcation and Number of Mooring Vessels)

2) Increased number of vessels to use Providence fishing port

Table 2-2-2(2) shows the mooring number of vessels and average vessel's size in original plan (2006) and present (2015) in Providence fishing port. The number of mooring number had increased double from 12 at Phase 1 planning stage to 23 within 10 years, and the average length of vessels has upsizing to 12.3 m from 8.8 m.

Consequently, 11 vessels have been increased comparing with planned mooring number of vessels in Providence fishing port, suggesting capacity of the quay has reached its maximum and becomes short with the number of the exiting mooring quay.

Table 2-2-2(2) In-port number of vessels in Providence fishing port (mooring number of vessels) and Vessel's size

Vessels / Year	Small	Middle	Semi-industrial	**Total**
2006	5	4	3	**12**
(Original Plan)	L=5m, B=2m	L=9m, B=3.5m	L=15m, B=5m	**L=8.8m, B=3.2m**
2015	1	10 (6)	6	**23**
(Present)	L=6.3m, B=1.8m	L=10.7m, B=3.2m (L=13.4m, B=4.2m)	L=15.2m, B=4.4m	**L=12.3m, B=3.8m**

(Remarks) Data in 2006：Number of vessels setup at Phase 1 in Providence fishing port
Data in 2015：Number of vessels based on mooring survey executed in this project study, ( ) means sea cucumber vessel
L：Length of Vessel, B：Breadth of vessel

3) Additional number of vessel purchase by Fishery processing facility

Behind the Project site in Providence fishing port, fishery companies have made a land lease agreement with SFA to establish processing facilities. Some of those companies had been planning to purchase new fishing vessels for stable factory operation. Those vessels are planned to use Providence fishing port as a base port. Accordingly, the number of the vessel that had been purchased or ordered by fishing companies is included for planning of the Project design.

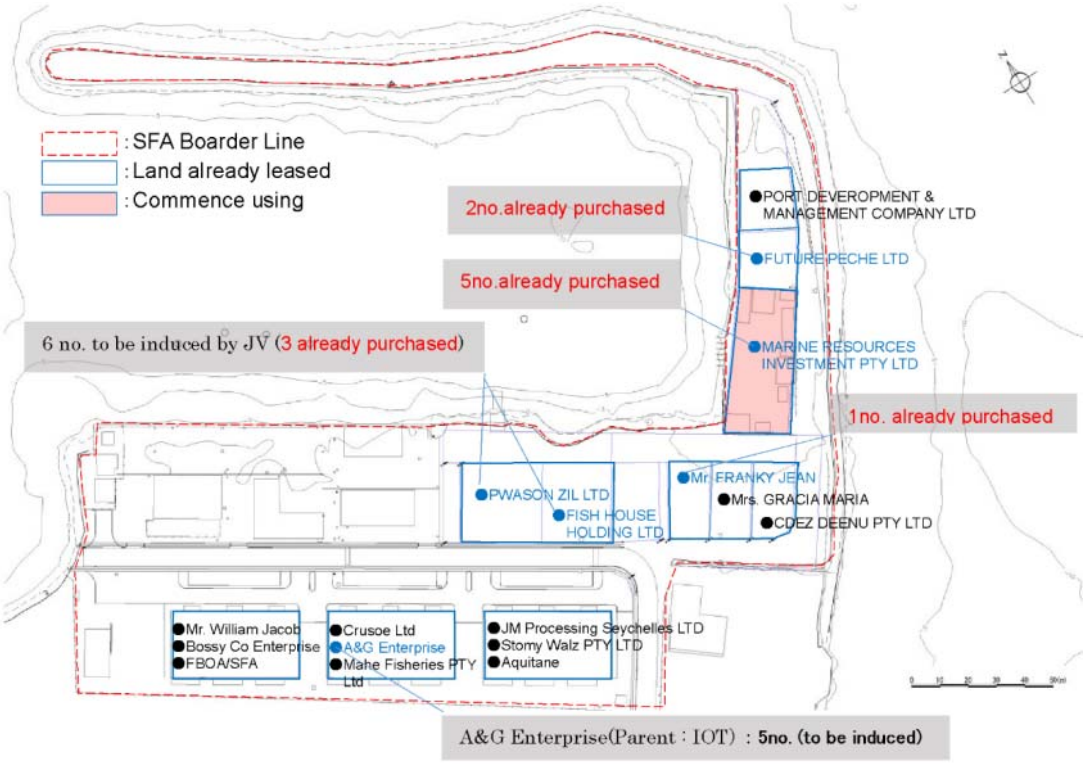
Demarcation of lease lane of the fishery companies and newly induced number of fishing vessels are shown in Table 2-2-2(3) and Figure 2-2-2(6).

The lease agreements with fishery processing companies were entered from end of 2014 to March 2015. The allotted parcel for Marine Resources Investment PTY. LTD. had been commenced to use the land. Fishing vessels introduced by those processing companies are larger size of fishing vessels mainly consisted with semi-industrial type. As a result, the quay in the project is design with additional 11 newly purchased fishing vessels for the mooring water space.

Table 2-2-2(3) Newly inducing fishing vessels by Providence Fishery Processing Company

No	Name of Processing Company	New fishing vessel		Current condition of Purchased fishing vessels
		Plan	**Purchased**	
1	FUTURE PECHE LTD		2	2：moored in Victoria
2	MARINE RESOURCES INVESTIMENT PTY LTD		5	1：moored in Providence 1：moored in Victoria 3：shipbuilding in Malaysia
3	MR. FRANKY JEAN		1	1：moored in Victoria
4	PWASON ZIL LTD	3	3	3：shipbuilding in Sri Lanka 3：future purchase
5	FISH HOUSE HOLDING LTD			
6	A&G Industrial	5		5：future purchase
Total		**8**	**11**	Total 19 are scheduled to induce

Source: Surveys conducted in March and June 2015



Source: Surveys conducted in March and June 2015

Figure 2-2-2(6) Fishing vessels induced by processing companies

4) Target Fishing Vessels in the project

(a) In port ratio

Average in port ratio (ratio of number of mooring vessels against number of vessels in use) of Victoria fishing port are calculated to 56% and Providence is 48% as shown in Table 2-2-2(4).

Table 2-2-2(4) In port ratio of Victoria fishing port and Providence fishing port

	Victoria fishing port			Providence fishing port		
	Using	Mooring	In port ratio	Using	Mooring	In port ratio
1997	83	40	0.48			
2006	113	58	0.51	24	12	0.50
2015	78	54	0.69	49	23	0.47
Average			0.56			0.48

(Remarks) Number of fishing vessels to use is based on the data of SFA. Number of mooring fishing vessels is based on the setup numbers in 1997 and 2005 and the mooring survey in 2015.

(b) Estimation of number of target vessels

In this project, target number of fishing vessels to use port and the number of mooring fishing vessels were assumed as shown in Table 2-2-2(5) to Table 2-2-2(6). The table shows number of the vessels include, presently active fishing vessels in Providence, relocation fishing vessels from Victoria and purchased fishing vessels by fishery processing company. The number of fishing vessels utilize the Providence fishing port under the project are estimated to 80 vessels and 39 vessels for the mooring vessels.

Table 2-2-2(5) Target number of fishing vessels to use port (Providence fishing port)

Project Target <Number of vessels to use port>	Small	Middle size fishing vessel			Large	Total
	LEK	LAV	WH	SCH & SEA	LL	
Current number of vessels in Providence	1	3	9	27	9	49
Relocated vessels from Victoria				20		20
Already purchased vessels by fishery processing company					11	11
Total	1	3	9	47	20	80

(Remarks) - Currently active fishing vessels: statistic number by SFA in 2014
- Relocated fishing vessels from Victoria : Presumed number using in-port ratio from number of mooring vessels of relocation plan

Table 2-2-2(6) Target number of mooring fishing vessels (Providence fishing port)

Project Target <Number of mooring vessels>	Small	Middle size fishing vessel			Large	Total
	LEK	LAV	WH	SCH & SEA	LL	
Current number of vessels in Providence	1	3	7	6	6	23
Relocated vessels from Victoria				11		11
Already purchased vessels by fishery processing company					5	5
Total	1	3	7	17	11	39

(Remarks) - Currently active fishing vessels：Based on the mooring survey and the baseline survey in 2015
- Relocated fishing vessels from Victoria were setup as Schooner class judging from the average vessels size
- Already purchased fishing vessels of fishery processing company: Presumed using in-port ratio from number of vessels to use port

(c) Dimensions of target vessels

As shown in Table 2-2-2(7), the dimension (sizes) of target vessels in this project are 13m length and over, 3.8m breadth, 1.6m draft and 1.3m free board for 1.3m, all figures are approximate and in average. In addition, the maximum sizes of target vessels are 24m LOA, 2.0m drafts and 50 tonnages.

Table 2-2-2(7) Sizes of target fishing vessels (Providence fishing port)

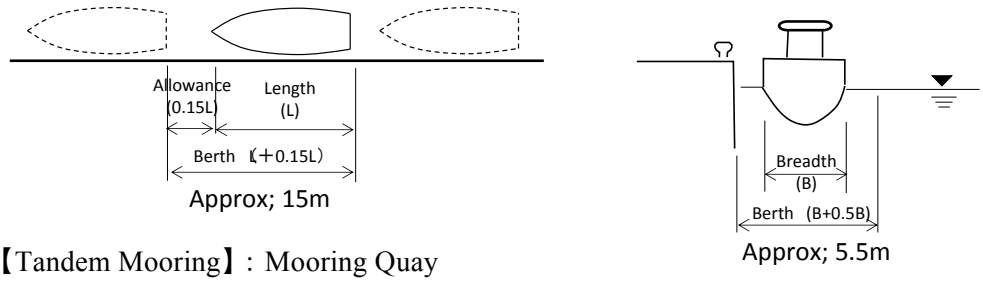
Size item		No.	LOA	Breadth	Draft	Freeboard	Total tonnage
Current in Providence	Ave.	23	12.30m	3.75m	1.63m	1.34m	10ton
	Max.		22.00m	5.00m	2.00m	1.80m	45ton
Relocated fishing vessels from Victoria	Ave.	11	12.50m	3.70m	1.61m	1.23m	10ton
Already purchased vessels by fishery processing company	Ave.	5	21.10m	4.66m	1.78m	1.65m	40ton
	Max.		24.00m	5.10m	1.89m	1.80m	50ton
Weighted average of target vessels		39	13.4m	3.8m	1.6m	1.4m	14ton
Maximum size of target vessels		-	24.0m	5.1m	2.0m	1.8m	50ton

(Remarks) - Total tonnage was presumed from correlation chart from LOA and total number of tonnage of "Guide for Fishing Port Plan"
- Data was made based on the mooring survey, baseline survey and hearing survey executed in 2015.

(d) Occupied water area require for vessel

Occupied water area for one target fishing vessels is estimated from the factors of 13m LOA and 3.8m breadths in average of target vessels as Figure 2-2-2-2-1(6). Approximately 15m in the case of alongside mooring and approximately 5.5m in case of tandem mooring were estimated. However, when the largest target vessel is used in port, a landing quay of 28m in the length (= 24m + 0.15 × 24m) will be required.

【Alongside Mooring】: Landing Quay



【Tandem Mooring】: Mooring Quay

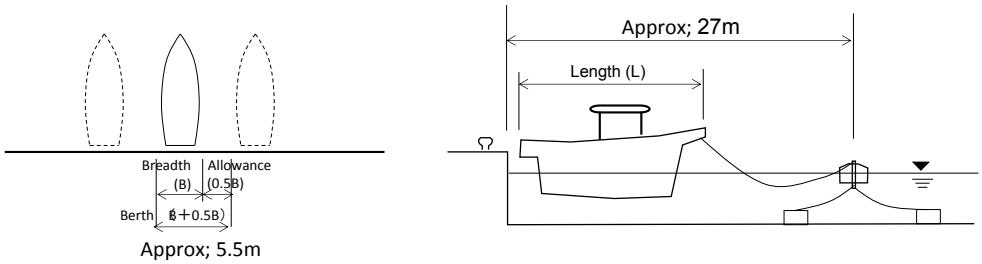


Figure 2-2-2(7) Standard of mooring method in this project (Providence fishing port)

(2) Quantities analysis of Civil Facilities

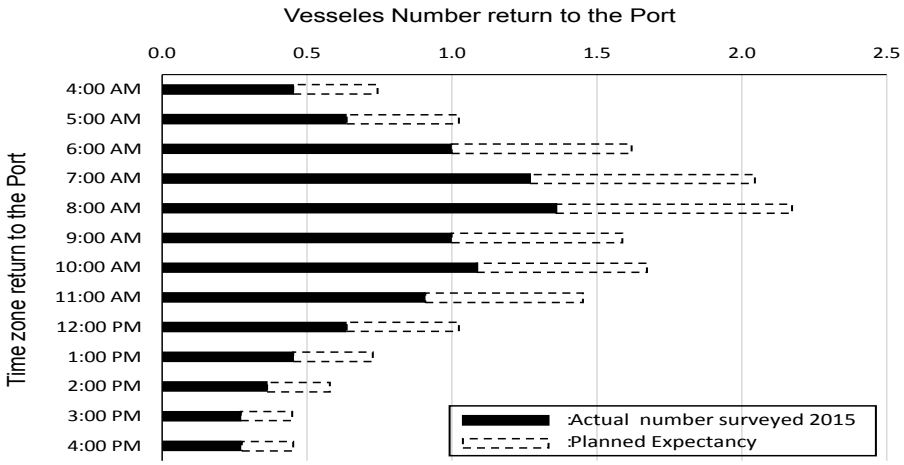
1) Estimation of Landing Quay

(a) Landing time and the number of berth

According to the baseline survey performed in March 2015, 32 vessels on in-port vessel were recorded to use landing quay in 2 weeks of time. Accordingly, daily in-port vessels (except Sunday) in Providence were calculated to 2.7 vessels per day (= 32 ÷ 12 days), which is relatively small. As shown in Figure 2-2-2(8), more than one vessel is intensively used during five hours between 06:00 am to 11:00 am. In the case of number of vessels, to use the port, have increase to 80 vessels from 49 in future, perspectives of simultaneous landing with 1.5 to 2 vessels are expected.

While, although the time for landing works per one vessel is taken up to 1.5 hours in average as shown in Table 2-2-2(8). Relatively large size sea cucumber vessel or semi-industrial type fishing vessel use more than three hours per vessel in average, causing the berth pausing period have already arisen.

Currently, one berth (20m) as landing quay is available. As described before, the Project is aiming to increase the vessel number; simultaneous unloading of fisheries product by two vessels is highly achievable during peak time from increase of port activities. From this reason, one additional new berth is required to be constructed by the project.



Data was made up based on the baseline survey executed in 2015

Figure 2-2-2(8) Number of In-port vessels and In-port time zone (current status and Project prediction)

Table 2-2-2(8) Landing Hours

Providence Fishing Port	Survey result in Phase 1 Project			Survey result by base line of this Project					
	Small Boats	Middle Vesseles	Semi-industrial	Small Boats	Middle Vesseles	Sea Cucumber	Semi-industrial	Average	Waitting Time for Berthing
Landing Time	0.5h	1h	1.5h	0.5h	1h	3h	3h	1.5h	8.5h
Preparation Time	0.25h	0.5h	1h	(30 min ～ 6 hour) ／ 4days ～ 7days)					

Data was prepared based on the baseline survey.

(b) Necessary length of landing quay

Necessary length of additional berth (one) shall require 28m long quays when the largest fishing vessel is to operate. However, in the project the connecting area with 10m length adjoining to existing landing quay shall be effectively used and plan enabling simultaneous landing by two vessels are to be achieved by constructing new 20m landing quay (one berth).

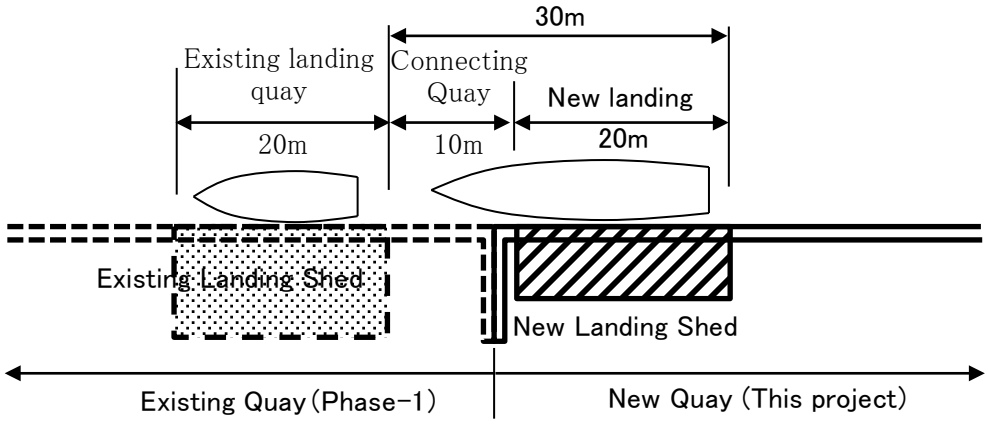


Figure 2-2-2(9) Length of new landing quay

2) Quantitative Estimation of Mooring Quay

Preparation work for fishing activity is generally conducted for four days to one week for the working for half hours to more than six hours as shown in Table 2-2-2(8). In other words, as preparation work is conducted with combination of vessel's rest in mooring quay, it can be included in calculated number of in-port vessels activity in the project.

As previously described, a length of mooring quay shall be 215m, as necessary length is calculated from occupied water area of tandem mooring per one vessel as shown in Figure 2-2-2(7) as 39 vessels are targeted as mooring vessels in this project (refer to Table 2-2-2(7)).

Necessary length of mooring quay = necessary length per one vessel of tandem mooring × number of mooring vessels

= 5.5m × 39 vessels

≒ 215m

3) Estimation of Supply Quay

The supply quay at the time of Phase 1 was constructed as 10m quays in total length. However, this supply quay is situated adjoining to the ice loading quay and does not fulfill to receive average parameter of 13.4m in LOA used in this project. In addition, fishing vessels using the port is not only the fishing vessels from Providence, but also vessels from other ports (base on other port, other islands). In the project, the length of the supply quay is re-adjusted to 20m lengths from following reasons.

The largest fishing vessel in the project is 24m LOA. The larger semi-industrial type is planned to use the Providence fishing port by the fishery processing facilities.

4) Estimation of Ice Loading Quay

Ice loading quay at the time of Phase 1 was built with 20m quays in front of ice-making facility. In the project, the existing Ice-loading quay is used, however, reviewing from the function allocation, design is to apply sliding vessels to the side with the change of supply quay previously stated as shown in Figure 2-2-2(10).

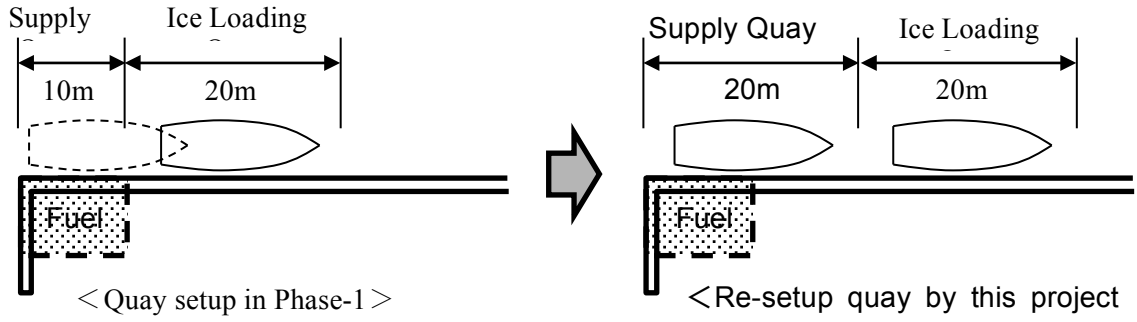


Figure 2-2-2(10) Scale design of Supply Quay and Ice Loading Quay

(3) Function Allocation Plan of Facilities

Facility function allocation plan has been discussed with SFA with number of alternatives. Alternative 1 and 2 are shown in Table 2-2-2(9) and (10). The basal conditions of function by allocation are as follows.

1) Landing function shall be allocated to Quay No.1 in order to consolidate with the existing function.
2) Behind the quay No.2, a vehicle turning point as function at end access way is to construct for future road construction.
3) The planning of the construction of Quay No.2 is to design with the future prospect of construction of Quay No.3.
4) Since a piece of the land for fishery processing facilities is still re-locatable, the allocation of ice-making facility shall be carefully adjusted in the plan with the function of the facilities

   The access function to the project site from main road behind the site shall be included in the project.

As the result of study, facilities in this project shall be allocated based on “Alternative -B”.

Table 2-2-2(9)　Alternative–A Facility Function Allocation

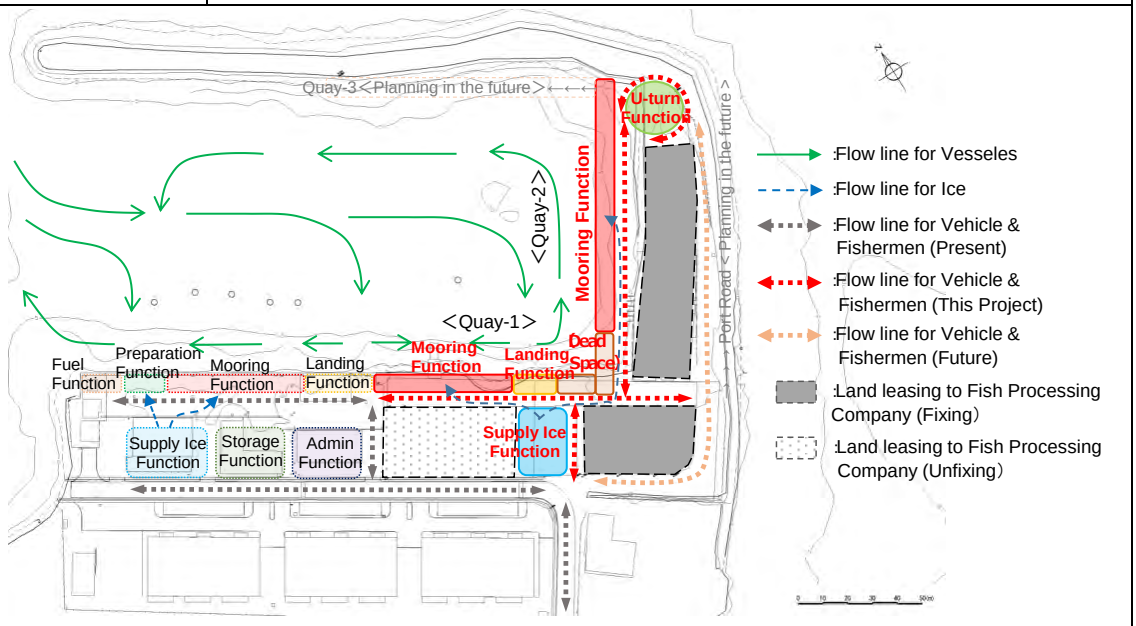
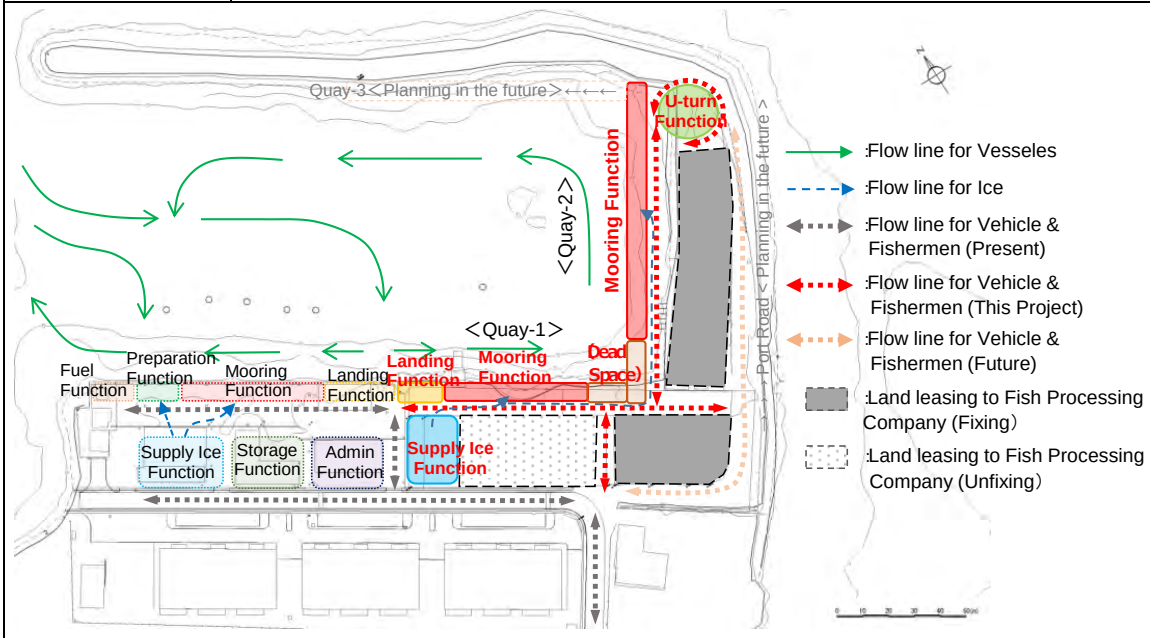
Alternative-A	Idea is to separate landing function and ice making function from the existing facilities.	
		
