People's Republic of Bangladesh
Bangladesh Fisheries Development Corporation

DRAFT OUTLINE DESIGN REPORT

PREPARATORY SURVEY
ON
THE PROJECT FOR IMPROVEMENT OF BANGLADESH FISHERIES DEVELOPMENT CORPORATION FISH LANDING CENTER, COX'S BAZAR

May 2023

JAPAN INTERNATIONAL COOPERATION AGENCY

FISHERIES ENGINEERING CO., LTD

SUMMARY

① Overview of the country

Bangladesh is a coastal nation located in South Asia, borders India to the west and north, Myanmar to the east and the vast Bay of Bengal to the south. Despite having a land area of 148,460 km^2, the coastline is 710 km long. Approximately 66,440 km^2 of the marine exclusive economic zone of 164,400 km^2 is continental shelf. The coastal waters are shallow, with 24,440 km^2 of the water area shallower than 10 m. (Shahriar Nazrul et al., 2018)

Bangladesh's GDP has been growing steadily at an average annual rate of 6.5% since 2010, and the percentage of households below the poverty line (< US$1.9) declined significantly to 13.8% in 2016. The average annual growth rate of the fisheries sub-sector since 2010 is 6.2%, which is much higher than the 2.7% of the agriculture sector. Fisheries play a vital role in the country's economy, contributing 3.57% to the total national GDP in FY 2019-20 and 26.50 % to the agricultural and fisheries sector GDP (DoF, 2021) as well as 1.24 % to national export earnings (EPB 2021), second only to the textile industry as a source of foreign currency. With a vast population of about 16.51 million (BBS, 2022), the livelihoods of more than 12% of the population are supported directly or indirectly by various activities in the fisheries sub-sector (DoF, 2021).

However, the growth of inland water fisheries and aquaculture fisheries, which have driven the growth of the fisheries sector to date, is threatening to plateau. Therefore, the Government of Bangladesh expects marine fisheries to be the next source of growth as it has great development potential, and has made protection, conservation, and diversity of coastal marine resources a priority.

Bangladesh ranks the 3rd in inland open water fisheries production, accounting for about 11% of world production, and ranks the 5th in aquaculture production (SOFIA, 2022). However, despite the growth of the fishery sub-sector as a whole, 23.9% of fishery workers live in poverty and 13.2% live in extreme poverty.

The majority of Bangladesh fisheries production is for domestic consumption. Bangladesh is self-sufficient in fishery products. Also, Bangladesh ranks as one of the world's biggest fish-eating countries, with fish accounting for 60% of animal-based protein intake for all Bangladeshis, or 20-25 kg of fish consumption per person per year. Bangladesh's total fisheries production in FY 2020/21 was 4.621 million tons. Of this, marine fisheries production accounted for 15% or 6.081 million tons. Furthermore, artisanal marine fisheries production accounted for about 83% of total marine fisheries production, or 502,000 tons.

② Background, circumstances, and overview of the project

With the area of 228,23 km^2 of the Cox's Bazar Sadar Upazila in Cox's Bazar District,

Chattogram Division, has a prospering tourism industry and marine fisheries industry. Situated 150 km south of Chattogram, the area is bordered by the Maheshkhali Channel, into which the Bakkhali River flows, on the northeast and the Bay of Bengal on the west. Cox's Bazar District is one of the coastal districts where both aquaculture and marine and inland water fisheries are thrived, with marine fisheries in particular accounting for 20%, or about 680,000 tons, of the national fish catch in 2020-2021.

There are four major fishing grounds in Bangladesh waters, of which the South Patch, a small trench west of Cox's Bazar covering 3,400 km^2 starting 10 km from the shore, is the most well stocked. To the south of that is the South of South Patch, another fishing ground located south of Teknaf in Cox's Bazar District. Both grounds are very close to Cox's Bazar and Teknaf, making them important fishing grounds for artisanal fishers.

Artisanal fishers and fishery production capital for important fishing gear for artisanal fisheries, such as estuarine set bag nets and gill nets, are concentrated in Cox's Bazar District. The number of artisanal fishers in Cox's Bazar District is 356,601, or 39.3% of the national total, the number of estuarine set bag nets is 21,372, or 40%, and the number of gill nets is 28,018, or 29.3%.

Most of the marine catch along the southeast coast of Bangladesh is landed in Cox's Bazar District from where it is distributed around the country as well as exporting. However, appropriate quality of fish cannot be maintained during transportation due to lack of fishery infrastructure, post-harvest losses are high and about 30-33% of all fish caught becomes inappropriate for human consumption. (Rabbani, 2017)

The Fish Landing Center, Cox's Bazar (referred to as "CXB FLC") operated by Bangladesh Fisheries Development Corporation (referred to as "BFDC"), is a landing and distribution center located in Cox's Bazar Sadar. CXB FLC handles approximately 80% of the district's annual total catch, but around 2012s parts of the landing platform, fish handling area, stairway jetties and piers started collapsing due to accelerating bank erosion, and at present the pier foundations are impairing prone to collapse. Landed catches are therefore transported to the remaining handling area via an existing pontoon and slope revetment through a disorder of flow lines of workers, fish and vehicles, making landing and handling of fish inefficient and unhygienic. Moreover, with the decline in ice-production capacity due to aged equipment, the ice required by the fishing boats cannot be sufficiently supplied in either quantity or quality. Therefore, the quality of fresh fish is not maintained.

Since August 2017, the augmentation of refugees from neighboring Myanmar to Cox's Bazar District has had a substantial impact on the livelihood of the host communities, resulting to severe competition for employment opportunities and lower wages. There is a growing need for poverty reduction measures for local residents of the host communities, including artisanal fishers.

③ **Outline design and facility/equipment plan**

Based on the above background, the Japanese government decided to conduct a preparatory survey, and the Japan International Cooperation Agency (JICA) dispatched a study team from July 16 to September 2, 2022. The study team held discussions with BFDC, the executing agency, and the Ministry of Fisheries and Livestock (MoFL), the line ministry, and also conducted a field survey at CXB FLC.

In this project, the following civil engineering facilities and building facilities, and equipment for fish handling are planned. The main project components are shown below.

Items	Outline of the component
1) Facilities and Equipment	
Civil engineering facilities	Revetment, pontoons, gangways, etc.
Building facilities	Fish landing area, washing, selling and handling area, ice crushing area, administrative space, trader office, toilet for women, public toilets, canteen/shops, residential building（two-stories）, etc.
Equipment	Fish handling equipment (Fish wash basins, Fish baskets, Pallet etc.)
2) Consulting services and soft components	
Consulting service	Detailed design, assistance for bidding and concluding construction contract(s), supervision of construction
Soft components	Guidance and Training in fish handling and hygiene management

④ **Project term and approximate project cost**

The required overall project term consists of 4 months for detailed design, 4 months for the bidding process, 35 months for facility construction and 9 months for procurement of equipment.

The cost to be borne by the Bangladesh side, if the project is implemented under the grant aid of Japan, is estimated to be about 142.91 million BDT, or about 207.93 million yen.

⑤ **Project evaluation**

About 40 fishing boats unload their catch at CXB FLC every day, but only one or two boats can come alongside the single existing pontoon at a time. As a result, most of the boats anchor in the river and transport their fish in small boats called dingi, resulting in highly inefficient landing operations.

The existing fish handling area at CXB FLC is old and deteriorated and has partly collapsed, resulting in major congestion with insufficient handling space and a disorder of

flow lines with fish, workers, ice and vehicles. Inefficient unloading and handling and unhygienic handling of the fish are also major problems. The fish in the handling area are unclean due to being kept directly on the ground where workers without hygienic precautions walking around. The fish are washing with river water to clean, but the river water itself is contaminated.

The construction of the new landing facilities under this project is expected to lead to an increase in the number of fishing boats come alongside as well as more efficient fish landing operations. Prevention of fish quality degradation during transportation and the supply of safe fish to consumers are also expected by the hygienic supply of clean water from plan deep wells, provision of cold storage facilities and fish handling equipment. And construction of a fish landing center building with efficient flow lines of fish, workers, ice and vehicles, will make it possible to handle the landed fish hygienically.

Most of the fishing boats that use CXB FLC are registered in some upazillas where the host community have taken in refugees from neighboring Myanmar. The most of residents of the host communities who use CXB FLC are crew members of the artisanal fishing boats or fishery workers, and improvement of CXB FLC will have the effect of supporting the host communities residents by improving their labor environment by reducing waiting time for unloading from fishing boats and shortening unloading and handling fish. Implementing the project with grant aid from Japan is therefore deemed appropriate.

About 2,000 people per day will directly benefit from the project, including the boat owners, fishers, distributors and workers who use CXB FLC.

It is estimated there will also be about 200,000 indirect beneficiaries, including residents of Cox's Bazar District who buy and consume fish distributed from CXB FLC, and users of Chattogram and Dhaka fish markets.

■ Quantitative effects

Target item	Present value (2022 actual value)	Target value 2031 (Three years after project completion)
Berthing boats for landing (ship／day)	20	60
Time span of landed fish staying at the landing center from landing to shipping (hour)	4	2
Coliform count in water for cleaning (Total Coliform CFU／100ml)	River water：88	Deep well water：0

■Qualitative effects

1) Improved working environment for artisanal fishers and fisheries workers who use the CXB FLC facilities by reducing waiting time for unloading from fishing boats and shortening unloading and handling fish. (about 80% of all fishing boats using CXB FLC are registered in Upazilas consists of host communities, and many host community residents are fishers and fisheries workers who use CXB FLC)
2) Decrease number of fishing boats opting for alternative landing sites (e.g. Chattogram) other than CXB FLC, avoiding long waiting.

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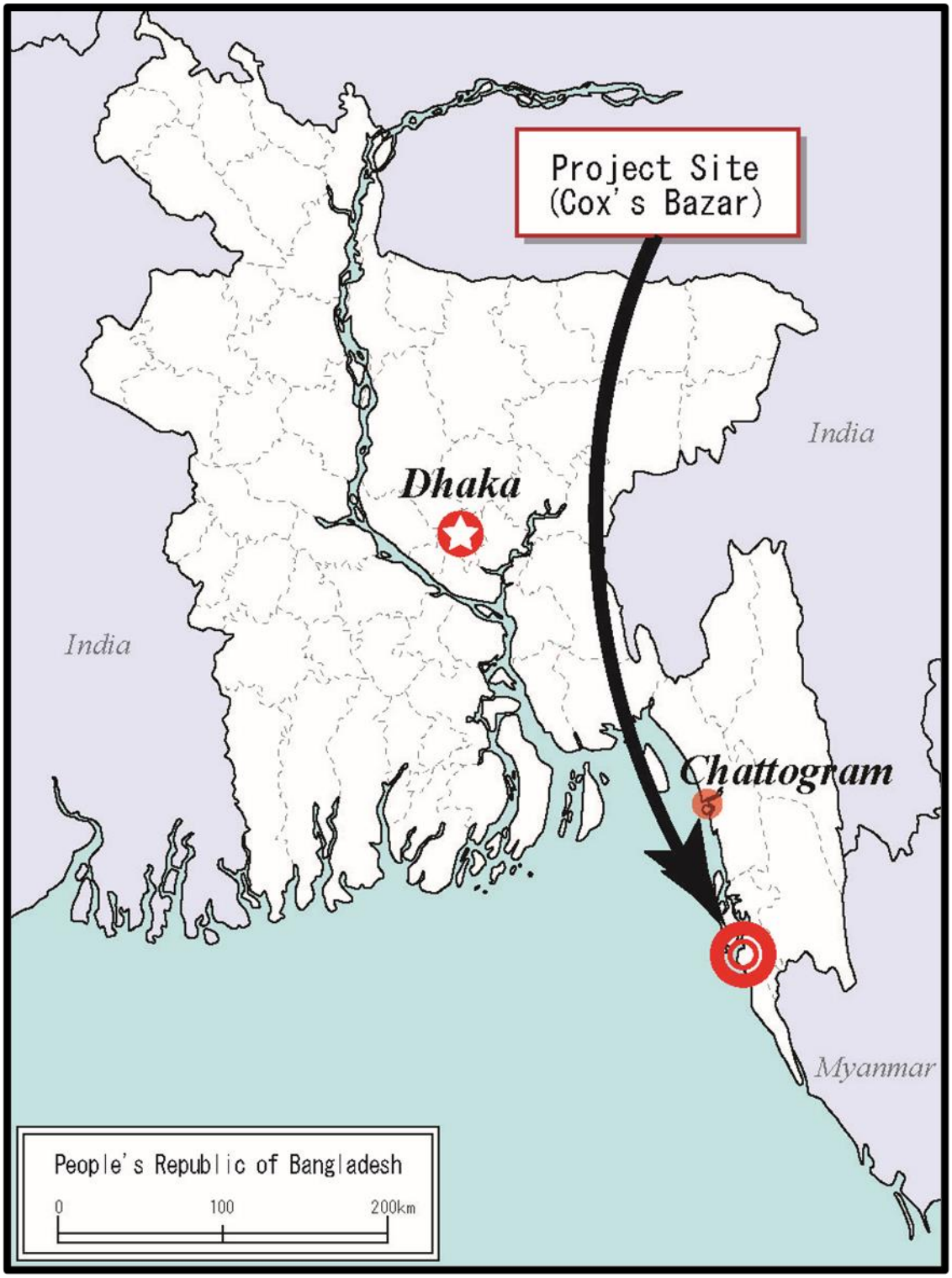
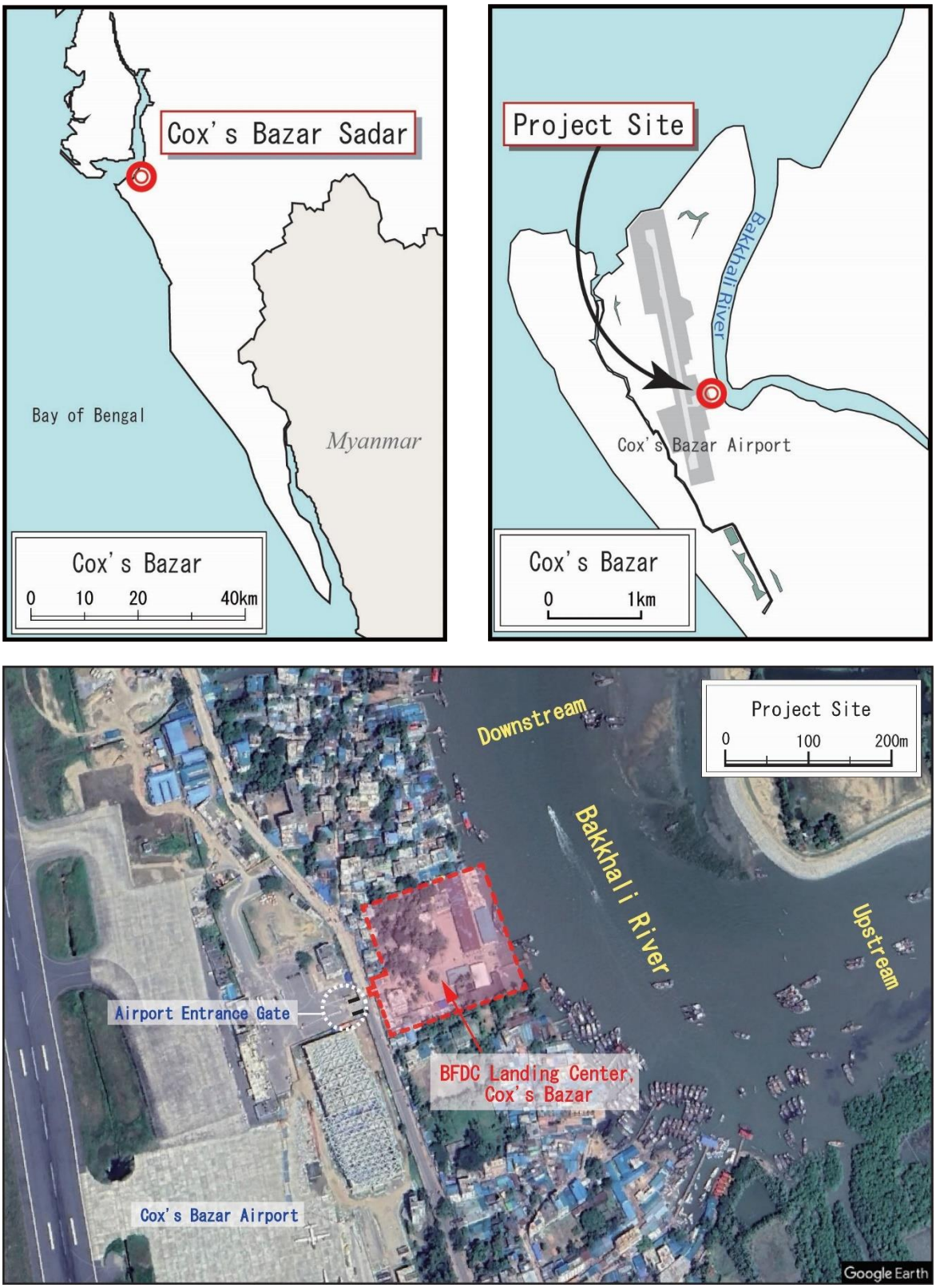


Location Map



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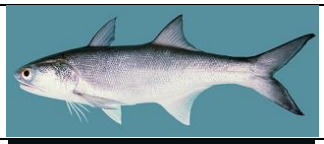
Abbreviations

ADCP	Acoustic Doppler Current Profiler
AIDS	Acquired Immunodeficiency Syndrome
BBS	Bangladesh Bureau of Statistics
BDT	Bangladesh Taka
BECA	Bangladesh Environmental Conservation Act
BECR	Bangladesh Environmental Conservation Rules
BFDC	Bangladesh Fisheries Development Corporation
BIWTA	Bangladesh Inland Water Transport Authority
BM	Bench Mark
BNBC	Bangladesh National Building Code
BPDP	Bangladesh Power Development Board
BUET	Bangladesh University of Engineering and Technology
BWDB	Bangladesh Water Development Board
CCSM4	Community Climate System Model 4
C.D	Chart Datum
CDA	Cox's Bazar Development Authority
COD	Chemical Oxygen Demand
CXB FLC	BFDC Fish Landing Center, Cox's Bazar
DPP	Development Project Proposal
DoF	Department of Fisheries
ECA	Ecological Critical Area
ECAMR	Ecologically Critical Area Management Rules
ECC	Environmental Clearance Certificate
ECNEC	Executive Committee of the National Economic Council
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPB	Export Promotion Bureau
GDP	Gross Domestic Product
HIC	High-Income Country
HIV	Human Immunodeficiency Virus
H.W.L	High water level
IPCC	Intergovernmental Panel on Climate Change
IEE	Initial Environmental Examination
IWFM	Institute of Water and Flood Management
LGED	Local Government Engineering Department
L.W.L	Low water level
M／D	Minute of Discussion
MoFL	Ministry of Fisheries and Livestock
MSBN	Marine Set Bagnet
MSL	Mean Sea Level
NCAR	National Center for Atmospheric Research
pH	potential of hydrogen
PWD	Public Works Datum
RCP	Representative Concentration Pathway
SoB	Survey of Bangladesh
SOFIA	The State of World Fisheries and Aquaculture
SS	suspended solids
TOR	Term of Reference
T-P	Total Phosphorus
UNIC	Upper Middle-Income Country

List of Major Marine Fish

1.English Name 2.Local Name *3.Scientific Name*	Image	1. English Name 2, Local Name *3, Scientific Name*	Image
1,Hilsa Shad 2,Hilsa *3,Tenualosa ilisha*		1,Sea catfish 2,Sea catfish *3,Plicofollis dussumieri*	
1,Chinese Pomfret 2,Chinese Pomfret *3,Stromateus chinensis*		1,Black Pomfret 2,Black Pomfret *3,Parastromateus niger*	
1,Scabbard fish 2,Ribbon fish *3,Lepturacanthus savala*		1,Less Tiger-tooth Crocker 2,Poa *3,Otolithes ruber*	
1,Indian Salmon 2,Indian Salmon *3,Eleutheronema tetradactylum*		1,White sardine 2,Sardine *3,Escualosa thoracata*	
1,Indian mackerel 2,Mackerel *3,Rastrelliger kanagurta*		1,Goldspotted grenadier anchovy 2,Anchovy *3,Coilla dussumieri*	
1,Croakers 2,Jewfish *3,Johnius argentatus*		1,Bombay duck 2,Bombay duck *3,Harpadon nehereus*	
1,SeaBass 2,Koral *3,Lates calcarifer*		1,Paradise threadfin 2,Tapasi *3,Polynemus paradiseus*	
1,Giant tiger prawn 2,Shrimp (Tiger shrimp) *3,Penaeus monodon*		1,Tuna 2,Tuna *3,Katsuwonus pelamis*	
1,Indian white prawn 2,Prawn (Indian white prawn) *3.Penaeus indicus*			

Source : Fish Base

CHAPTER 1. OUTLINE OF THE PROJECT

1.1. Background of the project

1.1.1. Background

The project site is located in Cox's Bazar Sadar Upazila, Cox's Bazar District, Chattogram Division, People's Republic of Bangladesh (hereinafter referred to as "Bangladesh"). Cox's Bazar District is where many artisanal fishers and the important fishing gear for artisanal fisheries, such as estuarine set bag nets and gill nets, are concentrated. The number of artisanal fishers is 356,601, which is 39.3% of the national total, the number of estuarine set bag nets is 21,372, which is 40 %, and the number of gill nets is 28,018, which is 29.3%. The district also boasts the largest volume of artisanal fishery landings in Bangladesh.

