Pohnpei Port Authority (PPA)
Federated States of Micronesia

Data Collection Survey on Port Development in Federated States of Micronesia

Final Report

July 2019
Japan International Cooperation Agency (JICA)

Ides Inc.
The Overseas Coastal Area Development Institute of Japan (OCDI)
ECOH CORPORATION
Fisheries Engineering Co., Ltd

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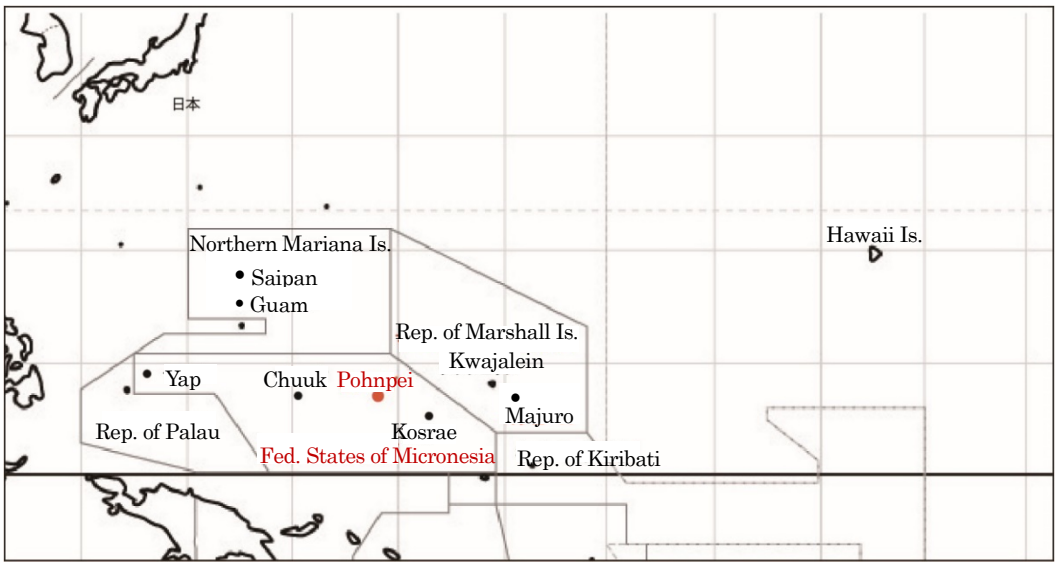


Fig.-1 Location of the Federated States of Micronesia

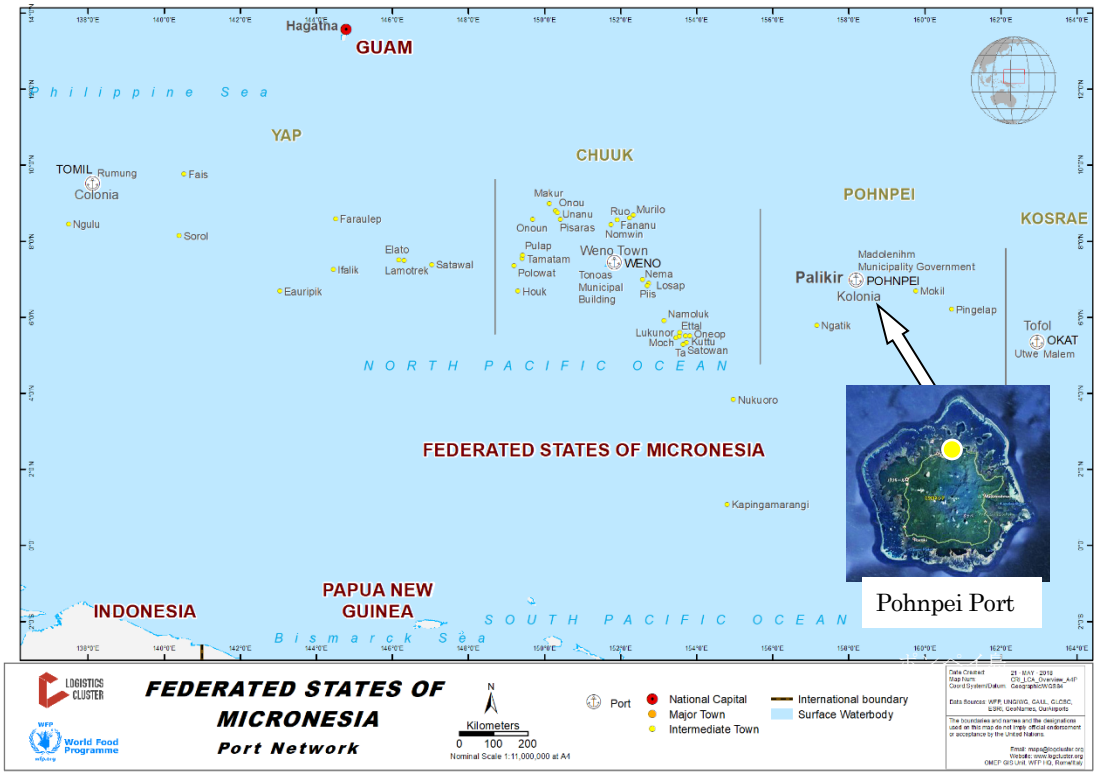
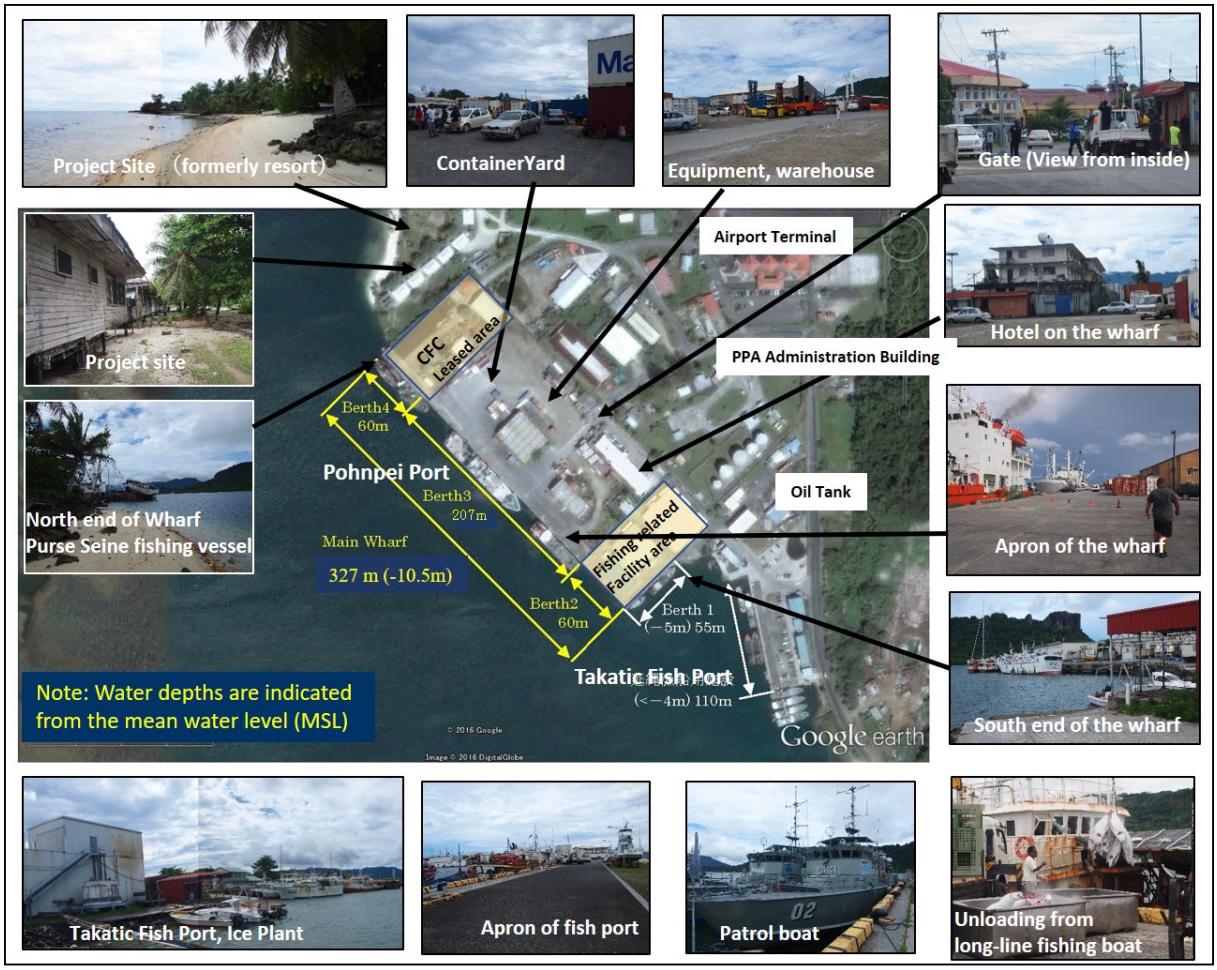


Fig. -2 Federated States of Micronesia and Pohnpei Island

Prepared by Survey Team

Fig.-3 Conditions around Pohnpei Port Area



Prepared by Survey Team

Fig.-4 Port Facilities in Pohnpei Port

Source: PPA (Aerial Photo taken by a Drone on Feb. 2, 2019)

Fig.-5 Bird-eye view of Pohnpei Port

ABBREVIATIONS

ADB	Asian Development Bank
CCTV	Closed Circuit Television
CDM	Cement Deep Mixing
CFC	Caroline Fishing Corporation
CIQ	Custom、Immigration、Quarantine
COD	Chemical Oxygen Demand
COFA (Compact)	Compact of Free Association
CSP	Conservation Society of Pohnpei
DDT	Dichlorodiphenyltrichloroethane
DL	Datum Level
DO	Dissolved Oxygen
DWT	Deadweight Tonnage
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EDA	Economic Development Authority
EIA	Environmental Impact Assessment
EIS	Envritonmental Impact Statement
EPA	Environmental Protection Agency
FAA	Federal Aviation Authority
FADS	Fish Aggregating Devices
FAO	Food and Agriculture Organization
FFA	Pacific Islands Forum Fisheries Agency
FSCO	Federal Shipping Corporation
FY	Fiscal Year (Oct. - Sep.)
FSM	Federated States of Micronesia
GI	Galvamized Iron
GPS	Global Positioning System
GRDP	Gross Regional Domestic Product
HHWL	Highest High Water Level
IA	Initial Assessment
IATTC	Inter-American Tropical Tuna Comission
IEE	Initial Environmental Examination
IMF	International Monetary Fund
ISPS	International Ship and Port Facilit Security Code
JICA	Japan International Cooperation Agency
LLWL	Lowest Low Water Level
LOA	Length Over All
LTFV	Luan Thai Fishing Venture

MELL	Marina Express Line
MHWL	Mean High Water Level
MLWL	Mean Low Water Level
MWL	Mean Water Level
NFC	National Fisheries Corporation
NGO	Non-Governmental Organization
NOAA	Naional Oceanic and Atmospheric Administration
OLS	Obstacle Limitation Surfaces
PAPs	Project Affected Persons
PFC	Pohnpei Fishing Corporation
PH	Potential of Hydrogen
PIC	Pacific Island Countries
PNA	Parties to the Nauru Agreement
PPA	Pohnpei Port Authority
PRIF	Pacific Region Infrastructure Facility
PVC	Polyvinyl Chloride
PUC	Pohnpei Utility Cooporation
RoRo	Roll-on Roll-off
SCP	Sand Compaction Pile
SPC	Secretariat of the Pacific Community
SPREP	Secretariat of Pacific Regional Environment Programme
SS	Suspended Solids
TA	Techinical Assistance
TEU	Twenty-foot Equivalent Unit
T&I	Transport & Infrastructure Division
TMC	Taiyo Micronesia Corporation
USGS	United States Geological Survey
VDS	Vessel Day Scheme
VHF	Very High Frecuency
VTS	Vessel Traffic Services
WCPFC	Western Central Pacific Fisheries Commission

Summary

1. Introduction

On Pohnpei Island, where the capital of the Federated States of Micronesia (FSM) is located, Pohnpei Port is an important logistics facility. The number of vessels calling at the port once decreased significantly from 2015 to 2016, but began to increase in 2017, and in 2018 returned to the level of 2010 to 2013. The main types of vessels calling at the port are cargo vessels (container vessels and tankers), fishing-related vessels (purse seine fishing vessels, longline fishing boats and fish carriers). Among these types of ships, purse seine fishing vessels made the largest number of port calls every year, about 400 calls except for FY2015 and FY2016, followed by long-line fishing boats that made port calls of 100 to 150 over the period from FY2013 through FY2018. Port calls by container vessels were around 50 except for the period from 2015 to 2017, while tankers made 10 to 15 port calls over the period from 2013 to 2018.

Pohnpei Port has two wharves, one is the main 338m long wharf where all types of vessels including cargo ships, purse seine fishing vessels, fish carriers and domestic passenger-cargo vessels are moored, and the other is the fishing wharf that is designated for the mooring of long-line fishing boats. Pohnpei Port is, thus, a port that plays roles of commercial and fishing ports. The biggest issue of the port is the congestion particularly at the main wharf due to many purse seine fishing vessels multiply moored at both ends of the wharf. Especially during high fishing season, more than 10 purse seine fishing vessels stay at the wharf, and cargo ships have to dock within the space between the flock of purse seiner fishing vessels. This situation makes manoeuvring of cargo ships very dangerous.

To cope with this situation, improvement plans have been prepared by the Pacific Region Infrastructure Facility (PRI) and ADB since 2010.

2. Purpose of the survey

This survey has been carried out with the following aims:

- to review those expansion plans proposed in the historical studies to cope with the congestion of Pohnpei Port
- to collect vital information and data required for the confirmation of the feasibility of the proposed plans,
- to realize the existing situation of the infrastructure, facilities, wharf operation of the port including Takatik Fish Port,
- to examine the proposed plans and other possible alternative plans based on the collected information,
- to make recommendations of possible measures to mitigate congestion and enhance operational capacity of the port.

3. Socioeconomic situations of FSM

The population growth rate of FSM used to be 2 to 3 % until large population outflow started in 1997, and,

thus the rate remains at 0.17% thereafter. The growth rate of GDP per capita is estimated to be around 0.5% in the coming few years (IMF). Among the four states of FSM, GRDP, population and GRDP per capita in the other three provinces remain almost the same level, while, in Pohnpei State increasing trends are seen in all these socioeconomic indicators.

The import cargo volume except oil at the Pohnpei Port has been forecasted up to 2035 on the basis of the statistics of PPA over the past eight year period from FY2011 through FY2018, and the volume of import cargoes in FY 2035 is estimated to be 42% larger than that recorded in FY2018, which corresponds to 2% annual growth rate. Since no statistics data of export cargoes were available from PPA day-to-day container operations, records for the past three calendar years were obtained from FSCO, the stevedoring company of the port. The records show that, the number of laden export 20-foot containers has increased by only 62% from 130 boxes in 2016 to 210 boxes in 2018, while that of 40-foot box has increased by 100 boxes per year from 104 boxes in 2016 to 321 boxes in 2018. Taking into consideration the fact that the principal export commodity of FSM is tuna and bonito, it is most likely that the export volume of frozen fish has increased, but, due to lack of records, it is unable to be determined whether the container boxes are dry or reefer. In fact, the transhipment volume, from long-line fishing boats to reefer containers has increased by 70% from 2,250 tons in FY 2017 to 3,840 tons in FY2018.

4. Current situation of Pohnpei Port

(1) Number of vessels called at Pohnpei Port

Two shipping lines, namely Kyowa Line and Marine Express Line (MEL), operated regular services via Pohnpei Port throughout the year in 2018. Each shipping line provides bi-weekly service and a total of 54 port calls were made by the two shipping lines in FY2018. Except for the period from FY2015 through FY2017, container vessels used to call about 50 times a year over the period from FY2010 to FY2014. It is assessed that the frequency of port calls by container vessels has been recovering.

Vessels related to fishery calling at the Pohnpei Port are purse seine fishing vessels having LAO of 70 to 80m, long-line fishing vessels having LAO of 20 to 50m and fish carriers having LOA of 90 to 120m, and the number of port calls in FY2018 by the three types of vessel were 415, 136 and 138, respectively. The number of port calls made by purse seine fishing vessels in FY2018 is comparative to the number of calls recorded over the peak years of from FY2010 to FY2013, and, in FY2015 and FY2016, the number fell down to about a half. In accordance with the decrease in port calls by purse seine fishing vessels, the number of fish carriers also decreased during the same period, but recovered since FY2017. Such a fluctuation in the number of port calls by purse seine fishing vessels results from a change of fishing sites which may be linked with el Nino, since the fishing vessels tend to call at the nearest port for transshipment of their fish catch. Port calls by purse seine fishing vessels are concentrated during high fishing season in May and June and more than 10 purse seine fishing vessels were moored at the main wharf almost every day in 2018.

The number of port calls by long-line fishing boats once reached 550 in FY2009 but thereafter kept decreasing until it reached just 100 in FY2013. It has maintained 100 to 150 over the past five years.

(2) Utilization of the main wharf.

Long-line fishing boats are moored at the wharf in the fishing port. Their fish catch is unloaded at the wharf and stuffed into 40' reefer containers. The reefer containers are put either on the chassis on any space available within the fishing port or at the reefer container stacking yard on the main wharf area, and stay there until the arrival of a container vessel. Some of the fish catch is processed at the port, put in carton boxes and then exported by air.

The 60m long portion at the north end of the main wharf is leased to CFC for their exclusive use to moor purse seine fishing vessels, while another 60m long portion at the south end of the wharf is allocated for mooring of fishing related vessels, i.e. purse seine fishing vessels and fish carriers. It is usually seen that purse seine fishing vessels are multiply moored at the both ends of the wharf. Cargo ships are the priority users of the 218m long portion in the middle of the wharf, where any type of vessels may dock while no cargo vessels are in the port.

So far, fish catch brought by purse seine fishing vessels to the port has usually been transhipped at the anchorage. However, it was said that sometimes purse seine fishing vessels unload their fish catch on the middle portion of the wharf and stuff the fish in reefer containers on the spot. In fact, Study Team saw such scenes twice during its a month-long stay in Pohnpei. Though how much fish have been exported by reefer containers is unknown due to the lack of statistical information of export containers. This type of fish transhipment seems to have resulted in the rapid increase in the export laden 40-foot containers over the past few years. It is expected for export containers to increase in the coming years.

In addition to cargo ships and fishing-related vessels, the port also is called by yachts and research vessels, as well as two passenger-cargo ships, namely, Micronesian Navigators and Caroline Voyagers based at Pohnpei. These interisland ships call the port twelve times a year.

(3) Situation of fishery within Micronesia Region

The current situation of fishing activities in the Micronesia Region is characterized as follows:

a. Countries in the Micronesia region tend to tighten restrictions on pelagic fishing in this region. The volume of transshipment is expected to increase in the future, because of an increase in the cost of directly bringing fish back to home countries such as to Japan due to the prohibition of transshipment in high sea (international water), pressures to promote local corporation by these countries by the reduction in entering fee, etc..
b. At Pohnpei Port, most of the purse seine fishing vessels are currently transshipping their fish catch to fish carriers at the anchorage of the port.
c. Fish carriers tend to stay at the anchorage for a few weeks to a month and sometimes cause environmental issues such as the disposal of sewage, ballast water and waste oil, etc. Movements requesting phasing out carriers and transference from the anchorage is attracting attention of people. In response, there is a trend for purse seine fishing vessels to transfer fish to reefer containers at

wharf. In fact, the Survey Team observed purse seine fishing vessels unloading fish and stuffing into reefer containers. Current fish transference at the wharf seems to be at trial stage, which may indicate the direction of development of the port. It is foreseen that more purse seine fishing vessels tend to carryout transference if work space on the wharf is available to these fishing vessels.

d. In Majuro, Marshall Islands, a private company is developing an integrated fishing base port that is not only mooring facilities for purse seine fishing vessels but also provides maintenance yards of fishing nets and facilities for the transshipment of fish such as a cold storage and a reefer container yard. The company also has further development plans to construct oils storage tanks for fuel supply and shipyard for the maintenance and repair of fishing vessels. This indicates that there is a movement among those countries in the Micronesia region to develop fishery businesses as a core industry to maximize the benefit from their own EEZ by promoting joint ventures for rationalizing domestic fishing companies, creating job opportunities by establishing fish processing factories, logistics businesses for supply and maintenance of necessary consumables and equipment related to fishing.

   Thus, it seems to be very urgent for Pohnpei Port to promote transshipping and processing businesses in the port area as well as conventional services such as mooring, supply and maintenance of nets and machines.

e. Longline fishing boats have already adapted transshipment at the quay in the fishing port zone of Pohnpei Port. A processing firm is performing fish related businesses: sorting fish for “Sashimi” from processing, and exporting fresh tuna by air, keeping good quality by taking advantage of the proximity to the airport.

(4) Issues of Pohnpei Port

a. Issues of channels, anchorage and basins

   The main issues at the Pohnpei Port are the configuration, width and the existence of shallow spots of the access navigation channel and the lack of aids to navigation, which makes manoeuvring container ships dangerous when they enter and leave the port. In particular, the narrow width of the port entrance channel, which is the opening of the atoll, and the occurrence of a strong tidal flow makes the situation extremely dangerous. While the improvement of configuration, width and depth of the channel is urgently needed, the implementation of this work is quite difficult technically and financially because a large number of shallow spots are scattered over a wide area. It is indispensable to begin with conducting hydrographic surveys to formulate dredging plans realizing the existing situation. For the meantime, it is urgent to repair and improve navigation aid facilities.

b. Issues of mooring facilities

   Another serious issue is the lack of capacity of the mooring facilities due to multiple functions of the main wharf of the port: The main wharf of the port is used for both the commercial port function and the fishing port function.

- A large number of purse seine fishing vessels are moored at the wharf during the high season for fishing. In general, the period of ship-in-port is much larger for fishing vessels (average period of purse seine vessels is 7.6 days) than that of cargo vessels (the average is 2 days).
- Because the middle part of the wharf is designated for cargo vessels, the latter have to dock in between multiply moored purse seine fishing vessels, thus their arrivals and departures are extremely dangerous.
- The security control of the container terminal is difficult to conduct strictly, because of the mixture of functions of commercial and fishing port functions.

c. Issues as container wharf

- Because the strength of the existing wharf is unknown, it is difficult to introduce heavy-duty equipment for cargo handling and to judge whether the wharf is strong enough to moor a cargo vessel having DWT of exceeding 10,000 DWT.
- As the container yard is unpaved, transportation and stacking of containers are unstable and efficiency of cargo handling operations remains unimproved.
- Due to the lack of lighting facilities, loading and unloading work is performed during daytime only and, therefore, night hours cannot be efficiently used for cargo operations. The installation of lighting facilities is also essential for security of the port.
- There are various buildings on the main wharf that are not necessary for the operation of the wharf. These buildings sometimes interfere with cargo handling operations.

d. Other components to upgrade port services

As indicated in the plan by PRIF and ADB, water supply and refueling facilities, waste treatment facilities and firefighting facilities need to be installed and/ or improved.

5. Evaluation of the proposed project sites

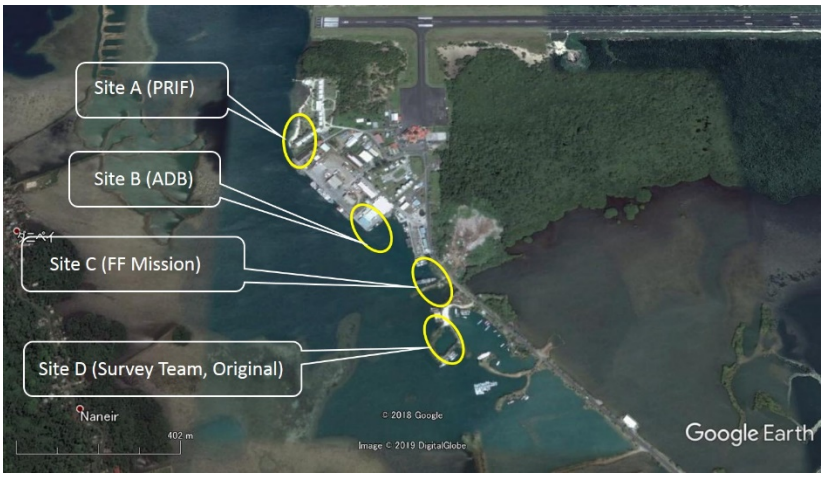
(1) Proposed project sites

Four project sites have been proposed as shown in Figure- 1.

1) The area on the north of the main wharf proposed in PRIF (Site A)
2) The area on the south of the main wharf proposed in ADB report (Site B)
3) The area to the south of fishing the port zone proposed by JICA Fact Finding Mission (Site C)
4) The area further to the south of the fishing port zone added by Survey Team at the start of the survey (Site D)

(2) Results of the examination of the four alternative project sites

The results of the examination and comparison of the four alternative project sites are summarized as follows:



Source: Survey Team

Figure- 1 Alternative proposed project site for examination

On the basis of the following reasons, it was judged that Site A is the only suitable site for the construction of a quay:

- Sites C and D have disadvantages that the dredging volume is greater than Site A,
- Site D may cause more complicated issues with landowners than Site A because the consent with landowners is essential. Above all, the ground condition is likely to be worse than Site A.
- Site B seriously interferes with the operation of the existing fishing port.
- Site A has a potential to provide a large back up area for the port related businesses.

6. Proposals by Study Team

(1) Requirements for the development plan

Pohnpei Port is expected to play the following roles:

- Basic function as a port: safe operation of cargo and fishing vessels in the port area,
- Function as a commercial port: efficient cargo handling and secure port security
- Function as a fishing port (1): mooring fishing vessels, repair and maintenance and supply
- Function as a fishing port (2): transhipment, sorting, processing of fish

To fulfil these requirements, Pohnpei Port need to settle existing issues. Among others,

for cargo vessels, the following issues have been identified

- The mooring capacity of the existing wharf structure is insufficient to moor large cargo vessels, which are the size of those currently calling at Pohnpei Port,
- Deteriorations of the main wharf by aging,
- Insufficient security and safety systems of the container terminal and limited yard space.

and for fishing port function: the following issues have been identified:

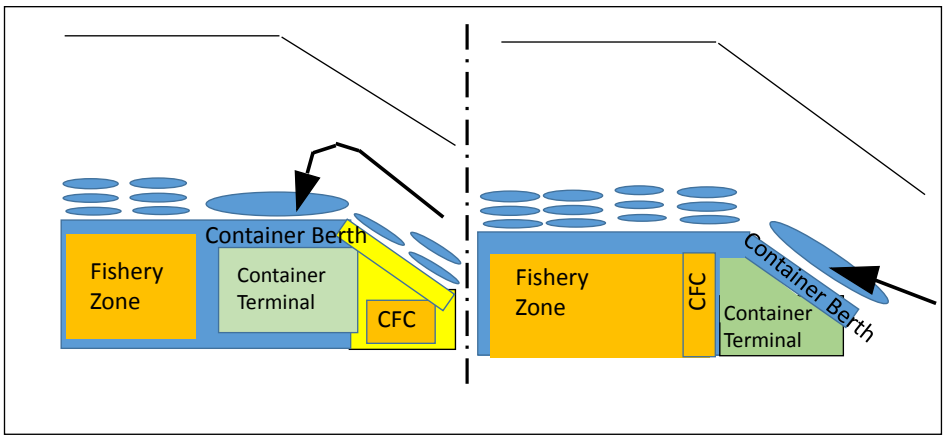
- Provision of yard and facilities for efficient fish transshipment from sea to land as well as mooring capacity for fishing vessels,

- Mitigate the congestion and the interference between cargo vessels and fishing vessels.

Taking into consideration these issues, Survey Team recommends to reconsider the usage of the new quay to be constructed, where it would be surely suitable to use it for mooring purse seine fishing vessels.

The previous studies and this study have been focused on the congestion caused by the fishing vessels and the development of mooring facilities for purse seine fishing vessels. The proposal by PRIF recommends that area currently exclusively used by CFC should be relocated to the new wharf in order to provide additional berth length for cargo vessels in the existing wharf. This proposal is schematically shown in the left figure in Figure- 2. In such case, the difficulties and dangers for maneuvering cargo vessels remain unsolved since purse seine fishing vessels are expected during high seasons of fishing, and with the same utilization of the wharf, there is a high possibility for the purse seining vessels to be multiply moored during high seasons.

On the other hand, if the new quay is used to moor cargo ships, interference with the fishing vessels can be avoided (see the right figure in Figure- 2).



Plan by PRIF Alternative usage of the new quay

Source: Survey Team

Figure- 2 Mitigation of the conflict between cargo and fishing vessels and the integration of fishing zones

In order to make the new quay available to cargo vessels, the new wharf should be so planned and designed that the quay is robust enough to moor cargo vessels. In addition, by relocating the priority berth for cargo ships to the new wharf, the whole main wharf can be used for fishing port functions only and potentiality is given to the existing wharf to be developed as an integrated fishing port.

With the consideration described above, and for the reasons described hereunder, Survey Team has prepared a conceptual plan, a preliminary design and cost estimate for further examination of the technical and financial feasibility.

a. There is an anxiety if the size of the cargo vessels may currently exceed the design condition of the existing wharf.
   As the bearing capacities, against the impact force at the time a cargo vessel hits the wharf, that of the mooring bollards against the pulling force of moored vessel and that of the apron

against heavy cargo handling equipment and containers are unknown, a robust quay is necessary for safety and port operational viewpoints.

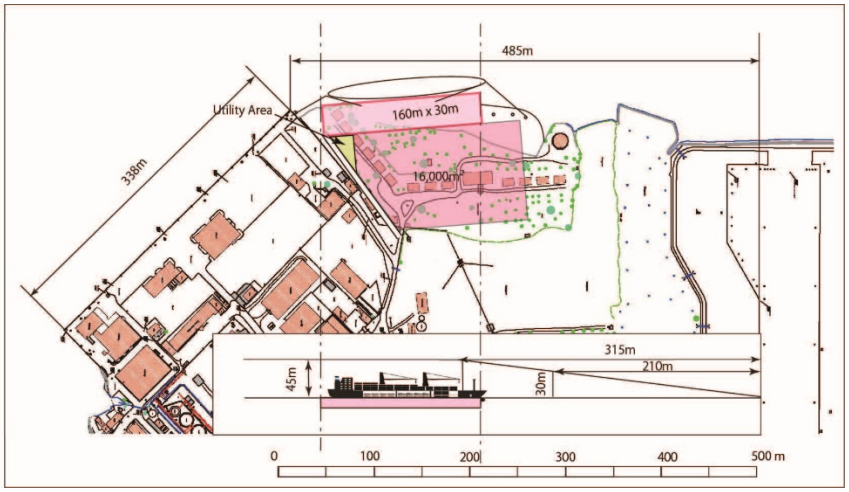
b. To secure land space for container terminal.
A land area of 160 m x 100 m can be created (assuming a total of 200 TEUs of loading and unloading: 10,000 m^2 for import and export container storage, 2,000 m^2 for empty container storage, 3,000 m^2 for cargo handling machines and 1,000 m2 for office building)

c. To be able to eliminate the effects of the mooring purse seine fishing vessels at the time of arrival and departure of container vessels and to ensure the security of the container terminal by complete separation of the terminal from the fishing port zone.

d. Integrated fishing port complex can be realized on the existing main wharf.

(2) Facility layout plan and project components

Figure- 3 shows a conceptual plan when the new quay is fully developed as a container terminal in the future.



Source: Survey Team

Figure- 3 Location of new quay and the layout plan

The container terminal shown in Fig.-3 will be fully and efficiently operated when all the following project components are implemented:

1) a new quay for mooring container vessels and container yard and access roads,
2) equipment necessary for container cargoes, lighting system, security system ,
3) services for calling vessels such as water and fuel supply, collection of garbage and waste oil.

In this study, it is one of the tasks to examine the feasibility of the project for a grant aid program by the Japanese government. Among others, some of the prerequisites are land tenure of the project site, technical aspects and the scale of the project. Thus, the project cost should be within a set limit, therefore, it is necessary to choose components for the project components. Survey Team classified the project components into three groups in accordance with the priority as follows:

1) Group A : Core component of the project (Priority 1)

（Key components of the project for a grant aid program of Japanese government）

a. Construction of a new quay having a length of 160m, apron width of 30m and water depth of -10m （Design ship dimension: container vessel having 15,000 DWT, length of 160m, and full load draft of 9m ）

a-1 Dredging/Foundation excavation,

a-2 Procurement of replaced sand and backfilling material,

a-3 New quay (including bollards/fenders, slope protection)

b. Pavement for wharf apron: 160m x 30m,

c. Access road (A) to the new quay: 1,000m^2.

2) Group B: Components other than new quay structure (Priority 2)

(Assuming fund sourced other than Japan's grant aid program: WB, ADB, State government, Private, etc.)

d. Dredging for turning basin (diameter 400m) in front of the new wharf (this component is given Priority 2, because for the time being, the existing turning basin can be used),

e. Pavement of container yard (160m x 100m=16,000m$^{2)}$

f. Fence/gate (4 gates and 600m-long fence)

g. Lighting facility (3 sets on new quay and 6 sets in container terminal)

h. Facility for reefer container (50 power supplies for reefer containers, 1000KVA backup generator)

i. Security/Monitoring facility (CCTV camera system)

j. Access road (B) to the container terminal

k. Water/fuel supply facility (2 water supply pits and 1 fuel supply pit in new quay)

3) Group C: those components proposed in PRIF and ADB reports that are not related to the new quay.

l. Sewage treatment facility (capacity: 5m^3/day, dilution tank, septic tank, water tank)

m. Waste oil disposal facility (capacity: 10m^3/day, Oily water tank. Oil separator, Filter and adsorption tank, Oil storage tank.)

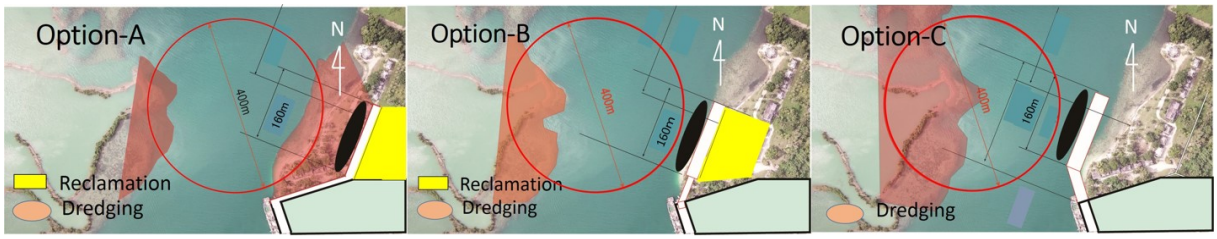
n. Improvement of access channel (Navigation aids)

(3) Layout plan and the estimation of project cost

a. Three options for the location of the face line of the new quay.

The construction cost of the new quay is greatly affected by the ground conditions of site of the construction. Detailed soil quality data were not available, but the soil conditions are expected to differ greatly depending on the location of the quay: whether on land or on the sea. Thus, three options have been chosen for the location of the construction of the quay:1) on land, 2) along shoreline, and 3) in the sea with the hypotheses that the soil condition would be worse toward seaside (to the west). On the basis of experience through the projects in the past (results of the boring surveys carried out during the implementation of the airport and fishing port projects) and the appearance of the sediment collected by Survey Team at the project site. The three options for the locations are figuratively shown in Figure- 4.

It should be noted that the examination of the three options at this stage of survey involves conditions other than soil conditions such as the volume of dredging, type of quay structure, amount of landfill, etc. In the structural design the most unfavorable soil condition is employed for all the three options, and that the design of the quay and the cost estimates should be carried out based on the actual soil data obtained by boring tests at respective locations.



Option A Option B Option C

Source: Survey Team

Figure- 4 Options of the locations of the new quay

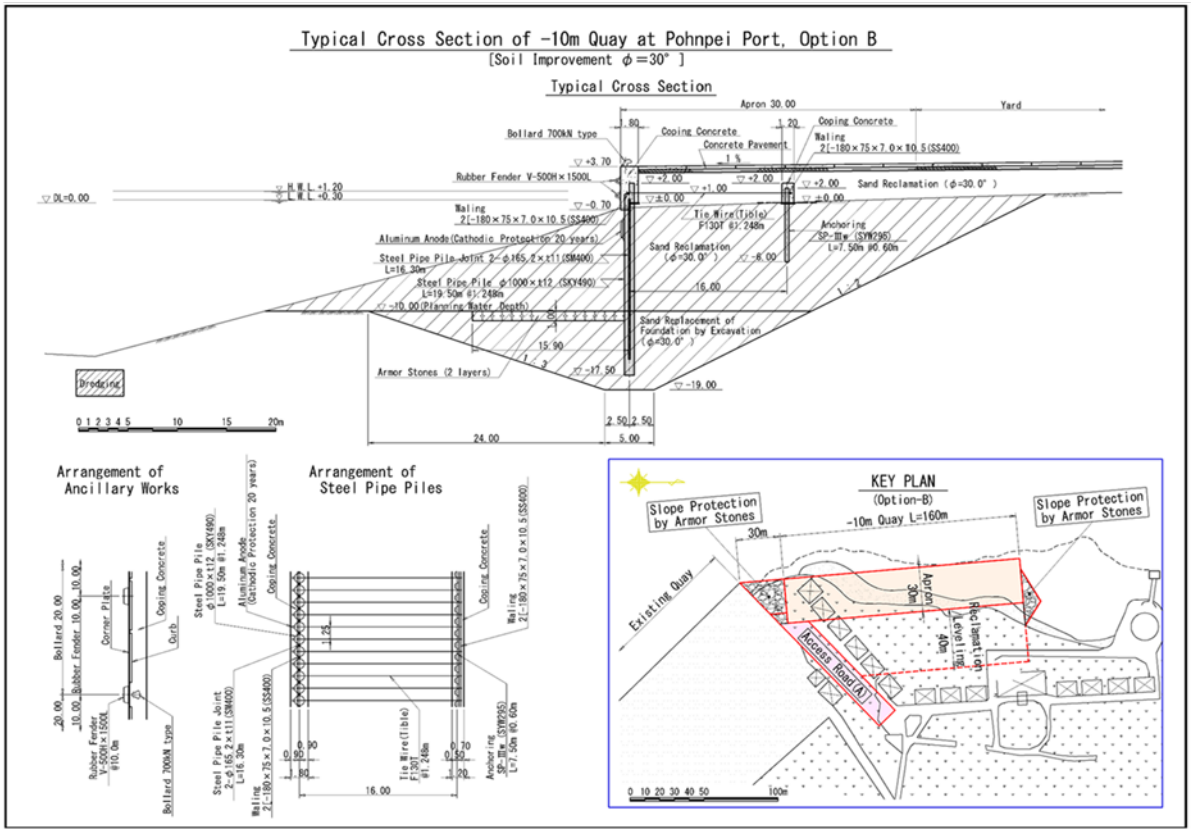
7. Preliminary design and cost estimates of the quay

(1) Selection of structural type

Three structural types are commonly adopted for ship mooring quays: gravity type, pile type and steel pipe sheet pile type. Since ground of the project site for the new quay is assumed to be very soft, the anchored steel pipe sheet pile type of which type has been widely employed as quay wall over a wide range of water depth, is assessed to be the most suitable. Soil improvement is supposed necessary. Among various methods for soil improvement, replacement of bed material is recommended with consideration of the procurement of construction equipment for this project in Pohnpei Port.

(2) Drawing of cross section of the structure

As an example of the preliminary structural design, the cross section of the new quay for Option B is shown in Figure- 5.



Source: Survey Team

Figure- 5 Option B （Cross section of the quay structure -10m, improved foundation）

(3) Preliminary cost estimate

Group A

The construction costs including all the components of Group A have been estimated for Options A, B and C (see Table-1). Components of Group A, listed below, compose the core of the project and the minimum set up to function as a quay for mooring container vessels currently calling the port.

a. Construction of new wharf with the extension 160m, apron width 30m and water depth DL-10m designed for a container vessel of 15,000 DWT,
   - Dredging and foundation excavation,
   - Procurement of replaced sand and backfilling material
   - New quay (including bollards and fenders, slope protection by armor stones and excavation and leveling of apron

b. Pavement for wharf apron: 160m x 30m

c. Access road (A): 1,000m^2

Table- 1 Estimated project cost for Group A

Project Cost (Group A)			Option A		Option B		Option C	
1. Construction Cost	Unit	Unit Price ($)	Quantity	Amount ($ 1,000)	Quantity	Amount ($ 1,000)	Quantity	Amount ($1,000)
a-1. Dredging/Foundation excavation	m3	65	300,800	19,451	115,200	7,449	56,000	3,621
a-2. Procurement of Replaced sand and Backfilling material	m3	28	112,000	3,104	112,000	3,104	102,400	2,838
a-3. New Quay	m	69,284	280	19,400	160	11,085	320	22,171
b. Pavement for wharf apron	m2	296	4,800	1,419	4,800	1,419	4,800	1,419
c. Access road(A)	m2	296	1,000	296	1,000	296	1,000	296
Total				**43,669**		**23,353**		**30,345**
2. Consultant Fee	%		10	**4,367**	10	**2,335**	10	**3,034**
Grand Total （1+2）				**48,036**		**25,689**		**33,379**

Source: Survey Team

Note: The figures include indirect costs, consultant fee is 10% of the total construction cost.
Quay denotes sea wall and persons, not including yard. 1$=¥108.25 (June 3, 2019)

In Table- 1, the following aspects are observed:

- Since the quay length of Option C is the longest (160m x 2=320m) due to its jetty type, sheet pile walls are required for both sea and land sides, the construction cost is bigger than Option B,
- Option A requires a large volume of excavation of land and the construction of 120m long seawall at the north side of the existing wharf. Thus the cost is the largest.
- The cost of Option B is the lowest. The area between the north end of the existing wharf and the new quay is designed as a simple slope protection by armor stones for reduction of the cost.
- The dredging cost of $\$65/m^3$ seems to be rather high considering the dredging work is done not in Japan but on an island in Oceania.

Group B

The components of Group B are the same for all the three options except for the dredging of the turning basin. The estimated costs of the turning basin are shown in Table- 2, which indicates the cost is the highest for Option C due to a large volume of dredging at the opposite side of the navigation channel.

