REPUBLIC OF DJIBOUTI
MINISTRY OF EQUIPMENT AND TRANSPORT
MARITIME AFFAIRS DJIBOUTI

REPUBLIC OF DJIBOUTI
THE PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF MARITIME TRANSPORT CAPACITY BETWEEN DJIBOUTI AND TADJOURAH

FINAL REPORT
(1/2)

AUGUST 2019

JAPAN INTERNATIONAL COOPERATION AGENCY

THE OVERSEAS COASTAL AREA DEVELOPMENT INSTITUTE OF JAPAN
SANKYO TECHNO CO., LTD.
JAPAN PORT CONSULTANTS, LTD.

EI
JR
19-097

REPUBLIC OF DJIBOUTI
MINISTRY OF EQUIPMENT AND TRANSPORT
MARITIME AFFAIRS DJIBOUTI

REPUBLIC OF DJIBOUTI
THE PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF MARITIME TRANSPORT CAPACITY BETWEEN DJIBOUTI AND TADJOURAH

FINAL REPORT
(1/2)

AUGUST 2019

JAPAN INTERNATIONAL COOPERATION AGENCY

THE OVERSEAS COASTAL AREA DEVELOPMENT INSTITUTE OF JAPAN
SANKYO TECHNO CO., LTD.
JAPAN PORT CONSULTANTS, LTD.

Preface

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to Joint Venture for Preparatory Survey on Reinforcement of Maritime Transport at Gulf of Tadjourah consist of The Overseas Coastal Area Development Institute of Japan, SANKYO TECNOCO., LTD and JAPAN PORT CONSULTANTS, LTD..

The survey team held a series of discussions with the officials concerned of the Government of Republic of Djibouti, and conducted field investigations. As a result of further studies in Japan, the present report was finalized.

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

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

August 2019

Itsu Adachi
Director General,
Infrastructure and Peacebuilding Department
Japan International Cooperation Agency

Summary

1. Background and History of Project

The Republic of Djibouti is located in the "Horn of Africa" facing the Gulf of Aden that connects the Red Sea and the Indian Ocean. The strategic importance of this area is highlighted by the fact that 18,000 vessels pass through each year on their way to Europe, the Middle East and East Asia. Moreover, Djibouti Port is the only gateway port for Ethiopia, a large country with a population of around 92 million.

A ferry route is operated between the capital city Djibouti and the city of Tadjourah and Obock on the northern coast via the Gulf of Tadjourah. The existing ferry which was provided by Japan went into operation on December 10, 2009; there are four weekly services between Djibouti and Tadjourah and two weekly services between Djibouti and Obock. As the ferry is often fully-booked with passengers and vehicles, it has become necessary to increase capacity.

In addition, ferry service is often interrupted during the Khamsin season from July to August due to high wind speeds of 5-10 m/s on average.

Land transport to Djibouti, Tadjourah and Obock involves lengthy detours around the Gulf of Tadjourha. In addition, there are many Wadi (dry valleys) in the middle of the road which make the road dangerous to use during seasons when there are heavy rains. Therefore, ferry service is vital for the transport of residents, vehicles and cargo, and at the same time it is a lifeline for the northern region.

While the population of approximately 530,000 is concentrated in the capital city Djibouti located in the south, the northern area has a low population density; moreover, the development of road networks has been delayed due to the many mountainous areas and thus the transport of daily necessities such as food, fuel, and water has become a major issue. The 5-year (2015-2019) Strategy for Accelerated Growth and Promotion of Employment (SCAPE) is expected to spearhead the medium-term implementation of "Djibouti Vision 2035," the national development plan. The first pillar of SCAPE is “economic growth through development of economic infrastructure and enhancement of private sector competitiveness”. In the transport sector, the key strategy is to strengthen the domestic transport network by addressing regional gaps and at the same time to strengthen the international transport network.

“The project for reinforcement of maritime transport capacity between Djibouti and Tadjourah” which includes the procurement of a new ferry with high operational capacity and berthing facilities to respond to the increasing transport demand and enable navigation during the Khamsin season is consistent with the aims of SCAPE (i.e., promoting regional development and strengthening the domestic transport network to correct regional economic disparities).

2. Survey Result and Project Outline

JICA dispatched a team for the Preparatory Survey on the Project for Reinforcement of Maritime Transport Capacity between Djibouti and Tadjourah (hereinafter referred to as the “Survey team”) to Djibouti from June 29 to October 14, 2018.

The survey team discussed and reconfirmed with the Government of Djibouti the contents of the project

through the field survey. The Government of Djibouti requested that the new ferry vessel be operational during the Khamsin season and capable of carrying 250 passengers as well as the development of new ferry berthing facilities at Djibouti and Tadjourah. The survey team proposed to JICA a plan for the new ferry and ferry berthing facilities at both Djibouti and Tadjourah based on analysis in Japan following the survey in Djibouti. The specifications of the new ferry, berthing facilities, boarding facilities as well as required reclamation works, construction method, procurement plan, project management plan, project schedule and a cost estimate were determined based on the results of field investigations.

JICA then dispatched the survey team to discuss the results of the Preparatory survey including the basic design of the Project and the obligations of both parties with the government of Djibouti from May 24th to 31st, 2019. The government of Djibouti agreed to the basic design and obligations of both parties.

An outline of the Project is shown in Table 1.

Table 1: Outline of contents and scale of the Project

Description	Item	Configuration and Dimensions
Equipment Supply	New Ferry	Overall Length 49.95m、Width 11.0m、Full Draft 2.5m、Passenger 250 seats、Car on board 20 car、Deadweight 240t、Boarding ramp：Bow and Stern 2Nos
Facility (Djibouti)	Reclamation	Area Approx.9,600m2、Planned Elevation +3.5mCD
	Dredging	Dredging volume 76,000m3、 Planned Dredging Depth -3.5m CD、
	Mooring Dolphin	Steel Pile type 3 Dolphins、Planned Elevation +3.5mCD
	Floating Pontoon	Steel Pontoon 1 Nos、Width 11.0m、length 18.0m、
	Access Ramp	Steel made type 1Nos、Width 5.6m (Effective width 5.0m)、Length 22.1m
	Bollard	3 Nos、150kN type
	Corrosion Protection	50 year type anode
	Catwalk	Steel structure、Width 0.9m、Length 10.5mx2 Nos、10.7mx1No.
	Navigation Light	3 Nos、
Facility (Tadjourah)	Reclamation	Area Approx.5,300m2、Planned Elevation +3.8mCD
	Dredging	Dredging volume 12,000m3、 Planned Dredging Depth -3.5mCD、
	Breakwater	Sloping stone dyke、Length 160m、Planned Elevation +3.7mCD
	Mooring Dolphin	Steel Pile type 3 Dolphins、Planned Elevation +3.5mCD
	Floating Pontoon	Steel Pontoon 1 Nos、Width 11.0m、length 18.0m
	Access Ramp	Steel made type 1Nos、Width 5.6m (Effective width 5.0m)、Length 22.1m

	Bollard	3 Nos、150kN type
	Corrosion Protection	50 year type anode
	Catwalk	Steel structure、Width 0.9m、Length 10.5mx2 Nos、10.7mx1No.
	Navigation Light	2 Nos、

3. Project Implementation Schedule and Rough Cost Estimation

Estimated implementation period is 25.0 months including the tender process (9 months for Detailed Design for Civil Engineering works, 6 months for equipment procurement) and 14.5 months construction works and 19 months for new ferry procurement. Initial Project Cost is estimated at 4,368 million yen in total (of which the Japanese side bears 3,943 million yen and Djibouti side 425 million yen).

4. Project Evaluation

（1）Validity of the Project

The validity of the implementation of the Project as a Japanese grant aid project is evaluated from the following points.

① Benefit of the Project

The existing ferry (150-passenger) service consists of 6 round sailings a week (4 round sailings between Djibouti and Tadjourah and 2 round sailings between Djibouti and Obock), but after the introduction of the new ferry (250-passenger capacity), ferry service between Djibouti and Obock will increase to 6 times a week except for the Khamsin season while new ferry can be operated year-round, six times a week between Djibouti and Tadjourah. In the future, it may be possible to operate 2 round sailings per day with the new ferry. Therefore, the number of beneficiaries will increase to several times compared with the current operation. Accordingly, the benefit effect will become great.

② Consistency with the National Plan

The Strategy of Accelerated Growth and Promotion of Employment (SCAPE) states that one of the planning targets for port development and maritime transport is to establish modern a transport means to meet the demands for the movement of people from the metropolitan area to regional areas. This Project is perfectly consistent with this target.

③ Necessity of Utilizing Japanese Technology

The necessity of utilizing Japanese technology will be fully demonstrated for not only ferry building and marine construction works but also facility maintenance management.

There are two types of maintenance management works which should be conducted by the Maritime Bureau related to ferry operation: maintenance of the ferry itself and maintenance of port facilities. At present, there is

no maintenance and management section in the Maritime Bureau, and thus daily and regular maintenance work has not been conducted.

However, the Maritime Bureau has confirmed that regular inspections of existing and new ferries will be carried out and the maintenance works for the new facilities will also be carried out by the new staff that will be hired to coincide with the introduction of the new ferry.

Therefore, it is considered necessary to transfer Japan's superior maintenance management technology through the Project which will greatly contribute to the improvement of Djibouti's maintenance management technology.

（2）Effectiveness of the Project

This Project is an urgent and indispensable project for Djibouti. By correcting the regional disparities between the north and south coasts of Tadjourah bay, the project will contribute directly to the economic development and social stability of the country. In addition, it will greatly contribute to the security and safety of the people and promote tourism. As a result, it can be concluded that this project will be highly effective.

Contents

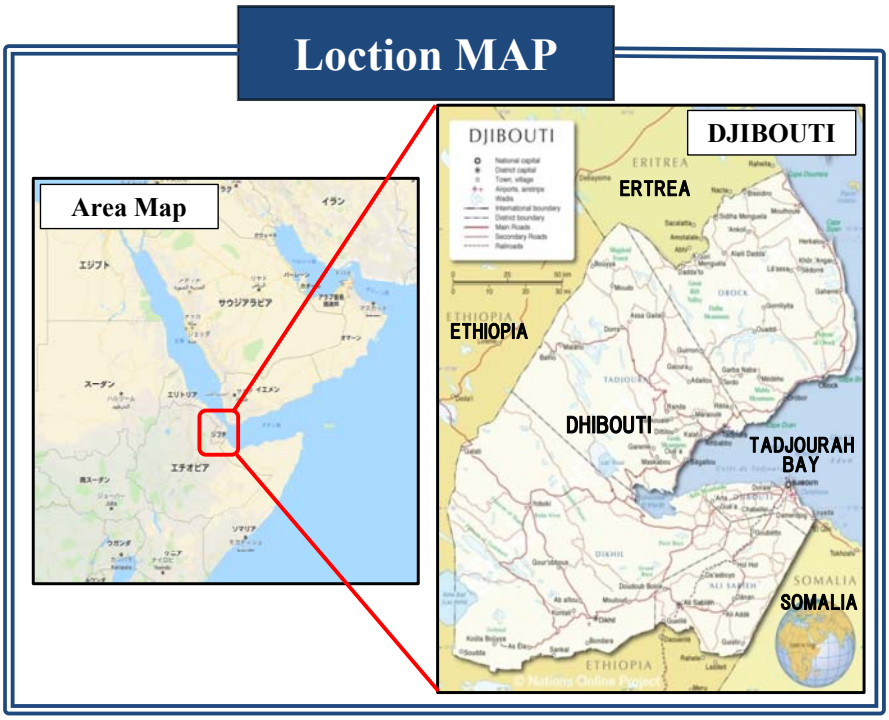
List of Tables

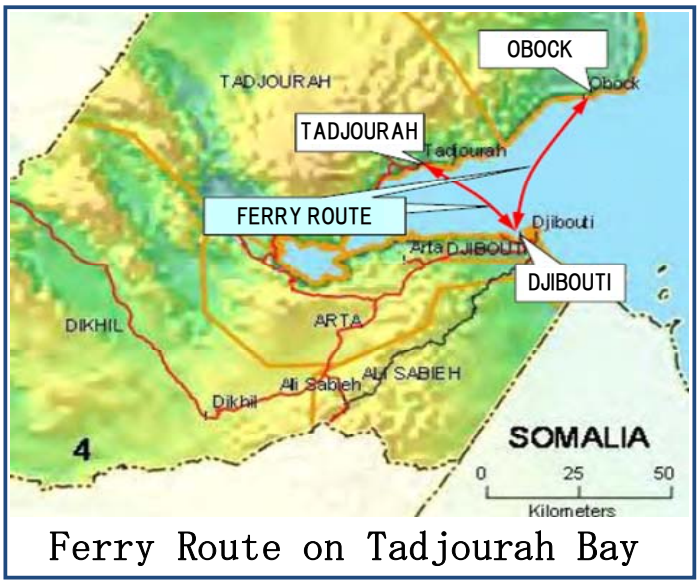
List of Figures

Abbreviation		
A		
B	B/A	Banking Agreement
C	CDL	Chart Datum Level
	CH	Channel
	COD	Chemical Oxygen Demand
	COG	Center of Garavity
D	dB	Decibel
	DJF	Djibouti Franc
	DO	Dissolved Oxygen
	DWT	Dedweight Tonnage
E	EHS	Environment, Health and Safety
	EIA	Environmental Impact Assessment
	E/N	Exchange of Note
	ESS	Environmental and Social Standards
	EU	European Union
F	FWD	Foreward
	FOT	Fuel Oil Tank
	FWT	Fresh Water Tank
G	G/A	Grant Agreement
	GDP	Gross Domestic Product
	GPS	global positioning system
	GT	gross tons
H	H.H.W.L.	Heighest High Water Level
	H.W.L.	High Water Level
	Hz	Hertz
I	IFAD	International Fund for Agricultural Development
	IFC	International Finance Corporation
	IMO	International Maritime Organization
	IUCN	International Union for Conservation of Nature
J	JIS	Japanese Industrial Standards
	JG	Japanese Government
K	kN	kilonewton
	kN・m	Kilonewton Meter
	kW	Kilowatt
	kWh	Kilowatt Hour
	kVA	Kilovolt Ampere
L	LAT	Lowest Astronomical Tide
	LED	Light Emitting Diode
	LPP	Length between Perpendiculars
	L.W.L.	Low Water Level

M	MCR	Maximum Continuous Rating
	MET	Ministry of Equipment and Transports
	MHUPE	Ministry of Housing, Urban Planning and Environment
	MLD	Mould
	m / s	Meter per Second
	M.W.L.	Mean Water Level
N	N	newton
	NGO	Non-governmental Organization
	NK	Nippon Kaiji Kyokai
	NM	Nautical Mile
	N/mm^2	newton per square millimeter
	NNW	North-northeast
	NOx	Nitrogen Oxide
	NW	Northeast
O	O.A.	Over All
P	PAID	Port Autonomu International de Djibouti
	pH	Potential of Hydrogen
	ph	Phese
	PM	Particle Matter
Q		
R	Ro-Ro	Roll On/Roll Off Ship
S	SE	Southeast
	SEZ	Special Economic Zone
	SKK	Steel Kokan Kui
	SM	Steel Marine
	SMA	Steel Marine Atmospheric
	SOx	Sulfur Oxide
	SS	Suspended Solids
	SSE	South-southeast
	SSW	South-southwest
	STCW	The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers,1978
	SW	Southwest
T	tf	Ton Force
	t/m^2	ton per square meter
	TOR	Terms of Reference
U	US$	US Dollar
V	VHF	Very High Frequency
W	W	West
	WC	Water Closet
	WHO	World Health Organization
	WNW	West-southwest
X		
Y		
Z		

Project Location





Ferry Route on Tadjourah Bay

Image of Port Facility Development

Image of Djibouti Port Facilities Development Plan

Image of New Ferry and Djibouti Port Facilities Development Plan

Image of Tadjourah Port Facilities Development Plan

Image of New Ferry and Tadjourah Port Facilities Development Plan

Image of New Ferry






Photograph (1/10)	Outline Design Survey	Meeting

Minutes of Discussion (M/D) Signing Ceremony

Greeting and Explanation on Preparatory Survey by Director, Maritime Affair and JICA Leader (1st July 2018)

Minutes of Discussion (M/D) Signing Ceremony

Signing of the Minutes of Discussion (1st July 2018)

Meeting with Director, Maritime Affair

Discussion for Survey Details and Necessary documents and information, Stakeholder meetings (1st July 2018)

Investigation and Interview for Ferry at Djibouti Port

Site visit at Djibouti port, Survey existing ferry, Interview with Captain and Crews (2nd July 2018)

Meeting with Director, Maritime Affair

Individual Discussion(Ship related) (2nd July 2018)

Meeting with Director, Maritime Affair

Individual Discussion(Social and Environment Consideration) (2nd July 2018)

Photograph (2/10)	Outline Design Survey	Meeting

Meeting with Director, Maritime Affair

Individual Discussion(Social and Environment Consideration) (Port Management and Maintenance System) (2nd July 2018)

Survey on board and Interviews

Survey on board from Djibouti to Tadjourah, Interview with Captain and Crews (3rd July 2018)

Tadjourah Port Stakeholder Meeting

Stakeholder Meeting attended by Director, Maritime Affair and Tadjourah Port related parties and officials in Tadjourah City (3rd July 2018)

Site Investigation and Interviews at Tadjourah Port

Site visit at Tadjourah port, Survey IFAD project reclamation yard, View from South to North (3rd July 2018)

Site Investigation and Interviews at Tadjourah Port

Site visit at Tadjourah port, Survey IFAD project reclamation yard, View from East to West (3rd July 2018)

Meeting with Harbor Master

Meeting with Harbor Master for Procedure for Approval for Site Investigation such as Bathymetric Survey etc. (4th July 2018)

Photograph (3/10)	Outline Design Survey	Meeting

Meeting with Central Laboratory

Meeting with Central Laboratory for Site Investigations (5th July 2018)

Meeting with Ministry of Environment

Meeting with Ministry of Environment for on-site investigation and Environment related matter. (5th July 2018)

Meeting with City Planning Bureau

Meeting with City Planning Bureau for City Planning stc. (5th July 2018)

Djibouti Port Stakeholder Meeting

Stakeholder Meeting attended by Director, Maritime Affair and Djibouti Port related parties and officials in Djibouti City(10th July 2018)

Photograph (4/10)	Outline Design Survey	Present Condition

New Ferry Terminal Area at Djibouti Port

View from entrance to Djibouti city (2nd July 2018)

New Ferry Terminal Area at Djibouti Port

View from entrance to Coast Guard (2nd July 2018)

New Ferry Terminal Area at Djibouti Port

View from sea side to land side (2nd July 2018)

New Ferry Terminal Area at Djibouti Port

View from new terminal area to sea side. Old ferry donated by German government berthed at just front of new terminal area (2nd July 2018)

Current Berthing Situation at Djibouti Port

Berthing Ferry along to Dolphin at Djibouti Port (2nd July 2018)

Current Loading Situation at Djibouti Port

Loading Water Bowzer (2nd July 2018)

Photograph (5/10)	Outline Design Survey	Present Condition

Cleaning by fresh water

Cleaning by fresh water from water cart (2nd July 2018)

Main Engine for Present Ferry

Under poor maintenance (2nd July 2018)

Present Ferry Terminal Area

View from Ferry to Terminal Area (3rd July 2018)

Passenger Tickets

Passenger Ticket, Adult: White color and Student: Yellow color (3rd July 2018)

Current Ticket Selling Booth at Djibouti Port

Ticket Selling Booth on the Load at Djibouti Port (3rd July 2018)

Current Ticket Checking Booth at Djibouti Port

Ticket Collecting Booth before boarding at Djibouti Port (3rd July 2018)

Photograph (6/10)	Outline Design Survey	Present Condition

Cargo Loading

Cargo Loading by Manual (3rd July 2018)

Loading Cargo on Board (Deck)

Loading Water Bottles on Board from Truck (3rd July 2018)

Loaded Cargo on Board (Deck)

Loaded cargo on the deck (3rd July 2018)

Loaded Cargo on Board (Deck)

Loaded cargo on the walkway (3rd July 2018)

Loaded Vehicles and Passengers on Board Deck)

Loaded vehicles and passengers on deck (3rd July 2018)

Passages on Board (Deck)

Passengers relaxing on deck (3rd July 2018)

Photograph (7/10)	Outline Design Survey	Present Condition

Passengers Room

Passengers relaxing on passengers room (3rd July 2018)

Approaching Tadjourah Port

Passengers waiting Ferry arrival at Tadjourah Port, Ferry Ramp. Ferry ramp downed (3rd July 2018)

Berthing Situation at Tadjourah Port

タジュラ港フェリーターミナルの到着待ちの人々及び車両（着岸時）の状況（3rd July 2018）

Berthing Situation at Tadjourah Port

Personnel flow into the deck for cargo transpotation (3rd July 2018)

タジュラ港フェリー着岸後

ターミナル部からフェリーを望む（3rd July 2018）

Berthing Situation at Tadjourah Port

View to Rampway (3rd July 2018)

Photograph (8/10)	Outline Design Survey	Present Condition

New Ferry Terminal Area at Tadjourah Port

View new reclamation area for new terminal and present ferry terminal (4th July 2018)

New Ferry Terminal Area at Tadjourah Port

View new reclamation area for new terminal and IFAD reclaimed area (4th July 2018)

Accident on road between Djibouti and Tadjourah

Rolled over vehicles (4th July 2018)

Accident on road between Djibouti and Tadjourah

Rolled over vehicles (4th July 2018)

Floating Dock for Maintenance

Floating Dock owned by Djibouti Port Authority (4th July 2018)

Shipwreck in Djibouti Port

Shipwreck in Djibouti Port (19th JAugust 2018)

Photograph (9/10)	Outline Design Survey	Investigations

Geotachnical Investigation at Djibouti Port

Natural condition survery:
Geotechnical investigation by pontoon
(Djibouti Port and Tadjourah Port)

Sampling seabed sediment at Tadjourah Port

Environmental survey:
Sampling seabed sediment
(Djibouti Port and Tadjourah Port)

Bathymetric survey (Calibration) at Djibouti Port

Natural condition survery:
Bathymetric survey
(Djibouti Port and Tadjourah Port)

Coral Survey at Tadjourah Port

Environmental survey:
Coral Survey
(Tadjourah Port)

Current and Water Quality (Calibration) at Tadjourah Port

Environmental survey:
Survey for Current and Water Quality
(Tadjourah Port)

Wave Observation at Tadjourah Port

Natural condition survery:
Wave observation
(Tadjourah Port)

Photograph（10/10）	Explanation Draft Outline Design	Present Condition and Meeting

General View at Djibouti Port

View from Ferry to Djibouti Port（28th May 2019）

General View at Tadjourah Port

View from Ferry to Tadjourah Port（28th May 2019）

Progress of Tadjourah related project

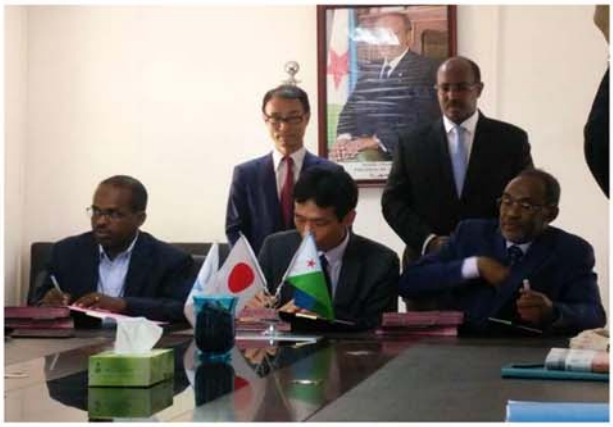
IFAD project, Building Foundation Work((28th May 2019）

Meeting with Director, Maritime Affair

Explanation on Draft Preparatory Survey Report（26th May 2019）

Meeting with Ministry of Fisheries

Discussion between IFAD and JICA projects planned at Tadjourah Port（27th May 2019）



Minutes of Discussion（M/D）Signing Ceremony

Signing of the Minutes of Discussion （29th May 2019）

1. Background of Project

1.1. Current Status and Issues of the Sector

1.1.1. Current Status and Issues

(1) Current Status

The Republic of Djibouti is located in the "Horn of Africa" facing the Gulf of Aden that connects the Red Sea and the Indian Ocean. The strategic importance of this area is highlighted by the fact that 18,000 vessels pass through each year on their way to Europe, the Middle East and East Asia. Moreover, Djibouti Port is the only gateway port for Ethiopia, a large country with a population of around 92 million.

A ferry route is operated between the capital city Djibouti and the city of Tadjourah and Obock on the northern coast via the Gulf of Tadjourah. The existing ferry which was provided by Japan went into operation on December 10, 2009; there are four weekly services between Djibouti and Tadjourah and two weekly services between Djibouti and Obock. As the ferry is often fully-booked with passengers and vehicles, it has become necessary to increase capacity.

In addition, ferry service is often interrupted during the Khamsin season from July to August due to high wind speeds of 5-10 m/s on average.

Land transport to Djibouti, Tadjourah and Obock involves lengthy detours around the Gulf of Tadjourha. In addition, there are many Wadi (dry valleys) in the middle of the road which make the road dangerous to use during seasons when there are heavy rains. Therefore, ferry service is vital for the transport of residents, vehicles and cargo, and at the same time it is a lifeline for the northern region.

(2) Current Maritime Transport Demand

Domestic maritime transport in Dibouti is available to and from the town of Obock and the cities of Tadjourah and Djibouti. It also covers the mountainous area behind Tadjourah via both cities as well as inland areas behind Obock province and the Red Sea coast. In addition, a small fiber reinforced plastic (FRP) outboard motor boat operates irregularly between Djibouti city and Moucha Island (a beach resort).

The Maritime Affairs, a public entity, owns one of the existing ferries while a private company operates the other ferry (which was donated by Germany) which mainly transports cargo. Wooden Dhow ships, small FRP outboard motor boats, small fishing boats, pleasure boats, etc. can also be observed.

The ferry owned by the Maritime Affairs (Mohamed Bourham Kassim, granted through JICA Grant Aid in 2009) is engaged in the transport of passengers, vehicles and cargo while small outboard motor boats carry a small number of passengers; Dhow ships transport cargo at the request of ship owners. The items being transported are as follows.

① Passengers (i.e., passengers and accompanying vehicles returning home from the metropolitan area where they have purchased daily necessities)

② Commercial goods (consumer goods, drinking water, luxury items, daily necessities, construction materials etc. are transported from the metropolitan are to rural areas while sheep, goats, fish and shellfishes, charcoal etc. are transported from rural areas to the metropolitan area)

③ Tourists and tourist-related products (transport of passengers and goods to sightseeing areas such as the Maskali island and Moucha island)

(3) Issues

The following issues need to be addressed to improve the current ferry operations in Tadjourah Bay.

1) Securing Stable Operations during the Khamsin Season

In the Khamsin season from July to August, the average wind speed reaches 5-10 m/s which forces ferry operations to stop due to safety considerations. It is necessary to introduce a ferry that can navigate during the Khamsin season.

2) Coping with the Increase in Passenger and Cargo Movement

There are four services a week between Djibouti and Tadjourah and two services a week between Djibouti and Obock. As ferries are often fully-booked with passengers and vehicles, it is necessary to increase capacity.

3) Coping with Increasing Containerization and Larger Vehicles

Along with the economic growth of Djibouti, domestic container transport is increasing, and container transport vehicles are required to be loaded onto the existing ferry. Domestic logistics is also becoming more active, making it necessary to deal with larger vehicles.

4) Enhancing the Safety and Efficiency of Embarking/Disembarking Passengers and Vehicles

Currently, passengers and vehicles are using one ramp way at the bow of the ferry when embarking and disembarking. When disembarking from the ferry, passengers and vehicles use the ramp at different times to separate the movement flows. However, in the case of boarding the ferry, some passengers board the vessel just prior to departure which makes it difficult to separate passenger and vehicle movements. Waiting areas for boarding passengers and vehicles are also not clearly separated. It is necessary to enhance the safety and efficiency of embarking/disembarking passengers and vehicles.

5) Improving the Traffic Flow and Safety of the Ferry Facility

At the existing ferry facility at Djibouti Port, about 10 minibuses wait for passengers disembarking from the ferry in the vacant lot adjacent to the existing facility. They often spread onto to the road and hinder road traffic. Therefore, it is also necessary to prepare a standby area for these pick-up vehicles.

6) Maintenance Management of Facilities

Maintenance of the existing port facility is not regularly conducted. Ferry crews merely exchange tires of the dolphin fenders. It is necessary to properly maintain and manage port facilities.

1.1.2. Development Plan

Review of the Government of Djibouti's Plans related to the Transport Sector

There is a five-year plan SCAPE (Strategy of Accelerated Growth and Promotion of Employment) 2015 – 2019, which is the implementation strategy of the national development plan "Vision Djibouti 2035" in Djibouti. In terms of port development and marine transportation, the following goals of the transport sector framework are specified in SCAPE.

- Enhancement of functions for Djibouti port to become a regional hub port
- Increase in SEZ development and number of operating companies
- Development and modernization of air transport infrastructure and promotion of tourism sector
- Economic integration through railway transport activation between Djibouti and Ethiopia
- Establishment of a national road network to promote people's movement and logistics
- Development of a modern transport system to facilitate mobility between the metropolitan area and rural areas

The Preparatory Survey on Reinforcement of Maritime Transport at Gulf of Tadjourah is a plan to be consistent with "Development of a modern transport system to facilitate mobility between the metropolitan area and rural areas" which is one of the above goals of the transport sector.

1.1.3. Socio-Economic Status of Djibouti

(1) Outlook for Economic Growth in Djibouti

According to the Strategy of Accelerated Growth and Promotion of Employment (SCAPE) 2015 - 2019, GDP of Djibouti is expected to maintain a high growth rate of 10.6% in 2019. The following table shows the projected GDP and growth rates of Djibouti according to SCAPE 2015-2019

Table 1.1-1 Predicted GDP and Growth Rate of the Djibouti

in millions of Djibouti francs

	2013	2014	2015	2016	2017	2018	2019
GDP constant price	112,285	120,706	128,552	138,193	150,216	164,486	181,922
growth rate (%)	5.1	6.0	6.5	7.5	8.7	9.5	10.6

Remark: constant price base year 1990

Source: SCAPE 2015-2019

In the period from 2015 to 2019, the primary industry sector is forecast to grow at an annual rate of 7.8%; annual growth of 11.8 % is expected in the secondary industry sector while the tertiary industry sector

including the transportation and telecommunications sector is forecast to grow by 12.5% per year. The following table shows GDP growth forecasts for each sector.

Table 1.1-2 Forecast of GDP Growth for each sector in Djibouti

unit: %

	Actual		Projection					
	2012	2013	2014	2015	2016	2017	2018	2019
GDP	5.2	2.4	6.1	7.5	8.0	8.3	8.3	8.4
Agriculture, fisfing and livestock	-1.6	3.7	7.0	7.0	9.0	9.0	7.0	7.0
Mines	4.3	2.7	0.0	2.0	5.0	5.0	5.0	5.0
Manufacturing Industries	-4.3	2.7	4.0	7.0	5.5	5.5	5.5	5.5
Water and electricity	11.1	6.6	12.0	12.0	13.0	12.0	12.0	12.0
Construction nd Public Wotks	22.4	7.6	10.0	15.0	15.0	12.0	10.0	10.0
Commerce and tourism	3.3	1.0	4.0	5.0	5.0	7.0	7.0	7.0
Bank and Insurance	5.3	2.3	4.0	7.0	7.0	7.0	7.0	7.0
Transportation and telecommunication	4.4	2.3	7.0	8.0	9.0	10.0	10.0	10.0
Other services	8.4	3.3	3.0	3.0	3.0	3.0	3.0	3.0
Public administration	0.9	-1.2	4.0	3.0	3.0	3.0	3.0	3.0

Source: SCAPE 2015-2019

High economic growth is forecast in Tadjourah province due to the development of the Tadjourah New Port and road development between Tadjourah and Ethiopia, which is expected to stimulate trade. In addition, there are abundant potential tourism resources Tadjourah Province as well as abundant underground resources (salt, gypsum, diatom etc.) that are expected to be developed.

In Obock province, development of a crude oil port (Crude Oil Terminal) in the northern coastal area between Obock and Tadjourah and development of a platform for ship maintenance and repair facilities (Ship Repair and Dry docks) in Obock are planned.

(2) Fiscal Balance of Djibouti

The table below shows the results and forecasts of Djibouti's fiscal balance by the International Monetary Fund (IMF) from 2014 to 2021. Expenditure always exceeds revenue. About 15% of revenue depends on aid.

Table 1.1-3 Results and Forecasts of the Fiscal Balance of Djibouti（2014－2021）

in millions of Djibouti francs

	Actual			Est.	Projection			
	2014	2015	2016	2017	2018	2019	2020	2021
Revenues and grants	87,326	114,222	109,424	114,444	122,358	132,089	141,874	152,653
Tax revenues	52,600	61,779	63,349	65,438	72,985	80,038	87,164	95,036
Direct taxes	22,941	26,724	26,541	27,338	30,101	33,013	36,081	39,494
Indirect and other taxes	29,660	35,055	36,808	38,100	42,884	47,025	51,082	55,542
Indirect taxes	26,485	31,280	31,948	33,750	36,980	40,519	43,979	47,787
Other taxes	3,175	3,775	4,860	4,350	5,903	6,506	7,103	7,755
Nontax revenue	21,527	31,323	31,062	35,132	37,069	38,643	40,207	41,918
Domestic	8,684	13,037	11,777	13,227	15,163	16,737	18,302	20,013
External	12,843	18,286	19,285	21,905	21,905	21,905	21,905	21,905
Grants	13,199	21,120	15,013	13,874	12,304	13,409	14,503	15,698
Development projects	9,521	8,474	6,500	7,282	10,819	11,924	13,018	14,213
Budget support	3,678	12,646	8,513	6,592	1,485	1,485	1,485	1,485
Expenditure	114,392	180,805	162,750	120,108	124,958	136,060	149,156	163,411
Current expenditure	64,566	70,685	81,607	83,979	93,266	93,557	98,089	102,488
Wages and related expenditure	29,561	31,023	34,212	35,482	38,247	41,207	43,957	46,866
Wages and contributions	26,432	27,748	30,846	32,016	34,467	37,085	39,505	42,057
Housing subsidies	3,129	3,275	3,366	3,466	3,780	4,122	4,452	4,809
Goods and services	20,245	22,999	27,702	26,148	26,890	27,818	28,885	29,938
Civil expenditure	16,577	19,055	22,789	20,413	21,058	21,857	22,781	23,690
Military expenditure	3,668	3,944	4,913	5,735	5,831	5,961	6,105	6,248
Maintenance	1,456	1,320	1,403	1,403	1,489	1,640	1,791	1,956
Transfers	10,955	12,239	12,767	13,096	13,596	14,096	14,596	15,096
Interest	892	1,747	4,630	7,049	12,165	7,829	7,807	7,487
Loans to central government	892	796	4,630	7,049	7,357	1,441	1,418	1,361
Large projects	0	951	0	0	4,807	6,389	6,389	6,127
Foreign-financed current spending	1,456	1,357	893	801	880	967	1,052	1,146
Capital expenditure	49,827	110,120	81,143	36,129	31,693	42,503	51,067	60,923
Domestically financed	19,368	30,704	15,188	13,176	12,012	20,279	23,371	26,859
Foreign-financed	30,459	79,416	65,955	22,953	19,681	22,223	27,696	34,063
Grants	9,521	8,474	6,500	7,282	10,819	11,924	13,018	14,213
Loans to central government	3,767	5,377	5,943	7,282	8,862	10,300	14,677	19,850
Large projects	17,171	65,565	53,512	8,389	0	0	0	0
Overall balanace	-27,066	-66,582	-53,326	-5,664	-2,601	-3,971	-7,281	-10,758

Source：IMF Djibouti Staff Report for the 2016 Article Ⅳ Consultation

(3) Population Growth Forecast of Djibouti

In 2015 the population of the Djibouti was 966,000. According to Vision Djibouti 2035, the population of the Djibouti is expected to increase by an average of 2.8% annually until 2035. Tadjourah province and Obock province are expected to have population growth rates of 3.77% and 3.17%, respectively, which exceed the national average. The future population and the growth rate forecast of Djibouti until 2035 are shown in the following table.

Table 1.1-4 Future Population and Growth Rate Forecast of Djibouti

	2010	2015	2020	2025	2030	2035	Annual growth rate %／year
Djibouti Ville	488,309	557,959	636,392	725,192	853,188	999,302	
Aki Sabieh	87,962	93,207	98,765	104,654	110,895	117,507	1.16
Dikhil	90,636	99,569	109,381	120,161	132,004	145,014	1.90
Tadjourah	89,971	108,249	130,241	156,700	188,535	226,837	3.77
Obok	39,056	45,648	53,354	62,360	72,886	85,189	3.17
Arta	45,134	60,966	80,434	103,636	103,636	103,636	
Total	841,068	965,598	1,108,567	1,272,703	1,461,144	1,677,485	2.80

Source: VISION Djibouti 2035

1.2. Background and History of Grant Aid

In 1981 the Government of the Djibouti received a ferry boat from Germany and started pendulum operation twice a week to each of Tadjourah and Obock between Djibouti Port to transport residents, vehicles, animals, construction materials, living goods, fishery products, etc. In addition, Dhow ships, operated by the private sector irregularly, also transport passengers. However, as Djibouti has achieved economic growth of 2 to 3% per year on average since the year 2000, there has been a growing demand for maritime transport. To response to this increasing demand and to safely and efficiently transport people and goods to the northern region, the Djibouti government requested grant aid from Japan in order to replace aging ferry boats with new boats in July of 2002.

The Japanese Government implemented Grant Assistance and carried out “The Project for Reinforcement of Maritime Transport Capacity in the Gulf of Tadjourah.” In addition, assistance was provided for building a new ferry (360 tons) and procuring materials to rehabilitate existing port facilities.

From 2010 to 2013, three services a week between Djibouti and Tadjourah and two services a week between Djibouti and Obock were provided. However, as demand on the Tadjourah route increased, four services between Djibouti and Tadjourah have been provided since 2014.

However, due to population growth and economic development in recent years, the transport capacity of existing ferry ship has become unable to meet the demand. Moreover, during the two-month Khamsin season, ferry operation has been suspended due to safety reasons (it is deemed unsafe to navigate due to strong winds).

It has been confirmed that the ferry now takes more passengers on board that the actual capacity. To improve this situation, the Djibouti Government needs to introduce a new ferry that allows stable operation even during the Khamsin season and to increase the number of services to Tadjourah and Obock in response to increasing demand.

In response to the request of the Djibouti Government, the Japanese Government carried out the "The Data Collection Survey on Maritime Transport Capacity in the Gulf of Tadjourah" in May 2017 to collect basic data and information on maritime traffic in the Gulf of Tadjourah Bay and to assess cooperation needs and examine its cooperation policy.

1.3. Assistance Trend of Japan

1.3.1. Aid Policy of Japan

Djibouti is located along a strategic maritime transport route linking Asia, Africa and Europe. The domestic situation is stable and Djibouti has a good relationship with foreign countries including Japan. In addition, Djibouti Port is a logistics hub for East African inland countries such as Ethiopia. Djibouti Port has contributed greatly to the steady economic growth of such East African countries.

Japan's aid policy regarding Djibouti, which is actively tackling international issues such as countermeasures against piracy, is to promote the development and stability of the country by addressing the various problems the country faces and by so doing contribute to the stable development of the international economy including East Africa region and Japan. The following three areas are focused on.

- Improvement of economic and social infrastructure for sustainable development

- Training of personnel to support economic and social development
- Strengthening of regional stabilization efforts

The current study is directly related to "Improvement of economic and social infrastructure for sustainable development."

1.3.2. Assistance Record of Japan

Japan's assistance to Djibouti in the maritime transport sector is shown below. Acceptance of trainees, provision of ship, grant aid for port facility improvement, etc. have been among the forms of assistance provided.

(1) Acceptance of Trainees

The following table shows the number of trainees from Djibouti who participated in training courses related to the maritime transport sector.

Table 1.3-1 Number of Trainees accepted into Maritime Transport-related Training Courses from Djibouti

Year	Course	number
1993	Shipbuidlding and Maintenance	1
1995	ditto	1
1997	Ship Safety & Maritime Pollution Control	1
1998	ditto	1
1999	ditto	1
2000	Maritime International Convention and ship safety inspection	1
2006	Maritime International Convention and ship safety inspection Ⅱ	1
2007	Salvage and marine disaster prevention	1
2009	Ship operation and maintenance capacity building	1
	Maritime International Convention and ship safety inspection	1
2010	Maritime International Convention and ship safety inspection	1
	Strategic Port Administration and Management	1
2011	ditto	1
2012	ditto	1
	Maritime International Convention and ship safety inspection	1
2017	Port Security	2
2018	Port Logistic Efficiency	1

Source：JICA

(2) Grant Aid Projects

The following table shows Grant Aid provided to Djibouti in the maritime transport sector.

Table 1.3-2 Value of Grant Aid provided to Djibouti in the Maritime Transport Sector

（unit: billion yen）

year	Project title	Amount limits	Outline
1988～1989	Port facilities development plan (1, 2 Phase)	12.03	Small salvage ship one ship, pilot ship one ship, oil removal ship one ship, one ship multi-purpose vessels, bowline ship one ship
1994～1996	Port facilities development plan	27.27	Djibouti port No.11 and 12 oil Bath rehabilitation
2007～2009	Tadjoura Bay Marine transport capacity enhancement plan	8.80	Gross tonnage 380 tons one ship ferry
2013	Patrol boat construction plans for maritime security capacity building	9.24	CL type patrol boat 2 vessels

Source: JICA

1.4. Aid from Oher Donors

Foreign aid related to maritime transport in the Gulf of Tadjourah from other donors is limited to the provision of a ferry boat from Germany as shown in the following table.

Table 1.4-1 Grant Aid Record of Other Donors in the Gulf of Tadjourah Bay Maritime Transport

year	country	project	amount（US$)	Assistance form	Outline
1981	Germany	Ferry boat donation	457,000	Grant	Provide a length of 40.5 m, 1 185 GT type ferry boat

Source：JICA

2. Circumstances Surrounding the Project

2.1. Project Implementation Formation

2.1.1. Organization and Personnel

(1) Organization

The organization chart of the "Ministry of Equipment and Transport" is shown in Figure-2.1-1.
Ferry operations are managed by the "Ferry Management Division" within the "Maritime Bureau" (which is shown in red in the organization chart). The authority (and role) of the Division is defined in the Law (Low No. 74 / AN / 14 / 7th) which stipulates the organization of the Ministry of Equipment and Transport.
The article 32 and 36 in the Law, which have the strong relation with the ferry operation, are described below. Based on these two (2) articles, the Ferry Management Division is the main management body of the ferry operation. This point will have been continued after the introduction of a new ferry.

[Article 32] The Maritime Bureau shall develop the laws and regulations on strengthening navigation safety and certainty in the domestic maritime fields. The Maritime Bureau shall manage leisure boats and marine leisure activities, sanitation and protection of seafarers, and operation of ferries.
In order to achieve the roles, the Bureau has four (4) sections below.

- Section on Safety and Certainty of Maritime Navigation
- Section on Sanitation and Protection of Seafarers
- Section on Leisure Boat/Marine Leisure
- Section on Ferry Management and Operation

[Article 36] The Ferry Management Section is in charge of the following operations.

- Periodical Maintenance of the Ferry
- Creation of Annual report on the conditions of the ferry, and/or in case of an emergency, the emergency report including an indication of the required equipment
- Procurement of Maintenance Equipment and Facilities
- Creation and Announcement of the Timetables for Passengers
- Determination of Fares
- Creation of Work Instructions on Ferry Operation
- Conducting of Periodical Simulation Training on Maritime Accident and Maritime Rescue

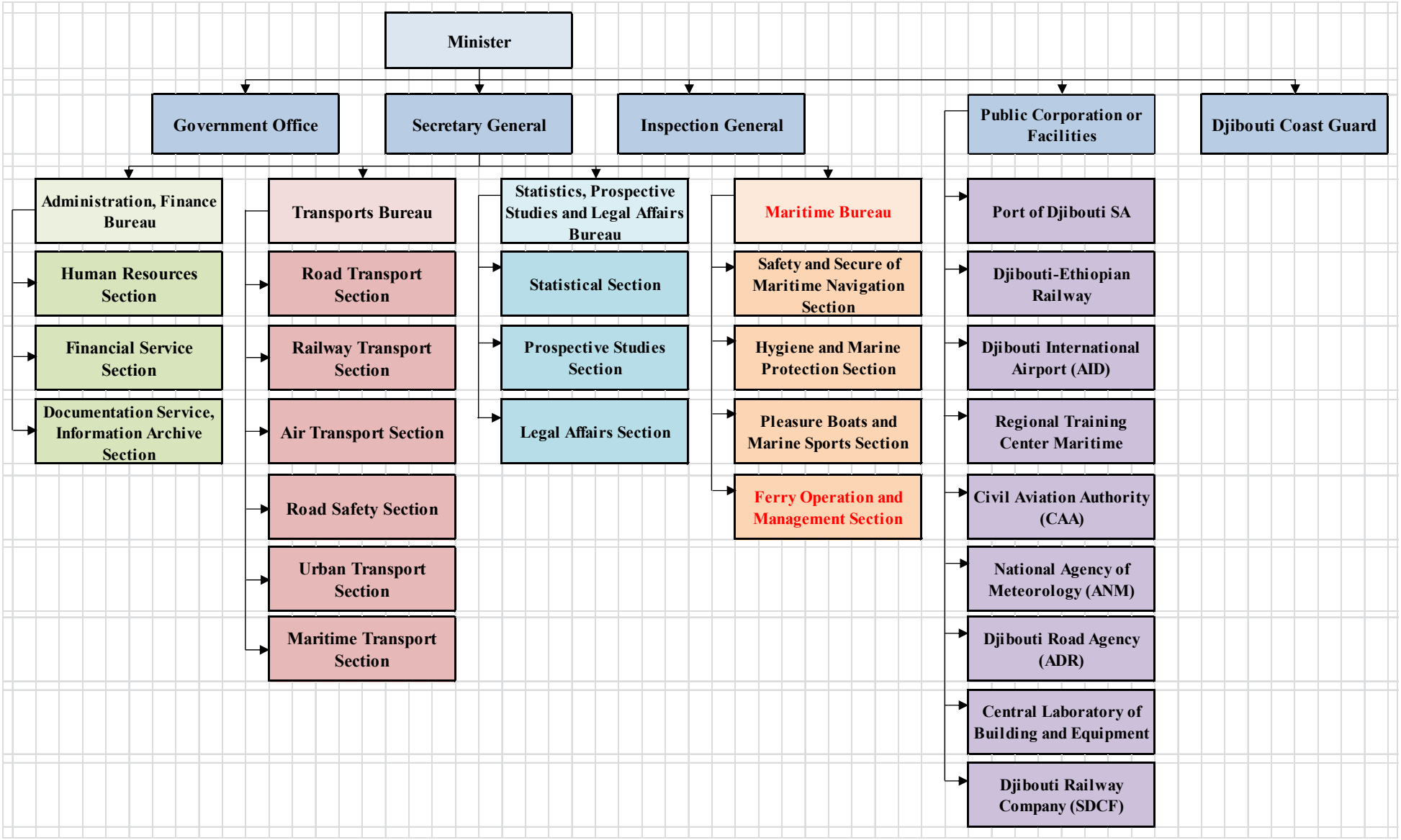


Figure 2.1-1 Organization Chart of the Ministry of Equipment and Transport

(2) Personnel and system Operation and Maintenance Management System of the Maritime Bureau

1) Maritime Bureau operation and maintenance system

The crews and staffs of the exsisting ferry “Mohamed Bourham Kassim” are as follows.

Table 2.1-1 The Crews and Staffs of” Mohamed Bourham Kassim”

Departments	Positions and numbers
Management of the ferry	Accountant：1 Managers：2 Assistant：1
Navigation crews （10 crews are on board. 2 of 11 except for the captain can take days off by turns）	Captain：1 Chief officer：1 Chief engineer：1 Second engineer：1 Chief electrician：1 Second electrician：1 Ordinary seamen：6
Djibouti port members	Tickets seller：1 Passenger record：1 Car checker：1 Cargo checker：1 Accountant：1
Tajoura port members	Tickets seller：1 Security officer：1
Obock port members	Tickets seller：1 Security officer：1
Security supervisers	Djibouti Coast Guard：4
Total	29

Regarding maintenance, periodic inspections are carried out on the floating dock. In the hearings from the captain and the chief engineer, routine maintenance work on the deck, such as painting for corrosion prevention, is being carried out by the crew.

2.1.2. Finance and Budget

Article 36 of the Law (Law No. 74) mentioned above stipulates “The Determination of Ferry Fares and Charges” as one of the roles of the Ferry Management Section. As a result, there is the Decree (No.2012-0328 / PR / MET on passenger and freight transportation fares and charges in the use of ferry boats. The article 3 of the Decree stipulated the fares and charges of the ferry. The list of fares and charges are shown in Table-2.1-2.

Regarding the fare system, the following points have been clarified through the hearings. The fare for children and students shown in the table is "350 FD", however, this value is currently revised to "400 FD" and has been collected from 2018.

Table 2.1-2 Fare System of Existing Ferry Service " Mohamed Bourham Kassim"

Category	Passenger / Cargo Classification	Fare Table	
		Djibouti - Tadjourah	Djibouti - Obock
Passengers	Adult	700 DJF	700 DJF
	Child (2 -12 year-old)	350 DJF	350 DJF
	University, High School Student	350 DJF	350 DJF
	Physically Handicapped Person (Wheelchair User)	Free	Free
Vehicles	Light Vehicle (4-door Sedan)	5,000 DJF	5,000 DJF
	4-wheel Drive Vehicle, Pick-up, Mini Bus	6,000 DJF	6,000 DJF
	Truck, Bus	8,000 DJF	8,000 DJF
	Truck over 10 tons	13,000 DJF	13,000 DJF
	Motorbike	1,500 DJF	1,500 DJF
Cargo	Cement (50kg)	200 DJF	200 DJF
	Rice, Sugar, Wheat, Salt etc. (50kg)	150 DJF	150 DJF
	Fuel (200 lrs.)	1,500 DJF	2,000 DJF
	Fish, Crustaceans	80 DJF	80 DJF
	Other Cargo (under 50 kg)	100 DJF	100 DJF

Source: Decree No.2012-0328/PR/MET

The annual operational expense for ferry service in 2017 is shown in Table-2.1-3. There is no government subsidy for inspection and maintenance costs from 2017. Also, from 2018, there was no subsidy to fuel. Therefore, all government subsidies are currently zero.

Table 2.1-3 Annual Operational Expense for Ferry Service in 2017 (unit: DJF)

Crew Salary	Administration Staff Salary	Daily Allowance for Crew	Fuel Expense	Maintenance Cost	Other Expense	Total
21,247,872	21,838,008	4,411,000	28,618,100	4,000,000	1,500,000	81,614,980

Source: Maritime Bureau, Ministry of Equipment and Transport

2.1.3. Technical level

(1) Operation and maintenance management ability

As a result of inspection of the existing ferry "Mohamed Bourham Kassim" and interviews with the captain

and the chief engineer, maintenance such as painting, replacement of anti-corrosion plate, replacement of ramp way hinges etc. is well done as daily maintenance. There is no problem in the state of the technical level.

It has been confirmed that there is no problem with floating dock operation for regular dock inspections. An example of floating dock maintenance work based on the field survey is shown in Table 2.1-4.

Table 2.1-4 The Existing Ferry "Mohamed Bourham Kassim" floating dock operation (2014)

Modules	Maintenance items
Main engine	+ Oil change and lubrication + Confirmation of seawater turbine (rotor) + Cleaning of oil cooling system (seawater sediment) + Cleaning of seawater system (precipitate) + Cleaning of fresh water system (precipitate) + Injector replacement + Check the complete set of valves + Replacement of light oil filter and water separator + Fresh water system -Check thermostat + Cleaning of compressor tube deposits + Oil and lubrication system -Check thermostat + Maintenance of exhaust manifold +Maintenance of remote control cable (acceleration / connection)
Generator	+ Cleaning of seawater system (precipitate) + Cleaning of fresh water system (precipitate) + Replacement of light oil filter + Water separation + Fresh water system -Check thermostat + Cleaning turbo compressor + Maintenance of exhaust manifold
Reduction/reverse gear (Gearbox)	+ Oil change + Cleaning of deposits

Regarding this item, the problems of the existing ferry by the visual inspection of the Study Team and the hearing to the captain of the ferry are as follows.