Most of the marine catch along the southeast coast of Bangladesh is landed in Cox's Bazar District from where it is distributed around the country as well as exporting. However, appropriate quality of fish cannot be maintained during transportation due to lack of fishery infrastructure, post-harvest losses are high and about 30-33% of all fish caught becomes inappropriate for human consumption. (Rabbani, 2017)

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Since August 2017, the augmentation of refugees from neighboring Myanmar to Cox's Bazar District has had a substantial impact on the livelihood of the host communities, resulting to severe competition for employment opportunities and lower wages. There is a growing need for poverty reduction measures for local residents of the host communities, including artisanal fishers.

Based on the above, the Japanese government decided to conduct a preparatory survey, and from July 16 to September 2, 2022, Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a study team. The team held discussions with the executing agency BFDC and the Ministry of Fisheries and Livestock (hereinafter referred to as "MoFL"), the line ministry, and also conducted a field survey at CXB FLC.

1.1.2. Present situations and issues of CXB FLC

1.1.2.1. Outline of CXB FLC

CXB FLC, the site of the project, is one of the 12 fish landing centers in the country operating under BFDC and a key fish landing hub in Cox's Bazar Sadar Upazila. Its primary sources of revenue include fees imposed on the packages of fresh fish shipped from CXB FLC, the sales of block ice produced in the ice making facility and rent from facilities within CXB FLC.

At present, CXB FLC has the following functions, which are used for multiple purposes:
1) Landing, trading, packing and shipping fresh fish, such as hilsa, outside Cox's Bazar District (Dhaka, Chattogram, etc.)
2) Landing, trading, packing and shipping fresh fish within Cox's Bazar District
3) Retail sale of fresh fish within CXB FLC

At CXB FLC, the revetment and foundations of the fish handling shed have been collapsing since the stairway jetties, fish handling shed and part of the pier began to collapse around 2012 due to riverbank erosion. Only one pontoon is currently functioning as a landing/mooring facility. The transaction/packing space is also limited as the fish handling area has been reduced due the foundation collapse. Moreover, the fragmentation of work at CXB FLC has resulted in a disorder of flow lines of workers, fish and vehicles, seriously disrupting landing, transaction, weighing, packing and shipping operations.

Fresh fish landed from boats are directly placed and traded in a heavy traffic area where many workers walk around with their shoes on. Coliform has been detected on the surface of the fish handling sheds. A water quality survey also found that the river and well water (from shallow wells) using for cleansing the catches and cleaning the facilities was contaminated. Under these circumstances, the catches are further spoiled, making it difficult to maintain fish quality. Refrigeration facilities are also underdeveloped, and part of the landed fresh fish is left outside under direct sunlight without being iced, which makes it all the more difficult to maintain quality.

In the discussions with BFDC Headquarters, it was confirmed that there is no alternative site for CXB FLC landing operations, which shall be continued during construction of plan landing facilities. Users of CXB FLC also expressed a desire to continue their landing and shipping operations by shifting their activity area within the CXB FLC site instead of temporarily relocating to another alternative site, and requested transitional work space, provisional work by modifying their working space within CXB FLC. They, thus, requested provisional space to work and pray, that they can use during the construction period. It is confirmed in the minutes of discussions with BFDC, these makeshift spaces and facilities should be secured by BFDC. It is planned to divide CXB

FLC into the Construction Area (north side) and the Fishery Area for fishery activities (south side) during the construction period.

1.1.2.2. Present situations and issues of the existing facilities and equipment

1) Present situations of the existing facilities and equipment

The present layout of CXB FLC is shown below.

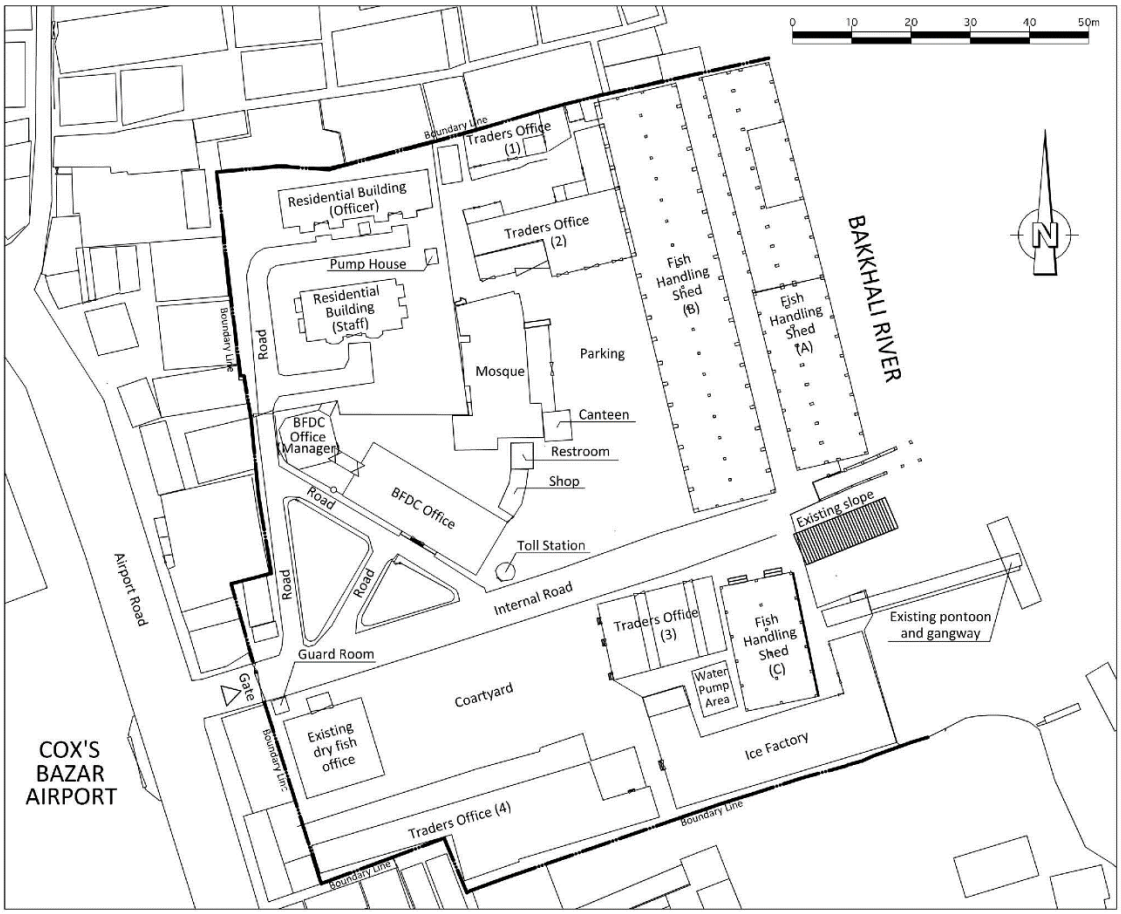


Figure 1-1 : The present layout of CXB FLC

CXB FLC is located some 3 km upstream from the Bay of Bengal, via the Maheshkhali Channel and the Bakkhali River. The entrance (west side) to CXB FLC is directly opposite the entrance to Cox's Bazar Airport. The site is fenced on its southern and northern limits, and it borders the Bakkhali River on the east.

The land on which CXB FLC stands is owned by BFDC. The total area of the site is 3.7 acres, as per the *mouza* (land tax) map and *khatian,* a title ledger recording the possession of land, both of which are kept at the Assistant Commissioner Land Office (Cox's Bazar District office). The borders of CXB FLC with neighboring land were verified in the presence of a surveyor of the Upazila Land Office and a staff member of CXB FLC.

Existing facilities at CXB FLC include a pontoon and a slope revetment near the point

where the gangway is connected to land. After landed at these facilities, fish catch is transacted, packed and shipped in one of the three fish handling sheds ([A], [B] and [C] in the map above) at CXB FLC.

CXB FLC has an ice making facilities in the south, where block ice is produced for fishing boats. The block ice is also crushed by a machine installed near a fish handling shed to ice the fresh fish transacted there.

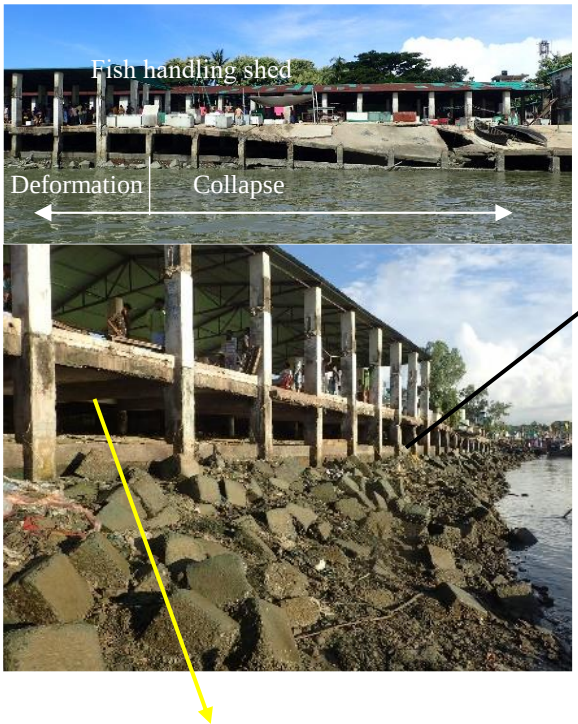
CXB FLC has space dedicated to the distributors engaged in the transaction of landed fresh fish, as well as user service facilities for use by fishers and residents in the neighborhood, such as a mosque, residential buildings for BFDC staff, a public toilet, canteen etc.. On the opposite side of the Bakkhali River, a dry fish office was completed in February 2023 as part of a separate ongoing project to construct a fish processing complex.

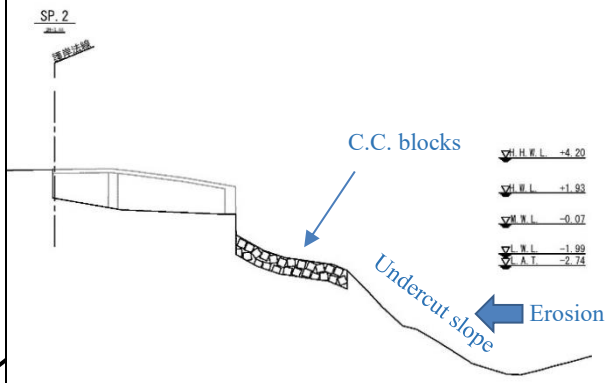
The table below provides an outline of the existing facilities.

Table 1-1 : The present situation of existing civil engineering facilities CXB FLC

[Civil engineering facilities]

1) Revetment (photo taken from the river)





Total length of the revetment: ≈70 m

The revetment is basically a natural revetment (river bank). On the top of the revetment is the foundation floor of the partially collapsed fish handling shed (photo on the lower left).

A brick retaining wall has been built at the top of the revetment slope below the foundation floor.

C.C blocks filling has been done at the front of the foundations as an emergency measure to prevent the erosion of the collapsed part, but this has not proven to be a permanent solution.

2) Slope revetment

Total length: ≈20 m

Surface: Concrete block structure

Blocks are configured to form steps on part of the slope.

Due to the shortage of mooring facilities, fishing boats, unable to dock at the pontoon, stay in the middle of the river to transship their catches to small boats (*dingi*) for landing on the slope revetment.

・The clearance below the foundations are in the water of the river, function as a flow section of the river at high tide (photo below).

3) Pontoon 	Built in 2018 Dimensions: 15.2 m L × 3.7 m W × 1.2 m D (freeboard: 0.8 m, draft: 0.4 m) Anchor chains measure φ25 mm in diameter. Gangway: 2.7 m wide (of which 0.5 m is used for carrying block ice) Paint maintenance is performed every six months It has not been damaged after built

[Building facilities]

Building/room	Area	Use	Condition
1) Fish landing center building	**1644 ㎡**		
- Fish Handling Shed A	372 ㎡ (some 450 ㎡ collapsed)	Single-story reinforced concrete structure (partial steel construction) for the sorting, weighing, transaction and packing of landed catches. Unsold catches are stored in cool boxes placed in a roofless space (the dismantled part of the shed).	Originally constructed as a two-story building in 1966, but half of the slab under the foundations is now slanted due to erosion (see the photo of the revetment shown in Item 1 of [Civil engineering facilities]). The entire second floor and some of the columns on the first floor were subsequently dismantled, with a new roof attached to cover the remaining columns. The shed Is still in a dangerous condition as shown by a further collapse during the survey period. There is no water supply system.
- Fish Handling Shed B	1008 ㎡	Landed catches are carried in for sorting, weighing, transaction	It is a single-story reinforced concrete structure (partial

Building/room	Area	Use	Condition
		and packing. Space is used for fishing net maintenance except for busy hours. Retail sale of the catches (non-wholesale transaction) is carried out in this shed.	steel construction). A lack of water supply system makes cleaning difficult.
- Fish Handling Shed C	264 ㎡	There is a new fish handling shed built recently. The floor is at a higher level than in the other sheds to prevent flooding.	It is a single-story reinforced concrete structure (partial steel construction). A lack of faucets makes cleaning difficult.
Traders' office building	**800 ㎡**	Trader's offices are located scattered throughout the site.	See *1 below.
- Traders' office	800 ㎡	Sales of baskets and styrofoam boxes for carrying fish and the storing and packing of fish are performed here as well as the clerical work of distributors. Four major traders have their offices nearby Fish Handling Shed B as they handle large quantities of fish, including for export.	Although the trader's offices were built at different times and used for different purposes, they are all now becoming completely decrepit. The lack of toilets is one of the major inconveniences.
Management office building	**584 ㎡**	It is a two-story RC structure. The ground floor is an office, and the first floor provides accommodation.	
- Manager's office	62 ㎡	It is the office of the CXB FLC manager. Meetings with staff members and visitors are held in this room.	Windowpanes are broken and the steel bars are severely damaged due to age deterioration. Frequent blackouts make it often dark inside.
- Staff office	131 ㎡	Each room is used by 1–3 staff members to perform clerical work.	As with the manager's office, the opening section is severely damaged due to age deterioration.
- Storage	25 ㎡	It is used for storing documents, supplies,	Sufficient space has been secured.

Building/room	Area	Use	Condition
		etc.	
- Toilet	10 ㎡	It is used by BFDC staff.	There is ample space for one person only. There is no gender segregation.
- Dining room	25 ㎡	It is used to serve food for those staying in accommodations.	Propane is used to provide hot water and for cooking. The room is kept clean, but the paint on the wall is visibly deteriorating.
- Kitchen	10 ㎡	It is used as a kitchen for the staff office and those staying in accommodations. Propane stoves provide hot water.	The wall and floor surfaces are severely damaged due to age deterioration.
- Accommodation for staff and guests (4 rooms)	63 ㎡	There are three rooms for staff and one for guests.	Ample space is available as each room is used by one person.
- Living room (for the manager and guests)	76 ㎡	It is used as a living room for the manager.	The fittings are poorly constructed.
- Multipurpose room	10 ㎡	It is used for storing supplies and as a living room for staff, etc.	It is kept tidy with no apparent problems.
- Other (hall)	172 ㎡	Employees' motorbikes as well as cement and other building materials are kept in the entrance hall. Corridors are dark and located well inside the hall.	Same as above
Residential building for CXB FLC (2 buildings)	**516 ㎡**	It is located in the northwest corner of the site, farthest from the bustling fish landing center buildings. It has a tranquil atmosphere, being surrounded by fences.	
- Residential building for CXB FLC (Officer)	236 ㎡ (59 ㎡ x 4 rooms)	It is used by BFDC officers and their families. Equipment is powered by electricity and gas (propane). Water is supplied by a well. Although a septic tank is available,	The outer walls are discolored. The opening section is severely damaged due to age deterioration, as attested by broken glass and rusted

Building/room	Area	Use	Condition
		wastewater is discharged into the river untreated.	security grids, most likely due to heavy rain and wind.
- Residential building for CXB FLC (Staff)	280 ㎡ (35 ㎡ x 8 rooms)	It is used by BFDC staff and their families. It is the same as above as regards equipment.	Same as above
Mosque	**356 ㎡**	The mosque was constructed with a donation from CXB FLC users (particularly distributors). It is a two-story RC structure.	
- Prayer room	194 ㎡	It is used by CXB FLC users and neighboring residents for daily prayer. The floor is tiled in a variety of colors to indicate the places where prayers should place their feet. Equipment includes a power supply, an air conditioner, fans on the ceiling and loudspeakers.	People pray five times a day (six times on Fridays) for about 30 minutes each. The existing facilities cannot accommodate the extraordinary number of users on Friday afternoon, with many praying outside the prayer room.
- Foot washing basins	47 ㎡	People perform *wudu* (washing their feet) before entering the prayer room. The foot washing basin is equipped with fixed chairs to facilitate wudu. Eight additional faucets are available outside the room.	There are two foot washing basins to the left and right of the prayer room with a capacity of 37 persons each. The number of users varies depending on the day of the week and time. The entrance to the ablutions basins is narrow, and crowded at peak times.
- Toilet	16 ㎡	It is for men only.	It is kept tidy, but the floor is slippery and particularly dangerous at peak times. The number of toilets is small given the number of users.
- Accommodation (4 rooms)	72 ㎡	It is used by religious leaders and their followers.	It is windowless, dark and poorly ventilated.
- Toilets for religious leaders	3 ㎡	It is used by religious leaders and their	The entrance door is poorly built and

Building/room	Area	Use	Condition
		followers.	difficult to open.
- Canteen	24 ㎡	It is located in the space available beneath the stairway of the prayer room. It is used as a resting place for CXB FLC users.	Only 24 seats are available, which is very few given the sheer number of facility users.
Ice factory	**568 ㎡**	It is a single-story RC structure.	
- Ice making room	267 ㎡	It is used to supply ice to fishing boats before departure and the fish handling sheds. It is equipped with a manual hoist crane for carrying ice can from the ice making tank. For the supply of water, a pump is placed outside the ice making facilities to pump up water. It takes 24 hours to make 60 kg of ice and 48 hours to make 100 kg.	The ice making facilities were installed almost 20 years ago, and the walls, floors, and ceilings are quite dilapidated. It is hard to say that they are well-maintained.
- Ice making tank	150 ㎡	Measuring 8.4 m x 17.8 m x 1.2 m, the concrete ice making tank contains about 300 ice cans. An ice can is about 0.49 m x 0.23 m x 1.20 m (H) in size, with nominal ice making capacity of 30 tons per day.	The capacity of the system is declining due to refrigerant ammonia leaking from rusted piping caused by aging and inadequate maintenance. Due to inadequate location of the surge drum, the temperature in the ice making tank is uneven, resulting in poor ice making efficiency. (The surge drum is currently located on a corner of the ice making tank. Normally it is placed at the center.) Elbows are usually used for bent piping, but here the pipes are welded at right angles, which prevents smooth refrigerant flowing.
- Condenser	48 ㎡	Condensers are placed	It is grimy, and the

Building/room	Area	Use	Condition
		outside the ice factory. They are atmospheric condensers, as is generally the case in Bangladesh.	condensers are not working at full efficiency.
- Office/machine room	253 ㎡	It is used as the operations office of the ice factory, where a compressor and a pump are installed. Part of the space is used as a trading office.	Ample space is available with no specific problems.
Other facilities	**222 ㎡**		
- Small shop	21 ㎡	It sells drinks and snacks.	This space is kept clean and sanitized every day after closing. The space is used by many people and is short of capacity during peak hours.
- Public toilet	16 ㎡	It is equipped with three Oriental-style pans, one urinary and two shower rooms. Users bring a bucket of water with them to the stall. It has a janitor's room.	The toilets are kept clean as a janitor is present on a full-time basis.
- Dry fish office	185 ㎡	It is an office for the construction of a fish processing complex on the opposite side of the Bakkhali River as a part of a separate BFDC project. It is a three-story RC structure.	It was completed in February 2023.

