No.

MINISTRY OF MARINE AFFAIRS AND FISHERIES
THE REPUBLIC OF INDONESIA

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR THE PROMOTION
OF
THE SUSTAINABLE COASTAL FISHERIES
IN
THE REPUBLIC OF INDONESIA

JANUARY 2007

JAPAN INTERNATIONAL COOPERATION AGENCY

SYSTEM SCIENCE CONSULTANTS INC.
NIPPON KOEI CO., LTD.

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PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan decided to conduct a basic design study on the Project for the Promotion of the Sustainable Coastal Fisheries and entrusted the study to Japan International Cooperation Agency (JICA).

JICA sent a study team to Indonesia from July 5 to August 2, 2006. The study team held discussions with the officials concerned of the Government of Indonesia, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Indonesia in order to discuss a draft basic design from December 9 to December 19, 2006 and as this result, the present report was finalized.

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

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

January, 2007

Masafumi Kuroki
Vice President
Japan International Cooperation Agency

January, 2007

Letter of Transmittal

We are pleased to submit to you the basic design report on the Project for the Promotion of the Sustainable Coastal Fisheries in the Republic of Indonesia.

This study was conducted by the Consortium of System Science Consultants Inc. and Nippon Koei Co., Ltd., under a contract with Japan International Cooperation Agency, during the period from June, 2006 to January, 2007. In conducting the study, we examined the feasibility and rationale of the Project with due consideration to the present situation of Indonesia and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Tamotsu Tomiyama

Project Manager
Basic Design Study Team on
the Project for the Promotion of
the Sustainable Coastal Fisheries
in the Republic of Indonesia
The Consortium of
System Science Consultants Inc.
and Nippon Koei Co., Ltd.

SUMMARY

Summary

1. Country profile

The Republic of Indonesia is a maritime nation comprising 17,508 large and small islands. Its offshore economic zone is 2.8 fold larger than the nation's land mass itself. This ranks third in the world in terms of size, and fishery resources are abundant throughout the country. These provide an essential source of nutrition for the Indonesian population (fishery products account for 2/3 of animal protein consumed). Although the fishery sector is seen as an essential economic resource in regional development, the size of catches at major fishing grounds has either leveled-off or begun to decrease in recent years

The Indonesian economy was seriously affected by the Asian currency crisis in 1997. Nevertheless, through effective measures including macroeconomic stabilization and financial system reform, the country has been able to achieve 3% or more real economic growth since 2000 (5.6% in 2005). On the other hand, unemployment continues to remain high (10.9 million [9.9%] in 2005), requiring greater economic growth to absorb 2.5 million new members to the available work force each year. Particularly in outer island areas, strengthening of development infrastructure is necessary.

East Nusa Tenggara Province (Nusa Tenggara Timur; hereinafter "NTT Province") including East Flores District (on Flores Island) within which the Project site is located, is the most economically depressed among the 30 provinces of Indonesia. Furthermore, disparity in terms of economic development compared to other regions in the country has continued to further widen in recent years

2. Background and outline of the requested Project

The Indonesian government announced a Mid-term National Development Plan (2004~2009) in January 2005. The plan encompasses three key themes: (i) building a peaceful and safe nation, (ii) creating an impartial and democratic state, and (iii) upgrading the welfare of the national citizenry. The plan focuses particularly on mitigating the skewed level of development between urban Java Island and outlying islands of the country.

Under the theme of upgrading the welfare of the nation's citizenry are targets of alleviating poverty, creating job opportunities and accelerating economic growth. The issue of coastal development is also sited under the plan and comprises four components, i.e. enhancing the welfare of coastal communities (particularly fishermen and fish farmers), strengthening fishermen's organizations, capacity building in management of the coastal environment, and strengthening capabilities for safe fishing operations and protecting marine resources from illegal poaching.

Based on the above described national policy, the Mid-term Strategies for Marine and Fisheries Development (2004~2009) embraces the following basic four points: ① revitalizing the fishery sector, ② improving rural community access to fishery products, ③ establishing fishery infrastructure and a sustainable fishery sector and ④ promoting sound conservation and management of marine resources and marine environments.

Specific items under the above strategy encompass nine issues: ① enhancing the livelihood of small fishermen and fish farmers, ② increasing national revenue and foreign income generated by the fishery sector, ③ creating and extending job opportunities within the fishery sector, ④ increasing availability of fish and promoting fish consumption, ⑤ optimizing fishery resources management, ⑥ increasing productivity, produce quality, value added, and produce marketability, ⑦ increasing availability of raw materials for fish processing industries, ⑧ achieving optimum utilization of fishery resources and the marine environment and ⑨ sustained guarantees for fishery

resource access and aquaculture space for fish farmers.

Against the above background, the Japanese government conducted a development study titled "Master Plan Study on Coastal Community Development in Eastern Region of Indonesia" during 2000~2002, aimed at improving the livelihood of small fishermen and a stable supply of fishery products in NTT and NTB (Nusa Tenggara Barat; hereinafter "NTB Province") Provinces. This study comprised two components: (i) formulating a master plan for development of small scale fishery communities and (ii) carrying out feasibility studies on selected priority areas. Based on the result of this study, the Indonesian government formulated a development plan for sustainable promotion of coastal fisheries in the high priority target areas of Amagarapati (in Larantuka Sub-district) of East Flores District in NTT and Waworada (Bima District) in NTB, and requested technical and grant cooperation from the Japanese government in 2004.

In response to the above, the Japanese government carried out a preparatory survey in May and October 2005. Based on this, project-type technical cooperation has been scheduled over a three year period starting from August 2006.

The Project aims at formulating a model to promote sustainable development in coastal fishing communities. It is planned to carry out activities to strengthen basic capabilities of fishermen, upgrade fishing technologies, and improve overall standards of living in coastal fishing communities.

On the other hand, with regard to the specific grant-aid cooperation for fishing infrastructure under the Project, the fact that (i) the appropriateness of the Project site as changed from the original request under the preparatory survey for project-type technical cooperation has not been thoroughly studied, (ii) full details of request content remain unclear, and (iii) there is a perceived need to narrow down the target Project area and facility components in light of an excessive requested Project cost; a follow-up preliminary survey was subsequently carried out in January 2006.

As a result, because material and equipment will be input to Waworada as a base for experts dispatched under technical cooperation, only Amagarapati was subsequently targeted under the Project for construction of fishing port structure and facilities. An overview of requested content confirmed by preliminary survey is as follows:

1) Civil works: Landing jetty, access bridge, landing wharf for small fishing boats, slipway, on-premise roads, parking area.
2) Buildings: Fish handling shed, ice making and storage facility, fuel storage facility, fueling shed, fresh water tank and water supply shed, administration building, workshop, wastewater processing facility, outdoor drying yard, kiosk (combined with fishermen's cooperative office).
3) Equipment: Generator, consumables, etc.

On the basis of the above, the Japanese government determined to carry out a Basic Design Study for the Project. A Basic Design Study Team was accordingly dispatched to Indonesia from July 5 to August 2, 2006. The Study Team held discussions with concerned officials of the Indonesian government, carried out a survey of site conditions, and gathered necessary information and data for formulating a basic design for the envisioned Project. A basic design strategy was subsequently formulated based on the results of site survey, and the Study Team was again dispatched to Indonesia from December 9 to December 19, 2006 to brief key officials of the Indonesian government on the components of the Project basic design. On that basis, this Report was subsequently prepared.

3. Overview of Study findings and Project components

3.1 Study on appropriateness of requested facilities/equipment, and approach to cooperation

Requested Project components include (i) a fish landing and handling function, (ii) a boat re-supply function, and (iii) a port operation and related information management function. Accordingly, the Project will entail the construction of necessary facilities and the provision of necessary equipment to effectively enable these functions. The appropriateness of requested facilities and equipment, as well as the most effective approach to cooperation are described in the following table.

Requested component	Result of study on appropriateness and approach to cooperation
Fish landing and handling function	At present, there are no public fishing port facilities in Larantuka Sub-district. Coastal topography is shallow bottom extending far offshore. Fishing catches are landed by hand. Middlemen negotiate individually with each fishing boat, and fish purchase prices are not uniform. This is a source of discontent and distrust on the part of the fishermen with regard to fish transactions. Local fishermen strongly desire catch landing and fish handling facilities, and these facilities are essential in modernizing fishing operations in the area, enhancing fishermen awareness of the potential of their profession, and upgrading living standards in coastal fishing communities.
・Landing jetty	Because the Project site comprises landfill located on a coastline where a shallow bottom extends far offshore, catch landing presently at the site is not possible during low tide. Accordingly, a catch landing structure extending offshore to deep water is necessary.
・Access bridge	An access bridge is essential to connect the onshore site to the offshore landing jetty.
・Landing wharf for small fishing boats	Because of the shallow draft of small fishing boats, it is possible to berth adjacent to shore during high tide. Accordingly, a revetment as the seaward side of the site that also enables small boats to land their catches would be the most cost effective means of accommodating such small craft.
・Fish handling shed	A fish handling shed is essential to enable the display of landed catches at a single location, where fishermen can then negotiate with middlemen for a uniform and fair purchase price for their catches. Construction of a fish handling shed (which emphasizes sanitation as well) is thus deemed appropriate.
Vessel resupply function	After landing their catches, fishing boats carry out necessary resupply of ice, fuel, water, food, etc. for the next fishing operation. At present, fishermen must obtain such provisions at scattered locations. This is time consuming and costly (ice costs twice that produced at an ice plant; and fuel is 10% more expensive than the officially set price). To address this issue, an ice making and storage facility, a fuel storage and supply shed, a water storage and supply shed and a kiosk (selling various sundries) have been requested. If these are constructed under the Project, fishermen will be able to more cheaply re-supply their boats at a single location.
・Ice making and storage plant	There is ice demand in Larantuka for both fishing operations and fish marketing. Because there is a shortage of ice during the peak season from October to November, an ice making plant is essential. Also, because demand drops during the full moon period, an ice storage facility is necessary to store surplus ice at such time. Because the existing ice factory in Larantuka responds to ice demand for fish marketing outside the area, the ice making plant under the Project will serve primarily to supply ice for fishing operations. Ice supply pertaining to marketing should be limited to only enough ice for temporary fish storage at the port prior to produce being moved off-premises for distribution.
・Fueling shed storage and supply facility	Almost all fishing boats are powered by diesel engines. Accordingly, a fueling facility is essential. The facility will be designed to fuel fishing boat using the Project port. Because fuel will be supplied by PERTAMINA (government oil corporation) on a regular basis, a fuel storage tank is also necessary. The main type of fuel to be handled by the facility is diesel. However, it will also be designed to handle kerosene for lamps used during night fishing operations, as well as lubricating oil for boat operation and maintenance.
・Fresh water storage and supply facility	Prior to setting out on fishing operations, boats take on board fresh water for drinking and food preparation. Large volumes of fresh water will also be consumed for short periods in the course of ice making and port compound cleaning works. Although there is water supply available from the Larantuka city water system, water pressure

	is low making it difficult to obtain a large amount of fresh water in a short period of time. Accordingly, a water supply facility equipped with a storage tank is essential under the Project.
・Slipway	Because there are a number of small workshops (plus a well equipped workshop operated by a church) located within Larantuka city that deal with automotive and machine repair, engine maintenance and propeller shaft machining, etc. can be adequately carried out by these existing workshops. On the other hand, boats registered to Amagarapati moor offshore the planned Project site (landfill) and carry out daily repairs and maintenance onshore during low tide. However, when landfill construction works are completed, such repair works will no longer be possible. Accordingly, construction of a slipway to enable routine maintenance of fishing boat hulls, etc. is appropriate.
・Workshop	Numerous auto repair workshops are located in Larantuka city that can handle engine and other mechanical problems. Accordingly, the workshop within the port compound under the Project will focus primarily on small boat hull and rigging repair works, as well as repair and maintenance works directly related to port facilities and equipment.
・Kiosk (Combined with administration building)	During fishing operations, fishermen eat and smoke on board. They also carry out emergency fishing gear repairs that may be required in the course of ongoing fishing operations. Accordingly, the capacity to supply related consumables and sundries to boats after they have landed their catches will upgrade the efficiency of boat refitting compared to the present situation. A kiosk stocked with such items is accordingly deemed appropriate. It is planned that the kiosk would be operated by the fishermen's cooperative (as is also planned in the case of refueling and water supply servicing). Accordingly, it is necessary that the kiosk be designed with an adjacent simple office and meeting room for cooperative use.
Operation and information management function	This is the core function in terms of Project operation.
・Administration building	There is a high possibility that the port operational format under the Project will be in the form of a public corporation. Although this enables more flexibility in terms of financial and personnel management compared to direct management by the district government; conversely, it entails a greater degree of accountability on the part of the port authority organization. A port management office facility is accordingly essential to enable effective supervisory and coordinating works by the port chief, general administrative duties including accounting, etc., managing the storage of materials as well as the convening of regular meetings by the port operation and management committee. To enhance efficiency of information exchange and work processing, the port operations office is to be housed within the same structure as the kiosk. Also, contained within the additional request form the Indonesian side, it is necessary that the following also be included under Project cooperation: **Technical training in facility management** There are currently no personnel at the district government level with either training or practical experience in fishing port operation. Furthermore, there are no relevant training courses available in Indonesia in this regard. Accordingly, it is necessary to include minimal port operation training as a soft component under the Project.
Other	These are components additionally necessary to enable effective fishing port functions.
・Retaining walls	The site comprises a landfill area constructed by the Indonesian side, with an outer wall of stone masonry. This structure is too fragile as a shore protection revetment facing on the ocean. (At the revetment for Oeba fishing port in Kupang, Timor Island. This revetment was completed 2 years ago using the same type of stone masonry design.) To ensure the long term safety of Project facilities, revetment reinforcement works are necessary.
・On-premise roads and parking lot	On-premise roads and parking area are necessary along the operational flow lines for persons and vehicles using the port facilities, and the movement of fish and material within the port compound. Also, drainage channels will be necessary on the site to discharge runoff from the hinterland slopes during heavy downpours. At such times, this runoff flows across the main road in front of the site and enters the envisioned port compound area.
・Outdoor drying yard	Sardines comprise the bulk of catches by round-haul netting. At present, catches are observed being sun-dried on roadtops in the area. Accordingly, an available space in one corner of the port compound will be set aside as an outdoor drying yard. The racks for outdoor drying contained in the Project request can be easily fabricated by the fishermen themselves at the port workshop. Accordingly, such racks are outside the scope of equipment provision under the Project.

・Wastewater treatment facility	Numerous persons will be using the port each day, and its lavatory facilities, in addition to the fact that large amounts of raw and effluent waste will be produced in the course of port operations. Because the site is in an urban area adjacent to local residences, wastewater will be subject to appropriate treatment. Accordingly, a simple water treatment facility is necessary. For sanitation purposes, it will be necessary to construct adequate lavatory facilities within the port compound, as well as a garbage disposal area.
・Power supply facility	Power for use within the port compound can be supplied by the local power utility. However, a power run-in transformer and distribution panel, etc. will be necessary. Because water supply from the city system as well represents an external source, a storage capability is necessary, and this can be constructed in the most cost-efficient manner by integrating it with the water supply facility.
Equipment	Equipment details are unclear as contained within the original request (generator, fire extinguishing equipment, etc.). During the Basic Design Study field survey, additional request was made for support equipment for catch landing and fish handling, equipment for facility operation and maintenance, as well as equipment for data processing. There is power available from the Larantuka grid; however, blackouts of 1~2 hour duration are frequent. Accordingly, an emergency generator is necessary for backup to operate the ice storage freezer and lighting at core port facilities. The emergency generator will be incorporated as one component of the ice making and storage facility plan. Once operational startup for Project facilities begins, works including transport of large amounts of fish catch and re-supply materials, catch weighing, storage, facility and boat maintenance/repair, and general office administrative tasks will be necessary. It will be impossible for all of these works to be carried out manually. Accordingly, support equipment will be required. In particular, fire-extinguishing equipment will be essential given the large amounts of flammable fuel that will be handled within the port compound. Furthermore, computer equipment for processing catch landing, transaction and accounting data will also be necessary. However, because computer equipment falls into the category of office equipment, this is to be provided by the Indonesian side. Also, selection of maintenance/repair equipment is to take into consideration local procurement for replacement when the utility life of such items has expired.

On the basis of the above, the scope of cooperation under the Project for facilities, equipment and technical support to Amagarapati in Larantuka Sub-district is summarized as follows:

a) Civil works: Landing jetty, access bridge, landing wharf for small fishing boats, slipway, retaining walls, on-premise roads and parking lot, drainage channel,

b) Buildings: Administration building / kiosk, fish handling shed, ice making and storage plant, fueling shed, workshop, electric power supply and water supply shed, security guard house, public lavatory, simple wastewater treatment facility,

c) Equipment: Support equipment for catch landing and fish handling, equipment for facility operation and maintenance, and equipment for on-premise safety

3.3 Basic design

(1) Design approach

Facilities to be established under the Project are in line with the following basic approach.

1) Common criteria

a) The following basic criteria are applied for Project facilities, which will be a base for area fishing operations:
- Easy access to landing facilities that are not affected by tidal levels.
- Integrated re-supply servicing that reduces fishing overhead cost.
- Fish handling facilities that facilitate the out-shipping of fresh fish and promote fair and uniform transactions between fishermen and middlemen

b) Because the port facilities under the Project are aimed at small fishermen and middlemen, transport of produce within the port compound is designed to be performed either by hand or by pushcart.

c) Project scale is based on 2004 data that can identify catch volumes by type of fishing boat in Larantuka Sub-district.

d) Because most of the targeted fishing boats are relatively small, port facilities are designed for safe and efficient berthing regardless of fluctuations in tidal levels.

e) The site is newly created landfill that does not offer a sound foundation. Accordingly, foundation design for onshore structures will emphasize preventing uneven settlement.

f) Downpours where daily rainfall exceeds 200 mm have been recorded. Accordingly on-premise layout and facility design will take this into consideration. Also, because the hinterland slope is steep, it is anticipated that rain runoff will flow across the main road surface in front of the site and enter the compound. Accordingly, a site gradient is needed that ensures efficient drainage of rainfall runoff.

g) Because the site is located within an area of frequent seismic activity, structure design must take into consideration an appropriate amount of resistance to horizontal stress.

h) Maximum wind speed, air temperature and other meteorological factors prevailing in Larantuka Sub-district are reflected in design criteria. Offshore facility layout and design are likewise to reflect prevailing wind and sea current directions. Furthermore, materials and equipment for outfitting buildings will incorporate salt resistant specifications.

2) Natural conditions

a) Design tidal level

Design water level at the site is set at the reference level for the adjacent Larantuka commercial port. Tidal level conditions based on harmonic analysis over a 15 day continuous observation period are (i) approx. highest high water level (H.H.W.L) + 3.02 m (ii) approx. lowest low water level (L.L.W.L) + 0.23 m

b) Design wave height

Design wave height at the site is calculated by the S.M.B. based on wind speed and fetch.

・Wind speed: Based on wind speed data at Larantuka airport near the Project site

・Fetch: Based on topography for Flores Strait, a maximum distance in the. 213° direction is adopted.

c) Soil conditions

It necessary that the design location of the landing jetty be in deeper water (around 10.0 m) compared to the originally planned water depth of 2.0m~-3.0m. Accordingly, soil conditions based on the results of test boring in the recommended vicinity are adopted.

d) Design earthquake

Design seismic activity at the Project site is derived from the tabulated correlation between seismic zone category based on seismic standards issued by the Indonesian government and corresponding earthquake strength. A seismic force of 0.17 for seismic category 4 was adopted as a design criterion under the Project.

3) Socio-economic strategy

Based on specifics of socio-economic conditions within the Project area, planning takes into consideration the following:

・Consideration is given to local custom with regard to architectural design.

・Facility design, construction method and layout is to be such that impacts to the surrounding area are minimized.

・Because the site is located in urban area, a fixed distance is to be achieved between neighboring residences and port facilities that house dangerous materials, as well as road alignments within the port compound.

・Ice production scale is to be such that it does not compromise the current operating rate of existing ice making plants.

・Garbage and sewage disposal on site is to emphasize waste separation, in order to mitigate negative impacts to the surrounding environment.

4) Strategy with regard to construction, procurement, and local commercial practices

・Building materials are to be consistent with generally adopted methods of construction.

・Both durability and facilitated maintenance are applied as criteria to structure design.

・Basic infrastructure:

Electricity, water and phone service are to be provided by public utilities (PLN, PDAM, TELECOM). Run-in to the Project site in the case of these utilities will depend on application to and approval by the relevant agencies.

・The fuel supply facility design is to be reviewed and inspected upon completion by PERTAMINA.

5) Strategy with regard to operation and maintenance capacity by the Executing Agency

Soft components pertaining to port operation and management will be carried out.

It is further recommended that the district government allocate port operation funding in the first year of port facility operational startup.

6) Facility and equipment design

Facility and equipment design level is to be such that local maintenance is possible. Emphasis is placed on minimal operation and maintenance cost.

7) Construction method, procurement and implementation period

In line with local specifications and construction methods, as well as the need for a minimal construction period, an RC framework is to be adopted using concrete aggregate and bricks that can be procured locally (building walls are to be brick masonry).

At the same time, roof framing is to be factory manufactured in Surabaya, etc. to shorten the construction period and upgrade quality.

8) Contamination of surrounding environment

The drainage channel outfalling to the sea at the western edge of the site has devolved into a backed up trap for waste.

Also, hogs are being raised at the outside of the jetty at the eastern edge of the site. Coli bacillus concentration in water is slightly high at 1000 / 100 ml. Is accordingly necessary under the project to enhance local residence awareness regarding sanitary measures, as well as formulate a specific garbage disposal strategy.

9) Construction permit application

Prior to construction, it is necessary to obtain construction permits from the district government.

① Surrounding area development; urban development

This is based on the construction policy for site surrounding area as confirmed by the district government.

② Application for construction permits

The applying agent prepares project overview documents and plan designs, and then obtains approval from local area and Larantuka representatives. Next, the district planning agency (BAPPEDA) reviews the project content, and the district public works office then carries out a technical evaluation.

③ Fueling facility

Application to PERTAMINA, and a final inspection from the same after completion of facility construction is necessary. General inspection criteria include an assessment of : (i) safe distance from adjacent structures (at least 10 m), (ii) preventive measures for leakage, (iii) tank safety, (iv) fire extinguishing equipment, and (v) overall operational parameters.

(2) Design criteria

Project facility planning is based on the following design criteria.

1) Design seismic factor

Larantuka is located within Zone-4 under the Indonesian earthquake categorization. This zone has a seismic factor stipulated as 0.17. In structural planning under the Project , 0.17 is applied for seismic force.

2) Wind load

The maximum observed wind speed calculated in seconds at the Larantuka airport weather station is 15 m/s.

Confirmed return period wind speed is 19.454 m/s. Accordingly, a wind speed of 20 m/s for design wind load is adopted.

3) Design criteria

- ☐ Construction equipment and material: Local general material criteria, local design criteria and Japanese standards in this regard are applied.
- ☐ Structural design: Seismic intensity based on seismic zone, building critical and height coefficients are to be in line with Indonesian standards. However, stress analysis is based on Japanese methodology.
- ☐ Facility criteria: Design criteria for similar facilities in Japan, as well as internationally accepted criteria, are applied.
- ☐ Floor space criteria: Reference is made to the Architectural Institute of Japan (architectural design guidelines) as well as floor space in local public facilities. Room dimensions are designed on the basis of design room activity, available lateral and longitudinal space, as well as room shape.

(3) Basic plan

1) Civil works and buildings

Basic approach and overview of civil works and buildings as planned under the Project are described in the table below.

Basic approach to facility layout

①Overall layout	・The access jetty connecting with the landing jetting is aligned at the southwest side of the site in consideration of the dominant tidal flow direction. Accordingly, layout of onshore facilities assumes a basic operation flow starting from this access jetty. ・Facility positioning toward the site road side allows a set distance, taking into consideration both discharge of runoff during heavy downpour as well as intentions by the district government with regard to basic infrastructure outside the port compound. ・Fueling facility fronts on the main axis work-flow line, and at the same time is located at a safe distance from adjacent residents.
②Berthing facility layout and scale	The landing jetty is to be aligned in the direction of the dominant tidal flow which is to the northeast. Final jetty design positioning will be based on necessary facility scale as well as other factors including the boat manoeuvring space needed at the jetty, boat utilization time, work rate, etc. a) Maneuvring space To ensure safe boat navigation during low tide, it is necessary to ensure adequate space at the landing jetty. Maneuvring radius for target boats under the Project is 30.0 m ([boat length 15.0] × 2) b) Utilization time of berthing facilities Boat berthing and catch landing is to be possible both during high tide at the landing jetty (crest height +3.5m) and at the landing quay for small boats. At low tide, mooring and catch landing is also to be possible for fishing vessels other than non-motorized boats (crest height +1.8 m). By effectively separating use of the main landing jetty and the landing quay for small boats, it is possible to enable catch landing regardless of tide level. c) Operational rate for berthing facilities (landing jetty): Occurrence rate for waves in excess of 30 cm at the site is 5.2%. On this basis, the operational rate for the landing jetty is assumed at 94.8%. d) Required scale: Based on fishing operations by the targeted boats that will use the port, landing jetty scale is calculated at 154~173 m. Because both sides of the jetty can be used, required berthing length is calculated at a minimum of 140 m ([front side 60 m] [back side 60 m] ＋ [front edge end 10 m] ＋ [back edge end 10 m]. Fishing boats will accommodate each other for any lacking berth space by mutual maneuvering. On the other hand, the required scale for the landing quay for small fishing boats is initially calculated at 62~83 m. However, considering the mooring space for fishing vessels registered to Amagarapati, this is considered inadequate, and instead the landing quay for small boats is planned at around 100 m.

Overview and scale of civil structures and buildings

	Facility name	Structure	Description	Scale
Civil works	・Landing jetty	Steel pipe piles; RC jetty;two portion landing stairway	Fishing boat mooring, catch landing, re-supply service.	Width 10m, Length 60m
	・Access bridge (partial causeway)	Steel pipe piles; one side of causeway is RC stair	Connection between landing jetty and shore.	Width 5.6m, Length 150m
	・Small fishing boat landing quay	RC step type	Step-type landing walf for small fishing boats.	Length 60m
	・Slipway	RC slope; shelling material	Slipway for overhead repair of small fishing boats.	Width 15m, Length 60m
	・On-premise road parking area	Interlocking block; RC surface to the seaward	On-premise roadway and parking area for vehicles and pushcarts.	Width 6m
	・On-premise rain drainage channel	RC “U” shaped channel; one portion grating	Drainage channel for rain runoff within the port compound.	—
	・Safety lighting for landing jetty	Solar type; 2 installations on jetty	Marker lamps to prevent boat berthing accidents.	2 locations
	・Other (reinforcement of existing revetment)	RC “L” shaped revetment	Reinforcement of coastal revetment and drainage canal constructed by the Indonesian side.	Two locations: site southwest and site northeast
Buildings and other facilities	・Fish handling shed	Pile foundation; RC frame structure; steel frame housing; metal roofing	Fish handling and transactions for landed catches.	226.8m^2
	・Ice making and storage plant	RC base foundation; RC frame structure; partial RC roofing; asphalt waterproofing	Ice making for fishing operations; Ice making equipment: 2 units x 2.5 tons; Ice storage: approx. 35 tons.	256.0m^2
	・Administrative building / kiosk	RC base foundation; RC frame structure; steel framework shed abutment; metal roofing	Fishermen’s cooperative facility for managing a portion of port operations as well as re-supply service.	247.5m^2
	・Fueling shed ・Appurtenant facilities: Fuel storage tank, drum storage area, fire-extinguishing equipment storage	RC base foundation; RC frame structure; steel framework shed abutment; Appurtenant facilities: diesel tank (10 KL); tank platform foundation; oil spillage prevention wall	Management of storage and sale of diesel fuel, kerosene and lubricating oil for fishing operations. Appurtenant facilities necessary for fuel storage and boat fueling.	45.4m^2 —
	・Workshop	RC base foundation; RC frame structure; steel frame housing; metal roofing	Minor repair works for small fishing boats; and repair of port facilities and equipment; work area for other fishing related fabrication and repair tasks.	45.4m^2
	・Electricity supply / water supply shed (overhead water tank)	RC base foundation; RC frame structure; metal roofing Overhead water tank:	Fresh water supply within the port compound; receiving tank (12 tons); elevated tank (4 tons) Electrical supply to port facilities: 220//380V, 50Hz, 100KVA capacity	73.7m^2
	・Lavatory	RC base foundation; RC frame structure; steel frame housing; metal roofing	Lavatory for fishermen and middlemen using the port facilities. Two lavatories stalls apiece for male and female, with appurtenant washing sink.	18.2m^2
	・Security guard house	Same as above	To prevent unauthorized entry to the port compound (entrance fee required), and enable safety patrol within the compound.	9.0m^2
	・Simple wastewater treatment facility	RC underground tank: 3 tank structure	Processing of wastewater generated within the port compound. (Rainwater drainage is by a different system)	37.5m^2
	・Garbage disposal site	RC slab on grade, brick walling, no roof	For disposal of fish refuse and other solid waste generated within the port compound.	17.9m^2
	・Well	Shallow well equipped with approx. 0.5 kW pump and appurtenant piping	For cleaning operations within the premises and watering on-premise greenery.	Shallow Well
	・Water tank for fire fighting	RC underground tank	5 ton capacity for fire-fighting on premise.	Approx. 5 tons
	・Emergency generator	20 KVA diesel generator to be located within the ice making plant	For backup power during blackouts. Supply range: ice storage freezer, lighting within the ice making plant, etc.	20 KVA
	・Outdoor facilities	6 outdoor lights on shore within the premises, and 2 jetty lights	Outdoor lighting, outdoor water spigots, on-premise electric conduits, water supply and drainage piping.	—

2) Equipment plan

Equipment to be provided under the Project is that which can be effectively utilized within the site, including support equipment for fish landing, fish handling, as well as for facility operation, maintenance and safety. A list of main equipment in this regard is shown below.