- Regarding the maintenance of the outer side of the hull, such as replacement of the anticorrosion plate and cleaning of the bottom of the ship, it is carried out regularly at the floating dock. But some important maintenance procedures such as engine overhaul or megatests of electrical equipment have not been carried out.

- Equipment maintenance records are not managed.

(2) System Concerning Ship Operation Safety

The captain has been trained on French navy's amphibious assault ship, and there is no problem with the basic operation techniques of the existing ferry. However, from the on-boarding survey on site, the following issues can be pointed.

- In the case of normal constant speed navigation, although it should be operated with engine power around 80%, it always operates with 100% output. Therefore the noise near the passenger seat is large.
- At the time of landing at Tadjourah port, the bow ramp of the ferry lowered while approaching to the port. The opened ramp way plunges into the port slope to stop the ferry. This is the cause of the frequent failure of the bow ramp hinge.

(3) Operational Safety Measures

The safety measures for ship operation can be roughly divided into

a) Passengers getting on and off the ferry

b) Ferry boarding and unloading

c) Safety management of passengers under navigation

d) Vehicle and cargo safety management

can be mentioned. The field survey revealed the following status.

・As for a) and b), the captain and the chief engineer conduct traffic adjustment immediately after the ferry's landing, but the passenger and the vehicle are mixed, and it is necessary to distinguish their flow line.

・ As for c), there is a risk of passengers' falling water, such as sitting on stairs or handrails, and adequate management is required.

・ As for d), vehicles and cargo were mixed, and it was observed that passengers who were monitoring their cargo were lying on the vehicle deck and unsafe.

Therefore, the issues of the present system are as follows.

・ It is necessary to create and implement operational safety rules to improve the current situation as described above and to take measures.

(4) Technical Level of Port Facility Maintenance Management

The results of interviews on the maintenance capability of port facilities are summarized below.

1) Interview with the Maritime Bureau

Regarding the maintenance of port facilities for ferries, the government decree (No. 2006-0202 / PR / MET) stipulates that "repair, management and maintenance of ferries and port facilities shall be carried out by the

government's full responsibility".

However, at present, the government (the Maritime Bureau) does not have a facility maintenance system/department in charge of this duty. Although the facility maintenance inspections based on the above-mentioned government decree have been implemented, the technical level is not high. Therefore, technical assistance from the private sector is required. The actual repairing and maintenance works are executed by the Maritime Bureau itself or outsourced to the private sector.

From the above, it is assumed that port facilities will be managed directly by the Maritime Bureau, but private companies may be necessary for large-scale repairs and inspection. Accordingly, interviews with private companies were conducted in order to ascertain their technical level.

2) Interview with the Private Sector

Currently, there are about 80 private construction companies in Djibouti. However, most companies focus on roads and buildings, while few companies have experience in port construction works. Therefore, the technical level of private companies in the field of maintenance and management of port facilities is not high. However, since many young engineers at major construction companies have studied at overseas universities and skilled human resources are increasing, private companies should be able to conduct maintenance and management of port facilities in the future.

2.1.4. Existing Facilities and Equipment

(1) The Existing Ferry

The principal dimensions and main characteristics are shown in the table below.

Table 2.1-5 The Principal Dimensions and Main Characteristics of the Existing Ferry

Items	Existing ferry
Length overall	48.21m
Breadth	9.80m
Depth	2.90m
Draft	1.90m
Speed	10．5knots
Number of passengers	150
Crews	8
Main engine	367kw(500ps)×2
Hull material Navigation area	Steel Flat water area
Type of ship	Flat type
Bow shape	Launching type
Vehicles	Trucks 4+ cars 6

Loading capacity	120 tonf
Max height of car deck	3500mm
Ramp way	Only bow side
Bow thruster	N/A
Rudder type	Ordinary type
Ballast system	Equipped
Draft meter	N/A
Bridge airconditioner	100V home type
Outside chairs	150

The issues on the existing ferry from the on-site visual inspection and interview survey are as follows.

- It cannot be operated in the Khamsin season.
- Large vehicles (high vehicle height) can not be on board.
- The noise from the engine exhaust funnel is large and it is difficult for passengers to spend on the passenger deck.
- There is no safe space for the sick to have a rest.
- At Tadjourah Port, it is difficult to maneuver at the time of landing because it is a tailwind.

Moreover, there are the following problems in operation and maintenance.

- It is dangerous because the flow of passengers and vehicles at the time of getting on and off is not secured.
- There are many passengers staying in areas other than passenger space such as vehicle decks and stairs.
- There are many toilets that can not be used because of its pipe blocking.

(2) Condition of the Existing Ferry Berthing Facility

The condition and specifications of the existing berthing facility of ferry at Djibouti Port and Tadjourah Port are as follows.

1) Existing Ferry Berthing Facility at Djibouti Port

The land use plan around the ferry port facility at Djibouti Port is shown in the following figure.

Source: City Planning Bureau, Housing, Environment and City Planning Ministry of Djibouti

Figure 2.1-2 Land Use Plan around the Ferry Berthing Facility at Djibouti Port

Existing ferry facilities of Djibouti port were built by reclamation of an underwater road in 1969. The facilities are equipped with a ramp way, mooring dolphins, and a ticket office. It is adjacent to the base of the Coast Guard. The specifications of the facility are as follows.

Table 2.1-6 Specifications of Existing Ferry Berthing Facility at Djibouti port

Existing Facility	Specification
Access Road	Length 30m、Width 12－9.5m
Ramp Way	Top elevation＋3.5m, Width 12m, Slope 1／10 (about)
Mooring Dolphins	3 in number, Top elevation＋3.5m, Planar dimension 4.0m×3.0m (Gravity type concrete structure)

The following figure shows the existing ferry berthing facility layout at Djibouti Port.

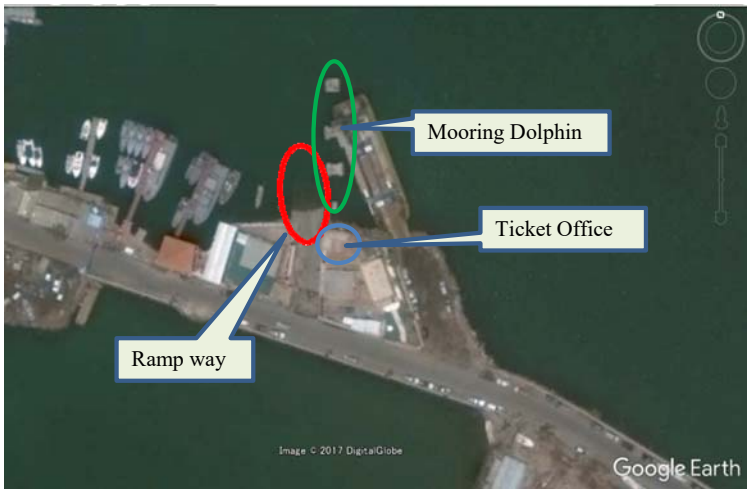


Figure 2.1-3 Existing Ferry Berthing Facility Layout at Djibouti Port

The current status of existing ferry berthing facility at Djibouti Port is shown in the photos below.

Photo: Current Status of the Existing Ferry Berthing Facility at Djibouti Port

Access Road to Escar area

Entrance of berthing facility

Mooring dolphin and Ramp way

Congestion by waiting vehicles

The condition of the existing berthing facility at Djibouti Port is as follows.

Table 2.1-7 Condition of the Existing Berthing Facility at Djibouti Port

State of Facility		Degree of dificulty for ferry operation			Port facility rehabilitation	
		Ship operation	Cargol handling / Boarding	Ship hull／Engine	necessity	unrgency
Ramp way side Wall	good partial damage	no impact	no impact	no impact	no yes	 low
Paving	good	no impact	no impact	no impact	no	
Sea wall	good	no impact	no impact	no impact	no	
Mooring dolphin	good	no impact	no impact	no impact	no	
Fender	partial damage	no impact	no impact	no impact	yes	low
Bollard	good	no impact	no impact	no impact	no	
Water depth	Shallow	Dificult to berth at low tide	Influence on passenger, vehicle's boarding time	Possibility of hull damage	yes	high
others Walkway	missing	Do not quickly connect mooring rope			no	high

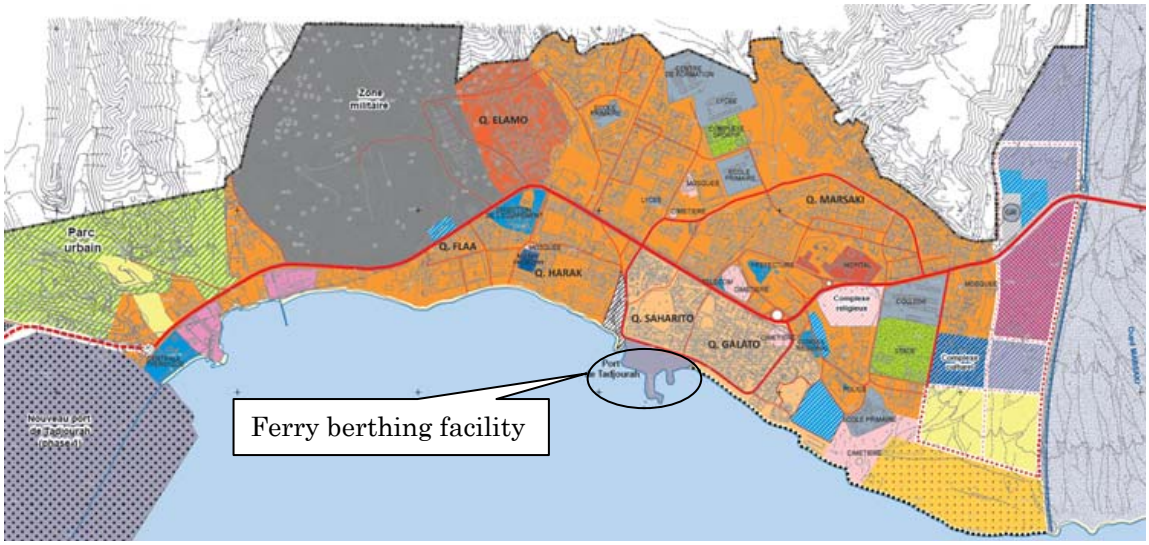
Source: The Data and Information Collection Survey on Maritime Transportation Capacity of the Gulf of Tadjourah

The following issues related to the existing facilities of Djibouti Port were identified by the study team through visual inspection and through an interview with the captain of the ferry.

- The water depth in the berthing facility area is shallow which makes berthing dangerous during low tide. Securing a safe water depth is necessary.
- All of the fenders installed in the dolphin are damaged and need to be replaced.
- Since there is no walkway to access the dolphin by land, during berthing a seaman has to throw the mooring rope until it successfully wraps around the mooring pole, which often takes time.

2) Existing Ferry Berthing Facility at Tadjourah Port

The land use plan around the ferry berthing facility at Tadjourah Port is shown in the following figure.



Source: City Planning Bureau, Housing, Environment and City Planning Ministry of Djibouti

Figure 2.1-4 Land Use Plan around the Ferry Berthing Facility at Tadjourah Port

Tadjourah Port's ferry berthing facility is located in the center of Tadjourah city and includes a ramp way, mooring dolphins, a boarding ticket office and a waiting area. The specifications of the facility are as follows.

Table 2.1-8 Specifications of Existing Ferry Berthing Facility at Tadjourah Port

Exiting Facility	Specification
Access Road	Length 130m、Width 20m
Ramp Way	Top elevation ＋3.5m、Width 12m、Slope 1／10 (about)
Mooring Dolphins	2 in number、Top elevation ＋3.5m、Planar dimension 4.0m×3.0m (Gravity type concrete structure)

The layout of existing ferry berthing facilities at Tadjourah Port is shown in the following figure.

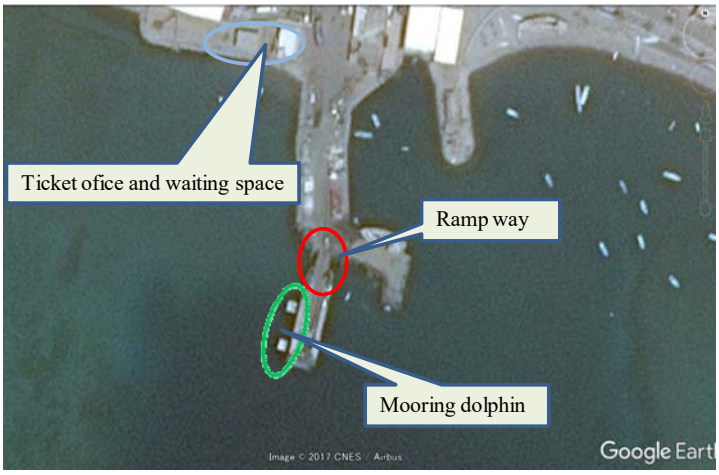


Figure 2.1-5 Existing Ferry Berthing Facility Layout at Tadjourah Port

The current status of the ferry berthing facility at Tadjourah Port is shown in the photos below.

Photo: Current Status of the Existing Ferry Berthing Facility at Tadjourah Port

	
Ramp way and Mooring dolphin	**Ramp way at low tide**
	
Offshore side dolphin(fender missing)	**Pier for small boat**

The condition of the existing berthing facility at Tadjourah Port is as follows.

Table 2.1-9 Condition of the Existing Berthing Facility at Tadjourah Port

State of Facility		Degree of dificulty for ferry operation			Port facility rehabilitation	
		Ship operation	Cargol handling / Boarding	Ship hull／Engine	necessity	unrgency
Ramp way	good	no impact	no impact	no impact	no	
Paving	good	no impact	no impact	no impact	no	
Sea wall	normal	no impact	no impact	no impact	no	
Mooring dolphin	partial damage	no impact	no impact	no impact	yes	low
Fender	partial missing	Hindrance for positioning and mooring	Mooring is unstable	Possibility of hull damage	Securing safety of cargo handling, passengers and ships	high
Bollard	good	no impact	no impact	no impact	no	
others Navigation beacon Walkway	 slanting missing	 no impact Do not quickly connect mooring rope	no impact	no impact	 yes yes	 low high

Source: The Data and Information Collection Survey on Maritime Transportation Capacity of the Gulf of Tadjourah

The following issues related to the existing facilities of Tadjourah Port were identified by the study team through visual inspection and through an interview with the captain of the ferry.

- Dolphin fender on the offshore side is missing. Therefore, when the wind is strong, the hull may shake and hit the dolphin directly, causing damage.
- Since there is no walkway to access the dolphin by land, during berthing a seaman has to throw the mooring rope until it successfully wraps around the mooring pole, which often takes time.
- At the time of berthing, when the wind blows from the south direction (the tailwind), it is difficult to maneuver the ferry. Installation of a third dolphin or improvement of the existing dolphin structure is required.

2.2. Project Site and Surrounding Circumstances

2.2.1. Development Status of Related Infrastructure

(1) Road Maintenance Status

Of the total length of roads in the Djibouti (about 1,806 km), the number of paved roads is only about 38% (about 690 km) of the total. Among them, the national highway pavement rate is as low as 44% and the city road's pavement rate is as low as 28%. (Preparatory survey report “The project for improvement of road management equipment in the Republic of Djibouti” 2016 JICA)

Table 2.2-1 Length of Road under Jurisdiction of the Road Authority in Djibouti (as August 2015)

Pavement Type	Road Total Length (km)			Ratio
	National Road	City Road	total	
Asphalt pavement	519	169	688	38%
Crushed pavement	675	442	1,117	62%
Total	1,194	611	1,805	100%

Source: Preparatory survey report “The project for improvement of road management equipment in the Republic of Djibouti” 2016 JICA

1) Roads between Djibouti and Tadjourah

Roads are severely damaged by Wadi floods. Dangerous conditions were confirmed in some places due the presence of stones and soil that that had carried by the flood. In addition, truck rollover accidents were observed at some locations. Some truck drivers also engaged in dangerous driving practices on the road between Djibouti and Tadjourah.

Due to lack of convenience and poor safety conditions, people are reluctant to transport goods or travel by road. Accordingly, land transport is used only occasionally during the Khamsin period when ferry operations stop.

The road between Djibouti and Tadjourah has no lighting, there are falling rocks, etc., and it is said that traffic accidents will increase during the Khamsin season when existing ferries can not be used. So the new ferry that can be available during the Khamsin season are strongly desired.

The current status of the road between Djibouti and Tadjourah is shown in the photos below.

Photo: Damaged Road

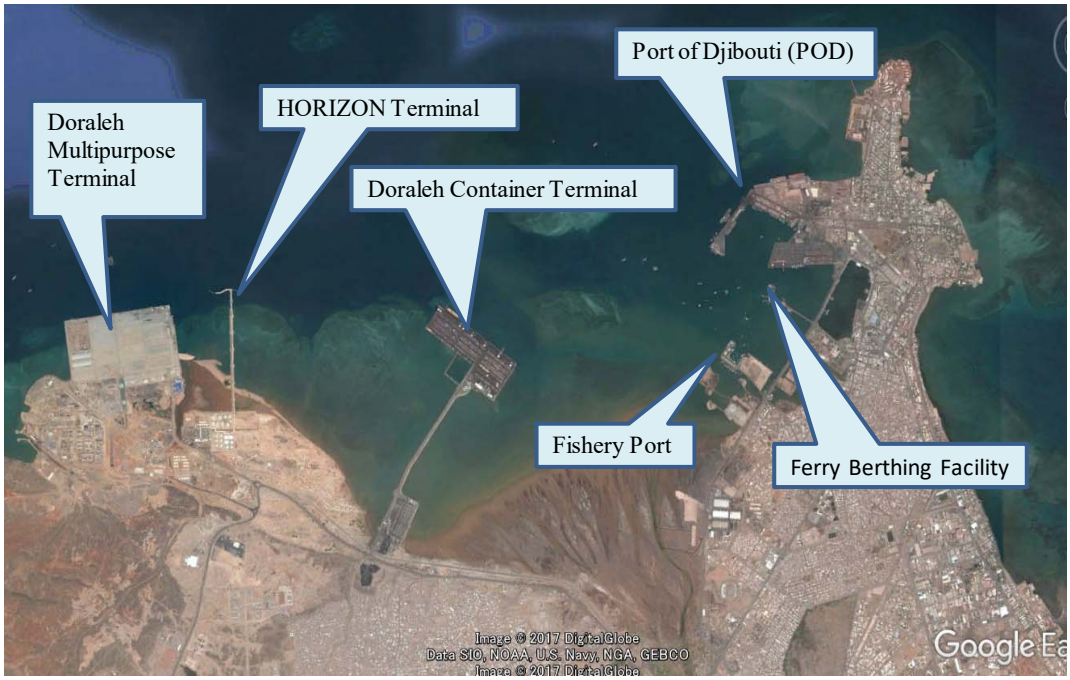
Photo : Rollover accidents

(2) Situation of Port

1) Port of Djibouti

Djibouti Port is located at the entrance of the Red Sea and along a strategic maritime transport route connecting Asia, Africa and Europe. It has been playing an important role as a hub port for transshipment cargo. Since 1998, Djibouti port has handled nearly all of Ethiopia's port cargo (cargoes are transported by truck and railway between the capital Addis Ababa).

The facility layout plan of Djibouti Port is shown below. Until 2006, Djibouti Port area was confined to the old port district but the petroleum handling facility was moved to the Doraleh area after the handling capacity at the old facility was exceeded. After the container handling capacity (350,000 TEUs) was also exceeded, Djibouti port developed the Doraleh container terminal which began operations in January 2009. The amount handled in 2016 was 910,000 TEU while the annual handling capacity of the container terminal is 1.6 million TEUs. In 2017, the Doraleh Multipurpose Terminal went into operation in the west area of the Doraleh Container Terminal. In this way, all facilities of the old port which were located in the town have been successively moved to a port area in the suburbs.



Source: The Data and Information Collection Survey on Maritime Transportation Capacity of the Gulf of Tadjourah

Figure 2.2-1 Facility Layout Plan of Djibouti Port

a) Activity of Djibouti Port

The table below shows the cargo handling volume and number of calling ships at Djibouti Port from 2010 to 2016. Container cargo handling volume, non-container cargo handling volume and number of calling vessels are increasing every year.

Table 2.2-2 Cargo Handling Volume and Number of Ship Calls at Djibouti Port from 2010 to 2016

		2010	2011	2012	2013	2014	2015	2016
Container Cargo	TEU	424,888	742,871	793,117	794,731	856,064	910,165	987,189
Non-container Cargo	ton	2,815,946	3,595,506	4,205,545	4,132,669	4,276,424	5,177,150	6,524,740
Calling ships		1,550	1,730	1,577	1,644	1,694	1,903	1,841

Source: The Data and Information Collection Survey on Maritime Transportation Capacity of the Gulf of Tadjourah

2) Tadjourah Port

a) Tadjourah New Port

The Tadjourah New Port was developed 1.5 km west of Tadjourah Port and began operation in 2017. Major target cargo handled by Tadjourah New Port is general cargo for the northern region of Ethiopia and export of potassium carbonate (Potash) mined from Ethiopia. The Tadjourah New Port has a quay with a depth of 14 m and an extension of 488 m; target vessels are 65,000 DWT. The location of Tadjourah Port and Tadjourah New Port is shown in the following figure.

The Tadjourah New Port is being financed by Arab funds. The office buildings for the Harbor Master, the Coast Guard, the quarantine office and the Customs office building have already been developed.

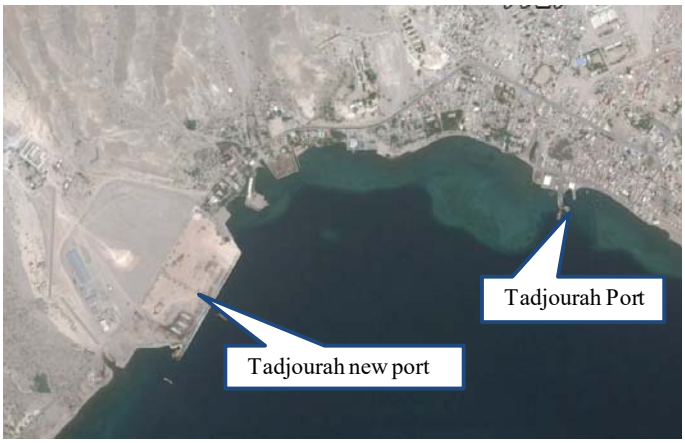


Figure 2.2-2 Tadjourah Port and Tadjourah New Port

Source: Tadjourah Port Company

Figure 2.2-3 Image of Tadjourah New Port

b) Development Plan of Tadjourah Fishery Facility

Reclamation works of approximately 40 m × 30 m in scale are being carried out near the site of the new ferry facility planned at Tadjourah Port with financial support of the IFAD (International Agricultural Development Fund). Fishery facilities (pier for fishing boats, refrigeration facilities etc.) are planned to be developed here.

Figure 2.2-4 Fishery Project Reclamation Area

The outline of the plan is as follows.

- Improvement of fishery facilities is part of a program which will continue for 6 years through support of IFAD (International Agricultural Development Fund)
- The program covers all of Djibouti; half of the financing comes from loans and half from grants
- The program will provide extensive support mainly for fishing industry such as ships, related facilities, training, value chain construction, environmental conservation etc.
- Department of Fishery, Ministry of Agriculture is responsible for implementation on the Djibouti side
- Mauritania consultants Group is responsible for design works

The current status of the reclamation area of the fishery project is shown in the photos below.

Photo: Current Status of Fishery Project Reclamation Area

	
Reclamation area for fishery project (left)	**Planned location of new ferry berthing facility**

	
Shore protection of fishery project area	**Planned location of new ferry berthing facility**

During the meeting with the Fisheries Bureau of the Ministry of Agriculture in May 2019, the study team found that the development plan of the fishery facilities was advanced as follows.

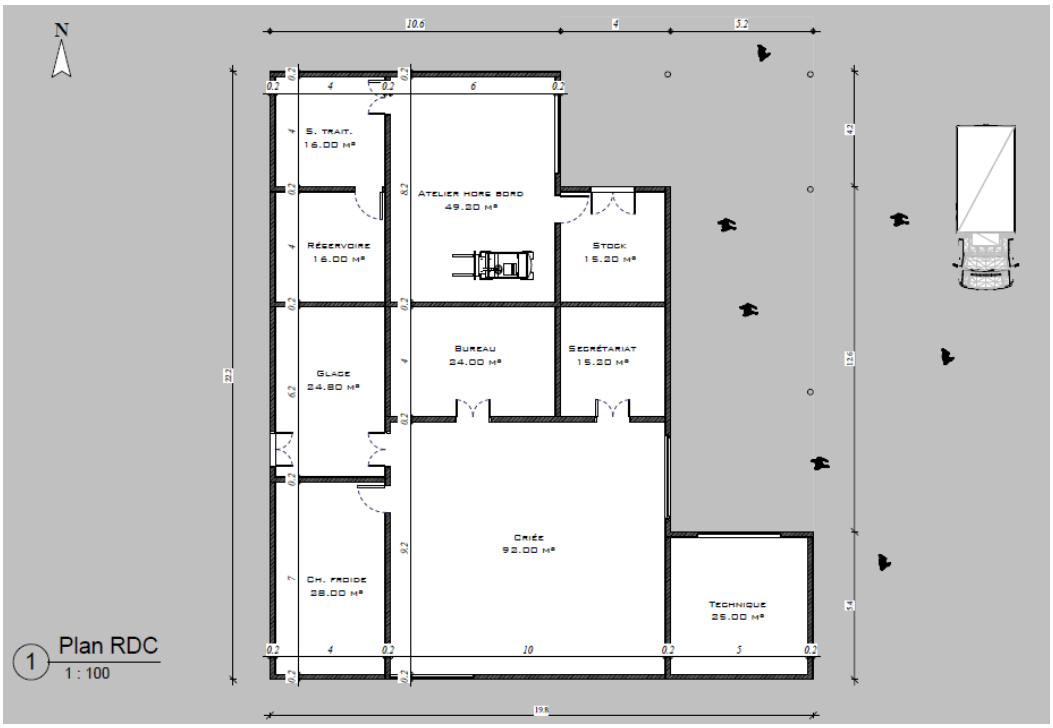
- The layout plan has been decided taking into consideration the ferry berthing facilities and the breakwater plan by JICA.
- A floating jetty of 24m long is planned to install at the edge of 55m long stone jetty.

The rough layout of the fishery jetty is shown in Figure 2.2-5.

Source: Fisheries Bureau of the Ministry of Agriculture

Figure 2.2-5 Rough Layout Plan of Fishery Jetty

The following building maintenance is also planned in the reclamation area.



Source: Mauritania Consulting Group

Figure 2.2-6 Fishery Facility (Land Building 22.2m×19.8m) Layout Plan

Source: Mauritania Consulting Group

Figure 2.2-7 Image of Fishery Building

From now on, it will be necessary to confirm both project implementation steps and make adjustments so that both plans can be implemented without delay.

(3) Status of Ship Repair Facility

The floating dock, DAMEN MODULAR FLOATING DOCK DMD4020 (Fig.2.2-8, 2.2-9), is in operation and available for maintenance of the New Ferry. The principal dimensions of the floating dock are as follows.

Maximum lift capacity	1,750 tf
Deck load	15 tf/㎡
Length	50 m
Breadth	40 m
Height	12 m
Crane capacity	8.3 tf@26m

Figure 2.2-8 Schematic view of the floating dock（DAMEN brochure）

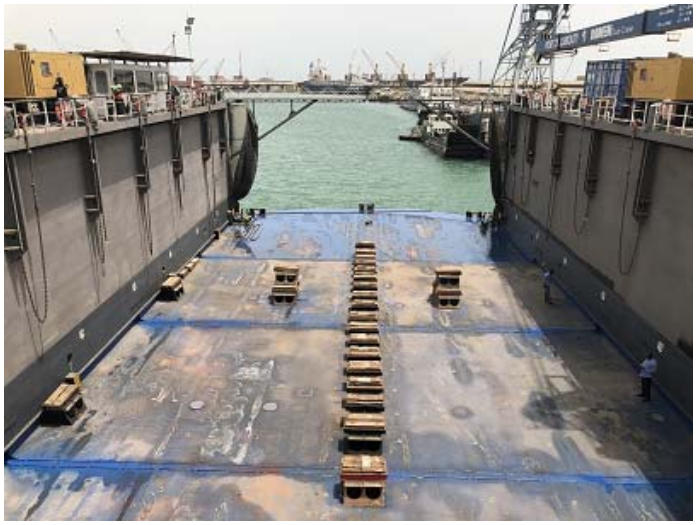


Figure 2.2-9 Floating dock current situation (source: consultant）

2.2.2. Natural Condition

(1) Tide

Design tides are as below. Design tides will be estimated on the basis of observed records of over continuous one year. CD of Tadjourah Bay is nearly equal to LAT.

- H.H.W.L. + 3.20 m CD
- H.W.L. + 2.95 m CD
- M.W.L. + 1.93 m CD
- L.W.L. + 0.62 m CD

(2) Current

Design current velocity of Djibouti port will refer to JICA previous report. In addition, design current velocity of Tadjourah port will be considered on the basis of the site survey result.

- Djibouti Port v = 0.14 m/sec (0.27 knots)
- Tadjourah Port v = 0.60 m/sec (1.10 knots)

(3) Wind velocity

Design wind directions for Djibouti Port and Tadjourah Port will be determined according to considering the respective landscapes.

Djibouti Port : NNW、NW、WNW、W
Tadjourah Port : SW、SSW、S、SSE、SE

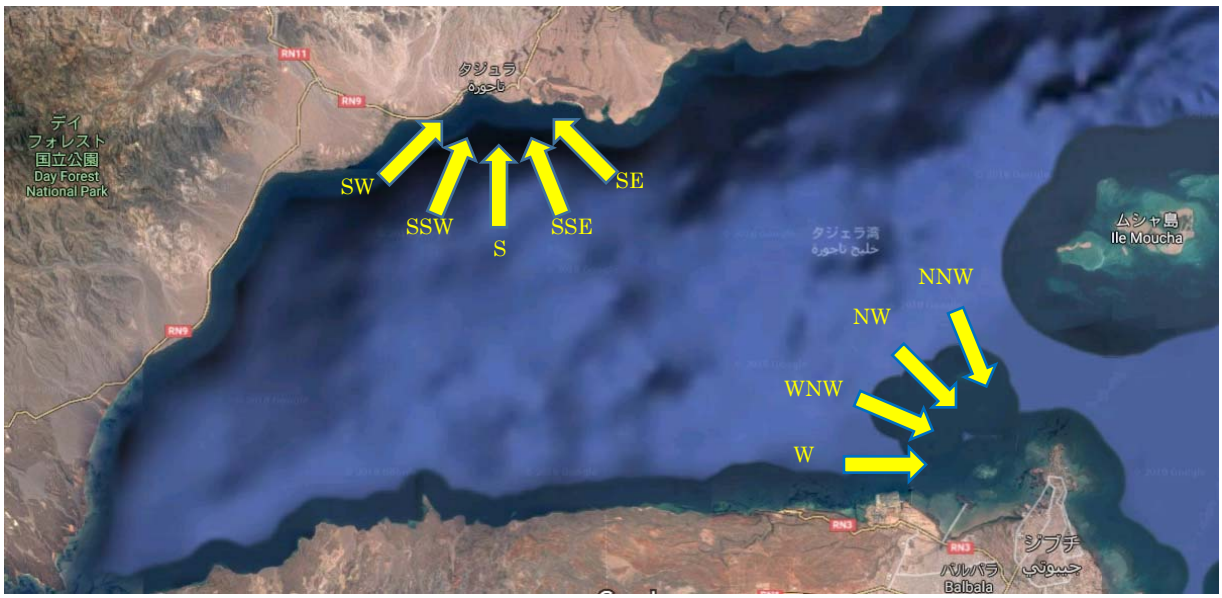


Figure 2.2-10 Design Wind Directions

1) Djibouti Port (50-year probability wind velocity)

Design wind velocity will be determined by the observation record at Djibouti Airport (2008~2017).

Table 2.2-3 50-year probability wind velocity by the record at Djibouti Airport

wind direction	50-year probability wind velocity	equivalent velocity at 1 m above water surface
NNW	9.37 m/sec	6.4 m/sec
NW	11.96 m/sec	8.1 m/sec
WNW	26.46 m/sec	17.3 m/sec
W	14.21 m/sec	9.7 m/sec

2) Tadjourah Port (50-year probability wind velocity)

Design wave velocity for Tadjourah port will be calculated using the data compiled by NCEP (National Centers for Environmental Prediction), since there is was no available observed data there. NCEP data cover the period from 1980 to 2017.

Table 2.2-4 50-year probability wind speed for Tadjourah port

wind direction	50-year probability wind velocity	equivalent velocity at 1m above water surface
SE	16.12 m/sec	11.6 m/sec
SSE	14.52 m/sec	10.4 m/sec
S	11.16 m/sec	8.0 m/sec
SSW	10.15 m/sec	7.3 m/sec
SW	10.08 m/sec	7.3 m/sec

(4) Wave

Design wave height (Ho' and $H_{1/3}$) for Djibouti port and Tadjourah port will be calculated by SMB method that uses design wind velocity as above.

Table 2.2-5 Design Wave Height

Djibouti port				Tadjourah port			
wave direction	equivalent deepwater wave height (m)	significant wave height (m)	significant wave period (sec)	wave direction	equivalent deepwater wave height (m)	significant wave height (m)	significant wave period (sec)
NNW	0.08	0.07	3.5	SE	1.01	0.95	3.9
NW	0.17	0.15	4.0	SSE	0.67	0.63	3.2
WNW	0.48	0.46	5.8	S	0.77	0.74	3.4
W	0.19	0.17	4.0	SSW	0.83	0.81	4.1
-	-	-	-	SW	0.57	0.53	4.2

(5) Soil

Soil site surveys were conducted at three(3) points in Djibouti port and Tadjourah port, respectively. In Djibouti port, stiff clay is found widely. However, soft clay (N=0) is found on the surface layer around the area of the new ferry berthing facility. Cohesive soil of N=5 occurs from -11.5 to -15m, and cohesive soil of N≒40 further below. Soil of N=50 occurs below -30 m. On the other hand, sand layer of N≒4 occurs around

revetment and reclamation area up to -11.5m. The layer below a silt layer of N=30 to 40.

In the Tadjourah port, sand layer is found widely. Generally N values will be larger than Djibouti port, and sand layer of below -12m is over N≥50.

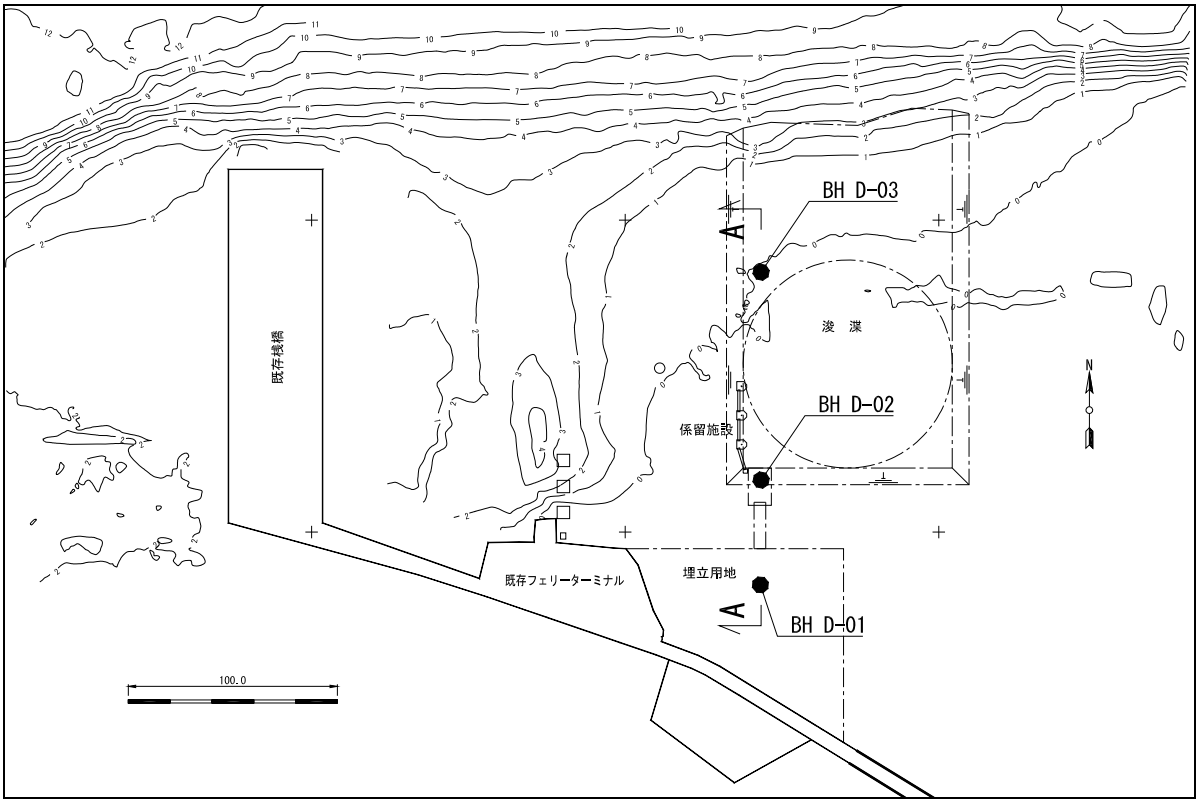


Figure 2.2-11 Survey Points in Djibouti Port

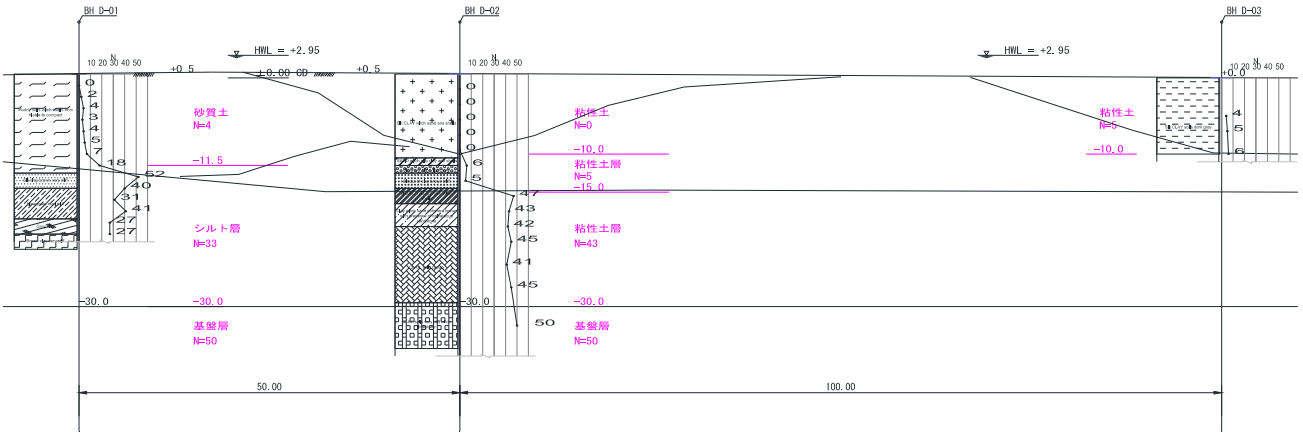


Figure 2.2-12 Soil Distribution of Djibouti Port (SECT.A-A)

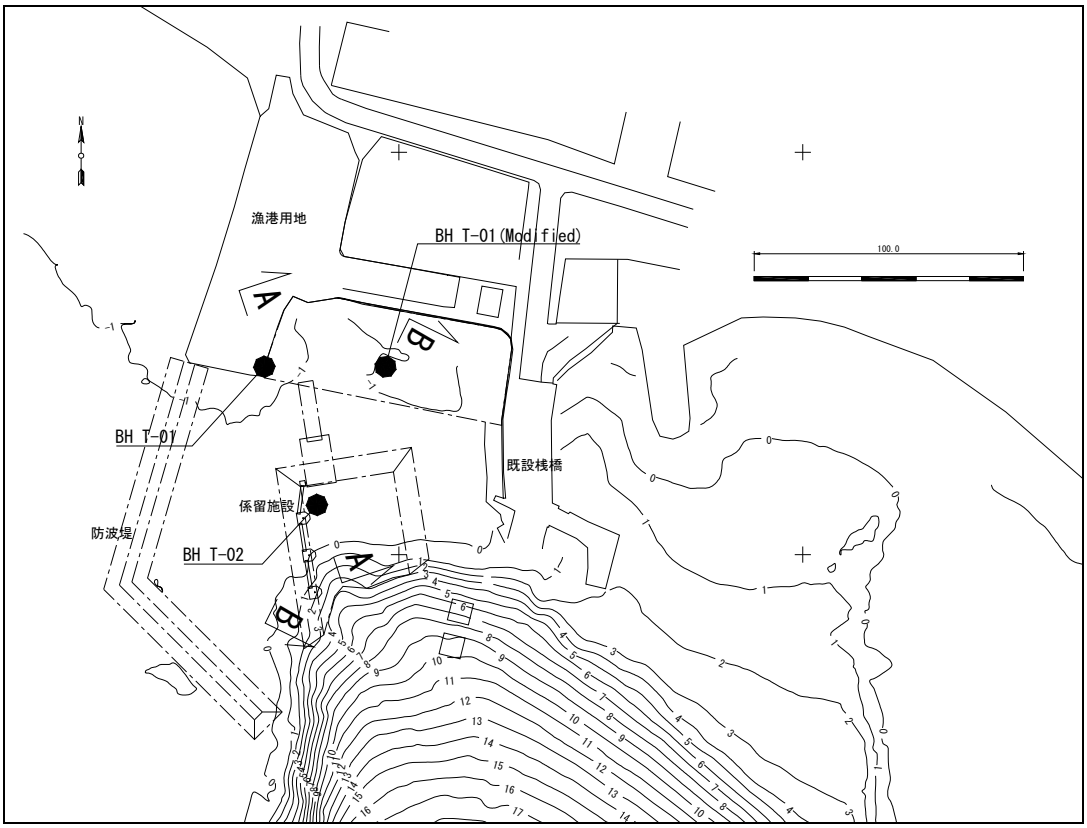
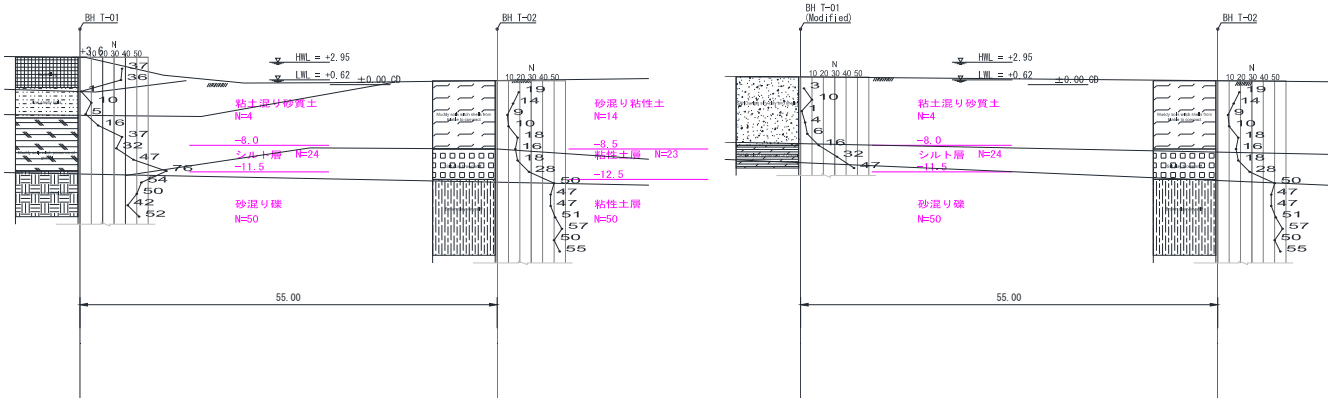


Figure 2.2-13 Survey Points in Tadjourah Port



SECT.A-A **SECT.B-B**

Figure 2.2-14 Soil Distribution of Tadjourah Port

(6) Dead weight and load

Design load will be considered as below on the basis of Japanese port technical standards:

Table 2.2-6 Design Load

Item	Load Values
surcharge	Crowd load 5 kN/m^2 (3.5 kN/m^2 for catwalk) Surcharge on revetment 10 kN/m^2 Vehicle 25t (Truck)
berthing force	355 kN (450 GT Ferry, berthing velocity 30 cm/sec, fender SX500H)
pulling force	150 kN bollard (200~500 GT vessel)

(7) Material

The characteristic value of unit weight to calculate design load will be considered as below:

Table 2.2-7 Material Profiles

Materials	Unit weight (kN/m^3)
Steel and casting steel	77.0
Aluminum	24.0
Reinforced concrete	22.6
Un-reinforced concrete	26.0
Stone (granite)	25.0
Sand, gravel, and ,rubble (dry)	16.0
Sand, gravel, and ,rubble (wet)	18.0
Sand, gravel, and ,rubble (saturated)	20.0

Source: Technical Standards and Commentaries for Port and Facilities in Japan 2018

(8) Steel

Table 2.2-8 Shape Specifications for Steel (JIS)

Type of steel material		Symbols	Applications
Structural steel	Steel bar	JIS G3191	SS400
	Shaped steel	JIS G3192	SS400, SM400, SM490, SM490Y, SM520, SM570, SMA400, SMA490, SMA570
	Steel plate and steel strips	JIS G 3193	SS400, SM400, SM490, SM490Y, SM520, SM570, SMA400, SMA490
	Flat steel	JIS G 3194	SS400, SM400, SM490, SM490Y, SM520
Steel pile	Steel pipe pile	JIS A 5525	SKK400, SKK490

Source: Technical Standards and Commentaries for Port and Facilities in Japan 2018

Table 2.2-9 Mechanical Characteristics for Steel

Young's modulus E	2.0×10^{5} N / mm^2
Shear modulus G	7.7×10^{4} N / mm^2
Poisson's ratio ν	0.30
Linear expansion coefficient α	12×10^{-6} 1 / °C

Source: Technical Standards and Commentaries for Port and Facilities in Japan 2018

Table 2.2-10 Characteristic Values of Yield Strength for steel pile and Steel Pipe Pile (JIS)

(N/mm^2)

Type of stress \ Steel grade	SKK400	SKK490
Axial tensile stress (per net gross-sections area)	235	315
Bending tensile stress (per net gross-sections area)	235	315
Bending compression stress (per net gross-sections	235	315
Shear stress (per net gross-sections area)	136	182

Source: Technical Standards and Commentaries for Port and Facilities in Japan 2018

(9) Corrosion Protection

Corrosion protection will be designed since steel members will exposed to a corrosion condition. Steel especially at level below L.W.L. will be properly treated for corrosion since heavy local corrosion may occur.

1) Corrosion rates of steel

Since corrosion rates of steel vary depending on corrosive environmental conditions, the rates will be properly determined considering the environmental conditions in which the project facilities will be located. Corrosion rates for steel will use the values below.

Table 2.2-11 Standard Values of Corrosion Rates for Steel

Corrosion environment		Corrosion rate (mm/year)
Seaside	H.W.L. or higher	0.3
	H.W.L.～L.W.L.-1m	0.1～0.3
	L.W.L.-1m～seabed	0.1～0.2
	Under seabed	0.03
landside	Above ground and exposed to air	0.1
	Underground (residual water level and above)	0.03
	Underground (residual water level and below)	0.02

Source: Technical Standards and Commentaries for Port and Facilities in Japan 2018

2) Corrosion Protection Method

Corrosion protection methods for steel will be taken appropriately by employing cathodic protection method, the covering/coating method, or corrosion prevention method, depending on the environmental conditions in which the steel material is placed. For the sections below L.W.L., the cathodic protection shall be employed. For the sections above the depth of 1.0 m below L.W.L., the covering/coating methods will be employed.

2.2.3. Environmental and Social Considerations

(1) Description of project components and environmental and social impacts

The description of project components is show in Table 2.2-12 below.

Table 2.2-12 Description of Project Components

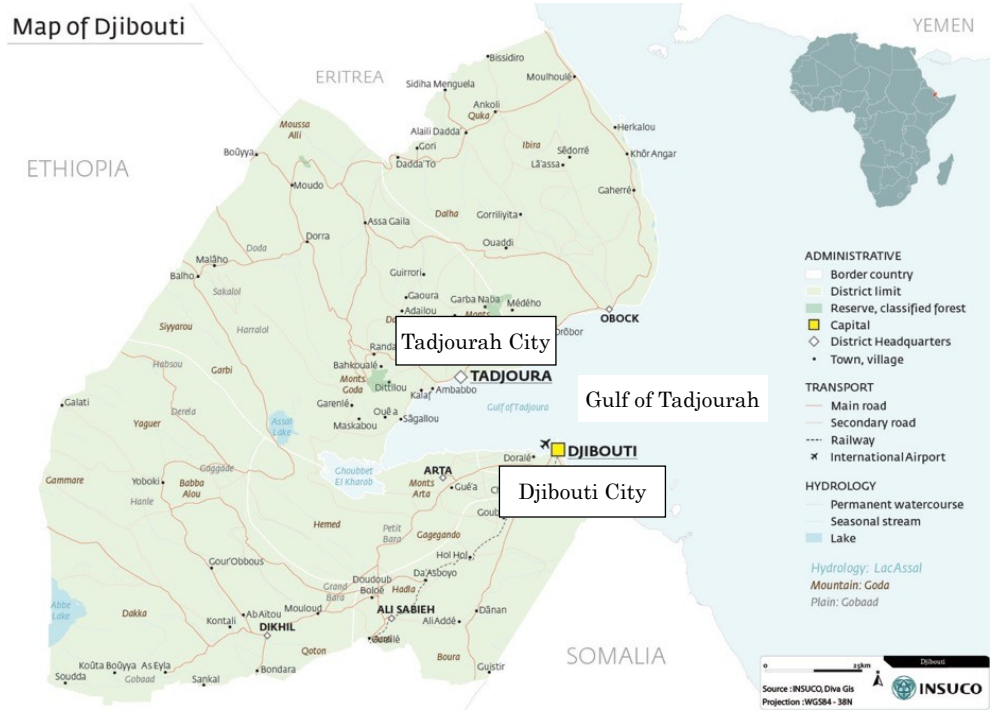
No.	Project component	Contents (Land needed for the Project, etc.)
1	Port of Djibouti	Rehabilitation of the existing port facilities (including construction of a new berthing structure and navigation dredging). Land reclamation is planned to expand the land area. The activities will be conducted within the existing port; hence, no land acquisition is required.
2	Port of Tadjourah	Rehabilitation of the existing port structures (including construction of a new berthing structure, breakwater, navigation dredging). Land reclamation is planned to expand the land area. The activities will be conducted within the existing port; hence, no land acquisition is required.

Source: Study team

(2) Environmental and Social Baselines

1) Natural environment

The Project sites are Djibouti City and Tadjourah City. Both cities face the Gulf of Tadjourah, and a plain area spreads in the coast of the Gulf.



Source: Study team

Figure 2.2-15 Location of Djibouti City and Tadjourah City

a) Climate

The climate of Djibouti City and Tadjourah City is classified as a subtropical desert climate (BWh) under the Köppen Climate Classification System. The average temperature and annual rainfall of Djibouti City is 30.1°C and 121 mm, respectively; and the average temperature and annual rainfall of Tadjourah City is 30.6°C and 145 mm, respectively[1]. There is a dry season in June, while more rainfall is observed in November. The climate conditions are harsh between June and September, when dry and hot winds from the desert Khamsin are blowing into the cities.

b) Air quality

The following baseline survey was conducted to obtain data on air quality in the Project area.

