4. Activity for Output 2 (Short-term Development Plan)

4.1 Examination of Facility Layout Plan

4.1.1 Planning Period

As described in Chapter 3, the target year for the phased development plan of JPT is three phases, 2030, 2035 and 2047. This is different from the target years (four categories) as set out in DPW M/P, a comparison of which is shown in the table below. The target year of the short-term development plan of JPT is 2030, as agreed between PAD and JICA in February 2022, and it has been reconfirmed to the PAD that there is no wish to change the target year at the start of the Project.

Table 4.1 Comparison of DPW and JPT Phased Development Plan

	2021	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	2047
DPW	Phase1							Phase2							Phase3						Phase4						
JPT	Short										Medium				Long												

Source：JPT

4.1.2 Scope of Short-term Development Plan

Considering the congestion situation at the Port of Dakar, the demand forecasts for Senegal, and the state of coordination between PAD and private port operators, priority development projects were identified, and the facilities, scale and layout required for each target year of 2030, 2035 and 2047 are shown in below table.

Table 4.2 List of Facilities

	Short (2030)	Middle (2035)	Long (2047)
Container Terminal	Number of berth (2) Length of berth (1,000 m) Depth of berth (19.2 m) Estimated cargo volume（156,000 TEU/year）	Number of berth (3) Length of berth (1,500 m) Depth of berth (19.2 m) Estimated cargo volume（214,000 TEU/year）	Number of berth (4) Length of berth (2,000 m) Depth of berth (19.2 m) Estimated cargo volume（310,000 TEU/year）
General Cargo (including Dry) Terminal	Number of berth (1) Length of berth (300 m) Depth of berth (14 m) Area (11.3 ha) Estimated cargo volume（2,250,000 ton/year）	Number of berth (3) Length of berth (750m) Depth of berth (15m) Area (20.6ha) Estimated cargo volume（2,880,000 ton/year）	Number of berth (6) Length of berth (1,500 m) Depth of berth (15 m) Area (79.6 ha) Estimated cargo volume（6,360,000 ton/year）
RORO Terminal	Number of berth (1) Length of berth (300 m) Depth of berth (14 m) Area (10 ha) Estimated cargo volume（210,227 unit/year）	Number of berth (2) Length of berth (600 m) Depth of berth (14 m) Area (21.3 ha) Estimated cargo volume（250,374 unit/year）	Number of berth (2) Length of berth (600 m) Depth of berth (14 m) Area (21.3 ha) Estimated cargo volume（350,000 unit/year）
Breakwater	About 1,000 m	(Same as left)	(Same as left)
Tugboats and other small boat mooring	Base of container-side breakwater	(Same as left)	(Same as left)
Channel	Width (312 m) Depth (19.2 m)	(Same as left)	(Same as left)
Turning Basin	Depth (19.2 m) Diameter (600 m)	(Same as left)	(Same as left)
Access Road	Two-lane road	Four-lane road	Eight-lane road
Drainage	River mouth - downstream end of airport drainage channel	(Same as left)	(Same as left)
Sand pockets (for the time being, used as fishing boat landing sites)	sandbank100 m, revetment length 730 m	(Same as left)	(Same as left)
Ship Dismantling Facility	20 ha（Details unknown）	(Same as left)	(Same as left)
PIZ (not including DPW SEZ)	Land development, basic infrastructure, roads, plants (Total 503 ha)	Land development, basic infrastructure, roads (Total 253 ha）	(Same as left)
Railway	unnecessary	Airport ~Ndayane	(Same as left)

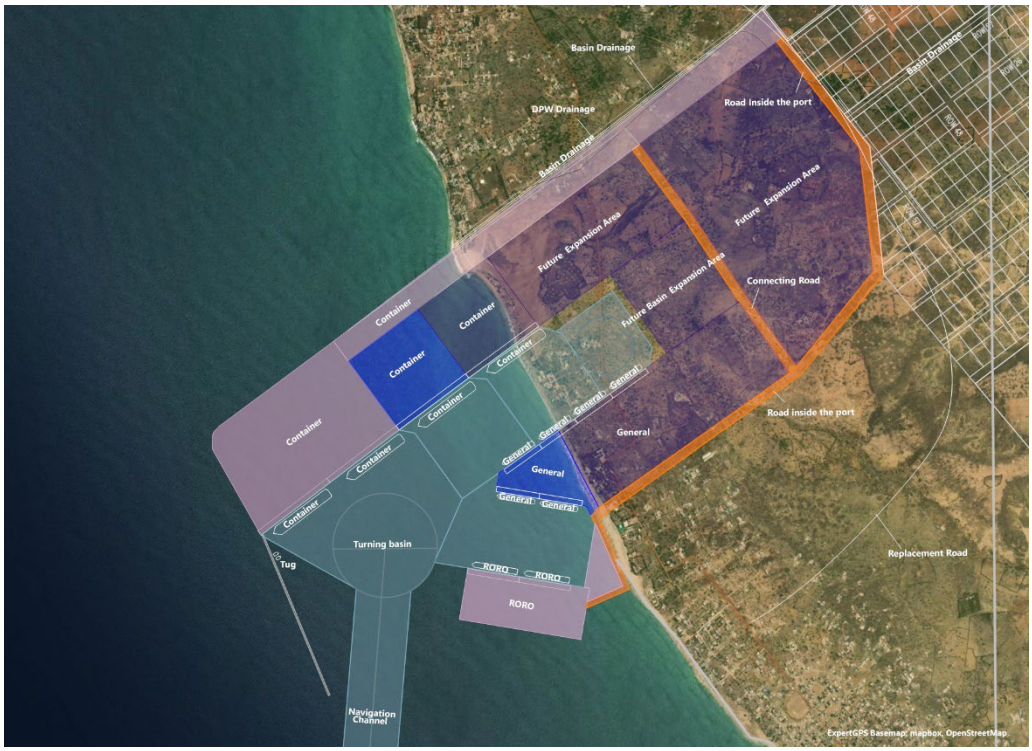
Source：JPT

Source : JPT

Figure 4.1 Ndayane Port Short-Term Development Plan (Target Year: 2030)

Source : JPT

Figure 4.2 Ndayane Port Middle-Term Development Plan (Target Year: 2035)



Source : JPT

Figure 4.3 Ndayane Port Long-Term Development Plan (Target Year: 2047)

The period is limited to 2030, the target year of the short-term development plan, and construction needs to be able to start as soon as possible, so land areas other than the 1,200 ha for which PAD has development rights from the Presidency are not included in the scope of the plan. PAD has informed us that it is possible to carry out the offshore part of the work and, in fact, DPW is proceeding with the offshore work, so it is considered possible to start work on the offshore part at an early stage and the offshore part is included in the short-term development plan.

Regarding the division of responsibility for access roads and drainage channels within 1,200 ha, access roads and drainage channels within 1,200 ha are to be included in the short-term development plan, based on the results of interviews with the PAD, which indicated that the PAD would be responsible for the construction. Although there are requests from other government agencies to build them in PAD, the responsibility classification of access roads and drainage channels outside of 1,200 ha has not been finalized and is not included in the short-term development plan. As indicated in M/P, it is assumed that roads outside of 1,200 ha will be connected to access roads and drainage channels within 1,200 ha at the appropriate time.

Facilities within 1,200 ha but for which private companies such as DPW are already responsible for construction works are also excluded. PAD continues to reduce its holdings of cargo handling machinery and other equipment at the Port of Dakar, which is still procured and operated by private companies. This short-term development plan covers facilities that do not interfere with the construction of container

terminals, breakwaters and other facilities for which DPW has started construction from 2023.

There is a SEZ planned for development by DPW in the area around the proposed PIZ in PAD. The Senegalese Government instructed PAD in December 2023 to jointly develop PIZ and the SEZ of DPW, information provided by PAD in February 2024. PAD was unable to share the government instructions or other information, nor could it provide information on the DPW's SEZ. At present, the management and operational structure of PIZ does not appear to have been decided. Although the early realization of PIZ is desirable, PIZ should not be included in the short-term development plan for this project, as there is a significant lack of information for short-term development planning, and it is not a port facility.

Therefore, port civil engineering facilities that are relatively likely to be constructed by PAD in the onshore extent and offshore reclamation area within 1,200 ha are included in the short-term development plan.

RORO terminal

Wharf 2 at the Port of Dakar is operated by Dakar Terminals, which handles mainly vehicles and containers, with many RORO vessels calling at the terminal. The company also operates a storage area for unloaded vehicles in Diamnadio, as there is not enough storage space for these vehicles in the terminal. RORO cargo can be relocated with the simplest port infrastructure (site and mooring facilities), and thus does not require cargo handling machinery to be installed on the wharf, making it possible to put it into service earlier than other functional relocations. In addition, there are plans to modernize the wharf 2 of the Port of Dakar in the future as a terminal where cruise ships can call at after RORO cargoes are relocated to Ndayane.

General Cargo terminal

Estimates of the cargo to be handled in 2030 indicate that some general cargo demand will not be handled at the Port of Dakar. With regard to this demand, as the general cargo wharf in 2047 when completed is set to be at the back of the port, handling will be carried out provisionally at part of the RORO wharf (offshore reclaimed section) when completed. In 2030, cargo handling will be carried out by ship-side cranes (ship gear), without mobile harbor cranes or conveyor belts.

4.1.3 Required Functions in the Short-Term Planning Period

The main port's functions required in the target year 2030 are listed below.

Table 4.3 Comparison of Main Functions in the Short-term (2030)

Facility	DPW	Short-term development plan	Remarks
Container wharf	Construction	not subject	
RORO wharf	—	Subject	
General Cargo wharf	—	Subject	Half of the RORO wharf is in use until 2035
Breakwater	Construction	not subject	Container wharf side
Sea Route	Construction	not subject	
Turning Basin	Construction	not subject	
Administration office	Construction	not subject	
Access Road inside Port	△	Subject	DPW only partly implemented
Access Road Outside Port	—	not subject	
Drainage inside Port	△	Subject	DPW only partly implemented
Drainage outside Port	—	not subject	
PIZ	—	not subject	
DPW SEZ	Construction	not subject	

Source：JPT

4.1.4 Scale and Layout of Individual Facilities

(1) Outer Facilities (Breakwater and Revetment)

- The western breakwater is not included in the short-term development plan as it will be constructed by DPW.
- RORO wharf side is included in the short-term development plan, as the results of the calmness analysis confirmed that it could be handled by a revetment not a breakwater.
- Therefore, a sloping revetment of approximately 700 m in length is to be installed on the seabed at an average depth of - 6.0 m.

(2) Water Facilities

➢ Dredging of outer navigation channels and in-port turning basin

- Not included in the short-term development plan as it will be constructed by DPW.

➢ Port navigation routes

- The port navigation channel for the container terminal will be built by DPW and is not included in the short-term development plan. On the other hand, the port navigation channel for the RORO terminal is not included in the construction of DPW and is included in the

short-term development plan. The slip width between RORO wharf and general cargo wharf is not the minimum 320 m width, but a slip width of "1.5 L = 460 m" to improve this safety feature, as this type of vessel is known to have more difficulty in taking off and landing at low speeds than other vessels. The design water depth shall be -14.0 m, the same as the quay depth of the RORO terminal.

(3) Wharf Facilities

As for RORO turnover, the current temporary storage directly behind the wharf at the Port of Dakar Wharf2 is slow at 2 times/month. As there is ample land behind the port of Ndayane, it is assumed that the turnover rate can be increased to 4 times/month, as piston transport to inland bonded areas can be expected to reduce cargo handling directly behind the wharf site. As a result, the area required in 2047 directly behind the RORO wharf is 18 ha. Adding to this the area required for general cargo, including dry bulk, the size of the site required for the 2030 target year is approximately 43 ha, as described below.

Consideration should be given to onshore (PIZ areas within 1,200 ha) use, so that, with regard to the area required from the demand, not all of it is to be covered by landfill, but as far as possible, sea reclamation is to be minimized.

The table below summarizes the required wharf lengths and wharf depths for RORO and general cargo as described in Chapter 3. The required wharf depth of the general cargo is 1 m deeper than that of the RORO wharf, but it is assumed that no general cargo vessels of the expected maximum ship size will enter the port in 2030, and that the - 14.0 m wharf of the RORO wharf can safely be used for take-off and berthing.

Table 4.4 Required Site Size

Year	Terminal	Area	Cargo Handling Volume (car/year, ton/year)	R: Turnover (times/year)	α: utilization factor	ω: Cargo capacity per unit area (times/year)	B: Building to land ratio	A: Area (m2)	A: Area (ha)	Area (m2)	Area (ha)
2030	RORO	Yard	210,227	48.0	0.6	0.07	1	104,279	10.4	104,279	43
	General	Cargo Handling Area	1,195,302	22.5	0.6	2.5	0.6	59,027	5.9	172,866	
		Storage site		10.0	0.7	2.5	0.6	113,838	11.4		
	Dry Bulk	Cargo Handling Area	1,051,648	22.5	0.6	2.5	0.6	51,933	5.2	152,090	
		Storage site		10.0	0.7	2.5	0.6	100,157	10.0		
2035	RORO	Yard	250,374	48.0	0.6	0.07	1	124,193	12.4	124,193	54
	General	Cargo Handling Area	1,564,481	22.5	0.6	2.5	0.6	77,258	7.7	226,257	
		Storage site		10.0	0.7	2.5	0.6	148,998	14.9		
	Dry Bulk	Cargo Handling Area	1,311,301	22.5	0.6	2.5	0.6	64,756	6.5	189,641	
		Storage site		10.0	0.7	2.5	0.6	124,886	12.5		
2047	RORO	Yard	350,000	48.0	0.6	0.07	1	173,611	17.4	173,611	109
	General	Cargo Handling Area	4,027,420	22.5	0.6	2.5	0.6	198,885	19.9	582,449	
		Storage site		10.0	0.7	2.5	0.6	383,564	38.4		
	Dry Bulk	Cargo Handling Area	2,331,948	22.5	0.6	2.5	0.6	115,158	11.5	337,248	
		Storage site		10.0	0.7	2.5	0.6	222,090	22.2		

Source : JPT

Table 4.5 Wharf Dimensions

		Plan	Short-term Development Plan
RORO Wharf	Wharf width	300 m (Same as length of berth)	Include
	Wharf length	710 m (depth -14m, 300m×2 berth＋road)	Include
	Area	21.3 ha (710 m×30 0m)	Include
Slip width		460 m (LoA 265 m×1.5＋ship's beam×2)	Include
General Cargo Wharf	Wharf width	Approx. 210 m vertically from the shoreline Max. 460 m	Not include
	Wharf length	530 m (depth -15m, 250m×2 berth＋mounting)	Not include
	Area	14.0 ha	Not include
Other (roads, administration)		Approx. 8 ha	Partly include
Total of Reclamation Required		46.2 ha	---

Source：JPT

(4) Access Road

As described in the phased development plan in Chapter 3, the access road runs along the south side of the general cargo terminal to the RORO terminal. However, it is located outside the 1,200 ha for which the PAD currently has development rights. To connect to the terminal, a temporary access road of approximately 4 km in length shall be included in the short-term development plan, within the scope of the early construction and development rights up to the 2030 target year. This temporary access road will be converted into a general cargo terminal yard in 2047.

The two-lane main road in the PIZ shall also be included in the short-term development plan. On the other hand, the area outside the PIZ is not included in the short-term development plan (Pre-FS) as there are no development right.

(5) Drainage

As described in the phased development plan in Chapter 3, the drainage channel runs through the center of the PIZ and along the north side of the DPW container terminal to the sea. DPW is currently constructing a drainage channel along the north side of the DPW container terminal to drain its own yard. In addition, a retention basin is planned to be constructed on the northeast side of the container terminal. This retention basin and drainage channel of DPW are planned to take into account not only the drainage within the terminal, but also the rainwater drainage flowing down from the airport area, but there are no plans to build a drainage channel near the PIZ. Therefore, in order to prevent flooding in the PIZ, the drainage channel connected to the retention basin and drainage channel of DPW will be included in the short-term development plan (target of Pre-FS). However, since PAD does not have the development rights outside the 1200ha area, only the area within the 1200 ha area will be included in the short-term development plan (target of Pre-FS).

(6) Scope of Coverage

The scope of the short-term development plan is shown in the below figure. The area within the red line is the area where the DPW shall be implemented.

Source：JPT

Figure 4.4 Facility Layout Plan (2030)

4.2 Examination of outline design

4.2.1 Port Facilities

(1) Target Facilities

Table 4.6 shows the target facilities.

Table 4.6 List of Target Facilities

Item	Water Depth	Number of Berths	Length of Berth	Total Length of Berth
RORO/General Terminal	14 m (Design Water Depth)	2	300 m/B	600 m
Causeway	0 m (Present Ground Level)	—	—	—

Source: JPT

(2) Terminal Layout

The figure below shows the layout for RORO/General terminal.

RORO terminal and general cargo terminal are expected to be operated by separate operators, and gates to enter each terminal are located. An administrative building was also placed for the RORO terminal. As of the middle-term development plan in 2035, the general cargo terminal will be relocated to another

location within Ndayane Port, both of which will be used as RORO terminal, and it was assumed that this administration building, gate, and the road leading to the RORO terminal are temporary and will be removed and reused as a yard. On the other hand, the electrical sub-station, water supply facilities, and water cleanup tanks located between the apron for the general cargo terminal and the apron for triangle area.

Since the maximum ship size for RORO ships is assumed to be 30,000 DWT and the average loading capacity is 6,000 units (see Table 3.33 Number and Completion Schedule of New Container Ships by LOA), 6,000 units can be located in the yard behind the wharf. To locate one berth each for RORO and general cargo terminal at the time of the short-term development plan in 2030, the yard layout was created so that 3,000 units (125 units/row x 24 rows), half of the total, could be parked.

The cargo handling efficiency is assumed to be 1,200 vehicles/day, which means that up to 2.5 days of storage will be possible in 2030. Currently, Dakar Terminal operates RORO vessels with vehicles and containers as the main cargo at wharf 2 of the Port of Dakar, but imported vehicles are transported to the vehicle storage facility in Diamnadio (with a capacity of 1,800 vehicles) due to lack of storage space for the cargo. It is assumed that even after the function is relocated to the port of Ndayane, the operation will continue to transport vehicles to the vehicle storage area in Diamnadio. Since imported vehicles are currently transported using carrier cars at the current Port of Dakar, it is necessary to secure a waiting and loading area for carrier cars at the Port of Ndayane as well.

In addition, the terminal will require approximately 0.6 hectares of container storage space (handling approximately 24,000 TEUs) in 2030. The terminal is planned to be operated with reach stackers, similar to the current Port of Dakar, with a maximum of four-tier container stacking.

The maximum vessel size for general cargo/dry bulk vessels is assumed to be 40,000 DWT and the average loading capacity is 15,000 DWT (see Table 3.32 Number and Completion Schedule of New Container Ships by LOA). Based on the micro analysis results, no imports are assumed as of 2030. On the other hand, as of 2030, exports are expected to total approximately 1.0 million tons as general cargo and 1.2 million tons as dry bulk, with illuminate, phosphate, and attapulgite as the main exports. The cargo yard was divided and arranged to accommodate the export of multiple items.

Source: JPT

Figure 4.5 Terminal Layout in Short-term Development Plan

(3) Standard Cross-Section

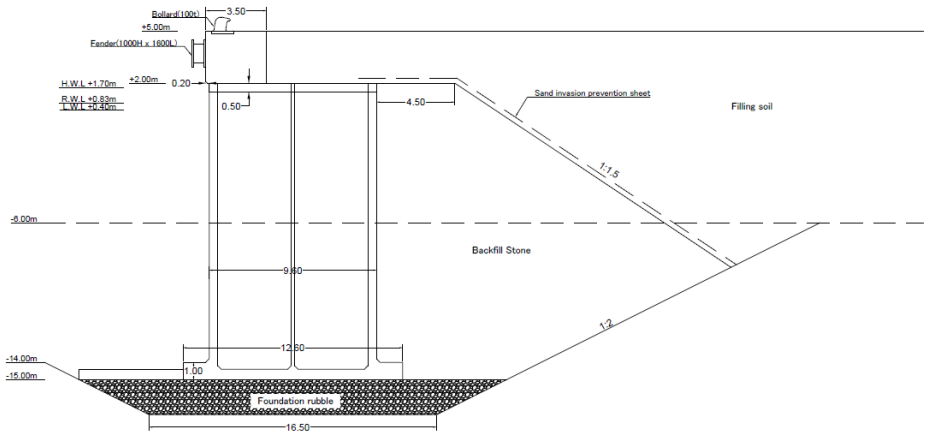
Table 4.7 shows the design conditions.

Table 4.7 List of Design Conditions

Item	RORO/General Berth	RORO/General Revetment	Causeway
Planned Water Depth	-14 m	-6 m	0 m
Design Water Depth	-15 m （Overbreak of 0.5 m）	-6 m	0 m
Crest Height	+5.0 m	+5.0 m	+3.5 m
Target Vessel	40,000 DWT	-	-
Surcharge Load	30 kN/m^2	-	-
Tractive Force	1,000 kN/unit (20 m pitch)	-	-
Fender Specification	1,000 H × 1,600 L (10 pitch）	-	-

Source: JPT

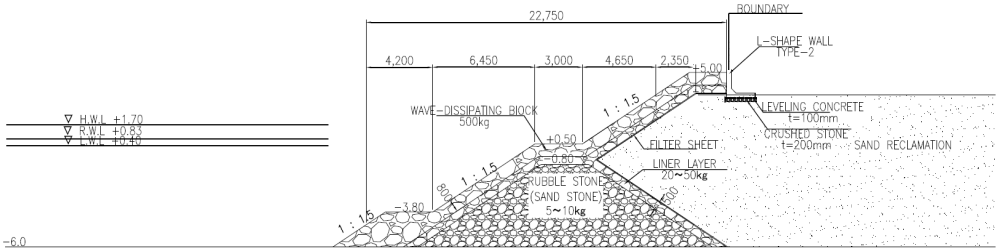
a) RORO/General Berth



Source: JPT

Figure 4.6 Standard Cross-section of -14 m Berth (Caisson Type)

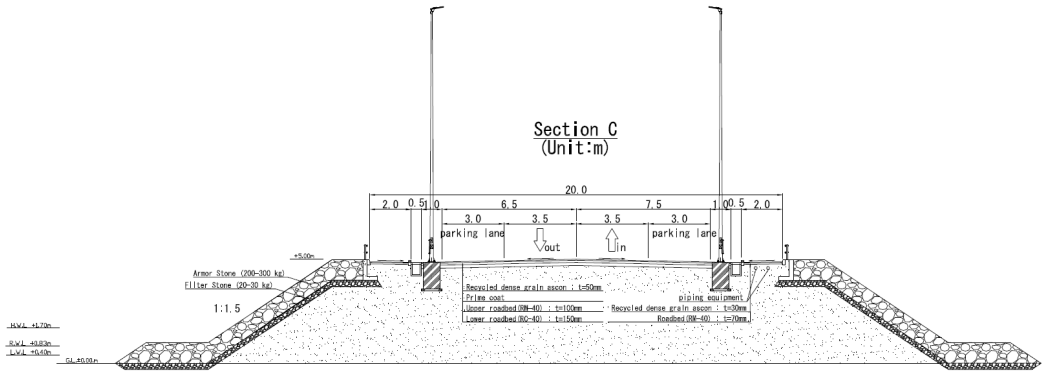
b) RORO/General Revetment



Source: JPT

Figure 4.7 Standard Cross-section of -6 m Revetment

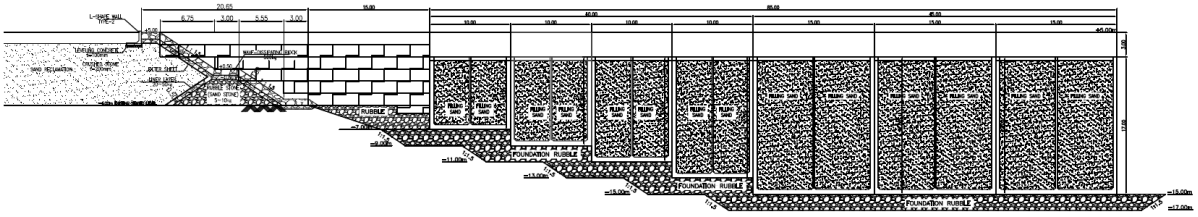
c) Causeway



Source: JPT

Figure 4.8 Standard Cross-section of Revetment for Seaside Road

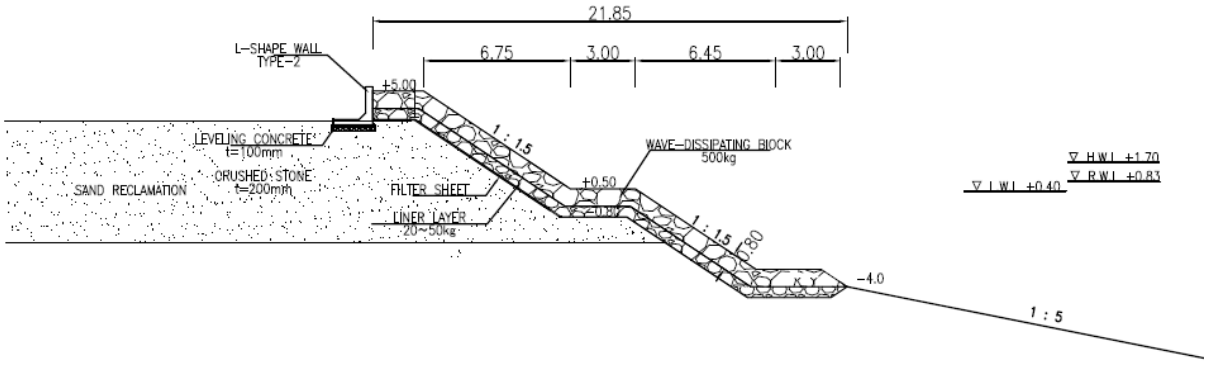
d) Transition Part of RORO terminal



Source: JPT

Figure 4.9 Front View of Transition Part of RORO terminal

e) Revetment between RORO terminal and Causeway

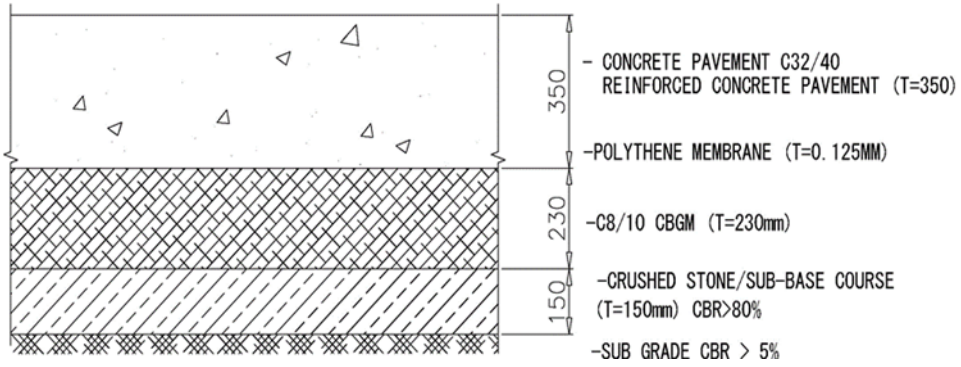


Source: JPT

Figure 4.10 Standard Cross-section of Revetment between RORO terminal and Causeway

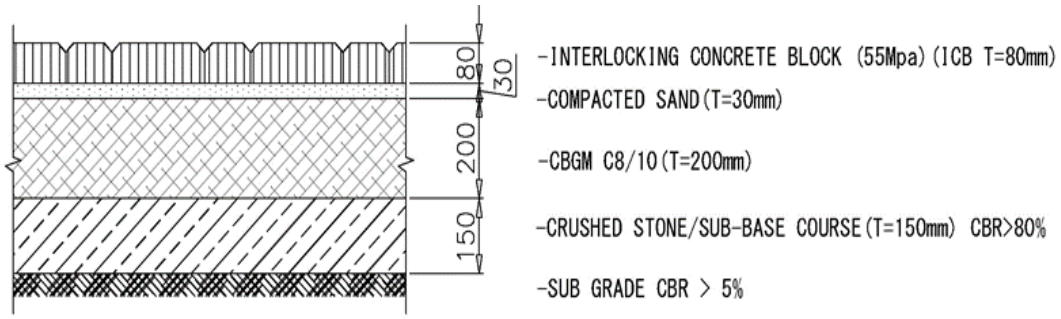
f) Pavement

Figure 4.11 shows the standard cross- section of pavement for container stacking area and general cargo terminal. Figure 4.12 shows the standard cross-section of pavement for RORO terminal.