List of main equipment

Equipment	Application	Qt'y
Support equipment for fish landing and handling		
Push cart	For transporting fish catches from the landing jetty to the fish handling shed	4
Fish box	For removing fish catches from the boat hold	20
Bucket	For carrying catches, and displaying fish at the fish handling shed for transaction with middlemen	392
Drum carrier	For transporting diesel fuel to berthed fishing boats	2
Hand pump	For measuring fuel supply from fuel drums	2
Platform scale (100 kg class)	For weighing large quantities of fish at the fish handling shed	2
Balance scale (30 kg class)	For weighing small quantities of fish at the fish handling shed	2
Insulated box for fish storage (type A)	For cold storage of fish catches	4
Insulated box for fish storage (type B)	Same as above	2
Operation and maintenance equipment for Project facilities		
Drill press	For facility operation and maintenance and fishing boat repairing	1
Engine welder	Same as above	1
Overhead movable crane	Same as above	1
Washing equipment	Same as above	1
Motorized compressor	Same as above	1
On-premise safety equipment		
Push cart mounted fire extinguisher	For emergency fire-fighting use	2
Small hand-held fire extinguisher	Same as above	6

3) Soft component plan

Manuals will be prepared for minimum necessary procedures with regard to port operation, including organizational management, facility management, accounting, etc. A consultant expert in fishermen's cooperative guidance and fishing port operation will be dispatched for one month at the three month point prior to scheduled completion of facility construction. This expert will provide guidance and instruction to Fishery Department personnel, centering primarily on the candidate for port chief.

4. Project implementation period and cost estimate

(1) Project implementation period

- Detailed design: 5 months
- Construction and equipment supply: 15 months

(2) Project cost estimate

1.071 billion yen (portion borne by the Japanese side = 1.049 billion yen; portion borne by the Indonesian side = 22 million yen)

5. Verifying appropriateness of the Project

(1) Impacts anticipated by implementing the Project

Impacts anticipated as a result of implementing the Project are indicated below.

Project impacts

Current status and problem points	Target under the cooperation project	Direct impacts	Indirect impacts
The Project site is located in Larantuka sub-district within East Flores district, a major base for fish landing and marketing. However, public fishery facilities are completely lacking. Topographically, the coastal area comprises extended shallow water to the seaward during low tide, and as a result local fishermen spend an excessive amount of time and labor landing fish during low tide. Also, because catch landing locations are scattered at various points along the coast, both ice and fuel prices are high. Conversely, because the landing location and landing time varies, middlemen lose time while waiting for a catch to be ready for transaction. The existing fishermen's cooperative and facility capability is limited, in turn constraining the level of service to local fishermen.	Catch landing, fish handling and resupply functions are established within the Amaragapati area of Larantuka Sub-district. Number of serviced fishing boats will be 149 (total of 780 fishermen).	①The landing time for round-haul netters, which accounts for the bulk of landed catch, will be reduced by one hour. ②Lack of ice available to boats during the peak season will be alleviated. ③Ice purchase price for small fishing boats will be more than halved (price per 25kg ice block will drop from around RP 20,000 to RP 8,000). ④Purchase price for boat diesel fuel will become about 10% cheaper (fuel price will drop from RP 5,000/L to RP 4,500/L). ⑤Purchasing time required by middlemen will be halved (from 2~3 hours to 1~2 hours). ⑥Fish handling will be uniformly carried out in a sanitary manner at the fish handling shed. ⑦It will be possible to temporarily store excess landed catch during the peak season (approx. 1 ton per day). ⑧It will be possible to collaborate with the existing fishermen's cooperative in certain aspects of port operation.	①The Project port facilities will become a center for catch landing on Flores island. As this becomes widely recognized by both fishermen and middlemen, quantity of transacted fish will steadily increase, and a stable supply of fish to the surrounding area will be established. ②Location of fish transaction will be centralized, enabling local fishermen to better understand prevailing prices. ③Because the local fishermen's cooperative will participate in port operation, fishermen in the area will acquire a better understanding of the benefits of cooperative organization. ④Availability of ice in the area would promote frequent use in fishing operation; fish freshness will be maintained. Thereby, consumers have access to fresh fish.
Staff of the district Fisheries Department lack experience in fishing port operation.	Minimally essential operational rules etc. for fishing port startup are to be drafted as part of technology transfer training with regard to soft components.	Port chief and staff of the district Fisheries Department will gain knowledge regarding initial management of fishing port startup.	Operational methods for the Project port will serve as a model for the management of other local small fishing ports, thereby promoting generally improved facility construction and operation.

(2) Appropriateness of the Project

By constructing and equipping fishing port facilities, the Project aims to enhance the standard of living of fishermen in the area, particularly low income coastal fishermen. The Project site is located within NTT Province, which is the most economically backward province in Indonesia. The Project is consistent with the Indonesian government's program to eradicate poverty as set out in its mid-term development strategy. Assessment of Project appropriateness for inclusion within the Japanese grant-aid program is described in the following table.

Assessment of Project appropriateness for cooperation

Indicators in assessing Project appropriateness	Project consistency with regard to indicators
①Targeted beneficiaries: General populace including impoverished segment of society. Number of beneficiaries is large.	Port beneficiaries: Targeted 149 boats (approx. 780 fishermen. Beneficiaries in surrounding area: Population of Larantuka Sub-district (approx. 35,000 persons). Indirect beneficiaries: Residents of East Flores District who have enhanced access to fish supply (400,000 persons).
②Project objective: Consistency from the standpoint of ensuring welfare and safety of the populace. High degree of urgency with regard to stabilizing and upgrading standards of living.	Economic performance of NTT Province (within which the Project site is located) is on average only about one-third that of other provinces in Indonesia. Furthermore, this gap in development is widening. Accordingly, the Project exhibits high priority.
③Operation and maintenance capability: In principle, independence in terms of operation and maintenance capital, personnel and technology is possible. Project operation/maintenance does not require an excessively sophisticated amount of technical input.	The envisioned fishing port facilities do not require an excessively high degree of technical input for operation and maintenance. Approx. 10% of the district's development budget will be required at the time of port facility operational startup. However, this will be necessary only in the first year. Although the district does not currently have personnel experienced in fishing port management, it will be possible to transfer minimally required technology in this regard by dispatching short-term experts.
④Consistency with national development policies	Project objectives are consistent with national development strategy with regard to eradicating poverty, developing coastal areas, assisting coastal fishing communities, building fishery infrastructure, etc.
⑤High rate of return	Rate of return is not high given the fact that major equipment under the Project will have to be replaced within about a five year period.
⑥Social and environmental aspects: Negative impacts, if any, can be readily addressed.	The district government has met repeatedly with local residents concerning land acquisition for the Project, and agreement has been reached with regard to compensation. At present, the only remaining issue is that a groundbreaking ceremony in keeping with local tradition be carried out prior to the start of construction.
⑦Constraints in terms of the Japanese grant-aid system Specifically, the Project is not excessively difficult to implement.	No specific constraints in this regard in the case of the Project.

As shown in the above table, the Project is both necessary and urgent. Also, the Project can be expected to have a significant impact as a key base for fishing operations within the region. Accordingly, it is assessed that the Project is appropriate for inclusion under Japan's grant aid assistance program.

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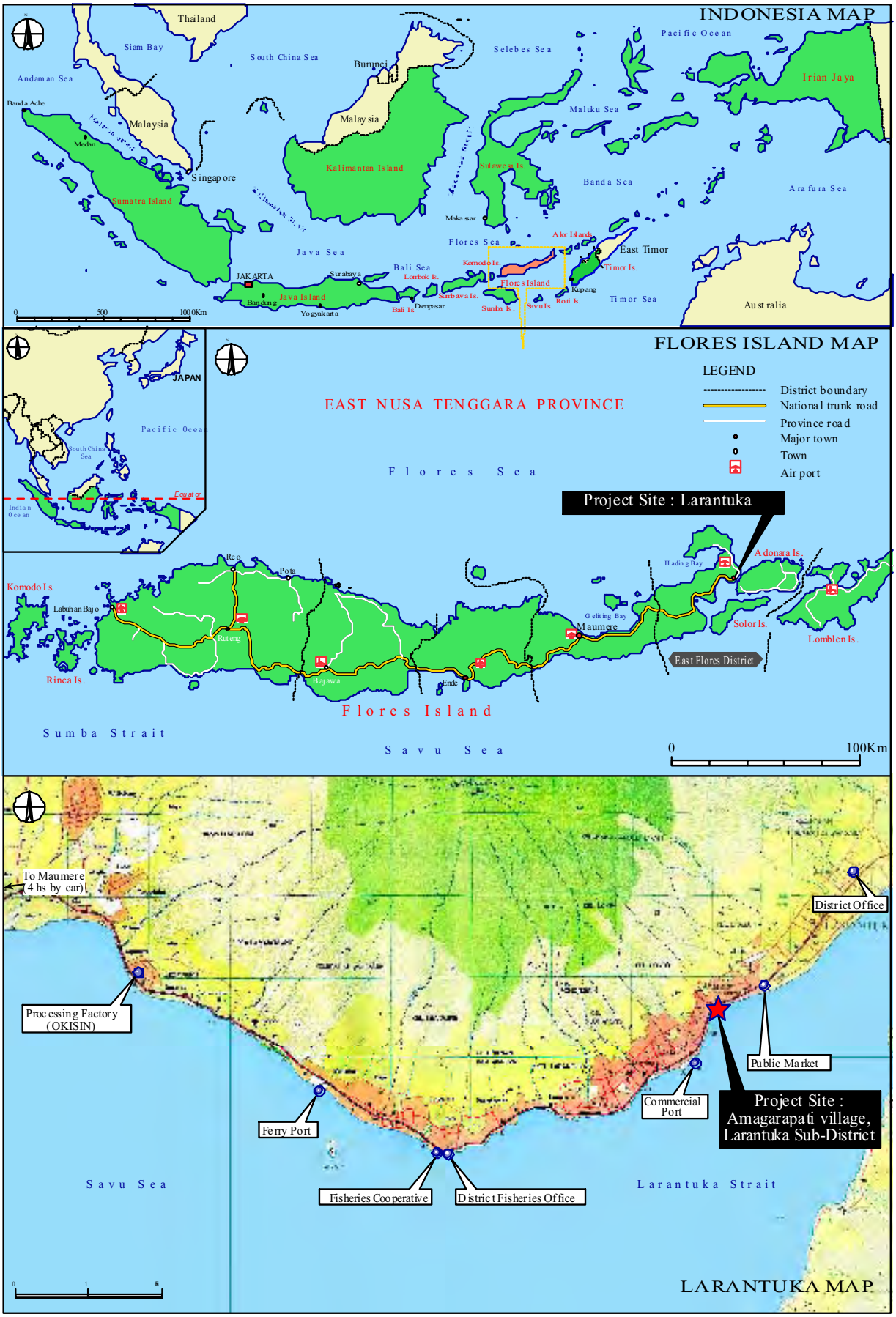

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Abbreviations

A/P	Authorization to Pay
B/A	Banking Arrangement
E/N	Exchange of Notes
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standard
Kab.	Kabupaten (administrative divisions under Province)
Kec.	Kecamatan (administrative divisions under District)
Kel.	Kelurahan (administrative divisions under Sub-district)
M/D	Minutes of Discussion
NTT	Nusa Tenggara Timur Province
NTB	Nusa Tenggara Barat Province
PQ	Pre-Qualification
The Master Plan	"The Study on Fisheries Infrastructure Support and Communities Development Plan in Eastern Indonesia", the master plan study, conducted by Japanese government in 2002

CHAPTER 1

BACKGROUND OF THE PROJECT

Chapter1 Background of the Project

1-1 Background and Overview of Request for Grant-aid Cooperation

In response to the situation of coastal community in eastern region of Indonesia, the Japanese government conducted a development study titled "Master Plan Study on Coastal Community Development in Eastern Region of Indonesia" during 2000~2002, aimed at improving the livelihood of small fishermen and establishing a stable supply of fishery products in NTT and NTB Provinces. This study comprised two components: (i) a master plan formulation for development of small scale fishery communities and (ii) subsequent feasibility study on selected priority areas.

Based on the result of this master plan study, the Indonesian government formulated a development plan for sustainable promotion of coastal fisheries in the target areas of Amagarapati, Larantuka Sub-district, East Flores District in NTT and Waworada, Bima District in NTB. These two areas are of highest priority as core bases for fishing and marketing among the selected priority areas, and technical and grant cooperation was subsequently requested to the Japanese government in 2004.

Project type technical cooperation was scheduled to start from 2006 for a three year period based on the results of the preparatory survey conducted by the Japanese government in May 2005 and October 2005. The Project aims at formulating a model to promote sustainable development in coastal fishing communities. It is planned to carry out activities to strengthen basic capabilities of fishermen, upgrade fishing technologies, and improve overall standards of living in coastal fishing communities.

On the other hand, with regard to the specific grant-aid cooperation for fishing infrastructure under the Project, the fact that (i) the appropriateness of the Project site as changed from the original request had not been thoroughly studied under the preparatory survey, (ii) full details of request content remained unclear, and (iii) there was a perceived need to narrow down the project components in light of an excessive requested Project cost; a preliminary survey was subsequently carried out in January 2006.

As a result, because material and equipment will be input to Waworada as a base for dispatched experts under the said technical cooperation, only Amagarapati will subsequently be targeted under the Project for construction of fishing port structures, ice production facility, etc. An overview of requested content confirmed based on the preliminary survey is as follows:

1) Civil works: Landing jetty, landing wharf for small fishing boats, slipway, access bridge, on-premise roads, parking area.
2) Buildings: Ice making and storage plant, fuel supply facility, fuelling shed, fresh water tank, water supply shed, workshop, wastewater processing facility, outdoor drying yard, kiosk (combined with administrative office).
3) Equipment: Generator, consumables, etc.

1-2 Natural Conditions

(1) Topography and geology

The Ili Mandiri Mountain with elevation of 1,501 meters and comprising hard rock is located immediately to the hinterland side behind the Project area. Several meter-class boulders that have rolled off the mountain are observed within the site.

Coastal gradient at the landfill site is an extremely gentle 1.0%. During low tide, shallows extend approximately 150 m offshore with some rock reefs exposed.

In terms of seabottom topography, water depth at proposed site for the fish landing wharf for small

boats is around +0.7 m ~ +1.0 m. At about 120~130 meters to the seaside from that point, water depth is -0.5 m and features an extremely gentle seabottom gradient of 1.0%. From that point on, the seabottom then drops off at a steep gradient of 5.0~10.0%.

Results of onshore test drilling at land side indicate a large content of very coarse gravel. N-values in excess of 50 were confirmed at a drilling depth of -5.0 m. Offshore drilling at the fish landing jetty site confirmed the presence of a layer of gravel mixed with silt extending from near the bottom surface. Specifically a part of offshore test drilling results, an underlayer of hard rock beneath the upper layer of gravel and silt was confirmed. Also, a hard coral layer over 150 cm thick and with an N-value of 50 is observed. Immediately below this layer a weak clayey gravel layer and a thin layer of weathered rock exist. N-values range 2~3 and 7~9 respectively, and this geology is believed to be the result of sediment intrusion in the past. Based on overall condition, this is estimated to be cap rock, and careful attention will accordingly be necessary in selecting the structure type for fish landig jetty.

(2) Meteorological conditions

1) Temperature (average, maximum, minimum)

Monthly mean temperatures observed at Larantuka airport over the period January 2003 to June 2006 are indicated in Table 1.2.1.

Table 1.2.1 Monthly mean temperatures

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual average
Average	28	27.5	27.9	28.1	28.1	27.3	27.4	26.8	28.2	29.0	29.8	28.7	28.1
Maximum	31.5	30.9	31.4	32.2	32.9	32.3	32.3	32	33	33.8	34	32.4	32.4
Minimum	24.4	24.1	24.1	23.8	23.4	22.6	22	21.1	22.4	23.6	24.9	24.5	23.4

Source: Based on observational data from Larantuka airport

2） Rainfall

Based on statistics for the period from January 2003 to June 2006, maximum daily rainfall was observed at 223.0 mm/day in April 2003. Total annual rainfall for that year was 1,451.3 mm/year. Also during the foregoing period, monthly mean cumulative rainfall was greatest in February at 374.4 mm/month. Annual mean rainfall for the observation period was 1,288.1 mm/year.

Table 1.2.2 Maximum daily rainfall and monthly mean rainfall

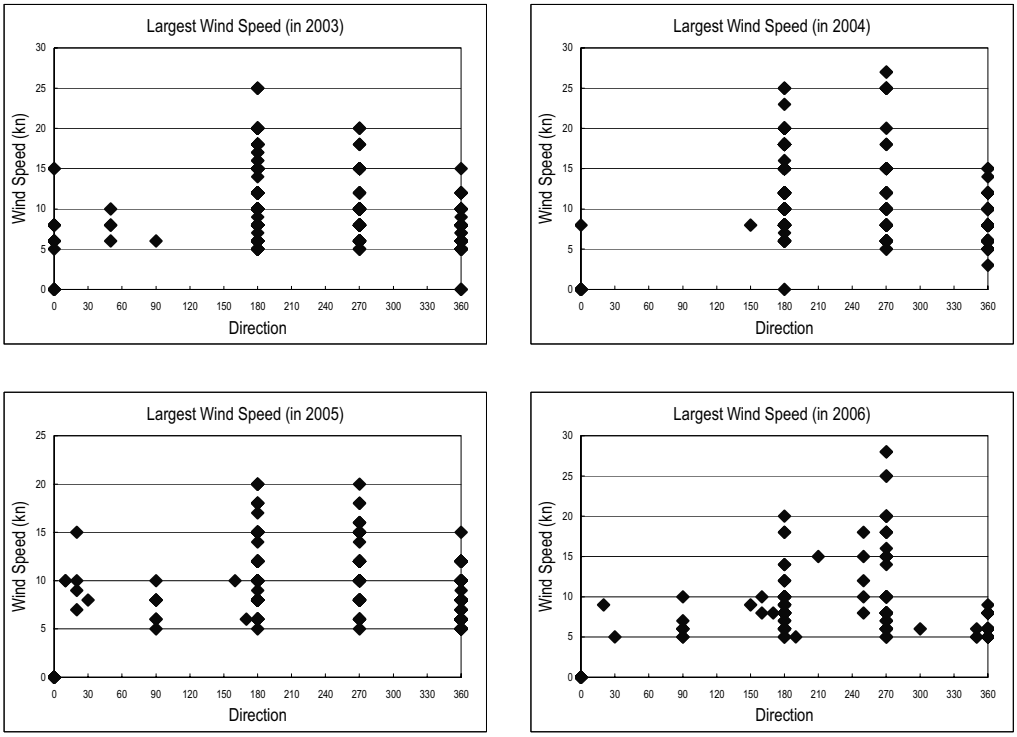
Month	1	2	3	4	5	6	7	8	9	10	11	12	Total
Cumulative total for monthly mean rainfall	188.6	273.4	374.4	174.8	160.6	26.4	11.5	0.0	10.1	0.0	27.7	40.7	1,288.1
Max. daily rainfall (mm)	81.9	102.4	144.9	150.4	223.0	51.2	23.7	0.0	20.2	0.0	59.7	43.0	-
Monthly mean rainfall (mm)	55.8	65.2	104.6	56.2	83.7	15.3	6.2	0.0	10.1	0.0	20.4	23.6	-
Rainy days (no. of days)	13.0	16.8	18.3	15.0	9.0	3.3	1.0	0.0	0.7	0.0	1.3	5.0	83.3

Source: Based on observational data from Larantuka airport

3) Wind conditions

Based on data collected at Larantuka airport for the past 42 months (January 2003 ~ June 2006), predominant wind direction is south to west. Maximum wind velocity is 28 knots (westerly

direction) occurring mainly in the period from January to March.



Source: Based on observation data from Larantuka airport.

Figure 1.2.1 Maximum wind velocity and direction

Table 1.2.3 Wind velocity and monthly occurrence

Month	Wind Speed(Kn)						Total
	0-4	5-9	10-14	15-19	20-24	25<	
January	6	64	27	21	4	2	124
February	4	71	14	16	4	4	113
March	7	78	23	9	1	6	124
April	6	98	14	2	0	0	120
May	5	77	33	9	0	0	124
June	1	56	25	36	2	0	120
July	2	28	27	25	10	1	93
August	0	49	33	7	3	1	93
September	1	42	26	15	5	1	90
October	1	43	27	16	3	3	93
November	3	58	18	11	0	0	90
December	5	66	17	5	0	0	93
Year	41	730	284	172	32	18	1277

Source: Based on observation data from Larantuka airport.

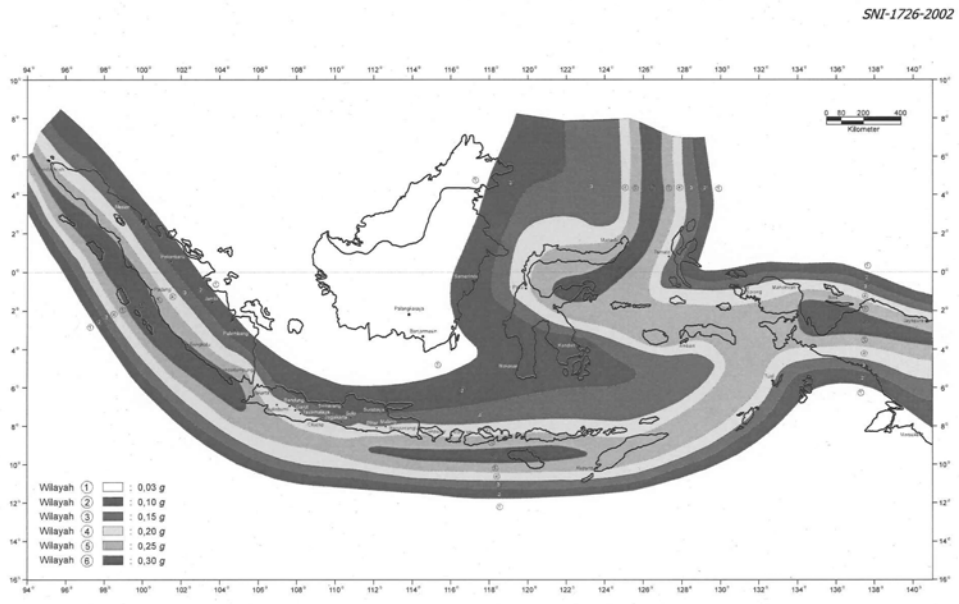
Table 1.2.4 Wind velocity and monthly frequency

Month	Wind Speed(Kn)						Total
	0-4	5-9	10-14	15-19	20-24	25<	
January	0.5%	5.0%	2.1%	1.6%	0.3%	0.2%	9.7%
February	0.3%	5.6%	1.1%	1.3%	0.3%	0.3%	8.8%
March	0.5%	6.1%	1.8%	0.7%	0.1%	0.5%	9.7%
April	0.5%	7.7%	1.1%	0.2%	0.0%	0.0%	9.4%
May	0.4%	6.0%	2.6%	0.7%	0.0%	0.0%	9.7%
June	0.1%	4.4%	2.0%	2.8%	0.2%	0.0%	9.4%
July	0.2%	2.2%	2.1%	2.0%	0.8%	0.1%	7.3%
August	0.0%	3.8%	2.6%	0.5%	0.2%	0.1%	7.3%
September	0.1%	3.3%	2.0%	1.2%	0.4%	0.1%	7.0%
October	0.1%	3.4%	2.1%	1.3%	0.2%	0.2%	7.3%
November	0.2%	4.5%	1.4%	0.9%	0.0%	0.0%	7.0%
December	0.4%	5.2%	1.3%	0.4%	0.0%	0.0%	7.3%
Year	3.2%	57.2%	22.2%	13.5%	2.5%	1.4%	100.0%

Source: Based on observation data from Larantuka airport.

4） Earthquakes

There have been numerous instances of earthquake damage in Indonesia in recent years. Particularly noteworthy among these have been the Sumatra offshore earthquake on December 26 2004, the Java island earthquake on May 27 2006, and the Jogjakarta earthquake in southern Java on July 17, 2006. On December 12, 1992 a magnitude M7.5 earthquake shook the northwest of Flores island, causing a tsunami that killed roughly 1,000 persons. Specifically in the Larantuka sub-district in eastern Flores, and surrounded by Solor island and Adonora island, damage from tsunami activity has not been observed. The Indonesian government has mapped zones of seismic activity within the country, and under its criteria (RSN14, Revisi SNI 03-1726-1989) for earthquakes, Larantuka sub-district on Flores island falls within seismic area Zone-4.



Gambar 2.1. Wilayah Gempa Indonesia dengan percepatan puncak batuan dasar dengan perioda ulang 500 tahun

Source: Standar Perencanaan Ketahanan Gempa Struktur Bangunan Gedung

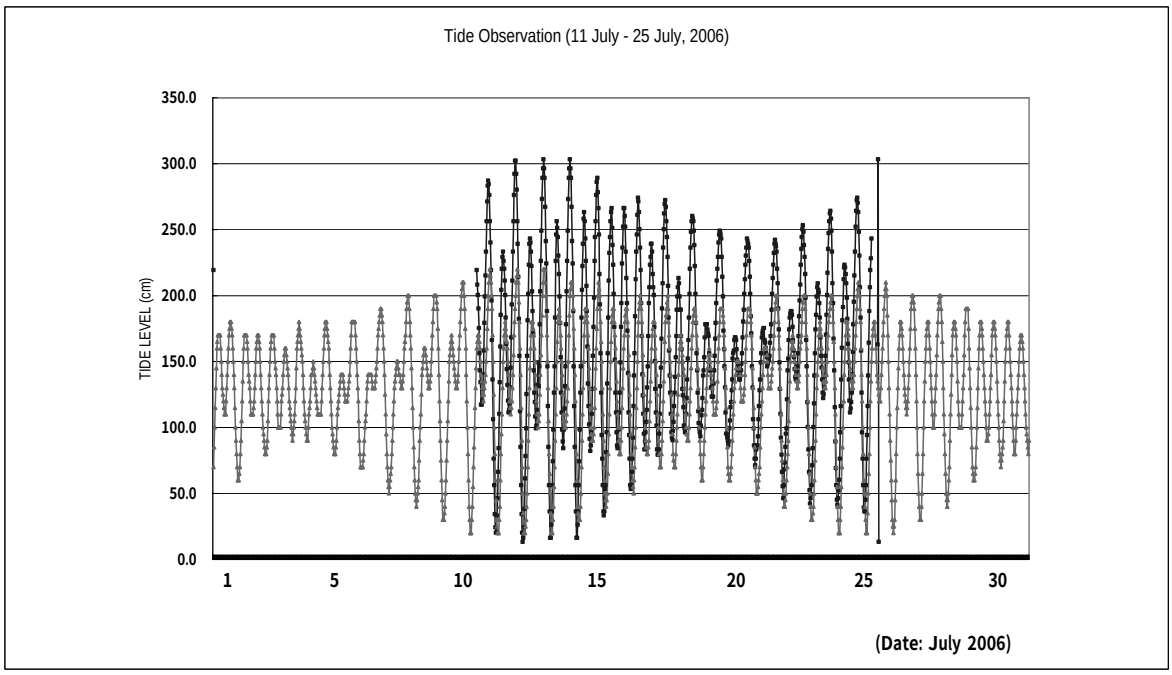
Figure 1.2.2 Seismic activity zoning in Indonesia

(3) Oceanography

1） Tides

In order to identify tidal level characteristics in and around the Project site, tidal level observations were carried out for a continuous 15 days period over the period July 11~25 2006 at the Larantuka

commercial harbour located approx. 500 m to the south of the Project site.



Note: Lighter line indicates tidal level (at Maumere)

Figure 1.2.3 Tidal level observation results

Amplitude and tide lag angle based on the results of tidal level observation are computed below with regard to main tides constants (M2: principal lunar semi-diurnal tide; S2: principal solar semi-diurnal tide; O1: principal lunar diurnal tide period, and K1: principal lunar diurnal tide period). The sum of the major tides constants (i.e. the average height [ZO] from the chart datum level is M2+S2+O1+K1 = 139.34 cm). Also, tidal type is (O1+K1) / (M2+S2) ＝0.366; and 0.25 ≦ (O1+K1) / (M2+S2)≦1.50. Accordingly, this is classified as a mixed tidal type.