Table 2.2-13 Summary of baseline assessments on air quality

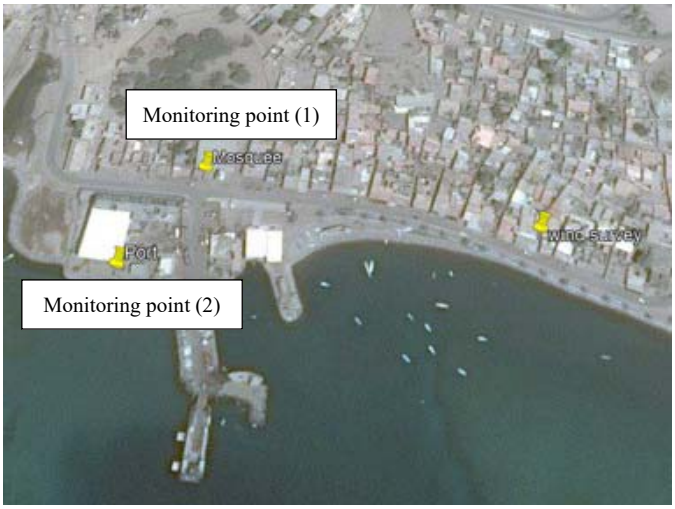
	Location	Date	Coordinates	Parameter	Notes
1	Point at Djibouti port	17 November 2018	269099/ 1303585	PM2.5, PM10	24-hour monitoring
2	Point at Tadjourah port (1) (In front of mosque)	11 November 2018	269160/ 1303644		
3	Point at Tadjourah port (2)	12 November 2018	269099/ 1303585		

Source: Study team

Source: Study Team

Figure 2.2-16 Air quality monitoring site (near the Port of Djibouti)

[1] Source: Climate-Data. Org （https://ja.climate-data.org/）



Source: Study team

Figure 2.2-17 Air quality monitoring site (near the Port of Tadjourah)

The daily average values of PM 2.5 and PM10 near the Port of Djibouti were 5μg/m^3 and 9μg/m^3, respectively. Near the Port of Tadjourah, these values were 10.75μg/m^3 and 10μg/m^3, respectively, and specifically in the mosque area, 7.25μg/m^3 and 17μg/m^3, respectively. All measurements of PM2.5 and PM10 were below the WHO air quality threshold values[2].

c) Water quality

The following baseline assessments were conducted to obtain data on water quality in the Project area. Monitoring of water quality is planned during construction and operation of this Project, with reference to these results as baseline data.

Table 2.2-14 Summary of baseline assessments on water quality

	Location	Date	Coordinates	Parameter
1	Djibouti port (1)	18 October 2018	296868/1283349	pH、COD、turbidity、DO、electrical conductivity、nitrates、sulfates、bicarbonates、chlorides
2	Djibouti port (2)		297063/1283314	
3	Djibouti port (3)		297157/1283201	
4	Tadjourah port (1)	20 October 2018	268958/1303474	
5	Tadjourah port (2)		268963/1303395	
6	Tadjourah port (3)		269152/1303402	

Source：Study team

Table 2.2-15 Results of baseline assessments on water quality

	Parameter	Unit	Djibouti port			Tadjourah port		
			(1)	(2)	(3)	(1)	(2)	(3)
1	pH	-	8.29	8.28	7.42	8.41	8.23	8.39
2	COD	mg/l	90	60	60	50	60	70
3	Turbidity	FNU	0.43	0.44	0.65	0.49	0.12	0.29
4	DO	mg/l	8.0	7.6	7.0	8.7	8.2	9.0
5	Electrical conductivity	μS/cm	53.8	55.0	55.2	56.7	56.6	56.5
6	Nitrates	mg/l	73	72	72	71	72	71
7	Sulfates	mg/l	2900	2800	2700	2800	2800	2700

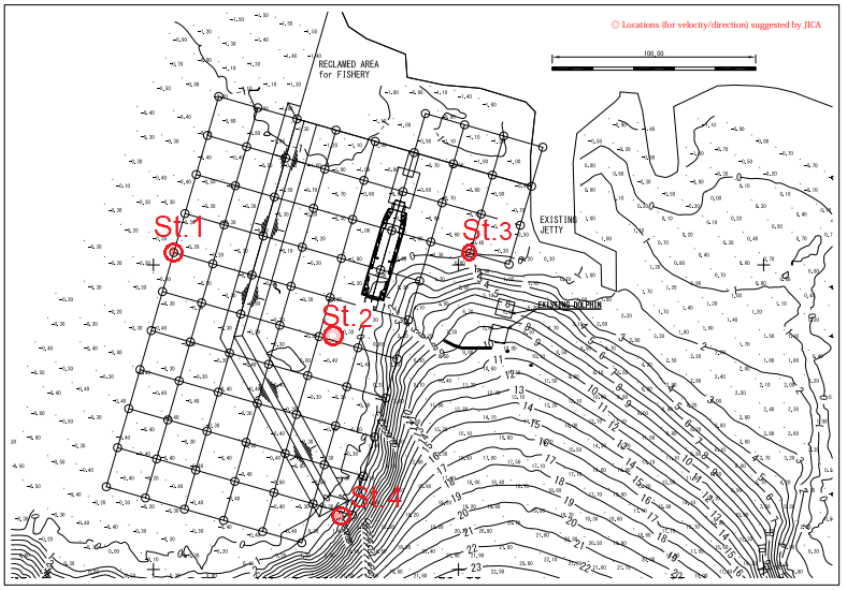
[2] There are no environmental standards concerning air quality in Djibouti.

8	Bicarbonates	mg/l	186	164	159	161	149	148
9	Chlorides	mg/l	21000	20000	20000	20000	20000	20000

Source：Study team

d) Current velocity and direction

The survey of current velocity and direction was conducted from 13 March to 15 March 2019 to obtain data on the marine in the Project area. The monitoring locations are shown in Fig. 2.2-18.



Source：Study team

Figure 2.2-18 Monitoring locations for current velocity and direction (Tadjourah Port)

Table 2.2-16 Summary of a survey of current velocity and direction (Tadjourah port)

	Location	Date	Coordinates (Latitude／longitude)
1	Tadjourah port (1) (Point 1 (St1))	12 - 15 March 2019 (24 hours/ location)	11°47’01.93”/42°52’48.38”
2	Tadjourah port (2) (Point 2 (St2))		11°47’01.00”/42°52’50.45”
3	Tadjourah port (3) (Point 3 (St3))		11°47’01.33”/42°52’52.12”
4	Tadjourah port (4) (Point 4 (St4))		11°46’56.36”/42°52’49.77”

Source: Study team

According the survey results, the current velocity in the Point 4 ranged from 2cm/second to 70cm/second, while in the points near land (Points 1, 2, and 3) the range was between 2cm/second and 30cm/second. At Point 1 and 2, the current flows northwest, while at Point 4 the water flows primarily in a northwest and southwest direction. The direction of water flow at Site 3 was scattered, and a pattern could not be determined.

e) Noise

The following noise survey was conducted to obtain data on noise in the Project area.

Table 2.2-17 Summary of noise survey

	Location	Date	Notes

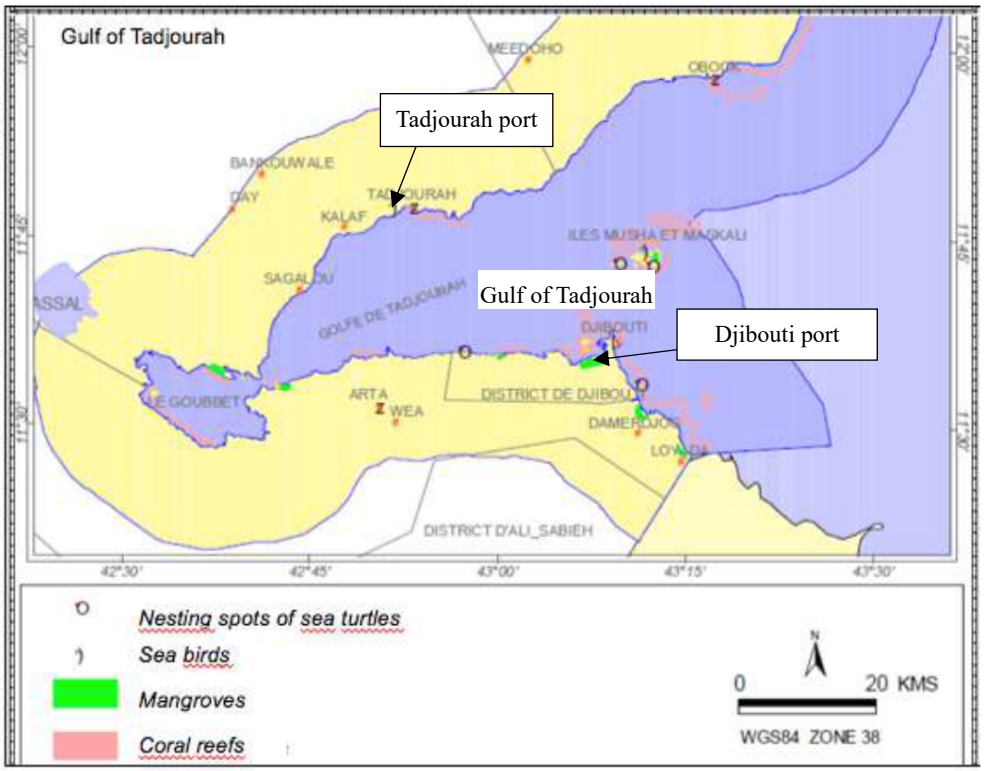
1	Djibouti port (1)	9 November - 10 November 2018	24-hour monitoring
2	Tadjourah port (1) （in front of mosque）	9 November - 10 November 2018	
3	Tadjourah port (2)	9 November - 10 November 2018	

Source: Study team

The noise levels near Djibouti port during the daytime (7:00- 22:00) and nighttime (22:00- 7:00) were 44.6 -51.1 dB (A) and 45.4-49.3dB (A), respectively. Compared to the IFC standards (daytime: 55dB (A), nighttime: 45 dB (A)), the noise level during the day satisfies these standards. Meanwhile, the noise level during the night will exceed the standard by a maximum of 5 dB (A). At Point (1) of Tadjourah port, the noise levels during the daytime and nighttime were 53.8- 59.9 dB (A) and 49.89- 56.48 dB (A), respectively. The noise levels in the area near the Tadjourah port (2) were 48.8- 58.8 dB (A) and 47.93- 53.12dB (A) during the day and night, respectively. Therefore, IFC standards for noise will be temporarily exceeded near the Tadjourah port as well, by a maximum of approximately 4 dB (A) and 9 dB (A) during the day and night, respectively. The proximate cause of this noise is vehicular traffic near the monitoring sites.

f) Ecosystem

Along the Gulf of Tadjourah, there are regions with mangrove ecosystems. The dominant species are *Avicennia marinna* and *Rhizophora mucronata*. The mangroves are located 1.4 km east of the Djibouti port, and no mangroves have been confirmed near the Tadjourah port.



Source: Study team

Figure 2.2-19 Distribution of coral reefs and mangroves

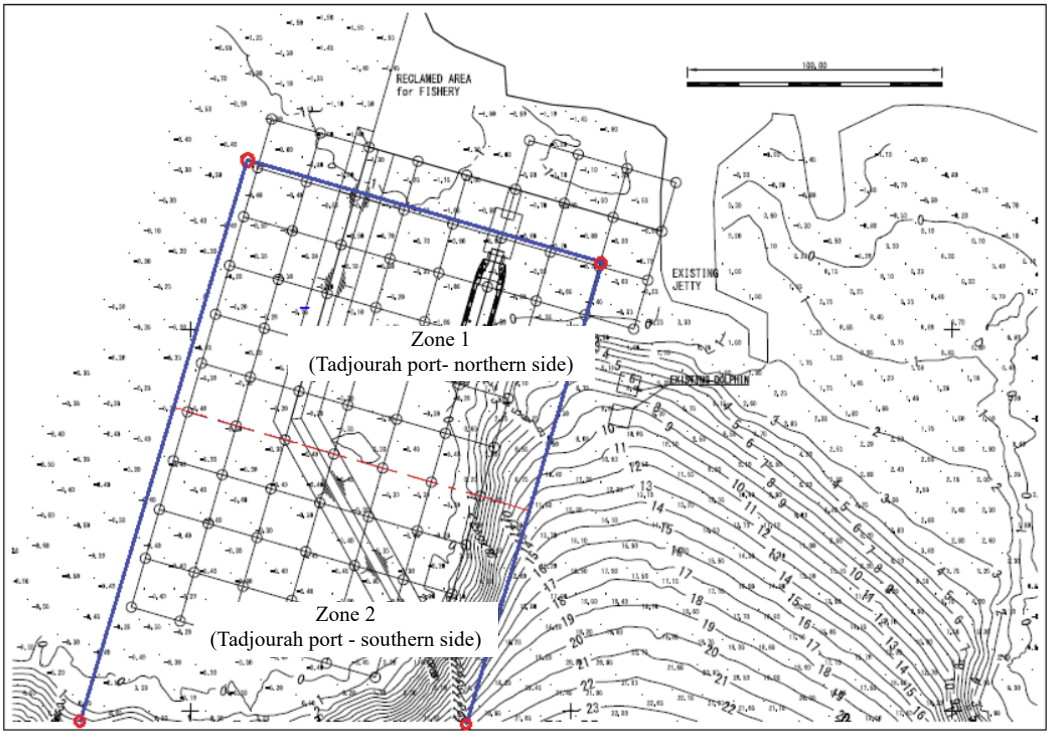
According to a previous study conducted on the Gulf of Tadjourah, there are 235 species of coral in the

Gulf of Tadjourah within Djibouti[3]. Due to the distribution of coral reefs in the gulf, it is necessary to determine the percent coverage of each species and the presence, if any, of important species. Therefore, the following surveys were conducted on coral species in the Tadjourah port:

Table 2.2-18 Summary of coral surveys

	Extent of study	Date	Summary of the study
1	Brief coral survey	8 October 2018	- Study area: Area overlapping with the planned breakwater construction - Belt transect method was used to confirm the presence/absence of coral in the survey range; the belt was approximately 200 m long and 10 m wide (5 m from the center, on both sides of the belt)
2	Detailed coral survey	5- 7 December 2018	- Study range: Area overlapping with the planned breakwater construction and all areas where dredging is expected to occur (Northern side: Zone 1, Southern side: Zone 2) - Belt transect method was used to confirm the presence/absence of coral in the study area; belt was approximately 200 m long and 1m wide (0.5 m from the center, on both sides of the belt) - Quadrat method was used to confirm the absence/presence of ecologically valuable species; 50 cm x 50 cm quadrats were placed and photographed to determine which species were present.

Source: Study team



Source: Study team

Figure 2.2-20 Study area of detailed coral study (marked in blue)

According to the results of the study, it was found that there is a high coverage (over 50%) of coral, primarily hard coral, in the study area, especially in Zone 2. The species exist as communities of hermatypic coral (Figure 2.2-21). Additionally, in the same study, 40 species of coral were confirmed in the area. Of these

[3] Source: The Lower Awash-Lake Abebe Land and Seascape Project, CORDIO East Africa, August 2017 (Date of study: 13～26 September 2014)

species, one (1) is classified as VU (Vulnerable) and 11 as NT (Near Threatened) under the IUCN Red List. These species are not considered endemic, because they can be found not only in Djibouti, but also in areas all around the world. Hence, it was judged that the Project site is not considered as a critical habitat, as defined in the JICA guidelines for environmental and social consideration[4].

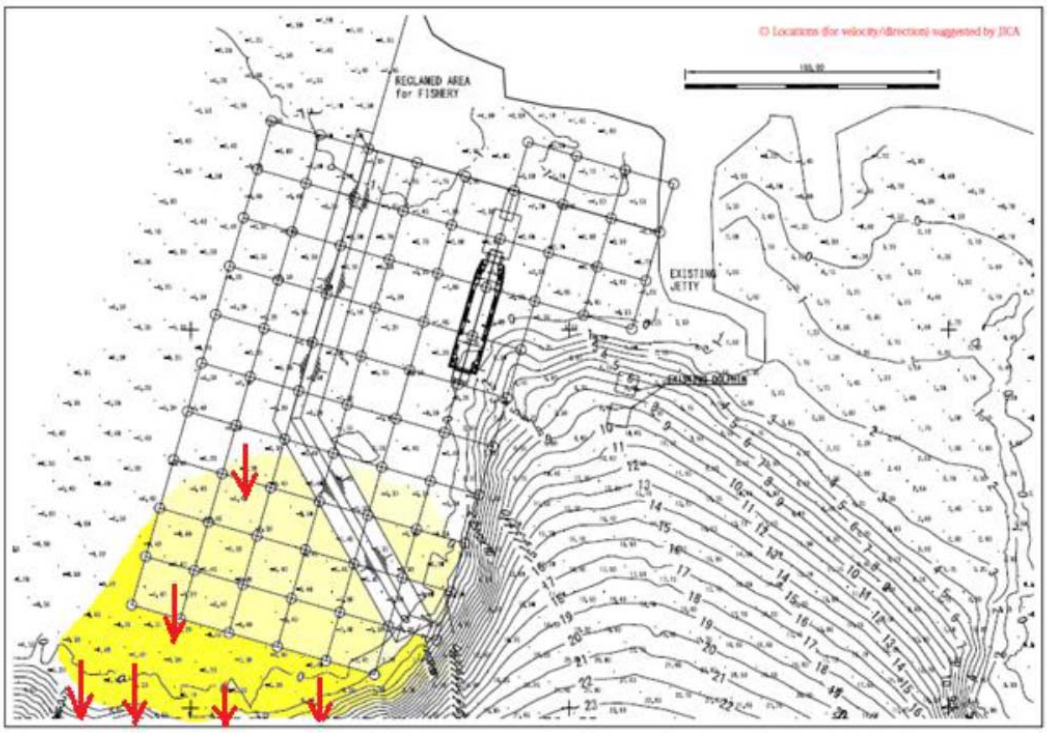
Additionally, as shown in Table 2.2-19, there are no critical habitats, as defined under the World Bank Environmental and Social Standards (ESS), "ESS6: Biodiversity Conservation and Sustainable Management of Living Resources."

Table 2.2-19 Comparison with "Critical Habitats" as defined by the World Bank ESS6

ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources 23. Critical habitat is defined as areas with high biodiversity importance or value, including:	Status of Project area
(a) habitat of significant importance to Critically Endangered or Endangered species, as listed in the IUCN Red List of threatened species or equivalent national approaches;	A coral survey was conducted near the Project site in the Tadjoura port from 5 December to 7 December 2018. There were no species classified as CR or EN by the IUCN. There was 1 species classified as VU and 11 as NT. These species are distributed not only in Djibouti, but also in areas around the world. A hearing with a coral expert confirmed that these species were listed as threatened (VU, NT), but not specifically within the environment of the limited region of the Project area; instead, they were listed as threatened on the premise of environmental change on a global scale. Therefore, the Project area is not considered a critical habitat for VU and NT species.
(b) habitat of significant importance to endemic or restricted-range species;	In the aforementioned study, 40 coral species were identified. Of these species, one is classified as VU and 11 as NT on the IUCN Red List. These species are distributed not only in Djibouti, but also in areas around the world. Therefore, the Project area is not considered a critical habitat for an endemic species or for a species whose distribution is limited. Additionally, in a hearing with a coral expert, there were comments that confirmed that the VU and NT species identified in the coral survey are common species that are widely distributed around the world. It is difficult to consider that these species are rare or critical.
(c) habitat supporting globally or nationally significant concentrations of migratory or congregatory species;	According to the results of a hearing with stakeholders as well as literature review, it was confirmed that there are no migratory or congregatory species or ecosystems that would support such species in the Project area.
(d) highly threatened or unique ecosystems;	According to the results of a hearing with stakeholders as well as literature review, it was confirmed that there are no highly threatened or unique ecosystems in the Project area. During a hearing with a coral expert, the coral species identified in the Project area are not rare or critical. Hence, threatened or unique ecosystems are not expected in the area.
(e) ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d).	The project area is not considered as an area with the functions or characteristics detailed in (e). See above for details.

Source: Study Team

[4] In Djibouti, the Law concerning land and marine protected areas (No. 2004/45) stipulates three (3) marine protection areas ((a) Musha/Maskhali Islands, (b) Seven Brothers Islands/ Ras Syan/ Khor Angar/ Godoria Forest, (c) Haramous). These areas are not located near the Tadjoura port.



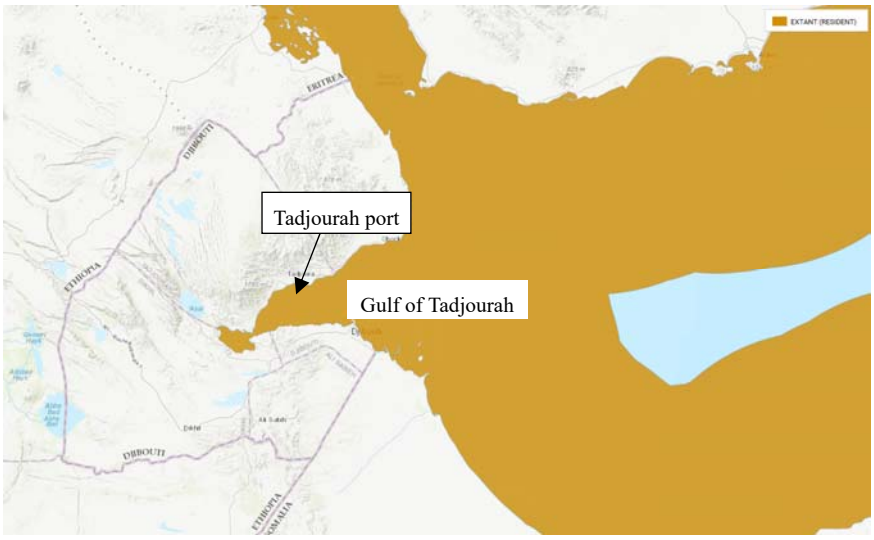
Note: Yellow indicates areas with high coverage (50%). Red arrows indicate areas where VU species were identified in the study.
Source: Study team

Figure 2.2-21 Survey range of in-depth coral study

Table 2.2-20 Species confirmed by coral study (VU and NT species)

	Genus	Species	IUCN Red List categorization	Notes (*1)
1	*Pavona*	*decussata*	VU	Widely distributed throughout the Red Sea, Indian Ocean and Persian Gulf. In Djibouti, they can be found in all regions along the Gulf of Tadjourah (Figure 1.3-8 and Figure 1.3-9).
2	*Acropora*	*digitifera*	NT	Widely distributed throughout the Red Sea, Gulf of Aden and Indian Ocean.
3	*Echinopora*	*forskaliana*	NT	Widely distributed throughout the Red Sea and along the eastern African coast.
4	*Echinopora*	*fruticulosa*	NT	Distributed throughout the Red Sea, Madagascar and Mauritius.
5	*Galaxea*	*fascicularis*	NT	Widely distributed throughout the Red Sea and southeast Asia and along the eastern African coast.
6	*Goniopora*	*lobata*	NT	Widely distributed throughout the Red Sea and Southeast Asia and along the eastern African coast.
7	*Montipora*	*saudii*	NT	Distributed between the Red Sea (all areas) and the Gulf of Tadjourah.
8	*Platygyra*	*acuta*	NT	Distributed throughout the Red Sea, Madagascar, Mauritius and Southeast Asia.
9	*Platygyra*	*lamellina*	NT	Widely distributed throughout the Red Sea and Southeast Asia and along the eastern African coast.
10	*Porites*	*lobata*	NT	Widely distributed throughout the Red Sea and Southeast Asia and along the eastern African coast.
11	*Psammocora*	*contigua*	NT	Widely distributed throughout the Red Sea and Southeast Asia and along the eastern African coast.
12	*Stylophora*	*pistillata*	NT	Widely distributed throughout the Red Sea and Southeast Asia and along the eastern African coast.

Source: Created by Study team, using IUCN Red List of Threatened Species website (https://www.iucnredlist.org/)



Note: Brown indicates distribution range.

Source：IUCN Red List of Threatened Species website

Figure 2.2-22　Distribution of *Pavona decussata*（near Djibouti）

Source：Reef coral genera of the Western Indian Ocean, Cordio East Africa (2015)

Figure 2.2-23　*Pavona decussata*

g)　Protected areas

Under "Law concerning land and marine protected areas (No. 2004/45)," the following areas are designated protected areas in Djibouti[5]:

(a) Terrestrial protected areas (four regions)：(a) Day Forest, (b) Mabla Forest, (c) Lake Abbe and (d) Lake Assal.

(b) Marine protected areas　(three regions)[6]　：(a) Musha/Maskhali Islands, (b) Seven Brothers Islands/ Ras Syan/ Khor Angar/ Godoria Forest and (c) Haramous.

These protected regions are not near the Djibouti port, Tadjourah port and the surrounding areas. Additionally, in the Project area and its surroundings, there are no ecologically critical habitats nor areas of historical or cultural value, as designated by Djiboutian laws.

[5] The same law designates protected areas as regions that require special measures for biodiversity conservation .While biodiversity conservation within these protected areas are regulated, traditional agricultural and fishing practices as well as ecotourism are permitted in the protected areas.
[6] In marine protected areas, it is prohibited to harvest coral and shellfish.

2) Social environment

Djibouti is comprised of five (5) states and one (1) city, Djibouti City. The population in Djibouti is as shown in Table 2.2-21.

Table 2.2-21 Population in Djibouti

No.	State/city	Population (number of people)	Male population (number of people)	Female population (number of people)	Population density (number of people/km^2)
1	Ali Sabieh	86,949	42,360	44,589	36.229
2	Arta	42,380	21,083	21,297	23.544
3	Dikhil	88,948	45,753	43,195	12.185
4	**Djibouti**	**475,322**	**267,722**	**207,600**	**792.203**
5	Obock	37,856	19,934	17,922	6.641
6	**Tadjourah**	**86,704**	**43,215**	**43,489**	**11.877**
Total		**818,159**	**440,067**	**378,092**	

Source: Djibouti Census Data (2011), Djibouti Data Portal[7]

(3) Legal and institutional framework for environmental and social considerations in Djibouti

1) Legal framework for environmental and social considerations

a) Environmental laws and regulations

i) General environmental laws and regulations

The basic environmental code in Djibouti (No. 2009/51) was promulgated on 1 July 2009. It establishes the principles of environmental conservation that will achieve sustainable development, and it is comprised of nine (9) chapters and 149 articles. Article 97 calls for the environmental and social considerations by requiring the followings: 1) a strategic environmental assessment, 2) environmental impact assessment, 3) monitoring and evaluation, and 4) environmental audit. This code mentions the necessity for environmental regulations, specifically on the management of effluent that may degrade water quality (Articles 18-24), ecosystem conservation (Article 40) and industrial and hazardous waste management (Article 75), among others. Article 100 stipulates that receptors who may be affected by impacts from development have the right to information access concerning the development.

The ordinance on EIA procedures (No.2011/29) regulates EIA procedures and the required components, including the preparation of an environmental management plan. The Ministry of Housing, Urban Planning and Environment will certify the EIA report and issue an environmental permit. The permit is valid for five (5) years, and it may be renewed after an environmental assessment. Under the same ordinance, it is required to prepare EIA reports and environmental management plans in French. Additionally, the law concerning land and marine protected areas (No.2004/45) regulates protected areas and their use. The ordinance on biodiversity conservation (No.2004/65) defines critical species and endangered species in Djibouti and prohibits the hunting and collection, commercial use and import and export of critical flora and fauna.

The environmental laws and regulations in Djibouti are shown in Table 2.2-22.

Table 2.2-22 Environmental laws and regulations in Djibouti

[7] http://djibouti.opendataforafrica.org/DJS2015/djibouti-census-data-2011

	Environmental laws and regulations	Outline
1	Environmental law (No.2009/51)	Basic environmental law in Djibouti.
2	Ordinance on EIA procedures (No.2011/29)	Stipulates EIA procedures and required components.
3	Law concerning land and marine protected areas (No. 2004/45)	Regulates land and marine protected areas and their use.
4	Ordinance on biodiversity conservation (No.2004/65)	Defines critical species and regulates their hunting, commercial use and import and export.

Source: Study team

Additionally, Djibouti has ratified the following conventions (Table 2.2-23), and the execution of the Project will strictly follow these conventions:

Table 2.2-23 Relevant international conventions ratified by Djibouti

	Relevant international conventions ratified by Djibouti	Date of effect
1	International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (Annex I&II)	1990/06/01
2	International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (Annex III)	2016/01/12
3	International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (Annex IV)	2016/01/12
4	International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (Annex V)	2016/01/12
5	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	2002/05/31 (accepted)
6	International Convention for the Safety of Life at Sea	1984/06/01

Source: Study team

ii) Environmental standards

There are no national environmental standards concerning air, water quality, noise and vibration. Hence, international standards such as WHO or EU standards will be applied.

iii) EIA system

Projects subject to EIA

Under Article 99 of the basic environmental code, all projects that are expected to have impacts on the environment must undergo an EIA and obtain a permit from the 1) Ministry of Housing, Urban Planning and Environment. The ordinance on EIA procedures (No. 2011/29) stipulates the required components of the EIA depending on the scale and type of project, as follows:

- Projects that require a brief EIA
- Projects that require a detailed EIA

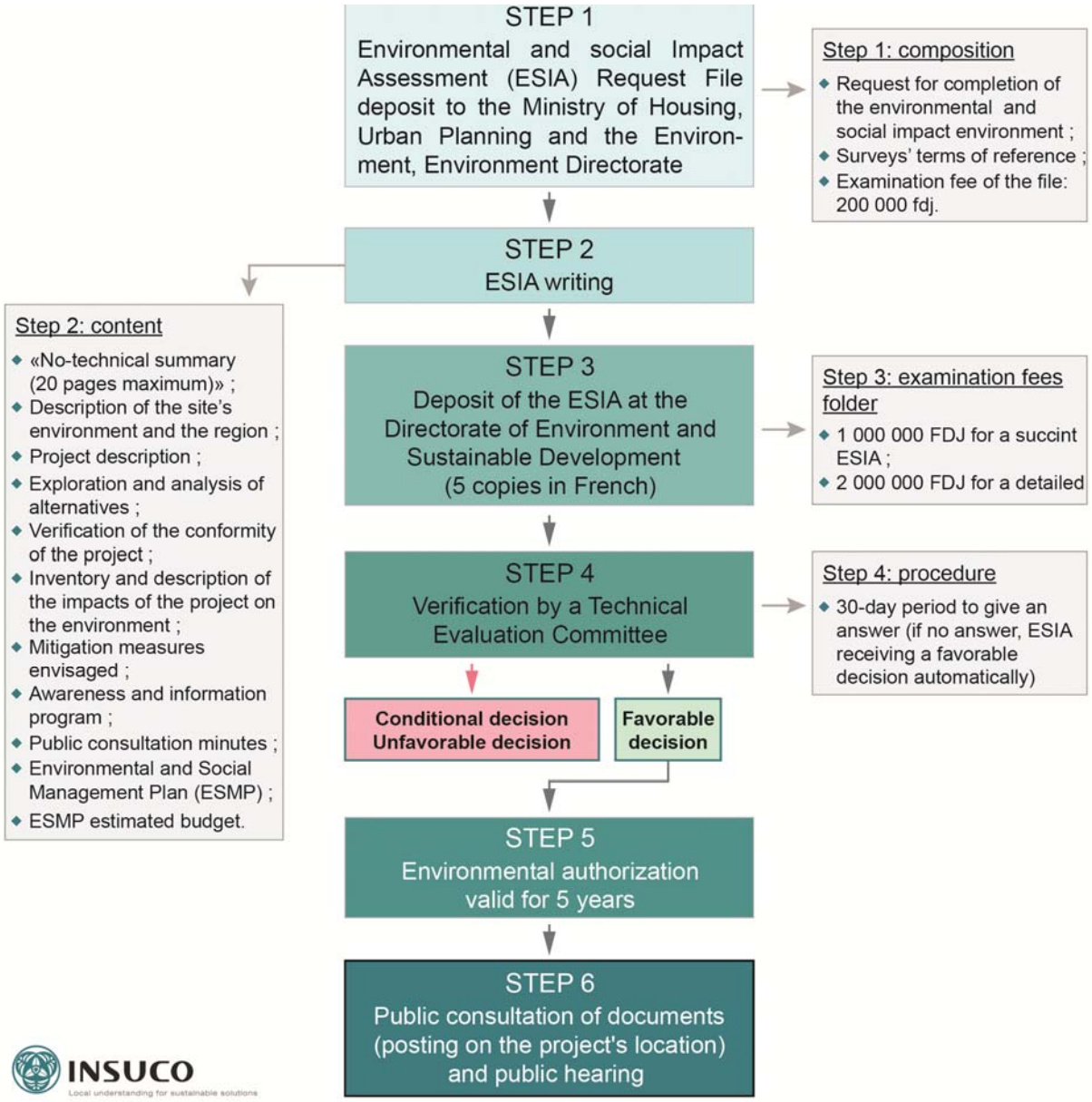
In regards to ports, a detailed EIA is required if the port requires maintenance, the project expands upon an existing port, or if the port to be built will receive ships over 1,350 tons. The Project exhibits these conditions, and therefore, an detailed EIA is to be expected. Additionally, in March 2019, a hearing was held with the Ministry of Housing, Urban Planning and Environment, and it was confirmed that the Project requires a detailed EIA.

According to a result of the hearing with the Ministry of Habitat, Urban Planning and Environment, a project summary must be submitted to the Ministry for the screening of the Project. The Directorate of Maritime Affaires (DMA) will submit the project summary and undertake an EIA that adheres to the environmental laws and regulations of Djibouti.

EIA procedures and components

The EIA procedures as stipulated by the ordinance on EIA procedures (No. 2011/29) are outlined in Figure 2.2-24. Article 101 of the basic environmental code regulates the content that must be included in an EIA report. The EIA report must include the following, at minimum:

- Analysis of environmental baselines at the Project site
- Negative environmental impacts and their mitigation measures
- Necessary expenses for the mitigation measures
- Environmental management plan
- Results of stakeholders meetings



Source: Study team

Figure 2.2-24 EIA flow

The proposed EIA schedule for the Project is shown in Table 2.2-24.

Table 2.2-24 EIA implementation schedule (proposed)

No.	Activity	Period/deadline	Responsible body
1	Hiring EIA consultant	- June 2019	DMA
2	Submission of Project summary to the Ministry of Habitat, Urban Planning and Environment	- July 2019	DMA/ EIA consultant
3	EIA implementation based on screening results	July - September 2019	DMA/ EIA consultant
4	Submission of EIA report to MHUPE	- October 2019	DMA/ EIA consultant
5	Obtaining environmental permits	- December 2019	DMA/ EIA consultant

iv) Gap analysis concerning EIA

The results of the gap analysis between the JICA environmental and social consideration guidelines and the relevant laws and regulations of Djibouti are shown below, along with the policy that the Project will follow:

Table 2.2-25 Results of gap analysis and policies to be taken by this project

Items	JICA guidelines	Relevant laws/regulations in Djibouti	Gap (Y/N)	Policy to be followed
Underlying Principles	・ Environmental impacts that may be caused by projects must be assessed and examined at the earliest possible planning stage. Alternatives or mitigation measures to avoid or minimize adverse impacts must be examined and incorporated into the project plan (JICA guidelines, Appendix 1, Underlying principles. 1).	・ In order to predict and manage impacts caused by the project, EIA shall be implemented and shall include the analysis of alternatives and mitigation measures, which shall be taken into consideration in the decision making of the project. It will promote sustainable development (Ordinance on EIA procedures (No.2011/29)).	N	・ Impacts on environmental and social aspects, alternatives and mitigation measures will be examined in this study. The results will be taken into account in the project plan.
Information disclosure	・ EIA reports (which may be referred to differently in different systems) must be written in the official language or in a language widely used in the country in which the project is to be implemented. When explaining projects to local residents, written materials must be provided in a language and form understandable to them (JICA guidelines, Appendix 2). ・ It is necessary to make EIA reports available to the local residents of the country, in which the project is to be implemented. The EIA reports must be available at all times for perusal by project stakeholders such as local residents, and copying must be permitted (JICA guidelines, Appendix 2).	・ The EIA report must be written in French, an official language of Djibouti. If the report is written in any other language, it must be translated into French by a professional translation company (Ordinance on EIA procedures (No.2011/29)). ・ The access to EIA reports by residents shall be secured. (Ordinance on EIA procedures (No.2011/29)). ・ There is no directive regarding copies of the EIA report and obtaining them (Ordinance on EIA procedures (No.2011/29)).	Y (There is no directive regarding copies of the EIA report and obtaining them.)	・ EIA report will be prepared in an official language of Djibouti. ・ The EIA report will be disclosed to the public and any stakeholders. Additionally, the report will be made available and city administration offices etc.
Public consultation	・ For projects with a potentially large environmental impact, sufficient consultations with local stakeholders, such as local residents, must be conducted via disclosure of information at an early stage, at which time alternatives for project plans may be examined. The outcome of such consultations must be incorporated into the contents of project plans (JICA Guidelines, Appendix 1, 5. Social acceptability. 1). ・ Appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, the poor, and ethnic minorities, all members who are susceptible to environmental and social impacts and may have little access to decision-making processes within society (JICA Guidelines, Appendix 1, 5. Social acceptability. 2).	・ It is stipulated that the public must be consulted during the EIA process, but there is no directive regarding information disclosure and public consultation at an early stage (Ordinance on EIA procedures (No.2011/29)). ・ At the preparation stage of draft EIA reports, the comments from stakeholders including residents (especially people affected by the project) shall be reflected in the report (Ordinance on EIA procedures (No.2011/29)). ・ There is no directive concerning vulnerable groups, such as women, children, the elderly, the poor and ethnic minorities for public consultations (Ordinance on EIA procedures (No.2011/29)).	Y (There is no directive regarding public consultations or appropriate consideration for socially vulnerable groups at an early planning stage.)	・ At the scoping and preparation stage of draft EIA reports, the comments from residents shall be reflected in the report. ・ Focus group discussions will be held to facilitate the participation of socially vulnerable groups in public consultation, including women, children and the poor.
Items to be assessed	・ The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste,	・ The EIA report must include any direct and indirect, temporary and cumulative impacts resulting from the project. These include impacts to flora and fauna, scenery, water quality, air, soil, noise, vibration, climate change,	Y (There is no directive regarding derivate and secondary impacts or impacts that	・ An EIA that adheres to JICA guideline will be implemented, including derivate and secondary impacts,

Items	JICA guidelines	Relevant laws/regulations in Djibouti	Gap (Y/N)	Policy to be followed
	accidents, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. These also include social impacts, including migration of the population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety (JICA Guidelines, Appendix 1, Scope of impacts to be assessed. 1). ・ In addition to the direct and immediate impacts of projects, their derivative, secondary, and cumulative impacts as well as the impacts of projects that are indivisible from the project are also to be examined and assessed to a reasonable extent. It is also desirable that the impacts that can occur at any time throughout the project cycle should be considered throughout the life cycle of the project. (JICA Guidelines, Appendix 1, Scope of impacts to be assessed. 2).	ecosystems, social economy and health and safety (Ordinance on EIA procedures (No.2011/29)). ・ There is no directive concerning derivate and secondary impacts or impacts that are indivisible from the project (Ordinance on EIA procedures (No.2011/29)).	are indivisible from the project.)	cumulative impacts and impacts that are indivisible from the project.

Items	JICA guidelines	Relevant laws/regulations in Djibouti	Gap (Y/N)	Policy to be followed
Monitoring and grievance mechanisms	・Project proponents etc. should make efforts to make the results of the monitoring process available to local project stakeholders (JICA Guidelines, Appendix 1, Monitoring. 3). ・When third parties point out, in concrete terms, that environmental and social considerations are not being fully undertaken, forums for discussion and examination of countermeasures are established based on sufficient information disclosure, including stakeholders' participation in relevant projects. Project proponents etc. should make efforts to reach an agreement on procedures to be adopted with a view to resolving problems (JICA Guidelines, Appendix 1, Monitoring. 4).	・Project proponents must undertake monitoring and regularly submit the results in a report to the Ministry of Habitat, Urban Planning and Environment. However, there is no directive concerning information disclosure to stakeholders (Ordinance on EIA procedures (No.2011/29)). ・If, as a result of monitoring, the environmental and social measures taken by the project proponents are found to be insufficient, the project proponents must implement additional mitigation measures, under the guidance of the Ministry of Habitat, Urban Planning and Environment. (Ordinance on EIA procedures (No.2011/29)). ・There is no directive concerning responses to a third party's claim, in concrete terms, that environmental and social considerations are not being fully undertaken (Ordinance on EIA procedures (No.2011/29)).	Y (There is no directive regarding the implementation of a grievance mechanism.)	・Monitoring results will be submitted to the Ministry of Habitat, Urban Planning and Environment, and be disclosed to relevant stakeholders. ・A grievance mechanism will be established, so that any person who has grievances towards the project will be able to submit their grievances.

Source: Study team

b) Legislations concerning land acquisition and resettlement

Legislations in Djibouti concerning land acquisition and resettlement are shown in Table 2.2-26 below.

Table 2.2-26 Legislations in Djibouti concerning land acquisition and resettlement

	Laws and regulations in Djibouti	Outline
1	Law concerning the system and confirmation of public land (No.171/1991)	Stipulates ownership and registration procedures for real estate in Djibouti.
2	Law regulating the expropriation of land for public use (No.172/1991)	Regulates the procedures for the expropriation of land for public use.
4	Law concerning the system of land ownership (No.177/1991)	Define the purpose and duty of the system of land ownership.

Source: Study team

2) Relevant institutions (Institution for Environmental and Social Considerations, other relevant institutions, NGOs, etc.)

a) Ministry of Housing, Urban Planning and Environment (MHUPE)

MHUPE is the central agency that holds jurisdiction over environmental matters in Djibouti, and it oversees activities such as the development and implementation of environmental policies and land use plans. The Environment and Sustainable Development Directorate belongs to MHUPE, and the main duties of the directorate as listed below:

a) Implementation, strengthening, and monitoring of environmental legislations
b) Review and approval of EIA reports
c) Promotion of cooperation among environmental NGOs and communities

b) Ministry of Equipment and Transports (MET)

In the Directorate of Maritime Affaires (DMA) of MET, two (2) staff members who are responsible for the environment; they oversee (a) EIA implementation and preparation of the EIA reports, (b) implementation and monitoring of environmental managements plans, (c) preparation and implementation of resettlement action plans and (d) any other general environmental and social affairs.

(4) Comparison of alternatives

The analysis of the alternative measures is shown in Table 2.2-27 and 2.2-28. The alternatives were comprehensively examined from the viewpoints of environmental and social impacts as well as project cost.

Table 2.2-27 Comparison of alternative measures (new port facilities in the Djibouti Port)

Item	Alternative 1	Alternative 2	No implementation
Summary	New port structures such as a berthing facility will be installed near existing berthing facilities.	New port structures such as a berthing facility will be installed on land, about 300m southeast of Alternative 1.	The project will not be implemented.
Benefit to local communities	Local industry and marine traffic will be enhanced because of the new port facilities.	Local industry and marine traffic will be enhanced because of the new port facilities.	No benefit to local communities.
Impact on natural environment	There is less dredging construction compared to Alternative 2, so there will be a relatively lower impact on the surrounding ecosystems due to dredging and less creation of dredged soil.	Construction will occur in shallow areas, so there will be more dredging construction compared to Alternative 1. Therefore, there will be a relatively higher impact on the surrounding ecosystems due to dredging and greater creation of dredged soil.	No impact on natural environment.
Impact on social environment	The location is farther from land compared to Alternative 2, so the facilities will be relatively less convenient to the residents in terms of transportation on land.	The location is closer to land compared to Alternative 1, so the facilities will be relatively more convenient to the residents in terms of transportation on land.	No impact on social environment.
Cost of project	Compared to Alternative 2, dredging cost will be relatively low.	Compared to Alternative 21, dredging cost will be relatively high.	No project cost.
Benefit	◎	◎	×
Natural environment	○	×	◎
Social environment	△	○	◎
Project cost	○	△	◎
Evaluation	◎ (Alternative 1 is recommended due to the benefit, impact on the natural environment, and the Project cost.)	△ (Alternative 2 is not recommended due to the impact on the natural environment.)	× (The option of no implementation is not recommended due to the lack of benefits to local communities.)

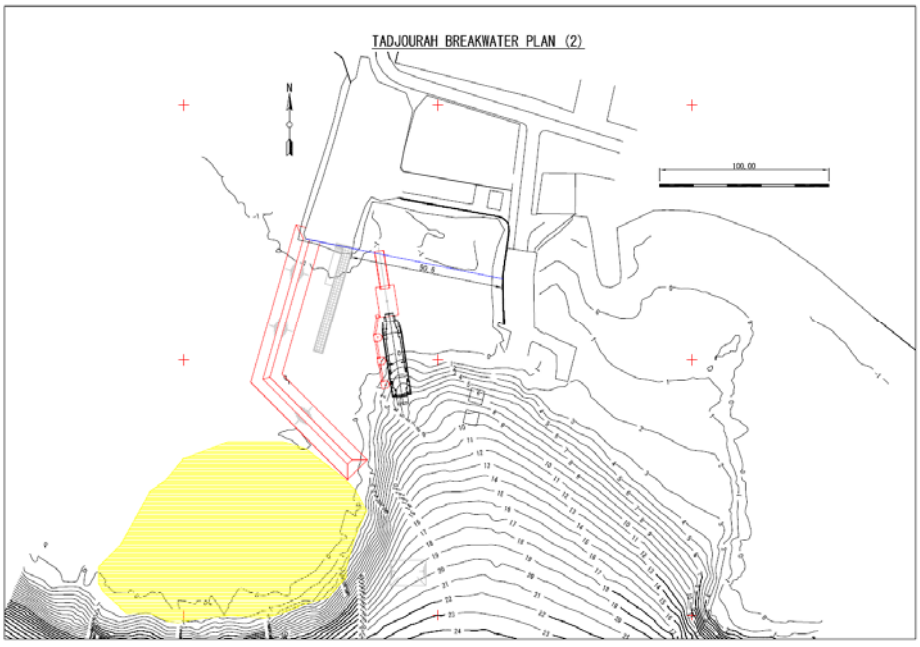
Source: Study team

Table 2.2-28 Comparison of alternative measures (breakwater construction in the Tadjourah Port)

Item	Alternative 1	Alternative 2 (original plan)	Zero option

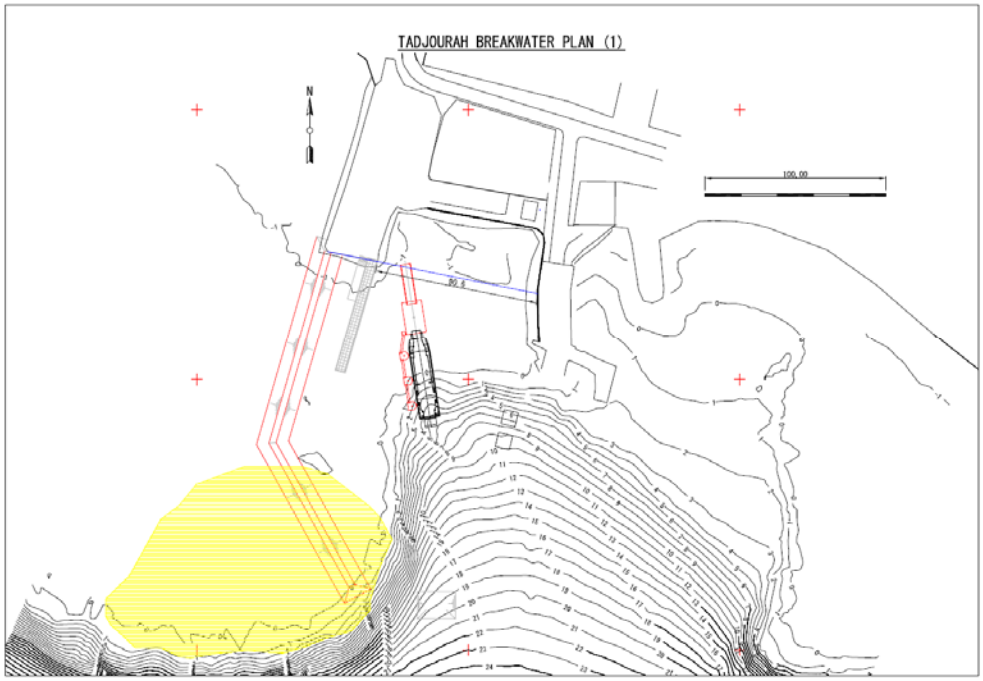
Summary	Breakwater (200 m length): The degree of calmness would be approximately 90%. It is designed to avoid an area with high coral coverage.	Breakwater (250 m length): The degree of calmness is 97%, but the design passes through an area with high coral coverage.	The project will not be implemented.
Benefit to local communities	Because of the relatively reduced degree of calmness, any effects from breakwater construction would also be relatively reduced.	Because of the relatively higher degree of calmness, the benefit from breakwater construction would also be enhanced.	There is no benefit to local communities.
Impact on natural environment	Although some parts of coral habitat would be lost due to breakwater construction, the area with high coral cover would be avoided. Therefore, there would be limited impact on coral.	Because the area with high coral coverage would be affected due to breakwater construction, there would be significant impacts on coral habitat.	There is no impact on natural environment.
Impact on social environment	Although the degree of calmness would be relatively reduced, there are no predicted positive or negative effects on the social environment.	Since the degree of calmness would be relatively higher, there are no predicted positive or negative effects on the social environment.	There is no impact on social environment.
Cost of project	The cost of breakwater construction must be financed.	The project cost would be higher than that of Alternative 1, due to the longer breakwater construction.	No project cost
Benefit	○	◎	×
Natural environment	○	×	◎
Social environment	◎	◎	◎
Project cost	○	△	◎
Evaluation	◎ (Alternative 1 is recommended due to the impacts on the Project surroundings.)	× (Alternative 2 is not recommended due to the impact on the natural environment.)	× (The zero option is not recommended due to the lack of benefits.)

Source: Study team



Source: Study team

Figure 2.2-25 Breakwater construction design in the Tadjourah port (Alternative 1)



Source: Study team

Figure 2.2-26 Breakwater construction design in the Tadjourah port (Alternative 2)

(5) Scoping

During scoping, impacts that may arise from the project were taken account as shown in bellows table.

Table 2.2-29 Scoping (Djibouti port, Tadjourah port)

	No.	Item	Planning/construction	Operation	Expected impacts
Social environment	1	Involuntary resettlement	D	D	Planning/construction phase: Involuntary resettlement is not expected because the Project is a rehabilitation work within the existing ports. Operation phase: No expected impacts.
	2	Poverty	D	D	Planning/construction phase: Impacts to the poor are not expected, as the Project does not require physical or economic resettlement. Operation phase: No expected impacts.
	3	Indigenous/minority peoples	D	D	No impacts are predicted, because no settlements of indigenous or minority peoples are in the Project area.
	4	Economic activities, living and livelihood	B±	B±	Planning/construction phase: Dredging and land reclamation during construction may negatively affect the fishing industry. Meanwhile, the local labor force would be employed for the construction of the ports. Additionally, benefits to the local economy can be expected due to the influx of laborers. Operation phase: A negative impact on the fishing industry is expected due to an increase in marine traffic. Meanwhile, due to the improvement of port facilities, there would be a positive social and economic effect on local industries. In addition to the fact that the port area is already developed, there are no critical fishing areas in the Project area; therefore, there are no expected significant impacts on fishery and other economic activities.
	5	Land use and use of local resources	D	D	There would be no land acquisition because construction will occur within existing port facilities. Therefore, there would be no significant impacts on land use or the use of local resources.
	6	Water use and water rights	D	D	The port area is already being developed, so there would be no significant impacts on water use and water rights.
	7	Social infrastructure and services	D	A+	Construction phase: During construction, there may be an increase in traffic due to the use of transport vehicles, but as the existing port area is already being developed, there would be only limited impact on traffic in the Project area. Operation phase: Due to the project, ferries that can operate during the Khamsin season will run between Djibouti and Tadjourah, improving the logistics of transportation. At the Port of Tadjourah, the installation of breakwaters would ensure calmness even during Khamsin season, improving its use as a port.
	8	Social institutions such as social infrastructure and local decision-making institutions	D	D	The Project site is geographically limited. Additionally, the purpose of the Project is to improve the public services offered by the port. Hence, there would be no impacts to social institutions and infrastructure.
	9	Uneven distribution of benefits & damages	D	D	Logistics of the port services would be improved, and there would be no uneven impacts, such as the uneven distribution of benefits.
	10	Local conflicts of interest	D	D	Logistics of the port services would be improved, and there would be no conflicts of interest.
	11	Heritage	D	D	In the Project area, there are no heritage or cultural sites that must be preserved.
	12	Landscape	D	D	Land reclamation is included in the Project. However, the construction will occur within the existing port area, and therefore, there would be no significant impacts on the landscape.
	13	Gender	D	B+	Since the purpose of the Project is to improve the logistics of port services, there would be no negative impacts on gender. Due to these improvements, women may receive income from increased, small-scale business opportunities, such as operating shops near the ports.