Source: JPT

Figure 4.11 Standard Cross-section of Pavement for Container Stacking Area and General Cargo Terminal



Source: JPT

Figure 4.12 Standard Cross-section of Pavement for RORO terminal

4.2.2 Road Facilities

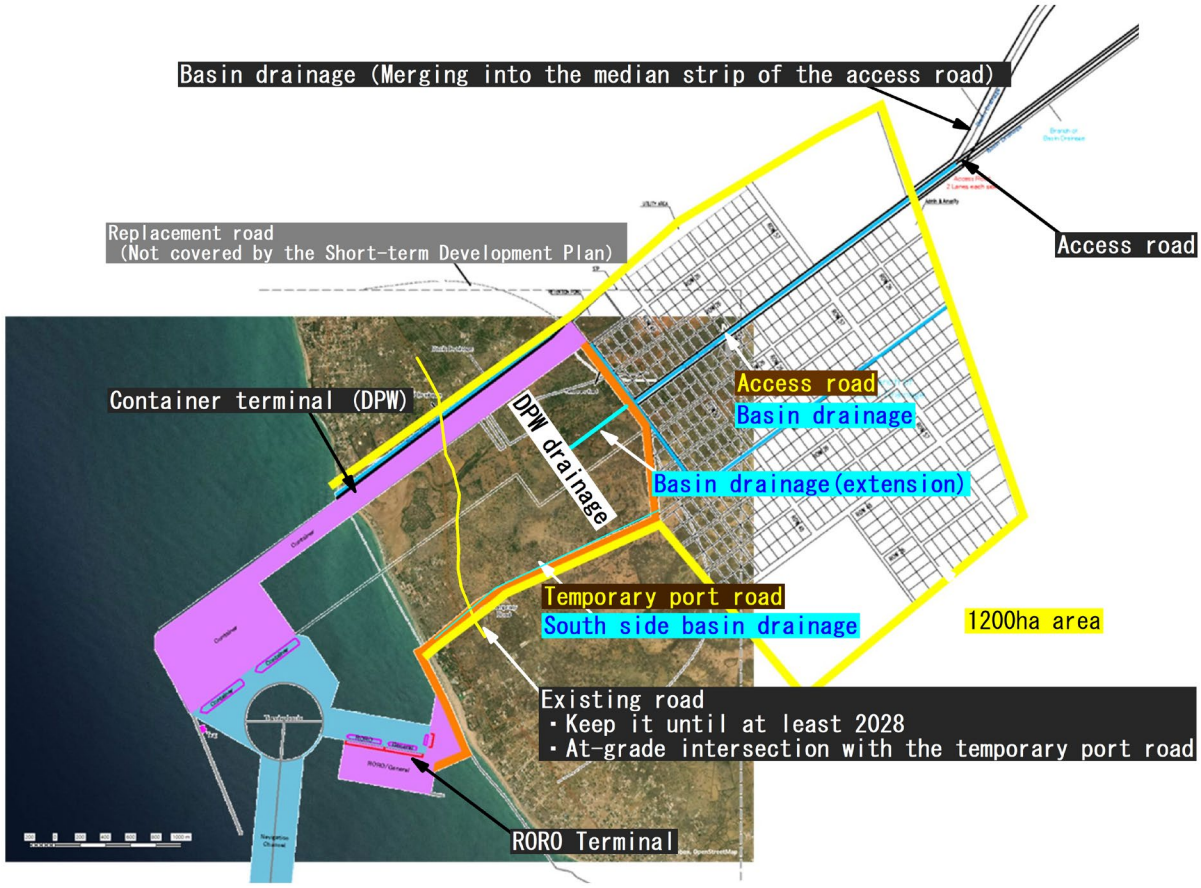
(1) Road Facilities in the Short-term Development Plan

The road facilities within the 1,200 ha area and above sea level, for which new port development permission has been obtained, are planned.

The planned road facilities are of two types: “access roads” and “road inside the port”. As for the “road inside the port”, the plan calls for it to be completed after 2035, assuming the expansion of port land, so as of 2030 it will be developed as temporary road facilities under a tentative plan.

Figure 4.13 shows the two types of road and related facilities planned in the short-term development plan.

Figure 4.14 shows the plan of the road inside the port as completed in 2035.



Source: JPT

Figure 4.13 Road Facilities and Related Facilities in the Short-term Development Plan

Source: JPT

Figure 4.14 Plan of the Road inside the Port as Completed in 2035

(2) Access Road

a) Planning Policy

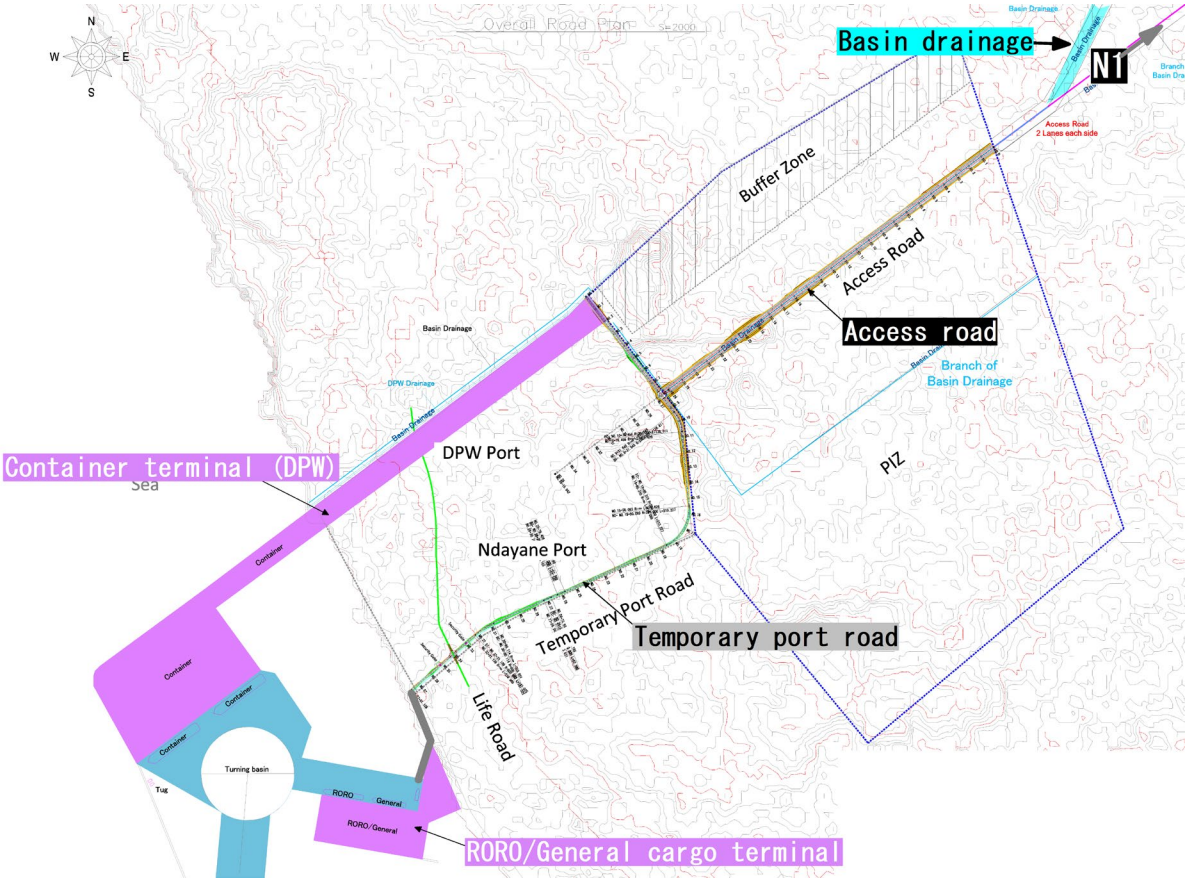
The access road in the short-term development plan is planned according to the following conditions.

i) Design Conditions

- Design speed : V = 100 km/h
- Road width : W = 3.5 m
- Waiting lane width : W = 3.0 m
- Sidewalk width : W = 2.0 m

ii) Plane Alignment

- As mentioned in Chapter 3, the route will be a straight alignment connecting “Ndayane Port” and “the intersection of N1 and the airport access road”.



Source: JPT

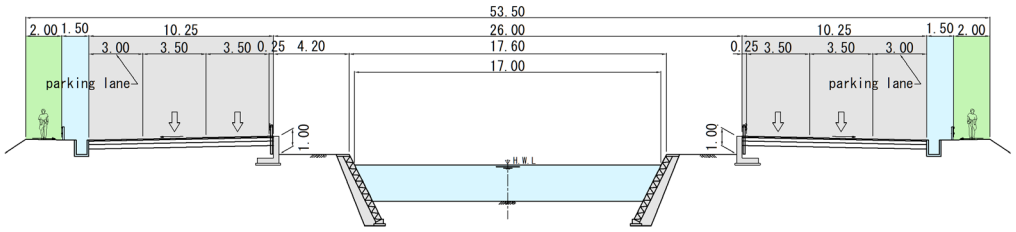
Figure 4.15 Plane Alignment of the Access Road

iii) Width Composition

- The access road is planned to be developed in stages according to the utilization of the future expansion area of Ndayane Port, the SEZ, and the PIZ, and will have two lanes on each side in

the short-term development plan for 2030. In addition, within the area covered by the short-term development plan (within the 1,200 ha area), the width composition will be such that the drainage channel merges into the central median strip.

- Parking lanes and sidewalks will be provided on both sides of the road.

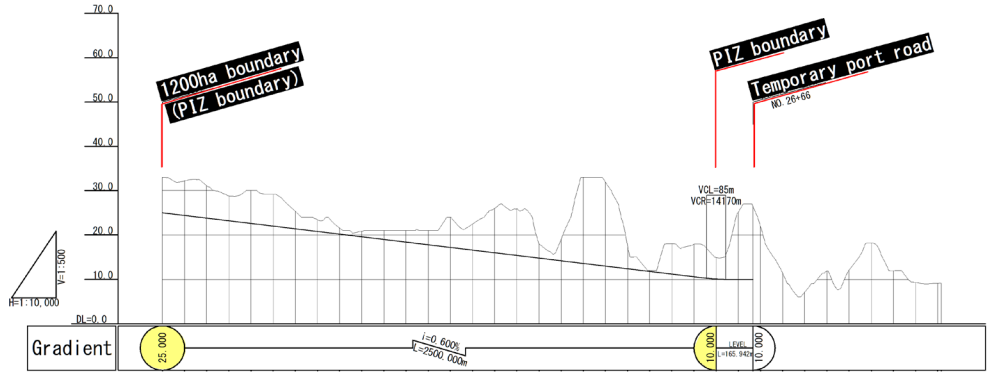


Source: JPT

Figure 4.16 Width Composition of the Access Road

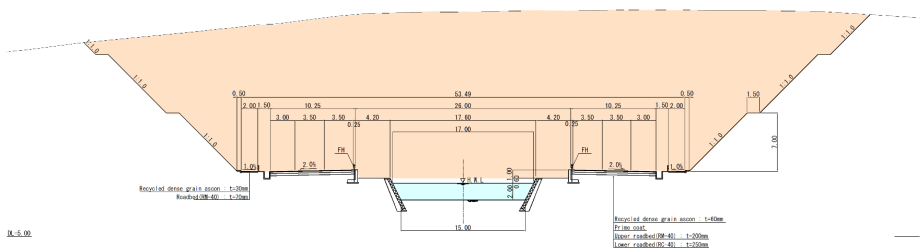
iv) Vertical Alignment and Standard Cross-section

- The planned height of the start and end points of the access road's vertical alignment will be set based on the planned development elevation of the PIZ, which was planned taking into account the current topography. In addition, since the access road will be constructed before the PIZ is developed, cutting works will be required.



Source: JPT

Figure 4.17 Vertical Alignment of the Access Road



Source: JPT

Figure 4.18 Standard Cross-section of the Access Road

b) Important Notice

i) Plane Alignment

The plane alignment of the access road is a straight line connecting "Ndayane Port" and "the intersection of N1 and the airport access road". However, alignment adjustments may be required due to detouring residential areas along the route and due to land development plans and layouts of the PIZ implemented by DPW.

ii) Vertical Alignment

Same as the plane alignment, the vertical alignment will also need to be confirmed and adjusted based on future plans to be implemented by DPW.

iii) Pavement Composition

In this outline design, the following pavement composition is planned. However, in the detailed design stage, it is necessary to decide the pavement composition in accordance with the design CBR based on the ground investigation as well as the pavement materials that can be procured.

Table 4.8 Pavement Composition of the Outline Design

Pavement Composition	
Surface layer	Recycled dense graded asphalt mixture, t = 60 mm Prime coat
Upper Subbase	Recycled mechanically stabilized crushed stone, t = 200 mm
Lower Subbase	Recycled mechanically stabilized crushed stone, t = 250 mm

(3) Temporary Road Inside the Port

a) Planning Policy

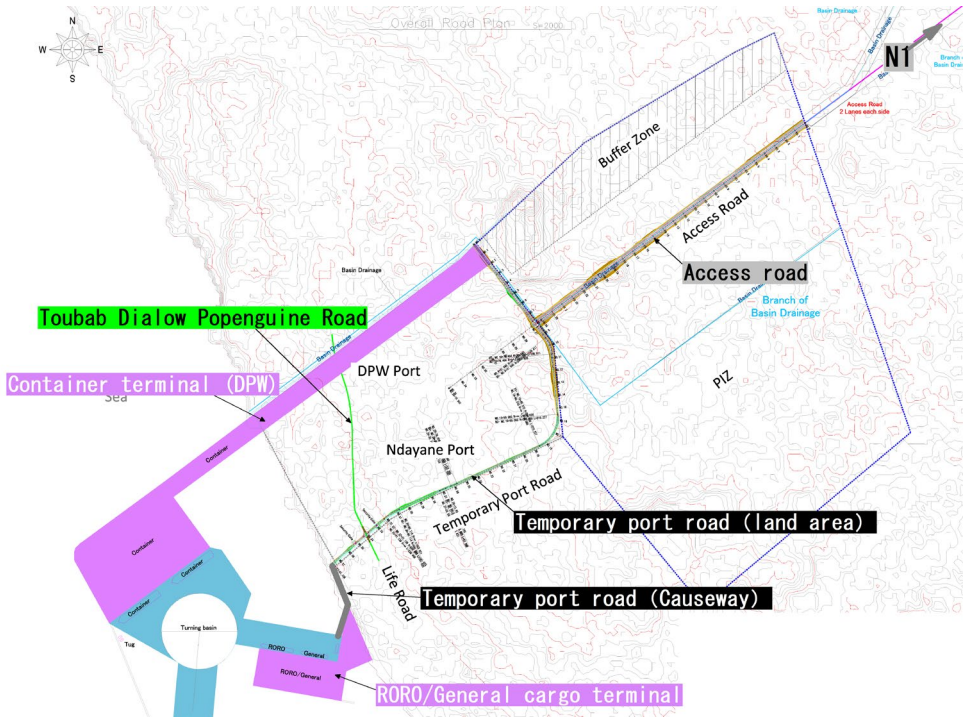
The temporary road inside the port in the short-term development plan is planned according to the following conditions.

i) Design Conditions

- Design speed : V = 30 km/h
- Road width : W = 3.5 m
- Waiting lane width : W = 3.0 m
- Sidewalk width : W = 2.0 m

ii) Plane Alignment

- The plane alignment must satisfy the following requirements:
  1. Connects to the Access Road.
  2. Connects to the Container Terminal (DPW).
  3. Connects to the RORO/General Cargo Terminal (PAD).
  4. Located within the area of 1,200 ha.



Source: JPT

Figure 4.19 Plane Alignment of the Temporary Road Inside the Port

iii) Width Composition

- The number of lanes required for the temporary road inside the Port will be set according to the number of terminals that will be connected. Therefore, the route will be divided into sections, and the width composition will be set for each section.

<u>Section A: Connecting to the Container Terminal</u>

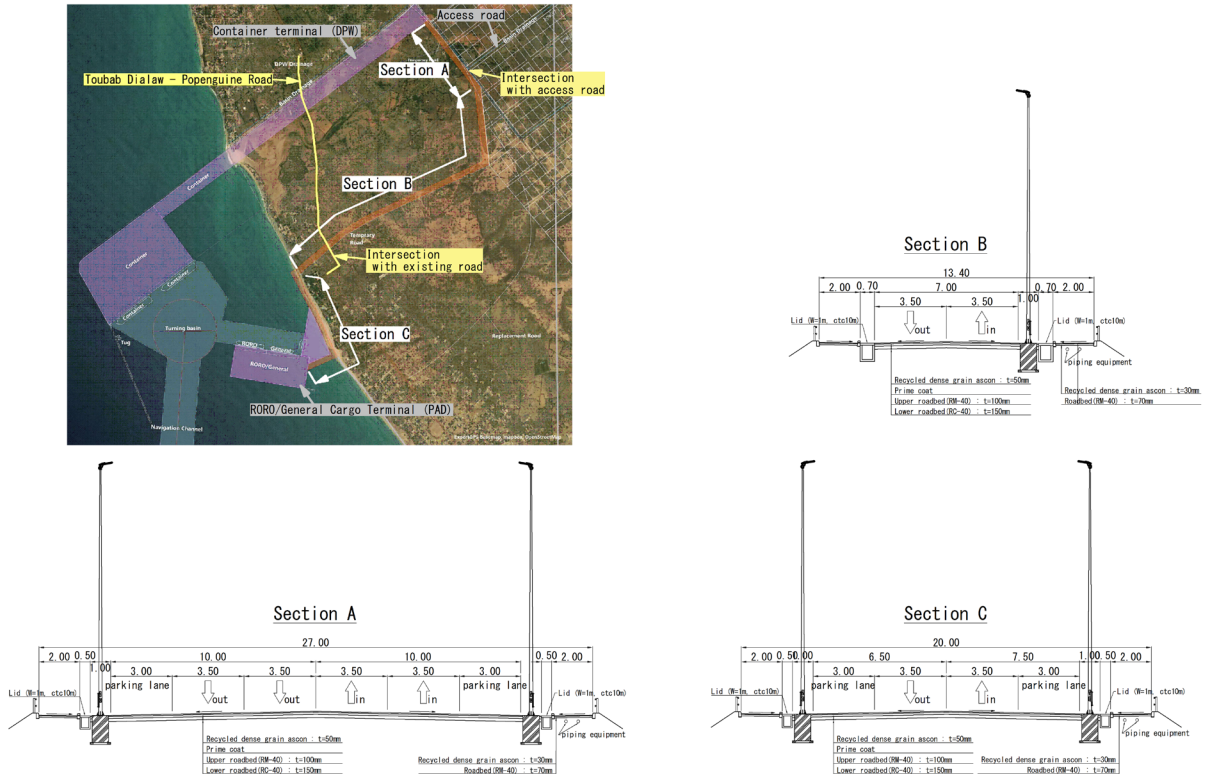
- Since the section has an intersection with an access road and connects to the Container Terminal, two lanes will be required in each direction. In addition, parking lanes and sidewalks will be provided on both sides of the road.

<u>Section C: Connecting to the RORO/General Cargo Terminal</u>

- Since the section has connects to the RORO/General Cargo Terminal, one lane will be required in each direction. In addition, parking lanes and sidewalks will be provided on both sides of the road.

<u>Section B</u>

- There will be one lane in each direction as this section connects Section A and Section C. There will be sidewalks, but no parking lanes.



Source: JPT

Figure 4.20 Width Composition of the Temporary Road Inside the Port

iv) Vertical Alignment and Standard Cross-section

- The vertical alignment of the temporary road inside the port will basically follow the current topography, and the planned height will be set at the following control points.

Connection point to container terminal: +21.0

- ➢ We have been informed by DPW that there are no plans yet for a container terminal on the land side of Toubab Dialow Popenguine Road. In addition, since the connection point is at the "foothills" of a nearby mountain, and information has been obtained that DPW has a policy of not cutting into the mountain, the current ground level, +21.0, is adopted.

Intersection with the access road: +10.0

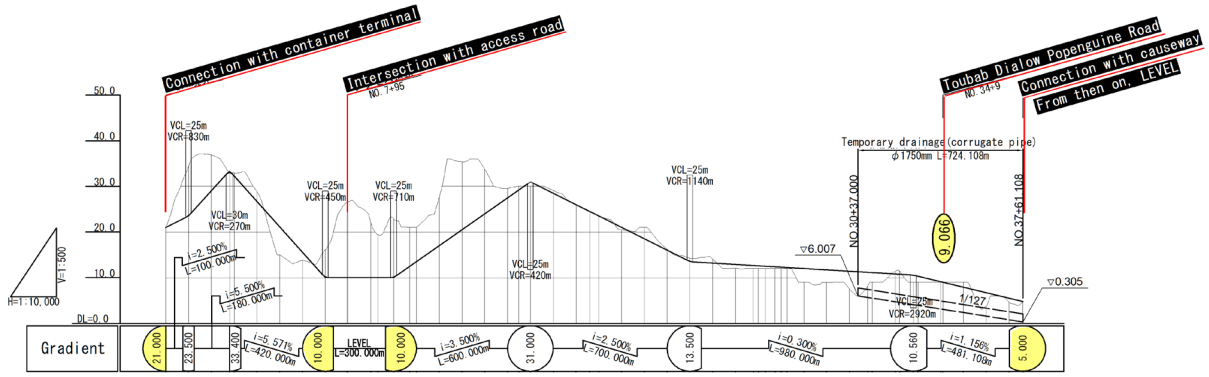
- ➢ The planned height of the access road, +10.0, is adopted.

Intersection with Toubab Dialow Popenguine Road: +9.066

- ➢ The current height of the existing road, +9.066, is adopted.

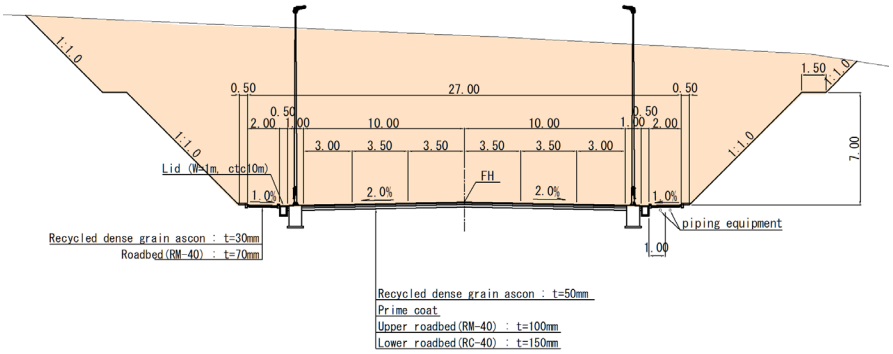
Connection point to causeway: +5.0

- ➢ Following the RORO/general cargo terminal plan, it is set at +5.0, and the causeway section will be level.



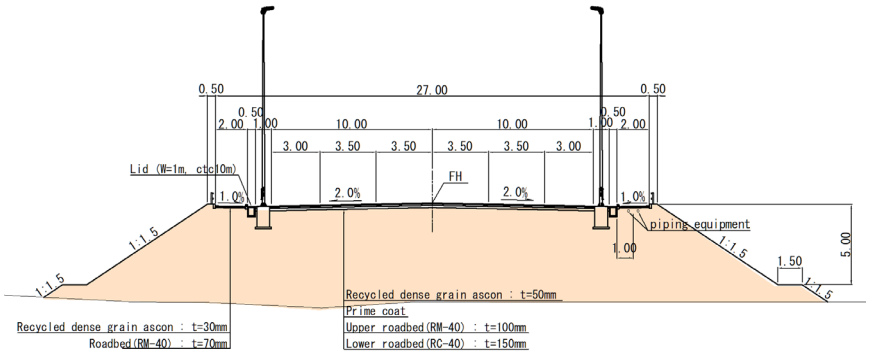
Source: JPT

Figure 4.21 Vertical Alignment of the Temporary Road Inside the Port



Source: JPT

Figure 4.22 Standard Cross-section of the Temporary Road Inside the Port (Cutting Section)



Source: JPT

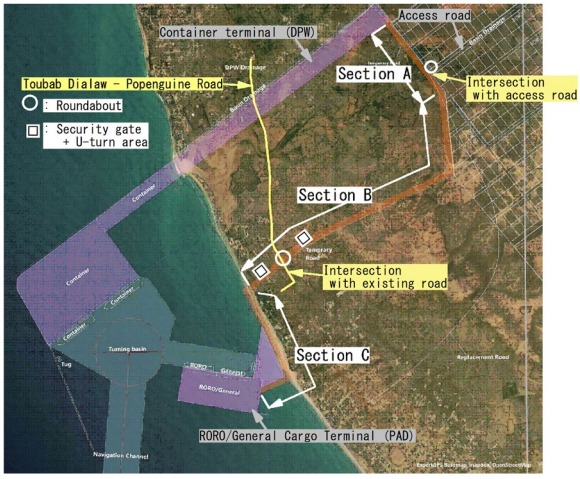
Figure 4.23 Standard Cross-section of the Temporary Road Inside the Port (Embankment Section)

v) Intersection and Security Gate

- The temporary road inside the port will have two intersections as follows, and both of which will be roundabouts.

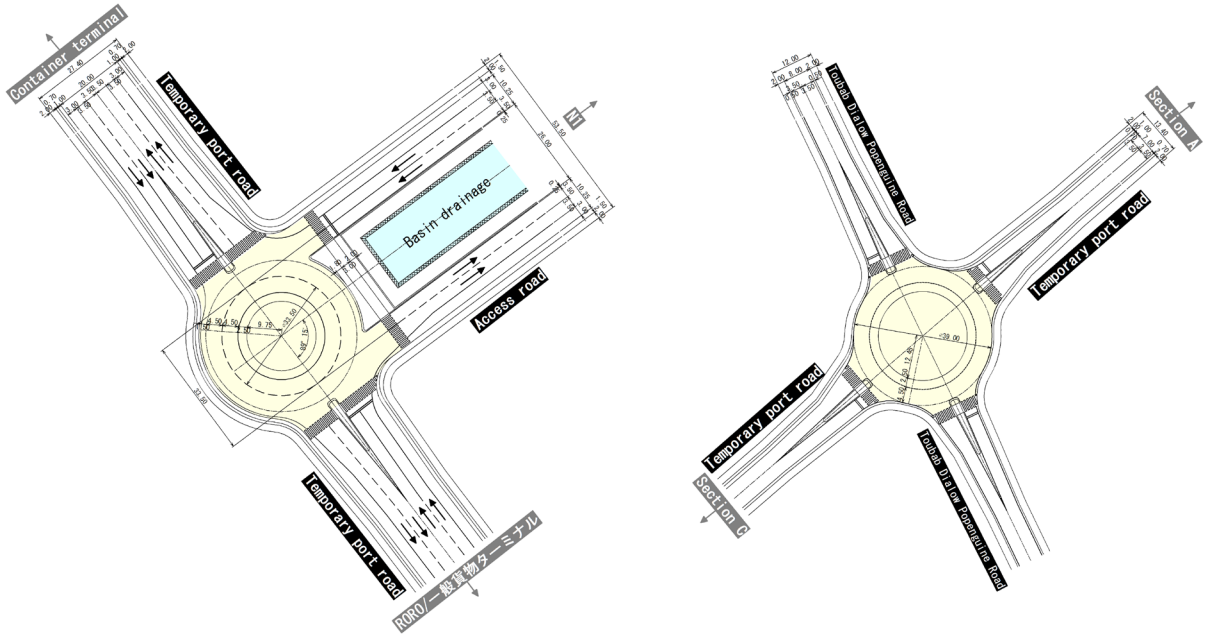
1. Connection to the access road
2. Intersection with the existing road

- Security gates will be installed on both sides of the intersection with the existing road to prevent general vehicles from entering the port roads, and U-turn areas will be provided to allow vehicles that have entered by mistake to return.