Table 1.2.5 Principle diurnal tide (results of harmonic tidal analysis)

Harmonic constant	M2	S2	O1	K1
Amplitude (cm)	67.67	34.32	15.06	22.29
Tide lag (degrees)	296.3	353.33	277.29	278.36

Source: Results of harmonic tidal analysis survey

The following results are obtained from the calculated principle tides constants:

Highest High Water Level (H.H.W.L)	:	＋3.02 m
High Water Level (H.W.L)	:	＋2.65 m
Mean Sea Level (M.S.L)	:	＋1.63 m
Low Water Level (L.W.L)	:	＋0.61 m
Lowest Low Water Level (L.L.W.L)	:	＋0.23 m
Chart datum level (C.D.L)	:	＋0.00 m

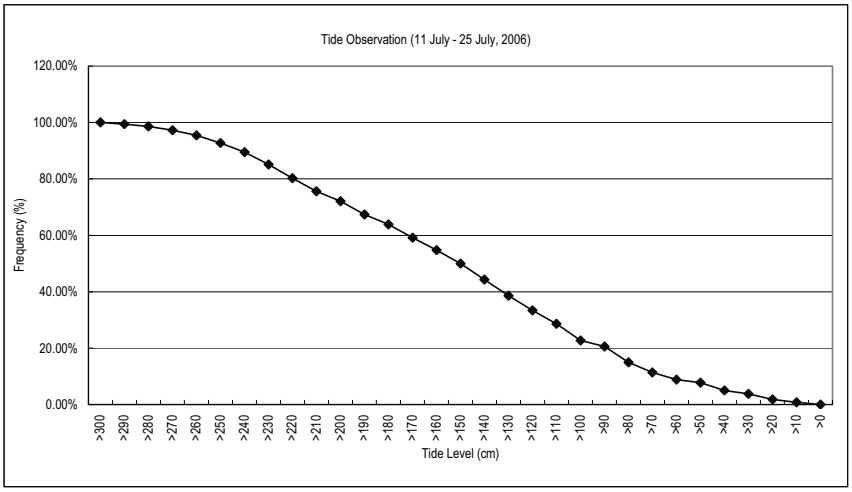


Figure 1.2.4 Tidal level occurrence

2) Wave height

Due to a lack of actual observational data for the sea area in the vicinity, wind velocity data logged at Larantuka airport was used. Gumbel and Weibull distributions were applied, and return period for wind velocity was calculated. On this basis, wave behaviour was calculated applying the S.M.B. method. However, despite the fact that Larantuka airport is near the Project site, wind direction and velocity are highly affected by island and mountain disposition. Also, because recorded wind velocity data is from a single direction, return period for maximum daily wind velocity from all directions was extrapolated as a basis for calculating the wave height and wave period for respective return periods. Accordingly, fetch distance was then calculated for the wind direction of 213 degrees which exhibits the longest fetch distance.

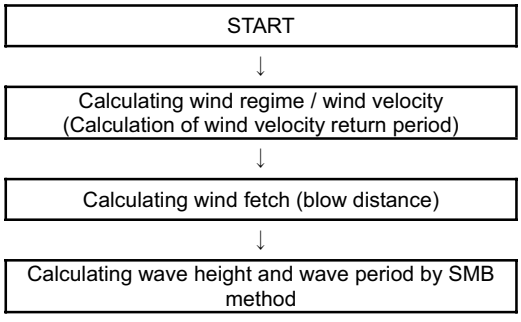


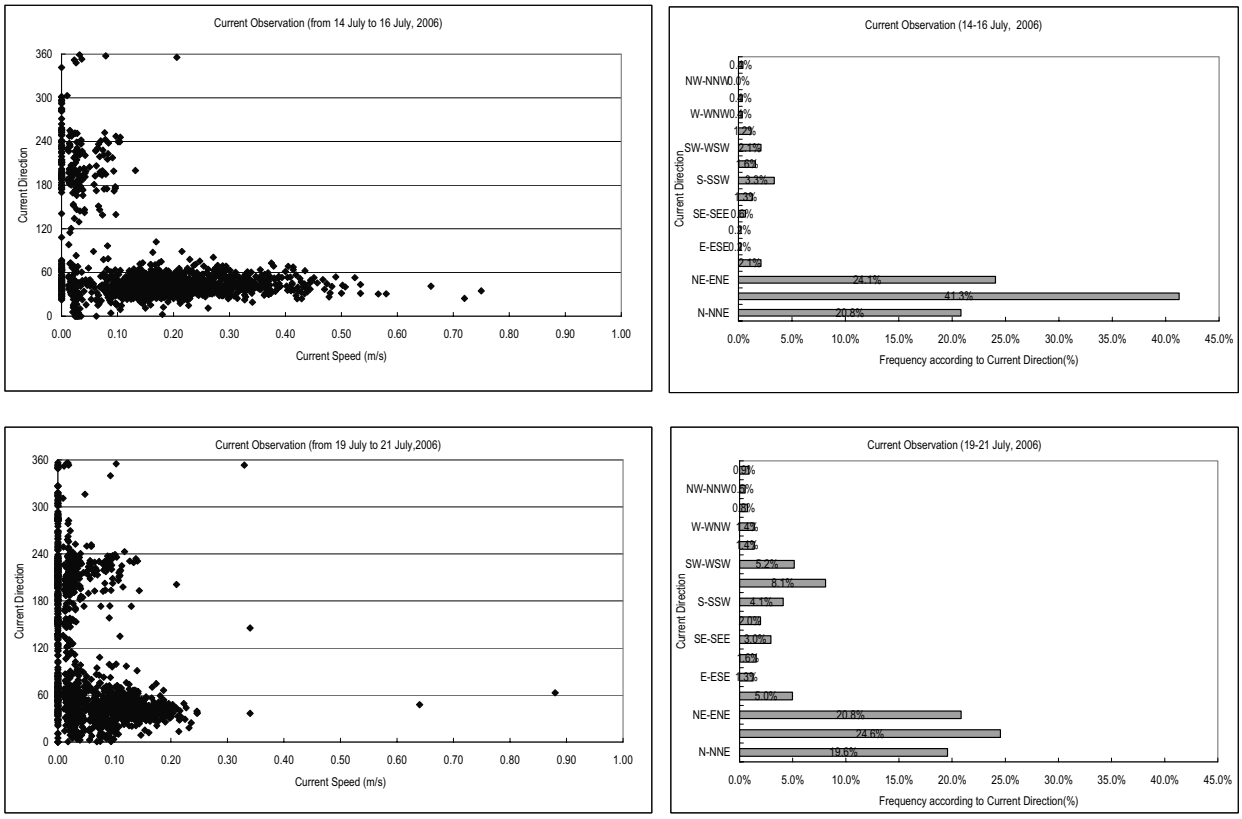
Figure 1.2.5 Flow chart for wave analysis

Table 1.2.6 Wave height and wave periods by SMB method

Return period (years)	1	5	10	20	30	40	50
Wind velocity x(kn)	27.65	32.58	34.63	36.65	37.82	38.64	39.27
Wind velocity x(m/sec)	14.22	16.76	17.82	18.85	19.45	19.88	20.20
Fetch distance (km)	10,887	10,887	10,887	10,887	10,887	10,887	10,887
Significant wave height H 1/3 (m)	0.998	1.198	1.282	1.364	1.412	1.445	1.471
Wave period T 1/3 (sec)	3.357	3.610	3.708	3.800	3.852	3.887	3.915

3） Tidal current

In order to identify characteristics of tidal current within the Project area and environs, tidal observations were carried out for a continuous three day period from July 14 to 16, 2006, and a continuous three day period from July 19 to 21, 2006. For this purpose, a gauging station was established at Larantuka commercial harbour. During the observation period, maximum current velocity was below 0.90m/sec. From July 14 to 16, 2006, flow direction was 22.4% to the NE~ENE, 32.8% to the NNE~NE and 20.2% to the N~NNE, indicating an 85.4% predominance in the generally northeast direction. From July 19 to 21, 2006, flow direction was 24.1% to the NE~ENE, 24.1% to the NNE~NE and 41.3% to the N~NNE, indicating an 86.2% predominance in the generally northeast direction.



Source: Collated from results of tidal survey

Figure 1.2.6 Results of current measurement

(4) Littoral drift

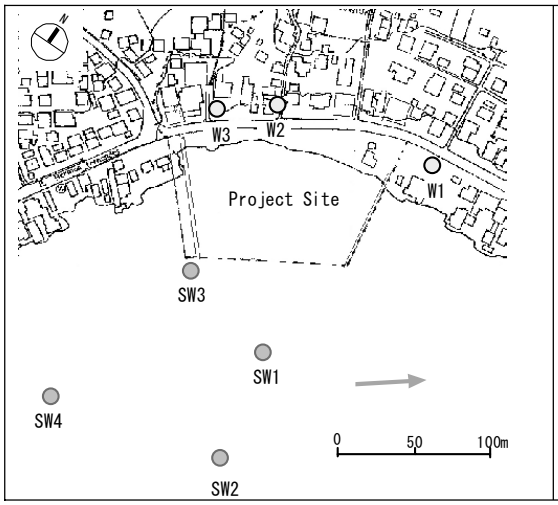
On the basis of site reconnaissance and interview survey in and around the Project area, it was not possible to identify a dominant trend in littoral drift. Instead, conditions are observed to be relatively stable in this regard, with only very minor impact anticipated. However, attention must be given to the possibility of some partial sedimentation as a result of soil erosion from the inland-side mountain slope.

(5) Water quality and bottom quality

1） Water quality

A water quality survey was carried out for sea water and well samples to identify water quality for the general sea area in and around the Project site, as well as water quality at specific structure sites.

Items analyzed under the water quality survey included pH, water temperature, DO, SS, bacillus coli, BOD, COD, n-hexane, etc. In the case of surveyed well water, BOD value slightly exceeded the reference value under standard No. 82 of the Indonesian Ministry of Environment.



【seawater】
- SW1: proposed site for fish landing jetty
- SW2: deepwater where tidal current activity is present
- SW3: outlet of existing drainage (approx.80m from main road to the sea side)
- SW4: around the commercial harbour side at same condition swith SW2

【wellwater】
- W1: around project site
- W2: around project site
- W2: around project site

Figure 1.2.7 Locations of sampling tests (water qualiry and seabed material)

Table 1.2.7 Results of water quality test (July 9, 2006 - during high tide)

Measured item		Standard value under Ministry of Environment criteria [1]			Sampling location			
		St-1	St-2	St-3	SW1	SW2	SW3	SW4
Temp.	℃	Natural	Natural	Natural	27.3	27.5	27.4	27.4
pH	-	6.5-8.5	7.0-8.5	7.0-8.5	8.2	8.1	8.2	8.2
COD	Mg/L	-	-	-	18.8	12.6	32.4	14.8
BOD	Mg/L	-	10>	20>	6.4	5.2	12.6	5.8
T.Coli	MPN/100ml	1000>	1000>	1000>	65	55	895	25
NH_3-N	Mg/L	0.3>	0>	0.3>	0.24	0.12	0.44	0.18
SS	Mg/L	80>	20>	20>	12.4	9.8	22.6	8.6
DO	Mg/L	-	>5	>5	5.4	6.8	3.6	7.2

Source: Collated from results of water quality tests
Note 1: Indonesian Environmental Ministry standard No. 51; 2004
St-1: for harbour, St-2: for sea water tourism, St-3: for marine organism

Table 1.2.8 Results of water quality test (July 9, 2006 – during low tide)

Measured item		Standard value under Ministry of Environment criteria [1]			Sampling location			
		St-1	St-2	St-3	SW1	SW2	SW3	SW4
Temp.	℃	Natural	Natural	Natural	27.8	27.2	29.3	27.4
pH	-	6.5-8.5	7.0-8.5	7.0-8.5	8.2	8.2	7.7	8.2
COD	Mg/L	-	-	-	22.8	18.4	34.4	16.6
BOD	Mg/L	-	10>	20>	7.2	6.8	22.4	6.2
T.Coli	MPN/100ml	1000>	1000>	1000>	45	50	915	20
NH_3-N	Mg/L	0.3>	0>	0.3>	0.16	0.08	0.52	0.22
SS	Mg/L	80>	20>	20>	18.8	12.4	34.6	9.2
DO	Mg/L	-	>5	>5	4.8	5.4	2.2	5.8

Source: Collated from results of water quality tests
Note 1: Indonesian Environmental Ministry standard No. 51; 2004
St-1: for harbour, St-2: for sea water tourism, St-3: for marine organism

Table 1.2.9 Results of well water quality test (July 9, 2006 - during low tide)

Measured item		Standard value under Ministry of Environment criteria [1]			Sampling location		
		Class-1	Class-2	Class-3	W1	W2	W3
Temp.	℃	Natural	Natural	Natural	25.2	25.6	25.7
pH	-	6-9	6-9	6-9	7.6	7.7	7.9
COD	Mg/L	10>	25>	50>	6.45	3.58	8.42
BOD	Mg/L	2>	3>	6>	2.72	2.46	2.84
T.Coli	MPN/100ml	1000>	5000>	10,000>	500	450	750
NH_3-N	Mg/L	0.5>	N/A	N/A	0.14	0.08	0.22
SS	Mg/L	50>	50>	400>	8.2	4.8	12.6
DO	Mg/L	6>	4>	3>	5.8	5.2	7.4

Source: Collated from results of water quality tests

Note 1: Indonesian Environmental Ministry standard No.82; 2001, Class-1: for drinking water, Class-2: for water recreation, Class-3: for marine aquaculture

2) Seabed material

Results of seabed material survey at the Project site are as indicated in the following table. According to these results, the sample (SB-02) taken in the vicinity of the excisting drainage channel at the southwest side of the project site contains a relatively high percentage of fine grain.

Table 1.2.10 Results of Seabed material test

Grain dia. (mm)	Percentage of permeable mass					
	SB-01	SB-02	SB-03	SB-04	SB-05	SB-06
6.30	74.4	99.5	99.2	94.4	87.4	85.4
4.75	71.9	99.2	99.0	92.7	85.1	83.6
2.00	57.3	90.0	93.6	76.9	65.8	65.6
0.84	44.6	76.5	86.5	50.1	46.0	42.5
0.59	31.0	57.4	76.6	27.7	22.9	17.7
0.42	25.8	49.1	65.5	17.0	14.5	10.6
0.21	15.0	29.3	14.1	3.4	2.9	3.2
0.105	3.6	6.5	0.3	0.3	0.1	0.4
0.063	0.8	1.6	0.0	0.1	0.0	0.1
Grain dia. D50	1.165	0.433	0.347	0.832	0.965	1.054
Specific gravity (g/cm^3)	2.650	2.616	2.663	2.655	2.645	2.635

Source: Collated from results of seabed material test

(6) Summary of natural conditions

Item	Description		
1. Onland topography	A rock layer has been identified that consists of hardened lava that flowed into the Project area from hinterland volcanic activity in the past. Large boulders are numerous. Also, the road passing in front of the Project site has low points where rain runoff from the hinterland flows across the road surface in the direction of the sea. Countermeasures to deal with this will be necessary. Also, within the current site area subject to ongoing reclamation works by the Indonesia side, there are observed several locations of water outpour form small holes in the ground. Therefore, there is a concern about localized subsidence or settlement of surface at reclaimed land fill due to leakage of reclamation material under consequence of this water outpour or residual water		
2. Seabottom topography	Topography exhibits a long off-shore shallow sloping at about 1.0%. After about 150 m off-shore, however, seabottom gradient sharply changes to 10.0% or more. The location for the fish landing wharf for small-boat is water depth + 0.7~1.0 m. Water depth at the fish landing jetty is estimated at around -10.0 m.		
3. Geology	At the onland side of the Project site, a rock layer is identified at approx. 5.0 m below the ground surface layer. Seabottom, particularly at the fish landing jetty site, comprises mostly coral mixed with silt. At shallow points up to around -10.0 m, a rock cap is identified that comprises a loose silt layer with N values ranging from over 50, to 2~3 and 7~9. Accordingly, a steel pipe pile structure would be considered appropriate.		
4. Meteorology (based on data from 2003/01~ 2006/06)	Wind direction	High wind speed recorded in the south~southwesterly direction	
	Maximum wind velocity	28 knots (westerly direction)	
	Rainfall	Annual mean rainfall: 1,288 mm/year	Maximum daily rainfall: 223 mm/day
		Daily mean maximum rainfall: 104.6 mm/day	Annual mean number of rainy days: 83
	Average temperature	Monthly mean temperature	28.1℃
		Monthly maximum mean temperature	32.4℃
		Monthly minimum mean temperature	23.4℃
		Mean temperatures tend to be high throughout the year. Accordingly, special attention must be given to concrete placement and curing.	
5. Earthquake	Under Indonesian government seismic activity zoning, Larantuka belongs to zone-4 .		
6. Wave activity	Wave analysis based on wind speed indicates that direction in which maximum wave height occurs is in the direction of 213 degrees (213^{o}) which exhibits the greatest wind fetch distance given topographical conditions. Offshore wave height with a return period of 30 years as calculated from wind forece analized by SMB method is 1.4m with a wave period of 3.9 sec.		
7. Tidal levels	Maximum tide level during the observation period was 303 cm. Minimum tide level was 13 cm. The following are derived from calculated principle quarter tides. Highest High Water Level (H.H.W.L) : ＋3.02 m High Water Level (H.W.L) : ＋2.65 m Mean Sea Level (M.S.L) : ＋1.63 m Low Water Level (L.W.L) : ＋0.61 m Lowest Low Water Level (L.L.W.L) : ＋0.23 m Chart datum level (C.D.L) : ＋0.00 m		
8. Littoral drift	No dominant littoral drift trend is observed. Impact is predicted as minimal.		
9. Water quality	Due to pollution of the existing rain drainage channel flowing into the sea area, water quality in the vicinity of the channel is poor.		
10. Seabed Material	Soil granularity in the vicinity of the existing drainage channel is fine.		
11. Tidal current	Maximum current flow during the observational period was 0.90 m/sec. Predominant flow direction was NE~ENE, NNE~NE, N~NNE (85~90% in the general N~NE direction).		

1-3 Socio-environmental Considerations

Socio-environmental considerations in line with Project implementation are as follows:

(1) A local ethnic center cottage for group community activity has been bought by the district government prior to Project implementation. Local residents have acquiesced to land acquisition for the Project. However, they request that an appropriate ground-breaking ceremony in line with local custom be carried out prior to the start of construction works.
(2) The Project site is located in urban area. It also fronts on a major trunk road. Accordingly, the facility layout as well as the construction plan must take into consideration distances between residential areas and storage points for dangerous materials, as well as transport methods.
(3) Periodic garbage collection is carried out within the town. It is necessary to coordinate garbage collection at the Project site with the existing Larantuka garbage collection system. Also, because the Project site fronts on a strait with current, it is anticipated that waste discharge will quickly disperse throughout the immediate area. However, because this is an urban area, direct outfall of waste discharge should be avoided (i.e., discharge should be minimally treated at the primary level to minimize environmental impact).
(4) Existing ice plant in the city supplies ice to the fish trading middlemen (current operation rate is 57%). Specifically in the case of the ice production facility envisioned under the Project, it is necessary that its ice production does not compromise the production of currently operating ice plant.

CHAPTER 2

CONTENTS OF THE PROJECT

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

2-1-1 National Objectives and Project Objectives

The Indonesian economy was seriously affected by the Asian currency crisis in 1997. Nevertheless, through effective measures including macroeconomic stabilization and financial system reform, the country has been able to achieve 3% or more real economic growth since 2000. On the other hand, unemployment rate continues to remain high (9.9% in 2003), requiring greater economic growth to absorb 2.5 million new members to the available work force each year. Particularly in rural areas, strengthening of development infrastructure is necessary.

Against this background, the mid-term (2004~2009) development strategy of the Indonesian government comprises the following three mainstays:

- Alleviating poverty
- Generating new employment opportunities
- Accelerating economic growth

At the same time, Indonesia is a maritime nation with the world's third largest Economic Exclusive Zone. Marine products are an essential source of nutrition for the country's population (accounting for two-thirds of consumed animal protein), as well as being a key economic resource in pursuing rural development.

The Ministry of Marine Affairs and Fisheries positions the following as basic issues to be addressed under its mid-term strategy (2004~2009):

- Revitalizing commercial fishing
- Improving access by rural communities to agricultural and marine products, promoting a sustainable fishing sector as well as establishing fishing infrastructure
- Promoting conservation and management of agricultural and marine resources and the environment

East Nusa Tenggara Province (hereunder referred to as "NTT") within which the Project area is located, is the most backward and impoverished province in the country (per capita GRDP for this region is the lowest among the 30 provinces of Indonesia, being only one-third of the national average). The fishing industry in the area comprises mainly small fishing operations that supply fresh fish to local towns and their environs. Although there remains ample room for future development of fishery resources (currently only about 30% developed), the present income and living standard of coastal fishermen (approximately 200,000) are extremely low due to backward fishing techniques and lacking fishing infrastructure.

In order to break this cycle of poverty, the Indonesian government targets sustained livelihood and improved standard of living for small coastal villages within the area. Among these, Amagarapati located in Larantuka sub-district in East Flores district, an important center for fishing activity and marketing of marine products, generates the second largest fish harvest after Kupang district which is the site of the capital of NTT province. However, because of insufficient fishery facilities, fishing efficiency is low. This in turn is aggravated by fish losses incurred after fish hauling.

The Project accordingly aims to invigorate the fishing industry in this overall area by upgrading the efficiency of fishing operations and reducing post-harvest losses. This will be accomplished by

establishing a core fishing port infrastructure including facilities for landing, fuelling and re-supply, marketing, vessel repair, etc.

2-1-2 Study on the Appropriateness of Requested Facilities and Approach to Cooperation

Requested facilities and equipment are described below. These pertain to primary port functions including (i) fish landing and handling, (ii) comprehensive re-supply servicing, and (iii) operations and information management. Also included under the request are other pertinent items.

(1) Arrangement of fish landing and handling function

At present, there are no public fishery facilities specifically allocated in Larantuka for fishing operations. Instead, the adjacent commercial port authority unofficially acquiesces to one corner of the port being used for fish landing, while fish landing is also carried out at the coastal foreshore within the sub-district. Tidal variation in the area is 2.8 m, and consequently during low tide two-man teams must offload and carry catches up the beach.

Because middlemen negotiate catch prices separately for each boat, purchase prices for identical catches may vary from boat to boat. This in turn instills the fishermen with a feeling of not being treated fairly with regard to fish transactions.

To resolve these problems, request was made for a landing jetty and landing wharf for small fishing boats to enabling rapid catch landing even during low tide, as well as a fish handling facility where landed fish can be first gathered in one location prior to negotiating price. These facilities are strongly desired by the fishermen themselves, and are indispensable in modernizing commercial fishing in the area, making fishermen more aware of the potential of their industry, and raising living standards.

The appropriateness of the facilities related to the primary functions of fish landing/handling is examined below.

- Landing jetty

The Project site is a reclaimed land. Because the sea side of this site is a shoaling beach with shallow bottom extending some distance offshore, middle sized fishing boats used (i.e., skipjack pole and line, and round haul netters) locally cannot land catches during low tide. Accordingly, a landing facility extending to a deeper place is necessary that enables vessel mooring and catches off-loading at low tide.

- Access bridge

To connect the land site with a landing jetty located offshore, arrangement of an access bridge is indispensable.

- Landing wharf for small fishing boats

Small fishing boats with shallower draft such as gill netters, non-motorized boats, etc., can access to the landward side of the Project site when the tide goes up. Accordingly, constructing a landing wharf for small fishing boats on the sea side periphery of the Project site is deemed appropriate from the standpoint of overall cost-effectiveness when establishing fish landing facilities.

- Fish handling shed

In terms of creating a modern marketing system for marine products, it is essential that a facility be established where landed fishes can be gathered in one location, after which middlemen and marketers then negotiate a fair purchase price. Accordingly, constructing a handling facility that meets the requirements as well as sanitation needs is deemed appropriate.

(2) Arrangement of comprehensive re-supply servicing function

After landing its catch, a fishing boat must then take on board the necessary items (ice, fuel, water, food, etc.) for the next fishing operation. At present, this re-supply cannot be performed at one consolidated location; instead fishermen must procure individual items separately from scattered sources. This takes time, and entails higher costs (double the ex-factory price in the case of ice and a 10% surcharge on the official price for fuel).

To resolve this problem, an ice making and storage plant, fuelling facility, water supply facility and kiosk have been requested for the port. These facilities will enable the fishermen to more cheaply re-supply in a shorter period of time, and thereby directly impact on an improved standard of living. Furthermore, this type of re-supply facility integration will enhance the port's status as an effective fishing operations base, thereby inducing fishermen from the outer island areas to bring their catches to the port. At the same time, this can be expected to expand the area's fresh fish market including outer areas of Larantuka.

It is envisioned that the existing fishermen's cooperative will participate in re-supply servicing, which will enhance the feeling among fishermen that they are more in control of their operations and pave the way for the fishermen themselves to ultimately take over port administrative duties.

The appropriateness of the facilities related to the primary functions of re-supply servicing is examined below.

- Ice making and storage plant

Ice is required in the course of both fishing operations and fish marketing in Larantuka. Since the ice supply cannot keep up with demand at present during the peak fishing season, April to November, an ice making and storage facility is thus indispensable under the Project.

Specifically in the case of marketing, the majority of production by existing local ice plant is diverted to meet ice demand for fish marketing outside the area. Accordingly, it is highly appropriate that an ice making facility be established under the Project to meet primarily the demand for ice under fishing operations at sea. In terms of the marketing side, ice produced at the Project site should be limited only to that necessary for temporary storage of fresh fish prior to entering the distribution system.

- Fuelling facility (Fuelling shed, tank area)

With the exception of non-motorized boats, fishing boats are generally powered by inboard diesel engine. Accordingly, a fuelling facility is essential for fishing boats that will use the Project port. Although this facility will handle primarily diesel, it must also be designed for storing other types of fuel including kerosene for night lighting and lubricating oil.

- Slipway

A slipway has been requested to enable both regular fishing boat maintenance, as well as engine, rigging and hull repair when necessary. However, since there are numerous small workshops repairing vehicles and a standard workshop operated by a catholic church in the local town, non-regular repairs such as engine repair, propeller shaft processing, etc., are to be handled by these workshops.

At present, regular maintenance and repair works on small fishing boats registered at Kel. Amagarapati are carried out on the site beach during low tide. However, once reclamation works are completed at the Project site, it will no longer be possible for these boats to be repaired on the beach.

Accordingly, it is deemed appropriate under the Project to construct a small slipway to enable regular maintenance and repairs targeted at these fishing boats.

- Workshop

As described above, there are numerous engine repair shops in the local town, it is deemed appropriate that equipment supplied for the workshop be primarily aimed at maintaining and repairing facilities and electrical equipment located inside the port premises. Workshop equipment is also to be suited to fishing boat hull and rigging repair, etc.

- Kiosk

During fishing operations aboard boat, fishermen will want food, fluids (rice, water, etc.) and everyday articles such as soap, cigarettes, etc. Also they will have emergency fishing gear repairs. If a ready supply of replacement for these materials after fish landing is realized, their fishing operation will become more efficient. Accordingly, it is deemed appropriate that a kiosk be established within the Project site to make such sundry items available to fishermen using the port.

It is planned that the kiosk would be operated by the fishermen's cooperative, which also will operate the fuelling and water supply services. Accordingly, it is necessary that kiosk design incorporate a space for conducting simple administrative and clerical tasks.

(3) Arrangement of operations and information management function

The appropriateness of the facilities related to the primary functions of operation/information management is examined below.

- Administration building

There is a high likelihood that operation of Project facilities will be in the form of a public corporation. Although this enables more flexible financial and personnel management compared with direct operation by the district government, conversely it means a greater accountability is borne with regard to operational performance. An administrative building will accordingly be an essential core facility necessary for integrated operations by the port chief, regular meeting of advisory bodies, the execution of general administrative tasks and overseeing the storage of goods and materials.

It may be more efficient for information exchange and work performance in case the said kiosk is integrated in the same building.

- Technical support for facility management

Technical consulting services have been requested with regard to training on port management in preparation for start-up of actual port operation. This request is deemed appropriate in light of the fact that there are no personnel at the district level within East Flores district that have training or practical experience in port management and that there are no relevant training programs in Indonesia. The soft component is to be conducted for minimum management training on setting management stipulations and minimum task execution standards, as well as methodology for processing landed fish data.

(4) Others

The appropriateness of other facilities and equipment related to port operation is examined below.

- On-premises roads and parking area

On-premises roads and parking area are deemed appropriate in order to ensure a rational movement line for facilities' users, transport vehicles in and out of cargo, and fish/materials.

- Sanitation facilities (lavatory, garbage disposal, waste water processing)

Establishing a public lavatory and a garbage depot to ensure sanitation at the Project site is deemed essential since many users daily come into the port and go out, and much volume of solid waste and residue will be generated by port facilities. The wastewater processing facility will be necessary to treat effluents to an appropriate level of cleansing prior to being discharged into the sea. since the Project site locates inside the local town and general inhabitant live nearby.

Provision of rainwater drainage is also deemed appropriate since flooded water from the hinterland will flow into the site crossing over front trunk road during very heavy raining.

- Fish drying yard

Catches by round haul netter, etc. often land small sardines. In the area, there are often seen cases where sardines are sun dried on the road. Accordingly, a space will be set aside in one corner of the Project site to serve as a fish drying yard. Specifically with regard to the requested rack for sun drying, it is deemed appropriate that this be outside the scope of cooperation under the Project, in light of the fact that a wood and net type rack structure can be easily constructed by the fishermen themselves using the equipment to be provided for the workshop.

- Retaining wall

The peripheral wall around the site reclaimed by Indonesian side is a mortar and stone masonry structure. This is a weak structure for a sea revetment, and it is worried some collapse may occur within the short period (ex.; collapse is seen at a number of places at the Oeba fishing port quay in Kupang even though it was completed only two years ago). Due to concern about long term safety, it is necessary to reinforce the peripheral revetment directly affecting the facilities to be constructed under the Project.

- To secure existing sewage pipe alignment

There is a sewage channel used by residents adjacent to the Project site. It was found during the field survey of the Basic Design study that this channel comprises a sewage pipe embedded beneath the road passing in front of the site and out falling to the sea-side within the Project site. It was clearly foreseen the function of this drainage pipe would be lost when its exit was covered by the reclaimed works of the Project site. Indonesian side requested that the Japanese side deal with this problem.