	No.	Item	Planning/construction	Operation	Expected impacts
	14	Children's rights	D	D	Since the purpose of the Project is to improve the logistics of port services, there would be no negative impacts on children's rights, such as disrupted access to local schools. According to Djiboutian law, it is illegal to hire laborers under the age of 16[8].
	15	Infectious disease (HIV/AIDS, etc.)	D	D	Construction phase: Laborers for the Project will be primarily be locals. There would be a limited influx of laborers from outside of the local community, as the Project does not include camps or living facilities for laborers. Therefore, there would be no impact by the risk of infectious disease and epidemics due to the mass influx of laborers.
	16	Labor environment	B-	D	Construction phase: There is a need to ensure the health and safety of the labor environment.
Natural environment	17	Protected areas	D	D	There are no protected areas in the Project area.
	18	Ecosystem	B-	B-	【Port of Djibouti】There are mangroves 1.4 km east of the Djibouti port, but the Project would not have impacts on these communities due to sufficient distance. Dredging and land reclamation may have negative impacts on surrounding ecosystems. 【Port of Tadjourah】There is a high coral coverage area in the Tadjourah port, so they maybe be impacted by the construction and operation of the Project.
	19	Hydrology	B-	D	Construction phase: The Project requires dredging and land reclamation, so there is a possibility that the hydrology of the surrounding area will change.
	20	Geological features	B-	D	Planning phase: The Project requires dredging and land reclamation, so there may be local impacts on geological features.
Pollution control	21	Air pollution	B-	D	Temporary air pollution is expected, such as dust from earthworks during the planning phase and emissions from heavy machinery during the construction phase.
	22	Water pollution	B-	B-	Construction phase: Temporary water pollution is expected, such as silt dispersion due to dredging and landfilling. Operation phase: Water pollution is possible, from sources such as the dumping of effluent and oil from ships.
	23	Soil pollution	D	D	No soil pollutants would be used in the Project.
	24	Waste	B-	B-	Construction phase: Impacts due to waste may occur due to the generation of waste such as scrap construction materials and soil from dredging. Operation phase: It is expected that waste that is dumped from ships entering the port would increase, as the number of ships is expected to increase.
	25	Noise and vibration	B-	D	Construction phase: Temporary noise and vibration is expected from the operation of heavy machinery. Operation phase: Compared to the level of noise and vibration before the operation of the new facilities, there would be no increase after operation has begun; the Project would have no significant impact on noise or vibration.
	26	Ground subsidence	D	D	There would be no impact on ground subsidence.
	27	Odor	D	D	There would be no odors generated by the port facilities to be constructed by the Project.
	28	Bottom sediment	B-	D	There is a possibility of silt dispersion due to dredging.
Others	29	Accidents	B-	B-	Construction phase: Accidents are expected during construction activities and the operation of construction vehicles. Operation phase: Ship accidents are possible.

[8] In Djibouti, child labor has been observed in the sectors of agriculture (e.g., raising livestock) and shoe-cleaning services at restaurants or on the street. There are no reports of children working as port laborers (Source: Findings on the worst forms of child labor in Djibouti (2017), United States Department of Labor). Additionally, stakeholder consultation confirmed that laborers working as porters and other positions were not under the age of 16.

	No.	Item	Planning/construction	Operation	Expected impacts
	30	Transboundary impacts and climate change	D	D	The Project site is geographically limited, so there would be no transboundary impacts or impacts to climate change.

Legend:
A＋/－：A large impact is expected.
B＋/－：Some impact is expected.
C＋/－：Impact is unknown and will be determined upon further study.
D：Almost no impact is expected.

Source: Study team

(6) TOR for Environmental and Social Considerations Study

Based on the above scoping results, the TOR for EIA study was determined as shown in Table 2.2-30.

Table 2.2-30 TOR for Environmental and Social Considerations Study (Djibouti Port, Tadjourah Port)

No.	Item	Evaluation	Study Item	Methods
4	Economic activities, living and livelihood	Pre-construction phase B± Construction phase B±	• Households to be impacted by the Project • Land use and social economic activities in the Project site • Benefits to local communities	• Stakeholder consultation; site visit • Review of published documents and statistics
16	Occupational health hazards	Construction Phase B-	• Labor safety measures	• Review of existing documents and data (relevant labor regulations, health and safety policy, etc.)
18	Ecosystem	Construction Phase B- Operation Phase B-	• Situation of the site in and around the proposed project site	• Site visit • Review of existing documents and data
19	Hydrology	Construction Phase B-	• Methods/ impacts of dredging and reclamation	• Review of existing documents and data (design, methods, etc.) • Site visit
20	Geological Features			
21	Air Pollution	Construction Phase B-	• Environmental standards (ambient air) • Operation of heavy machineries	• Review of existing documents and data (relevant labor regulations, health and safety policy, etc.)
22	Water Pollution	Construction Phase B- Operation Phase B-	• Environmental standards (water quality) • Methods/ impacts of dredging and reclamation	• Review of existing documents and data (design, methods, local laws etc.) • Site visit
24	Waste	Construction Phase B-	• Disposal of construction waste and dredged soil etc.	• Review of existing documents and data (relevant agreement, health and safety policy etc.)
25	Noise/ Vibration	Construction Phase B-	• Environmental standards (noise) • Situation of the site in and around the proposed project site	• Review of existing documents and data (local laws etc.) • Site visit (confirmation of sensitive receptors etc.)
28	Bottom sediment	Construction Phase B- Operation Phase B-	• Situation of the site in and around the proposed project site	• Review of existing documents and data (relevant agreement, health and safety policy, examples, etc.) • Site visit
30	Accidents	Construction Phase B- Operation Phase B-	• Situation of the site in and around the proposed project site • Accident prevention measure during construction phase	• Review of existing documents and data (relevant labor regulations, health and safety policy, etc.) • Stakeholder meetings including Maritime Bureau

Source: Study Team

(7) Results of Environmental and Social Consideration Study

The results of the Study based on the above TOR are summarized in Table 2.2-31.

Table 2.2-31 Results of Environmental and Social Consideration Study (Djibouti Port, Tadjourah Port)

No.	Item	Results
4	Economic activities, living and livelihood	• Construction will improve existing port facilities, and there are no important fishing areas in the Project area. During the stakeholder consultation, fisher folk did not express any worries concerning impacts of the Project, such as decreased income. Therefore, no impact on fishery is expected due to construction or increased marine traffic. • On the other hand, employment is expected during the construction phase of the Project; locals will be hired as laborers, and the influx of laborers will benefit the economic activities in the area. During operation, local industries will benefit socially and economically from the improved port facilities and distribution services.
16	Occupational health hazards	• Absence of proper measures may give rise to accidents and poor labor environment during the construction phase.
18	Ecosystem	【Djibouti port】 • The mangroves are located 1.4 km east of the Port of Djibouti; however, there is sufficient distance from the project site, and no significant impacts are expected. Since there are no critical habitats and the project is a rehabilitation work within the existing port, no significant impacts on ecosystem are predicted during the construction and operation. 【Tadjoura port】 • According to the results of the study, it was confirmed that there is a high coverage (over 50%) of hermatypic coral, primarily hard coral, in the area, especially in the southern area of the proposed project site. • 40 species of coral were confirmed in the area. Of these species, one (1) is classified as VU (Vulnerable) and 11 as NT (Near Threatened) under IUCN Red List. These species are not considered endemic, because they can be found not only in Djibouti, but also in areas all around the world. Hence, the project site is not considered as critical habitat as defined in the JICA guidelines for environmental and social considerations. • In this project dredging is planned in Tadjourah Port (Dredged amount: 9,827m^3、 Required period: 12 days), which will cause loss of some portion of coral within the port. However, the project is a rehabilitation work of the existing port and a newly developed area is approximately 1.3 ha for land reclamation, dredging, jetty and breakwater, of which approximately 0.2ha is the area with a high coverage of coral. Coral habitat in the entire Djibouti region is 40,000ha[9], and the area impacted by this Project is limited. • The above-mentioned species classified as VU under IUCN Red List is also distributed all over Djibouti (Figure 1.3-8); hence, it is not considered as rare species in Djibouti. • Environmental considerations are planned for this project, including installation of a silt screen, and changing the location of breakwater in order to avoid the area with a high coverage of coral. By conducting these mitigation measures, the negative impact during the construction will be limited. • The area around Tadjourah port has been already developed, and impacts on ecosystem during the operation phase will be also limited. 【Djibouti port and Tadjoura port】 • Djibouti port and Tadjourah port are both located in the Gulf of Tadjourah. The vessels concerned with this Project do not include those coming from outside of the gulf, so there would be no significant impact due to ballast water.
19	Hydrology	【Djibouti port】 • No significant impact on hydrology and geological features is predicted, because the project is a rehabilitation work within the existing port, and the project area is also limited.

[9] Source: National Monograph of the Biological Diversity of Djibouti (2000), Ministry of Housing, Urban Planning and Environment

No.	Item	Results
20	Geological Features	【Tadjourah port】 • The project will require the development of approximately 1.3 ha for land reclamation, dredging, jetty and breakwater. No significant impact on hydrology and geological features is predicted, because the project is a rehabilitation work within the existing port, and the project area is also limited.
21	Air Pollution	• Due to the operation of heavy machineries during the construction work, temporary impacts on air pollution are expected. However, these impacts may be mitigated largely by general measures that are required to be carried out by the contractor.
22	Water Pollution	• The project requires dredging and land reclamation etc. (total construction period: 14.5 months). During the construction, silt will be dispersed, which may cause temporary deterioration of water quality. • During the operation, if the disposal of wastewater and oil is not properly done, water quality may be deteriorated. • Djibouti port and Tadjourah port are both located in the Gulf of Tadjourah. The vessels concerned with this Project do not include those coming from outside of the gulf, so there would be no significant impact due to ballast water.
24	Waste	• The project requires dredging and reclamation etc. The amount of dredged soil is 64,259m^3 for Djibouti port and 9,827m^3 for Tadjourah port. The required period for dredging is 67 days for Djibouti port and 12 days for Tadjourah port. Grab dredgers will be used, and the dredged soil will be transported by barges and tugboats. The final disposal point of dredged soil is at deeper than -20mCD, where there is water flowing to the sea floor. Therefore, the impact of dredged soil to the surrounding environment would not be significant. Note that the location of the disposal site has not been determined yet, but the current plan is to select a disposal site used previously. • Djibouti has ratified MARPOL Convention, and the waste generated by the project will be disposed in accordance with MARPOL Convention. Under Djiboutian environmental law, it is necessary to implement measures to prevent pollution to the marine environment from hazardous substances. For example, it is prohibited to transport hazardous substances that violate conventions signed by Djibouti. The DMA and the Ministry of Housing, Urban Planning and Environment will monitor marine pollution, including monitoring of the Project. For this Project, the DMA and the Ministry of Housing, Urban Planning and Environment will cooperate to follow the relevant conventions and legislation, as well as implementing mitigation measures and monitoring.
25	Noise/ Vibration	• Temporary impacts are expected due to the operation of heavy machineries during the construction.
28	Bottom sediment	• Since the bottom sediment is formed by sand and bedrock etc. the dredging work may cause silt dispersion.
30	Accidents	• Construction work has risks of accidents. • During the operation, accidents on ships may happen.

Source: Study Team

(8) Impact Evaluation

Based on the above study results, the impacts of the project are evaluated and compared to the evaluations at the time of scoping as shown in Table 2.2-32.

Table 2.2-32 Impact Evaluation (Djibouti Port, Tadjourah Port)

	No.	Item	Evaluation at Scoping		Evaluation Based on Results (*1)		Reason for Evaluation
			Construction Phase	Operation Phase	Construction Phase	Operation Phase	
Social environ	1	Involuntary Resettlement	D	D	N/A	N/A	
	2	Poverty	D	D	N/A	N/A	
	3	Indigenous/Minorities	D	D	N/A	N/A	

	No.	Item	Evaluation at Scoping		Evaluation Based on Results (*1)		Reason for Evaluation
			Construction Phase	Operation Phase	Construction Phase	Operation Phase	
	4	Economic activities, living and livelihood	B±	B±	B+	A+	There will be no impacts on fishery during construction and operation. The construction and operation of the port will positively impact the local economy etc.
	5	Land Use and Utilization of local resources	D	D	N/A	N/A	
	6	Water Use and Water Right	D	D	N/A	N/A	
	7	Existing social infrastructure and services	D	A+	N/A	A+	During operation, vessels that can operate during Khamsin season will be in operation, thereby improving distribution services. Through the installation of breakwaters at Tadjourah port, calmness will be guaranteed during Khamsin season, improving the functionality of the port.
	8	Social institutions such as social infrastructure and local decision-making institutions	D	D	N/A	N/A	
	9	Misdistribution of benefits & damages	D	D	N/A	N/A	
	10	Local conflicts of interest	D	D	N/A	N/A	
	11	Heritage	D	D	N/A	N/A	
	12	Landscape	D	D	N/A	N/A	
	13	Gender	D	B+	N/A	B+	With the improved logistics of port services, women may receive income from increased, small-scale business opportunities, such as operating shops near the port.
	14	Children's right	D	D	N/A	N/A	
	15	Infectious Disease (HIV/AIDS, etc.)	D	D	N/A	N/A	
	16	Occupational health hazards	B-	D	B-	N/A	The impact is only caused during construction phase and can be mitigated with general measures.
ロ	17	Protected Areas	D	D	N/A	N/A	

	No.	Item	Evaluation at Scoping		Evaluation Based on Results (*1)		Reason for Evaluation
			Construction Phase	Operation Phase	Construction Phase	Operation Phase	
	18	Ecosystem	B-	B-	B-	B-	【Djibouti port】 The impact on ecosystem during the construction can be mitigated. Since the surrounding area has been developed, impacts during the operation is also limited. 【Tadjourah port】 Coral was identified in Tadjourah port; however, The impact on ecosystem during the construction can be avoided by mitigation measures. Since the surrounding area has been developed, impacts during the operation is also limited.
	19	Hydrology	B-	D	D	N/A	No significant negative impacts on hydrology are predicted, because the project is a rehabilitation work within the existing port and the development area is limited.
	20	Geological Features	B-	D	D	N/A	No significant negative impacts on geological features are predicted, because the project is a rehabilitation work within the existing port and the development area is limited.
Pollution control	21	Air Pollution	B-	D	B-	N/A	The impact is only during construction phase and the affected area is limited Hence, the impacts can be mitigated with general measures.
	22	Water Pollution	B-	B-	B-	B-	The impacts are expected during construction and operation phase; however, those impacts can be mitigated with general measures.
	23	Soil Pollution	D	D	N/A	N/A	
	24	Waste	B-	B-	B-	B-	The impacts are expected during construction and operation phase; however, since the affected area is limited, those impacts can be mitigated with general measures.

	No.	Item	Evaluation at Scoping		Evaluation Based on Results (*1)		Reason for Evaluation
			Construction Phase	Operation Phase	Construction Phase	Operation Phase	
	25	Noise/Vibration	B-	D	B-	D	The impact is expected during construction phase; however, those impacts can be mitigated with general measures.
	26	Ground subsidence	D	D	N/A	N/A	
	27	Odor	D	D	N/A	N/A	
	28	Bottom sediment	B-	D	B-	N/A	The impact is only expected during construction phase; however, those impacts can be mitigated with general measures.
Others	29	Accidents	B-	B-	B-	B-	The impacts are expected during construction and operation phase; however, those impacts can be mitigated with general measures.
	30	Global warming	D	D	N/A	N/A	

(*1) For the items evaluated as “D” at Scoping, “N/A” was applied in the Impact Evaluation.

Source: Study team

(9) Mitigation Measures

Mitigation measures towards the items with adverse impacts are summarized in Table 2.2-33.

Table 2.2-33 Environmental management plan (Djibouti port, Tadjourah port)

No.	Item	Impact	Mitigation Measures	Implementation/Responsible Body	Cost
	Construction Phase				
16	Occupational health hazards	Health and safety of port construction workers	• Based on laboring laws, providing protective gear to workers, ensuring them to wear them and providing safe working environment. • Conducting safety management to avoid or minimize the risk of accidents • Ensuring that construction site will be fenced, lighted and guarded by security guards to prevent intruders and theft	DMA/ Contractor	Included in construction cost
18	Ecosystem	Loss or deterioration of coral during the construction	• Installing silt screen in consideration of current direction, in order to avoid silt dispersion during construction • Minimizing and properly disposing construction waste • Treating waste from ship (wastewater and waste oil etc.) properly in accordance with the MARPOL Convention.	DMA/ Contractor	Included in construction cost
21	Air Pollution	Air pollution caused by operation of heavy machineries	• Conducting inspection of vehicles • Sprinkling water at the site to avoid dust • Controlling vehicle speed in unpaved roads • Installing the cover of trucks for construction works	DMA/ Contractor	Included in construction cost
22	Water Pollution	Water quality deterioration caused by dredging, reclamation work, disposal of wastewater and oil etc.	• Installing silt screen. • Set threshold of turbidity levels to determine when construction should be stopped[10].	DMA/ Contractor	Included in construction cost
24	Waste	Waste including dredged soil and construction waste	• Selecting final disposal points of dredged soil for the location with a depth of -20mCD, where there is a flow in a seabed layer. • Reusing construction waste and handling over unusable materials to licensed waste management companies. • Treating waste from ship (wastewater and waste oil etc.) properly in accordance with the MARPOL Convention.	DMA/ Contractor	Included in construction cost
28	Bottom sediment				
25	Noise/ Vibration	Noise during construction	• Controlling operation time (7a.m.-5p.m.) to reduce impact by noise as much as possible. • Conducting inspection of vehicles	DMA/ Contractor	Included in construction cost

[10] It is expected that, compared to the current turbidity of the Project site, increased turbidity level due to construction would not exceed suspended particulates (SS) +2 mg/L (source: JICA Final Report on Global Coral Reef Environmental Consideration Handbook (2016)).

No.	Item	Impact	Mitigation Measures	Implementation/Responsible Body	Cost
30	Accidents	Accidents involving workers and residents	• Conducting safety management to avoid or minimize the risk of accidents • Ensuring that construction site (especially the storage site) will be fenced, lighted and guarded by security guards to prevent intruders and theft	DMA/ Contractor	Included in construction cost
	Operation Phase				
18	Ecosystem	Loss or deterioration of coral during the operation	• Treating waste from ship (wastewater and waste oil etc.) properly in accordance with the MARPOL Convention[11]. • Install oily water separators on vessels, and select equipment that can be used with engines complying with international air pollution prevention (IMO Tier II standards).	DMA	N/A
22	Water Pollution	Water quality deterioration caused by wastewater and waste oil etc. from ships	• Treating waste from ship (wastewater and waste oil etc.) properly in accordance with the MARPOL Convention. • Install oily water separators on vessels.	DMA	N/A
24	Waste	Wastewater and waste oil etc. generated from ships	• Treating waste from ship (wastewater and waste oil etc.) properly in accordance with the MARPOL Convention. • Install oily water separators on vessels.	DMA	N/A
28	Bottom sediment				
30	Accidents	Accidents by ships etc.	• Setting restriction area to inform users of surrounding sea areas • Restricting ship speed • Securing safety in accordance with international agreements etc. to ensure the safety of human life	DMA	N/A

Source: Study team

(10) Environmental Monitoring Plan

Monitoring plan for each item is described in Table 2.2-34.

Table 2.2-34 Monitoring Plan

	Monitoring items	Monitoring methods	Monitoring location	Frequency	Implementation body	Responsible body	Cost
	Construction Phase						
16	Occupational health hazards (trainings of health and safety, provision of protective gears etc.)	Training records, Visual observation, Conducting interview with contractors and workers	Construction site	Daily	Contractor	DMA	Included in construction cost

[11] According to MARPOL Annex 1, the oil content of the effluent without dilution must not exceed 15 ppm.

	Monitoring items	Monitoring methods	Monitoring location	Frequency	Implementation body	Responsible body	Cost
18	Ecosystem (loss of coral) (*1)	Monitoring of aquatic species including coral, Conducting interview with government agencies and relevant experts	Tadjourah Port (the same areas as the baseline study)	3 times (Before/ During/ After the construction)	Contractor	DMA	Included in construction cost
21	Air Pollution (dust etc.)	Conducting interview with surrounding communities, Record of grievance, Checking contractors' monthly reports (results of vehicle inspection)	Project affected communities, construction site	Once per two months for interview, Once a month for check of grievance records and monthly reports	Contractor	DMA	Included in construction cost
22	Water pollution (turbidity etc.)	Water quality monitoring, Visual observation (turbidity)	Construction site (the same location as the baseline study)	3 times (Before/ During/ After the construction) for monitoring, Daily for visual observation	Contractor	DMA	Included in construction cost
24	Waste (dredged soil etc.)	Checking record of waste including dredged soil, (type, amount (quantity and volume), disposal location and conditions), Visual observation	Construction site	Once per two weeks	Contractor	DMA	Included in construction cost
28	Bottom sediment						
25	Noise/ Vibration	Measurement of noise level	Construction site, sensitive receptors (the same locations as the baseline study)	Once a week	Contractor	DMA	Included in construction cost
30	Accidents (safety management, provision of safety gears, trainings, traffic conditions etc.)	Visual observation, Conducting interview with contractors, workers and surrounding communities etc.	Construction site, project affected communities	Once a week	Contractor	DMA	Included in construction cost
	Operation Phase						
18	Ecosystem (loss of coral) (*1)	Monitoring of aquatic species including coral, Conducting interview with government agencies and relevant experts	Tadjourah Port (the same areas as the baseline study)	Once/ year (Within 2 years after completion of construction), Once (5 years after the construction)	DMA	DMA	30,000 USD/time
22	Water pollution	Water quality monitoring, Visual observation (turbidity)	The same locations as the baseline study	Once/ year	DMA	DMA	20,000 USD/time
24	Waste (dredged soil)	Checking record of waste including dredged soil, (type, amount (quantity and volume), disposal location and conditions), Visual observation	Project site	Once/ year	DMA	DMA	N/A
28	Bottom sediment						

	Monitoring items	Monitoring methods	Monitoring location	Frequency	Implementation body	Responsible body	Cost
30	Accidents (accidents by ships etc.)	Visual observation, Interview with facility managers	Project site	Every day (visual observation), Quarterly (interview)	DMA	DMA	N/A

Source: Study team

(*1) The outline of coral survey to be conducted during the construction and operation is described in the Table below:

Table 2.2-35 Outlie of coral survey

Location	Items	Survey contents
Tadjourah port	Survey area	The same area as the baseline survey (Figure 1.3-6)
	Frequency	(ア) During construction: 3 times (Before/ During/ After the construction) (total construction period is supposed to be 14.5 months) (イ) During operation: Once per year (Within 2 years after completion of construction), Once (5 years after the construction)[12]
	Purpose	To confirm if the conditions of coral are at the same level as those before the construction, and to check the impacts by turbidity of construction activities etc. In monitoring during the operation, to confirm the conditions of coral and to check the coral implantation in the breakwater.
	Methods/ Contents	i) Belt transect method: to confirm coral coverage, conditions of coral bleaching, silt accumulation (200m line with width of 1m (0.5m from the centerline), the distance between each line is 10m.) ii) Quadrat method: to confirm the survival conditions of rare species by installing quadrat (50cm x 50cm) and identifying species with photographs iii) Interview with governmental officers and experts: to confirm the conditions of coral, checking any other impacts on coral bleaching etc., in addition to the impacts caused by construction activities

Source: Study team

(11) Stakeholder Meetings

Stakeholder meetings were conducted in Djibouti port on 10 July 2018 and in Tadjourah port on 3 and 12 July 2018. During the meeting, environmental and social considerations for this project were discussed. The main comments and concerns raised by the stakeholder meetings are shown in Table 2.2-36. No opposition against the project was raised during the meetings. Based on those comments and concerns, mitigations measures and monitoring plan were developed.

In addition, in accordance with the local laws, stakeholder meetings are planned in the course of EIA to be conducted under the responsibility of Djiboutian government, and opinions raised from stakeholders will be incorporated in the project.

[12] In order to confirm the conditions of coral after the construction, the monitoring of coral will be conducted once per year (noting that the impact during the operation is limited). In the Manual of Rehabilitation of Coral Communities by Using Coral Implantation Equipment IV (2010, Ministry of Environment, Japan), the recovery period of coral is set as 5 years. Hence, coral survey is planned 5 years after the construction in order to confirm the conditions of coral implantation.

Table 2.2-36 Main Comments and Concerns Raised during the Stakeholder Meetings

Djibouti/ Tadjourah	Participants	Main comments and concerns etc.	Answers to the comments and concerns etc./ Feedback in the planning
Djibouti port	DMA, porters working at the ferry terminal	・There is a big expectation that this project will increase the work of porters and contribute to stable income ・DMA plans to actively support the establishment of a porter organization in Djibouti port, in order to protect the rights of labor. ・There is a risk of minor collision with vehicles and persons walking around the project site.	・It is expected that local employment opportunities during the construction and benefits on local surrounding economy will be enhanced through the project. ・The project will pay considerations on safety management during the construction, and intend to prevent and reduce the risks of accidents on labor and communities.
Tadjourah port	Tadjourah provincial governor, representative of local communities, representative of fishermen, representative of business entities etc.	・It is necessary to consider odor and noise etc. ・Preservation of coral should be considered. ・Waste should be managed properly. There are many wastes disposed by ships. There is no waste management plan established so far in Tadjourah. ・The study should be conducted by hiring experts who are familiar with the local conditions.	・No impacts on odor are predicted by the project; however, the considerations on noise will be given such as construction methods and operation time of heavy machinery etc. ・Considerations on coral will be examined. ・DMA will manage and control to prevent illegal waste disposal from vessels. ・The project will hire local consultants who are familiar with the local conditions.

In addition to the above stakeholder meetings, the interviews with coral reef experts were conducted as shown in Table 2.2-37. Based on the interview results, mitigation measures etc. were examined.

Table 2.2-37 Results of Interviews with Coral Reef Experts

	Results of interviews	
	Interview with an coral reef expert (engineering field)	Interview with an coral reef expert (biological field)
Interview date	22 February 2019	25 March 2019
Species of coral and the impacts	・Due to the construction of breakwater, coral habitat is likely to be expanded. Therefore, it seems that the impacts during the operation will not be so serious. ・Rocks used as embankment materials of breakwater are suitable for coral habitat. Since the porosity is high, it is good place for the habitat of aquatic species. In the case of vertical revetments, coral can be colonized. ・There are many cases of expanding coral habitat due to revetment construction.	・Regarding coral species found in Tadjourah Port, it is considered that there are no rare and valuable species. ・It is noted that those species in Tadjourah port, categorized as VU and NT under IUCN Red List, are relatively strong in environmental stress such as turbidity. ・Most of the VU and NT species found in Tadjourah port are common species distributed all over the world. It seems that those species identified as threatened in the coral survey were categorized as threatened on the premise of environmental change on a global scale, not on a local specific context. ・In general coral and other aquatic species will increase around the breakwater after its construction.

Considerations for construction (breakwater etc.), environmental conservation measures	・ It is recommend to install silt fence during the construction. ・ Construction can be done by conducting mitigation measures such as setting rules of construction materials, restricting the construction period, conducting monitoring and setting criteria of construction cancellation.	・ The original idea (Alternative 2 in Table 1.3-14) will be preferable In consideration of breakwater effects. ・ Construction of breakwater may affect water flow from the west. Installation of water pipes in the breakwater can be a solution; however, more dredging may be required, because it could produce wave and sedimentation inside the breakwater.

(12) Draft Monitoring Form

Draft monitoring forms for environmental management are shown below.

I. Environmental permit

Monitoring Item	Monitoring results		
Environmental permit	☐Obtained ☐Not obtained	Application Date: YYYY/MM/DD	Obtained Date: YYYY/MM/DD

II. Construction Phase

2.1 Response /Action to comments and guidance from government authorities and public

Monitoring Item	Monitoring Results
Number of comments made by the public and government agencies	
Contents of comments made by the public and government agencies	
Actions to be taken	

2.2 Occupational health hazards/ Accidents

Monitoring Item	Monitoring Results
No. of workers provided with occupational health trainings	
No. of workers provided with protective clothing & equipment:	
Accident records (if any)	

2.3 Ecosystem

Monitoring Item	Monitoring Results
Aquatic flora and fauna including coral	Date / Time:
	Type of Species observed:
	The result of observation:
	Required Action:

2.4 Air quality (Dust)

Monitoring Item	Monitoring Results
Results of vehicle inspection	
Interview results with surrounding communities	

2.5 Water quality

Measurement period		Any issue observed (Yes/No) If yes, please describe the outline of planned mitigation measures.
Measurement method		
Measurement points	Please attach map if necessary	

Parameter[*1]	Unit	Measured Value			Baseline data (*1)	National Standards (*2)	Referred Standards (*3)
		Point 1	Point 2	Point 3			
Djibouti port							
Water temperature	°C				25	N/A	-
pH	-				7.42-8.29		7.0-8.3
COD	mg/l				60-90		<8mg/L

Parameter[*1]	Unit	Measured Value			Baseline data (*1)	National Standards (*2)	Referred Standards (*3)
		Point 1	Point 2	Point 3			
DO	mg/l				7.0-8.0		>2mg/L
Salinity/ Conductivity	μS/cm				53.8-55.2		-
SS/ turbidity	FNU				0.43-0.65		-
Tadjourah port							
Water temperature	°C				25	N/A	-
pH	-				8.23-8.41		7.0-8.3
COD	mg/l				50-70		<8mg/L
DO	mg/l				8.2-9.0		>2mg/L
Salinity/ Conductivity	μS/cm				56.5-56.7		-
SS/ turbidity	FNU				0.12-0.49		-

(*1) Baseline results conducted in October 2018.
(*2) No local standards on water quality in Djibouti
(*3) Environmental Standards in Japan (Sea water quality (category C: environmental conservation))

2.6 Waste (including dredged soil)

Monitoring Item	Monitoring Results
Waste type	
Waste amount/volume	
Disposal location and conditions	

2.7 Noise

Measurement period		Any issue observed (Yes/No) If yes, please describe the outline of planned mitigation measures.
Measurement method		
Measurement points	Please attach map if necessary	

Monitoring Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Baseline data (*1)	Country's Standards (*2)	Referred International Standards (*3)
Noise Level Leq						
Djibouti port (1)	dB(A)			44.6-51.1	N/A	55 or maximum increase in background levels of 3dB
Tadjourah port (1)				53.8-59.9		
Tadjourah port (2)				48.8-58.8		

(*1) Baseline results conducted in November 2018. The measured values should be within a maximum increase in background level of 3dB, as defined in IFC EHS Guidelines, General EHS Guidelines.
(*2) No local standards on noise in Djibouti
(*3) IFC EHS Guidelines, General EHS Guidelines (Daytime (07:00-22:00))

III. Operation Phase

3.1 Response /Action to comments and guidance from government authorities and public

Monitoring Item	Monitoring Results
Number of comments made by the public and government agencies	
Contents of comments made by the public and government	

agencies	
Actions to be taken	

3.2 Accidents

Monitoring Item	Monitoring Results
Accident records (if any)	

3.3 Ecosystem

Monitoring Item	Monitoring Results
Aquatic flora and fauna including coral	Date / Time:
	Type of Species observed:
	The result of observation:
	Required Action:

3.4 Water quality

Measurement period		Any issue observed (Yes/No) If yes, please describe the outline of planned mitigation measures.
Measurement method		
Measurement points	Please attach map if necessary	

Parameter[*1]	Unit	Measured Value			Baseline data (*1)	National Standards (*2)	Referred Standards (*3)
		Point 1	Point 2	Point 3			
Djibouti port							
Water temperature	°C				25	N/A	-
pH	-				7.42-8.29		7.0-8.3
COD	mg/l				60-90		<8mg/L
DO	mg/l				7.0-8.0		>2mg/L
Salinity/ Conductivity	µS/cm				53.8-55.2		-
SS/ turbidity	FNU				0.43-0.65		-
Tadjourah port							
Water temperature	°C				25	N/A	-
pH	-				8.23-8.41		7.0-8.3
COD	mg/l				50-70		<8mg/L
DO	mg/l				8.2-9.0		>2mg/L
Salinity/ Conductivity	µS/cm				56.5-56.7		-
SS/ turbidity	FNU				0.12-0.49		-

(*1) Baseline results conducted in October 2018.
(*2) No local standards on water quality in Djibouti
(*3) Environmental Standards in Japan (Sea water quality (category C: environmental conservation))

3.5 Waste (including dredged soil)

Monitoring Item	Monitoring Results
Waste type	
Waste amount/volume	
Disposal location and conditions	

(13) Environmental Checklist

Table 2.2-38 below is an environmental checklist of the project based on the JICA Guidelines for Environmental and Social Considerations (2010).

Table 2.2-38 Environmental checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1. Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) N (b) N (c) N (d) N/A	(a)-(b) EIA report is planned to be submitted to MHUPE and approved by MHUPE under the responsibility of Djiboutian government. (c) The conditions will be general issues such as regular reporting to MHUPE, so will be satisfied by DMA. (d) No additional approval is required.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(c) Y (d) Y	(a) Stakeholder meetings were conducted in Djibouti on 10 July 2018, and in Tadjourah on 3 and 12 July 2018. During the meetings, the project outlines were explained, and their concerns on environmental and social considerations were discussed. No opposition against the project was raised. In the local law, the public consultations are required at the EIA scoping and draft report stage. In the course of EIA, stakeholder meetings will be conducted in line with JICA guidelines and local laws/ regulations. (b) Main comments raised during meetings were reflected on the project design.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Regarding port facilities in Djibouti port and a breakwater in Tadjourah port, alternative plans, including no-project option, were examined from the viewpoints of benefits to the public, impacts on natural, social and economic aspects.
2 Pollution Control	(1) Air Quality	(a) Do air pollutants, such as sulfur oxides (SOx), nitrogen oxides (NOx), and soot and dust emitted from ships, vehicles and project equipment comply with the country's emission standards? Are any mitigating measures taken?	(a) Y	(a) Due to the operation of heavy machineries during the construction work, temporary impacts on air pollution are expected. Exhaust gas from construction vehicles etc. will be largely mitigated by safety management measures obliged for the contractor. Engines complying with international air pollution prevention (IMO Tier II standards) will be installed. There are no local emission standards in Djibouti.
	(2) Water Quality	(a) Do effluents from the project facilities comply with the country's effluent and environmental standards? (b) Do effluents from the ships and other project equipment comply with the country's effluent and environmental standards?	(a) N/A (b) Y (c) Y (d) N (e) N/A	(a) This project is to develop port facilities (land reclamation for a terminal, construction of revetment, berthing facilities, breakwater). Hence, no effluents form these facilities are predicted. (b) In case disposal of wastewater from ships is not done properly during the operation, water quality may be deteriorated. However, since the

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(c) Does the project prepare any measures to prevent leakages of oils and toxicants? (d) Does the project cause any alterations in coastal lines and disappearance/appearance of surface water to change water temperature or quality by decrease of water exchange or changes in flow regimes? (e) Does the project prepare any measures to prevent polluting surface, sea or underground water by the penetration from reclaimed lands?		wastewater from ships will be disposed properly in line with MARPOL Convention, no significant impacts on water quality are expected. There are no local effluent standards. (c) Waste generated by ships will be properly disposed in accordance with MARPOL Convention (Oily water separators will be installed on vessels). (d) 【Djibouti port】The project is located within the existing port, and the affected area is geographically limited. Hence, no significant impacts on geology and flow regimes were predicted. 【Tadjourah port】A newly developed area is approximately 1.3 ha for land reclamation, dredging, jetty and breakwater. However, the development is done within the existing port, and the impact is considered to be localized. Hence, no significant impacts on geology and flow regimes are predicted. (e) The soil for land reclamation is not contaminated, and no contamination by the penetration from reclaimed lands is predicted.
	(3) Wastes	(a) Are wastes generated from the ships and other project facilities properly treated and disposed of in accordance with the country's regulations? (b) Is offshore dumping of dredged soil properly disposed in accordance with the country's regulations? (c) Does the project prepare any measures to avoid dumping or discharge toxicants?	(a) Y (b) Y (c) Y	(a) Djibouti has ratified MARPOL Convention, and the waste generated by the project will be disposed in accordance with MARPOL Convention. (b) The project requires dredging. The amount of dredged soil is 76,000m^3 for Djibouti port and 12,000m^3 for Tadjourah port. The required period for dredging is 67 days for Djibouti port and 12 days for Tadjourah port. There are no local standards on disposal of dredged soil; however, final disposal points of dredged soil will be the location with a depth of -20mCD, where there is a flow in a seabed layer, so that no negative impacts on the surrounding sea area will be caused. (Note that the location of the disposal site has not been determined yet, but the current plan is to select a disposal site used previously.) (c) Since Djiboutian government ratified MARPOL Convention, any hazardous waste generated by the project will be treated and disposed in accordance with MARPOL Convention (Oily water separators will be installed on vessels).
	(4) Noise and Vibration	(a) Do noise and vibrations from the vehicle and train traffic comply with the country's standards?	(a) Y	(a) Temporal increase of noise and vibration is predicted due to the operation of heavy machineries during the construction. However, since considerations for operational hour etc. will be taken, no significant impacts will be caused by noise and vibration.
	(5)	(a) In the case of extraction of a large volume of	(a) N/A	(a) This project does not require a large volume groundwater.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	Subsidence	groundwater, is there a possibility that the extraction of groundwater will cause subsidence?		
	(6) Odor	(a) Are there any odor sources? Are adequate odor control measures taken?	(a) N	(a) No odor source is predicted from the facilities constructed by the project.
	(7) Sediment	(a) Are adequate measures taken to prevent contamination of sediments by discharges or dumping of hazardous materials from the ships and related facilities?	(a) Y	(a) Since Djiboutian government ratified MARPOL Convention, any hazardous waste generated by the project will be treated and disposed in accordance with MARPOL Convention (An oily water separator will be installed on vessels).
3 Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) There is no protected area near the project site.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Is there a possibility that the project will adversely affect aquatic organisms? Are adequate measures taken to reduce negative impacts on aquatic organisms? (e) Is there a possibility that the project will adversely affect vegetation or wildlife of coastal zones? If any negative impacts are anticipated, are adequate measures taken to reduce the impacts on vegetation and wildlife?	(a) N (b) N (c) N/A (d) N (e) N	(a)-(c) 【Djibouti port】The mangroves are located 1.4 km east of the Port of Djibouti; however, there is sufficient distance from the project site, and no significant impacts are expected. Since the project is a rehabilitation work within the existing port, no significant impacts on ecosystem is predicted during the construction and operation. 【Tadjourah port】40 species of coral were confirmed in the area. Of these species, one (1) is classified as VU (Vulnerable) and 11 as NT (Near Threatened) under IUCN Red List. These species are not considered endemic, because they can be found not only in Djibouti, but also in areas all around the world. Hence, the project site is not considered as Critical habitat as defined in the JICA guidelines for environmental and social considerations. The above-mentioned species classified as VU under IUCN Red List is also distributed all over Djibouti; hence, it is not considered as rare species in Djibouti. (d) Silt screen will be installed in consideration of water flow direction, in order to avoid silt dispersion during construction. Waste from ship (wastewater and waste oil etc.) will be properly treated and disposed in accordance with the MARPOL Convention. In addition, Djibouti port and Tadjourah port are both located in the Gulf of Tadjourah. The vessels concerned with this Project do not include those coming from outside of the gulf, so there would be no significant impact due to ballast water. Hence, no significant impacts on aquatic organisms are predicted.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
				(e) The development is done within the existing port, and the impact is considered to be localized. Hence, no significant impacts on vegetation and wildlife of coastal zones are predicted.
	(3) Hydrology	(a) Do the project facilities affect adversely flow regimes, waves, tides, currents of rivers and etc if the project facilities are constructed on/by the seas?	(a) N	(b) 【Djibouti port】The project is a rehabilitation work within the existing port, and the impact is considered to be localized. Hence, no significant impacts on hydrology are predicted. 【Tadjourah port】A newly developed area is approximately 1.3 ha for land reclamation, dredging, jetty and breakwater. However, the development is done within the existing port, and the impact is considered to be localized. Hence, no significant impacts on hydrology are predicted.
	(4) Topography and Geology	(a) Does the project require any large scale changes of topographic/geographic features or cause disappearance of the natural seashore?	(a) N	(a) 【Djibouti port】The project is a rehabilitation work within the existing port, and the impact is considered to be localized. Hence, no significant impacts on topography and geology are predicted. 【Tadjourah port】A newly developed area is approximately 1.3 ha for land reclamation, dredging, jetty and breakwater. However, the development is done within the existing port, and the impact is considered to be localized. Hence, no significant impacts on topography and geology are predicted.
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Are the compensations going to be paid prior to the resettlement? (e) Are the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?	(a) N/A (b) N/A (c) N/A (d) N/A (e) N/A (f) N/A (g) N/A (h) N/A (i) N/A (j) N/A	(a)-(j) No involuntary resettlement is expected.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?		
	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (b) Is there a possibility that changes in water uses (including fisheries and recreational uses) in the surrounding areas due to project will adversely affect the livelihoods of inhabitants? (c) Is there a possibility that port and harbor facilities will adversely affect the existing water traffic and road traffic in the surrounding areas? (d) Is there a possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are considerations given to public health, if necessary?	(a) N/A (b) N/A (c) N/A (d) N/A	(a)-(j) The project area has been already developed, and no resettlement is required. Hence, the impact on living and livelihood is not predicted.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) There is no local archeological, historical, cultural, and religious heritage in and around the project site.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) The project requires land reclamation. However, the project is located within the existing ports, and no significant impacts on landscape were expected.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) N/A (b) N/A	(a)-(b) There are no ethnic minorities and indigenous people affected by the project.
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the	(a) N (b) Y (c) Y	(a) -(d) DMA observes all laws and ordinances associated with working conditions of the country, conducting necessary tangible and intangible

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(d) Y	safety measures.
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	(a) Y (b) Y (c) N	(a) Pollution control measures are planned in line with local laws and regulation. The expected impacts are dust, exhaust gas, noise, vibration and waste etc. Mitigation measures will be taken such as water spraying, cover for dust prevention, restriction of construction time. (b) 【Djibouti port】The mangroves are located 1.4 km east of the Port of Djibouti; however, there is sufficient distance from the project site, and no significant impacts are expected. Since the project is a rehabilitation work within the existing port, no significant impacts on ecosystem is predicted during the construction. 【Tadjourah port】40 species of coral were confirmed in the area. Of these species, one (1) is classified as VU (Vulnerable) and 11 as NT (Near Threatened) under IUCN Red List. Since the construction work might affect these species, mitigations measures will be taken including installation of silt screen. (c) There is a possibility of temporary increase in traffic volume due to the vehicles transporting materials etc.; however, the project is a rehabilitation work within the existing port, and the impact on the surrounding traffic is limited. Since the project area has been already developed, no significant impacts on water use or water right are expected during the construction.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) Y (c) Y (d) Y	(a)-(c) DMA is responsible to conduct monitoring for the items to be affected by the project, in line with the monitoring plan developed under this study. The monitoring framework will be described in the EIA report. (d) The monitoring results will be reported to MHUPE on a regular basis in accordance with local laws/regulations.
6 Note	Note on Using Environmental Checklist	(a) Where necessary, impacts on groundwater hydrology (groundwater level drawdown and salinization) that may be caused by alteration of topography, such as land reclamation and canal excavation should be considered, and impacts, such as land subsidence that may be caused by groundwater uses should be considered. If significant impacts are anticipated, adequate mitigation measures should be taken. (b) If necessary, the impacts to transboundary or global issues should be confirmed, if necessary (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N/A (b) N/A	(a) The project requires land reclamation. However, the project is located within the existing ports, and the affected area is considered to be limited. Hence, no significant impacts on groundwater hydrology were predicted. Groundwater use is not planned for the project. (b) Since the project is geographically limited and completed within short period, no impacts to transboundary or global issues are expected.

2.3. Other Issues

Djibouti has faced more than a decade of drought as the annual rainfall has been less than 90 mm since 2007. This is a common problem in East Africa affecting not only Djibouti but also Kenya, Ethiopia, and Somalia. Due to the influence of drought, the number of people trying to immigrate to rich Gulf countries from Ethiopia via Djibouti in recent years has been increasing. Many of the immigrants seem to be generally aimed at crossing the Obock facing the Gulf of Tadjourah on foot, then crossing to Yemen by boat before heading to their final destination.

However, many people run out of funds and end up stuck on the way. Under these circumstances, International Organization of Migration (IOM) operates refugee camps and provides other assistance in order to safely repatriate them to Ethiopia. Furthermore, due to the conflict in Somalia and the Yemen civil war which began in March 2015, the number of refugees flowing into relatively safe Djibouti has been increasing. To support these refugees, donors such as UNHCR, WFP, etc. operate refugee camps in various places such as Obock, Ali Sabieh and so on, and are providing food distribution and medical support. To facilitate their efforts, improvement of road infrastructure and maritime transport capacity for transporting goods is required in Djibouti.

(Quote from “The project for improvement of road management equipment in the Republic of Djibouti 2016 JICA”

2.4. Points to noted when implementing grant aid projects in Djibouti

Maintenance of ferry and berthing facilities

Existing ferry provided by Japan is regularly put in dry dock and inspected, but some important inspections such as engine overhaul and electrical equipment tests are not conducted. In order to ensure navigation safety and stable operations, the necessary inspections need to be performed regularly and properly. It is important to establish and maintain a maintenance system for the new ferry and berthing facilities.

In the procurement of spare parts, it is necessary to create a list of distributors in Djibouti and ensure smooth procurement.

Ensuring efficient and safe ferry operations

A sufficient management system to separate passenger and vehicle traffic at the time of boarding and ensure passengers are not able to access vehicle sections during navigation is lacking in the current ferry operation. In order to secure a safe and efficient boarding / disembarking ferry, it is necessary to improve onshore facilities such as passenger waiting rooms, onboard vehicle parking lots, and security gates, etc.

Preparation of French Operation manual

As Djibouti engineers are not proficient in English, it is necessary to prepare a French manual.

2.5. Consideration on Climate Change Countermeasures (Mitigation)

By introducing a new ferry between Djibouti Port and Tadjourah Port, the traffic volume on land and greenhouse gas emissions can be reduced. The reduction effect was calculated by the following method.

2.5.1. Comparison of "With Case" and "Without Case"

In order to examine the greenhouse gas reduction effect of the introduction of the new ferry, two cases, a "With Case" and a "Without Case" will be compared.

(1) With Case

A new ferry will be introduced for the maritime transport between Djibouti and Tadjourah, which will carry 250 passengers and 20 vehicles on a one-way voyage.

(2) Without Case

The existing ferry will continue to operate between Djibouti and Tadjourah, which carries 150 passengers and 12 vehicles on a one-way voyage.

2.5.2. Difference in Greenhouse Gas (CO2) Emissions between "With Case" and "Without Case"

Study team estimates the difference in emissions in 2022 when the new ferry service begins. It is assumed that the number of ferry services is four round trips a week, and that the ferry carries the maximum capacity of passengers and vehicles.

(1) Difference in Greenhouse Gas Emissions between New Ferry and Existing Ferry

1) Greenhouse gas emissions from the new ferry

Engine power：487 Kw × 2
Navigation time：2hours
Fuel consumption (Diesel)： 0.256 liter /Kwh
CO2 Emission factor : 2.62 kg / liter

Greenhouse gas emissions during one-way navigation
974 Kw × 0.256 liter /Kwh × 2 h × 2.62 kg/ liter = 1,307 kg
Annual greenhouse gas emissions
1,307 kg × 2 × 4 × 52 = 543.7 tons

2) Greenhouse gas emissions from the existing ferry

Engine power：367 Kw × 2

Navigation time：2.5 hours
Fuel consumption (Diesel)： 0.256 liter /Kwh
CO2 Emission factor : 2.62 kg / liter

Greenhouse gas emissions during one-way navigation
734 Kw × 0.256 liter /Kwh × 2.5 h × 2.62 kg/ liter = 1,231 kg
Annual greenhouse gas emissions
1,231 kg × 2 × 4 × 52 = 512.1 tons

Emissions with the introduction of the new ferry will increase by 31.6 tons in 2022 compared to the existing ferry.

(2) Greenhouse gas emissions due to increased land transportation

The following table shows the transportation capacity of the new ferry and exiting ferry.

	New Ferry	Exiting Ferry	difference
Passengers	250	150	100
Vehicles	20	12	8

The difference in the maritime transport capacity between Djibouti and Tadjourah shall be compensated by land transportation with vehicles.

1) Greenhouse gas emissions generated by passengers using land transportation

Number of passengers using land transport : 100 × 2 × 4 × 52 ＝ 41,600
Land transport distance : 180 km
Number of vehicle traffic : 41,600 ÷ 15 ＝ 2,773 times
Vehicle fuel consumption (gasoline)： 8 km/ liter
CO2 Emission factor : 2.32 kg / liter

Annual greenhouse gas emissions
180 km ÷ 8 km/ liter × 2,773 × 2.32 kg/ liter = 144.8 tons

2) Greenhouse gas emissions generated by land transportation of vehicles

Number of vehicles transported by land : 8 × 2 × 4 × 52 ＝ 3,328 cars
Land transport distance : 180 km
Vehicle fuel consumption (gasoline)： 12 km/ liter
CO2 Emission factor : 2.32 kg / liter

Annual greenhouse gas emissions

180 km ÷ 12 km/ liter × 3,328 × 2.32 kg/ liter = 115.8 tons

3) Total amount of greenhouse gas emissions

The following table shows the greenhouse gas emissions (unit: tons) for the “With Case” and “Without Case”. The introduction of the new ferry is expected to reduce greenhouse gas emissions by 229 tons in 2022.

Source of Greenhouse Gas	With Case	Without Case	difference
New Ferry	543.7		
Exiting Ferry		512.1	
Land transport (passenger)		144.8	
Land transport (vehicles)		115.8	
total	543.7	772.7	229

3. Contents of the project

3.1. Outline of the Project

This project will contribute to the development of economic and social infrastructure for the sustainable development of Djibouti by strengthening maritime transport capacity by ferry development and port development in Tadjoura and Djibouti.

3.1.1. Project Goals

The project goals are as follows.

- To introduce a ferry that can be operated during the Khamsin season between Djibouti and Tadjourah
- Secure transportation capacity to meet future demand
- Develop port facilities to introduce new ferry services at both ports of Djibouti and Tadjourah
- Improvement of efficiency and safety when passengers and vehicles board/disembark from ferries
- Improvement of management and safety management of ferry boarding grounds
- Appropriate maintenance and management of ships and port facilities

3.1.2. Outline of the Project

(1) The new ferry

Considering the survey and hearing at Djibouti, the scopes of the new ferry are as follows.

- The ship hull is a displacement type to be able to navigate in Khamsin season.
- A bow thruster is equipped to enhance its turning ability in the port.
- The rampways are equipped on both sides of the ferry's bow and stern to provide smooth exchange of passengers and cargos at ports.
- The car deck height is enough for a trailer.
- Passenger and vehicle flow lines are distinguished clearly to increase passenger safety.
- An isolated space on the vehicle deck is provided for the sick person to rest.

(2) Development of Port Facility Corresponding to New Ferry Operation

1) Ferry Berthing Facility of Djibouti Port

At Djibouti Port, it is necessary to develop facilities to maintain the operation of two fleets, the new ferry to be introduced on the Tadjourah route and the existing ferry for the Obock route. The scope of the newly developed facility is as follows.

- Reclamation of terminal land and construction of revetment
- Development of berthing facilities for new ferries
- Improvement of port navigation channel by dredging

2) Ferry Berthing Facility of Tadjourah Port

At Tadjourah Port, a new berthing facility for receiving the new ferry will be developed. Since it is assumed that the annual periodic inspection and maintenance of the new ferry will take place outside of the Khamsin season, it is also necessary to maintain the existing berthing facilities for existing ferries and other vessels. The scope of works related to the new berthing facility is as follows.

- Reclamation of terminal land and construction of revetment
- Development of berthing facilities for new ferries
- Development of breakwaters to ensure calmness in the port during the Khamsin season
- Dredging of channel to improve navigation safety

3.2. Preliminary Design of Target Ship and Port Facility

3.2.1. Design Policy

(1) Basic Policy of Ship Design

1) Future Demand and study of Operation Plan

Study team conducts demand forecast for ferry passengers and vehicles, then determine the size of the new ferry and examine the operation plan

a) Passenger Demand

Current number of passengers

The current 4 ferry services per week generally carry the full capacity of 150 persons. Depending on the time, some customers are unable to board the ship may due to capacity constraints and are left behind. Therefore, there is likely considerable latent demand for ferry services.

Number of passengers per week: $150 \times 4 = 600$／week

Potential demand per week: $600 + 100 = 700$／week

Forecast of future demand

The traffic volume of people and vehicles in Djibouti will be greatly affected the degree to which the Djibouti economy grows. Therefore, it is assumed that the increase in the number of passengers in the future will be proportional to Djibouti's GDP. The average GDP growth rate from 2013 to 2019 is 7.7%, and this average growth rate is expected to continue until the target year of 2032. The following table shows the future GDP assuming the current growth rate of 7.7% is sustained.