Source: JPT

Figure 4.24 Location Map of the Intersections and the Security Gates

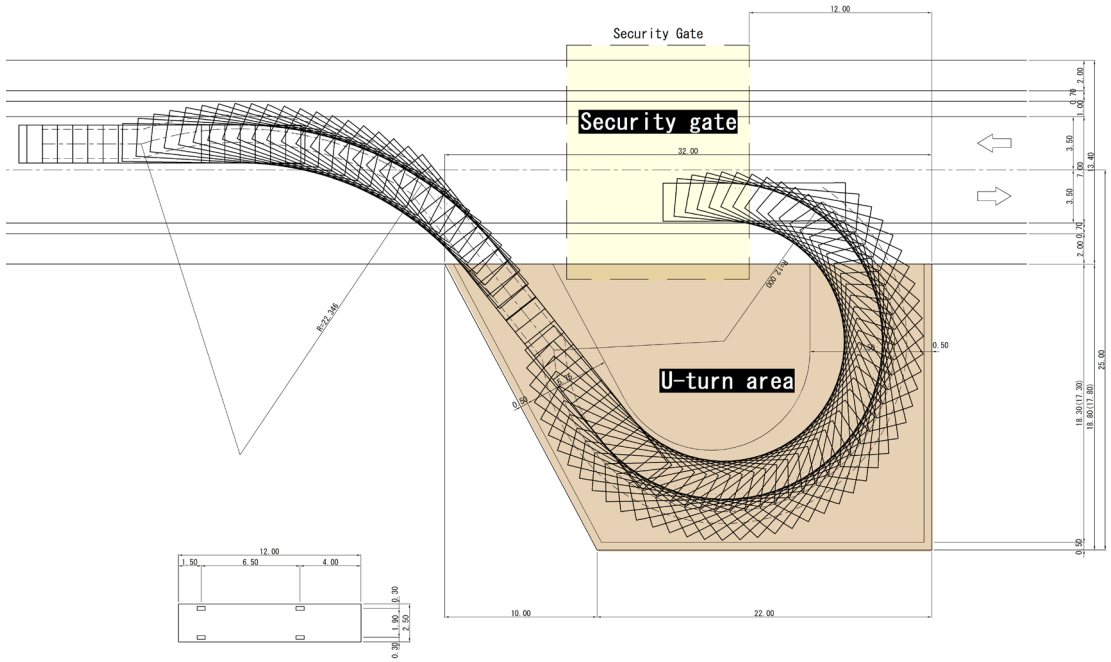


Roundabout 1 Roundabout 2

Source: JPT

Figure 4.25 Plan of the Roundabouts

- The U-turn areas will be located across the security gates, and their shape will be designed to allow the bus-size vehicles to turn around.



Source: JPT

Figure 4.26 Plan of the U-turn Area

b) Important Notice

i) Connection Point to Container Terminal (Section A)

Plans for the container terminal to be constructed by DPW have not yet begun on the landward side of Toubab Dialow Popenguine Road. For this reason, both the horizontal and vertical alignments of the temporary road inside the port are assumed in this outline design, so it will be necessary to ensure consistency with the latest DPW plans at the detailed design stage.

ii) The Section Parallel to the PIZ (Section A, Section B)

No information is available regarding the PIZ to be constructed by DPW. In this outline design, it is assumed that the construction of the temporary road will precede the PIZ, and the current topography will be used. If the construction of the PIZ is carried out in advance or in parallel, it will affect the vertical alignment, so the construction sequence must be confirmed at the detailed design stage.

iii) Pavement Composition

In this outline design, low-cost asphalt pavement is planned considering that the road within the port is temporary. On the other hand, there are some sections (Section A, Section C) where the width composition will not change in the completed form in 2035, so it is possible to use the permanent pavement composition at the time of the short-term development work. When using a permanent pavement composition, it is necessary to decide the pavement composition in accordance with the design CBR based on the ground investigation as well as the pavement materials that can be procured.

Table 4.9 Low-Cost Pavement Composition of the Outline Design

Pavement Composition	
Surface Layer	Recycled dense graded asphalt mixture, t = 50 mm Prime coat
Upper subbase	Recycled mechanically stabilized crushed stone, t = 100 mm
Lower subbase	Recycled mechanically stabilized crushed stone, t = 150 mm

Source: JPT

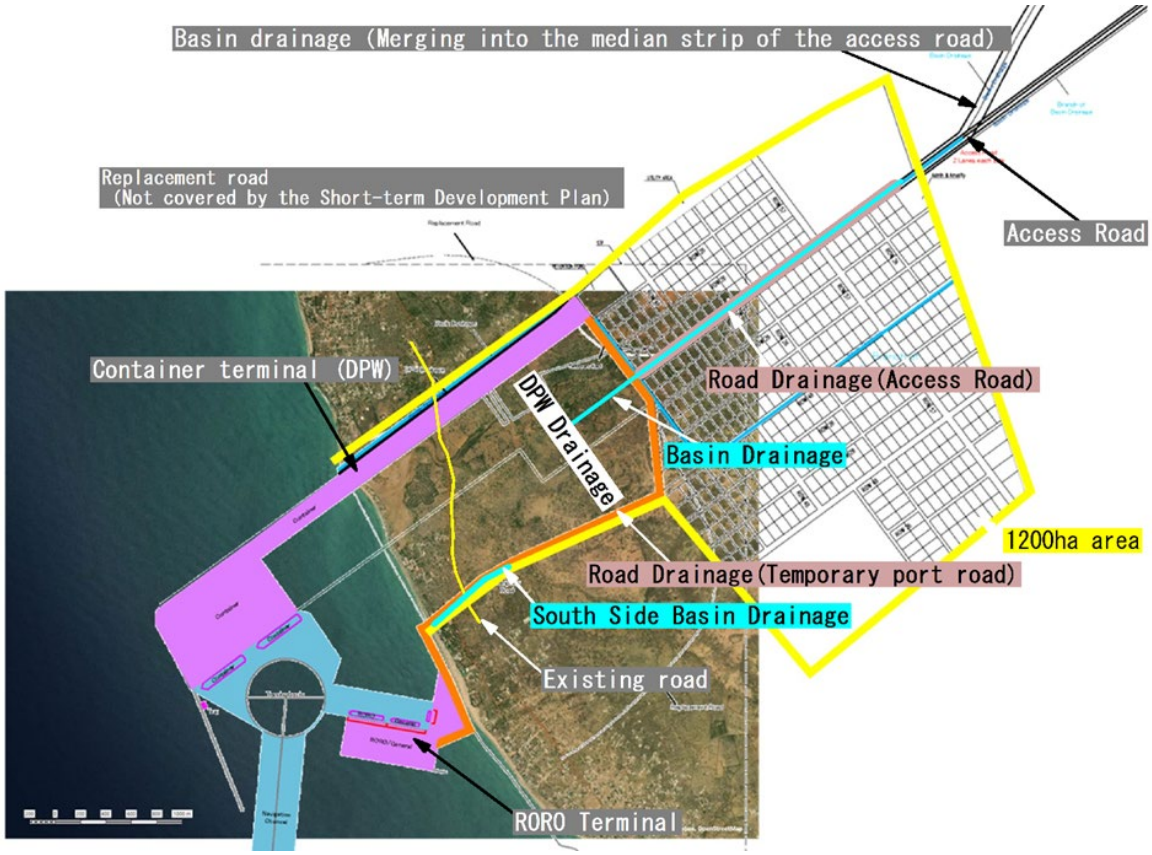
4.2.3 Drainage Facilities

(1) Drainage Facilities in the Short-term Development Plan

The drainage facilities within the 1,200 ha area and above sea level, for which new port development permission has been obtained, are planned.

The planned drainage facilities are of three types: the “basin drainage”, the “south side basin drainage”, and “road drainage” for the access road and the temporary port road. As for the “south side basin drainage”, the plan calls for it to be completed after 2035, assuming the expansion of port land, so as of 2030 it will be developed as temporary drainage under a tentative plan.

Figure 4.27 shows the three types of drainage facilities planned in the short-term development plan.



Source: JPT

Figure 4.27 Drainage Facilities in the Short-term Development Plan

(2) Basin Drainage

a) Planning Policy

The basin drainage in the short-term development plan will be planned according to the following principles:

i) Design Conditions

- Design flow rate

The design flow rate will be 1/10 of the design scale considered in 3.11.13.

PIZ upstream boundary ~ PIZ downstream boundary: 155 m^3/s

PIZ downstream boundary ~ Connecting point to DPW drainage: 219 m^3/s

- Cross Sectional shape

The waterway will be an open channel, and the revetment will be a block revetment.

- Calculation of flow rate

The flow rate of the drainage facility shall be calculated using the following formula.

$$Q = A \times V$$

A : Cross-sectional area of water passage (m^2)

V : Flow velocity (m/s)

$$V = \frac{1}{n} \cdot R^{2/3} \cdot i^{1/2} \quad \text{... Manning formula}$$

V: Flow velocity (m/sec)
n: Roughness coefficient
R: Diameter depth(=A/P)
A: water flow cross-sectional area, P: wetted perimeter length)
i : Flow gradient

- Roughness coefficient

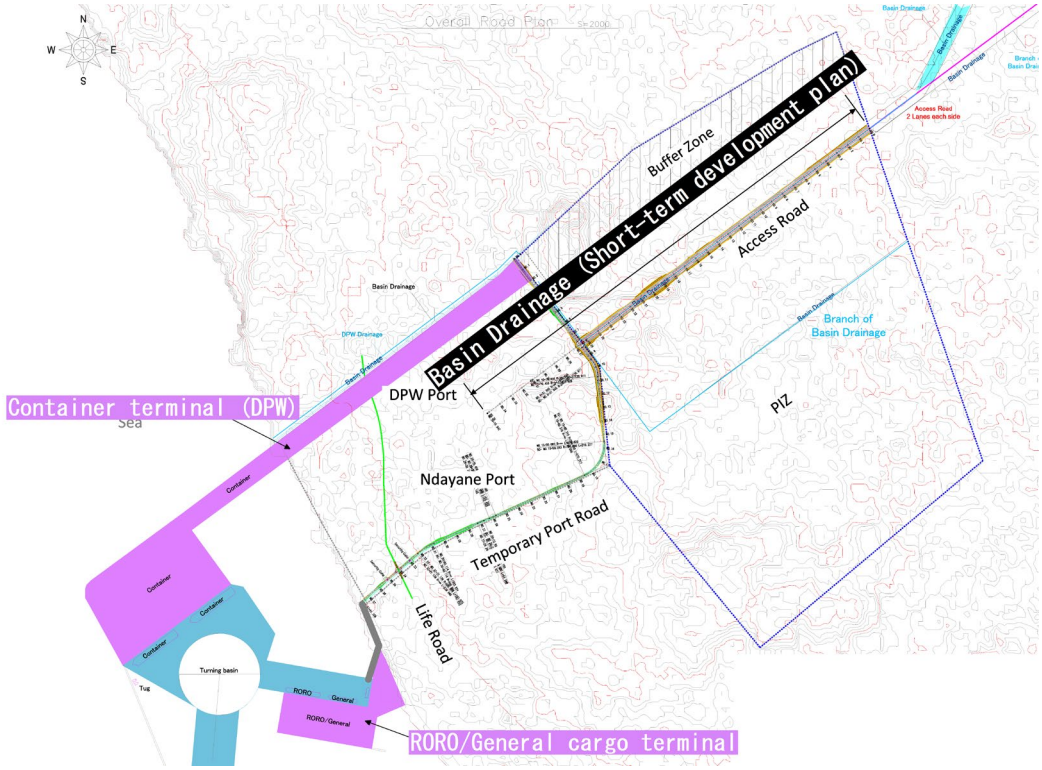
The roughness coefficient is set as 0.020 (the upper limit for concrete artificial waterways) in accordance with Japan's Technical Criteria for River Works.

- Design water depth

In sections with a flow rate of less than 200 m^3/s, the allowance height from the HWL to the top of the levee will be 0.6 m, and in sections with a flow rate of 200 m^3/s or more, the allowance height will be 0.8 m in accordance with Japan's River Management Facilities Structure Act.

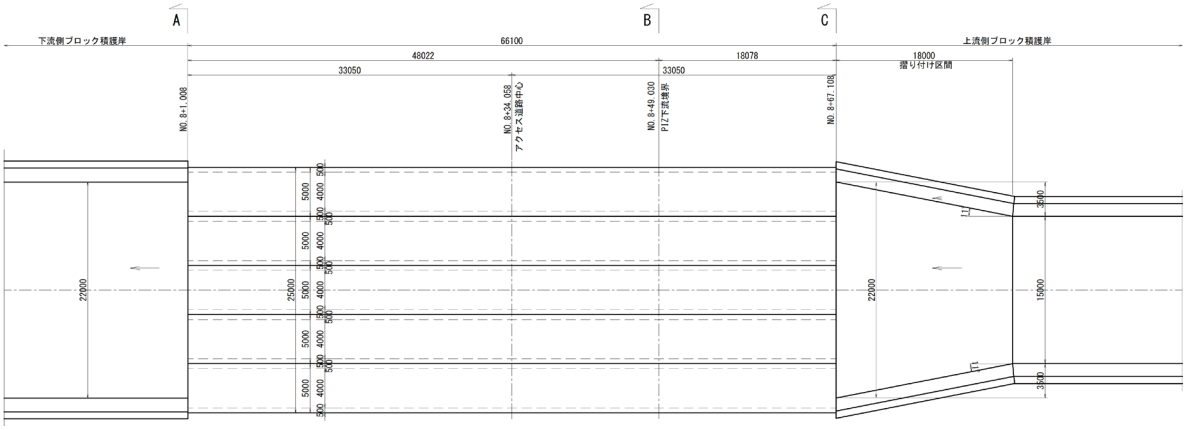
ii) Plane Alignment

- As planned in Chapter 3, the access road will be constructed in the median strip, and the route downstream from the downstream boundary of the PIZ will connect to the retention pond constructed upstream of the DPW drainage.
- A box culvert is planned for the intersection of the downstream boundary of the PIZ and the temporary port road.



Source: JPT

Figure 4.28 Plane Alignment of the Basin Drainage

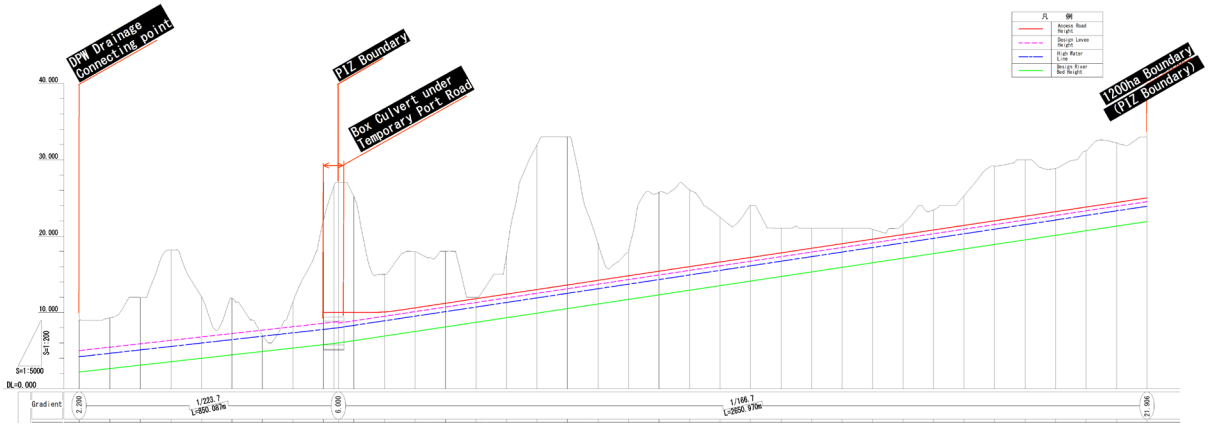


Source: JPT

Figure 4.29 Plane Alignment of Box Culverts at the Intersection of Temporary Port Road

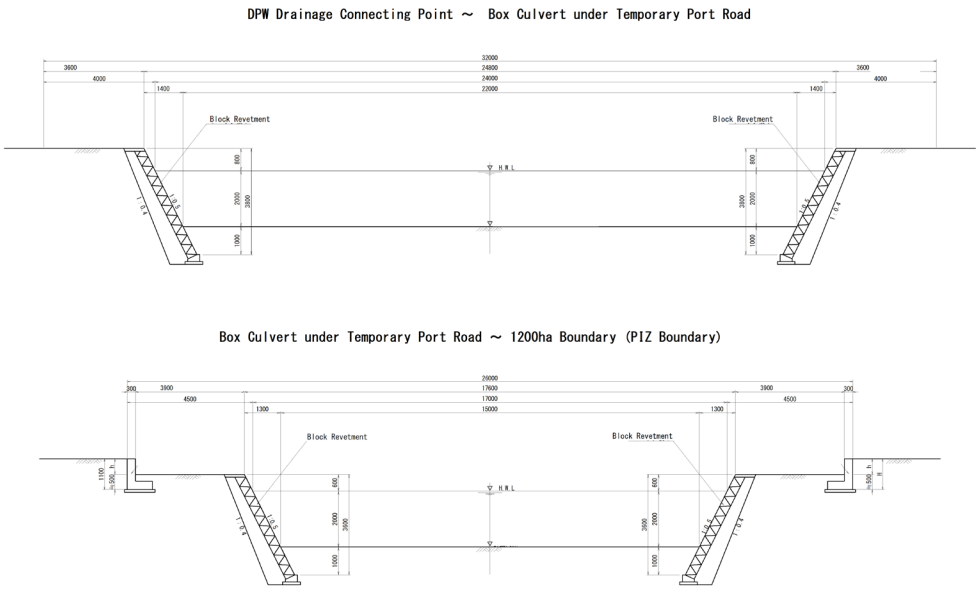
iii) Vertical Alignment and Standard Cross-section

- The vertical alignment of the basin drainage will be set based on the access road alignment. The gradient will be the same as that of the access road. The planned elevation will be set based on the overburden height of the box culvert to be installed under the temporary port road.
- For the downstream area from the PIZ boundary, the planned elevation is set by assuming that the HWL at the DPW drainage connection point is +4.2 m, calculated by subtracting a margin of 0.8 m from the planned elevation of the terminal of +5.0 (riverbed elevation is +2.2 m, calculated by subtracting the design water depth of 2.0 m).



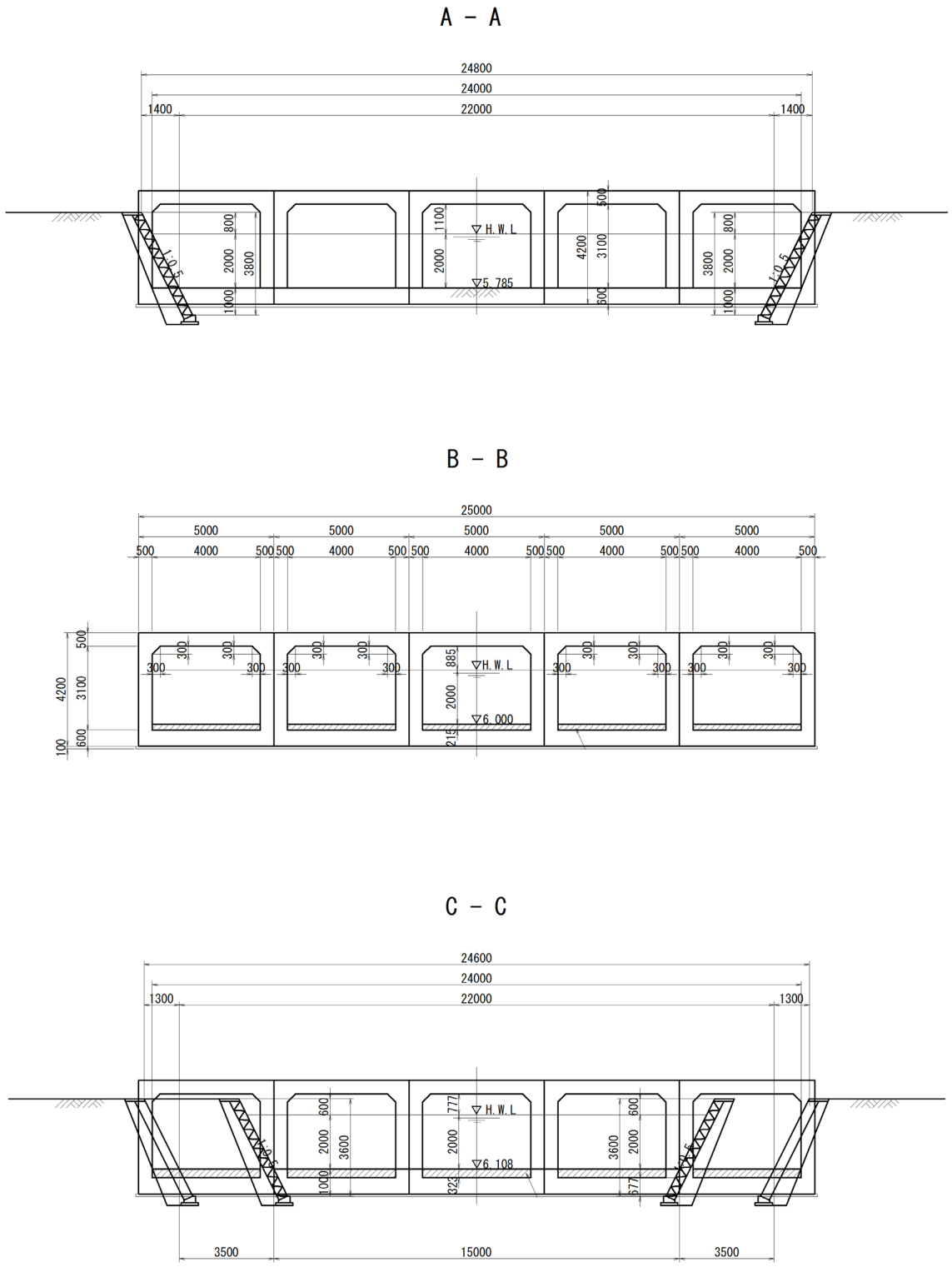
Source: JPT

Figure 4.30 Vertical Alignment of the Basin Drainage



Source: JPT

Figure 4.31 Standard Cross-section of the Access Road



Source: JPT

Figure 4.32 Standard Cross-section of Box Culvert at the Intersection of the Temporary Port oad

b) Important Notice

i) Design Flow Rate

It is important to ensure consistency between the DPW drainage plan currently being developed by DPW regarding planned scale and rainfall intensity data.

ii) Plane Alignment

Since the plane alignment within the PIZ is integrated with the access roads, any changes to the layout of the PIZ or the layout of the access roads may require adjustments to the alignment.

In this study, the location of the DPW drainage channel was estimated because the plan drawings of the DPW drainage channel were not available. It is necessary to ensure consistency with the DPW plan when carrying out detailed design.

iii) Vertical Alignment

Same as the plane alignment, adjustments will be required based on the DPW drainage plan.

(3) South Side Basin Drainage

a) Planning Policy

South side basin drainage is to be completed after 2035, assuming the expansion of port land, so as of 2030 it will be developed as temporary drainage under a tentative plan. The south side basin drainage in the short-term development plan will be planned according to the following principles:

i) Design Conditions

- Design flow rate

Since the facility will be a temporary facility until 2035 and considering that its service life will be less than five years, the design flow rate to be of 5 m3/s in design scale of return period 2 years.

- Cross Sectional shape

Corrugated pipe shall be used.

- Calculation of flow rate

Same as with basin drainage, the Manning Method to be used.

- Roughness coefficient

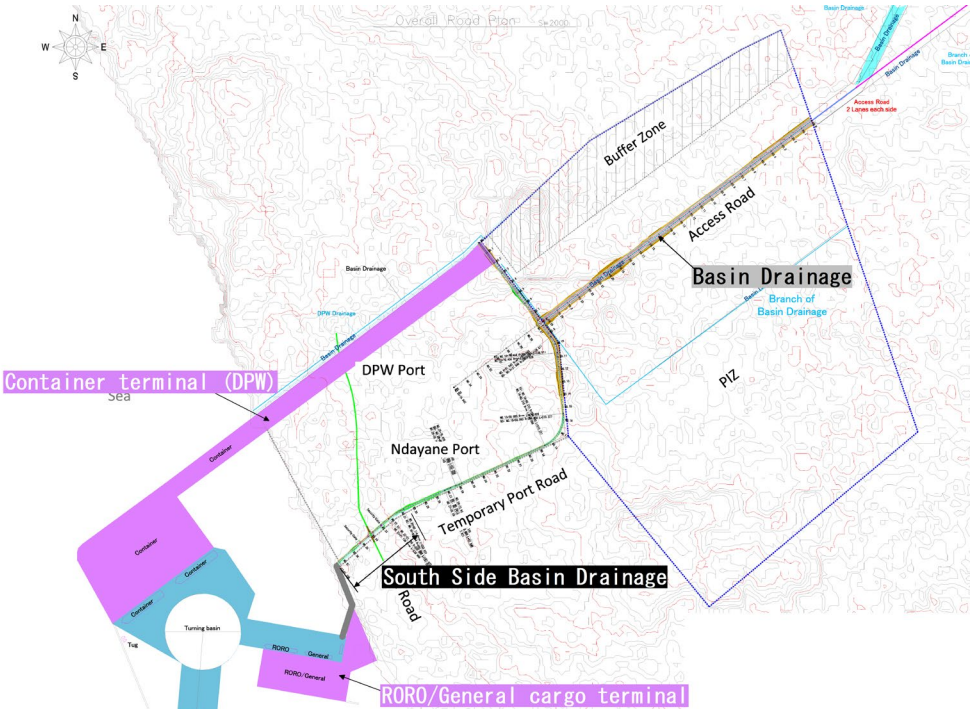
The roughness coefficient is set as 0.024 (corrugated pipe) in accordance with Japan's Technical Criteria for River Works.

- Design water depth

Evaluate at 80% water depth.

ii) Plane Alignment

- The upstream end will be the point where the existing natural river channel joins, and the route will run along the boundary of the 1,200ha site (along the temporary port road) to the coast.

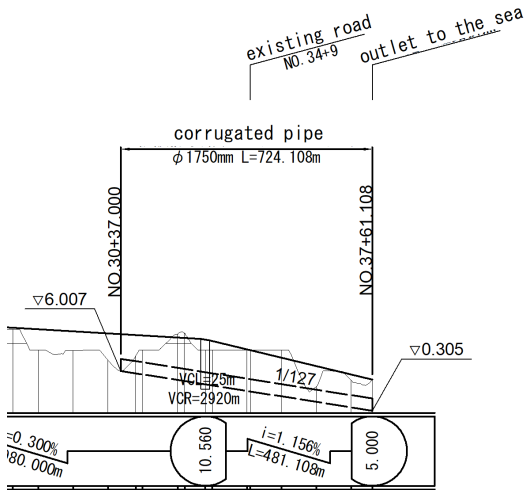


Source: JPT

Figure 4.33 Plane Alignment of the South Side Basin Drainage

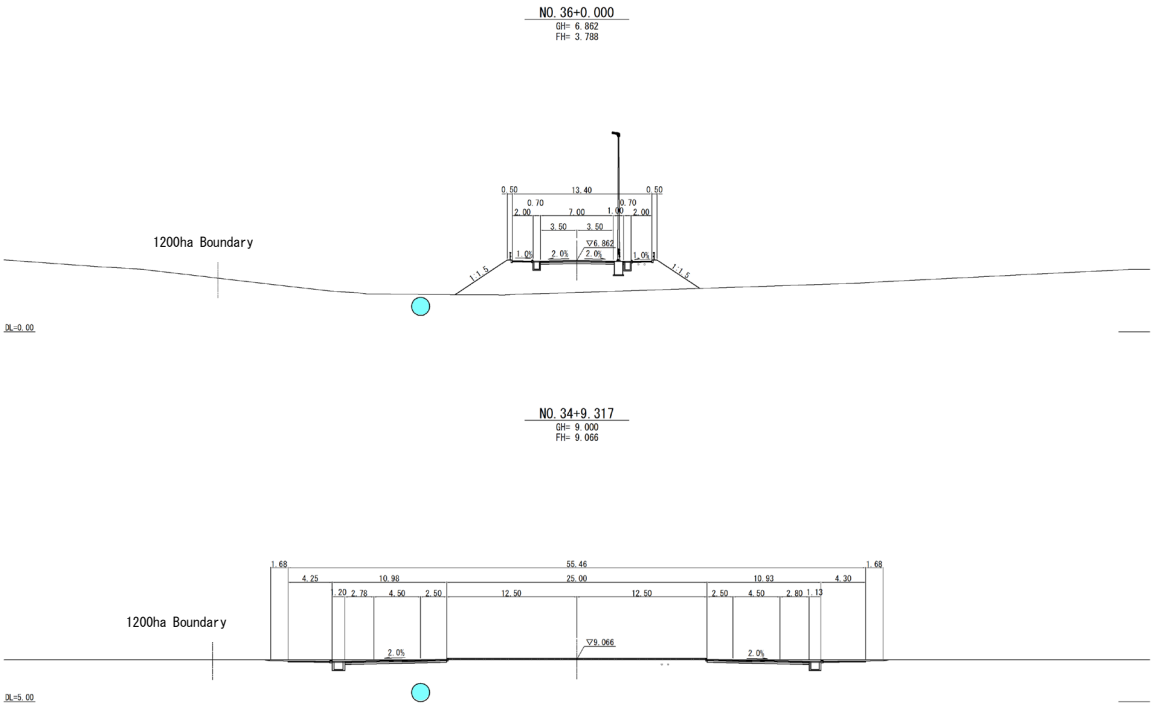
iii) Vertical Alignment and Standard Cross-section

- The vertical alignment of the south side basin drainage channel will be set at the riverbed elevation of the natural river at the point where the current natural river intersects with the 1,200 ha area boundary, which is “+6.007”, and will discharge into the sea at a position higher than sea level “+0.0”.