Table- 2 Estimated Construction Cost of Dredging for Turning Basin (400m dia.)

Group B			Option A		Option B		Option C	
Coostroction Cost	Unit	Unit P rice ($)	Quantity	Amount ($ 1,000)	Quantity	Amount ($ 1,000)	Quantity	Amount ($ 1,000)
d. Dredging for turn in g basin	m^3	65	175,000	11,316	350,000	22,633	490,000	31,686

Source: Survey Team

Note: 1$=¥108.25 (June 3, 2019)

Other components of Group B may not come under the influence of the location of proposed construction site, therefore, the approximate construction cost of each option will be mostly the same, and the estimated

cost is shown in Table- 3.

Table- 3 Estimated Construction Cost of Others for Group B

Construction Cost (Group B)	Unit	Unit Price	Quantity	Amount	Remarks
e. Pavement for container yard	m^2	296	16,000	4,730	Length 160m x Width 100m
f. Fence/Gate	Ls		1	554	4 gates and 600m fence
g. Lighting facility	Ls		1	346	3 sets on new quay and 6 sets on container terminal
h. Facility for reefer container	Ls		1	924	50 power supplies, 1000KVA back up generator
i. Security/Monitoring facility	Ls		1	185	CCTV camera system
j. Access road (B)	m^2	296	1,000	296	Construction of the access road to container terminal
k. Water/Fuel supply facility	Ls		1	462	2 water supply pits and 1 fuel supply pit in new quay
Total				**7,497**	

Source: Survey Team

Note: 1$=¥108.25 (June 3, 2019)

For the purpose of reference, the rough estimates of components of Group C are shown in Table- 4.

Table- 4 Estimated Cost for Group C

Construction Cost (Group C)	Unit	Quantity	Amount ($ 1,000)	Remarks
l. Sewage treatment facility	Ls	1	785	Capacity: $5m^3$/day, dilution tank, septic tank, water tank
m. Waste oil disposal facility	Ls	1	4,619	Capacity: $10m^3$/day, Oily water tank. Oil separator, Filter and Adsorption tank, Oil storage tank
n. Improvement of access channel	Ls	1	185	Navigation Aids (Beacon No.1 and No.2)
Total			**5,589**	

Source: Survey Team

Note: 1$=¥108.25 (June 3, 2019)

The cost for the whole project is shown in Table-5.

Table-5 Cost for Whole Project

Unit: $ 1,000

Group	Project component	Option A	Option B	Option C
A	Construction of quay	48,036	25,689	33,379
B1	Dredging of turning basin	11,316	22,633	31,686
B2	Construction of container terminal	7,497	7,497	7,497
C	Improvement of access channel, Sewage treatment and waste oil disposal facilities	5,589	5,589	5,589
	Total Cost	**72,438**	**61,407**	**78,150**

Source: Survey Team

Note: 1$=¥108.25 (June 3, 2019)

8. Recommendation for the Preparatory Survey for the project

(1) Key issues for the preparatory Survey

In order to move the project forward, the Survey Team firstly identified the project site through the examination of the four alternative locations and confirmed that the land area on the north end of the main wharf, which is currently under dispute between PPA and a former counterparty of lease contract, is the only potential site for the development of a new quay from technical and port operational viewpoints.

At the beginning of the survey, the aim of the survey was thought to focus on the mooring facilities for the overwhelming purse seine fishing vessels calling at the port and to make recommendations for the formulation of a project that would be implemented by Japan's grant aid program. However, taking into consideration the existing situations of the facilities and operational aspects of the port, Survey Team concluded that the identified project site, which is the only the potential site available for port development of PPA, should be developed for a new container terminal with an aim not only to upgrade the commercial port functions but also to the integrated fishing port functions of Pohnpei Port. Thus, a concept of a long-term development has been proposed by Survey Team.

In the formulation of a project for Grant Aid Program, it is important to make up a project within a set budget. At the same time the project must be a complete set of all the essential components in order to achieve the aim of the project. To this end, Survey Team grouped project components into three: Group A, B and C. The components of Group A were given the first priority to realize a quay for mooring fishing vessels, while Group B, which was given the second priority, includes those components to develop the quay into a container wharf. In addition, those components that are not directly related to the development of the new wharf were classified as Group C.

Survey Team carried out preliminary structural design of the quay and estimated costs for the components of Group A and B. Those components of Group A consist of the candidate project for Japan's grant aid program. However, it should be noted that the cost estimates presented in this survey are based on the assumed soil condition and should be recalculated for confirmation on the basis of actual soil data, and that the project components for Japan's grant aid program to be included in a project should be reviewed. It is expected that, by refining the estimates of each component's cost, some of the Group B components are included in the grant aid program.

In order to complete the container terminal, those components that are not included in Japan's grant aid program need other financing sources. Some of the components such as paving the container yard, water and fuel supply system, lighting system, power generators may be funded by private sector. Negotiations with relevant government agencies and private agencies will also be required.

Furthermore, with this report, Survey Team proposes to construct a new quay with a view to further expand it to a container terminal in the future instead of simple substitution for the fishing wharf of CFC as proposed in the previous studies. Thus, this report is proposing a change of development policy. Therefore, it is essential to get a consensus of PPA, State government and other agencies concerned about the change of development policy. The dispute concerning the land area for the project should be settled and the project site should be formally designated as the site for the container terminal.

(2) Natural condition and Environmental surveys

The following surveys should be carried out to formulate a project proposal:

a. Bathymetric Survey and Magnetic Prospecting
b. Topographic Survey
c. Soil Investigation
d. Bottom Sediment Survey
e. Water Quality Survey
f. Current Survey
g. Construction Material Survey
h. Flora and Fauna Survey

(3) Procedures related to Environmental and Social Consideration aspects

a. Procedures of Environmental Impact Assessment

In general, the environmental impact assessment (EIA) in accordance with the Pohnpei Environmental Impact Assessment (EIA) regulations "Pohnpei EPA EIA Regulation 1995" should be carried out to obtain the approval of Environmental Impact Statement (EIS) from the Pohnpei Environmental Protection Authority (Pohnpei EPA). Since the proposed project site is not an undeveloped area but the area where various projects have been done in the past, it is likely that Pohnpei EPA may approve the project implementation by the evaluation of the initial assessment (IA) only. However it is the requirement of JICA for the EIA to be carried out based on the Environmental and Social Consideration Survey in accordance with the "JICA New Environmental and Social Consideration Guidelines", which requires obtaining formal environmental permits from Pohnpei EPA including proper environmental management and monitoring plans.

b. Procedures to obtain other environmental permits for the project implementation

- Municipal Government Clearance

  This clearance may automatically be approved if the relevant stakeholders of adjacent cities to the port, i.e., Nett, Sokhes and Kolonia, are invited to all the public hearings held during the EIA procedure.

- Earthmoving Permit:

  PPA requires to renew the Earthmoving Permit. To this end, PPA has to prepare several documents including such information as the dredging area, method of dredging, volume of dredging, location of reclamation and method of reclamation including drawings in the application for the permit. However, in case the project includes the dredging of the turning basin listed in Group B that involves large volume of dredging, Pohnpei EPA may request to employ a certain dredging method and construction method and mitigation of the dredging volume.

- Forestry Clearance, Marine Resource Assessment:

  Forestry Clearance and Marine Resource Assessment may be required by Resource and Development Department (R&D Dept.). Since the dredging work may give influence on a live mangrove and coral reef, precaution should be taken to this forest and marine life and

the movement of R&D Dept., local environmental NGO, and other related stakeholders for the request of additional mitigation measures.

(4) Land dispute regarding the Project site

The dispute regarding the land area, which is recommended as the project site, on the north of the main wharf has been lingering on ever since the lease contract expired in October 2005. The dispute is based on a claim by a person who is a relative of the former lease of rights of the assets, which include buildings and accompanying facilities, constructed on the leased lot by the latter. The person is seeking settlement by the State Court for certain amount of compensation from PPA, etc. PPA has been waiting for the State Court's decision on the settlement. It is said that the court will announce within six (6) to seven (7) weeks after the last hearing, which was held in mid-May, 2019. The State Court ordered PPA to withhold, for the time being, to take any action of the relocation of those illegal settlers who currently live in the buildings under dispute. Therefore, all those concerned with the Pohnpei Port development only need wait for the announcement of the conciliation by the State Court, and then make efforts to reach a settlement with the claimer on the basis of the conciliation.

Index

Tables, Figures and Photos

1. Introduction

1.1. Background of Survey

Situated in Pohnpei State where the capital of the Federated States of Micronesia (FSM), Pohnpei Port is the most important logistics hub of FSM as well as Pohnpei State. In recent years, the number of ships calling at Pohnpei Port has tended to increase, and interference among the moored and the berthing ships at main wharf occurs frequently during peak hours. Thus, expansion of the main wharf has been desired. Such situation at the main wharf affects the berthing and unloading activities of those long line fishing boats in Takatik Fish Port.

To cope with this situation, the Federal Government planned to expand the port facilities in Pohnpei Port using the ADB fund. The development project of Pohnpei Port was completed by TA (Technical Assistance) of ADB in August 2013. The Port Authority of Pohnpei (PPA), however, sought grant from Japanese government instead of ADB loan to implement the project.

Fundamental data collected through the ADB study and other related studies are not sufficient to implement the port expansion project. Therefore, further data and information must be collected to finalize the port expansion plan. Especially the following items that are not fully described in the development plan proposed in TA of ADB and must be confirmed: (1) operational scheme of the existing port facilities, (2) the integrity of land use plan adjacent to the port, and (3) the integrity of Takatic Fish Port operation plan.

1.2. Objective of the Survey

The purpose of this survey is (1) to review those expansion plans intending to cope with the congestion of Pohnpei Port proposed by historical studies, (2) to collect vital information and data required for the confirmation of the feasibility of the proposed plans, (3) to understand the present situation of the infrastructure, facilities, wharf operation of the port including Takatic Fish Port, (4) to examine the proposed plans and other possible alternative plans based on the collected information, and (5) to make recommendations of possible measures to mitigate congestion and enhance operational capacity of the port.

1.3. Survey Area and Executing Agency

The survey area is Pohnpei State, Federated States of Micronesia.

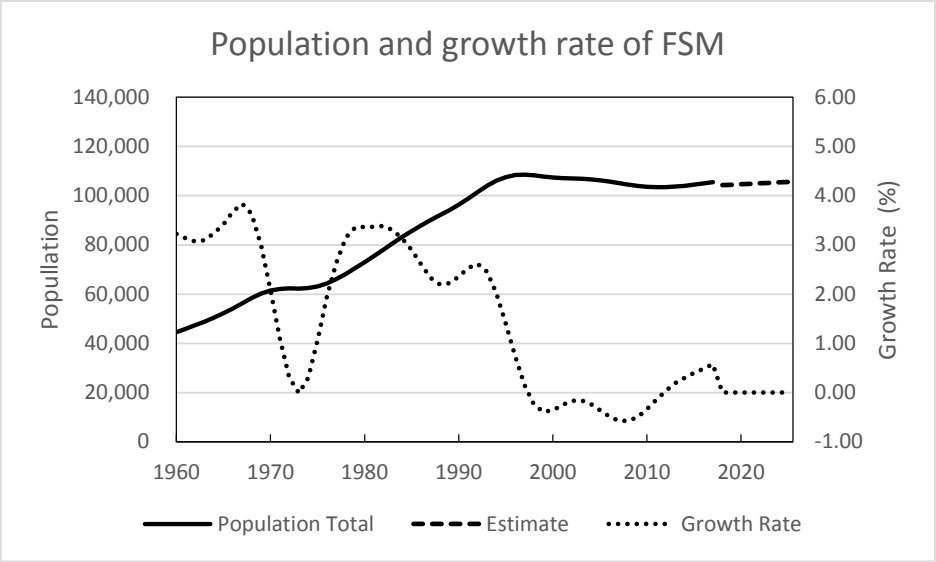
The agencies concerned with this survey are PPA and other relevant agencies such as the State government of Pohnpei for the development plan of the Port and its surrounding area and the Ministry of Public Works of the Federal Government for the Maritime Polity.

2. General information of Federaed States of Micronesia and Pohnpei State

2.1. Socioeconomic situation of Federated States of Micronesia and Pohnpei State

2.1.1. Population and GDP forecast

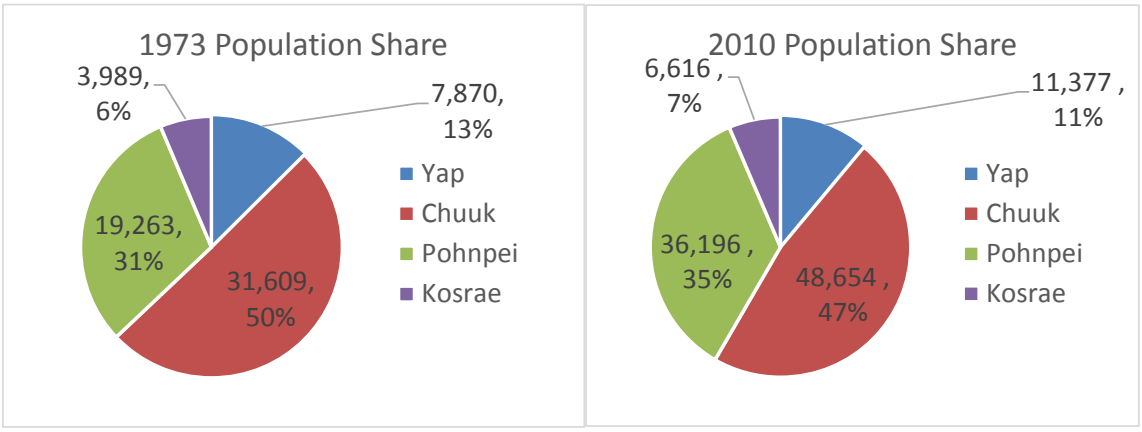
The historical variation of the population of FSM and the population growth rate are shown in Figure-2.1: dotted line indicates forecast. It is observed that, until 1997, the population growth rate was 2% to 3% a year except in 1970-1975 and that the rate started to fall down in 1995 due to a large number of population outflow. Thereafter, the population growth rate was negative until 2012. The population start to increase in 2013, but the growth rate was very small: The Micronesian Bureau of Statistics has predicted the population growth rate of 0.17% in 2018 and afterward.



Source: WB up to 2017 and estimates by National Statistics Office of FSM from 2018 and afterward

Figure- 2.1 FSM Population and forecast

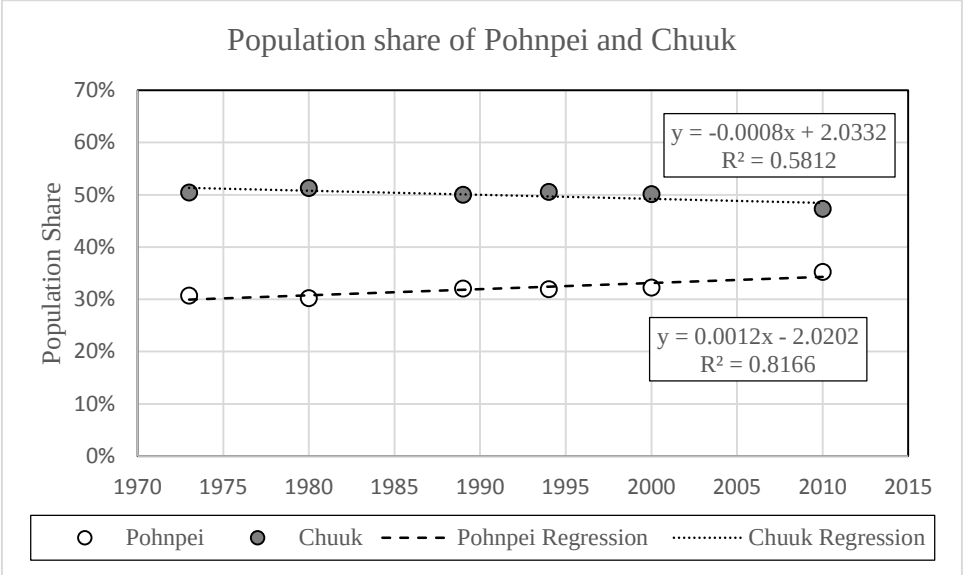
Chuuk State has the largest population followed by Pohnpei, Yap and Kosrae. Figure- 2.2 shows the comparison of the population share among the four states in 1973 to that in 2010. It is seen that the population share of Pohnpei has increased from 31% to 35%, while the share of Yap staes has decrease from 50% to 47%.



Source: Statistics office of FSM

Figure- 2.2 Population share among the four states of FSM

Figure- 2.3 shows the historical variation of percentage shares of the population share of Pohnpei and Chuk States over the past 40 years. A contrast between the two states is obviously seen and it is expected that the population ratio of Pohnpei will continue to increase. The dotted lines drawn in the figure indicate the best fit approximation obtained by a regression analysis. The regression equations indicate the population of Pohnpei State will tend to increase with annual growth rate of 0.12 % over the coming years.

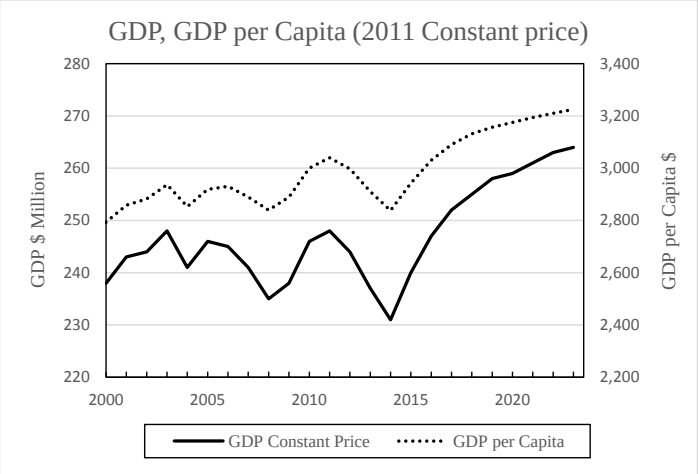


Source: Edited by Survey Team baed on data of Statistics office of FSM

Figure- 2.3 Historical variation of the percentage share of Pohnpei and Chuuk States

2.1.2. Gross Regional Domestic Products (GRDP) of Pohnpei State

Figure- 2.4 shows the fluctuation of GDP and GDP per capita of FSM published by IMF. The values after 2016 are the forecast by IMF, which projected GDP growth rate of 3% in 2016, 2% in 2017, 1.4% in 2018, 0.9% in 2019, 0.7% in 2020-2021 and 0.6% in 2022 and afterward.



Source: IMF (The values after 2016 are IMF forecast)

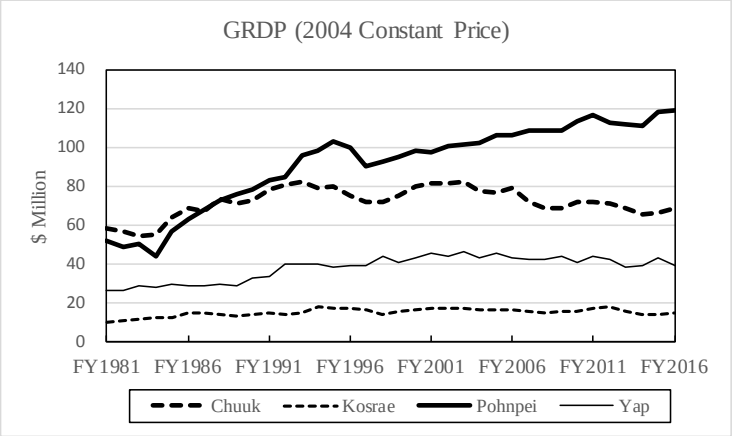
Figure- 2.4 GDP and GDP per capita of FSM

The GDP, population and per capita GDP of the whole country and provinces in 2016, which are the latest figures published by Statistics Office of FSM, are as shown in Table- 2.1. The GRDP of Pohnpei State accounts for almost a half (49%) of GDP. From Figure- 2.5 to Figure- 2.7, shows GRDP, population and GRDP per capita, respectively, over the past 35 years. These figures indicate Pohnpei State has steady upward trends in all these socioeconomic indicators while other states left unchanged.

Table- 2.1 GRDP of the States of FSM（FY2016）

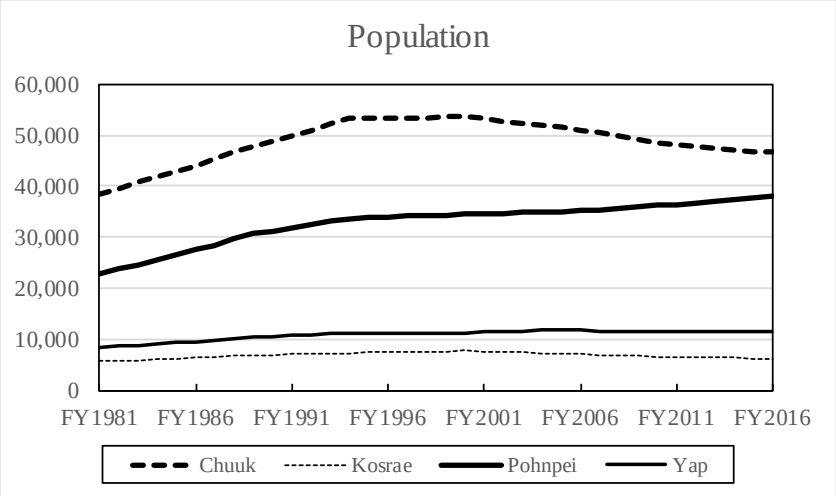
FY2016 Oct. 2015 -Sep. 2016	Constant price GDP (2004 Price)		Population		GDP per capita Constant price
	US$' millions	Share	Population	Share	US$
FSM	242.0	100.0%	102,453	100.0%	2,362
Yap	39.3	16.2%	11,645	11.4%	3,372
Chuuk	68.7	28.4%	46,688	45.6%	2,362
Pohnpei	119.2	49.2%	37,893	37.0%	3,145
Kosrae	14.9	6.1%	6,227	6.1%	1,472

Source: Edited by Survey Team based on data of Statistics Office of FSM



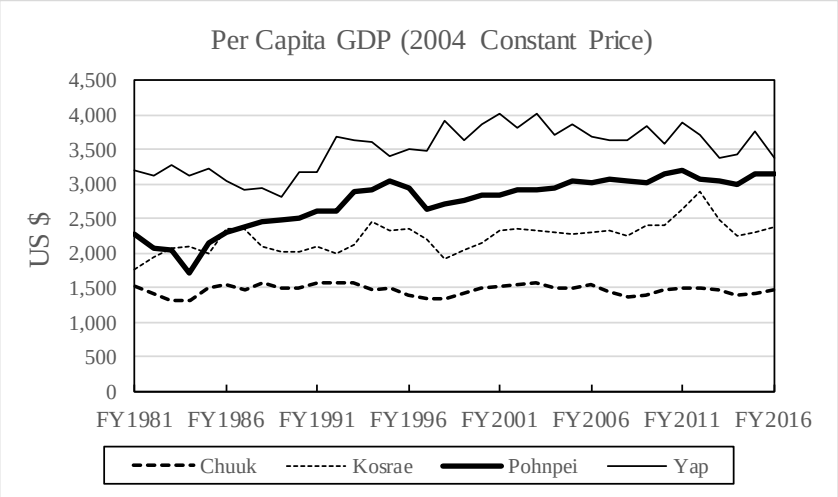
Source: Edited by Survey Team based on data of Statistics Office of FSM (FY2016)

Figure- 2.5 Historical variation of GRDP



Source: Edited by Survey Team based on data of Statistics Office of FSM

Figure- 2.6 Annual variation of population by state



Source: Edited by Survey Team based on data of Statistics Office of FSM

Figure- 2.7 Annual variation of GRDP per capita by state

Industrial sector share of GRDP in each state is shown in Table 2.2. The top four industries of each state are shown in bold letters. In Yap and Chuk, agriculture, fishery, real estate and education appear on the top, while administration and education are major industries in Pohnpei and Kosrae States.

Table- 2.2 Share of industrial sectors in GRDP （FY 2015、2004 Constant Price）

	Sector	Yap	Chuuk	Pohnpei	Koarae
A	Agriculture, Hunting and Forestry	**24.4%**	**20.0%**	**12.1%**	5.9%
B	Fisheries	**22.5%**	**14.0%**	10.2%	7.3%
C	Mining and Quarrying	0.0%	0.0%	0.0%	0.0%
D	Manufacturing	0.2%	0.3%	0.4%	1.2%
E	Electricity, Gas and Water Supply	1.4%	1.6%	2.0%	2.3%
F	Construction	3.3%	2.7%	2.0%	5.1%
G	Wholesale and Retail Trade and Repairs	8.7%	8.8%	11.4%	**12.5%**
H	Hotels and Restaurants	2.3%	1.6%	1.6%	1.7%
I	Transport, Storage and Communications	5.0%	5.3%	5.8%	4.6%
J	Finance	1.5%	1.4%	5.7%	1.8%
K	Real Estate, Renting, Business Activities	**9.0%**	**17.7%**	**12.4%**	**12.1%**
L	Public Administration	7.0%	6.9%	**15.7%**	**16.9%**
M	Education	**9.5%**	**12.4%**	**13.7%**	**19.3%**
N	Health and Social Work	4.1%	6.6%	5.0%	8.3%
O	Other Community, Social, Personal Services	1.2%	0.9%	2.0%	1.1%

Source: Statistics Office of FSM (FY 2015)

2.2. Present Status of Port-Related Development Plan and Pohnpei Port Improvement by Federated States of Micronesia (FSM) and Pohnpei State Government

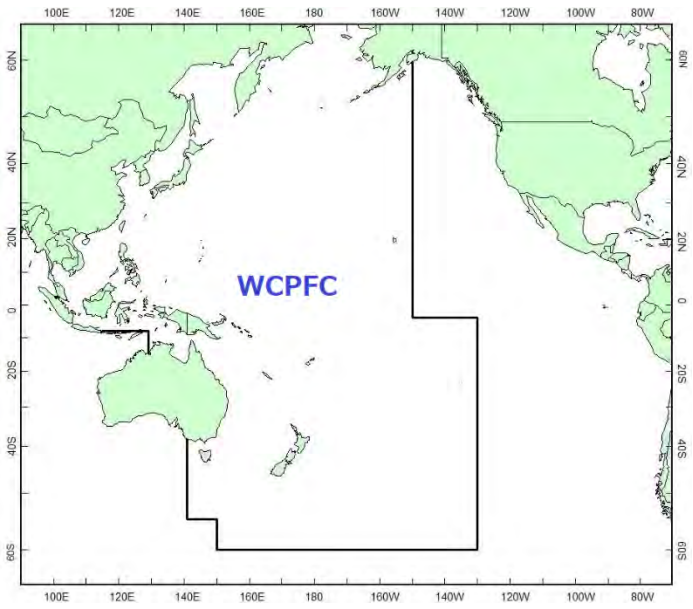
2.2.1. History of bonito and tuna fishery and Pohnpei Port

The survey for the improvement plan of Pohnpei Port, which was triggered by the PRIF report released in 2010, is aimed at the improvement of mooring facilities for purse seine vessels, which are the most common type of vessels calling at the Port. Along with the fishing vessels whose home port is Pohnpei Port, many fishing vessels call at Pohnpei Port when in search of bonito and tuna fishing grounds or the most convenient port to send the catch to consumption areas. These fishing vessels tend to change the calling port over the years in accordance with the movement of tuna and bonito fishing grounds and changes in the policies of the countries having an exclusive economic zone (EEZ) in the waters of Micronesia.

As such, let us look back on the history of bonito and tuna fishery in this region and Pohnpei Port, which may be regarded as a background to the port development plan of the Port.

(1) Fishery in the central and western central Pacific Ocean

The “United Nations Convention on the Law of the Sea”, which was concluded in 1982, marked the beginning of the 200 nautical miles area for the international order of the seas based on the declaration of EEZ by each nation. Against this backdrop, in September 2000, the “Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean” was adopted and in August 2004, the Western and Central Pacific Fisheries Commission (WCPFC) was established.



Source: WCPFC Tuna Fishery Yearbook 2017

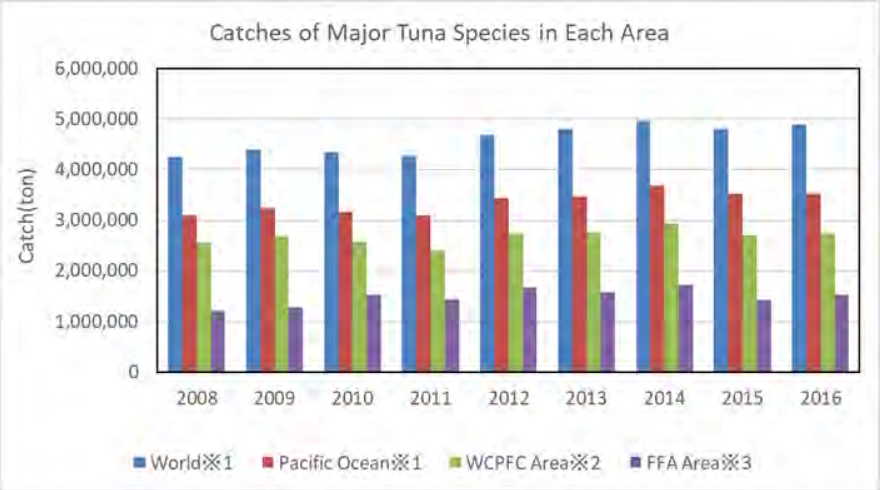
Figure- 2.8 Waters under the jurisdiction of WCPFC

It is declared that Oceanian countries including FSM, which are members of this Commission, "fully recognize special requests particularly from island countries, and overseas and overseas dependent territories, which are in the process of development", which means that disproportionate burdens will not be imposed on island countries with respect to the implementation of resources management.

WCPFC is a regional fishery management agency covering the most important fishing grounds of Japan, as its target waters are the central and western Central Pacific Ocean in which Japan is located, and the catch of bonito in the waters of island countries scattered around the equator accounts for the majority of the raw material for *katsuobushi* (dried bonito) in Japan (100,000 tons).

The bonito and tuna catch in the world remains slightly less than 5 million tons. The catch in the 2010s shows an increase of around 10% as compared to the 2000s.

As shown in Figure- 2.9, the bonito and tuna catch in the WCPFC waters accounts for about 60% of the catch in the whole world. Moreover, the catch in the Pacific Islands Forum Fisheries Agency (FFA) waters, whose members include FSM, has continuously been over a half of the catch in the WCPFC waters (around 1.5 million tons).



Source: ※1: FAO Fishery Statistical Collections Global Capture Production

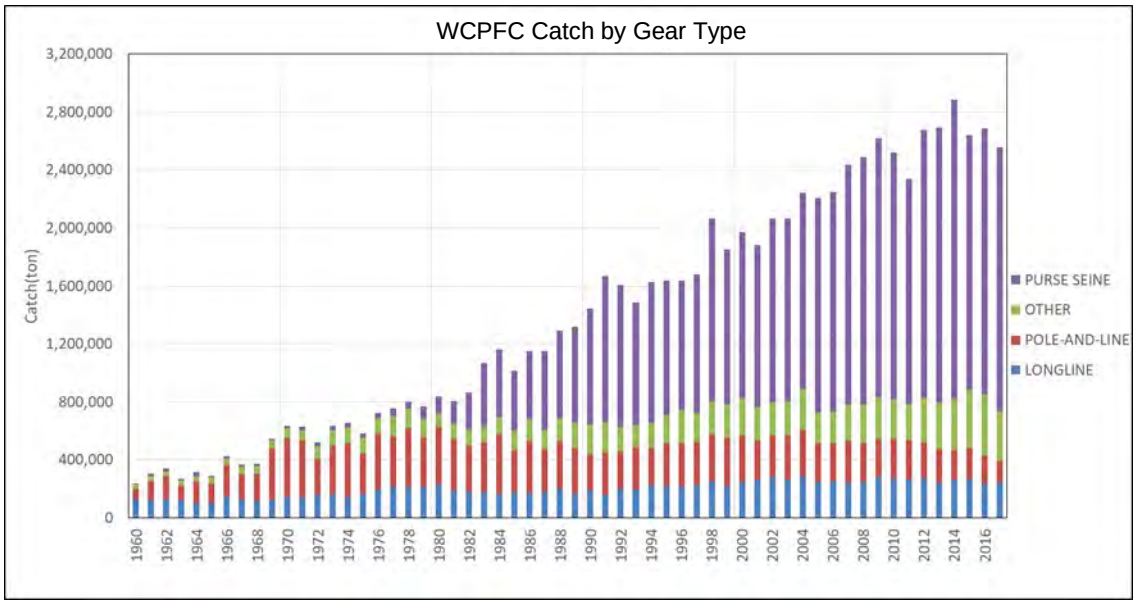
※2: WCPFC Yearbook Data File

※3: FFA Economic and Development Indicators and Statistics 2017

Figure- 2.9 Transition of bonito and tuna catch in the world

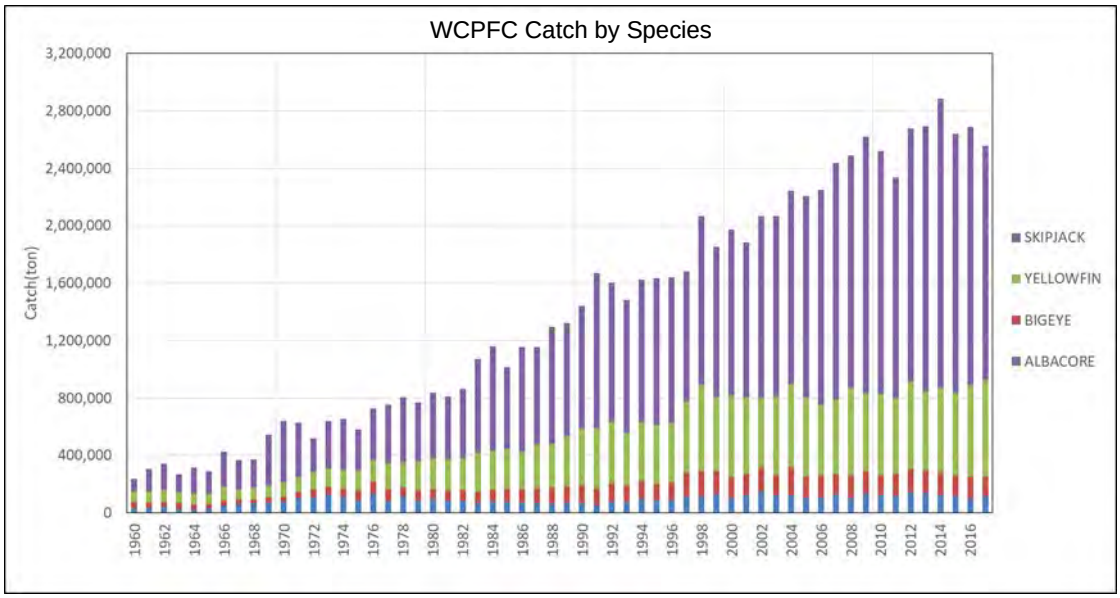
Next, let us look at the catch in the WCPFC waters classified by fishing method and species.

As shown in Figure- 2.10, classified by fishing method, the catch by purse seine fishing has shown an overwhelming growth. With respect to the catch by species (Figure- 2.11), bonito (skipjack) and yellowfin tuna make up the majority and the catch of these species has been increasing year after year. The catch of bonito is the overwhelming majority. The increase in the catch by purse seine fishing after the introduction of the United Nations Convention on the Law of the Sea in 1982 induced the growth of overall catch and as such, the catch is around 2.8 million tons, which is more than double the catch in those days.



Source：WCPFC Tuna Fishery Yearbook 2017

Figure- 2.10 Transition of catch in the WCPFC waters by fishing method



Source：WCPFC Tuna Fishery Yearbook 2017

Figure- 2.11 Transition of catch in the WCPFC waters by species

(2) Parties to the Nauru Agreement (PNA) and Vessel Day Scheme (VDS)

As a new method for fishing effort management, in 2007, eight of the member countries of Parties to the Nauru Agreement (PNA) introduced the method of setting an upper limit for vessel days (Vessel Day Scheme: VDS) instead of the conventional method of limiting the number of vessels. After this, all the member countries shifted to the method of selling VDS by day in 2012. As shown in the next table, the total number of VDS days has settled to approximately 45,000 days per year in recent years.

After the introduction of VDS, FSM has been steadily increasing the number of allocated days. The allocation of VDS days is determined by referring to the actual catch of each country within the EEZ and the evaluation of resource reserves by WCPFC.

Table- 2.3 shows the number of VDS days of each PNA member country.

Table- 2.3 Number of VDS days of PNA member countries

	2012	2013	2014	2015	2016	2017	2018	2019
PNG	13,105	14,299	13,709	15,651	16,290	15,065	14,054	12,678
KI	5,480	6,253	5,823	7,994	9,213	9,650	10,005	10,446
FSM	**5,634**	**6,132**	**5,430**	**6,481**	**7,309**	**7,280**	**7,268**	**7,702**
SB	2,782	3,185	2,794	3,531	3,997	3,629	3,553	3,649
MH	2,234	2,234	1,935	2,472	2,769	2,997	3,016	3,185
NR	1,733	1,967	1,622	2,181	2,713	3,247	3,307	3,424
TV	1,055	1,223	1,065	1,772	1,890	2,004	2,110	2,188
PW	517	569	510	635	709	733	720	762
PN Total	32,540	35,862	32,888	40,717	44,890	44,605	44,033	44,034
(TK)	0	0	985	985	991	985	1000	1000
Total	32,540	35,862	33,873	41,702	45,881	45,590	45,033	45,034

Source: Interviews and information edited from WCPFC website, etc.

FSM has about 7,700 days, which is the third largest after those of Papua New Guinea (PNG) and Kiribati and the VDS days of these three countries combined account for 68% of the total. The Japan Far Seas Purse Seine Fishing Association buys about 2,000 days from FSM to carry out purse seine fishing in the EEZ of FSM. The vessels, when fully loaded, return to the Japanese bases, such as Makurazaki, Yamakawa and Ishinomaki and as long as the VDS days remain, they depart again for fishing. The rest of the allocation to FSM, which is around less than 6,000 days, is purchased by Korean, Chinese and Taiwanese companies, which also conduct purse seine fishing in the EEZ of FSM. Most of the catch by these companies is transshipped to reefer vessels in Pohnpei Port.

The VDS days allocated to the Marshall Islands are about 3,000 days, which are not so large, but the value of transshipment in Majuro Port is the highest of those in the PIC member countries. This means that a lot of fishing vessels carry out purse seine fishing in public waters other than the EEZ of Marshall Islands or in the EEZ of other Pacific Island Countries (PIC) member countries and use Majero Port for the purpose of transshipment. Conversely, Kiribati, which is allocated with a large number of VDS days, does not have so much amount of transshipment.

(3) Transshipment and Pohnpei Port

As a rule, although exceptions are made for vessels carrying the flag of PNG, which is among the PIC member countries, and the Philippines transshipment of the catch in high sea from purse seine vessels to reefer vessels is prohibited

Offshore transshipment from purse seine vessels has been prohibited in the PNA member countries, including FSM and Marshall Islands, since 1993.

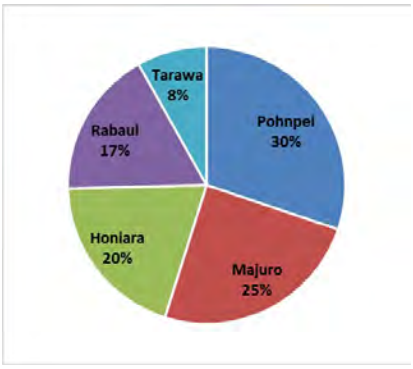
Reefer vessels are broadly classified into the following three types, according to the loading capacity and product usage. These vessels are not owned by fishing companies, but they are mostly chartered for operation.

- Large reefer vessels (loading capacity 2,000 to 5,000 tons)
- Vessels for transshipment of fish to be canned (bonito) 1,200 to 2,000 tons
- Reefer vessels handling sashimi-grade tuna (part of the fish storage has cryogenic freezing equipment of -55 to -60ºC)

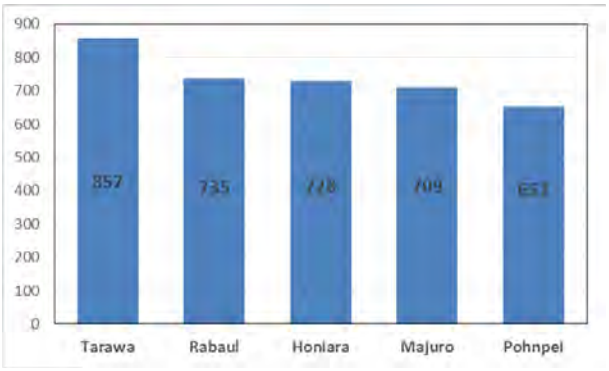
After offshore transshipment was prohibited in high sea around the PIC member countries, purse seine fishing companies searched for ports suitable for transshipment. Finally, the following five ports were selected.

a. Pohnpei (FSM), b. Majuro (Marshall Islands), c. Rabaul (PNG), d. Honiara (Solomon Islands), e. Tarawa (Kiribati)

In 2010, 1,276 transshipments were carried out in these five ports. Fig.-2.12 shows the breakdown.



(a) Comparison of Purse Seine Transshipments Frequency in 5 Major Ports



(b) Comparison of Average Tons Per Transshipment by Purse Seiners in 5 Major Ports (ton)

Source: A Survey of Tuna Transshipment in PIC member countries, 2012

Figure- 2.12 Transshipment frequencies in Pohnpei, Majuro, Rabaul, Honiara and Tarawa and average weight per transshipment

Of the five ports suitable for transshipment, Pohnpei Port has the highest frequency of transshipment (accounting about 30% of the total). On the other hand, in terms of profitability, its transshipment revenue is ranked the third. The total number of transshipment in other ports of PIC member countries, namely, Funafuti (Tuvalu), Christmas (Kiribati), Lae (PNG), Noro (Solomon Islands), Suva (Fiji) and Wewak (PNG) is only 64 times, which accounts for only 5% of the total.