However, it was considered the request was not to be included in the cooperation scope since the content of this request is incorporated as one part of overall regional drainage plan by the district government. And the Indonesian side understood the decision of Japan side in the stage of explanation of the draft final report.

- Equipment

In the initial stage of the request, details of the equipment request were not indicated although emergency generator and fire extinguisher were listed. During the field survey of the Basic Design Study, the equipment for fish landing/handling, facility maintenance/boat repair and data processing were additionally requested.

In Larantuka, an electrical interruption for 1 - 2 hours is frequently being occurred although power supply is comparatively stable. Accordingly, it is necessary to install an emergency generator for important facilities such as a cooling machine of ice storage, lighting of a core facilities, etc.

Once the operation of planned port is stared, various works will be generated inside the premises, such as transport, weighing, storage works of fishes and re-supply materials, repair works of facilities/boats and general management works. It is necessary to provide a supporting equipment according to needs of contents of such works since it is not efficient to cover such works only by using manpower. Furthermore,

it is indispensable to provide a equipment of fire prevention since much volume of fuel will be handled in planned port.

It is deemed appropriate that a computer be provided by the recipient country side as it is nowadays categorized into a kind of stationery although it is essential equipment for accounting works and recording data of fishing port operation such as fish landing, fish trading, etc. Selection of equipment is to be such that it can be easily replaced or renewed in the local market.

2-1-3 Project Outline

In order to achieve the above objective, the following facilities, equipment and technical support are to be provided to Amagarapati in Larantuka sub-district under the Project.

a) Civil works: landing jetty, access bridge, landing wharf for small fishing boats, slipway, retaining wall, on-premise roads, and parking area

b) Buildings: administration building/kiosk, fish handling shed, ice making and storage plant, fuelling shed, workshop, electric power and water supply shed, lavatory facility, security guard house, and simple wastewater processing facility

c) Equipment: fire extinguishers, support equipment for fish landing and handling, operations, and facility maintenance/boat repair

d) Soft component: technical training on fishing port operation

The above are expected to upgrade the efficiency of fishing operations (fish landing, fish handling and marketing). Specifically, the scope of cooperation under the Project entails the relevant construction, procurement and technical support in this regard.

2-2 The Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

(1) Determining design approach

1) Common criteria

The scope of cooperation will basically cover the construction of a local fishery base, from among the request components put forth by the Indonesian side and confirmed during Basic Design Study field survey.

- Catch landing and fish handling facility that is unaffected by tidal levels, enables convenient landing, and fosters fair business transaction.
- Integrated boat re-supply servicing that reduces fishery production costs
- Facilities that expedite fresh produce shipping to outside areas

Project scale is determined according to the specified number and types of fishing boats that would use the facility based on 2004 data indicating the landed catches by type of boat within Larantuka sub-district. Specifically, this is based on daily landed catch volumes, degree of vessel re-supply, number of boats moored, and amounts of landed catch marketed inside and outside the sub-district.

The port under this Project is not large scale. It is intended as a local fishing port to be used by fishermen and fish marketers within the surrounding region. Accordingly, facilities will not rely on machinery and equipment, but rather basically emphasize human power, pull carts, etc.

Because the targeted fishing boats are small, facilities are to be safe in terms of tidal fluctuation, efficient in terms of berthing convenience, and of maximum utility with minimum facility scale.

Because the site is located on newly reclaimed land, a firm foundation is not anticipated. Accordingly, on-land structural foundations are to consider steps to prevent effects from differential settlement.

The immediate hinterland is steep topography. In the case of heavy downpour during the rainy season, runoff overruns the road in front of the port area and flows into the Project site itself. The on-premises drainage plan is to be such that it achieves a balance between the need for sufficient gradient to enable efficient drainage during heavy rain while at the same time not being to too steep to adversely affect port operations during the dry season.

Annual average rainfall in the Project area is around 1,500mm, with some deluges recorded at over 200 mm per day. Port premises and facility design is accordingly to be such that damage from an extreme downpour is avoided (this type of damage at present is significant in the Project area and its environs).

Because the Project site is in an area of frequent seismic activity, structure design is to take into appropriate account horizontal stress. Also, because lightening strike occurs at low elevations, all buildings under the Project are to be in principle equipped with lightening rods.

Facility design will take into consideration maximum wind speed, air temperature, etc. Buildings and equipment will also be designed to be salt resistant.

Off-shore structures will be designed with consideration to prevailing winds and ocean current.

2) Natural conditions

a) Design tide level

The datum level of the project site is adjusted to that of existing adjacent commercial port of Larantuka and a bench mark has been established at the site after leveling survey between two locations. The design tidal elevations of the Project site are determined using the results of harmonic analysis based on the 15days tide observation, which are assumed the recorded high and low tides as H.H.W.L (+3.02m) and L.L.W.L (+0.23m).

Table 2.2.1 Results of harmonic analysis

Items	Tide elevations
Highest High Water Level (H.H.W.L)	+ 3.02m
High Water Level (H.W.L)	+ 2.65m
Mean Seawater Level (M.S.L)	+ 1.63m
Low Water Level (L.W.L)	+ 0.61m
Lowest Low Water Level (L.L.W.L)	+ 0.23m
Chart Datum Level (C.D.L)	+0.00m

b) Design wave height

Since the Project site is located in a closed location of the Flores Strait. The design wave height is calculated by S.M.B (Sverdrup-Munk-Bretshneider) method based on the wind velocity and fetch distance. The data on wind and fetch distance used for calculation were as follows;

- Observation data used

From the 3.5 years wind data obtained from the Larantuka airport covering the period from January 2003 to June 2006, maximum wind velocity applied for S.M.B method is determined through a probable analysis.

- Fetch Distance

Based on the present conditions of groins (revetments) that are located in both northeast side and southwest side in the Project site, it is judged the wave influence from the southwest direction is large since the groin in the southwest side has been much affected by the wave. Therefore, the direction of 213 degrees should be applied as the fetch direction since it is topographically longest in the Flores Strait.

c) Soil conditions

According to the result of bathymetric survey of the Project site, originally proposed location of landing jetty with the design depth of -2.0 to -3.0 m needs to be moved to the design depth of more or less -10.0 m as described in chapter 3-2-2-1 (2) [Study on berthing facility layout planning]. Thus, the soil condition at landing jetty should be assumed based on the result of boring and bathymetric survey data.

d) Design seismic coefficient

The design seismic coefficient will be applied to Area Zone 4 with reference to Indonesian standard for seismic condition (RSN14, Revisi SNI 03-1726-1989) as indicated in the Table 2.2.2.

Table 2.2.2 Relation between Seismic Zoning and Seismic Coefficient in Indonesia

Area zone	Seismic coefficient	Applied
Zone No.1	0.20	
Zone No.2	0.19	
Zone No.3	0.18	
Zone No.4	0.17	*Larantuka
Zone No.5	0.16	
Zone No.6	0.15	

Source: Standar Perencanaan Ketahanan Gempa Struktur Bangunan Gedung

3) Socio-economic conditions

Planning of project facilities will take into consideration the following socio-economic factors prevailing in the Project area.

- Building design taking into consideration local architectural tradition, compatibility with the surrounding community and environs, and maximally efficient utilization of space.
- Emphasis on layout, design and construction method that minimizes to the extent possible adverse impacts on the surrounding natural and social environment.
- Because the Project site is located in an urban area, facilities that generate noise, areas of vehicle traffic and facilities that store hazardous or dangerous materials (fuelling facility, etc.) are to be located at a prescribed safe distance from adjacent residences.
- The scale of the ice making plant is to be such that it does not impinge upon the operating rate (approx. 57%) of existing ice plant in the area.
- Methodology will be studied for disposing of waste generated at the Project site, whether it be wastewater, solid waste, general trash, etc., in a manner that is most efficient for each type of waste and that minimizes adverse environmental impact.

4) Construction and procurement conditions; special sector conditions and business practices

- Construction materials will be studied and determined on the basis of durability (particularly with regard to saline resistance), cost, ease of constructability, ease of maintenance, as well as compatibility with local construction methods and technology.
- An appropriate structure design and construction method will be adopted that produces superior durability and ease of operation and maintenance. This will take into consideration local construction industry conditions as well as material and equipment procurement conditions.
- Basic infrastructure:

  Because electricity (PLN), water service (PDAM) and telephone service (TELECOM) are supplied by separate public corporations, it is necessary to apply to each of these upper authorities with regard to the Project. Request has already been made that these agencies reach an internal agreement concerning the Project by December 2006 when the Indonesian side is to be briefed on the content of the Draft Final Report.

  At the time of explanation of the Draft Final Report of the basic design, the schedule pertaining to infrastructure construction is to be explained to the district government, and the envisioned period

for construction discussed is to be included in the minutes of meeting.
However, with regard to the fuel supply facility, separate examination and final approval is necessary by PERTAMINA. At the time of the explanation of Draft Final Report of the basic design, a request for a provisional determination will be made in line with facility planning.

5) Engaging local contractors, and utilizing local equipment and materials

Because there is almost no demand within the Project area for large project construction, contractors are small in scale. In particular, skilled building construction laborers are in short supply. Also, building materials that can be procured locally are limited to concrete aggregate (gravel, sand, etc.). Other principle materials such as cement, rebar, lumber, fixtures, hardware, etc. are imported mainly from Surabaya. In short, construction materials within the immediate locale of the Project are extremely limited. In this regard, emphasis is to be given to capability to provide consumables and spare parts at short notice, ability to respond to future needs for upgrading and repair (in line with previously adopted equipment and materials), and an implementation level that allows for operational and maintenance works at local technical levels.

6) Operation and maintenance on the part of the executing agency

Whether or not the operation of the Project port is to be (i) directly under the discretion of the district government or (ii) by pubic corporation, still remains to be decided. Regardless of the case, it is evident that staff of the fishery office as well as district government employees are not well versed in port operation. Accordingly, the soft components set out below are to be carried out as a minimum. Because the district government must allocate funding for operation in the first year, recommendation will be made to the district government for budget allocation as soon as possible once Project implementation has been given the go-ahead.

Technology transfer with regard to soft components is essentially as follows:

－Analysis of previous experience at Maumere port in adjacent Sikka district
－General organizational and management rules, as well as specific facility management rules
－Accounting rules (including various expense proposals)
－Stipulations for collaboration with the fishermen cooperative

7) Criteria for grading facilities and equipment

The level of facilities and equipment to be provided under the Project will emphasize effective operation, and maintenance at minimal cost.

8) Construction and procurement procedure, and construction period

Buildings will adopt an RC framed structure using concrete aggregate and bricks that can be procured locally to both minimize the length of the construction period and enable specifications and construction methods in keeping with local practices. Building walls will consist of brick masonry in keeping with building specifications generally adopted in the area. At the same time, roof grids will be fabricated by factory in Surabaya, etc., and then assembled and put in place at the site once the RC framed structure and brick masonry walls have been completed. This is expected to both minimize the construction period while still maintaining appropriate structure quality.

9) Countermeasures against environmental contamination at the site and surrounding area

The existing sewage channel running along the western edge of the site and out falling into the sea has become clogged with garbage. Also, hogs are being raised on the outer side of the jetty at the eastern edge of the site. The concentration of coli bacillus in the costal water area is close to 1000 per 100 ml. After Project facilities become operational, this situation is a potential source of contamination at the site, and it is accordingly necessary that the district government promote awareness among the local community regarding such environmental hazards as well as taking concrete steps to address the issue of adequate garbage disposal.

10) Expediting construction permit application

Construction permits must be obtained prior to commencing actual construction works. These include permits for both offshore facilities as well as on-land facilities.

(i) Surrounding area development programs, and urban planning

Although a development plan was drafted for the whole of East Flores district including Larantuka sub-district in 1992, this plan is no longer relevant to current conditions in the area, and subsequently is not being applied.

Although urban planning guidelines (2000~2010) have been drafted with regard to street and building wall alignment, these are not currently being applied in much the same manner as the above described development plan for the district.

As a result, discussions were held with the district planning office and the district public works office which confirmed the following in terms of the structural layout policy of the East Flores district government for the area around the Project site.

(Present)

・Width of public road (total width: approx. 9.0 m)

- Existing road :
  Single lane with alternating passing in both directions; width 6.0 m
- Sidewalk on both sides of road : Approx.. 1.0 m (one side) × 2 → Approx. 2.0 m
- Drainage channel along northern side of road :
  Approx. 0.7 m (effective width: 0.3 m; partially constructed)
- Drainage channel along southern side of road :
  None at present. Runoff drains into the site area

(Future)

・Public road

- Road width :
  A lane will be added to the Project site side of the road. This will be an approximate 2.5 m increase in road width.
- Sidewalk on both sides of road :
  Sidewalks, each approximately 1.0 m wide, will be established on both sides of the road.
- Drainage channel along northern side of road :
  Drainage channel will remain for the time being as it is now. Drainage plan, however, will be reviewed in the future.
- Drainage channel along southern side of road :

In the future, a rainwater drainage channel will be constructed under the sidewalk along the south side of the road.

- Infrastructure along south side of road :

A space will be allocated along the south side of the road to accommodate electric power and telephone poles, water piping and greenery. The width of this area will be approximately 1.5 m.

(Building wall alignment)

・Project site boundary (wall) :

Located along the edge of the Project site to the inside of the above described infrastructure area along the south side of the road.

・Building wall alignment at the site :

External building walls are to be aligned at least 2.0 m back from the site boundary wall.

(ii) Requesting building permits

The team member in charge of application for construction permits will collate a Project overview report as well as Project drawings, and brief government officials with immediate jurisdiction over the Project site area. After an understanding has been reached, permit application will then be submitted to the concerned officials at the Larantuka sub-district level for their approval. Next, the district planning office (BAPPEDA) will examine the Project content, amend comments where appropriate and finally pass the application on to the district public works office (PU) for technical review.

Documentation for building permit application is as follows:

・Copy of property ownership certificate
・Facility layout diagram
・Architectural drawings (floor plans, elevations, cross-sections, structural diagrams), utilities drawings (electricity, water supply, sewage, others).
・Construction cost estimate tables

In light of the fact that the Project is grant-aid cooperation, whether or not certain cost-estimate tables are necessary will be discussed and confirmed with the district planning office as well as the district public works office.

(iii) Fuelling facility

In the case of fuelling facility and equipment, permit application to PERTIMINA is necessary as well as final inspection by PERTIMINA once facility construction has been completed. Specifically, application for permit entails submitting relevant documentation and drawings to the Larantuka branch of PERTAMINA, with technical examination being successively carried out at the Kupang, Surabaya and Jakarta levels of the corporation. Upon completion of construction, the facility is then checked by PERTAMINA inspectors after which the final go-ahead for fuelling operations is given. Items inspected in this regard generally include safe distance from other structures and facilities (at least 10 m), measures to prevent fuel leakage, fuel tank safety, fire extinguishing equipment as well as facility management plan.

(2) Design criteria

The following design criteria will be applied to facilities under the Project.

1) Seismic coefficient

Seismic transverse stress of Larantuka is stipulated zone 4. Under this Project, seismic force is calculated applying a shear coefficient based on this seismic transverse stress.

2) Design wind load

According to daily data for the past 3.5 years from the adjacent Larantuka airport meteorological station, maximum observed wind speed is 28 knots per hour. Converted to seconds, this represents a wind speed of around 15 m/s. Based on this data, probable wind speed is calculated at 19.454 m/s as shown in the Table 2.2.3. Accordingly design wind load adopts a wind speed of 20 m/s.

Table 2.2.3 calculation of probable wind speed

Observation period	K	3.5 year							
No. of data	N	1000 pieces							
Return period (year)	Rp	1	5	10	20	30	40	50	75
Probability of non-exceedance	P[H≦x]	0.997	0.999	1.000	1.000	1.000	1.000	1.000	1.000
Normally variable	rv	4.00	4.89	5.26	5.62	5.83	5.98	6.09	6.30
Wind speed	**x(kn)**	**27.649**	**32.579**	**34.633**	**36.651**	**37.816**	**38.637**	**39.270**	**40.412**
	x(m/sec)	**14.224**	**16.760**	**17.817**	**18.855**	**19.454**	**19.876**	**20.202**	**20.790**
A	5.557								
B	5.427								

(30 years Probability)			Relative coefficient
Probable wind speed	**37.816**	**kn**	**0.984**
Probable wind speed	**19.454**	**m/sec**	**0.984**

3) Design Standard and Design Manual

With regard to building materials, criteria generally applied locally to materials and design, as well as standards used in Japan serve as reference. With regard to structural design, standards for seismic stress zoning, structural-type factor, building height coefficient, etc. as adopted by the Indonesian government are applied. For stress analysis in structural design, Japanese analytic methodology is to be applied.

Equipment and facility standards take into consideration the level of infrastructure development at the Project site, and apply criteria for similar type facilities and equipment in Japan as well as other internationally accepted standards.

Local standards will be given priority with regard to general materials such as concrete, etc. Also, local stipulations will be adopted for disaster prevention and sanitation as these directly pertain to everyday facility operation and management.

4) Floor space criteria

General working room floor space is determined with reference to case examples on per person floor space as set out in the building design and materials guidelines published by the Architectural Institute of Japan, as well as observation of floor space for existing facilities managed by the district fishery office and the district public works office. A maximally efficient and user friendly building design will be adopted taking into comprehensive account the content of activities by each operational sector under the Project, room-by-room floor space, room length and width, building frame configuration, etc.

Based on the above, floor space for main facilities is as shown in the table 2.2.3 and 2.2.4.

Table 2.2.4 Primary functions and design floor space for main facilities

Rooms by function	Main function	Planned unit/ Persons	Similar facility/ Area/Capacity	Planned area/ Capacity
Facility for fish landing/handling function				
Fish handling shed				
-Fish handling area	Display of fish tubs	Approx. 6tons/time	270 m^2 *1	226.8 m^2
-Storage-1	For 200L insulated boxes(4 nos.)	-	-	8.0 m^2
-Storage-2	For 1000L insulated boxes(2 nos.)	-	-	8.0 m^2
-Storage-3	For fish tubs and cleaning tools	-	-	8.0 m^2
-Staff room	Issues of trading slips and recording	2-4 persons	4-6 m^2/person	8.0 m^2
Facility for resupply servicing function				
Ice making plant				
-Ice making room	Production of block ice(25kg)	2.5tons×2sets	width:6-10m	width:6m
-Office	Production/sales management	2-4 persons	4-6 m^2/person	9.0 m^2
-Ante room	To minimize chilled air loss	-	4-8 m^2/room	4.0 m^2
-Ice storage	To store ice	Approx. 35-40tons	20/50tons	35tons
-Service deck	Space for ice shipment	-	width:2-3m	width:2m
-Machine room	To install compressor, etc.	-	50-100 m^2	49.5 m^2
-Generator room	To install emergency generator	-	local cases:75KVA	20KVA
Fuelling shed				
-Work room	To store kerosene, lubricant oil, others	2-4 persons	8-15 m^2/person	19 m^2
-Reception office	To issue fuel slips and others	1-2 persons	4-6 m^2/person	5.5 m^2
-storage	To store fuel pumps and others	-	-	5.5 m^2
-Push cart parking	To park 4 push carts	-	-	15.1 m^2
-Oil drum depot	To depot oil drums and containers	-	-	25 m^2
-Oil tank	To install diesel oil tanks	-	-	10KL×2 sets
Workshop				
-Work room with storage	For maintenance works	4-6 persons	8-15 m^2/person	37.8 m^2
-Equipment storage	To store maintenance equipment	-	6-12 m^2/room	7.5 m^2
Facility for administrative and kiosk function				
Administrative building				
-Manager room	To do overall port management	2-4 persons	10-30 m^2/room	15.1 m^2
-Accounting room	To do overall accounting works	1-2 persons	6-10 m^2/person	7.5 m^2
-Equipment storage	To store office equipment and others	-	5-12 m^2	7.5 m^2
-Office room	For division chiefs and their staff	6-12 persons	4-6 m^2/person	30.2 m^2
-Lavatory	Exclusive for adm. office staff	each one person	2-4 m^2/booth	2.5 m^2/booth
-Corridor with roof	Movement line to each rooms	-	width:1.5-2.5m	width:2.0m
Kiosk				
-Kiosk with reception	To sell food/goods to fishermen	2-4 persons	16-36 m^2/room	18.9 m^2
-Storage	To store food/goods for sale	-	10-20 m^2/room	15.1 m^2
-Office room	To manage re-supply serving activities	1-4 persons	10-30 m^2/room	11.3 m^2
-Staff room (meeting room) *2	To hold meeting and do desk works	12-16 persons	4-6 m^2/person	30.2 m^2
-Corridor with roof	Movement line to each rooms	-	width:1.5-2.5m	width:2.0m

(Notes)

・Design number of persons: Because port staff will be for the most part engaged in jetty/wharf activities, cargo handling, refueling, water servicing, etc., it is not necessary that main office space be such that it can accommodate all port personnel at one time. Accordingly, design no. of persons includes both the minimal number of persons that would occupy the office area at a given time, as well as the standard number of persons expected to regularly utilize the space.

・Floor space at similar facilities: The standard referenced floor space as set out in the building design and materials guidelines published by the Architectural Institute of Japan comprises per-person working space (i.e. it does not include appurtenant space for storage, etc. in the case of daily operations). Total space is accordingly set at around 1.3 fold the standard working space. Floor space at similar facilities takes into consideration the actual working space observed at the district fishery office and the district government office.

・Design floor space: This is determined with comprehensive consideration to design number of persons, floor space at similar facilities, and intended facility function. Room floor space is calculated in principle on the basis of the frame center line.

・*1: The case of fish handling shed in Maumere fish market.

・*2: The meeting room in the table above is to be jointly used as an administrative office and gathering place for the fishermen's cooperative.

Table 2.2.5 Primary functions and design floor space for appurtenant facilities

Rooms by function	Main function	Planned unit/ Persons	Similar facility/ Area/Capacity	Planned area/ Capacity
Facility for premises safety function				
Security guard house - Staff room	Entrance and premises control	3 persons (24hrs.)	6-12 m^2	6 m^2
Facility for sanitary function				
Public lavatory - Toilet booth	For general users (male/ female)	Each 2 persons	2-4 m^2/ booth	2.5 m^2/ booth
- Garbage depot	Temporary depot for garbage in premises	-	-	17.9 m^2
- Simple waste water processing facility	Simple processing of wastewater from the premises	-	-	37.5 m^2
Facility for premises infrastructure function				
Electric power supply and water supply shed				
- Water receiving tank/pump room	To store fresh water for premises facilities	-	-	12 tons
- Elevated water tank	To supply fresh water for premises facilities	-	-	4 tons
- Receiving from pole transformer	To reduce from 20,000V of trunk line voltage to 380/220V	-	-	Approx. 100KVA
- Power supply room	To supply power for premises facilities	-	-	220/380V

2-2-2 Basic Plan (Construction Plan/ Equipment Plan)

2-2-2-1 Facility layout and basic facility planning criteria

(1) Zoning and building layout plan

1) Basic approach to layout planning

As the Project site is located within urban area in Larantuka sub-district, utility infrastructure including electricity and water supply facilities is in place. Vehicle access to the site is also good since the site area fronts on a major trunk road. Items of high priority in facility layout planning include: (i) an efficient work flow between on-land and off-shore facilities, (ii) rain runoff toward the site from the immediate hinterland can be safely processed, (iii) fuelling facilities are located at safe distance from nearby residences, and (iv) wastewater outfall to the sea has no direct impact on the fish catch landing area.

In this light, basic approach to facility layout planning is as follows:

- Because the access bridge is positioned at the southwest side of the Project site due to the prevailing tidal current direction and wave conditions, the line of work flow to the land side from the access bridge will comprise the primary work flow axis within the Project site. This primary axis will in turn serve as the reference line for on-land facility layout taking into consideration respective facility functions, work flow as well as on-premise management structure.
- Project facilities to be located toward the road side of the site will be located back from the existing road alignment a prescribed distance taking into consideration handling rainwater runoff, future widening of the existing road (including pedestrian sidewalk) by the district government, as well as to accommodate space for future infrastructure implementation along the road including sewage works, power supply works, etc.
- Fuelling facilities will front on the above described primary work flow axis, while at the same time being located at a safe distance from nearby residents.

2) Layout plan

In line with the above criteria, an overview of zoning and work flow planning is shown in the Fig.2.2.1 below based on zoning and work flow lines (these include on-premise catch landing work flow, re-supply servicing work flow, vehicle traffic flow, etc.).

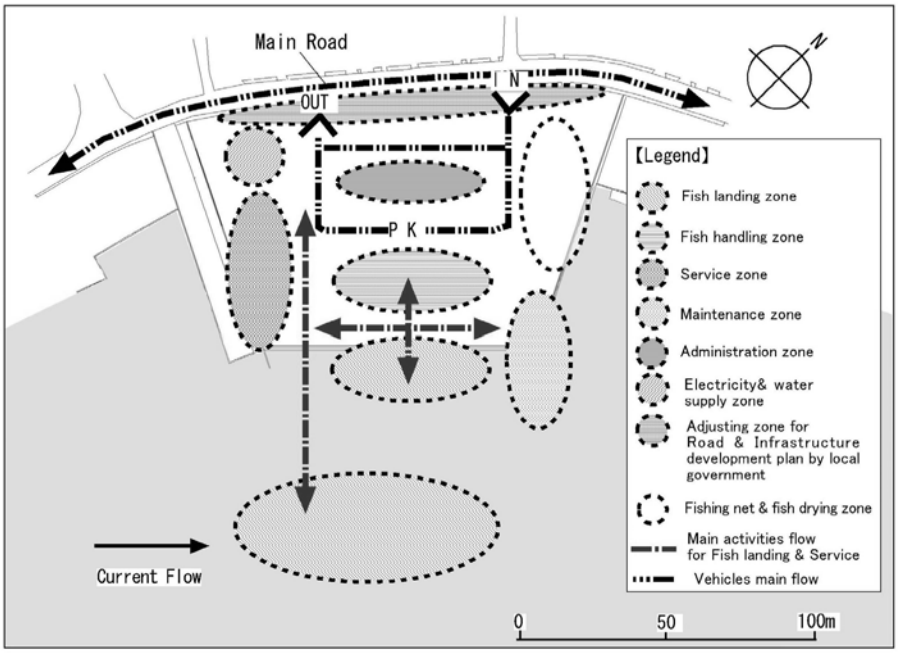


Figure 2.2 1 Outline of layout planning based on zoning and lines of work flow

(2) Study on berthing facility layout planning

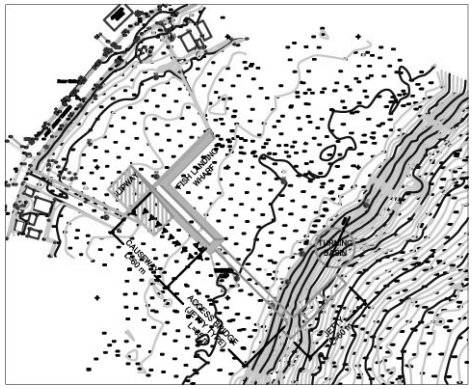
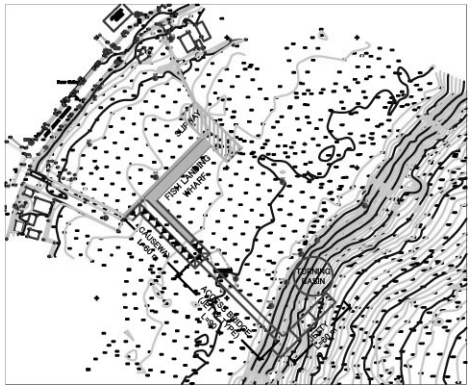
1) Basic approach to layout planning

Because the dominant tidal current is to the northeast based on examining field survey results of natural conditions prevailing in the Project area, it is envisioned that most fishing boats will be moored in the position with bow toward southwest. Accordingly, comparative studies on the layout planning for the landing jetty were carried out assuming a basic alignment to this direction of SW-NE.

Specific layout plan is examined in the subsequent items as shown in the Table 2.2.6 below.