*1: Three types of Trader's office buildings were identified in CXB FLC during the survey period. Based on historical information from around 1966, when CXB FLC was inaugurated, the facilities were categorized as follows:

① Adat ghar (20 compartments): The term, which is short for *ghadigal*, refers to "wholesale." The building is still used as offices by wholesalers or *dadondar*, financial services providers specific to Bangladesh who lend money to fishers and ship owners.

② Dep ghar (9 compartments): The term originally refers to space for storing ice. Now that ice is delivered directly to fishing boats or distributors, those ice storage space has been converted into the offices of exporters and distributors.

③ Shop ghar (16 compartments): The term originally referred to shops dealing in salt or packing materials for transporting fish. Only a few shops remain now, with the rest having been converted into offices, etc.

④ Storage, unused (13 compartments): Some of the rooms are rented by the aforementioned distributors as workshops or for storage while other compartments remain vacant.

2) Present situation of existing facilities

◆ **Power supply**

The power supply in Bangladesh are single-phase 230V/50Hz and three-phase 400V/50 Hz. As for the power infrastructure at the project site, an aerial high-voltage cable (11,000 V) runs along the road on the west side (Airport Road). Power is distributed to the project site from this high-voltage cable in two lines after voltage reduction. The first line is directly connected to the ice factory from a pole-mounted transformer at 250 kVA, while the second line comes from a pole-mounted transformer installed at the side of the entrance road for distribution to internal facilities via aerial wires. According to the facility engineer, the transformer for this second line frequently causes blackouts due to deficiency of capacity or age-related failures.

◆ **Water supply facilities**

There is no municipal water supply system at the project site, which relies on well water. The site has seven wells, mainly near the ice factory and the residential buildings for staff. They are shallow wells between 9 m (30 ft) and 5 m (18 ft) deep, all of which were found to be contaminated in a water quality survey.

◆ **Drainage facilities**

The site has no sewer system, and it discharges untreated wastewater into the Bakkhali River.

◆ **Communication facilities**

The internet is currently available at the BFDC office through wireless WiFi.

3) Present situation of existing equipment

The following table shows the existing equipment owned by each user in CXB FLC.

Table 1-2：Existing equipment owned by each user in CXB FLC

Equipment (Photos)	Outline of equipment
	Bamboo baskets Used for landing fish from boats and are owned by groups specializing in fresh fish transportation within CXB FLC. Measuring 540 mm wide and 360 mm high, it can hold about 40 kg of fresh fish. A bamboo pole is used by two people to carry two baskets at a time.
	Metal bowl Used to carry fresh fish transacted at fish handling sheds to the packing area and are owned by facility users specializing in weighing fish catches. The weight of fresh fish is measured with a balance scale suspended from beam during transportation with fish in the metal bowls. (Dimensions: 650 mm wide and 200 mm high)
	Half-sized plastic drums Plastic drums cut in half are widely used in Bangladesh. They are used for transporting crushed ice and landing and shipping small fresh fish. They are owned by their users. (Dimensions: 560 mm wide and 500 mm high)
	Styrofoam boxes Used for shipping fresh fish in bulk. They are purchased and used by distributers shipping large amounts. More than 1,500 boxes are used on a typical day when a sizable volume of fish is shipped to distant market. (Dimensions: small size: 300 mm wide, 500 mm deep and 280 mm high large size: 400 mm wide, 580 mm deep and 280 mm high)
	Balance scales Used to weigh fresh fish in metal bowls. There are six balance scales available in the fish handling sheds. They are owned by facility users that specialize in weighing fish catches.
	Digital platform scales They are used for packing fresh fish purchased. Each distributor owns.

Equipment (Photos)	Outline of equipment
	Storage boxes They are placed to the north of the riverside fish handling shed, where the foundations have collapsed. Owned by retailers and distributors, it is used with ice for the purpose of storing fresh fish bought on days when large amounts of fish were caught to be sold the following day or later. The boxes come in various sizes; about 114 boxes of different sizes were identified.
	Ice crushers Engine-powered ice crushers are owned by providers specializing in ice crushing. A total of 10 ice crushers have been identified at the site, including two placed around the existing fish handling shed. The loud engine noise is a nuisance.
	Chest freezers Chest freezers with a cooling function are owned by the distributors. Multiple chest freezers are located and used in the leased space.

Source：Field survey 2022

4) Possible causes for the collapse of the existing fish handling shed

Through interviews with staff at BFDC Headquarters and CXB FLC users, it was found that the existing fish handling shed of CXB FLC (Fish Handling Shed (A) in Figure 1-1), which opened in 1966, was originally a two-story building with stairway jetties on the riverside. See the photos below.

However around year of 2012, stairway jetties, parts of the landing platform, fish handling area and piers started collapsing due to accelerated bank erosion. According to the records of BFDC Headquarters, Bangladesh Water Development Board (BWDB) fixed the revetment with concrete blocks around 2014–2015, but the collapse of the foundations was still in progress during survey period in 2022. Following the partial collapse of the revetment, they had unsuccessfully tried to level and restore the foundation floor of the fish handling shed. Thus, the whole first floor and the northern half of the ground floor were dismantled while the remaining columns of the ground floor covered with new roofs to enable continued operations. The shed was a single-story building at the time of this preparatory survey in 2022.

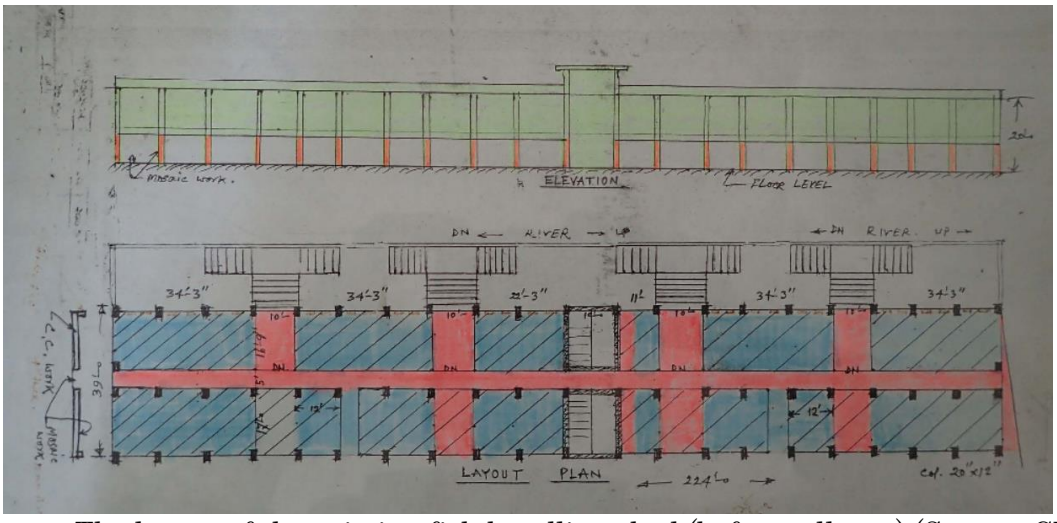


Photo 1-1 : The layout of the existing fish handling shed (before collapse) (Source: CXB FLC data)

Photo 1-2 : The fish handling shed before it collapsed (Source: Flickr.com Author: rony_crp)

Photo 1-3 : The stairway jetties in front of the existing fish handling shed before the collapse

(Source : Youtube https://www.youtube.com/watch?v=kzkQKgcB58k)

Below are photos taken at the time of the preparatory survey in 2022 of Fish Handling

Shed (A) and (B) in Figure 1-1 at the top of the columns, as well as the riverside front of Fish Handling Shed A, which was originally connected to the stairway jetties. It was confirmed that the tops of the columns on the ground floor of both fish handling sheds were covered by a roof. No fishing boats were seen mooring and landing directly in front of the fish handling sheds even at high tide. Only the existing pontoon is currently used for mooring.

Photo 1-4 : Tops of columns at Fish Handling Shed A

Photo 1-5: Tops of columns at Fish Handling Shed B

Photo 1-6 : Front side of the fish handling shed (at high tide)

Photo 1-7: Front side of Fish Handling Shed A (at spring low tide)

Photo 1-8 : Current use of the existing pontoon

An assessment about the cause of the collapse of the foundations of the fish handling shed follows, in light of the result of a survey on natural conditions conducted on-site.

Figure 1-2 below is a contour map showing the depth of the Bakkhali River. As shown by the yellow arrow, a water route has been formed at river bend. The water route is positioned to collide with the river bank just in front of CXB FLC. Moreover, the water route is particularly deep near the project site, with the river depth reaching 9.96 m.

In view of the characteristics of the river bed topography, it may be considered that bank erosion is in progress in the water impact area in front of CXB FLC, thus forming an undercut slope.

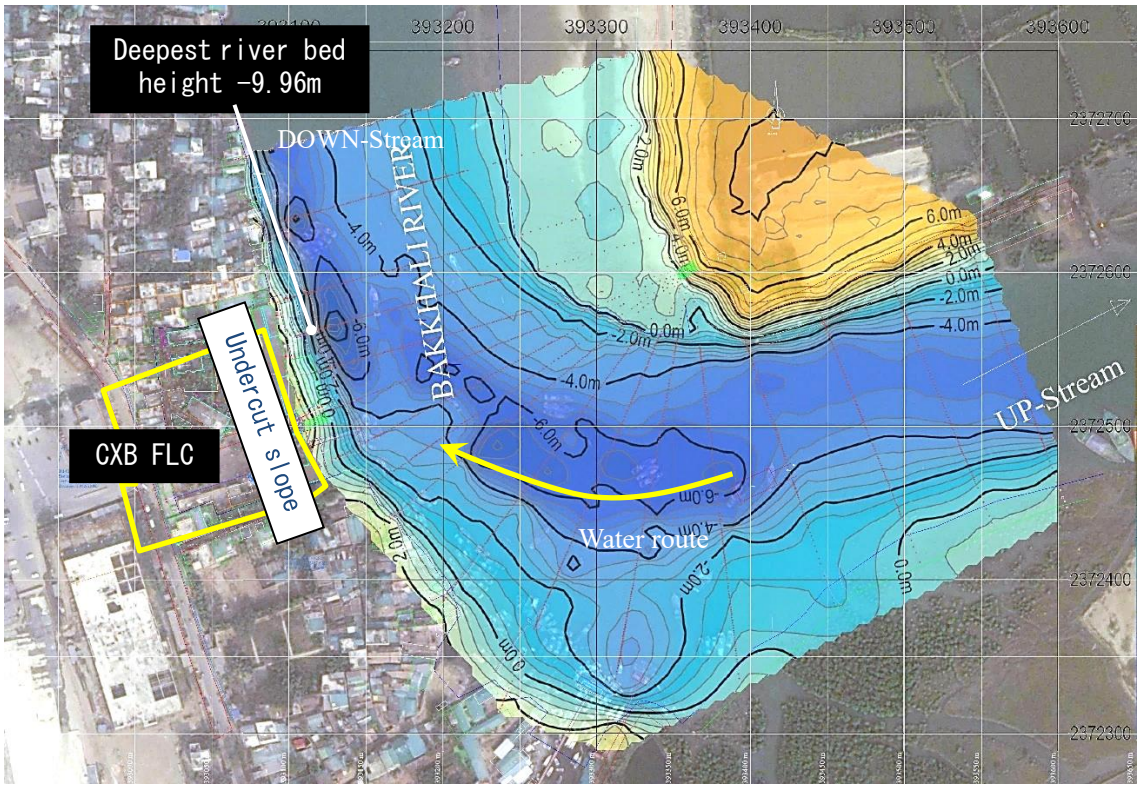


Figure 1-2 : Formation of a water route and the water impact area

It may be inferred that this bank erosion led to the collapse of the foundations near Survey Line SP.1 (north side of the fish handling shed), where the water route is at its deepest. In contrast, erosion is not so serious near Survey Line SP.6 (south side of the shed) compared to SP.1 as deformation has not resulted in the collapse of the foundations thus far. Figure 1-3 below shows photos of the foundations near SP.1 and SP.6 as well as the location of the survey lines.

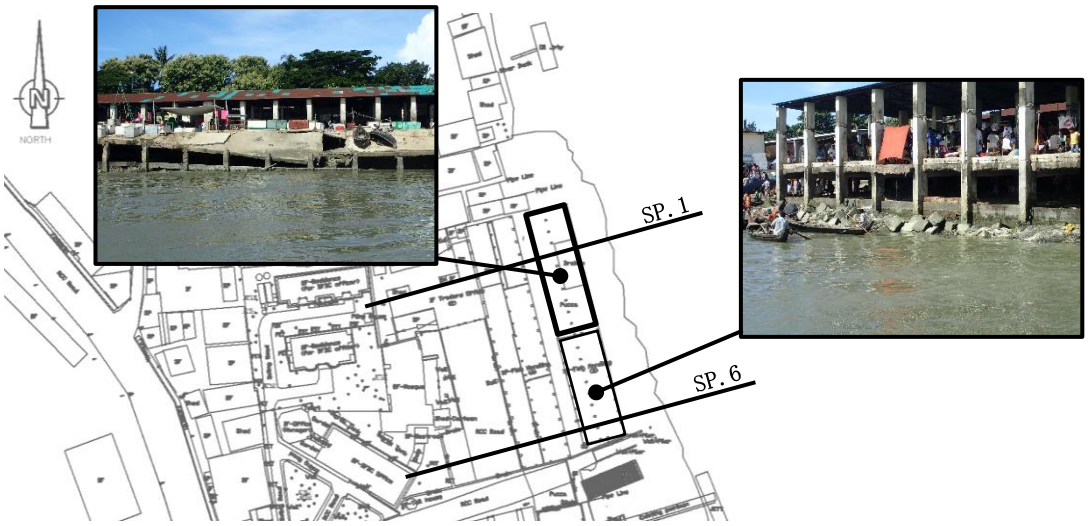


Figure 1-3 : The condition of the foundations of the fish handling shed on the riverside

Figure 1-4 below overlays the foundations (according to the initial drawings of the design) with the results of the cross-sectional surveying near Survey Line SP.6, where no collapse has been observed. It is not a pile foundation but a spread foundation with a short embedded length. Sand has been introduced directly below the foundations, with a thickness of about 1.0 m. Since it was confirmed that anti-erosion concrete cube blocks (concrete cube blocks measuring 0.55 × 0.55 × 0.55 m; hereinafter referred to as "C.C. blocks") had been introduced in two layers, the layer thickness is shown to be 1.10 m. The records of BFDC Headquarters indicate that C.C. blocks were introduced in 2014–2015.

Judging from this figure, the sand in the foundations had remained intact at Survey Line SP.6 even before the introduction of C.C. blocks.

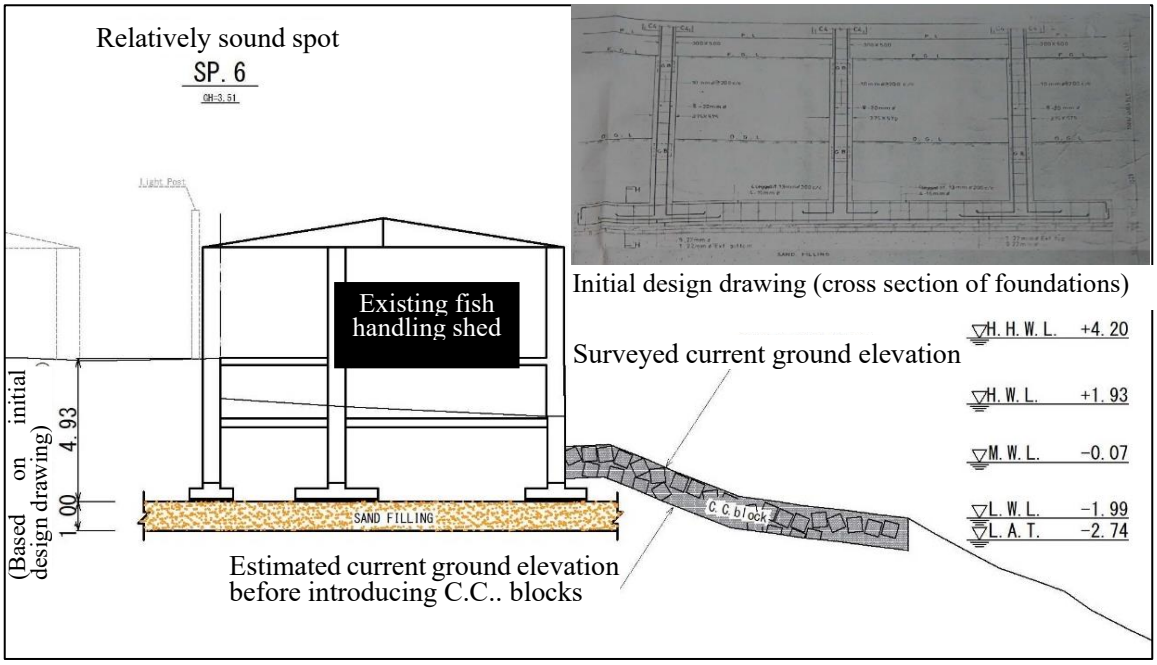


Figure 1-4 : Current cross-section of the existing fish handling shed
(*relatively sound spot @Survey Line SP.6)

Figure 1-5 below shows the result of a cross-sectional survey near Survey Line SP.1, where collapse had occurred. It points to an advanced stage of bank erosion compared with Survey Line SP.6.