Flow line of vessels	・Flow line of vessels shall be complicated in the port by the separation of landing function from the existing one.	×
Flow line of ice	・Since the ice making function is allocated near Quay No.1 and No.2, the ice transportation distance becomes short and work load shall be lessened in comparison with Alternative-B.	◎
Flow line of vehicles	・Same as Alternative-B	—
Management Function	・The access to landing function and ice making function becomes far for administrators.	△
Overall Evaluation	SFA who needs strengthening of management for ice making function requests abutment to the existing administration office rather than the flow line of ice. And, although the landing function is allocated to Quay No.1, landing places to be separated into two that means to manage two places for landing.	△

Table 2-2-2(10) Alternative-B Facility Function Allocation

Alternative-B	Idea is to consolidate landing function and ice making function with the existing facilities.	
		
Flow line of vessels	・As the landing function is allocated integrally with the existing one, the flow line of vessels in the port shall be simplified in comparison with “Alternative-A”	◎
Flow line of ice	・As the ice making function is allocated near the existing landing quay and Quay No.1, the ice traffic distance to Quay No.1 becomes shorter but the one to Quay No.2 becomes fur.	△
Flow line of vehicles	・same as Alternative-A	—
Management Function	・The access to landing and ice making functions is easier and manageable for administrators.	◎
Overall Evaluation	SFA who needs strengthening of management for ice making function requests abutment to the existing administration office rather than the flow line of ice. And, the landing function can also be used integrally with the existing facilities so that the management can be made by one place.	◎

(4) Basic Plan of Civil Facilities

1) Quay Plan

(a) Estimation of Crown Height

The crown height of quay is estimated with freeboard height of target vessels and the sea level departure from normal level. The freeboard height of target vessels is average of 1.4m as stated in Table 2-2-2(7). Therefore, the crown height is calculated to +2.5m from average sea levels and freeboard height with below formula. The crown height of existing quay is +2.5m, and users suggest good feedback were raised concerning the crown height. In this context, the crown height of quay in the project is planed with +2.5m as shown in Figure 2-2-2(10).

Quay crown height = M.S.L ＋ Average freeboard of target vessels

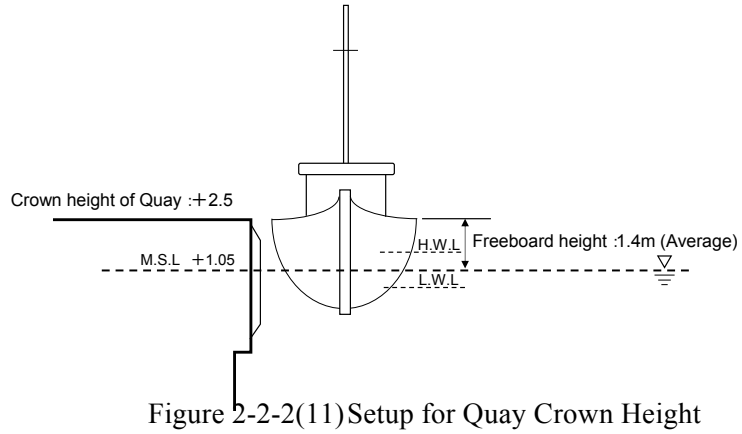


Figure 2-2-2(11) Setup for Quay Crown Height

(b) Basic Structure of Quay

Generally, quay structures of fishing port are considered from three types, which are "Sheet Pile Type", "Jetty Type" and "Gravity Type". Type is selected from the results of study for soil condition, workability, economic efficiency, and maintainability. As result of comparison among those three structure as shown in Table 2-2-2(11), Steel sheet pile method is selected form overall evaluation.

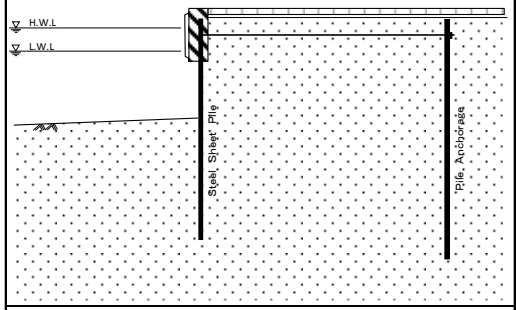
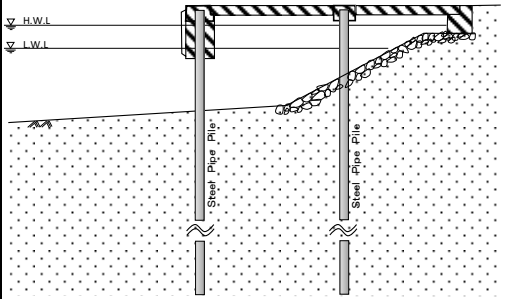
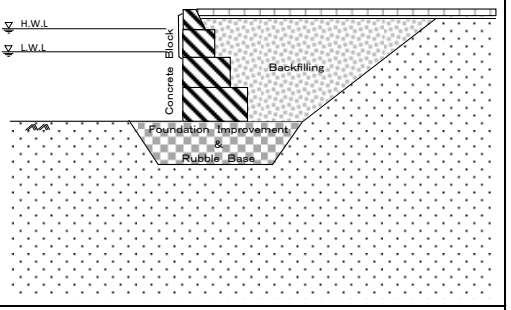
Similar to the Providence district, a landfilling work and quay construction work using similar type operation has been developed in the east coast of Mahé Island, near the project site. The steel sheet pile structure was engaged for this work, since soft layer covers the most of surfaces and bearing stratums are located at 30m of depths. Incidentally, structure type of steel sheet piles was also used by the quay construction of Phase 1 and also at Victoria fishing port. It is concluded, that the Project will adopt the steel sheet pile structure as quay structure.

The distance between anchorages in steel sheet pile structure (distance from front sheet pile to anchor pile in behind) was designed to considerate the impact on the land behind the quay for fishery processing facilities where is concluding lease agreement.

As the result of structural calculation, the distance between front sheet piles to anchoring piles shall be 9 m length in order to minimize impact at the time of piling work for anchorage, since existing building in front of the area of fishery processing facilities on Quay No.2.

- Distance to anchorage pile in Quay No.1
  : 11m (in front of land to be for fishery processing facilities)
- Distance to anchorage pile in Quay No. 2
  : 9m (in front of existing fishery processing factory)
  : 11m (in front of land to be for fishery processing facilities)

Table 2-2-2(11) Comparison table for alternatives of quay structures

Structure Type		Steel Sheet Pile Type		Jetty Type		Gravity Type	
Basic Structure & Structure Concept							
		・This is the structure to have steel sheet pile in front and anchoring pile in back ・This is to be used in reclaimed revetment in general		・This is the dual structures by jetty and gentle slope revetment. ・The structure of jetty is reinforced concrete for super structure and steel pipe for substructure. ・The structure of floor to be apron is also concrete structure.		・Gravity structure to install concrete block or others to fair ground	
Feature		・relatively easier to correspond to soft ground ・piling of sheet pile is difficult in case of the hard ground or boulder stratum. ・relatively strong for waves		・fit to soft ground ・however, if bearing stratum is deep, the length piles shall be longer. ・in case of hard ground or boulder stratum, piling work shall be difficult. ・There is possible damage of floors by wave impact.		・This fits to fair ground. ・While in the soft ground, subsidence of structure body is predicted and soil improvement work shall be necessary. ・This is relatively strong for waves.	
This Project	Soil condition	It will be easier to correspond to soft ground with N value 3	○	Steel pipe pile will be necessary to pile up to 30m of bearing stratum.	△	Soil improvement of foundation shall be necessary due to the soft ground with N value 3.	△
	Construction work	・Structure itself is simple and underwater work becomes less. ・This has good workability and short working period ・Procurement of steels in the country is difficult.	◎	・As structure is complicated and there are many construction methods, the construction period shall be long. ・Marine work ship shall be necessary for piling works. ・Procurement of steels in the country is difficult.	△	・Large size crane shall be necessary for the installation of concrete block. ・Period and the yard shall be necessary to produce concrete blocks. ・It is possible to produce concrete block in the country.	△
	Economic efficiency	This is the most economical one due to the shallow water depth	◎	The water depth is shallow though this shall be expensive not only because the bearing stratum of pile will be 30m but also using more volume of concrete due to the dual structures.	△	Large scale of soil improvement works is necessary and the volume of concrete shall be bigger.	×
	Maintenance	Anticorrosion measures for steel material is necessary.	○	Anticorrosion measures for steel material is necessary.	○	Maintenance shall be easier.	◎
Overall evaluation		○		△		×	

(c) Estimation of Quay Formal Line

Formal lines figures of Quay No.1 and No.2 shall be setup as follows.

A) Formal line of Quay No.1

The formal line of Quay No.1 shall allocate on the extension of formal line of quay of steel sheet pile type constructed at the time of Phase 1 so as not to twist each other. And it allocates until the intersection with Quay No.2.

The space from quay formal line to the boarder of the land behind is approximately 13m in width and apron and access way in this space shall be constructed.

B) Formal line of Quay No.2

The formal line of Quay No.2 will design to allocate in a vertical direction to the formal line of Quay No.1 to the edge of Quay No.3.

While, there is a part of land behind quay where is already used by investor, and land width is narrowed as shown in Figure 2-2-2(12). Therefore, construction of the apron and access way behind the quay is to design with two alternative candidates with different depth for quay formal line. First design is setting to -3m water depth line (candidate-1) and second is -5 m water depth line (candidate-2). After discussion of alternatives plan with SFA, Candidate-1 with formal line with -3 m is to adapt from economical point of views as shown in Table 2-2-2(12). However, the area behind quay becomes narrow. In order to secure apron and access way in the space behind quay, land adjustment with land leaser behind are required to parcel adjustment with some modification on agreement for the existing agreement between SFA and Fishery processing company.

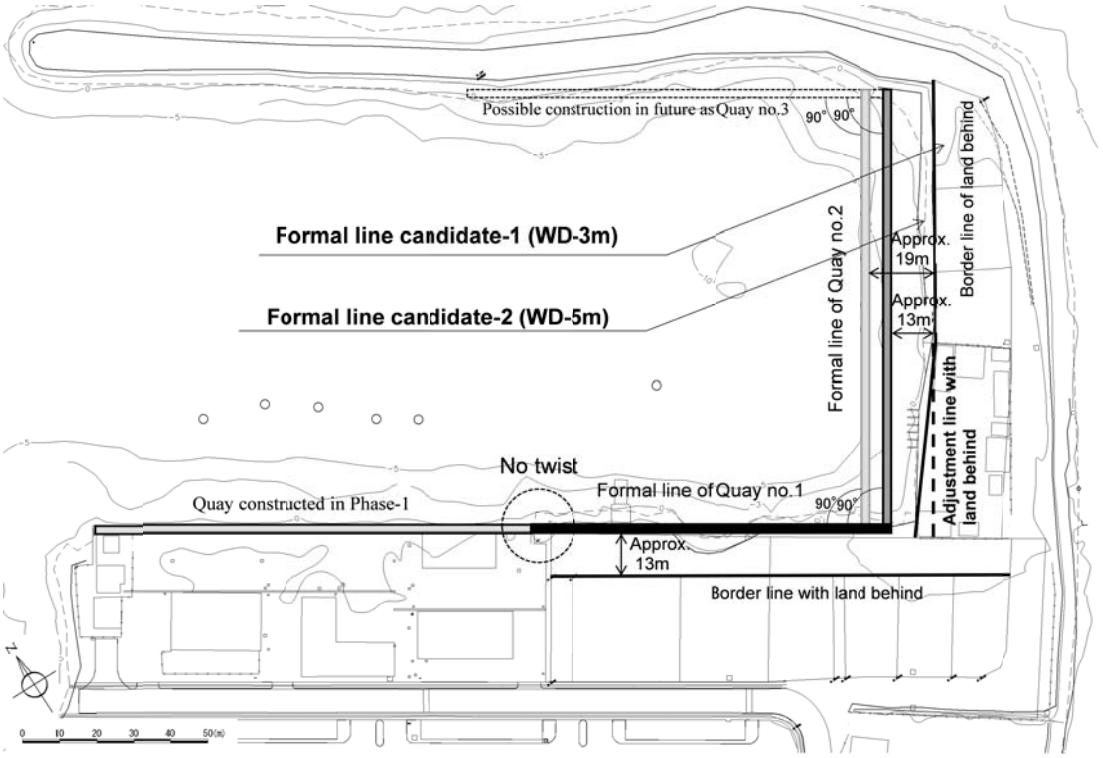


Figure 2-2-2(12) Setup of Quay Formal Line

Table 2-2-2(12) Estimation of Formal Line of Quay No.2

Alternative	WD	Distance behind	Feature	Evaluation
Candidate -1	-3m	6 to 13m	① As the water depth is shallower than candidate-2, cross-section structure of quay is small and the area to be landfilled is also small. ② In order to secure space for apron and access way behind quay, borderline with the land behind is partly necessary to be adjusted.	◎
Candidate -2	-5m	15m	① As it is installed to the place deeper, construction cost is more than candidate-1 however, enough land to be necessary for fishery activities can be secured. ② Border lien adjustment with the land behind is not necessary.	○

(Remark) Discussion was made between SFA and Fishery-processing Company for formal line by candidate-1 with the borderline behind and the fishery processing company has agreed it.

From the above studies, the formal line of Quay No.2 is design with -3m water depth lines as shown in “candidate-1”.

(d) Design quay water depth

Design quay water depth was determined for safe and smooth use by fishing vessels in the port. Water depth design is to establish with 0.5m of margin to enumerate to the draft length of the largest fishing vessel from target fishing vessels.

Design water depth shall be setup as 2.5m with the accordance with following formula.

Quay design water depth = Draft of Largest Fishing Vessel + Keel Clearance
= 2.0m ＋ 0.5m
= 2.5m

(Remark) Keel clearance is properly determined considering tranquility and etc. in the port however, in case of soft foundation, 0.5m is to be added in general.

Designing water depth of Quay No.2 is set to -3.0m; as to current water depth of allocated quay is set to -3m.

- Design water depth of Quay No.1 : - 2.5m
- Design water depth of Quay No.2 : - 3.0m

(e) Basic Quay Cross-Section

The conditions of structure parameter for designing of steel sheet pile are shown below. The structure calculation of basic section is shown in Figure 2-2-2(13) to Figure 2-2-2(15).

1. Tide Level

H.W.L. : +1.65m

L.W.L. : +0.45m

2. Quay Size

Quay Height : D.L.＋2.5m

Design Water depth : D.L. - 2.5m (Quay No.1)、D.L. - 3.0m (Quay No.2)

3. Wave condition : In port waves shall not be considered to the design.

4. Soil Condition

N Value : 3

Cohesion : 0 (sandy series)

Inner Friction Angle : φ=25°

5. Seismic intensity : unconsidered

6. Target Vessels

Total Tonnage : 15 ton in average/ the maximum 50 ton

L.O.A. : 13.5m in average/ the maximum 24m

Breadth : 3.8m in average / the maximum 5.1m

Draft : 1.6m in average/ the maximum 2.0m

7. Mooring speed : 0.4m/sec

8. Load : 10kN/m2

9. Service life : 30 years

10. Corrosion Measure of steel sheet pile

Heights of lowest end of super structure are design to 0.0m and cathode protection is to use (30 years' service life) for under water part.

11. Distance to anchorage pile

Quay No.1 : shorter than 11m

Quay No.2 : shorter than 11m and shorter than 9m (in front of existing fishery processing factory)

【Basic Section of Quay No.1】

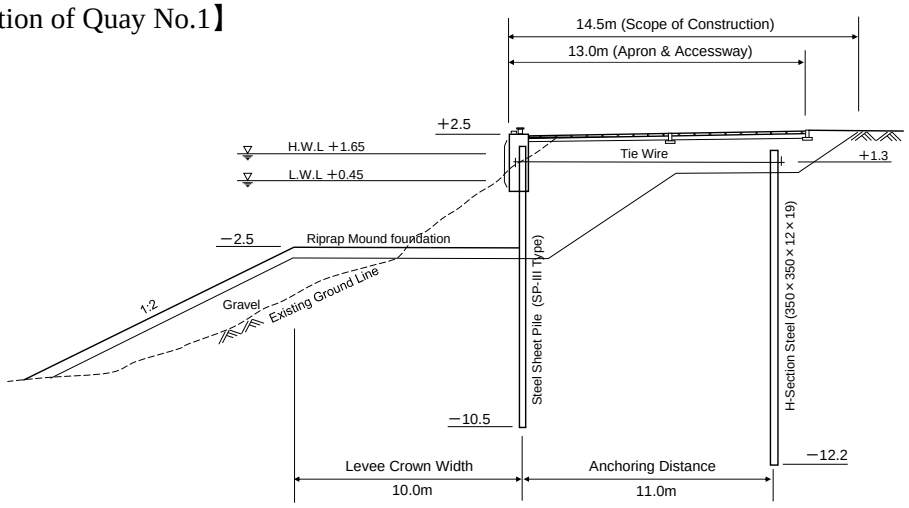


Figure 2-2-2(13) Basic Section of Quay No.1

【Basic Section of Quay No.2】

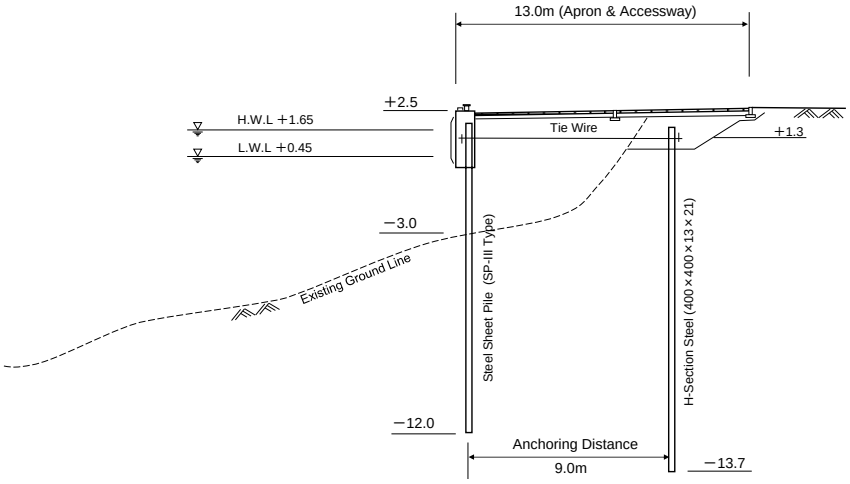


Figure 2-2-2(14) Basic Section of Quay No.2 (in front of existing fishery processing factory)

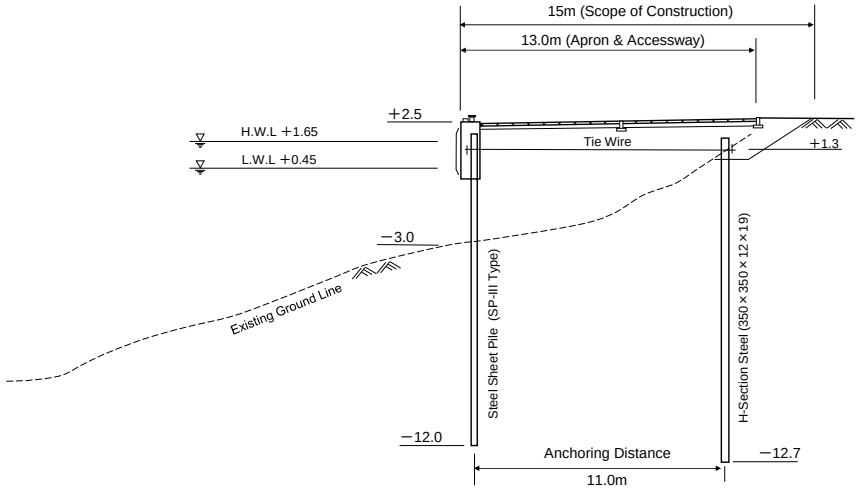


Figure 2-2-2(15) Basic Section of Quay No.2 (in front of fishery processing facilities to be constructed)

2) Plan for Apron and Access way

(a) Width of Apron and Access way

The width of apron shall be estimated from the usage of quay, the condition of land behind, the quay structure as shown in Table 2-2-2(13). Quays must be on the same normal lines to have consolidation of the apron width.

10m lengths of the apron width was employed to constructed in Phase 1, and to secure the similarity to reduce stress on working activity is to include in the project design is recommended. However, as stated previously, the distance from quay to land at fishery processing facilities is limited to 13m from the apron or the access way shall be secured.

Table 2-2-2(13) Apron Width

Usage	Width(m)
In landing quay	10.0m
In preparation quay (for resting)	10.0m(6m)

Source：Guide for design of infrastructures in Fishing Port and Fishing Ground

While, the road width shall be designed to 6m (= 3m/lane x 2) by one side with 3m to bare the width for small traffic volume. The road is designed without sideslip since width becomes narrow with existing facilities, the vehicle speed is to limit at 30km/h from safety reason.

Accordingly, the apron width of Quay is to design with 7m (= 13m - 6m).

(b) Structure of apron and access way

Structure of apron and access way of Providence fishing port is to retain both function and appearance with existing part. In the Project, similar interlocking block and pavement to the existing pavement structure are to be installed.

The border of access way and apron are shown in Figure 2-2-1(16). Marking by curb is to be installed to clarify the function demarcation between the access way and the apron. The slope for rainwater discharging behind the quay is to design with 1 % of slope to be flow from land to seaside.

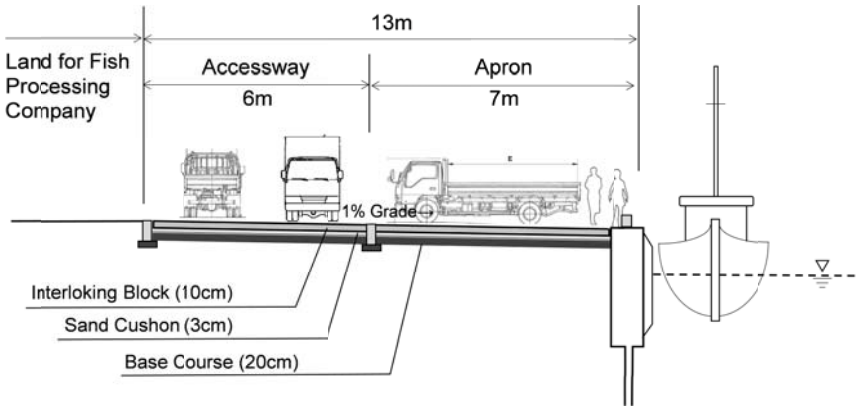


Figure 2-2-2(16) Conceptual Scheme of Apron and Access way

3) Quay ancillary facilities

(a) Fender

The size of fenders is 200H×2,000L, installing at interval of 5m vertical as the existing quay. Fenders are designed to be installed to Quay No.1 and No.2. In addition, installation of the fender is to be designed to the fuel quay (10m) and connecting quay (10m) constructed since at the Phase 1 fender in this section was not installed. A fishing vessel with the LOA of 20 m or longer is not include in to design and the mooring speed must be kept less than 0.4m/s.