Source: JPT

Figure 4.34 Vertical Alignment of South Side Basin Drainage



Source: JPT

Figure 4.35 Cross Section of South Side Basin Drainage

b) Important Notice

i) Design Flow Rate

It is important to ensure consistency between the DPW drainage plan currently being developed by DPW regarding rainfall intensity data.

ii) Vertical Alignment

Since there are sections that pass underneath temporary roads, any changes to the longitudinal profile of the temporary roads will need to be made to ensure consistency.

(4) Road Drainage

a) Planning Policy

i) Design Conditions

- Design flow rate (Q)

The design flow rate is calculated using a rational formula.

$$Q = \frac{1}{360} \times C \times I \times A$$

Here, Q: Runoff volume (m^3 / sec)

C: Runoff coefficient

I: Rainfall intensity (mm/h) during the concentration time (t)

A: Basin area (ha)

- Rainfall Intensity (I)

For rainfall intensity (I), the "10-year return period" from the rainfall intensity data of the Thies Meteorological Observatory (created by the National Civil Aviation and Meteorological Agency (ANACIM)) is used, same as the case of the basin drainage channel considered in Chapter 3.

- Concentration time (t)

The concentration time (t) is the sum of the inflow time (t_1) it takes for rainfall to reach the drainage facility from the ground surface and the flow down time (t_2) it takes for rainwater to flow through the drainage facility.

t: Concentration time = Inflow time t_1 (min) + Downflow time t_2 (min)

Inflow time t_1: 5 minutes

Downflow time t_2: Facility length (L) divided by flow velocity (V)

$t_2 = L / (60 \times V)$

The inflow time used is "5 minutes" based on the Japanese Road Civil Engineering Guidelines.

- Runoff Coefficient (C)

Runoff coefficient is set to 0.83, which is the average value for roads in the Japanese Road Civil Engineering Guidelines.

➢ Basin Area

The catchment area shall be the area of the road.

➢ Drainage Facilities

The drainage facilities will consist of U-shaped gutters.

➢ Flow Calculation

The flow rate is calculated using the Manning formula, the same as for basin drainage channels.

- Roughness coefficient (n) is set to "0.015" (cast-in-place concrete) based on the Japanese Road Civil Engineering Guidelines.

- The design water depth for cross-sectional capacity will be "80% water depth" based on the Japanese Road Civil Engineering Guidelines.

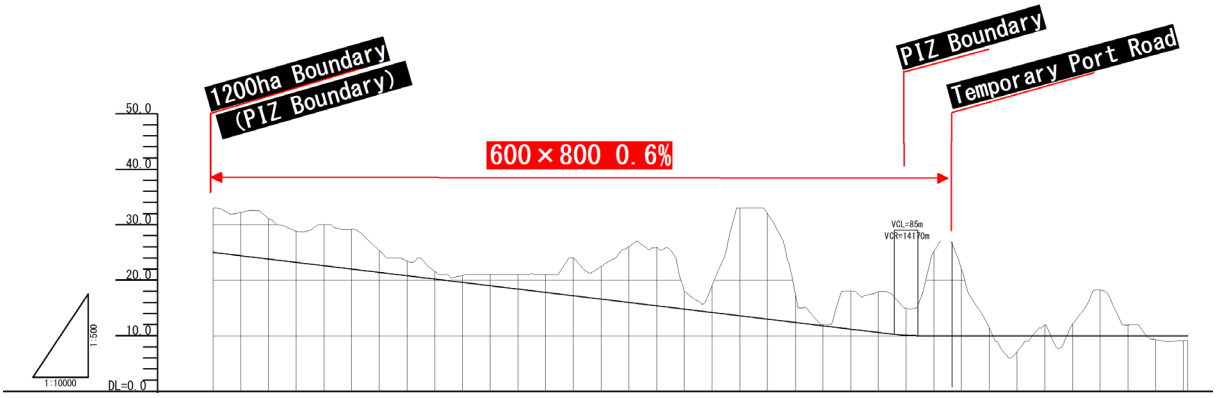
- Permissible flow velocity is set in the range of 0.6 to 3.0 m/sec, in accordance with Japan's Road Civil Engineering Guidelines.

ii) Plane Alignment

- To be planned on both the access road and the temporary port road.

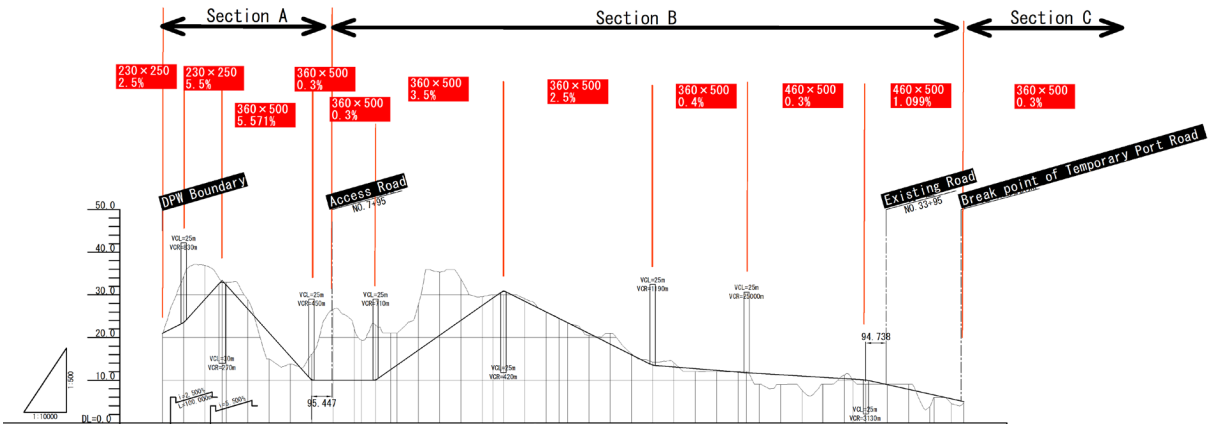
iii) Vertical and Horizontal Alignment

- The canal will be designed with the same longitudinal gradient as the road, except for sections where the road is horizontal, where the minimum gradient is set at 3% as specified in the Road Earthwork Guidelines.



Source: JPT

Figure 4.36 Vertical Alignment of Road Drainage (access road)



Source: JPT

Figure 4.37 Vertical Alignment of Road Drainage (temporary port road)

b) Important Notice

i) Vertical Linear Section

Since there are sections that pass underneath temporary roads, any changes to the vertical profile of the temporary roads will need to be made to ensure consistency.

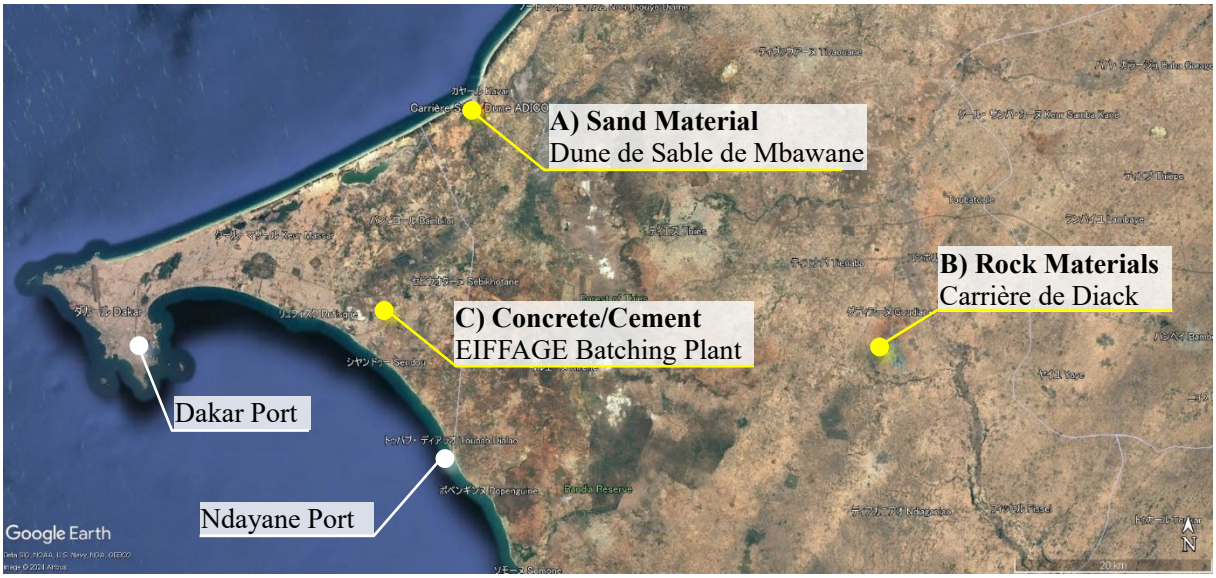
4.3 Examination of Construction Plan

4.3.1 Procurement Source of Major Construction Materials

The interviews and the site reconnaissance to the suppliers and construction companies were conducted, it is confirmed that major construction materials such as sand materials, rock materials, concrete/cement, and steel products can be procured domestically. Typical examples of procurement sources for the major construction materials are summarized below.

Cement is produced domestically (such as SOCCOCIM) from the imported clinkers. EIFFAGE, a major French construction company located approximately 20 km from project site, operates a commercial concrete batching plant with decent quality.

- **A) Sand Material**: Dune de Sable de Mbawane / approximately 45 km from project site
- **B) Rock Material**: Carrière de Diack / approximately 70 km from project site
- **C) Concrete/Cement**: EIFFAGE Batching Plant / approximately 20 km from project site



Source：JPT

Figure 4.38 Typical Examples of Procurement Sources for Major Construction Materials

Fine Aggregate (0.1 mm)

Coarse Aggregate (8～16 mm)

Appearance of EIFFAGE Batching Plant

Source：JPT

Figure 4.39 Samples of Construction Materials and Appearance of Concrete Batching Plant

Steel materials can be procured locally, as they are imported through Dakar Port and sold by suppliers/agents, there are many other construction materials in the local market imported mainly from Europe and China.

Major construction equipment for general construction works can also be procured domestically, and many used items imported from Europe at relatively low prices and is widely used in Senegal.

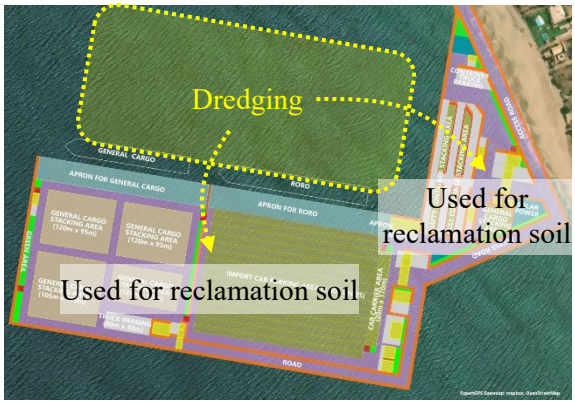
4.3.2 Preliminary Construction Method

(1) Temporary Work

First, the triangular area is reclaimed and used as the temporary works area for the construction of temporary offices, material storage and process yards, and temporary jetty. If the timing and scale are suitable, diversion of the temporary yard currently being used by DPW will be considered.

(2) Dredging

The basin area in front of terminals is dredged to -14 ~ -15 m with the dredged volume of about 3.3 million m^3. Although there are some sandstone and limestone strata, it would be possible to dredge with a cutter suction dredger with a total power over 5,000 kW. The dredged soil will be used for reclamation of terminals.



Source：JPT

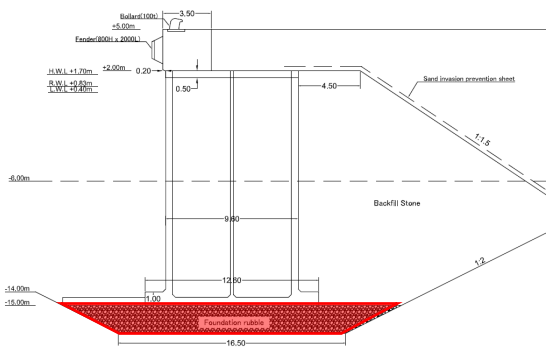
Figure 4.40 Location of Dredging and Reclamation

Source：Jan De Nul Group website[1]

Figure 4.41 Cutter Suction Dredger (8,330 kW)

(3) Excavation for Foundation of Caisson and Block

The excavating and shaping at the bottom of the caisson and block berths will be carried out by a grab dredger (Right: Red highlighted area). The dredged soil will be transported to the reclamation area using an open-bottomed barge.



Source：JPT

Figure 4.42 Standard Cross-section of -14 m Berth

(4) Reclamation

In order to reduce costs, it is expected that dredged materials will be used for the reclamation. Cutter suction dredger will blow the dredged soil directly onto the reclaimed area through the discharge pipeline. It is planned that the volume of dredged soil covers the volume of the reclaimed soil, but if the soil volume is insufficient, additional area toward the future General Cargo Terminal will be dredged. As mentioned above, the triangular area will be reclaimed in advance for land preparation.

[1] https://www.jandenul.com/fleet/cutter-suction-dredgers

(5) Berth

Regarding the construction procedure of Caisson Berth, refer to (4) Construction Procedures mentioned in 3.12.8 Overview of Each Port Facility.

Floating Dock for caisson fabrication will be procured from overseas and caissons will be fabricated in Ndayane. Alternatively, it is assumed that the caissons will be fabricated at the dock in Dakar Port and bring to Ndayane.

(6) Revetment including Basin Drainage

Regarding the construction procedure for Rubble Sloping Breakwater/Revetment, refer to (4) Construction Procedures mentioned in 3.12.8 Overview of Each Port Facility.

(7) Pavement and Drainage including Access Road

As the construction equipment and materials are easily available domestically, common construction methods can be used.

4.4 Preliminary Cost Estimate

4.4.1 Conditions of Cost Estimate

Cost estimation was made with reference to the Manual for Design and Cost Estimation of Preparatory Survey (JICA, 2009). The funding method is not determined except for the work items which are carried out by DPW since this study is Pre-Feasibility (Pre-FS), therefore, the preliminary project cost shall be estimated in consideration of the JICA ODA Loan, etc.

(1) Base Year used in Cost Estimation

The base year for the estimation is 2025.

(2) Exchange Rate

The exchange rates at the end of the previous month are applied as shown below (T.T.S., Tokyo Mitsubishi UFJ Bank as of February 2025).

- USD: 150.67 JPY
- EUR: 157.10 JPY
- CFA: 0.23828 JPY

(3) Construction Cost

Regarding the unit price of the work items for which approximate construction costs have been examined in DPW M/P (2021) such as Dredging, reclamation, excavation, etc., these unit costs are applied after adjusting for the effects of inflation, etc. For the other major cost items such as berth, revetment, pavement, drainage, access road and basin drainage, the construction method and productivity were considered as well as costs of the resources (material, equipment, and labour). Indirect costs (20%) are added to direct construction cost as office management and site expenses.

Regarding the minor cost items such as buildings, electrical works, mechanical and utilities, the

construction costs for the past similar projects were used as references. To reach the current price, the factors such as scale, specification, price escalation were considered.

Unit price of major construction materials (including transportation cost), equipment, and labour was surveyed from September to October 2024 in Senegal (refer to Table 4.10 - Table 4.12 for the major unit price) In addition, the depreciation costs of major working vessels were referred to Depreciation Cost for Construction Machinery Table (Japan Construction Machinery and Construction Association).

Table 4.10 Unit Price for Major Construction and Equipment (Material)

No.	Item of Materials	Unit	Nominal Quantity	Unit Rate (CFA)
M1. 1	Fuel (Heavy Oil - C : IFO 380)	Ltr.	1	2,150.00
M1. 2	Fuel (Heavy Oil - A : MGO)	Ltr.	1	2,250.00
M1. 3	Fuel (Diesel : Light fuel)	Ltr.	1	2,500.00
M1. 4	Fuel (Gasoline)	Ltr.	1	2,500.00
M1. 5	Cobble Stone 10-50 kg	m3	1	17,500.00
M1. 6	Rubble Stone 10-100 kg	m3	1	22,000.00
M1. 7	Armor Rock 50-200kg	m3	1	15,000.00
M1. 8	Armor Rock 200-500kg	m3	1	23,000.00
M1. 9	Sand (0-4mm)	m3	1	6,000.00
M1. 10	Gravel (4-25mm)	m3	1	16,000.00
M1. 11	Gravel (25-75mm)	m3	1	27,000.00
M1. 12	Geotextile (200g/m2)	m2	1	18,000.00
M1. 13	Geotextile (1,000g/m2)	m2	1	28,000.00
M1. 14	Expansion Joint filler 12mm	m2	1	8,000.00
M1. 15	50 mm	m2	1	15,000.00
M1. 16	100 mm	m2	1	32,000.00
M1. 17	Sealant - 50 mm	m	1	13,000.00
M1. 18	Prime Coat MC -30	Ltr.	1	2,800.00
M1. 19	MC - 70	Ltr.	1	3,200.00
M1. 20	Tack Coat K1 - 40	Ltr.	1	3,500.00
M1. 21	K1 - 60	Ltr.	1	3,500.00
M1. 22	Bitumen 80/100	kg	1	3,800.00
M1. 23	Bitumen 60/70	kg	1	27,000.00
M1. 24	DBM - (Dense Bituminous Macadam)	t	1	32,000.00
M1. 25	Asphalt concrete - AC	t	1	15,500.00
M1. 26	Sub-grade Material	m3	1	8,500.00
M1. 27	Concrete Block (ICB) t=60 mm	pc	1	1,050.00
M1. 28	Concrete Block (ICB) t=80 mm	pc	1	1,200.00
M1. 29	Deformed bars (Grade 500) - 8mm	kg	1	2,300.00
M1. 30	10 mm	kg	1	2,400.00
M1. 31	20 mm	kg	1	2,600.00
M1. 32	30 mm	kg	1	2,800.00
M1. 33	Round bars - KS -02 -22 - 8mm	kg	1	2,500.00
M1. 34	20 mm	kg	1	11,500.00
M1. 35	30 mm	kg	1	30,000.00
M1. 36	Portland Cement 32.5	Kg	1	850.00
M1. 37	Portland Cement 42.5	Kg	1	1,000.00
M1. 38	Coarse Aggregate 20 mm - 40 mm	m3	1	27,000.00
M1. 39	Fine Aggregate	m3	1	17,000.00
M1. 40	Ready mix concrete (15MP)	m3	1	75,000.00
M1. 41	Ready mix concrete (20MP)	m3	1	75,000.00
M1. 42	Ready mix concrete (25MP)	m3	1	78,000.00
M1. 43	Ready mix concrete (30MP)	m3	1	7,800.00
M1. 44	Oxygen	cyl.	1	87,288.00
M1. 45	Acetylene	cyl.	1	72,800.00
M1. 46	Welding Rod (5Kg pkt)	kg	1	2,000.00
M1. 47	Steel Angle 50 x 50 x 6 mm	kg	1	13,500.00
M1. 48	150 x 150 x 12 mm	kg	1	160,000.00
M1. 49	Steel pipe D50	kg	1	11,500.00
M1. 50	H-shaped Pile H305x305	kg	1	1,050,000.00
M1. 51	Steel Plate t=8 - 20 mm	kg	1	260,000.00
M1. 52	PVC pipe D150 (PN16)	m	1	22,000.00
M1. 53	Lighting pole H=10,000	No's	1	439,800.00
M1. 54	Marine ply - 18mm thick: 8*4 sheets	Pcs	1	24,000.00
M1. 55	Water (Clean)	m3	1	1,200.00

Source : JPT

Table 4.11 Unit Price for Major Construction and Equipment (Equipment)

No.	Item of Equipment	Unit	Nominal Quantity	Unit Rate (CFA)
Land Works				
E1. 1	Backhoe 0.28m3 (0.20 m3)	day	1	250,000.00
E1. 2	Backhoe 0.5m3 (0.4 m3)	day	1	250,000.00
E1. 3	Backhoe 0.8 m3 (0.6 m3)	day	1	250,000.00
E1. 4	Backhoe 1.4 m3 (1.0 m3)	day	1	300,000.00
E1. 5	Backhoe 2.7 m3 (2.1 m3)	day	1	300,000.00
E1. 6	Wheel Loader (2.0m3 : 1.9 ~ 2.2 m3)	day	1	120,000.00
E1. 7	Wheel Loader (4.0m3 : 4.0 ~ 4.1 m3)	day	1	120,000.00
E1. 8	Bulldozer 6 t class (6 ~ 8t)	day	1	350,000.00
E1. 9	Bulldozer 15 t class (13 ~ 16t)	day	1	350,000.00
E1. 10	Bulldozer 32 t class (33 ~ 37t)	day	1	350,000.00
E1. 11	Bulldozer 16 t class (wet type : 15 ~ 17t)	day	1	350,000.00
E1. 12	Truck Crane 20 t	day	1	100,000.00
E1. 13	Truck Crane 45 t (40 ~ 45t)	day	1	120,000.00
E1. 14	Crawler Crane 55 t (50 ~ 55t)	day	1	350,000.00
E1. 15	Crawler Crane 80 t	day	1	400,000.00
E1. 16	Crawler Crane 120 t	day	1	400,000.00
E1. 17	Crawler Crane 250 t	day	1	400,000.00
E1. 18	Trailer Truck 35 t	day	1	120,000.00
E1. 19	Boom Truck 4t (2t lift)	day	1	120,000.00
E1. 20	Water Tank Car 10 t	day	1	80,000.00
E1. 21	Dump Truck 10 t (on road type)	day	1	90,000.00
E1. 22	Dump Truck 25 t (3 Axel on road type)	day	1	90,000.00
E1. 23	Motor Grader 3.1 m	day	1	350,000.00
E1. 24	Asphalt Finisher (crawler type 4.5 m)	day	1	400,000.00
E1. 25	Tire Roller 14 t (8 ~ 20t)	day	1	400,000.00
E1. 26	Macadam Roller 10 t (10 ~ 12t, 2.1m)	day	1	350,000.00
E1. 27	Vibratory Roller (Tandem : 6 ~ 7.5 t)	day	1	9,750,000.00
E1. 28	Tamping Rammer 60 kg	day	1	1,570,000.00
E1. 29	Plate Compactor 70 ~ 80 kg	day	1	988,000.00
E1. 30	Concrete vibrator dia. 38~46 L=1.2m	month	1	520,000.00
E1. 31	Generator 37/45 KVA	day	1	7,600,000.00
E1. 32	Generator 125/150 KVA	day	1	22,000,000.00
E1. 33	Generator 270/300 KVA	day	1	35,000,000.00
E1. 34	Welding Machine 300 A	day	1	775,000.00
E1. 35	Belt Conveyer(900mm, 10m)	day	1	60,000.00
E1. 36	Submergible pump 2inch 10m pressure	day	1	15,000.00
E1. 37	Submergible pump 4inch 10m pressure	day	1	15,000.00
E1. 38	Passengers vehicle (5PP)	day	1	40,000.00
E1. 39	Passengers vehicle (8PP)	day	1	40,000.00
E1. 40	Passengers mini Bus (14PP)	day	1	80,000.00
E1. 41	Passengers Bus (40PP)	day	1	450,000.00
E1. 42	Echo sounder (dual 90~230kHz)	day	1	65,000.00
E1. 43	Batching Plant	day	1	75,000.00
Marine Works				
E1. 44	Grab Dredger (spud type : 15m3)	month	1	160,000.00
E1. 45	Anchor Handling Boat (5 ton)	day	1	250,000.00
E1. 46	Bottom Open Hopper Barge (1,500m3)	month	1	70,000.00
E1. 47	Heavy Lifting Barge 2,000ton	day	1	30,000.00
E1. 48	Cutter Suction Dredger (diesel : 8,000ps)	day	1	20,000.00
E1. 49	Trailing Suction Hopper Dredger (8,000m3 TSHD)	day	1	45,000.00
E1. 50	Piling Barge (H-150)	day	1	30,000.00
E1. 51	Piling Barge (H-125)	day	1	300,000.00
E1. 52	Anchor Handling Boat (5 ton) Local	day	1	250,000.00
E1. 53	Sand barge (2,000ton : 20m x 50m)	day	1	16,000.00

Source : JPT

Table 4.12 Unit Price for Major Construction and Equipment (Labour)

No.	Item of Labor	Unit	Nominal Quantity	Unit Rate (CFA)
L1. 1	Civil Engineer (over 10 years)	month	1	850,000
L1. 2	Supervisor (over I0 years)	month	1	700,000
L1. 3	Foreman (over 10 years)	month	1	700,000
L1. 4	Rigger	month	1	650,000
L1. 5	Scaffolder	month	1	300,000
L1. 6	Re-bar Assembler	month	1	250,000
L1. 7	Carpenter	month	1	300,000
L1. 8	Welder	month	1	250,000
L1. 9	Plaster	month	1	250,000
L1. 10	Mason	month	1	350,000
L1. 11	Electrician	month	1	350,000
L1. 12	Skilled Labor	month	1	350,000
L1. 13	Unskilled Labor	month	1	180,000
L1. 14	Safety Officer (0 -2 y ears)	month	1	200,000
L1. 15	Safety Officer (3 -9 years)	month	1	220,000
L1. 16	Safety Officer (Over 10 years)	month	1	250,000
L1. 17	Unarmed guard man	month	1	200,000
L1. 18	Operator (Wheel Loader, Excavator)	month	1	300,000
L1. 19	Operator (Bulldozer, Roller)	month	1	300,000
L1. 20	Operator (Grader)	month	1	300,000
L1. 21	Operator (Asphalt Finisher)	month	1	300,000
L1. 22	Operator (Crawler Crane)	month	1	300,000
L1. 23	Operator (Truck Crane)	month	1	300,000
L1. 24	Operator (Vibration hammer)	month	1	300,000
L1. 25	Operator (Concrete Pump)	month	1	300,000
L1. 26	Driver (Car)	month	1	250,000
L1. 27	Driver (Truck)	month	1	250,000
L1. 28	Driver (Dump Truck)	month	1	250,000
L1. 29	Driver (Low bed Trailer)	month	1	250,000
L1. 30	Captain/Boat driver	month	1	300,000
L1. 31	Skilled Crew	month	1	300,000
L1. 32	Unskilled Crew	month	1	300,000
L1. 33	Diver	month	1	250,000
L1. 34	Surveyor	month	1	240,000
L1. 35	Assistant surveyor	month	1	240,000

Source：JPT

(4) Design and Supervision Cost

As an engineering services cost, 10% of the construction cost are assumed for the local currency and foreign currency.