Table 3.2-1 Future GDP of Djibouti (assuming an annual growth rate of 7.7%)

year		2018	2019	2020	2021	2022	2023	2027	2032
GDP	growth rate	1.077	1.077	1.077	1.077	1.077	1.077	1.077	1.077
	Scale	1.00	1.08	1.16	1.25	1.35	1.45	1.95	2.83

Source: Study team

Year 2022: At the start of the new ferry service

Number of passengers per week: 700 × 1.35 ＝ 945

It is assumed that the number of services is the same as at present: 4 services／week

945／4 services ＝236 ／Vessel

The boarding capacity per vessel shall be 250 people.

Year 2027: Five years after commencement of the new ferry service

Number of passengers per week: 700 × 1.95 ＝ 1,365

Number of Services 1,365 ／250 ＝5.5 services／week (6 services)

Year 2032: Ten years after commencement of the new ferry service

Number of passengers per week: 700 × 2.83 ＝ 1,981

Number of services 1,981 ／250 ＝7.9 services／week (8 services)

b) Number of Vehicles on Board

Current average number of vehicles on board

Based on the results of the traffic survey conducted from September to October 2018, there is an average of 13.2 ordinary passenger cars on board.

Forecast of future demand

Study team assumes that the future demand will increase in proportion to the scale of GDP compared to 2018.

Year 2022: At the start of the new ferry service

13.2 cars × 1.35 ＝ 17.8 cars

It is assumed that the number of services is the same as at present: 4 services／week

Approximately 20 ordinary passenger cars will be on board.

Year 2027: Five years after commencement of the new ferry service

Number of cars per week: 13.2 × 1.95 ＝ 25.7

Number of services 25.7 × 4／20 ＝5.1 services／week (6 services)

Year 2032: Ten years after commencement of the new ferry service

Number of cars per week: 13.2 × 2.83 ＝ 37.4

Number of services 37.4 × 4／20 ＝7.5 services ／week (8 services)

2) Traffic Demand Survey

a) Survey objective

In order to identify the current issues and reflect them in the new plan, a traffic survey was conducted.

b) Survey method

We interviewed relevant officials and observed ferry operations to understand the current vehicles and cargo volumes, operating conditions, and the number of passengers transported on the existing ferry between Djibouti and Tadjourah, Obock. Other transport modes were also examined.

・ Survey Target: Current ferries, Dhow boats, Small boats (fishing boats), Land traffic (minibuses, etc.)

・ Survey Items: Purposes for Utilizing the Ferry, Operation Status, Number of Passengers, Vehicles and Cargo Volume, Terminal and Road Status

・ Survey Methods: Observation of current traffic conditions (Direct method), Interviews with Transport Companies, etc. (Indirect method)

c) Result of the survey

i) Purpose of Using Ferry Service

The main purposes of utilizing the ferry service between Djibouti and Tadjourah, Obock were as follows:

- Transportation needs for everyday life
- Commercial transportation
- Transport related to tourism and leisure

ii) Current Ferries and Other Traffic Operations

The transport of goods and people between Djibouti and Tadjourah and between Djibouti and Obock is heavily dependent on the 150-person ferry currently in service. However, for about two months during the Khamsin period, ferry operations are usually suspended due to deterioration of sea conditions, so that residents are forced to use road transport which is greatly inferior in terms of convenience and safety. As a result, the volume of traffic during the Khamsin season greatly decreases compared to the rest of the year when ferry service is available.

The following table shows the characteristics of each transport mode and the results of traffic volume surveys.

Item			Maritime traffic			Land transport
			Current Ferry	Dhow Boats	Small Boats (fishing boats)	Minibus and 4WD/ tracks
Mode of operation			Regular	Irregular	Irregular	Irregular
Usages			Full load	Almost full load	Case by case	Almost full load
Operation	Operation	Djibouti	4 round trips	1-2 round	2 round trips	A few round

Operation Frequency	Period	～ Tadjourah	per week	trips per week	on day of fishing	trips on day of no Ferry
		Djibouti ～ Obock	2 round trips per week	1-2 round trips per week	2 round trips on day of fishing	A few round trips on day of no Ferry
	Khamsin Period			Missing	Missing	Daily few round trips
Object			Passengers, Vehicles, Livestock Daily necessities, Household goods, Building materials, etc.	Bulk, Drinking water, Wood, etc.	Fishery products (to the Djibouti market) and passengers could get the seat if there is demand	Mainly passenger
Total estimated elapsed time and Distance		Djibouti ～ Tadjourah	2.0 hours Seaway 35km	2.0 hours Seaway 35km	1.0 hours Seaway 35km	4.5 hours Landway 35km
		Djibouti ～ Obock	2.5 hours Seaway 45km	2.6hours Seaway 45km	1.3hours Seaway 45km	6.0 hours Landway 45km
Passenger fare		Djibouti ～ Tadjourah	700DJF	500DJF	1500DJF	1500DJF
		Djibouti ～ Obock	700DJF	600DJF	1500DJF	2000DJF
Specifications			Max.150 passangers Max.12 vehicles Ferry L=50 m	Full load 50tons Boat L=20 m	Max.20 passangers Boat L=8 m	Max.20 passengers
Suspended service		Probable Causes	High waves and strong winds	High waves and strong winds	Higher waves and weaker winds	Disruption of roads due to flooding and rocks and sediment on roads
Safety			High safety and stubborn hull	Poor safety and stability	Poor weather resistance	Road conditions are poor and traffic condition are dangerous.
Wishes of residents			The most desirable means of transportation for residents	For the shipowner's own business	Special cases, such as inconsistent time in ferries	No active hope on residents even during Ferry operation suspended
Characteristic			Very convenient for people, goods and vehicles	Less convenient, and not suitable for passengers	Low convenience, and cargo and vehicles cannot be carried	Low convenience. and cargo and vehicles cannot be carried

iii) Number of passengers boarding the current ferry

The number of passengers onboard the ferry was counted during the field survey period. Current ferry is

usually operating at full capacity. The following table shows the results of the survey on ferry passenger occupancy.

Table 3.2-2 Actual Number of Ferry Passengers

Route	Number of Ferry Services Surveyed	Occupancy rate (Capacity: 150)
Djibouti➡Tadjourah	5 trips	Almost 100%
Tadjourah➡Djibouti	4 trips	Almost 100%
Djibouti➡Obock	3 trips	Almost 100%
Obock➡Djibouti	4 trips	Almost 100%

(Field Survey Period: Sep.26, 2018-Oct.12,2018: survey was conducted for a total of 9 days)

iv) Vehicles and Cargo Volumes transported by the Current Ferry Service

Vehicles and cargo volumes transported by the current ferry were surveyed during the field survey period. The survey results indicate that a significant amount of goods are transported from Djibouti to rural areas on both the Djibouti-Tadjourah route and the Djibouti-Obook route. The average cargo volume (one-way) per voyage on the Djibouti-Tadjourah Traffic Route consisted of 11.1 vehicles, 6.1 m3 cargoes, and 4.7 livestock.

The following table shows the survey results of vehicles and cargo volume transported using the existing ferry service.

Table 3.2-3 Volume of Vehicles Transported by the Existing Ferry Service

Item	Route	Survey date	4WD	Truck	Passenger-car	Total	Content
Vehicles (units) Note: without motorcycles	Djibouti ～ Tadjourah	2018/9/27	5	2	0	7	Mainly 4WD pickups was transported, and next truck is popular..
		2018/9/28	19	2	2	23	
		2018/9/29	7	1	1	9	
		2018/10/6	7	1	0	8	
		2018/10/12	20	0	0	20	
	Tadjourah ～ Djibouti	2018/9/27	5	2	0	7	
		2018/9/28	2	1	2	5	
		2018/9/29	16	1	1	18	
		2018/10/12	2	1	0	3	
	Average		9.2	1.2	0.7	11.1	

(Field Survey Period: Sep.26, 2018-Oct.12, 2018: The survey was conducted for a total of 5 days)

Table 3.2-4 Volumes of Cargo and Livestock Transported by the Existing Ferry Service

Item	Route	Survey Number	Transportation volume (Average)	Weighted Average	Content

Cargo (m3)	Djibouti ～ Tadjourah	5	6.6	6.1	Transportation of wheat flour, drinking water and juice, vegetables, marine products, canned and other daily necessities, daily necessities, and building materials is common.
	Tadjourah ～ Djibouti	4	5.5		
Livestock (Number of heads)	Djibouti ～ Tadjourah	5	4.6	4.7	Goats only
	Tadjourah ～ Djibouti	4	4.8		

(Field Survey Period: Sep.26,2018-Oct.12,2018: The survey was conducted for a total of 5 days)

3) Consideration of Design Condition of the New Ferry

a) Safety

As the service of the New Ferry is limited within Gulf of Tadjourah, the domestic safety standards of the Djibouti Government will be applied from the viewpoint of its operation. On the other hand, as for the design of the New Ferry, considering the situation that regulations for shipbuilding safety are not yet matured in Djibouti, safety standards of Japanese Government will be employed so that safety of the New Ferry is ensured.

i) The navigation area

The sea condition in Khamsin season is as follows. The maximum wind speed is 15.0m/s, the maximum wave height is 1.8m. Considering the service speed of the New Ferry and distances from Djibouti and Tadjourah port, the navigation area is set to limited coasting area defined in the Japanese rules.

ii) Maneuverability

The New Ferry needs to turn around at the time of berthing to the pier at Djibouti port.
A side thruster and a flap rudder (Fig.3.2-1) will be deployed to secure its enough maneuverability.

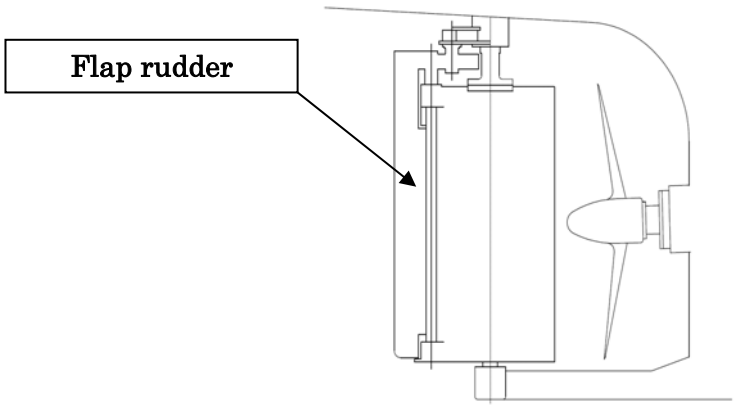


Figure 3.2-1 Flap rudder

iii) Stability

The New Ferry should be a displacement type hull to secure its safe stability even in the Khamsin season. In addition, the super structure should be made of aluminum alloy to lower its center of gravity. The super structure should be designed so as to have wide openings to suppress the influence of strong side wind. The New Ferry should be designed so as to equip a passenger room which is air-conditioned to encourage passengers not to stay on the cargo deck or stairs for passengers' safety. (Fig.3.2-2)

iv) Draft control system

The New Ferry should be designed to equip the draft control system which consists of draft sensors, trim and heel sensors as well as ballast control devices. These help the New Ferry adapt its draft to the water depth of the new port at Djibouti and Tadjourah.

v) Cargo deck

The New Ferry should be so designed as to be able to separate the vehicle route and the passenger route during their boarding and alighting to secure passengers' safety. The passenger route will be marked separately or a simple device like a rope or a kind of handrail will be equipped.
The cargo deck should be so designed as to have enough height and strength to load a trailer less than 245kN.

vi) Ramp way

The New Ferry has two ramp ways at its bow and stern to make a vehicle's boarding and alighting smooth. At the outward, the vehicles enter from the stern side at Djibouti port and they leave the ship from the bow side at Tadjourah port. At the homeward, this route is to be vise versa.

vii) Passenger route between decks

The New Ferry is designed to equip safety device such as handrails along the passenger route to secure passengers' safety.

viii) Accommodation

An air-conditioned cabin will be designed on the promenade deck to ensure passengers' safety during the cruise. Awning will be installed on the promenade deck to cut engine noise from the funnel and to provide sunshade.

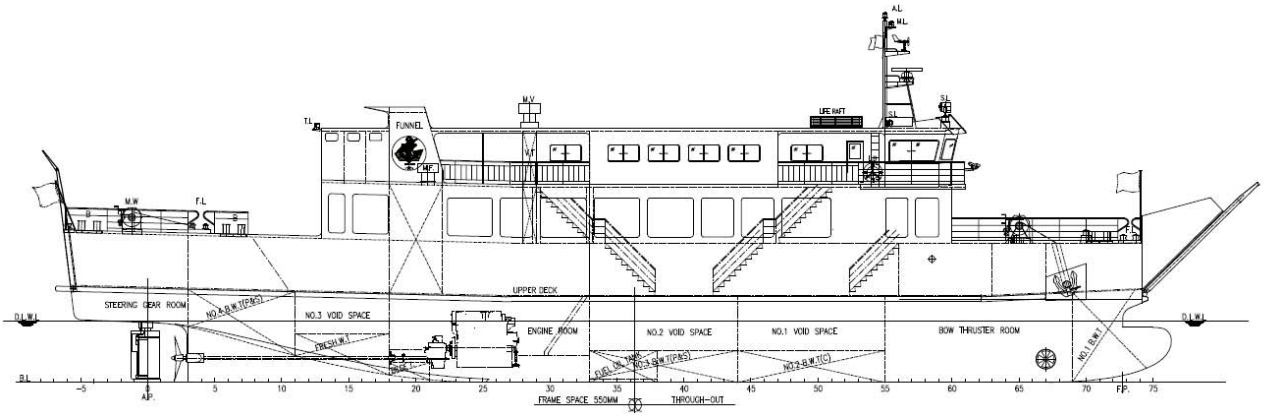


Figure 3.2-2 Aperture of Super Structure and Cabin

b) Hull form consideration

The New Ferry is so designed as to its overall length is less than 50m, its breadth is less than 11m, considering the size of the floating dock and securing its stability in the Khamsin season. The full load draft is estimated as 2.5m from its total displacement. The molded depth and freeboard will be designed considering the height gap between its ramp way and the port. Bulbous bow will be designed to minimize its wave resistance and an optimized streamlined shape will be designed to minimize its drag force.

4) Economical consideration

Wave resistance will be decreased by deployment of bulbous bow. The estimated relation between power and speed of the New Ferry is as shown in Fig.3.2-3. From this estimation, the service speed 12knots (about 6.0m/s) can be achieved in 80～85%MCR of two 480kW engines. The propulsion efficiency should be improved by adopting a slower rotating large diameter propeller. These designs will achieve low fuel consumption.

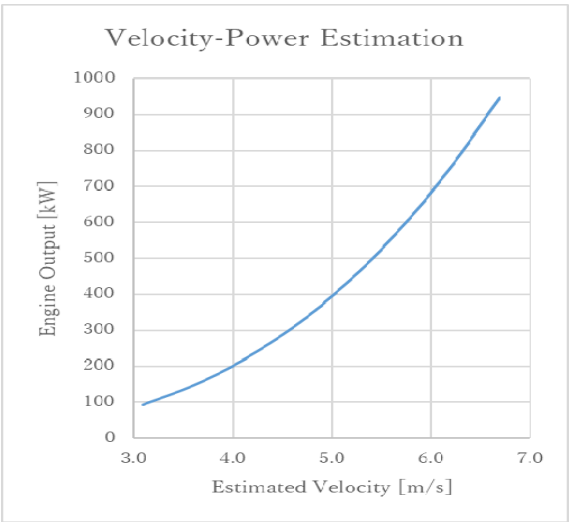


Figure 3.2-3 Power Speed Estimation

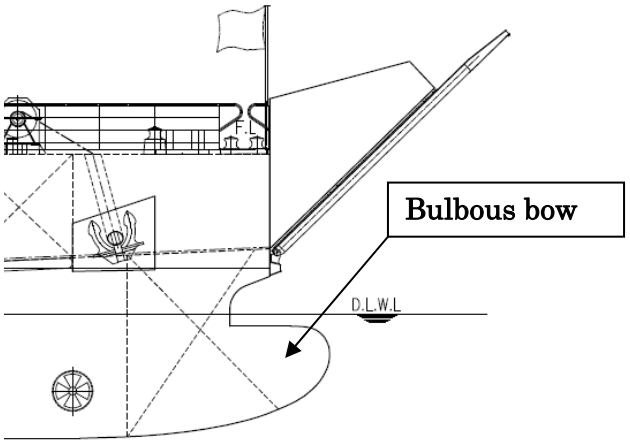


Figure 3.2-4 Bulbous Bow Shape

(2) Basic Policy of Port Facilities Design

1) Design Facilities

Target port facilities for design are as below. Verification of performance will be conducted by maintaining the performance requirements and performance criteria of each facility.

- Berthing Dolphin
- Boarding Platform
- Revetment
- Dredging and Reclamation
- Breakwater (only for Tadjourah Port)
- Ancillary Equipment (such as fender, bollard, ladder and navigation aid)

a) Berthing Dolphin

The location of berthing dolphins and the scale of new facilities such as design depth and crown height will be studied considering the connection to the ground, berthing of the new ferry, as well as use of the existing ferry. The dolphin structure will be designed in consideration of the result of survey of natural conditions, and workability or/and economic efficiency. The dolphins will be connected to each other by the catwalk to secure operators' safety while conducting berthing works.

b) Boarding Platform

The new ferry is not a flatbed type and has a bulbous bow with a full draught deeper than the existing ferry. In addition, equipping two boarding ramps is planned for passengers and vehicles at both the bow and the stern. Consequently, a new platform will be designed according to the hull structure of the new ferry.

c) Revetment

Location and dimensions of the revetment will be designed according to the reclamation area required for the use of the new terminal. Its structure will be designed in consideration of the natural conditions established on the basis of the result of natural conditions survey at the project site, as well as workability and economic efficiency.

d) Dredging and Reclamation

The seabed of the project site is shallow near the shore, becoming suddenly deeper offshore. Hence, dredging will be required to allow construction of the new port facilities. The area and section of dredging will be designed taking into account handling with dredged soil maintained small.

e) Breakwater

The breakwater planned in Tadjourah port will be designed considering the safety of ferry handling. The seabed around Tadjourah port has a reefy landform, and water depth deepens suddenly offshore. Hence, breakwater design will be made in consideration of workable areas for its construction and enhanced calmness.

f) Ancillary equipment

Required items, dimensions and quantity as the ancillary equipment will be studied and determined taking into account utility and safety.

2) Design life period

The design life period will be 50 years, being regarded as normal when considering the examples in the table below:

Table 3.2-5 Design Work Life and Design Situation for Port Facilities

Case example	Design working life	Return period of variable actions
Breakwater	50 years	・Level 1 earthquake: 75 years ・Design wave: 50 years
Breakwater	100 years	・Level 1 earthquake: 150 years ・Design wave: 100 years
Berthing facility	50 years	・Level 1 earthquake: 75 years
Buried tunnel	100 years	・Level 1 earthquake: 150 years
Bridge	100 years	・Level 1 earthquake: 150 years

Source; Technical Standards and Commentaries for Port and Facilities in Japan 2018

3) Design Criteria

Design criteria are as below:

- Technical Standards and Commentaries for Port and Facilities in Japan (1999, 2007, 2018)
- Design and Construction Manual for Floating Berthing Structure (2015)
- Specifications for Highway Bridges (2012)
- Design Manual for Floating Pier for Pleasure Boat (2011)
- 「Eurocode 8: Design of Structures for Earthquake Resistance」(BS-EN 1998-1:2004)

(3) Design Policy of Marine Structure for Natural Conditions

Natural conditions for marine structure design shall be determined on the basis of the results of bathymetric survey, topographic survey, soil survey and wind observation at the sites. In addition, the site survey results shall be considered in a way to match available wind observation results at the Djibouti airport and public open data. Likewise, wind and wave conditions shall consider year-round condition site wind observation was conducted only in the Khamsin period.

(4) Design Procedure for Environmental and Social Impact Assessment

In carrying out design, location or structure of each facility will be considered so that the construction work will not enlarge environmental impacts. In addition, construction will be carried out considering reduction of pollution diffusion and adverse effects on marine organisms.

(5) Policy on Ferry Management and Facility Maintenance

1) Operation

The crews of the present ferry “Burham Qasem” have experienced its operation for around 10 years without any serious accidents. Thus the crew ability can be considered enough to operate the New Ferry. However, the cancellation of the ferry seems to depend on the captain’s decision at seven o’clock in the morning with no specific operational guidelines. The shipyard will provide the “Stability Booklet for the captain” to be requested by “Japanese Safety rules for sea going vessels” from which the crews can study the ferry’s stability performance in a certain sea condition. The shipyard will help crews understand how to develop their operational manual using this booklet during their training in Japan. The limitation of wind speed and wave height should be specified tin their operational manual.

2) Budgetary Measures

a) Port Facility

It is desirable for the Maritime Bureau to establish a new section which is in charge of port facility

maintenance works. The staff of the new section shall formulate a “Port Facility Maintenance Management Plan” which will be used to extend the service life of the facilities and conduct the actual maintenance works. In order to secure the required budget including actual operation and management expenses, it is necessary to forecast future income and expenditures.

In addition, in order to realize a financially autonomous system, an accurate statistical system should be established to obtain various statistics; a new statistics section in the Maritime Bureau should also be established. These budgetary measures are also included in the above financial balance forecast.

b) The New Ferry

When a new ferry is provided, the operation and management will be conducted by the executing agency, the Maritime Bureau of the Ministry of Facilities and Transport. Efforts should be made to ensure independent profitability under the executing agency for operation budget including maintenance management.

The new ferry is designed to increase the number of passengers and vehicles that can be transported, in addition to its ability to navigate during the Khamsin season, and it is expected to increase income compared to the present ferry.

On the other hand, fuel costs tend to rise in recent years, and the construction shipyard will train the crews at the time of proficiency training so as to the new ferry is operated at economic speed (85% of main engine output) to reduce fuel consumption as much as possible during its service.

With regard to main engine and power generating engine, which have a major impact on profitability if they fail, the manufacturer will provide explanation how to handle them and will provide maintenance plans including inspection cycles at the time of proficiency training at the construction shipyard.

3) Maintenance Management Ability

a) Port Facility

It is necessary to determine whether Djibouti has the required capability to conduct effective maintenance. Many interviews including with many government officials were conducted to examine this matter. Findings based on these interviews are as follows.

The maintenance of port facilities (for ferries) is defined in Article 23 of "Decree (No. 2006-0202 / PR / MET)" as follows: - Repair, management and maintenance of ferry and port facilities are done exclusively by the government at its own expense.

At present, the Maritime Bureau has no maintenance section for port facilities. The maintenance of the existing ferry itself is carried out by her crews. However, the maintenance of port facilities is not conducted. When damage is observed, repair works are conducted by the Maritime Bureau itself or the private sector depending on the degree of damage. Therefore, when the new ferry is introduced, it is assumed that a new maintenance section for the port facilities will be established in the Maritime Bureau.

At this time, the Maritime Bureau does not possess sufficient technical skill related to port facility maintenance. Accordingly, assistance from the private sector is needed.
Prior to introducing private sector participation, however, it is necessary to examine the maintenance capability of the private sector.

Currently, there are about 80 private construction companies in Djibouti. However, most companies specialize in road and building construction; few companies have experience in port construction works. Therefore, it cannot be said that the technical level of the private sector in this field is particularly high.

Accordingly, it is necessary to develop a port facility maintenance system in order to properly maintain the new port facilities after introducing the new ferry. In this respect, officials concerned have expressed the need for technology transfer, including the introduction of Japan's advanced maintenance technology.

Maintenance of port facilities shall be implemented systematically based on the concept of life cycle management. First, "Inspection and Diagnosis" will be conducted to grasp the present condition of the facility based on uniform standards. Then, future deterioration is predicted based on the results of Diagnosis. Finally, "Comprehensive Evaluation" will be conducted of the future usage plan, the remaining service life, the life cycle cost, etc., and based on the results, the necessary "Maintenance Management Measures" will be introduced.

In order to implement the above systematically, the "Facility Maintenance Management Plan" needs to be prepared by technical personnel and maintenance should be conducted according to the Plan.

It is recommended that technical transfer be carried out during the construction of the new port facility for the new ferry. At that time, the latest diagnostic and maintenance technology of Japan will also be introduced.

b) The New Ferry

The floating dock, DAMEN MODULAR FLOATING DOCK DMD4020 (Fig.3.2-5, 3.2-6), is in operation and available for maintenance of the New Ferry. The principal dimensions of the floating dock are as follows.

Maximum lift capacity	1,750 tf
Deck load	15 tf/㎡
Length	50 m
Breadth	40 m
Height	12 m
Crane capacity	8.3 tf@26m

Figure 3.2-5　Schematic view of the floating dock（DAMEN brochure）

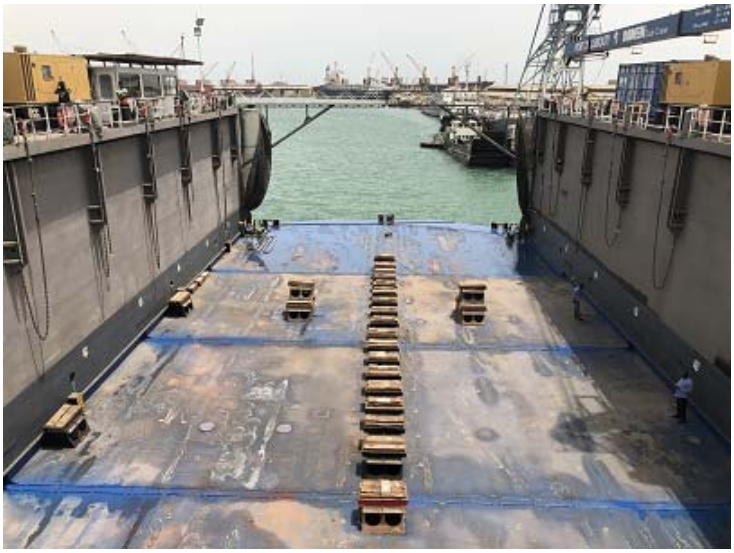


Figure 3.2-6　Floating dock current situation (source: consultant）

According to the hearing survey from the captain and the chief engineer, the maintenance of the present ferry is carried out properly by its crews. The maintenance includes coating, anti-corrosion plate replacement, exchanging hinges of the ramp way and so on. However, not only these ordinary maintenances but also maintenance of engines such as overhaul is important for the New Ferry. Thus, the selection of important modules in the design of the New Ferry should be carried out considering their procurement easiness at Djibouti by investigating the maker's branch, service and business support including near countries.

(6)　Policy Concerning the Setting of Grades of Port Facilities and New Ferry

1)　Grade of Port Facilities

There are many cases of deterioration with time of port facilities due to material degradation, component

damage, foundation scour, settlement or burial because of severe natural conditions in general. Consequently, the facilities need to be maintained adequately to prevent the possibility of their not satisfying the performance requirements caused by the deteriorations. New ferry terminal will be required minimum damage during operation because of important infrastructure. Therefore, maintenance level II is selected.

Table 3.2-6 Maintenance Level for Port Facilities

Classification	Concept of dealing with damage and deterioration
Maintenance level I	Implementing high-level measures against damage and deterioration to prevent the facilities from failing to satisfy performance requirements during their design working life.
Maintenance level II	Frequently implementing small-scale measures at a stage of minor damage and deterioration to prevent the facilities from failing to satisfy performance requirements during their design working life.
Maintenance level III	Allowing certain degree of performance degradation within the scope of satisfying performance requirements and implementing large-scale measures once or twice a design working life to deal with damage and degradation ex post facto.

Source: Technical Standards and Commentaries for Port and Facilities in Japan 2018

2) The Grade of the New Ferry

The New Ferry will be in service within Gulf of Tadjourah only. The laws and regulations to be applied for designing the New Ferry are as follows to make its operation safe even in the Khamsin season.

- Qualification: JG limited coasting area, JG class 2 vessel
- Applied acts: *Japan Government, class 2
  (For domestic passenger ship)
  * Safety rules for sea going vessels
  * Rule for mariners
  * International convention for prevention collision at sea
  * International convention for the prevention of pollution from ship
  * Rules for navigation radio
  * International tonnage regulations
  * Relating regulations to be required

(7) Policy for Method of Construction, Procurement method and Construction Schedule

1) The New Ferry

a) Shipbuilding Policy

The super structure of the New Ferry should be made of aluminum alloy to secure stability. Two ramp

ways will be equipped to improve the boarding/alighting safety of passengers and cargos. It has bulbous bow and a bow thruster to improve its economic efficiency and maneuverability. To secure those characteristics, sufficient investigation and planning are required through from its design to construction. Furthermore, the strict schedule management is essential to complete the project without any delay in accordance with the regulations of Japanese international cooperation. Thus, the ship building company for construction of the New Ferry must be selected properly from the viewpoint that it needs to have such sufficient abilities to proceed this project as enough experiences, facilities and workers. Examinations of candidates' qualifications such as building ability and experience of international transportation of a ship will be carried out in selecting the candidate to complete the project successfully in accordance with the required schedule and quality.

b) Ship Transferring and Delivery Policy

The New Ferry will be transported from Japan to Djibouti by the contracted shipbuilding company's cost and responsibility. Before this transportation, the shipbuilding company should conduct the sea trial of the New Ferry in Japan to confirm its specifications and quality. Equipment and documents are also transported. A heavy cargo ship with a heavy derrick will be used for this transportation of the New Ferry. As the operation schedule of a heavy cargo ship equipped with a heavy derrick may be usually determined depending on the cargos to be loaded, the shipbuilder shall start negotiations with the carrier in the early stage of construction so that the completion of the construction and its transportation will be arranged timely to meet delivery schedule in time. After transportation, a sea trial shall be carried out in Gulf of Tadjourah for confirmation of its specifications. After transferring, delivery and acceptance of the New Ferry all responsibilities are also transferred to Djiboutian side.

2) Port Facilities

In designing port facilities, construction methods, procurement or materials and equipment, and construction period will consider the following points:

- For the study of construction methods and period, information on local conditions of procurement of materials or equipment, price conditions and securing construction yard that has been obtained through hearing surveys will be reflected
- Reduction of construction cost will be designed by sharing the same construction method or machine between Djibouti and Tadjourah port.
- Studying of construction period will be considered according to working possibility in the Khamsin season in Tadjourah port.

3.2.2. Basic Design (Port Facility Plan / Ship Plan)

(1) Overall Plan of Port Facility

1) Djibouti Port

At Djibouti Port, it is necessary to develop facilities to maintain the operation of two fleets, the new ferry to be introduced on the Tadjourah route and the existing ferry for the Obock route. The scope of the newly developed facility is as follows.

- Reclamation of terminal land and construction of revetment
- Development of berthing facilities for the new ferry and existing ferry
- Improvement of port navigation channel by dredging

In addition to the facilities above, the following facilities will be developed in the future (at Djibouti's own expense).

- Paving of terminals and parking lots
- Passenger waiting room
- Utilities such as electricity, water supply and sewerage
- Security facilities such as gates and fences

The study team will examine the size of terminals necessary for the development of these facilities.

a) Passenger's Waiting Area

The total required capacity is 400 people: 250 people for the Tadjourah service and 150 people for the Obock service.

Waiting area 48m×15m ＝720m2 （1.8 m2／person）

b) On-board Vehicle Parking Lot

Study team assumes that the departure times of the two ferries for Tadjourah and Obock will overlap and thus it is necessary to secure a parking lot area with sufficient capacity for the vehicles which will board the two ferries. The required capacity is calculated to be 40 vehicles in total: 20 for Tadjourah and 20 for Obock .

c) Parking Lot for Vehicles Transferring Ferry Boat Passengers to Town

Currently there are about 10 minibuses on standby to transport passengers to town when the ferry arrives. In future, the number of minibuses for the Tadjourah will be 17 due to the forecast increase in passengers while 10 minibuses will be needed for the Obock service. In designing the size of the parking lot, it is assumed that there will be cases when both ferries return around the same time. Accordingly, a parking lot with a capacity of 27 vehicles is required.

d) Others

It is necessary to secure a passage for vehicles disembarking from the ferry, a temporary storage area for transported baggage, the crew's office, the seafarer's parking lot, etc.

e) Terminal Layout Planning

The proposed terminal layout plan of Djibouti port including the facilities mentioned above is as follows.

Terminal area: 9,600m2

Total length of shore protection : 200m

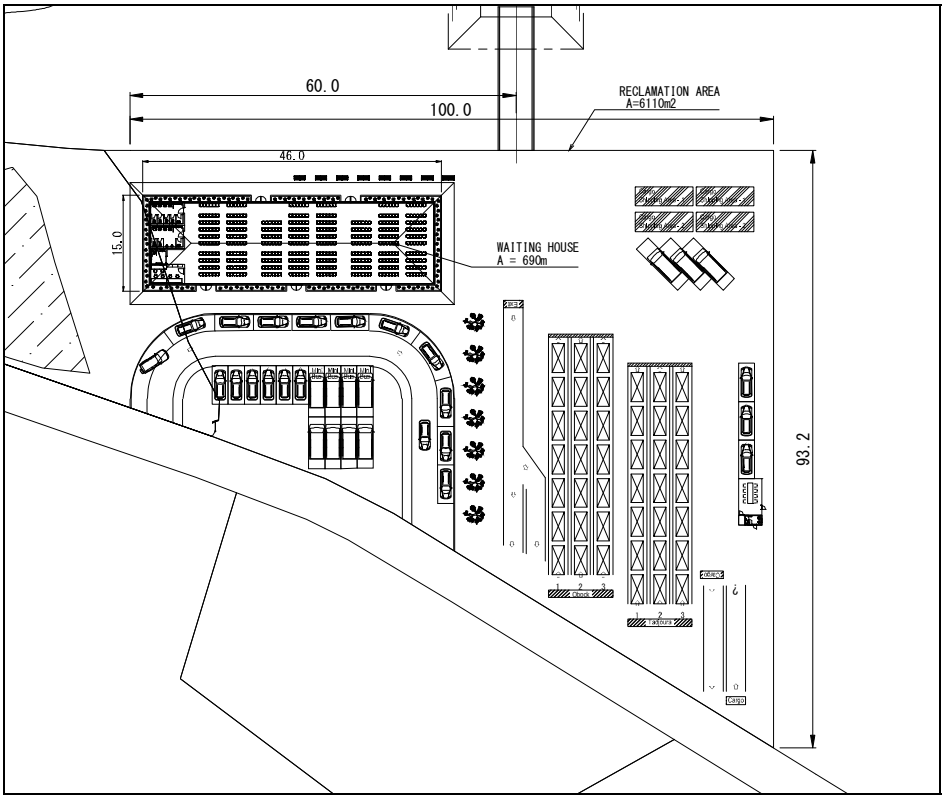


Figure 3.2-7 Terminal Layout Plan of the Djibouti Port

2) Tadjourah Port

At Tadjourah Port, new berthing facility for receiving new ferry will be developed. Since it is assumed that the annual periodic inspection and maintenance of the new ferry will take place outside of the Khamsin season, it is also necessary to maintain the existing berthing facility for existing ferries and other vessels. The scope of the newly serviced facility is as follows.

- Reclamation of terminal land and construction of revetment
- Development of berthing facilities for new ferry
- Breakwater to secure calmness of berthing facilities in the Khamsin season
- Port entry navigation channel by dredging

In addition to the facilities above, the following facility will be developed in future (at Djibouti's own expense).

- Paving of terminals and parking lots
- Passenger waiting space
- Utilities such as electricity, water supply and sewerage
- Security facilities such as gates and fences

The study team will examine the size of terminals necessary for the development of these facilities.

a) Passenger Waiting Area

The required capacity for the passenger waiting area is 250 people for the Djibouti service.

Waiting area 32m×15m ＝480m2 （1.9 m2／person）

b) On-board Vehicle Parking Lot

The required capacity of the on-board vehicle parking lot is 20 for the Djibouti service.

c) Passenger Transfer Vehicle Parking Lot

The required capacity of the parking lot for passenger transfer vehicles is 17 for the Djibouti service.

d) Others

The same as in the case of Djibouti port, it is necessary to secure the passage for vehicles disembarking from the ferry, the temporary storage place for transported baggage, the crew office, the seafarer's parking lot, etc.

e) Terminal Layout Planning

The proposed terminal layout plan of the Tadjourah port including the above facilities is as follows.

Terminal area: 5,300m2

Total length of shore protection : 90m

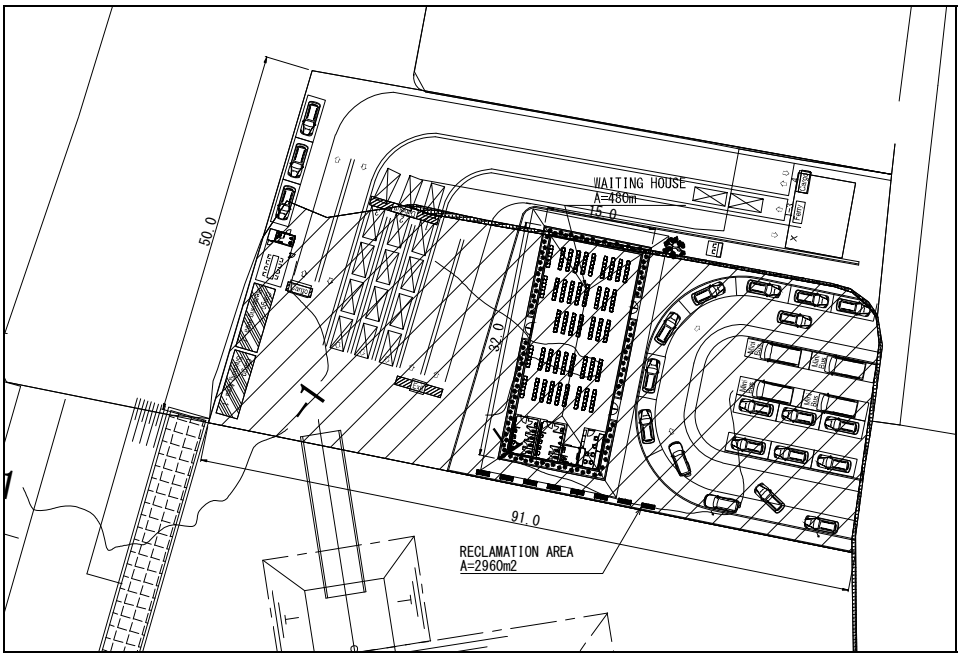


Figure 3.2-8 Terminal Layout Plan of the Tadjourah Port

(2) Design of Port Facilities

Design of port facilities will consider safe and smooth use of the ferry, safe boarding of passengers and vehicles so that performance requirements of each facility will be satisfied.

1) Djibouti port

a) Berthing Dolphin

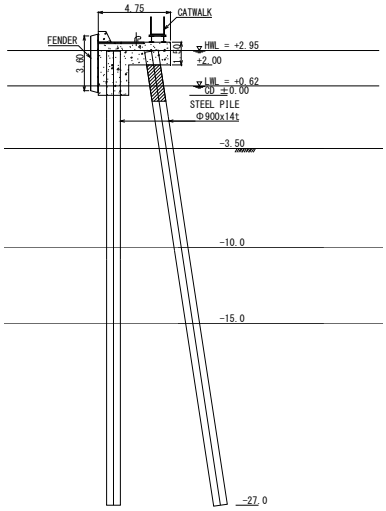
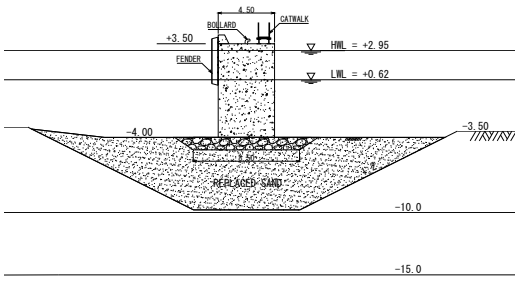
i) Berthing plan of the ferry

The new ferry has two ramps equipped on the bow and the stern for to enable vehicles to get on and off the ferry by advancing only. The new ferry will berth with the stern and the bow approaching the boarding facility of Djibouti port and Tadjourah port, respectively.

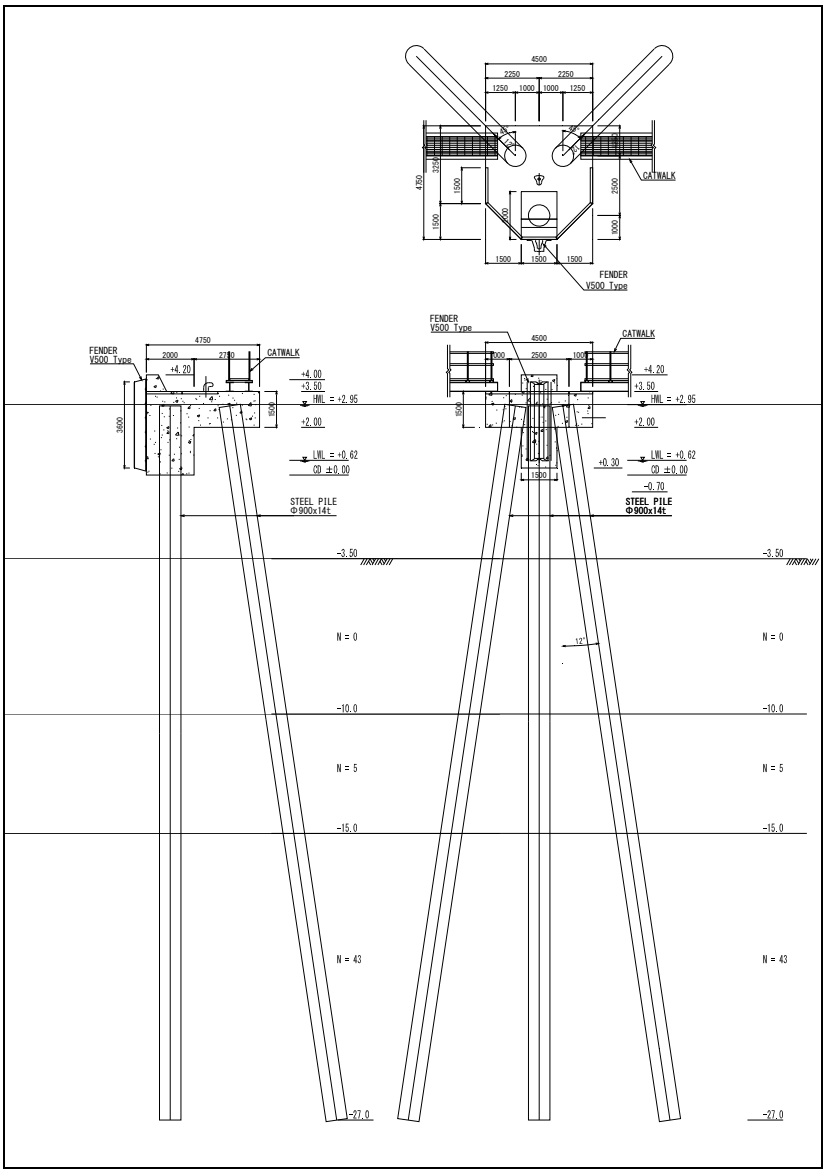
ii) Structure type

Gravity types are not suitable for this port facility since the soft clay will require large scale sand replacement. Thus, the structure type of berthing dolphin will adopt a steel pile type.

Table 3.2-7 Comparison of Structure for Berthing Dolphin

Structure Type	Steel pile type	Gravity type
Typical Section		
Structure Characteristics	Structure will be composed of pile foundations and superstructure. Piles are driven to deep layers since soft clay occurs on the surface layer.	Gravity-type caissons will be installed on the rubble stone foundation. Replacement of soft clay with sand will be necessary to increase bearing capacity.
Construction Ability	Construction period will be short because of small number of piles and small superstructure.	Replacement sand volume will be large, and the construction area will be large. Construction yard for making the body will be difficult, and a long construction period will be necessary.
Economic Efficiency	Concrete cost will be expensive in Djibouti. The cost, however, will not to increase because of small superstructure.	A large volume of replacement sand and concrete will be necessary, and cost of construction yard or floating dock will be large. Thus, economic efficiency is inferior.
Evaluation	○	△

Source: Study Team



Source: Study Team

Figure 3.2-9 Typical Section of Berthing Dolphin

iii) Structural Specifications

Depth	Dolphin depth is -3.5 m according to the new ferry draught.
Crown height	Crown height is +3.5 m the same as the existing dolphin.
Fender	The fender type is V-500H taking into account berthing energy of the new ferry. One fender is to be installed at one dolphin.
Bollard	The bollard type is 150kN taking into account the new ferry size (500GT). The interval of between bollards is 14 m.
Corrosion protection	Cathodic protection will be applied to the portion below sea level and coating protection to the portion above sea level.
Accessory	Corner plates will be installed on the sea side face line of the superstructure. Berth lights to be installed on shore dolphin.

iv) Performance Verification

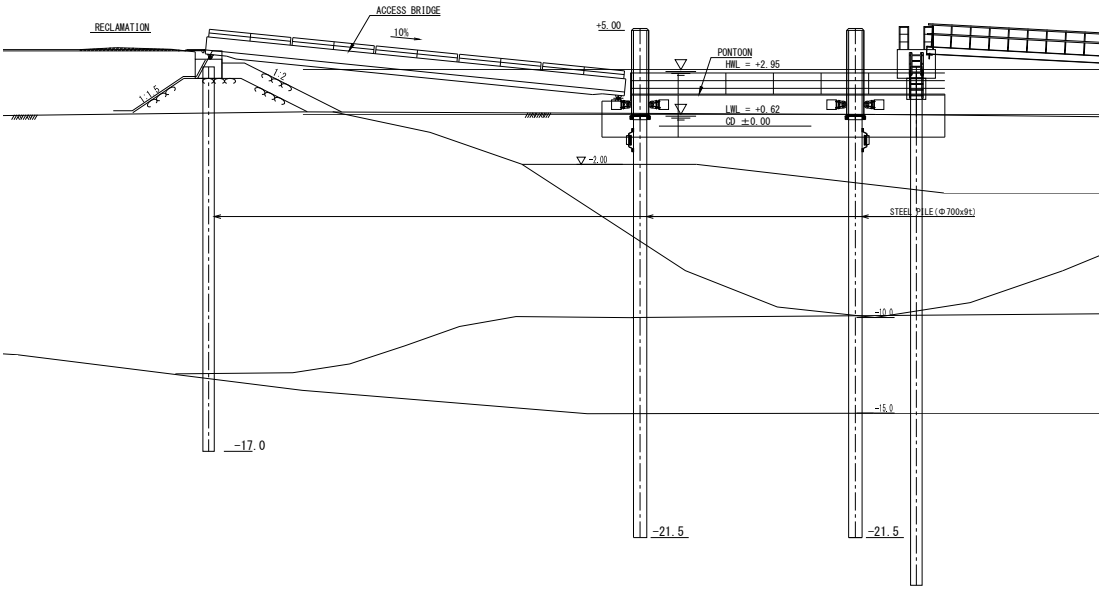
Table 3.2-8 Performance Verification Results of Berthing Dolphin

Action	Results		
Berthing	Vertical force (kN)		1070
	Horizontal force	Longitudinal (kN)	107
		Transverse (kN)	355
	Stress ratio		0.837 < 1.00
	Bearing capacity (kN)		869 < 8013
	Displacement (mm)		44
Earthquake	Vertical force (kN)		1293
	Horizontal force	Longitudinal (kN)	0.00
		Transverse (kN)	336
	Stress ratio		0.763 < 1.00
	Bearing capacity (kN)		1427 < 4006
	Displacement (mm)		41

b) Boarding Platform

i) Structure type

Having a bulbous bow, the new ferry cannot berth to connect its ramp with a fixed slope boarding facility unlike the existing ferry that has a flatbed structure. Thus, the structure of the boarding platform should be of a floating type.



Source: Study Team

Figure 3.2-10 Platform Structure

ii) Structural Specifications

Pontoon	Pontoon width will be 11 m the same as that of the ferry, length 18 m considering lump usability and vehicle length, and height 2.2m.
Anchoring structure	Pontoon anchorage will be by piles. Pile top level is +5.0 m taking into account an allowance added on HHWL+$H_{1/3}$.
Access bridge	The access bridge to connect the pontoon and the revetment will be steel. Effective width is 5 m, and the maximum slope 10% the same as the existing boarding platform.

iii) Performance Verification

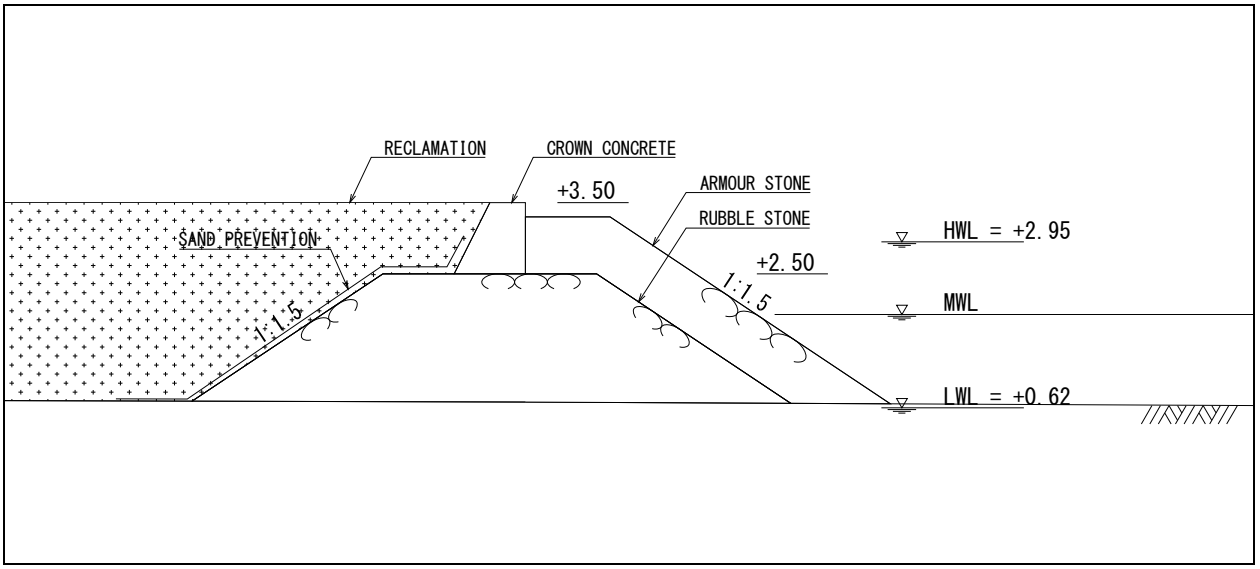
Table 3.2-9 Performance Verification Results of Platform

Action	Results			
Wave force	Vertical force (kN)		144	
	Horizontal force	Longitudinal (kN)	121	
		Transverse (kN)	70	
	Stress ratio		0.773	< 1.00
	Bearing capacity (kN)		35.91	< 2140
	Displacement (mm)		223	

c) Revetment

i) Structural Specifications

Revetment structure will be a sloping dyke the same as the existing revetment.



Source：Study Team

Figure 3.2-11 Typical Section of Reclamation

ii) Structural Specifications

Crown height	Crown height is +3.5 m taking into account 0.02 m^3/m/sec of overtopping discharge.
Armor stone	Armor stone will be 50 kg/pc class according to the wave height, and its slope is 1 : 1.5.

iii) Performance Verification

Table 3.2-10 Performance Verification Results of Revetment

Action	Results	
Ordinary	Circular slip	1.304 > 1.30

d) Dredging

i) Structural Specifications

Depth	-3.5 m to fit in with the dolphin depth.
Area	Dredging area will be large enough to secure 2L of turning basin in front of the dolphin.
Incidental facilities	Three (3) navigation aids will be installed to show dredging boundaries.

e) Reclamation

i) Structural Specifications

Ground level	Reclaimed ground level is +3.5 m the same as the revetment crown height.
Pavement	Pavement will not be constructed since it belongs to the Djibouti scope.