(b) Bollard and Mooring ring

Designed parameter of tonnage used for fishing vessel was between 10 to 50 tons. Correspondingly, estimation of the tractive force of fishing vessel against one bollard is calculated to 30kN.

Installation interval of bollard, as shown in Table 2-2-2(14) is to design with 5 m intervals. In the Project, the vertical bollards with 50kN are design to install at interval of 10m as the existing quay. Supporting these bollards, mooring ring (30kN) is to install halfway distance of the bollards.

Table 2-2-2(14) Installation interval of Bollard (Mooring ring)

Water Depth	Interval
Less than - 3m	5.0m
More than - 3m to less than - 5m	7.5m
More than - 5m	10.0m

Source: Guide for design of infrastructures in Fishing Port and Fishing Ground

(c) Ladder (rubber ladder)

Ladder, associated equipment to the quay is the lifesaving tool to be included in the design of the port. Installation of the ladder is normally adjusted to 50m intervals from safety purposes. Accordingly, the Project is to design to install two sets of ladder in each Quay No.1 and No.2. Descriptions of the ladder use in design are width of 45cm, with the interval of rung of 25 to 30cm length. The lowest end of ladder is to design to descend to under L.W.L.

(d) Curb

Curbs are constructed on quay superstructure with 10m spans. Basic layout plan of curbs is shown as Figure 2-2-2(17).

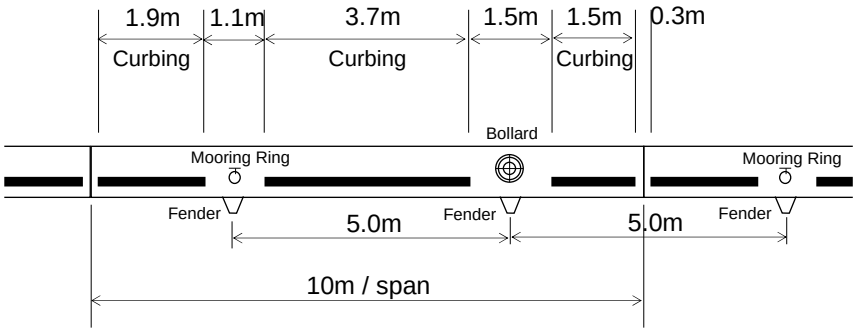


Figure 2-2-2(17) Location of Curbs

4) Mooring buoy

Tandem mooring method is used in Victoria and Providence fishing port with support of mooring buoy installed in every 15 m. Mooring buoy is used for prevention of vessels to limit movement caused from wind, wave and currencies.

In Providence fishing port, the length of mooring quay is designed to include 59m. In the Project, this length is being reduced to 50 m cause from re-allocation plan of the quay as shown in Figure 2-2-2 (18).

Thus, mooring buoys arranged in Phase 1 are required to re-arranged to another area according to the plan prepare by the Project. Mooring buoys are movable and not difficult to relocate. One of an established mooring buoy is relocate to Quay No.1 and additional new ten buoys are to install to Quay No.1 and No.2. Installation positions of mooring buoys are designed to separate 27 to 30m apart from the quay as shown in Figure 2-2-2(18).

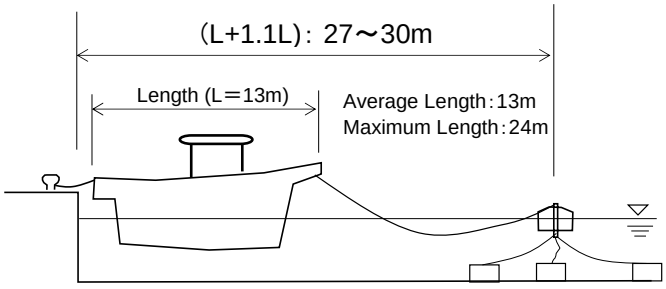


Figure 2-2-2(18) Installation location of mooring buoys

5) Facility allocation plan

The facility allocation plan of Providence Fishing port is shown in Figure 2-2-2(19). In the Project, the numbers of vessels in the Providence fishing port are designed to consist with 39 vessels.

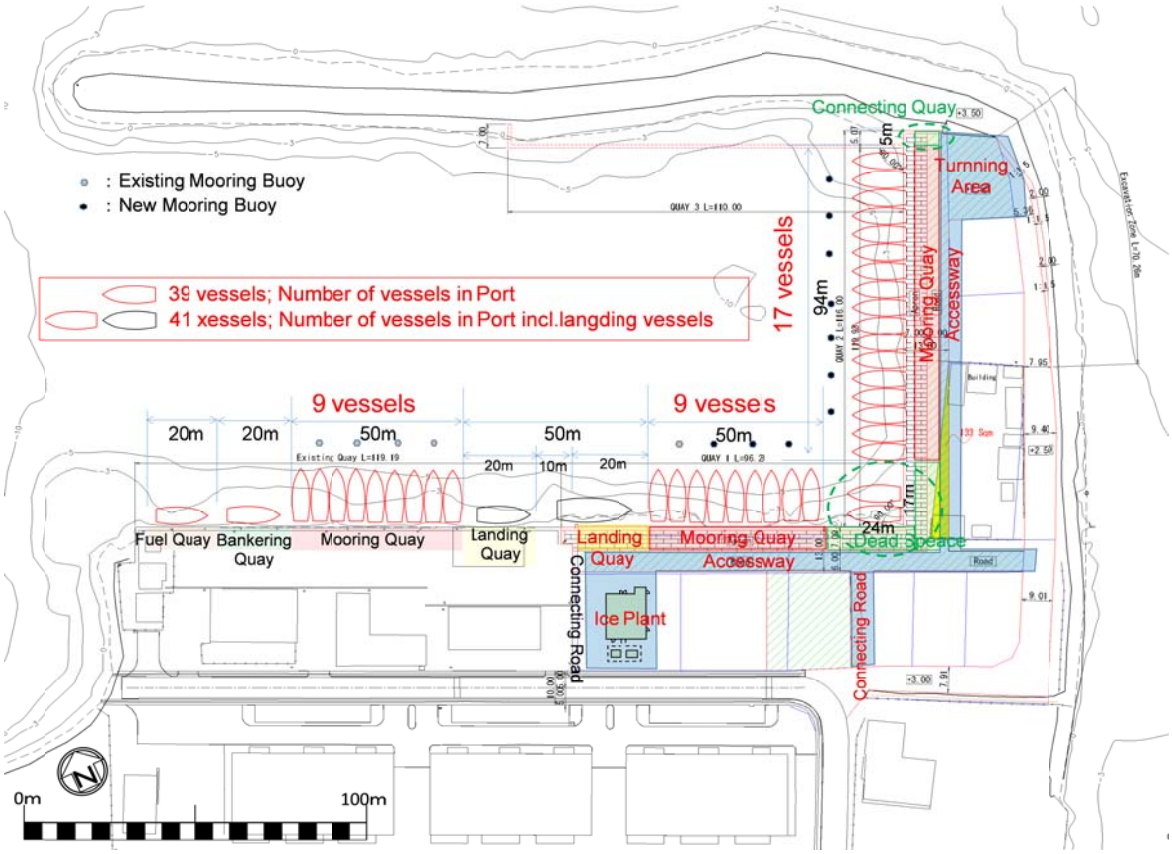


Figure 2-2-2(19) Facility Allocation Plan in Providence Fishing Port

2-2-2-2 Building Facilities and Equipment

(1) Facility Layout Plan

1) Ice-making facility

Ice produced from ice-making facility is mainly used for fishing activities. Artisanal fishing vessels loads ice before departure to fishing. The facility is designed with facing toward quay No. 1 and No.2 with double swing door, installed in front of building to provide good accessibility to the quay and better usability for fishermen.

The facility ranges needing to design are calculated based on dimensions and clearance space for arranged the facility of main equipment (ice-making units, ice storages) and ancillary device (a condenser, an electric board). In the design, requiring spaces for the access, operation maintenance and safety areas are also to be included in estimation.

At least one engineer of permanent staff is planned to allocate for the facility operation, thus 12 m^2 of office space to be designed, in order to accommodate two persons during maintenance. This office space is protrudes toward quay by securing access space of 800 mm was designed. Equipment is designed to locate with careful consideration of space needing for maintenance work. Maintenance of ice-making unit is generally use heavy tools, thus, access to ice-making units (upper floor) are prepared with 900 mm width of walking stairs with steel stand. In addition, a door in the office space is to be installed facing existing administration building to improve accessibility. On contrast, the window is to face the quay to monitor the customer of ice.

The evaporative condenser is component of ice-making facility used for spouting water upward for cooling the refrigerant. Stable and efficient operation of this equipment can be prepared with stable water pressure against ice making machine at water reservoir tank. Large space is required placing the condenser with reservoir tank. A space can be reduced and efficiency can be improved with designing the condenser to install above water reservoir tank. As consequence, the condenser must be placed outside of the building. Access-path around the equipment is to design with respect of safety. The safety equipment design of facility is, manual warning bells, CO_2 fire extinguisher, horse reel. In addition, three emergency evacuation doors are to be installed to the ice-making room and office space.

2) Landing shed

The landing shed is planned for use of unloading fish and fish handling from arriving vessel. Purpose of landing shed is to protect of fresh fish from unexpected hard rain or severe sunlight. Length of the shed was design accordance with the existing landing shed, number and

size of the vessels, and current use of unloading process. Accordingly, to length of fishing boat is designed to 20 m width consisted with 7m length to the land direction, witch are adjusted maximum length of the project area.

3) Connection road

The access road currently connect to existing quay in the Providence fishing port are only the road constructed besides administration building. In the Project, the quay is to be extended by the project and designing of connection road is essential to quay No. 1 and No.2, accordance with increase of the traffic. The access road is designed with 6 m width for two ways traffic covered with the interlocking finish, and drainage is prepared on both sides. The pedestrian pavement designed with 1.0m widths, concrete made is to be constructed along with the access road.

(2) Structure plan

1) Ice-making facility

Structure plan of the ice-making facility is designed to use steel structure to reduce total weigh of the facility, since live load of ice-making units and storages are large. The foundation is planned to construct with continuous footing with reinforced concrete construction including the slab. The floor is prepared with the expanding metal to reduce weight, in addition, the loading footstool of the ice-making units is designed with steel to reduce dead load of footstool. Concurrently, the internal footstool for the evaporation condenser is also designed with expanding metal, steel structure from good drainage with lighter load.

The footstool of ice-making facility is designed as one floor building consists with high ceiling, with the cost effectiveness of the project. The cost of construction will be higher by the increase of column and construction material to build as two-floor building.

2) Landing shed

Structural plan for the landing shed is designed with following:

a) The length from seaside to land side is restricted to 7m, by arrangement of access way behind quay
b) Construction of two columns are not practical from limited length from quay to the vertical direction
c) The column must sustain to drag force against the wind pressure with having strong performance on foundation to support column
d) Reinforced concrete construction is used as material for the column and the foundation
e) Structure is placed with the center of two tie wire, which is adjusted with mat

foundation of 200 mm less than interval of two tie wires are installed (the tie wire as the tensile member in support of sheetpile of the quay)

f) Beam of the steel are used for upper part the column to obtain the lightweight flexibility and to reduce the dead load to consistent against the wind pressure

g) Confirmation of the bearing capacity of soil is required using plate loading test before the construction. Since the shed is implemented after installation and construction of the tie wire by civil construction.

3) Power supply system, water supply system and Water drainage system

The increase of fishing activity is prospected by implementation of the project with increase of vessels mooring in Quay No.1 and No. 2. Accordingly, additional ancillary are required installing by the Project.

(a) Power supply system

Electric supply connection socket is designed to arrange by the project. It is necessary to locate the receptacle outlet which transmitting of loads require. Power meters are installed to ice-making facility to monitor the consumption of electric.

(b) Water supply system

A large quantity of water is loaded as drinking water for fishing activities. It was estimated to 300 to 1000 liters of water, however loading quantity varies with vessel size and duration of a trip. Water system is to design to load supply 1,000 liter of water within one hour with having pressure of two to three atmospheric pressures. Supply outlet is to place inside and outside of ice making facility, landing shed, and behind the Quay No.2. Water consumption is controlled through meter system installed to ice-making facility to monitor the consumption.

(c) Water drainage system

The water drained from ice-making facility is small, however it is planed to design with small slope guiding to external drainage. Water drains are collected at catchment prepared in side drain of the facility door and ice-storage and discharge to quayside.

As Seychelles is located in equator region, heavy rain is common in the country. Establishment of the drainage basin for rainwater in each leased area on Quay No. 1 and No.2 are necessary to retain function of quay and apron. Rainwater collected to basin is merged to discharge from the lower part of quay.

(3) Cross Sectional plan

a) Ice-making facility

The ice-making facility is to design to construct with the lower part and upper part. A lower part is installed with ice-storage and upper part with ice-making unit. Accessibility for maintenance work is taken as consideration to design. In the design, floor level of evaporative concentrator located outside and ice-making unit located inside are adjusted to similar level, with installation of access door is installed to improve accessibility.

The facility also needs to be designed with concern of temperature from the sun, as extreme hot weather in Seychelles. The roofing materials with insulation material are selected to be used for this facility to protect from temperature raise for ice-making units. The eaves are designed to be used larger size to prevent sunlight of Seychelles, and increase sunshade area. The level of the floor establishes from front of an ice storage is set to 1% gradient towards an exit, to release fusion water to outside. Instantly, a floor level of parking space are also adjusted to the same gradient level as thinking as extension of the floor.

b) Landing shed

The landing shed is designed as follows. Waterside of a roof is adjusted to the quay surface having 1/20 gradient to land side, with 4.3 m high as to avoid strike form vessel mast. Trabecular position is set to 5 m from quay to create maximum space between column and the quay

(4) Finishing Plan

Exterior and interior finishes of buildings are as follows.

a) Ice-making facility

A Roof panel is designed with a galvalume steel having anti-corrosive covered with fluoric resin coating for acid-resistant. Thermal insulating material is installed on backside of roof panel to reduce temperature difference in internal and external temperature of the building. Outside exterior wall is fabricated with galvalume steel coating with fluoric resin to retain acid-resistant effect. Exterior wall is siding to be enclosed thermal insulating material.

Table 2-2-2(15) Finishing work for Ice-making facility

Section	Finishing material
Roof	V-shaped acid-resistant galvalume steel sheet roof with fluoric resin coating and thermal insulating material on back side of roof
Soffit	Asbestos free Calcium Silicate board
Exterior Wall	Siding with thermal insulating material enclosed with fluoric resin coating
Openings	Steel doors with Oil Paint, Aluminum windows
Apron	Concrete with steel trowel finish

Table 2-2-2(16) Inertia Finishing work for Ice-making facility

Room	Floor	Base	Wall	Ceiling	Ceiling mold
Ice Making Machine room	Urethane waterproof on reinforced concrete steel trowel finish	Urethane waterproof on cement mortar	Siding with thermal insulating material	Exposed roof panel	None
Office	Reinforced concrete steel trowel finish	Cement mortar steel trowel finish	Cement board with AEP	Asbestos free	PVC

b) Landing shed

Roof panel is planned to use similar material as Ice-making facility, without thermal insulating on backside of roof.

Table 2-2-2(17) Finishing work for landing shed

Section	Finishing
Roof	V-shaped acid-resistant galvalume steel sheet roof with fluoric resin coating
Girder	Galvanized Steel
Column	Reinforced concrete with AEP
Floor	Reinforced concrete steel trowel finish

(5) Scale setting for Ancillary Facility plan

a) Electrical facility

Electrical capacity by facilities constructed by this project in Providence port was estimated. Estimated volume is shown in Table 2-2-2(18).

Table 2-2-2(18) Electrical consumption

Name of facility	Volume (KVA)
ICE plant (Ice making facility)	70.0
Others	35.0
Landing shed	2.8
Lamppost	2.1
Total	109.9

b) Water consumption

Daily water consumption of facilities constructed by the Project is estimated as shown in Table 2-2-2(19).

Table 2-2-2(19) Required quantity of water supply

Facility	Water requirement (Tons/day)	Remark
Ice-making facility	22.4 t/day	Ice making facility: 12.4 ton Evaporative-condenser: 10 ton
Fishing vessel	0.4 t/day	12ton/month: 12/30=0.4
Total	22.8 t/day	

Additional amount of 22.8 tons daily water is required by the project. Accordingly, water reservoir tank is designed from equilibrium amount daily consumption as following equation:

Water tank ratio: 23.0t/ 0.8 = 28.75

Dimension of Reservoir tank: 28.75 m^3 ≒ 30 m^3 (30.0 t) = 3.0m D × 5.0m W× 2.0mH

c) Water drainage system

Design was made to collect the drain rainwater on the leased land at backside of access roads. The design was made for one pit per each in front of the land. Material specification for the pipe used in the drain is PVC pipe to installed underground from the pit directly to the quay for disposal. PVC pipe shall be 300mm diameter; height of disposal mouth at the quay shall be above water level on a high tide. Bottom of PVC pipe shall be above a high, not to block the pipe mouth at the quay for securing smooth disposal of rainwater. Slope of PVC pipe shall be designed to be base on 2 %.

(6) Estimation of Ice Production Volumes for New Ice-making facility

1) Production capacity of existing ice-making facility

Ice production facilities in Seychelles are shown in Table 2-2-2(20).

Table 2-2-2(20) Production of Ice for Artisanal fishing vessel in Seychelles

Ice-making facility	Daily Ice production			Remark
	2015			
	May	June	By the end of 2015	
Oceana Fisheries	8	<-	<-	Victoria fishing port
SEA HARVEST	14	<-	<-	Victoria fishing port
SFA Providence	3	5	13	8 ton capacity of Ice-making facility were temporally constructed
SFA Bel Ombre	3	4	4	Under maintenance
SFA Ansé Royale	3	3	3	Under maintenance
SFA Ansé la Mouche	3	3	3	Under maintenance
Mahé Island Total:	34	37	45	
SFA Praslin Island	3	3	11	8 ton capacity of Ice-making facility were temporally constructed
TOTAL (ton)	37	40	56	

Ice production shortage (required quantities) for ice-making facility for artisanal fishing vessels in the Providence fishing port were estimated from following criteria. (a) First is estimation from artisanal fishing vessels based on Providence fishing port and Victoria port. (b) Second is estimated demand from artisanal fishing vessels registered in Mahé islands.

(a) Estimation of ice shortage from Providence fishing port and Port Victoria

The production capacity of ice-making facility was calculated by deduction of total amount of ice capacity required for artisanal fishing vessel based in Providence and Victoria from total ice productive capacity. Table 2-2-2(21) shows number of artisanal vessels and ice demand based in Providence Fishing port and Port Victoria.

Table 2-2-2(21) Demand volumes of ice for Artisanal fishing vessels

	SCH	LAV	LEK/MM	WH	LL	SEA	Others	Total
Number of vessels	47	18	9	31	12	25	5	147
Number of operation (per month)	2	3	3	2	1.5	1	0	
ICE demand (Each trip)	6	1.5	2	3	10	1.5	1.5	
Total (ton)	564	81	54	186	180	37.5	0	1,102.5

The ice shortage for artisanal fishing vessels is calculated by subtraction the amount of ice necessary for artisanal fishing vessels on a monthly basis from the monthly ice production volume available from three Ice-making facility located in Providence and victoria fishing port (Oceana, Sea harvest, and SFA Providence) for these vessels (35 tons/day) as described above.

[1] Daily production of the existing ice-making machines:
35.0 × 95% = 33.32 tons/ day (refracting a thawing loss of 5%)

[2] Monthly ice demand by artisanal fishing vessel
＝ 1,102.5 tons/month

[3] Monthly number of days of ice-production: 25 days (due to maintenance and holidays)

[4] Demand of ice production per day (1,102.5 tons/ 25 days)
= 44.1 tons/day, Ice shortage for artisanal fishing vessels
＝Ice demand per day - Daily production of the existing ice-making machines
= [4] - ［1］ =44.1-33.32 = 10.78 tons/ day ≒ 10 tons/ day

(b) Estimation of ice shortage for artisanal fishing vessels in Mahé Island:

Ice shortage for artisanal fishing activities in Mahé Island was estimate based on the number of fishing vessel (Seychelles fishing vessels statistics, 2013), shown in Table 2-2-2-2 (8). Result from the baseline survey were used to determine the quantity of ice storage and monthly number of travel for fishing by different type of fishing vessels

[1] Daily production of the existing ice-making machines:
45.0 × 95% = 42.75 tons/ day (refracting a thawing loss of 5%)

[2] Monthly ice demand by artisanal fishing vessel
＝ 1,513. 5 tons/month

[3] Monthly number of days of ice-production: 25 days (due to maintenance and holidays)

[4] Demand of ice production per day (1,513.5 tons/ 25 days)
= 60.54 tons/day, Ice shortage for artisanal fishing vessels

＝Ice demand per day - Daily production of the existing ice-making machines

= [4] — ［1］ =60.54 - 42.75 = 17.79 tons/ day ≒ 17 tons/ day

Table 2-2-2(22) Ice demand from artisanal fishing vessel (volume)

Type of fishing vessel	Number of vessels	Traveling number per month	Demand of ICE (Tons)	Demand of ICE (tons/month)
Semi-industrial LL	15	1.5	10	225.0
Schooner	20	2	6	240.0
Whalers	96	2	3	576.0
Lavenir	1	3	1.5	4.5
Lekonomi and minimahe	287	3	0.5	430.5
Sea cucumber	25	1	1.5	37.5
Total				1,513.5

(Result from Baseline survey)

Accordingly, ice shortage in Providence Fishing Port can be estimated to 10 tons, long as estimation is regulated to shortage from artisanal fishing vessels based in Providence fishing port and Port Victoria. On the other hand, about 17 tons are calculated as shortage by estimate prepared from all of the artisanal vessels (registered) in Mahé Island. Maximum ice supplies are limited 45 tons in Mahé Island, suggesting artisanal fishermen in Mahé Island are always facing shortage of ice for fishing activity.

In the Project, designing of quantities capacity of ice-making facility is to constraint to daily production of 10 tons, from limited manpower in SFA.

2) Number of ice-making unit

As it is obligatory to secure ice production during maintenance period /or in the case of the machine failure, it is suitable to install multiple numbers of machines. Meanwhile, if large numbers of units are to be introduced, the initial investment will increase. The maintenance and repair cost is also expected to increase by the larger number of components. Accordingly, two units of ice-making machines are to install; each unit with capacity with 5 tons/day is to be designed in the Project.

3) Estimation of ice storage capacities

Three-day worth of ice will be secured in ice storage, considering demand fluctuation due to weather factors and holidays.

Maximum storage capacity:

10 tons/ day × 3day ＝ 30 tons ≒ 30 tons(15tons × 2 rooms)

Based on the above, the number of storage units is calculated as follows.

Maximum storage capacity:

Internal dimension of the ice storage:

$4.0 \times 3.9 \times 2.4 = 37.44\ m^3$

Storage factor for Plate ice = 0.385

Ice storage volume is calculated by multiplying the capacity with the storage factor.

Ice storage capacity(one unit) ＝ $37.44.m^3$ x 0.385= 14.41 tons

4) Ice-making facility components

Plate type ice-making machines will be installed on the upper floor of the ice storage. Ice is produced in an automated manner and stored in ice-storage by dropping with its own weight after being crushed. A set of ice-making equipment consists of the main unit with compressor and condenser (heat exchangers). A condenser is usually installed in open area to enhance its heat efficiencies. Installation of main ice-making units and compressors along with maintenance space are to be required equilibrium areas as the ice-storage.