It seems that Chuuk and Kosrae were also considered as candidates for transshipment ports in FSM, but Pohnpei was finally chosen. With regards to Kosrae Port, it is still used as a transshipment base by Luen Thai Fishing Venture based on the long-term leasing contract with Kosrae State government.

2.2.2. Infrastructural development plans of Pohnpei Port

The main wharf of Pohnpei Port, which is presently operated as the foreign-trade wharf, was built during 1970s under mandate of the US. Since FSM along with the Republic of Marshall Islands (RMI) and the Republic of Palau (PLW) formed a compact with the US, which is called the Compact of Free Association, COFA or COMPACT and has continued infrastructure development by the US economic aid through COMPACT over the 15 years thereafter. Subsequently, COMPACT was updated in 2003 and the US economic aid was extended further for 20 years for FSM and RMI and for 50 years for PLW. The updated Compact, which is called COMPACT II, provided FSM with financial support and, in 2003, the government of FSM formulated the Basic Plan for the Infrastructure Development 2004-2023 based on funds from COMPACT II and other countries and international aid agencies.

However, while COMPACT's funds were mainly allocated to welfare, education and life related basic infrastructure such as roads and bridges, no COMPACT fund was allocated to the shipping and international port (see Table-2.4).

Table- 2.4 Investment plans for infrastructure development for respective states

Project	Location	FY05	FY06	FY07	FY08	FY09-13	FY14-18	FY19-23	Source
CHUUK STATE									
Weno Commercial Ports Improvement	Weno		2,080						Other
Weno Ferry Terminal Building	Weno			1,333					Other
Dock for Lagoon/Outer Island Ferry	Weno	160	2,500	2,000	2,000			2,734	Compact/Other
Southern Namoneas Ferry Terminals	S. Namoneas				1,000	2,000	2,000	3,000	Other
Faichuk Ferry Terminals	Faichuk				500	1,000	5,000	5,000	Other
KOSRAE STATE									
Conversion of Tuna Industry Building	Kosrae	118							Other
POHNPEI STATE									
Dekehtik Port Dredging	Dekehtik				1,000	2,500	5,000	5,000	Other
Dekehtik Commercial Port Improvements	Dekehtik		500	500			1,500	1,000	Other
Kolonia Outer Island Ferry Terminal	Kolonia				1,500			943	Other
Outer Island Dredging	Outer islands					1,770			Compact II
Island Ferry Docks/Mooring Buoys	Outer islands					1,320	1,320		Compact II
YAP STATE									
Dredging Approach Channel	Colonia					1500	500	500	Compact II
Yap Commercial Port Improvements	Colonia		500	500			1,500	1,000	Other
Colonia Dock and Ferry Terminal	Colonia			500	500		2,000	696	Other
Reconstruct Fisheries Refrig. W/house	Colonia					3540			Other
NATIONAL GOVERNMENT									
National Small Ports Fund			300	300	300	1500	1500	1500	Compact II
Maritime Safety Operations Fund				100	100	500	500	500	Compact II

Source: : Basic Plan for the Infrastructure Development 2004-2023, FSM

In accordance with the Investment Plan, passenger-cargo vessels for domestic service were procured and ports were upgraded with funds from bilateral cooperation of foreign governments and from international lending institutions such as the World Bank and ADB. Through Japanese grant aid program, Takatic Fishing Port, which is a part of Pohnpei Port and a commercial wharf of Weno Port in Chuk State completed in 2002 and in 2008, respectively, and in 2010, the runway extension and terminal building of Pohnpei Airport were completed.

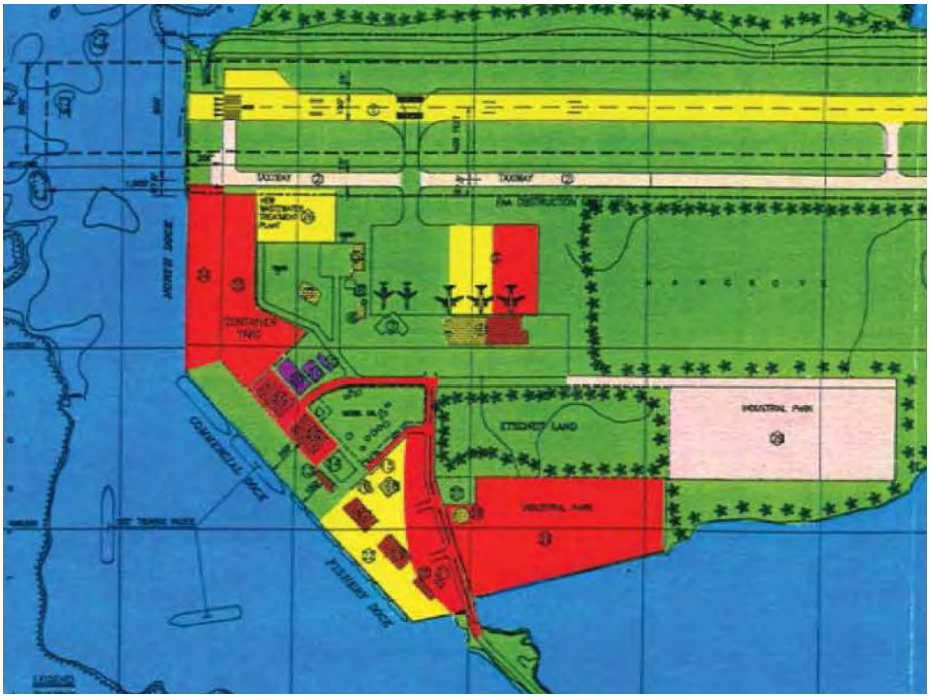
With the enhancement of interisland shipping service within FSM, two passenger-cargo vessels were procured through the grant aid program of Japanese government; Caroline Voyager (870DWT, LOA; 57m, started service in 1998) and Micronesian Navigator (781DWT, LOA; 59m), and started service in 2015). These two vessels were deployed to continue in the interisland shipping service and replaced the five aged vessels procured through Japan's grant aid from 1976 through 1980.

As of 2018, these two vessels operate at FSM nationwide, while Hopilmoho1, which was procured through the fund from the Chinese government in 2007, operates short distance routes within Yap State.

After the PPA was established in 1991, E. M. Chen and Associates has proposed a master plan for Pohnpei Port (see Figure 2.13). This master plan shows not only the expansion of the existing wharf but also the concept for the future development of the airport and industrial areas. The master plan also proposed the following development components (reference cited: ADB TA 8148-FSM Pohnpei Port

Development, Inception Report, Feb. 2013, according to Table 1).

a. Southward expansion of the existing wharf: the yellow area on the south side of the main wharf in Fig.-2.13
   - Current status: Takatic fishing port completed in 2002 corresponds to this component
b. Installation of mooring piers or buoys for purse seine fishing vessels that are not necessarily moored at the wharf. The master Plan suggests including a water area of further south of the Takatic Fishing Port, which is outside the jurisdiction of PPA.
   - Current status: only anchorage area is available.
c. Southward extension of the existing main wharf
   - Current status: proposed in the ADB development Plan.
d. Northwad extension of the existing wharf: construct a new wharf at Misko Beach, which is proposed in the master plan as a long-term development plan of PRIF.
   - Current status: due to the dispute on land tenure of the beach, ADB plan proposed a southward expansion.
e. To ensure safety: 24-hour deployment of tugboats with fire extinguishing equipment
   - Current status: PPA has no tugboat while motorboats are available from private company for the transportation to and from the anchorage.



Source: :ADB TA8148－FSM Pohnpei Port Development, Inception Report, Appendix B, Feb. 2013

Figure- 2.13 Pohnpei Port Master Plan proposed by E.M. Chen in 1994

In 2006, PPA prepared the 2007-2011 Strategic Plan to follow up the above-mentioned Master Plan. Although this plan includes the following components for port infrastructure, virtually no progress has been seen by August 2012, which was the time for starting the port development planning study funded

by ADB (reference cited: Inception Report of ADB study). The ADB study took over following project components:

a. Extension of the main wharf
b. Deepening and widening of the turning water area and channel
c. Deepening of fishing port and maintenance of mooring facilities for domestic vessels
d. Deepening of fishing ports and maintenance of passenger facilities
e. Renewal of refueling pipeline at the fishing port and the main pier

The PPA has been preparing a strategic plan every five years. However, its strategic plan focused on staff training and the efficiency of administrative functions of PPA rather than infrastructural developments. The loan for the implementation of the proposed projects by the ADB study was not approved by the Micronesian Federal Government, and, thus, PPA and State Government seek alternative source of funding.

2.3. Status of support for port sector by World Bank

On January 31, 2019, a meeting between the PPA and the World Bank (WB) was held for a discussion on the future development of the Port of Pohnpei. On February 18, another meeting was held between WB team and JICA (Representative and the Study Team) for exchange of views on possible cooperation. In the meeting the Study Team explained the outline of findings according to the presentation materials to PPA.

The following points were particularly emphasized in the explanation by Survery Team:

a. The Japan's grant aid may cover three components: construction of a quay, dredging of the berth and landfill, provided that the dredged material is suitable for landfill.
b. It is desirable to dredge and widen the approach channel and provide another turning basin in front of the new quay for safer ship maneuvering to and from the new quay when it is constructed on the north side of the existing wharf.
c. The current access channel is extremely dangerous due to many shallow areas and high spots and ridges, and it is imperative to remove shallow portion and ridges and to repair navigation markings.
d. Study Team has explained that PPA should consider additional funding for the items b and c described above since the construction cost of a new quay foreseen to be quite large amount. The WB team said that it was their plan to carry out the development of navigation signs and light buoys with their grant aid. The time schedule of the implementation of the plan would be determined by October 2019.
e. The Study Team also explained that cargo handling operation cannot be performed at night due to the lack of lighting equipment, the warehouse in the middle of the container yard was an obstacle to the passage of top loaders transporting containers between the apron and the container yard and that the port urgently needed sewage receiving facilities.

During the Survey Team's second visit in June 2019, Mr. Pius General Manager of PPA informed the Team that the following project components have been included in the WB funded port development Project of FSM:

a. Replacement of fenders and bollards of the main wharf,
b. Demolition of FSCO's shed in the middle of the main wharf,
c. Paving the container yard on the main wharf
d. Fencing of the container yard,
e. Upgrading navigational aids.

3. Present status and issues of Pohnpei Port

3.1. Port infrastructure development since 1970's

The historical development of Pohnpei Port is listed in Table- 3.1. Since a 280m long wharf constructed in 1972, an additional 40m long wharf was constructed in 1992 at the north of the original wharf.

Table- 3.1 Key stages of development at Pohnpei Port

Stage Description	Year*	Scope of Work
Harbour dredging and Construction of Main ("Commercial") Wharf	1972	Dredging of harbour and navigations channel, reclamation to Dekehtik Island. Construction of approximately 280m of wharf with dredged depth of -9.7m. Dock paving, access roads, utilities/services, lighting office and warehouses.
Repairs to dock paving and dock wall structure	1978	Dock and Access Road Paving and Bulkhead Repairs. Manhole repairs to adjust to new finished paved level (+2.43m above MSL).
Cold stores	1986	Construction of cold stores at southern end of dock.
North Dock Extension	1992	Construction of an additional 40m of wharf, and paved storage area, adjoin existing commercial dock.
Takatik Fishing Port	2002	Construction of 110m + 45m of new fishing wharf with dredged depth of -3.0m, 10.0m wide pavement, parking, water supply, fuel line, power and lighting, toilets, fish storage and transhipment buildings and surveillance offices
Fender and Bollard replacement	Nov-10	Installation of new fenders (14nos) on southern end of main dock and replacement of some fenders (approx. 80 nos) on main commercial wharf. New bollards (2 large + 6 small) on main Commercial Wharf.

*Note: actual dates are uncertain and some relate to the date of design drawings, rather than actual construction or commissioning dates.

Source：ADB TA 8143－FSM：Preparing the Pohnpei Port Development Project, Technical Assessment-Port Engineering, April 2013

As this survey focuses on the extension project of the main wharf, as the first step of the recognition of the current status of the existing pier, Survey Team collected information and data related to the structure, specifications, etc. at the time of construction, repair as well as current conditions. In addition, weather and martime meteorology data of the port area were also collected. It is assumed that the ground is soft around Pohnpei Port, hence as-built drawings of "Takatik Fishing Port Development Plan" and the existing main wharf of the port were also collected.

Soil survey data necessary for design and construction cost estimate of a new wharf were not found available.

3.2. Current situation and issues of the existing facilities

It is described in the PRIF report 2010 that the following issues were commonly observed at the four major four ports of FSM and that countermeasures should be urgently implemented.

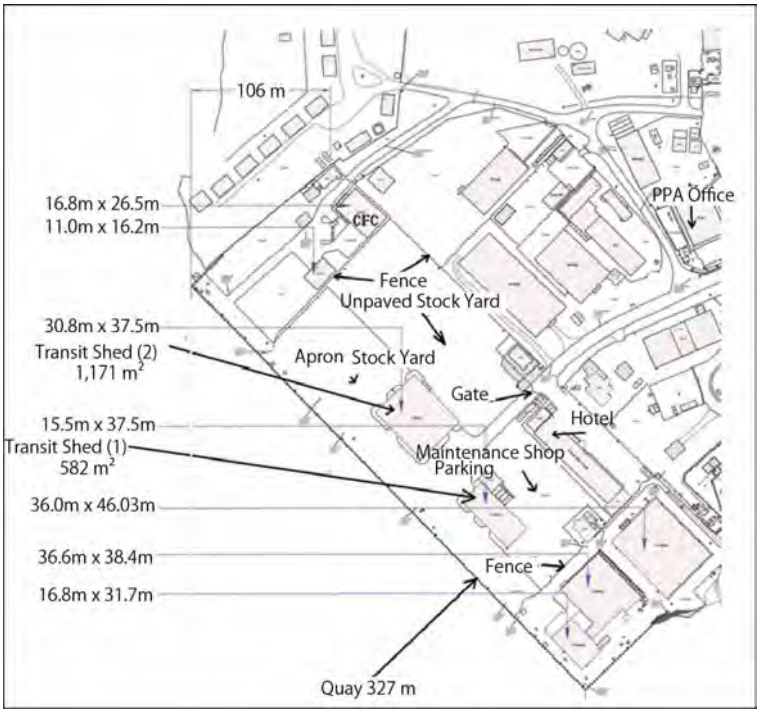
- Narrow approach channel, high spots and shallows, substandard navigation aids to navigation,
- Narrow turning basin,

- Interference between incoming and outgoing oceangoing vessels and moored fishing vessels,
- Inefficient use of aprons and yards since such areas are divided into the commercial and fishing boat areas.
- Private facilities that unnecessaily occupy the wharf area preventimg effective use of the wharfs
- Deterioration of wharf structures by aging,
- Lack of facilities for receiving sewage and waste oil from calling vessels,
- Lack of passenger facilities,
- Lack of tugboats and pilot boats (lack of spare engines),
- Old vessels are disposed around the port area, and
- No ship repair facility is available.

In consideration of the above-mentioned issues, Survey Team examined situation of the facilities of Pohnpei Port. The present conditions and issues of each facility are described below.

3.2.1. Overview of existing facilities

The locations and situations of various facilities on and around the main wharf of the port are visually shown in Figure- 3.1. The main wharf is divided into three portions by fences. A 60 m long portion at the north end of the main wharf is leased to Caroline Fishing Corporation (CFC) and exclusively used for supply and maintenance of its fishing fleet, while another 60 m long portion at the south end is allocated for mooring of fishing related vessels. There is a warehouse in the middle of the wharf and a private hotel on the wharf area. Behind the wharf, there are oil tanks, PPA management building and office buildings of a cargo operating company and shipping agents.



Source: Prepared by Survey Team

Figure- 3.1 Facilities of Pohnpei Port

The dimensions and owners of major facilities are listed in Table- 3.2.

Table- 3.2 Dimensions of facilities and operating body

Facilities	Dimensions	Administared by
Wharf	Main wharf 327 m（Depth 10.5 m from MSL） Apron width 20 m, Concrete pavement	PPA
Channel, Basin	Channel width about 100 m, Depth -10m) Turning basin D = 400 m、Aid to navigation	PPA
Yards, Warfehouses	Warehouse No. 1 on the wharf (1,150 m^2) Warehouse No. 1 on the wharf (875 m^2)	FSCO
Administration Facilities	PPA Office building Fence, Gare, Guard house	PPA

Source: Survey Team

3.2.2. Quay wall

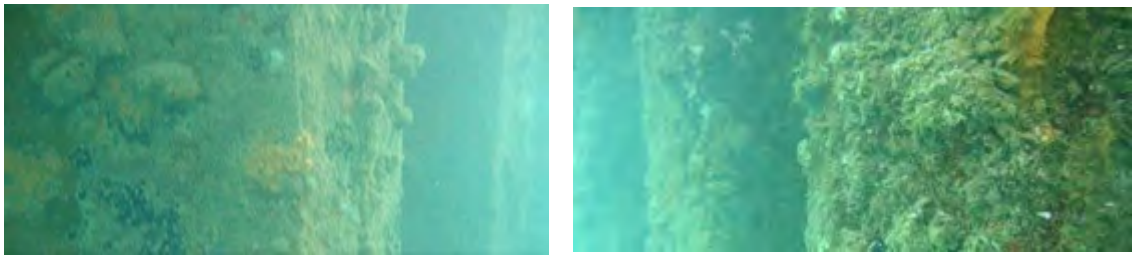
The 10 m deep quay is an important port facility of Pohnpei Port. The quay length is 327 m in total, but the 60 m section on the south side and 60 m on the north side are separated by fences. The central section (207 m) is primarily used for ocean-going vessels. Cargo handling at this quay is conducted by FSCO, a private cargo handling company. Fishing boats also use the quay when there are no cargo vessels at the port. However, they are obliged to move to other areas if an ocean freighter calls.

The quay was built in 1975. The structure is a steel sheet pile type that has been used for 40 years. The results of a diving survey revealed that steel sheet piles had no significant damage and no remarkable buckling due to rust. Fenders and bollards were also observed and found that one fender wants repair.

Photo-3.1 shows the scene of the observation of the surface of the quay wall by divers, while Photo- 3-2 is an underwater photos showing typical surface condition of the quaywall.

Source: preprared by Survey Team

Photo- 3-1 Diving survey



Source: prepared by Survey Team

Photo- 3-2 Conditions of surface of quaywall

3.2.3. Channels, basins and aid to navigation

The Pohnpei Port area including the entrance channel and the Anchorage Area is shown in Figure- 3.2. The PPA manages the water area surrounding the island as far as 7 km offshore. The port area of Pohnpei port is composed of the Takatik fishery port zone, navigation channels, and anchorage areas. The navigation channel has a length of approximately 4 km from the opening of the atoll to the Pohnpei port (commercial port) wharf. A wide anchorage water area is designated on the west side of the entrance channel. Apart from this, old vessels are moored at the south area, outside of the port, which is also used as a dumping site for discarded ships. Privately reclaimed lands and a temporary embankment are found in the water area to the south of the port.

The navigation channel is curved in sections in order to avoid shallow water areas. After passing a narrow short straight, the channel separates into two routes, one is to the port and the other is to the anchorage area. The bend to the anchorage area has a steep angle. The access route to the main pier is also greatly curved, while the distance from the runway edge to the channel is short due to the shallow water on the opposite shore. Cargo vessels (130 to 160 m in length) face extremely dangerous situations as the channel markers are insufficient. In addition, the area around the wharf is narrow and there is no tugboat, therefore, careful manoeuvring is required. Pilotage is compulsory, not only for cargo ships but also fishing boats when they enter and leave Pohnpei Port. Currently only two pilots are available, and training is urgently needed to increase the number of pilots.

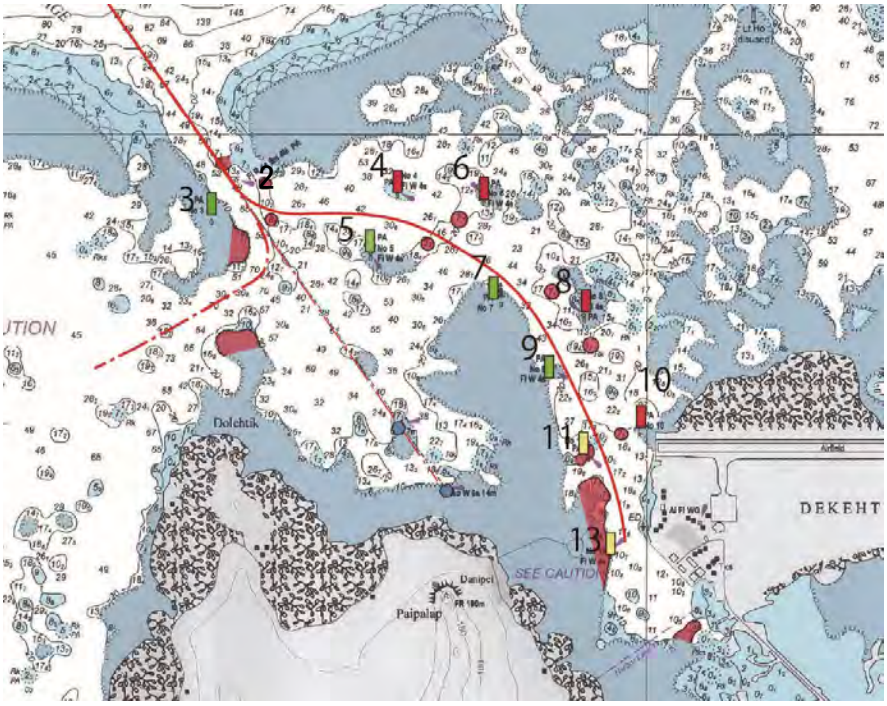
Figure- 3.2 shows the location of shallow areas and the location of the navigation sign boards (number plate with red or green characters). As can be seen from this figure, the entrance is extremely narrow, and the bend has a sharp angle. Since the port entrance area is subject to strong waves and currents, the channel markers often become damage, on those occasions, immediate repair is necessary.

The front water area of the main wharf is used for turning of ships, and it has a diameter of 400m, and the water depth is 10 to 11m. There is no Vessel Traffic Service (VTS) or maritime safety, but there is Very High Frequency (VHF) for communication.

The captain of the cargo ship Kyowa Stork said that he felt he was in a dangerous situation when two fishing boats entered the turning basin area while his ship was turning. The PPA did not manage the approach of small ships. Navigation control was performed only with the cargo ship through the VHF.

The navigation channel passes under the final approach of the airport, and it is the responsibility of the pilot on board, prior to passage, to contact with aircontroler by VHF and to make sure that ther is no scheduled airpolane departure or arrival during the passage of thew ship under the final approach of the airport.

It is compulsory for all the cargo ships and purse seiner fishing vessels to have pilotage service. Night navigation is prohibited and all the shipps leave or enter the port between 06:00 and 18:00.



Source: Developed by Survey Team based on interviews with pilots

Figure- 3.2 Alignment of the access channel and location of shallows

The current status of the markings of the shallows is as shown in Table- 3.3. The most important navigation aids that are located at the narrow entrance have been damaged due to winds and waves.

Source: Edited by Survey Team based on Google Map

Figure- 3.3 The existing turning basin

Table- 3.3 Condition of navigation aids of Pohnpei Port（As of Jan, 2019）

Lead	Color	Light	Board
Front Lead		Working,	No light on board
Rear Lead		Working	Light working on board
Navigation aids			
No. 1	Green	Broken(Pole only)	No
No. 2	Red	working	No
No. 3	Green	Light is working	No
No. 4	Red	Light is working	No
No. 5	Green	Light is working	Need repaint
No. 6	Red	Light is working	Yes
No. 7	Green	Light is working	Yes
No. 8	Red	Light is working	Yes
No. 9	Green	Light is working	Yes
No. 10	Red	Light is working	Yes
No. 11	Green	Light is working	No
No. 13:	Green	Light is working	No

Source： Researched by Survey Team (February 3, 2019)

The navigation aids (No. 1 and No. 2) located at the atoll's passage are made of steel. However, the No. 1 post is barely standing as if it is waiting to fall. The No. 2 structure is made of three H-shaped steels, but the light is missing. These structures need to be rebuilt stronger because strong waves and currents act on them,

The waves are calm in the bay. Most of the navigation signposts are painted white and have a diameter of 12 cm and a length of 5 m. Generally, a small solar-powered lamp is attached to them at the top about 2.5 m above the water surface,.which is only visible in close vicinity as the lamp is situated just slightly above the water. Some signboards have been lost due to sea breezes. The channel marker No.2 at the entrance is shown in Photo- 3-3, and it is observed that the sign board is missing. Photo-3.4 shows the channel marker No.9, which is well maintained and the sign board and the beacon are in good condition. .

The water area in front of the main wharf is used as a turning basin for ships; it has a diameter of 400m and a water depth of 10 to 11m. There is no VTS for maritime safety, but VHF is used for communication.

Source: Photographed by Survey Team

Photo- 3-3 Beacon No.2 located at the entrance

Source: Photograhed by Survey Team（Feb. 3, 2019）

Photo- 3-4 Beacon No. 9

3.2.4. Mooring facilities, loading facilities, storage facilities, etc.

The bollards and fenders of the commercial wharf are maintained in good condition. There are ten bollards which can be classified into three sizes (large, medium and small). The mediumsized and small sized bollards have a poor mooring capacity against pull-out forces of cargo ships (see Photo-3-5).

A couple of fenders have been installed, but they have a low impact absorption capacity for cargo ships.

Source: Photographed by Survey Team

Photo- 3-5 Bollards

The wharf apron is paved with concrete. There are pits (holes) in some places, from which oil and water can be taken out. The oil pipe is connected to Vital Company, and the water supply pipe is connected to the PUC (public utility corporation) pipe.

Since Pohnpei Port is located in the Pacific Ocean, water supply and fuel supply demands are large.

Oil supply is available at two places at the main quay, but no special loading arm has been installed. The pit in the north is said to be unusable because of oil leaks.

Source：Edited by Survey Team based on a photograph provided by PPA

Photo- 3-6 Pit location

As for water supply to the ships, there are complaints that the water is contaminated.

PPA thinks that it is caused by corrosion of the galvanized iron pipe; it would thus be necessary to replace it with a polyvinyl pipe or install a water purification filter.

A warehouse is located in the area behind the apron.

The area from the apron to the warehouse is paved and utilized for the marshalling of containers. But the area behind the warehouse is unpaved and it is used for the stacking of containers. Since Pohnpei has a lot of rain, it is desirable to pave this area as the rain can create larger holes which is issueatic for cargo handling.

There are two areas to be paved, approximately 6,240 m^2 and 3,000 m^2.

Source: Photographed by Survey Team

Photo- 3-7 Container handling at the unpaved stock Yard

Source: Photographed by Survey Team

Photo- 3-8 A casual water pond

Source: Photographed by Survey Team

Photo- 3-9 Broken place of drain at the roof of the warehouse

3.2.5. Cargo handling equipment

The cargo handling equipment (see Table- 3.4) is owned and operated by FESCO (operator).

Table- 3.4 Cargo handling equipment (As of Jan.2019)

Facility	Type and Number of Equipment	Operator
Cargo Handling Equipment	Three (3) tractor heads Large forklift 40 ton Komatsu Top Lifter 35 ton karmar top lifter 25 ton fork (used for 32 years) 24 tons fork (used for 19 years) (32 and 19 years are waiting for parts) Small forklift TCM 4ton Toyota 5ton TCM 2.5 ton	FSCO

Source: Survey Team

Small forklifts are mainly used in warehouses, and large forklifts and top lifters are mainly used for handling containers.

Source: Photographed by by Survey Team

Photo- 3-10 Maintenace shop of FSCO (Left) and trackter at the side of the shed (right)

3.2.6. Port welfare facilities and port management facilities

PPA has no port welfare facilities, etc. However, there is a hand washing room in the fishery port area, and there is a private hotel adjacent to the port. The main office for management is located outside the port fence, and there are three security gate stations and a coast guard office inside the fence.

Source: Photographed by Survey Team

Photo- 3-11 Private hotel on the main wharf (Left) and PPA administration building (right)

Source: Photographed by Survey Team

Photo- 3-12 Office building for Police Maritime Wing for moniotoring fishing vessels in EEZ

3.2.7. Facilities and equipment related to port security

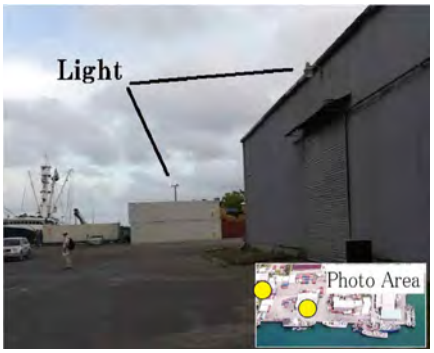
A fence with a height of about three (3) meters was installed in 2017. It is relatively new and has no damage or rust. Gate bars are raised and lowered manually. The port has no surveillance cameras or monitoring system. Solar power should be made available to ensure that there is lighting even in the event of a power failure.

There is lighting for cargo handling, however, the number of lights is limited and their intensity is low.

There is no firefighting facility or equipment in the port. In the event of a fire, assistance from the airport or oil company would be sought.

Source: Photographed by Survey Team

Photo- 3-13 Gate at the main wharf (left) and gate at the fishing port (left)



Source: Photographed by Survey Team

Photo- 3-14 Lighting system on thwe main wharf

3.2.8. Other facilities in the port area

An oil storage facility of the Vital Group is located at the corner of the port area in front of the PPA office. Vital stocks and supplies ship’s bunker oil and aviation fuel.

Source: Photographed by Survey Team

Photo- 3-15 Petroleum complex of Vital Company

Water will be supplied up to the end of public road by PUC (Pohnpei Utility Corporation). After that, water pipes will be laid by PPA.

Currently three (3) inch GI (Galvanized Iron) pipe is used for water supply but four (4) inch PVC (Polyvinyl Chloride) pipe is preferwable to improve water supply speed. PPA prefers to install a cartridge type filter device since the maintenance is easy.

Vital's safety requirements for fuel filler pipes are as follows:

- The inner space of a girder should be a minimum 60 cm x 60 cm, 60 cm from the ground surface to the top of the tube.
- Rain water should be drained easily from the girder, slope or pump drainage must be considered.
- Repair is difficult if pipes are laid under the tie rods.
- Water supply pipe and fuel filler pipe can be put in the same girder. However, additional space shall be provided for the water supply pipe.
- Electric cables can not be placed in the girders that contain oil tubes.
- Maximum load on girders is 40 tons (load of a forklift).
- The fuel filler pipe is currently 6 inches, but in the future 8 inches is optimum.
- Fueling speed of 2000 barrel/hr can be easily attained if the pipe is 8 inches.

There are no waiting facilities for passengers of ships, but it is possible for them to rest at the airport building.

3.3. Summary of Issues

Based on the results of interviews and surveys, issues that should be addressed are identified below.

1) The existing wharf does not have sufficient capacity to accommodate the larger container vessels which have been calling in recent years. For instance, bumping force and mooring line tension force became large. The load on the wharf and apron has increased due to the truck loads, etc.

2) Arriving and departing cargo vessels may become involved in accidents when multiple purse seiners

moor closely.

3) The yard area is insufficient to achieve the required cargo handling efficiency and to provide a proper restricted area for international cargo.

4) It is generally difficult to navigate the access channel since there are a number of shallow areas. It will be not easy to carry out dredging work at the entrance channel due to the strong waves and tidal current.

There are changes in the role of Pohnpei Port that were not clear in the previous PRIF and ADB surveys. According to the port statistics of PPA, the container handling volume (TEU) is increasing, however, more accurate and detailed statistics are required.

3.3.1. Deterioration and maintenance of facilities

The issues related to the maintenance of equipment are as follows.

(1) Navigation Aids

Navigation aids are prone to deterioration since they are exposed to strong winds and waves. In addition, the salt and strong ultraviolet rays act on the paint and the structure. PPA has spares for lanterns, and daily maintenance is conducted, but there are also broken sign boards and unstable structures that require significant improvement.

(2) Pavement

Unpaved open storage areas should be paved as much as possible to prevent accidents where containers are stacked.

(3) Piping

In order to supply fuel and water, it is necessary to remove the pavement and replace rotten pipes. This work should be carried out as soon as possible. (The scheduled repair works were postponed.)

If the pipe is laid in the gutter, replacement is easy.

(4) Warehouse

The roof is made of steel and easy to repair.

The warehouse should be relocated outside of the port to increase the efficiency of container handling in the narrow open yard.

3.3.2. Navigation channel, dredging of channel, and turning basin

The entry and departure of ships are limited from 6:00 am to 6:00 pm since shallow waters are scattered throughout the bending channel; in addition, the route signs are not reliable.

It is prohibited to enter the port at nighttime since the channel width at the port entrance is 100m, and the angle of curvature of the channel is steep. The maximum length of vessel that can use Pohnpei Port

is 160 m.

The interview with the pilots revealed that the entrance channel of Pohnpei Port is narrow and shallow, and the reefs are scattered at all places.

It is sometimes difficult for large ships to enter and leave due to strong winds and waves.

The opinion of the pilots is that the turning basin should have a diameter of 500m to navigate ships safely in windy conditions without the assistance of tugboat (the turning basin is currently 400m in diameter). Recently no accidents have been recorded. However, in December 2014, the refrigerator ship Ding DA 7 (2586 DWT, built in 2002, already abandoned) hit ground, and there has been a risk of oil leaks (JICA 2015). In addition, the captain of the Kyowa Hibiscus requested that a pilot be replaced (June 14, 2014 request by Captain Kyowa Hibiscus to PPA, PRIF, 2014) due to his inexperience and dangerous maneuvering.

As for the navigation channel, it is necessary to remove the shallows. The entrance is particularly dangerous.

3.3.3. Port security and surveillance

As the main wharf of Pohnpei Port is the only deep quay in the island, it is used by not only ocean freighters but also fishing boats and inter-island liners (domestic vessels).

The restricted area (in the container terminal area) is separated by a fence, but there is no fence between the wharf and the container yard and the shed, and thus there is nothing to prevent crews of the fishing boats from entering the container terminal. Furthermore, when a large cargo ship arrives, the fence door must be open to pull mooring ropes widely.

In addition, the lack of lighting equipment in the container terminal, and the lack of surveillance cameras and monitoring equipment are issues that need to be addressed.

Other security issues include the shortage of security personnel (17 people are supposed to be engaged in security but currently only 15 people are observed), and the need for a larger rest area and solar-powered lighting.

4. Operational performance of facilities at Pohnpei Port

4.1. Operational performance of Pohnpei Port (Commercial Port)

4.1.1. Cargo handling performance

The import cargo volumes by commodity handled are shown in Table- 4.1 over the period from FY2011 through FY2018.

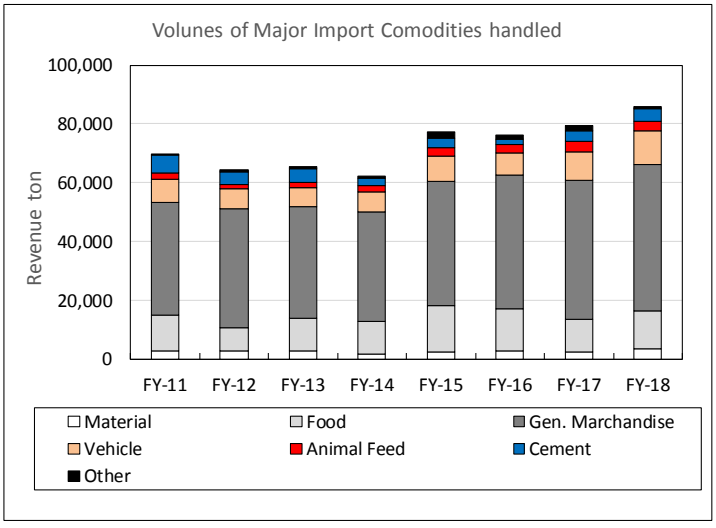
Table- 4.1 Import cargo volumes by commodity at Pohnpei Port (FY2011-FY2018)

Fiacal Year	Material	Food	Gen. Mer-chandise	Petro-reum	Vehicle	Liquor	Animal Feed	Cement	Boat	Heavy Equip.	Total (Excl. oil)	Auto (Unit)	Container (TEU)
FY-11	2,887	12,184	38,221	32,519	7,839	317	2,363	5,774	0	39	69,624	665	1,994
FY-12	2,780	7,888	40,542	27,728	6,639	495	1,586	4,345	0	22	64,297	608	1,832
FY-13	2,959	10,986	37,910	26,105	6,536	362	1,644	4,932	306	176	65,812	590	2,190
FY-14	1,729	11,347	37,005	26,043	6,890	823	1,947	2,649	22	0	62,412	605	1,965
FY-15	2,474	15,787	42,277	24,069	8,511	2,006	2,724	3,434	40	16,375	93,627	657	2,400
FY-16	3,044	14,027	45,529	24,182	7,661	1281	2,671	1,996	32	87	76,328	713	2,562
FY-17	2,532	11,236	47,268	20,691	9,539	1715	3,594	3,498	0	193	79,576	834	3,083
FY-18	3,588	13,087	49,650	20,691	11,454	824	3,190	4,091	187	370	86,452	1,062	2,979

Source: PPA (FY: Fiscal Year, from October of the previous year through September)

Yearly variation of volumes of major import commodities are shown in Figure- 4.1 excluding oil. The total volume varies between 60,000 and 80,000 revenue tons. It used to keep decreasing until FY2014 and turned to increasing in FY2015. Although the total import cargo volume in FY2016, especially General Cargo seems to have decreased compared with that of the previous year, this is because, in FY2015, an unusually large amount of 16,000 tons of heavy machinery was imported in FY2015 (see Table- 4.1).

Except for the import of heavy machinery in 2015 the cargo volume of Pohnpei Port has been steadily increasing since FY2015 and exceeded 80,000 tons in FY2018. The main import commodities are food, general merchandise and vehicles.

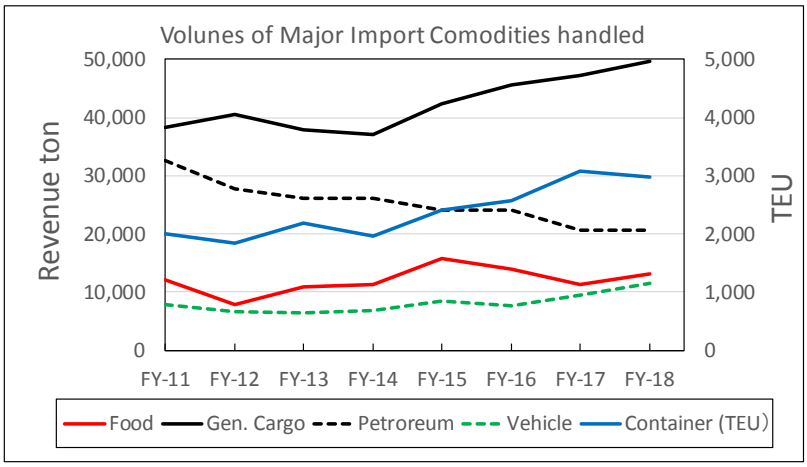


Source: Edited by Survey Team based on the data provided by PPA

Figure- 4.1 Annual variation of import cargo volume

Figure- 4.2 shows the annual variation of import volume of the top three import commodities, i.e., general merchandise as well as oil and import laden containers (in TEU) over the past 8 years. This figure exhibits the increasing trend of the three commodities while import volume of oil tends to decrease. The import laden container volume (in TEU, right axis) also tends to increase.

Despite the increase in vehicle import and the increase in the number of vessels (see Section 4.4), the reason for the decline in oil import may be improved fuel efficiency of increasing new cars and calling vessels may tend to refuel at elsewhere rather than at Pohnpei Port.



Source: Edited by Survey Team based on the data provided by PPA

Figure- 4.2 Annual variation of import volume of top commodities, oil and container

4.1.2. Regular shipping service route

Regular international shipping service connecting Guam/Hawaii with the four principal islands of Micronesia is provided by three shipping lines, namely Marina Express Line (MELL), Matson Line, Kyowa Line. The respective service routes are as follows:

MELL : West Coast of US - Hawaii- Majuro- Kosrae – Pohnpei - Chuuk - Saipan – Guam - Yap - Palau

Matson Line: West Coast of US - Hawaii - Guam – Majuro - Kosrae - Pohnpei - Chuuk - Guam

Kyowa Line: China - Korea - Japan - Saipan - Guam - Chuuk - Marshal Is. - Kosrae – Pohnpei -Yap-Palau

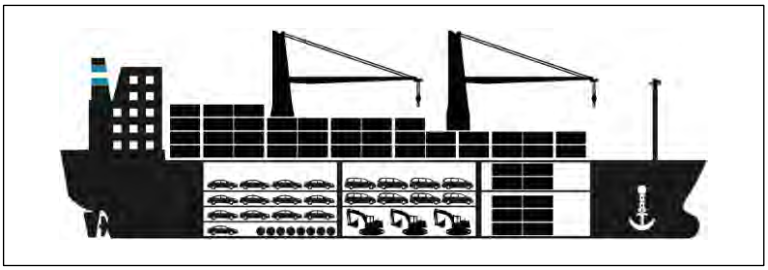
As described above, these shipping lines operate the service routes connecting four major ports of FSM and Majuro Port of Marshall with Hawaii or Guam as the starting points.

Figure- 4.3 shows three routes for Pacific countries operated by Kyowa Line. Kyowa Line is operating multipurpose vessels which are designed to carry not only containers but also vehicles and heavy cargoes (see Figure- 4.4). The 12,000 DWT (LOA 125 m-143 m) type multipurpose vessels were built from 2009 to 2018 in accordance with the length and depth of the mooring facilities in these countries on the Saipan-Guam route around the Micronesian Islands, and currently their vessels carry National Flag of Marshall Islands.