2) Tadjourah port

a) Berthing Dolphin

i) Berthing plan

The new ferry will berth in Tadjourah port without turning round, for passengers and vehicles getting on and off the ferry at the bow.

ii) Structure type

In Tadjourah port, a gravity type can be considered since ground is suitable for this type. Dolphin of steel pile structure is, however, more suitable because, 1) the gravity type has a difficulty for fabrication and storage in the construction yard, 2) needs large work ships, and 3) total cost will be more than that of steel pile type.

iii) Structural Specifications

Structural Specifications is the same as those of Djibouti port, and pile profile is as below,

- Pile section Pile diameter 800 mm, thickness 12 mm
- Pile bottom level -14.0 m

iv) Performance Verification

Table 3.2-11 Performance Verification Results of Berthing Dolphin

Action	Results		
Berthing	Vertical force (kN)		975
	Horizontal force	Longitudinal (kN)	107
		Transverse (kN)	355
	Stress ratio		0.711 < 1.00
	Bearing capacity (kN)		687 < 5507
	Displacement (mm)		18
Earthquake	Vertical force (kN)		1229
	Horizontal force	Longitudinal (kN)	0.00
		Transverse (kN)	371
	Stress ratio		0.790 < 1.00
	Bearing capacity (kN)		1167 < 2504
	Displacement (mm)		19

b) Boarding Platform

i) Structure type

The structural type will be the same as Djibouti port.

ii) Structural Specifications

The structural specifications will be the same as Djibouti port, and pile profile is as below,

- Pile top level +5.5m
- Pile bottom level -13.0m

iii) Performance Verification

Table 3.2-12 Performance Verification Results of Pontoon

Action	Results		
Wave force	Vertical force (kN)		130
	Horizontal	Longitudinal (kN)	236

	force	Transverse (kN)	136	
	Stress ratio		0.835	< 1.00
	Bearing capacity (kN)		32.57	< 2189
	Displacement (mm)		93	

c) Revetment

i) Structural type

The revetment structure will be of a sloping dyke the same as the existing revetment.

ii) Structural Specifications

Crown height	Crown height is +3.8 m taking into account 0.02 m^3/m/sec of overtopping discharge.
Armor stone	Armor stone will be 50 to 100 kg/pc according to wave height, and its slope is to be 1 : 2.

iii) Performance Verification

Table 3.2-13 Performance Verification Results of Revetment

Action	Results		
Ordinary	Circular slip	1.325	> 1.30

d) Dredging

i) Structural Specifications

Depth	-3.5 m to fit in with dolphin depth.
Area	Dredging area will be large enough to secure 2L of turning basin in front of the dolphin.
Incidental facilities	Two (2) navigation aids will be installed to show dredging boundaries.

e) Reclamation

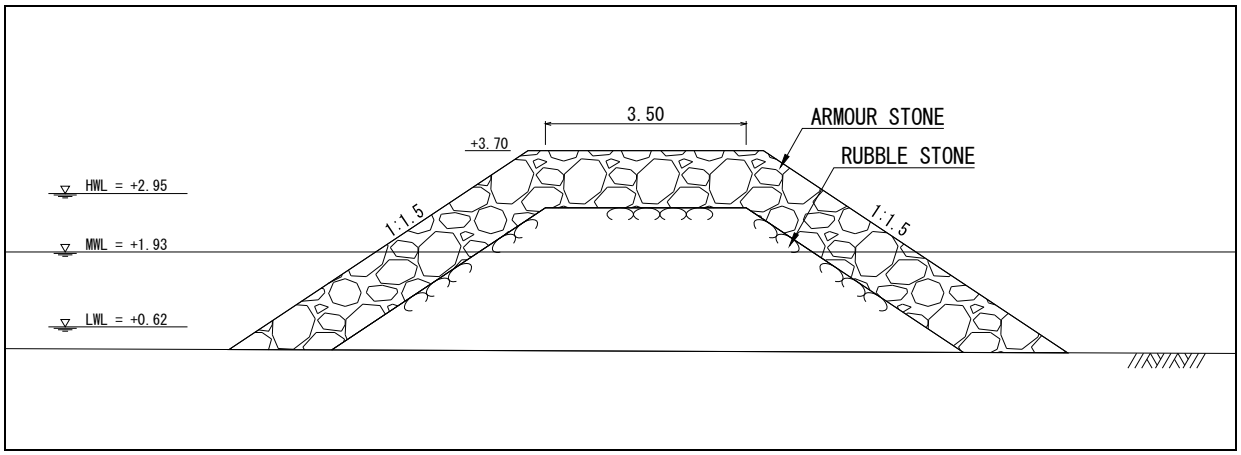
i) Structural Specifications

Ground level	Reclaimed ground level will be +3.8 m the same as the revetment crown height.
Pavement	Pavement will not be constructed since it belongs to the Djibouti scope.

f) Breakwater

i) Structural type

The structural type of breakwater will be sloping dyke considering the availability of material procurement.



Source: Study Team

Figure 3.2-12 Typical Section of Breakwater

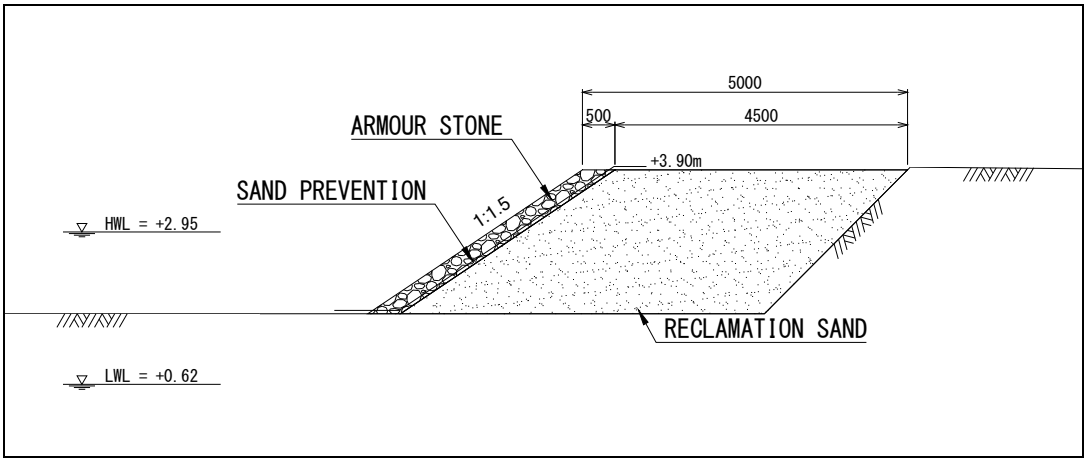
ii) Structural Specifications

Crown height	Crown height will be +3.7m considering design wave height ($H_{1/3}$), and formula of H.W.L. + $0.6H_{1/3}$.
Armor stone	Armor stone will be 200 kg/pc class according to wave height, and its slope is to be 1 : 1.5.

g) Construction Access Road

To obtain temporary yard for construction of the breakwater is difficult in Tadjourah port since construction of a new fishery building is ongoing. Hence, a temporary yard for installation of the breakwater shall be constructed along the hinterland of the port. Reclamation sand will be used and armoured by rubble stone.

Crown height	Crown height is about +3.9m the same as existing yard level.
Armour stone	Armour stone will be of a 50 kg/pc class with a slope of 1 : 1.5.



Source: Study Team

Figure 3.2-13 Typical Section of Access Road for Breakwater

(3) Determination of Principal Dimensions of the New Ferry

1) The navigation Area

The maximum design wind speed is set to 15m/s and the maximum wave height is set to 1.8m. The definition of limited coasting area in Japanese Government regulations is as follows. If the ship can reach an evacuation port within 2 hours by its maximum speed, this area is called “the limited coasting area”. As the cruise speed of the New Ferry is supposed to 12 knots and the distance between Tadjourah port and Djibouti port is 19 nautical miles, we can set the area as limited coasting area. The regulation for “limited coasting area” requires the ship stability calculation to be bearable in maximum wind speed 19 m/s, which is sufficient for the New Ferry.

2) Regulations applied

Japanese Government regulations for class 2 vessel shall be applied.

3) Type of ship and principal particulars

Type of ship is displacement typed. Considering the dimensions of the floating dock for its maintenance and the deadweight, the principal dimensions of the New Ferry are specified as follows.

Length overall	49.95m
Molded breadth	11.00m
Molded depth	3.50m
Full draft	2.50m
Crews	12 personnel
Passengers	250 persons
Deadweight	200 ton
Cars	maximum 20

4) Hull materials

The materials for the hull should be JIS or NK steel. Super structure (Promenade deck and upward) should be aluminum alloy.

5) Crews

The numbers of crews are 12 according to the request from Djiboutian side.

6) Cruise time and service speed

The distance between Tadjourah port and Djibouti port is 19 nautical miles. The service speed is designed as 12 knots to make one way within 2 hours.

a) Cruise time

The cruise time is around 1 hour and 35 minutes.

b) Berthing and Deberthing time

Berthing and deberthing operation to the port will be estimated to take 5 minutes respectively. The loading and unloading time of cargos and passengers are supposed to be around 30 minutes. The total navigation time is estimated around 2 hours and 20 minutes for one way.

7) Cruising range

The New Ferry's cruising range is estimated as follows.

The total distance of one round trip cruise is 38 nautical miles, e.g. around 40 miles for calculation.
Two round trips a day means 80 nautical miles a day.
Four trips a week means 320 nautical miles a week.
Four weeks a month means 1280 nautical miles a month.
The cruising range is set to 640 nautical miles because fuel bunkering is supposed to be twice a month.

8) Main engines and propellers

Considering the power-speed estimation curve in Fig.3.2-3, two 480kW engines are selected as the main engines with two fixed pitch propellers.

9) Passenger compartment

① The passenger room is designed so that it is settled in the superstructure to reduce noise of main engines and is air-conditioned. The passengers are enforced to stay in the passenger room and their remaining on the cargo deck is strictly prohibited to secure their safety.

② Considering the request that isolated space for sick people is needed. Nursing room will be arranged.

10) Ramp ways

Two ramp ways will be equipped to realize smooth boarding and alighting of cars. The measures for passengers' safety will be considered.

11) Navigation and radio communication devices

The equipment for navigation and radio communication are as follows

- Radar
- GPS navigation
- GPS plotter
- Acoustic depth sensor
- International VHF radio device
- Draft sensor
- Trim and heel inclinometer
- Ballast control system

12) Generators

Generators will be selected properly after the total electrical power demand of the New Ferry is examined. The electrical power calculation will be carried out checking power consumption on each condition taking into account for all electrical devices on the bridge, hydraulic pump unit for deck machinery, air conditioner, lighting and so on.

13) Marine pollution prevention device

- Oil separators will be installed.
- Engines must be conforming to IMO tier 2 emission controls.

14) Life-saving appliance

From the regulations for JG type 2 ship in the ship safety act, rigid life buoys, life jackets（wearing type）etc. will be equipped. (See Table 3.2-14 for details)

(4) Determination of Specifications of the Ferry

1) General

- The weight balance and the center of gravity will be determined properly investigating the New Ferry stability including damaged condition.

- The super structure will be made of aluminum alloy to lower its COG as much as possible.
- The maximum loading condition of the cargo deck for the design strength is less than 245kN.
- The cargo deck clearance height at the center line of the New Ferry will be secured around 4.1m according to JG regulations.
- The numbers of passengers are 250.
- The molded breadth will be 11.0 m considering the arrangement of 20 cars onboard.

2) Hull part

- The ship hull type is a displacement type.
- Bulbous bow is settled.
- The fuel tank has enough capacity to satisfy the cruise range.
- Considering the strong following wind in Tadjourah port, the ship will berth ahead at Tadjourah port and astern at Djibouti port.
- The ramp way can be bearable 245kN.
- For passengers' safety, a passenger route will be secured.
- Ballast control system will be deployed to control the ship's trim and heel inclinations.
- Several draft sensors will be implemented to monitor the ship's inclination on the bridge.
- A bow thruster will be attached to improve its turning performance.
- Flap rudders are deployed to improve its maneuverability.
- Rear camera to support the officer on the bridge will be installed.
- Air conditioners will be installed at the passenger room and the bridge, nursing room.

3) Machinery part

a) Vibration and noise suppression measures

The onboard survey of the existing ferry proved that navigation at 100% MCR caused excessive vibration and noise. It was evident that the passengers were likely to stay at the cargo deck due to this unpleasant vibration and noise. From the viewpoint of passengers' safety, the passenger room should be so designed that the noise and vibration are reduced.

b) Main engine

In consideration of the condition to be secure service speed for 12 knots and to minimize vibration and noise, the main engine output should be not less than 480kW. Selection of the engine depends on its reliability in hot environment in Djibouti and also maintainability, it should be equipped a backup cooling water system. Two 480kW engines will be installed with two fixed pitch propellers.

4) Electricity

- Salt damage countermeasure should be arranged for electric devices and wires.

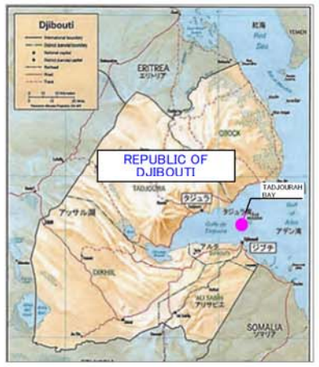
- Electric devices must be suitable for Djiboutian voltage.
- Search light should be equipped in case of night cruise.
- LED lights are recommended.
- Insulation test of electric devices should be mandated in maintenance procedure.

3.2.3. Outline Design Drawing

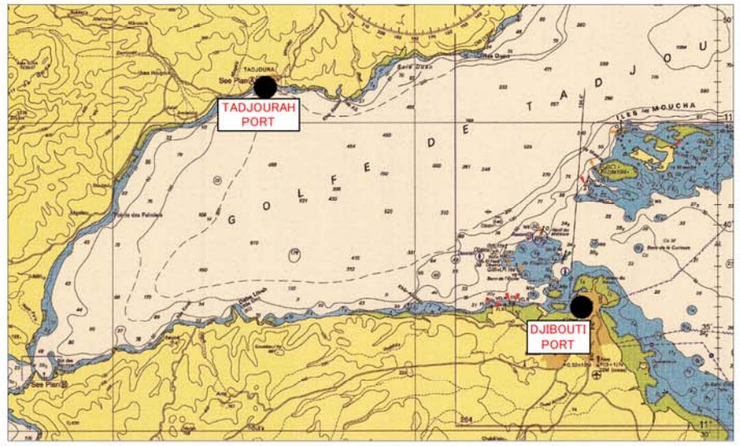
(1) Outline Design Drawing of Port Facility

DWG001

LOCATION OF DJIBOUTI AND TADJOURAH PORT



TADJOURAH BAY



LOCATION OF DJIBOUTI AND TADJOURAH PORT

PRESENT LOCATION (DJIBOUTI PORT)

PRESENT LOCATION (TADJOURAH PORT)

Figure 3.2-14 Location of Djibouti and Tadjourah Port

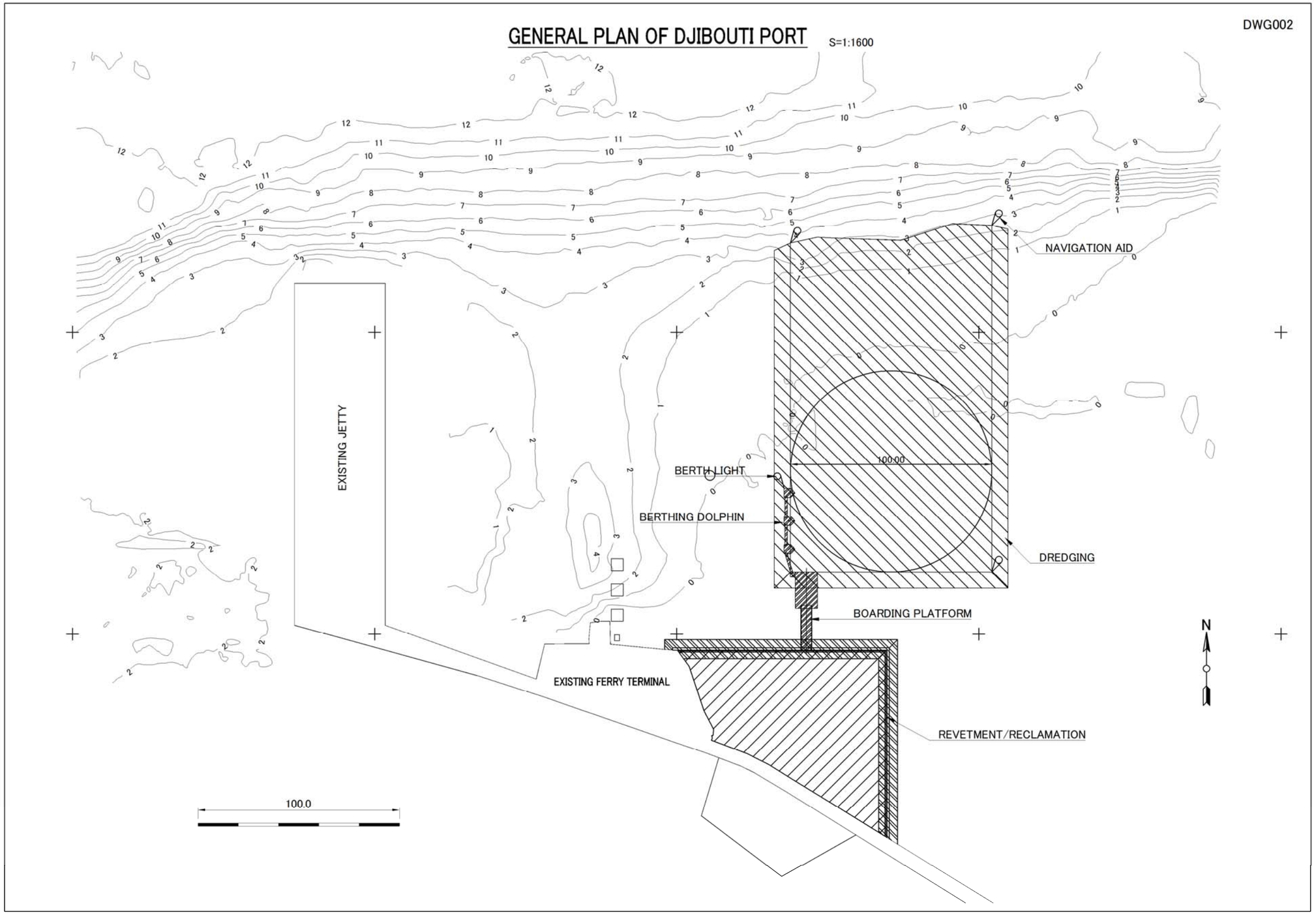


Figure 3.2-15 General Plan of Djibouti Port

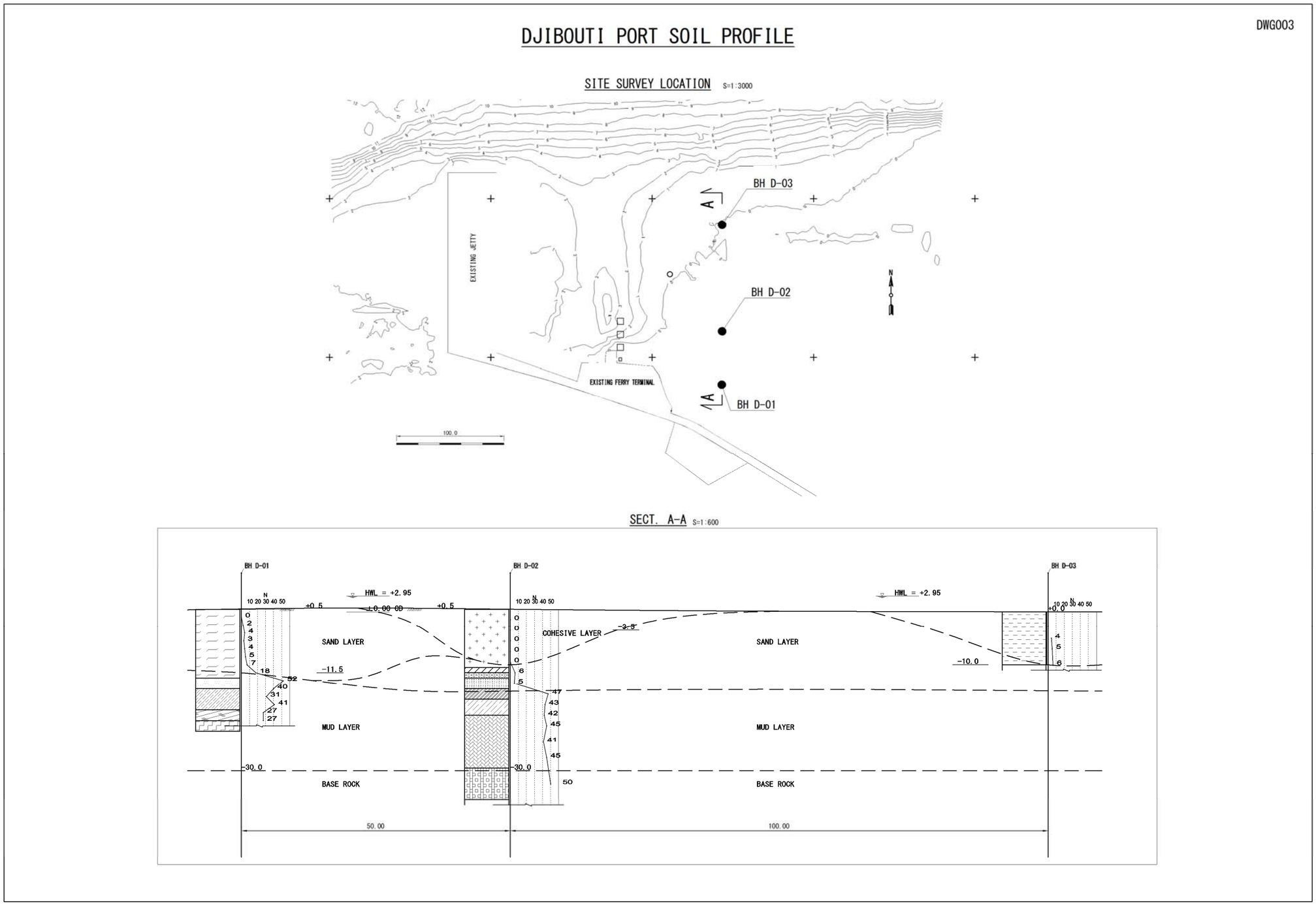


Figure 3.2-16 Djibouti Port Soil Profile

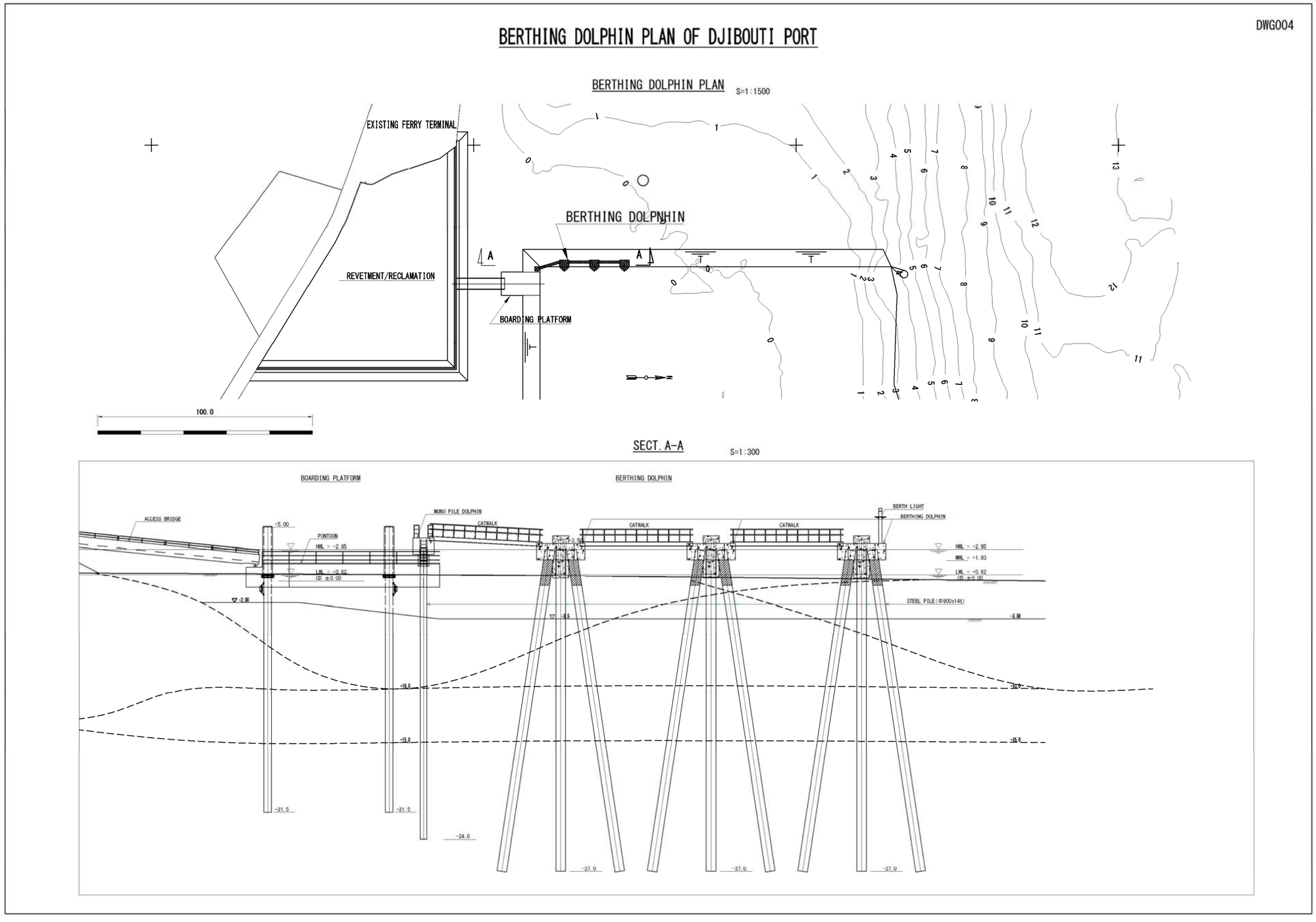


Figure 3.2-17 Berthing Dolphin Plan of Djibouti Port

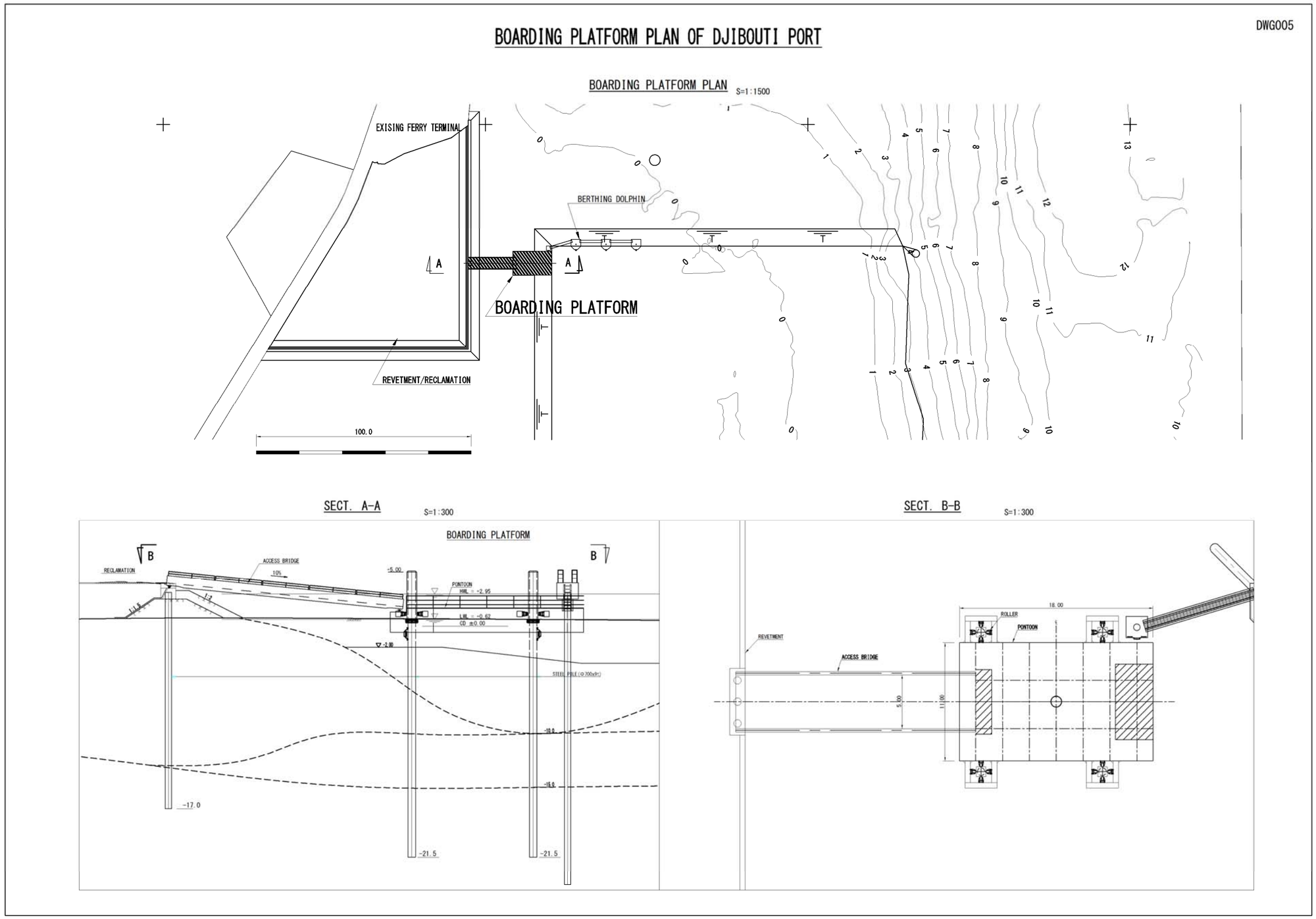


Figure 3.2-18 Boarding Platform Plan of Djibouti Port

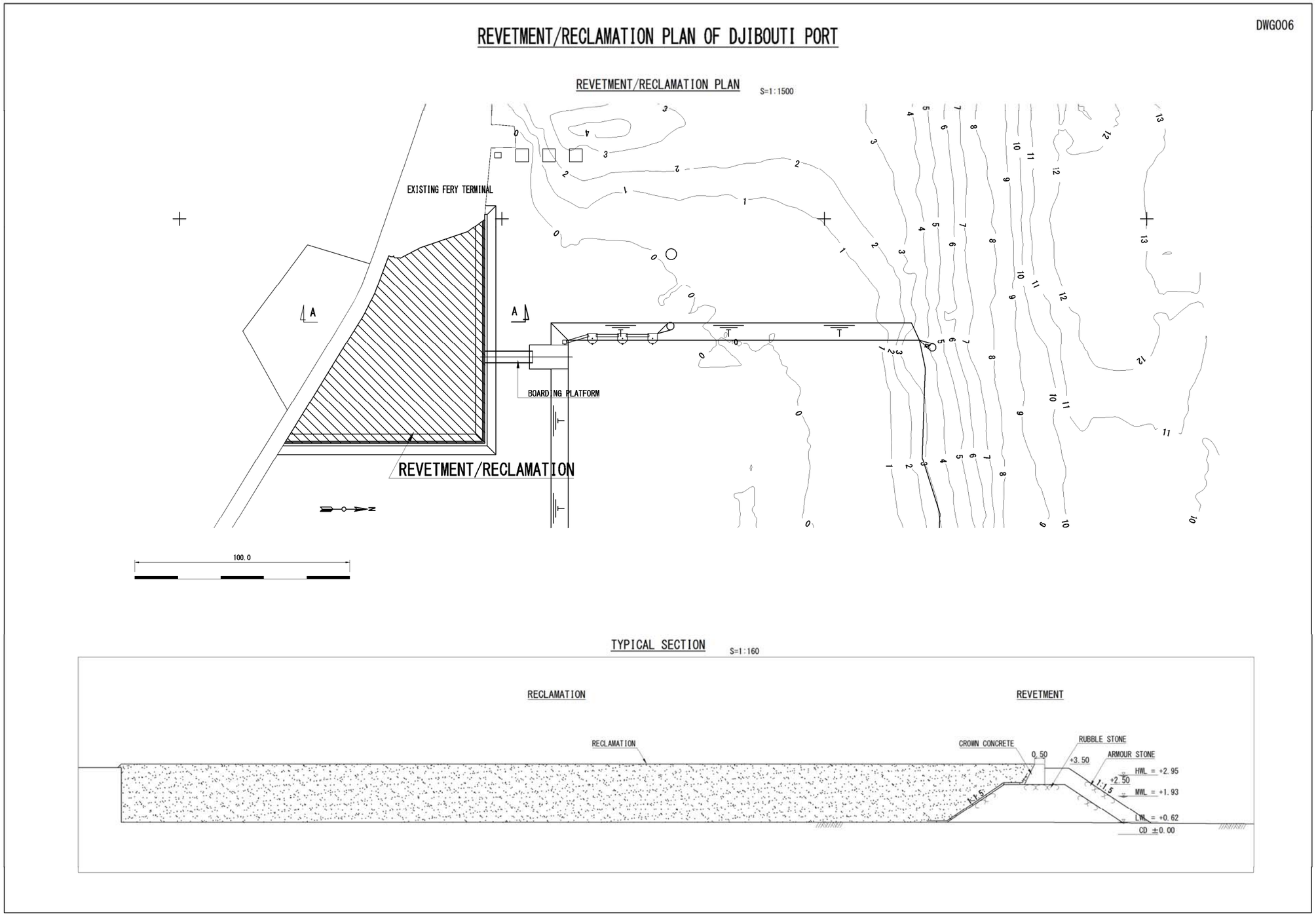


Figure 3.2-19 Revetment / Reclamation Plan of Djibouti Port

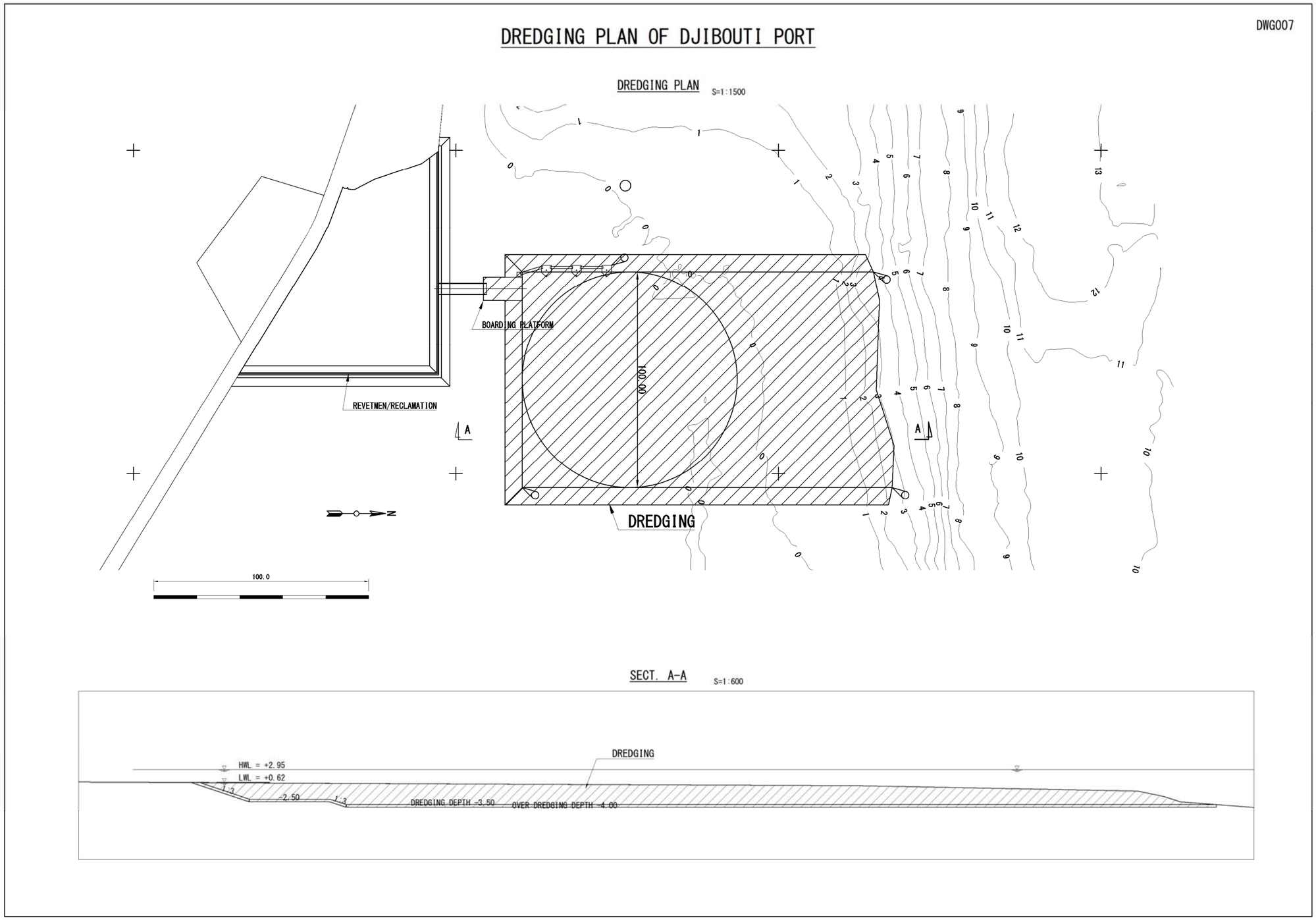


Figure 3.2-20 Dredging Plan of Djibouti Port

DWG008

GENERAL PLAN OF TADJOURAH PORT S=1:1500

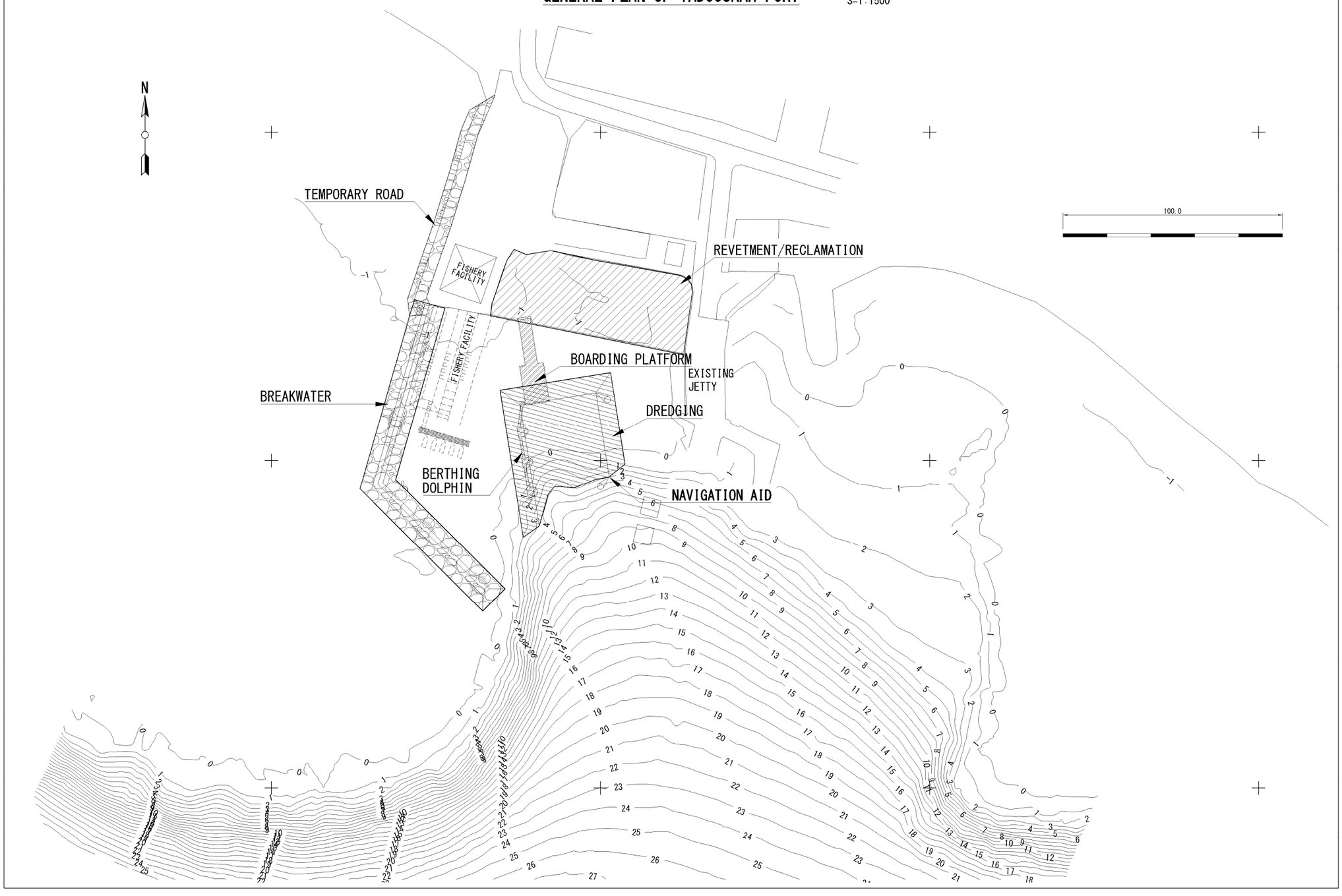


Figure 3.2-21 General Plan of Tadjourah Port

DWG009

TADJOURAH PORT SOIL PROFILE

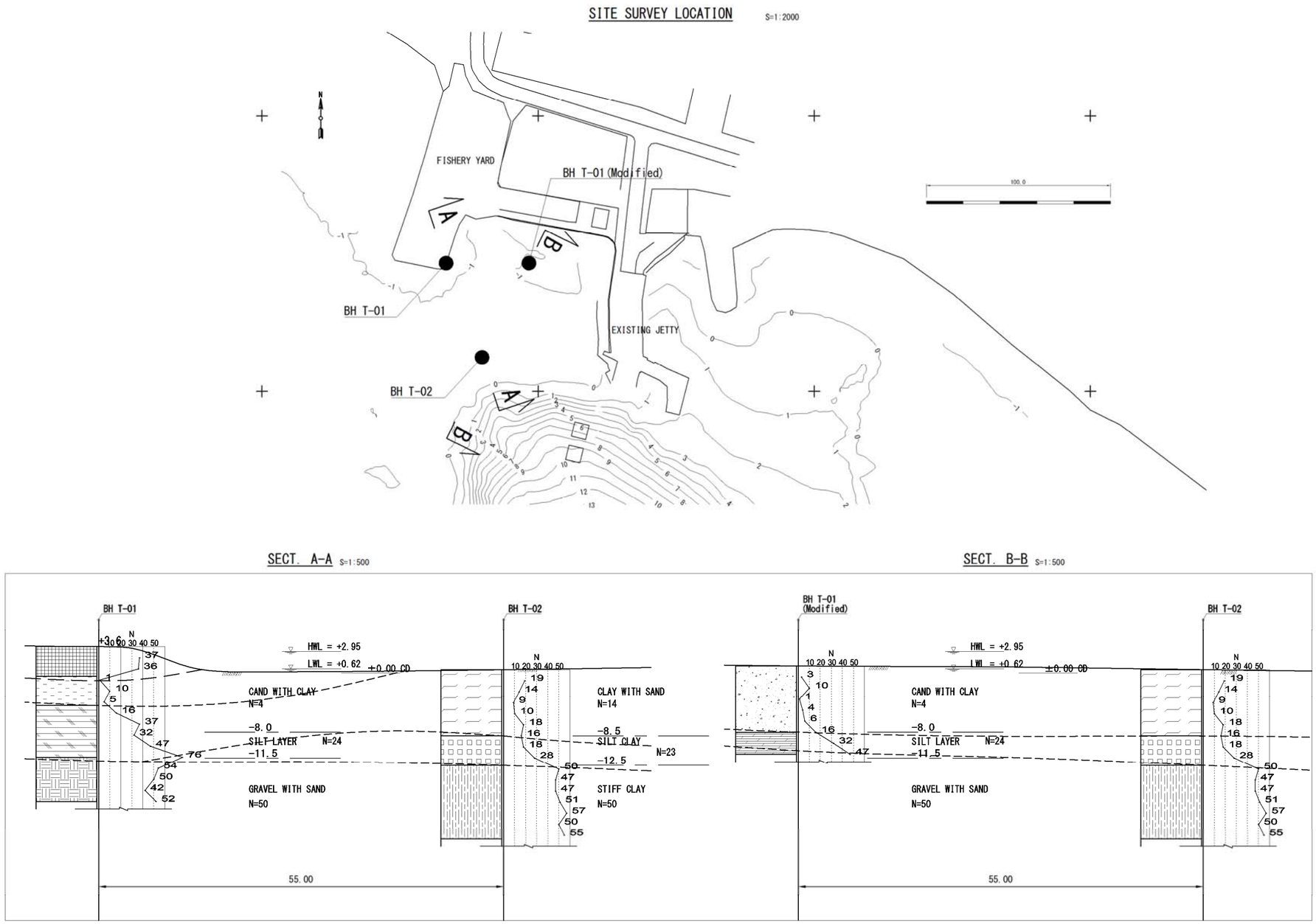
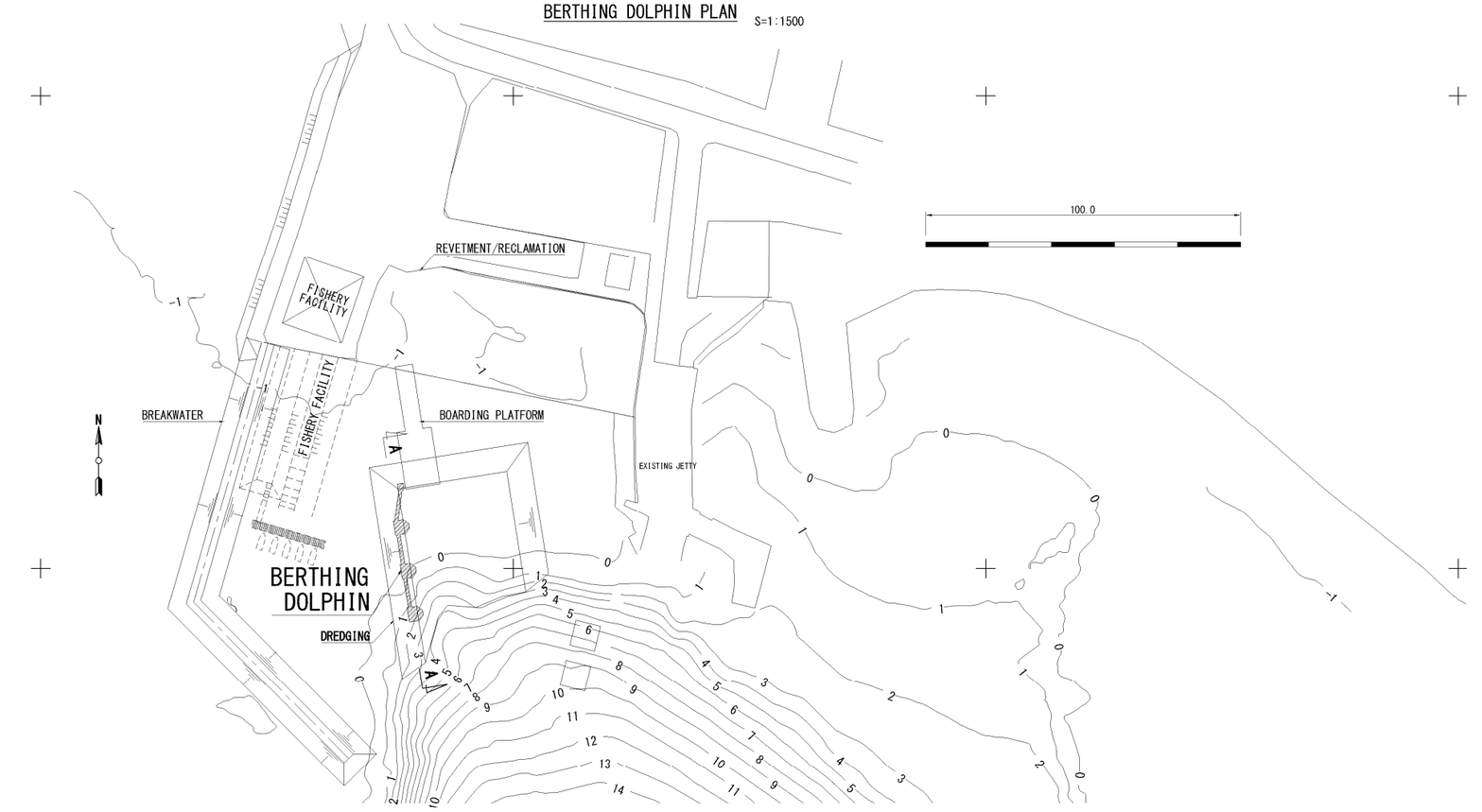