In the Project, an ice-storage is design with composed prefabricated heat-protection panels to used with walls for the protection from sea winds and heavy rains in order to keep better condition.

5) Specification of the ice making units and ice-storages

Specification of ice-making units is described in Table 2-2-2(23).

Table 2-2-2(23) Specification of Ice-making facility

No.	Item	Specification
1	Shape of Ice	Plate ice (crush ice)
2	Refrigerant	Ammonia (R-717)
3	Cooling method	Ammonia direct expansion and dry
4	Condensation method	Evaporation system
5	Harvesting of ice	By Hot gas
6	Oil withdraw (de-oiling) method	Suction pressure method (oil drum)
7	Ammonia Leak detector	By 2sets of electronic sensor on the wall
8	Ice storage	Prefabricated insulation panel assembly (Storage only, cooling units are non require)
9	Power supply	AC380V x 50hz x 3phs x 4wires
10	Outside temperature	

2-2-3 Outline Design Drawing

2-2-3-1 Outline of this project

The outline of facilities to be constructed by this project are as per Table 2-2-3(1), (2) and (3)

Table 2-2-3(1) Outline of civil facilities

Facility Name	Content of Plan	Size
Quay No.1	1) Quay ① Crown height : D.L+2.5m ② Quay design water depth : D.L-2.5m ③ Width of superstructure : 0.9m ④ Structure : Anchor pile method by steel sheet piles 2) Ancillary facilities ① Fender : V-type 200H×2000L ② Bollard : 50kN ③ Mooring ring : 3t ④ Ladder : LADDER 150H×2100L	Quay total extension: 96.23m Landing Quay: 22.40m Mooring Quay: 50.00m Connecting Quay: 23.83m Anchoring distance : 11.00m 23 pcs (incl. 4 pcs for the existing quay) 10 pcs 9 pcs 2 pcs
Quay No.2	1) Quay ① Crown height : D.L+2.5m ② Quay design water depth : D.L-2.5m ③ Width of superstructure : 0.9m ④ Structure : Anchor pile method by steel sheet piles 2) Ancillary facilities ① Fender : V-type 200H×2000L ② Bollard : 50kN ③ Mooring ring : 3t ④ Ladder : LADDER 150H×2100L	Quay total extension: 116.00m Mooring quay: 94.00m Connecting quay: 22.00m Anchoring distance : 9.00m (in front of building) :11.00m (other than the above) 22 pcs 11 pcs 11 pcs 2 pcs
Apron (7m)	1) Behind mooring quay (IR/B pavement) 2) Behind landing quay (concrete pavement)	IR/B pavement: 6.1m×192.23m Paving area: 6.1m×20m
Access way (6m)	Specification : IR/B pavement Width : 6.0m(two lanes)	Paving area of access way: 1,470m^2 Paving area of turn around: 394m^2
Mooring buoy	Polyethylene made Diameter : approx.1,400mm Height : approx. 990mm	10 pcs (Quay No.1 : 4pcs and Quay No.2: 6 pcs)

Table 2-2-3(2) Outline of Building Facilities

Name of facility	Specification	Quantity of plan
Ice-making facility	Steel Structure: 2 stories 1. Roof : V-shape Galvalume plate pre-coated by fluoric resin coating 2. Exterior Wall : Galvalume plate siding Openings: steel doors	Building Area: 191.6 m^2 150mm height 0.8mm thickness Thermal insulating material on back side of roof Fluoric resin coating 50mmthickness, Thermal Insulating Material enclose with Door Closer
	External facility RC Apron Steel Frame	 1.0m wide Use for Water Reservoir Tank and Evaporative Condenser
	Equipment 1. Ice-making unit 2. Ice-storage 3. Raw water receiving tank 4. Single phase receptacle apparatus (water proof) 5. Ventilation fan Lighting apparatus Ice making room : High bay type fall arrester with wire 250W x 6 each Office : V-shape type 40W 1 each	 Daily production 5 tons, 2sets 10 tons capacity, 2 sets 30m^3 (validity 24m^3) Single phase 230V, 2 sets Illumination : 200 lx Illumination : 300 lx
Landing shed	Column : Reinforced Concrete Girder : Steel structure	20.4 m x 7.0 m Building Area : 98.5 ㎡
	Equipment : 1. Lighting fixture 2. Water faucet	 Weatherproof FL40W 1valve 18each Floor luminance 100 lx. 1each
Ancillary equipment		
	Lamppost	250W x 7 each(1 repair included) Floor IL luminance 5 lx.
	Water supply Landing Shed and Northeast point of Quay-2	Approx. 3.0 m wide road Approx. 6.0 m wide road with pavement both side of road
	Electric supply Northeast point of Quay -2	Single phase, 230V x 1 set, 3 phase 400V x 1 set
Access Road	R1 Surface: Interlocking Block R2 Surface: Interlocking Block	Approx. 3.0 m wide road Approx. 6.0 m wide road with pavement both side of road

2-2-3-2 Project Outline

Outline Design Drawings of facilities to be constructed by this project are shown in Figure 2-2-3(1) to (17).

Figure 2-2-3(1)	General Layout Plan
Figure 2-2-3(2)	Layout Plan of Civil Facilities
Figure 2-2-3(3)	Standard Section of Quay No.1
Figure 2-2-3(4)	Standard Section of Quay No.2 (Front part of existing Fishery Processing Factory)
Figure 2-2-3(5)	Standard Section of Quay No.2 (Public part)
Figure 2-2-3(6)	Layout Plan of Steel Sheet Pile and Anchor
Figure 2-2-3(7)	Layout Plan of Ancillary of Quay No.1
Figure 2-2-3(8)	Layout Plan of Ancillary of Quay No.2
Figure 2-2-3(9)	Basic Drawing of Fender and Ladder
Figure 2-2-3(10)	Layout Plan of Total Building Facilities
Figure 2-2-3(11)	Floor Plan of Ice-making Facility
Figure 2-2-3(12)	Floor Plan of Ice-making Facility 1F
Figure 2-2-3(13)	Section Plan of Ice-making Facility
Figure 2-2-3(14)	Elevation Plan of Landing Shed
Figure 2-2-3(15)	Plan of Landing Shed
Figure 2-2-3(16)	Sections Plan of Landing Shed
Figure 2-2-3(17)	Layout Plan of Ancillary Equipment

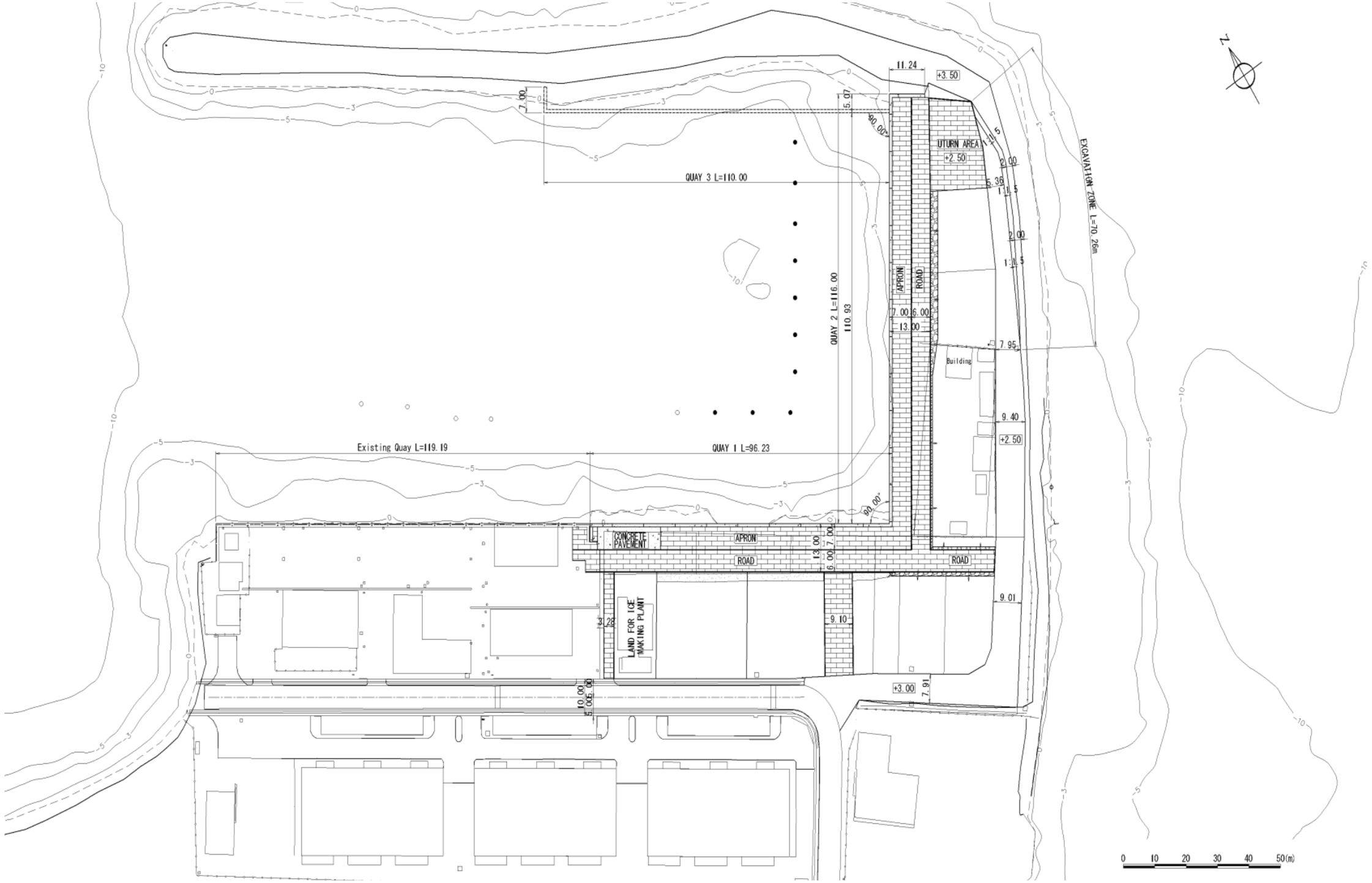


Figure 2-2-3(1) General Layout Plan

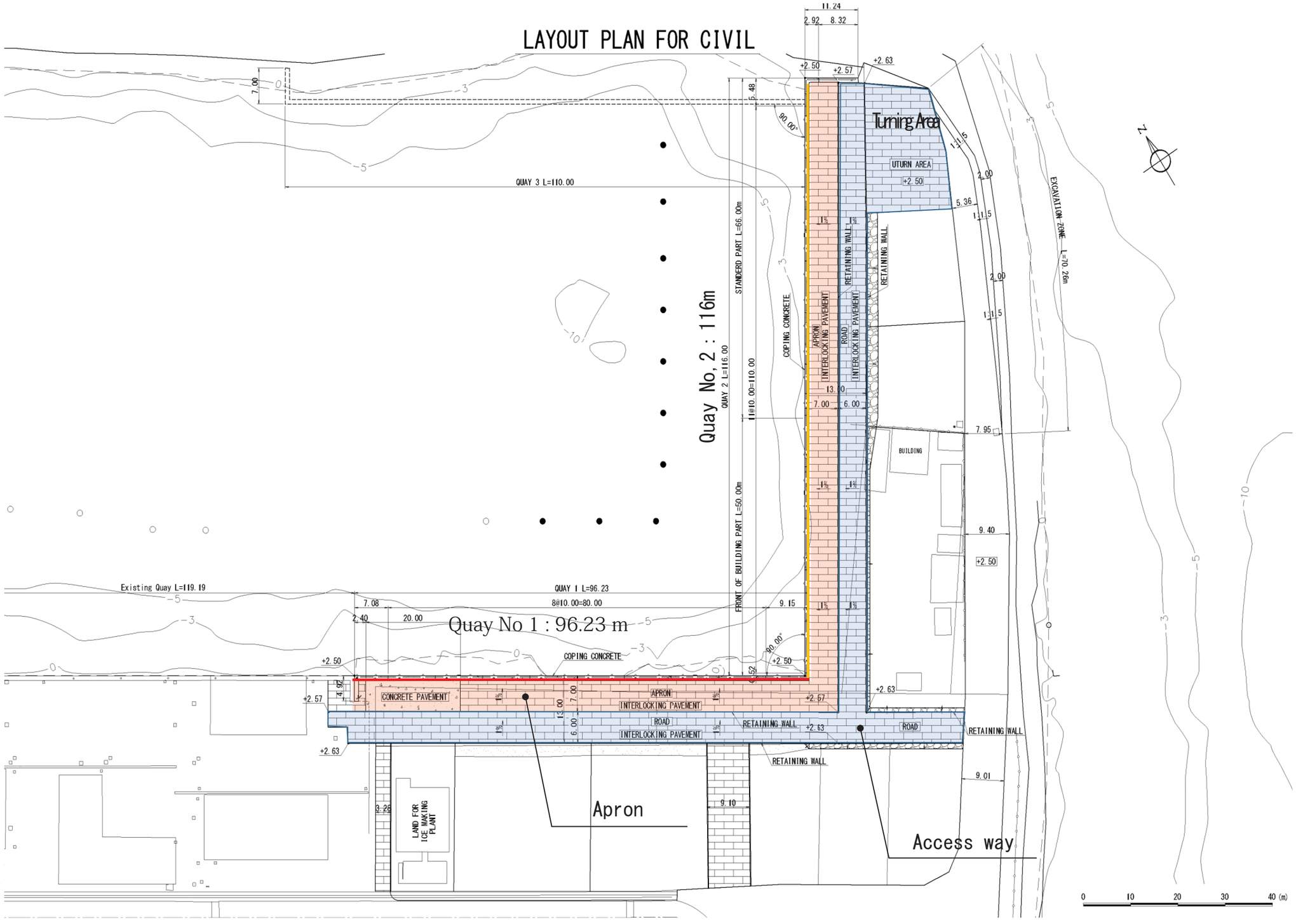


Figure 2-2-3(2) Layout Plan of Civil Facilities

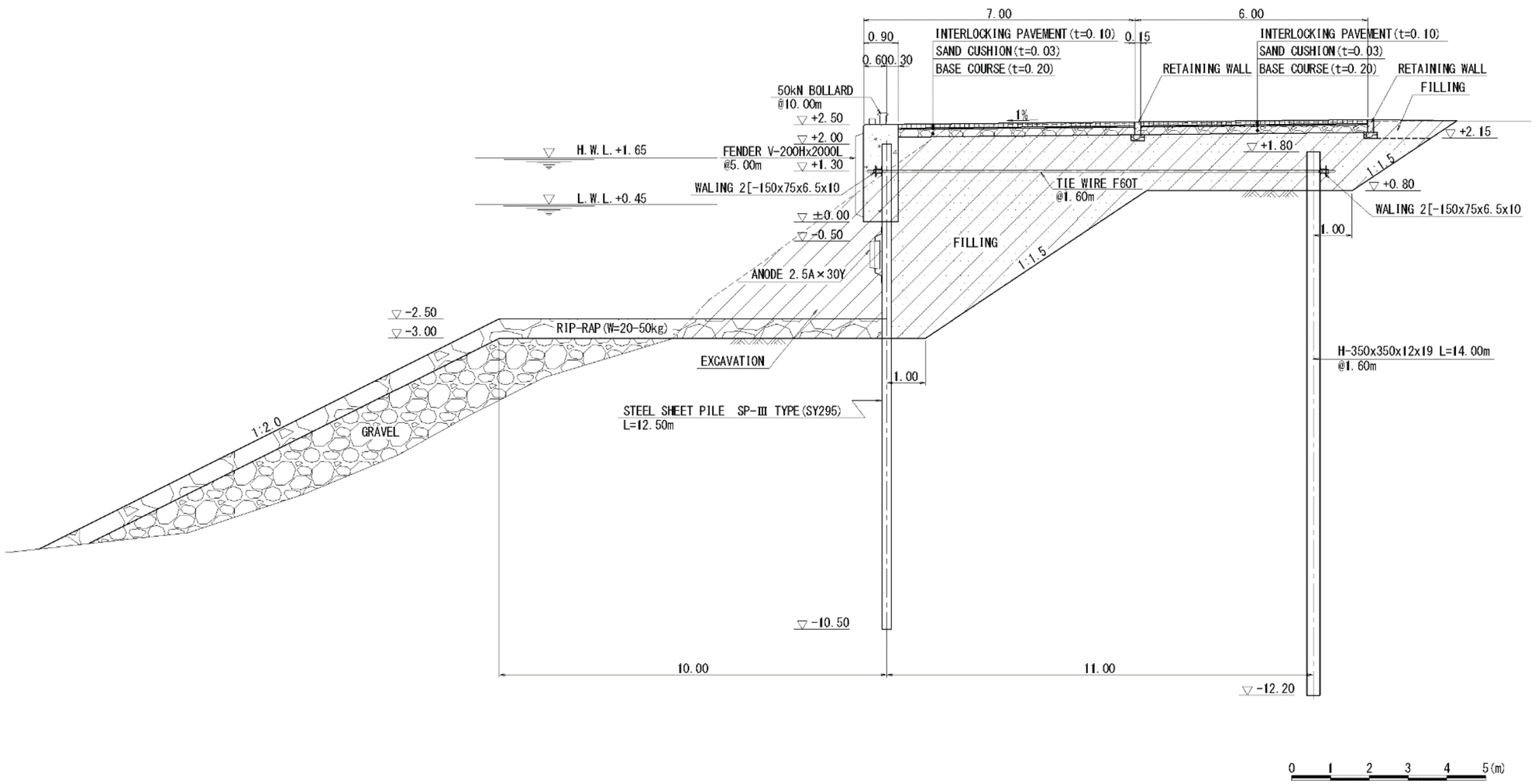


Figure 2-2-3(3) Standard Section of Quay No.1

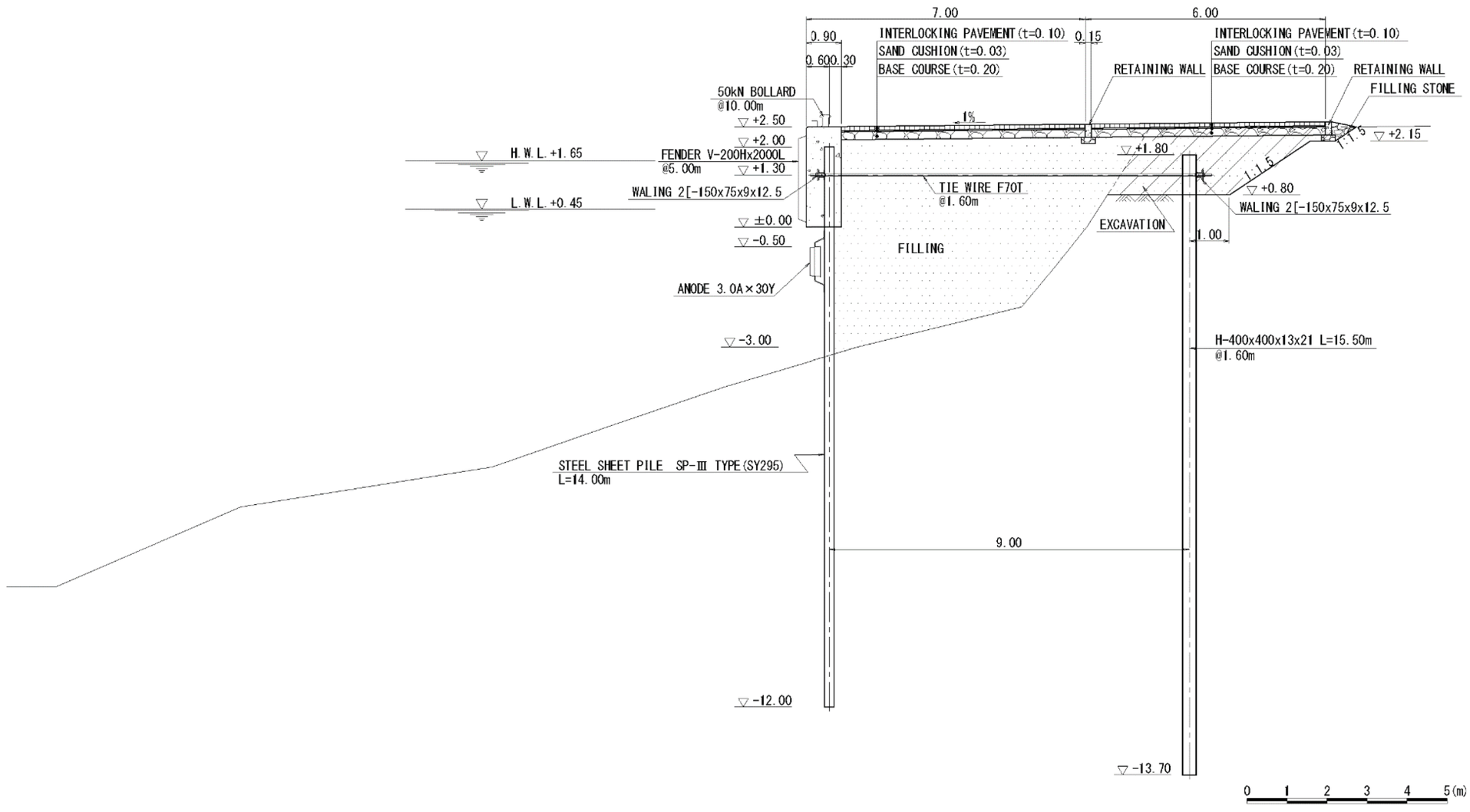


Figure 2-2-3(4) Standard Section of Quay No.2 (Front part of existing Fishery Processing Factory)