Judging from the ground elevation before the introduction of C.C. blocks, the sand filling just under the foundations might have been scoured. It may be that this scouring of sand filling from bank erosion caused the front-line columns to slant and sag toward the river, effectively contributing to the collapse by drawing the foundation floor into the river. The current conditions on-site also support this assessment.

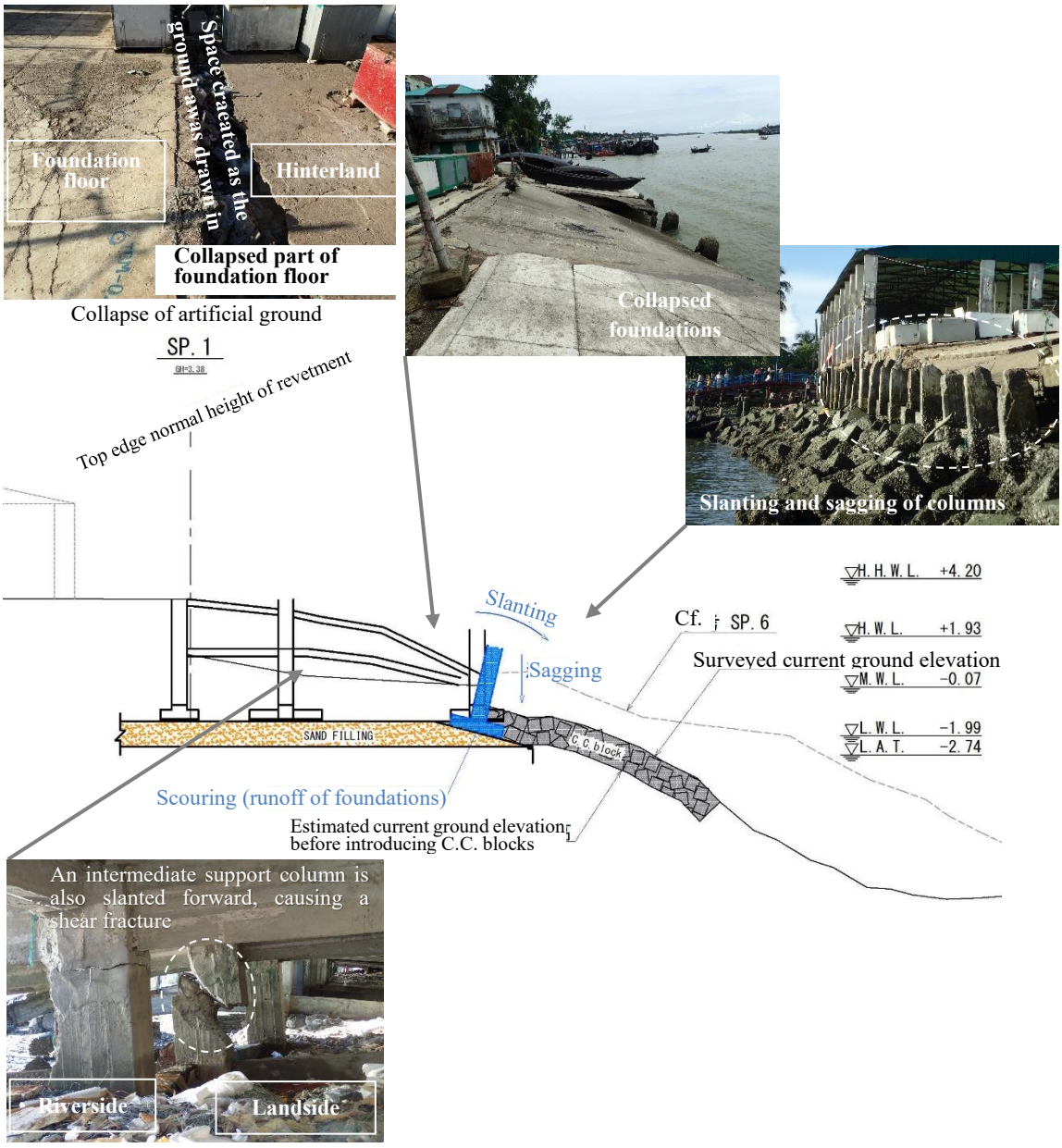


Figure 1-5 : Cross section near Survey Line SP.1

5) Key issues regarding the existing facilities and equipment

The table below lists key issues regarding the existing facilities and equipment in view of the current situation at CXB FLC described above.

Table 1-3 : Issues of existing facilities and equipment in CXB FLC

Item	Name of facilities	Issues
Civil engineering facilities	Revetment	・Bank erosion: Flow condition survey and bathymetric surveys found that the revetment is located in a water impact area at river bend, where an undercut slope has been formed that is exposed to intense bank erosion. ・Collapse of the existing fish handling sheds: The existing fish handling sheds, which are directly supported by foundations, are located in the water impact area. The suction of the ground under the foundations due to bank erosion has created an extremely dangerous situation where the downstream part of the fish handling shed has almost totally collapsed while the upstream part also suffers from deformation, such as sagging and cracks in the concrete foundations. ・Although the Bangladesh Water Development Board (BWDB) has put concrete cube blocks (C.C. blocks) on part of the riverbank slope as an emergency measure to prevent bank erosion, those C.C.blocks didn't cover the deeper areas of the riverbed where erosion is most severe, therefore it has not been enough to completely prevent the erosion of the riverbank slope.
	Mooring facilities	・Since the stairway jetties in front of the fish handling shed collapsed due to bank erosion, a small pontoon (total length of 15.2 m) now functions as the only facility to land catches from the moored boats. The shortage of mooring facilities is one of the reasons for the inefficient catch-handling operations. ・Located in the estuary of the Bakkhali River, CXB FLC is strongly influenced by the tides. Indeed, the difference in water level almost reaches 4 m in spring tides. Moreover, the river constantly change flow direction due to the rising and ebbing tides, which makes the conditions even more difficult.

Item	Name of facilities	Issues
Building facilities		・The facilities of CXB FLC have been expanded and renovated as necessary and without any comprehensive plan, disrupting the flow line of workers and causing much inconvenience to users. ・The fish handling sheds are located in a congested area where the flow lines of facility users intersect. The floor of the fish handling sheds were also found to be contaminated with coliform. It is difficult to preserve the quality of fresh fish under these circumstances. ・Water for washing fresh fish is insufficient both in quantity and quality. It is difficult to preserve the quality of fresh fish under these conditions. ・The collapse and structural deformation of the foundation and columns have put the fish handling sheds in a dangerous situation. ・Due to aging ice factory, the supply of ice to users is problematic. ・In general, the facilities are significantly decrepit.
Equipment		・There is a lack of sufficient equipment for hygienic fish handling. There is also a lack of equipment capable of storing fish in a fresh condition.

1.1.2.3. Present situations of fresh fish handling activities at CXB FLC

1) Traffic of landed fresh fish

The following figure shows the flow line of fresh fish at CXB FLC for landing and transportation in CXB FLC.

Fishing boats land their catches either on the existing pontoon or on the slope revetment. Catches are carried into the fish handling sheds through one of the two routes for transaction and packing (yellow and orange arrows). Fish to be shipped is loaded onto a large truck for long-distance transport or a three-wheeler or pickup truck for distribution to neighboring markets at various loading points, including the parking area to the east of the landside fish handling shed on the north side of the fish handling shed C (red arrows).

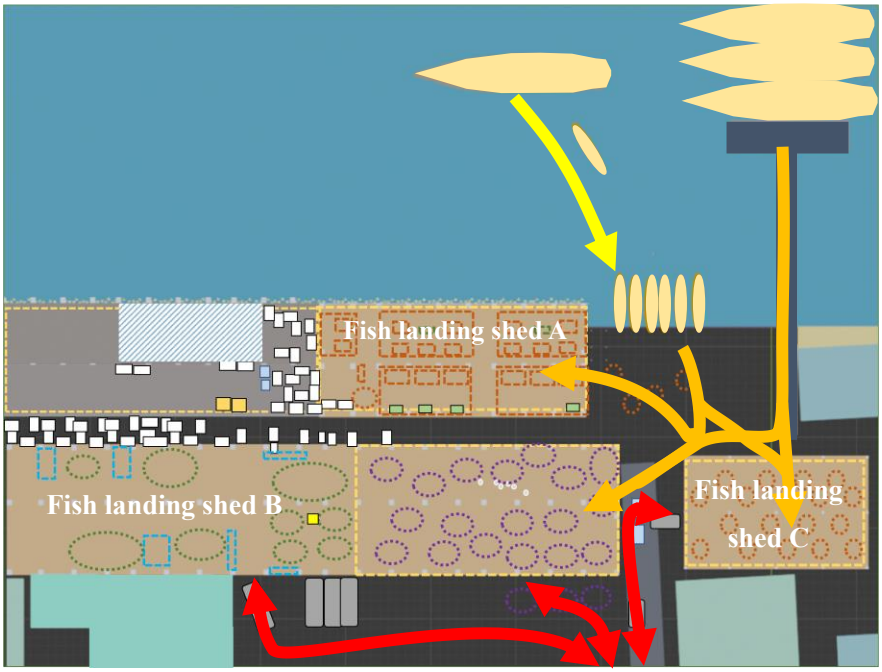


Figure 1-6 : Flow of fish landing and transportation in CXB FLC

Source : Field survey 2022

Fresh fish handling operations at CXB FLC comprise various processes, such as landing, transaction, sorting, weighing, icing, packing and shipping (loading onto trucks). Details and photos of each process follow.

2) Landing

Fishing boats can land their catches at CXB FLC in two ways: They either use the existing pontoon or, transship the catches to small boats (*dingi*) for landing. Since there is only one pontoon, with limited mooring facilities available for landing, when fishing boats find the pontoon fully occupied, they have to transship their fresh fish catches to dingi, which carry them to CXB FLC for landing.

	Fishing boats gathered for landing at the existing pontoon (right) and the slope revetment (left)

		
Dingi gathered along the slope revetment Fresh fish catches are directly loaded onto the dingi from fishing boats. The catches are subsequently landed from dingi with bamboo baskets.	Landing on the existing pontoon Landed fresh fish is carried to the fish handling shed in bamboo baskets.	Landing on the existing pontoon Landed fresh fish is carried to the fish handling sheds in (plastic) half drums.

Generally, fresh fish landed from fishing boats is carried in CXB FLC from 6:00 a.m. to 12:00 daily. During the three-hour peak time, from a little past 7:00 a.m. to a little past 10:00 a.m., fish catches are carried into the fish handling sheds at a pace of some 20 tons per hour.

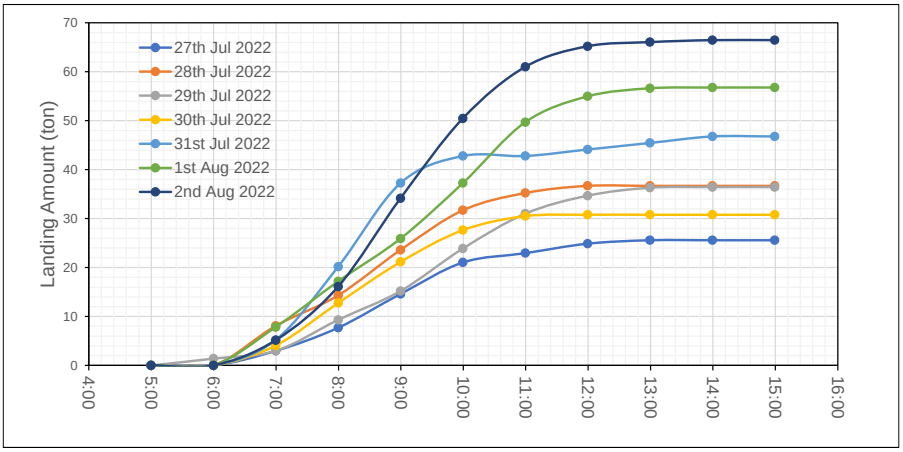


Figure 1-7 : Landing hours at the fish handling sheds (Jul–Aug 2022)

Source : Field survey 2022

Average landing per fishing boat amounted to some 1.5 tons during the seven-day survey period (from July 27 to August 2, 2022). It takes a little over an hour on average for a fishing boat to land catches on the pontoon. The time extends to about 1.5 hours

when dingi are used.

3) Transport to the fish handling sheds

Catches landed onto the existing pontoon and the slope revetment are transported to the fish handling sheds in bamboo baskets by pairs of carriers.

	
Landed catches in bamboo baskets are transported to the fish handling sheds by pairs of carriers.	Landed catches in plastic drums and other containers are also transported to the fish handling sheds by carriers working in pairs.

4) Transaction

Transported catches are directly placed on the floor of the fish handling sheds for sorting and grading. After being purchased by distributers from the boatowner. the fresh fish is packed for transport by trucks to distant markets. Some distributors store fresh fish in cool boxes, etc. for local hotels and restaurants or freeze or process the fish for shipment to export markets.

	
Fresh fish transaction in the fish handling shed Catches are directly placed on the floor from bamboo baskets or plastic drums. Transaction is performed in the fish handling sheds near the existing pontoon and the slope revetment (located on the south side of the site). Flow lines of fish and workers cause congestion inside the fish handling sheds.	Fresh fish is also handled in the parking area due to the limited capacity of the fish handling sheds.

	
Purchased catches are placed in metal bowls.	Catches in metal bowls are carried to the weighing area.

5) Weighing

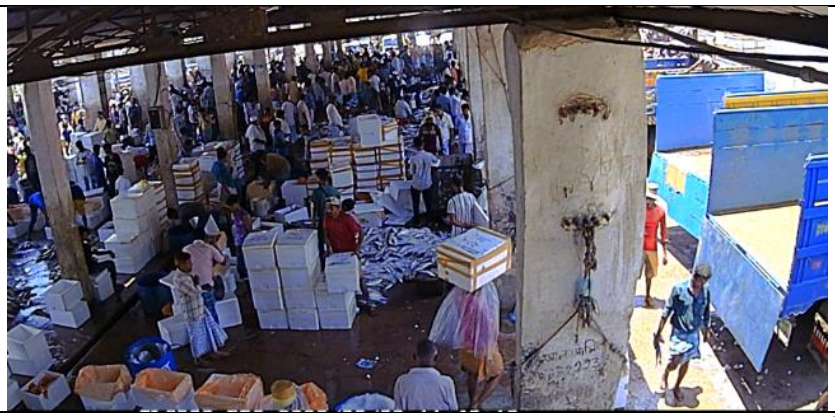
Landed catches in metal bowls are weighed.

	
Weighing a catch	Metal bowls are placed at a location in the fish handling shed specified by the distributor

6) Washing/weighing/icing/packing

Of the catches to be shipped, fresh fish (particularly Hilsa) destined for distant markets, such as Dhaka and Chattogram, is usually iced and packed in a styrofoam box. Half-sized/full-sized plastic drums and bamboo baskets are mainly used for transporting to neighboring markets.

	
Washing, weighing, icing and packing	



Washing, weighing and packing are performed in the fish handling shed (B), and styrofoam boxes are piled up after packing and waiting for loading.

Shipping and packing for local markets

Fresh fish in plastic baskets is iced and covered with plastic sheets.

Washing, packing and shipping to local markets

7) Loading

Catches packed in Styrofoam boxes or plastic drums are loaded onto large-sized trucks.

Loading from the fish handling sheds to a truck

Multiple distributers share a truck for transportation to Dhaka and other distant markets.

	
Transportation to local markets	Transportation to local markets or fish processing factories

Trucks for shipment are dispatched by a truck driver's association at the request of the distributor packing the fresh fish. The trucks come in three sizes depending on the volume of the cargo: large (7 tons), medium (5 tons) and small (3 tons).

More than half of the catches are shipped to distant markets. The number of shipping trucks was as high as 10 per day during the survey period. The average weight of cargo per truck ranged from 3 to 5.5 tons. The maximum number of styrofoam boxes shipped per day exceeded 1,500, each containing 25 kg of fresh fish. Multiple distributors share trucks for shipping : As many as 50 distributors use a truck per day. Most of the shipped fish was hilsa, as the survey period corresponded to a bumper period for hilsa. 80% of the hilsa landed at CXB FLC was shipped to remote markets. Pomfret and other premium fish species are shipped to remote markets during the low season for hilsa. Part of the fresh fish catch is also transported to refrigeration factories for export.

About five large-sized trucks, four medium-sized trucks, four small-sized pickups, and 20 motorbikes enter and leave CXB FLC per day on average.

	Total landing (ton)	Shipment to distant market (ton)	No. of trucks	No. of operators using trucks	Average weight of fish per truck (kg/truck)	No.of boxes shipped	Gross shipping weight of Hilsa (kg)	Shipment weight of Hilsa/Total shipments	Shipment weight of Hilsa/Landing of Hilsa
2022/7/26	32,271	19,250	4	25	4,813	759	17,000	88%	83%
2022/7/27	26,576	16,766	3	28	5,589	593	12,800	76%	76%
2022/7/28	32,848	19,025	4	30	4,756	755	15,250	80%	62%
2022/7/29	28,048	17,710	4	27	4,428	700	14,810	84%	65%
2022/7/30	41,267	28,586	6	41	4,764	1,128	23,970	84%	73%
2022/7/31	43,595	28,450	6	37	4,742	1,117	25,260	89%	70%
2022/8/1	58,431	30,801	10	48	4,138	1,546	34,830	93%	79%
2022/8/2	46,843	31,133	8	46	4,452	1,327	28,197	79%	78%
2022/8/26	13,156	6,620	2	15	3,310	262	5,310	80%	74%
2022/8/27	17,359	9,231	3	24	3,077	369	5,400	58%	80%

Figure 1-8 : Volume of fresh fish input and output (Jul–Aug 2022)

Source : Field survey 2022

8) Ice traffic

Ice traffic at CXB FLC refers to block ice supplied from the ice factory within CXB FLC and block ice carried from private ice factories. Ice for fishing boats is delivered to the boat via the existing pontoon, or directly from the private factories to the boats, whereas that used for the icing of fresh fish in the fish handling sheds is delivered to either of the two ice crushers in the sheds. The crushed ice is used for packing inside the fish handling sheds.

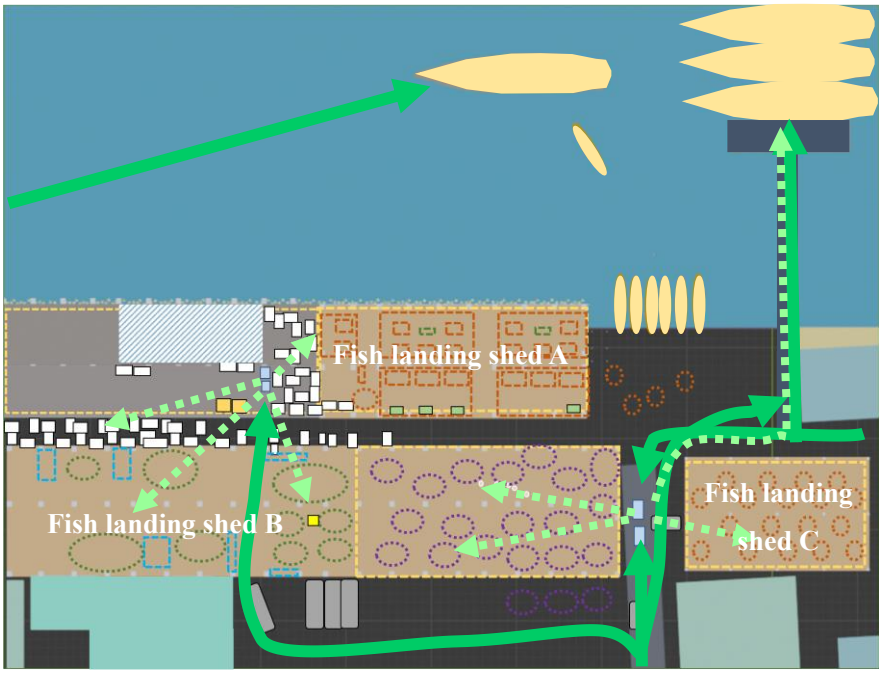


Figure 1-9 : Flow of block ice

Source : Field survey 2022

	
Ice transported from the ice factory within CXB FLC	Block ice transported from the ice factory to a fishing boat moored to the existing pontoon

	
Ice is also carried in from neighboring ice factories.	Ice crushed by an ice crushing operator
	
Ice crushed by an ice crushing operator	Crushed ice is carried into the fish handling sheds.