(5) Contingencies

Contingency for price escalation is set as 20% of the construction cost for the local currency and foreign currency and physical contingency is set as 10% for the local currency and foreign currency.

(6) Preparation Cost (Land Acquisition Cost and Compensation)

The preparation cost such as land acquisition and compensation are not considered.

(7) Others

Since the funding method is not determined, it is difficult to set the required cost items and its amount, thus, 20% (VAT: 18% + others) of the construction cost shall be provisionally as the taxes and other expenses.

4.4.2 Project Component

The major scope of the Short-term Development Plan is summarized in Table 4.13.

Table 4.13 Major Project Components (Short-term Development Plan)

No.	Work Items	Unit	Quantity
(1)	**General Requirement and Temporary Works**		
	Performance Security and Insurance	L.S.	1
	Provided Safety Measure	L.S.	1
	Facilities for the Engineer	L.S.	1
	Temporary Contractor's Facilities	L.S.	1
	Mobilization and Demobilization of Equipment	L.S.	1
	Environmental Management and Monitoring	L.S.	1
	Site Laboratory	L.S.	1
	Monthly, Video and Completion Report	L.S.	1
	Prevention of HIV/AIDS Programme	L.S.	1
	Metocean Monitoring	L.S.	1
(2)	**Dredging Works**		
	Dredging of Port Basin	m3	3,300,000
(3)	**Excavation Works**		
	Excavation	m3	132,000
(4)	**Reclamation Works**		
	Reclamation	m3	2,720,000
(5)	**Berth Structures**		
	RORO Terminal	**m**	**600**
	Caisson	m3	18,000
	Caisson Infill	m3	84,000
	Foundation Rubble	m3	24,600
	Covering Block	m3	2,400
	Back Fill Stone	m3	132,000
	Sand Invasion Prevention Sheet	m2	15,000
	Fender	nr	61
	Bollard	nr	31
(6)	**Revetment Works**		
	Outer Revetment	**m**	**1,940**
	Rubble Stone (Sand Stone) 5-10kg	m3	349,200
	Liner Layer 20-50kg	m3	116,400
	Wave-Dissipating Block 500kg	m3	174,600
	Filter Sheet	m2	38,800
	L-Shape Wall	m	1,940
	Road Inside Port Area	**m**	**380**
	Armor Stone 200-300kg	m3	30,240
	Filter Stone 20-30kg	m3	10,080
	L-Shape Wall	m	1,260
(7)	**Pavement and Drainage**		
	Yard Pavement	m2	280,000
	Storm Water Drainage	m2	280,000
(8)	**Access Road**		
	Access Road	**m**	**2,666**
	Earthworks (Cut)	m3	1,258,744
	Asphalt Pavement	m2	54,239
	Sidewalk Pavement	m2	10,658
	Drainage (Ditch)	m	5,290
	Curb Works	m	7,995
	Temporary Port Road	**m**	**3,761**

No.	Work Items	Unit	Quantity
	Earthworks (Cut)	m3	456,342
	Earthworks (Fill)	m3	99,174
	Asphalt Pavement	m2	44,073
	Sidewalk Pavement	m2	15,249
	Drainage (Ditch)	m	7,394
	Curb Works	m	15,235
(9)	**Basin Drainage**	**m**	**3,501**
	Earthworks (Cut)	m3	388,630
	Earthworks (Fill)	m3	1,628
	Box Works (B=4.0m×H=3.1m×5)	m	66
	L-Shape Wall (H=1.5m, 1.1m and 1.0m)	m	5,266
	Revetment Block Type (H=3.8m and 3.6m)	m	6,870
(10)	**Building and Utilities**		
	Power Supply Facility	nr	2
	Water Supply Facility	nr	2
	Maintenance Shop	m2	900
	Terminal Building (3 buildings in total)	m2	5,400
	Gate Control Office (2 buildings in total)	m2	375
	Deballasting	m2	400
	Toilet (3 buildings in total)	m2	550
	Gate (5 buildings in total)	m2	1,075
	Office for triangle area	m2	150
	Sub-station	L.S.	1
(11)	**Security Equipment (Gate, Fence, CCTV, PA, etc.)**		
	Equipment for RoRo Terminal	L.S.	1
	Container X-ray scanner at Yard	L.S.	1
	Radiation Detection Scanner at Yard and Terminal Gate	L.S.	1
	Data Transfer System	L.S.	1
(12)	**Cargo Handling Equipment**		
	Forklift 5,000 kg for General Cargo	nr	2
	Forklift 10,000 kg for General Cargo	nr	3
	Forklift 24,000 kg for General Cargo	nr	1
	Tractor for General Cargo	nr	4
	Chassis for General Cargo	nr	4
	Tractor for RoRo	nr	12
	Chassis for RoRo	nr	12
	Reach Stacher for RoRo	nr	4
	Car Carrier Vehicle	nr	5

Source : JPT

4.4.3 Cost Estimation Result

The estimated result of construction cost for the Short-term Development Plan implemented by PAD with target year 2030 is summarized in Table 4.14. It is noted that this amount represents the construction cost only, and is one component of the project cost shown in Table 4.16.

Table 4.14 Estimation Result of Construction Costs (Short-term Development Plan)

Unit: '000 EUR

No.	Work Items	Amount		
		Local Currency	Foreign Currency	Total
(1)	General Requirement and Temporary Works	48,000	12,000	60,000
(2)	Dredging Works	34,650	34,650	69,300
(3)	Excavation Works	1,190	510	1,700
(4)	Reclamation Works	9,520	4,080	13,600
(5)	Berth Structures	39,600	32,400	72,000
(6)	Revetment Works	104,630	40,070	144,700
(7)	Pavement and Drainage Works	48,420	5,380	53,800
(8)	Access Road	54,396	3,504	57,900
(9)	Basin Drainage	19,600	0	19,600
(10)	Building and Utilities	25,522	2,836	28,358
(11)	Security Equipment	26,352	11,294	37,645
(12)	Cargo Handling Equipment	0	6,290	6,290
Construction Cost		**411,880**	**153,013**	**564,893**

Source: JPT

4.4.4 Construction Period

The construction period for the Short-term Development Plan is presented in Table 4.15, which is including the preparatory works for the construction of civil, building, and equipment. The arrows by red in the table indicate work items that can be critical paths, then the construction period is assumed as four (4) years.

Table 4.15 Construction Period (Short-term Development Plan)

Work Items			Project Year		2026	2027	2028	2029
			Unit	Quantity	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12	1 2 3 4 5 6 7 8 9 10 11 12
1	General Requirement and Temporary Works		L.S.	1				
3	Dredging Works		m3	3,300,000				
4	Excavation Works		m3	132,000				
5	Reclamation Works		m3	2,720,000				
6	Berth Structures	RORO Terminal	m	600				
7	Revetment Works	Outer Revetment	m	1,940				
		Road Inside Port Area	m	380				
10	Pavement and Drainage Works		m2	280,000				
11	Access Road	Access Road	m	2,666				
		Temporary Port Road	m	3,761				
12	Basin Drainage		m	3,501				
14	Building and Utilities		L.S.	1				
15	Security Equipment		L.S.	1				
16	Cargo Handling Equipment		L.S.	1				

Source: JPT

4.5 Examination of Implementation Plan

4.5.1 Estimated Project Cost

The estimated result of project cost for the Short-term Development Plan is summarized in Table 4.16.

Table 4.16 Estimation Result of Project Costs (Short-term Development Plan)

Item	LC ('000 EUR)	FC ('000 EUR)	Total ('000 EUR)	Remark
i Construction Cost	411,880	153,013	564,893	
ii Price Escalation	82,376	30,603	112,979	20%*(i) Construction Cost
iii Physical Contingency	41,188	15,301	56,489	10%*(i) Construction Cost
iv Consulting Services	41,188	15,301	56,489	10%*(i) Construction Cost
vi Others such as TAX, etc.	82,376	30,603	112,979	20%*(i) Construction Cost
Project Cost	**659,008**	**244,821**	**903,829**	

Source : JPT

4.5.2 Project Implementation Schedule

The expected project implementation schedule for the Short-term Development Plan is shown in Table 4.17. It generally takes four (4) to five (5) years until the commencement of construction works to complete the feasibility study, loan procedures, detailed design, etc. in case of the JICA ODA Loan. It is noted that even if the feasibility study were to start in early 2025, the schedule for completing the construction in 2030 is unrealistic.

- Feasibility Study (F/S) by JICA: approximately 1 year
- Loan Procedures such as Appraisal, Pledge, L/A, etc.: approximately 6 months – 1 year
- Procurement of the Consultant: approximately 6 months – 1 year
- Detailed Design (D/D): approximately 1 year
- Tender Assistance (T/A): approximately 1 year

The following measures could be considered as an option for early completion of the Project, however, JPT assumes that it will be difficult to complete the Project by 2023.

- Divide the project component into phases and implement only the high-priority facilities in advance (shorten construction period)
- Adopt the construction methods that enable rapid construction, although construction costs will be higher (shorten construction period)
- Adopt the design-build method (shorten design and construction period)
- Utilize the private funds (shorten the overall project period including contract procedures and bid evaluation)

Table 4.17 Preliminary Construction Period (Short-term Development Plan)

Work Items	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
	1	2	3	4	5	6	7	8	9	10
Feasibility Study										
Appreisal										
Pledge										
Signing of Loan Agreement										
Procurement of Consultant										
Detailed Design										
Procurment of Contractor										
Construction										

Source : JPT

4.6 Economic and Financial Analysis and Evaluation

The objectives and overview are the same as those in chapter3 Economic and Financial Analysis. However, since this section focuses on short-term development plans, there are some differences, such as the project period.

4.6.1 Assumptions for economic analysis

(1) Project duration and exchange rate

- Construction will start in 2024 (year 1).
- Partial operation of general cargo and provision of the RORO terminal will begin in 2031 (year 7).
- From then on, benefits will be measured until 2080 (year 57) (the total number of years including the construction period until 2030 and the 50-year useful life of the port facilities after operation begins), but demand forecast data for 2047 will be used, and no additional demand will be assumed.
- For the general cargo terminal, a RORO terminal will be used provisionally only from 2031 to 2035. Currently, Dakar Terminals handles RORO cargo at Dakar Port. This cargo includes finished vehicles and containers, and since Dakar Terminals has the intention to handle containers as well when it relocates to Ndayane Port, it is assumed that containers will also be handled at the RORO terminal at Ndayane Port. Therefore, from 2031 to 2035, three cargoes will be handled: general cargo, RORO, and containers, and from 2036 onwards, only two cargoes, RORO and containers, will be generated and added to the benefits.
- The exchange rate used was the exchange rate at the end of last month (Mitsubishi UFJ Bank's TTS at the end of February 2025).

- USD: 150.67 JPY

- EUR: 157.10 JPY

(2) Preconditions that are the same as M/P

- Useful life of fixed assets
- Setting with project/without project
- Upper limit of cargo volume handled at Dakar Port without project (actual value in 2022)
- Setting route, ship type, hinterland, etc.
- Discount rate (9%)
- Standard conversion factor (0.96)
- Savings value after project development will be set at 0.

(3) with project/without project

Although there is no difference from the M/P, the description is limited to the target facilities in the short-term development plan.

without project

- The Port of Dakar will continue to be used, but Abidjan port is assumed as an alternative port to meet the increase in demand.

with project

- The RORO terminal will be relocated from the Port of Dakar in 2031.
- As mentioned above, the RORO terminal will handle three types of cargo: general cargo, RORO, and containers from 2031 to 2035, and will handle two types of cargo: RORO and containers from 2036 onwards.

4.6.2 Economic analysis

(1) Calculation of benefits

Benefits will be realized after the construction period, when delivery begins in 2031. The same basic units and ship size will be used to calculate benefits.

Table 4.18 Basic units used in calculating marine transport costs

Cargo		Ship Type	Unit（Euro/Box・day）
Container	20ft	1,000TEU	32.85
		4,000TEU	22.53
		6,400TEU	21.04
	40ft	1,000TEU	49.27
		4,000TEU	33.80
		6,400TEU	31.55
Cargo		Ship Type	Unit（Euro/Box・day）
Vehicle		12,000DWT	460.55
		30,000DWT	707.13
Bulk/General		10,000DWT	460.55
		15,000DWT	544.01

Source: Guideline for Evaluation of Port Investment, 2017, Waterfront Vitalization and Environment Research Foundation

Table 4.19 Basic units used to calculate land transport costs

Cargo		Euro	Unit
Container	20ft	1.42	Euro/box・km
	40ft	2.11	
Vehicle	Trailer	4.65	Euro/Day
Bulk/General	Truck	1.63	Euro/Day

Source: JPT based on USAID data

Other settings such as cargo volume and hinterland are also similar.

(2) Calculation of costs

The figures converted to economic prices are shown below. The costs are the total M/P figures presented in Chapter 3 excluding DPW, and there are some changes.

a) Project Cost

Project costs will also be converted to economic prices and displayed as before.

Table 4.20 Project cost at economic prices ('000Euro)

year	2024	2025	2026	2027	2028	2029	2030
Construction	9,736	4,868	116,826	116,826	116,826	116,826	4,868
Physical Contingency	974	487	11,683	11,683	11,683	11,683	487
Consulting Service Fee	974	487	11,683	11,683	11,683	11,683	487
Total	11,683	5,841	140,191	140,191	140,191	140,191	5,841
Local Currency	7,840	3,920	94,085	94,085	94,085	94,085	3,920
Foreign Currency	3,842	1,921	46,107	46,107	46,107	46,107	1,921

Source: JPT

b) Operation and maintenance costs

Operation and maintenance costs are also set in the same manner as in the M/P.

Table 4.21 Operation and maintenance costs

Expense	Explanation
Personnel	Revenue×20%
Administration	Revenue×7%
Operation	Revenue×5%
Maintenance& Repair	Sum of below Infrastructure×1% Handling Equip.×3%
Renewal Cost	Categorized by Useful time 20years 10years 5years
Dredging	Based on required quantity

Source：JPT

(3) Economic evaluation

a) Economic evaluation results

The results of the economic analysis of the short-term development plan are shown in the table below. The discount rate in the short-term development plan is 9%.

Note that it may take a certain amount of time to transition to the new operating system after the ports opening. Therefore, in order to prevent overestimation, it is assumed that it will take three years for a complete transition, and the annual benefit amounts for the first and second years of benefit generation have been adjusted (first year: 1/3, second year: 2/3). On parallel, personal expense, administration expense and operation expense in operation and maintenance cost has been adjusted like benefit.

Table 4.22 Economic analysis results

EIRR	B/C	NPV('000EURO)
20.60%	2.22	859,590

Source: JPT

b) Sensitivity analysis

To confirm the feasibility of the project when the conditions of benefits and costs are changed, sensitivity analysis was carried out for the following cases. The results are shown in the table below.

- Case 1) When costs (construction costs) increase by 10%
- Case 2) When benefits decrease by 10%
- Case 3) When the above two occur simultaneously

Table 4.23 Sensitivity analysis results

Base	Case1	Case2	Case3
20.60%	19.08%	18.92%	17.44%

Source：JPT

c) Conclusion (Economic Analysis)

The EIRR exceeds the discount rate of 9%. The B/C ratio also exceeds 1.0. NPV is a positive value. In addition, in the three cases of sensitivity analysis, all economic analysis indicators exceed the standard values. From the above analysis results, it can be said that the project should be effective for Senegal economics if a certain degree of change in circumstances occurs.

Table 4.24 EIRR calculation sheet

'000Euro

年	建設費	運営・維持管理費						費用計	便益			便益計	便益 - 費用
	Phase1 短期	人件費	事務費	運営費	修繕費	更新費	浚渫費用		コンテナ	RORO	一般		
2024	11,683							11,683					-11,683
2025	5,841							5,841					-5,841
2026	140,191							140,191					-140,191
2027	140,191							140,191					-140,191
2028	140,191							140,191					-140,191
2029	140,191							140,191					-140,191
2030	5,841							5,841					-5,841
2031		9,934	3,477	2,484	3,737		321	19,953	3,987	56,514	42,246	102,748	82,795
2032		20,687	7,241	5,172	3,737		321	37,158	8,214	117,185	88,972	214,371	177,214
2033		32,261	11,291	8,065	3,737		321	55,676	12,691	182,013	140,178	334,881	279,206
2034		33,493	11,723	8,373	3,737		321	57,647	13,072	188,248	146,897	348,217	290,570
2035		34,729	12,155	8,682	3,737	5,514	321	65,138	13,464	194,493	153,616	361,573	296,436
2036		24,491	8,572	6,123	3,737		321	43,243	13,868	200,738		214,606	171,363
2037		25,250	8,837	6,312	3,737		321	44,458	14,284	206,983		221,267	176,809
2038		26,011	9,104	6,503	3,737		321	45,676	14,712	213,228		227,940	182,264
2039		26,775	9,371	6,694	3,737		321	46,898	15,154	219,473		234,626	187,729
2040		27,541	9,639	6,885	3,737	5,514	321	53,638	15,608	225,718		241,326	187,688
2041		28,344	9,921	7,086	3,737		321	49,409	16,076	232,276		248,352	198,944
2042		29,150	10,203	7,288	3,737		321	50,698	16,559	238,834		255,393	204,695
2043		29,958	10,485	7,490	3,737		321	51,991	17,055	245,392		262,448	210,456
2044		30,770	10,769	7,692	3,737		321	53,289	17,567	251,950		269,517	216,228
2045		31,584	11,054	7,896	3,737	5,514	321	60,106	18,094	258,509		276,603	216,497
2046		32,401	11,340	8,100	3,737		321	55,899	18,637	265,067		283,704	227,804
2047		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2048		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2049		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2050		33,221	11,627	8,305	3,737	38,515	321	95,727	19,196	271,625		290,821	195,094
2051		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2052		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2053		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2054		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2055		33,221	11,627	8,305	3,737	5,514	321	62,726	19,196	271,625		290,821	228,095
2056		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2057		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2058		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2059		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2060		33,221	11,627	8,305	3,737	5,514	321	62,726	19,196	271,625		290,821	228,095
2061		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2062		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2063		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2064		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2065		33,221	11,627	8,305	3,737	5,514	321	62,726	19,196	271,625		290,821	228,095
2066		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2067		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2068		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2069		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2070		33,221	11,627	8,305	3,737	38,515	321	95,727	19,196	271,625		290,821	195,094
2071		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2072		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2073		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2074		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2075		33,221	11,627	8,305	3,737	5,514	321	62,726	19,196	271,625		290,821	228,095
2076		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2077		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2078		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2079		33,221	11,627	8,305	3,737		321	57,212	19,196	271,625		290,821	233,609
2080		33,221	11,627	8,305	3,737	5,514	321	62,726	19,196	271,625		290,821	228,095
												EIRR	**20.60%**

Source : JPT

4.6.3 Financial Analysis

(1) Assumptions for financial analysis

Like economic analysis, the financial analysis is not significantly different from Chapter3 Economic and Financial Analysis. However, since the analysis targets short-term development plans, there is difference in the project duration.

- Project Duration
- Base year (no difference): 2024
- Project period: The calculation period is 57 years from 2024 to 2080. (The total number of years is the construction period until 2030 and the useful life of the port facilities after the start of service, which is 50 years.)

(2) Calculation of Revenue

The condition of the short-term development plan is below.

- RORO terminal: To be relocated from the Port of Dakar in 2030. The specific expected cargo handling volumes are as shown in "Table 4.2 List of Target Facilities".
- As mentioned above, the RORO terminal handles three cargoes (general cargo, RORO, and containers) in the period from 2031 to 2035, and two cargoes (RORO and containers) after 2036.

Here JPT shows concrete process of calculation for revenue below. Revenue which comes from Handling fee etc., are calculated by DPW tariff (2019) for the container terminal. Revenue in other terminals is calculated as below based on the hypothesis that other terminal operators also operate like DPW and pay Royalties to PAD at the same ratio.

- Based on Financial Statements of PAD, at first, JPT distributes PAD royalty to each terminal and develop each royalty unit per 1 cargo (1TEU, 1 Car, 1ton), shown as(A) at the table below.
- Based on DPW tariff, JPT assumes revenue of DPW and revenue unit per 1 TEU, shown as (B) at the table below.
- JPT develops the ratio, 14.32% by dividing (A)royalty unit by (B)revenue unit. This ratio would be the same for other terminals as DPW, container terminal. Then, JPT divided (A)royalty unit again by the ratio, 14.32%. This figure should be (B)revenue unit for other terminals, RORO terminal and Bulk/General cargo terminal.

Table 4.25 List of unit prices developed in the calculation process

Terminal	(A)Royality	(B)Revenue	(A)/ (B)
Container Terminal	**€ 68.29** / TEU	**€ 476.97** / TEU	**14.32%**
RORO Terminal	**€ 62.99** / Car	**€ 439.94** / Car	**Same as 14.32%**
Bulk/General Terminal	**€ 2.85** / ton	**€ 19.88** / ton	

Source: JPT

In accounting for the amount of cargo handling charges and other revenues, the ship type was assumed to be the same as the assumption used in the economic analysis.

(3) Calculation of costs

a) Project Cost

The costs in the financial analysis are estimated based on market prices. The project costs (short-term development plan) used in the financial analysis are shown in the table below.

Table 4.26 Project costs at market prices ('000Euro)

year	2024	2025	2026	2027	2028	2029	2030
Construction	11,298	5,649	135,574	135,574	135,574	135,574	5,649
Physical Contingency	1,130	565	13,557	13,557	13,557	13,557	565
Consulting Service Fee	1,130	565	13,557	13,557	13,557	13,557	565
Total	**13,557**	**6,779**	**162,689**	**162,689**	**162,689**	**162,689**	**6,779**

Source : JPT

b) Operation and maintenance costs

Operation and maintenance costs are calculated using the same principles as in the economic analysis. We added interest payments based on the payment term.

(4) Financial Evaluation

a) Financial evaluation results

The results of the financial analysis of the short-term development plan are shown in the table below. The discount rate is 2.15% same as M/P. As with the economic analysis, since it may take a certain amount of time to transition to a new operating system at each construction stage, in order to prevent overestimation, we have assumed that it will take three years to fully transition and adjusted the annual revenue amounts from the first year of revenue generation to the third year after the terminal construction (first year: 1/3, second year: 2/3).

Table 4.27 Financial Analysis Results

FIRR	NPV('000EURO)
8.77%	1,841,867

Source：JPT

b) Sensitivity analysis

In order to confirm the feasibility of the project when revenue and cost conditions change, a sensitivity analysis was conducted for the following cases. The results are shown in the table below.

- Case 1) When costs (construction costs) rise by 10%
- Case 2) When revenues fall by 10%
- Case 3) When the above two occur simultaneously

Table 4.28 Sensitivity analysis results

Base	Case1	Case2	Case3
8.77%	7.68%	7.97%	6.93%

Source：JPT

c) Conclusion (Financial Analysis)

The FIRR exceeds the hurdle rate of 2.15%. The NPV is also positive. All financial analysis indicators exceed the benchmark figures in the three cases of sensitivity analysis. From the above analysis results, it can be said that there will be no issues with the profitability of the project even if certain changes in circumstances occur.

Table 4.29 FIRR calculation sheet

'000Euro

年	建設費	運営・維持管理費						営業外	費用計	収益			収益計	収益－費用
	Phase1 短期	人件費	事務費	運営費	修繕費	更新費	浚渫費用	利息		コンテナ	RORO	一般		
2024	13,557							12,428	25,985					-25,985
2025	6,779							12,428	19,206					-19,206
2026	162,689							12,428	175,117					-175,117
2027	162,689							12,428	175,117					-175,117
2028	162,689							12,428	175,117					-175,117
2029	162,689							12,428	175,117					-175,117
2030	6,779							12,428	19,206					-19,206
2031		10,332	3,616	2,583	4,326		360	12,428	33,645	3,930	32,006	15,723	51,659	18,015
2032		21,515	7,530	5,379	4,326		360	12,075	51,186	8,096	66,367	33,113	107,576	56,390
2033		33,552	11,743	8,388	4,326		360	11,714	70,083	12,509	103,081	52,171	167,761	97,678
2034		34,834	12,192	8,708	4,326		360	11,342	71,762	12,884	106,613	54,671	174,168	102,407
2035		36,118	12,641	9,030	4,326	6,290	360	10,960	79,725	13,271	110,150	57,172	180,592	100,867
2036		25,471	8,915	6,368	4,326		360	10,567	56,007	13,669	113,686		127,355	71,348
2037		26,260	9,191	6,565	4,326		360	10,164	56,866	14,079	117,223		131,302	74,436
2038		27,052	9,468	6,763	4,326		360	9,749	57,719	14,501	120,760		135,261	77,542
2039		27,847	9,746	6,962	4,326		360	9,323	58,564	14,936	124,297		139,233	80,669
2040		28,644	10,025	7,161	4,326	6,290	360	8,886	65,692	15,384	127,833		143,218	77,526
2041		29,479	10,318	7,370	4,326		360	8,436	60,288	15,846	131,548		147,393	87,105
2042		30,317	10,611	7,579	4,326		360	7,974	61,167	16,321	135,262		151,583	90,416
2043		31,157	10,905	7,789	4,326		360	7,500	62,037	16,811	138,976		155,787	93,749
2044		32,001	11,200	8,000	4,326		360	7,012	62,900	17,315	142,690		160,005	97,106
2045		32,848	11,497	8,212	4,326	6,290	360	6,511	70,043	17,835	146,404		164,239	94,196
2046		33,698	11,794	8,424	4,326		360	5,996	64,598	18,370	150,118		168,488	103,890
2047		34,551	12,093	8,638	4,326		360	5,467	65,434	18,921	153,832		172,753	107,319
2048		34,551	12,093	8,638	4,326		360	4,923	64,890	18,921	153,832		172,753	107,863
2049		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2050		34,551	12,093	8,638	4,326	43,935	360		103,902	18,921	153,832		172,753	68,851
2051		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2052		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2053		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2054		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2055		34,551	12,093	8,638	4,326	6,290	360		66,257	18,921	153,832		172,753	106,496
2056		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2057		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2058		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2059		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2060		34,551	12,093	8,638	4,326	6,290	360		66,257	18,921	153,832		172,753	106,496
2061		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2062		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2063		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2064		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2065		34,551	12,093	8,638	4,326	6,290	360		66,257	18,921	153,832		172,753	106,496
2066		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2067		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2068		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2069		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2070		34,551	12,093	8,638	4,326	43,935	360		103,902	18,921	153,832		172,753	68,851
2071		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2072		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2073		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2074		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2075		34,551	12,093	8,638	4,326	6,290	360		66,257	18,921	153,832		172,753	106,496
2076		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2077		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2078		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2079		34,551	12,093	8,638	4,326		360		59,967	18,921	153,832		172,753	112,786
2080		34,551	12,093	8,638	4,326	6,290	360		66,257	18,921	153,832		172,753	106,496
													FIRR	**8.77%**

Source : JPT

4.7 Environmental and Social Impact Consideration

A preliminary environmental impact assessment was carried out for the short-term maintenance plan proposed in this chapter. When the project is implemented, consultation with the Ministry of the Environment and Ecological Transition (French name: Ministère de l'Environnement et de la Transition écologique: METE) will be required, and the EIA procedures required under Senegalese law must be carried out.

4.7.1 Target Project Outline

The projects to be covered in this environmental and social analysis study are as follows.

- RORO terminal
- Access roads and main roads in PIZ 1,200 ha
- Drainage channels in PIZ 1,200 ha

4.7.2 Current Status of Environmental and Social Situation in the Project Site

The current state of the environment and society is shown in "2.6.3 Current State of Environmental and Social Considerations". The Pre-FS Project area is included in the scope of SEA.

4.7.3 Environmental and Social Consideration Systems and Organizations in the Country

The environmental and social consideration systems and organizations in the country are shown in "3.3.3 Gap Analysis between Domestic Regulations and JICA Guidelines".

4.7.4 Scoping

Based on existing related documents, JICA Team examined the environmental impacts that could be expected to occur as a result of the project. The proposed scoping, including the reasons for the assessment, is summarized in the table below.