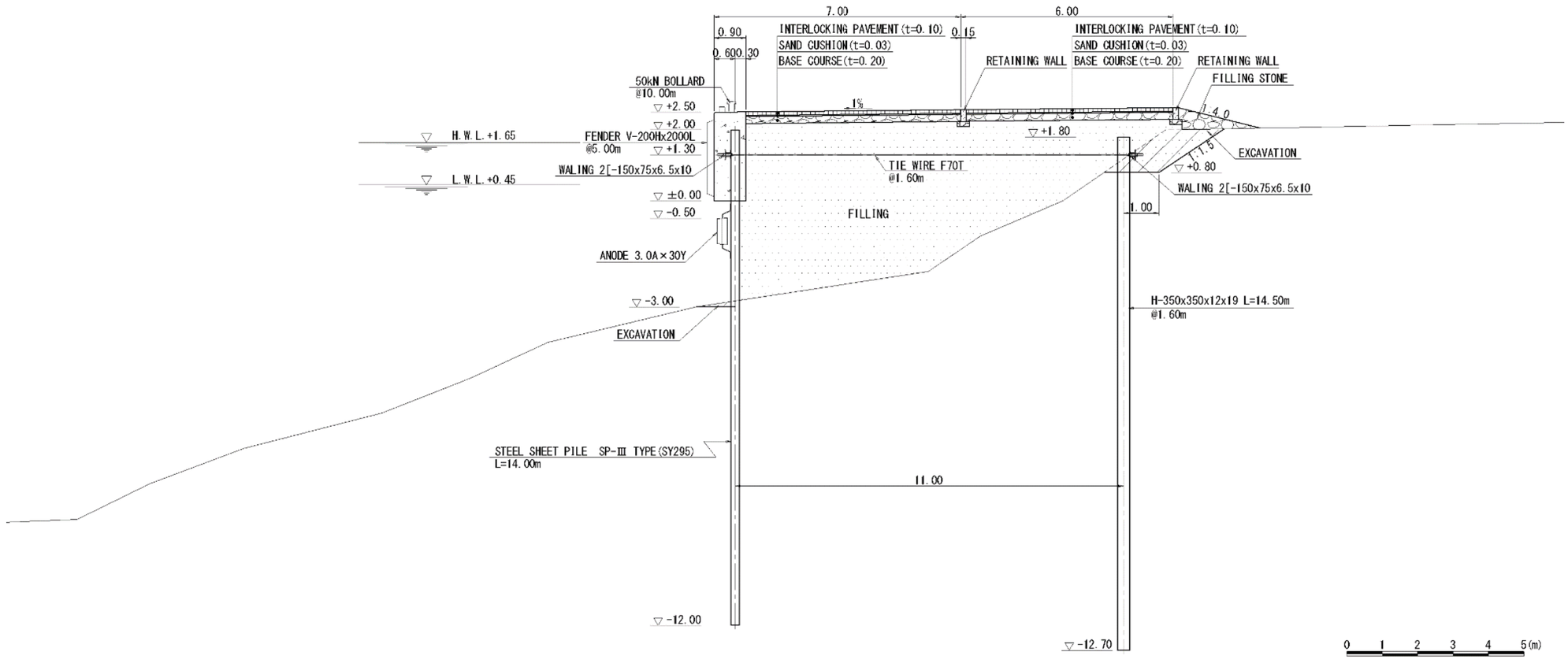
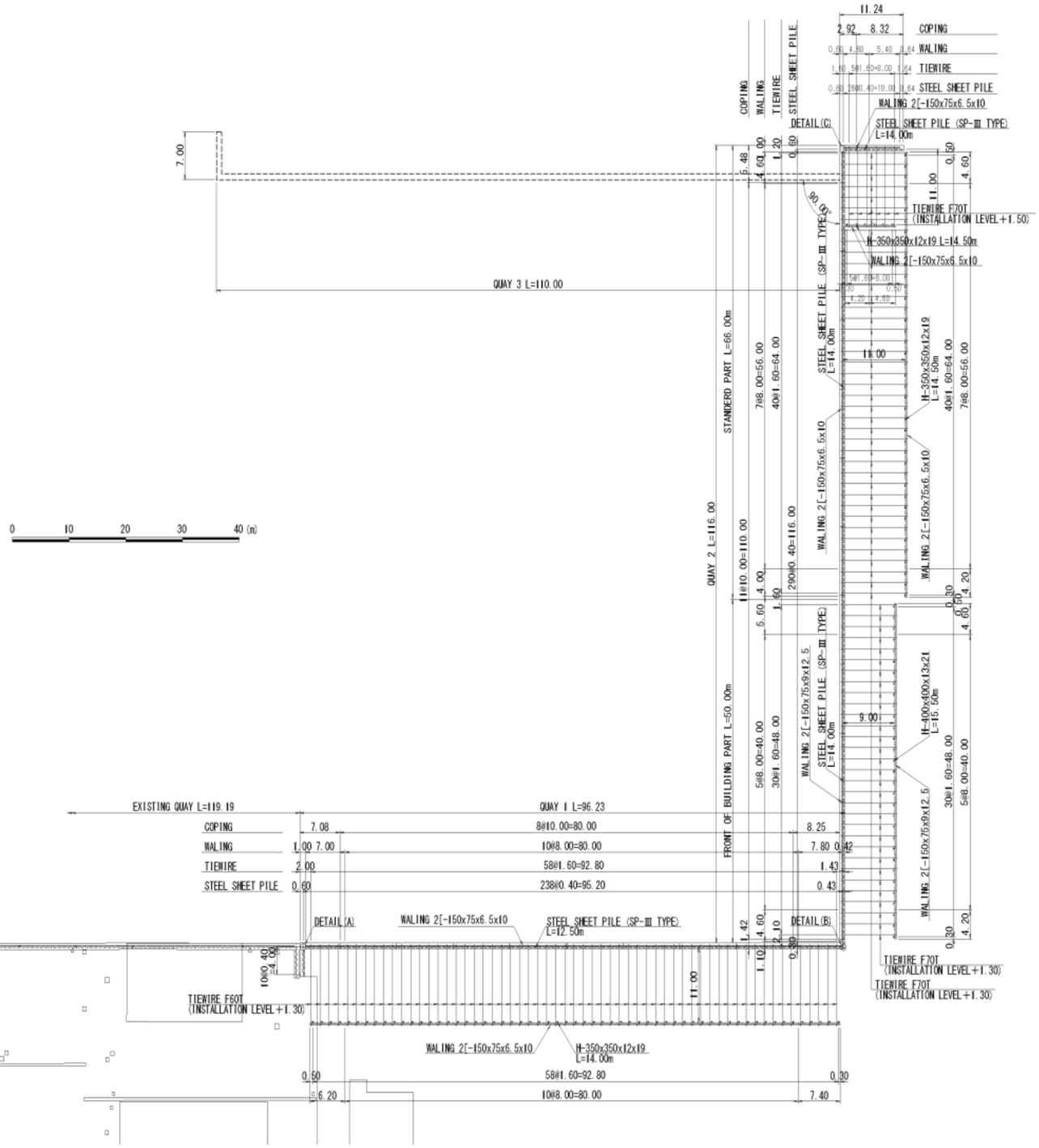


Figure 2-2-3(5) Standard Section of Quay No.2 (Public part)



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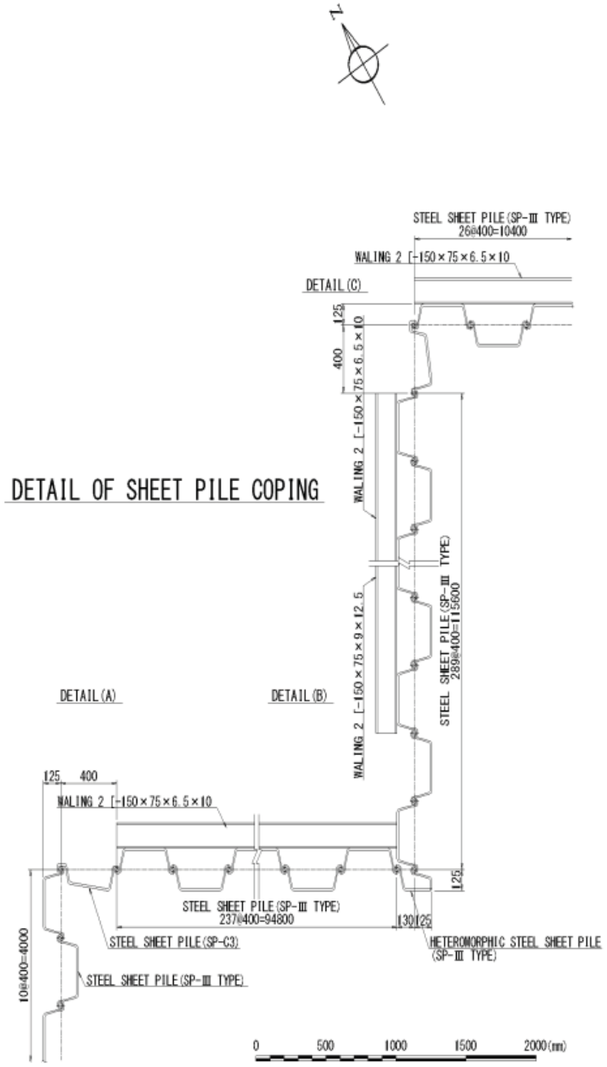


Figure 2-2-3(6) Layout Plan of Steel Sheet Pile and Anchor

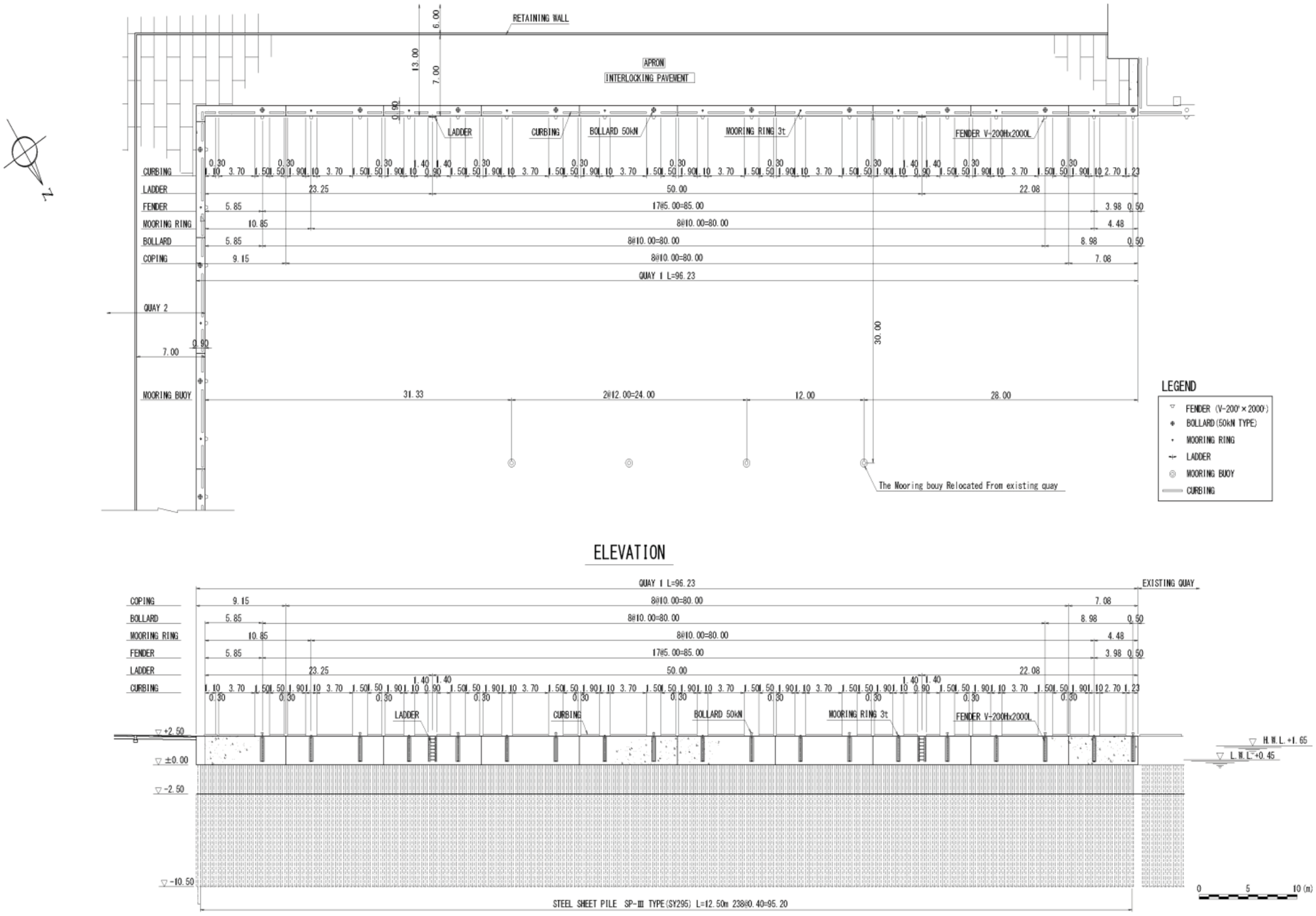


Figure 2-2-3(7) Layout Plan of Ancillary of Quay No.1

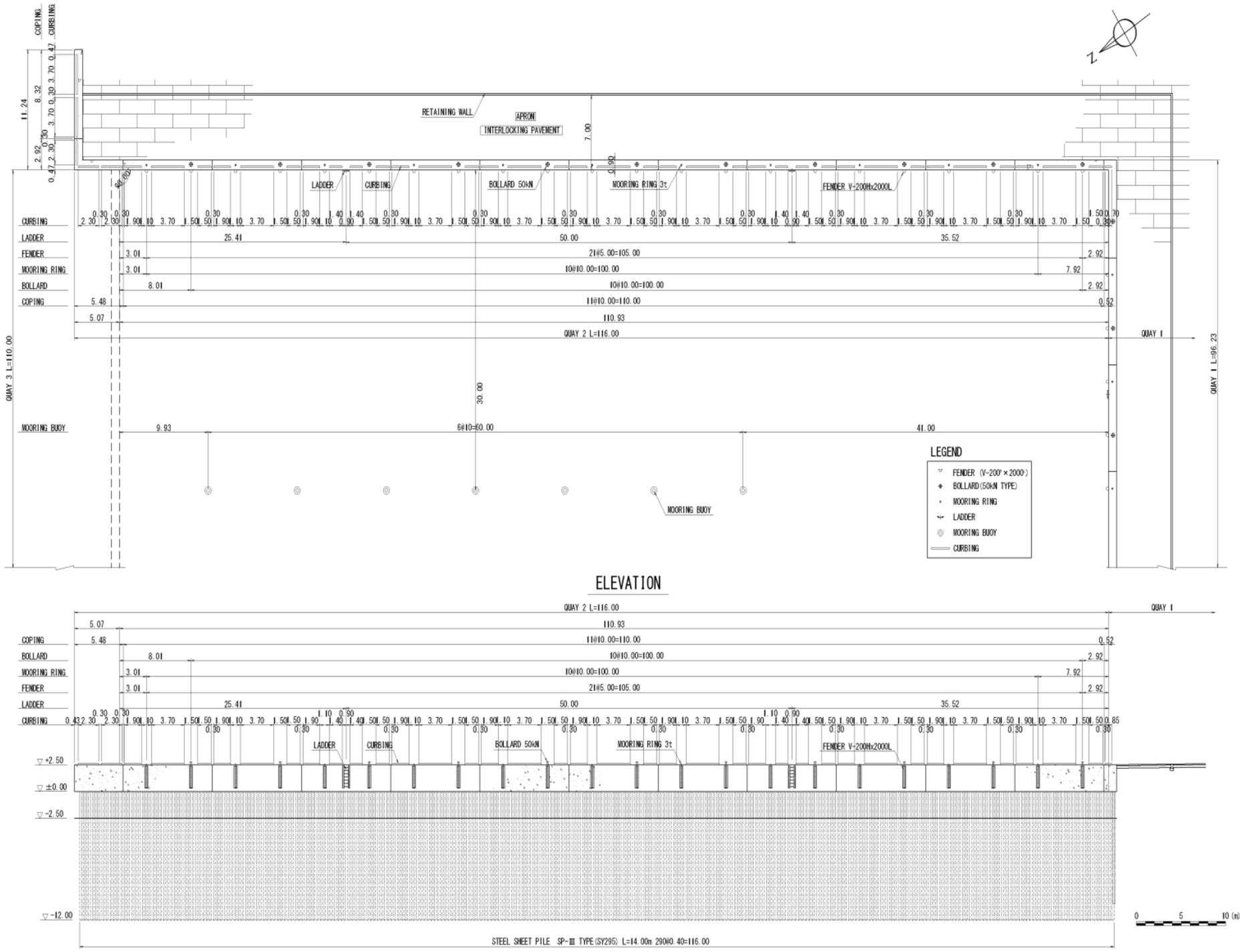
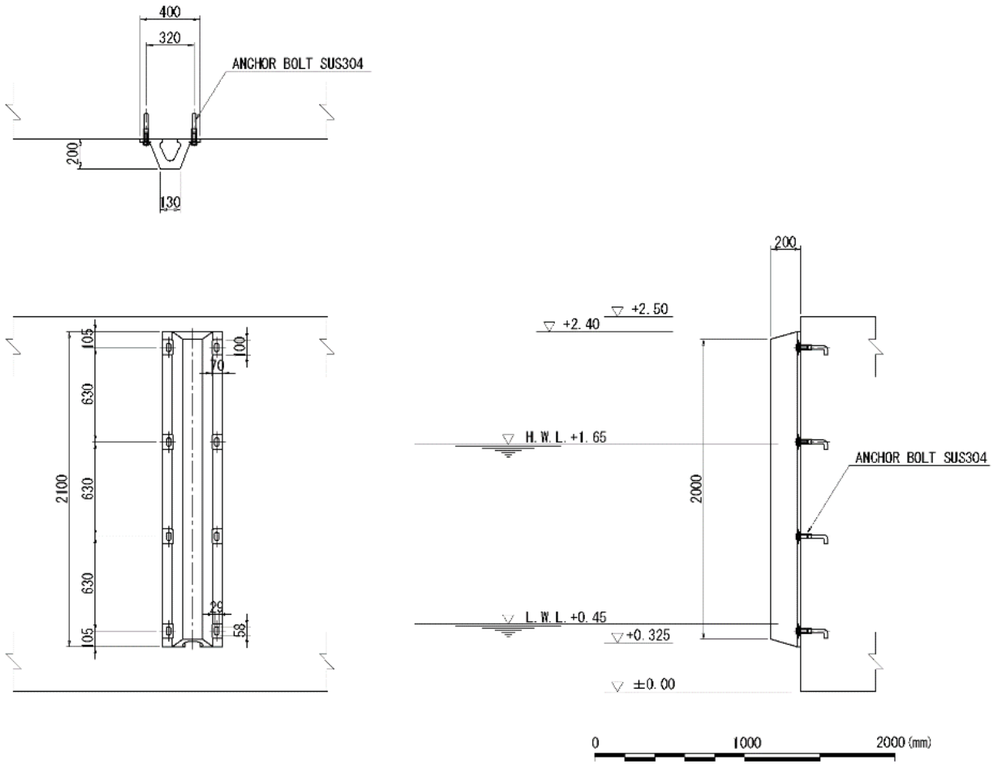


Figure 2-2-3(8) Layout Plan of Ancillary of Quay No.2

RUBBER FENDER V-200Hx2000L



RUBBER LADDER GH-150Hx2100L

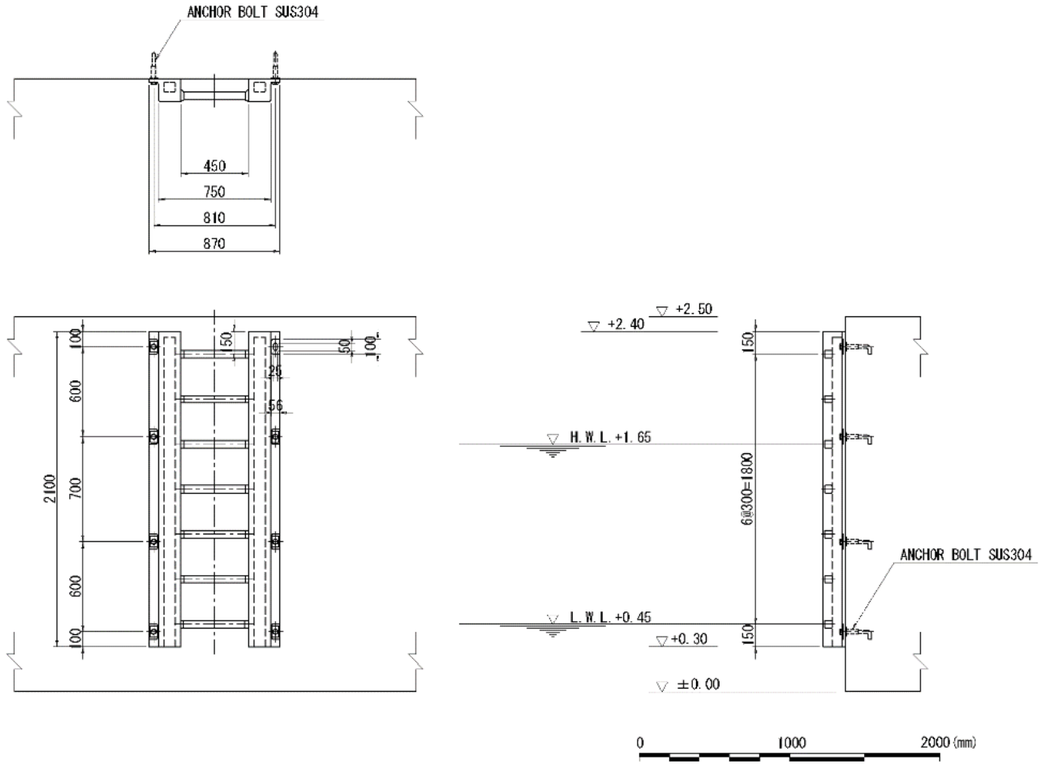
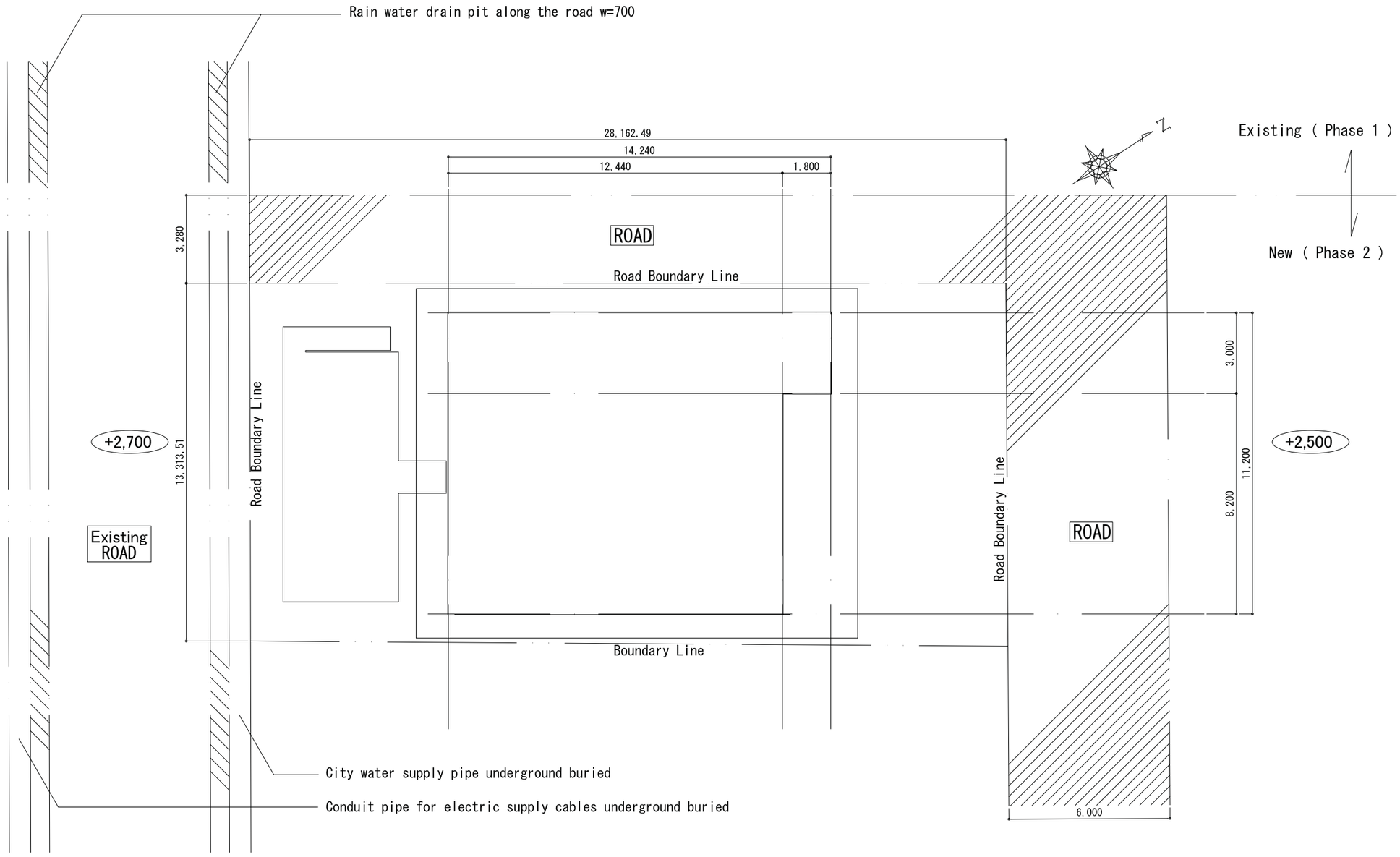
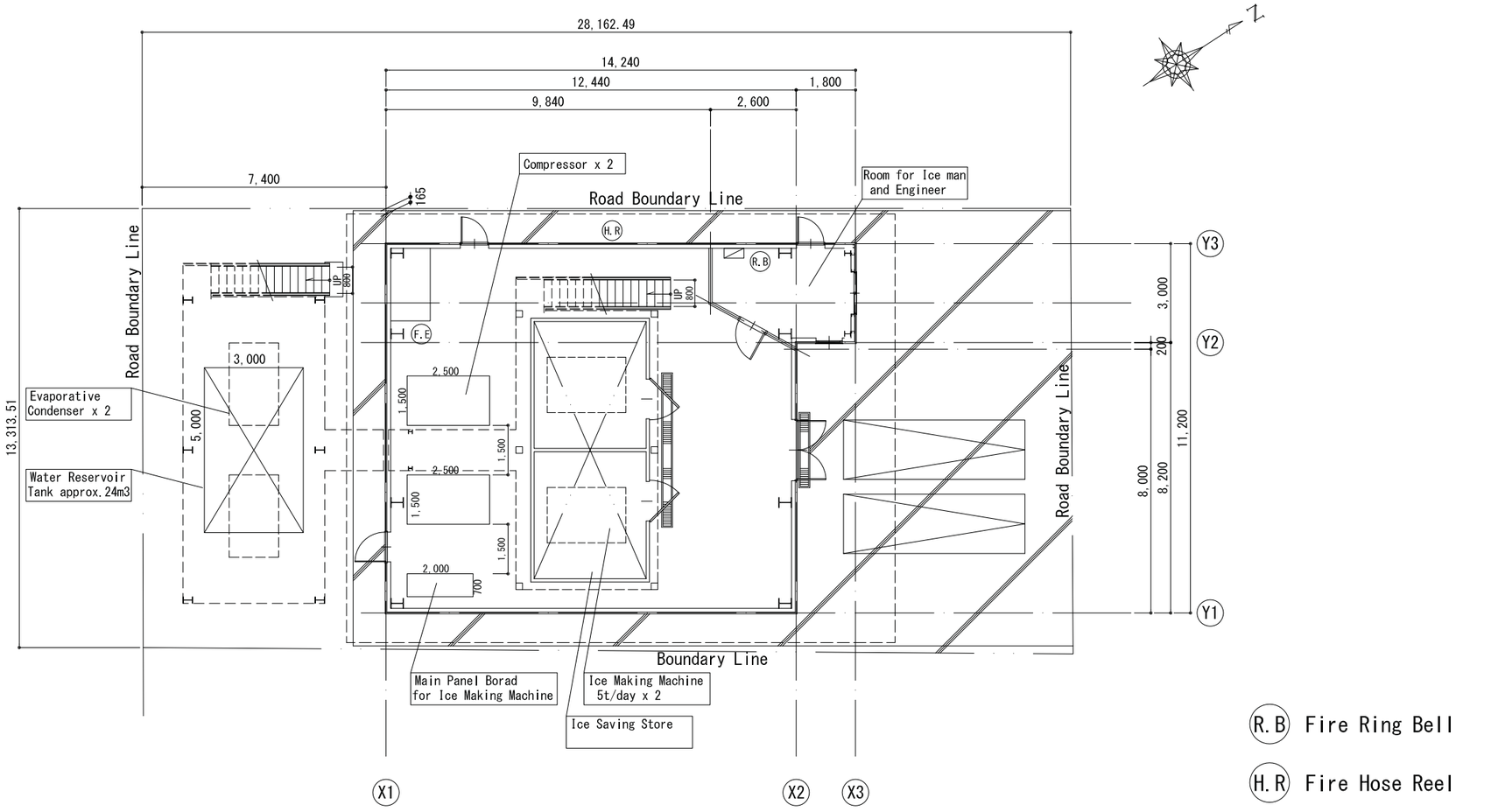