9) Facility users

At CXB FLC, 19 staff members are involved in the management of facilities and operations of ice factory within CXB FLC. Users also include members of related associations, including three associations of traders working in the landing area, a boatowner association and an association of landing workers, among others.

Staff members perform three primary tasks, the collection of charges on fresh fish shipped from CXB FLC, ice-making and selling operations and cleaning the facilities. Other fish market functions, including landing, carrying, weighing, washing, transaction, packing and shipping are performed by distributors working inside the facilities. The table below lists the conditions of offices and shops in operation at the time of the field survey.

User category	Operations
Distributors (wholesalers): (19 offices)	They play a pivotal role at wholesale markets, such as CXB FLC. They purchase and pack fish catches for delivery across Bangladesh.
Distributors (exporters): (2 offices)	They purchase catches and export overseas fresh or frozen fish, depending on the destination. Many have a branch in Dahka. Exporters require a license issued by the national government.
Distributors (financial operators (*aratdar*/*dadondar*)) : (11 offices)	They play the most important role in the fishery product value chain. Basically being financial operators, they provide finance for fishing boat owners and control the auctions of catches. It is also known as a commission business as they usually charge a commission of 5% or so on the revenue.

User category	Operations
Distribution equipment shops (2 offices)	They deal in styrofoam boxes, carrying baskets, salt for preservation and other items required to transport fresh fish purchased by distributors.
Trucking association offices (1 office)	This is an association of truck owners involved in the transport of landed catches. The distributor asks the trucking association to dispatch vehicles, and the latter assumes responsibility for making the necessary arrangements.
Fish traders associations (1 office)	This is an association of small-scale distributors (*faria*), with a membership of 300.

Users of the CXB FLC facilities include BFDC staff, their family members (living in the residential building for staff), visitors such as tourists and local residents (prayers in mosque), as well as workers engaged in each job from landing to shipment.

The whole process, from landing to shipment, is subject to a strict division of labor, generating a whole range of very specific jobs, including fish carrying only on landing and carrying ice that has been crushed in the fish handling shed. The workers directly involved in landing operations, such as washing, sorting, selling or the icing of fresh fish, number 600–700, in addition to large truck and auto-rickshaw drivers for shipment, indirect workers including three-wheeled motorbike drivers carrying ice from private ice factories, and financial operators involved in fresh fish distribution by lending money to distributors and fishers.

External visitors include about 500 domestic tourists who come to Cox's Bazar every year. Other external visitors include local residents who come to buy fresh fish, as well as college students and researchers for field visits and studies.

The table below shows the number of daily facility users and its variation with time, as per interviews with stakeholders. The number of facility users exceeds 1,500 per day. In particular, over 2,000 users are present at CXB FLC around 10:00 a.m. on days where there is a good catch.

Table 1-4 : Number of the facilities users at CXB FLC

User category	Number per day
Dingi operators for fish transportation	200
Catch carriers	200
Carriers of fresh fish traded in the facilities	30
BFDC ice-making machine operators	10
Ice carriers from private ice factories	20
Ice crushers	40
Ice transporters in the facilities	15
Fresh fish sorters	130

User category	Number per day
Measurers	6
Workers packing fresh fish for shipment	120
Workers packing fresh fish for retail sales	30
Primary processors of fresh fish	4
Janitors	2
Fishers	400
Distributors	50
Retailers	20
Internal visitors	10
External visitors	200
Total	≈1,500

Source : Field survey 2022

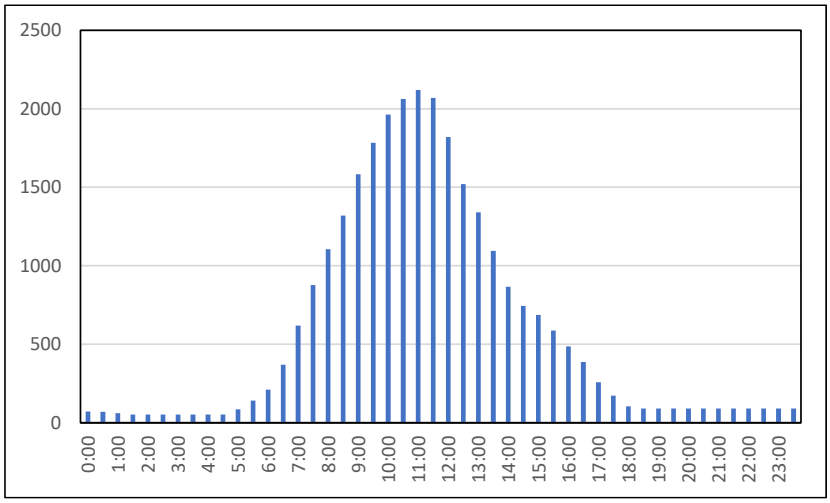


Figure 1-10 : Number of users staying in CXB FLC over time (July–August 2022)

Source : Field survey 2022

9) Key issues fish handling activities

The poor hygienic treatment of fresh fish is the most serious issue in the handling process at CXB FLC that requires rectification. Currently, catches that are carried to the fish handling sheds are placed directly on the floor or even in the parking lot for transaction. As the table below indicates, however, the floor of the fish handling sheds has a very high coliform count of 200 CFU/100 ml since the floor is walked on by many workers and visitors. As the facilities that handles fresh fish as food, this is a menace for ensuring food safety. Moreover, fresh fish is very often washed with water from the neighboring Bakkhali River prior to shipment because insufficient well water is allocated to the fish handling sheds. But Bakkhali River water is unacceptable for washing fish as coliform has been detected due to sewage and waste from the neighborhoods along the river. The table below shows the result of a coliform test

conducted during the field survey on water sampled from three sources: surface water on the floor of the fish handling sheds, Bakkhali River water, and wells water in CXB FLC.

Table 1-5 : Results of a water quality test (coliform)

Test item	Unit	Surface water on fish handling sheds	Bakkhali River water	Well water for fish handling sheds	Well water for staff residential building	Well water for ice making
Total Coliform	CFU/100ml	700	88	0	0	11
Fecal Coliform	CFU/100ml	500	18	0	0	4
E-Coliform	CFU/100ml	200	9	0	0	0

Fresh fish are placed on the ground and washed in river water, resulting in a situation where multiple contaminated fresh fish are shipped.

1.1.2.4. Current conditions and issues related to landing by artisanal fishing boats using CXB FLC

1) Landing at CXB FLC

CXB FLC is the largest of the landing sites in Cox's Bazar District in terms of both the number of landing boats and the number of fishing gear units equipped for fishing boats. The total amount landed of marine fisheries in the district is reported to be 140,000 tons.[1] Unlike the other landing sites in the district, CXB FLC functions as the only site with infrastructure for landing by large fishing boats. Annual landing volume amounts to some 10,000 tons, albeit with some variations.

In order to identify the relationship between the number of landing days and the volume of landing per month at CXB FLC, the chart below shows the volume of landing at CXB FLC over three years (July 2019–June 2022) as estimated from data on charges imposed on fresh fish shipments. Considerable fluctuations may be observed in landing for the three-year period, partly because of the existence of closed seasons. Thus, monthly landing decreases during the following two fishing bans: (1) 65 days from May 20 to July 23 for all the marine fisheries and (2) 23 days from October 3 to October 25 for Hilsa. Elsewhere, landing declines in months of bad catches or canceling of departure due to bad weather conditions.

[1] Strengthening resilience of coastal fishery communities in Cox's Bazar for improving livelihoods, ecologically and economically (World Fish)

Landing usually peaks twice a year, from August to October for hilsa and from December to February for other species including shrimp.

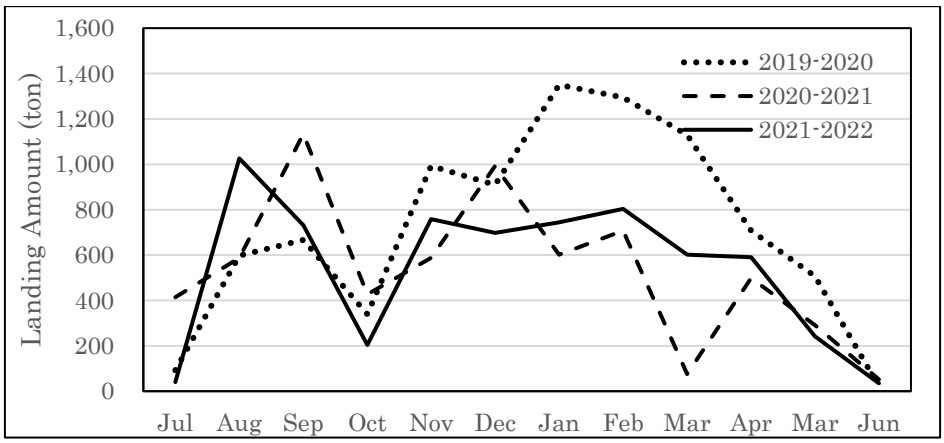


Figure 1-11 : Landing volume at CXB FLC from July 2019 to June, 2022

Source : CXB FLC

The table below shows average daily landings by month. Average daily landings are calculated from the number of operating days, taking account of the fishing ban periods mentioned above and monthly landings from July 2019 to June 2022, whereas maximum daily landings of each month are estimated from interviews with fishers and distributors using CXB FLC.

Average daily landings peaks in October with 40 tons a day and bottoms in May with 18 tons a month, excepting the closed seasons.

Maximum daily landings, on the other hand, peak in September and October with 100 tons a day. From August to December, it exceeds 65 tons a day for five consecutive months.

Table 1-6 : Average fish landing volume per day from 2019 to 2021

Month	7	8	9	10	11	12	1	2	3	4	5	6
Operation days	5	31	30	8	30	31	30	28	31	30	19	0
Average landing based on 3-years of data (tons/day)	36	24	28	40	26	28	30	33	19	20	18	0
Maximum landing as told by users (tons/day)	50	65	100	100	80	75	35	40	45	50	55	0

Source : Field survey 2022

Figure 1-12 shows fish landings for the five years by species. Hilsa tops the list, accounting for almost half of the total landings. “Mixed fish” is a classification under the

charging system of CXB FLC and includes Ribbon fish, shrimp, Bombay duck, Tuna and Anchovy, among others.

	Hilsa	Pomfret	Mackerel	Cat fish	Mixed fish	Total
2017-18	5,457.3	153.5	136.0	99.2	5,222.3	11,068.0
2018-19	3,653.4	123.7	166.1	83.0	5,697.4	9,606.0
2019-20	4,286.2	154.2	54.8	116.3	6,365.9	10,977.4
2020-21	2,988.8	183.3	167.9	380.5	3,490.6	7,211.0
2021-22	3,075.7	102.5	380.5	309.3	2,867.7	6,611.3
Average	4,159.7	164.4	212.4	218.0	5,662.0	10,368.1

Figure 1-12 : Annual fish landing volume at CXB FLC by species from 2017 to 2022

Source : Field survey 2022

Composition of landings by species fluctuate throughout the year as each species has its own harvest season. The field survey was conducted in July and August, 2022, during Hilsa fishing season, and the records of CXB FLC also shows that Hilsa accounts for about 75% of the total catches.

	Hilsa	Pomfret	Mackerel	Cat fish	Mixed fish	Total
2022/7/26	20,370	620	610	127	10,544	32,271.0
2022/7/27	16,866	724	280	670	8,036	26,576.0
2022/7/28	24,581	947	845	420	6,055	32,848.0
2022/7/29	22,961	300	222	480	4,085	28,048.0
2022/7/30	32,737	150	240	480	7,660	41,267.0
2022/7/31	35,935	260	120	540	6,740	43,595.0
2022/8/1	44,339	550	200	240	13,102	58,431.0
2022/8/2	36,269	210	262	1,005	9,097	46,843.0
Average	29,257.3	470.1	347.4	495.3	8,164.9	38,734.9

Figure 1-13 : Fish landing volume during July to August, 2022

Source : CXB FLC

The chart below shows the composition of landings by species according to the result of an interview with all landing boats at the time of the field survey. “Mixed fish” includes Ribbon fish, shrimp and Bombay duck, among others.

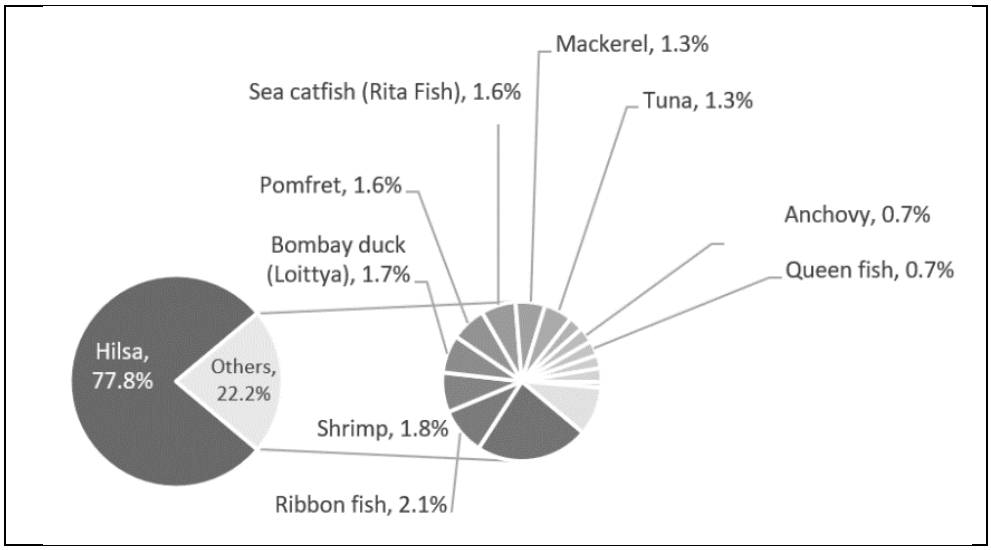


Figure 1-14：Composition of Fish landing by species at CXB FLC（July to August, 2022）

Source：Field survey 2022

2）Current conditions of artisanal fishing boats using CXB FLC

2）-1. Number of fishing boats and landing methods

Some 500 fishing boats are registered in Cox's Bazar District, according to the Department of Fisheries. Fishing boats registered outside the district also use CXB FLC.

A large volume of fresh fish for processing is landed at Nazirtek, located to the west of the Cox's Bazar Airport. Fishing boats landing at Nazirtek use fishing gear called marine set-bag-net (MSBN) to catch and land raw fish for processing. In contrast, fishing boats landing at CXB FLC mainly use gill nets to catch fish to be distributed in fresh. Fishing boats landing at Nazirtek will not change their landing site to CXB FLC instead.

The table below shows the composition by size of fishing boats that used CXB FLC during survey the period. Most of the fishing boats are medium size, representing 52% of the total, followed by small boats with 25%, and large and extra-large boats combined with 23%.

Table 1-7：Number of fishing boats by size using CXB FLC（July to August, 2022）

Size	Number of boats	(%)
Small boat（14m less）	29	25%
Midium boat（14m or more to 17m less）	61	52%
Large boat（17m or more to 18.7m less）	22	19%
Extra Large boat（18.7m or more）	5	4%
total	117	100%

Source：DoF

On average, a fishing boat operates for 11 days and makes two trips per month and some 20 trips per year. The crews of fishing boats using CXB FLC number some 1,200 per day at peak times.

In the field survey period, fishing boat surveys were conducted for seven consecutive days (one week from July 27, 2022), which corresponded the high season for hilsa fishing. During the survey period, each of the 16–38 boats operating per day (Table 1-8) landed some 30–60 tons of catches (Table 1-9), with a low of 27.1 tons and a high of 61.6 tons. On average, 26 fishing boats returned from operations per day, landing some 42.9 tons of catches.

Currently, fishing boats can land their catches at CXB FLC in two ways: They either moor alongside the existing pontoon or anchoring in the middle of the river to transship their catches to small boats (*dingi*) for landing. The number of fishing boats landing at the pontoon ranged from seven to 12 per day, whereas that of fishing boats using dingi fluctuated daily between six and 38. In extreme cases, the number of fishing boats performing this indirect landing exceeded that of boats using the pontoon by a factor of over three. It may, thus, be said that landing via dingi is the main method of landing when a large number of fishing boats come into CXB FLC.

Table 1-8 : Number of artisanal fishing boats using CXB FLC (July to August, 2022)

Date / Way of landing	7／27 (Wed)	7／28 (Thu) (New moon)	7／29 (Fri)	7／30 (Sat)	7／31 (Sun)	8／1 (Mon)	8／2 (Tue)	weekly total
Using Pontoon	10	12	9	7	11	9	10	68
Using Dingi	6	12	8	15	18	28	28	115
Total	16	24	17	22	29	37	38	183

Source : Field survey 2022

A comparison of landing volumes between the fishing boats using the pontoon and those using dingi revealed that the former landed less than 20 tons even on a busy day, while the latter exceeded 40 tons per day. The result indicates that the majority of landings at CXB FLC are from dingi.

Table 1-9 : Landing volume by using pontoon or using dingi at CXB FLC (July to August, 2022)

(Unit: ton)

Date / Way of landing	7／27 (Wed)	7／28 (Thu) (New moon)	7／29 (Fri)	7／30 (Sat)	7／31 (Sun)	8／1 (Mon)	8／2 (Tue)	weekly total
Using Pontoon	17.7	21.2	15.9	12.4	19.4	15.9	17.7	120.1
Using Dingi	9.4	18.8	12.6	23.5	28.3	44.0	44.0	180.5
Total	27.1	40.0	28.4	35.9	47.7	59.8	61.6	300.6

Source : Field survey 2022

2) -2. Type of fishing boats used

Over half of the fishing boats registered with Upazila in Cox's Bazar District (58%) are registered with Cox's Bazar Sadar Upazila, followed by Moheshkhali with 20%, and Kutubdia with 7% (Figure 1-15). Among the fishing boats operating from other regions, those registered at Chattogram account for 10%. Inside Cox's Bazar Sadar Upazila, many fishing boats operate from along the Bakkhali River in the vicinity of CXB FLC, while in Moheshkhali Upazila, a number of fishing boats are based in Gorokghata. Combined, these fishing boats account for almost 80% of the registered boats.

Confirmed bases of fishing boats outside Cox's Bazar District include Hatia, Noakhali and Bhola, which indicates that fishing boats are also coming to land at CXB FLC from distant places (Figure 1-16). The reasons why those fishing boats operating from remote places select CXB FLC as a landing site include easy access to major fishing grounds off the coast of Cox's Bazar District and the possibility of landing and finding shelter when operations are curtailed due to bad weather.