Saipan - Guam Route Papua New Guinea Route South Pacific Route

Source: Web site of Kyowa Line

Figure- 4.3 Regular service routes of Kyowa Line for South Pacific Region



Source: Web site of Kyowa Line

Figure- 4.4 Cross section of a multipurpose vessel deployed in South Pacific Region by Kyowa Line

Contrary to the trend in oceangoing cargo vessels designed for transportation of specific type of cargoes, the multipurpose vessels are designed to carry various type of cargoes. Therefore, this type of vessels is suitable for services to Pacific Island Countries (PIC), where import cargo volumes brought by a ship are small but in different shapes. On the other hand, in terms of cargo handling at their calling port, different types of cargo are handled at the same time. It is expected to introduce such a cargo handling method so that no conflicts should occur between different cargo handling equipment on aprons and wharf.

In addition to these international shipping services, domestic routes covering four major islands of FSM is operated by FSM government. The annual operation schedule is prepared annually by Department of Shipping, the Ministry of Transport and Communication Infrastructure.

4.1.3. Current situation and issues related to ports in FSM

The piers of the four major ports are assessed to be in good condition, and all these ports are able moor more than 10,000 DWT of ocean-going vessels and have enough capacities to receive the current frequency of calls and cargoes brought by their international services. All these ports are also called by many fishing vessels employed for catching fish for supply and repair of fishing nets. The fishing vessels have a tendency to stay longer than commercial cargo vessels. The tendency is particularly noticeable in Pohnpei Port, as described later in the chapter. On the other hand, fishing is also popular around Yap Island and Kosrae Island, and, therefore, wharfs are divided into two areas: a commercial port area and

a fishing port area.

Regarding port security, the FSM government has set up a maritime security committee, and hold a forum that consists of state governments and related parties to carry out activities to implement security management in compliance with ISPS (“Supporting Safe, effective sustainable Maritime Transport System in North Pacific Countries-Improving Ports and Maritime Shipping”, JICA, Aug. 2015). However, due to the limited capacity of the mooring facilities, it is difficult to enforce completely separate operation between ocean-going vessels from the fishing vessels.

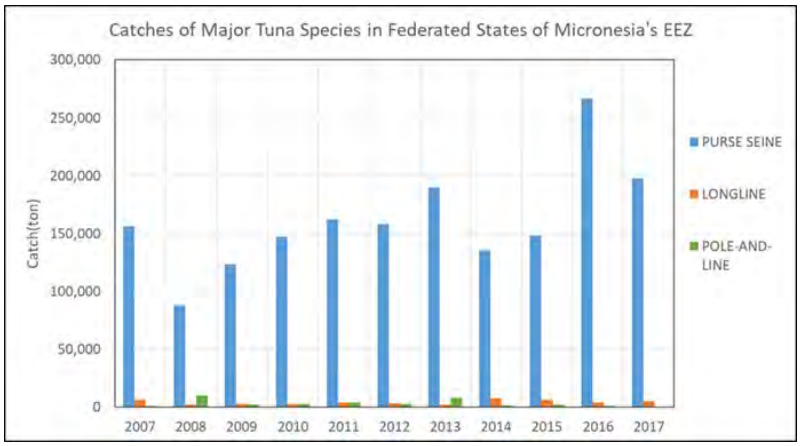
4.2. Operating Status of Pohnpei Port (Fishing Port)

4.2.1. Forms of fishing and trend of logistics

As described earlier, despite the fact that it does not have a favorable environment for transshipment because of the narrow channels for navigation and turning around, protruding rocks and shallow waters, and underdeveloped navigation safety facilities, Pohnpei Port is popular as a transshipment port of bonito and tuna among the PIC member countries. The Survey Team observed the fishing-related logistics in Pohnpei Port.

(1) Catch of bonito and tuna within the EEZ of FSM and transshipment in Pohnpei Port

Fishing methods for bonito and tuna are broadly classified into purse seine fishing, longline fishing and pole-and-line fishing. The figure below shows the transition of the catch of bonito and tuna by fishing method from 2007 to 2017 (Figure- 4.5).



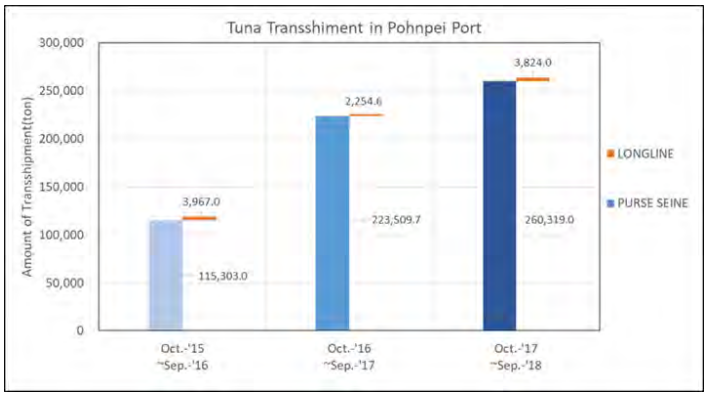
Source: Graduate School USA, Federated States of Micronesia Fiscal year 2017 Statistical Appendices

Figure- 4.5 Catch of bonito and tuna within the EEZ of FSM by fishing method

Of the three types of fishing methods, the catch by purse seine fishing accounts for more than 95% of the total catch. Longline fishing and pole-and-line fishing contribute only a small amount. Percentage of the catch by pole-and-line fishing is the smallest and it is less than 1% in some years.

The catch varied greatly from 100,000 tons to 270,000 tons in the last 10 years. It was 270,000 tons in 2016 and 200,000 tons in 2017. These two years were the highest catch in the last 10 years.

In order to clarify the details of transshipment in the bonito and tuna logistics of Pohnpei Port, Survey Team analyzed the amount of transshipment of bonito and tuna in Pohnpei Port from fiscal 2016 to fiscal 2018 (fiscal year in FSM is from October to September of the following year) based on the materials obtained at the site.



Source： Eited by Survey Team based on data provided by PPA

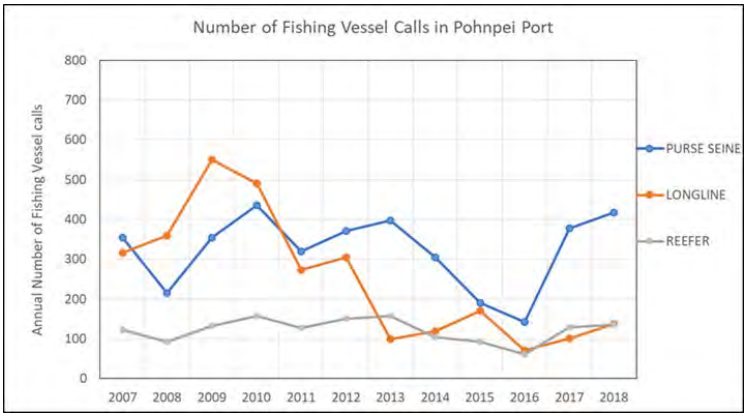
Figure- 4.6 Amount of bonito and tuna transshipment in Pohnpei Port

Although the reliability of the data is low because the amount of transshipment in fiscal 2016 was less than that of the other two years, the amount of transshipment in fiscal 2017 and 2018 was about 220,000 tons and 260,000 tons, respectively. Since these amounts are almost equivalent to the amount of the catch in the EEZ of FSM shown earlier, it can be assumed that most of the catch of bonito and tuna within the EEZ of FSM is traded in Pohnpei Port. More than 97% of the transshipment is the catch by purse seine fishing and the rest is by longline fishing.

(2) Fishing vessels and reefer vessels calling at Pohnpei Port

Survey Team analyzed the use of Pohnpei Port by vessels related to the catch of bonito and tuna. The vessels covered by the analysis are longline vessels, purse seine vessels and reefer vessels. The reefer vessels use the Port for the purpose of transshipment of the catch by purse seine fishing.

Record of calls by the three types of vessels involved in the handling of bonito and tuna in Pohnpei Port is shown in the following.

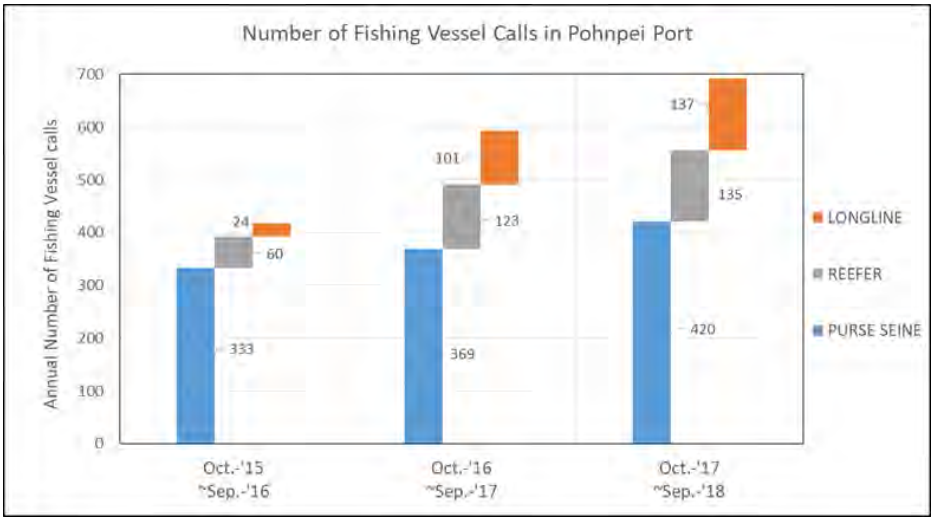


Source: Eited by Survey Team based on data provided by PPA

Figure- 4.7 Number of calls by fishing-related vessels at Pohnpei Port

Of the calls by three types of fishing-related vessels, calls by longline vessels alone have been on the declining trend in the last 10 years, showing a significant decrease from more than 500 calls in 2009 to around 100 calls per year in recent years. On the other hand, the number of calls by purse seine vessels, despite yearly variations, has been around 400 calls per year in the last two years and the number of calls by reefer vessels, which fluctuate in accordance with the number of calls by purse seine vessels, has been around 100 calls per year.

Figure- 4.8 shows the result of analyzing the number of fishing-related vessel calls in Pohnpei Port based on the statistics of the Port.



Source: Eited by Survey Team based on data provided by PPA

Figure- 4.8 Cumulative number of fishing-related vessel calls per year

While FY2016 shows a different trend from those of the other two years, FY2017 and FY2018 had the greatest number of calls by purse seine vessels, which was about 400 calls per year, and more than 100 calls per year by longline vessels and reefer vessels, respectively.

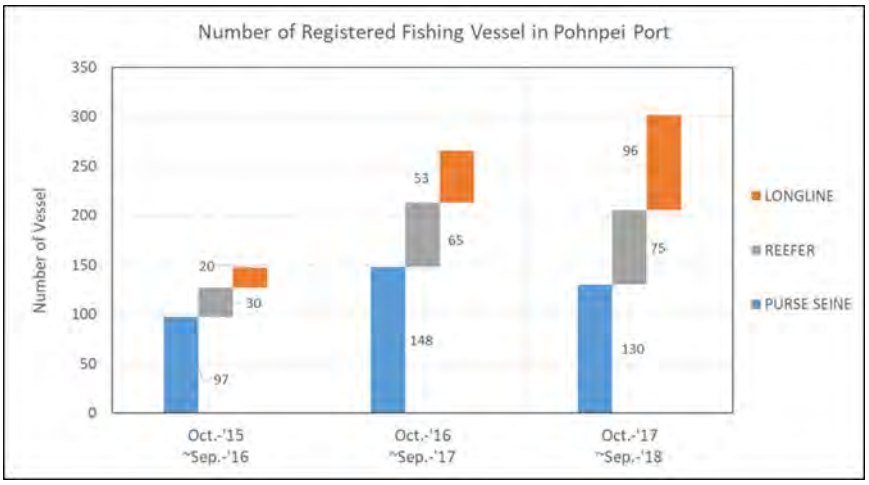
More than 95% of the bonito and tuna transshipment in Pohnpei Port corresponds to the catch by purse seine vessels. Bonito and tuna landed from purse seine vessels in Pohnpei Port are subsequently transshipped to reefer vessels.

The amount of bonito and tuna transshipped per transshipment is about 500 tons for purse seine vessels and about 1,500 tons for reefer vessels, according to the estimation based on the distribution amount of bonito and tuna and the number of calls by purse seine vessels and reefer vessels in Pohnpei Port. (Annual distribution of bonito and tuna is 250,000 tons and there are about 400 purse seine vessel calls and about 130 reefer vessel calls per year.)

Considering the length and the fish hold capacity of the purse seine vessels annually using the Port, which are about 70 m and about 1,200 tons, and the length and fish hold capacity of the reefer vessels, which are about 120 m and about 2,000 tons, the estimation is valid. Although the transshipment from longline vessels accounts for only 5% of the bonito and tuna transshipment in the Port, the impact of longline vessel calls in the Port, which amount to about 100 calls per year, on the congestion of the Port

cannot be neglected.

The following figure shows the analysis result of the number of registered fishing-related vessels that used the Port in the recent three years.

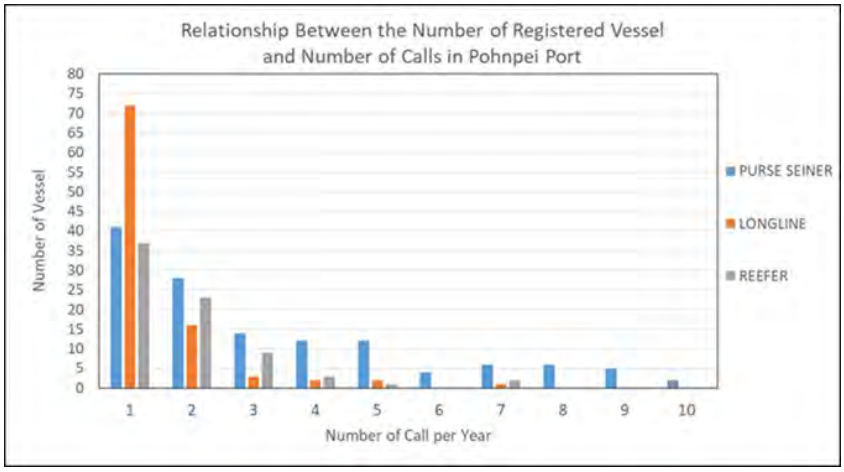


Source: Eited by Survey Team based on data provided by PPA

Figure- 4.9 Number of registered fishing-related vessels using Pohnpei Port

In FY2018, the number of registered vessels is30 for purse seine vessels, about 100 for longline vessels and 75 for reefer vessels, which are almost the same as in the previous FY2017.

Annual average number of calls by type of vessels can be calculated as about 3 for purse seine vessels, about 1.5 for longline vessels and about 2 for reefer vessels. The result of detailed analysis of the number of calls in FY2018 by each registered vessel is as shown in Figure- 4.10.



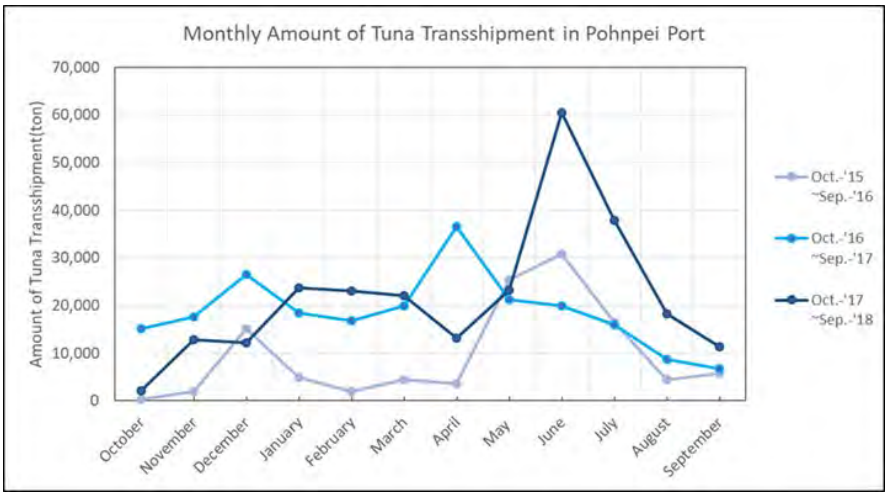
Source: Eited by Survey Team based on data provided by PPA

Figure- 4.10 Number of annual calls by fishing-related vessels using Pohnpei Port (2018)

While more than a half of the registered purse seine and reefer vessels make two or more port calls per year, as many as 75% of the registered longline vessels make only one call per year, which is a temporary call on an emergency basis for replenishment of fuel and water, and as such, we can see that longline vessels behave differently from purse seine vessels. The maximum number of annual calls per registered vessel is 10 calls for purse seine vessels and 7 calls for longline vessels and reefer vessels.

(3) Fishing season of purse seine fishing

It is said that purse seine fishing is seasonal and that the high season is March to July, when the Equatorial Countercurrent develops. The graph below shows the monthly amount of transshipment in Pohnpei Port. Although the amount varies from one year to another、we can see from the graph that transshipment is usually active from May to July.

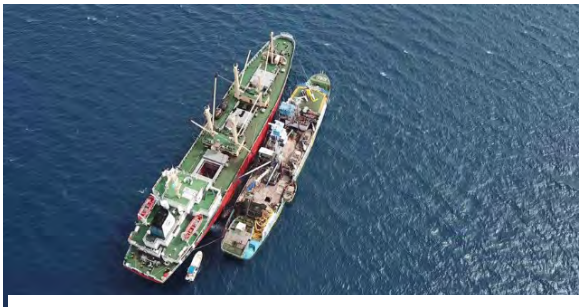


Source： Eited by Survey Team based on data provided by PPA

Figure- 4.11 Transition of monthly amount of transshipment in Pohnpei Port (FY 2016 – FY 2018)

(4) Current and future transshipment activities in Pohnpei Port

Transshipment from purse seine vessels to reefer vessels in Pohnpei Port is conducted in the anchorage within the reef of the Port, where up to 18 reefer vessels are allowed to moor by anchoring. Reefer vessels sometimes stay there for nearly one month for transshipment from purse seine vessels.



Photographed by Survey Team (Feb. 2019)

Photo- 4-1 Transshipment in the anchorage 1

Photographed by Survey Team (Feb. 2019)

Photo- 4-2 Transshipment in the anchorage 2

Constraints on distant water fishing nations in the WCPFC waters tend to increase. Transshipment in high sea is prohibited and because of incentives for conversion to local corporation (reduced fishing fees, etc.) and increasing expenses for bringing the catch directly to the home country (about 150,000 tons, 10 to 15% of the catch in the entire WCPFC waters) as is the case for Japan, it is considered that

the amount of transshipment in Pohnpei Port will tend to increase in the future.

Moreover, since long-term mooring of reefer vessels in the anchorage may negatively impact the environment (due to wastewater, solid waste treatment, ballast water, etc.), landing of the catch by purse seine vessels has been carried out in the form of onshore transshipment without the use of reefer vessels. For example, in Majero, which Survey Team visited in this Survey, a development project of facilities for onshore transshipment, such as wharf, freezer and container yard, was being implemented, although by private companies. This made a strong impression on Survey Team that the PNA member countries are aimed at fishery-based industrial development of the island countries, focusing on the creation of employment opportunities by establishing joint ventures, installation of processing factories, etc. and procurement of fuel oil, equipment and expendables, repair of fishing nets, and inspection and maintenance of machinery in order to provide more benefits to island countries.

When visiting Pohnpei Port in this Survey, Survey Team witnessed onshore transshipment from a purse seine vessel in the Port. It must have been carried out on a trial basis, but it is considered to represent a future direction.

Source: Photographed Survey Team (February 2019)

Photo- 4-3 Transshipment on the main wharf (1)

Source: Photographed Survey Team (February 2019)

Photo- 4-4 Transshipment on the main wharf

Source：Photographed by Survey Team (February 2019)

Photo- 4-5 Handing of reefer container on the wharf

Source：Photographed by Survey Team (February 2019)

Photo- 4-6 Direct loading on the reefer container

On the other hand, for longline vessels, transshipment is carried out in the fishing port zone in the south of Pohnpei Port (Takatik fishing port) from vessels to land. The catch consists of either yellow fin tuna or big eye tuna, and it is sorted into tuna for sashimi or tuna for processing, according to freshness and quality. In order to supply sashimi-grade tuna to the global market, longline vessels equipped with -60ºC freezing system or ice storage facility intended for supplying fresh tuna by air transportation are used. In accordance with the usage, refrigerated containers with three different set points, namely, -20ºC, -40ºC and -60ºC, have been set up.

Source：Photographed by Survey Team (February 2019)

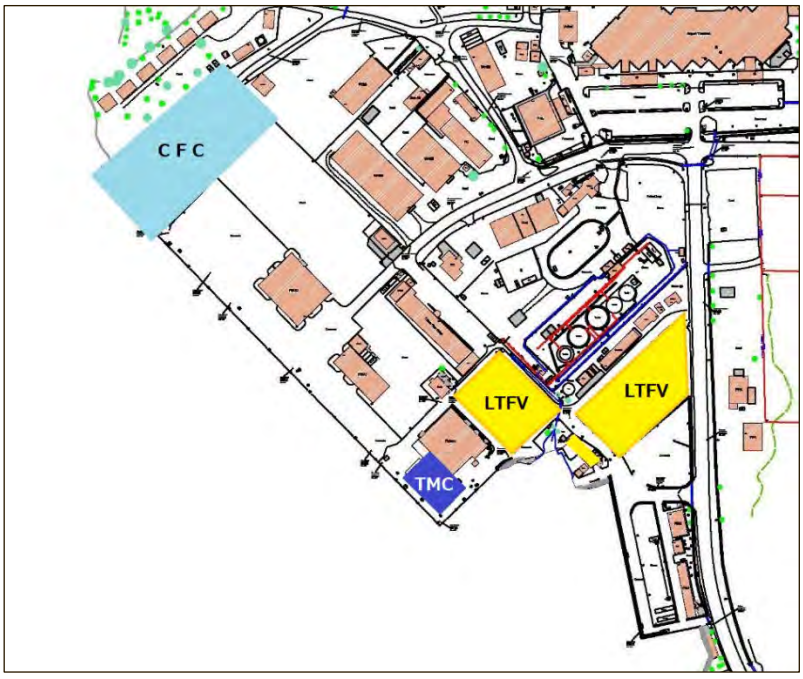
Photo- 4-7 Longline vessels moored at fish port

Source：Photographed by Survey Team (February 2019)

Photo- 4-8 Landing from longline vessel

4.2.2. Usage status of wharf and onshore facilities in the fishing port section within Pohnpei Port

The following three companies are engaged in joint ventures within Pohnpei Port.



Source：Edited by Survey Team based on the data provided by PPA

Figure- 4.12 Usage status of onshore facilities in the fishing port section of Pohnpei Port

(1) Luen Thai Fishing Venture (LTFV)

Luen Thai Fishing Venture (LTFV) entered the business of fresh tuna air transportation using small longline vessels in the 1990s, following Japan and Taiwan. As its parent company (Luen Thai International Groupe Ltd.) owned an airline as a group affiliate, LTFV survived through a severe competition in the air transportation business of tuna in FSM in those days, and it has achieved steady growth, while changing its business format. In 1993, the company concluded a leasing contract with Pohnpei State Government for a fisheries processing plant (PFC: Pohnpei Fishing Corporation), its administration building and the surrounding area in Takatik fishing port, which are owned by Pohnpei State Government. In August 2018, the contract was renewed to extend the contract period by 25 years for the same site. Since PPA is not involved in this contract, management is under the direct control of the State Government.

Basically, this company mainly deals with onshore transshipment (landing), chiefly handling tuna. As such, it is not interested in bonito so much. The market of the company extends widely, including Japan. In accordance with the leasing contract extension last year, the company intends to expand its business, whose major segments are as follows:

1) Frozen tuna business: Export of tuna frozen at -60^{o}C using refrigerated containers, mainly targeting the Japanese market.

2) Fresh tuna air transportation business: Export of fresh tuna by air transportation, which was prosperous in the 1990s. The company introduced seven longline vessels dedicated to this business.

3) Frozen loin processing business: The company has a plan to perform processing of frozen loins using the PFC processing plant and this business is scheduled to begin around September 2019.

4) Eastern little tuna culturing business: Cage-net culturing at Sokehs Rock on the opposite shore of Pohnpei Port. The company plans to culture eastern little tuna for export as fresh produce or live fish, bringing in fertilized eggs from Japan to incubate and grow. The plan failed last year, but the company plans to continue the implementation of this plan.

The company owns about 70 longline vessels for tuna fishing by itself and acts as an agent for about 40 longline vessels (owned by Chinese) on a contract basis. So, the company operates a little more than 100 vessels in total. Also, the company has freezers of -35^{o}C and -25^{o}C (for bait) and a refrigerator in the PFC processing plant. A lot of 40ft refrigerated containers are used, seemingly because of the shortage of freezer capacity.

In accordance with the business expansion, the company wishes to use an unused freezer facility owned by former Economic Development Authority (EDA), which is an agency of Pohnpei State Government, because it is located adjacent to PFC. At the point of the Survey, the company was not authorized to use it.

With respect to purse seine fishing, although it does not own purse seine vessels, the company provides

vessel agent services. For local employment, the company employs about 100 Micronesians for transshipment, processing, office and security works, etc. As regular employees of LTFV, eight Chinese work for the company.

The company has bought and operates a repair facility (dry dock) in Kosrae, which was built by a Korean contractor in the early 1990s, and it claims that vessels of up to 600 tons can be grounded in this facility. Based on a long-term leasing contract concluded with Kosrae State about the use of a part of Okato Port, the company is making investments. For example, according to the explanation, items subjected to on-board brine freezing are frozen again in an onshore air blast freezing facility to be made into products for export.

(2) Caroline Fishing Corporation Inc. (CFC)

Caroline Fishing Corporation Inc. (CFC), which is a three-party joint venture established by Pohnpei State Government, FSM national government (National Fishing Corporation: NFC) and an Australian private company in 1990, owned three secondhand purse seine vessels. The main wharf was extended by 60 m northward when CFC was established. Later, because of the sluggishness of business, the management body was changed to a Ukrainian company and FSM national government withdrew from the management. Since then, the company has been operating as a new purse seine fishing company with 49% of its capital is owned by Pohnpei State Government while the rest of 51% owned by the Ukrainian company.

CFC currently owns six purse seine vessels, which are based in Pohnpei Port and mainly operate in the PNA waters. The catch of these vessels is transshipped to reefer vessels either in an anchorage or at the company-owned wharf and it is mainly traded with C. Itoh & Co., on the spot of the transshipment to reefer vessels.

Two power blocks, which are devices to haul nets for purse seine fishing vessels, are installed on the wfarf area of CFC. Moreover, standby purse seine fishing vessels of two fleets were stocked. FADS (fish aggregating devices) were under preparation. The material was palm fiber rope. The captains and chief fishermen of the purse seine vessels of the company were Croatians and Filipinos and Micronesians are employed as the crew members.

The company’s leasing contract is scheduled to terminate in 2021, but it is expected to be extended. If Pohnpei Port is expanded with the assistance of Japan by then, there is a possibility of relocation. The company is also engaged in the vessel agent business for fishing vessels other than their own vessels.

The company has a plan to construct a loin processing plant as it intends to further expand its business. Other than that, the company also has plans to build a container yard for transshipment and workshop and to start material supply services.

(3) Taiyo Micronesia Corporation (TMC)

Taiyo Micronesia Corporation (TMC) was established in 2012 as an overseas purse seine fishing joint

venture between Taiyo A&F Co., Ltd. of Japan and FSM national government. The company sequentially transferred six large purse seine vessels to the site and mainly catches bonito in the central and western central Pacific Ocean.

As part of the joint venture, in February 2018, TMC established a local plant for production of *katsuobushi* and pig farming feed for the purpose of industrial development in FSM. This plant produces *arabushi* (dried bonito before the final processing stage, used for producing *hanakatuo* shavings) with the daily production target of one ton.

When an amount suitable for shipping is produced, the product is exported to Japan (Makurazaki, Kyushu) by reefer vessels, shipped together with frozen bonitos.

The company produces fish meal from the head, bones, etc., which are byproducts, and has started to sell it as feed for pigs. The feed is currently 100% fish meal, but the company is considering blending it with other types of feed to improve the yield. Since imported feed is marketed at $18 per bag (20kg), the company has reduced the price of the product from $30 per bag to $20 per bag. The company is also studying the way to utilize mackerel scads, which are mixed in the catch of purse seine.

Since there is no freezer for raw fish, refrigerated containers are used, but since they are unreliable, the company is considering using the freezer owned by National Fisheries Corporation (NFC, a state-owned fishery company of FSM), which is currently non-operational, after repairing it.

4.2.3. Wharf and onshore facilities in the fishing port section

With respect to the usage status of facilities, Survey Team obtained and used statistics (amount of landing, number and types of vessels using the fishing port, in consideration of chronological and seasonal changes), interviewed the personnel involved in the maintenance structure, and verified the situation at the site. The findings are outlined in the following. (See Table- 4.2)

Table- 4.2 Fishery-related port facilities on the main and the fishing wharves of Pohnpei Port

Facility	Usage status/facility condition/	Management body
Quay	Used for mooring of inter-island ferry boats, tuna longline vessels, patrol vessels, etc.	PPA
Cold storage warehouse, processing facility, ice making facility	Freight handling building: *Katsuobushi* processing plant (TMC)	Leasing contract between PPA and TMC
	Cold storage warehouse (non-operational): Pohnpei State Ice making facility (non-operational): LTFV PFC processing plant (operational): LTFV	Leasing contract between Pohnpei State Government and LTFV
	Administration office, toilet (operational):	PPA
	Maritime Security Office (operational):	Maritime Police

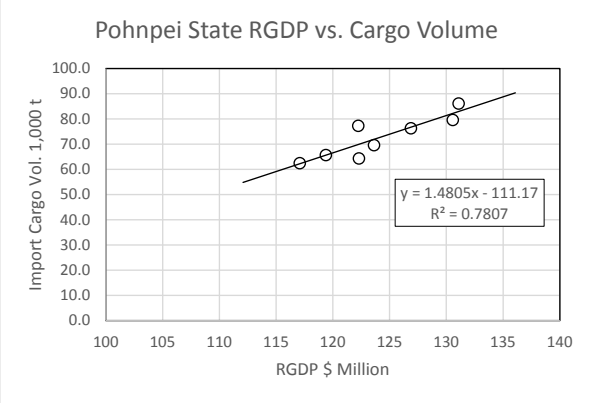
Sourse: Prepraed by Survey Team

4.3. Cargo Forecast

4.3.1. Correlation between GRDP of Pohnpei State and import cargo volume

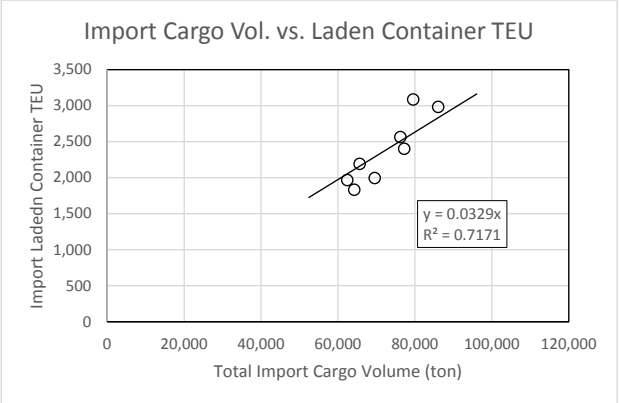
The amount of cargo handled by a port is highly dependent on the economic activity in the area behind the port, which is called the hinterland of the port, and generally there is a strong correlation between these two quantities. In the future, the volume of cargo handled by Pohnpei Port will be estimated using the correlation with the GRDP of the hinterland of the port, which is the GRDP of Pohnpei State. The GRDP of each state varies in accordance with rise and decay of economic activity of the state.

With an assumption that the GRDP share recorded in 2010 should remain unchanged in 2011 and afterward, the relationship between GRDP of Pohnpei, which is 46.9% of FSM's GDP (see Chapter 2 Table-2.1) and the import cargo volume of Pohnpei Port (excluding oil and heavy machinery) is shown in Figure- 4.13. The figure indicates that the correlation between the two is relatively high and, therefore, the future cargo volume can be estimated by applying the regression drawn by straight lines in the figure. In addition, it is seen that there is a relationship shown by a straight line in Figure- 4.14 between the amount of imported cargo (excluding oil and heavy machinery) and the volume (in TEU) of import laden containers.



Source：Prepared by Survey Team

Figure- 4.13 Correlation between import cargo volume and GRDP



Source：Preprared by Survey Team

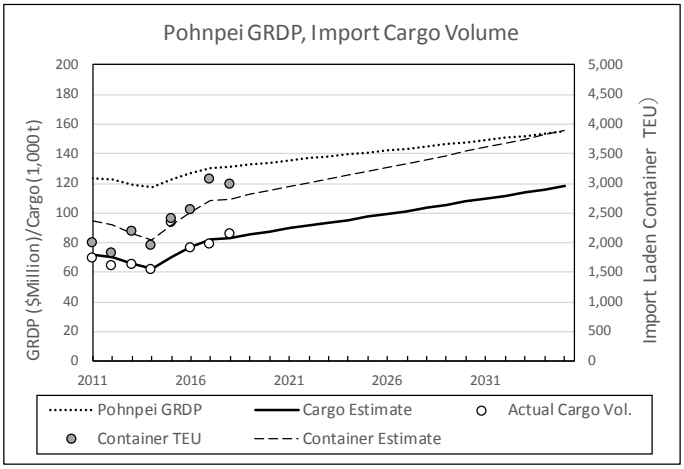
Figure- 4.14 Correlation between import cargo volume at Pohnpei Port

4.3.2. Forecast of cargo volume at Pohnpei Port

By utilizing the regression equation determined through the regression analysis shown in Figure- 4.13, the volumes of import cargo (except oil) has been firstly forecasted based on the GRDP of Pohnpei State up to the year 2035. Then, the volume of import laden containers has been forecasted by using regression equation obtained in Figure- 4.14 from the volume of import cargo.

The results are shown in Figure- 4.15. In the figure, ○indicates the actual volume of imported cargo while ●indicates actual volume of imported laden containers. It is can be seen that the growth rate of imported cargo volume is larger than the growth rate of GRDP. According to this estimate, cargo volume

and container volume are expected to increase 25% in 2028 and 43% in 2035 over 2018.



Source: Prepared by Survey Team

Figure- 4.15 Forecast of import cargo volumes and import laden containers

4.3.3. Breakdown of containers by size and laden/empty

As mentioned above, the estimation of the volumes of container cargoes has been carried out, only for the import laden containers because the statistics of PPA contains only import cargoes. For the examination of the productivity of container cargo handling, total container volumes shall include export containers with breakdown by laden/empty and by size (20 feet/40 feet). Survey Team analysed container handling records for the past three years provided by FSCO (the cargo handling company).

The results are shown in Table- 4.3. Since the number of 40' export empty containers are not available for the year 2016 and 2015, it is estimated with the assumption that the number of 40' containers (a total of laden and empty containers) imported in a year should be the same as that of the 40' containers exported in the same year. The estimated number of export 40' empty containers are shown with yellow shade in the table Table- 4.4.

Table- 4.3 Breakdown of import and export containers (by calendar year)

		Laden (Box)		Empty (Box)		Total (Box)			Laden	Empty	Total
		Laden 20'	Laden 40'	Empty 20'	Empty 40'	20'	40'	20'+40'	TEU	TEU	TEU
2016	Import	1,408	598	40	135	1,448	733	2,181	2,604	310	2,914
	Export	145	104	931	1,001	1,076	1,105	2,181	353	2933	3,286
	Total	1,553	702	971	1,136	2,524	1,838	4,362	2,957	3243	6,200
2017	Import	1422	762	114	109	1536	871	2,407	2,946	332	3,278
	Export	210	219	1178	800	1388	1019	2,407	648	2778	3,426
	Total	1632	981	1292	909	2924	1,890	4,814	3,594	3110	6,704
2018	Import	1,585	927	23	180	1,608	1,107	2,715	3,439	383	3,822
	Export	130	321	1,376	666	1,506	987	2,493	772	2,708	3,480
	Total	1,715	1,248	1,399	846	3,114	2,094	5,208	4,211	3,091	7,302
		Laden 20'-40' Share		Empty 20'-40' Share		20'-40' Share (Box)			Laden-Empty Share (TEU)		
2016	Import	70%	30%	23%	77%	66%	34%	100%	89%	11%	100%
	Export	58%	42%	46%	52%	49%	51%	100%	11%	89%	100%
2017	Import	65%	35%	46%	54%	58%	42%	100%	90%	10%	100%
	Export	49%	51%	60%	49%	64%	36%	100%	19%	81%	100%
2018	Import	63%	37%	11%	89%	59%	41%	100%	90%	10%	100%
	Export	29%	71%	67%	33%	60%	40%	100%	22%	78%	100%

Source: Prepared by Survey Team based on data provided by FSCO

The following aspects are observed in Table- 4.3.

- The number of containers (boxes) handled increased by approximately 10% compared with the previous year in 2017 and 2018: see the column of “20’+ 40” under “Total Box” in the middle of the upper rows.
- The 20'/40' ratio of import laden containers (see the columns of “Laden 20'- 40' share” shown in the three rows from the bottom of the Table) is approaching to 6:4 in 2018 from 7:3 in 2016. This implies that import by 40' containers tends to gradually increase. Such trend is more obvious in export laden containers. The 20’-40’ ratio of export laden containers has changed significantly from about 6:4 in 2016 to 3:7 in 2018.
- Regarding the number of laden export container boxes (see the columns of “Laden (Box)” in upper rows), while number of 20' container boxes decreased in 2018 compared with the previous years, 40' containers boxes increased by 100 every year. Taking into account the fact that the principal export commodity at Pohnpei Port is fishery products, it is likely that there is a trend in export of fish to utilize 40’ reefer containers as well as the conventional means, i.e. reefer fish carriers. The amount of transshipment to containers performed at the fishing port of Pohnpei Port has increased significantly from 2,250 tons in FY2017 to 3,842 tons in FY2018.
- The ratio of 20 feet container to 40 feet container is 6: 4 for import and export (2017, 2018). Using this ratio, TEU / Box is 1.4.
- For import containers, the ratio of the laden and the empty container volumes in TEU is 9: 1 over the past three years (see the column “Laden-Empty-Share (TEU)” at the bottom right of the table). This indicates that 10 % (in terms of TEU) of import containers are empty containers. In other words, the total import container volume including empty containers is 1.11 times import laden container volume.

As the import container cargo volume (TEU) shown in Figure- 4.15 in Section 4.3.2 is the estimate of laden container volume only, the total import container volume including empty containers and export container volumes have been estimated as follows:

- The total volume of the import containers (in TEU) is estimated as 1.11 times the volume of the import laden container (in TEU). In practice, the volumes of the import and the export container are not equal every year. However, since all the imported containers should be exported and therefore, the import and the export container volumes should be equal to each other in the long run. The total container volume is thus estimated as twice of the import container volume.
- The total number of container boxes has been estimated applying 20’- 40’ ratio of 6:4, which was realized in 2017 and 2018 for both import and export containers.

Table- 4.4 shows the estimated container throughput (total of import and export containers) and the number of boxes of 20’ and 40’ containers calculated in the manner described above. The volume of

import laden containers (in TEU) shown in Table- 4.4 is the estimated volume obtained using the regression equation in Figure- 4.3 and 4.4, while the volume of import empty container is estimated to be 0.11 times the volume of the import laden container.

Table- 4.4 Estimation of the breakdown of container boxes

Year	Import			Throughput	Total	Share	
	Laden	Empty	Total			20	40
	TEU	TEU	TEU	TEU	Box	Box	Box
	(1)	(2)	(3) [(1)+(2)]	(4) [(3)x 2]	(5) [(4)/1.4]	(6) [(5)x0.6]	(7) [(5)x04]
2011	2,364	263	2,627	5,253	3,752	2,251	1,501
2015	2,297	255	2,552	5,104	3,646	2,188	1,458
2018	2,728	303	3,031	6,061	4,329	2,598	1,732
2020	2,878	320	3,198	6,396	4,569	2,741	1,828
2025	3,206	356	3,562	7,124	5,088	3,053	2,035
2030	3,540	393	3,934	7,867	5,619	3,372	2,248
2035	3,890	432	4,322	8,644	6,174	3,704	2,470

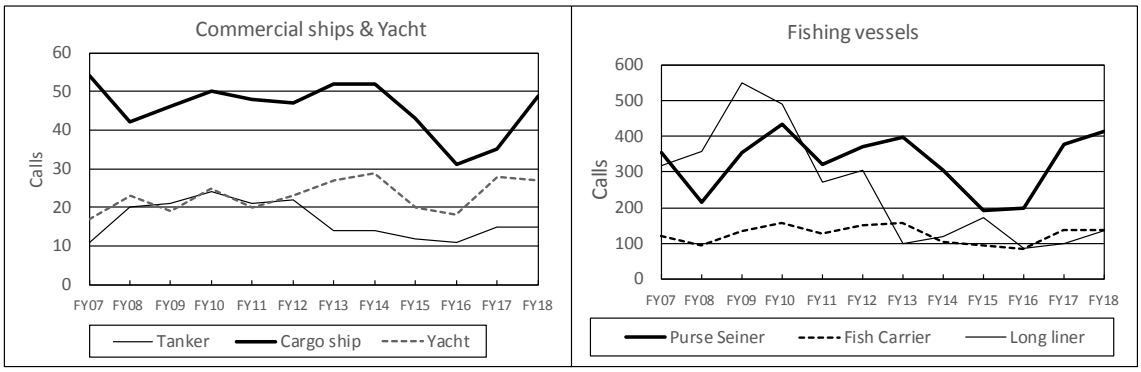
* based on the assumption of 50 calls per year

Source: Prepared by Survey Team

4.4. Forecast of number of port calls by container ships

4.4.1. Statistics of calling ships

The annual variation in the number of port calls by type of ship is drawn over the period from 2007 to 2018 in Figure- 4.16. The left figure (a) shows the number of tankers, cargo ships (container ships) and yachts, while the right figure (b) shows the number of fishing vessels (Purse Seine vessel, Fish Carrier, and Long-liner).