Table 4.30 Scoping Result

	Impact Factor	Result of Scoping		The basin of Scoping Result
		BC/ DC	OP	
Pollution Control				
1	Air Quality	✓	✓	**DC:** The project is expected to involve construction works on land and at sea, and the effects of exhaust gas and dust from construction machinery and material transport vehicles are expected.
				OP： With the construction of a new RORO terminal, container ships/cargo ships will be calling at the port, and it is expected that the exhaust gases from these increased numbers of ships will cause air pollution. The opening of new access roads and main roads will greatly increase the volume of traffic by port-related vehicles, so the impact on air quality is expected to be significant.
2	Water Quality	✓	✓	**DC:** The construction of the RORO terminal is a new land reclamation project, and unless appropriate water pollution prevention measures are taken, it is expected to have a significant impact on the quality of the sea water quality. In addition, some dredging and the disposal of dredged soil and sand in the ocean will be necessary, and this may affect the quality of the seawater. Measures are needed to reduce pollution, such as securing appropriate sites for ocean disposal.

	Impact Factor	Result of Scoping		The basin of Scoping Result
		BC/ DC	OP	
				OP: As the number of container/cargo vessels increases with the operation of RORO terminals, there is concern about the impact on water quality in the surrounding sea area due to wastewater from container/cargo vessels and spills of waste oil from maintenance.
3	Soil contamination	✓	✓	**DC/OP:** The access/main roads and drainage channels will be implemented on land side, and soil contamination is a concern during and after the construction period. On the other hand, the RORO and oil terminals will be constructed offshore and is expected to have little impact on soil contamination.
4	Noise/Vibration	✓	✓	**DC:** Noise during construction is expected to be generated from piling operations at sea and onshore and from other construction works. However, for construction work to be carried out at sea, the distance from settlements adjacent to the port area is such that the impact on surrounding settlements etc. is expected to be limited. Transport of machinery and materials is likely to be carried out by sea transport, while land transport of construction vehicles and machinery may have impacts in terms of traffic, noise and vibration.
				OP: Noise is expected to be generated by the operation of the facilities, but the impact is expected to be limited as the majority of the facilities are offshore and sufficiently distant from settlements and houses.
5	Subsidence	✓	✓	**DC/OP:** In this project, the water source is currently under consideration, but if groundwater is used due to the lack of a large water source, the impact on land subsidence is expected.
6	Odor		✓	**DC:** No activities that cause odors are scheduled for this project. **OP:** No odors are expected to be generated from the proposed facility.
7	Sediment	✓	✓	**DC:** There is a possibility that this project will have an impact on the seabed sediment. As some of the dredged sediment will be disposed of at an external site for disposal of seabed sediment, it is necessary to consider an appropriate disposal method. **OP:** Disturbance of the bottom sediment due to regular dredging is expected.
8	Waste/Hazardous Substances	✓	✓	**DC:** The amount of waste from the labor camp and solid waste generated by construction work is increasing. As the waste will be transported off-site for disposal, it is necessary to check whether it can be disposed of appropriately.
				OP: At the RORO terminal, it is expected that the number of container ships will increase after the port begins operating. The impact of clay layer dredging, excavation, and maintenance dredging will also be examined.
Natural Environment				
9	Topography and Geology	✓		**DC:** As this project involves land reclamation at sea, it will change the topography of the seabed. It will also change the topography of the land area.
				OP: After construction is complete, there are no expected impacts due to the terrain being stable.
10	Hydrography	✓	✓	**DC:** As this project involves new land reclamation in the sea, there are concerns about the direct impact on the hydrology and hydrography of the sea area.
				OP: This project involves the construction of offshore structures, which will permanently change the currents. In addition, maintenance dredging is also expected, which will have a significant impact on the sea area.
11	Groundwater	✓	✓	**DC/OP**: In this project, the water source is currently under consideration, but if groundwater is used due to the lack of a large water source, there may be an impact.

	Impact Factor	Result of Scoping		The basin of Scoping Result
		BC/ DC	OP	
12	Ecosystems/flora and fauna /biodiversity	✓	✓	**DC:** A large area along the coast, including part of the project area, has been designated as an IBA as "La Petite Côte". This project is part of a large-scale port development project, and it is predicted that there will be a significant impact on the surrounding area. **OP :** This project involves the construction of offshore structures such as RORO terminals, and because it will permanently change the tides, there are concerns that it will have a significant impact on the marine ecosystem.
13	Protected area	✓	✓	**DC:** This project is outside the protected area, and no direct changes to the protected area are expected, but the Réserve naturelle de Popenguine is located about 5km south of the project area. **OP :** Concerned about the indirect impact on 'the Réserve naturelle de Popenguine' due to an increase in the number of vessels and vehicles calling at this port.
14	Coastal zone	✓	✓	**DC:** As the construction area of the project covers the entire coastal zone, there is concern about the impact of the project due to the large scale of the works. Negative impacts due to navigation channel dredging are also expected.
				OP: As the project area includes part of the coastal zone, there are concerns about the quality and quantity of effluent water from the terminals and PIZ area, the quality of water in the ocean downstream of the treated water discharge point, and the impact of maintenance dredging.
Social Environment				
15	Land acquisition/Resettlement	✓		**BC:** The project is expected to result in resettlement/land acquisition on land area. On the other hand, the access roads, main roads and drainage channels which targeted by the project are in the PIZ area, and it is not envisaged that resettlement and land acquisition will be carried out independently under the project.
				OP: No impact is expected from this project.
16	Poor	✓	✓	**DC:** Local fishermen live in the surrounding area, and there are concerns about the impact on the poor by the construction work. There is a possibility that the poor people living nearby will get employment opportunities in the construction and related projects.
				OP: There are concerns about the impact of the terminal's operation on the fishing industry in the surrounding waters due to the ships calling at the port and the impact on water quality. If the opening of the RORO terminal facility guarantees employment opportunities for the poor, positive impacts can be expected.
17	Ethnic minorities/Indigenous peoples	✓	✓	**DC/OP:** The area where the project is being implemented is already developed, and there are no official minority ethnic groups living area in this area, but there is a possibility that a small number of minority ethnic groups live in the project site.
18	Local economy, including employment and means of livelihood	✓	✓	**DC:** It is expected that the negative impact on the village, which relies on fishing and tourism as its main source of income, will come from the construction phase. In the other hand, the positive impact on the local economy will come from the increase in employment opportunities of construction workers related to the terminal facilities.
				OP: In the long term, the project is expected to increase commercial/employment opportunities due to the growth of the local economy in the project area. On the other hand, there is a risk of negative impacts after the end of construction works due to permanent impacts on the fishing, fish processing and tourism industries and the termination of temporary employment opportunities for local workers.
19	Land use and utilization of regional resources	✓	✓	**DC:** The project involves large-scale land alteration and land use impacts are expected to be significant. It is envisaged that there may be a need for land use for construction yards and worker accommodation setup, but these impacts will only be temporary.
				OP: The project is expected to have a significant impact as it will significantly change land use patterns in both terrestrial and coastal areas.

	Impact Factor	Result of Scoping		The basin of Scoping Result
		BC/ DC	OP	
20	Water Use	✓		**DC:** The use of water sources due to construction activities and obstruction of access to water sources due to construction are assumed, but the area is well served by water supply and the impact on water use is expected to be small.
				OP: Potential impact of water abstraction by the project.
21	Existing Social Infrastructure and Social Services	✓	✓	**DC:** As many areas are in close proximity to residential areas, social infrastructure and services may be temporarily affected by temporary construction yards and workers' quarters, traffic congestion due to the increase in construction vehicles, etc., and one-lane traffic and lane restrictions due to pipe laying under roads.
				OP: The impact on safe access to the open sea for boats of nearby fishermen due to vessel operation routes, etc. that will occur after the port facilities are operational needs to be considered. Social infrastructure services such as water, sewerage and electricity as facilities associated with the project are expected to be provided to the surrounding settlements when they are introduced to the project.
22	Social organizations and decision-making bodies at the local level.	✓	✓	**DC:** The influx of construction workers and people from outside the area is expected to have an impact on social organizations and decision-making bodies at the local level. The impact of construction works is expected to be temporary.
				OP: The influx of new port facility workers, new shipping-related residents, etc. is expected to have an impact on social relations capital and social organizations and decision-making bodies at the local level.
23	Disparities in losses and benefits	✓	✓	**DC:** The project will involve resettlement and land acquisition. Indirect and direct impacts on the surrounding population will occur.
				OP: There is concern about the uneven distribution of harm and benefits, including fishermen and tourism agency negatively affected by port facilities, as well as port facility workers and commercial beneficiaries.
24	Conflicts of interest within the region	✓	✓	**DC:** As the project will involve resettlement and land acquisition, there are concerns about conflicts of interest between target and non-target parties.
				OP : There are concerns about accidents and conflicts between new port facility users (container vessels) and fishermen passing through existing port facilities.
25	Religious facilities	✓	✓	**BC/DC/OP:** Land acquisition and other factors may have an impact, such as the relocation of religious facilities.
26	Cultural Heritage	✓	✓	**BC/DC/OP:** No Senegalese national cultural heritage sites, such as international cultural heritage sites (tangible and intangible) such as World Heritage Sites, are located on the project site or in the vicinity of the project site within the planned area. On the other hand, land acquisition and other factors may have an impact on the relocation of religious facilities.
27	Land scape	✓	✓	**DC/OP:** The neighborhood of the existing facility is essentially agricultural land or residential area. The coastal area, which is part of the altered area, is used as a scenic area by the tourism industry, and there is concern about the impact of a significant alteration of the landscape.
28	Gender	✓	✓	**DC:** Although the project is not anticipated to have an impact, it is desirable to implement measures to ensure equal employment opportunities for men and women in relation to construction work, for example.
				OP: Care should be taken to ensure that gender equality is maintained, for example in working conditions at new port facilities.
29	Children 's right	✓	✓	**DC:** If child labor is customary in the target area, exploitation and disruption of schooling opportunities due to labour in construction may occur, which should be confirmed during the field survey. In addition, there is a possibility of obstruction of school routes due to the passage of construction vehicles.
				OP : As the new port facilities will also only provide employment to adults, no negative impact is expected from the project. On the other hand, the installation of new schools, educational facilities and infrastructure in the surrounding area in parallel with the establishment of new port facilities is likely to improve the educational environment in the area.

	Impact Factor	Result of Scoping		The basin of Scoping Result
		BC/ DC	OP	
30	Occupational safety and health	✓	✓	**DC:** The influx of construction workers to new port facilities and PIZ areas increases the risk of Occupational safety and health to a certain degree. Furthermore, the risk of STDs/STIs and HIV/AIDS among construction workers and the local population is likely to increase.
				OP: The expected migration of many workers from other regions to meet the labor needs of the new RORO terminal could lead to disease outbreaks on site.
31	HIV/AIDS infection	✓	✓	**DC:** Consideration should be given to the occupational health and safety of construction workers.
				OP: Continued attention needs to be given to the occupational health and safety of workers involved in the operation, maintenance and upkeep of new port facilities RORO terminals.
Other				
32	Accident	✓	✓	**DC:** An increased risk of accidents arising from the operation of construction equipment and the driving of construction vehicles at sea and on land is expected.
				OP: Accidents related to the operation of new port facilities and the increased volume of container vessels and container trucks transporting cargo will increase the likelihood of accidents. There is particular concern about the occurrence of collisions between boats of fishermen in the vicinity and cargo/container vessels.
33	Climate change	✓	✓	**DC:** Greenhouse gases (GHGs) will be emitted from the operation of construction equipment and the driving of construction vehicles. The project may involve the mass clearing of some coastal forests and other areas, and there are concerns about the impact of the project.
				OP: The increased volume of container vessels and container trucks for freight transport needs to be assessed for its impact on climate change.

*Impact items for this scoping proposal were selected with reference to the JICA Guidelines for Environmental and Social Considerations and other guidelines.

BC: Before Construction Phase, DC: During Construction Phase, OP: Operation Phase

Source: JPT

4.7.5 Results of Environmental and Social Considerations Survey

The results of the field surveys carried out in the SEAs, including the Project area, are detailed in Section 3.4.5 Result of Environmental and Social Consideration Study.

4.7.6 Environmental Impact Assessment

A preliminary environmental impact assessment of the impacts of the project, including mitigation measures, was carried out as shown in the table below. This analysis is based on the Pre-FS level plan and an environmental impact assessment will need to be carried out after more detailed plans have been implemented.

Table 4.31 Preliminary Environmental Impact Assessment Result

No.	Impact Factor	Evaluation of Scoping		Evaluation of Impact Assessment		Reason for Evaluation
		BC/DC	OP	BC/DC	OP	
Pollution Control						
1	Air Quality	✓	✓	B-	B-	**DC**：There is a possibility of the effects of exhaust gas from construction machinery and material transport vehicles, and dust from the movement of construction vehicles, but these effects will be minimized by mitigation measures such as sprinkling water and consideration of construction routes. **OP:** With the construction of a new RORO terminal, container ships/cargo ships will be calling at the port, and it is expected that the resulting increase in exhaust gas will cause air pollution. With the construction of new access roads and main roads, the traffic volume of vehicles related to the port will increase significantly, so there is expected to be an impact on air quality. Environmental protection measures include the introduction of an onshore power supply system, the use of low-sulfur fuel, and the introduction of liquefied natural gas (LNG) fuel ships and low-carbon vehicles, but further study is needed on the details.
2	Water Quality	✓	✓	A-	A-	**DC** : The construction of the terminals is a new land reclamation project, and unless appropriate water pollution prevention measures are taken, it is predicted that there will be a significant impact on the quality of the seawater. In addition, some dredging and the disposal of dredged soil and sand in the ocean will be necessary, and this may affect the quality of the seawater. Appropriate measures are necessary to reduce pollution, and during construction, the construction company will be required to install silt fences and turbidity treatment equipment. **OP :** With the increase in container ships and cargo ships due to the operation of the RORO terminal, there are concerns about the impact on water quality in the surrounding waters due to the discharge of wastewater from container ships and cargo ships and waste oil from maintenance work. In addition, as they are large-scale facilities, consideration must be given to the water quality of the drainage channels.
3	Soil contamination	✓	✓	B-	B-	**DC/OP :** The access road, main road and drainage channel will be constructed on land, and there are concerns about soil contamination during the construction period and after the facilities are in use. On the other hand, the terminal will be constructed offshore, and there is little concern about soil contamination.
4	Noise/Vibration	✓		B-	B-	**DC:** The village is far enough away from the construction site (container terminal) to be considered not to be significantly affected. In addition, the transportation of construction materials is mainly by sea. Some materials and equipment are transported by land, but the impact is limited. **OP:** The terminals on the sea are sufficiently distant from the village and houses, so it is assessed that there will be no impact from noise or vibration caused by the operation of the facilities. It is expected that the number of container

No.	Impact Factor	Evaluation of Scoping		Evaluation of Impact Assessment		Reason for Evaluation
		BC/DC	OP	BC/DC	OP	
						trucks will increase after the facilities are put into service, and there will be an impact on traffic, noise, vibration, and congestion around the roads in the village.
5	Subsidence	✓	✓	B-	B-	**DC/OP:** The project is currently considering the water source. As there are no large water sources nearby, if groundwater is used, there is a possibility of ground subsidence.
6	Odor	✓	✓	B-	B-	**DC/OP:** No activities that cause bad odors are scheduled as part of this project.
7	Sediment	✓	✓	B-	B-	**BC/DC:** There is a possibility that this project will have an impact on the seabed sediment. If some of the dredged sediment is to be disposed of at an external site for disposal of seabed sediment, it will be necessary to consider an appropriate disposal method. **OP:** Disturbance of the bottom sediment due to regular dredging is expected.
8	Waste/Hazardous Substances	✓	✓	B-	B-	**DC:** Construction waste, including soil, scrap wood, oil, and other waste, is generated at construction sites and from workers' accommodation facilities, but the impact is assessed as limited due to the proper disposal of construction waste. **OP:** The waste from ships will be disposed of appropriately in accordance with international law, port regulations, and Senegalese law, so the impact will be minimal.
Natural Environment						
9	Topography and Geology	✓	✓	B-	B-	DC: As this project involves land reclamation at sea, it will change the topography of the seabed. It will also change the topography of the land area.
10	Hydrography		✓	A-	A-	**DC:** As this project involves new land reclamation in the sea, there are concerns about the direct impact on the hydrology and hydrography of the sea area. **OP:** This project involves the construction of offshore structures, which will permanently change the currents. In addition, maintenance dredging is also expected, which will have a significant impact on the sea area.
11	Groundwater	✓	✓	B-	B-	**DC/OP:** In this project, the water source is currently under consideration, but if groundwater is used due to the lack of
12	Ecosystems/flora and fauna/biodiversity	✓	✓	A-	A-	**DC:** A large area along the coast, including part of the project area, has been designated as an IBA as “La Petite Côte”. As this project is part of a large-scale port development project, and as it involves land reclamation and dredging of shipping channels, it is expected to cause significant changes in both the land and sea areas, and it is assessed that it will have a significant impact on the ecosystem. **OP:** This project is scheduled to construct offshore structures such as RORO terminals, and there is a high possibility that it will permanently change the tides. In addition, maintenance dredging is also expected, and there are concerns that it will have a significant impact on the marine ecosystem.
13	Protected area	✓	✓	B-	B-	**DC:** A large area along the coast, including part of the project area, has been designated as an IBA as “La Petite

No.	Impact Factor	Evaluation of Scoping		Evaluation of Impact Assessment		Reason for Evaluation
		BC/DC	OP	BC/DC	OP	
						Côte". This project is part of a large-scale port development project, and it is predicted that there will be a significant impact on the surrounding area. **OP:** This project involves the construction of offshore structures such as RORO terminals, and because it will permanently change the tides, there are concerns that it will have a significant impact on the marine ecosystem.
14	Coastal zone	✓	✓	A-	A-	**DC:** The scope of this project covers the entire coastal area, and there are concerns about the impact of the large scale of the construction work. There are also concerns about the impact of dredging the shipping lanes. **OP:** As the project area includes part of the coastal area, there are concerns about the direct impact of physical changes to the coastal area, the quality and quantity of wastewater from the terminal and PIZ area, the quality of the water in the ocean downstream of the discharge point for treated wastewater, and the indirect impact of maintenance dredging.
Social Environment						
15	Land acquisition/Resettlement	✓		A-	N/A	**BC/DC:** The project is expected to result in resettlement/land acquisition on land area. On the other hand, the access roads, main roads and drainage channels which targeted by the project are in the PIZ area, and it is not envisaged that resettlement and land acquisition will be carried out independently under the project.
16	Poor	✓	✓	B-	B-	**DC:** It has been confirmed that many local fishermen with low incomes live in the surrounding area, and there are concerns that the poor will be affected if the noise from the construction work affects their fishing. On the other hand, there is a possibility that the poor people living nearby will be given employment opportunities through the construction work and related projects. **OP:** There are concerns about the impact of ships calling at the port and the impact on the fishing industry in the surrounding waters due to the impact on water quality caused by the operation of the port facilities at the terminal. If the opening of port facilities such as RORO terminals guarantees employment opportunities for the poor, positive impacts can be expected.
17	Ethnic minorities/Indigenous peoples	✓	✓	C	C	**DC/OP:** The area where the project is being implemented is already developed, and there are no official minority ethnic groups living area in this area, but it is possible that a small number of minority ethnic groups are living there. In light of the social situation, it is highly likely that these minorities in the site are living in the same way as the general population and do not fit the definition of a minority ethnic group. Although the impact on minority ethnic groups was not confirmed in this stakeholder consultation, it is necessary to conduct a more detailed survey through each EIA procedure, etc., in the future, and to understand the impact.
18	Local economy,	✓	✓	A-	A+/B-	**DC:** It is expected that there will be a negative impact on the villages that rely on fishing and tourism as their main

No.	Impact Factor	Evaluation of Scoping		Evaluation of Impact Assessment		Reason for Evaluation
		BC/DC	OP	BC/DC	OP	
	including employment and means of livelihood					source of income during the construction period. It is expected that there will be a positive impact on the local economy due to the increase in employment opportunities related to the terminal facilities created by the construction activities. **OP:** In the long term, there are expectations of an increase in commercial and employment opportunities in line with the growth of the local economy in the project implementation area. On the other hand, there is a risk of negative impacts after the construction work is completed due to permanent impacts on the fishing industry, seafood processing industry, tourism industry, etc., and the temporary employment opportunities for local workers coming to an end.
19	Land use and utilization of regional resources	✓	✓	A-	A-	**DC:** The project involves large-scale land alteration and land use impacts are expected to be significant. It is envisaged that there may be a need for land use for construction yards and worker accommodation setup, but these impacts will only be temporary. **OP:** The project is expected to have a significant impact as it will significantly change land use patterns in both terrestrial and coastal areas.
20	Water Use	✓	✓	B-	B-	**DC:** It is assumed that construction activities will use water sources and obstruct access to water sources, but the area has a certain level of water supply infrastructure, so the impact on water use is expected to be small. On the other hand, if groundwater use is necessary, sufficient consideration must be given to the water use of local residents. **OP:** There is a possibility that the project will affect water intake.
21	Existing Social Infrastructure and Social Services	✓	✓	A-	A-	**DC:** As there are many areas close to residential areas, there is a risk of temporary disruption to social infrastructure and services due to traffic congestion caused by the construction of temporary construction yards and accommodation for workers, as well as an increase in the number of construction vehicles, and the occurrence of one-way traffic and lane restrictions due to the laying of pipelines under roads. **OP:** The impact on the safe access to the open sea for the boats of local fishermen due to the operational routes of ships, etc. that occur after the port facilities come into operation needs to be considered. It is hoped that social infrastructure services such as water, sewage and electricity will be provided to the surrounding villages when they are introduced as facilities associated with the project.
22	Social organizations and decision-making bodies at the local level.	✓	✓	B-	B-	**DC:** The influx of construction workers and people from outside the area is expected to have an impact on social organizations and decision-making bodies at the local level. The impact of construction works is expected to be temporary. **OP:** The influx of new port facility workers, new shipping-related residents, etc. is expected to have an impact on social relations capital and social organizations and decision-

No.	Impact Factor	Evaluation of Scoping		Evaluation of Impact Assessment		Reason for Evaluation
		BC/DC	OP	BC/DC	OP	
						making bodies at the local level.
23	Disparities in losses and benefits	✓	✓	B-	B-	**DC:** The Project will involve the relocation of residents and land acquisition, leading to both direct and indirect impacts on the surrounding population. **OP:** There are concerns about the unequal distribution of negative impacts and benefits, such as the fishermen and tourism operators who may be adversely affected by the port facilities, and the workers and commercial entities who may benefit from them.
24	Conflicts of interest within the region	✓	✓	A-	A-	**DC/OP:** There is a possibility of a misallocation of profits and losses between port-related parties and fishermen during both the construction and operation stages. There is also concern about accidents and conflicts between new port facility users (container ships) and fishermen passing through existing port facilities. It is necessary to consider appropriate compensation and support to minimize damage to fishermen and avoid uneven distribution of profits.
25	Religious facilities	✓	✓	B-	C	**DC/OP:** In the land area of the project implementation zone, there is a possibility of impacts such as the relocation of religious facilities. However, this has not yet been identified, so it will be necessary to address this during more detailed examinations in the future.
26	Cultural Heritage	✓	✓	N/A	N/A	**DC/OP:** There are no international cultural heritage sites (tangible or intangible), such as World Heritage Sites, nor any nationally designated cultural properties of Senegal located within the project site or its surrounding area.
27	Land scape	✓	✓	A-	A-	**DC/OP:** The coastal area, which is part of the modification zone, is currently utilized as a scenic spot for tourism. With the construction of new port facilities, the landscape will be permanently and significantly altered, resulting in a completely different, artificial view compared to the current state. Therefore, the impact is considered substantial.
28	Gender	✓	✓	B-	B-	**BC/DC:** No significant impacts from this project are anticipated. However, it is desirable to implement measures to ensure equal employment opportunities for both men and women during the construction phase. **OP:** The Senegalese government has developed a national policy on gender equality (Stratégie Nationale pour l'Égalité et l'Équité de Genre, SNIG) aimed at achieving gender equality in all sectors. The labor conditions at the new port facilities will adhere to this policy.
29	Children 's right	✓	✓	B-	B-	**DC:** In Senegal, child labor is prohibited by law, and this project will comply with the relevant regulations. To prevent the occurrence of child labor during construction, measures will be taken to mitigate the impact by specifying the appropriate employment age in the specifications, and establishing notification obligations and penalties in case of violations. Additionally, the routes for construction vehicles, container trucks, and other equipment will be determined with consideration for the safety of multiple schools in the project area, minimizing the impact on children's education. **OP:** In SEA, alongside the construction of port facilities, the development of infrastructure and the construction of

No.	Impact Factor	Evaluation of Scoping		Evaluation of Impact Assessment		Reason for Evaluation
		BC/DC	OP	BC/DC	OP	
						educational facilities have been proposed. Similar measures are also desirable for this project.
30	HIV/AIDS infection	✓	✓	B-	B-	**DC:** There is a concern that the influx of construction workers may have an impact on public health, and there is also a concern that there may be an increase in the risk of sexually transmitted diseases (STDs/STIs), HIV/AIDS, and COVID-19 between workers and local residents. In order to avoid infringing on the rights of residents and workers, the environmental management officer of the project in question will minimize the impact by giving lectures to security guards on safety programs and measures against COVID-19. **OP:** Minimize the impact by complying with Senegalese laws and ordinances related to public health.
31	Occupational safety and health	✓	✓	B-	B-	**DC:** There is expected to be an increase in the risk of accidents occurring due to the operation of construction machinery and the movement of construction vehicles, but safety measures are scheduled to be implemented in accordance with labor laws, so the impact is assessed to be limited. In addition, construction workers will be required to wear helmets and safety belts, and safety equipment such as warning signs will be installed in construction areas. Contracts with waste disposal companies are required for hazardous waste. It is proposed that manuals and safety guidelines for the disposal of hazardous waste be prepared. **OP:** Work at port facilities is dangerous and requires sufficient environmental protection measures. Adhere to Senegalese laws and ordinances regarding working conditions at new port facilities to minimize the impact.
Other						
32	Accident	✓	✓	A-	A-	**DC:** There is concern about accidents occurring involving construction vehicles and boats, so sufficient consideration should be given to this. Necessary environmental conservation measures such as the selection of construction routes and speed limits should be taken. In addition, although the main method of transporting construction materials will be by sea, it is also expected that the number of vehicles involved in the construction work will increase, so emergency vehicle routes, etc. should be secured in case of accidents. **OP:** The possibility of maritime accidents increases as cargo ships make port calls. In particular, there is concern about collisions between fishing boats and container ships that use the surrounding waters, but measures to minimize the impact of such accidents include restrictions on the departure times of both types of vessels, alerts when container ships enter port, and the installation of signboards in port areas. There is also concern that the use of access roads and main roads will lead to an increase in accidents involving container vehicles and general vehicles.
33	Cross-border effects and		✓	B-	A-	**DC:** This project involves large-scale construction work, and the operation of construction machinery and the

No.	Impact Factor	Evaluation of Scoping		Evaluation of Impact Assessment		Reason for Evaluation
		BC/DC	OP	BC/DC	OP	
	climate change					movement of construction vehicles will result in large-scale emissions of greenhouse gases (GHGs). In addition, since this project involves the felling of a large area of coastal forest, there are concerns about the impact on the amount of carbon dioxide absorbed, etc. **OP:** The number of container ships and container trucks used for cargo transport is expected to increase, leading to a large increase in GHG emissions.

BC: Before Construction Phase, DC: During Construction Phase, OP: Operation Phase

Source: JPT

4.7.7 Mitigation Measures and Costs of Implementing Mitigation Measures

There is concern that the impact of the project on the surrounding environment could be significant, and various mitigation measures need to be properly planned and implemented to mitigate the impact. As detailed plans have not been defined at this stage, the table below shows the mitigation measures proposed from the impact items. In addition, mitigation measures for the social environment shall be considered in the preparation of the RAP.