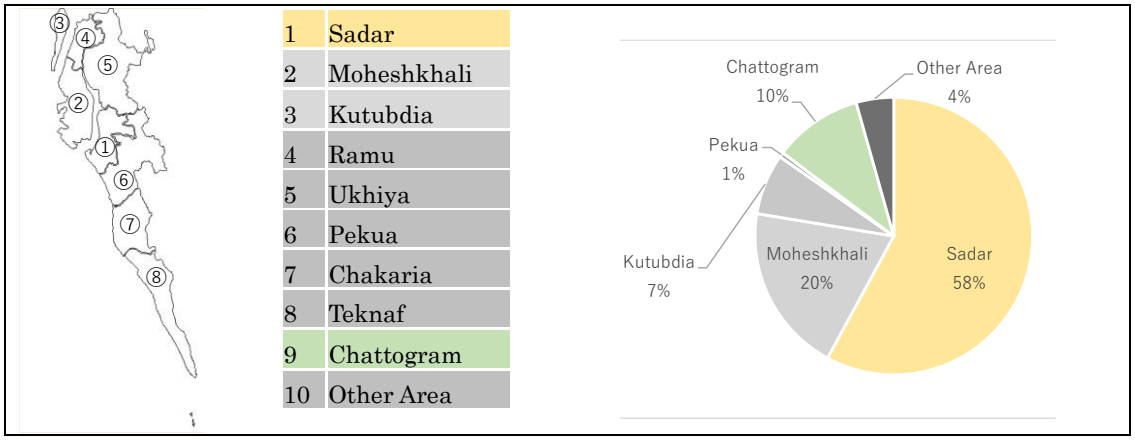


Figure 1-15 : Main base of artisanal fishing boats using CXB FLC by Upazila (July to Aug. 2022)

Source : Field survey 2022

Cox'sBazar Sadar	
Majhir ghat	36%
Katsura ghat	30%
BFDC	17%
Peskarpara	11%
Noniar Chora ghat	6%

Moheshkhali	
Ghorokghata	77%
Ghotibanga	16%
Kalamarchora	3%
Matarbari	3%

Kutubdia	
Boroghop	100%

Pekua	
Rajakhali	100%

Chittagon	
Bashkhali	61%
Chaktai	39%

Others	
Hatiya	75%
Noakhali	13%
Bhola	13%

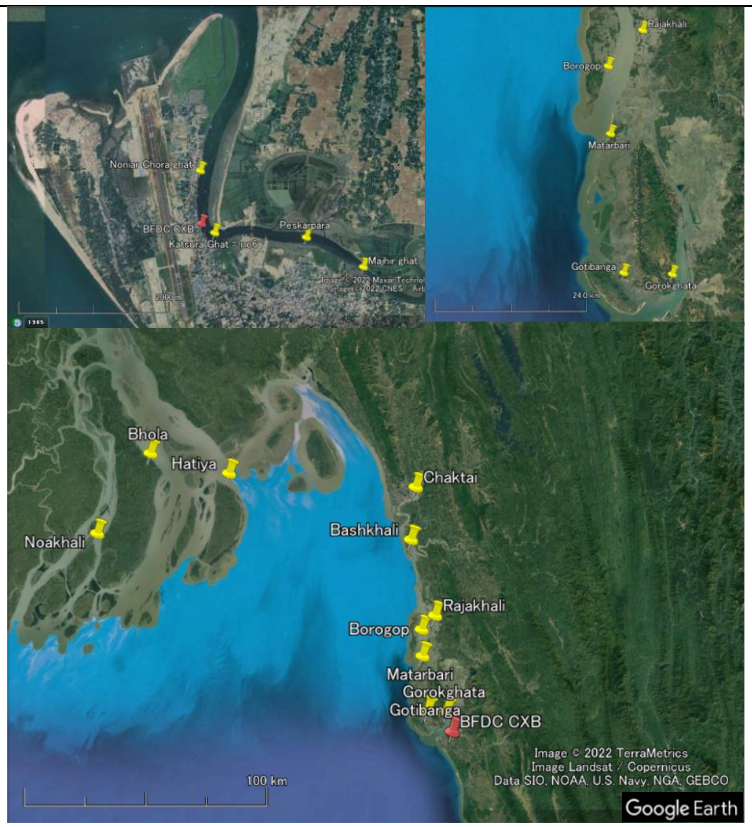


Figure 1-16 : Main base of artisanal fishing boats using CXB FLC by area (July to Aug. 2022)

Source : Field survey 2022

2) -3. Sizes and landing methods of fishing boats

The Department of Fisheries classifies the registered artisanal fishing boats into the following sizes:

Table 1-10 : Classification of registered artisanal fishing boats by size

Category	Boat Length	Average length (m)
Small boat	14m less	12m
Medium boat	14m or more to 17m less	16m
Large boat	17m or more to 18.7m less	17.6m
Extra large boat	18.7m or more	19m

Source : DoF

The following chart shows the composition of the fishing boats using the pontoon by size and the composition of the fishing boats using the pontoon and dingi by size, based on the result of a questionnaire covering the 117 fishing boats that landed their catches at CXB FLC in the survey period (Table 1-7). Medium-sized boats top both lists, accounting for

some 50% of the total, followed by small-sized boats with about 30%. Small- and medium-sized boats combined account for some 80% of the total. This ratio rises to about 95% when large-sized boats are included, which points to a negligible presence of extra-large boats. The average length of those boats largely corresponds to Table 1-10.

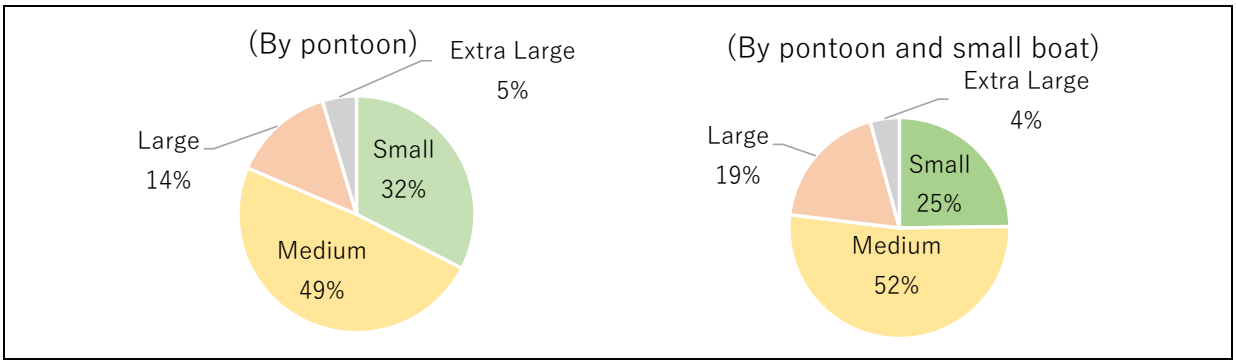


Figure 1-17 : Percentage of artisanal fishing boats using CXB FLC by boat size

Source : Field survey 2022

The following chart shows the results of an analysis of the sizes of fishing boats that came alongside the existing pontoon during the seven-day period from July 27 to August 2, based on recorded images. The findings support the results of the above survey, as small-, medium- and large-sized boats account for 24%, 58% and 18% of the total, respectively.

A survey on hourly changes in the number of artisanal fishing boats using the existing pontoon found that fishing boats began to arrive at the pontoon before dawn and increased toward the peak hours of 6:00–9:00 a.m. It was observed that multiple fishing boats moored on the front side of the pontoon at the same time while the shorter sides of the pontoon (both upstream and downstream) were also used by fishing boats. Although no landing activities were observed in the evening and at night, fishing boats were moored alongside the pontoon for the loading of ice and the boarding of crew before departure.

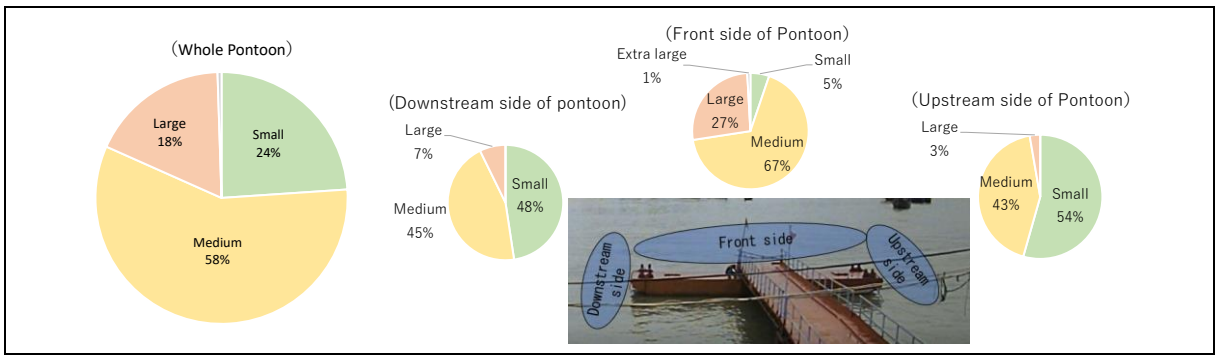


Figure 1-18 : Composition of fishing boats using the pontoon by size (July–August 2022)

Source : Field survey 2022

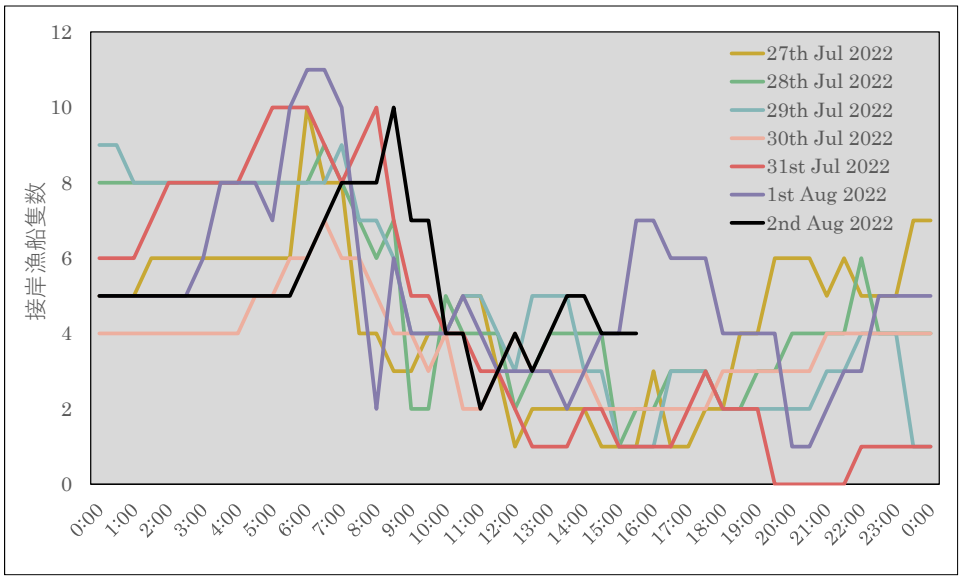


Figure 1-19 : Hourly change in number of artisanal fishing boats using the pontoon of CXB FLC（July to August, 2022）

Source : Field survey 2022

Hourly changes in the number of dingi used for the landing of catches from fishing boats indicate that dingi gather around CXB FLC from around 6:00a.m to around 15:00. It was found that the number of dingi constantly exceeds 20 from 7:00a.m to 14:00 and can even surpass 30 between 10:00 and 13:00 on busy days.

According to an interview, three dingis at a time work to carry catches from a single fishing boat.

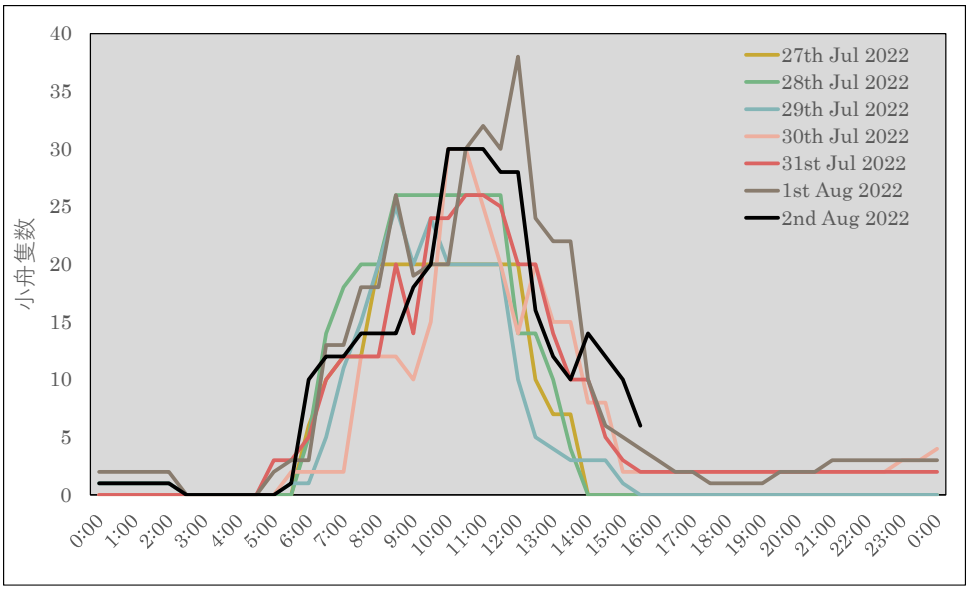


Figure 1-20 : Hourly change in number of dingi landing to CXB FLC（July to August, 2022）

Source : Field survey 2022

3) Key issues for artisanal fishing boats using CXB FLC

Since the existing pontoon is the only landing facility available at CXB FLC, the area

around the pontoon swarms with fishing boats waiting to unload their catches, particularly in high seasons. As only a limited number of fishing boats can use the pontoon at the same time, many have to wait for many hours and rely on dingi for landings. All of those inconveniences make landing operations all the more inefficient.

Due to the congestion at CXB FLC, some fishing boats are found to be landing their catches at other landing sites such as Chattogram, resulting in longer sailing hours for fishing boats and fishers as well as extra fuel costs.

1.1.2.5. Current conditions and key issues regarding the ice-making business

1) Current conditions selling ice at CXB FLC

Table 1-11 shows the monthly revenue of the ice-making business at CXB FLC during the 12-month period from July 2020 to June 2021. Average ice sales per day and average ice production volume per day in each month are also estimated. In estimating above, the unit price block ice was assumed to be BDT100, which was identified during the survey period, although it varies depending on the season as it is set by the ice factories association, and it was also assumed that ice is sold to customers other than fishing boats, such as aquaculture business. even in fishing ban season.

The monthly revenue of the ice-making business was found to peak in September and bottom in June. This has much to do with the volume of landed fresh fish as this pattern corresponds to that of charges collected by CXB FLC on the shipment of catches from the facilities. It was also found that the monthly revenue of the ice-making business almost equals the charges for shipping fresh fish, indicating that both are making comparable financial contributions to BFDC as key sources of income.

Table 1-11 : Monthly revenue of selling block ice in CXB FLC (FY2020-FY2021)

Month	Monthly revenue (BDT)	Average revenue per day (BDT)	Average ice production volume per day (blocks)	Estimated monthly charges on fresh fish shipment (BDT)
Jul	509,448	16,430	164	413,695
Aug	794,008	25,610	256	587,805
Sep	1,044,406	34,810	348	1,133,860
Oct	821,294	26,490	265	426,690
Nov	469,158	15,640	156	587,965
Dec	610,420	19,690	197	993,365
Jan	588,616	19,620	196	601,875
Feb	569,480	20,340	203	708,315
Mar	623,116	20,100	201	76,090
Apr	566,536	18,880	189	498,960
May	291,732	9,410	94	291,245
Jun	79,304	2,640	26	52,135

Source : CXB FLC

2) Current conditions of private ice factories near CXB FLC

Although CXB FLC has an ice factory with anominal capacity of 30 tons per day, it is failing to meet the robust demand for ice from the large number of fishing boats in operation and fresh fish shippers even in the off-season, to say nothing of the peak season. A large volume of ice is supplied by 19 private ice factories operating nearby. Ice transportation to CXB FLC has developed into a major business, employing some 400 workers and operating four large trucks, 10 small pickups and 150 motorbikes/rickshaws. The next table shows an outline of private ice factories:

Table 1-12 : Outline of Private ice factories near CXB FLC

Location	Ice-making units	Year	Distance from CXB FLC
Ghat No. 6, Airport Road	4	1980 for 2 plants 2008 for 2 plants	Within 400 m
Notunpara	3	1980-2000	Within 250 m
Middle Nuniachora	6	After 2010	0.50 km
South Nuniachora	4	After 2010	0.60 - 1.5 km
Majhir Ghat	2	1980s	1 - 1.5 km
BFDC premises	1	2000	Inside (0 km)
Total	**20**		

Source : Field survey 2022

The table below shows the results of a survey on the capacity of ice factories. CXB FLC is classified as Type 1, the lowest ice-making capacity.

Table 1-13 : Capacity of private ice factories near CXB FLC

Type	Ice-making capacity (no. of ice cans)	Reported ice-making capacity (tons/day)	No. of ice-making units	Total number of ice cans	Total reported ice-making capacity per day (C) and actual total ice production per day (AP) (tons)
1	<600	≈24	8		
2	600=< <1000	≈40	4		
3	1000=< <1500	≈71	6		
4	1500=<	≈130	2		
Total			20	17,481	C=1077 & AP=753.20

Many of the ice factories use ice cans 70 cm long, 48 cm wide and 22 cm high. An ice block weighs some 60 kg on average. Being easy to carry and handle, ice blocks of this weight and size are treated as standard in Cox's Bazar and are sold at a uniform price set by the ice-makers association, which CXB FLC is also a member of. The price may rise in high seasons, but one 60 kg block of ice was sold at BDT100 during the survey period. Although the ice factory of CXB FLC uses ice cans 110 cm long, 56 cm wide and 25 cm

high, it adjusts the quantity of water poured into the ice cans to produce ice blocks of 60 kg so as to meet the demand of customers and compete with private operators under the uniform price regime.

The operation of ice factories varies depending on the fishing season. Most of the ice factories cease to operate during the three months of fishing ban seasons. Only a few ice factories operate under the prior permission of the Department of Fisheries to meet the demand of freshwater and brackish water culture business. An ice block is sold at about BDT100 on average, but the price fluctuates between BDT80 and BDT200 in a year, depending on the landing volume in each fishing season. Daily sales volume reportedly peaks at 16,000 blocks (960 tons) and bottoms at 4,317 blocks (259 tons).

Daily ice production is estimated to average 753.2 tons in the whole area. Although production at the ice factory of CXB FLC only represents some 2% of the total, it enjoys sizable demand for icing packing fish to be shipped from CXB FLC. Of the private ice factories, 10 own jetty to allow fishing boats directly to load ice onboard, whereas the nine ice factories without jetty own vehicles to carry ice to CXB FLC, mainly for supplying fishing boats.

Only two of the private ice factories are equipped with a private electric generator, which is not used for ice production but for the offices and residences. Those ice factories employ 280 workers in total. An ice factory employs 15 workers on average, of whom nine are employed full-time.

Ice factories, including private companies, do not use ice storage to avoid operational costs due to electricity. Unsold ice blocks are conserved in the brine tank.

Fishing boats are the largest purchaser of ice per day about 370 tons (89%) followed by those shipping landed fresh fish to distant areas with 18 tons (4.3%), local operators at the fish handling sheds after landing with 14 tons (3.4%), local fish brokers with 6.4 tons (1.4%) and local retailers with 5.8 tons (1.2%). Local shoppers also purchase ice in very small amounts (about 0.10 tons) to preserve fish on their way home.