(a) Calls by Tanker, cargo ships and Yacht (b) Calles by fishery related vessels

Source: Edited by Survey Team based on the data provided by PPA

Figure- 4.16 Variation of port calls by type of vessels

The characteristics of the variation of number of port calls by fishing vessels observed in Figure- 4.16 (b) are as follows:

- Port calls made by purse seine fishing vessels decreased to about 200 vessels in 2015 and 2016, while in other years about 300 to 400 purse seine fishing vessels called at the port. The reason

for the decrease observed in 2015 and 2016 may be that the purse seine fishing vessels moved to other countries such as the Marshall Islands in accordance with the fishing place moving to the east of FSM's water.

- Number of calls by fish carriers (reefer ships) vary in accordance with the number of purse seine fishing vessels and about 0.4 to 0.5 times the number of port calls by the latter. On average, the number of calls by fish carriers have been 100 to 150 per year.
- Longline fishing boats sharply decreased from 500 in 2009 to 100 in 2013, and thereafter remain in the range of 100 to 150 per year.

4.4.2. Forecast of number of port calls of container ships

Container ships call at Pohnpei Port approximately 50 times a year except over the period from 2015 through 2017. The size of container ships currently calling at the port in service is about 15,000 DWT with loading capacity is ranging from 900 to 1,250 TEU (estimated by interpolating the data from "National Research Institute Research Report No. 28 2006"). According to a pilot, the width of port entrance is wide enough to allow container vessels of this size, which is the maximum size to maneuver the curved approach channel.

In this section, it is examined whether the number of port calls by container ships will increase as the volume of container cargo at Pohnpei increases.

Container ships calling at Pohnpei Port also call at seven to eight ports in a voyage. Therefore, a 15,000 DWT ship having a capacity of 900 to 1,250 TEU, can load 110 to 130 TEU per calling port. Since Pohnpei Port is one of the largest ports along the service route via Palau, FMS and RMI, shipping lines may allocate larger spaces for Pohnpei Port than the average.

Assuming that container ships call at Pohnpei Port 50 times a year, the import container volume per call is estimated from the forecasted volume shown in Table- 4.5. Estimated container volumes per call are 61 TEU in 2018, 64 TEU in 2020, 71 TEU in 2025 and 86 TEU in 2035 (see Table- 4.4), which are smaller than the above-estimated load allocation space. Therefore, it seems to be realistic to assume that, over the coming years, two shipping lines operate the Micronesian route every two weeks, i.e., approximately 50 calls a year.

In order to examine duration of ships in port, the mooring time required for loading and unloading time per call is examined. The cargo handling performance is indicated by the number of container boxes per hour regardless of the size of container. Assuming that container ships call 50 times a year, the average number of container boxes handled per call (Box) is calculated by dividing the total number of container boxes per year by the number of calls. Table- 4.5 shows the results of the calculation as well as the handling time required per ship with the assumption that two units of on-board cranes having a productivity of 8 box per hour are simultaneously operated and, therefore, total productivity is 16 boxes per hour. The productivity of eight boxes per hour per on-board crane was chosen based on the experience of a small and medium-sized container port and was confirmed to be realistic through the

observation of container operation by Survey Team during Kyowa Stork being at Pohnpei Port on Feb. 8, 2019)

Assuming that cargo handling will remain unchanged, i.e., two on-board cranes per ship, the loading and unloading time per ship will be 7.7 hours in 2035, which is 1.4 times longer than 5.4 hours in 2018 (see Table- 4.5) . Thus, container handling can be completed within the port operational time of 12 hours from 6:00 to 18:00. However, freight statistics show January is the peak month and that the container volume in January generally jumps up to 1.5 times larger than the average. The total time of container handling may also be 1.5 times longer or about 12 hours. Therefore, it may be necessary to install lighting facilities to allow container handling work at night.

Table- 4.5 Annual container volumes and estimates of container operation time per ship

	Throughput		Box/call*	Total handling
	TEU	Box	(In&Out)	Hours**
2011	5,253	3,752	75	4.7
2015	5,104	3,646	73	4.6
2018	6,061	4,329	87	5.4
2020	6,396	4,569	91	5.7
2025	7,124	5,088	102	6.4
2030	7,867	5,619	112	7.0
2035	8,644	6,174	123	7.7

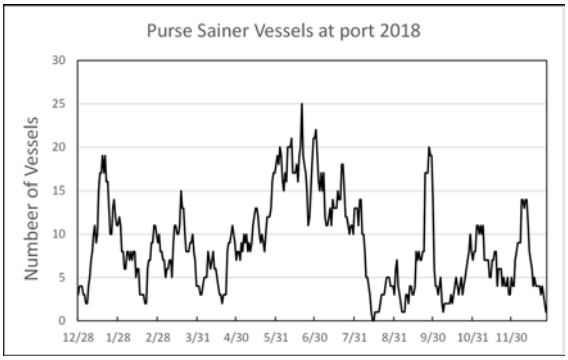
*Number of container boxes loaded and unloaded per call

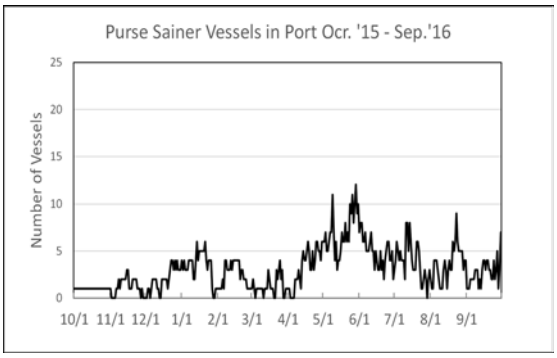
** Hours needed with the productivity of 16 box per hour

4.4.3. Situation of berth operation

"Berth" and "quay" are often used as synonyms, but in this report, "quay" is used when a discussion focuses on structures of mooring facilities including the wall structure and the deck, while “berth” is used when the discussion focuses on a water and land space designated by type and size of the mooring vessels including a portion of the quay where a ship docks, water area occupied by the ship and the mooring posts used to moor the shp. In this report, “wharf” means the whole structure that consists of quay and a backup land area, which is called yard, connected to the quay.

The main users of the main wharf are purse seine fishing vessels. The number of port calls by purse seine fishing vessels fluctuates from year to year. The left figure of Figure- 4.17 shows the number of calls by purse seine fishing vessels in 2018, while the figure on the right shows that in FY2016, i.e. from October of 2015 to September of 2016. Both figures show the peak season appears in May or June. It is obvious that the number of calls is much larger in 2018 (left figure). The maximum number of purse seine fishing vessel in the port in 2018 was 25, while that in 2016 was 12.

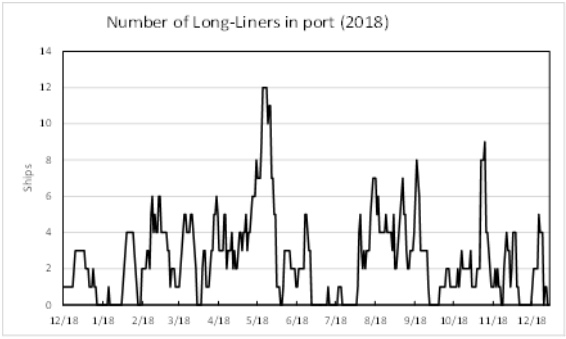




Source: Edited by Survey Team based on data provided by PPA

Figure- 4.17 Daily fluctuation of number of purse seine vessels in port in 2018 and FY 2016

Figure- 4.18 shows the fluctuation in the number of longline fishing boats moored in 2018.



Source: PPA edited by Survey Team

Figure- 4.18 Changes in the number of daily moorings for longliners (2018)

The situation of mixed mooring of cargo ship and fishing vessels at the main wharf is exhibited in Photo-4-9. Four (4) purse seiner vessels are moored breast to breast at the south end and some other purse seiner vessels are also moored at the north end of the wharf, while a container ship stays in between the moored purse seine vessels.

When a cargo ship is arriving at or leaving the wharf, purse seine vessels relocate for safety purposes

Source: PPA, Dec 14, 2016, taken from the material provided by JICA

Photo- 4-9 Congestion at the main wharf of Pohnpei Port

5. Port operation and management

5.1. Port Authorities in FSM

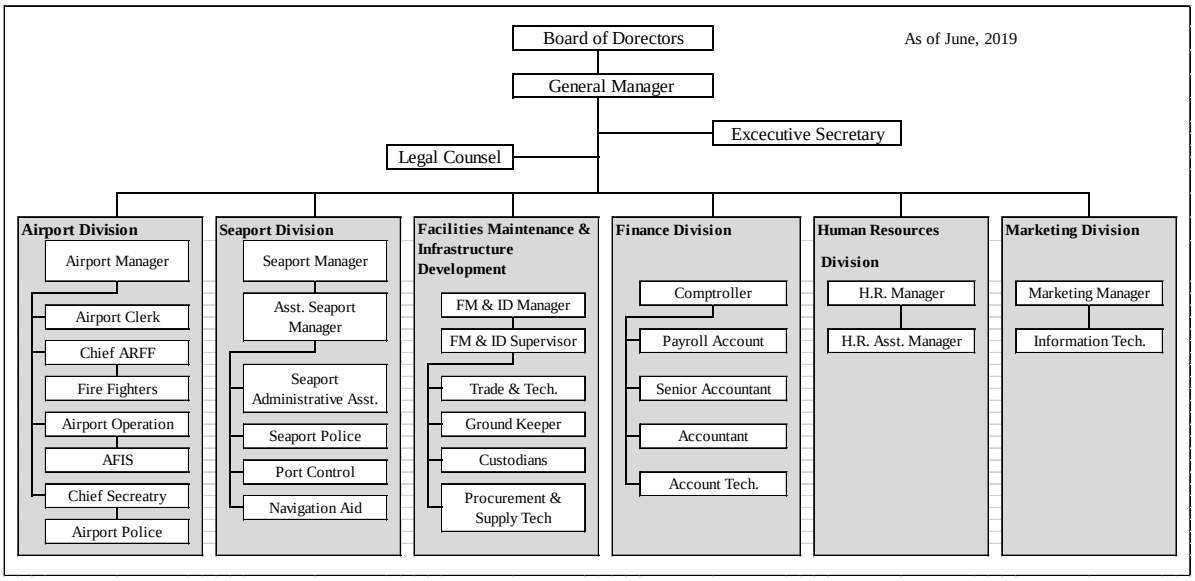
All the four major islands of FSM have international ports. While Colonia Port in Yap Island and Weno Port on Chuk Island are administered by state government, Pohnpei Port in Pohnpei Island and Okat Port on Kosrae Island are administered by Ports Authorities of respective ports. These Ports Authorities administer both port and airport.

The Pohnpei Port Authority (PPA) is an autonomous organization under the government of Pohnpei State established by the Pohnpei State Law No. 1 L-198-87 (Pohnpei Port Authority Law), which came into effect in 1991. In addition to managing and operating Pohnpei Port (Commercial Port Area and Fishing Port Area) and the airports, PPA is engaged in leasing land area within the Transportation Zone, which is under the jurisdiction of PPA. It administrates the port and airport areas including the navigation channel, the wharves and the water area up to 12 nautical miles from the entrance of the port.

5.2. Port and Airport Operation and Management System

The organization of PPA is shown in Figure- 5.1. The Board of Directors, which consists of seven members, is the highest decision-making body of PPA. There are six (6) divisions including the Port and the Airport Divisions under respective Division Managers. The four(4) other divisions, namely, Facilities Maintenance & Infrastructure Security Development, Finance, Human Resources, and Marketing Divisions, are not divided into port and airport businesses.

Cargo handling is performed by the Federal Shipping Corporation (FSCO) under a concession contract. Piloting service is provided by a consignment contract with a private company. The line handling service is provided by office staff of PPA.



Source: : PPA

Figure- 5.1 Organizational chart of PPA (As of June, 2019)

5.3. Status of operation lease and lending contract of PPA

As seen in Table- 5.1, PPA leases land spaces on the wharf and in their land area adjacent to the wharf in support of the port related activities to private companies (fishing company [CFC, Luen Thai], shipping company [SeaAir], cargo handling company [FSCO], hotel, oil company [Vital]) . In addition, PPA lends land space and buildings for warehouses and offices to state government agencies (National Fisheries Corporation, Federal Marine Police, Federal Government, State Government, etc.).

The following companies have lease contracts for the exclusive use of some portions of the main wharf:

- Federal Shipping Co. (FSCO): Performs cargo handling operations at the commercial wharf,
- Caroline Fishing Corporation (CFC): Lease the north portion of the main wharf (including 60m long berth) for repair and supply services for purse seine fishing vessels.
- Luen Thai: Lease buildings and land areas located within the fishing port area for their businesses such as handling and processing fish, transferring fish catch from long-line fishing vessels to reefer containers. The contract with the State government was renewed in 2019.

The following are lending agreement (Memorundom of Understanding) with government agencies:

- State Government of Pohnpei: a warehouse for stocking disaster relief supplies
- Federal Marine Police: Patrol boat mooring (control illegal fishing and rescue)

Contracts with state and federal governments do not charge fees. It is not PPA to conclude lease contracts on properties within the fishing port area, but the Pohnpei government directly contracts with companies. In addition, lease fees are paid to the state government. The other contracts are land lease in transportion zones other than the main wharf or the fishing port area for facilities such as warehouses, offices, and hotels. The lease of Misko Beach that is a proposed project site located on the north of the main wharf, where a dispute still continues after the lease contract expired in 2005.

Table- 5.1 Lend-lease contracts of PPA properties within transportation zone

Leesee	Location	Name of Organization	Type of Business	Status	Period (Year)	Date of Expire (mm/dd/year)
Fedeated Shipping Company	Wharf area	FSCO	Stevedor, warehose & transport	Lease	25	03/04/2044
Isamu Nakasone	TZ land	Harbor View Hotel	Hotel & Shop	Lease	4	12/14/2023
Tnakio Ehsa		*Pohnpei Marine Services*	*Warehouse & shipping Agent*	*		Expired
Pohnpei Transfer & Storage	TZ land	PT&S	Warehouse & shipping Agent	Lease	4	04/29/2021
National Fisheries Corp.	TZ land	NFC	Warehouse & shipping Agent	Lease	3	03/31/2022
Caroline Fisheries Coporation	Wharf area	CFC	Fishing Fleet Ooerations	Lease	30	06/17/2021
FSM Petroleum Corp.	TZ land	VITAL	Bulk Liquid Storage and Transport	Lease	3	08/31/2022
Misko Beach			*Hotel & Bar*	*		Expired
Luen Thai	Wharf area	LTFV	Fishing Fleet Operations and Processin	S.G.		
Oceania Inc.			*Cold Storage Fish Transfer Fcility*	*		Expired
FSM Natoional Government CDA	TZ land	CDA	Warehouse &Agricultural Processing	Lease	2	05/31/2021
SEAIR Transportation Agency	TZ land		Warehouse & Shipping Agent	Lease	5	11/29/2021
FSM National Government	TZ land	Police Maritime Wing	Patrol & Surveliance Vessels	MOU		
Pohnpei State	TZ land		Warehouse	S.G.		
FSM National Government	TZ land		Warehouse	Lease	10	09/30/2019
AMBYTH			*Shipping Agent*	*		Expired
Pohnpei State Government	TZ land	Economic Develop. Authority	Cold Storage & Provisioning	S.G.		
Micronesia Taiyo Corporation	TZ land		Processing	Lease	3	09/09/2020

Note) TZ land: Land lease in Transportation Zone, S.G.: Contract by Pohnpei Staye Government,

*: Lease has been terminated and not renewed

Source：PPA, as of June 2019

6. Natural Conditions of Pohnpei Port

6.1. Climatic and Oceanographic Conditions (tide and current)

6.1.1. Climatic Phenomena

(1) Temperature

Monthly mean temperature of Pohnpei in 2017 is shown in Table- 6.1. The weather in Pohnpei is Oceanic tropical climate and the temperature is almost stable through a year. The mean temperature is 28℃, the maximum is 30 to 32℃and the minimum is 24 to 26℃with small temperature difference.

Table- 6.1 Monthly mean temperature

Temprerature (℃)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Average
Mean Maxumum	29.9	30.3	30.3	30.6	30.4	30.4	30.9	31.7	31.3	31.3	30.7	30.3	30.7
Mean Minimum	25.2	25.4	25.7	25.9	25.7	24.6	24.8	24.3	24.6	24.4	24.6	25.4	25.1
Mean	27.6	27.8	28.1	28.2	28.1	27.5	27.8	27.9	27.9	27.9	27.7	27.8	27.9

Source：Local Climatological Data, NOAA, National Climatic Data Center (2017)

(2) Rainfall Depth

Monthly rainfall depth and the number of days of rainfall of Phonpei in 2017 are shown in Table- 6.2. Annual rainfall depth of Pohnpei reaches to about 4,800mm and the days of rainfall exceeds the 300 days.

Table- 6.2 Monthly rainfall depth and the number of days of rainfall

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Year
Monthly Precipitation (mm)	609.6	171.7	529.8	449.1	468.6	529.6	443.2	198.6	387.9	312.7	358.9	529.8	4,844.8
Number of Days of Precipitation	27	23	22	24	27	28	30	28	26	28	23	27	313

Note: Number of days of rainfall is more than 2.5mm

Source: Local Climatological Data, NOAA, National Climatic Data Centre (2017)

(3) Wind

Monthly wind speed and the wind direction of Pohnpei in 2017 are shown in Table- 6.3. Monthly mean wind speed is below 4m/sec and its maximum does almost not exceed 10m/sec which is calm. The wind direction from NE to E is prevailed through a year.

Table- 6.3 Monthly wind speed and wind direction

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Year
Mean Wind Speed (m/sec)	3.1	3.6	3.6	3.6	3.4	2.6	2.5	2.1	2.5	2.2	2.5	3.1	2.9
Prevail Wind Direction	NE	NE	NE	NE	E	NE	NE	SE	SE	SE	E	E	
Maximum 2 Minute Wind Speed(m/sec)	9.4	8.9	8.0	8.0	10.3	7.6	8.0	6.7	7.2	7.6	9.4	7.6	

Source：Local Climatological Data, NOAA, National Climatic Data Center (2017)

（4）Typhoon

Pohnpei Island has less damages by typhoons in comparison with other Micronesian islands. The instantaneous wind speed of about 32.9m/sec. was the maximum at the time of typhoon Juli in November 1991. According to the Basic Design Study Report on the Project for Improvement of Takatik Fishing Port, around West Caroline Islands where Pohnpei Island exists is an area where typhoons are easily borne, and the typhoons are almost always pass to the north side of Pohnpei Island and then move in a westerly direction while developing.

6.1.2. Oceanographic Phenomena

（1） Tide

According to the Basic Design Study Report on the Project for Improvement of Takatik Fishing Port, following tides are adopted.

Highest High Water Level （HHWL）	+1.58m （+5.2ft）
Mean High Water Level （MHWL）	+1.22m （+4.0ft）
Mean Water Level (MWL)	+0.70m （+2.3ft）
Mean Low Water Level (MLWL)	+0.30m （+1.0ft）
Lowest Low Water Level (LLWL), Datum Level (DL)	0.00m （ 0.0ft）

（2）Wave and Current

Pohnpei Port is calm since it is sheilded from the outside waves by the offshore barrier reef. It’s also assumed that the current in the port does not affect the vessel operation.

6.2. Sea Bottom Topography

Simple sounding was executed in the front, north side and the south side water areas of the existing wharf on January 29, 2019 during the field survey using simple depth sounder and GPS. And the results are shown in the Figure- 6.1 to Figure- 6.3. The water depth is the depth from the DL described in the above.

Source: Survey Team

Figure- 6.1 Result of simple sounding survey at north side water area of the existing wharf

Souce: Survey Team

Figure- 6.2 Result of simple sounding at front water area of th existing wharf

Source: Survey Team

Figure- 6.3 Results of simple sounding at south side water area of the existing wharf

6.3. Earthquake

Past earthquake record around Pohnpei Island is shown in Table- 6.4. No big damage occurred by earthquake after the big one occurred in 1971.

Table- 6.4 Earthquake record around Pohnpei Island

Date	Latitude	Longitude	Depth (km)	Magnitude (dyn cm)	Distance from Kolonia (km)	Horizontal Acceleration (gal)	Design Seismic Coefficient
March 12, 1974	8°76′ N	150°95′ E	33	5.5	825	4.09	0.004
April 18, 1981	6°91′ N	159°08′ E	25	5.0	188	16.84	0.017
December 22, 1983	0°04′ S	152°78′ E	33	4.0	972	1.60	0.002
September 5, 1991	2°53′ N	153°99′ E	33	4.5	640	3.34	0.003
September 23, 1993	9°01′ N	150°22′ E	33	5.0	912	2.83	0.003
June 11, 1998	5°76′ N	149°55′ E	33	4.6	955	2.20	0.002
July 26, 2000	6°08′ N	149°55′ E	33	4.3	948	1.91	0.002
February 9, 2003	7°14′ N	151°81′ E	33	4.2	698	2.60	0.003
June 28, 2003	13°76′ N	155°57′ E	33	4.5	839	2.44	0.002
May 11, 2004	5°77′ N	149°43′ E	10	4.7	964	2.28	0.002

Source: USGS, Earthquake Hazards Program

According to the Basic Design Study Report on the Project for Improvement of Takatik Fishing Port, horizontal seismic coefficient kh=0.05 is adopted as minimum preparedness, although seismic load is not considered on the design of the existing port facilities.

6.4. Topography and Soil Condition

6.4.1. Topography

Pohnpei Island is a volcanic island with diameter of about 24km and the area is about 335km^2. There are 600m to 800 m high mountains forming rough terrains and deep valley and many big rocks of basalt are exposed markedly in Deke Sokehs. The shoreline of theisland is consists of the mangrove swamps and dry flat lands and the outside of the coastal reef is lagoon. The coral reefs are developed at about 3km offshore and the barrier reefs are formed so as to surround the island. Pohnpei Port is located at the south west of Dekehtik Island and connected with the capital city of Coronia by the causeway.

6.4.2. Soil Conditions

The outline of soil investigation conducted at the time of construction of Pohnpei Port and its surrounding area are as follows. The borehole locations are shown in Figure- 6.4.

（1） At the Time of Construction of Pohnpei Port (1970)

BH-1 (behind the north side of wharf)

DL-1.5 to DL-10.5m	Sandy silt with N value 0 to 4
DL-10.5 to DL-14.5m	Silty sand with N value 3 to 8
DL-14.5 to DL-20.0m	Silty sandy gravel with N value 8 to 22

BH-3 (behind the center of wharf)

DL-1.5 to DL-12.0m	Silty sandy gravel with N value 1 to 5
DL-12.0 to DL-20.5m	Silty sand with N value 6 to 20

BH-6 (behind the south side of wharf)

DL1.5 to DL-4.5m	Sandy silt with N value 3 to 9
DL-4.5 to DL-8.0	Silty sand with N value 1 to 2
DL-8.0 to DL-21.0m	Silty sand with N value 2 to 8

Source: PONAPE DOCK CIVIL, BORING LOGS & TEST DATA, LYON ASSOCIATES INC, 1970

（2） At the Time of Repair of Main Wharf of Pohnpei Port (1980)

SD-4（north of center part of wharf）

DL -9.0 toDL-20.0m	Silty sandy gravel with N value 11to 20
DL-20.0 to DL-26.0m	Silty gravelly sand with N value 19
DL-26.0 to DL-30.0m	Silty sandy gravel with N value 9

SD-5（south of center part of wharf）

DL -5.0 to DL-18.0m	Silty sandy gravel with N value 17 to 34
DL-18.0 to DL-27.0m	Silty sand with N value 8 to 12

HD-6（south of north extension of wharf）

DL -4.5 to DL-17.0m Silty sand with N value 5 to 7

DL-17.0 to DL-23.5m Silty sand with N value 18 to 22

HD-7（north of north extension of wharf）

DL -4.5 to DL-17.0m Silty sand with N value 5 to 7

Source: HARBOR DREDGING, DOCK EXTENSION & MARINE RESOURCES FACILITY IMPROVEMENT, LOGS OF BORING, DEPARTMENT OF THE NAVY, NAVAL FACILITIES ENGINEERING COMMAND, 1980

（3） At the Time of Improvement of Pohnpei Airport (2006)

BH-1 and BH-2 (center part of runway)

DL+3.0 to DL about -5.0m	Landfill soil by gravel sand
DL about -5.0 to DL about -23.0m	Silty clay with N value 1 to 5
DL about -23.0 to DL about -40.0m	Silty sand with N value 5 to 10
DL about -42.0m	Reach to basalt (bearing stratum)

Source：POHNPEI RUNWAY REHABILITATION PROJECT, GEOLABS INC, JUNE 30, 2006

（4） At the Time of Construction of Pohnpei Fishing Port (2000)

BH-3（north of south extension of wharf）

DL-6.8 to DL-22.8m Clayey silt with N value 1 to 3

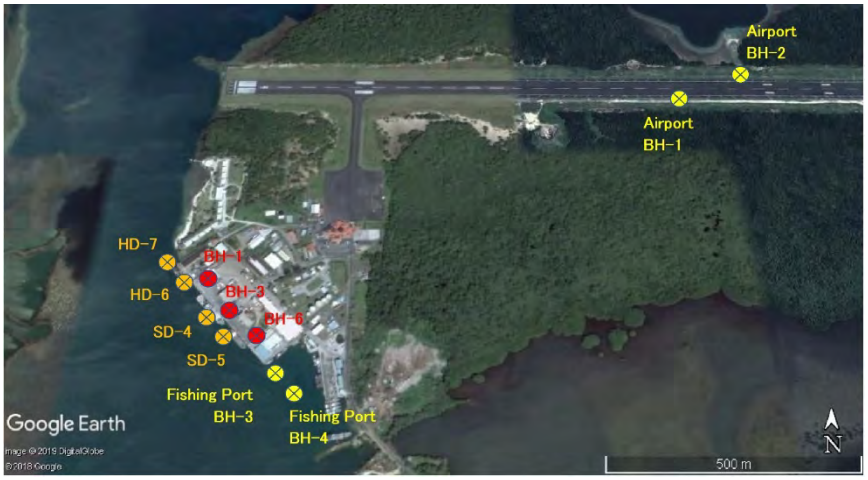
DL-22.8 to DL24.8m Silty sand with N value 3 to 4

BH-4（south of south extension of wharf）

DL-6.5 to DL-24.5m Clayey silt with N value 1 to 3

Source：BASIC DESIGN STUDY REPORT ON THE PROJECT FOR IMPROVEMENT OF TAKATIK FISHING PORT, FEBRUATY 2000

It is understood that the soil conditions even on coral are different by location.



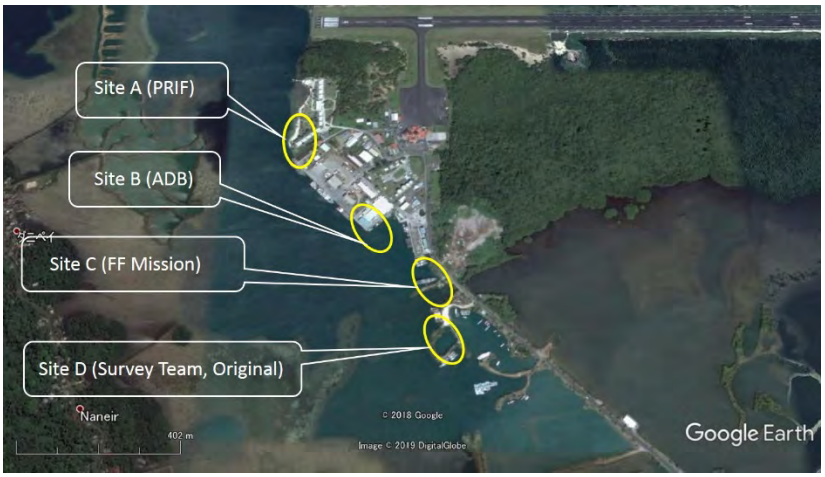
Source: Survey Team

Figure- 6.4 Borehole locations previously conducted around Pohnpei Port

7. Review of historical development plans of Pohnpei Port and recommendations

7.1. Development plans proposed in the past

There are two consecutive studies for the development of Pohnpei Port: Pohnpei Port development planning studies carried out by PRIF and ADB, which are referred to as PRIF and ADB Reports. As for the project sites, there are two other locations proposed by the Fact-Finding Mission dispatched by JICA in 2016 and by this Survey Team. The proposed sites are shown in Figure- 7.1.



Source: Edited by Survey Team based on Report of JICA Fact-Finding Mission 2016

Figure- 7.1 Alternative project sites

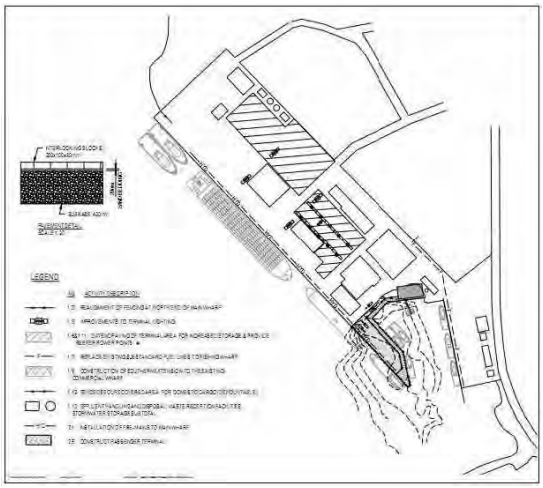
7.1.1. Plan proposed in PRIF 2010

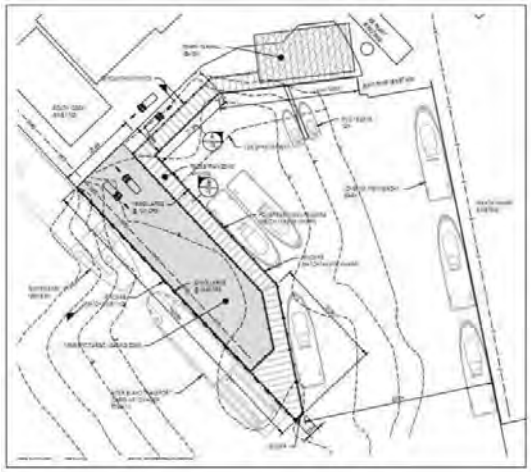
This report is the first study of the specific development plan of the port which proposed the scope of Pohnpei Port development study. The present condition, operation condition and financial condition of the facility are described in detail. With regard to cargo forecasting, in view of ship and cargo statistics until 2010, population growth rate and growth rate of GDP, it is assumed that the volume of cargo and the number of cargo vessels will not increase in the future, and the estimated volume indicated in the master plan of Chen (1994) is excessive. It is assumed that the north extension of the main wharf is unnecessary, and in the short and medium term, the main wharf improvement plan is proposed. However, in order to use a part of the main quay which is the base of the purse seining vessel (CFC constructed with its own funds and dedicated use) as a dedicated quay for cargos, PRIF proposed to extend the wharf by 100m on the north side of the main wharf as the alternative facility to the CFC wharf. This development policy has been taken over to the next ADB-funded survey.

7.1.2. Plan proposed by ADB report, 2013

Pohnpei Port Development Plan prepared by ADB proposes an alternative project site for the development of a quay for the mooring of purse seine fishing vessels instead of the northward extension as proposed by PRIF due to the dispute regarding an expired lease contract on the land area. The

alternative plan is to construct a 100m long and 20m wide quay at the south side of the existing wharf as shown in Figure- 7.2 and Figure- 7.3. The report also proposed to construct a 70m long berth on the inner side of the quay.





Source: ADB TA 8143-FSM Pohnpei Port Development F/R Initial Environmental Examination, 2013

Figure- 7.2 Development plan by ADB Figure- 7.3 Image of the development of Quay

ADB report proposed the following components as well as the quay:

(i) installation of navigation safety facility, (ii) installation of lighting facilities, (iii) improvement of oil pipeline, (iv) procurement of a pilot boat and transportation service to the anchorage, (v) construiction of passenger terminal including, fence to enclose the commercial port zone, (vi) installation of mooring buoys at the anchorage, (vii) improvement of navigation aid and (viii) receiving facilities for waste oil and garbage.

The government of Pohnpei State has requested through the federal government, Japanese government grant aid to implement this plan.

7.1.3. Alternative project sites proposed by the Fact Finding Mission of JICA（2016）

In response to the request of FSM, JICA dispatched a mission, which is called the Fact-Finding Mission, to Pohnpei to recognize the status of the preparedness of the state government and realize the existing situation of Pohnpei Port. The mission proposed another alternative site for the construction of a quay on the south of Takatik fishing Port, which is an unused land and water area within the Transportation Zone under the jurisdiction of PPA.

7.1.4. Other alternative project sites

Survey Team of this survey has included another alternative project site for evaluation, which is an area to the south of the alternative proposed by JICA Fact Finding Mission where many abandoned boats are disposed.

7.2. Evaluation of the alternative project sites for the development

7.2.1. Selection of Project site

The advantages of the four alternatives (Alternative 1 to Alternative 4) for the project site described in Section 7.1 above were compared and examined from the viewpoint of the desired requirements as a project site. The results are summarized in Table- 7.1. In the Table, advantages are shown in green and disadvantages in yellow.

Table- 7.1 Comparison of suitability as a project candidate site

Alternative	1	2	3	4
	North Extension	South Extension	South of Fish Port	Inner harbor area:
Land use plan	designated as wharf in Port Master Plan	designated as fish port in Port Master Plan	designated as fish port in Port Master Plan	NA
Right of way	PPA's Jurisdiction but unsettled dispute on land lease	PPA's Jurisdiction	PPA's jurisdiction	Several private land and existing lease contract
Negative effects	Obstruct passage of other ship unless channel is widened	Obsteruct ship maneuvering in the fishing port	Removal of Micro Grory	Removal of Many Sunken vessels
Sea bed Soil condition	Bad	Worse	Worse	Worst
Connectivity with existing port	Good	Good	Apart	Apart
Potential buckup space	Large	No space	Small	Enough
Dredging volume	Large but may be used for construction	Medium	Very large	Very large

: Advantage : Disadvantage

Souce: Survey Team

As described in Table- 7.1, every candidate site has adverse factors. PRIF originally proposed that the site on the north side of the main wharf for the expansion of the port, but due to the unsettled dispute at the proposed site, alternative site to the PRIF plan have been proposed. Therefore, the advantages / disadvantages of the alternative sites were examined by comparison with the PRIF plan, which is called the alternative site 1 hereafter.

1) Alternative Sites-3 and -4 have the disadvantage that the dredging volume is larger than that of Alternative Site-1.
2) Alternative Site-4 may cause more complicated issues than those raised for Alternative Site-1. It is essential to get consent of the land users. Furthermore, the soil condition is supposed to be worse than Alternative Site-1.
3) Alternative Site-2 will seriously affect the maneuvering of long-line fishing boats in the basin of the existing fishing port.
4) There is underused land behind Alternative Site-1, and therefore, the Site-1 has a potential for further development.

On the bases of the above four points, Alternative Site-1, the PRIF plan, is the most suitable for this project.

7.2.2. Possible measures to mitigate by the improvement of port management

As a measure to mitigate the congestion at Pohnpei Port, there is such an idea to improve the method of ship mooring and cargo handling, which may be called the soft approach, while the expansion of port infrastructure may be called the hard approach. If the cause of congestion at the wharf is long mooring time due to cargo handling of cargo ships, the congestion can be mitigated by improving the productivity of cargo handling. It may be another idea to relocate long-stayed fishing boats to the anchorage with a simple jetty for mooring, which was one of the proposals in Chen's master plan. However, the water area to the south of Pohnpei Port is outside the transportion zone, and it is necessary to redefine the transportion zone in order to construct an anchorage or mooring facilities. In addition, the current anchorage is located far from the wharf, and it requires time and cost to get back and forth by service boats that have long been requested by customs and quarantine officials, pilots and shipping agents.

The congestion at Pohnpei Port is caused by many purse seine vessels calling at the port for supply and maintenance as well as the transhipment of fish catch to reefer ships that stay at the anchorage of the port. During peak season for fishing in the North Pacific Ocean, which is usually May to June, tens of purse seiner vessels stay at the port together. Such congestion not only results from large number of purse seiners calling in a day, but also results from the presence of vessels staying on the quay over many days. Out of the 84 purse seining vessels that made port calls at Pohnpei Port in June 2018, 15 vessels stayed for 10 days or more, 26 vessels for 7 to 9 days, 32 vessels for 4 to 6 days while 11 vessels stayed for only less than 3 days. Pohnpei Port is expected to play a roles as a fishing port as well as a commercial port. Having assumed that there is no other way to mitigate the congestion of the port other than providing additional mooring facilities for long-staying purse seine vessels, the north extension plan was proposed by PRIF and then the southward extension was proposed by ADB study as an alternative plan.

7.2.3. Discussion on the purpose of utilizing the new wharf to be constructed

The ADB survey (Final Report Supplementary Appendix D, Berth Occupancy and Congestion, Port Congestion Analysis, 2013) analysed how long of berth length is required to reduce the berth occupancy rate to less than 100%, and it concluded that a total of 170 m (100 m quay + 70 m quay) extension is necessary. However, this calculation focused only on the annual average berth occupancy rather than during the high season for fishing.

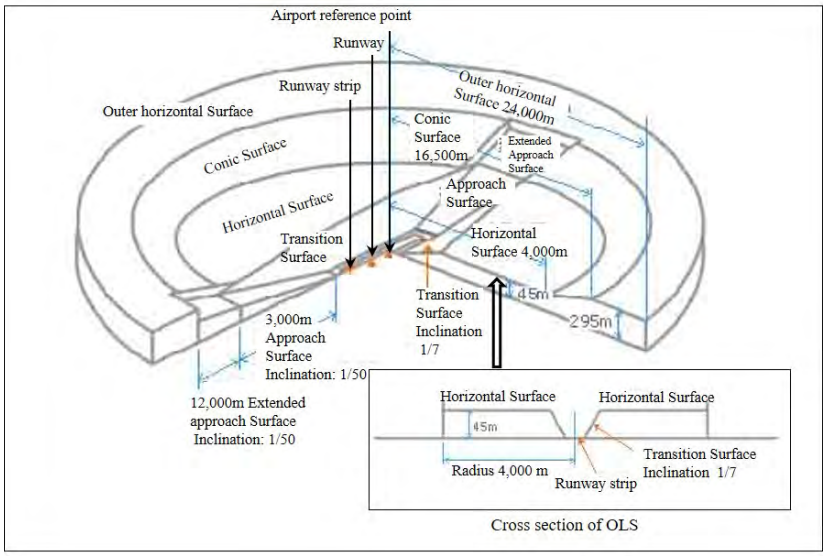
The reduction of average berth occupancy rate will not improve the congestion during high season, and the risk in maneuvering cargo ships in the port remains unresolved.

Therefore, in the following section, whether the mooring facility newly constructed should be used by purse seine vessels as proposed by PRIF and ADB is discussed.

7.2.4. Options for quay location of the new mooring facilities

(1) Restriction by Obstacle Limitation Surface (OLS) of the Airport

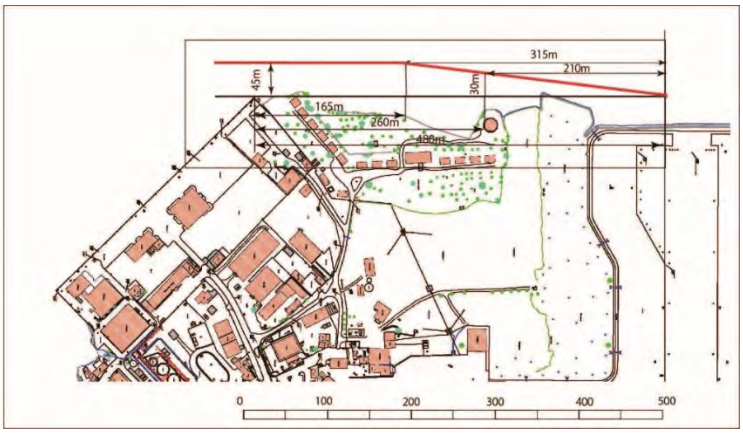
As for the north side extension proposed by PRIF, it is necessary to take into considerations of the Obstacle Limitation Surfaces (OLS) of the airport, because the site is near the runway of the airport. As a result of consultation with an airport official of PPA about issues with the new port facility expansion and its construction work (aircraft departure/arrival and relationship with restricted surface etc.), it was confirmed that the OLS of Pohnpei Airport conforms to the rules of ICAO and FAA. The OLS of the runway is shown in Figure- 7.4. Pohnpei Port is located beside the runway of Pohnpei Airport, and the structures and vessels in Pohnpei Port are subject to this height restriction.



Source: Web site of Ministry of Land, Infrastructure and Transportation, East Japan Civil Aviation Board

Figure- 7.4 Schematic illustration of Obstacle Limitation Surfaces (OLS)

Figure- 7.5 shows the OLS shown in Figure- 7.4 applied to the locations of Pohnpei Airport and Pohnpei Port. The height limit is 45 m and the section ends at a point 165 m away from the north end of the main wharf. The height decreased at a 1/7 slope toward the runway and it is 30 m at 260 m away from the main wharf.



Souce: Edited by Survey Team based on the figure provided by PPA

Figure- 7.5 The OLS on the project site

On the other hand, the relationship between the heights of ships above sea surface and the class (size) of vessels has been obtained by statistical analysis as shown in Table- 7.2. Among ships within in the same class, the height varies, and the average height is shown in the column of 50% of non-exceedance, the heights shown in the columns of 75% and 95% indicate that the 75% of ships fall on this class are lower than the height shown in the Table and that 95% of ships that fall on this class are lower than the listed heights, respectively.

The heights of container ships having 15,000 DWT capacityare shown in bold in Table- 7.2, which have been estimated as the average of the heights given for 10,000 DWT and 20,000 DWT, since no values are shown for 15,000 DWT in the original report. The height of the ships of 15,000 DWT should be 40 m or less.

OLS are defined on the basis of the elevation of the landing zone, while the height of the ship is given as the height from the sea surface, therefore, assuming the elevation of the runway of Pohnpei Airport is 3 to 4 m above sea level, OLS may provide additional allowance to ships in the port.