Table 4.32 Proposed Mitigation Measures

Environmental Factor	Environmental Mitigation Measures	Responsible Unit (RU)/ Implementation Unit (IU)	Cost (USD)
1. Before Construction Phase			
Land acquisition/Resettlement	➢ Preparation of the RAP ➢ Implementation and Monitoring of Appropriate Resident Relocation and Land Acquisition	RU: PAS (Project owner)	Resettlement and Land Acquisition Costs
2.During Construction Phase			
Air Quality	➢ Requirement for Proper Management of Vehicles and Machinery, and Use of High-Quality Fuel ➢ Prevention of Overloaded Transport and Vehicle Congestion ➢ Thorough Covering of Materials During Transportation ➢ Regular Watering Along Roads ➢ Monitoring of Air Pollution from Dust and Complaints from Local Residents (If complaints arise, contractors are required to reconsider the applicable technical aspects and address those issues) ➢ Development and Strict Implementation of Traffic Management Plans During Construction	RU: PAS (Project owner) IU: Contractor	Included in the Construction Costs
Water Quality	➢ Requirement for Cleaning Machinery at Sedimentation Tank Facilities ➢ Proper Installation and Spill Prevention for Fuel Storage Locations ➢ Obligation for Contractors to Install Sanitary Toilets ➢ Introduction and Selection of High-Quality Dredging Equipment ➢ Installation of Silt Fences Around the Dredging and Landfill Construction Areas ➢ Reduction of Dredging Duration to Minimize Turbidity	Ditto	Ditto

Environmental Factor	Environmental Mitigation Measures	Responsible Unit (RU)/ Implementation Unit (IU)	Cost (USD)
Soil Contamination	➢ Requirement for Cleaning Machinery at Sedimentation Tank Facilities to Prevent Oil Pollution	Ditto	Ditto
Noise/Vibration	➢ Use of Low-Noise and Low-Vibration Vehicles and Construction Machinery, and Proper Management of Vehicles and Equipment ➢ Compliance with Construction Time Periods ➢ Prohibition of Nighttime Driving and Operations	Ditto	Ditto
Subsidence/Groundwater	➢ (In the case of groundwater use) Proper Monitoring of Water Use	Ditto	Ditto
Sediment	➢ Monitoring of Sediment in the Port and Navigation Routes ➢ If the concentration of harmful metals in sediments exceeds environmental standards, consult with METE on appropriate disposal methods	Ditto	Ditto
Waste/Hazardous Substances	➢ Development of Manuals and Safety Guidelines for the Handling of Hazardous Waste ➢ Implementation of Waste Disposal Prohibition Programs for Construction Workers ➢ Installation of Sanitary Toilets at Worker Camps ➢ Requirement to Contract Licensed Waste Disposal Operators ➢ Identification of Proper Waste Transport and Disposal Sites ➢ Regular Monitoring of Waste Transportation to Disposal Sites ➢ Disposal of Waste at Locations Designated by Local Environmental Agencies and Authorities	Ditto	Ditto
Ecosystems/flora and fauna/biodiversity, Coastal area	➢ Detailed Survey of Flora and Fauna in the Project Implementation Area and Consideration and Implementation of Conservation Measures for Protected Species ➢ Conducting Appropriate Dredging, Marine Dumping, and Regular Monitoring of Water Quality by Contractors. Strict enforcement of construction suspension in the event of abnormal conditions. ➢ Education for Construction Workers on the Prohibition of Marine Dumping of Waste	Ditto	Ditto
Poor	➢ Prior Consultation with All Stakeholders ➢ (Consider Compensation Policies, Livelihood Restoration, and Support Measures during the Preparation of the RAP)	Ditto	Ditto
Ethnic minorities/Indigenous peoples	➢ (Implementation of detailed survey for identification of ethnic minorities)	Ditto	Ditto
Local economy, including employment and means of livelihood	➢ Prior Consultation with All Stakeholders ➢ (Consider Compensation Policies, Livelihood Restoration, and Support Measures during the Preparation of the RAP)	Ditto	Ditto
Land use and utilization of regional resources	➢ Prior Consultation with All Stakeholders ➢ (Consider Compensation Policies, Livelihood Restoration, and Support Measures during the Preparation of the RAP)	Ditto	Ditto
Water Use	➢ Prior Consultation with All Stakeholders ➢ (Consider Compensation Policies, Livelihood Restoration, and Support Measures during the Preparation of the RAP)	Ditto	Ditto
Existing Social Infrastructure and Social Services	➢ Prior Consultation with All Stakeholders ➢ (Consider Compensation Policies, Livelihood Restoration, and Support Measures during the Preparation of the RAP)	Ditto	Ditto
Social organizations and	➢ Prior Consultation with All Stakeholders	Ditto	Ditto

Environmental Factor	Environmental Mitigation Measures	Responsible Unit (RU)/ Implementation Unit (IU)	Cost (USD)
decision-making bodies at the local level	➢ (Consider Compensation Policies, Livelihood Restoration, and Support Measures during the Preparation of the RAP)		
Disparities in losses and benefits	➢ Prior Consultation with All Stakeholders ➢ (Consider Compensation Policies, Livelihood Restoration, and Support Measures during the Preparation of the RAP)	Ditto	Ditto
Conflicts of interest within the region	➢ Prior Consultation with All Stakeholders ➢ (Consider Compensation Policies, Livelihood Restoration, and Support Measures during the Preparation of the RAP)	Ditto	Ditto
Gender	➢ Guaranteeing Gender Equality in Labor Employment Agreements	Ditto	Ditto
Children ‘s right	➢ Inclusion of Appropriate Employment Age in the Specifications and Establishment of Notification Obligations and Penalties for Violations ➢ Consideration of Safety for Multiple Schools in the Project Area Regarding the Routes of Construction Vehicles, Container Trucks, and Other Equipment	Ditto	Ditto
HIV/AIDS infection）	➢ Implementation of Education on Sexually Transmitted Infections for Staff and Workers ➢ Implementation of Infectious Disease Prevention Programs in the Surrounding Project Area	Ditto	Ditto
Occupational safety and health	➢ Development of Manuals and Safety Guidelines for the Handling of Hazardous Waste ➢ Construction of Sanitary Toilets with Septic Tanks for Staff and Workers ➢ Provision of Clean Water for General Consumption ➢ Establishment of a Health Center with Medical Facilities and Doctors in the Port Area ➢ Implementation of Infectious Disease Prevention Programs in the Surrounding Project Area ➢ Safety Warnings for Fishermen During the Construction Period	Ditto	Ditto
Accident	➢ Requirement for Contractors to Consult with Fishermen Regarding Restrictions on Navigational Times and Routes ➢ Prior Sharing of Construction Period Information with Local Authorities ➢ Installation of Traffic Signs at the Construction Site ➢ Ensuring Emergency Vehicle Routes in the Event of an Accident	Ditto	Ditto
Cross-border effects and climate change	➢ Minimization of Forest Clearing Areas	Ditto	Ditto
3. Operation Phase			
Air Quality	➢ Introduction of Onshore Power Supply Systems ➢ Use of Low-Sulfur Fuel ➢ Implementation of Liquefied Natural Gas (LNG) Fuel Vessels and Low-Carbon Vehicles ➢ Regular Monitoring of Air Quality in the Port Area and Surroundings ➢ Introduction of Energy Conservation Education Programs for Workers and Staff ➢ Provision of Seedbeds for Tree Planting and Securing Green Spaces for This Purpose	RU/IU: PAD (Project owner)	Operational Budget by PAD
Water Quality	➢ Regular Monitoring of Seawater Quality	Ditto	Ditto

Environmental Factor	Environmental Mitigation Measures	Responsible Unit (RU)/ Implementation Unit (IU)	Cost (USD)
	➢ Implementation of Marine Dumping Prohibition Education Programs for Workers and Staff ➢ Proper Management of Fuel Storage Locations ➢ Installation and Operation of Wastewater Treatment Facilities for All Discharges from Port Facilities ➢ Prohibition of Ballast Water Discharge by Visiting Vessels in the Port (Basel Convention)		
Soil Contamination	➢ Proper Management of Oil Terminals	Ditto	Ditto
Noise/Vibration	➢ Proper Management of Vehicles with Low Noise and Vibration ➢ Prohibition of Nighttime Driving and Operations	Ditto	Ditto
Subsidence /Groundwater	➢ (In the case of groundwater use) Proper Monitoring of Water Use	Ditto	- Ditto
Sediment	➢ Monitoring of Sediment in the Port and Navigation Routes ➢ In cases where concentrations of harmful metals in sediments exceed environmental standards, consult with METE on appropriate disposal methods	Ditto	- Ditto
Waste/Hazardous Substances	➢ Regular Monitoring of Solid and Liquid Waste on Vessels ➢ Implementation of Marine Dumping Prohibition Education Programs for Workers and Staff ➢ Development of Manuals and Safety Guidelines for the Handling of Hazardous Waste	Ditto	Ditto
Ecosystems/flora and fauna/biodiversity	➢ Water Quality Monitoring in the Surrounding Area ➢ Ecosystem Monitoring in Coastal Areas ➢ Implementation of Environmental Conservation Measures for Key Species	Ditto	Ditto
Poor	➢ Prior Consultation with All Stakeholders ➢ (Consider Compensation Policies, Livelihood Restoration, and Support Measures during the Preparation of the RAP)	Ditto	Ditto
Ethnic minorities/Indigenous peoples	➢ (Implementation of detailed survey for identification of ethnic minorities)	Ditto	Ditto
Local economy, including employment and means of livelihood	➢ Set of Priority Employment Quotas for Local Residents at the Port Facilities	Ditto	Ditto
Land use and utilization of regional resources	➢ Prior Consultation with All Stakeholders ➢ (Consider Compensation Policies, Livelihood Restoration, and Support Measures during the Preparation of the RAP)	Ditto	Ditto
Water Use	➢ Prior Consultation with All Stakeholders ➢ (Consider Compensation Policies, Livelihood Restoration, and Support Measures during the Preparation of the RAP)	Ditto	Ditto
Existing Social Infrastructure and Social Services	➢ Prior Consultation with All Stakeholders ➢ (Consider Compensation Policies, Livelihood Restoration, and Support Measures during the Preparation of the RAP)	Ditto	Ditto
Social organizations and decision-making bodies at the local level	➢ Prior Consultation with All Stakeholders ➢ (Consider Compensation Policies, Livelihood Restoration, and Support Measures during the Preparation of the RAP)	Ditto	Ditto
Disparities in	➢ Prior Consultation with All Stakeholders	Ditto	Ditto

Environmental Factor	Environmental Mitigation Measures	Responsible Unit (RU)/ Implementation Unit (IU)	Cost (USD)
losses and benefits	➢ （Consider Compensation Policies, Livelihood Restoration, and Support Measures during the Preparation of the RAP）		
Conflicts of interest within the region	➢ Prior Consultation with All Stakeholders ➢ (Consider Compensation Policies, Livelihood Restoration, and Support Measures during the Preparation of the RAP)	Ditto	Ditto
Gender	➢ Introduction of gender equality in hiring workers at port facilities	Ditto	Ditto
Children's right	➢ Infrastructure improvements and new construction at educational facilities around the facilities	Ditto	Ditto
HIV/AIDS infection）	➢ Construction of sanitary toilets for staff and workers with septic tanks ➢ Supply of clean water for general consumption ➢ Establishment of a health center with medical facilities and doctors in the port area ➢ Implementation of an infectious disease prevention program in the area around the project	Ditto	Ditto
Occupational safety and health	➢ Provision of training and education on the use of vehicles, machinery and related equipment. ➢ Implementation of all safety work standards ➢ Provision of PPE (gloves, shoes, helmets) to staff and workers ➢ Preparation of manuals and safety guidelines for the disposal of hazardous waste	Ditto	Ditto
Accident	➢ Setting (negotiating) fishing vessel navigation times and route restrictions ➢ Implementation of Safety Warnings for Vessels ➢ Monitoring traffic in the project area and surrounding areas ➢ Working with Local Traffic Police and Local Authorities to Manage Traffic Conditions and Provide Safety Education for Drivers ➢ Instructing Ships to Respect Marine Transport Regulations, such as Storage Periods ➢ Installing Traffic Signs for Marine Traffic ➢ Issuing alerts when container ships are entering port	Ditto	Ditto
Cross-border effects and climate change	➢ Tree Planting and Monitoring ➢ Introduction of Renewable Energy Facilities ➢ Introduction of Energy Efficiency Improvement and Emission Reduction Programs, etc.	Ditto	Ditto

Source: JPT

4.7.8 Environmental Monitoring Plan

The table below shows the proposed monitoring plan for typical impact items. The number of survey points and frequency of surveys will be set based on the construction plan and schedule, but the details are still being considered in this Pre-FS. The table below focuses on pollution control and natural environment items, and does not include social environment items covered by the RAP. In addition, because the source of groundwater is not clear at this time, subsidence and groundwater are excluded from the list of items.

Table 4.33 Proposed Monitoring Plan(Main Impact Factor)

Environmental Factor	Monitoring items	location	Frequency	Responsible Unit (RU) / Implementation Unit (IU)
Construction Phase				
Air Quality	Dust, CO, NO_2, SO_2, O_3, TSP, PM_{10}, $PM_{2.5}$ and Pb	2 locations	Twice a year	RU: PAD (Project owner) IU: Contractor
Water Quality	pH, temperature, turbidity, salinity, TDS, TSS, DO, BOD, COD, oil content, detergent, SO4, TN, TP, lead, arsenic, cadmium, iron, mercury, coliform bacteria	4 locations	Quarterly	Ditto
	- Abnormal conditions (e.g. turbidity, red tide, oil spill, etc.)	Project site (Sea area)	Daily	Ditto
	- Turbidity	Disposal site	Timing of ocean dumping	Ditto
Soil Contamination	- Monitoring records during construction	Access roads and main roads	Once a month	Ditto
Noise/Vibration	- Sources of noise and vibration - Measurement of environmental noise and vibration	2 locations	Twice a year	Ditto
Sediment	As, Cd, Cu, CN-, Pb, Mn, Hg, Mo, Ni, Zn, PCBs	One location (dredging site)	Twice a year	Ditto
Waste/Hazardous Substances	- Amount of waste - Method of waste disposal	Project site	Once a month	Ditto
Ecosystems/flora and fauna/biodiversity	- Ecosystem monitoring survey - Water quality monitoring survey - Status of implementation of mitigation measures	Project site	Twice a year Once a month	Ditto
Religious facilities/ Cultural Heritage	- (If there are religious facilities) Status of relocation - Number of complaints	Each location	One time	Ditto
Gender	- Confirmation of hourly rates for male and female construction workers - Gender-sensitive facilities (women's toilets)	Project site	Once a week	Ditto
Children‘s right	- Confirmation of whether or not child labour is being used	Project site	Once a week	Ditto
HIV/AIDS infection	- Implementation status of education programs	Project site	Once a week	Ditto
Occupational safety and health	- Sanitation and safety facilities provided to staff, such as drinking water and toilets. - Record of number of work-related accidents - Implementation status of education programs	Project site	Once a week	Ditto

Environmental Factor	Monitoring items	location	Frequency	Responsible Unit (RU) / Implementation Unit (IU)
Accident	- Regulations regarding the safe navigation of ships in the port - Record of the number of accidents (on land and at sea) - Implementation status of education programs	Project site	Once a week	Ditto
Operation Phase				
Air Quality	Dust, CO, NO_2, SO_2, O_3, TSP, PM_{10}, $PM_{2.5}$ and Pb	Two	Once a year	RU/IU: PAD (Project owner)
Water Quality	pH, temperature, turbidity, salinity, TDS, TSS, DO, BOD, COD, oil content, detergent, SO4, TN, TP, lead, arsenic, cadmium, iron, mercury, coliform bacteria	Four locations	Twice a year	Ditto
Noise/Vibration	- Sources of noise and vibration - Measurement of environmental noise and vibration	Two locations	Once a year	Ditto
Occupational safety and health	- Sanitary and safety facilities provided to staff, such as drinking water and toilets. - - Number of work-related accidents (recorded) - Implementation status of education programs	Project site	Once a week	Ditto
Accident	- Regulations concerning the safe navigation of ships in the harbour - Number of accidents (land and sea) recorded	Project site	Once a week	Ditto

Source: JPT

4.7.9 Implementation Organization

(1) Construction Phase

The environmental and social considerations during the construction of the project will be the main PMU implementer of the PAD as the project owner. During construction, the construction supervision consultant will provide guidance, supervision, grievance redressal and reporting to the PAD on the environmental management implemented by the contractor; the PAD reports to JICA and, where necessary, to the local authorities and METE.

(2) Operation Phase

During operation phase, a management organization will be set up by the PAD to manage the new container terminal in an integrated manner, with a view to future operations, and it is proposed that a dedicated environmental monitoring department will be set up within this organization.

4.7.10 Stakeholder Meetings

Local stakeholder meetings are conducted at three levels: national level, local government level and the level of local resident and relevant institutions, details of which are shown in section of 3.4.6 Stakeholder Meetings.

4.8 Recommendations

In this chapter, JPT outlines the points that PAD should consider or implement.

4.8.1 Port Plan and Implementation Plan

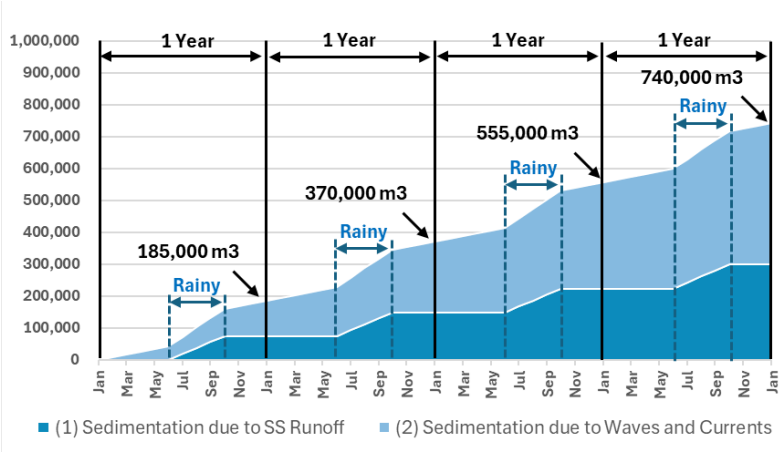
The breakwater and navigation channel/basin are being constructed by DPW based on their study results. The target vessels of this study differ from those of DPW. According to DPW M/P (2021) planning values, the depth of the navigation channel, the width of the channel, and the size of the turning basin in the port are insufficient based on PIANC standards. Therefore, it is possible that a larger navigation channel and basin scale will be needed in the future. For RORO ships, general cargo ships, and bulk ships at Ndayane Port, the DPW's M/P planning values are satisfactory. However, there are concerns about insufficiency for container ships. Therefore, in the port facility layout plan, as proposed in this M/P, it is desirable to leave room for future widening and deepening of navigation channel and basin.

In order to reduce construction costs and environmental impact, it is desirable to reuse dredged soil for land reclamation. The port facilities targeted in the Pre-F/S have a dredged soil volume of approximately 3.3 million m3, which is sufficient to cover the reclamation soil volume of approximately 2.7 million m3. However, in future study such as the F/S, it is necessary to confirm the extent to which the dredged soil is suitable for use as reclamation soil, considering its characteristics.

In the case of PAD's own funds or loans, there is a high risk of delays in opening due to the time required for F/S, consultant selection, detailed design, and contractor selection. Therefore, in order to achieve early opening, it is desirable to consider the participation of private companies.

4.8.2 Shoreline Change and Maintenance Dredging

The results estimated based on the data obtained in this study are as follows.



Source: JPT

Figure 4.43 Estimated Sedimentation Trends based on the Simulation Results

(Same as figure in Chapter 3)

Sediments in the basin area are expected to be caused mainly by SS that discharged from the rivers during the rainy season. The annual thickness of sedimentation is approx. 0.2 m. In addition, in the

navigational channel, sediments are expected to gradually accumulate from the slope of the channel towards the interior due to waves and currents throughout the year. The annual thickness of sedimentation is approx. 0.3 m. Therefore, depending on the impact on vessel navigation, maintenance dredging should be carried out annually or every few years to ensure the necessary water depth.

It is also expected that after the construction of the breakwater, sediment transport will be prevented by the breakwater, resulting in sedimentation to the north of the breakwater and erosion trends in the southern part of the coast. It is possible that the dredged sand in the maintenance dredging could be put into the erosion area as a countermeasure against erosion.

Meanwhile, the results discussed above are based on limited information and involve uncertainties. Therefore, long-term monitoring should be carried out during and after construction to verify the actual mechanism, sedimentation distribution and rate before determining the maintenance dredging method and frequency.

As a monitoring proposal, bathymetric surveys should be carried out at least twice a year in the basin area and navigational channel areas to record long-term sedimentation trends. If there is significant sedimentation, the sedimentation factors should be reviewed again. Shoreline monitoring should also be carried out regularly to determine the impact of the port construction on the surrounding coasts and to identify any long-term trends.

4.8.3 Economic/ Financial Analysis

The discount rate for the financial analysis is set based on the interest rates of JICA (loans) and the West African Central Bank. Generally, interest rates tend to be higher when raising funds from the market (issuing corporate bonds or increasing capital). On the other hand, in the case of borrowing, the discount rate presented in this report (2.15%) is likely to be close to the figure. When making the final investment decision, it is desirable to set the discount rate based on the actual financing.

Revenues were calculated based on estimates from cargo volume handled and past financial statements. Due to confidentiality obligations, it is believed that revenues from concessions cannot be made public. However, to enable more realistic revenue forecasts, it is desirable to use figures based on each concession contract, especially when calculating forecasted revenues within the PAD.

4.8.4 Road Planning

(1) Access Road

The access road needs to be adjusted horizontal and vertical alignments due to the latest residential areas, facilities, DPW's plan and PIZ development plans.

Pavement composition using recycled materials is proposed in the outline design, however in the F/S and detailed design stage, it is necessary to decide the pavement composition based on the possibility of procurement and cost.

In this outline design, ground survey has not been conducted. Therefore, at the F/S and detailed design

stages, it is necessary to design the pavement composition based on the design CBR derived from the ground survey.

(2) Temporary Road Inside the Port

The temporary road inside the port proposed in this Pre-F/S connects with the container terminal under construction by DPW, but information on DPW's road plan was not obtained. Therefore, both the horizontal and vertical alignments of the temporary road inside the port are assumptions, and it is necessary to align them with DPW's latest plans at the F/S and detailed design stages.

In this Pre-F/S, the proposed temporary road within the port is planned to run parallel to the southwestern end of the PIZ. This plan assumes that the construction of the temporary road will precede that of the PIZ, following the current topography. However, if the construction of the PIZ precedes or occurs simultaneously, it will affect the vertical alignment. Therefore, at the F/S and detailed design stages, it is necessary to align with the latest PIZ plans and confirm the construction sequence.

In this outline design, a simple asphalt pavement is planned considering that the road within the port is temporary. If it is going to be a permanent pavement structure, it is necessary to confirm 1) the width structure of the temporary and final forms, 2) the design CBR based on ground survey, and 3) the pavement materials that can be procured.

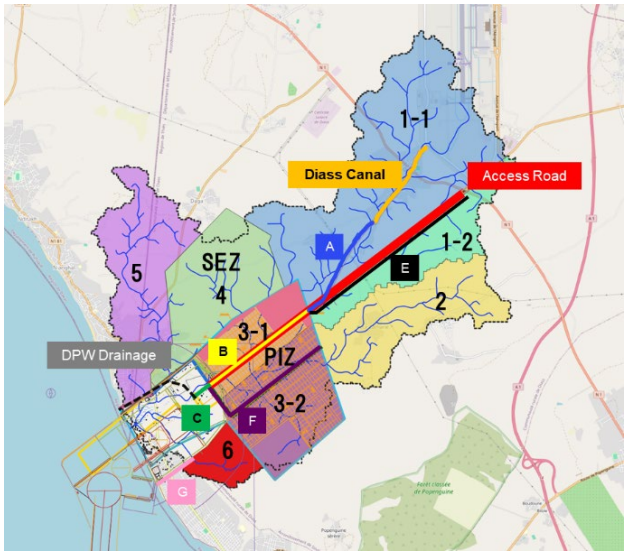
4.8.5 Drainage Planning

(1) Basin Drainage

The basin drainage will receive water from the Diass canal, so it is necessary to ensure consistency with the Diass canal plan. In addition, since the channel will connect to the DPW drainage channel that is being developed separately by the DPW, it is necessary to ensure consistency in terms of the planned scale, planned rainfall intensity, and planned flow rate.

The plane and vertical alignments of the basin drainage (Sections A-C, E&F) will require coordination with the access road plan, PIZ's development plan and layout, and DPW's drainage channel plan

The south basin drainage (Section G) will be developed along the temporary port road in the 2030 plan. It should be noted that the south basin drainage will need to be relocated when the port area is expanded in the 2035 plan.



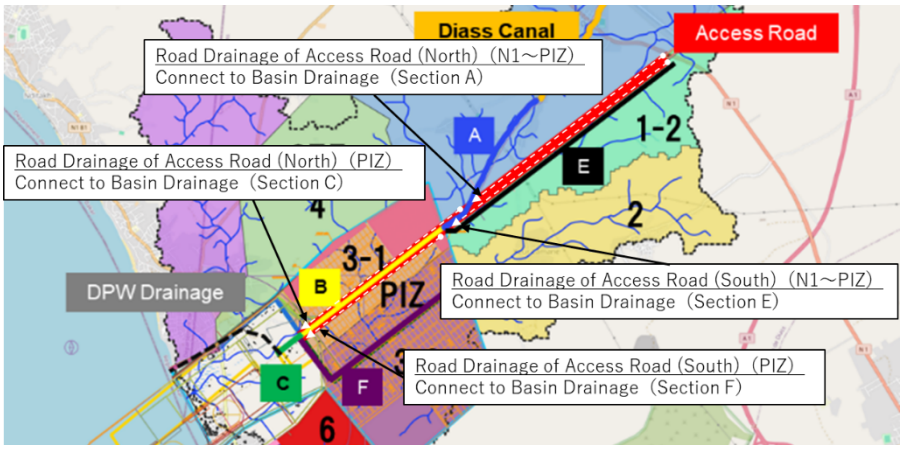
Source : JPT

Figure 4.44 Basin Drainage Channel

(2) Road Drainage

Same as the basin drainage, it is important to ensure consistency between the DPW road drainage plan currently being developed by DPW in terms of planned scale, planned rainfall intensity, and other specifications.

In this study, the road drainage of the access road is to be connected to the basin drainage at the border of PIZ area. The connection point needs to be confirmed according to DPW's access road.



Source: JPT

Figure 4.45 Drainage Route Map of the Access Road

4.8.6 Environmental and Social Consideration

(1) Introduction of water quality management system for shipment origin water pollution

The Ndayane Port project may impact various environment items, including air quality, water quality, noise and vibration, both during construction and operation phases. Particularly, water quality may be

deteriorated through oil spills and introduction of invasive alien species by ballast water. To mitigate these, MARPOL Convention-compliant treatment systems should be installed. Furthermore, it is essential for sustainable port operations that education and training on environmental management is regularly provided for port personnel, to improve their ability to respond to possible oil spills and to foster awareness of environmental protection.

(2) Development and Implementation of mitigation measures for coastal ecosystem conservation

The terrestrial and marine coastal ecosystems near the Ndayane Port site is internationally important, serving as a habitat for migratory birds and sea turtles. These natural ecosystems are at high risk of being directly affected by port construction, dredging and reclamation of navigation channels, etc. It is highly recommended to integrate measures to minimize the impact on coastal ecosystems from the planning stage while giving due consideration to stakeholders such as fishermen, farmers and tourism operators who profit from ecosystem services.

It is essential that to develop environmental management and monitoring plans and develop a framework for environmental conservation in conducting Environmental Impact Assessment EIA for individual development projects to minimize impact of development activities on the critical natural environment. In developing environmental management framework, the results of field surveys which take into account the timing of migratory bird arrivals and the exact location of sea turtle breeding sites, and various stakeholders' opinions should be reflected.

(3) Adoption of coherent compensation policy

It is recommended to adopt a coherent compensation policy to Project Affected People (PAPs) of all relevant projects that include DPW port development, PIZ development etc. The compensation policy should comply with Senegalese law and international standards such as World Bank operation policy and JICA's guidelines.

(4) Implementation of inclusive livelihood recovery assistance programs

The project is expected to have a wide range of impacts on the livelihoods of the affected population, including direct impacts such as the acquisition of commercial land and facilities, and indirect impacts such as impacts on ecosystem services due to changes in the surrounding environment. Considering these impacts, it is recommended that the livelihood assistance programmes should be designed while taking into account both direct and indirect impacts. In addition, it is recommended that vocational training be conducted taking into account the new jobs to be created by the project. Furthermore, in employing nonskilled staff, priority be given to the PAPs.