Figure 3.2-22 Tadjourah Port Soil Profile

DWG010

BERTHING DOLPHINS PLAN OF TADJOURAH PORT

BERTHING DOLPHIN PLAN S=1:1500



SECT. A-A S=1:300

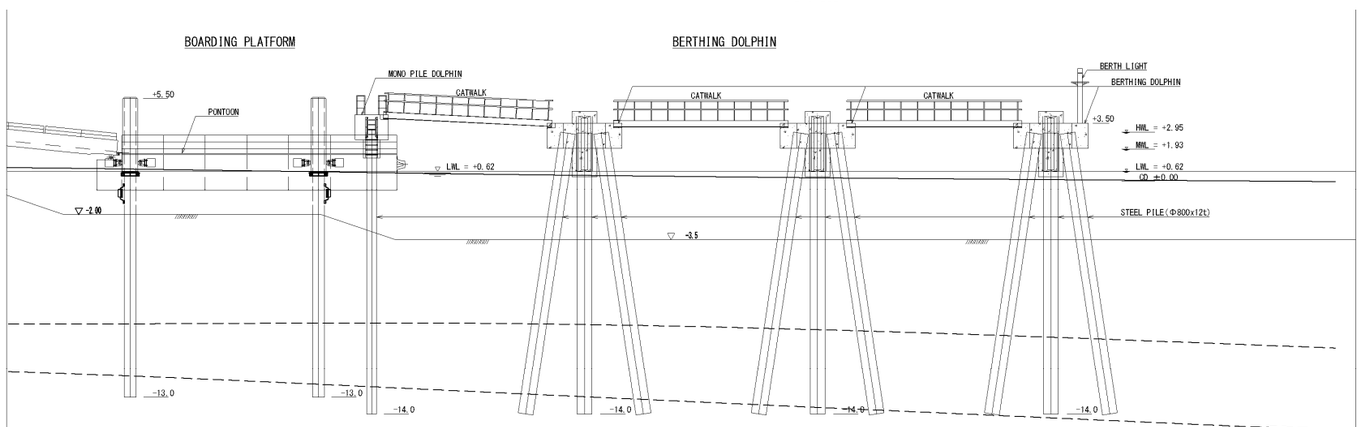


Figure 3.2-23 Berthing Dolphins Plan of Tadjourah Port

DWG011

BOARDING PLATFORM PLAN OF TADJOURAH PORT

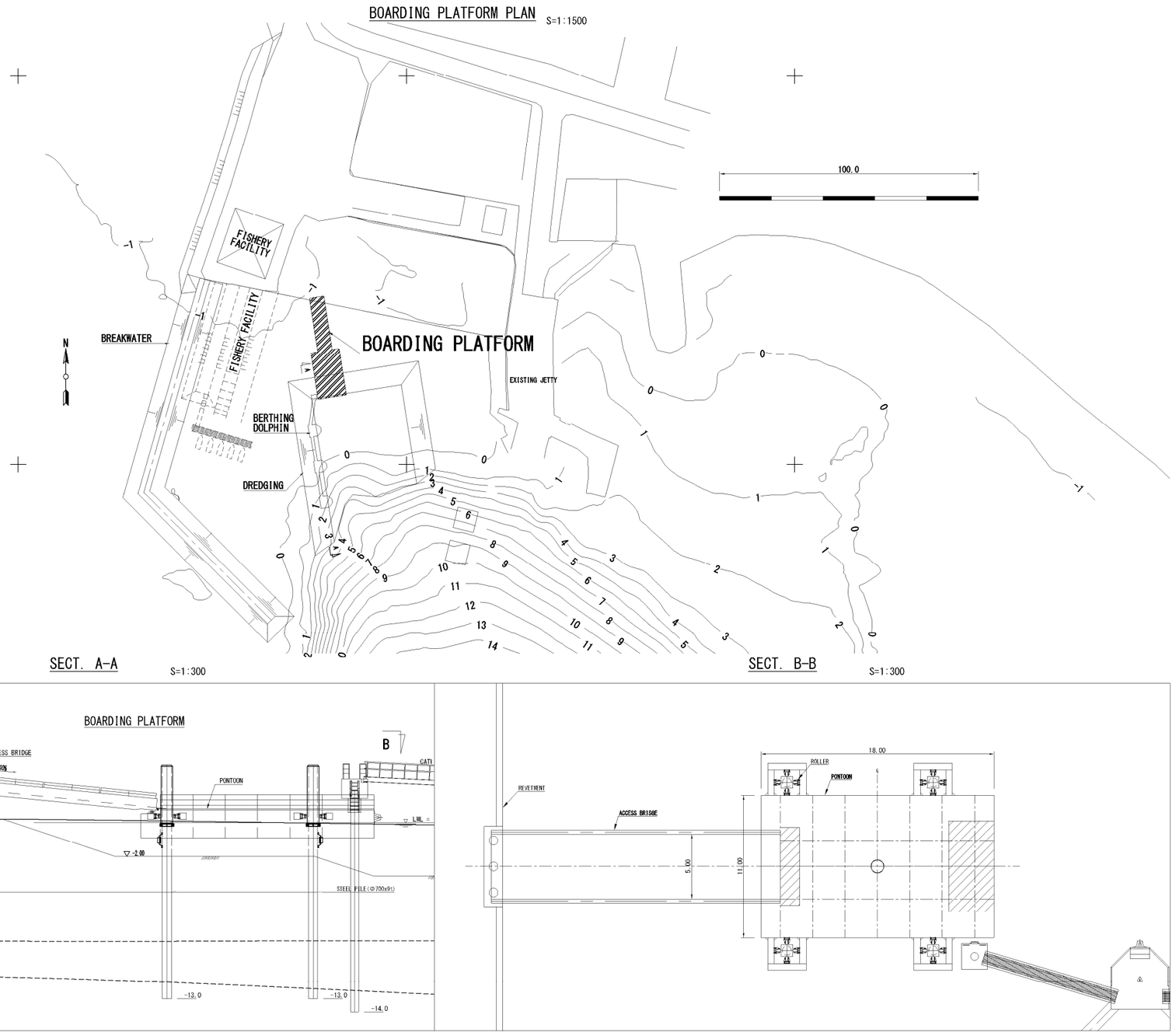


Figure 3.2-24 Boarding Platform Plan of Tadjourah Port

DWG012

REVEMENT/RECLAMATION PLAN OF TADJOURAH PORT

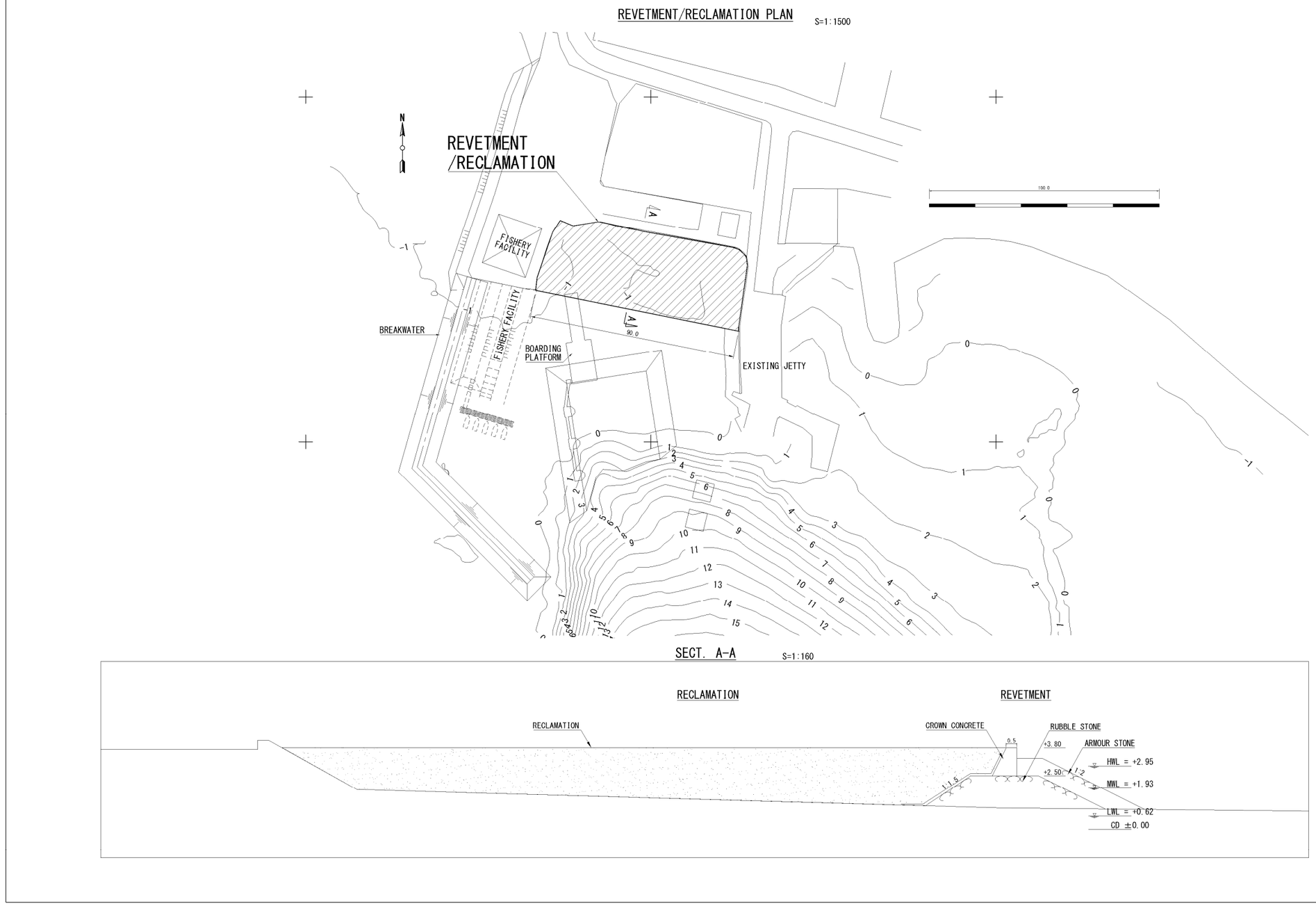


Figure 3.2-25 Revetment / Reclamation Plan of Tadjourah Port

DWG013

DREDGING PLAN OF TADJOURAH PORT

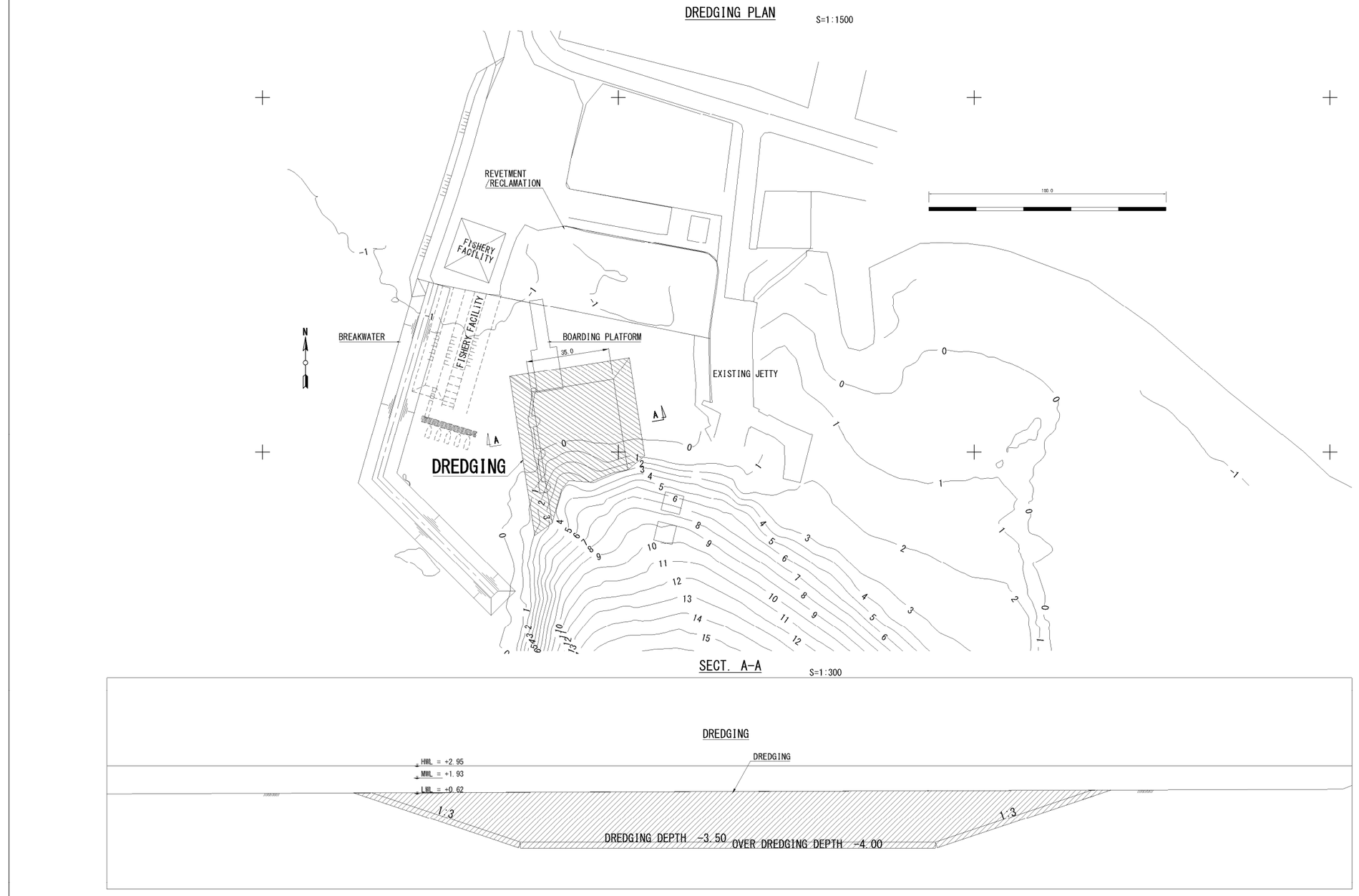


Figure 3.2-26 Dredging Plan of Tadjourah Port

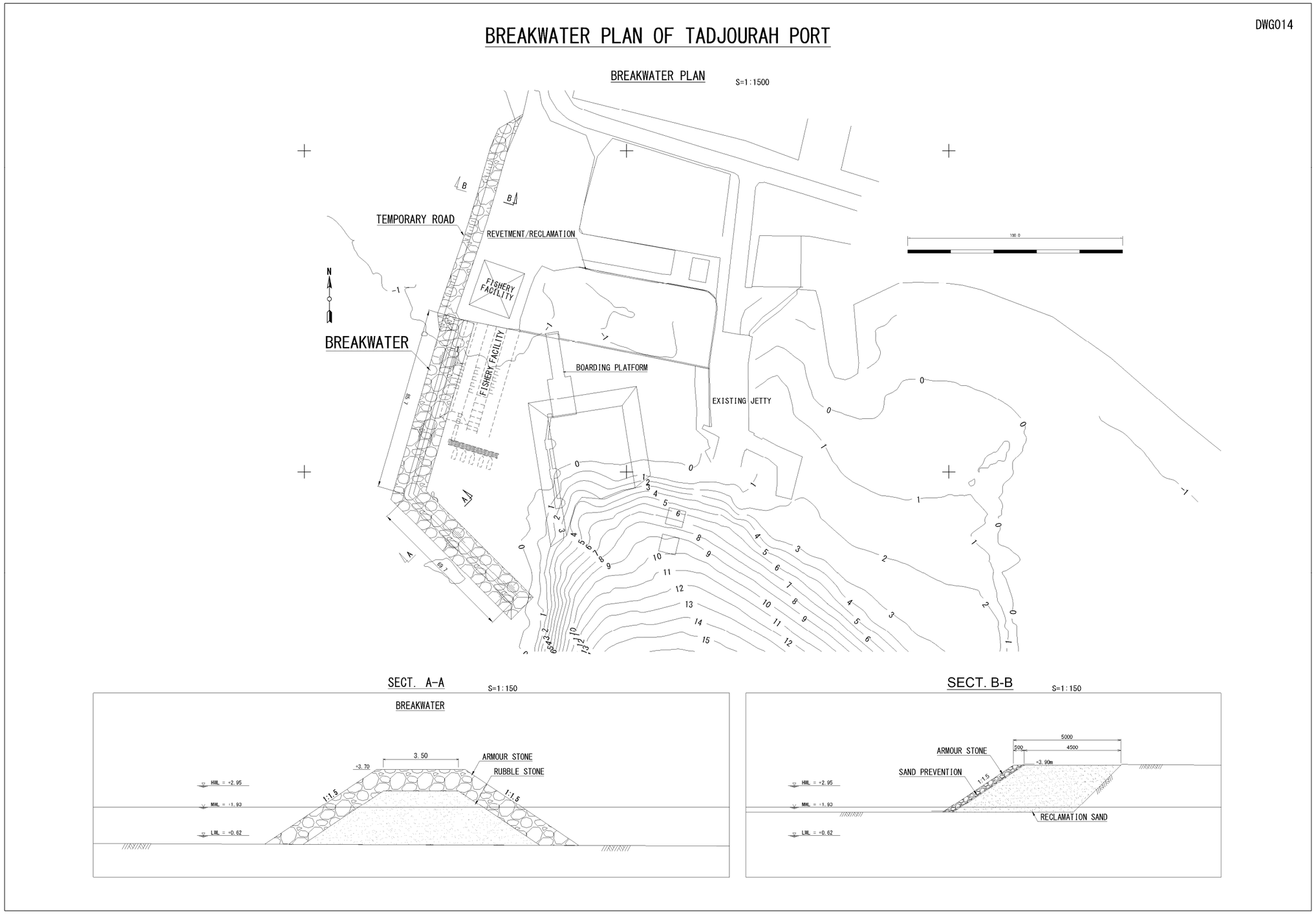


Figure 3.2-27 Breakwater Plan of Tadjourah Port

(2) Ship Design Drawings

Table 3.2-14 Specification of the planning ship (Proposal)

1. Principal particulars	
1) Type of hull	Single flat freeboard deck type
2) Flag	Republic of Djibouti
3) Navigation area	Gulf of Tadjourah (Equivalent to Japanese restricted coasting area)
4) Cruise time	Less than two(2) hours
4) Classification	-
5) Regulation and rules	Japan Government, class 2 (Passenger ship, Domestic voyage) Safety rules for sea going vessels Rule for mariners International convention for prevention collision at sea International convention for the prevention of pollution from ship Rules for navigation radio International tonnage regulations Relating regulations to be required
6) Gross tonnage	about 450 GT
7) Length (O.A.)	About 49.95 m
8) Breadth	about 11.00 m
9) Depth	about 3.50 m
10) Designed draft	about 2.50 m
11) Deck height (Upper deck ～ Mooring deck) (Upper deck ～ Promenade deck) (Promenade deck ～ Wheelhouse top)	 about 2.20 m about 4.50 m about 2.30 m
12) Capacity of tanks (Fuel oil tank) (Fresh water tank) (Ballast water tank)	 about 18.0 m^3 about 14.0 m^3 about 200.0 m^3
13) Main Engine	4cycle diesel engine 2 sets Maximum continuous output: more than 487 kW（650 PS）× 1,350 min^{-1}
14) Propulsion	Fixed pitch propeller 2 sets
15) Auxiliary engine for generator	more than 89kW（121PS）×1,500 min^{-1} 2 sets
16) A.C. generator	more than 100 KVA AC380V, 50 Hz, 3ph 2 sets

17) Navigation speed	12 knots
18) Complement	262 P (Passenger: 250 P) (Crew: 12 P)
19) Maximum loading capacity	4×4WDcars＋4×Trailer trucks (Equivalent to 20 cars)
20) Endurance	(at service speed) 640miles
2. Hull part	
1) Principal construction material application	To be complied with regulation for ship structure or JIS standard materials / NK certified materials
2) Structure material	Under promenade deck : Welded steel Promenade deck and upward : Welded aluminum alloy
3) Rudder	Flap type 2 sets
4) Skeg	Welded steel structure
5) Fender	Steel pipe
6) Bow thruster	Engine driven, 19.6 kN・m 1set Engine：Rated power more than 128kW
7) Mooring fittings	Bollard: Steel plate or steel pipe 250φ ×8 sets Fairleader: Steel plate or steel pipe 200φ×6 sets 2 roller type Stand roller: Steel plate or steel pipe 200φ×4 sets
8) Anchor, Anchor chain and lines	Anchor: Stockless 520ｋｇ 2 sets Anchor chain: GladeⅡ 25φ 12 cables Moor line: Nylon 28φ×165m 1 line Tow line: Nylon 28φ×135m 1 line Moor line: Cremona rope 26φ×50m 4 lines
9) Windlass	Electro hydraulic driven 2 sets Gypsy wheel：3.1ｔ×9 m／min Drum：1.2ｔ×15 m／min
10) Mooring winch	Electro hydraulic driven 2 sets 1.2ｔ×15 m／min
11) Ramp door	FWD×1set, AFT×1set Dimension (Clear) Approx. 6.5m (L) ×4.0m (B) Designed condition (Passing): 25 ton (shaft weight condition: 10ton) Driven : Hydraulic cylinders Electro Hydraulic pump unit: Combined system with deck machinery Flap: Portable type
12) Vehicle lashing device	Lashing band 65 units
13) Air conditioner	Wheelhouse：Water cooled, wall mount type 1 set Passenger rm.：Water cooled, floor mount type 2 sets Nursing rm.：Air cooled, wall mount type 1 set

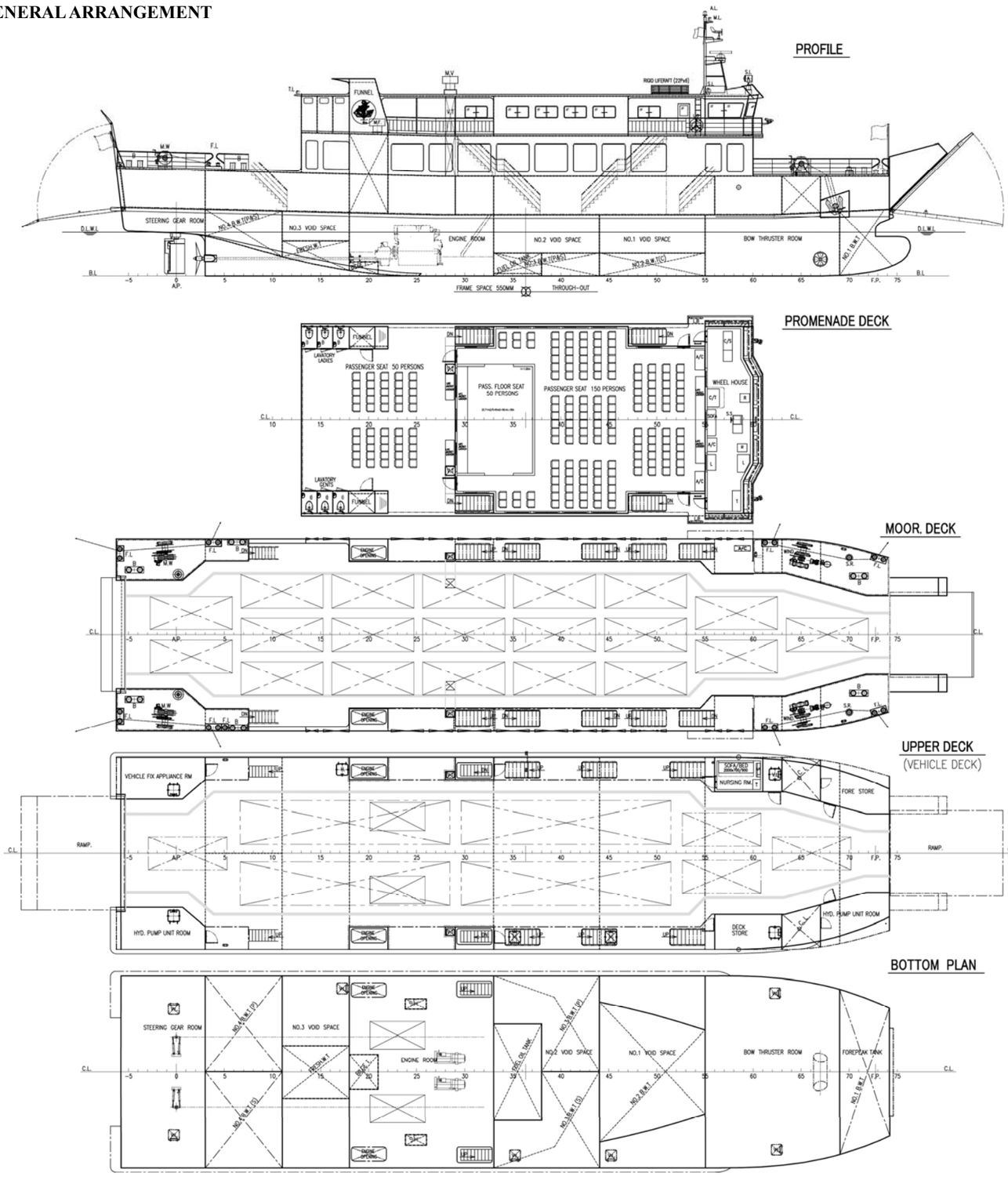
14) Ventilator	WC : Home duct fan	6 sets
	Wheelhouse：Home duct fan	1 set
	Steering gear rm. : Axial flow fan	1 set
	Bow thruster rm. : Axial flow fan	2 sets
15) Steering gear	Electro hydraulic driven 19.6 kN・m	1 set
16) Navigation equipment	Binoculars	1 set
	Compass（Desk top type）	1 set
	Mast light	1 set
	Side light	1 set
	Stern light	1 set
	Anchor light	1 set
	Red light (Hanger type)	1 set
	Clock	1 set
	Inclinometer	1 set
	Wind speed direction indicator	1 set
	Echo sounder	1 set
	Paper weight	1 set
	Three-screen ruler	1 set
17) Signal appliance	Whistle (more than 130dB less than 138dB)	1 set
	Black ball 600mm dia.	3 sets
	Gong	1 set
	National flag	1 set
18) Life-saving appliance	Rigid Life buoy for 22 person	12 sets
	Life jacket（Wearing type）	
	For adults×262, For children×25, for infants×7	
	Life buoy	4 sets
	Self-ignition signal（Battery type）	2 sets
	Self-smoke signal	1 set
	Parachute signal	4 sets
	Fire flare signal	2 sets
	Embarkation ladder	1 each for each ship side
19) Fire-fighting appliance	5.0kg portable powder fire extinguisher	16 sets
	5.0 kg portable carbon dioxide gas fire extinguisher	3 sets
	45 L portable foam fire extinguisher	1 set
	Fire man appliance	2 sets
	Fire detector system (Thermal, Smoke)	1 set
20) Ballast control system	1 set	
	(Water level detectors 6 sets)	
	(System monitor and electrical remote valves)	

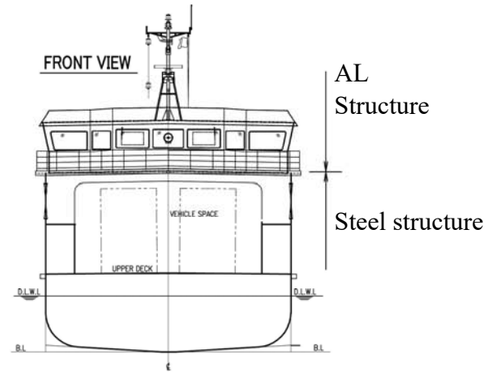
21) Draft gauge	4 sets
22) Inclinometer	(With 2 monitors) 1 set
23) Tank level gauge	For F.O.T. 1 set For F.W.T. 1 set
24) Painting	
Bottom shell (Under water line)	Epoxy paint× 2 、 Self-polishing antifouling paint× 2
Side shell/ Outside deck Outside of super structure	Epoxy paint× 2 、 Polyurethane paint× 2
Bow thruster room Engine room Steering gear room	（Under insulation） Oil based anticorrosive paint× 1 （Above the floor） Oil based anticorrosive paint× 1 、 Finish paint× 1 （Under the floor） Epoxy paint× 1
Fuel oil tank	Oil wipe
Fresh water tank	Epoxy paint× 1
Inside of Aluminum alloy super structure	（Under insulation） Epoxy paint for AL structure × 1 （Without insulation） Epoxy paint for AL structure × 1 、 Acryl finish paint×2
Outside of Aluminum alloy super structure	Epoxy paint for AL structure× 1 、 Acryl finish paint×2
Ballast tank	Epoxy resin paint for tank×2
Void	Oil based anticorrosive paint× 1
3. Engine part	
1) Main engine	Single act 4cycle marine diesel engine 2 sets M.C.O. more than 480 kW（653 PS） Revolution（at M.C.O.）about 1350 min^{-1}
2)Reduction gear	Reduction ratio about 4.5 ： 1 1 set
3) Propulsion	4 blades, fixed pitch al- bronze propeller 2 sets Stainless shaft 2 sets Cast iron stern tube 2 sets Forged steel stern boss 2 sets
4) Generator sets	Marine diesel engine 2 sets Rated power more than 89 kW （121 PS） Revolution（at rated power）more than1500 min^{-1} A.C. generator AC385V, 50Hz, 3 phase

	Capacity: more than 100kVA	
5) Oil separator	Capacity: 0.25m^3/h	1 set
	Bilge pump 0.25m^3/h×20m	1 set
6) Ventilator for engine room	Supply: Axial flow fan	2 sets
	Exhaust: Axial flow fan	1 set
7) Pump		
Fresh water pump	Home pump	1 set
Sanitary pump	Home pump	1 set
Bilge and general water pump	Centrifugal pump	1 set
Bilge, ballast and fire pump	Centrifugal pump、remote control	1 set
Fuel oil transfer pump	Gear pump	1 set
Sludge pump	Gear pump	1 set
8) Tank		
Fuel oil	(Hull structure)	about 18.0 m^3
Fresh water	(Hull structure)	about 14.0 m^3
Ballast water	(Hull structure)	about 200.0 m^3
Fuel oil service	(In depended)	about 1.0 m^3
Sludge	(Hull structure)	about 0.5 m^3
Lubricant	(In depended)	about 0.2 m^3
4. Electrical part		
1) Power sources		
A.C. generator	Drip-proof, Brushless	2 sets
	Capacity: more than100 kVA	
	AC 385V, 50Hz, revolution : 1500min^{-1}	
Trans	Dry type, drip proof	
	3phase, 30kVA, AC380V／225V×50Hz	1 set
Rectifier		1 set
Battery	DC24V	4 pieces
Main switch board	Drip-proof, dead front	1 set
Distribution board	1 set	
Charging and discharging board	1 set	
Navigation light board	1 set	
Alarm box	1 set	
Shore connection box	1 set	
2) Lighting		
Ceiling light	1 set	
Wall light	1 set	
Hand light	2 sets	
Working light	1 set	

Emergency light	1 set
Chart table light	1 set
Search light	1 set
Vehicle deck light	1 set
Flood light	4 sets
3) Navigation, signal lights	
Navigation light	1 set
Side light	1 set
Stern light	1 set
Anchor light	1 set
Signal light	2 sets
4) Inter communication	
Public addressor	Amplifier and speaker 1 set
Automatic telephone	1 set
Signal bell	1 set
Telegraph	2 sets
Main engine and propeller revolution indicator	2 sets
Rudder indicator	2 sets
Whistle(Electric horn)	DC24V 1 set
TV Monitoring device	4 sets
Emergency alarm panel	1 set
Fire alarm panel	1 set
Bilge Flooding alarm system	1 set (For bow thruster room,NO1void, NO.2 void, Engine room, NO.3 void, steering gear room)
5) Nautical equipment	
Radar	X band、12ｋW／96 nm 1 set
Wind speed direction indicator	1 set
Echo sounder	2 frequencies、range：more than １ｍ 1 set
GPS navigator	more than 12 channels、 1 set
VHF radio telephone	frequency155.000 MHz ～161.475 MHz 1 set Channel 57CH

Figure 3.2-28 GENERAL ARRANGEMENT



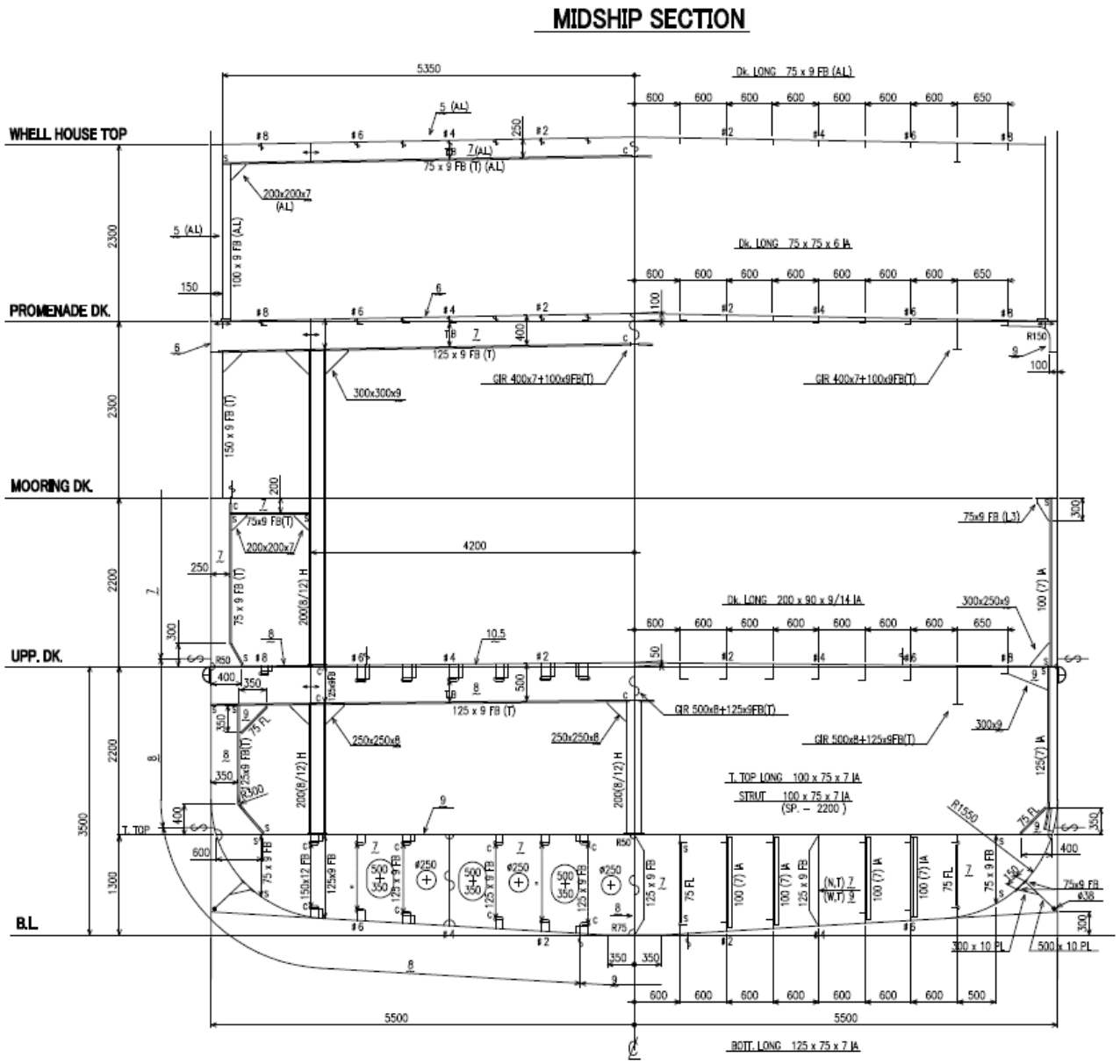


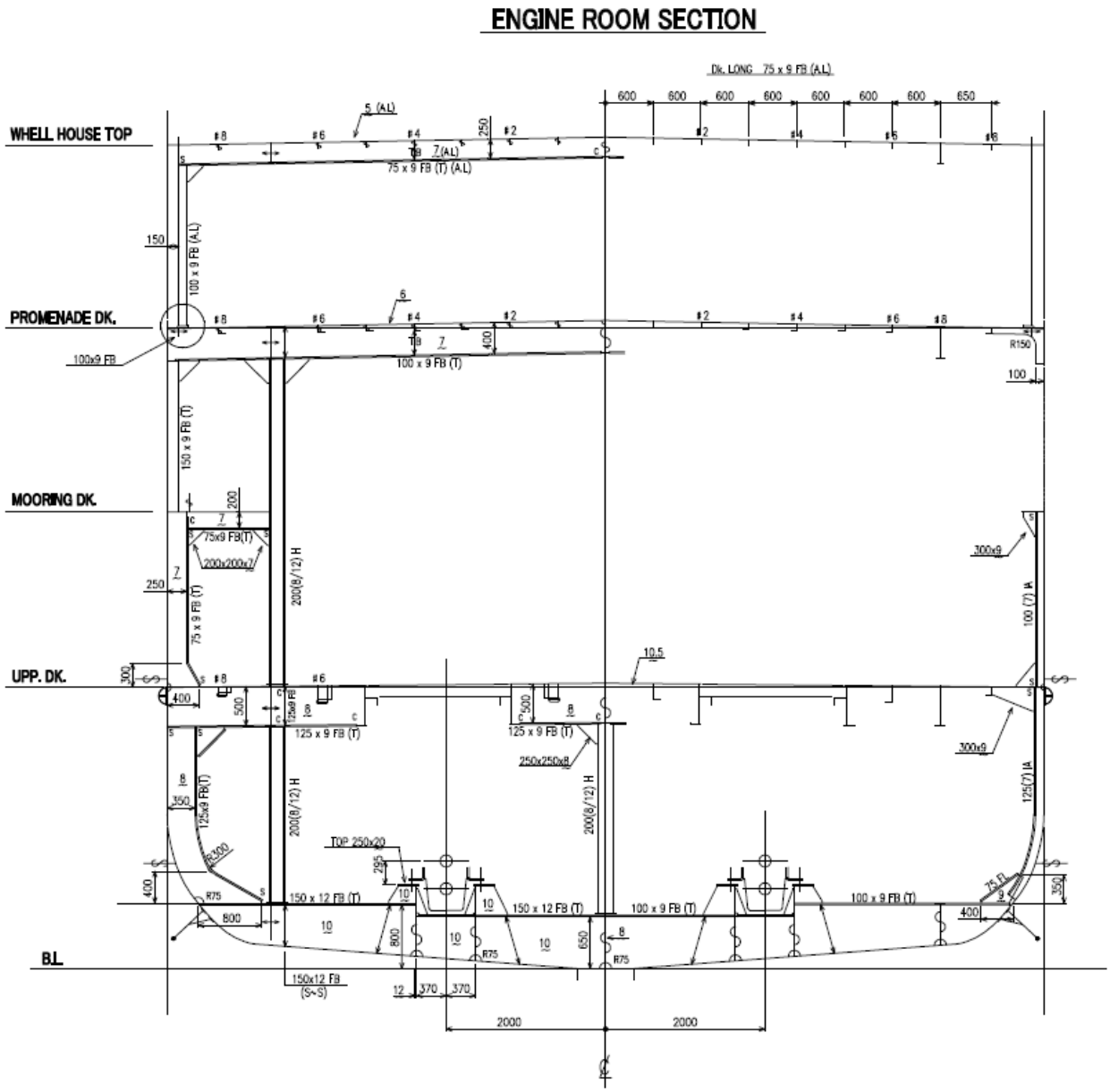
PRINCIPAL PARTICULARS

LENGTH (OVER ALL)	abt	49.95 M
LENGTH (REG.)	ab't	40.80 M
LENGTH (L.P.P)	ab't	40.00 M
BREADTH (MLD.)		11.00 M
DEPTH (MLD.)		3.50 M
DRAFT DESIGNED (MLD.)	ab't	2.50 M
GROSS TONNAGE	ab't	450 GT
MAIN ENGINE	478kW (650PS)	× 2 Sets
SERVICE SPEED	ab't	12.0 Knots
FUEL OIL CAPACITY	ab't	18.0 M^3
FRESH WATER CAPACITY	ab't	14.0 M^3
COMPLEMENT		262 P
CREW		12 P
PASSENGER		250 P
VEHICLE	(CARS, TRUCKS, BUSES, etc.)	

GENERAL ARRANGEMENT

Figure 3.2-29 Midship Section





3.2.4. Implementation Plan

(1) Port Facility

1) Construction Policy and Procurement Policy

The project is implemented under the following basic policy.

① To secure completion of the Project within approved schedule which is essential for Japanese Grant Aid, proper supervision shall be implemented to maintain smooth control of procurement for equipment and material and to maintain smooth progress of construction under the implementation schedule.

② For recruitment of workforce, special consideration shall be paid for local customs, observance and regulation and workforce shall be employed from local source as much as possible.

③ For implementation, special effort shall be necessary to keep contact with local peoples concerned and to harmonize with local communities to avoid occurrence of claims and problems related to the Project.

④ For offshore construction, always collect weather and maritime condition forecast in advance and special attention shall be paid to secure safety

2) Implementation Condition

Construction site is located within Port area and it is estimated maximum wave height will be Approx. 1.5m through khamsīn season at only Tadjourah according to the natural condition survey. Safety First shall be prioritized for offshore construction work and working vessels such as Dredger fleet, Crane Barge and others shall be sheltered to safe location when adverse weather condition encountered.

① Construction material such as stone, rock etc. which are available at local source shall be utilized as much as possible for the Project. For recruitment of manpower, it should respect for opinion of local concerned person and local communities to avoid any dispute to society.

② At Tadjourah, urban area locates nearby construction site and it will be sensitive for environmental circumstance against Noise and Vibration. Therefore, special care shall be taken to minimize such affect during construction period.

③ Country “Djibouti” locates tropical disease stricken area such as Malaria, Deng fever, etc. Special care and monitoring for health condition and safe sanitary environment shall be taken for staffs and workers.

3) Scope of Works

Scope of Work for the Project between Government of Djibouti and Government of Japan are outlined hereinafter.

a) Scope of Work provided by Japanese Government

- Detailed Design, Preparation of Tender Documents and Assistant for Tendering
- Provision of New Ferry Ship
- Construction of berthing and landing facilities for Ferry
  Dredging of Channel and Basin, Construction of Berthing Dolphins, Installation of Floating Pontoon and Access Ramp, Installation of Fender and Bollard, Establishment of Navigation Buoys, Construction of Breakwater (Tadjourah only)

b) Scope of Work provided by Recipient Country (Djibouti)

- Secure and hand over of the Construction area

- Obtain or support for obtain of various permits
- Construction of Ferry Passenger Terminal (Passenger building, Road, Parking area, Electricity, Water and Sewage system, etc.)
- Construction of Boundary Fence and Gate
- Bear necessary expenditure for Banking Arrangement and Tax Exemption of the Project

4) Consultant Supervision

Immediately after signing of Exchange Note, Maritime Affair, Ministry of Equipment & Transport make the Contract for implementation of the Project with Japanese consultant. Japanese consultant shall provide their service for provision of Detailed design, preparation of Tender document, assistance for Tender and Construction supervision and shall be responsible for hand-over of the Project and shall undertake supervision responsibility until the end of Defect Liability Period.

a) Implementation Plan of the Consultant

i) Detailed Design

The consultant shall engage Detailed Design work of the Project based on the result of Outline Design. Following works are implemented under Detailed Design.

1) Review of Outline Design and prepare Detailed Design
2) Preparation of Tender document

ii) Selection of the Contractor

After completion of Tender document, Maritime Affair implements for Selection of the Japanese Contractor by Public Open Tender Method with assistance of the Consultant.

The Consultant assists Maritime Affair for following procedure.

1) Tender Notice
2) Prequalification
3) Pre-Tender Meeting
4) Preparation of Answer to the Contractor's questionnaire
5) Tender
6) Evaluation of Tender proposal
7) Contract

iii) Consultant supervision

The Consultant commences Consultant supervision work after receiving commencement order issued by Maritime Affair.

The Consultant implements construction supervision work at site in accordance with the Specification of the Project and given power.

b) Manning Schedule

Necessary manpower and his/her scope for detailed design, Tender assistance and Construction supervision are listed as follows.

a) Team Leader (Responsible for all activity of the Project and Report)
b) Person in charge of Detailed design of Marine Facilities (Review of Outline design documents, Detailed design and preparation of Design report and Drawings)
c) Checking and Examination of Design (Outline Design, Detailed Design)
d) Assistant for Detailed design of Marine Facilities (Review of Outline design documents, Detailed design and preparation of Design report and Drawings)
e) Person in charge of Tender assistance (Preparation of Tender document, Assistance for Tender)
f) Person in charge of Contract (Assistance for Tender, Administration work for the Contract)
g) Consultant supervision Engineer stationed at Djibouti site (Construction supervision of the Project)
h) Environmental Specialist (Periodical Environmental monitoring)
i) Consultant supervision assistant Engineer stationed at Tadjourah site (Construction supervision of the Project)

5) Quality Control Plan

In principle, "General Specification for Port and Harbor" published by Ministry of Land, Infrastructure and Transport, Japan is applicable for Quality Control.

Especially, special attention shall be paid for following items listed below table and quality stipulated in the Tender Documents shall be secured.

Table 3.2-15 Quality Control Items

Work Item	Item	Quality Control Methodology
Steel Pipe Pile	Material	Confirm Manufacturer's Mill Sheet
	Thickness, Diameter, Length	Measure at site
	Rust, Damage	Check appearance and actual condition
	Driving (Position)	Check Plan and Survey result
	Driving (Bearing capacity)	Record driving record for all piles Confirm Bearing capacity by using Hiley's Formula
Concrete	Material	Confirm Manufacturer's Certificate Confirm by Sieve Analysis Test
	Mix Design	Review Mix Design Plan Implement Trial Mix and confirm result
	Strength	Confirm strength by Compressive Strength Test

	Construction (Cast)	Check Slump, Air content and Temperature
	Construction (Finished Shape)	Measure after curing
Reinforcement Bar	Material	Confirm Manufacturer's Mill Sheet
	Diameter, Length	Measure at site
	Rust, Damage	Check appearance and actual condition
	Construction (Position, Space)	Confirm by actual measurement and visual appearance

6) Procurement Plan

a) Procurement Plan of Material

In Djibouti, only civil material such as sand, crushed stone, rock material and ready mixed concrete (Djibouti city only) are available.

Most of construction material such as Steel, Re-bar, Cement, Plywood, Timber and others are available at market but all are imported material and major parts are imported from Turkey or imported through Yemen. Recently, imported material from China is rapidly grown but there is doubtful for quality, informed from local source. Judging from scale of construction component of the Project, procurement of material for the Project is planned mainly from Local Market even if imported one except special items.

Construction materials which are not produced in Djibouti such as Floating Pontoon, Access Ramp, Rubber Fender, Bollards and Navigation Aids are procured from Japan or Japanese-Affiliated Company in Third Country such as Singapore..

Source of main construction material is shown in Table 3.2-16 below.

Table 3.2-16 Procurement Source of Main Material

Source / Material	Locally procured	Procured from 3rd Country	Procured from Japan	Remarks
Ready Mixed Concrete	○			Local (Djibouti)
Cement	○			Market (Import)
Sand	○			Local
Rock Material	○			Local
Reinforcement bar	○			Market (Import)
Plywood	○			Market (Import)
Timber	○			Market (Import)
Construction Water	○			Local
Steel Pipe Pile			○	
Steel (H-steel, etc)	○			Market (Import)
Fuel	○			Market (Import)

Floating Pontoon		○		
Access Ramp		○		
Catwalk	○			Local fabricate
Rubber Fender			○	
Bollard			○	
Scarified Anode			○	For SPP
Navigation Aids			○	

b) Procurement Plan of Construction Equipment

Most of large Construction Equipment is owned by Private Construction Company or Port of Djibouti and availability of Equipment to procure in Djibouti is very limited and expensive. And due to limited small market, number of General Construction Equipment is also limited, old and expensive. Therefore, local procurement is only applied for the equipment whose construction volume is rather small and period is short. Construction equipment which use general purpose and use long term is planned to procure from Japan. According to the Site Investigation of Tadjourah, almost no construction equipment is available. Therefore, all construction equipment mobilizes from Djibouti city or mobilizes from Japan through Djibouti city.

For Marine Working Vessel in Djibouti, no Equipment is available except 1 small pontoon for boring, 1 old fixed type trident crane barge as a result of Site Investigation. Considering scheme of Japanese Grant Aid, Japanese Contractor will be awarded and considering their business trend, cost, easiness of procurement and mobilization period, Marine Working Vessels such as Grab Dredger Fleet and Crane Barge Fleet are planned to procure from Singapore.

List of Major Equipment and source of procurement are shown in Table 3.2-17

Table 3.2-17 Source of Procurement for Major Equipment

Source / Equipment	Locally procured	Procured from 3rd Country	Procured from Japan	Remarks	Route
Crane Barge (combined Piling)		○		Multi works	1
Material Barge		○	○		1
Anchor Handling Boat		○	○		1
Grab Dredger		○		Dredging	1
Anchor Handling Boat		○			1
Hopper Barge		○			1
Pusher Tug Boat		○			
Tug Boat (Djibouti ~ Tadjourah)	○			Charter from Port of Djibouti	
Passenger Boat	○				
Excavator (0.6m3 class)			○	For Tadjourah	2

Truck Crane (40t)	○				
Truck Crane (20t)	○				
Portable Concrete Plant	○			For Tadjourah only	
Agitator Truck	○				
Truck with crane			○	General use	2
Bulldozer	○			Reclamation	
Dump Truck	○			Reclamation, Rock transport	
Dozer Shovel	○			Rock loading	
Re-bar Machine	○				
Generator			○	General use	3
4 wheel drive car	○			General use	

Route 1: Singapore ~ Djibouti by Semi-Submersible Lifting Barge
Route 2: Japan ~ Djibouti by Cargo ship (Ro-Ro type)
Route 3: Japan ~ Djibouti by Container

(2) The New Ferry

1) Construction Policy and Procurement Policy

a) Procedure

The New Ferry will be planned, documented and constructed along following procedure under the Grant Aid scheme of the Government of Japan.

① Exchange of Notes between the Government of Japan and the Government of Djibouti and Grant Agreement between JICA and the Government of Djibouti, for the implementation of the Project.
② Conclusion of a Consultant Agreement between a Consultant recommended by Japan International Cooperation Agency (JICA) and the Project Implementing Agency established by the Government of Djibouti, for the Consultant's work to implement the Project.
③ Verification of the Consultant Agreement by JICA.
④ The Consultant prepares detail designs and draft tender documents, and obtains approval from the Government of Djibouti. These include methods of pre-qualification, technical specifications, general arrangement plan, project cost estimates, and draft shipbuilding contract.
⑤ Based on the approved Tender Qualification procedure, the Consultant conducts Tender qualification examination, obtains the approval of the Government of Djibouti, and selects applicants. The Applicant must be Japanese ship building firm(s).
⑥ The Consultant carries out the Tender process, in the presence of the Government of Djibouti, and examines the Tender documents submitted by the applicants. Based on the results of the applicant evaluations, the Consultant recommends the intended contractor to the Government of Djibouti.
⑦ The Consultant assists in contract negotiations with the Government of Djibouti and witness the

Contract.

⑧ Verification of the signed contract by JICA.

⑨ Based on the shipbuilding contract, the Contractor builds and conducts sea trials of the New Ferry, and hand-over the New Ferry together with the Equipment. The Consultant, in accordance with the Consultant Agreement, provides construction supervision, conducts sea trial, and witness the hand-over of the Vessel.

⑩ The New Ferry will be carried by loading on heavy carrier to Djibouti for Delivery.

b) Basic provisions related to the Project procedures

Basic items related to the Project procedures under Japan's Grant Aid scheme are as follows.

i) Responsible Agency and Project implementing Agency for the Project

The Responsible Agency and Project implementing Agency are the same organization, the Maritimes Affaires, Ministry of Equipment and Transport, the Government of Djibouti.

ii) Consultant

Following the Exchange of Notes and the Grant Agreement, a Consultant Agreement will be concluded between the Government of Djibouti and the Consultant, which is Japanese firm recommended by JICA. As the proxy of the Government of Djibouti, the Consultant will prepare the Tender documents including technical specifications and give assistance as necessary in the tender bidding and contractual phases, and further provide continuous supervision of the Vessel construction.

For the purposes of carrying out this supervisory function, the Consultant will dispatch responsible engineers and outfitting experts to the shipyard, as necessary during the construction process.

iii) The New Ferry building and Equipment procurement

For the New Ferry building and related equipment procurement, qualification data submitted by Japanese firms will be evaluated first, and those who had passed the prequalification appraisal are allowed to participate in the tender bidding. The tender is conducted along with the procedure established in advance. The successful tenderer signs the Contract for building the New Ferry and procurement of related Equipment. The Contractor will have responsibility to build the New Ferry, and conduct sea trials, procure the Equipment and transport the New Ferry with the Equipment on board to Djibouti for delivery.

iv) Building plan of the New Ferry

To build the New Ferry, the Contractor, pursuant to the contract and technical specifications, designs the hull and outfitting for building in the Contractor's yard facilities. Following preparation of the construction design by the Contractor, the Vessel is built along shipbuilding process: steel hull construction, outfitting (deck, machinery and electrical), tests, and then transport to Djibouti. The following areas must be given

careful consideration when examining the Construction Plan.

① As this Project is implemented under the Japanese Grant Aid scheme, strict adherence to the construction schedule is the major premise. The building plan must be prepared so as to fulfill all contract conditions within the term validity stipulated in the Exchange of Notes.
② With regard to the delivery deadlines for machinery and equipment, careful consideration must also be given to preventing disruption of the construction work flow by maintaining tight control of machinery and equipment procurement and linking the hull construction and outfitting program to delivery schedules of the relevant machinery and equipment.
③ Various tests must be performed, as required by Djibouti and Classification Society. The required sea trial must be performed upon completion of the construction phase to confirm vessel performance.
④ In the final stage of construction, crews/engineers appointed for the New Ferry are invited to Japan for seven days. Three days are assigned to them to learn about the whole ship, the machinery, and the electricity respectively. Two days are assigned to them for operational training including pier docking and undocking. Another two days are assigned to them for visit of a similar ferry route in Japan. They will be onboard to study the way of safety guidance of passengers and cargos as well as the way of controlling the ship. The shipyard is responsible for these training.
⑤ The Contractor transports the New Ferry, at his own responsibility, from the Contractor's quay (wharf) to the Vessel's homeport. After arrival at the homeport, final inspection will be immediately conducted and thereafter the New Ferry with the equipment will be delivery to the Government of Djibouti.

v) Procurement plan of the Equipment

The Contractor procures the equipment for the Project based on the Contract and technical specification.

vi) Dispatch of engineers

After delivery of the New Ferry, engineers shall be dispatched by the shipbuilding Contractor to Djibouti to cope with the first service round trip between Djibouti and Tadjourah port. Those engineers will give instructions for operation and maintenance of machinery, system as far as possible.

2) Special consideration with regard to Construction and Procurement

① The procedure of hull assembly and outfitting should be established taking into consideration of the layout and special features.
② For those materials, machinery and equipment, whose delivery is not very firm, delivery possibility should be followed up frequently and reflect the change in the work schedule promptly.
③ On-board tests for principal machineries and equipment and sea trials should be proposed in detail planned and included in the work schedule.
④ The work schedule should be regularly (at least once in a week) followed up and updated.

3) Scope of Works

Scope of Works at Japanese side and Djibouti side are generally as follows.

① Building of the New Ferry, procurement of the Equipment and their transportation from Japan to Djibouti are all undertaken by the Japanese side.
② Djibouti side is to undertake arrangement of all licenses and certificates necessary for the execution of the Project.
③ Djibouti side is to prepare parts store for large spare parts for the New Ferry.

After completion of the delivery of the New Ferry in Djibouti, Djibouti side is to undertake all arrangements necessary to operate the New Ferry, i.e. crew, operator, running costs, insurance, government subsidy, etc., safely and smoothly.

Following is the further breakdown of the works at Japanese side and Djibouti side.

a) Scope of work at Japanese side

The followings are the scope of work at Japanese side, as the Project under the Japan's Grant Aid scheme.

① Design and construction of the New Ferry.
② Procurement of the related equipment for the Project.
③ Transportation of the New Ferry from Japan to Djibouti with the equipment on board.
④ Consultant services for detail design, assistance in tender and supervision during shipbuilding and equipment procurement.

b) Scope of work at Djibouti side

The followings are the scope of work at Djibouti side.

(Arrangement during implementation of the Project)
① Conclusion of Banking Arrangement with an authorized foreign exchange bank in Japan, issuance of an authorization to pay, and bearing necessary commissions to the bank, for the contracts verified by JICA in relation with this Project
② Acquisition of all licenses and certificates of the Government of Djibouti, necessary for the Project, e.g. Provisional Certificate of Nationality, Radio Station License etc.

(Arrangements when the New Ferry has arrived at Djibouti)
③ Exemption of the New Ferry and the Equipment from customs duties, internal taxes and fiscal levies, and prompt customs clearance.
④ Exemption of Japanese nationals from customs duties, internal taxes and fiscal levies for their services in Djibouti.