- Linkage between on-land facilities and work flow planning
- Study on turning basin for fishing boat maneuvering area (to secure 2~4L at the landing jetty)
- Study on time frame for use of berthing facilities
- Study on operational rate for berthing facilities
- Calculation of necessary berthing facility (catch landing facility) scale

Table 2.2.6 Comparison of planar layout

Studied case	Alternative-A	Alternative-B	Alternative-C (dredging proposal)
Preliminary drawing			
Basic facilities	Steel pipe pile jetty	Steel pipe pile jetty	Steel pipe pile jetty
	Access bridge (combination steel pipe pile jetty and causeway)	Access bridge (combination steel pipe pile jetty and causeway)	Access bridge (combination steel pipe pile jetty and causeway). Access bridge is accorded a berthing function as well.
Features	Dredging is not necessary since the landing jetty is planned in the off shore side.	Dredging is not necessary since the landing jetty is planned in the off shore side. Compared with Alternative-A, a wider landing wharf could be secured.	An off-shore jetty is not necessary since a mooring area and a fishing boat maneuvering area (2L to 4L) are secured by dredging.
Natural environment aspect	Berthing space is kept even when tidal current flow and wind direction are southwesterly.	Berthing space is kept even when tidal current flow and wind direction are southwesterly. Because the slipway is positioned to the northeast, calm water at the slipway can be expected in the case of southwesterly wind and wave activity.	After dredging, there is concern that the dredged area will again fill with soil runoff from the drainage channel at the southwest side.
Construction aspect	The causeway can be used as a temporary access road. Construction period is roughly the same for both Alternative-A and Alternative- B.	The causeway can be used as a temporary access road. Construction period is roughly the same for both Alternative A and Alternative- B.	Disposal of approximately 20,000 m^3 of dredged sludge will be problematic. The causeway can be used as a temporary access road. Construction is the shortest among the options.
Maintenance aspect	Basically maintenance free.	Basically maintenance free.	Maintenance dredging is necessary. (Dredging equipment is not available on Flores island.)
Construction cost	Cost is about the same for Alternative-A and Alternative-B.	Cost is about the same for Alternative-A and Alternative-B.	This alternative is most economical (however, cost will be ultimately be affected by disposal method for dredged sludge).
Preliminary construction quantity estimate	Landing jetty length: L=60.0 m ; access bridge length: L=85.0 m No. of piles: Landing jetty: 3 piles × 6 piles × 3 spans = 54 piles Access bridge: 2 piles × 4 piles × 6 spans = 48 piles Total: 102 piles	Landing jetty length: L=60.0 m ; access bridge length: L=90.0 m No. of piles: Landing jetty: 3 piles × 6 piles × 3 spans = 54 piles Access bridge: 2 piles × 4 piles × 6 spans = 48 piles Total: 102 piles	Access jetty (cum jetty) length: L= 80.0 m No. of piles: Landing jetty: none Access bridge (cum landing jetty): 3 piles × 6 piles × 4 spans = 72 piles Total: 72 piles (30 less than Alternative-A)
Evaluation	△	○	△

2) Navigational study (turning basin at the landing jetty)

The seabed topography in the site vicinity is shelving bottom (shallow to a considerable distance from the shore) making it difficult to achieve necessary depth for fishing boats during L.W.L. Accordingly, it is necessary to plan a landing jetty positioned in accordance with the Fig.2.2.2 in order to enable turning basin sufficient to accommodate target fishing boats operation and mooring. It is recommended that turning basin be 2~4 times the boat length (in the calm area) according to a guideline of fishing port planning. Thus under the Project, the turning basin is determined at 30.0 m, equivalent to two times of the target boat length of 15.0 m as shown in the Fig.2.2.2.

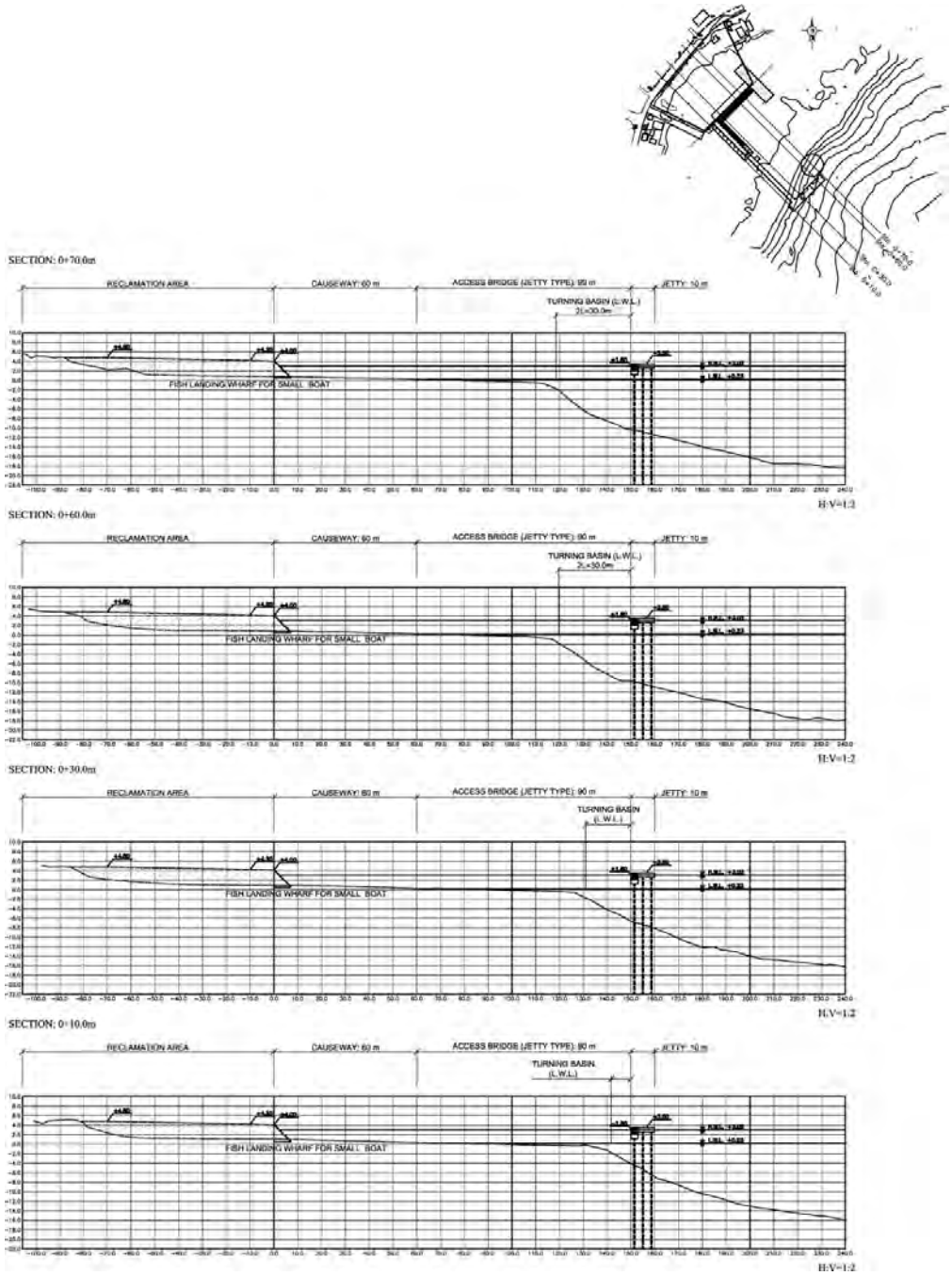


Figure 2.2.2 Relationship between landing jetty position and current topography

3) Study on time frame for use of berthing facilities

Differential in tidal levels at the proposed construction site is roughly a maximum of 2.80 m. Study was carried out in line with the Table 2.2.7 below to confirm the feasibility of catch landing and fishing boats re-supply operations in the case of fishing boats using the landing jetty and landing wharf (for small fishing boats) during the respective tidal phases. This study was based on results of tidal level observation, and confirmed the time frame that facilities can be used based on the frequency and duration of specific tidal phases.

Based on the study results, it was identified that it will be necessary for (i) berthing and catch landing operations at the landing jetty (crown height of +3.5m) and the landing wharf for small boats during high tide, and (ii) jetty berthing and catch landing operations for non-motorized and other fishing boats during low tide (crown height +1.8m). Accordingly, it will be possible to mitigate tide level impact on landing operations by effectively allocating usage of the landing jetty and landing wharf for small fishing boats.

Table 2.2.7 Tidal phase during with landing facilities can be utilized

Tide level	No. of Occur.	Occur. rate (%)	Average Continuation time (hr)	Mooring facility					
				Jetty(c. level +3.5m)		Jetty (c.level+1.8m)		L. wharf (depth+1.0m)	
				Restricted by					
				depth	c. level	depth	c. level	depth	c. level
+40cm above+70cm below	5	2.8	2.0	○	○	○	△	○	○
+250cm above+280cm below	15	7.8	1.9	○	○	○	△	○	○
+220cm above+250cm below	19	13.9	2.6	○	○	○	△	○	○
+190cm above+220cm below	26	11.7	1.6	○	○	○	△	○	○
+160cm above+190cm below	30	13.9	1.7	○	○	○	△	○	○
+130cm above+160cm below	27	16.7	2.2	○	×	○	○	○	○
+100cm above+130cm below	22	12.8	2.1	○	×	○	○	□	○
+70cm above+100cm below	11	11.7	3.8	○	×	○	○	×	○
+40cm above+70cm below	7	8.9	2.6	○	×	○	○	×	○

Remarks: 1) Assumed that fishing boats will not be moored when the tide become higher than the crown level.
2) Assumed that fishing boats will not be moored when the tide become 180cm lower than the crown level.
3) Data used was obtained from 15 days tidal observation.
4) ○:means mooring/landing possible, and △means mooring/landing possible by using stairs.
□means mooring/landing impossible except small non-motorized boat, and ×means impossible for all boats

4) Study on operational rate for berthing facilities (landing jetty)

In order to calculate the operational rate for the landing jetty, the average daily wind speed from all directions as observed at Larantuka airport for the period January 2003 to June 2006 was applied. Applying the SMB method (Sverdrup-Munk-Bretshneider) in calculating occurrence frequency for wave height at the jetty site, the operational rate for the landing jetty was calculated..

Generally in the case of fishing port facility planning, maximum wave height where catch landing operations are still possible is a maximum 30~40 cm for small boats. According to the Table 2.2.8, a wave

height of 40 cm or more is 2.9% and the one with a 30 cm or more is 5.17%. As a result, it is concluded that the operational rate for the landing jetty would be 97.1% in the case of wave height of 40cm or more and be 94.8% in the case of wave height of 30cm or more.

Table 2.2.8 Occurrence frequency for wave height calculated from average daily wind speed

Wind speed (knot)	Wind speed (m/s)	Wave height (m)	Frequency of occurrence (%)	Operational rate (%)
28	14.4	1.00 m or more	0.08%	99.92%
28	14.4	0.90 m or more	0.08%	99.92%
23	11.8	0.80 m or more	0.23%	99.77%
22	11.3	0.70 m or more	0.39%	99.61%
18	9.3	0.60 m or more	0.55%	99.45%
16	8.2	0.50 m or more	1.10%	98.90%
13	6.7	0.40 m or more	2.90%	97.10%
11	5.7	0.30 m or more	5.17%	94.83%
8	4.1	0.20 m or more	13.16%	86.84%
4.7	2.4	0.10 m or more	33.75%	66.25%
0	0	0.00 m or more	100.00%	0.00%

Source: Calculated by SMB method based on observational data from Larantuka airport.

As the result of above mentioned examinations, it is confirmed that the operational rate of the off shore jetty will be sufficiently secured. Accordingly, the Alternative-B shown in the Table 2.2.6 is to be adopted since it is not required dredging works and a wider area could be used for the landing wharf for small fishing boats.

(3) Calculation of necessary scale for berthing facility (landing facility)

1) Calculation criteria

In calculating the scale of berthing facilities, consideration is given to local mooring procedures. Accordingly, berthing method at the landing jetty is to be berthing alongside, while berthing method at the landing wharf for small boats is to be berthing perpendicular to jetty and landing catch at bow (or stern). Study on berthing facility requirements was carried out based on the design criteria set out below and in line with target fishing boat operations and re-supply goods/services supply to the boats such as ice, water, foods, fish net, oil, etc.

a) Type and number of target boat

Type and number of fishing boats that land fish catch in Larantuka during the peak season are shown in the Table 2.2.9 below. Out of them, shadow marks are put to the fishing boats that will land fish to the planned facility. Reasons of the selection are as follows:

- Skipjack pole and line boat :The boats that do not have any trading contract with existing fish trading companies, will use the planned facility to get re-supply services, when ice become deficit in the peak season.
- Tuna vertical line boat :Only 7 boats belonging to Larantuka Sub-district will come to the planned facility instead other boats that come from other district have a tradition to make salted fish when they can not secure ice

- Vertical/trolling line boat :All the 22 local boats will use the planned facility to get re-supply services, when they can not secure ice in the peak season.
- Round haul netters :Their catch is usually much and spending much time and labor for landing their catch during the low tide. Accordingly, all of this type of boats will use the planned facility.
- Gill netters :All the boats that belong to Larantuka Sub-district will use the planned facility because they can access without consuming much fuel.
- Blanket netters :Only the boat registered to the planned site will use the planned facility because their catch is sold to skipjack pole and line boats as a live bait on the sea and do not move around from their base village.
- Non-motorized boats Only the boats registered to the nearest villages from the planned site will use the planned facility.

Table 2.2.9 Type and number of target boats

Type of boat in Larantuka (No.)	Boats landing fish to trading companies (No.)		Boats landing fish at commercial port (No.)	Boats landing fish at beaches (No.)	Total of target boats (No)
	Contracted	Not contracted			
Pole and line boat (108)	87	21	-	-	21
Tuna vertical liner (7+42)	-	(42 Boats from outside district)<1 + 7 boats in Larantuka :51	-	-	7
Vertical/trolling liner (22)	-	22	-	-	22
Round haul netters (37)	-	-	30 boats from outside Larantuka+3 boats in Larantuka :33	4 boats in Larantuka 4	37
Gill netters (36)	-	-	9	27	36
Blanket netters (7)	-	-	-	1 boat registered to the site :1	1
				6 boats registered to other villages	-
Non-motorized boats (289)	-	-	-	25 boats registered to 3 adjacent villages including the site 289	25
				264 boats in other villages	-
Total (548)	87	92	42	327	149

Remark<1: 47 Boats from outside district will not use the planned facility

b) Number of target fishing boat by port function and by utilization purpose

The number of target boats by port function and by utilization purpose is shown in the Table 2.2.10 below.

Table 2.2.10 Number of target boats by port function and by utilization purpose

Type of fishing boat	No. of target boats	Fishing port function				Utilization purposes of port facility					
		Landing / re-supply / berthing	Landing / berthing	Re-supply /berthing	Re-supply	Jetty			Landing wharf		
						Landing	Re-supply servicing	Re-supply servicing	Landing	Re-supply servicing	Re-supply servicing
Landing / re-supply servicing time						Morning	Other	Other	Morning	Morning	Other
Type (A+B): pole/line	21	-	-	3	18	0	0	21	0	0	0
Type C: tuna vertical line	7	-	-	1	6	0	0	7	0	0	7
Type D: vertical line and trawler	22	-	-	1	21	0	0	22	0	0	22
Type E: round haul netter	37	-	37	-	0	37	37	0	37	37	0
Type F: gill netter	36	-	36	-	0	36	36	0	36	36	0
Type G: blanket netter	1	-	-	1	0	0	0	0	1	1	0
Type H: non- motorized boat	25	23	2	-	0	0	0	0	25	25	0
Total	149	23	75	6	45	(73)	(73)	(50)	(99)	(99)	(29)
Cases studied for calculating scale						Case-1		Case-2	Case-3		Case-4

Remark: Number of boats indicated in ( ) is applied to the case for calculating facility scale.
Source: See Appendix 6-4 "Unit values of Target Boat Shapes, Daily Fish Catch Volume and Daily Demand of Re-supply Services"

c) Studied cases and number of fishing boats using facilities

Following 4 cases for calculating scale as indicated above are studied in terms of calculation criteria for jetty scale and landing wharf scale as shown in the Tables 2.2.11~2.2.14.

<To be used for calculating required scale of landing jetty>

Case 1: 73 boats (both for landing and re-supply services)

Case 2: 50 boats (only for re-supply services)

Table 2.2.11 Calculation criteria for landing jetty scale (case-1)

Fishing boat type	No. of boats	Boat length: L (m)	Boat width: B (m)	Draft: D (m)	Catch landing time	Re-supply servicing time
Type-E (round haul netter)	37	15.00	1.25	1.00	48 min	45 min
Type-F (gill netter)	36	7.00	1.00	0.60	14 min	41 min
Average	(73)	11.00	1.13	0.80	31 min	43 min
To be used for required time for landing and re-supply services					30min	45min

Table 2.2.12 Calculation criteria for landing jetty scale (case-2)

Fishing boat type	No. of boats	Boat length: L (m)	Boat width: B (m)	Draft:D (m)	Catch landing time	Re-supply servicing time
- Type-A (skipjack pole and line)	13	18.00	3.75	2.00	0 min	95 min
- Type-B (skipjack pole and line)	8	12.00	1.25	1.00	0 min	59 min
- Type-C (tuna vertical line)	7	7.00	1.25	1.00	0 min	46 min
- Type-D (vertical line and trawler)	22	7.00	1.00	0.60	0 min	46 min
Total no. of boats, and average L, B, D	(50)	11.00	1.81	1.15	0 min	60 min
To be used for required time for landing and re-supply services						60 min

<To be used for calculating required scale of landing wharf of small boats>

Case 3: 99 boats (for fish landing and for re-supply services)

Case 4: 29 boats (only for re-supply services)

Table 2.2.13 Calculation criteria for small boat landing wharf scale (case-3)

Fishing boat type	No. of boats	Boat length: L (m)	Boat width: B (m)	Draft: D (m)	Catch landing time	Re-supply servicing time
- Type-E (round haul netter)	37	15.00	1.25	1.00	45 min	36 min
- Type-F (gill netter)	36	7.00	1.00	0.60	11 min	29 min
- Type-G (blanket netter)	1	14.00	10.50	1.00	0 min	0 min
- Type-H (non-motorized boat)	25	4.00	0.60	0.30	6 min	15 min
Total no. of boats, and average L, B, D	(99)	10.00	3.34	0.73	22 min	28 min
To be used for required time for landing and re-supply services					30min	30 min

Table 2.2.14 Calculation criteria for wharf scale for small boat landing (case-4)

Fishing boat type	No. of boats	Boat length: L (m)	Boat width: B (m)	Draft: D (m)	Catch landing time	Re-supply servicing time
- Type-C (tuna vertical line)	7	7.00	1.25	1.00	0 min	34 min
- Type-D (vertical line and trawler)	22	7.00	1.00	0.60	0 min	34 min
Total no. of boats, and average L, B, D	(29)	7.00	1.13	0.80	0 min	34 min
To be used for required time for landing and re-supply services					-	30min

d) Required catch landing and fishing boats re-supply servicing time

Average required time for catch landing and re-supply servicing for target boats is the total necessary time for catch landing, ice supply, fuel supply and water supply for fishing boats using the berthing facilities. In this regard, average required time for catch landing and re-supply servicing was set at 30 min, 45 min and 60 min, respectively, as indicated in the above Tables 2.2.11~2.2.14.

e) Planned time for catch landing and re-supply servicing under the Project

The peak catch landing time is 5:30~7:30 am.. However some boats may come earlier or later. Considering a 30 min margin period both before and after this time frame, planned catch landing time is basically calculated as 3 hours. In addition, planned time for re-supply servicing is estimated at 2 hours and 15 minutes following immediately upon completion of the above described catch landing operations. With the inclusion of subsequent time for crew dining, using lavatory facilities, and inspecting fishing gear and boat condition, the design time for re-supply servicing is put at four hours (essentially taking up the entire morning).

f) Required berthing length per boat

In reference to "Technical Guideline of Fishing Port Planning in Japan", required berth length per boat was set as follows:

- Landing jetty (berthing alongside) = average boat length (L) × 1.15
- Landing wharf for small fishing boats (bow/stern berthing) = average boat width (W) + allowable width (0.5 × W)

g) Berthing turnaround

Number of berthing turnarounds = 60 min ÷ required time for catch landing, or
= 60 min÷ required time for re-supply servicing

h) Required number of berths

Required no. of berths = the number of boats using the berthing facility ÷ (turnaround rate × planned time for catch landing), or
= the number of boats using the berthing facility ÷ (turnaround rate × planned time for re-supply servicing)

i) Total berth length

Total berth length = required no. of berths × necessary berth length per boat

2) Study results

Results of calculation on the required scale for berthing facilities (landing jetty and landing wharf for small fishing boats) are as described below.

a) Landing jetty

Scale calculation results for the landing jetty are shown in the Table 2.2.15.

Table 2.2.15 Results of calculation scale for the landing jetty

Studied case	Case-1		Case-2
	Catch landing operations	Re-supply servicing operations	Re-supply servicing operations
No. of boats using port facilities	73 boats	73 boats	50 boats
Necessary catch landing and re-supply servicing time	30 min	45 min	60 min
Planned catch landing and re-supply servicing time	3 hours	4 hours	4 hours
Berth length per boat	12.7 m	12.7 m	12.65m
Berth turnaround	2.0 times	1.3 times	1.0 times
Required no. of berths	12 berths	14 berths	13 berths
Berth length	154 m	173 m	158 m

On the basis of the above, the required landing jetty scale is 154~173 m. For maximum economy of use, however, both the front and back side of the jetty can be used for berthing. In order to minimize the design facility scale, berthing length is to accordingly be 140 m (front-side 60.0 m ＋ back-side 60.0 m ＋ 10.0 m

at each end of the jetty). Any lack of berthing space will be addressed by appropriate boat maneuvering and operation.

b) Landing wharf for small boats

Scale calculation results for the landing wharf for small fishing boats are shown in the Table 2.2.16.

Table 2.2.16 Results of calculation scale for the landing wharf for small boats

Studied case	Case 3	Case 4	
	Catch landing	Re-supply servicing	Re-supply servicing
No. of boats using port facilities	99 boats	99 boats	29 boats
Necessary catch landing and re-supply servicing time	30 min	30 min	30 min
Planned catch landing and re-supply servicing time	3 hours	4 hours	4 hours
Berth length per boat	5.0 m	5.0 m	1.7 m
Berth turnaround	2.0 times	2.0 times	2.0 times
Required no. of berths	17 berths	12 berths	4 berths
Berth length	83 m	62 m	6 m

On the basis of the above, the required scale for the landing wharf for small fishing boats is calculated at 62~83 m. Considering berthing of boats registered in Amagarpati, there may be an insufficiency of facility scale. Accordingly, the landing wharf of about 100m length is planned considering the mooring space for these Amagarpati boats.

2-2-2-2 Civil works plan

(1) Design guidelines and standards

In terms of project design manuals for port facilities in Indonesia, various standards are applied including Japanese design standards as well as the Shore Protection Manual issued by the U.S. Army, etc. Such standards have come into practice through various cooperative efforts over the years by international agencies. Accordingly, the guidelines and standards to be applied to facility design under the Project are primarily the following based on reference to port facility planning and design manuals widely accepted in Indonesia.

- Guidelines for Fishing Port and Fishery Facility Design in Japan (2003 edition)
- Guidelines for Fishing Port Design as issued by the All Japan Fishing Ports Association (revised edition as of 1992)
- Shore Protection Manual (1984)

(2) Design criteria

Civil works design criteria is indicated in the Table 2.2.17.

Table 2.2.17 Civil works design criteria

Item	Content	Remarks
Utility life	30 years	
Design tidal level	H.W.L+3.02 m、L.W.L+0.23 m、M.S.L+1.63 m	
Design wave	Landing jetty : Wave height : H1/3=1.4 m, Wave period: T=3.852sec Causeway : Wave height : H1/3=1.2 m, Wave period: T=3.852sec Landing wharf: Wave height : H1/3=0.9 m, Wave period: T=3.852sec	Wave with a return period of 30 years by SMB method
Soil quality	Jetty : 1st layer : N value=16; ϕ 36°; 2.0ton/m^2 2nd layer : N value=31; ϕ 36°; 2.0ton/m^2 3rd layer : N value=50; ϕ 40°; 2.2ton/m^2 Access jetty : 1st layer : N value=29; ϕ 36°; 2.0ton/m^2 2nd layer: N value=42; ϕ 36°; 2.0ton/m^2 Landing wharf: 1st layer : N value=31; ϕ 36°; 2.0ton/m^2 2nd layer: N value=50; ϕ 40°; 2.1ton/m^2	
Seismic coefficient	0.17 is applied from Zone No.4	Larantuka
Targeted fishing boats	3GT～15GT	
Boat berthing speed	V=0.50m/s	
Boat pull force	P=30 k N	
Surcharge load	10kN/m^2; during earthquake: 5kN/m^2	
Upper structure dead load	20kN/m^2	
Vehicle live load	Equivalent to T14 load (total weight of 14 tons)	
Steel corrosion speed	H.W.L or greater: 0.30 mm/year H.W.L～L.W.L-1.0m: 0.20 mm/year L.W.L-1.0m～seabed level: 0.15 mm/year Under seabed: 0.03 mm/year	

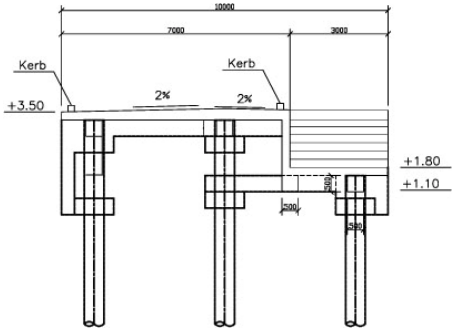
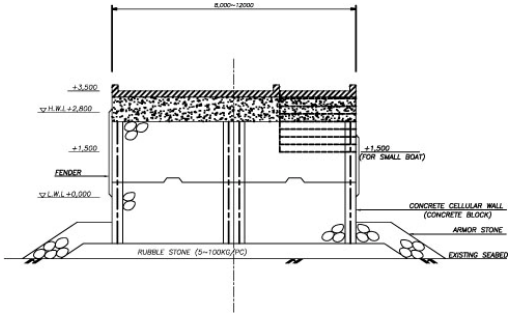
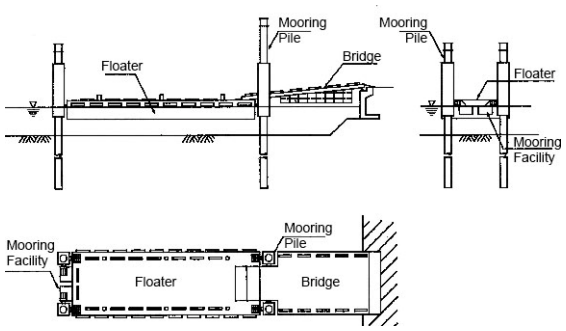
(3) Facility overview

1) Landing jetty

a) Selecting structure type

As for the structure of landing facilities, jetty type, gravity type and floating type were examined as indicated in the Table 2.2.18 below. As a result of comparison, it is concluded that Alternative-A is optimal from view points of functional, environmental, construction work, maintenance work and economic aspects. This is structural layout and format optimum for local natural conditions, and is applied to Larantuka commercial harbor, the ferry terminal and Tabilota harbor on Adonara island across from Flores Island those are all nearby the Project site.

Table 2.2.18 Structural comparison of berth facilities

Structure type	Alternative-A: Jetty type berth	Alternative-B: Gravity type berth	Alternative-C: Floating type berth
Cross Section of Structure			
Features	Catch landing height varies depending on the tidal phase.	Catch landing height varies depending on the tidal phase.	Catch landing is not affected by the tidal phase.
Natural environment aspect	Because cap rock with an N value of approx. 50 has been partially observed during sub-soil survey, steel pipe piles are recommended. Impact from tidal current flow is not perceived to pose any problem.	Seabed topography gradient ranges from 1/5 to 1/10, meaning deep water. Because this poses a concern with regard to scouring of structure foundations due to tidal current action, adoption of this type of design is not deemed appropriate.	Connection with the mainland requires a mechanically operating type access bridge. Because the maximum tidal level differential is 3.0 m, this would entail a large-scale structure. Furthermore, impact from sea flow as a result of high tide would be large.
Construction aspect	Cases of similar structures in the vicinity are numerous, and structurally no major problem is envisioned. However, dealing with cap rock in the case of pile driving will require careful attention.	Installation works require a floating dock and large-scale crane.	Because the structure is manufactured at a location away from the construction site, a set of floating equipment including tugboat is necessary to transport floating jetty.
Maintenance aspect	Basically maintenance free.	Basically maintenance free.	Periodic maintenance is necessary for floating jetty and anchoring system.
Cost	Most economical of the options.	Costly.	Costly.
Evaluation	○	×	×

b) Setting design length

The landing jetty is to be 60.0 meters in length based on the study result on landing facility scale as discussed above. As for span, 20m x 3 spans are planned taking into account effective construction works including the amount of concrete that can be placed daily, etc.

c) Setting design width

Landing jetty width is to be 7.0 m. This takes into consideration (i) a crown level at + 3.5 m to accommodate opposite passing of T14 vehicles (2.75m×2 vehicles), (ii) opposite passing of a T14 vehicle and two pushcarts (2.75 m x 1 vehicle + 1.20 m x 2 pushcarts), (iii) safety lighting, and (iv) mooring post and curb stone installation space, etc. Also, width is to be 3.0 m at crown level +1.8m for an overall width of 10 m considering the space for loading/unloading works.

d) Setting crown height

Landing jetty crown height is set with reference to the Table 2.2.19 below. Because tide level differential at Larantuka according to observation data is 2.8m (2.79 m = 3.02-0.23), crown elevation is set at +3.5m (3.5 ≒ 3.02 + 0.50). Also, low crown height is set at +1.8 m which is above the M.S.L.