5. Activity for Output 3 (Training and Long-term Capacity Development Planning)

5.1 PAD's Current Training Programs

5.1.1 Training in Senegal

JPT asked PAD about the training program that PAD conducts on a regular basis. PAD answered that PAD do not have any regular training program in Senegal. Instead, PAD holds training on equipment maintenance and management from the makers occasionally.

5.1.2 Training Conducted by Tanger MED Port in Morocco

According to Tanger Med Port Authority, PAD staff conduct training on ship-handling simulator owned by Tanger MED Port Authority. The ship-handling simulator can simulate the operation of a 3D model of Dakar Port. The facility was considered as sufficient for training.

On the other hand, PAD confirmed that they conducted training in Morocco. However, it is irregular and conducted as needed, and there is no regular training program. For confidentiality, PAD could not disclose details of the training at the Tanger MED Port. Therefore, JPT was unable to obtain more information about the content of the training.

5.2 Training Program by JICA and JPT during the Project Period

Ndayane Port is a large multifunctional port that needs to be developed in cooperation with other organizations. It is necessary to manage the port in a harmonious way with a bird's eye view of the port. In this Project, JICA and JICA Project Team conducted training to improve the basic port skills of PAD staff. There are three training programs planned: Knowledge Co-Creation Program (KCCP), Guide to Ports in Japan, and Seminar in Senegal.

5.2.1 Knowledge Co-Creation Program (KCCP)

"The Knowledge Co-Creation Program (KCCP) for Group and Region Focus" is a program which aims to transmit Japanese strengths to developing countries as well as to enhance further co-learning among participating countries including Japan. This characteristic is very unique and is rarely seen in ODA activities in other international organizations. During the period of this Project, PAD staff participated in two KCCPs; "Port Maintenance Planning" and "Strategic Port Administration and Management".

(1) Port Maintenance Planning

Many developing countries have developed port facilities in order to meet demand on maritime transport supporting their rapid economic growth. It is essential for governments/port management authorities to maintain their port facilities properly to avoid negative impact on their social and economic activities.

In this regard, this course aims to enhance capacity of port maintenance planning, inspection methods, maintenance strategy and prioritization, and others related port maintenance based on the concept of life cycle management.

This program was conducted from early October to late November 2023, and one PAD staff participated.

(2) Strategic Port Administration and Management

This program aims to improve capabilities of strategic port administration, and proper port management and operation by formulating an Action Plan for port related problems in respective countries.

In this training, the trainees deepen their knowledge through lectures and site visits on how to improve the efficiency of port maintenance/operation management, which is an interface for marine logistics, which is essential for economic development. By organizing the various problems in their country reports, and creating an action plan while consulting with an external consultant to consider the comprehensive solution on their own, the capacity of the relevant organizations to improve strategic port administration and operational management is developed.

The program was conducted from middle of January to middle of March 2024, and one PAD staff participated.

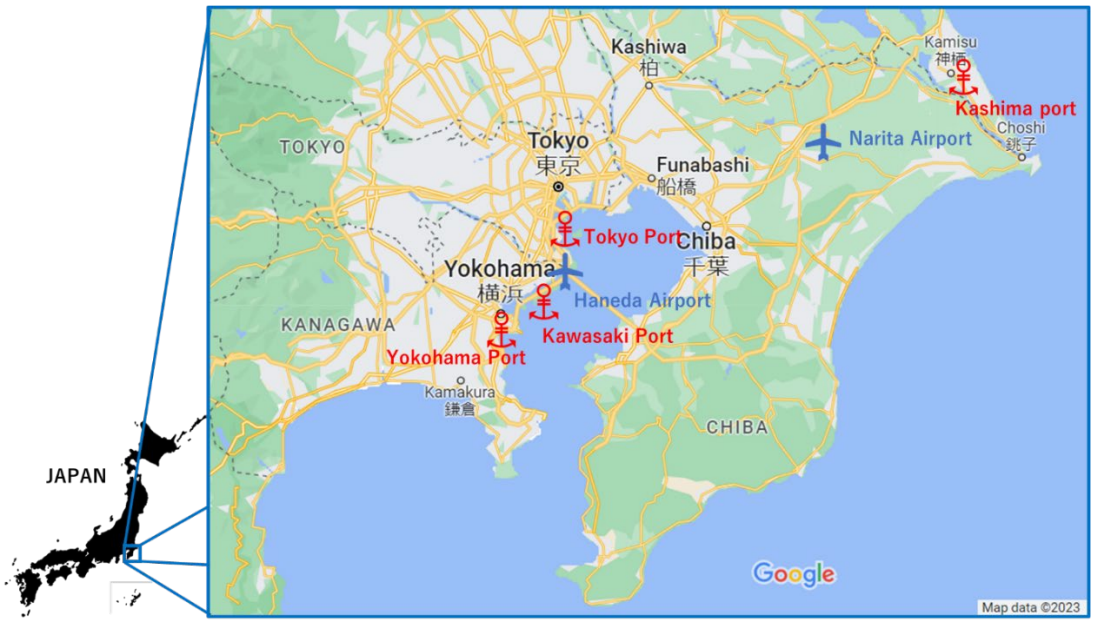
5.2.2 Guide to Ports in Japan

JICA and JPT are planning to invite five PAD staff to Japan for 11 days from February 4-14, 2024. JPT will guide the four ports of Kashima, Yokohama, Kawasaki, and Tokyo. Port and Airport Research Institute (PARI) and Hasaki Oceanographical Research Station (HORS) were visited to gain more knowledge on sediment transport associated with the construction of the new port. The schedule is shown in Table 5.1. The Location of the Ports of Kashima, Yokohama, Kawasaki, and Tokyo are shown in Figure 5.1.

Table 5.1 Schedule for Guide to Ports in Japan

Date	Schedule
4/2/2024	Arrival to Japan
5/2/2024	JICA briefing
6/2/2024	Courtesy Call to MLIT and Nippon Koei
7/2/2024	Site Visit to Tokyo Port, Kawasaki Port Road and Kawasaki Port
8/2/2024	Site Visit to Port Construction Site, Visit to PARI
9/2/2024	Site Visit to Yokohama Port, Visit to Tokyo Camii (Mosque) and NEC
10/2/2024	Sightseeing in Tokyo
11/2/2024	Holiday
12/2/2024	Holiday
13/2/2024	Site Visit to HORS and Kashima Port
14/2/2024	Closing ceremony
15/2/2024	Departure from Japan

Source: JPT



Source: JPT based on Google Map

Figure 5.1 Location of the Ports of Kashima, Yokohama, Kawasaki, and Tokyo

(1) Courtesy Call to MLIT and Nippon Koei

On the first day of the training, the participants visited the Ministry of Land, Infrastructure and Transport (MLIT) and Nippon Koei, where they were received with a warm welcome. At MLIT, director of international policy planning office ports and harbors bureau gave a briefing on the overview of Japanese ports. Nippon Koei provided an explanation of the company, the training itinerary and the progress of this project.

Source: JPT

Figure 5.2 Courtesy Call to MLIT

Source: JPT

Figure 5.3 Courtesy Call to Nippon Koei

(2) Kashima Port (Industrial Port)

Kashima Port is located 80 km from Tokyo, the capital of Japan. Kashima Port is an industrial port built as the core facility of the Kashima seaside industrial zone, since Kasumigaura, a lake with an annual inflow of 1.1 billion tons, is located behind the port. Kashima Port is a constructed on sandy coast and is the largest excavated port in Japan. In 2011, the Ministry of Land, Infrastructure, Transport and Tourism in Japan selected Kashima Port as an International Bulk Strategic Port (Grain) and has been promoting efforts to improve productivity and strengthen international competitiveness. The Port of Kashima is working towards the formation of an offshore wind farm project and a carbon neutral port (CNP).

The visit to the Port of Kashima provided a briefing on the current situation and future prospects of the Port of Kashima, and then the participants observed the port at sea from the ship.

Source : Ibaraki-ken

Figure 5.4 Kashima port

Source: JPT

Figure 5.5 Briefing on the Port of Kashima

Source: JPT

Figure 5.6 Tour from the Ship

(3) Yokohama Port (Re-development of waterfront)

Yokohama Port was constructed in 1859 and has a history of more than 150 years. Currently, Yokohama Port is a comprehensive logistics port that handles all kinds of cargo, including containers, completed cars, oils, grains, etc. Yokohama Port is surrounded on three sides by moderately undulating hills to the north, west, and south, which gives it a geographical advantage in terms of wind and wave effects throughout the year. Therefore, cargo handling is very rarely restricted by natural conditions, enabling stable port operations.

In 1979, Yokohama-city, which manages Yokohama Port, proposed the "Yokohama Minato Mirai 21" concept for redevelopment of the waterfront area by integrating it with the surrounding area. Yokohama Port and its surrounding area have undergone a large-scale urban development. Yokohama Port and its surrounding area have become a place where businesses, shopping, and cultural facilities are concentrated, creating a place of employment and bustle for citizens. The development of parks and green areas along the seashore, such as Rinko Park, has created a waterfront space where citizens can relax and enjoy themselves. Yokohama Port and its surrounding area are also famous as a sightseeing spot.

The visit to the Port of Yokohama provided a panoramic view of the Port of Yokohama from Yokohama Marine Tower and confirmed the history of each building and facility as it was constructed and how it is being used as a tourist resource. In addition, the participants were guided by Toa Corporation, which is currently carrying out construction work in Honmoku area, to the construction site and were given an explanation about the port construction work.

Source：Yokohama-city

Figure 5.7 Night view of Yokohama Minato Mirai 21

Source: JPT

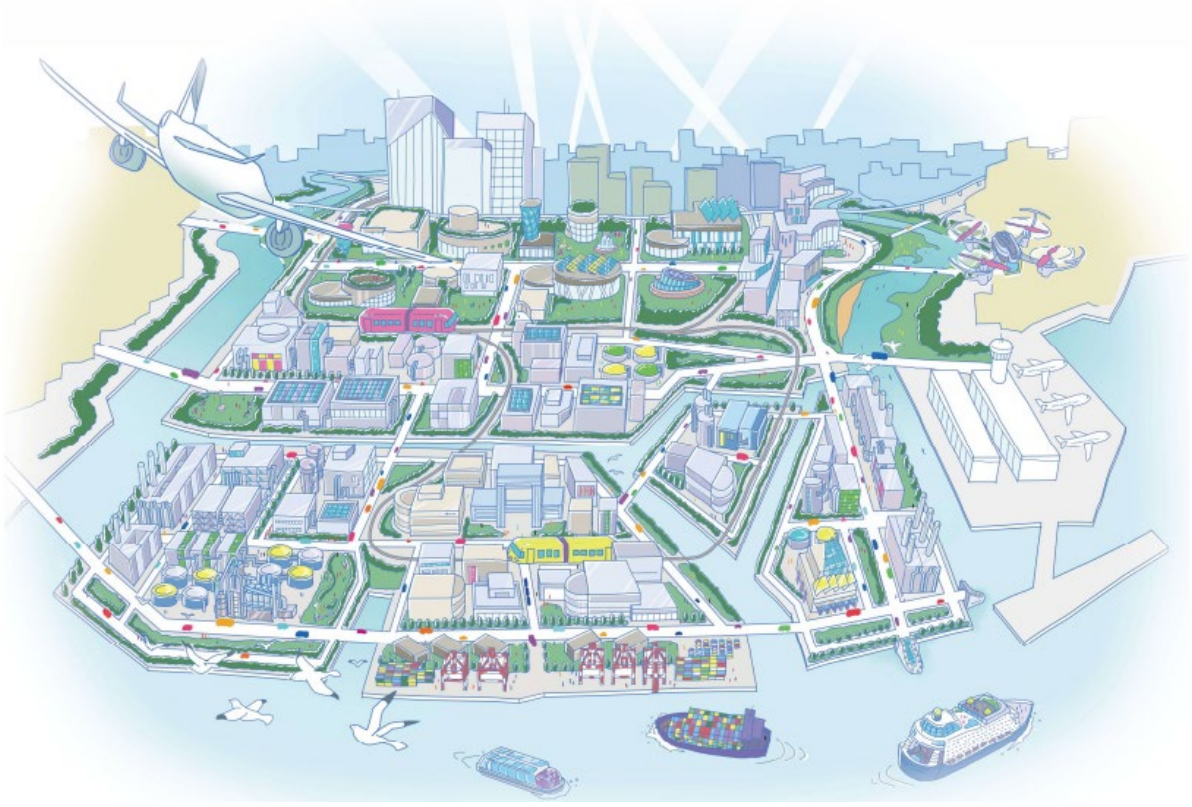
Figure 5.8 Panoramic View of the Port of Yokohama from Yokohama Marine Tower

(4) Kawasaki Port (Car terminal, logistic center, industrial zone)

Kawasaki Port was constructed by land reclamation. Kawasaki waterfront area is where the petroleum industry, steel industry, energy facilities, and logistics facilities are gathered. The concentration of heavy industries such as steel mills, power plants, and petrochemical plants caused serious environmental problems in the 1960s, but citizens, businesses, and government worked together to solve the problems and restore clean air and rivers. Today, Kawasaki waterfront area is an area where industry and the environment are in harmony.

In 2018, Kawasaki City, which manages the Port of Kawasaki, developed a vision for the future, "SUPER HYBRID FRONT KAWASAKI (Figure 5.9)," which it aims to achieve in 30 years. The city is working to realize this vision through nine basic strategies, including "strengthening port functions to support daily life and industry", "strengthening transportation functions to support the development of the waterfront area," and "creating an open waterfront area that citizens can be proud of".

Visit to Kawasaki Port provided a panoramic view of Kawasaki Port from Kawasaki Marien, in addition to observing the construction of the port bridge connecting Higashi Ogishima and the mainland. Explanations on the construction of the bridges were given using VR images, allowing participants to see images of the completed bridges from various perspectives and experience the latest technology.



Source : Kawasaki-city

Figure 5.9 Image of Kawasaki waterfront area in 30 years

Source: JPT

Figure 5.10 Panoramic View of the Port of Kawasaki from Kawasaki Marien

Source: JPT

Figure 5.11 the Construction of the Port Bridge

Source: JPT

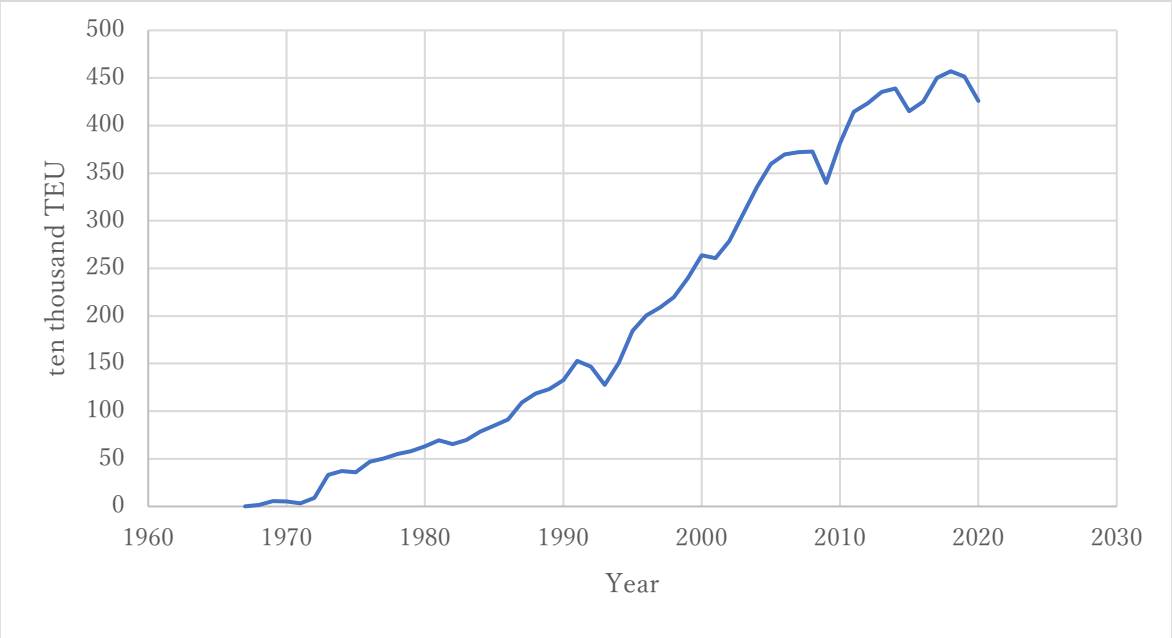
Figure 5.12 Watching VR images

(5) Tokyo Port (Container terminal)

Tokyo Port is a comprehensive urban port that handles the distribution of products necessary for the industrial activities of the metropolis and the daily lives of its citizens. In the 1960s, Tokyo port was one of the first to respond to container transportation innovations and built a container terminal. Tokyo Port is a port that has developed into an international trading port largely due to the increased convenience of the port.

As shown in Figure 5.13, the number of containers handled is decreasing in 2020 due to Covid-19, but overall, the number of containers handled is increasing every year. In 2022, Tokyo Port will handle 4.93 million TEUs of containers, and the number of containers handled is increasing.

Visit to the Port of Tokyo provided an explanation of the volume of cargo handled at the container terminal and the efficiency of cargo handling. In addition, the participants learnt about the history of the Port of Tokyo at Tokyo Minatorie.



Source：Created by JPT based on Bureau of Port and Harbor, Tokyo Metropolitan Government

Figure 5.13 Number of containers handled at Tokyo Port (1967-2020)

Source： Bureau of Port and Harbor, Tokyo Metropolitan Government

Figure 5.14 Container terminal at Oi Pier, Port of Tokyo

Source: JPT

Figure 5.15 Container terminal at the Port of Tokyo

Source: JPT

Figure 5.16 Explanation of the Port of Tokyo

(6) Visit to Port and Airport Research Institute (PARI) and Hasaki Oceanographical Research Station (HORS)

Visit to PARI, where the participants learned about the research facilities and received a basic lecture on sediment transport phenomena. The participants also visited HORS and conducted observations.

Source: JPT

Figure 5.17 Visit to PARI

Source: JPT

Figure 5.18 Visit to HORS

(7) Latest port security equipment

A visit to NEC Corporation was made to introduce the latest port security/gate management equipment, facial recognition systems and other Japanese technology at ports.

(8) Japanese Culture

The participants tried Japanese food for lunch during the training period and visited Tokyo Skytree, Asakusa and Odaiba on their days off to deepen their understanding of traditional Japanese culture.

(9) Closing Ceremony

On the last day of the training, the evaluation ceremony and the closing ceremony were held at the JICA Yokohama Centre. At the evaluation ceremony, the participants exchanged their impressions of the training and their expectations for future training from JICA. At the closing ceremony, the JICA representative presented the participants with certificates of completion. All four participating trainees were satisfied with the training and said that the knowledge and experience gained from the training would be useful for their own work and the development of the master plan for this project. The trainees stated that they would like to welcome more JICA experts to Senegal and actively participate in JICA training in the future.

Source: JPT

Figure 5.19 Closing Ceremony

5.2.3 Seminar in Senegal

The seminar was conducted to improve the basic port knowledge for PAD staff during the presentation from JPT at TC meeting on 21st September 2023. The seminar program is shown in Table 5.2. JPT conducted a training program requested by PAD, a case study of the third country, and an overview introduction to JPT's expertise.

Table 5.2 Seminar Program

Contents	Title
Requested by PAD	Monitoring and Maintenance Port Works Operational Marketing and Commercial Promotion General Concession Regulations
A case study of the third country	Port in Japan Industrial zone of Thilawa in Myanmar
Others	Strategic Environmental Assessment

Source：JPT

Table 5.3 shows the list of requested trainings received from PAD in September 2022. PAD's requests cover a wide range of topics such as design, construction and management of port facilities, marketing techniques and concession regulations. There are 10 departments listed as relevant departments.

The availability of seminars requested by PAD is listed in Table 5.3 and will mostly be conducted by JPT. JPT will not conduct seminars about "Management of Lift Machine and Port Metallic Works" and "Geotechnical and Works in Port Sites", as there are no experts in the relevant fields who can conduct seminars. "Cummins Engine Training" will not be conducted because Cummins is an American company and it is difficult to implement under Japanese technical cooperation.

Table 5.3 Trainings Requested by PAD

Training Title	Objectives	Target	Departments Concerned	Conducted/ Non-Conducted
Design And Construction Of Port Quays	- Learning the main techniques - Knowing how to choose the type of work, its design, the method of consulting companies and its method of implementation - Knowing the major aspects of soil consideration - Understanding sizing and execution calculations	DSTA Engineers/Work Controllers	DSTA (Technical Services and Planning Department)	Conducted
Management of Lift Machine and Port Metallic Works	- Knowing how to analyze the strengths and weaknesses of the management of a port's equipment and rectify any malfunctions. - Deepening knowledge of equipment maintenance management - Supporting the evolution of the port market through the acquisition, redesigning and upgrading of equipment - Understanding and managing the aging of lift machine, preventing risks - Optimizing operating costs and reducing investment risk	Work Controllers, Special Equipment Drivers, Crane Operators	DSTA (Technical Services and Planning Department)	Non-Conducted
Monitoring and Maintenance Port Works	- Appropriation of monitoring and maintenance methods for port installations. - Knowing the different pathologies and the associated repair techniques, - Choosing and implementing appropriate techniques.	DSTA engineers/ work controllers	DSTA (Technical Services and Planning Department)	Conducted
Operational Marketing and Commercial Promotion	- Studying best business practices to be competitive with shipowners, methods and tools for port marketing.	Commercial agents, communication agents	DCEC (Commercial and Customer Experience Department) CGGMI (International	Conducted

Training Title	Objectives	Target	Departments Concerned	Conducted/ Non-Conducted
			Ferry Terminal Management Unit) CCS (Strategic Communication Unit)	
Geotechnical and Works in Port Sites	- Designing and building works on port sites using sedimentological, geotechnical and dynamic data from the sites	Engineers, technical assistant for maritime and port project management	DSTA (Technical Services and Planning Department)	Non-Conducted
Reinforcement and Repair of Port Installations	- Mastering the maintenance techniques for strengthening and repairing port installations	Engineers, technical assistant for maritime and port project management	DSTA (Technical Services and Planning Department)	Conducted
Cummins Engine Training	- Mastering CUMMINS engine setting techniques	Armament Captain and Mechanics Armament/ LMDG Mechanics	DCAP (Harbour Master Department) /LMDG (Dakar Gorée Maritime Line)	Non-Conducted
General Concession Regulations	- Mastering the legal framework of concessions; - Mastering all the procurement procedures for each type of concession; - Ability to develop, monitor and evaluate concession contracts	Legal Officers / Responsible for Public Procurement Procedures / Financial Officers	DCH/SG (Human Capital Department) (CPM (Project Management Unit), CAJA (Legal Affairs and Insurance Unit)/ DFC (Financing and Accounting Department)	Conducted

Source: Created by JPT based on the hearing from PAD

5.3 Draft Training Plan and Long-term Capacity Development Plan by JICA and JPT

5.3.1 Role and Current Capabilities of PAD

Ndayane Port is a port planned as a large-scale multifunctional port. After the construction of Ndayane Port, PAD is expected to contribute to Senegal's development through more strategic port management and operations, taking advantage of the respective advantages of Dakar Port and Ndayane Port.

There is a PIZ development plan in the hinterland of Ndayane Port. It is unclear to what extent PAD will be involved in the management and operation of this PIZ, but PAD has no experience in managing and operating PIZ as well as other industrial area.

It is predicted that the capacity for port management and operation will be insufficient under the current PAD after the construction of Ndayane port. It is more necessary than ever to strengthen PAD's organizational capacity and improve individual capabilities. It is desirable to formulate a long-term human resource development plan and improve organizational and individual capabilities.

5.3.2 Required Capabilities

(1) Required Organization Capabilities

a) Sharing of Organizational Target

In order to create a well-communicated organization, it is important that everyone in the organization is aware of the direction the organization is aiming for and the philosophy it should have. Even if individual strengths are developed, it is difficult to achieve high performance as a team if the direction of these strengths is disjointed. Organizational targets shall be shared and an organizational environment shall be created in which all employees are worthy representatives of the organization and can work with pride.

b) Teamwork

Organizational targets cannot be achieved by one person alone; they require teamwork. Teamwork is also essential for the smooth functioning of an organization. Teamwork can be expected to be strengthened by sharing information and expertise with colleagues and by working together. Enhanced teamwork leads to increased productivity as an organization.

(2) Required Competencies of Individuals

a) Ability as a Generalist

In port management and operation, the generalist is required to have a comprehensive view of not only the port, but also the surrounding industries, logistics, and the environment. It is important to have knowledge and interest in a wide range of fields. The generalist shall be making comprehensive judgments on a variety of factors to formulate policies and create systems, rules, and other mechanisms.

b) Professional Expertise

While being a generalist, they also need to have specialized knowledge of the department to which they belong. It is important to strive to acquire the necessary specialized knowledge and to gain a great deal of experience.

c) Management skills

Leading a group of people by vectoring them toward a goal requires management skills such as leadership, guidance and development, and administrative skills. In addition, to enable the organization to become self-reliant as an organization, younger employees shall be trained and mentored to pass on the skills to them. By passing on skills, the organization will be able to operate stably over the long term.

5.3.3 How to Improve Capabilities

(1) Formulate a Long- and Medium-term Development Plan for the Port

The Ministry of Land, Infrastructure, Transport and Tourism, which oversees Japan's ports, formulated a medium- to long-term policy for ports called "PORT 2030" in 2018. This is a list of key policies and

the roles that ports should play in supporting Japan's economy, industry, and people's lives around the year 2030. Eight goals have been formulated as the direction for medium- and long-term policy, as shown below, and a roadmap is provided for each of them.

- Building a maritime transportation network to support global value chains
- Establishment of a domestic logistics system that is sustainable and creates new value
- Cruise islandization of the archipelago
- Space formation that generates brand value
- Formation of bases for receiving and supplying new natural resources and energy
- Greening port and logistics activities
- Smartening and strengthening ports and harbors through the use of information and communication technology
- Transformation of Port Construction and Maintenance Management Technology and Overseas Development

By creating a medium- to long-term policy focused on ports, PAD organizations will be able to share organizational goals, clarify the direction they should take as an organization, and strengthen their organizational capabilities.

(2) OJT and OFF-JT

Human resource development measures to improve competence are OJT (On the Job Training) and OFF-JT (OFF the Job Training). Capacity building will be done through OJT through daily work. OFF-JT shall be conducted at each milestone. The insights gained through OFF-JT play a catalytic role in facilitating effective daily OJT.

a) OJT (On the Job Training)

Each ability required to perform a job is developed step by step through a variety of experiences. In particular, the experience of trouble and failure in one's youth becomes fertilizer and helps one grow by leaps and bounds. The important thing is not to tackle any task in a haphazard manner, but to see it as an opportunity for new challenges and to improve the quality of the experience.

i) Practical OJT

Practical on-the-job training (OJT) is a method in which the instructor sets an example, and the learner learns through repeated practice by seeing, hearing, and speaking, allowing them to master the skill through hands-on experience. It is particularly effective in improving communication skills and other abilities that can be acquired through experience.

ii) Learning OJT

Learning OJT is a method in which the instructor teaches the basics, and the learner then improves their ability by learning on their own. Learning OJT is an effective way to acquire generalist and

specialized knowledge.

b) OFF-JT (OFF the Job Training)

Listening to the opinions of others is not only an opportunity to gain new insights, but also to gain clues and hints on how to resolve pending issues. Exposure to a diverse range of people in addition to the PAD organization not only expands one's network of contacts, but also provides an opportunity to objectively view one's own position and level and to become aware of one's own strengths and weaknesses. Opportunities for OFF-JT such as attending workshops and events at other institutions on a regular basis shall be provided.

5.4 Reaction of PAD to Draft Long-Term Capacity Development Plan Proposed by JPT

The above draft long-term capacity development plan was explained at TC meeting on 21st September 2023 and at JCC meeting on 25th September 2023. JPT met with Human Resources Department of PAD for a more detailed explanation on 26th September 2023. There were no specific comments from Human Resources Department of PAD and JPT considered that the above draft long-term capacity development plan was generally accepted.