Figure 2-2-3(9) Basic Drawing of fender and ladder



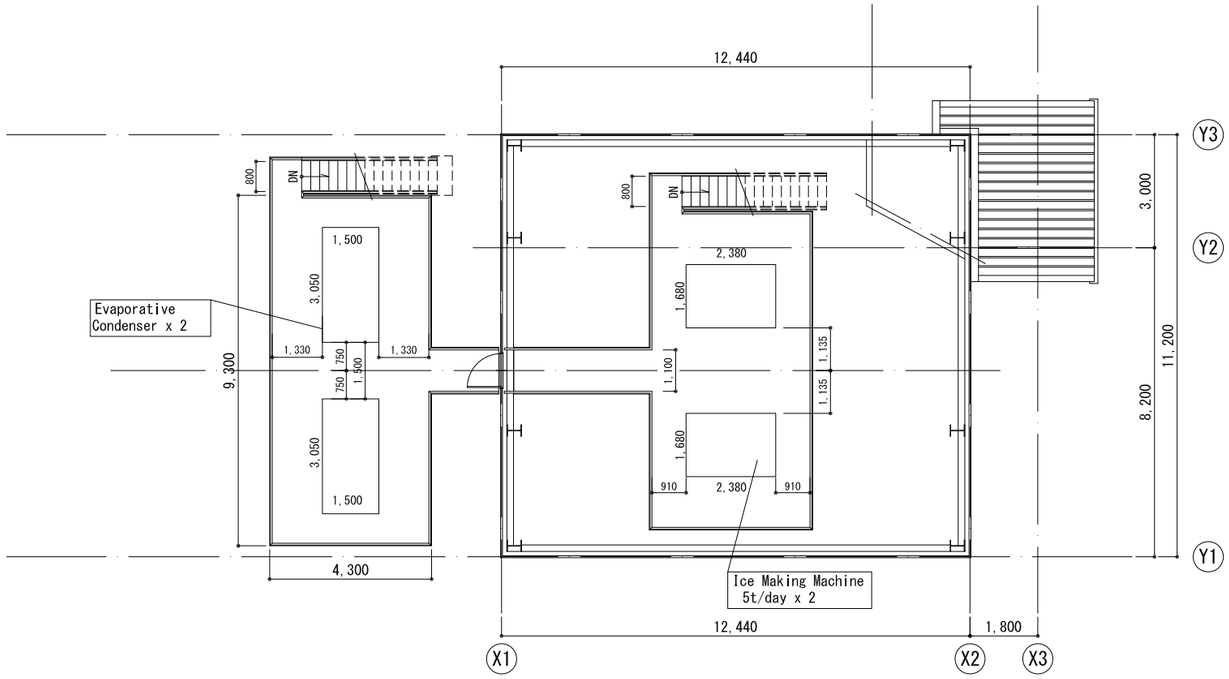
SEYCHELLES FISHING AUTHORITY THE REPUBLIC OF SEYCHELLES	THE PROJECT FOR CONSTRUCTION OF FISHERIES FACILITIES AT PROVIDENCE, ZONE 6	DRAWING TITLE ICE MAKING FACILITY PLAN of Land SCALE 1/100 @ A2 DATE	DESIGNED DRAWN CHECKED APPROVED	Consotium OAFIC Co.,Ltd. and ECOH CORPORATION	DRAWING NO. A-101

Figure 2-3-2 (10) Layout plan of Total Building Facilities



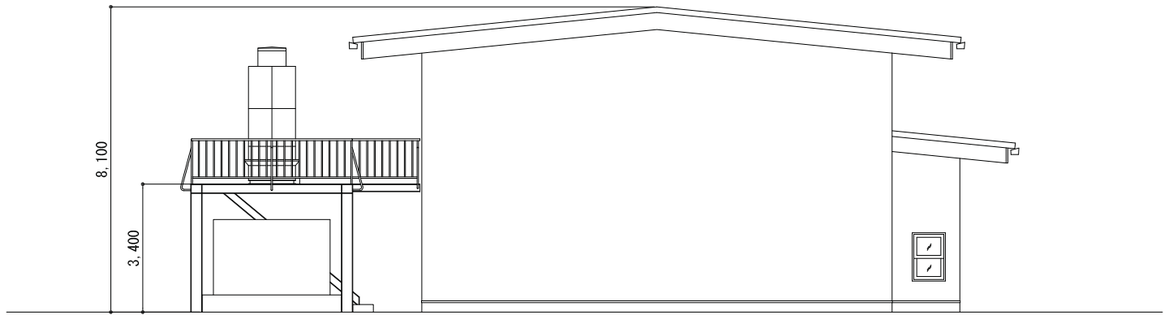
SEYCHELLES FISHING AUTHORITY THE REPUBLIC OF SEYCHELLES	THE PROJECT FOR CONSTRUCTION OF FISHERIES FACILITIES AT PROVIDENCE, ZONE 6	DRAWING TITLE: ICE MAKING FACILITY GROUND FLOOR PLAN SCALE: 1/100 @ A2 DATE:	DESIGNED DRAWN CHECKED APPROVED	Consotium OAFIC Co.,Ltd. and ECOH CORPORATION	DRAWING NO.: A-102

Figure 2-3-2 (11) Floor Plan of Ice-making facility

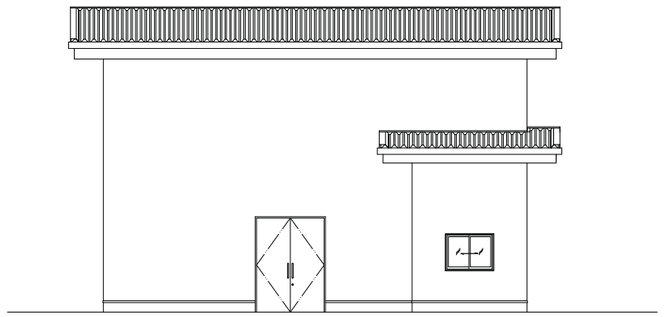


SEYCHELLES FISHING AUTHORITY THE REPUBLIC OF SEYCHELLES	THE PROJECT FOR CONSTRUCTION OF FISHERIES FACILITIES AT PROVIDENCE, ZONE 6	DRAWING TITLE ICE MAKING FACILITY FIRST FLOOR PLAN	DESIGNED DRAWN CHECKED	Consotium OAFIC Co.,Ltd. and ECOH CORPORATION	DRAWING NO. A-103
		SCALE 1/100 @ A2 DATE	APPROVED		

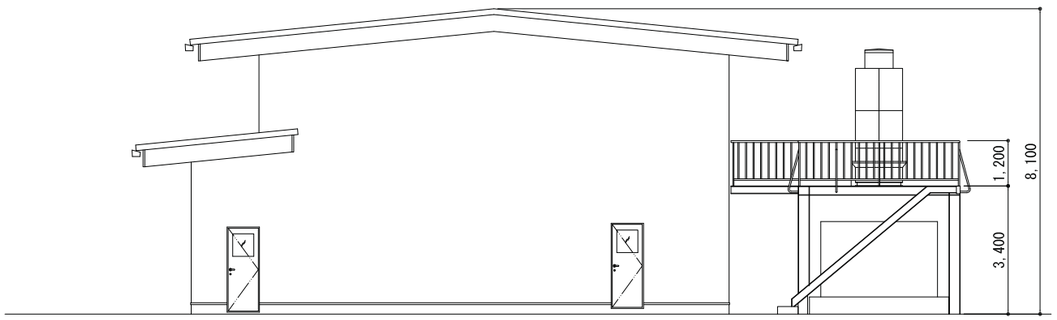
Figure 2-3-2 (12) Floor Plan of Ice-making facility 1F



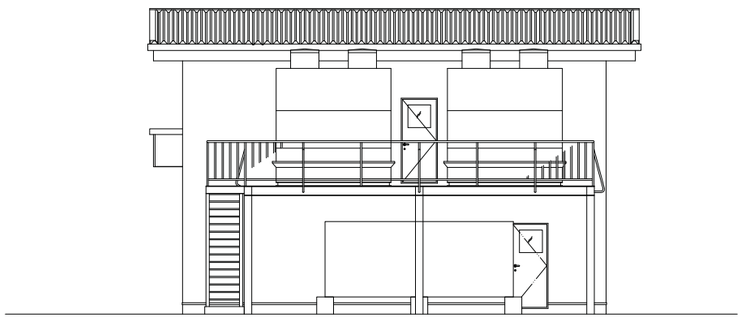
EAST ELEVATION



NORTH ELEVATION



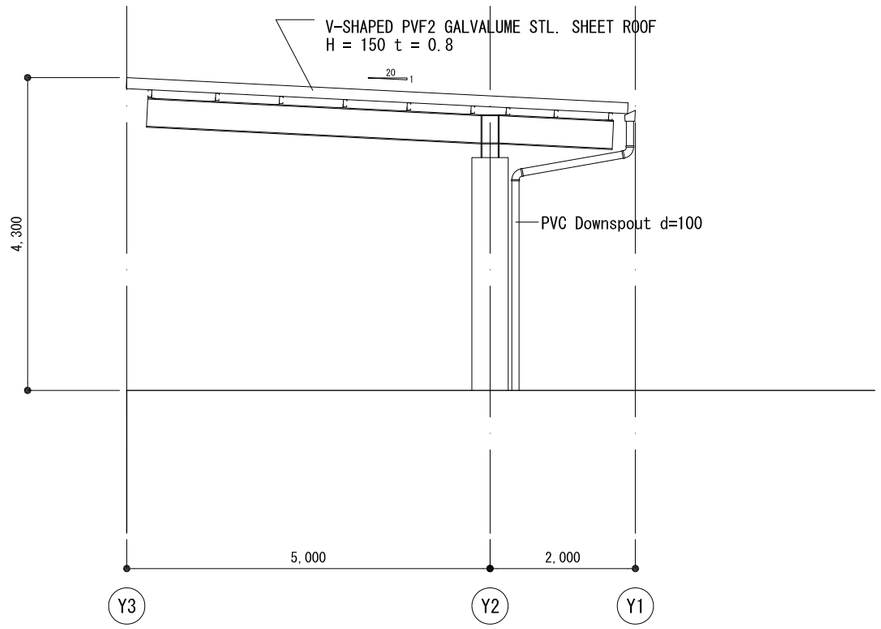
WEST ELEVATION

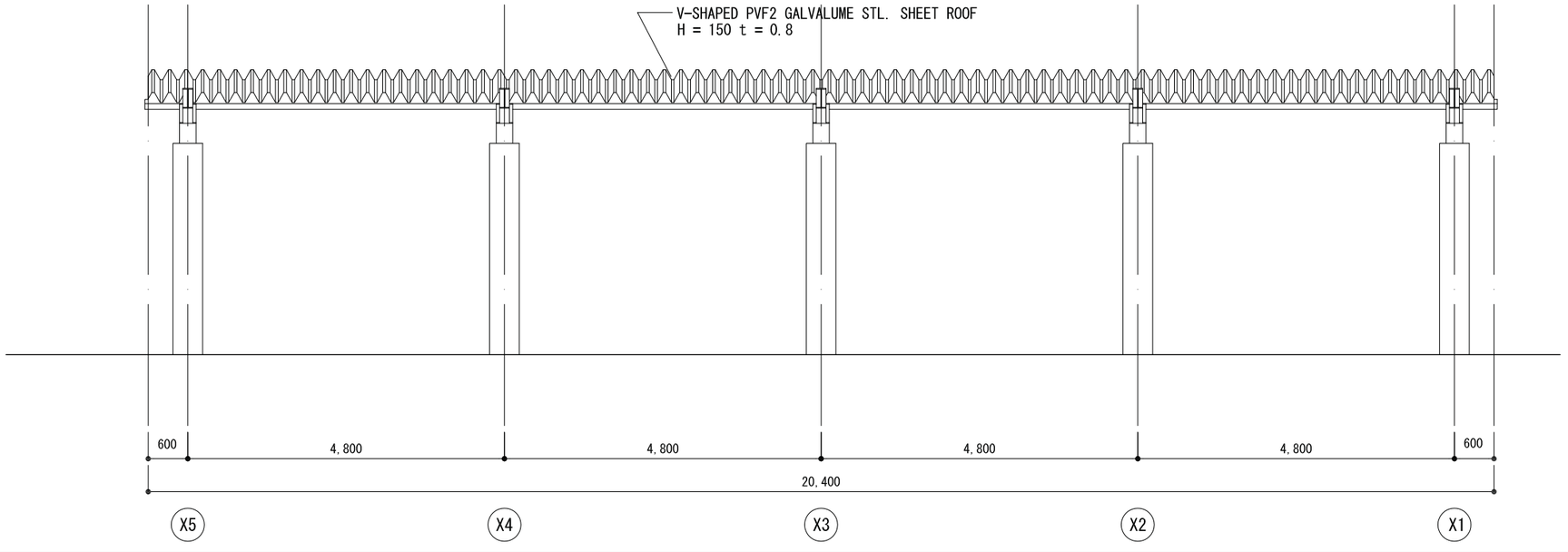


SOUTH ELEVATION

SEYCHELLES FISHING AUTHORITY THE REPUBLIC OF SEYCHELLES	THE PROJECT FOR CONSTRUCTION OF FISHERIES FACILITIES AT PROVIDENCE, ZONE 6	DRAWING TITLE: ICE MAKING FACILITY ELEVATIONS SCALE: 1/100 @ A2 DATE:	DESIGNED DRAWN CHECKED APPROVED	Consotium OAFIC Co.,Ltd. and ECOH CORPORATION	DRAWING NO. A-104

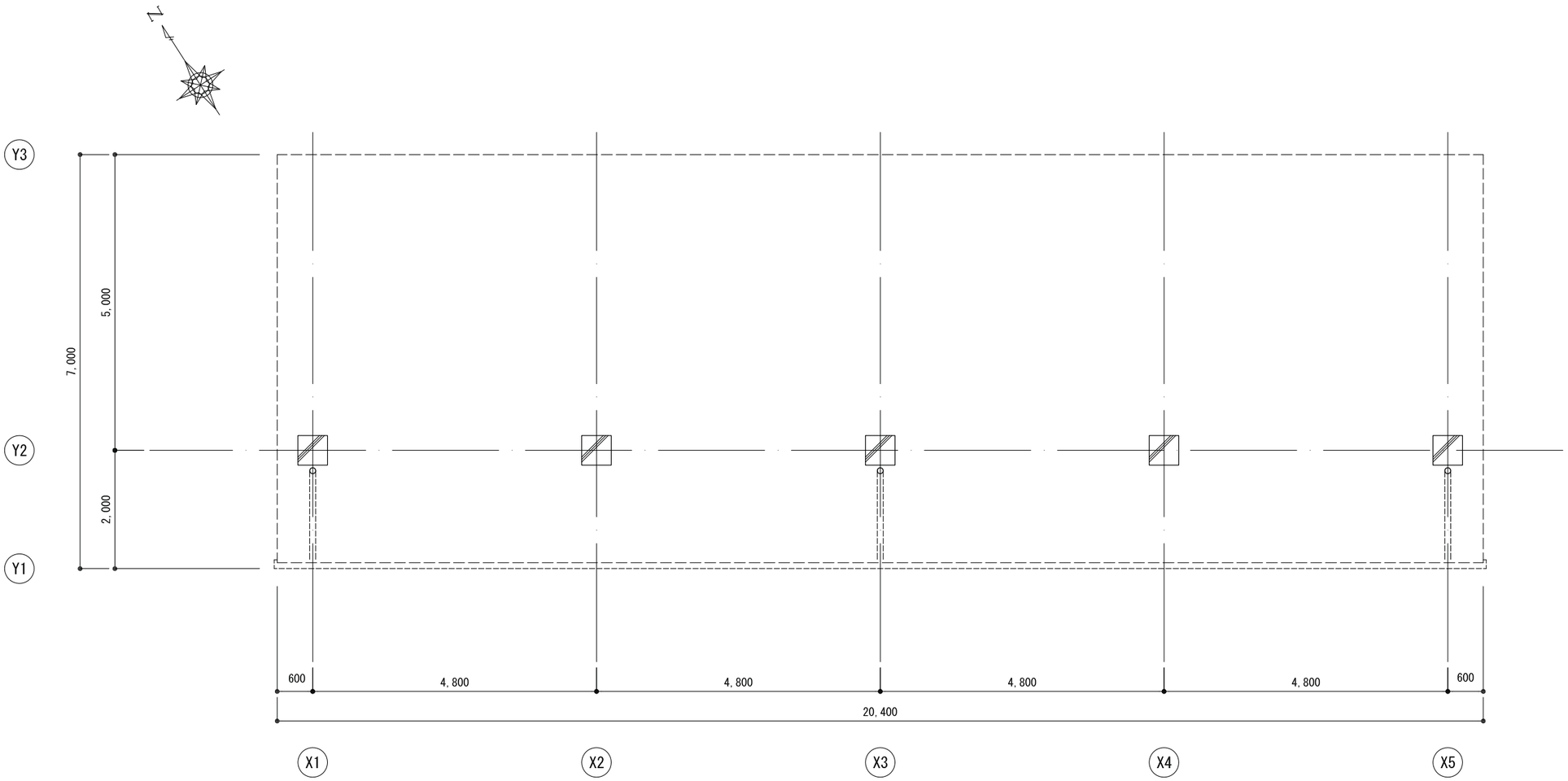
Figure 2-3-2 (13) Section Plan of Ice-making facility





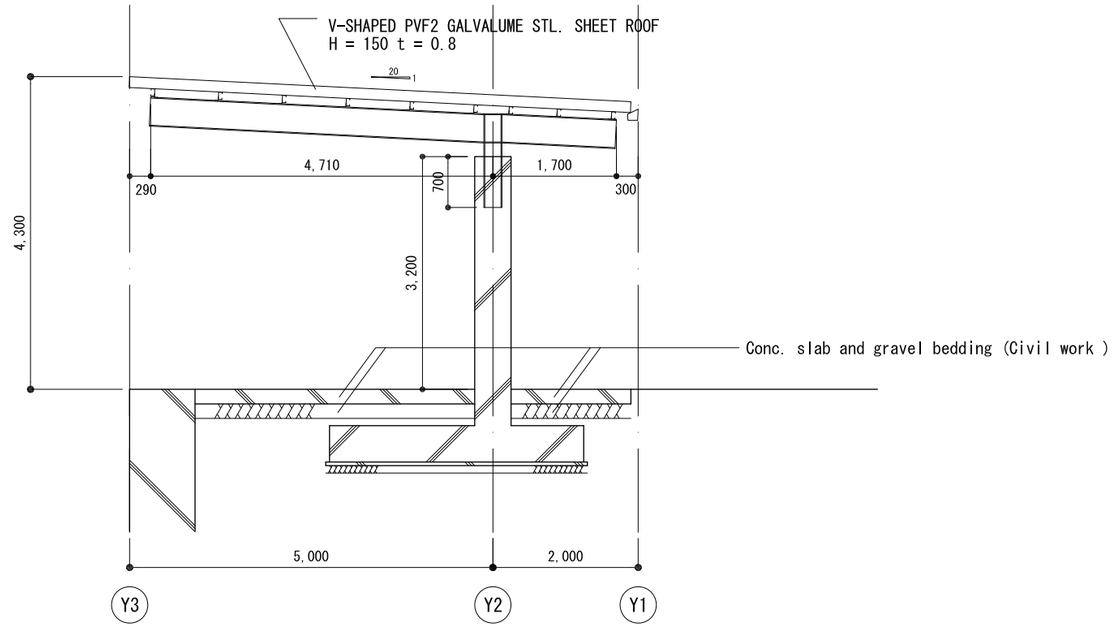
SEYCHELLES FISHING AUTHORITY THE REPUBLIC OF SEYCHELLES	THE PROJECT FOR CONSTRUCTION OF FISHERIES FACILITIES AT PROVIDENCE, ZONE 6	DRAWING TITLE: LANDING SHED ELEVATIONS SCALE: 1/50 @ A2 DATE:	DESIGNED DRAWN CHECKED APPROVED	Consotium OAFIC Co.,Ltd. and ECOH CORPORATION	DRAWING NO. A-203