Table 2.2.19 Crown height calculation values

Tide level differential (H.W.L－L.W.L)	Target fishing boats (G.T.)			
	0~20 tons	20~150 tons	150~500 tons	500 tons or more
0m～1.0m	0.7 m	1.0 m	1.3 m	1.5 m
1.0m～1.5m	0.7	1.0	1.2	1.4
1.5m～2.0m	0.6	0.9	1.1	1.3
2.0m～2.4m	0.6	0.8	1.0	1.2
2.4m～2.8m	**0.5**	0.7	0.9	1.1
2.8m～3.0m	0.4	0.6	0.8	1.0
3.0m～3.2m	0.3	0.5	0.7	0.9
3.2m～3.4m	0.2	0.4	0.6	0.8
3.4m～3.6m	0.2	0.3	0.5	0.7
3.6m 以上	0.2	0.2	0.4	0.6

Source: Guidelines for Fishing Port and Fishery Facility Design in Japan

2) Landing wharf for small fishing boats

a) Selection of structural type

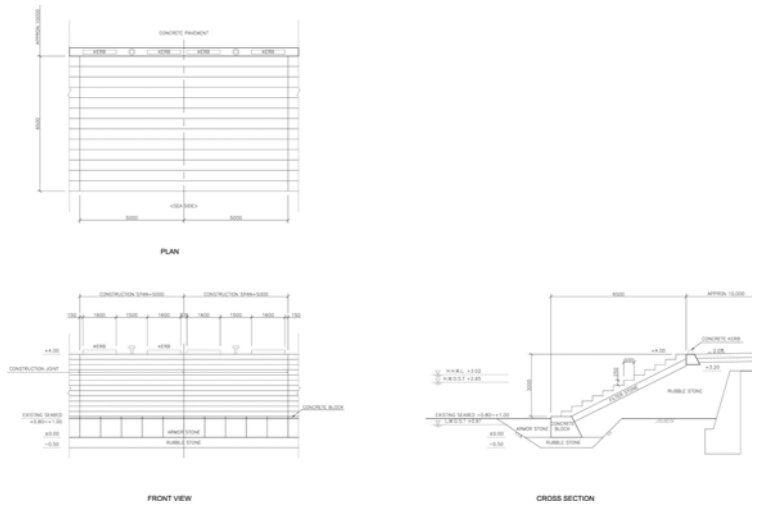
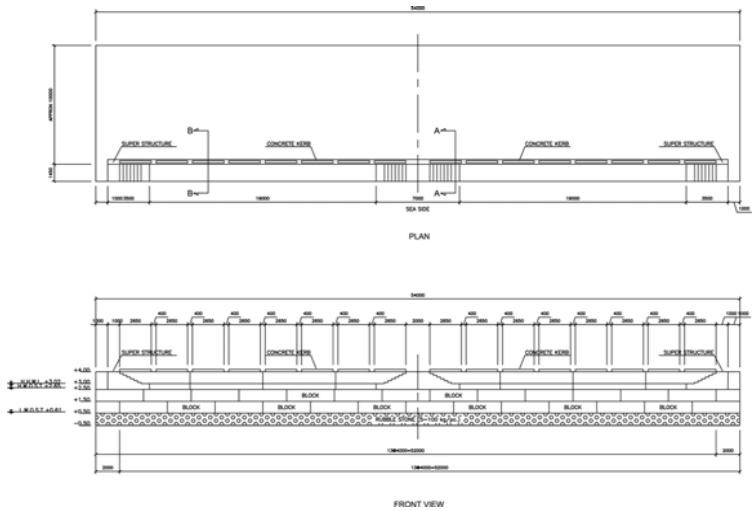
The landing wharf for small fishing boats fronts on the landfill revetment implemented by the Indonesian government side. Field survey together with fishermen assemblies confirmed the fact that local fishermen desire a stair-landing facility. In selection of structural type, following two types were compared:

Alternative-A: Stair-type berthing wharf (rock fill and in situ concrete) that the step portion be set parallel to the alignment of the wharf

Alternative-B: Stair-type berthing wharf (block structure) that the step portion be set vertical to the alignment of the wharf

Alternative-A was selected since it could be used in any tide level when the tide is more than the draft of target boats, and is more cost-effective and easier for construction compared to Alternative-B among the options entailing a stepwise mooring design (See Table 2.2.20 below).

Table 2.2.20 Structural comparison for landing wharf for small fishing boats

Structure type	Alternative-A: Stair-type berthing wharf (concrete mixed with coarse rock)	Alternative-B: Stair-type berthing wharf (block type)
Cross Section of Structure		
Advantages	Catch landing operations are possible even in the case of a tidal level exceeding the fishing boat draft.	Catch landing operations are possible even in the case of a tidal level exceeding the fishing boat draft. However, in the case of jetty crown elevation and tidal level deferential, it would be difficult for non-motorized fishing boats to perform catch landing operations.
Environmental aspect	Care in boat operation is necessary to prevent the boat bottom from contacted with the stair construct in the case of heavy wave activity.	No major problems are envisioned.
Construction aspect	Construction method is simpler than that for Alternative-B. Although a portion of construction works including foundation consolidating rock, etc. is subject to tidal level impact, most construction works can be carried out on dry land thereby reducing the construction period.	Although block manufacture can be performed on land, a large area construction yard as well as large crane equipment becomes necessary. Construction period is longer than that for Alternative-A due to longer time for block manufacture and placement.
Maintenance aspect	In principle, maintenance free.	In principle, maintenance free.
Cost aspect	More economical than Alternative-B.	Fittings for mooring fenders are necessary, making this more costly than Alternative-A.
Assessment	○	△

b) Setting design length

On the basis of necessary scale calculation as previously described, 62 m to 83 m are required. However, because the landing wharf for small fishing boats is planned on a narrow site, available length is the neighborhood of 55 m to 60 m. Accordingly, the design length is planned to be secured about 100m, and insufficient design berthing length is to be separately accommodated by stair-landing facility at one side of the causeway.

c) Setting crown height

Design crown height is set at +4.0 m considering an overtopping wave volume of around 0.02 (m^3/m/sec) against in view of the relationship between hinterland importance and tolerable wave overtopping as shown in the Table 2.2.21 below. This is calculated to prevent damage from ocean overflow with regard to the fish handling shed located to the rear of the landing wharf for small fishing boats.

Table 2.2.21 Relationship between hinterland importance and overtopping waves

Degree of hinterland importance on the Project	Tolerable wave overtopping (m^3/m/sec)
Areas of resident and public building concentration, particularly such areas where wave overtopping and sea spay could be expected to have a significant damaging impact.	Approx. 0.01
Other important areas	Approx. 0.02
Various other related areas	Approx. 0.02~0.06

Source: Guidelines for Fishing Port and Fishery Facility Design in Japan

d) Setting apron width

Apron width is set at 10.0 m with reference to the Table 2.2.22 below.

Table 2.2.22 Apron width

Category		Apron width (m)
Landing wharf	All fish catch is brought to fish handling shed	3.0
	Direct shipment from the apron by vehicle	10.0
Fishing embarkation wharf		10.0
Rest wharf		6.0

Source: Guidelines for Fishing Port and Fishery Facility Design in Japan

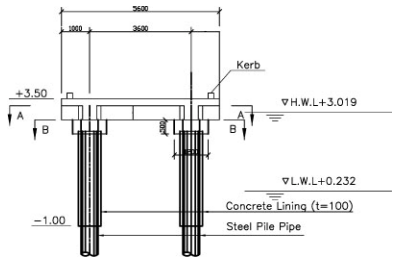
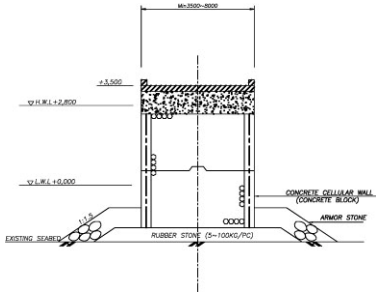
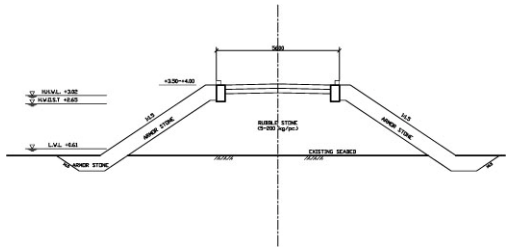
3) Access bridge (jetty type; causeway type)

a) Selection of structure type

On the basis of the comparison for access bridge structure as shown in the Table 2.2.23 below, a combination of jetty type and causeway type is planned. The reasons for combination with a causeway are as follows:

(i) Compensation for potential lack of berthing space at the wharf for small fishing boats.
(ii) Expect calmer conditions at the landing facilities by blocking wave activity from the southwest direction.
(iii) Enhanced sanitation by mitigating direct outflow of wastewater to the landing wharf area from the existing drainage channel at the southwest of the Project site, and
(iv) A portion of construction works can be carried out on land due to soil spreading and compaction by heavy machinery enabling economizing on construction cost.

Table 2.2.23 Structural comparison for access jetty

Structure type	Alternative-A: jetty type	Alternative-B: gravity type (block)	Alternative-C: causeway type
Cross Section of Structure			
Features	Structure suited to sandy foundation.	Block type structure is often adopted in cases where water depth is relatively shallow and foundation conditions are good.	Slope is stair-type, and can be used as a landing wharf if necessary.
Natural environment aspect	Does not obstruct tidal current, and is optimum in terms of impact on surrounding environment.	Obstructs tidal current; however, this creates calm water conditions at landing wharf.	Obstructs tidal current; however, this creates calm water conditions at landing wharf.
Construction aspect	Because water depth is shallow during low tide, pile driving works must wait for proper tidal conditions or seabed excavation is necessary to enable access by pile driving barge.	Block manufacture on land is possible. This however entails a large scale block manufacture yard as well as a large-scale crane for construction works.	Construction works from the on-land side are facilitated. Construction period is thereby shortened. Also, causeway can then be used as a temporary access road during the rest of Project construction works.
Maintenance aspect	Basically maintenance free	Basically maintenance free	Simple maintenance required.
Cost	△	△	○
Evaluation	○	△	○

b) Setting design length

On the basis of the previously discussed layout planning, total structure length is to be 150 m. The causeway component is to be around 60 m in length from the standpoint of maximizing utility and effectiveness as well as constructability from the on-land side. The jetty component is to be around 90 m in length.

c) Setting design width

Design width is to be 5.60m （5.60 m ≒ 2.75m×1 vehicle + 1.20m x 2 push carts + 0.20 m x 2）. This allows one-way passage of a T14 vehicle with simultaneous opposite direction passing of push carts, and placement of stone curbing.

d) Armor stone for causeway component

Required weight for armor stone is calculated at approximately 0.40 ton/piece according to the Hudson formula below. Required weight for base stone underlying the armor layer is calculated at 50 kg/piece equivalent to 1/10~1/15 the weight of armor stone in accordance with the "Shore Protection Manual".

$$W = p_r H^3 / (K_D \cot\alpha \ (S_r - 1)^3)$$

Where,

W	:	Required block weight
p_r	:	Block density (2.60t/m^3)
H	:	Wave height (1.23m)
S_r	:	Block specific gravity in relation to seawater
α	:	Angle to the horizontal plane (33.7°); gradient (1 : 1.5)
K_D	:	Constant (2.4) based on armor material shape and damage rate

4) Slipway

Necessary slipway length and area is generally calculated based on utility purpose at normal times and for refuge during stormy weather. As shown in the following photograph, fishing boats from Amagarapati (29 boats) are maintained and repaired during low tide at a rate of around four boats per day. A yard will thus be necessary to enable continued fishing boat maintenance and repair in the same manner. Under the Project, slipway design will take into consideration the minimum requirement for boat upkeep at normal times; i.e. use as refuge during stormy weather will not be considered in design.

Photo Maintenance and repair works being carried out at the planned construction site

a) Setting design length

Design length is envisioned at 60.0 m. This is based on sliding up to 10.0% from the slipway crown given conditions of ground elevation and design land preparation elevation at the site.

b) Design width

Design width is calculated based on the following formula taken from the Guidelines for Fishing Port Design issued by the All Japan Fishing Ports Association. The space between boats was set at 2.0m referred to sun protection awning in the above photo.

W=15.0 m

$W = \Sigma B + b(n+1)$

$W = (1.25 \times 4 + 2.0 \times (4+1)) = 15.0m$

W: slipway width

B: target fishing boats width (1.25m)

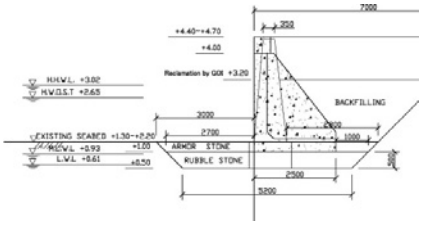
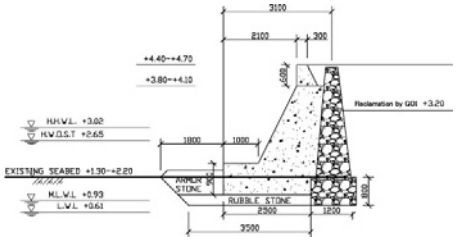
b: space between boats (2.0m)

n: number of boats using the slipway (4 boats)

5) Revetment works (northeast side and southwest side)

In case of the construction of the facilities on the reclaimed area, revetment reinforcement works are to be carried out in the northeast and southwest sides of the Project site which are subject to land preparation under the Project. These works comprise reinforcement of existing jetty structures. On the basis of structural comparison as indicated in the Table 2.2.24, Alternative-A (concrete L-type revetment) is adopted. Although Alternative-B (concrete gravity type) is advantageous in terms of cost, it is not recommended that water channels be blocked; which would occur given the fact that existing jetties in the northeast and southwest of the Project site adjacent to existing drainage channels. Range of reinforcement works would be approximately 85 m at the southwestern area and approximately 30 m in the northeastern sector to accommodate the planned slipway.

Table 2.2.24 Structural comparison for reinforcing the existing revetment

Structure type	Alternative -A: L-type concrete revetment	Alternative-B: Concrete gravity type
Cross Section of Structure		
Advantages	Construction quantities for the revetment main structure are less than that for the gravity type structure.	Suited to sites where design elevation is relatively low.
Natural environmental aspect	Existing drainage channels are not blocked.	Existing drainage channels on the northeast side and southwest side are blocked off when construction is implemented to the outside without removing the existing revetment.
Construction aspect	Construction period is minimized due to the fact that L-type block can be manufacturer in the construction yard.	Excavation and backfill works is not required compared to the L-type revetment works.
Maintenance aspect	The structure is basically maintenance free.	The structure is basically maintenance free.
Cost aspect	Compared to the gravity type structure, construction quantities are less for the revetment main structure, and therefore cheaper. However, excavation and backfilling are required that impact on the cost-effectiveness of this alternative.	Although quantity of concrete required is greater, excavation and backfill works are less than that in the case of Alternative-A.
Assessment	○	△Not desirable in light of the fact that water channels are blocked.

6) On-premise paving (roads and parking area)

Interlocking block is planned as paving for on-premise roads and parking area. This type of paving is superior in terms of ease of maintenance, of particular importance in light of potential subsidence at some locations due to future sump or residual water. Based on envisioned roadbed conditions after land preparation by the Indonesian side, a roadbed upper layer of 10.0 cm and roadbed sub-grade of 25.0 cm are to be spread, over which a cushion layer of 2.0 cm thickness (joint sand) is to be laid and covered with interlocking block (H=8.0 cm). Curb stone is to be laid at the road side to distinctly separate on-premise road and respective building site areas.

7) Rainwater drainage facilities

Facilities are required to dispose of rainwater falling on site and running off to the site from the anterior road surface during heavy deluges. In principal, these are to be U-type side drainage culverts (open culverts) to facilitate maintenance. Drainage channels crossing under the road will be culverts with grating covers.

8) Safety lights

Two pole mounted safety lights will be installed at both ends of jetties to facilitate safe vessel navigation at night. Specifications for these safety lights will be in accordance with standards issued by the IALA (International Association of Marine Aids to Navigation Lighthouse Authorities) in terms of color, luminescence, penetration efficiency and light travel distance. Light power source will be a combination of solar battery panel and storage battery.

2-2-2-3 Building and Facility Plan

(1) Building plan

Building scale is based on relevant basic values referred from "Unit Values of Target Boat Shapes, Daily Fish Catch Volume and Daily Demand of Re-supply Services" (See details in Appendix 6-4).

1) Fish handling shed

The fish handling place comprises an apron where landed fishes are sorted, the fish handling shed itself where round plastic containers (fish tubs) containing fish are arranged in sections for trading, and a truck berthing space where sold fish are temporarily placed prior to loading on to vehicles.

Fish handling shed design will take into account the fact that it will be most intensively used during the early morning hours, as well as the fact that catch volumes vary significantly depending on the moon phase. Also, in light of the time of over fish supply, a space is to be incorporated at this facility for short term placement of insulated cooling boxes to retain fish freshness.

a) Calculation of design scale

Fish handling shed scale is calculated on the basis of the following formula.

Necessary space = (fish volume handled daily) ÷ (fish volume handled per unit area) x (turn-over rate) x (occupation rate)

- Catch volume handled daily:
  The total volume of (i) fish landed at the Project site during the peak season and (ii) fish hauled to the site by vehicle from other sub-districts.

- Catch volume handled per unit area:
  Fish tubs (diameter 50~60 cm ; height 25 cm). Fresh fish weight per tub is 30 kg.

- Turnover rate:
  Two turnovers are envisioned during the peak landing period of two hours in the early morning from 5:30 to 7:30 a.m. when 80 percent of fish landing takes place.

- Occupation rate:
  Off loading, fish sorting and handling are intended to be performed manually. Occupation rate is determined based on the necessary space to efficiently accommodate fish tubs as well as allow for sufficient walking space among tubs.
- Truck berth for out-hauling fish:
  This is premised on hauling during peak fish-landing periods. Vehicles are small trucks.
  Values used in calculating the scale of the fish handling shed are as indicated in the Table 2.2.25 below.

Table 2.2.25 Basic values applied to calculating the scale of the fish handling shed

Type of Boat	No of target boat	No. of boat for landing	Landed fish catch/boat (Kg)	Landing time	Peak (New moon) Landed fish catch(Kg)	Lean (Full moon) Landed fish catch(Kg)
-Type A (Skipjack pole and line)	13	13	(○) 28	12:00-17:00	364	-
-Type B (Skipjack pole and line)	8	8	(○) 7	12:00-17:00	56	-
-Type C (Tuna vertical line)	7	-	×	-	-	-
-Type D (Vertical/trolling)	22	-	×	-	-	-
-Type E (Round haul netter)	37	37	○ 200	5:30-7:30	7,400	-
-Type F (Gill netter)	36	36	○ 30	5:30-7:30	1,080	1,080
-Type G (Blanket netter:)	1	-	×	-	-	-
Type H (Non-motorized)	25	25	○ 6	5:30-7:30	150	150
(Total)	149	119	-	-	9,050	1,230
Bringing in by vehicle					3,000	410
Daily handling volume					12,050	1,640
Daily handling volume except that of Type A and B					**11,630**	1,640

Note: - Values are based on the previously described base values for types of boats utilizing the design facilities, catches and re-supply servicing.
- Because the time frame for handling type-A and type-B catches differs from that for other types of catches, these have been excluded from the total catch intake during peak operating hours at the fish handling shed.

(Base values)

*Volume handled per one turnover at the fish handling shed:

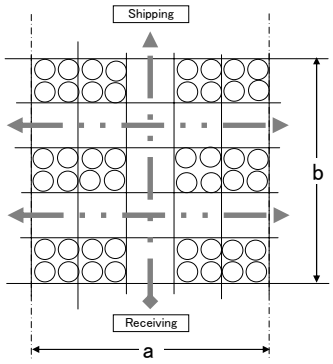
Half of the volume handled for peak time as indicated in the above table: 11,630 kg × 1/2 = 5,815 kg

*Space for fish tubs and aisles:

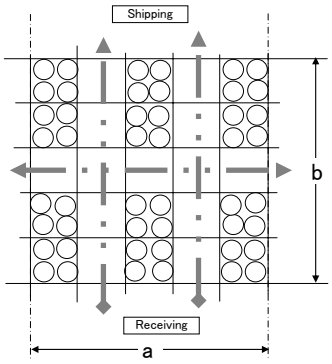
Tub space and aisle width takes into consideration the fact that work will be performed manually. The space for fish tubs can accommodate a minimum alignment of two rows. Aisle width is at minimum approx. 1.2 m.

(Space for fish tubs and aisles)

The relationship between fish tub placement and aisles is considered in terms of the model indicated in the figure 2.2.3 below. With emphasis on efficient direction of operational flow between the preparation space and the loading space, option-2 below is selected as the basic layout for tub placement and aisles.



Option-1: Principle direction of operational flow is horizontal in the figure



Option-2: Principle direction of operational flow is vertical in the figure

Figure 2.2.3 Options between fish tub placement and aisles

b) Facility overview

(Fish handling shed floor plan)

Spacing model for fish tub placement is shown in the figure 2.2.4 below. The broken line in the figure indicates space allowance to accommodate landed catches at peak times.

- Spacing model for peak time : (24 + 4) tubs × 30kg = 840kg
  : When aligned as per the figure below, 840kg × 7 lines
  = 5,880kg > volume handled per one turnover (5,815kg)

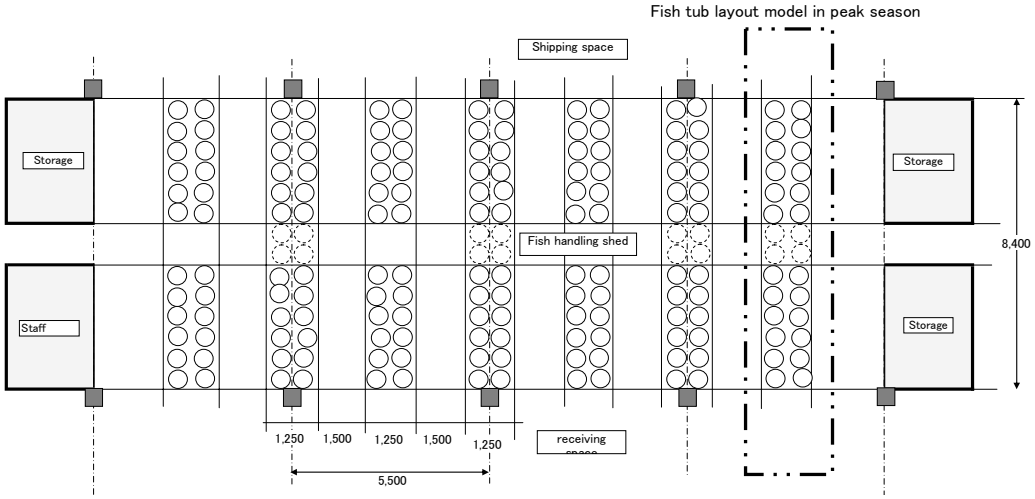


Figure 2.2.4 Floor plan for fish handling shed

(Space for insulated boxes)

There are conceivable scenarios where catches may be landed at times outside the normal time frame within which middlemen negotiate their purchases at the fish handling shed, or there may be times where the total fish brought in at a given time is in excess of that anticipated by the waiting middlemen. In either case, a temporary fish storage facility with a certain degree of insulation would

be extremely effective from both the point of view of the fishermen and the middlemen. Accordingly, a model to accommodate two types of insulated boxes, small ones and large ones, will be studied that would allocate space for these boxes on both sides of the fish handling shed. Sizes for insulated boxes are as follows:

- Small insulated boxes: These are of a size that can be carried by four female middlemen: 200 L × 4 nos.

[In order to encounter overnight stocking of 400kgs of skipjack that would be landed in the afternoon by pole and line vessels, four boxes with their single stocking capacity of 100kgs of fish, are to be provided: ice/fish rate; 100%]

- Large insulated boxes: These are of a size based on the present unit volume for marketing fish to the outside of the Project area: 1000 L × 2 nos.

[In order to encounter overnight stocking of one ton of fish on the assumption that about 10% of surplus fish over planned daily landing volume of 10 tons would be landed time to time in the peak season, two boxes with their single stocking capacity of 1000kgs of fish, are to be provided: ice/fish rate; 100%]

(Weighing scale, fish tubs, storeroom for cleaning gear)

Storerooms for stashing equipment and gear necessary for operating and maintaining the fish handling shed will be located at both sides of the facility.

- Fish tubs : These are fish tubs currently used locally for marketing fish; number of tubs is to be sufficient to handle 10% over the design landed fish at peak times (for two turnovers). Tubs are to be replaced by the Indonesian side.
- Weighing scales : Platform scales and suspended tilt scales
- Cleaning gear : Hoses and squeegees for cleaning shed interior. These cleaning gears are to be provided by the Indonesian side.

(Sanitation)

In order to maintain cleanliness within the fish handling shed, simple wash places will be established which supply fresh water. Fish residue, scales, etc. generated within the fish handling area will be collected to a solid waste pit. Wastewater will be conveyed to a simple waist water processing facility.

2) Ice making and storage plant

At present, ice is produced at two locations within the sub-district. One is at a fish buying company and is capable of a maximum daily production of 20 tons. The other is at an ice producing plant and is capable of 7 tons of output per day.

Almost all bonito and tuna caught by skipjack pole and line boats, vertical line boats (tuna), as well as vertical/trawling boats operating in the vicinity are landed at the fish buying company, at which time ice is supplied by the company at a price of RP 8,000 / 25 kg block. During the peak fishing season, however, a shortfall of approximately 8 tons of ice occurs. In such case, the fish buying company gives priority for ice supply to those fishing vessels with which it has entered into a purchasing contract. Fishing boats that have no contract subsequently encounter difficulties in obtaining ice. It is accordingly necessary under the Project that these fishing boats be supplied with sufficient ice to guarantee their fishing operations during the peak season.

On the other hand, the ice produced by the existing ice plant is priced at RP 10,000 / 25 kg which is higher than that for ice supplied by the fish buying company and beyond the affordability of almost all fishermen in the area. Nevertheless, large middlemen purchase ice from the plant to meet their ice demand for fish marketing operations. In determining the scale of ice making to be established under the Project, attention must be given to any adverse impact on the ongoing business operations of this ice plant.

Accordingly, ice making under the Project will be limited to meeting on-premise demand for ice for (i) fishing operations and (ii) maintaining fish freshness until landed fish can be moved into the distribution system.

a) Calculation of design scale

Ice demand for targeted boats must take into account ice/fish rates based on "Unit values for types of boats using the port facilities, catches and re-supply servicing" as set out in Appendix 6.4. Also, the amount of fresh fish hauled into the Project site by vehicle from adjacent sub-districts is estimated at 3 tons/day. Accordingly, ice demand at the site is calculated separately for (i) ice used in actual fishing operations and (ii) ice used in the course of fish handling at the port and moving fish catches into the marketing/distribution system.

(i) Ice demand for fishing operations

Ice demand in Larantuka drops significantly during the lean season (storm season) in January ~ February, as well as during the full moon phase each month (when skipjack pole and line boats that have large ice demand suspend operations). Mid-March to December comprises the peak fishing season, during which time shortages in ice supply occur. Accordingly, calculation of design ice making scale under the Project is premised on offsetting such ice shortages during the peak season.

Ice demand for fishing operations has been calculated based on landed fishes at the site during the peak season as well as fluctuations in monthly landed fishes depending on the moon phase, and is indicated in the table 2.2.26 below.

Table 2.2.26 Correlation between catches landed at the site, and ice demand (unit: daily ice requirement / kg of fish)

Target boat	No. of boat	Ave. catch (Kg/boat)	Landed Fish q'ty (Kg)	Ice use rate (%)	Ice fish rate (%)	Ice demand by boat (kg)	Influence of moon age	Fluctuation of ice demand by moon age (kg)		
								New moon (peak)	Half moon (medium)	Full moon (lean)
-Type A(Pole and line)	13	400	28kg/boat 364	100	100	5,200	large	5,200	-	-
-Type B (Pole and line)	8	100	7kg/boat 56	100	100	800	large	800	-	-
-Type C (Tuna vertical)	7	25	-	100	100	175	medium	175	175	
-Type D(Vertical/trolling)	22	25	-	100	100	550	medium	550	550	
-Type E (Round h. netter)	37	200	7,400	-	-	-	small	-	-	-
Type F(Gill netter)	36	30	1,080	15	50	81	small	81	81	81
-Type G(Blanket netter)	1	-	0	-	-	-	large	-	-	-
-Type H(Non-motorized)	25	6	150	-	-	-	small	-	-	-
Sub-total by boats	149	-	9,050	-	-	6,806	-	6,806	806	81
Bring in by vehicle	-	-	3,000	-	-	-	large	-	-	-
Total	-	-	12,050	-	-	6,806	-	6,806	806	81

Note: -Types A, B, C and D fishing boats at present land almost no catches at the Project site. However, it is anticipated such boats that are not under contract with the fish buying company will put into the Project port for ice supply.
-During the new moon phase, ice supply will target all boats using ice in their fishing operations. During the interim period, ice demand is anticipated for fishing boats that are only moderately or slightly affected by the moon phase. Also, demand is forecast for fishing vessels that are only slightly affected by the full moon phase.
-Ice/fish rates are based on "Unit Values of Target Boat Shapes, Daily Fish Catch Volume and Daily Demand of Re-supply Services" as set out in Appendix 6-4.

Ice demand for fishing boats targeted under the Project as shown in the above table for the full moon phase, interim moon phases and the new moon phase can be modeled as indicated in the table 2.2.27 below. According to this model, the monthly ice demand is calculated at 127.8 tons.

Table 2.2.27 Model for fluctuating ice demand depending on moon phase and landed fish volume

Date	1 2 3 4 5 6 7 8 9	10 11 12	13 14 15 16 17 18	19 20 21	22 23 24 25 26 27 28 29 30
Moon age Influence of moon age	New moon	Intermediate	Full moon	Intermediate	New moon
Daily ice demand for fishing	6,806kg	806kg	81kg	806kg	6,806kg
Pattern of ice demand for fishing	←	→ ←		→	→

Note: Skipjack pole and line boats and round haul netters are greatly affected by the moon phase, and operate on average 18 days and 20 days out of the month, respectively. Round haul netters operate on average 20 days per month. Vertical line / trawling boats are moderately affected by the moon phase. Gill netters and non-motorized boats are only slightly affected by the moon phase and operate an average of 25 days per month.

(ii) Ice demand for marketing

Correlation between moon phase and ice demand at the marketing stage for fish purchased at the fish handling shed is indicated in the table 2.2.28 below.