Table- 7.2 Height of container ships by non-exceedance probability

Dead Weight Tonnage (DWT)	Non-exceedance probability		
	50%	75%	95%
(ton)	(m)	(m)	(m)
10,000	32.6	34.5	37.4
15,000	**34.7**	**36.6**	**39.5**
20,000	36.7	38.7	41.5
30,000	39.1	41.1	43.9
40,000	40.8	42.8	45.6
50,000	42.1	44.1	47.0
60,000	43.2	45.2	48.0
100,000	46.2	48.2	51.1

Note: the figure in bold are the estimated by interpolation between 10,000 and 20,000 DWT

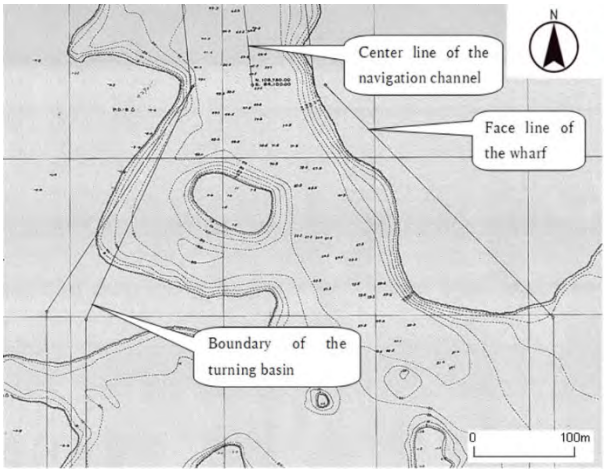
Source: National Research Institute Research Report No. 31 2009

(2) Options for facility layout plan

The existing main wharf was found in the PPA's office. Proposed location of the main wharf, basin and navigation channel are shown on the plan (see Figure- 7.6).

According to the plan, the face line of the existing main wharf is located along the edge of the island.

According to Figure- 7.6, the face line of the wharf ends at the edge of the island. It is assumed that the area in front of Misko Beach is unsuitable for the construction of wharf due to soft ground and that there is a bearing layer suitable for the foundation of the wharf at relatively shallow elevation.



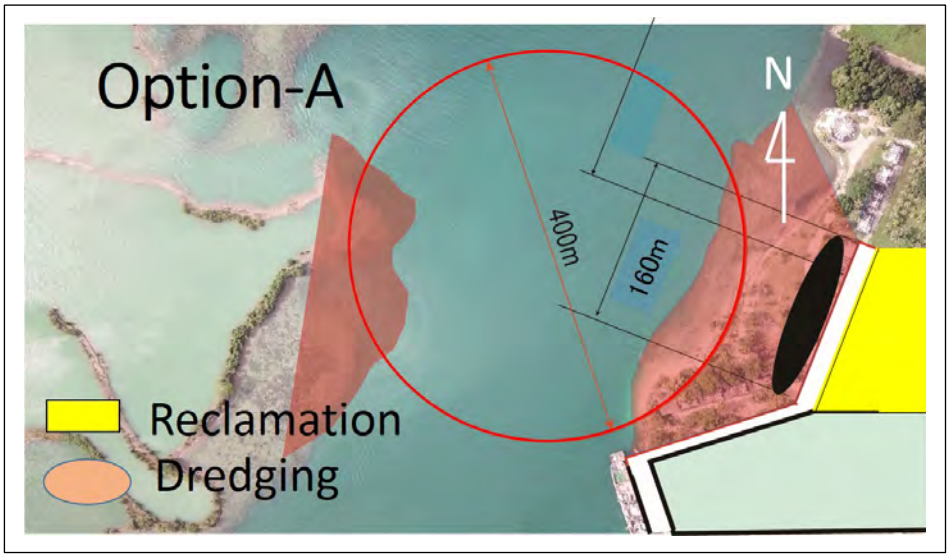
Souce: HYDROGRAPHY OF PROPOSED PONAPE TURNING BASIN AND CHANNEL,
TRASEN ASSOCIATES, LTD., APRIL 7, 1968

Figure- 7.6 Face line of the wharf, basin and channel

Thus, assuming the soil condition at offshore is worse than onshore, three locations have been selectred for preliminary design of the quay structure and for the comparison of construction costs. These three cases are called Option-A, B and C, respectively. These three options are figuratively shown in Figure-7.7Figure- 7.7, Figure- 7.8 and Figure- 7.9.

(a) Option A

This option is to construct a quay on land expecting the soil condition to be better than the other two options. This option requires dredging of land area. Thus, the dredging volume is larger than the other options, while the amount of dredging volume of the turning basin is small. It should also be noted that available yard area behind the quay may be limited.

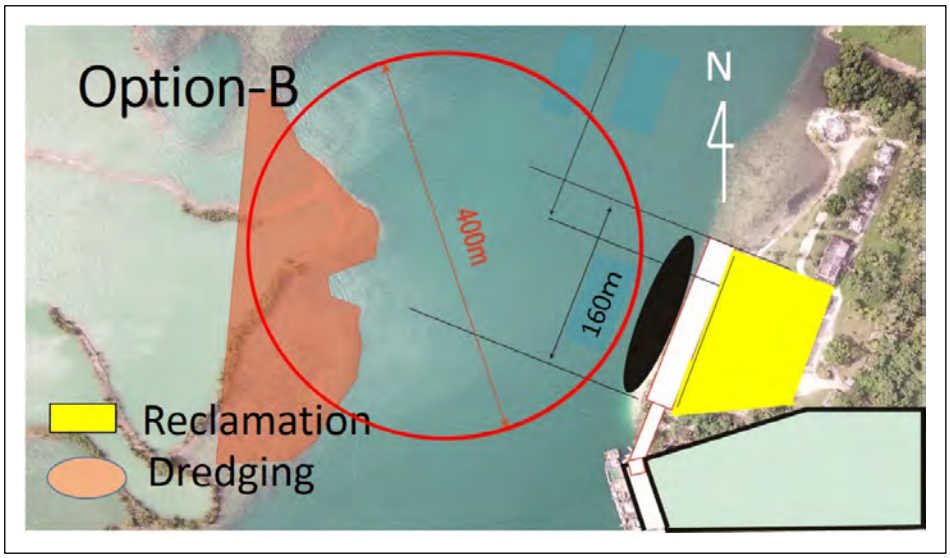


Souce：Prepared by Survey Team

Figure- 7.7 Layout plan of a new quay (Option A)

(b) Option B

This option is to construct a quay along the shoreline. The soil conditions, volume of dredge, and potential land area behind the quay are intermediate between the other two options.

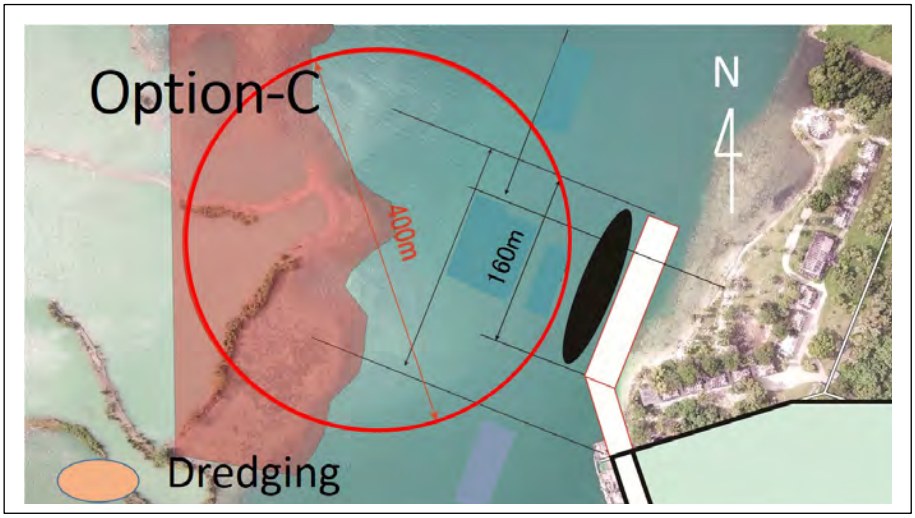


Source：Prepared by Survey Team

Figure- 7.8 Layout plan of a new quay (Option B)

(c) Option C

This option is to construct a quay outside of the disputed land area. The volume of dredging for the basin is small but that of the turning basin is expected to be large. It should be noted that a container yard area should be prepared somewhere else.



Source：Prepared by Survey Team

Figure- 7.9 Layout plan of a new quay (Option C)

These three options were selected based on the assumption that the ground condition will be worse as the quayside face line goes to the west side (the seaside) and better as it goes to the east side (the land side). It is necessary to conduct boring surveys to examine the soil conditions at the respective locations of the three options. On the basis of reliable soil conditions and detailed hydrographic data, the

construction costs of the three options should be carefully estimated.

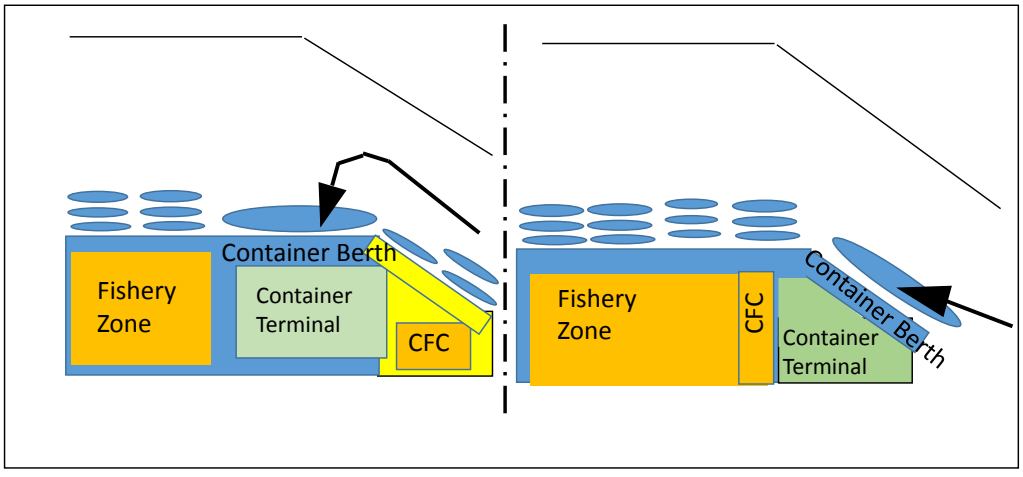
Since the boring survey was not carried out in this study, the soil condition was assumed to be the same for the three options. Preliminary design and cost estimate have been done for the three option to know the scale of the construction cost and to examine how the location of the quay influence on the structural design, volume of dredging and reclamation among others.

7.2.5. Discussion on the use of the quay

The basic development policy of both PRIF and ADB report are to improve the safety and productivity of the main wharf as a commercial port by relocating a 60 m long portion of north end of the main wharf, which is currently leased to CFC for exclusive use. In addition, the alternative plans for a new quay construction have been prepared to provide another mooring space for purse seiner vessels, as a substitute for CFC wharf. If the new quay will be constructed at the north of the main wharf and used for mooring of purse seiner fishing vessels in accordance with this development policy, it is very likely that more than two purse seine vessels are moored at the same berth, which is called multiple mooring, especially during high season for fishing. This situation will not mitigate the congestion or eliminate danger at the time of entering and leaving of cargo ships.

The current issue on the main wharf is the congestion and danger caused by purse seiner vessels at the both ends of the wharf. In addition, there is no way other than allowing double, triple or sometimes quadruple mooring during high seasons. This situation has a large influence on safety, security and productivity of cargo operation.

On the other hand, if the new quay is used as a commercial port, it is much safer and smoother for cargo vessels to enter and leave without being affected by multiple mooring of fishing boast. In addition, the existing dock will no longer be needed to be divided and the whole wharf can be used for fishery related activities. (see Figure- 7.10).



Proposed plan by PRIF Proposed plan by Survey Team

Figure- 7.10 Solution of the conflict between cargo ship and fishing vessels and integration of fishery zones

Another issue with the existing wharf is that the design conditions of the existing structure are unknown, therefore, it is practically impossible to determine whether the wharf structure is durable against the berthing force and the pulling force during a cargo ship being moored. It is also difficult to determine whether the apron is durable against the operation of heavy cargo handling equipment.

The purpose of this study includes the preliminary examination of the feasibility of previous proposals by other donors. During the field survey made by Survey Team it was found that there are some issues in mooring container ships of 15,000 DWT class from the viewpoint of strength and deterioration of existing piers. Furthermore, in order to effectively operate Pohnpei Port as both commercial and fishing port, it is effective to transfer commercial port function to the new wharf.

From this point of view, the maximum size of the container ships currently currently calling at the port have been chosen as the design ship for the preliminary design of a quay in the cost estimate.

The requirement for a new quay is as follows:

a. Quay length is 160 m, which is the minimum length needed for mooring the design ship LOA 160 m that is currently calling at the port on aregular basis. The quay designed for a 15,000 DWT container ship should have a length of 185m including margins at the bow and the stern of the ship for mooring with mooring lines in a proper angle. Therefore, the length of the quay can be shortened to the LOA provided that mooring posts and bollards are constructed outside the quay. Since the purpose of the design is to estimate the scale of the project cost the quay can be extended in the future, LOA of 160m is chosen as the design ship.

   There is a possibility for shipping lines to deploy larger sizees of container ships, therefore, it is expected for larger cargo ships to call at the port in the future. However, in order to accept larger container ships over 15,000DWT, the access channel should be widened and shallow spots along the approach channel shall be dredged and the curvature of the channel shall be improved.

b. The quay depth is -10m

   The water depth at the quay shall be as same as that of the existing quay. When the access channel is improved in the future, the port may accept larger size container ship. In such case, it is desirable to design the pier with water depth of -12 m. Since the quay depth is one of the most influential factors on the construction cos. A quay depth of -10m is used at this stage for the purpose of the examination of the minimum project cost. The design water depth should be re-examined based on more reliable data from soil survey and hydrographic survey.

c. Construction of 30 m wide apron on the quay and construction of a land area 16,000 m^2 (=160 m x 100 m) behind the quay as a container yard.

The size of the container yard is estimated on the assumption that a total of 200 TEUs of containers are handled per container ship including both loading and unloading. An area of 10,000 m^2 for import and export container storage, 2,000 m^2 for empty container storage, 3,000 m^2 for the storage and maintenance of cargo handling equipment and 1,000 m^2 office building and car parking) .

d. Complete separation of the container terminal from the fishing port area in order to avoid conflict during the arrival and departure of cargo ships and to ensure the security of the container terminal.

e. A turning basin with a diameter of 400 m in front of the new quay

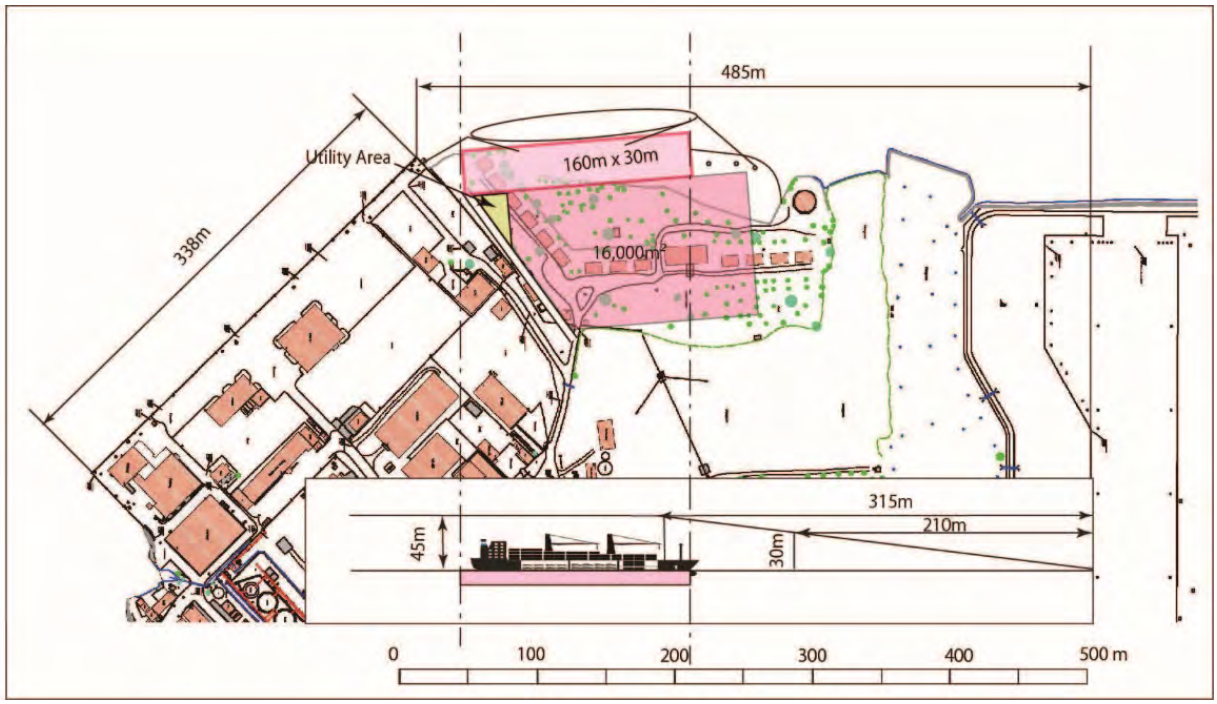
f. Equipment and facilities to ensure the security system at the container terminal.

7.2.6. Layout plan of the new quay

A layout plan is shown in Figure- 7.11.

In the preparation of the facility layout plan, considerations were made on the following: to avoid relocation or modification of the existing port facilities, to take into account OLS around the airport, and to provide mooring posts and bollards outside a the quay to moor a cargo ship at the quay having the same length as the ship.

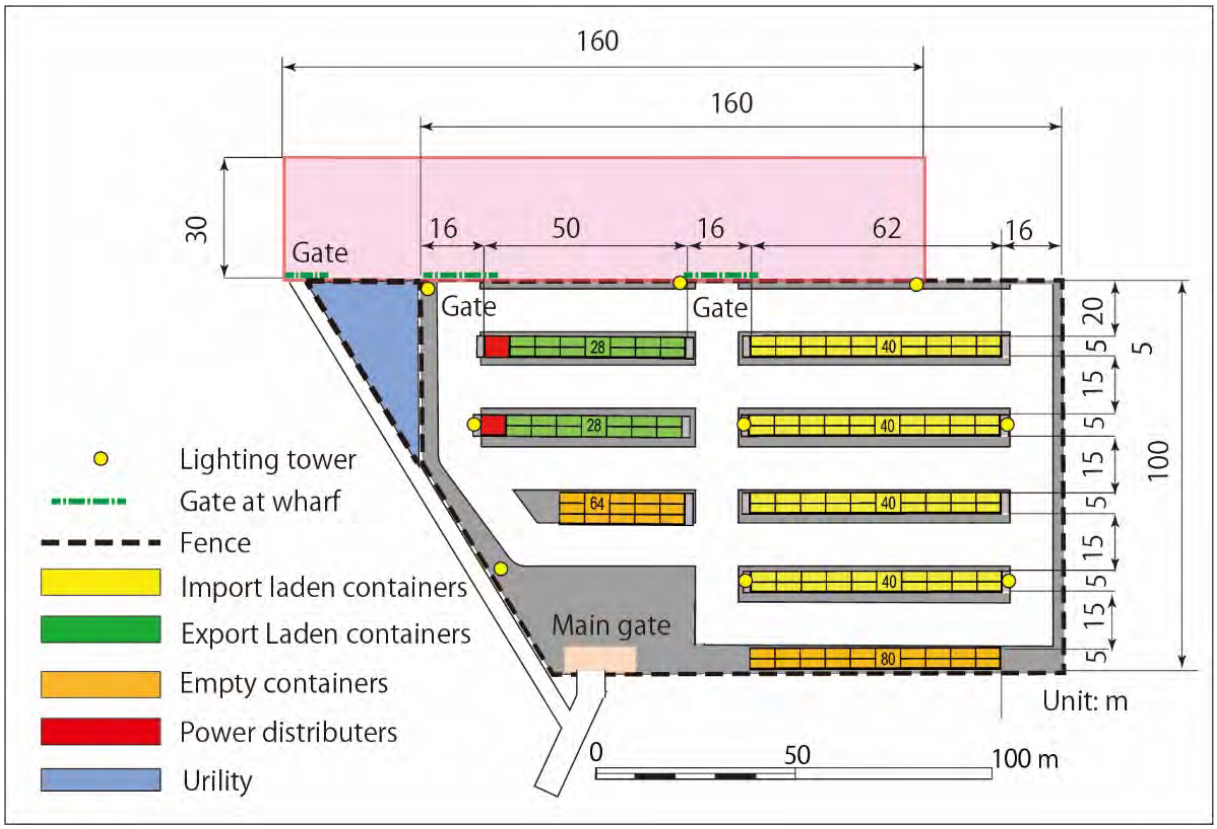
It is also taken into account that the quay sould be suitable for mooring domestic ships and fish carriers as well as international cargo ships.



Source: Prepared by Survey Team

Figure- 7.11 Layout plan of the new quay

In order to estimate the size of required land area for the container terminal, a facility layout plan was prepared for the landfill area behind the quay (see Figure- 7.12) In view of vessels other than international cargo ships docking at the new quay, a fence should be installed between the apron and the container yard and the gate of the fence should be always closed except during the container cargo handling between the quay and the yard in order to ensure security of the container terminal by preventing any person or vehicles entering the container yard without authorization.



Source: Prepared by Survey Team

Figure- 7.12 Layout plan of container terminal

The import laden containers are stacked at four lots colored in yellow where containers are placed in two(2) rows x ten(10) bays x two(2) stacks, while export laden containers are stacked at two lots colored in green where containers are stacked in two(2) rows x seven(7) bays x two(2) stacks. Empty containers are stacked at the two(2) lots colored in orange: one is along the fence (two(2) rows x ten(10) rows x four(4) stack) and the other is near the export laden container area (three(3) rows x six(6) bays x four stacks), basically the former is designated for import empty containers while the latter is designated for export empty containers.

It is assumed that the container operation employs reach stackers and yard chassis that are for the transportation between the quay and the yard. The space between the container stacking lots is 15m so that reach stackers loaded with a 40' container can turn around within the space. In the figure, the numerical values shown at container storage indicate the capacity (in TEU) of each lot. The capacity of the container yard is shown in Table- 7.3.

Table- 7.3 Container yard capacity

Import /Export	Laden/Empty	Estimated TEU per ship	Yard Capacity (TEU)
Import	Laden	90	96
	Empty	10	12
	Import total	100	108
Export	Laden	78	96
	Empty	22	24
	Export Total	100	120
Total		200	228

Source: Prepared by Survey Team

The Estimated TEU per ship (Import total 100 TEU and Export total 100 TEU) shown in the third column of Table- 7.3 was estimated in consideration of the seasonal fluctuation with some allowance to the container volume forecasted in 2025.

The number of power plugs for refrigeration containers was estimated as 50, which is the maximum number of export laden 40' containers loaded on a container ship in 2016. Since no record is available to classify laden or empty reefer containers, it is assumed that all of the 50 containers were loaded with fish.

7.2.7. Estimation of utilization rate of the new quay

The main user of the new quay is container ships and tankers. Other vessels expected to dock at the quay are fish carriers (reefer ships) and domestic passenger-cargo vessels. Table-7.4 shows the number of port calls, the average lengths, the total mooring days and the average mooring days per ship for the four types of ships called at Pohnpei Port in 2018.

If all these four types of vessels assumed to dock at the new quay, the total days of ship in port will be 363 days, and the berth occupancy rate will be almost 100%. This result of the calculation implies the quay will be extremely congested. This is because the statistics of port call available from PPA are recorded on daily basis, and ships which left in the early morning or arrived at late in the afternoon are also counted as ships in port all day long.

In the case of a carrier vessel in particular, the mooring purpose is generally the CIQ procedure and supply, so it is not necessary to be moored at the quay all day long, and it does not operate in accordance with the designated schedule like a container vessel. Thus, it may be possible for the carriers to dock at the quay when the quay is available.

The new quay provides a separate mooring spaces for commercial vessels including domestic ships, while all the purse seiner vessels dock at the existing main wharf in a manner of multiple mooring during the high season of fishing. Therefore, no conflict will occur during arrival and departure operation of commercial vessels with fishing vessels moored at the existing main wharf.

Table- 7.4 Number of port calls and berth utilization by ship type (FY2018)

Ship type	Port Calls	Averrage		
		LOA (m)	Days in port	Days in port/call
Cargo (Container)	54	142	108	2.0
Tanker	15	107	30	2.0
Fish Carrier (Reefer)*	141	108	141	1.0
Domestic ship	14	58	84	6.0
Total	224		363	
Purse Sainer	427	70	3,252	7.6
Long Liner	155	34	1,060	6.8

Note: It is assumed that carriers stay at the wharf for only one day per call

Source：Edited by Survey Team based on Ship data of PPA

7.2.8. Components of the project and the priorities

The construction of a 160 m long and -10 m deep container quay with a 16,000 m^2 container yard is recommended for the purpose of mitigating the congestion of the port during the high season of fishing. The components of the project and the priorities in the implementation are as follows. However, it is also recommended that components and the priorities should be re-examined on the basis of the design and cost estimate based on the soil data from boring and hydrographic surveys.

(1) Group A: Core components of the project (Priority 1)

（Key components of the project for a grant aid program of Japanese government）

a. Construction of a new quay having a length of 160m, apron width of 30m and water depth of-10m, including bollards and landfill behind the quay

（Design ship dimension: container vessel having 15,000 DWT, length of 160m, and full load draft of 9m,）

a-1 Dredging/Foundation excavation,

a-2 Procurement of replaced sand and backfilling material,

a-3 New quay (including bollards/fenders, slope protection)

b. Pavement for quay apron: 160m x 30m,

c. Access road (A) to the new quay: 1,000m^2.

(2) Group B: Components other than new quay structure (Second Priority)

The components of this group may be in Group B may need to find financing source such as the World Bank, ADB, state government, private sector, etc. other than Japan’s Grant Aid.

d. Dredging for turning basin (diameter 400m) in front of the new quay
(this component is given Priority 2, because for the time being, the existing turning basin can be used),

e. Pavement of container yard (160m x 100m=16,000m^2)

f. Fence/gate (4 gates and 600m-long fence)

g. Lighting facility (3 sets on new quay and 6 sets in container terminal)
h. Facility for reefer container (50 power supplies for reefer containers, 1000KVA back up generator)
i. Security/Monitoring facility (CCTV camera system)
j. Access road (B) to the container terminal
k. Water/fuel supply facility (2 water supply pits and 1 fuel supply pit in new quay)

(3) Group C: Other components proposed in PRIF and ADB reports that are not directly related to the new quay

l. Sewage treatment facility (capacity: 5m^3/day, dilution tank, septic tank, water tank)
m. Waste oil disposal facility (capacity: 10m^3/day, Oily water tank, Oil separator, Filter and adsorption tank. Oil storage tank)
n. Improvement of access channel (Navigation aids)

7.3. Environmental and Social Consideration for Project Implementation

7.3.1. Environmental Impact Assessment (EIA)

(1) EIA Procedure at Federated States Level under jurisdiction of the Environment & Emergency Control Office:

As for EIA Procedure at Federated State Level, it was confirmed by interview to the Federated States Office in charge that only those development projects to be implemented within the EEZ area beyond 12 miles away from the shore of the Micronesian territory are the subject of EIA at Federated State Level. Therefore, this JICA project is exempted from conducting EIA procedure at this Level.

Governing Laws and Regulations:

- Sec. 610, Sec.702 of Title 25 of Code of Federated States of Micronesia
- Section 13, Federated States of Micronesian Environmental Protection Act
- Public Law No. 17-57 (Amendment to Title 25 of Code of FMS, and revisions to FSM Environmental Protection Act), 2012
- Environmental Impact Assessment Regulation 1989

(2) Pohnpei State Level EIA Procedure based on Pohnpei EIA Regulation under jurisdiction of the Pohnpei EPA (Environmental Protection Agency):

Governing Laws and Regulations:

- Pohnpei Environmental Protection Act of 1992 (S.L. No. 3L-26-92)
- S.L.No.3L-45-93 (S.L.No.3L-26-92 Amendment Act)
- Pohnpei EPA Environmental Impact Assessment Regulation 1995

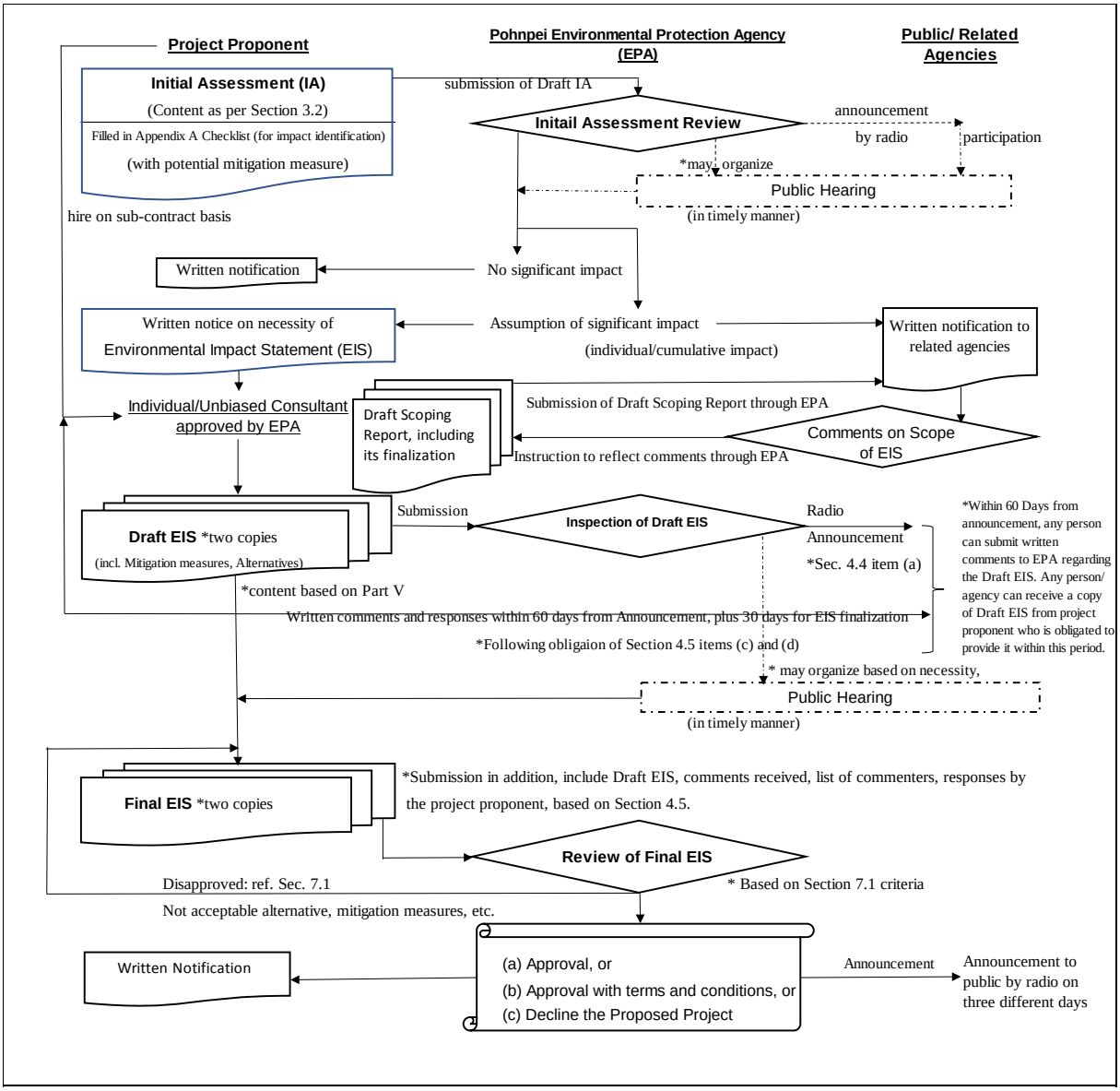
Though the ADB Study conducted the Initial Environmental Evaluation (IEE) in April 2013, the Pohnpei Environmental Protection Agency (EPA) neither recognized nor approved the result of the IEE. This is because the Federated States Cabinet did not approve the Pohnpei Port Development Plan funded

by ADB due to mainly financial reasons. Therefore, the development plan of the port by Japan's Grant Aid program must undergo the Pohnpei State Level EIA procedure from the beginning.

The Pohnpei State Level EIA Procedure proceeds in two steps. Firstly, the Project Proponent must undergo IA (Initial Assessment) by the Project Proponent. Reviewing the results of IA, the EPA Board assesses whether the development may cause significant impact or not. In such case that the development is judged to cause significant impact, the EPA Board requires to go through EIS (Environmental Impact Statement) procedure by an EPA accredited, independent and fair EIS Consultant* (see Fig.-7.10 EIA Flow Chart below). Based on decision by the Pohnpei EPA Board, public hearing may be held twice at IA review stage and Draft EIS stage.

Note* : An official of the Environmental & Emergency Control Office of FSM Government advised that an EIA consultants registered in an organization called SPREP (Secretariat of Pacific Regional Environmental Program) based in Samoa should be employed for the implementation of EIA procedure rather than adopting less qualified local EIA consultants. The SPREP is such an organization that register qualified EIA consultants from Australia, New Zealand, etc. and dispatch them to surrounding countries on request.

According to the Human Resource Manager who is in charge of Environmental matters in PPA and also happens to be one of the Board Members of the Pohnpei EPA Board, the EIA Procedure (including both IA, EIS) may take one (1) to three (3) years according to project. However, for a project that is not a new project within an undeveloped area, the procedure normally ends at IA level. Thus, he assumed that the EIA procedure of this JICA project may likely be completedwithin the IA level, and that the project is capable of gaining the approval by EPA within a short period of time.



Source: JICA Study Team, in reference to Pohnpei EIA Regulation, 1995

Note: Even if after Review of Final EIS, the EPA Board decides to (c) Deline the Proposed Project, the overall process could still be resumed, if the Project Proponent decides to follow suite to EPA's comments, and revise the Final EIS accordingly.

Figure- 7.13 Environmental Impact Assessment (EIA) procedual flow chart in compliance with Pohnpei EIA Regulation 1995

(3) Municipal Government Clearance:

The dredging area for the new turning basin in front of the proposed new quay on the north of the main wharf is under the municipal jurisdiction of Sokhes City. According to Lieutenant Magistrate Administrator of the city, a municipal government clearance is a part of EIA procedure that requires holding public hearings by the decision of Pohnpei State EPA during the stage of implementation of the scoping and drafting EIS at Pohnpei State level. Each municipal government, which has jurisdiction over the project site issues its clearance under the conditions that relevant stakeholders from each respective cities are listed in the participants and that all comments raised in the public hearings are reflected in finalizing the IA and EIS Reports.

The area on the north of the main wharf, which is known as Misko Beach (at which PPA is engaged in a land dispute), is under jurisdiction of Nett City. The land area across the navigation channel from Misko Beach is under jurisdiction of Sokhes City while and all other alternative project sites to the south of the fishing port area are under jurisdiction of Kolonia City.

7.3.2. Other Supplementary Environmental Procedures

(1) Earthmoving Permit:

This is a supplementary environmental procedure for acquisition of a permit that covers permission of dredging, reclamation and dumping works of the dredged material, under jurisdiction of Pohnpei EPA

Governing Laws and Regulations:

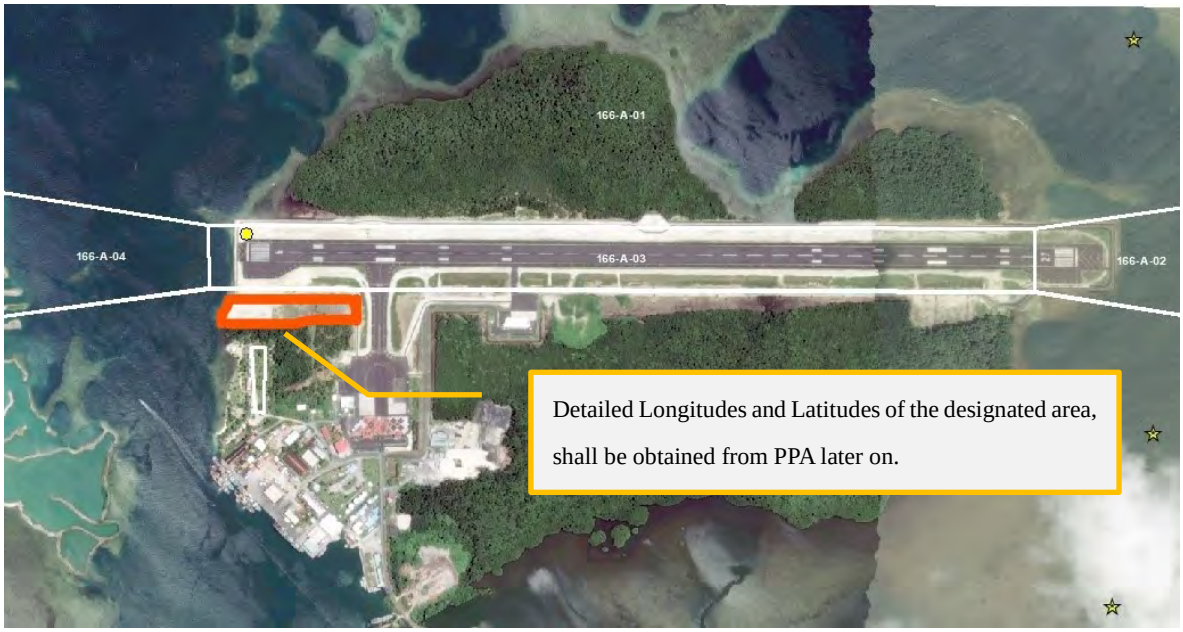
- Pohnpei Environmental Protection Act of 1992 (S.L. No. 3L-26-92)
- S.L.No.3L-45-93 (S.L.No.3L-26-92 Amendment Act)
- Pohnpei EPA Earthmoving Regulations, Amendment 2008

The important points of the regulation of Pohnpei State Earthmoving Permit, which is the amendment of 2008 of the former regulation of 1995, are as follows:

a. All earthmoving practitioners in Pohnpei State, in compliance with the Amendment Regulation, must prepare and submit an "Erosion and Sedimentation Control Plan" to Pohnpei EPA (Sec. 2.2). This Control Plan also requires including an "Erosion and Sedimentation Management Plan" that covers countermeasures against sediment runoff and errosion, including sedimentation control and installation of related facilities (Sec. 2.3). In addition, during the implementation of this Management Plan, the practitioner is obligated to maintain related facilities to conserve Protected Areas during the project implementation. Once the project is completed, those facilities must be restored to the extent possible (Sec. 2.4). After the affected area is restored, management facilities and equipment must be dismantled, and the ground must be leveled evenly.
b. Except for those earthmoving activities of certain limited scale with condition stipulated in Sec. 3.5 (that can be adopted by the EPA Executive Officer's approval only), all other earthmoving practitioners within Pohnpei State, in accordance with the application form regulated in Sec. 3.2, must acquire the permit from the Pohnpei EPA Board.
c. In compliance with S.L. No. 3L-26-92 (Pohnpei State Environmental Protection Act 1992), there are cases when public hearings are requested to be held by decision of Pohnpei EPA.
d. In case this regulation is violated, the violater may face civil penalty or even criminal punishment by Pohnpei EPA based on stipulation of the State Environmental Protection Act.

According to the Human Resource Manager of PPA, PPA's earthmoving permit has been expired as of February 2019. Therefore, the permit requires renewal. There is no description in this Amendment Regulation about mandatory duration of each step. However, according to the Marketing Manager of PPA who normally takes charge in applying for acquisition of this Permit, the Permit is normally acquirable without much difficulty and within a short period of time.

On the other hand, apart from the requirement to renew the earthmoving permit for implementation of this JICA project, as for the dumping area of dredged material, in accordance with the internal decision of PPA, the area enclosed in a red line, is expected to be PPA's designated dumping area.



Source: Edited by Survey Team based on Interviews with PPA

Figure- 7.14 Dredged material dumping site designated by PPA (in red markings)

(2) Forestry Clearance and Marine Resources Assessment Procedure

The Pohnpei State Resouce & Development Department (hereinafter called "R & D Dept.") is the authority of the Forestry Clearance and Marine Resources Assessment.

1) Forestry Clearance

Governing Laws and Regulations:

- S.L. No. 1L-128-87 (Pohnpei Watershed Forest Reserve and Mangrove Protection Act of 1987)

2) Marine Resources Assessment

Governing Laws and Regulations:

- S.L. No. 2L-158-82 & 2-1 (Conservation and Resource Enforcement Act of 1982)

a. The R & D Dept. regularly staffs one Forestry Clearance Specialist, and two Marine Resources Assessment Specialists; to undergo regular monitoring surveys for both area of study. Among them, Forestry Clearance includes monitoring of vegetation of mangroves and coral reefs and their ecological habitats.

b. Both procedures, must be undertaken according to each project. However, in actual terms, a brief report based on the regular monitoring data (the latest data collected by the department at the time of application is normally adopted) is usually applied and complied by the R & D Dept. It

is also normally the case that only it takes around three (3) days to one (1) week only to gain approval for each subject procedures.

c. For implementing both procedures, the R & D Dept., normally collaborate with a local NGO, namely the Conservation Society of Pohnpei (CSP), which is an expertized NGO in monitoring ecological conditions of Marine Resources, including vegetation state of mangroves and coral reefs, etc. within Pohnpei State (by adopting and applying latest regular monitoring data from CSP) and also in collaboration with the University of Micronesia, that is regularly monitoring meteorological data such as those on current movement, etc. As noted, the R & D Dept. normally compiles brief reports for undergoing each procedure, by utilizing also latest data from these collaborating organizations.