(Shore facilities in Djibouti)
⑤ Preparation of parts store in Djibouti for large spare parts of the New Ferry.

(Other)

⑥ Any other items which are not covered under the Project.

4) Consultant Supervision

a) Basic Concept of the Consultant Supervision

The Consultant will verify that the construction and procurement schedule have been designed based on the Japan's Grant Aid system. Supervision plan of both shipbuilding and equipment procurement will be prepared on this basis. The Consultant will check whether the quantities, plans, and specifications satisfy the contract documents. The supervision programs will be conducted as follows.

① Approvals of drawings and technical specification
The Consultant should examine, approve and/or give instructions to correct the construction plan, work schedule, production design drawings and specifications promptly, and should reply to the questions from the Contractor promptly as well, so as to prevent disruption in the project schedule.

② Work schedule supervision
The Consultant should always grasp progress of the work schedule, and order whenever necessary to adjust working schedule to ensure on-time completion.

③ Quality inspection
Along with building progress, the supervisor(s) in charge of outfitting and equipment should be dispatched for the necessary periods to workshops and the shipyard to inspect construction at site, checking machinery and outfitting work with the contract drawings, specifications, and approval documents. The supervisor(s) should conduct inspections of the equipment and outfitting work, based on the approved test procedure and the Contractor's in-house standards.

④ Delivery and acceptance
After transporting the New Ferry to the homeport, Djibouti, the Consultant should be present at all inspections at the wharf and issue the certification documents required for local delivery and acceptance.

⑤ Construction report
The Consultant should make monthly reports on construction progress and schedules work for the succeeding month, appending factory photos. These reports should be submitted to both the Government of Djibouti and JICA.

b) Supervisory arrangement

The Consultant should establish a project team consisting of the project manager, naval architect, outfitting staff, machinery staff, electric staff, joiner work staff and equipment procurement staff, and prepare implementing detail design and exercise supervision over the construction and procurement activities.

5) Quality Control Plan

Quality control of raw materials and installed machinery/equipment for the New Ferry and the equipment for the Project should be conducted as follows.

Table 3.2-18 Quality Control Plan

Items	Quality control
Structural steel, aluminum alloy	To use steel materials and aluminum alloy with certificate of inspection (mill sheet) for every plate and every bar section according to the Class NK standard or JIS certificate.
Pipes and valves	To use pipes and valves with JIS certificate.
Fire protection	Fireproof bulkhead, lining, insulation, fire door etc., for structural fire protection to be of Class NK standards, for which prototype tests had been conducted and have type approval.
Diesel engine	Designed according to JG regulations, prototype tests had been conducted, type-approved, manufactured and qualified by JG. Completed diesel engines to be load-tested including overload for necessary duration on test bench according to the JG regulations.
Auxiliaries	Designed according to JG regulations, manufactured in the factory qualified by JG, and have certificate of JG.
Fire extinguishers/Lifesaving appliances	Designed and have type-approval No. of HK (The ship Equipment Inspection Society of Japan).
Inventories	Type-approved by HK (The Ship Equipment Inspection Society of Japan).
Deck outfitting	Designed according to JIS, and the Consultant to inspect the equipment.

6) Equipment Procurement Plan

Machinery and equipment to be on board the New Ferry and associated Equipment will be in general of Japanese products, which are stable in quality, delivery and price.

7) Initial Operation Instruction and Operation Instruction Plans

a) Operation training

Before the New Ferry departure from Japan to Djibouti, some crews are invited to Japan from Djibouti to have operation training from shipyard engineers and maker engineers. All necessary costs, i.e. airfare,

domestic transport, accommodation, daily allowance and insurance, are to be covered by the shipbuilder as a part of the shipbuilding contract.

b) Guarantee engineer

After delivery of the New Ferry, engineers shall be dispatched by the shipbuilding Contractor to Djibouti to cope with the first service round trip between Djibouti and Tadjourah port. Those engineers will give instructions for operation and maintenance of machinery, system as far as possible.

(3) Implementation Schedule

1) Port Facility

a) Work Flow for Construction

Main Work Flow is as follows.

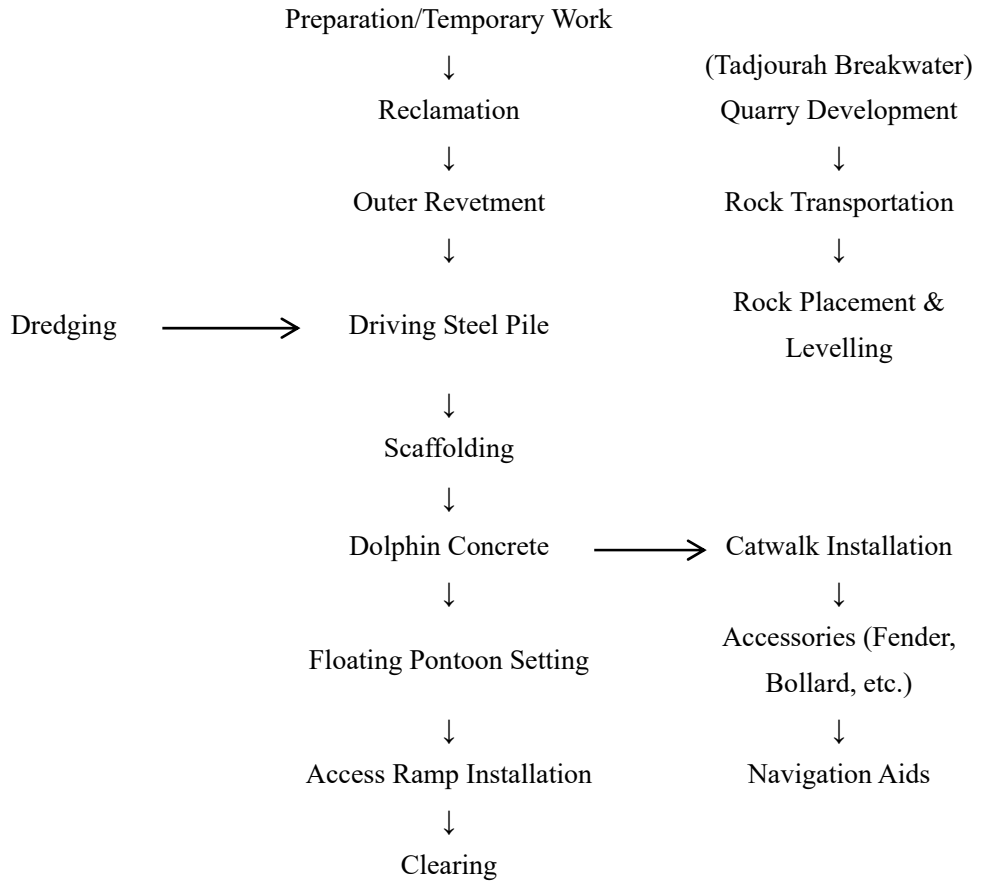


Figure 3.2-30 Construction Flow

b) Conditions for Establishment of Implementation Schedule

For Estimation of Construction period which is precondition for Establishment of Implementation Schedule, following Estimation Standards are used.

- Cost Estimation Standard for Port & Harbor Civil Works issued 2018 (approved by Ministry of Land, Infrastructure and Transport).
- Cost Estimation Standard for Civil Works issued 2014 (approved by Ministry of Land, Infrastructure and Transport).
- Depreciation Cost Standard for Vessel, Equipment and Machinery issued 2018 (approved by Ministry of Land, Infrastructure and Transport).
- Cost Estimation Standard for Fishery Harbor issued 2013(approved by Ministry of Agriculture, Forestry and Fisheries).

When latest edition provide no productivity unit, old edition which provide adequate productivity unit shall be used.

Adjustment of Productivity Unit is calculated in accordance with preparatory Survey-Design-Estimation Manual (Supplementary edition for Civil Work)(Trial edition) issued March 2009 and Revised version issued July, 2017 by Office for Design and cost Estimation, Financial Cooperation Implementation Department, JICA.

Area code “Africa” adopts to the Project and following factors are used.

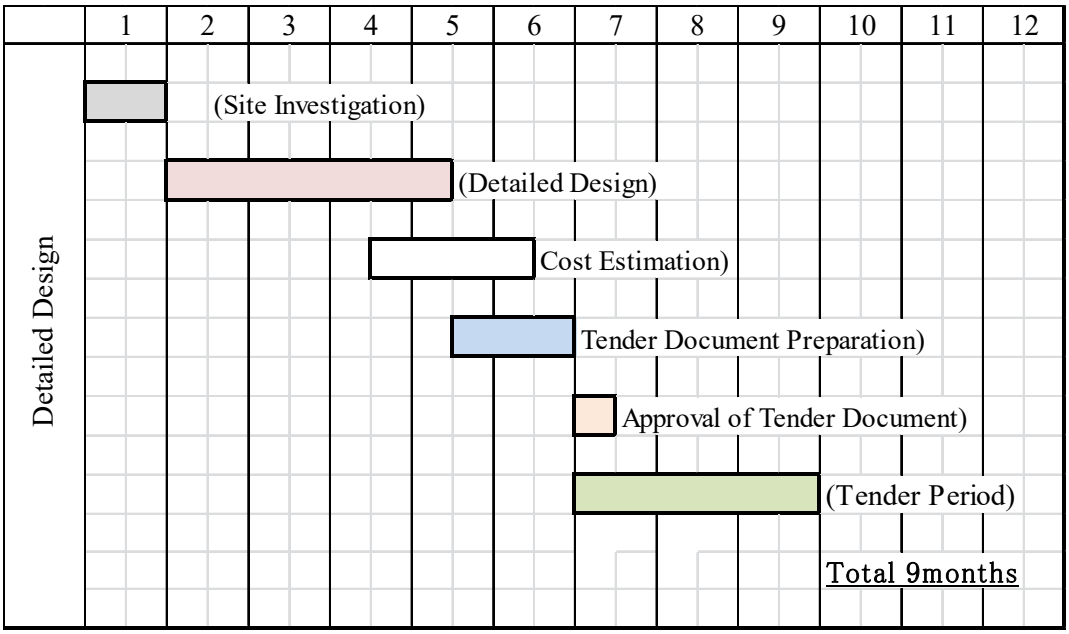
Adjustment factor for Labor Productivity Unit	Skilled labor work	4.5
	Unskilled Labor work	2.5
Adjustment factor for Machinery Productivity Unit	Simple work	0.55
	General work	0.60

Transportation is out of adjustment and Adjustment Factor is 1.00.

Work suspension factor is prepared in accordance with preparatory Survey-Design-Estimation Manual and 1.35 is applied.

c) Implementation Schedule

Implementation Schedule of the Project is shown below.



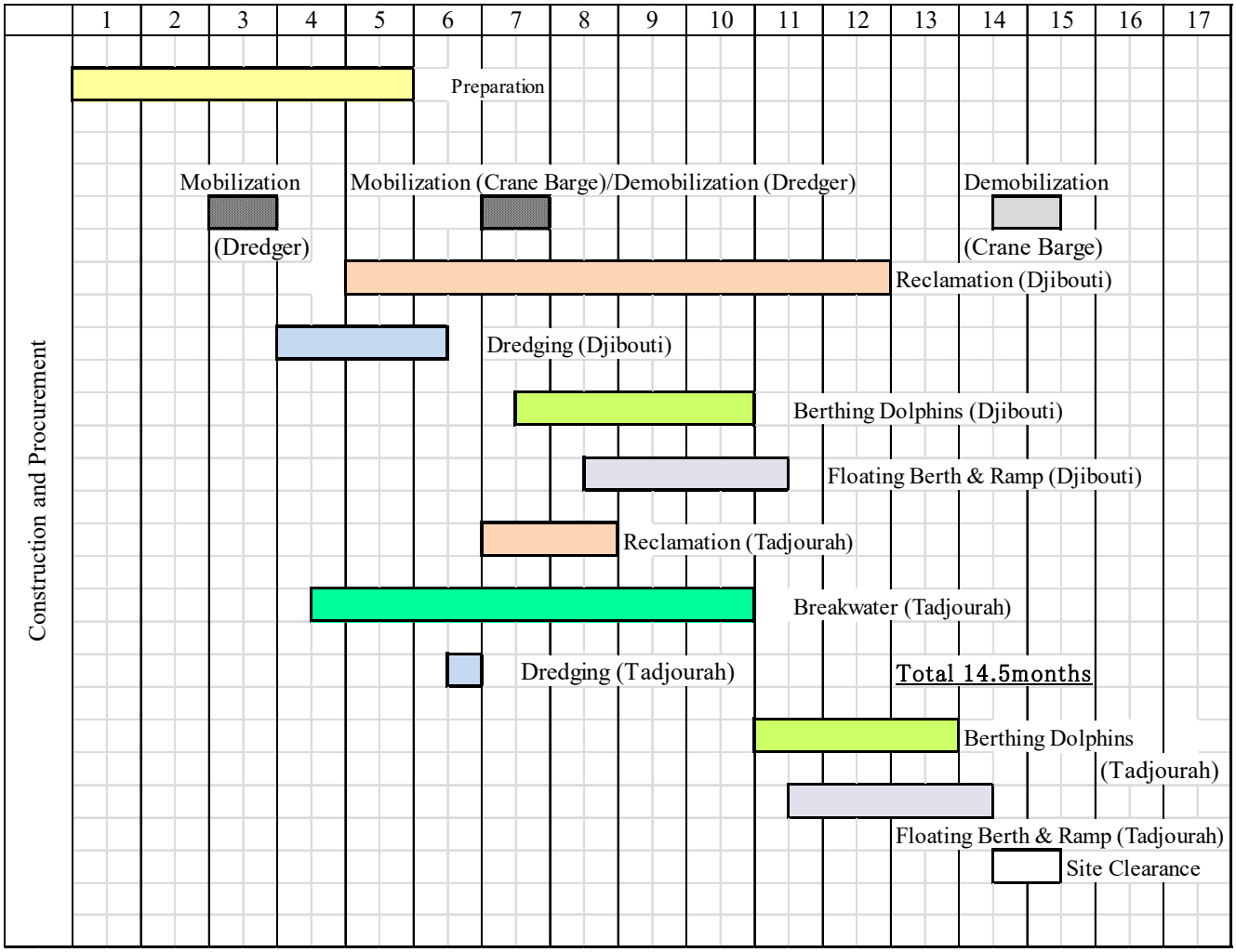


Figure 3.2-31 Implementation Schedule of Port Facility Development

2) The New Ferry

a) Portion of work at Djibouti side for the Project

After the shipbuilding and equipment procurement contracts, the Project implementation does not rely on the work to be shared by Djibouti side, except for national licenses, e.g. the Radio Station License and the Provisional Certificate of Nationality, which must be issued by the Government of Djibouti.

b) Detail of building schedule of the New Ferry

On building the New Ferry, the shipbuilding Contractor first carries out working designs of hull structures and various outfitting based on the contract and associated technical specification, based on the shipbuilder's own facility. With the completed working design drawings, hull construction, deck outfitting, machinery outfitting and electric outfitting follow as below.

① Hull construction
Hull is the watertight structure with internal volume as buoyancy, and with strength to withstand water pressure, wave pressure, cargo loads in static and dynamic conditions. The work starts from marking on raw steel material, cutting, sub-assembly and block assembly on shipbuilding yard.

② Deck outfitting
This work is performed after completion of the hull construction work. It comprises mooring arrangements, steering system, accommodation work, lifesaving apparatus, firefighting equipment, cargo gears, etc.

③ Machinery outfitting
This work comprises installation, piping and associated work of main engines, diesel generators, pumps, etc. mainly in the engine room.

④ Electric outfitting
This work is for installation of electric apparatus, control panels, etc. and for electric cable installation to supply electric power to all electric equipment on board.

⑤ Transport
After completion of the construction work at the shipyard and necessary tests, the New Ferry will be delivered to the Government of Djibouti. The procured Equipment is loaded on board the New Ferry. Transport of the New Ferry with the Equipment on board to Djibouti is carried out under the responsibility of the shipbuilding Contractor.

The projected building schedule of the Vessel is shown as follows.

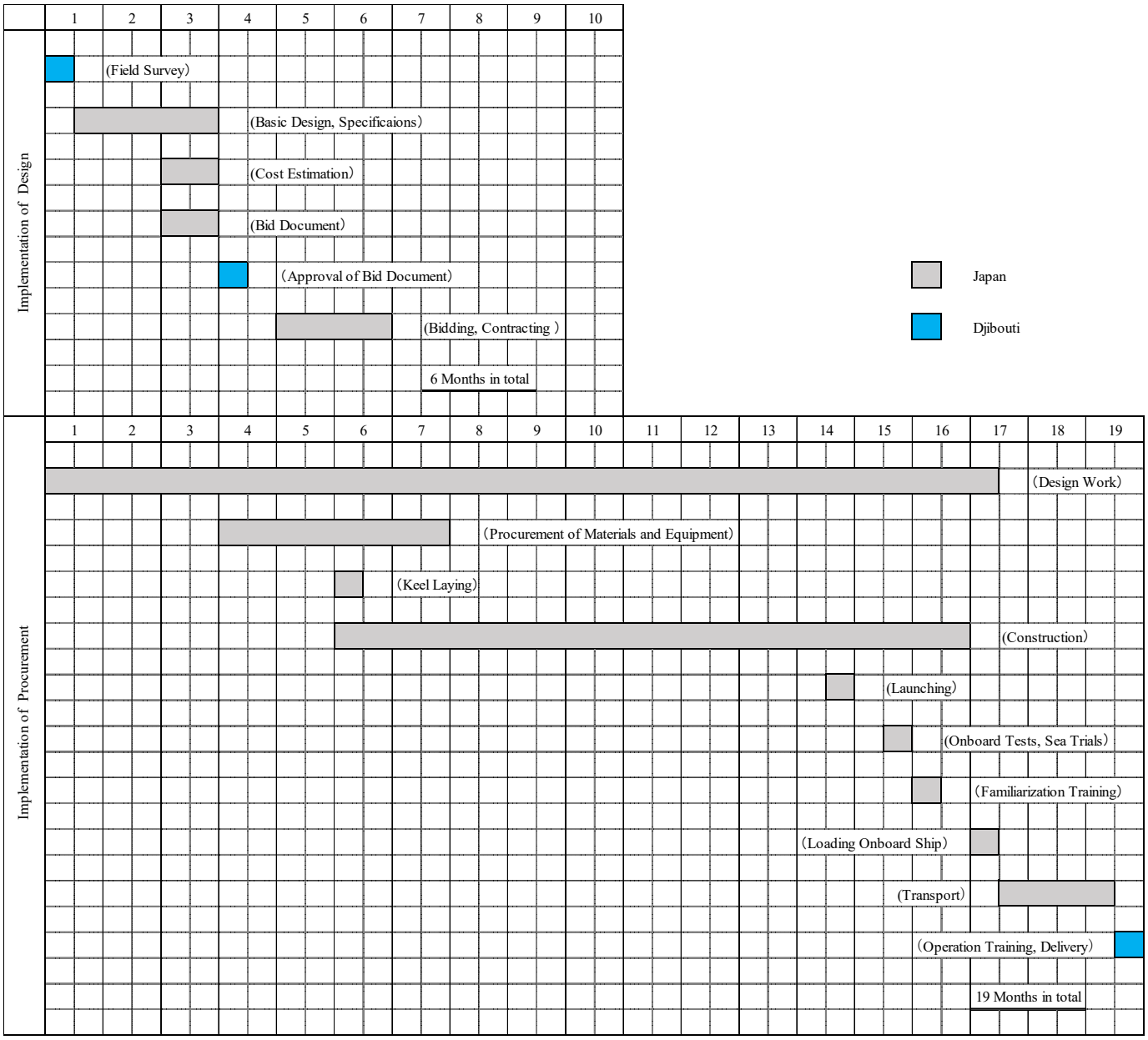


Figure 3.2-32 Ship Building Schedule

3.3. Summary of works to be borne by the Djibouti side

The scope of works to be borne by the Djibouti side is as follows.

3.3.1. Before the Notice of Project Announcement

(1) Opening a Bank Account and Bearing the Necessary Expenses

The Djibouti side will bear the expenses related to Banking Agreement (B / A) and B / A based Payment Authorization (A / P) for opening a bank account and acting on payment procedure.

3.3.2. Before Start of Construction

(1) Obtaining Permission Related to Environmental Consideration

Based on the local laws and regulations, the Djibouti side will conduct the Environmental Impact Analysis (EIA) for obtaining environmental permits prior to the commencement of construction.

(2) Securing and Acquiring Project Site

There are two sites for this project: Djibouti Port and Tadjourah Port. The Djibouti side will secure and acquire the sites for both projects.

(3) Securing and Provision of Construction Areas

There are two sites for this project, Djibouti Port and Tadjourah Port. In the vicinity of the project area, the Djibouti side will secure and provide construction yard and material stock area.

(4) Removal of Unnecessary Materials in the Construction Area

Several sinks have been identified in the construction area of Djibouti Port. The old ferry is also docked. The Djibouti side will remove or move objects that interfere with construction works.

3.3.3. During Construction Period

(1) Support for Obtaining Various Permits and Work Visas

The Djibouti side will assist with the acquisition of various licenses and approvals for this project and acquisition of work visas. It is necessary to obtain mining permission for the stone used for breakwaters and sand for landfills.

(2) Unloading of Imported Equipment and Customs clearance

The Djibouti side will provide assistance for the prompt discharge and customs clearance of imported equipment for this project. In addition, the Djibouti side will bear the customs fees and fixed bond storage fees at Djibouti Port.

(3) Provision of Convenience for Immigration and Stay in Djibouti

The Djibouti side will make arrangements to ensure the smooth entry, departure and stay of Japanese nationals involved in the project.

(4) Tax Exemption

Members of the Project Team will be exempt from duties, domestic charges and other charges imposed on procurement of materials and equipment and provision of services.

(5) Implementation of Maritime Control and Regulation

Implementation of maritime control and regulations upon implementation of construction work (when necessary)

(6) Submission of Environmental Monitoring Report

The Djibouti side will submit an environmental monitoring report to JICA.

3.3.4. After Completion of Construction

(1) Maintenance of Ferry and Facilities

To effectively and efficiently operate the port facilities and ferry provided by this project, the Djibouti side will establish an organization responsible for conducting operation and maintenance procure a budget for the necessary maintenance costs. In addition, a regular inspection system needs to be established.

(2) Development of the land facilities of Djibouti Port and Tadjourah Port

In order to operate the ferry efficiently and safely, it is necessary to develop the following land facilities at Djibouti Port and Tadjourah Port.

- Buildings such as the passenger waiting area and boarding ticket offices
- Paving and external construction of terminals and parking lots
- Security facilities such as fences and gates
- Rainwater drainage
- Water supply and sanitation
- Lighting in the terminal and building

(3) Infrastructure Connection to the Planning area

The following Infrastructure connection to the planning area is necessary to utilize port facilities efficiently and maintain safe and effective operation.

- Water supply
- Sewerage
- Electric power

3.4. Project Operation Plan

3.4.1. Organization

(1) Operation and Maintenance system

1) Operation management

As two ferries will be operated after the new ferry starts its service, the responsible organization has to establish a new plan for operation, maintenance, safety measure etc. The organization has to formulate a new operation/maintenance system considering those issues below.

- Hiring and arrangement of qualified crews who have enough abilities
- Management of passengers, cargos and loading conditions
- Establishment of periodical inspection procedure to keep the ferry safe and good conditions
- Budgetary provision which is needed for operation and maintenance
- Arrangement of related laws and regulations that are essential for above measures

The organization should be kept financially independent.

2) Maintenance of the ferries

The daily maintenance of the present ferry is carried out by crew members. The annual inspection is carried out by PAID using the floating dock. The new ferry's maintenance and inspection are also carried out on the floating dock. As most equipment suppliers have their branch offices at Dubai, then most of parts for maintenance of the new ferry will be procured through those Dubai branches. Necessary technical Information can be gotten from Dubai using FAX or e-mails etc.

3) Safety management for ship operation

There are not explicit manuals of the present ferry for its safety regulation and operational standard. As the New Ferry will be operated in the Khamsin season, the safety regulation and operational standard should be implemented as manuals. It is highly recommended that a manager in charge of safety operation should be assigned to carry out thorough operational safety control, who has certified as an International Safety Management code auditor or trained in an ISM training course.

(2) Personnel System for Operation and Maintenance

1) The New Ferry

It seems that the laws related to qualification and license of seaman are not well organized as well as the educational system in Djibouti. Although the crews of present ferry are well experienced and trained, all crews are recommended to be trained in a training course equivalent to STCW operation level or management level considering two ferries will be operated. Additional twelve crews are supposed for the New Ferry's operation.

2) Port Facility

The current Maritime Bureau does not have a maintenance system for port facilities; when necessary, repairs are outsourced to the private sector.

However, in order to properly maintain port facilities in the future, it is necessary to secure technical staff in charge of maintenance management and a budget for the facilities. A "Port Facility Maintenance Management Plan" should be prepared, and appropriate maintenance based on the facility check plan (daily check, periodical check, and temporary check) should be conducted.

For this purpose, article 36 of the "Low No. 74 / AN / 14 / 7th" needs to be revised. It is necessary to clearly show that maintenance of the port facility is one of the works of the Ferry Management Division, and to add a few technical staff who are actually in charge of the port facility maintenance works in the Ferry Management Division.

3) Personnel system for operation and maintenance

It is necessary to increase the number of crews for the new ferry. In addition, for the efficient and safety operation of two ferries, it is also necessary to increase the number of land side personnel involved in operation.

Staff composition for ferry operation (existing condition and after introduction of new ferry) is shown in Table- 3.4-1. The staff size will increase by 32 people in total as follows:

- Ferry Operation Management Division: 4 people
- New Ferry Crew: 12 people
- Djibouti Port Land-side Management: 4 people
- Tadjourah Port Land-side Management: 6 people
- Obock Port Land-side Management: 2 people
- Security Officer boarding the Ferry during Sailing: 4 people

4) Increase in the staff size of the Ferry Management and Operation Section

The Maritime Bureau will continue to be responsible for operation even after the introduction of the new ferry. In order to become completely financially autonomous (i.e., no financial subsidies or assistance will be offered by the government in future), the establishment of an appropriate "new fare system" after the

two ferry system will be one of the major issues.

It is essential to create a "statistics system" to obtain reliable data. Therefore, it is desirable to place several "Statistics staff members" in the Ferry Management Division.

At present, the Maritime Bureau does not have accurate statistical data on ferry operations.

As shown in Table 3.4-1, four new employees will be hired in the ferry management and operation section: two “Statistics Staff” and two “Maintenance Technical Staff”.

Statistical work is essential for accurately grasping the ferries’ performance and for determining the fare system. One of the new employees will perform on-site management and the other one will mainly perform the data processing at the headquarters.

The concept of life-cycle-management should be adopted to effectively carry out facility maintenance. The work covers 3 different ports, therefore, 2 staff will be required.

The data to be collected in the statistical work and the contents of work to be carried out by the maintenance staff are summarized below.

a) Data to be collected

Data should be collected in accordance with the ferry fare category defined in Article 3 of Decree No. 2012-0328 / PR / MET (see the Table below). The data will is collected daily by route and category, and will be compiled on a monthly and yearly basis.

The above decree is for the existing ferry and should be revised before the introduction of the new ferry. When revising the decree, it is desirable to reconsider the statistical data items. For example, while current the Decree No. 2012-0328 / PR / MET does not classify daily commodities and drinking water etc., these data are considered necessary for statistics and have been added to the table below.

Table 3.4-1 Data to be collected

Category	Item
Passenger (number)	Adult
	Child (2 years – 12 years old)
	Student (university and senior high school)
Vehicle (number)	Light Vehicle (4-door sedan)
	4 Wheel Drive Vehicle、Pick-up Car、Mini Bus
	Truck、Bus
	Truck (over 10 tons)、Trailer
	Motorcycle
Cargo (kg)	Construction Material (Cement, Steel Material etc.)
	Fuel、Lubricant etc.
	Daily Commodity
	Foods (Rice、Wheat、Sugar、Salt etc.)
	Seafood (Fish、Crustacean etc.)
	Beverage (Water、Juice etc.)

	Others

b) Tasks of the Maintenance Technical Staff

Listed below are the tasks of the maintenance technical staff. The new staff should acquire the required skills and knowledge during the actual construction works for the project.

- Familiarity with the concept of "Life-cycle-management"
- Formulation of the "Maintenance Manual"
- Implementation of "Daily Inspection", "Periodical Inspection" and "Urgent Inspection" for preventive maintenance based on the above manual and acquisition of the knowledge and technology to conduct them
- Acquisition of knowledge and techniques for determining diagnostic methods based on inspection results
- Implementation of actual maintenance works based on the diagnostic methods

Table 3.4-2 Increase in Required Personnel after Introduction of the New Ferry

Department/Entity responsible for Ferry Management/Operation	Current Personnel	Personnel after Introduction of the New Ferry	Increase in personnel
Ferry Administration and Management Department	Manager: 2 Accountant: 1 Assistant: 1	Manager: 2 Accountant: 1 Assistant: 1 Statistics Staff: 2 Port Facility Maintenance Staff: 2	+ 4
Existing Ferry (Mohamed Bourham Kassim): There are 6 officers and 6 crews. However, the ferry operation is usually done with 10 personnel in total.	Captain: 1 Vice-Captain: 1 Chief Engineer: 1 2nd Engineer: 1 Electrical Engineer: 1 2nd Electrical Engineer: 1 Crew: 6	Captain: 1 Vice-Captain: 1 Chief Engineer: 1 2nd Engineer: 1 Electrical Engineer: 1 2nd Electrical Engineer: 1 Crew: 6	-
New Ferry: The current management system used for existing ferry will be applied to the new ferry.	-	Captain: 1 Vice-Captain: 1 Chief Engineer: 1 2nd Engineer: 1 Electrical Engineer: 1 2nd Electrical Engineer: 1 Crew: 6	+ 12
Land Side Management of Djibouti Port	Ticket Seller: 1 Ticket and Passenger Controller: 1	Operation Controller: 1 Ticket Seller: 2	+ 4

	Vehicle Controller: 1 Cargo Controller: 1 Accountant Staff: 1	Ticket Controller: 2 Vehicle Controller: 2 Passenger and Cargo Controller: 2	
Land Side Management of Tadjourah Port	Ticket Seller: 1 Security Guard: 1	Ticket Seller: 2 Ticket Controller: 2 Vehicle Controller: 2 Passenger and Cargo Controller: 2	+ 6
Land Side Management of Obock Port	Ticket Seller: 1 Security Guard: 1	Ticket Seller: 1 Ticket Controller: 1 Vehicle Controller: 1 Passenger and Cargo Controller: 1	+ 2
Security Guard on board	Djibouti Coast Guard: 4	Djibouti Coast Guard: 8	+ 4
Total	29	61	+ 32

3.5. Project Cost Estimation

3.5.1. Initial Cost Estimation

The estimated Total Cost of the Project implemented is Japanese yen . The breakdown of Cost by Japan and Cost of Djibouti is Japanese yen by Japan and 4.25 hundred Japanese yen by Djibouti. However this Cost does not mean the ceiling of donated amount in the Exchange of Note.

(1) Cost of Japanese Side

Total amount of the Project is Japanese yen

Outline of the Project: Provision of New Ferry Vessel - 1No.Berthing Facilities at Djibouti Port and Tadjourah Port – 1 L.s.

Table 3.5-1 Estimated Cost of the Project (Japanese side)

Item	Location	Work Item		Initial Cost (Million yen)	
Equipment	Djibouti	New Ferry			
Facilities	Djibouti Port	Reclamation			
		Outer Revetment			
		Dredging			
		Berthing Dolphin	Steel Pipe Pile Concrete		

		Floating Pontoon	Floating Pontoon Access Ramp		
		Accessories	Bollard, Fender, Catwalk, Navigation Aids, etc		
	Tadjourah Port	Reclamation			
		Outer Revetment			
		Dredging			
		Breakwater			
		Berthing Dolphin	Steel Pipe Pile Concrete		
		Floating Pontoon	Floating Pontoon Access Ramp		
		Accessories	Bollard, Fender, Catwalk, Navigation Aids, etc		
Detailed Design, Construction Supervision (Equipment)					
Detailed Design, Construction Supervision (Facilities)					

(2) Cost of Djibouti Side

The costs burden of Djibouti is considered to be incurred in the following items, except for the maintenance of the ferry and port facilities.

- Opening a Bank Account and Bearing the Necessary Expenses
- Obtaining Permission Related to Environmental Consideration
- Removal of Unnecessary Materials in the Construction Area
- Development of the land facilities of Djibouti Port and Tadjourah Port
- Infrastructure Connection to the Planning area

The costs incurred are assumed as follows.

Table 3.5-2 Djibouti Side Expenses

	DJF	USD
Opening a Bank Account and Bearing the Necessary Expenses		40,000
Obtaining Permission Related to Environmental Consideration	7,620,380	
Removal of Unnecessary Materials in the Construction Area		4,000
Development of the land facilities		3,750,000
Infrastructure Connection to the Planning area		30,000
Total	7,620,380	3,824,000

Source: Study Team

(3) Conditions for Cost Estimation

1. Time of Estimation : July 2018 (by JICA Manual)
2. Exchange rate : US$1 = J¥110.09
   : US$1 = DJF.177.71
3. Implementation term : Refer to the Implementation schedule
4. Others : Estimation prepared based on Japanese ODA guideline

3.5.2. Operation and Maintenance Cost

(1) The New Ferry

1) Estimated annual fuel consumption

（Main engines）

- Service speed 12 knots
- Distance from Djibouti port to Tadjourah port is 19 nautical miles, 38 nautical miles for a round trip.
- Twice a day means 38× 2 ＝76NM/day.
- Four times a week means 76×4 = 304NM/week.
- Forty eight times a year means 304×48 ＝14592NM
- Service operation hours are 1216 hours @ 12 knots.

（Generators）

- Total anchorage time is assumed 1 hour per one voyage.
- 1hour×2times×4days×48weeks = 384hours total.
- Total generator time is 1216+384 = 1600 hours.

	Annual operation Hours	Power output	Fuel consumption rate	Estimated annual fuel consumption
Main engines	1216 hours	960kW	200g/kWh	233 ton
Generators	1600 hours	180kW	200g/kWh	58 ton
			Total	291 ton

2) Operational cost estimation

Annual fuel fee is estimated as follows.

1 JPY = 1.614225 DJF					
Oil price	Specific Weight	Annual consumption		Annual fuel fee	
(JPY/L)		(tonf)	(L)	(JPY)	(DF)
70	0.9	291	323,333	22,633,333	36,535,293

Crew labor cost is estimated as follows.

	Month (DF)		Year (JPY)	Year (DF)
Captain	140,000	1	1,040,747	1,680,000
Chief engineer	130,000	1	966,408	1,560,000
Engineer	75,000	2	1,115,086	1,800,000
Deck men	66,000	8	3,925,103	6,336,000
Total			7,047,344	11,376,000

Labor cost at Djibouti and Tadjourah port is estimated as follows.

	Month (DF)		Year (JPY)	Year (DF)
Port workers	33,000	20	4,906,379	7,920,000

3) Annual cost estimation for operation and maintenance

Other annual expenditures are maintenance cost, dock yard cost, insurance fee and so on. Though the maintenance cost of the main engine and auxiliary machines depends on their manufacture, 0.5% of the new ship price is usually assumed, which is around 7,760,000DJF. The dock yard cost is assumed to be 1%, which is 15,530,000DJF. The remaining cost including PI insurance, expendable parts are assumed to be 0.1%, which is 1,550,000DJF.

Thus the estimated total amount is around 80,000,000DJF.

COST	JPY	DF
Fuel	22,633,333	36,535,293
Crews	7,047,345	11,376,000
Workers	4,906,379	7,920,000
Dock yard maintenance	9,620,480	15,529,619
Engine maintenance	4,810,240	7,764,810
Others	962,048	1,552,962
Total	49,979,825	80,678,684

4) Profitability

The fee per person is assumed as 700DF. Assuming the number of passengers is 250, two operations per day, four days per week, forty-eight weeks per year, then the annual revenue is estimated as 67,200,000 DF. As for cars, assuming that the fee per a car is 10,000 DF and considering the above condition with the car capacity is 20, then the total revenue can be estimated as 76,800,000 DF.

Assuming the operational rate is 80%, the total revenue can be estimated as 115,200,000 DF. Substituting the operational cost 80,680,000DJF as estimated previously, the estimated annual profit might be about 34,520,000 DF.

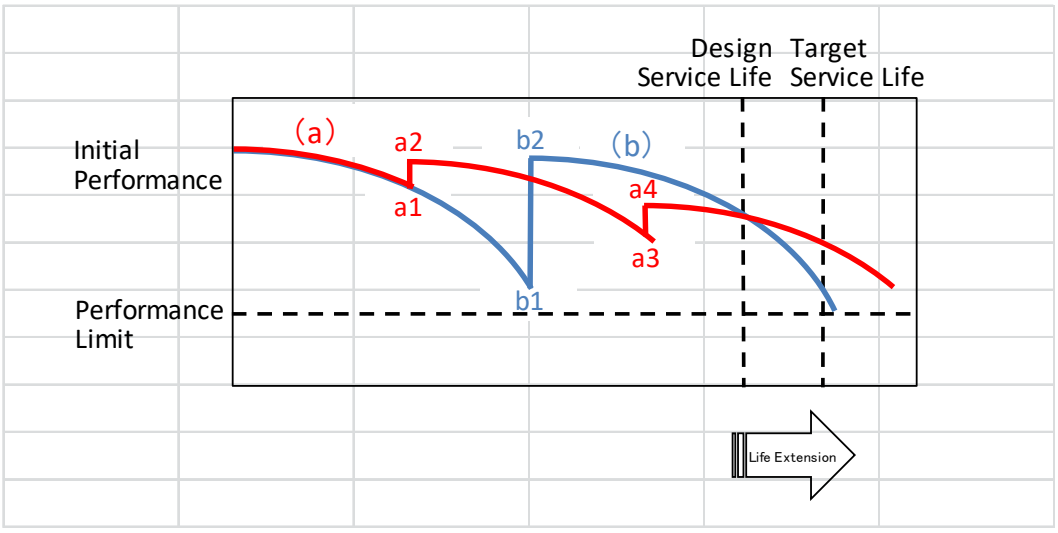
(2) Port Facility

The recommended approach to conducting maintenance of port facilities in the future is shown below. It can be seen that the new method will greatly affect future maintenance costs. It is a standard operation and

maintenance method implemented so that the facilities of the port can satisfy the required performance over the design service period (50 years in the case of ordinary civil engineering facilities). Under this method there are two types of facility maintenance management: "preventive maintenance" and "corrective maintenance." A definition of each is given below.

- "Preventive Maintenance": This method is implemented based on the “Port Facility Maintenance Management Plan” formulated in advance in order to prevent the occurrence of failure or malfunction during the service period of the facility. A facility is checked and diagnosed according to the prescribed intervals and criteria in order to reduce functional deterioration or the possibility of failure.
- “Corrective Maintenance”: This is a conventional maintenance method to repair or replace the facilities after wear, malfunction or break down.

The above concept is conceptually shown in Figure 3.5-1. The a-line (red) in the figure shows the performance curve of the facility when implemented based on "preventive maintenance", and the b-line (blue) shows that of corrective maintenance. The vertical lines (a1-a2 and a3-a4) of the a-line are the required maintenance costs for preventive maintenance, and the vertical lines (b1-b2) of the b-line are the maintenance costs arising from corrective maintenance. The purpose of both methods is to extend the service life of the facilities even after the design service period. However, as described below, the difference in maintenance costs between “a” and “b” is significant.



Source: “Maintenance Management Technical Manual for Port Facility – October 2007, Coastal Development Institute of Technology”

Figure 3.5-1 Performance Curves by Maintenance Method

However, it is difficult to predict the amount of maintenance expenses that will actually occur in the future. Therefore, reference was made to the "Method for Estimating Maintenance and Update Costs (Document 3) October 22, 2012"of the Port and Harbor Bureau of the Ministry of Land, Infrastructure, Transport and Tourism in calculating expenses (see Table 3.5-3). The trial calculation included structural types not listed in Table 3.5-3, and some assumptions were taken into account in the ratio.

Table 3.5-3 shows the ratio of costs to the initial cost of the two maintenance types by structure type. For example, in the case of “pier type quaywall”, the improvement cost ratio of preventive type maintenance is 19% of the initial construction cost on average, but in the case of corrective maintenance type that figure becomes 52% on average. In the case of a “Sheet pile quaywall”, the difference in the ratios becomes even larger, 13% and 106% respectively.

Table 3.5-3 Maintenance Cost Ratio by Maintenance Type

Type of Structure	Preventive Maintenance	Corrective Maintenance
Gravity Type Quaywall	x	17%（2% ～32%）
Steel Sheet-Pile Type Quaywall	13%（5%～34%）	106%（47%から 154%）
Steel Pipe-Pile Pier Type Quaywall	19%（1%～41%）	52%（26%～94%）
Mixed Type Revetment	x	20%（6%～32%）
Wave Absorption Block Type Revetment	x	17%（14%～28%）

Source: “Method for Estimating Maintenance and Update Costs (Document 3) - October 2012 - Ports and Harbors Bureau, Ministry of Land, Infrastructure, Transport and Tourism”

The maintenance and management costs of the port facilities calculated based on the above Table 3.5-3 are summarized in Table 3.5-4 The details of each are shown in Table 3.5-5 (corrective maintenance type) and Table 3.5-6 (preventive maintenance type).

In the “corrective maintenance type”, the maintenance cost is approximately 510 million DJF during the design and service period, while it is significantly less, approximately 275 million DJF, in the case of “preventive maintenance type.” Accordingly, "preventive maintenance type facility maintenance management based on the maintenance management plan is desirable" in the future.
The maintenance cost does not include the labor cost of the maintenance staff of the Maritime Bureau.

Table 3.5-4 Trial Calculation of Port Facility Maintenance Costs by Maintenance Type

Type of Maintenance	Maintenance Costs (DJF)
Corrective Maintenance	510,493,000
Preventive Maintenance	256,569,000

Table 3.5-5 Trial Calculation of Maintenance Cost by Corrective Maintenance Method

Port Name	Type of Work	Construction Cost (Yen)	Construction Cost (DJF)	Maintenance Cost (Corrective Maintenance)	
				DJF	(%)
Djibouti	1. Reclamation	60,147,038	97,089,650	9,709,000	10%
	2. Revetment	68,693,329	110,885,115	11,089,000	10%
	3. Dredging	85,304,454	137,698,877	13,770,000	10%
	4. Mooring Dolphin	105,428,891	170,183,843	88,496,000	52%
	5. Pontoon	150,462,980	242,878,095	126,297,000	52%
	6. Ancillary Works	36,156,295	58,363,672	11,673,000	20%
Tadjoura	1. Reclamation	17,672,950	28,527,764	2,853,000	10%
	2. Revetment	32,556,686	52,553,165	5,255,000	10%
	3 .Dredging	15,470,099	24,971,911	2,497,000	10%
	4. Breakwater	87,696,546	141,560,203	42,468,000	30%
	5. Mooring Dolphin	74,218,484	119,803,848	62,298,000	52%
	6. Pontoon	146,575,445	236,602,817	123,033,000	52%
	7. Ancillary Works	34,243,978	55,276,801	11,055,000	20%
Total		914,627,175	1,476,395,763	510,493,000	

Table 3.5-6 Trial Calculation of Maintenance Cost by Preventive Maintenance Method

Port Name	Type of Work	Construction Cost (Yen)	Construction Cost (DJF)	Maintenance Cost (Preventive Maintenance)	
				DJF	(%)
Djibouti	1. Reclamation	60,147,038	97,089,650	9,709,000	10%
	2. Revetment	68,693,329	110,885,115	11,089,000	10%
	3. Dredging	85,304,454	137,698,877	13,770,000	10%
	4. Mooring Dolphin	105,428,891	170,183,843	32,335,000	19%
	5. Pontoon	150,462,980	242,878,095	46,147,000	19%
	6. Ancillary Works	36,156,295	58,363,672	11,673,000	20%
Tadjoura	1. Reclamation	17,672,950	28,527,764	2,853,000	10%
	2. Revetment	32,556,686	52,553,165	5,255,000	10%
	3 .Dredging	15,470,099	24,971,911	2,497,000	10%
	4. Breakwater	87,696,546	141,560,203	42,468,000	30%
	5. Mooring Dolphin	74,218,484	119,803,848	22,763,000	19%
	6. Pontoon	146,575,445	236,602,817	44,955,000	19%
	7. Ancillary Works	34,243,978	55,276,801	11,055,000	20%
Total		914,627,175	1,476,395,763	256,569,000	

The required annual expenses in the case of employing two (2) "maintenance technical staff" and two (2) "statistical staff" are shown in Table-3.5-7.

Table 3.5-7 Required Annual Expense (DJF)

Staff Classification	Monthly Expense (DJF)	Number of Months	Number of Persons	Annual Expense (DJF)
Maintenance Staff	120,000	12	2	2,880,000
Statistical Staff	100,000	12	2	2,400,000
Total				5,280,000

4. Project Evaluation

4.1. Precondition for the Project Implementation

There are some issues to be solved as preconditions for the Project implementation by the Djibouti government. Main issues are described below.

4.1.1. Environmental and Social Considerations

Regarding the corals whose habitats have been confirmed in the construction area of Tadjourah during the preparatory survey work, the EIA (Environmental Impact Assessment) must be approved by December 2019 in order for the project to be implemented on schedule. Accordingly, the timeline for conducting and submitting the EIA should be as follows.

- Recruitment of a consultant by the Djibouti government (during June 2019)
- Submission of the Survey TOR to the Environmental Department and approval of it (mid-July 2019)
- Implementation of the Survey (July-October 2019)
- Submission of the EIA Report to the Environmental Department (mid-October 2019)
- Confirmation of contents of the EIA Report by the Departments concerned
- Approval of the EIA (December 2019)

4.2. Matters to be undertaken by the Djibouti Side/Government for the Project Implementation

Matters to be undertaken by the Djibouti side/government for the Project implementation are listed below. No timelines are included but it is desirable to address these matters as early as possible.

4.2.1. Permission for Reclamation

It is necessary to obtain permission for reclamation works in both the ports of Djibouti and Tadjourah. Therefore, the Djibouti side shall obtain permission before the signing of GA.

4.2.2. Tax Exemption

The import tax on all materials and equipment for the Project (including those to be re-exported) is exempted by submission of the application form with the detailed list attached. In addition, personal income taxes of the Japanese experts and the persons of third countries involved in the Project are exempted. Furthermore, Japanese companies who carry out the Project are able to carry out their works without the need to register their businesses as corporations in Djibouti; they are also exempt from corporate income tax. Therefore, these applications and procedures are necessary to be taken before commencement of the construction works.

It is necessary to complete the procedures at Djibouti Customs for the import tax exemption on the materials and equipment before they arrive in Djibouti. It is also necessary to complete the registration etc.

of the new ferry before she arrives in Djibouti.

4.2.3. Signing of Bank Agreement (B/A)

Immediately after the signing of the E/N, an account will be opened in a bank in Japan, in the name of the Djibouti government, for the purpose of receiving the Grant aid fund from the Japanese government and for paying the Japanese contractors of the Project. It will be necessary to sign B/A with the bank.

4.2.4. Issuance of Working Visa

The Djibouti government is required to assist with the issuance of working visas for the Japanese and third-country persons who will be involved in the Project.

4.2.5. Support for Procurement of Domestic Construction Materials

For the procurement of domestic construction materials, such as stone and sand etc., the Djibouti side is required to assist with the acquisition of mining rights, if necessary.

4.2.6. Construction of the Facilities on Land

The construction of facilities on land, such as a waiting room for passengers and pavement of parking area and road, is not included in the scope of the Project. Even though these facilities are not included in the project, it is desirable to construct them from the viewpoints of convenience, functionality and safety. Therefore, the Djibouti side is required to complete the construction of these facilities before the commencement of the new ferry operation.

4.2.7. Expansion and Rearrangement of Personnel System

In line with the introduction of the new ferry, the Djibouti government is required to expand and rearrange their personnel system. Specifically, new crew members, statistics staff, port facility maintenance staff and ground staff for the operation of new ferry should be hired. It is important that the new employees are hired and receive training necessary before the new ferry operation commences

4.3. External Conditions

The government of Djibouti is required to monitor external conditions and coordinate with the following project to successfully implement the Project.

4.3.1. International Fund for Agricultural Development (IFAD) Project

At Tadjourah port, the fisheries facility improvement project by IFAD fund is currently being planned near the construction site of the JICA Project. It was confirmed that the IFAD project has been designed based on the conditions of the JICA Project. However, it is necessary for the Djibouti government to coordinate

these two projects.

4.4. Examination of the Project Risk

Recently, Djibouti's economy has been steadily developing. Although the scale is not large, foreign investment is also growing. The safety risk is small compared to other surrounding countries as the domestic political situation is stable. Accordingly, the project risk from the viewpoint of social risk is considered small. In terms of natural risks, floods due to rainfall have been reported in recent years, but no other major natural disasters have occurred. Therefore, the overall project risk is judged to be small.

4.5. Project Evaluation

4.5.1. Validity of the Project

The validity of the implementation of the Project as a Japanese grant aid project is evaluated from the following points. Among them, there are some issues to be solved after the start of the new ferry operation, but these points have been already discussed with the government officials of Djibouti, and most of them have been committed to be implemented. However, it is necessary to monitor these issues to ensure they are being addressed.

(1) Beneficiary and Benefit Effect of the Project

The existing ferry (150-passenger) service consists of 6 round sailings a week (4 round sailings between Djibouti and Tadjourah and 2 round sailings between Djibouti and Obock), but after the introduction of the new ferry (250-passenger) ferry service between Djibouti and Obock will increase to 6 round sailings a week except for the Khamsin season while new ferry can be operated year-round, six round sailings a week between Djibouti and Tadjourah. In the future, it may be possible to operate 2 round sailings per day with the new ferry. Therefore, the number of beneficiaries will increase to several times compared with the current operation. Accordingly, the benefit effect will become great.

(2) Project Goals and Effects

Some issues in the existing ferry operation need be solved (they are listed below). This JICA Project would effectively solve all these issues and thus the effect of the project is considered to be great.

- Securing stable sailing during the Khamsin season
- Responding to the increase of passengers, vehicles and cargoes due to economic development
- Responding to the transportation demand for large vehicles due to the increase of logistics
- Ensuring efficiency and safety of passengers and vehicles at the time of embarking/disembarking
- Enhancement of operation and safety management of the ferry terminals

(3) Consistency with the National Plan

In the National Plan 『SCAPE (Strategy of Accelerated Growth and Promotion of Employment 2015 — 2019』 of Djibouti, it is mentioned that one of the planning targets for port development and maritime transport is "To establish modern means transportation demand of people from the metropolitan area to the regions". This Project is perfectly consistent with this target.

(4) Maintenance Management System in Djibouti and Technology Transfer for it

There are two types of maintenance management works of the Maritime Bureau. The first is the maintenance of the ferry itself and the second is that of the port facility. As for the former, the regular engine overhaul of the existing ferry has not been implemented, but the daily inspection is conducted by the crew themselves. As for the latter, at present, there is no maintenance and management section in the Maritime Bureau, therefore, the facility maintenance by routine and regular diagnosis has not been conducted.

However, in the discussion with the Maritime Bureau, it was confirmed that the regular inspections of existing and new ferries will be carried out and the maintenance works for the new facilities will also be carried out by the new staff. Therefore, although it will be necessary to closely monitor the situation, it can be concluded that the two cases of maintenance by the government of Djibouti will be implemented.

Therefore, it is expected that the transfer of Japan's superior maintenance management technology through the Project also greatly contribute to the improvement of maintenance management technology of Djibouti.

(5) Profitability

In the future, the ferry operation should be financially autonomous. Although it is desirable to operate the new ferry with the current fare system, the Maritime Department has the authorities to revise the fare in order to ensure profitability, if a loss occurs.

Since this project is a grant aid project, major emphasis is not placed on the aspect of profitability, but it will be necessary to review the fare system before the beginning of new ferry operation.

4.5.2. Effectiveness of the Project

With reinforcement of maritime transport capacity, the number of passengers transportation by the ferry service between Tadjourah and Djibouti will increase from 47,193 to 104,000, and the number of transportation vehicles will increase from 5,805 to 9,000 (3 year later after project completion).

As mentioned above, this Project is an urgent and indispensable project for Djibouti.
By correcting the regional disparities between the north and south coasts of Tadjourah bay, the project contributes directly to the economic development and social stability of the country. In addition, it will greatly contribute to the security and safety of the people and promote tourism.
As a result, it can be concluded that this JICA Project will be highly effective.