Table 2.2.28 Amount of fish handled at the site, and ice demand at the marketing stage

Date	1 2 3 4 5 6 7 8 9	10 11 12	13 14 15 16 17 18	19 20 21	22 23 24 25 26 27 28 29 30
Moon age	New moon	Intermediate	Full moon	Intermediate	New moon
Landing weight/day	9,050kg	4,930kg	1,230kg	4,930kg	9,050kg
Bring in weight by car/day	3,000kg	1,634kg	300kg	1,634kg	3,000kg
Landed weight for marketing	12,050kg	6,564kg	1,530kg	6,564kg	12,050kg
Ice demand for fishing ①	**6,806kg**	**806kg**	**81kg**	**806kg**	**6,806kg**
Internal marketing weight	3,000kg	2,700kg	1,530kg	2,700kg	3,000kg
External marketing weight	9,050kg	3,864kg	0	3,864kg	9,050kg
Ice demand for internal marketing (Ice rate 25%、Ice use rate 30%)	225kg	202kg	115kg	202kg	225kg
Ice demand for external marketing (Ice rate41%、Ice use rate100%)	3,710kg	1,584kg	0	1,584kg	3,710kg
Daily ice demand for fis②	**3,935kg**	**1,786kg**	**115kg**	**1,786kg**	**3,935kg**
Total ice demand (①＋②=③) ③	**10,741kg**	**2,592kg**	**196kg**	**2,592kg**	**10,741kg**

Note**:** Marketed fish quantity within the area = approx. 900,000 kg/300 days (one year) = 3,000 kg/day (new moon peak time)
Marketed fish quantity during the interim moon phases drops below 3,000 kg. During the full moon phase 100% of the fish catch is marketed within the area.

: Catch landed at the site during the interim moon phases is calculated at 50% of round haul netter catch100% of gill netter and non-motorized boat catch.
Catch landed at the site during the full moon phase is calculated at 100% of gill netter catch＋100% of non-motorized boat catch.
Quantity of ice in the table refers to daily ice demand.

(iii) Ice making on site that does not interfere with current production at the existing ice plant

Although potential production capacity at the existing ice plant is 7 tons per day, actual production amount is around 4 tons per day (average equipment operating rate is about 57%). The plant is equipped with both 4 ton and 3 ton ice making machines, and these are alternately operated depending on ice demand at the time.

According to interview survey with personnel at the ice plant with regard to operating status of ice making equipment, both the 4 ton machine and the 3 ton machine are operated at full capacity during the first week of the peak demand season. From the second week, only the 4 ton machine is operated. Also, depending on specific demand at certain times, the 3 ton machine is operated an extra 1~3 days and excess ice produced is stored. This surplus is subsequently shipped in response to demand.

As shown in the table 2.2.29 below, it is concluded that it is possible for this existing ice plant to meet ice demand for marketing fish landed at the Project site.

Table 2.2.29 Shortfall of ice for marketing Project site fish
(assuming supply from the existing ice plant)

Date	1 2 3 4 5 6 7 8 9	10 11 12	13 14 15 16 17 18	19 20 21	22 23 24 25 26 27 28 29 30
Moon age	New moon	Intermediate	Full moon	Intermediate	New moon
Ice demand for fishing/day	6,806kg	806kg	81kg	806kg	6,806kg
① Ice demand for marketing/day	**3,935kg**	**1,786kg**	**115kg**	**1,786kg**	**3,935kg**
Total ice demand/day	10,741kg	2,592kg	196kg	2,592kg	10,741kg
② Existing ice manufacturer Daily production following ice demand (Average operation rate 57% by 20 days operation)	**3,850kg**	**1,700kg**	**85kg**	**1,700kg**	**3,850kg**
Production by ice manufacture	7days operation				7days operation
Operation of 4t machine					
Operation of 3t machine	4days operation		(stop operation)		4days operation
			(stop operation)		
Adjusted shipping by using ice storage	3,850kg/day	1,700kg/day	85kg/day	1,700kg/day	3,850kg/day
Ice demand for marketing (①-②)	**85kg**	**86kg**	**30kg**	**86kg**	**86kg**
	Deficit	**Deficit**	**Deficit**	**Deficit**	**Deficit**

Note: Quantities of ice supplied by existing ice plant during new moon, interim and full moon phases are values taking into consideration an average equipment operating rate of 57% with the production of roughly 80 tons/month being adjusted for shipment in response to demand.

On the basis of the above, ice making under the Project will address 100% of ice demand for offshore fishing operations by targeted boats; and will not address ice demand for fish marketing.

The above calculation is based on landed fish statistics as of 2004. However, it can be expected that the demand for ice will increase with more landed fishes and expanded fish marketing in the future. Accordingly, it will be important in responding to future ice demand to coordinate Project site ice production with the ice production at the existing ice plant (which at present operates below potential capacity).

(iv) Design scale for ice making plant

As explained above, monthly ice demand in the site is estimates at 127.8 tons. Accordingly, the ice making system of the Project needs to produce monthly about 130 tons. However, the system is to achieve most economical in its operation by combining an ice making machine with an ice storage since the ice demand in Larantuka has much gap in between full moon phase and new moon phase. Following 3 cases are comparatively studied:

Case-1 (large ice making machine and small ice storage):

6.0 ton ice making machine ＋ 19 ton storage capacity (4 days worth of production)

Case-2 (smaller ice making machine and larger ice storage):

5.0 ton ice making machine ＋ 35 ton storage capacity (7 days worth of production)

Case-3 (case 2 by 2 ice production lines, more flexible production system):

2.5 ton ice making machine × 2 lines ＋ 35 ton storage capacity (7 days worth of production)

Case-1 assumes sustained capability to produce each day the ice shortfall occurring during the new moon phase. A large ice storage is not required. Case-2 assumes establishing a smaller ice making machine and a larger ice storage to hold surplus ice produced during the full moon phase to be later sold during the new moon phase to offset any shortfall in ice production capacity. Case-3 is the same system in terms of overall capacity of Case-2 but the ice making machine is divided into two lines aiming at obtaining more flexible operation in response to ice demand.

Comparative evaluation among 3 cases

3 cases are compared from view points of building cost, operation cost and maintenance aspect.

(Building cost)

In case of a block ice production plant, its building cost is more affected by the cost of related buildings and equipment than by the cost of ice making machine itself. Accordingly the building cost of each case will not have significant differences since the production capacity of each case is similar level.

(Operation cost)

The power consumption is the most influential factor of the operation cost of an ice making machine and an ice storage. For example, electric consumption of ice making machine of daily 5~6 tons of block ice production is 30~35KW and that of ice storage with its capacity of 20~35 tons ice is 3.4~4.5KW. In case that monthly ice production is about 130 tons and that ice is to be partially stored, the monthly electric consumption in the case of a larger ice making machine will become larger than that of the case with a larger ice storage capacity.

(maintenance aspect)

In the case of a block ice production plant, it is desirable that the ice making machine is continuously operated and that its interrupted period is made shorter in the standpoint of using the mechanical system in longer period. The interrupted period of an ice making machine is respectively 8 days/month in Case-1, 4 days/month in Case-2 and 0~4days/month according to operation method using two lines of ice making machines in Case-3 (Detailed relation between the scale of monthly ice production/ ice storage and interrupted period of operation is referred to Appendix 6.6 “Simulation of ice production and ice storage”).

On the other hand, when ice making machine is in trouble, ice production should be stopped in Case-1 and 2, instead either of two ice making machines can continuously produce ice in Case-3.

Based on the above discussion, comparative evaluation was carried out on ice making/storage system for 3 cases as set out in the table 2.2.30 below.

Table 2.2.30 Comparative study on ice making /storage system for 3 cases

	Case-1	Case-2	Case-3
Operating method	Production capacity is sufficient to meet ice demand during the peak season. Plant operating time is suspended during the lean season.	Surplus ice produced during the lean season is stored and then released during the peak season in response to demand.	Same as the Case-1 Two production lines respond as necessary to fluctuations in ice demand between the peak and lean seasons.
Facility scale	Ice production: 6 ton Ice store: 19 ton	Ice production: 5 ton Ice store: 35 ton	Ice production: 2.5 x 2 Ice store: 35
Machine cost	Nearly equal		
Operating cost	Most costly	intermediate	Cheapest
Maintenance aspect	Stop production when machine gets trouble.	Stop production when machine gets trouble.	No need to stop production by changing another cooling machine.

On the basis of the above evaluation, Case-3 is adopted.

(Design ice making equipment and storehouse)

- Ice making machine : Two units each with a design production capacity of 2.5 tons / day.
- Ice storehouse : Design storage capacity is 35 tons.

b) Facility overview

(Ice making machine and ice storage)

Ice making machine of the same general type as that currently used locally, and that can be easily operated and maintained will be adopted.

Because it is envisioned that the ice storage will be used such that cold air escape to the outside is minimized at times when ice is moved in and out of the storehouse, the ice storage will be designed with an antechamber as well as a hatch for inserting and removing ice. It will be designed with enhanced insulating performance since the storage period of ice becomes long -term during the lean fishing season of January to February (See table 2.2.31 and figure 2.2.5).

Table 2.2.31 Study on ice making machine and ice storage

Ice making machine	Design criteria
Can produce 25 kg blocks of ice	• Cracking resistant ice is to be manufactured at a temperature of around －10℃.
Operational adjustment is possible	• Two units of ice making machines, each with the same production capacity, are to be installed (identical units to simplify spare parts procurement and maintenance).
Refrigerant can be procured locally	• Ammonia (from the standpoint of local operational technology, refrigerant procurement)
Freezing machine, insulating material, canning material	• O&M at local technical levels can effectively be performed.

Ice storage	Design criteria
In principle, operation by manual labor	• Simplified work flow from ice removal from freezing mold to storage in ice storage. Enhanced safety and efficiency. • Ice stacking is to be a maximum of around 1.5 m high in the interest of safety.
High performance insulating panels	• Locally procurable insulating material with high cold insulating performance is to be adopted. Minimal cooler system to reduce operating cost.

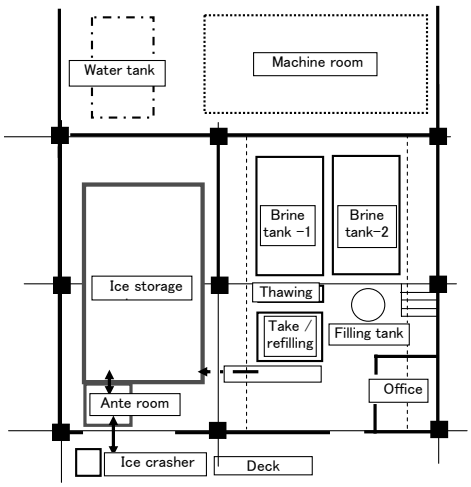


Figure 2.2.5 Basic layout for ice making machine and ice storage

3) Administration Building/Kiosk

An administration building is planned that is commensurate with the scale and organization of port operations. There is a high likelihood that the operational structure for the port will be in the form of a public corporation. Nevertheless, everyday operations with regard to re-supply servicing (fuel, water, rice, etc.), with the exception of ice production, are planned be carried out in collaboration with the fishermen's cooperative. The management works for fish landing/handling and other general matters will be finished within the morning, instead the re-supply servicing will be continued up to the evening. Accordingly it is planned that the space of kiosk is separated from the administrative space even though both functions are handled as a packaged facility

(Required rooms/common use rooms for works)

With regard to core works of port management, necessary rooms for activities of the service division on fish landing/handling/trading and the general matter division on accounting/data processing and facility maintenance under the port manager, are to be provided (See in [2-4-1. Operation System Plan] in details.).

With regard to re-supply servicing works by the fishermen's cooperative, a kiosk room for selling food/goods for fishing operation (rice, cigarette, fishing gear, etc.) and a office room for controlling fuel/water supply are to be provided. Further, a common use room be provided for staff (about 15 staff) engaged in service works at landing jetty, fish handling shed, etc. to provide working records and to have a rest. This room will have a storage to store desks/chairs which will be used for meetings of the Port Management Committee and other gatherings in this room.

(Room composition)

- Rooms for O&M management works:

(Administration building) Separate rooms for the port manager and accounting operations would be established. Other engineers and staff would share a single main room. Because staff in charge of fish landing/handling and the ice making plant will discharge their duties at those respective facilities themselves, it is not necessary that they be provided with their own desks within this building.

A meeting corner will be provided in this main room for daily meeting among division chiefs and their staff. This corner will also be used for meeting with visitors. Benches will be provided for staff and visitors along the building corridor.

- Rooms for re-supply servicing works:

(Kiosk) Because accounting management is extremely important with regard to fishermen services, the accounting area would be partitioned off so as to be distinctly separate. Also, a private room is to be provided for the person in charge of re-supply servicing, as these duties entail document management and coordinating sessions with other cooperative members. Benches will be provided for staff and visitors along the building corridor.

- Common use room:

Because this room will be used by both the staff of O&M management and re-supply servicing, its exit is set at the side of the building corridor so as to be kept as an independent room.

- Other:

Lavatory would be provided within the administration building for shared use by both the O&M management division and the cooperative operations division. Fishermen and middlemen within the port site would avail of other public lavatory.

a) Calculation of design scale

The design scale of rooms for administration building and kiosk is calculated as shown in the Tables 2.2.32~2.2.34 below.

Table 2.2.32 Design scale calculation of rooms for O&M management works

Room name	Purposes	No. of users	Room area of similar facility (m^2)	Planned area (m^2)
Manager room	-Overall port management -Meeting	Manger:1 Secretary:1 Visitor:2	10-30	15.1
Accounting room	-Overall accounting works -Data processing/filing	Accountant:1	6-10	7.5
Office room	-Arrangement on fish landing / handling / trading, works -Arrangement on overall re-supply servicing works - Arrangement on facility maintenance, workshop works and premises control	Service Division Chief :1 G. Matter Division Chief:1 Engineer:1 Other staff:6	4-6/ person	30.2
Equipment storage	-Data storage -Copy works	1-2	5-12	7.5
Corridor	-Movement line to each room -Waiting space for visitors	Bench for 2-4 persons	Width:2-3	Width:2

Table 2.2.33 Design scale calculation of rooms for re-supply service works

Room name	Purposes	No. of users	Room area of similar facility (m^2)	Planned area (m^2)
Kiosk	-Selling food/goods for fishing -Storage for food/goods	Receptionist:1 Assistant:1	16-36	26.4
Office room	-Re-supply works management -Data recording	Person in charge :1	6-10	7.5
Corridor	-Movement line to each room -Waiting space for visitors	Bench for 2-4 persons	Width :2-3m	Width :2m

Table 2.2.34 Design scale calculation of rooms for common use and lavatory

Room name	Purposes	No. of users	Room area of similar facility (m^2)	Planned area (m^2)
Common use room	-Data arrangement works and resting by staff -Periodical meeting by Port Management Committee -Storage for desks/chairs	-Ordinary tme:13 -Meeting time:12-16	2-4/person	30.2
Lavatory	Exclusive use for staff		2.5-5.0	3.0/booth

b) Facility overview

As the project site has sufficient construction space and is reclaimed land, a single story structure is basically adopted to reduce reducing foundation bearing load. Points of special note in design are shown in the Table 2.2.35. The facility will also adopt a floor plan that enables flexible room utilization in response to any future reorganization of facility operations as shown in the Figure 2.2.6 below.

Table 2.2.35 Points of special note in design

Item	Requirement
Rational design for efficient facility use	• Necessary rooms for administrative, general affairs and engineering activities are grouped together.
Strengthening the fishermen cooperative and private sector activities	• Conferencing by fishermen's cooperative representatives as well as technical cooperation activities are enabled.
Structure	• Main building frame is to be an RC structure, appropriately resistant to earthquake and salt damage. • With consideration to reduced construction period as well as local O&M technical levels, the building roof is to comprise steel-frame trussing covered with metal sheeting.
Minimizing operating costs	• Based on natural conditions prevailing at the site, building systems load is to be minimized by adopting natural light and ventilation to the extent practical.

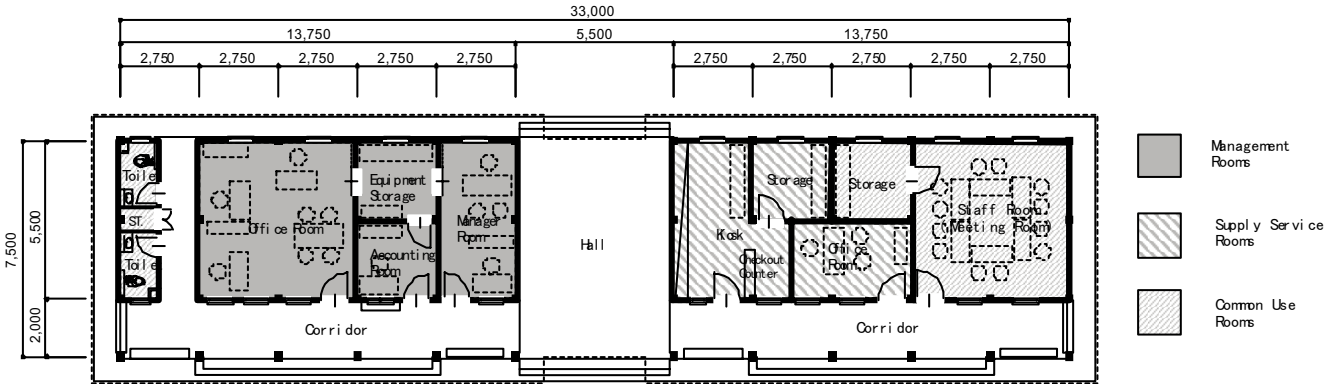


Figure 2.2.6 Design floor plan for administrative office and kiosk

4) Fuelling shed and storage tank

Diesel fuel will be supplied to motorized boats. Also, fish-luring lamps are often used locally during night time fishing. These burn kerosene, and it will accordingly be necessary to store kerosene at the facility.

a) Calculation of design scale

Fishing boats targeted for fish landing at the site are broadly classified according to fishing method and class of boat as a basis for calculating horsepower and daily fuel consumption for fishing operation. In addition, fuelling amounts and fuelling method (at-the-spot, hose, drum, etc.) were confirmed, and required quantities by types of fuel has been calculated for the peak fishing season as shown in the Table 2.2.36.

Table 2.2.36 Calculation of design fuel supply by type of fishing boat

Targeted boat (powered boat)	No.	Engine horsepower (HP)	Operating hours	Calculation HP × fuel consumption rate × operating factor × operating hours	Consumed fuel (L/boat)	Total fuel by type of boat (L)
- Type-A (Pole and line)	13	150	17:00-12:00 (19)	150x0.15x0.5x19=213.7	214	2,782
- Type-B (Pole and line)	8	15	17:00-12:00 (19)	15x0.2x0.6x19=34.2	34	272
- Type-C (Tuna vertical line)	7	7.5	17:00-12:00 (19)	7.5x0.2x0.6x19=17.1	17	119
- Type-D (Vertical line / trawling)	22	7.5	17:00-12:00 (19)	7.5x0.2x0.6x19=17.1	17	374
- Type-E (Round haul netter)	37	25	17:00-6:00 (13)	25x0.2x0.6x13=39.0	39	1,443
- Type-F (Gill netter)	36	7.5	17:00-6:00 (13)	7.5x0.2x0.7x13=13.7	14	504
- Type-G (Blanket netter)	1	20	17:00-6:00 (13)	20x0.2x0.6x13=31.2	31	31
Diesel fuel total (per day)						**5,475**
Kerosene (per day)	**38**				**10**	**380**

Note: 1: Fuel consumption rate per engine output and operating factor are in accordance with fishing port planning guidelines issued by the All Japan Fishing Ports Association.

2: In addition to engine fuel in the case of round haul netters and blanket netters that fish at night, an average 10 L of kerosene/operation/boat is consumed to burn fish-luring lamps

(Fuel tank scale)

The fuel amounts indicated in the above table represent daily fuel consumption during the peak season. The PERTAMINA outlet that will be the source of diesel fuel is located about 5 km from the Project site. The outlet has ample number of tank lorries (4~5 KL) and will be able to provide supply service to the site two times per week.

- Diesel storage tank (steel tank) : 5,475L × 7/2 = 19,162 L ≒ 20 KL
- Kerosene : 380L × 7/2 = 1,330 ≒ 1.4 KL (storage area accommodating around 7 drums)
- Lubricating : (storage area accommodating around 2 drums)

(Fuel supply method)

As shown in the Table 2.2.36, the required fuel for almost all the small fishing boats landing fishes at the site is around 20L/boat/day. Accordingly, it is deemed appropriate that a fuel supply method to boats by a plastic container from an on-land fuel storage tank be adopted in stead of direct fuelling method from a landing jetty to boats since it is highly safety and facility load is small. In the case of skipjack and tuna fishing boats, however, fuelling to be done by drums since required fuelling amount at the facility would be around 200 L/boat.

Because the maximum fuel servicing distance is around 150 m, fuel transport works be supported by a pushcart and a drum carrier provided by the Project.

(Fuelling facility layout)

As indicated in the Table 2.2.37 below, the fuelling facility layout will be such that safety, environmental protection and efficient operational flow are achieved. Positioning will also take into consideration possible increase in the number or size of fuel tanks in the future.

Table 2.2.37 Fuelling facility layout

Item		Requirements for facility layout and planning
Safe distance	→	• Other facilities and structures are to be located at least 10 m from a diesel tank with a capacity exceeding 0.5 t. • A vacant perimeter of at lease 3 m is to surround a diesel tank with a 10 t capacity.
Oil retaining wall	→	• The oil retaining wall is to have a capacity 110% that of the storage tank, and be at least 0.5 m high. • The fuelling work area is to be equipped with an oil trap as part of the area drainage system.
Structure	→	• Due to design difficulties arising from tidal levels in the case of an underground tank at the Project site, the fuel tank is to be above ground.
Location	→	• Facility is to meet the above criteria, as well enable access by tank lorry. • Safe location within easy access to the jetty by hand truck.

b) Facility overview

In terms of safety, it is a precondition that the facility adhere to relevant laws and regulations including fire prevention regulations, dangerous material regulations, urban planning law, etc. Also, because the state run oil company PERTAMINA has a virtual monopoly on fuel wholesaling, it is necessary to reflect supply methods and supply conditions applied by this public corporation in facility design.

5) Water supply shed

a) Calculation of design scale

Fresh water supply to the Project site will be a combination of city water and water from a well drilled within the site area. Because well output will be small, the majority of water supply will comprise city water. Instead, well water will serve to augment water for cleaning activities within the port premises, watering plants, etc.

(Calculating water supply quantity)

i) Fresh water use by fishing boats (per day)

Design water supply quantity is as indicated in the Table 2.2.38 below.

Table 2.2.38 Calculation of design water supply by type of fishing boat

Targeted boat	No.	Supplied quantity of fresh water (L/boat)	Total water supply by type of boat (L/day)
- Type-A (Pole and line)	13	80	1,040
- Type-B (Pole and line)	8	32	256
- Type-C (tuna vertical line)	7	8	56
- Type-D (Vertical line and trawling)	22	8	176
- Type-E (Round haul netter)	37	36	1,332
- Type-F (Gill netter)	36	8	288
- Type-G (Blanket netter)	1	12	12
- Type-H (Non-motorized boat)	25	8	200
Fresh water total (per day)			**3,360**

ii) Calculating overall water supply requirement

Overall water supply quantity is as indicated in the Table 2.2.39 below.

Table 2.2.39 Overall water supply

Fresh water demand	Items for study	Supply factor	Fresh water Requirement (L)
Supply to operating fishing boats	10% of planned requirement to be counted as water loss	1.1	3,360 × 1.1 = 3,696
Making ice (quantity for ice＋quantity for removing ice from molds)	10% of water for planned ice volume to be counted as water for removing ice from molds	1.1	5,000 × 1.2 = 6,000
Ice machine and storehouse condensers	Water for cooling tower and for defrosting the cooler of ice storage	Ice making: 5,000 L Ice storage＋defrosting: = 2,000 L	5,000 + 2,000 =7,000
Cleaning fish handling shed and apron	3L/m^2 to be assumed for cleaning water. Well water to be used for supplementary purposes	A × 3L × n *1 (A = surface area: m^2) (n= no. of cleaning times)	500 × 3 × 1 = 1,500
Washing fish, cleaning fish tubs, etc.	About 50% of requirement in the case of Japan to be assumed	200L/ton of landing volume *2	10 × 200 = 2,000
Supply to adm. building, etc.	Current status of local water use (10L/person)	10L x P (P = no. of users)	30 × 10 = 300
For toilet, wash basins, etc.	Fishermen, middlemen, etc	10L x P *3 (P = no. of users)	(48 + 60) × 10 = 1,080
For plants and general watering within the port premises	Not counted as fresh water demand (Well water to be used for this purposes)	-	-
Total fresh water demand:			21,076 L

Note *1 10L/m² value for fish shed and apron cleaning is applied with reference to fishing port planning guidelines issued by the All Japan Fishing Ports Association. Taking into consideration observation and interview survey during field survey, this has been further set at 3L /m².

*2 500L/ton value for washing fish catch and fish tubs is applied with reference to fishing port planning guidelines issued by the All Japan Fishing Ports Association. Taking into consideration observation and interview survey during field survey, this has been further set at 200L/m².

*3 With regard to toilet and wash basins, etc., these facilities adopt the local *mandi* system, and accordingly a value elicited by interview survey with the local PDAM (water utility) has been adopted.

From the above, daily fresh water demand is set at 21.0 tons. Based on this, the capacities of receiving tank and elevated tank are set as follows:

- Receiving tank: 21.0 t/day × 0.6 = 12.6 → 12 ton tank
  (Approx.60% of planned daily fresh water demand is applied with reference to Japanese standard on planning the capacity of receiving tank)
- Elevated tank: 21.0 t/day × 0.2 = 4.2 → 4 ton tank
  (Approx.20% of planned daily fresh water demand is applied with the same references)

b) Facility overview

Arrangement and confirmation with the local PDAM has already been completed for diverting water from PDAM's main 150mmφ pipeline to the Project site by means of a 50mmφ branch pipe. However, because water supply conditions are poor (low water pressure and frequent water outages), a receiving tank is to be installed within the Project site with water distribution to be carried out from an elevated tank.

Because sediment becomes mixed with city water during the rainy season, this must be factored into receiving tank design as well as making it necessary to consider such measures as a precipitation or filter system for water that is diverted for ice making.

6) Workshop

The function of the workshop is to enable day to day operation and maintenance of on-premise facilities and fishing boats. Particularly with regard to fishing boat repair such as overhaul of engines, processing of propeller shaft, etc., the workshop of the site will not handle since there are numerous automobile and motorbike repair shops in the local town that can tend to engine repair, and there is a large workshop at the Catholic church that is in operation and can respond to ship repairs requiring lathing, etc. Comparatively simpler maintaining works such as painting and seepage prevention works are also not focused onto the role of the workshop. Instead the workshop at the Project site will be supplied with only basic (as well as durable) equipment necessary for metal working, wood working, and machinery maintenance and repair. By providing such equipment, repair work efficiency of boats will be improved since repair works requiring adjustment with shapes of each part of boat become possible on the site.

With consideration to main O&M works within the port premises and dry dock maintenance and repair of fishing boats at the slipway, the workshop is to be located adjacent to the slipway on-land yard.

7) Wastewater processing facility

Because the foundation at the site is rock, disposing of wastewater by underground percolation is considered to pose problems. Prior to releasing effluents from port facilities, solid waste and residue

is to be removed to the extent possible and transported off-premises for disposal in order to minimize the operating load on the planned wastewater processing facility provided under the Project.

8) Other facilities

(Security guard house)

To collect the entrance fee and to ensure the premises security, a minimum scale of guard house at the location of the site entrance be provided under the Project. The gate and fence are to be provided by the Indonesian side.

(Garbage collection area)

Efficient transport of generated garbage off the port premises for processing is essential in maintaining sanitary conditions within the port site. Local garbage collection has been consigned by the district government to a civilian contractor and the Project will avail of this service.

Garbage placed at the garbage collection area under the Project will be divided according to type, i.e. raw fish residue, large trash items including pieces of wood, lumber, etc., recyclable garbage including cans, plastic, etc., as well as other categories of garbage. In the case of fish residue, the use of covered containers procurable locally will be studied from the standpoint of preventing foul odor and fly infestation. Also, a water hydrant will be installed at the garbage collection area to enable daily cleaning in the interest of appropriate sanitation.

(Lavatory)

Lavatory and wash basin (*mandi* style) facilities are essential at the site for use by port general users of the port. operations personnel; middlemen, fishermen and marketers using the fish handling shed; fishermen engaged in catch landing works; as well as fishermen and women engaged in sun drying works on the port premises. Separate male and female lavatory facilities will be established in light of the fact that almost all purchase brokers and fish retailers are women. About two lavatory stalls respectively for males and females each are considered, and these will be of a structure and specification that facilitates easy cleaning.

(2) Cross-section design

Study in this regard will be comprehensively directed at the environment around the site, status of bearing stratum, ceiling height commensurate with intended room function, system piping and conduit within the ceiling, natural ventilation to prevent salt damage, etc. Also, because of exposure to strong sunlight, building design will take into consideration insulation and sunlight shielding.

1) Design foundation and first floor level

The elevation of the landing wharf for small fishing boats at the Project site after land reclamation is set at ＋4.0 m, and this is also set as the standard level of the site. The design foundation of the port premises tilt at a gradual approx. 1/100 gradient extending from the sea side to the road side. This ensures effective runoff of rainwater as well as facilitating access into and from the site by vehicle.

The elevation of the adjacent on-premise road is set as the reference GL for a specific building. 600 mm above this GL is in principle to be the floor elevation (FL) for the building's first floor.