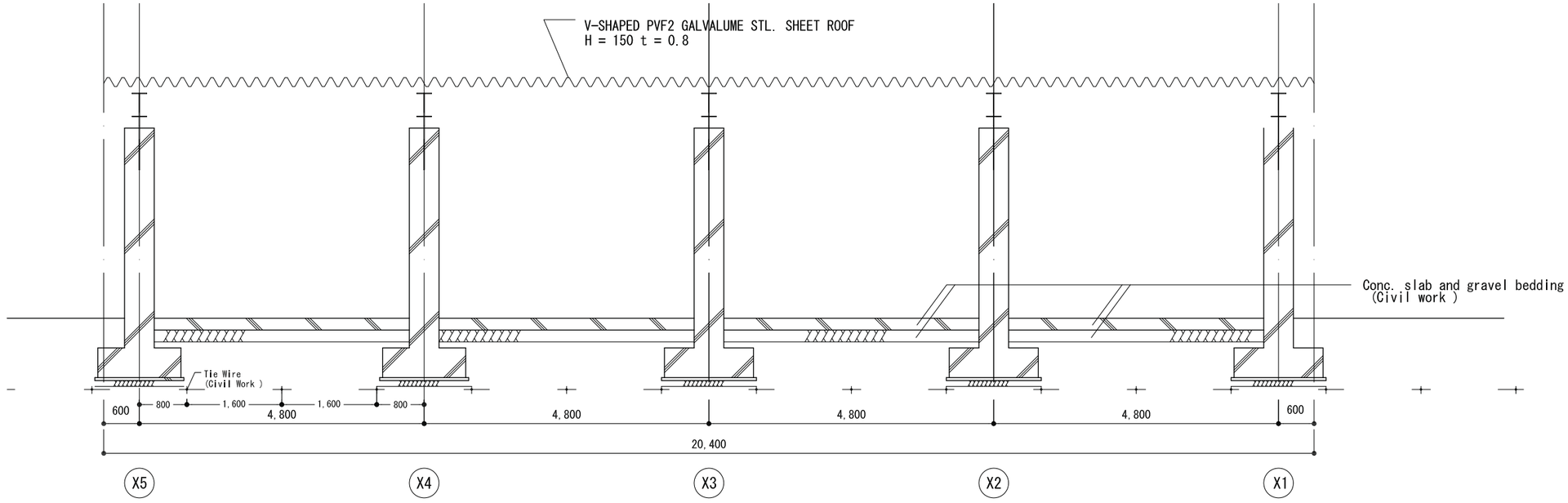
Figure 2-3-2 (14) Elevation Plan of Landing shed



SEYCHELLES FISHING AUTHORITY THE REPUBLIC OF SEYCHELLES	THE PROJECT FOR CONSTRUCTION OF FISHERIES FACILITIES AT PROVIDENCE, ZONE 6	DRAWING TITLE: LANDING SHED PLAN SCALE: 1/50 @ A2 DATE:	DESIGNED DRAWN CHECKED APPROVED	Consotium OAFIC Co.,Ltd. and ECOH CORPORATION	DRAWING NO.: A-201

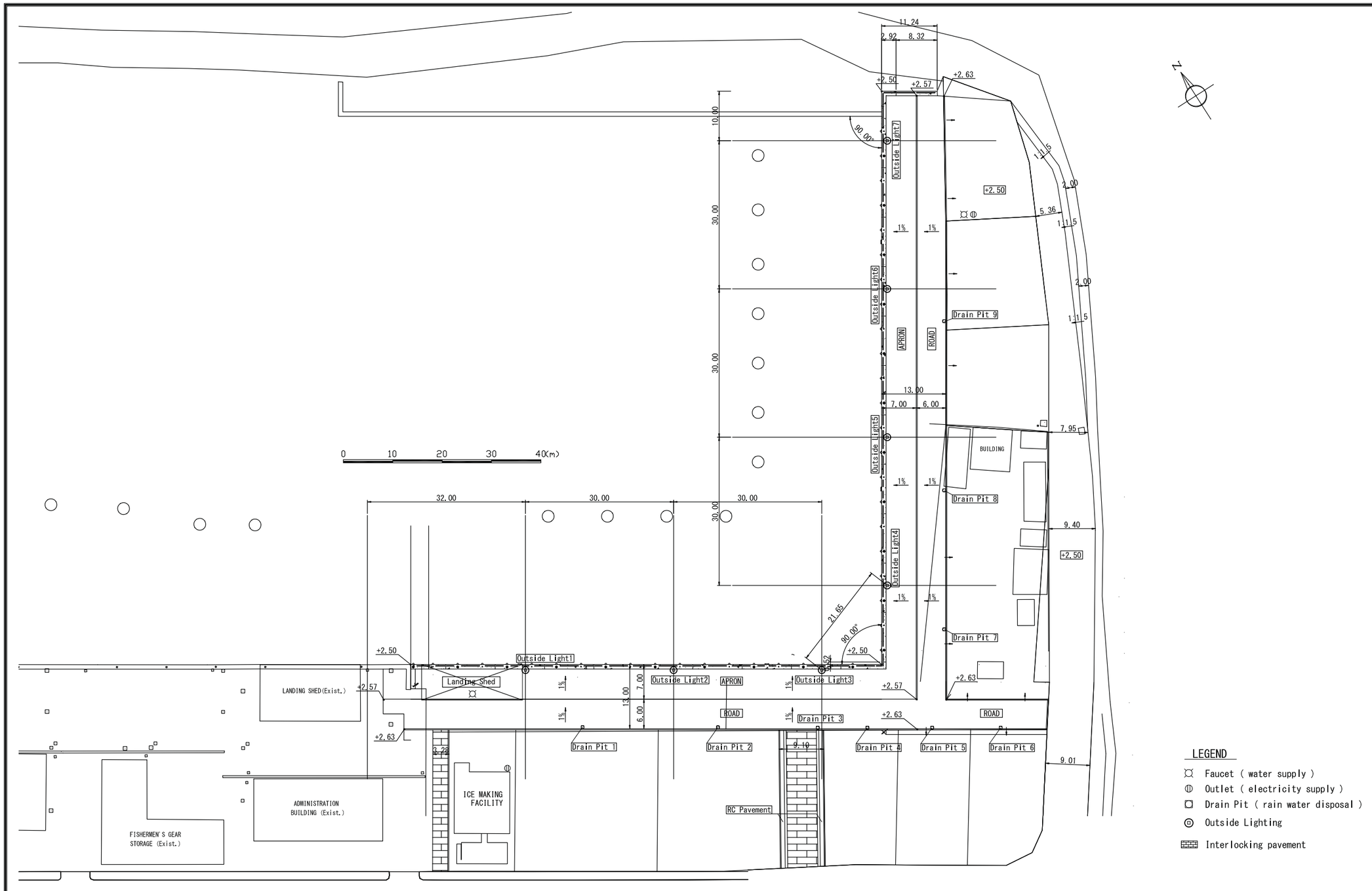
Figure 2-3-2 (15) Plan of Landing shed





SEYCHELLES FISHING AUTHORITY THE REPUBLIC OF SEYCHELLES	THE PROJECT FOR CONSTRUCTION OF FISHERIES FACILITIES AT PROVIDENCE, ZONE 6	DRAWING TITLE LANDING SHED SECTIONS	DESIGNED DRAWN CHECKED	Consotium OAFIC Co.,Ltd. and ECOH CORPORATION	DRAWING NO. A-204
		SCALE 1/50 @ A2 DATE	APPROVED		

Figure 2-3-2 (16) Sections plan of Landing shed



SEYCHELLES FISHING AUTHORITY THE REPUBLIC OF SEYCHELLES	THE PROJECT FOR CONSTRUCTION OF FISHERIES FACILITIES AT PROVIDENCE, ZONE 6	DRAWING TITLE PROVIDENCE PORT SITE PLAN PLAN of Land (ARCH Portion) SCALE 1/500 @ A2 DATE	DESIGNED DRAWN CHECKED APPROVED	Consotium OAFIC Co.,Ltd. and ECOH CORPORATION	DRAWING NO. A-001

Figure 2-2-3(17) Layout Plan of Ancillary Equipment

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

(1) Basic Policy

1) The Project will be implemented in accordance with the Gran Aid System of the Government of Japan afar execution of the Exchange of Notes (E/N) and Grant Agreement (G/A), concerning the implementation of the Project for The Construction of Fisheries Facilities at Providence, Zone 6 between Government between the Republic of Seychelles and the Government of Japan, following the decision by a Cabinet meeting of Government of Japan. The Consultant Agreement shall be concluded between the Government of Seychelles and the Consultant, which hold a Japanese nationality. After execution of the Exchange of Notes, SFA will enter into the Consultant Agreement for detailed design and project supervision with a Japanese consultant corporation, which will be validated after authorization by the Government of Japan. For smooth implementation of the Project, it is important to enter into the Consultant Agreement promptly after execution of the Exchange of Notes.
2) The Consultant shall prepare drawings, specifications and tender documents necessary for the construction as well as drawings necessary for the contract and, by the tender, through the evaluation of tender qualification and tender documents and upon receiving approval from the Government of Seychelles, select a construction company which holds Japanese nationality. Construction works shall be implemented in accordance with the construction contract concluded between the Government of Seychelles and the Construction Company.
   The tender formalities and work supervision activities will be made in accordance with the contents of the tender documentation.
3) The construction work shall be implemented in accordance with the Construction Contract agreed between the Government of Seychelles and a selected construction company
4) Refereeing from the scale of the project, the contents and the conditions of the construction site, the implementation design including tender will require 7 months and construction work for18 months, respectively

(2) Construction Policy/Procurement Policy

1) The fishery facilities to be constructed in the project are Quay No.1 & No. 2, Apron, Access way, mooring buoy for the civil works and ice-making facility, Landing shed and connecting road as for the building works.
2) This project is the extension works of an existing fishery port where fishing activities are

conducted. During construction period, although it is unavoidable to have an influence to the existing port functions. The construction and work execution plan and schedules is to prepare to minimize the influence to activities in addition to the safety concern of the port user.

3) The cost can be reduced by re-use of the waste soil and armor stones originated from the construction site as backfilling materials to the construction of quay and mound.

4) The quality and supply capacity of locally available materials and equipment shall be examined carefully and local procurement will be prioritized to minimize procurement from Japan or third countries for cost reduction.

5) Regarding to materials and equipment having difficulties to procure locally, total procurement cost is to evaluation before deciding procurement sources.

2-2-4-2 Implementation Conditions

(1) Construction conditions

1) Construction Company

There are several construction companies, which have experience of, civil and building works in Seychelles. As there are many companies as a candidate for the construction work in Seychelles, which had been participated to the construction works of considerable size of fishing port. Those companies can be assigned as candidate to work as subcontractors under the supervision of the Japanese construction company.

2) Construction Machinery

There is no leasing company for the construction machinery in Seychelles, and local construction companies also have limited construction machineries of models and the number. In the project, general construction machinery is procured locally, and special equipment such as crawler cranes and uni-float type barge are procured from Japan. Basically, as construction machinery are not able to procure locally or from neighboring countries, the machinery will be carried from Japan.

3) Labor

Supervision by skilled Japanese experts will employee for the steel sheet piling works and diving works. In addition, Japanese experts will supervise the local work for installation, construction and piping work for ice-making facility and roofing.

4) Construction Material

Construction materials, including ready-mixed concrete, armor stone, paving blocks and building blocks are produced in Seychelles. The most of the cement is imported though the stock

is sufficient. The other building materials are mostly imported as requested of customer, thus the stocked materials are always not sufficient. For the project, those materials that are insufficient stock, and item having difficult to secure necessary quality or quantity through local market are to procure from Japan.

(2) Control of construction works

1) Safety management shall be secure based on "The safety policy for ODA facility construction works" and "The Guidance for the Management of Safety for Construction Works in Japanese ODA Projects" issued by JICA.
2) As this project is the expansion works under the existing fishing port, during the construction period, fencing and safety signs will be installed to indicate hazardous areas around the project site clearly, in order to prevent entry of port users.
3) The contractor should inform the work schedule and working duration to Seychelles Civil Aviation Authority before commencing crane work, because the project site is located directly under the aircraft approach course of the international airport.
4) There are no marine liner services from Japan neither by container vessel nor general cargo ship. About 45 days is to secure for the marine transportation from Japan to Seychelles.
5) Procedure of the foundation work of the landing shed is to design to build after completion of installation of the tie wire in support of sheetpile. Before starting of fundamental construction of landing shed, the capacity of soil in the construction level by plate loading test must be applied to confirm.

2-2-4-3 Scope of Works

(1) Obligation of Japan side

1) Consultant services for Detailed Design, Support to Tender, Construction Supervision.
2) Provision of all necessary construction materials and labors needed for Japanese side construction works in the project.
3) Provision of marine and inland transportation including the transportation insurance being necessary for Japanese side construction works and procurement of equipment in this project.
4) Necessary quality inspection on Japanese side construction works and procurement of equipment in this project.
5) Concerning related infrastructure, the entire portion after lead-in work from the electric pole nearest to the project site as responsive boarder point for electricity. The entire portion after

water supply pipe being inside of project site is boarder line for water supply and the entire portion of discharging water works shall be include as the basic scopes.

6) Technical training for ice-making facility operation and management as Soft Component

(2) Obligation of Seychelles side

1) Acquisition of licenses and permissions necessary for carrying out the construction work, etc. for the Project
2) Implementation of Environmental impact assessment
3) Site clearance, Block removal from back quay wall, tree demolishing in the Project site
4) Construction of access road
5) Installation of fence around ice making facility
6) Employment of Technical staff for ice-making facility operation (two staffs)
7) Banking arrangement fees
8) Ensuring prompt Tax exemption and customs clearance involved in importing construction machines, equipment, and materials to be used foot the Project

2-2-4-4 Consultant Supervision

Based on the policy of Grant Aid Cooperation by the Government of Japan, consistent and smooth detailed design works and construction supervision works for the project shall be done by the Consultant who well understood the effect of cooperation study. At the time of construction supervision, the Consultant shall dispatch a resident engineer who has enough experiences of work site and supervise the construction works and to make contacts to related organizations. In addition to above, dispatch of professional engineers, support of inspection, and instruct on construction works will be provided as required.

(1) Policy of Construction Supervision

1) Project completion based on the work execution plan without delay shall be aimed by close contact and report to the pertinent organizations of Seychelles and Japan.
2) Prompt and proper instructions and advises to the contractor shall be made for the facilities construction met with the design drawings.
3) Taking the approach that technical transfer for construction method and technique shall be made and produce an effect as the project under the scheme of Grant Aid Cooperation.
4) Appropriate advises and instructions are to provide for a smooth management and maintenance after handing over the facilities.

(2) Construction Supervision Works

1) Service for Construction Contract

The Consultant shall make services for selection of the Construction Company, decision of construction contract method, producing draft of contract document, checking detailed construction works and witness for construction contract.

2) Examination and confirmation of shop drawings

The Consultant shall examine the shop drawings and inspect the construction material, finish samples, facility material submitted from the Contractor.

3) Instruction to Construction Works

The Consultant shall study the construction plan and work execution schedule and instruct the Contractor and report the work progress to the Client.

4) Cooperation to payment procedure

The Consultant shall check invoices and require documents. Including the procedures for the construction cost to be paid during and after the construction works.

5) Inspection

The Consultant shall inspect each progress during construction period upon needs and instruct the Contractor. The Consultant shall witness the handing over the facilities upon confirming the completion of construction and accomplish the content of contract and finish the works obtaining the confirmation of receipt from the Client. In addition, the Consultant shall report necessary matters related with progress during construction, payment procedures and handing over after completion to the concerned officials, the Government of Japan.

2-2-4-5 Quality Control Plan

Quality control plan is followed by the controlled items, controlled contents, controlled methods, quality standards, measuring frequency and the method of record on the quality of materials which are to be used in the project must have accordance with the particular specification documents (Tender documents, Drawings, question and answer and etc.) and the Quality Control Standard for Port and Harbor Construction described in "Port and Harbor Construction Work Common Specifications (in Japanese)".

2-2-4-6 Procurement Plan

Following items are to clarify for the procurement of material and equipment in the project.

(1) Procurement Policy

As for locally available materials and equipment, there quality and supply capacity shall be fully examined and local procurement shall be prioritized as much as possible. Those that are difficult to be procured locally are to obtain from Japan or third countries.

(2) Guarantee

Granted facilities shall be guaranteed for one year from the completion. Guarantee is not accessible for man-caused damage like rough handling on the facilities and equipment.

(3) Spare parts component

There are special appliances of the ice making building and pump as facility needing a spare part in this Project. That equipment shall be installed with consumable supplies and spare parts use of period until one year after handling over the facility.

(4) Procurement from the third countries and Japan

Procurement and transportation plan shall be obtain to prepare the materials and equipment procured from Japan and the third countries considering the schedule for order, production, packing and shipment when the materials and equipment are needed for manufacturing after order or domestic fabrication works. In case of procurement from Japan and the third countries, it is necessary to pay special attention to packing, transportation, insurance, port charges and the tax exemption.

(5) Tax exemption measures

Materials and equipment procured from Japan, third-party countries or locally are exempt from tax. For tax exemption procedures, a tax exemption application is usually made in advance. For the application procedure, a list of materials and equipment for procurement is submitted to the SFA as the project implementing body in the name of the contractors (including subcontractors). After this, the SFA attaches a project number and applies to the Ministry of Finance Trade and Blue Economy. The list of materials and equipment for procurement specifies the name, unit price, quantity, amount, country of origin, and the name of the subcontractor, if there is one. The Ministry of Finance Trade and Blue Economy calculates the tax exempt amount via the Seychelles Revenue Commission, and this amount is drawn down from the SFA budget upon customs clearance.

A prime contractor (a Japanese company) is appointed when procuring materials and equipment inside the Seychelles. When procuring, the materials and equipment needed for the project can be purchased without paying tax by presenting a certificate stating the project number. The tax is

paid after confirming the content of purchase by the implementing body.

(6) Procurement Item

Procurement sources of main construction materials studied previously is shown in Table 2-2-4(1) and the main construction machines are shown in Table 2-2-4(2).

Table 2-2-4(1) Procurement source of main construction materials

Construction Material		Procurement Source		
		Local	Japan	3rd Countries
Civil Facility	Cement	X		
	Sand, Aggregate, Stone material	X		
	Interlocking block	X		
	Steel reinforcing bar, Structural steel		X	
	Steel sheet pile		X	
	Port material (Fender, bollard and etc.)		X	
Building Facility				
	Cement	X		
	Sand, Aggregate, Stone material	X		
	Interlocking block	X		
	Steel reinforcing bar, Structural steel		X	
	Steel sash	X		
	Roofing material		X	
	Coating material	X		
	Lighting Equipment	X		
	Ice making Facility		X	

Table 2-2-4(2) Procurement source of main construction machines

Construction Machines		Procurement Source		
		Local	Japan	3rd Countries
Bulldozer	3t	X		
Bulldozer	15t	X		
Backhoe	0.8 (0.6) m^3	X		
Backhoe	1.4 (1.0) m^3		X	
Dump truck	10t	X		
Truck Crane	25t lifting capacity	X		
Trailer	20t	X		
Combined Roller	3-4t	X		
Vibratory Roller	0.8-1.1t	X		
Road Roller	10-12t	X		
Uni-float type barge			X	
Crawler Crane	80t lifting capacity		X	
Vibration hummer	60KVA		X	

2-2-4-7 Operation guidance plan

Ice making facility is the equipment to be procured in the Project. Method of operation assistance of Ice-making facility installed in this project will be varies in the difference by hardware and manufacture. Thus there is a need for initial operation guidance by the manufacturer. Basic operational guidance of the ice-making machine is highly required for handling. The equipment suppliers with attaching refrigeration engineers and electricians engaged during the construction work will hold initial operation guidance. They will provide fundamental technical instructional during the completion of test run of the facilities to the technical staffs of SFA.

On the other hand, SFA has been operating fishing port and facility from Phase 1 in Providence fishing port. Therefore, planning of operational guidance for port facilities will not include in this project.

2-2-4-8 Soft Component (Technical Assistance) Plan

Seychelles side requested training as the Soft Component of its personnel for the upgrading of technical capacity in the operation and maintenance/management of ice-making facility provided in the project.

(1) Activities of the Soft Component

Activity of the Soft Components is focused on:

Table 2-2-4(3) Activity of the Soft Components

Activity	Duration	Starting time
Improvement of technical operation on ice making facility	1.0 months	1.5 month before handing over

Outcome 1

Outcome： "Establishment of maintenance plan for the ice making plan"

Activities

1-1 To make a draft of maintenance plan and maintenance notes for the ice making plant.

1-2 To explain basic operation procedures and the relation between the each units of ice making facility.

1-3 To clarify the maintenance procedures for the equipment such as ice making plant and to coach actual maintenance.

1-4 To instruct the methods of collection of operation data for the equipment such as ice

making facility

1-5 To conduct method for recoding on the maintenance notes and analyzing the operation data for ice making facility

1-6 To make maintenance plan and maintenance notes for the ice making facility

Based on the information and lessons learned from the activities through 1-2 to 1-6, the maintenance plan (schedules) and records of maintenance (log-book) for the each equipment are to be prepared.

(2) Implementation Resources

Because the consultants or NGOs capable of giving total guidance with regard to management, accounting, and the operation of the concerned facilities of this Project, Resources for the Soft Component is not capable to find locally. It is determined to dispatch the Japanese consultants who was involved in this preparatory survey, and to engage the Soft Component in collaboration with the local counterparts.

1) Japanese side

One consultant who has experience on ice-making facility in fisheries sector will be dispatched. Consultants will have experience of training on those facilities and offer guidance on refrigeration management system. He/she will prepare the teaching materials in Japan.

2) Seychelles side

During the implementation of the Soft Component, following counterparts will be dispatched to collaborate with the Japanese trainer.

Two persons for facility maintenance personnel (technical staff)

(3) Outputs

1) Completion report
2) Maintenance plan (maintenance and inspection logbook, working record table, replacement parts manual)
3) Medium-and long-term maintenance plan (operation plan, maintenance schedule, parts replacement record)
4) Operation manual (operation regulation, operation guidance)

2-2-4-9 Implementation Schedule

The project implementation schedule after execution of the Exchange of Notes is shown in Figure 2-4-4(4). The project will consist of three types of work: Detailed design work by the consultants, the tender-related work, and the contractors' works and the consultants' construction supervision work.

(1) Detailed Design Work

The consultant agreement for the Project will be entered between SFA and a Japanese consultant company, and will be authorized by the Government of Japan. After that, the consultants will prepare the tender documentation (detailed design and bidding documents) in accordance with the Preparatory Survey report through consultations with SFA and submit the documentation to SFA for its approval MFA. The period of preparation of this tender documentation is scheduled for 3.5 months.