3) Issued related to ice factory at CXB FLC

The existing ice factory are aged and unable to produce ice from time to time due to declines in capacity or failures. Whereas ice blocks of 60 kg are the local standard, as they are easy to handle manually, the ice factory of CXB FLC, including ice cans and brine tank, are designed to produce ice blocks of 100 kg, effectively obliging the facilities to produce ice blocks of 60 kg in an inefficient manner. Since the facilities only has one compressor, it is impossible to operate ice factory during the checking or repairing period.

1.1.3. Summary of requests for facilities/equipment and the results of a review

The table below shows the composition of requests by Bangladesh for civil engineering facilities, building facilities and equipment to be provided by the project, and the results of a review by the Team on acceptability as a project item.

Table 1-14 : Result of review on acceptability as a project item

Component of request		Priority	Result of review on acceptability	
1. **Civil engineering facilities**				
1-1.	Revetment	A	○	The existing revetment needs improving as it is in the dangerous condition of partial collapse and deformation due to erosion.
1-2.	Pontoon/Jetty	A	○	Only one pontoon is available for artisanal fishing boats (average length of large fishing boats: 17.6 m) to land their catches, considerably delaying landing activities. An additional pontoon/jetty is needed.
1-3	Gangway	A	○	It needs to be built for carrying landed fish from the planned additional pontoon/jetty to the apron of the fish handling area.
1-4	Drainage	B	○	It needs to be developed to drain water from the premises.
	Parking Lot	B	○	It is necessary to provide parking lots for the vehicles of facility users.
	Paved Roads in the Premises	C	○	Paved roads need to be constructed on the premises to facilitate access of vehicles and facility users.
	Outdoor Lighting	C	○	It needs to be installed for ensuring security inside the premises in the evening and at night.
2. Building facilities				
2-1.	Fish Handling Area	A	○	The malfunctioning fish handling sheds, due to aging and partial collapse, needs to be rebuilt into a fish handling area that enables efficient and hygienic handling of fresh fish.
2-2.	BFDC Administrative Office	C	○	It needs to be taken down to secure sufficient area for construction. It needs to be renovated for management of CXB FLC.
2-3.	Fish Trader's Office	A	○	It needs to be taken down to secure sufficient area for construction. It also needs to be constructed in conjunction with the fish handling area as it should be located close to the fish handling area to ensure smooth fish transaction.
2-4.	Auctioneers Office	A	○	Same as the above trader's office It should be treated as a trader's office in the planned facilities.
2-5.	Meeting Room	C	○	Since CXB FLC has no meeting room, staff gather in the manager's room, which causes major inconveniences as the latter is available only for a limited time and a limited number of people. A small-size meeting room needs to be

Component of request		Priority	Result of review on acceptability	
				built, as requested, that is available for flexible use, including cross-functional meetings, communication with external entities and training for staff and facility users.
2-6.	Emergency Storage	B	○	The top floor of the fish handling center building will function as a cyclone shelter in times of disaster. A storage area, thus, needs to be constructed to keep emergency supplies.
2-7.	Mosque	A	×	It needs to be taken down to secure sufficient area for construction. The mosque at the project site is used by a large number of local residents as well as the users of fisheries facilities. New mosque will be secured by Bangladesh side at their own budget.
2-8.	Residential Area for BFDC Officer and staffs	A	△	It needs to be taken down to secure sufficient area for construction. Outer walls and fittings to the existing residential building for staff are totally decrepit. The ground floor is located only 60 cm above the ground level and, thus, needs leveling to prevent inundation. One residential building (two-stories) will be planned under the Project (hereinafter referred to as "residential building (two-stories).") and another will be secured by Bangladesh side at their own budget.
2-9.	Public Toilet	A	○	It needs to be taken down to secure sufficient area for construction. The number of toilets is downright insufficient considering the number of facility users, as many go the toilet alongside the river or behind buildings. Also, it needs improvement from a hygienic perspective.
2-10.	Canteen	B	○	It needs to be taken down to secure sufficient area for construction. It also needs improvement as a restaurant and as a place of relaxation for facility users.
2-11.	Vendor Shop	C	○	Same as the above canteen
2-12.	Fish Food Hall for Tourist	A	○	Thanks to easy access from the airport, the planned facilities are expected to attract many tourists. Creating such high-profile facilities to meet the demands of tourism will also serve as a showcase of economic cooperation with Japan.
2-13.	Fish transaction observation deck	C	○	Same as the above fish food hall for tourists
2-14	Electrical Room	C	○	Existing power receiving facilities in the facilities is aging. It would be appropriate to include its redevelopment in the plan given the expected rise in demand for power sources.
2-15.	Wastewater Treatment Facility	C	○	There is no public sewage system. A wastewater treatment facility is required to take action on primary treatment at the fish handling area.
2-16.	Deep Well	A	○	There is no public water supply system. A water quality survey found that the existing shallow wells fail the BOD and COD tests, and coliform

Component of request		Priority	Result of review on acceptability	
				has been detected in water from some wells, making it unacceptable for drinking. Deep wells need to be developed under this project to secure uncontaminated water.
3. Equipment				
3-1.	Temperature and Hygiene Management Equipment	A	○	Landed catches are contaminated as they are washed with river water and directly placed on the contaminated floor of the fish handling sheds. In order to prevent contact between landed fresh fish and those sources of contamination in the planned facilities, it is required to wash fish with clean well water, prevent their placement on the floor, and utilize fresh fish handling pallets and containers. As it is aware of the ongoing contamination of fresh fish and the quality deterioration because of the shortage of fresh fish handling equipment, BFDC also agrees to take necessary measures for improving the situation by systematically monitoring and controlling fresh fish washing, fresh fish handling and having contamination controls. Regarding know-how and expertise and theoretical training on the freshness and quality controls of landed catches, practical training on fish handling and in-house hygiene management are planned in the soft components of the project so that facility users may perform appropriate fresh fish handling and hygiene management in the planned facilities. Required equipment includes the following: Fresh fish washing basin, baskets for washing and transporting fresh fish, sorting trays, pallets, containers, cooler boxes, hanging scales, prefabricated refrigerators, high-pressure washing machines, and hand lifts.
3-2.	Ice making facilities			
3-2-1	Ice Can	B	×	Currently, ice cans designed to produce ice blocks of 100 kg ice are used to produce ice blocks of 60 kg to maximize user-friendliness. For efficient ice-making, however, smaller ice cans are preferred to be introduced.
3-2-2	Compressor	A	×	Only one aging compressor with a depressed capacity is currently available, and ice production has to be halted when it is checked or repaired. An additional compressor, as well as a reserve, is preferred to be introduced so that checks and repairs may be performed without stopping ice production.
3-2-3	Brine Tank	A	×	The existing brine tank is aging. It is designed for ice cans to produce ice blocks of 100 kg, but another brine tank is preferred to be developed

Component of request		Priority	Result of review on acceptability	
				to accommodate the downsized ice cans to produce 60 kg blocks.
3-2-4	Cooling Coil	A	×	It is preferred replacement as its ice-making function has declined due to aging.
3-2-5	Condenser	A	×	It is preferred replacement as its ice-making function has declined due to aging.
3-2-6	Ice factory	C	×	Its replacement seems to be a low priority as quick-fix measures would be effective, such as repainting outer walls.
3-2-7	Ice Shoot	B	×	It is used for loading block ice onto fishing boats along the existing pontoon, but many boats also procure block ice directly from private ice factories and not only from CXB FLC, which reduces the priority of a direct ice shoot via new gangway from the ice factory of BFDC. It is not included in the plan for constructing a new gangway.
3-3	Solar Power Generation System	A	○	Only a limited area is available within the planned facilities for installing solar panels. Moreover, the capacity of solar power generation is restricted in Bangladesh in such a manner that no sufficient amount of power generation is expected to amortize the cost of installation within the life cycle of the solar power generation system. Solar installation will, thus, be considered only for facilities that require a limited generation capacity, such as solar battery-powered outdoor lighting.
3-4	Toll Gate	B	○	A mechanical gate is also needed to control the entry and exit of vehicles using CXB FLC.
4. Soft Components				
4-1.	Guidance/Training for Fish Handling	A	○	It is needed to ensure that facility users and BFDC staff utilize and manage the planned facilities and equipment appropriately.
4-2.	Hygiene Management for Fish market	A	○	It is needed to ensure that facility users and BFDC staff are well-informed about handling fresh fish, freshness preservation and hygiene management so as to improve hygiene management in the whole fish handling area.

*Priority A: essential and top-priority component
*Priority B: second-priority and a highly needed component
*Priority C: low priority for the present project; it needs further review including for excluding from the scope of the project.

Although ice making facilities, mosque and residential buildings are classified as Priority A, they are excluded from the scope of the project due to the project budget. One residential building (two-stories) is planned under the project. A new mosque and one residential building excluding from the project, will be secured by Bangladesh side at their own budget. It is recommended to rehabilitate the decrepit ice-making facilities to produce

ice blocks of 60 kg, which are easy to handle and distributed locally, and to procure a reserve compressor to enable continued ice production during maintenance of the compressor.

1.2. Environmental and Social Consideration

1.2.1. Project component related to environmental and social consideration

This project includes two types of project components, consisting of civil engineering facilities (revetments, pontoons, etc.) and construction facilities (building facilities) which have an impact on the environment and society.

Discussions with the BFDC have confirmed that the method of reconstructing the planned facilities while landing activities within the site continue during the construction period, rather than temporarily transferring operations from the CXB FLC to an alternative site. This eliminates the necessity of land acquisition or resettlement.

1.2.2. Baseline of Environmental and Social Condition

1.2.2.1. Natural Environment

(1) Environment surrounding the project site

CXB FLC is located in an existing urban area, the entrance is adjacent to the entrance to Cox's Bazar International Airport, and stores, residential areas, private ice factories and other facilities are in the neighborhood.

Based on plans of the government of Bangladesh, construction work is proceeding to extend the runway and build airport facilities at Cox's Bazar International Airport. In addition, in the Khurushkul district which is located on the opposite side of the Bakkahali River across from CXB FLC, BFDC is constructing a fish processing center and housing for victims of cyclones, as well as performing Bakkahali River bank revetment work. Furthermore, the Local Government Engineering Department (LGED) is conducting construction work on the Bakkahali bridge which will provide a connection to the Khurushkul district approximately 1km upstream from CXB FLC.

(2) Ecologically Critical Area

The neighboring area including CXB FLC has been designated as an ecologically critical area by the Environment Conservation Act of Bangladesh, but BFDC headquarters have explained that the CXB FLC activities do not consist of prohibited activities within ecologically critical area under the "Ecologically Critical Area Management Rules (ECAMR)", verifying that it is not necessary to obtain separate permission from the Department of Environment in order to implement this project.

Furthermore, there are mangroves in the Naniar Char Upazila (subdivision) at the mouth of the Bakkhali River approximately 3km away from CXB FLC.

Thirteen areas in Bangladesh have been declared to be ECAs in accordance with the Environmental Conservation Act of Bangladesh, and the Cox's Bazar - Teknaf Sea Beach in Cox's Bazar District (longest natural sea beach in the world, approx. 120km long) which extends from Cox's Bazar Sadar Upazila to Teknaf Upazila at the southern end, was declared to be an ECA by the government of Bangladesh in 1999. In addition, Sonadia Island in the northern part of Maheshkhali Upazila and St. Martin's Island in Teknaf Upazila in the southern part of the country have also been declared to be ECAs.

(3) Biodiversity in Bangladesh and National Parks in Cox's Bazar District

Seven groups of wildlife in Bangladesh have been reported to be threatened in Bangladesh (IUCN, 2015), consisting of 138 species of mammals, 566 species of birds, 167 species of reptiles, 49 species of amphibians, 253 species of fresh water fish, 141 species of crustaceans and 305 species of butterflies, for a total of 1,619 species, with the breakdown of IUCN categories described in the table below[2].

Table 1-15 : Analysis of threatened status of seven groups of wildlife in Bangladesh (IUCN)

	Mammals		Birds		Crustaceans		Reptiles		Amphibians		Fresh water Fishes		Butterflies		Total	
category	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
EX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RE	11	0.7	19	1.2	0	0	1	0.06	0	0	0	0	0	0	31	2
CR	17	1	10	0.6	0	0	17	1	2	0.02	9	0.56	1	0.06	56	3.46
EN	12	0.75	12	0.75	2	0.02	10	0.6	3	0.03	30	1.85	112	6.91	181	11.18
VU	9	0.56	17	1	11	0.7	11	0.7	5	0.3	25	1.5	75	4.63	153	9.46
NT	9	0.56	29	1.8	1	0.06	18	1.17	6	0.37	27	1.67	0	0	90	5.56
LC	34	2.1	424	26.8	47	2.9	63	3.89	27	1.67	122	7.54	85	5.25	802	49.53
DD	39	2.4	55	3.4	79	4.88	27	1.4	6	0.37	40	2.47	32	1.97	278	17.17
NE	7	0.43	0	0	1	0.06	20	1.23	0	0	0	0	0	0	28	1.72
Total	138	8.52	566	34.94	141	8.7	167	10.31	49	3.02	253	15.62	305	18.83	1619	100

EX : Extinct, EW : Extinct in the Wild, RE : Regionally Extinct, CR : Critically Endangered, EN : Endangered, VU ; Vulnerable, NT : Near Threatened, LC : Least Concern, DD : Data Deficient, NE : Not Evaluated

Source : Red List of Bangladesh Volume 1: Summary, IUCN, 2015

There are several national parks in Cox's Bazar District. Himchari National Park stretches for approximately 10 km southeast of CXB FLC, the project site. The park has rich biodiversity and is home to 55 species of mammals, 13 species of amphibians, 56 species of reptiles, 117 species of plants, and 286 species of birds[3]. South of Himchari National Park are Sheikh Jamal Inani National Park and Teknaf Wildlife Sanctuary, an area of high biodiversity, including wild

[2] Red List of Bangladesh Volume 1: Summary, IUCN, 2015

[3] https://beautifulbangladesh.gov.bd/cat/green-zone/17, Bangladesh Tourism Board, Ministry of Civil Aviation and Tourism

Asian elephants[4]. There is also a series of protected forests along the Bay of Bengal, such as Reju-Cox's Bazar Reserve Forest in Ramu Upazila and Ukhiaghat Protected Forest in Ukhia Upazila.

（4）Borders with neighboring countries

Cox's Bazar District borders neighboring Myanmar. Cox's Bazar Sadar Upazila, where the project site is located, is not adjacent to the border.

（5）International conventions

International conventions to which Bangladesh is a signatory include the International Convention on the Protection of Birds (1950) and the International Convention on Climate Change (1997).

1.2.2.2. Social Environment

(1) Present situation of the project site in Cox's Bazar Sadar

1）Population

The population of Cox's Bazar Sadar Upazila was 459,082 in 2011 and 36.5% of the population is concentrated in the urban areas (Paurashava) near CXB FLC.

Table 1-16：Population of Cox's Bazar Sadar Upazila（2011）

location	Total number of households	Total population	Population (Men)	Population (Women)
Cox's Bazar District	415,954	2,289,990	1,169,604	1,120,386
Total (Cox's Bazar Sadar)	82,683	459,082	241,637	217,445
Urban (Paurashava)	31,431	167,477 (36.5%)	94,279	73,198
Rural	41,166	235,560 (51.3%)	119,003	116,557
Other	10,086	56,045 (12.2%)	28,355	27,690

Source：Population and Housing Census - 2011（Community Report: Cox's Bazar） Nov.2014

2）Ethnic Groups and Language

There are 27 officially recognized ethnic minority groups in Bangladesh, with Bengalis making up the majority[5]. The population of the groups is 1.1% (approx. 1.586 million) (2011) of the total population of Bangladesh[6]. The population of ethnic minority groups in Cox's Bazar District was 14,551 (2011), which is approximately 0.63% of the total population of the district.

[4] Ecological Assessment of Some Selected Sites in Ukhiya and Teknaf, Cox's Bazar, Bangladesh, 2019, https://www.adb.org/sites/default/files/project-documents/52174/52174-001-emr-en_3.pdf

[5] The Challenges Facing Plainland Ethnic Groups in Bangladesh, International Republican Institute, 2020

[6] Statistical Yearbook of Bangladesh 2021, Bangladesh Bureau of Statistics, 2022

Bengali is the national language of Bangladesh. Furthermore, ethnic minority groups do not reside in the target area for the project.

3) Religions

The distribution of population by religion in 2011 in Cox's Bazar Sadar is shown below. Muslims account for about 92% of the population, and Hindus, Buddhists, and other religions for about 8%.

Table 1-17 : Distribution of population by religion (2011)

Religions	Cox's Bazar District	(%)	Cox's Bazar Sadar Upazila	(%)
Muslim	2,151,958	93.97	423,142	92.17
Hindu	97,648	4.26	29,522	6.43
Buddhist	37,822	1.65	5,781	1.26
Christian	1,503	0.07	140	0.03
Others	1,059	0.05	497	0.11
Total	2,289,990		459,082	

Source : Population and Housing Census - 2011 (Community Report: Cox's Bazar) Nov. 2014

4) Literacy Rate

The literacy rate in Cox's Bazar (Urban) is 56.7% for men and 52.3% for women, which is higher than the average of 39.3% for Cox's Bazar District and 49.2% for Cox's Bazar Sadar Upazila.[7].

5) Basic infrastructure

・Drinking water

Many households in Bangladesh continue to depend on wells as the source of drinking water, and 60.18% of households used wells as of 2016. The main source of drinking water in Cox's Bazar Sadar Upazila is underground water.

・Toilets

Regarding the development status of toilets in Bangladesh, eighty percent of toilets in cities are in buildings with fixed roofs or walls as of 2016, but this figure is only about 50% in suburbs (local areas, farming villages). In Cox's Bazar Sadar Upazila, 27% of households have flushing toilets, and 73% have non-flush toilets.

・Solid waste

The Municipality Office's Conservancy Department is in charge of solid waste treatment in

[7] Population and Housing Census - 2011 (Community Report: Cox's Bazar) Nov. 2014

Cox's Bazar Sadar. The government organization applies to the mayor for permission to collect waste.

・Cleaning of septic tanks

The Municipality Office's Conservancy Department is in charge of the cleaning of septic tanks and they own 4 vacuum cars. The government organization applies to the mayor for permission to clean the tanks.

(2) Social status of CXB FLC users

The ratio of the 1,376 fishing boat owners who use CXB FLC which work full-time in the fishing industry is 25%, which is low compared to the other fish landing centers (75% for Maheshkhali, 60% for Nazirtek and 90% for Teknaf)[8]. Boat owners hire fishers (captain, crew), cover the cost of wages and boat operating expenses to operate their business, with few owners serving as captains of the boats. The relationship for many fishers consists of the boat owner being the employer of the crew (fishers), but there are many cases in which fisher take out loans (with interest) using an individual loan system called Dadon, which serves as an intermediary between them and the boat owner, to make ends meet, creating a pre-paid hiring contract with the boat owner[9]. In addition, there are many cases in which boat owners etc. have similar loan relationships with distributors, and there is a strong connection with brokers from this perspective. In addition to the marine fisheries sector in Cox's Bazar, this type of fund procurement method permeates farming villages in Bangladesh[10].