However, specifically with regard to the fish handling shed, its design foundation elevation will be set such that the effects of wind/wave swell (due to close proximity to the sea) are mitigated, and

transport of fish off-premises is facilitated. Also, in order to prevent the intrusion of rain runoff from the hinterland and road running in front of the port into the immediate site area where the administration building and kiosk will be located, the design foundation elevation for this area will be set around 100~200 mm higher than the port anterior road elevation. This will serve to avoid facility damage during heavy downpours.

2) Main structures, walls, roof frame, roofing, etc.

Buildings under the Project will in principle be one-story structures to streamline outside activity flow and operational connectivity among the various Project facilities. With exception of the administration building/kiosk, structures will be without ceilings to achieve maximum space inside facility structures including open attic space immediately below the roof. Structure type, roof frame specification, roofing specification, etc. are as indicated in the Table 2.2.40 below.

Table 2.2.40 Main structure, walls, roof frame, roofing, etc. of respective facility

Facility	Main structure	Walls	Roof frame	Roofing specification	Ceiling
Fish handling shed	RC frame	Brick masonry, mortar＋paint	Heavy steel truss	Metal roofing	None
Ice making plant	Same as above	Same as above	Light steel truss	Metal roofing (one portion RC + water proofing)	None
Administration building/kiosk, security guard house	Same as above	Same as above	Same as above	Metal roofing	Calcium silicate sheeting＋painting
Workshop, fuelling shed, lavatory	Same as above	Same as above	Same as above	Same as above	None
Electric power supply, water supply shed and elevated water tank	Same as above	Same as above	RC slab	RC + water proofing	RC exposed

3) Energy saving engineering based on in situ conditions

All buildings will be designed with protruding eaves sufficient to block sunlight and rain. The administration building/kiosk passageway will be roofed. This will enable windows to be open during moderate rainfall, allowing for natural airing without relying on mechanical ventilation such as fans, etc.

(3) Structure plan

1) Seismic force and foundation type

The Project site comprises land reclamation carried out by the Indonesian side. Landfill is earth mixed with cobbles and sand. In the case of test drilling for the existing groin constructed by the similar specification, N value was in the range 5~10. It is accordingly clear the landfill foundation plane cannot be expected to offer a large degree of bearing capacity. Because the field survey of the Basic Design Study was carried out before reclamation works had been commenced, test drilling at the time was subsequently done in the stratum underlying the current reclaimed layer. Although this test drilling indicated an area at the east side of the site consisting of a silty layer exhibiting N values ranging 4~5, sand mixed with gravel is dominant in the vicinity of planned building sites and exhibits N values from around 10 to 15. Accordingly, the ground prior to landfill would be expected to have a structure bearing stratum of 10 t/m^2.

Considering the above described bearing foundation conditions, emphasis is placed on light building design. Nevertheless, due to the inherent weight of the electric power supply and water supply shed with elevated water tank and the ice making and storage plant that will house ice making machine and ice storage, these structures will adopt a spread footing type foundation together with coarse gravel concrete extending down to the layer underlying the landfill. The fish handling shed located near the seashore will adopt a pile foundation.

Because other buildings are light, these will instead adopt either a strip footing or natural foundation, achieving a long-term bearing capacity of 6t/m^2. Also, because ground settlement can be anticipated given the fact the Project site is reclaimed land, ground at building sites will be thoroughly compacted prior to construction and a carefully balanced foundation design will be carried out.

2) Earthquakes and wind

(Earthquakes)

Larantuka is located in a region of seismic activity. Specifically, it falls within zone-4 of the seismic activity classification system applied by the Indonesian government. Zone-4 is subject to a horizontal shear coefficient of 0.20 g. Design seismic force (V) is calculated as follows:

$V = Ci \times I \times Ki \times W$

- V : seismic force (KN)
- Ci : shear coefficient (zone-4; 0.20 g)
- I : importance factor (general facilities: 1.0; elevated tank: 1.5)
- Ki : building coefficient (1.0)
- W : building weight (KN)

(Wind)

Maximum observed wind speed in Larantuka according to data for the past 3.5 years is approximately 15 m/s. Based on this data, wind speed with a return period of 30 years is estimated at 19.45 m/s. Accordingly, design reference wind speed is set at 20 m/s and design wind load is calculated according to the following formula.

$P = C \times qo \times A \times I$

- P : design wind load (KN)
- C : wind force coefficient (depending on the section of the building)
- qo : velocity pressure (0.6*E*Vo :E : environmental factor =1.0, Vo=20m/sec)
- A : surface area subject to pressure (m^2)
- I : importance factor (general facilities: 1.0; elevated tank: 1.5)

3) Building structure

Local public buildings are generally of concrete structure with wood-truss roof. In addition to the RC type roof recommended by the Preliminary Study, the use of light metal sheeting for building roofs will also be studied from the standpoint of reducing foundation load (thereby enabling a smaller foundation structure).

4) Main structural materials

Structural materials to be used will be materials that are of officially approved standard and are generally procurable locally. Although there are a variety of standards adopted locally including US standards, Japanese standards, etc., material quality standards to be applied are those officially recognized by the Indonesian government.

- Civil works

- Causeway : Rock that can be quarried in the vicinity of the site (basalt, etc.).
- Landing Jetty : Steel pipes will be used as foundation piles. Superstructure will be RC.
- Premises pavement : The revetment for landing from small boats near the coastline will be constructed by RC On-premise roads and parking lot will be paved with interlocking block.

- Buildings

- Main structure : Concrete frame structure.
- Foundation : Spread footing with coarse gravel concrete in the case of the water supply shed (elevated water tank) and ice making and storage facility.
- Walls : In principle, brick masonry using locally produced bricks.
- Roof : Galvanized steel sheeting produced locally. With regard to roof frame, this is to be galvanized heavy-gauge steel only in the case of the fish handling shed. For other buildings roof frame is to consist of galvanized light-gauge steel.

2-2-2-4 Building Utilities Design

(1) Electricity supply plan

It has been confirmed that the local electricity utility (LNTP) will supply electricity to the Project site. The existing 20,000 V main transmission line is strung on power poles aligned along the road. Local voltage is 220 V (general lighting and outlet circuits) and 380 V (locomotive power); frequency is 50 Hz.

A new power pole will be erected at the edge of the site for a distribution line to draw power from this existing main line. After being stepped down at a pole mounted transformer to be newly installed under the Project, electric power will then be conveyed to the electric power supply and water supply shed.

LNTP supplies power to the area by means of diesel generator, and despite the fact that supply capacity actually exceeds demand as of the year 2006, planned blackouts occur 1~2 hours daily for maintenance works or due to insufficient fuel. Fluctuations in voltage are also a daily occurrence. Accordingly, electricity supply facilities and equipment under the Project will be designed to operate effectively under these conditions.

With regard to power blackouts, a generator is to be installed to provide minimal power for lighting at the ice making and storage facility and mechanical room, as well as the fish handling shed.

Specifically with regard to voltage fluctuation, although it would be desirable that an AVR (automatic voltage regulator) be set for all electric power used on the port premises, this would entail excessive cost. Accordingly, a circuit breaker is to be installed for priority protection of equipment at

the ice making and storage facility by shutting down its circuits when voltage rises above or below a prescribed level. A small AVR and UPS (uninterruptible power supply) are to be provided by the Indonesian side to protect computer equipment being used in the administrative office.

a) Electrical load capacity under the Project

Summary of required electrical load capacity is as indicated in the Table 2.2.41 below.

Table 2.2.41 Summary of required electricity load capacity

Main electrical load sectors	Circuit load（KVA）
・Ice making and storage facility	56.5
・Fish handling shed	8.4
・Administration building,/kiosk	7.6
・Workshop	4.7
・Fuelling shed	2.9
・Electric power supply and Water supply shed	3.5
・Lavatory	0.5
・Security guard house	1.0
・On-premise lighting (outdoor lights)	8.9
・Other	1.0
Total	95.0

On the basis of the above, the required electricity capacity for Project facilities is approximately 95 KVA. Operating capacity is around 57 KVA.

b) Main line equipment

After passing to the main line lead-in pole installed outside the site, electric power is then stepped down from 20,000 V to 220/380 V at the transformer installed inside the site and fed to the electrical power supply shed. A main distribution board (MDB) is installed in the power supply room for branching power to the respective site facilities by means of underground cable. An overview of the main line system is shown in the Figure 2.2.7 below.

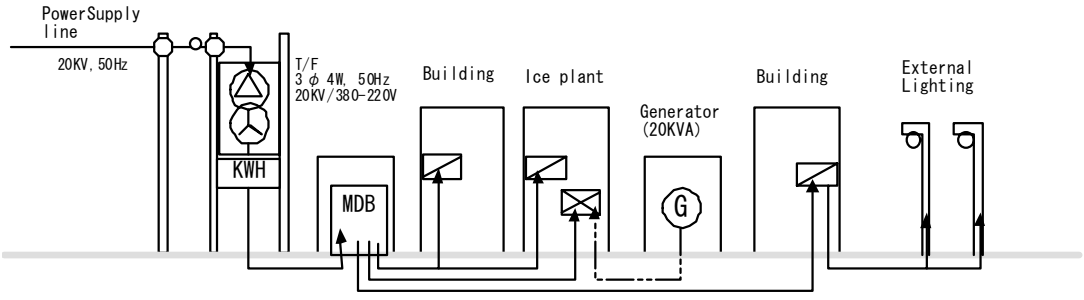


Figure 2.2.7 Overview of electrical main line system

c) Outlets

Outlets will be of the type generally used locally. Standard indoor outlets will be used, and positioned within buildings (administrative office/kiosk, various facility offices etc.) so as not to be

easily affected by moisture. In the case of outlets in the fish handling shed, workshop, fuelling shed, ice making and storage plant which may be subject to ambient humidity or moisture generated in the case of facility operations, these will be water-proofed type outlets. Furthermore, outside outlets will be equipped with covers.

d) Lighting

(General lighting)

Light fixtures will be of the type generally used locally. Standard indoor light fixtures will be used, and positioned within buildings (administrative office/kiosk, various facility offices etc.) so as not to be easily affected by moisture. In the case of lights in the fish handling shed, workshop, fuelling shed, ice making and storage facility which may be subject to ambient humidity or moisture generated in the case of facility operations, these will be light fixtures with water-proofed sockets and designed to salt resistant specifications. Light fixtures to be installed at the fuelling shed are to be designed to explosion-proof specifications.

Illumination standards will be set with reference to Japanese standards for similar facilities as well as the status of lighting implementation in similar local facilities as shown in the table 2.2.42.

Table 2.2.42 Study on design illumination

Facility:	Japanese standard	Similar facility (Larantuka)	Adopted value
・Office	300-750 LX (at desktop level)	150 LX	200 LX (at desktop level)
・Passageway	50-200 LX (at floor surface)	20-50 LX	20 LX (at floor surface)
・Fish handling shed / work room	100-300 LX (at floor surface)	100-200 LX	100 LX (at floor surface)
・Lavatory / storeroom	50-150 LX (at floor surface)	-	50 LX (at floor surface)
・Outdoor	1-2 LX (at ground surface)	-	1 LX (at ground surface)

Note: Japanese standards are in accordance with JIS Z9110-1979

e) Telephone

An outlet of telephone distribution is installed in the administrative building office. Connection to the outlet from the existing main telephone line outside the port premises is to be undertaken by the Indonesian side.

f) LAN conduit

A LAN system is not installed under this Project. The installation is to be carried out in the future by the Indonesian side when necessary.

g) Emergency alarm

A hand operated emergency warning bell is to be installed at the fuelling shed. An automatic fire alarm system will not be installed.

h) Lightning rod

Because lightning strikes in Larantuka occur at low elevations, Most of major public facilities are

invariably equipped with a lightning rod. Lightning rods will accordingly be adopted for the electric power supply and water supply shed, ice making plant, fuelling shed, fish handling shed and administration building under the Project.

i) Emergency generator

Emergency generator equipment is installed inside the ice making and storage plant to back up cooling equipment of the ice storage, as well as cover lighting at the emergency generator room, lighting at the ice making room, and a limited portion of the lighting at the fish handling shed.

- Generator capacity: 20KVA

(2) Air conditioning and ventilation

Ceiling fans are to be installed in the administration building office, the kiosk office and the common use room (also serving as staff room).

An air-conditioning unit will be installed only in the office of port manager in the administration building. Otherwise, building ventilation is to be in principle natural airing. The air-conditioning unit is to be installed by the Indonesian side, with the necessary earthed outlet for necessary power to be provided under the Project.

(3) Fire extinguishing equipment

Because there is no public function for fire prevention in Larantuka, initial fire-fighting measures will have to be carried out by personnel at the site. Accordingly, fire-extinguishing equipment is recommended for facilities handling flammable materials such as fuel, etc., as well as facilities carrying out repair activities such as the workshop. Specifically under the Project, the following fire-extinguishing equipment is to be provided.

- Large mobile fire-fighting equipment:
  Two units would be deployed at the fuelling shed. This equipment is of the same specification as that mandatory required for placement at fuel storage facilities by PERTAMINA.
- Small ABC10 type fire extinguisher:
  One unit each is to be placed at the workshop as well as offices for respective facilities.
- On-premise fire-fighting tank:
  An RC structure water tank with 5 ton storage capacity is to be constructed on site.

(4) Water supply and wastewater sanitation

a) Water supply

Fresh water supply to the Project site, is to be provided by the local PDAM (water utility) via a 50 mm ϕ branch pipe from the existing 150 mm ϕ main pipe. It has been confirmed that PDAM will supply fresh water via the water meter installed immediately before the water receiving tank on site.

Specifically with regard to water supply within the Project site, water will be first pumped from the receiving tank to the elevated water tank, after which fresh water will then be distributed by gravity to the respective site facilities.

Although discharge will be small, well water is available on site. This will entail excavating a shallow well equipped with a small pressure pump. Well water would be used for cleaning works on-premises. Water supply system is as diagrammed as shown in the Figure 2.2.8 below.

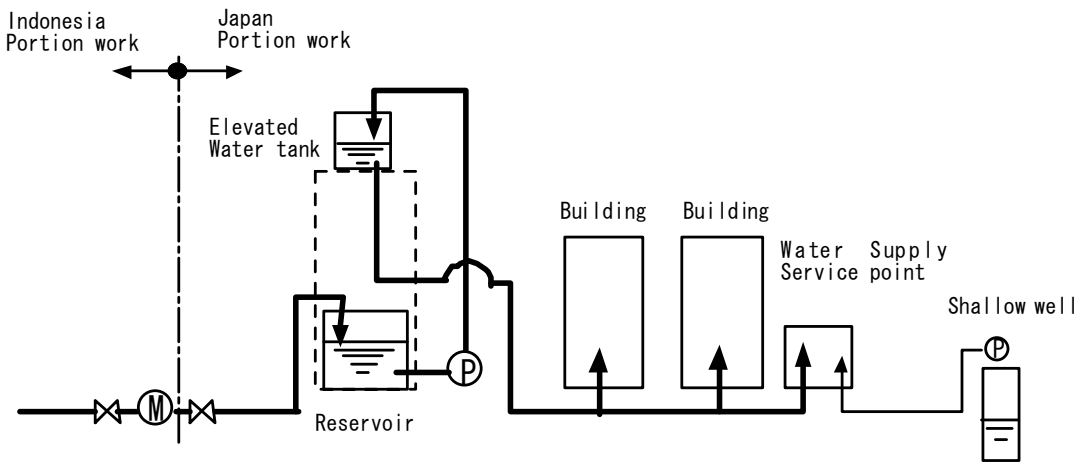


Figure 2.2.8 Overview of water supply system

b) Solid waste and wastewater treatment

Wastewater treatment will have to be performed on site due to the fact that there are no public sewage treatment facilities in the Project vicinity. Treatment method for both solid waste and wastewater will emphasize minimal operational and maintenance cost, simple operation as well as minimal impact on the nearby sea area and on-land environment.

- In the case of waste water containing oil, this oil is to be recovered by means of a grease trap.
- A garbage collection area is to be established for solid waste. The port facility will avail of the garbage collection system currently implemented by the district government for removing solid waste off the port premises.
- In the case of effluents flowing to the simple wastewater processing facility, a trash rack will be installed to catch solid garbage prior to inflow to the facility. This will reduce the processing load at the wastewater treatment tank. Although there are no present standards regarding simple wastewater treatment facilities, a three tank format is to be adopted (based on previous similar cases of simple treatment tanks in Japan) with storage capacity to be equivalent to roughly six day's worth of wastewater influx.

Treatment flow for both solid waste and effluents is basically conceived as indicated in the Figure 2.2.9 below.

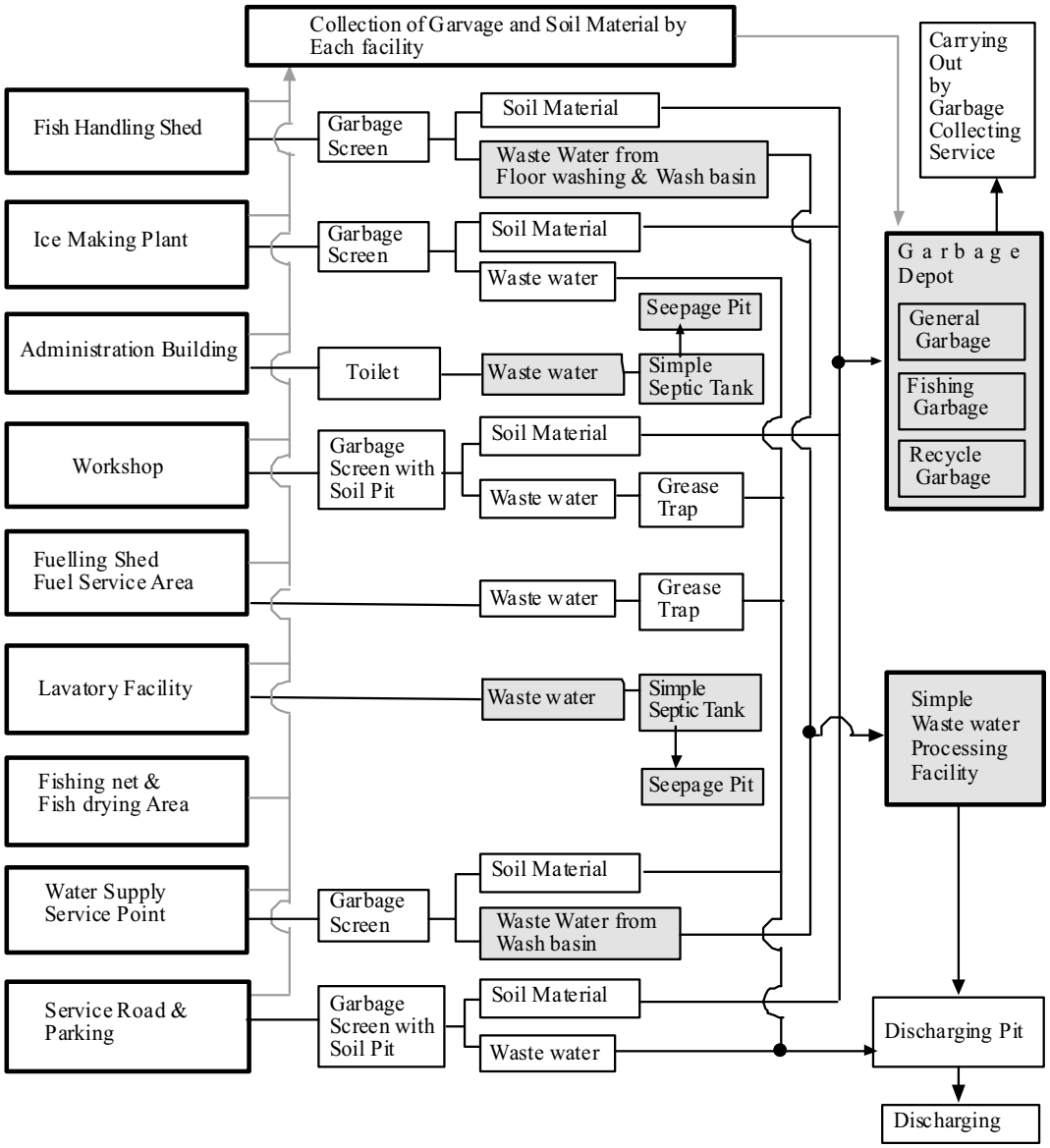


Figure 2.2.9 Basic operational flow regarding solid waste and wastewater processing

2-2-2-5 Construction Materials

In principle, construction materials and equipment are to be procured in Indonesia provided target items meet quality standards and present no problems in terms of procurement as shown in the Table 2.2.43 below.

Table 2.2.43 Main finishing specifications

Construction component	Main finishing specifications	Remarks
1. External finishing		
- Roof	- Galvanized aluminum for general buildings. However, in the case of the power supply and water supply shed, and a portion of the ice making and storage plant, roof is to be RC with a water proofing application of coarse asphalt.	-Local method
- Wall	- Columns and beams: painted RC. - Brick masonry coated with mortar and then painted. - Cosmetic finishing with hollow block.	- Local method - Local method - Local method
- Opening fixtures	- Aluminum sash doors and windows. - Steel frame, steel planked door (workshop, fuelling shed) - Wooden door (one portion fan light; with window)	- Local method - Local method - Local method
2. Internal finishing		
- Floor	- Administration building/kiosk: tiled Passageway for the above facility: mortar and hardener overlay - Lavatory: tiled - Other buildings: mortar and hardener overlay	- Local method - Local method - Local method
- Wall	- Administration building/kiosk: mortar overlay and painting Passageway for the above facility: mortar overlay and painting - Lavatory: tiled; upper portion painted. - Other buildings: mortar overlay and painted.	- Local method - Local method - Local method
- Ceiling	- Administration building/kiosk: calcium silicate sheeting and painting Passageway for the above facility: calcium silicate sheeting and painting - Lavatory: no ceiling - Other buildings: no ceiling	- Local method - Local method - Local method

2-2-2-6 Outdoor Plan

The outdoor area of the port premises will comprise access road in and out of the port area for users and vehicles, on-premise roads connecting site facilities, parking area, partition walls between construction areas, fish drying area, fishnet drying area as well as gardening, shade tree and lawn space. Each construction is to be applied local construction law and regulation, sanitary standard, etc. On-premise roads and parking area are to be paved with either concrete or interlocking block to enable surface cleanliness and prevent surface collapse by powerful rain downpour. Fish drying area and fishnet drying area are to be covered with crushed stone.

Also, site perimeter fence, entrance gates, motorcycle parking space and vegetation planting are works that will be assumed by the Indonesian side.

2-2-2-7 Equipment Plan

(1) Equipment to be provided by the Japanese side

Equipment subject to cooperation under the Project is equipment that will be used on the Project site premises for facility operation and maintenance, and to ensure safety. Categories of equipment and planned location for installation are broadly set out as shown in the Table 2.2.44.

Table 2.2.44 Equipment categories and planned location for installation

Equipment category	Planned location for installation	Remarks
Support equipment for catch landing and handling －Support equipment for jetty landing －Carry equipment for fuel, etc. －Catch weighing equipment －Cooling insulation	・Fish handling shed ・Fuelling shed	・Shortens catch landing time ・Supports fish landing and handling operations and shortens time for re-supply servicing ・Instills awareness about importance of preserving fish freshness ・Promotes sanitation
・Equipment for facility operation and maintenance/boat repair	・Workshop ・Ice making plant	・Operation and maintenance of on-premise facilities and equipment ・Small fishing boat repair works
・Equipment for on-premise safety －Mobile fire-fighting equipment	・Fuelling shed ・Workshop	・Emphasis on fire-fighting by port facility staff themselves given the absence of a fire station and fire trucks in the area ・Essential for fuelling facilities

(Main design equipment content)

・Support equipment for fish landing and handling

Carrying equipment for landed fishes, fishing gear, etc. will include push carts and fish tubs. Drum dollies will be used for transporting fuel drums. Weighing equipment will include both 100 kg platform scales and 30 kg hanging scales. Insulated boxes of both 200 L capacity and 1,000 L capacity will be provided for short term storage of fish.

The carrying and transport equipment will serve to upgrade the efficiency of on-premise operations. Weighing equipment will enable precise data with regard to landed and marketed quantities. Insulated containers are aimed at both temporary storage of fish and ensuring sanitation.

Quantities for the above described equipment will be based on landed fishes and nos. of fishing boats putting into port.

・Equipment for facility operation and maintenance

Wood working equipment, metal working equipment, vice, power tools, welder, work bench, movable chain block, and motorized compressor are to be provided for facility operation and maintenance works, fishing boat hull and rigging repair, as well as fish drying operations. This equipment is intended for simple maintenance and repair works. Major boat engine overhaul and repair will be carried out at professional repair shops located in the local town.

・Equipment for on-premise safety

A large, dolly-mounted powder-spray fire extinguisher with attached hose will be provided specifically for the fuelling shed, and one unit of identical equipment will be provided for general fire-fighting anywhere on premises. The extinguishing agent to be used by this equipment will be procurable locally. The optimum type of equipment in terms of operation and maintenance will be adopted in light of the fact that, depending on the fire-extinguisher size, a pressurizing tank may be separately necessary to ensure adequate spray pressure. Two small ABC type extinguishers (corresponding to a no. 10 extinguisher) each will be provided for placement at the workshop, near the ice making machinery and in the administrative office.

Design equipment specifications, intended purpose and quantities to be provided are indicated in the Table 2.2.45 below. Specifications are matched to local conditions taking into consideration O&M requirements.

Table 2.2.45 Design equipment list

No.	Equipment Name	Specifications	Q'ty
1	**Equipment for fish landing and handling support**		
1-1	**Equipment for landing support at jetty/wharf**		
1-1-1	Trolley	Loading capacity : Approx. 300kg Dimensions of platform : Approx. 700×1,100mm	4
1-1-2	Fish Box	Inner volume : Approx. 50L Handle for stacking : Equipped	20
1-1-3	Bucket	Capacity : Approx. 30L Round type, Approx. 550Φ×250Hmm	392
1-2	**Equipment for fuel transport**		
1-2-1	Carrier for Oil Drum	Capacity : 300Kg, 3 wheels type	2
1-2-2	Manual Pump	Flow rate : Approx. 0.5L/rotation, Hose : 3m or longer	2
1-3	**Weighing Equipment**		
1-3-1	Platform Scale (100kg)	Weighing capacity : Approx. 100kg Digital, Stainless steel made	2
1-3-2	Weighing Scale (30kg)	Suspension type, Analog Weighing capacity : Approx. 30kg	2
1-4	**Equipment for fish storage**		
1-4-1	Cool Box A	Inner volume : Approx. 200L Drain cap : Equipped	4
1-4-2	Cool Box B	Inner volume : Approx. 1,000L Drain cap : Equipped	2
2	**Equipment for facility maintenance (Fishing boat repair)**		
2-1	Carpentry Tools		
2-1-1	Electric Circular Saw	Base materials : Aluminum or equivalent Diameter of saw blade : Approx. 190mm Number of revolution : Approx. 5,000rpm	1
2-1-2	Electric Jig Saw	Cutting thickness : Approx. 60mm Tilting cutting angle : Both side 0～45°	1
2-1-3	Electric Dill for Wood	Maximum holing capacity : 30mm or more (wooden) Number of revolution : Approx. 1,100rpm	1
2-2	Metalworker's Tools		
2-2-1	Vice	Maximum clamping pressure : 1,200kg or more Jaws : Approx. 155×190×90mm	1
2-2-2	Electric Disc Grinder	Grindstone size : 125 dia.×3.7mm thickness Number of revolution : Approx. 8,000rpm	1
2-2-3	Table-top Electric Grinder	Grindstone size : 150 dia.×16mm thickness Number of revolution : Approx. 3,000rpm	1
2-2-4	Drilling Press	Capacity : diameter ϕ 13mm Swing : Approx. 360mm, Max. quill stroke : Approx. 80mm	1
2-3	Engine Welder	Current range : about 40～150A Applicable welding rod : 2.0～3.2mm Cable, Holder, Mask, Leather apron; Equipped	1
2-4	Work Bench	Middle weight table :weight load 800Kg Dimensions : Approx. 1500×900×740mm	1
2-5	Movable Lift	Compact crane, Loading capacity : 150～500Kg Height of suspension : 2000mm or more	1
2-6	Sink	Single basin sink Dimensions : 900×600×850(H)mm、	1
2-7	Engine Compressor	Gasoline engine : Approx. 0.75KW Exhaust air volume : Approx. 80L/min., Tank : more than 10L	1
3	**Equipment for safe keeping**		
3-1	**Movable extinguisher**		
3-1-1	Extinguisher with wheel	ABC type, Nitrogen gas cylinder : Equipped separately Pressure regulator : Equipped Carrier wheel : Equipped	2
3-1-2	Portable extinguisher	ABC portable type, Capacity : No. 10	6

(2) Equipment to be provided by the recipient country

General office supplies necessary to start-up, operate and maintain facilities are to be provided by the Indonesian side. Items and quantities in this regard with consideration to design facilities, scale, number of staff and operating plan are as shown in the Table 2.2.46 below.

Table 2.2.46 Items to be provided by the recipient country

Office items	Quantity
Writing instruments	11 sets
Port chief desk and chair	1 set
Staff desk and chairs	16 sets
Plastic chairs	50 nos.
Shelving	4 nos.
Safe	4 nos.
Filing cabinet	2 nos.
Blackboard	2 nos.
Bulletin board	5 nos.
Megaphone	2 nos.
Telephone	1 no.
Computer, printer, etc.	1 set
Simple workshop tools	1 set