(3) Required Procedure under jurisdiction of Historical Preservation Office, Pohnpei State (Historical Preservation Clearance)

Governing Laws and Regulations:

(US Government Level)

・Section 106 of the National Historic Preservation Act of 1966 (NHPA)

(Federated States Level)

・Title 26 - Historical Sites and Antiquities, Code of Federated States of Micronesia 2014 edition, annotated: Historical Preservation Procedures §§301-305

(Pohnpei State Level)

・Pohnpei Code Division II - Historic and Cultural Preservation Act, 2002

a. For certain large scale project, in some cases, Historical Preservation Procedure at US level in compliance to Section 106, is applied.

b. Historical Preservation Procedure at Federal States level, in compliance with Title 26, Code of FSM, is applied, but limited to Federal State Projects.

c. As for the Pohnpei State level Historical Preservation Procedure, the project proponent must,

c-1. submit the regular application form (already aquired by Survey Team for reference), filling out the project outline and scale of development area, etc., attached with an Excavation Plan and Ground Leveling Plan, etc., to the authority in charge (Historical Preservation Office, Pohnpei State).

c-2. According to the scale of the project, an archaeologist approved by the Historical Preservation Office may be appointed, at which the assigned archaeologist must complete a historical preservation survey, checking on the possibility of related impact, within 15 days from submission of the application form (though, in case of limited scale project, the survey will be carried out alone by the Historical Preservation Office's specialist in charge).

c-3. The Historical Preservation Survey's outcome review was formally by Historical

Preservation Board that existed and took charge. At present, however, the survey review is undertaken by the Historical Preservation Office staff alone.

c-4. In case the Historical Preservation Office rejects the project proponent to implement the said project, based on results of the survey review, the project proponent shall still be granted an extra 15 more days, to alter the development plan to an acceptable level for the authority to finally approve the project.

c-5. In case, even after the above process, the project may still not be approved, if the project proponent wishes to appeal complaint, then the case will be raised to the Court of Justice Department to seek final resolution by the State Court.

d. When the scale of development is limited, and if the project site is located in an already developed area, the subject procedure will most likely settle merely through survey and review by the Historical Preservation Office staffs in charge, and approval will be given within quite a short period of time. Those cases requiring survey by assignment of an archaeologist are normally limited to development projects at undeveloped areas. Thus, this project should be settled within scope of the former case.

7.3.3. Consideration related to Land Acquisition

(1) Land Acquisition system in Micronesia

Governing Laws and Regulations:

(U.S. Level)

・U.S. Secretarial Order No. 2969

(Federated States Level)

・Constitution of the Federated States of Micronesia

・Code of the Federated States of Micronesia

・Title 56: Government Property Acquisition, Federated States of Micronesia Annotated Code edition 2014

(Pohnpei State Level)

・Pohnpei Code

・Pohnpei State Law (D.L.) No. 4L-153-78 as amended Leases and Land Use Agreement on Public Trust Lands

・S.L. No. 1L-155-87 on Public Lands Act of 1987

・S.L. No. 5L-82-02 as amended designating certain public lands trust for lease of the Commission

・S.L. No. 21-224-91: Pohnpei Port Authority Act of 1991

・S.L. No. 1L-198-87: Transportation Zone Act of 1987

・S.L. No. 4L-130-99: Industrial Development Zone (Act of 1999?)

・S.L. No. 4 L-66-98: Planned Development Zone (Act of 1998?)

(Common Law)

・Pohnpei Constitution for Civil Damages and Compensation related to Theft, Personal Injuries, Separation

of Family Properties, Inheritance and Inter-Clan Disputes

In FMS, regardless of which State, a part of public land owned by the State Government or by public agency is offered to be utilized by other public agencies, individuals or corporations, based on long or mid-term contract (in case of Pohnpei State, either 25 years or 55 years contract, extendable until maximum 99 years).

On the other hand, according to the corporate lawyer of PPA in charge, there are no such law or regulation related to Resettlement Action Plan procedures, nor regulation to compensate the Project Affected Persons (PAPs) (regardless of legal or illegal settlers) on land acquisition in Micronesia, neither at Federated State Government level nor any State Government level. As regard to the land dispute issues related to State owned land, the Public Land Trust Board holds public hearings to settle such cases for arbitration, but if the arbitration cannot settle the dispute, then the case will be raised to seek resolution by trial. For those land disputes of public land owned by governmental agencies such as PPA, the State Court takes charge to seek settlement by arbitration or settled by civil action. For those land disputes where FSM individual nationals are claimers, the dispute will be settled by the State Court, and cannot be be appealed up to the Federated States level. However, for those land disputes where corporations or foreign individuals are involved as the claimer, then they are entitled to appeal the case to the National Court (at FSM level). Though depending on case by case, it is generally known that the Court process related land disputes are systematically very complex in FSM, and that there are even cases that prolong on for decades.

In FSM, there is a customary law as listed in the very end of the governing law and regulation list above. Since it has been traditionally a custom to resolve issues by taking respect of opinion by tribal leaders who have great influence on the local community, this customary law is well recognized and respected to a certain extent. However, at present, it is commonly regarded that such customary law is no longer mandatorily or so effective, in settling these issues.

With regard to this JICA Project, most of all the above listed land related laws and regulations of Pohnpei State level are involved.

Especially, it is essentially very important to quote, that the (i) land area stipulated as the “Transportation Zone” including the Pohnpei International Airport and Pohnpei Port, by establishment of the Transportation Zone Act of 1987, (ii) (where all the State owned public land and assets within the Zone) was transferred from the Pohnpei State to PPA in 1994, after the Pohnpei Port Authority Act as the governing establishment law of PPA was enacted in 1991. Therefore, PPA claims the right to mange those areas.

(2) Current situation on measures to resolve unsettled land dispute issues

1) Historical Background

Dekehtik Island where Pohnpei International Airport and Pohnpei Port is located, had been traditionally

owned by a locally well known Etscheit Family before. However, its land was unconditionally confiscated by the U.S. Military after WWII, and later on, based on U.S. Secretarial Order No. 2969 and Trust Territory Code (already abolished), was presented back to Micronesia (Pohnpei State) as Trust Territorial land of the U.S. Since then, following the background already explained in the last paragraph of previous above item, in accordance with the establishment of laws and regulations related to land acquisition of the area ("Transportion Zone"), the land was transferred from Pohnpei State to PPA. Currently, as for the Etscheit Family, one of its Family member (individual) is merely provided the right to claim private land at a certain very limited portion of land including vegetation of mangrove and a part of marine area, just south-east of the "Transportion Zone", cadastral wise, registered as No. 7001/ -T-75425.

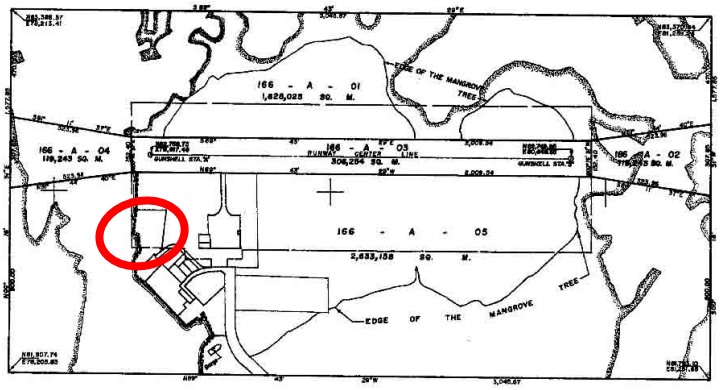
2) Background on Land Dispute with regard to this Project

Among the alternatives proposed to PPA by SurveyTeam through this study, the project site, known as Misko Beach, regarded as the most likely feasible site based on the plan for northern extension of the main wharf (the area marked in red round circle in below Figure- 7.15: Detailed Cadastral Survey No. 166-A-04 within Cadastral Survey Parcel No. No. 166-A-00 area; and further below Photo- 7-1 showing the dispute area by aerial picture), is the area where PPA had been engaged in the land dispute of most concern till today for many years.

However, it should be noted that Ms. E. (a Micronesian individual female), who is claiming the rights on assets within the land of dispute, against PPA, Pohnpei State and Public Lands Trust Board, is not a member of the Etscheit Family, explained previously as the former landowner of Dekehtik Island.

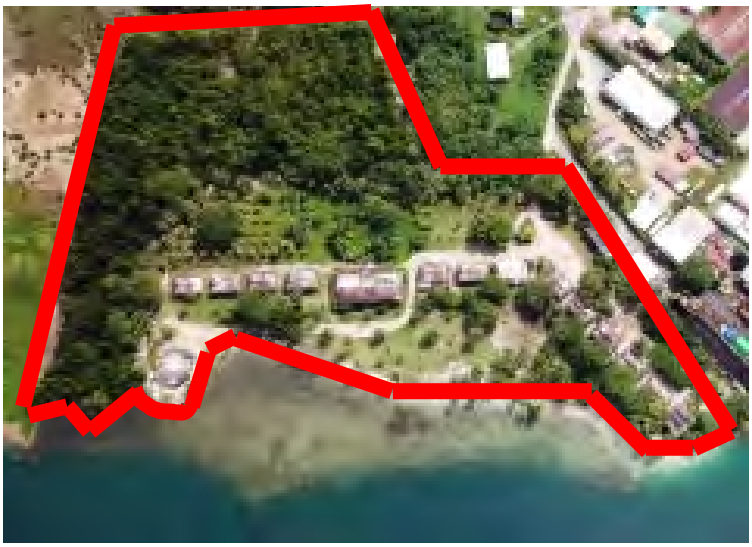
Seeking a settlement of the land dispute, the State Court held the third hearing on a motion held in mid-May. PPA's Counsel in charge said that the State Court should come to a ruling within around six (6) to seven (7) weeks after the last hearing. It is important for PPA and JICA to keep close watch to see if the issue maybe resolved as expected.

Regarding illegal settlers living in the area under dispute, the Port Police said that there used to be 16 illegal settlers in 2016, then the number had decreased to only 6 (4 households) in 2018 (not including the claimer, Ms. E.). The New Environmental and Social Guideline of JICA requires recipient countries to compensate the Project Affected Persons (PAPs) for involuntary resettlement, regardless of legal or illegal status of settlement, so that the PAPs' living and livelihood should be recovered or even improved after relocation. Therefore, PPA is required to be aware of this responsibility. Due to this respect Survey Team submitted a copy of the New JICA Environmental and Social Guideline (April 2010 version) to PPA and requested to take respect to be taken of the Guideline regarding this issue.



Source: Department of Land, Pohpei State

Figure- 7.15 Cadastral map of PPA owned public land (Parcel No. 166-A-00), including project site of northern extension plan of the main wharf (land dispute area) (in red circle marking)



Source：Edited by Survey Team based on photograph prroveded by PPA

Photo- 7-1 Misko Beach (Former Pwohmaria Hotel) location, identified as project site of northern extension plan of main wharf (land dispute area)

Source: Photographed by Survey Team（February 2019）

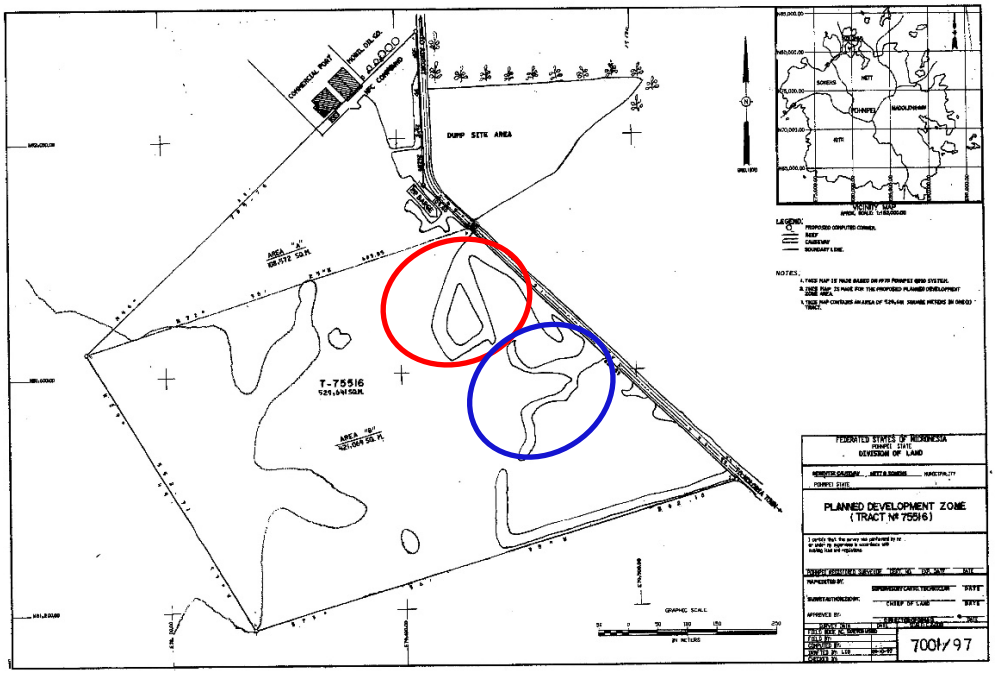
Photo- 7-2 Former Pwohmaria Hotel: with seaside bar, 14 buildings including main building, plus security building and sub-structure

(3) Matters of concern to be clarified at the start of this survey

1) Regarding the western coast area land just south of Takatik Fish Port

In addition to the project site on the north side and the south side of the main wharf proposed by PRIF and ADB, respectively, the survey Team examined the land on the west side of the causeway on the south of the Takatic Fishing Port proposed by JICA Fact Finding Mission and another coastal land further to the south of the fishing port. The examination has been performed from the viewpoint of the land acquisition for the project, i.e., land ownership and land lease contract, as sell as the technical viewpoint.

The northern area till the south end bridge of Takatik Fish Port, is the “Transportation Zone” which is owned and managed by PPA, while the causeway area further south of this bridge is separated into “Industrial Development Zone” (eastern coast area) and the “Development Plan Zone” (western coast area)”, regulated by the Pohnpei State Code. Among them, the southern west coast area can be identified as public land by its cadastrial map (registered as No. 7001/97: T-5516）.



Source: Department of Land, Pohpei State

Figure- 7.16 Cadastrial map of Western Coast of Causeway, south of Takatik Fish Port (No. 7001/97: T-5516)

According to the Pohnpei Public Land Trust Board, that manages all lease agreements of the Pohnpei State’s public land, this south western coastal area’s public land, the area marked by red circle in above Figure- 7.16, is utilized by the Fish and Wildlife Division, based on lease contract with Pohnpei State for 25 years from 2017. The south-western coastal area, around the middle area of the causeway, marked by blue circle is managed by one of the Etscheit Family members, based on 55 years long-term lease contract with Ponpei State from mid-1990s.

In the light of above mentioned facts, the Survey Team foresees another land dispute issues to occur if the western coastal area is chosen for the project site. Therefore, Survey Team concluded that either of the land areas in the south of fishing port is not recommended because the difficulties expected in the land acquisition as well as in the construction on the extremely soft ground condition of these areas.

2) Issue on possibility of relocation of CFC

The PRIF proposal proposes to construct a new mooring facility for a purse seine fishing vessels as the substitute for the norther part of the main wharf currently leased to CFC. CFC (Caroline Fishing Corporation) will soon face the maturity date of the contract in June 2021, in lease agreement with PPA for usage of public land of the northern end of the main wharf.

During the interview with the Survey Team, the CEO of CFC expressed his intension to renew ther current lease contract with PPA and even to widen lease area on the main wharf for the expansion of the businesses of CFC. In response to Survey Teams inquiry about the relocation to the new quay, the CEO said that he may consider to move out of the main wharf under such conditions that CFC is able to lease large backyard area as well as the new quay and that the expense for its relocation should be compensated. The construction of the new mooring facilities might not have been understood by the CEO as a realistic project at the time of the interview. It seemd that the plan to develop a new quay as the substitute CFC leased area was not attractive enough for the CEO of CFC.

Such a passive response of CFC is one of the reasons that Survey Team recommends the new quay should be developed as a commercial port rather than the substitute for the current CFC leased area and to developserve the main wharf to provide more space for fishery related business entities including CFC.

7.4. Structural Design

7.4.1. Setting of design conditions

（1）Load from the target vessel, cargo handling machine, etc.

At present, the size of ships regularly calling is around 10,000 DWT which is rather small. While fishing boats also frequently use the pier, it is preferable to develop quay walls and channels which can accommodate vessels up to 15,000 DWT, taking into consideration future demand. For reference, the list of vessels owned by Kyowa Shipping is shown in Table- 7.5

.

Table- 7.5 Ships operated by Kyowa Line

Name	Registered	Built	DWT	LOA	Rampway (ton)	Cargo Gear (ton)
Kyowa Stork	Marshall Islands	2018	12,084	143.0	30	40 x 2
Kyowa Falcon	Marshall Islands	2018	12,084	143.0	30	40 x 2
Kyowa Rose	Marshall Islands	2010	12,191	124.7	30	40 x 2
Kyowa Orchid	Marshall Islands	2009	12,122	124.7	30	40 x 2
Pacific Condor	Panama	1999	8,635	117.7	45	30 x 2, 25 x 1
Tropical Islander	Japan	2009	18,144	160.7	15	40 x 2
South Islander	Panama	2007	18,091	160.7	15	40 x 2
Pacific Islander II	Panama	2003	17,916	160.7	10	40 x 2
Coral Islander II	Panama	2002	17,913	160.7	10	40 x 2

Source: Kyowa Line

Japanese standards in the design manual indicates the desired quay length and water depth for various size of container vessels as shown in Table-7.6.

Table- 7.6 Standard quay length in Japan

DWT (ton)	Length of berth (m)	Water depth of berth (m)
1,000	80	4.5
2,000	100	5.5
3,000	110	6.5
5,000	130	7.5
10,000	160	9
12,000	170	10
18,000	190	11
30,000	240	12

Source: Design Standard version 2002

By interpolating the length and depth between 12,000 DWY and 18,000DWT given in Table-7.6, a 185m long amd 10.5m deep quay is desirable for a 15,000 DWT container vessel. However, for the purpose of minimizing the project cost, the length and the water depth of the water were chosen as 160m and -10m, respectively.

(2) Cargo handling equipment

Currently, ship's geas with spreders are employed for loading and unloading containers to and from container vessels.

As the container volume in 2030 is forecasted to be about 8,000 TEUs, it is unlikely that a gantry crane

will be installed. Accordingly, cargo handling will likely be conducted by a ship's gears in the same manner as at present. If it becomes necessary to increase operational efficiency, a mobile crane could be procured.

（3） Setting of Soil Condition

The topography of the north side is just going down from coral reef to flat seabed and the water depth is generally 9m to 18m. In addition, the soil at the seabed contains a lot of water and is soft so that rodding rod made of 9mm steel reinforcing bar can be easily inserted about one(1) m by a diver’s hand. It has somewhat plasticity. The Photo- 7-3 shows soil nature from seabed surface.

Source: Photographed by the Servey Team

Photo- 7-3 Nature of sea bottom soil

It is assumed from the past borling data that the soil is sandy silt. It has somewhat plasticity and it is so called the soft ground. The depth cannot be known without a boring survey however, the N-value could be less than 1 up to quite deep point for example, even if drilling to 20m under the seabed or even up to DL -30 m is made, the bearing layer may not be found.

7.4.2. Structural Design

(1) Condition Setting for Preliminary Design

1) Design Condition

(a) Tide

Highest High Water Level (HHWL)……+1.58m
Mean High Water Level (MHWL）……+1.22m
Mean Water Level (MWL）……+0.70m
Mean Low Water Level (MLWL）……+0.30m
Datum Level (DL）……±0.00m

The above tide level is the same as Takatik Fishing Port.

(b) Wave condition: No influence due to inner bay

(c) Exisitng ground soil: Assume mixed coral and sandy silt with N value 1 to 3 and no bearing layer

(d) Inner friction angle after ground improvement

Replacing the existing ground by local good quality coral sand and the inner friction angle shall be ϕ=30deg.

(e) Design seismic intensity: kh=0.05 (same as Takatik Fishing Port)

(f) Design wind speed: 30m/sec (at storm) (same as Takatik Fishing Port)

2) Use Condition

(a) Design vessel: 15,000DWT container vessel (LOA: 160m, Width: 27m, Draft: 9m)

(b) Planned water depth: DL-10.0m

(c) Crown height : DL+3.7m

(d) Surcharge: 2.0 t/m^2 (at ordinary time), 1.0 t/m^2 (at earthquake)

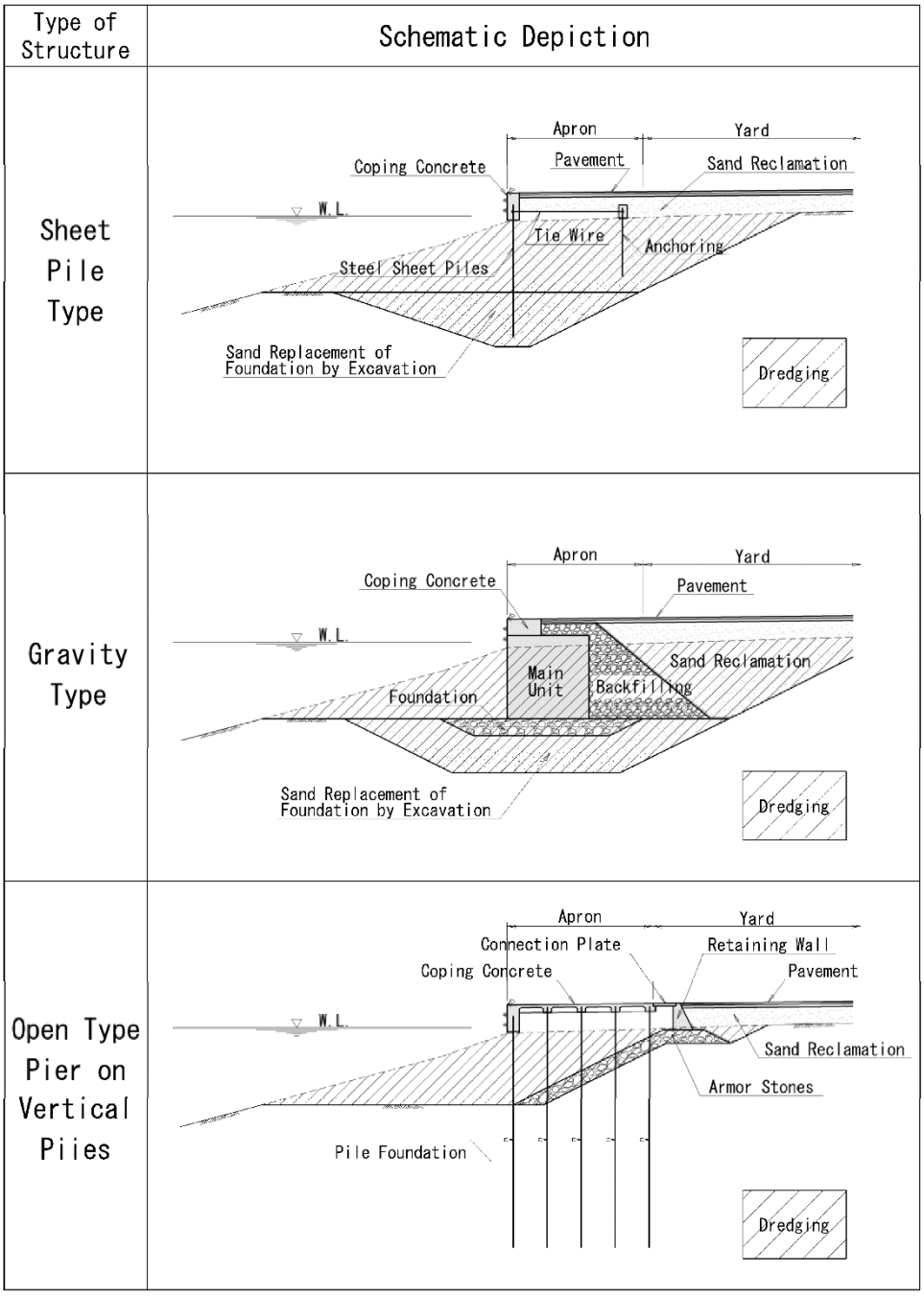
(e) Wheel load (at the time of cargo handling): 40 to 50 ton/wheel

(f) Expected lifetime: 50 years

(g) Anticorrosion method: Cathodic protection

(2) Selection of Structural Type

Three (3) types of structures, namely gravity type, pile type and sheet pile type can be considered in general as shown in Figure- 7.17, the applicability to this quay expansion in Pohnpei Port is studied as follows.



Source: The Servey Team

Figure- 7.17 Structural type of mooring quay

1) Gravity Type

Caisson type and concrete blocks type are preferable while the gravity type structure requirs relatively deeper water depth (planned water depth DL-10m). However, since Pohnpei Port is located at an island in the Pacific Ocean, caisson manufacturing yard is not available in the vicinity of the project site, therefore the applicability is low.

In the case of the concrete blocks type, since the weight of concrete blocks has a limitation due to the lifting capacity of the crane, concrete blocks shall be stacked in multiple layers are not suitable to uneven

seabeds. In addition, there are many other issues such as the difficulty in levelling work of the foundation mound, subsidence, poor bearing capacity therefore, the gravity type structure is not suitable for the quay.

2) Pile Type

Open type pier on vertical piles consists of two components: open type pier and earth retaining seawall at land side. Therefore, it is judged not economical compared with other types. In addition, without batter piles, the resistance against horizontal forces impact force when a ship docks at the quay, and the pulling forces of mooring lines,is poorer than other types. Since the piles are driven in a soft ground with N-value of 1 to 3, the required length of piles may be very long even if the bearing soil layer exists at the project site. Therefore without bearing soil layer, soil improvement is required and the construction cost should be large amount. Vertical bearing capacity cannot be clarified due to lack of actual soil data Therefore, the applicability of this quay is judged to be low.

3) Sheet Pile Type

Vetical pile anchorage type sheet pile quaywall has been used widely for shallow water to the deep-water area and its versatility is high. The sheet pile type is suitable to the quay when ompared to the other two types.

As a comparison result of the comparison of the three(3) structural types above, 3) Sheet pile type is selected. Necessary ground improvement methods are studied in the following section.

(3) Selection of Ground Improvement Method

The exsisting ground of the project site is very soft with N value from 1 to 3. At this stage, it cannot be determined whether it is sandy soil or silty soil. Since sheet pile type quaywall is selected as the quay structure, it is necessary to increase the shear strength of the seabed ground (ϕ or C). The following methods are available as the ground improvement method.

Replacement (excavation method) Method	(Replacement Method)
Sand Compaction Pile Method	(Compaction Method)
Vibrating Compaction Method	(Compaction Method)

Although Sand Compaction Pile Method (SCP Method) and Chemical Deep Mixing Method (CDM method) are more appropriate for a reliable improvement, the construction cost is very high so that it is not be suitable for the construction environment in the island country.

Vibrating compaction method which is one of the compaction methods, from the viewpoint of transportation costs of heavy construction equipment and its effectiveness, this method is not recommended.

As to the replacement method, the area to be improved will possibly be wide since the method make excavates a gently angled inclined slope (more than 1:3) in case of soft sandy ground. In addition, when the seabed is inclined, some ingenious devices are necessary for the excavation works. However, it is easy to procure the coral sand locally and secure the shear strength is assured.

Taking into considerations the above, the replacement method by excavation is considered the most suitable. However, during the excavation and replacement work, seawater may get muddy and certain environmental protection will be tken such as a silt curtain.

(4) Cross Section of Preliminary Design

Figure- 7.18 shows the results of the simple sounding survey at the north side of main wharf along the three lines almost perpendicular to the face lines of the proposed quay designated by Options A, B and C. Typical cross section of the quay structure of Options A, B and C (including the cross sections of replaced sea bed by excavation and replacement as well as the plane view of the quay) are shown in Figure- 7.19 through Figure- 7.21. The cross section of each Option including the channel bed profile in front of the quay is shown in Figure- 7.22. The existing channel bed profile is drawn from the measured water depths along the center line (see Figure- 7.18).

Source: Survey Team

Figure- 7.18 Simple sounding survey results at the north side of main wharf and quay alignment by Option A, B and C

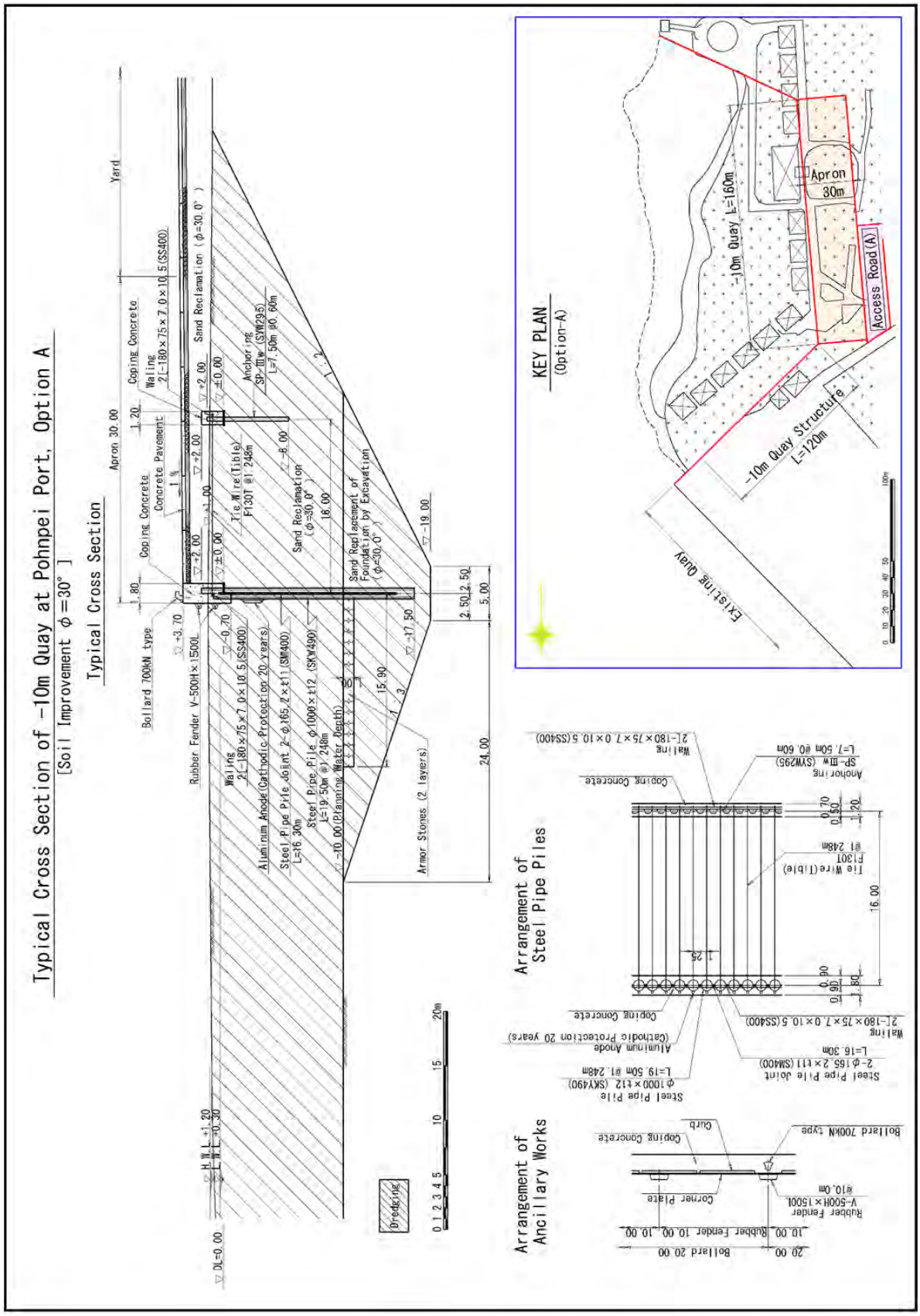


Figure- 7.19 Typical cross section of -10m quay by Option A

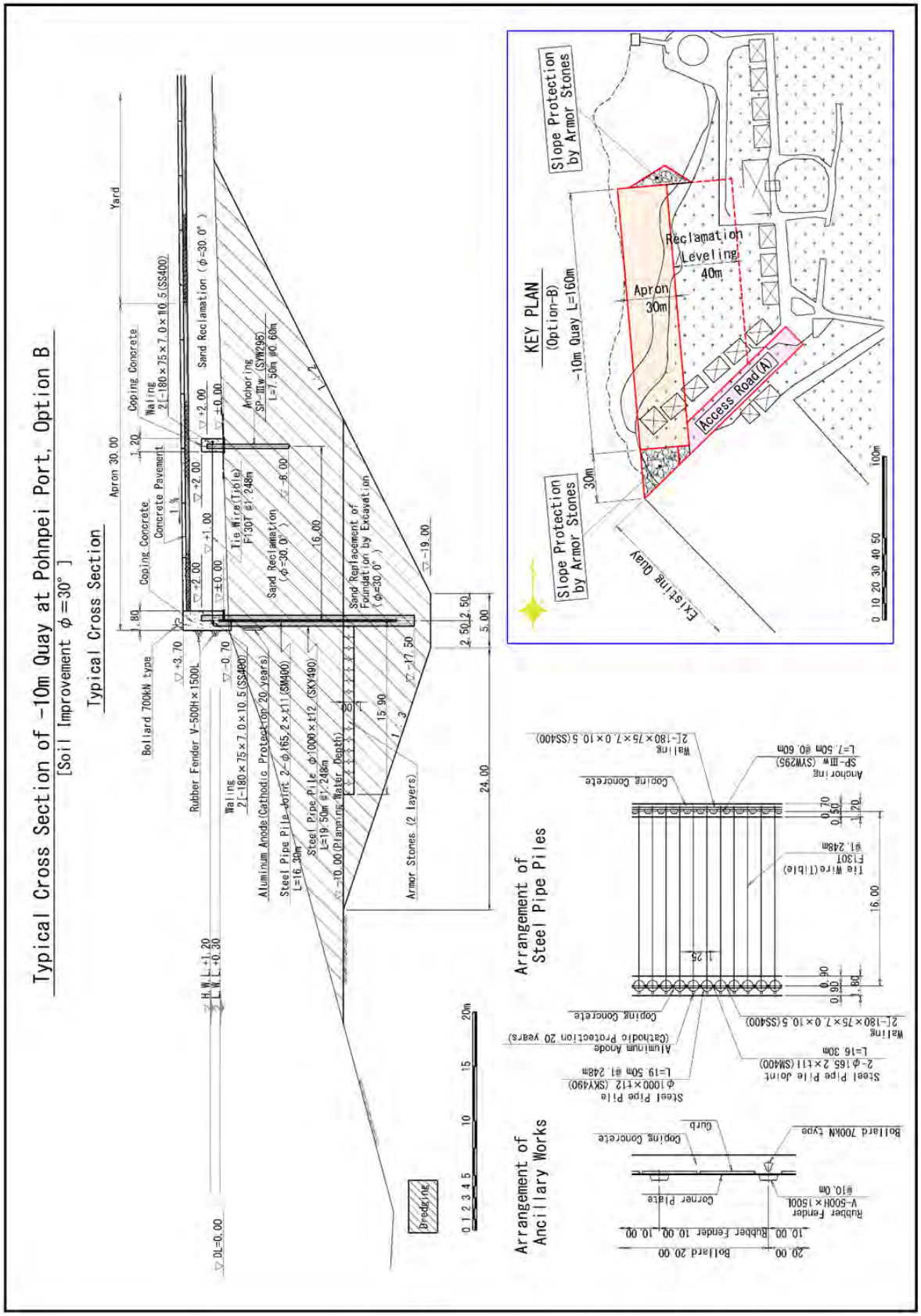


Figure- 7.20 Typical cross section of -10m quay by Option B

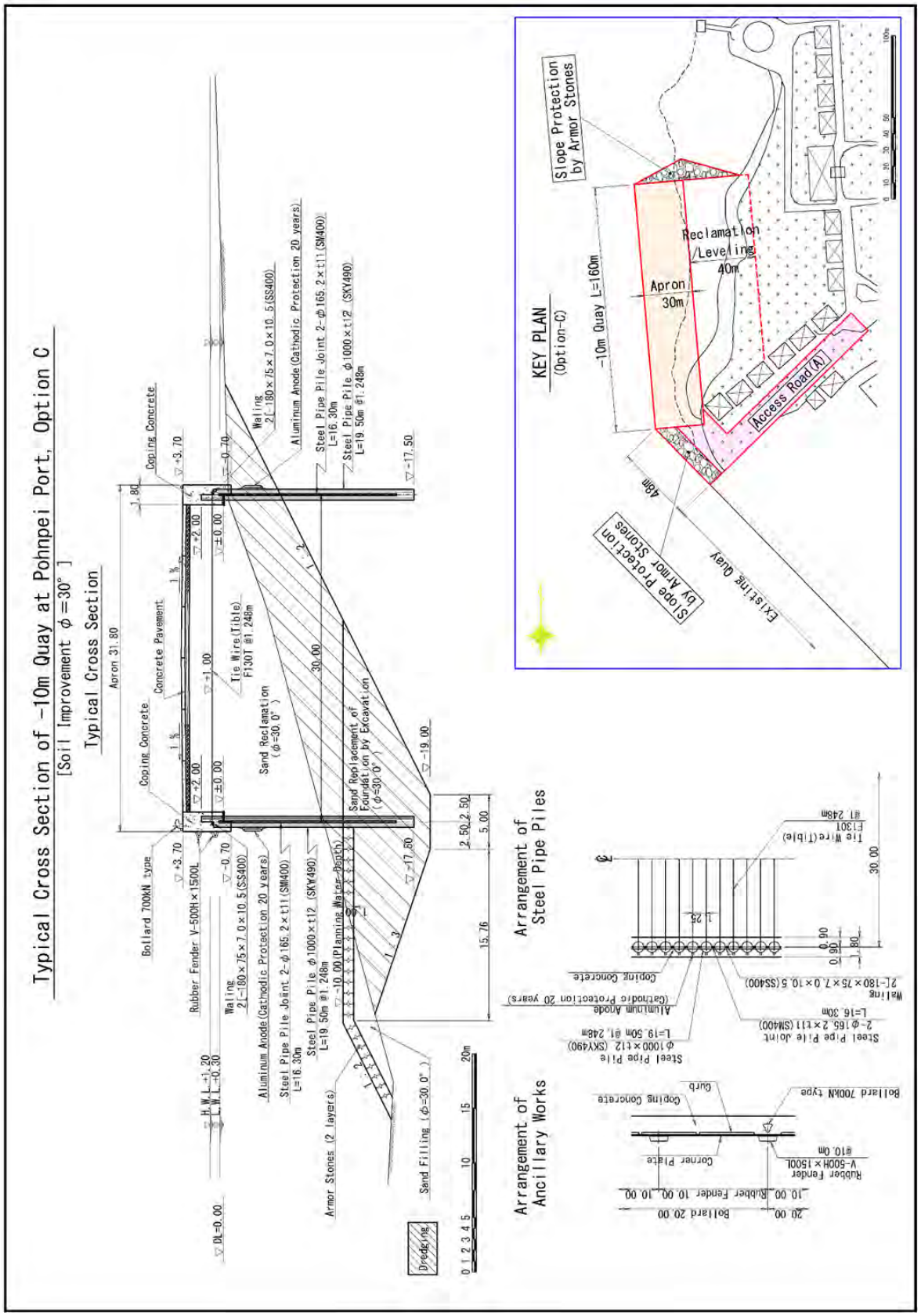


Figure- 7.21 Typical cross section of -10m quay by Option C

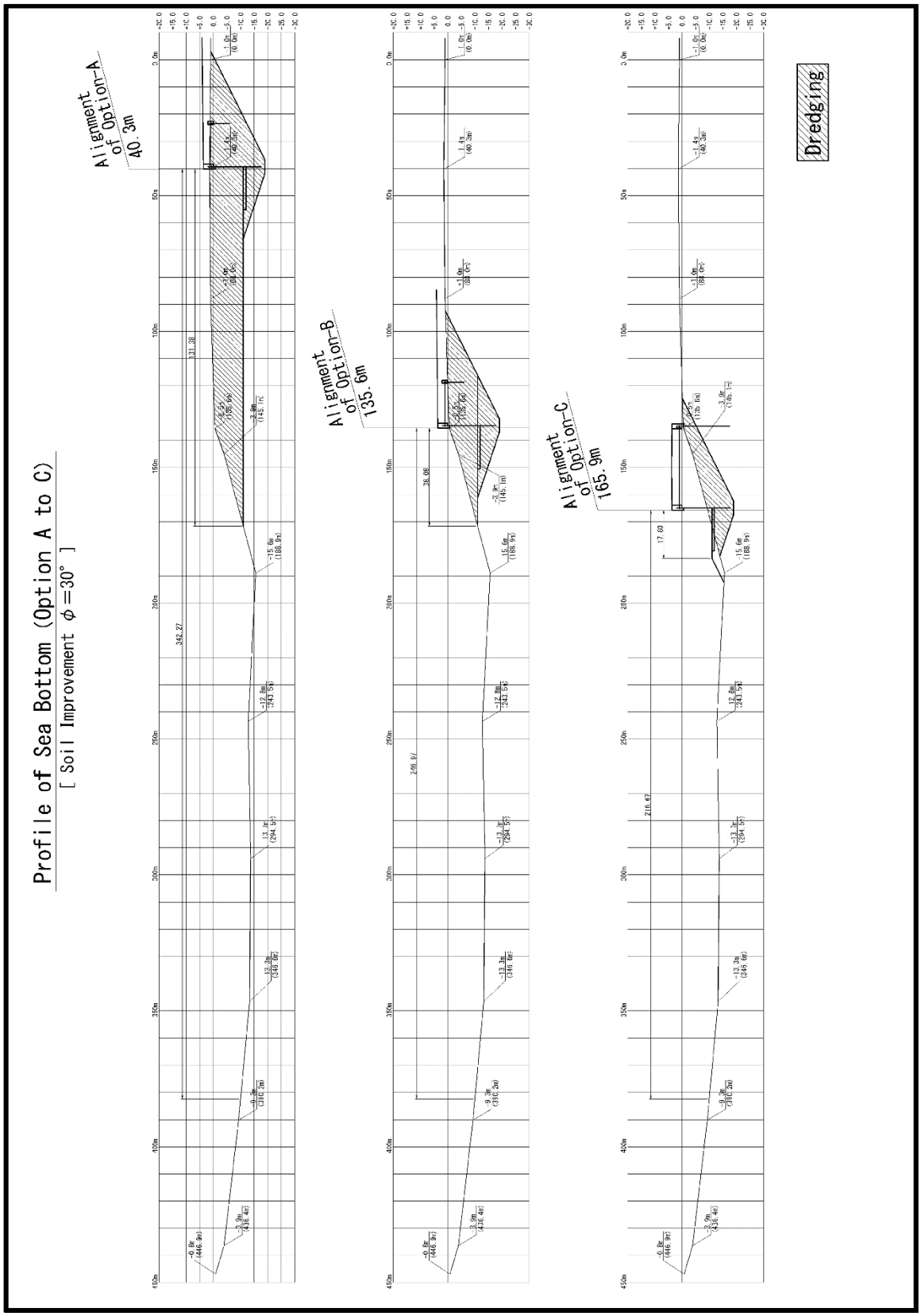


Figure- 7.22 Profile of sea bottom of channel and quay alignment

7.4.3. Project Cost Estimation

(1) Group A Components forming the basis of the project (First Priority)

(Key components of the project for a grant aid program of Japanese government - Minimum components)

a. Construction of a new quay having a length of 160m and the apron width of 30m and water depth of DL-10m
(Design vessel: 15,000 DWT, container vessel, LOA 160m and full load draft 9m)
a-1. Dredging/Foundation excavation
a-2. Procurement of sand for replacement and backfilling material
a-3. New quay (including bollards/fenders, slope protection by armor stones and excavation/leveling width of 30m)
b. Pavement for quay apron: 160m x 30m
c. Access road (A) :1,000m^2

The dredging of turning basin (Diameter 400m) in front of new quay shall be Group B (Second Priority), since the container vessels can be berthed at the new quay via the existing turning basin (400 m dia.) in front of the existing wharf.