(2) Tender-related Work

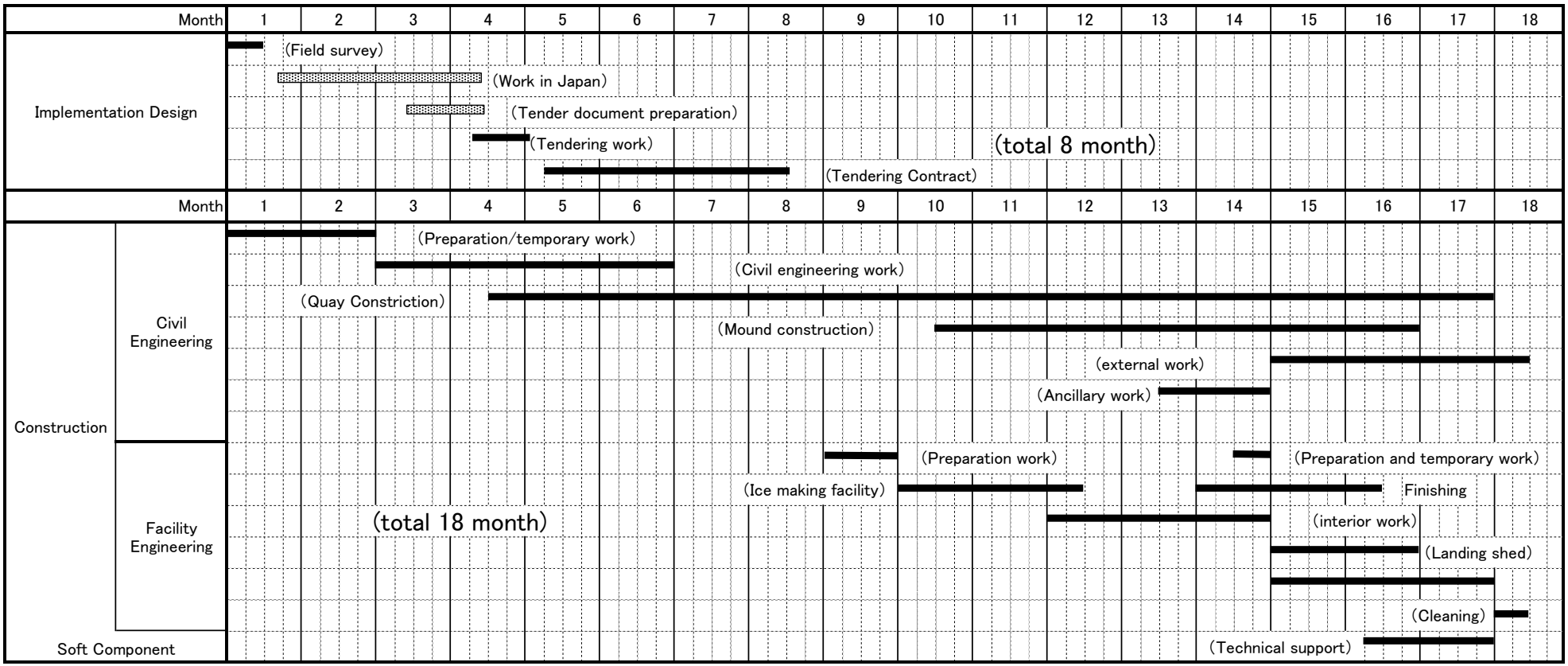
The work period required for the tender-related work is estimated to be 3.5 months

(3) Contractors' Works and Consultants' Construction Supervision Work

After the work contracts (for building procurement) are awarded, the contractors will start the respective works. Simultaneously, the consultants will start their construction supervision works.

For these works, a work period of 18 months is estimated as shown in Table 2-2-4(4).

Table 2-2-4(4) Implementation Schedule



2-3 Obligation of Recipient Country

The Scope of the work to be borne by Seychelles side will cover the following activities:

a) Application for acquirement of permits and approvals necessary for construction, buildings and works under the Project;
b) Conducting the Environmental impact assessment and the environmental authorizations for the Project
c) Site Clearance for project site
d) Securing land for temporary construction yard and cutting of the tree within project site.
e) Public announcement for restriction use of the port during construction
f) Construction of fence around the ice-making facility
g) Recruitment of two technical staffs for ice-making facility.
h) Conducted maintenance dredging in Providence fishing port
i) Construction of access road
j) Reestablishment of operation management committee for fishing port
k) Guarantee for prompt unloading of equipment and materials, tax exemption and customs clearance at an unloading port, as well as securing of speedy inland transportation;
l) Exemption of all customs duties and taxes imposed on the Japanese persons engaged in supply of equipment and materials and performing various activities under the authorized contracts;
m) Providing the Japanese persons engaged in supply of equipment and materials and performing various activities under the authorized contracts with necessary facilities for their entry and staying in Seychelles;
n) Banking Agreements (B/A) and issue of Authorization to Pay (A/P) as well as payment of their commissions;
o) Budgeting measures necessary for effective operation and maintenance of the facilities to be built and the equipment and materials to be procured under the Grant Aid;
p) Bearing of the costs necessary for other goods than those to be procured under the Grant Aid.

2-4 Project Operation Plan

2-4-1 Organization

The Providence fishing port is operated by SFA (implementing agency), which is under the supervision of Ministry of Fisheries and Agriculture as public facilities, and the SFA takes all the responsibility for construction and operation maintenance of fishing port with associated facilities. The maintenance system will continue from that created in Phase 1. Because new ice making facilities will be introduced, new personnel (engineering staff) will be employed to operate and maintain them. Some SFA employees have been laid off following a 2011 IMF policy of reducing public sector employees. At the SFA, employees in the Economy and Statistics Department and the Development Department, respectively, are creating systems wherever necessary to deal with the work involved in fishery statistics and fish measurement included in the work content of fishing port management. As a result, Providence Fishing Port is currently operated and maintained by 8 employees of the Fisheries Design and Planning Division. Of these, the Fishing Port Superintendent is selected from the staff of SFA Headquarters, and has responsibility for managing all fishing ports under the SFA's jurisdiction. Since ice making facilities will be additionally introduced in this Project, 2 members of personnel (engineering staff) needed to operate and maintain them will be employed.

There will be sufficient technical capability for maintaining the expanded part of fishing port facilities in Providence district developed under this Project, as staff of SFA Headquarters will give technical support and guidance. Refrigerated equipment engineers newly employed in Providence Fishing Port facilities will be in charge of maintaining the ice making machines.

To solve problems arising in the operation and use of Providence Fishing Port facilities, the SFA plans to set up a Fishing Port Management Committee as a body coordinating between fishing port users and government-related bodies. This will ensure that the facilities are used effectively.

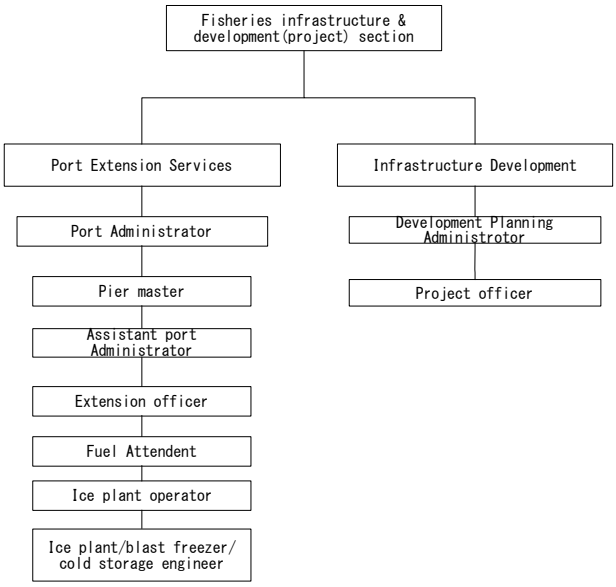


Figure 2-4(1) Organization structures

To solve problems arising in the operation and use of Providence Fishing Port facilities, the SFA plans to set up a Fishing Port Management Committee as a body coordinating between fishing port users and government-related bodies. This will ensure that the facilities are used effectively.

The Committee consists of members from the Seychelles Port Authority (SPA), Seychelles Maritime Safety Administration (SMSA), Fishing Boat Owners Association (FBOA), and Seychelles Fishing Authority (SFA), and is chaired by the CEO of the SFA.

2-4-2 Personnel Plan

The work content and management organization of personnel involved in operating and maintaining Providence Fishing Port are shown in Table 2-4(1) and Fig. 2-4(1). An annual budget from the FPA fund is earmarked for the SFA as an education and training budget for the fisheries sector. This is being used as a framework for strengthening the capabilities of the Fishing Port Superintendent. Table 2-4(2) shows training held so far and due to be held in future. A "Port and Harbor Management and Operation" course was held by STET (Singapore) in 2015, and training on port and harbor management has been held by the International Maritime Organization since September of the same year. As well as this, there are plans to attend the "Port Efficiency Management Course" and "Strategic Port Pricing and Commercial Billings Management Course" training courses offered by TTPM International Consultants Ltd. of the UK.

Table 2-4(1) Work content for operation and maintenance of Providence Fishing port

Personnel	Work Content	Number
Port Manager	General management representatives, Coordination with SFA, MFA, FBOA	1
Administrator	General affairs, accounting and the office work	1
Pier master	Responsible for quay use	1
Dep. Port Manager	Support of Port Manager	1
Enforcement officer	To monitor illegal operation of fishing vessels in Providence Fishing port	1
Fuel Sales	Supply of water, fuel and collect payment	1
Ice making facility operator	To sell ice and collect payment	1
Ice-making facility engineer	Engineer responsible for maintenance of ice-making facility	2
Maintenance engineer	Engineer responsible for maintenance of electric, water, and drainage	1
Cleaning	Cleaning within the port and office building	Outsourcing
Security	Security of the port	Outsourcing

Table 2-4(2) Training Programs for Fishing port operation

Training Course	Institution	Place	Periods
Port management and operation	ST Education and Training Pte. Ltd.	Singapore	Jan, 2015
Port management and operation	International Maritime Organization	France	Sep, 2015
Port Efficiency management	TTPM international consultants	UK	August, 2015
Strategic Port Pricing & Commercial Billings Management	TTPM international consultants	UK	Oct. 10,2015

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

(1) Project cost Estimate

The cost borne by the Government of Seychelles is estimated tentatively. Total cost will be 5,100,000 Seychelles Rupee (SCR). Details are shown in below.

a)	To obtain the approval of EIA (Environmental Authorization)	SCR 145,000
b)	To open the Bank Account/ Advising commission of A/P and payment commission	SCR 155,000
c)	To obtain the planning/construction/building/ development permission	SCR 150,000
d)	To clear, level and reclaim the Project sites	SCR 350,000
e)	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products.	SCR 4,200,000
f)	To construct the gates and fences in and around the ice plan facility	SCR 100,000
	Total	SCR 5,100,000

This amount must be secure to budget as the cost for the implementation of the project from National Budget by SFA. It has been confirmed at the time of Explanation of Draft Final Report that the SFA are to secure the budget by applying the budget to the MFTBE.

(2) Conditions for estimation

a)	Time of estimation:	June 2015
b)	Exchange rates:	US$1=¥ 122.47 SCR1= ¥ 9.35
c)	Procurement Period:	Detailed designs and procurement periods are as note in the Implementation Schedule.
d)	Other matters :	Estimation shall be conducted based on the Grant Aid cooperation scheme of the Government of Japan.

2-5-2 Operation and Maintenance Cost

(1) Estimation of Project cost

With the annual operational revenue of the Providence fishing port after the implementation of the project estimated as SCR 2,465,000 and the annual expenditure as 695,800, the Providence fishing port is expected to yield an annual profit of SCR 2,465,000. With maintenance/repair cost and depreciation cost for the facilities includes in the expense item. Accordance with the balance, feasibility is reasonable and stable financial operation and securing of budgets expected to be require in future for large scale replacement of facilities and replacement work. Meanwhile, it is not sufficient operating revenue in the amount considering the balance of the maintenance of long-term perspective.

As for this background, artisanal fishermen were supported were supported with governmental subsides by electricity and the water cost was paid by the government.

In this background, as parts of the policies.to the artisanal fisherman, subsidy was granted to ice production cost, including electricity and water consumption. In addition, as for the profit to be available by sale of the ice, the budget of maintenance and the repair of ice-making facility needs request to Ministry of Finance. In addition, maintenance, repair, and the depreciation cost are included in the expenditure. Respect to the financial aspect for mid to long term periods, the securing of the budget are require for the large scale replacement and re-construction cost.

1) Balance

In the test calculation of the income and expenditure of the project, estimation was made based on the achievements from Phase 1. Achievement for revenue was calculated from the increase number of staffs for ice-making facility fishing and additional ice production from ice-making facility is conducted. Conversely ice production from newly installed ice machine from Oceana fisheries were not include in estimate since this machine will be removed by SFA to Ansé la Mouche, once the Project is completed.

2) Revenue:

Sales of ICE: The existing Ice-making facility (5t/day x 2 set) of the Providence fishing port, current ice production is 5.0 t/day.

Table 2-5(1) Approximate cost estimation of facilities

Item	Price (SCR)	Remarks
Expenditure		
Personal cost	637,800	Calculated from information based on Phase 1(additional two staff have been increased for ice making facility) according to Table 4-2(1)
Electricity	0	Paid by Government subsidy
Water	0	Paid by Government subsidy
Maintenance cost for facilities	58,000	0.1% from construction cost
Total cost	695,800	
Income		
Sales of ice	2,700,000	(15ton/day×25days×12month)/50 kg×30 SCR
Rental fee for Fishermen's gear storage	201,600	700 SCR × 24 rooms × 12month
Electric supply for Refrigerated container	259,200	7,200 SCR/month×3 sets×12month
Drinking water		Drinking water supply to fishing vessel
Total income cost	3,160,800	
Grand total	2,465,000	

(2) Expenditure

Newly Income generating facility for Providence fishing port in the Project is ice-making facility. Table 2-5(1) shows water, and table 2-5(2) shows electric consumption to produce 10 tons of ice. All of the cost are born and paid by Seychelles government, as a part of subsidization to artisanal fishing sector.

Table 2-5(2) Water consumption for Ice making facility (daily)

Component	Volume (ℓ)	Cofactor	Efficiency	Time	Total (ℓ)
Ice Production (volume)	5,000	1.1	1.0		5,500
Cooling water (circulation) : specification 250 liter /min	7.5	1.03	1.0	1,440	11,124
				Total (one unit)	16,624
				Total (two unit)	33,248

Water consumption volume：33.248 m^3/day = 831.2 m^3/month

Table 2-5(3) Electric consumption for Ice making facility (daily)

Component	Currency (kw)	Cofactor	Require volume	Time	Daily volume
Compressor	22	0.7	15.4	1	369.60
Ice machine					
Ice crusher	1.5	1.0	1.5	0.166	5.98
Circulation system	0.75	1.0	0.75	1	18
Evaporator					
Motor fan	1.1	1.0	1.1	1	26.4
Motor fan	1.1	1.0	1.1	0.334	8.82
Circulation motor	0.4	0.8	0.32	1	7.68
Motor compressor (water circulator)	0.4	0.8	0.32	1	7.68
				Total (one unit)	444.15
				Total (two units)	888.31

Electric consumption volume：888.31 kwh/ day = 22,207.75 kw/month

Table 2-5(3) shows a result of running cost of ice making facility based on the on electric and water consumption require from Table 2-5(4). Electric and water price is divided into three category depend on the consumption volume as shown in Table.

The expense to produce the ice (exclude personnel expenses) is shown in table 3-4-3 (4) and calculated to SRC 482.62 for production of one ton of ice. 70% of sales price is cost of electric and water for production of one kilogram of ice (0.64-0.71 SCR/kg).

In other words, 120,655 SCR/ months is newly added to the expenditure as the running price for a new ice making facility. Balance can be maintain long as the income from newly produced 10 tons of ice is sold with the equal amount of price (50kg for 30 SCR).

Balance for the ice making facility:

Income from - Expense (water & Electric) = 150,000 - 120,655 = 29,323 SCR/ month

Table 2-5(4) Expenses of newly install Ice making facility (monthly)

Expense Item	Price (SCR)	Base of calculation
Water	29,178.77	Water consumption fee=(1)+(2)+(3) +(4) (1) Base rate, Environment tax：SRC 25 Consumption rate (2) 0-5 m^3：@113.18/ m^3 SRC 565.9 (3) 5-100 m^3： @27.61/m^3 SRC 2622.95 (4)100 m^3 or more: @35.51/m^3 SRC 25964.91
Electric	91,476.81	Electric consumption fee=(1)+(2)+(3)+(4) (1) Base rate：SRC 2,497.5 Consumption rate： (2) 0-500kw：@3.12 /kw SRC 1560.00 (3)500-1,000kw: @3.48 /kw SRC 1740.00 (4) More than 1,001kw :@4.04 /kw SRC 85679.31
Total amount	120,655.57	

(3) Recommendation to operation and management

a) A Fishing Port Management Committee should be created to manage the fishing port. It is recommended that operational plans be drawn up to ensure that effective use is made of the port, and to diversify revenues obtained from fishing port operation. In particular, regular exchanges of opinion should be held with fishing port facility users (fishermen), and the operating rules of the fishing port should be made clear. The existing system of levying fishing port usage fees should be revised, and the operation of a safe and easily usable fishing port should be planned. On fishing port usage fees, levies should be differentiated according to types of fishing boats, motor vehicles, length of stay in the port, etc. To reduce administrative burdens for the levying authority, it is recommended that an annual system or a ticketing system be introduced as the format for levying usage fees. A Fishing Port Administration Committee should be created to manage the fishing port. It is recommended that operational plans be drawn up to ensure that effective use is made of the port, and to diversify revenues obtained from fishing port operation.

b) Equipment newly added under this Project will consist of ice making facilities. Besides personnel costs, the cost of operating ice making facilities includes the cost of electricity, water supply and consumables. There will be no addition to the operating costs in connection with electricity and water supply charges, since, as stated above, these are subsidized by the Ministry of Finance Trade and Blue Economy to artisanal fishermen. Even without this subsidy, as far as the ice making machines added in this Project are concerned, the outlay will be covered by revenues from sales as long as ice can be sold at appropriate prices. As such, there is expected to be no addition to the subsidy amount. On the other hand, outlays of maintenance costs in periodically aggregated sums are assumed in connection with the maintenance of these fishing port facilities, as shown in Table 2-5(6). Items related to the ice making equipment, in particular, would include compressor lubricants, compressor parts, compressor units, replacement of principal parts

and replacement of exhaust fans. To properly secure the funds needed for these, it would be sensible to reserve part of the revenues arising as outlined above every month as a maintenance fund, and to furnish this for expenditure on maintenance. By setting aside 2,900 SCR (10% of projected revenues) every month from revenues as shown in Table 2-5(5), it should be possible to secure funds for the maintenance of ice making machines.

Proper maintenance plans should be created for the ice making facilities. Staff in charge of maintaining ice making facilities should be employed and daily records on the ice making machines kept. Education and training on monthly or six-monthly periodic maintenance should be given. An ice making engineer should be employed while the ice making facilities are being constructed, and should be asked to participate in soft components.

Table 2-5(5) Long and mid term maintenance plan and reserve fund(SCR)

Item	After 2.5 years	After 5 years	After 7.5 years	After 10 years	After 12.5 years	After 15 years	After 17.5 years	After 20 years
Lubricant oil for Compressor, Ice-making facility	4,300	4,300	4,300	4,300	4,300	4,300	4,300	4,300
Replacement for Motor, Spare parts for (Ice-making facility)		150,000		150,000		150,000		150,000
Replacement spare parts for (Ice-making facility)				300,000				300,000
Maintenance and operation cost (total)	4,300	154,300		454,300	4,300	154,300	4,300	454,300
Sum of Maintenance and operation reserve fund	87,000	169,700	435,400	855,400	821,100	1,236,800	1,502,500	1,918,200
Maintenance and Operation fund (Total Balance)	82,700	15,400	435,400	401,100	816,800	1,082,500	1,498,200	1,463,900

2-5-3 Technically concerned in operating fishing port

(1) Limitation of number of vessels to use port

In this project, the construction of Quay No.1 and No.2 where the width of tandem mooring water area become about 28m are planned and in this occasion, the average LOA of target vessels is 13.4m (maximum LOA is 24m).

However, in case that Quay No.3 is going to be constructed in the future, as Figure 2-5(1) shown, safe vessel maneuvering area in view of port operation becomes 60m as the diameter of vessel turning and therefore, it is ideal to limit the LOA of target vessels to use port as 20m.

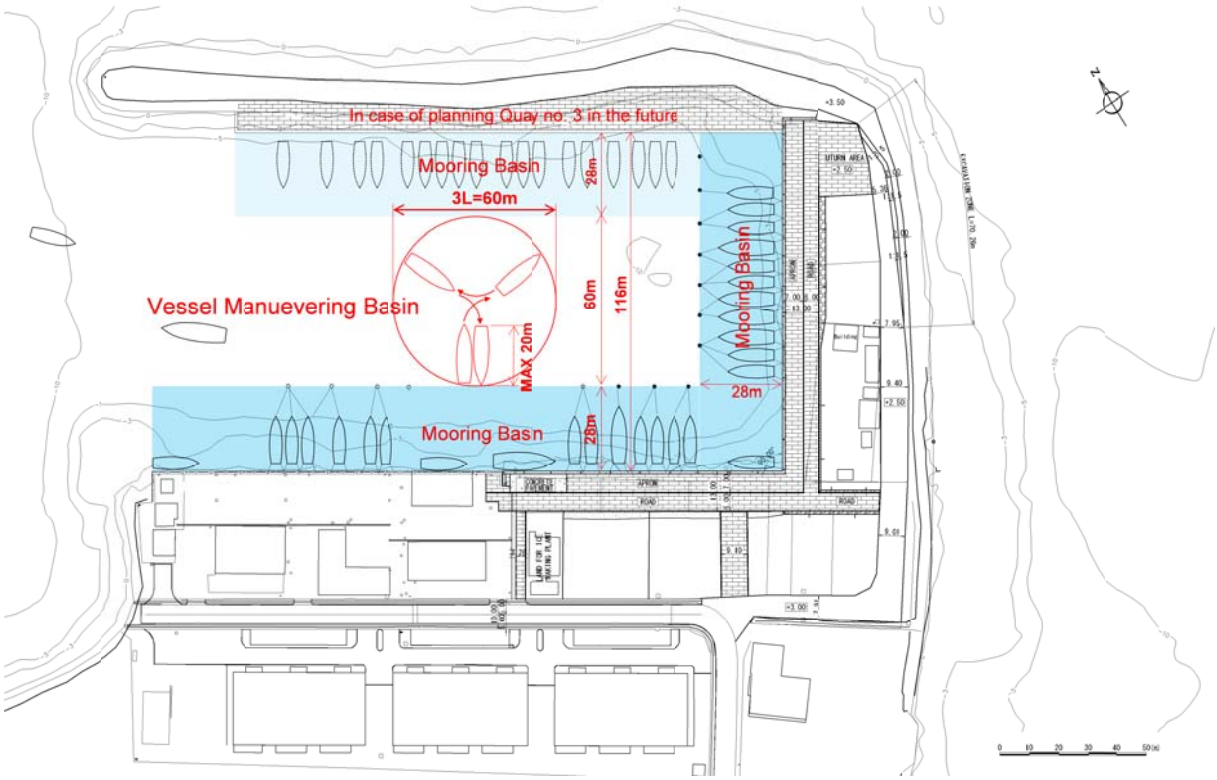


Figure 2-5(1) Future utilization plan of vessel maneuvering area and mooring water area

(2) Relation between port maintenance dredging and quay structure

The water depth in Providence fishing port is -2.5m in front of quay and about -10m at the center of port and it is considered that shoaling or deposition phenomena by sediment transport is minor since there is almost no change now comparing with the time of Phase 1 completion February, 2010. However, as landfilling development is proceeded in the east coast of Mahé Island as a whole, there will be possibly changed in its water depth in the port by the changes of currents or waves in the future. Therefore, it is ideal to execute a periodical sounding survey annually by SFA and if shoaling in the port will be confirmed in some distant future, the

maintenance dredging by the hand of government of recipient country shall be necessary.

While, in this project, the target water depth is setup as -2.5m in quay No.1 and -3.0m in quay No.2 and the structural design of steel sheet pile type quay is executed. For this reason, in case that dredging in front of quay is necessary in the future, it is necessary to excavate the foundation not deeper than -2.5m.

2-5-4 Recommendation

Providence fishing port is respected to maintain to operate after the implementation of the project by the SFA. However, implementation agency will have responsibility to keep budget to ensure sustainable medium- and long-term operation maintenance cost for appropriate depreciation.

It is recommended to secure the reserve funds for items as shown in Table 2-5(6) and Table 2-5(7) for sustainable operation of the project.

Table 2-5(6) Long term Maintenance Cost for Facilities

Interval	Cost (SCR)	Remark
5 years	214,000	Facilities painting, Repairmen of the port facility
10 years	428,000	Exchange of pump system

Table 2-5(7) Maintenance cost for Equipment

Interval	Cost (SCR)	Remark
2.5 years	43,000	Lubrication oil for refrigerating compressor, Refrigerant
5 years	150,000 210,000	Refrigerating compressor, Replacement of parts Bollards (10% of bollard to be change)
10 years	300,000	Refrigerating compressor, Replacement of main part, Replacement of ventilation fan