According to the Fig.-7.19 showing seabed profile of channel and quay alignment of each option, 160m wide channel as well as a mooring basisn can be ensured for each option.

The estimated project cost by option is shown in Table- 7.7.

Table- 7.7 Estimated project cost for Group A

Project Cost (Group A)			**Option A**		**Option B**		**Option C**	
1. Construction Cost	unit	Unit Price ($)	Q'ty	Amount ($ 1,000)	Q'ty	Amount ($ 1,000)	Q'ty	Amount ($ 1,000)
a-1. Dredging/Foundation excavation	m^3	65	300,800	19,451	115,200	7,449	56,000	3,621
a-2. Procurement of Replaced sand and Backfilling material	m^3	28	112,000	3,104	112,000	3,104	102,400	2,838
a-3. New Quay	m	69,284	280	19,400	160	11,085	320	22,171
b. Pavement for wharf apron	m^2	296	4,800	1,419	4,800	1,419	4,800	1,419
c. Access road(A)	m^2	296	1,000	296	1,000	296	1,000	296
Total				**43,669**		**23,353**		**30,345**
2. Consultant Fee	**%**		10	**4,367**	10	**2,335**	10	**3,034**
Ground Total (1+2)				**48,036**		**25,689**		**33,379**

Source: Survey Team

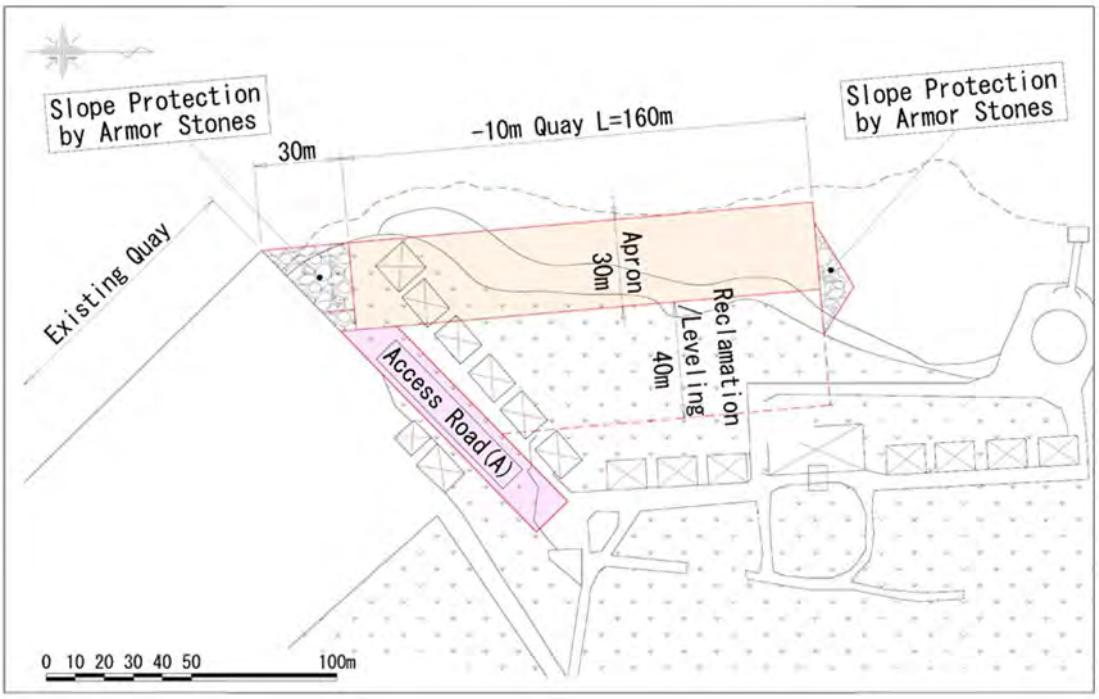
Note: 1$=¥108.25 (June 3, 2019)

The following are the observations of Table-7.7

- Construction cost includes indirect cost.

- Replacement method as soil improvement method is applied to all options.
- As Option C is jetty type structure (double sheet pile structure) is proposed, as shown in Figure-7.18. Length of the new quay at both front and rear is 160m, therefore, the construction is the sond highest among the options.
- As Option A, quay is constructed in land are, purse seine fishing boats can be berthed more than two (multiple lines mooring). Since the land dredging and the replacement soil volume is large, the cost for quay construction is also large. Therefore, the quay construction cost is the highest among the options.
- Quay constraction cost of Option B is lowenst. 30m connecting section between the north end of the existing wharf and 160m of the new quay shall be the slope protected by armor stones (slope face).
- Dredging cost is quite high at \$65/m^3 that is due to performance adjustment in Oceania by JICA cost estimation manual (two times as the reciprocal of price adjutment) is applied to the unit price of Grab Dredger in Japan (about \$21.2/m^3).
- The Consultant fee is estimated as 10% of the estimated construction cost.

Figure- 7.23 shows layout plan of Group A (for the case of Option B).



Source: Survey Team

Figure- 7.23 Layout plan of Group A (Option B)

(2) Group B Component except new quay structure (Second Priority)

(Assuming fund sourced from other than Japan's grant aid program: WB, ADB, State government, Private, etc.)

d. Dredging for turning basin (diameter of 400m) in front of new quay

e. Pavement for container yard (160m x 100m=16,000m^2)

f. Fence/gate (4 gates and 600m fence)

g. Lighting facility (3 sets on new quay and 6 sets in existing container terminal)

h. Facility for reefer container (50 power supplies for reefer containers, 1000KVA back up generator)

i. Security/Monitoring facility (CCTV camera system)

j. Access road (B) (construction of the access road of 1,000 m^2 to the container terminal)

k. Water/fuel supply facility (2 water supply pits and 1 fuel supply pit in new quay)

The estimated cost above, shown in Table- 7.8. If the new quay location moves to channel side, the dredging volume on the opposite shore will be larger, and the cost of Option C will be the highest.

Table- 7.8 Estimated construction cost of dredging for turning basin (400m diameter.)

Group B			**Option A**		**Option B**		**Option C**	
Construction Cost	unit	Unit Price ($)	Q'ty	Amount ($ 1,000)	Q'ty	Amount ($ 1,000)	Q'ty	Amount ($ 1,000)
d. Dredging for turning basin	m^3	65	175,000	11,316	350,000	22,633	490,000	31,686

Source: Survey Team

Note: 1$=¥108.25 (June 3, 2019)

Other components (e to k) of Group B may not be influenced by the location of new quay. Eestimated construction costs of those components are shown in Table- 7.9.

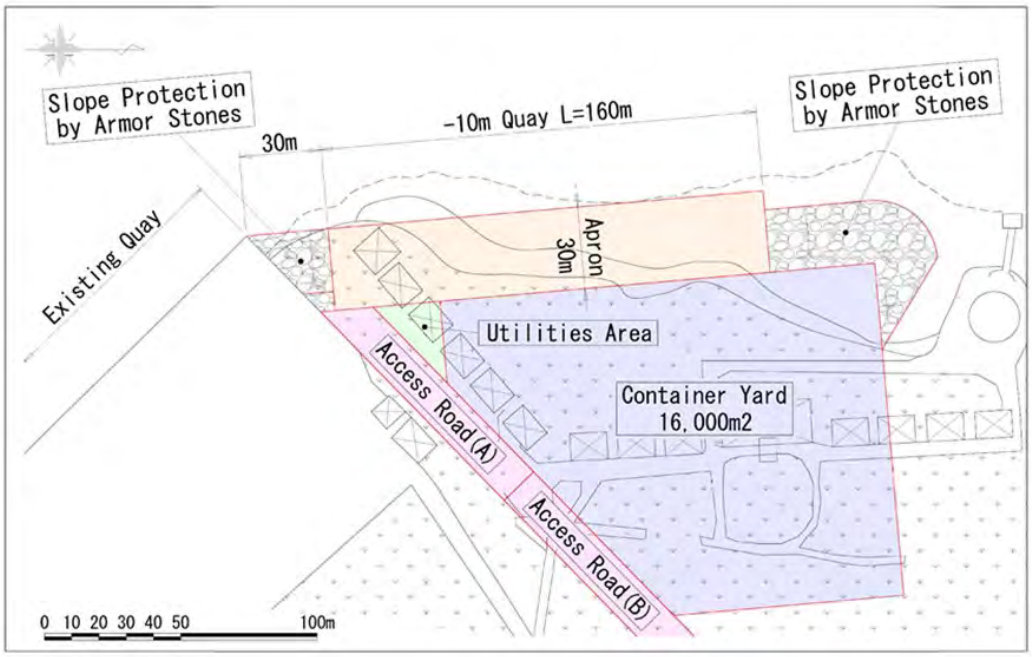
Table- 7.9 Estimated construction cost of compomnent e to k for Group B

Construction Cost (Group B)	unit	Unit Price ($)	Q'ty	Amount ($ 1,000)	Remarks
e. Pavement for container yard	m^2	296	16,000	4,730	Length 160m x Width 100m
f. Fence/gate	Ls		1	554	4 gates and 600m fence
g. Lighting facility	Ls		1	346	3 sets on new quay and 6 sets on container terminal
h. Facility for reefer container	Ls		1	924	50 power supplies, 1000KVA back up generator
i. Security/Monitoring facility	Ls		1	185	CCTV camera system
j. Access road (B)	m^2	296	1,000	296	Construction of the access road to container terminal
k. Water/fuel supply facility	Ls		1	462	2 water supply pits and 1 fuel supply pit in new quay
Total				**7,497**	

Source: Survey Team

Note: 1$=¥108.25 (June 3, 2019)

Layout plan (Option B) of components to k is shown in Figure- 7.24



Source: Survey Team

Figure- 7.24 Layout plan of component e to k (Option B)

(3) Group C

(Those components proposed in PRIF and ADB reports that do not comprise the components related to the new quay)

l. Sewage treatment facility (capacity: 5m^3/day, dilution tank, septic tank, water tank)
m. Waste oil disposal facility (capacity: 10m3/day, Oily water tank, Oil separator, Filter and adsorption tank, Oil storage tank)
n. Improvement of access channel (Navigation aids Beacon No.1 and No.2)

Table- 7.10 shows the estimated construction cost of Group C (same to all options).

Table- 7.10 Estimated cost for Group C

Construction Cost (Group C)	Unit	Quantity	Amount ($ 1,000)	Remarks
l. Sewage treatment facility	Ls	1	785	Capacity: 5m^3/day, dilution tank, septic tank, water tank
m. Waste oil disposal facility	Ls	1	4,619	Capacity: 10m^3/day, Oily water tank. Oil separator, Filter and Adsorption tank, Oil storage tank
n. Improvement of access channel	Ls	1	185	Navigation Aids (Beacon No.1 and No.2)
Total			**5,589**	

Source: Survey Team

Note: 1$=¥108.25 (June 3, 2019)

(4) Cost for Whole Project

Table- 7.11 shows the cost for whole project.

Table- 7.11 Cost for whole project

Unit: $ 1,000

Group	Project component	Option A	Option B	Option C
A	Construction of quay	48,036	25,689	33,379
B1	Dredging of turning basin	11,316	22,633	31,686
B2	Construction of container terminal	7,497	7,497	7,497
C	Improvement of access channel, Sewage treatment and waste oil disposal facilities	5,589	5,589	5,589
	Total Cost	**72,438**	**61,407**	**78,150**

Source: Survey Team

Note: 1$=¥108.25 (June 3, 2019)

7.4.4. Outline of Execution Plan and Construction Period

Outline of execution plan and the construction period of Group A are shown below.

(1) Execution Plan (outline)

1) Dredging Works

Grab dredger (D9m^3), Hopper barge (500t load) and Backhoe barge (1.4m^3). Dredged soil shall be desposed in the area designated by PPA. Grab dredger will be mobilized from Japan.

2) Quay Works

2)-1 Excavation Work and Replacement work

Grab dredger (D9m^3), Hopper barge (500t load) and Backhoe (1.4m^3) may be used. The surplus soil shall be desposed in the area designated by PAA. Local quality coral sand is purchased for the replacement sand.

2)-2 Main QuayWorks

(a) Driving of steel pipe piles

Crane barge (80t lift) and vibratory hammer (90kw) may be used.

(b) Driving of anchor sheet piles

Crawler crane (80t lift) and vibratory hammer (90kw) from land side may be used.

(c) Installation of waling and tie wire

Waling and tie wire will be installed to the front wall from seaside and anchor wall from land side respectively.

(d) Backfilling works

After installation of tie wire, it shall be backfilled up to sesign elevation. Local quality coral sand can be used for the backfilling material. Steel material, crawler crane (80t lift) and barges will be

imported/mobilized from Japan.

2)-3 Super Structure (including anchoring work)

Ready mixed concrete will be replaced by crawler crane (80 t lift) will concrete bucket.

2)-4 Apron Pavement

Ready mixed concrete will be placed by man-power.

(2) Construction Period

Estimaed construction period is around 2.5 years. Outline of construction schedule is shown in Table-7.12.

Table- 7.12 Outline of construction schedule

Work Items	Month																												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Preparation Works																														
Procuremet of Materials and Machineries																														
Excavation and Replacement Works																														
Main Works (Quay Structure)																														
Backfilling Works																														
Super Structure Works																														
Pavement Works																														
Cleanup Works																														

Source: Survey Team

The construction schedule is made with the follwoing assumptions,

- Excavation and replacement work: 1,978m^3/day and 45 days for mobilization of dredger from Japan
- Main works: driving steel pipe sheet pile with 4.9 pcs/day, anchor sheet pile with 26 pcs/day
- Installation of waling with 9.3m/day, Installation of tie wire with 6 pcs/day
- Backfilling: 225m^3/day
- Superstructure: 13 days per 2 spans, commencing from the third cycle
- Pavement work: 56m^2/day

8. Recommendation for the Preparatory Survey for the project

8.1. Key issues for the preparatory Survey

The Pohnpei Port Development Plan by PRIF (2010) and the subsequent development plan by ADB proposed many project components required to improve the service and to solve various issues of the Pohnpei Port. This survey aims to examine these proposed components by the two previous studies from technical and financial viewpoints. The survey also aims to identify a suitable project for a grant aid project of the Japanese government on the basis of the latest information and data.

One of the most serious issues of Pohnpei Port is the congestion of the main wharf during the high fishing season when many purse seine fishing vessels call on the port and they are multiply moored at both ends of the wharf. Under such circumstances the arrival and departure of cargo ships is extremely dangerous. The only way to mitigate the congestion that the project component is to increase capacity of the port by constructing additional mooring facilities for purse seine fishing vessels.

In order to move the project forward, Survey Team identified the project site through examinations of the four alternative locations and confirmed that the land area on the north end of the main wharf, which is currently under dispute between PPA and a former counterparty of lease contract, is the only potential site for the development of a new quay from technical and port operational viewpoints. In order to make the plan more concrete, Study Team prepared facility layout plans and carried out preliminary structural designs and cost estimates.

In the formulation of a project for Grant aid program, it is important to make up a project within a set budget. At the same time the project must be a complete set of all the essential components to achieve the aim of the project. To this end, it is indispensable to confirm the essential component, i.e., the construction of a quay, can be completed within the set budget.

Since this study lacks detailed information on soil conditions and bottom topography of the project site, Survey Team carried out structural design and cost estimates on the basis of soil conditions assumed form the soil data obtained elsewhere, which are published in the Basic Design Survey Report on Takatik Fishing Port Development and Pohnpei Airport Improvement Plan and the Basic Design Survey Report, and the results of simplified water depth surveys conducted by the Study Team.

Therefore, in order to determine project components, boring survey and hydrographic surveys should be done over the project site. and the structural design and cost estimate should be refined on the basis of actual data from the survey. Then, the components of the project should be re-examined carefully.

The following sections describe the surveys needed to finalize the project.

Furthermore, with this report, Survey Team proposes to construct a new quay with a view to further expand it to a container terminal in the future instead of in substitution for the fishing wharf of CFC as proposed in the previous studies. Thus, this report is proposing a big change of development policy. Therefore, it is essential to get a consensus of PPA, State government and other agencies concerned

about the change of development policy. The dispute concerning the land area for the project should be resolved and the project site should be formally designated as the site for the container terminal.

In order to complete the container terminal, those components that are not included in the Japan's grant aid program need another financing source. Some of the components such as paving the container yard, water and fuel supply system, lighting system, power generators may be funded by the private sector. Negotiations with relevant government agencies and private agencies will also be required.

8.2. Execution Content of Natural Conditions Survey

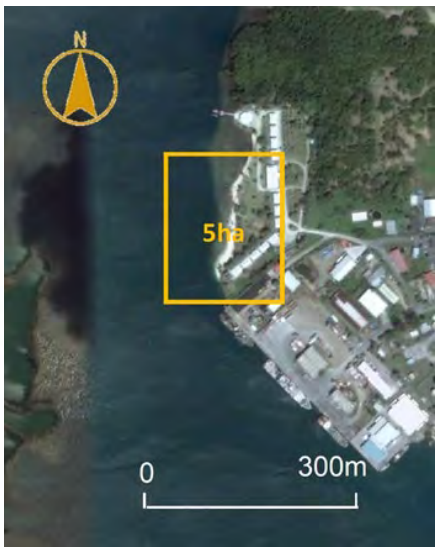
(1) Bathymetric Survey and Magnetic Prospecting

Marine chart surveyed by American Navy (executed in November 2018) is considered to be shared with Japan side by the end of 2019. However, it is unknown whether it was surveyed with the proper density and accuracy for the construction. Perhaps, the density is considered to be rough and therefore, the bathymetric surveys for the new quay site to be, the channel in front of the new quay and the existing turning basin are executed at the preparatory survey. Specifically, the dredging of the turning basin in front of the new quay shall not be executed as the water depth of the existing turning basin is confirmed since the existing turning basin is used. A pilot pointed out in his interview that present container vessels are turned at the existing turning basin by getting a pilot on board, though, the end of the existing turning basin becomes shallow with approximately eight (8) m water depth.

The area of bathymetric survey (approximately 380,000m^2) is shown in Figure- 8.1. Magnetic prospecting area (approximately 50,000 m^2) of dredgeing and reclamation for the construction of a new quay is shown in Figure-8.2 According to PPA, it is said that explosives of American military were found in February 2019 during the dredging works at the south side of the road to the airport from Colonia town. Fortunately, the explosives were not detonated due to the corrosion.

Source: Survey Team

Figure- 8.1 Area for bathymetric survey



Source: Survey Team

Figure- 8.2 Area for magnetic prospecting

（2） Topographic Survey

Topographic survey is executed on the land portion with about 70,000 m^2 (including Misco Beach) of wharf expansion land at the north side of the existing wharf. The survey area is shown in Figure- 8.3. The south side of the runway in Pohnpei Airport is the area to be a dredged. The sand dumping site, instructed by PPA, is included in the area of topographic survey.

Source: Survey Team

Figure- 8.3 Area for topographic survey

（3） Soil Investigation

As this site is soft ground, necessary tests should be planned regarding of soil improvement and the cost reduction. Survey is made along the quay alignment of Option B with 50m interval and 9 points (depth of survey up to -50m) with ±50m to the right angle direction. And, in order to confirm the applicability of coral sand taken from the reef on the opposite shore as the replacement material for soil improvement, 3 points are surveyed (up to the depth -10m).

- Soil Investigation (particle size analysis including sedimentation analysis), Moisture content test, Density test, Unit weight test, Liquid limit test, Plastic limit test
- Standard penetration test (N value)
- Soil hardness test (unconfined compression test and triaxle compression test for the undisturbed sample soil)
- Soil consolidation test (consolidation test for undisturbed sample soil)

Source: Survey Team

Figure- 8.4 Location of boring

(4) Bottom Sediment Survey

Confirmation for the feature of bottom soil (Particle size analysis including sedimentation analysis, moisture content test, Density test, Median particle diameter, Unit weight test and 4 points of sedimentation survey for the environment confirmation (heavy metal analysis) of dredged soil. The analysis of heavy metals include the following 10 items below.

1) Total Sulphur 2) Arsenic 3) Cadmium 4) Chrome 5) Copper
6) Lead 7) Mercury 8) Nickel 9) Zinc 10) DDT

Source: Survey Team

Figure- 8.5 Location of bottom sediment survey

(5) Water Quality Survey

3 points of water quality survey are to be executed as the base line investigation concerning water quality pollution during the construction works. Samplings of sea water are made two elevations, i.e., 0.5 m and 2.0 m below the water surface, and performed twice, i.e., in high watwer and in low water. Test items are as follows,

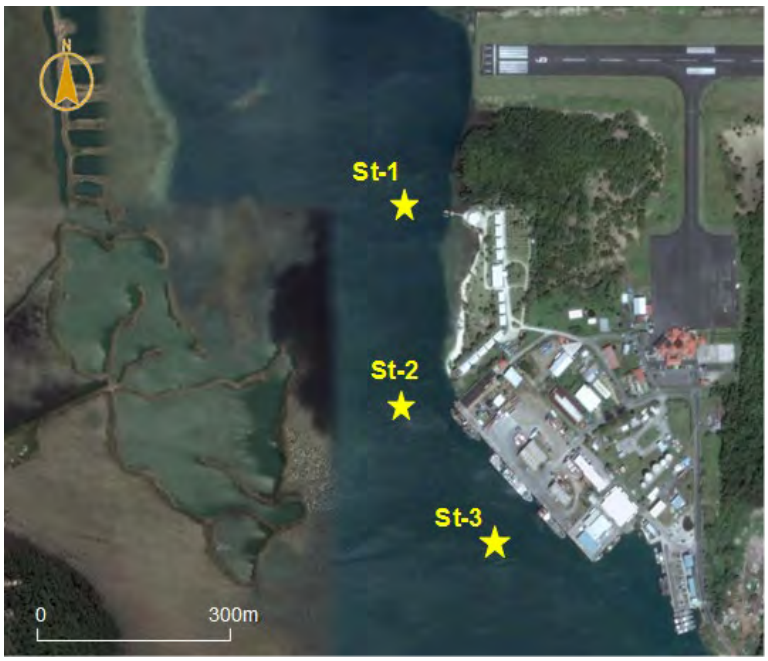
1) Hydrogenion concentration (PH)
2) Chemical oxygen demand (COD)
3) Dissolved oxygen amount (DO)
4) Suspended Solids (SS)
5) Coliform counts
6) n-hexane extracted substance（oily state etc.
7) Total nitrogen
8) Total phosphorus
9) All zinc

Source: Survey Team

Figure- 8.6 Location of water quality survey

(6) Current Survey

3 points of current survey are executed for confirming the influence of current in the front channel of the new quay site. The surveys are executed at the flood and the ebb tide of the spring and the neap tides. And, the current direction and speed are surveyed at the upper, middle and lower part of each points.



Source: Survey Team

Figure- 8.7 Location of current survey

(7) Construction Material Survey

Regarding the construction works, samples that are possibly to be procurement materials for armor stones and the concrete aggregates are collected from the quarry around the project site and the following material tests shall be executed.

1) Grain size test 2) Gravity test 3) Density test
4) Moisture content test 5) Compressive strength test

8.3. Measures to deal with Environmental and Social Consideration aspects

8.3.1. Regarding the EIA Procedure

The Environmental and Social Consideration Specialist of the JICA Study Team will require to

“Assist” under PPA’s name, the undertaking of EIA procedure based on the Pohnpei EIA Regulation.We understand that the JICA Project was initially based on request from the Federated States Government and not the Pohpei State Government, so we suspect that JICA should also take precaution on the request made from the Environmental & Emergency Management Office of FSM Government, on that “As for the EIA Study, required for implementing this Project, the Office would like to request if the Japanese side could bear its budget, as exemption to the JICA New Environmental and Social Consideration Guideline”. The EIA application and all EIA Documents, nonetheless, are required to be drafted under the name of PPA, and submitted through PPA as its official main actor.

As per the comment by the Human Resource Manager of PPA, who is also a member of the Pohnpei EPA Board, since the subject JICA Project’s main objective is redevelopment within the Port premise, and not at any non-developed area, due to official EIA procedural customs in FSM, the subject procedure

may most likely complete within the Initial Assessment stage. However, regardless of Pohnpei EIA's decision to extend the procedure up to full Environmental Impact Statement (EIS) level, we should take caution in how to select the EIA consultant to undertake the subject procedure. It may be wise to consider gaining quotation and proposal from the qualified foreign EIA consultants dispatching organization, SPREP, located in Samoa, as per advice from the Environment & Emergency Office of FSM Government, but taking into respect the economic point of view other than dispatching consultants from surrounding country for a long period of time, it may be wise to also take consideration of quotations and proposals from local qualified EIA consultant firms, before making the final choice.

8.3.2. Other Environmental Supplementary Procedures

Municipal Government Clearance: This clearance as explained previously, can automatically be approved if during the EIA procedure, recommended related stateholders of all subject municipalities of the project site are invited to all the public hearings to be organized, and if all their results are reflected into the Draft IA and Draft EIS before approval by EPA. The Environmental and Social Consideration Specialist of the JICA Study Team should take caution as to whether the EIA consultants in charge, are making arrangement with all subject municipalities (namely, the Nett, Sokhes, and Kolonia City Governments), prior to public hearings at Draft IA and Draft EIS stages, and to check and see if all the results of the public hearings are refected into the respective reports.

Earthmoving Permits: As mentioned earlier, PPA requires to renewal of the Earthmoving Permit (via EIA consultant according to necessity). However, for its application, the JICA Study Team should assist PPA by presenting or drafting required materials to indicate accurate information such as the subject dredging and reclamation area, dredging and reclamation works methodology (including drawings, if possible), dredging volume, reclamation area, etc. for filling out the application form or for related attachments. Especially, it is important to note that there is a mandatory requirement to draft and submit a Soil Erosion & Sedimentation Management Plan (including its mitigation measures). Note that if by decision of EPA, their may also be an additional requirement to organize a related stakeholder public hearing, in which the JICA Study Team may also be require to assist.

According to PPA, as long as the subject application form is completed correctly, there should not be much difficulty in acquiring the permit. However, since this project in particular, is assumed to involve a certain large volume of dredging works, we should also take into concern, that there could be certain comments or specific instructions from Pohnpei EPA, such as on methodology of dredging/ reclamation works, or related to their mitigation measures, during the course of the acquisition process of the permit in question. We must also note that this permit also has relationship with the below

nentioned forestry clearance and marine resource assessment, and that during the process of public hearing within scope of EIA, that there might also be a certain comment or specific request on mitigation measures from the Sokhes Municipality Government that is the subject municipality of the dredging/ relamation area.

Forestry Clearance, Marine Resource Assessment: These procedures also relate with the above procedure, however, we should take precaution as these procedures involves “possible impact toliving mangroves and/or coral reef, as well as aquatic and/or benthic species, and especially to any one of their important species registered in the IUCN Red Data Book”.

Therefore, an additional suevey of flora, aquatic and benthic organisums may be required. Considering the area of the project, the following surveys should be carriesd out:

(a) The existence and quantities of live corals and mangrove within the proposed dredging and reclamation area having an area of 250 m x 200m (see Figure 8.8) including the preparation of clustered coral by meands of Manta Method.

(b) Flora, aquatic and benthic organisms by means of Quodrat Method using a 5m x 5m frame);

Photographs for each quadrat, confirmation of IUCN status including counting number of aquatic and benthic organisms as well as the preparation of inventory of flora and aquatic biota by quadrate based on the results of the survey

Source: Prepared by Survey Team

Figure- 8.8 Survey area of flora, aquatic and benthic organisums

Basically, it is said that in general, as for any redevelopment project in which the project site is not located in any non-developed area, they are normally considered as

projects that does not cause any significant adverse impact, and therefore, all the above supplementary procedures relatively do not fall into any difficulty and therefore it can be quite easy to acquire approval from the respective authorities. Although with regard to the dredging and reclamation area in terms of JICA's development plan for the northern extension of the existing main wharf, there is an unconfirmed information on concerns of possible influence to coral reefs and/or mangroves. We understand that a part of the area has been utilized as a sand mining area, and therefore, the situation may probably not lead to any concerns of significant impact. It is nonetheless an issue that requires to be reconfirmed through JICA's Preparatory Study stage.

Historical Preservation Clearance: This JICA Project is neither extremely large scale nor a new development project at a non-developed area, therefore, it is expected that this Clearance procedure will complete within the scope of the simple Historical Preservation office staff in charge. Also, based on interviews with the Office Director and staff in charge, the subject port development project site area presumably should not cause impact to any historical heritage of importance that may require protection, therefore the subject clearance procedure should complete within the level of mere customary simple process.

T & I Procedure (requiring reconfirmation): Though not referred to in section 7.3.2 on Other Environmental Supplementary Procedures, the JICA Study Team during the course of this Survey, also confirmed that Pohpei State Govoernment's Transport & Infrastructure Division is currently under preparation of a Bill on Transport & Infrastructure (T & I) Procedure. Namely the Bill year 2018 for establishment of the Public Infrastructure Program Notification and Coordination Act, which may obligate such procedures to project implementers that wish to implement Transport Infrastructure development projects. Since the Bill is still a Draft (one that the JICA Study Team has already obtained to refer upon) requiring further stakeholder consultation and revisions, we will omit further explanation at this stage. However, as far as referring to the acquired Draft Bill as of February 2019, the procedure maybe obligated only to private entities (and not public entities) that wish to commit as project implementing bodies of public projects.

According to PPA, the T & I Division seems to be committed for early enactment of the subject Act, based on the Final Bill, and therefore, since it is most likely that this Act may be issued during the course of JICA's Preparatory Study stage, the JICA Study Team should also be aware of this. We recommend that the next JICA Study Team to recheck on the status of establishment of the related Act, as well as reconfirmation on whether the T & I procedure requires to be applied to JICA's subject project or not.

8.3.3. Countermeasures on land related issues including the Dispute area (Misko Beach)

1) The case in which Ms. M.E. is putting up a claim against PPA, etc., at the dispute area, is subject for the third hearing on motion, according to PPA around mid-May, 2019. However, the

assumption on that the case may settle within approximately 1 to 3 months after the State Court has collected the evidence related to the hearing on motion, is still an assumption by PPA's General Counsel in charge (therefore, concrete timing of settlement by the State Court is unpredictable). Since it is the case, JICA can only wait and observe on the decision of settlement by the State Court, and PPA's action in line with the Courts decision.

2) On the other hand, as for the treatment regarding the illegal settlers at the dispute area, it is important to keep monitoring PPA's treatment of the issue, and if its countermeasures prolong up to the Preapartory Study stage, the JICA Study Team should keep advising PPA to follow suite to the JICA New Environmental and Social Guideline, especially in terms of appropriate compensation to the illegal settlers for resettlement. Incidenatally, however, the State Court have have instructed to PPA before, that unless the Court reach up to settlement of the case, PPA must not take action to order the illegal settlers to resettle elsewhere. And therefore, the JICA Study Team should also bear this in mind.

3) Unfortunately, during this Survey, the JICA Study Team did not reach up to the point in investigating, for example, best practices of other international donors regarding treatment and methodology in handling involuntary resettlement issues of illegal settlers. It may be wise to consider for the JICA Study Team to investigate on past practices by PPA, if any, and to investigate on best practices as mentioned above as a follow up study at the Preparatory Study stage.

Annex

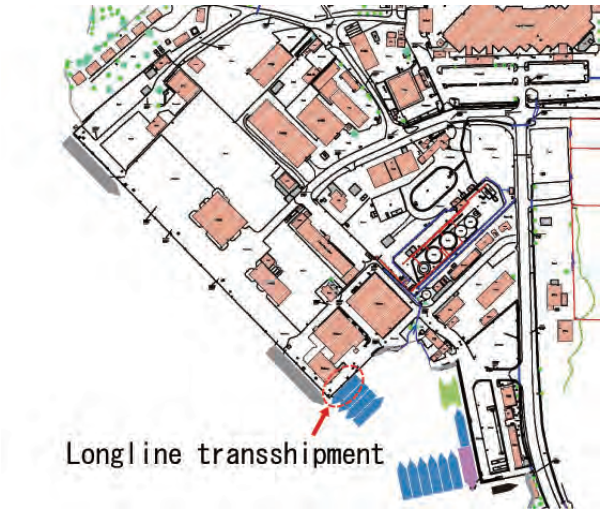
FSM Pohnpei port berthing and transshipment

Annex-1

FSM Pohnpei port berthing and transshipment 2/8/2019～2/18 1/4

2/8/2019 15:00

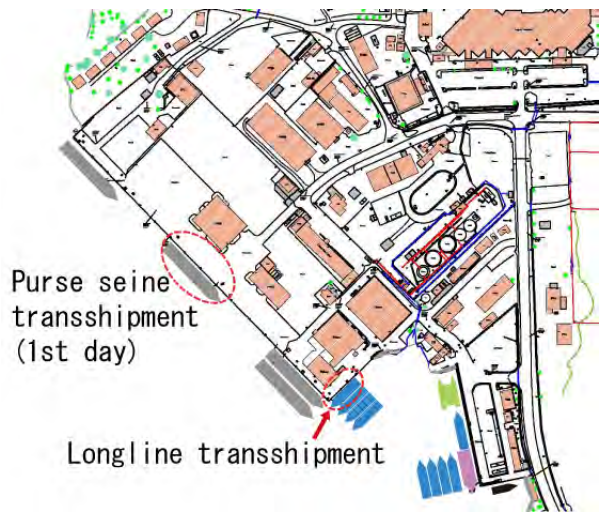
2/9/2019 13:30



Longline transshipment

Vessel to PFC

2/10/2019 14:00

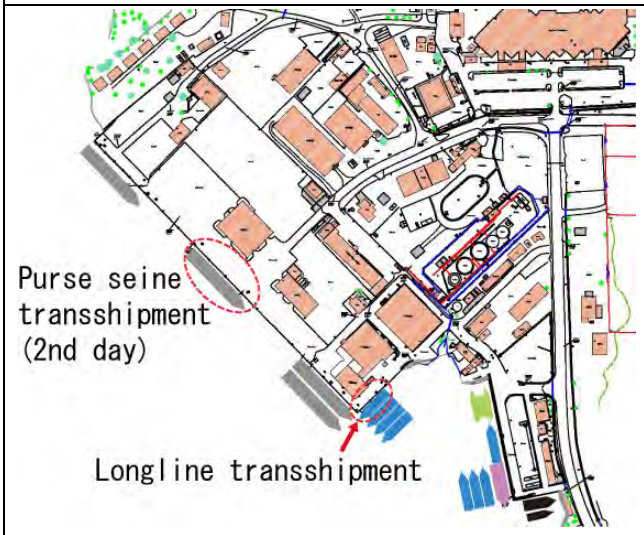


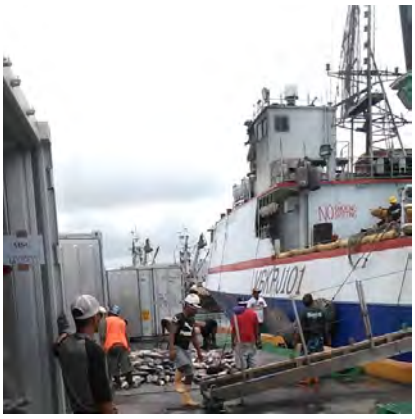
Purse seine transshipment

Vessel to container

FSM Pohnpei port berthing and transshipment 2/8/2019～2/18 2/4

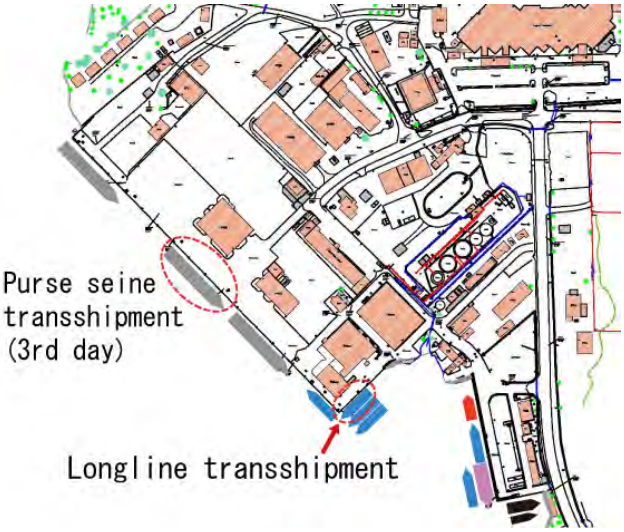
2/11/2019 13:30





Purse seine - container

2/12/2019 14:00



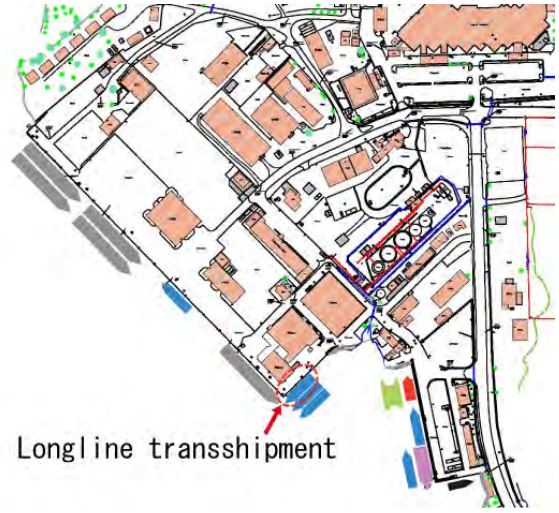
Purse seine - container

2/13/2019 13:00

FSM Pohnpei port berthing and transshipment 2/8/2019～2/18 3/4

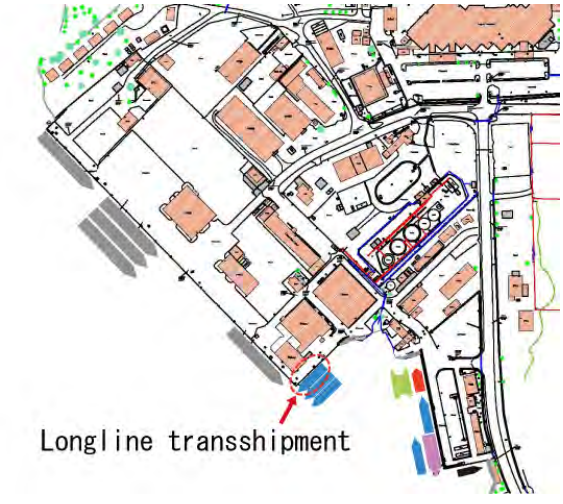
2/14/2019 14:00

2/15/2019 14:00



Longline transshipment

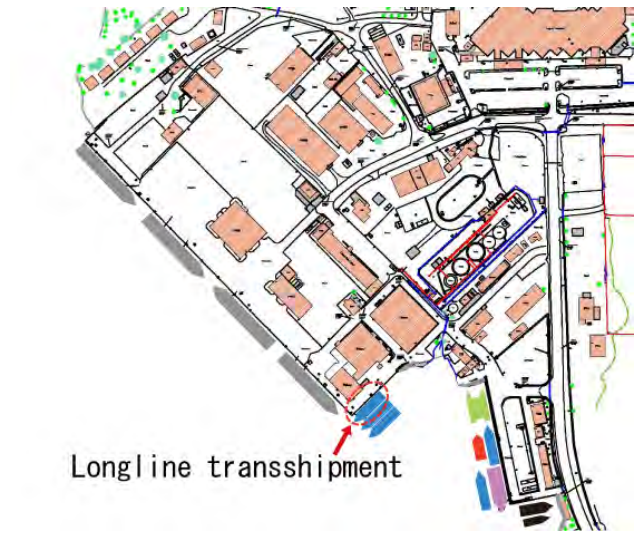
2/16/2019 12:00



Frozen yellowfin tuna

FSM Pohnpei port berthing and transshipment 2/8/2019～2/18 4/4

2/17/2019 11:00



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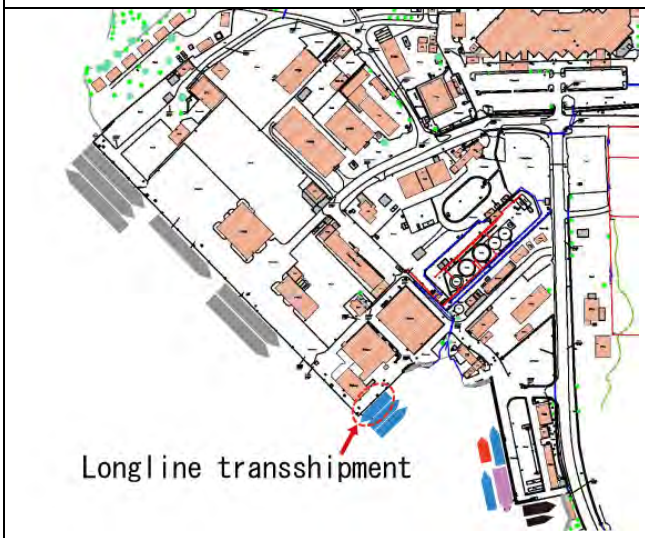

Longline transshipment by forklift