The monthly income of boat owners who use CXB FLC is 60,420 – 78,900BDT, and the loan amounts to fisher (captain, crew) vary ranging between 100,000 – 400,000 BDT, and sometimes exceeding 400,000 BDT. On the other hand, the monthly income of fishers is 10,000 – 20,000 BDT, and boat owners have a loan balance of under 50,000 BDT or between 50,000 and 100,000 BDT[11].

1.2.3. Environmental and Social Consideration Laws and Institutions

1.2.3.1. Environmental Laws and Regulations

1) National Environmental Policy

Bangladesh adopted a National Environmental Policy (NEP) in 1992, aimed at conservation and sustainable management of the environment, which sets out the policies for fifteen sectors. It also states that all major undertakings which will have a bearing on the environment must undertake an IEE (Initial Environmental Evaluation) and EIA (Environmental and Social

[8] Fish landing sites survey for the study of information, facts and data for infrastructure development in the fisheries value chain in Cox's Bazar (2021)

[9] Data Collection Survey on Fisheries Value Chain Infrastructure Development in South Chattogram Region in the People's Republic of Bangladesh Final Report (JICA, 2021)

[10] Nature of Dadon and Its Effect on Livelihood Status of Two Fishing Communities in Kishoreganj Haor of Bangladesh, 2021

[11] Fish landing sites survey for the study of information, facts and data for infrastructure development in the fisheries value chains in Cox's Bazar (2021)

Impact Assessment) before the projects are initiated. The major elements of the policy are as follows:

- maintaining the ecological balance for ensuring sustainable development;
- protection of the country against natural disasters;
- identifying and controlling activities which are polluting and destroying the environment;
- promoting sustainable and sound management of natural resources; and
- active collaboration with international initiatives related to the environment.

The "National Environmental Policy 2018" was formulated in 2018, which prescribes action policies and the basic framework for environmental action in 24 sectors, including land/water resource development, agriculture, fisheries, forestry, livestock and disaster management, and the following items were added to the main objectives:

- implementing EIA and Strategic Environmental Assessment (SEA) for relevant development surveys and activities;
- addressing climate change problems by expanding necessary measures; and
- strengthening monitoring to ensure compliance with laws and rules concerning the environment.

2) National Conservation Strategy

The government of Bangladesh prepared an initial draft for the National Conservation Strategy (NCS) in 1992, proposing that EIA be made mandatory for development actions. After multiple revisions were made to the initial draft in 1993 and after, the cabinet instituted a research project to incorporate the specified corrections / updates in the initial draft, support was received from the IUCN Bangladesh Office, and the National Conservation Strategy 2016-2031 was prepared in September 2016.

3) National Environmental Management Action Plan (NEMAP)

The NEMAP is a wide-ranging and multi-faceted plan which builds on and expands the statements set out in the National Environmental Policy. NEMAP was developed to address issues and management requirements for the period from 1995 to 2005 and it sets out the framework within which the recommendations of the NCS are to be implemented.

The main objectives of NEMAP are as follows;

- Identification of key environmental issues affecting Bangladesh
- Identification of actions necessary to halt or reduce the rate of environmental degradation
- Improvement of the natural and built environment
- Conservation of habitats and biodiversity
- Promotion of sustainable development
- Improvement in the quality of life of the people

(2) Outline of related Environmental Laws and Regulations

1）Bangladesh Environment Conservation Act (BECA)

The main objectives of BECA 1995 are: conservation of the natural environment and improvement of environmental standards, and control and mitigation of environmental pollution. According to Article-12 of BECA 1995, "No industrial unit or project shall be established or undertaken without obtaining, in the manner prescribed by rules, an Environmental Clearance Certificate from the Director General".

In addition, in Article 5 of BECA, the government of Bangladesh is provided with the authority to declare Ecological Critical Areas (ECA), and has given the Ministry of Environment, Forest & Climate Change the authority to determine these areas.

2）Bangladesh Environmental Conservation Rules (BECR)

The Bangladesh Environmental Conservation Rules (BECR, 1997) is a major supplementary law for the Bangladesh Environmental Conservation Act (BECA), setting (i) environmental standards concerning air, water quality (drinking water/surface water), industrial effluent, exhaust gas, noise, etc., (ii) requirements and acquisition procedures for Environmental Clearance Certificates (ECC) and (iii) IEE/EIA requirements according to the industry or development project category, and indicates an overview of the necessary procedures to comply with BECA related rules.

In Article 7 of BECR (1997), the procedures to acquire an ECC specified in Article 5 of BECA are indicated, and the Department of Environment published "A Guide to Environmental Clearance Procedure, 2010"[12].

According to section 3 "Declaration of Ecologically Critical Area" of BECR 1997, the Government shall take the following factors into consideration when declaring any area an Ecologically Critical Area under sub-section (1) of section 5, BECA: a）human habitat, b）ancient monument, c）archeological site, d）forest sanctuary, e）national park, f）game reserve, g）wild animals habitat, h）wetland, i）mangrove, j）forest area, k）bio-diversity of the relevant area and l）other relevant factors.

3）Ecologically Critical Area Management Rules (ECAMR)

The government of Bangladesh officially announced the Ecologically Critical Area Management Rules （ECAMR) for the management of Ecologically Critical Areas (ECA) declared in Article 5 of the Bangladesh Environmental Conservation Act (1995), which specify the exercising of authority, limits, discretion, decision making procedures and other such matters in ECAs.

According to the ECAMR, the following seven activities were prohibited under the notification:

[12]http://doe.portal.gov.bd/sites/default/files/files/doe.portal.gov.bd/page/71a829c3_6b74_4ee9_90a6_158e2898b228/Environmental%20Clearance%20Procedure.pdf

1. Cutting or harvesting any natural forest and vegetation;
2. All types of hunting and killing of wildlife;
3. Collecting and capturing molluscs, corals, turtles and other wildlife;
4. All activities destroying natural habitat of the flora and fauna ;
5. All activities that may deteriorate or change the natural characteristics of the land and water;
6. Establishing industry or establishments which pollute soil, water, air and cause sound pollution;
7. Any other activities which are harmful to the fish and other aquatic animals.

Furthermore, it is specified that the Director General of the Department of Environment has the authority to change/expand the range and limits of ECAs.

1.2.3.2. Outline of Environmental Clearance Certificate (ECC) application and necessity for EIA for the project

(1) Necessity for EIA for this project

The Bangladesh side confirms that there is no necessity for EIA under the laws of Bangladesh related to this project.

(2) Application for ECC

A categorized list of the projects is shown in Schedule-1 of BECR1997. For the purpose of issuance of the Environmental Clearance Certificate, the industrial units and projects shall be classified into the following four categories in consideration of their site and impact on the environment; Green, Orange-A, Orange-B and Red. The documents required for each category are shown below.

Table 1-18 : Supporting documents required for ECC application

Category	Supporting documents required for application
Green	General information about the project, No Objection Certificate from the local authority, etc.
Orange-A	General information about the project, No Objection Certificate from the local authority, layout plan (showing location of effluent treatment plant), outline of the plan for relocation (if applicable), etc.
Orange-B	Report on the feasibility of the project (applicable only to the proposed project), Initial Environmental Examination (IEE) report, Environmental Management Plan (EMP) report, No Objection Certificate from the local authority, emergency plan relating to adverse environmental impact and plan for mitigation of the effects of pollution, outline of the plan for relocation (if applicable), etc.
Red	Report on the feasibility of the project (applicable only to the proposed project), Initial Environmental Examination (IEE) report, Environmental Impact Assessment (EIA) report prepared on the basis of terms of reference previously approved by the Department of

Category	Supporting documents required for application
	Environment, along with the layout plan, Environmental Management Plan (EMP) report, No Objection Certificate from the local authority, emergency plan relating to adverse environmental impact and plan for mitigation of the effects of pollution, outline of the plan for relocation (if applicable), etc.

The necessity of a Location Clearance Certificate, Initial Environmental Evaluation (IEE), Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) differs depending upon the respective category. When the target project category is "Orange B[13]" or "Red", an IEE、EIA and EMP are required, and when the category is "Green" or "Orange A", an IEE、EIA and EMP are not prepared.

For projects etc. that are classified as the "Red" category, an Initial Environmental Evaluation (IEE) is first submitted, a Term of Reference (TOR) is attached to request approval for an EIA, and the EIA is implemented in accordance with the TOR for which advance approval of the Department of Environment was obtained.

Table 1-19：Application of ECC by category

	Green	Orange-A	Orange-B	Red
Submit application with supporting documents	Necessary	Necessary	Necessary	Necessary
Location Clearance Certificate	N/A	Necessary	Necessary	Necessary
IEE	N/A	N/A	Necessary	Necessary
EIA	N/A	N/A	Necessary *	Necessary **
EMP	N/A	N/A	Necessary	Necessary
Environmental Clearance Certificate	Necessary	Necessary	Necessary	Necessary

*There are cases in which Department of Environment requires an EIA. **Approval of Department of Environment is needed for TOR for EIA

Source：BECR

The general process steps for environmental clearance from submission of the application to decision, time frame and fee schedule (environmental clearance fees and renewal fees) are shown below.

Table 1-20：General Process Steps for Environmental Clearance

Step	General Process Steps
1	Submit application with supporting documents
2	Verification of application and supporting documents by DOE
3	Inspection by the authorized officer after verification of all reports and documents. [Then make a decision about the clearance (Only Green and Orange-A)]

[13] There are cases in which Department of Environment requires EIA for category Orange B.

Step	General Process Steps
4	Meeting of Environmental Clearance Committee (for Orange-B and Red Category)
5	Decision

Source : A Guide to Environment Clearance Procedure, 2010, DoE

Table 1-21 : Time frame for each category

No.	Category	Location Clearance	Environmental Clearance
1.	Green	N/A	15 days
2.	Orange-A	30 days	15 days
3.	Orange-B	60 days	30 days
4.	Red	60 days	30 days

Source : A Guide to Environment Clearance Procedure, 2010, DoE

Table 1-22 : Fee schedule (Environmental clearance fees and renewal fees)

No.	Investment Amount (BDT)	Environmental Clearance Fees (BDT)	Renewal Fees (BDT)
A	B	C	D
8.	500,000,000－1,000,000,000	120,000	1/4 of the stated amount in column C
9.	1,000,000,000－2,000,000,000	200,000	1/4 of the stated amount in column C
10.	2,000,000,000－5,000,000,000	300,000	1/4 of the stated amount in column C

Source : A Guide to Environment Clearance Procedure, 2010, DoE

The period of validity of an Environmental Clearance Certificate shall be, in the case of the Green Category, 3 years from the date of issuance and in all other cases 1 year.

1.2.4. Environmental Standards

The main environmental standards are shown as follows. WHO standards are added for reference.

（1）Drinking water

No	Parameter	Unit	Bangladesh Standard	【Reference】 WHO Standard
1	Aluminum	mg/l	0.2	0.2
2	Ammonia（NH3）	mg/l	0.5	
3	Arseic	mg/l	0.05	0.01
4	Balium	mg/l	0.01	0.7
5	Benzene	mg/l	0.01	0.01
6	BOD 20℃	mg/l	0.2	
7	Boro	mg/l	1.0	0.5
8	Cadmium	mg/l	0.005	0.003
9	Calcium	mg/l	75	
10	Chloride	mg/l	150-600	

No	Parameter	Unit	Bangladesh Standard	【Reference】 WHO Standard
11	Chlorinated alkanes			
	carbontetrachloride	mg/l	0.01	0.004
	1.1 dichloroethylene	mg/l	0.001	
	1.2 dichloroethylene	mg/l	0.03	
	tetrachloroethylene	mg/l	0.03	
	trichloroethylene	mg/l	0.09	
12	Chlorinated phenols	mg/l		
	- pentachlorophenol	mg/l	0.03	
	- 2.4.6 trichlorophenol	mg/l	0.03	
13	Chlorine (residual)	mg/l	0.2	
14	Chloroform	mg/l	0.09	0.3
15	Chromium (hexavalent)	mg/l	0.05	
16	Chromium (total)	mg/l	0.05	0.05
17	COD	mg/l	4	
18	Coliform (fecal)	n/100ml	0	
19	Coliform (total)	n/100ml	0	
20	Color		15	
21	Copper	mg/l	1	2.0
22	Cyanide	mg/l	0.1	0.07
23	Detergents	mg/l	0.2	
24	DO	mg/l	6	
25	Fluoride	mg/l	1	1.5
26	Hardness (as CaCO3)	mg/l	200-500	
27	Iron	mg/l	03.-1.0	
28	Kjeldhl Nitrogen (total)	mg/l	1	
29	Lead	mg/l	0.05	0.01
30	Magnesium	mg/l	30-35	
31	Manganese	mg/l	0.1	0.4
32	Manganese	mg/l	0.001	0.006
33	Nickel	mg/l	0.1	0.07
34	Nitrate	mg/l	10	50
35	Nitrite	mg/l	<1	3
36	Odor	mg/l	なし	
37	Oil and grease	mg/l	0.01	
38	pH	mg/l	6.5-8.5	
39	Phenolic compounds	mg/l	0.002	
40	Phosphate	mg/l	6	
41	Phosphorus	mg/l	0	
42	Potassium	mg/l	12	
43	Radioactive materials (gross alpha activity)	Bq/l	0.01	
44	Radioactive materials (gross beta activity)	Bq/l	0.1	
45	Selenium	mg/l	0.01	0.04
46	Silver	mg/l	0.02	
47	Sodium	mg/l	200	
48	Suspended particulate matters	mg/l	10	
49	Sufide	mg/l	0	Not configured
50	Sulfate	mg/l	400	
51	Total dissolved solids	mg/l	1000	1000
52	Temperature	℃	20-30	
53	Tin	mg/l	2	Not configured
54	Turbidity	JTU	10	
55	Zinc	mg/l	5	

（2）Noise

No.	Category of areas	Standards determined at dBa unit (Day)	Standards determined at dBa unit (Night)	Source
A	Silent zone	50	40	Noise Pollution (Control) Rules 2006
B	Residential area	55	45	ditto
C	Mixed area (mainly residential area, and also simultaneously used for commercial and industrial purposes)	60	50	ditto
D	Commercial area	70	60	ditto
E	Industrial area	75	70	ditto
Reference	—	53 Strongly recommended	45 Strongly recommended	Recommended in environmental noise guidelines for European region (2018)

1.2.4.1. Gaps between relevant environmental laws and regulations in Bangladesh and JICA Guideline for Environmental and Social Considerations (April, 2010) and policy for the project

The gaps between the relevant environmental laws and regulations in Bangladesh and JICA Guidelines for Environmental and Social Considerations (April, 2010) are shown in the following table.

Table 1-23 : Gaps between relevant laws and regulations in Bangladesh and JICA Guideline for Environmental and Social Considerations

Items	JICA Guidelines for Environmental and Social Considerations	Relevant laws and regulations in Bangladesh	Gaps and Policy for the Project
Basic Principles	1. Environmental and social impacts caused by projects must be assessed and examined at the earliest possible planning stage. Alternatives or mitigation measures must be examined, in order to avoid such impacts as much as possible, and to minimize, reduce or mitigate them when such avoidance is impossible. The result of the examinations must be reflected into the project plan. 2. Such examinations must be endeavored to include an analysis of environmental and social costs and benefits in the most quantitative terms possible, as well as a qualitative analysis, and to be in a close harmony with the economic, financial, institutional, social, and technical analyses of projects. 3. The findings of the examination of environmental and social	• In "National Environmental Policy 2018", an action plan and basic framework for environmental action are specified for 24 sectors, and it is stated that "an EIA and Strategic Environmental Assessment (SEA) shall be implemented for related development surveys and activities". • In ECR1997 (Environmental Conservation Rules 1997), industries/projects are divided into 4 categories according to the scale of	No significant gaps were identified.

Items	JICA Guidelines for Environmental and Social Considerations	Relevant laws and regulations in Bangladesh	Gaps and Policy for the Project
	considerations, including alternatives and mitigation measures, must be documented as an independent document or as a part of other documents. Environmental assessment reports must be prepared for projects with potential significant impacts. 4. For projects which may have significant impacts in particular, or for controversial projects, a committee of experts may be formed so that projects may seek their opinions, in order to increase accountability.	impact. The necessity of preparing/executing an Initial Environmental Evaluation (IEE), Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) report is prescribed according to each category.	
Examination of Measures	1. Multiple alternatives must be examined in order to avoid or minimize adverse impacts by the project and to choose better project options in terms of environmental and social considerations. In the examination of measures, priority is to be given to avoidance of environmental impacts. When this is not possible, minimization, reduction, and then mitigation of the impacts must be considered, in accordance with the mitigation hierarchy. Compensation measures must be examined only when significant impacts are still remain even with the aforementioned measures. 2. Appropriate plans and systems for measures, such as monitoring plans and environmental management plans, must be prepared. The costs of implementing such plans and systems, and the financial methods to fund such costs, must be determined. For projects with particularly significant impacts, detailed environmental management plans must be prepared.	• The Department of Environment issues EIA Guideline for Industries (2021) concerning the execution of an IEE and EIA. The same applies for the following provisions. A survey/review shall be conducted, measures to avoid, minimize or compensate for impact shall be reviewed in this order, mitigation measures shall be reviewed, and those results shall be reflected in the project plan. • ECR1997 classifies industries/ projects into 4 categories according to the scale of impact, and the executing agency needs to apply to the Department of Environment for an Environmental Clearance Certificate (ECC). The necessity of an IEE, EIA and EMP is stipulated based on the category.	No significant gaps were identified.
Scope of Impacts to Be Assessed	1. The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water use, climate change, biodiversity, and ecosystem services, including trans-boundary or global scale impacts. These also include social considerations such as: Migration of population including involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social	• Stipulated in EIA Guideline for Industries (2021), and "checklists of environmental components (scoping checklist)" is indicated. • EIA Guideline for Industries (2021) state that direct, indirect or cumulative impact needs to be examined.	No significant gaps were identified.

Items	JICA Guidelines for Environmental and Social Considerations	Relevant laws and regulations in Bangladesh	Gaps and Policy for the Project
	institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor peoples and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety. 2. In addition to the direct and immediate impacts of projects, derivative, secondary, and cumulative impacts as well as impacts associated with indivisible projects are also to be examined and assessed to a reasonable extent. It is also desirable to consider the impacts through a project life cycle.		
Compliance with Laws, Standards, and Plans	1. Projects must comply with the laws, ordinances, and standards related to environmental and social considerations established by host country governments, including local governments. Projects must also conform to the environmental and social consideration policies and plans of the host country governments. 2. In principle, Projects must be undertaken outside of areas that are specifically designated for conservation of nature or cultural heritages by the host country governments, unless the main purpose of the Projects is to promote or restore the protection of such areas. Also, projects shall not cause significant adverse impacts on such designated conservation areas.	• Based on ECR1997 (Environmental Conservation Rules), conducting an Initial Environmental Evaluation (IEE) and Environmental Impact Assessment (EIA) is mandatory according to the category, and an Environmental Clearance Certificate (ECC) must be acquired for all industries/projects. • EIA Guideline for Industries (2021) indicates selection criteria for suitable sites.	No significant gaps were identified.
Social Acceptability	1. Projects must be adequately coordinated so that they are accepted in a socially appropriate manner for the countries and areas where the projects are planned. For Projects with potentially significant environmental and social impacts, sufficient consultations with local stakeholders, such as local residents, must be conducted via disclosure of information at an early stage, at which time alternatives for project plans are examined. The outcome of such consultations must be incorporated into the project plans. 2. Appropriate considerations must be given to vulnerable social groups, such as women, children, elderly peoples, people in poverty, indigenous peoples, persons with disabilities, refugees, internally displaced persons, and	• Public Involvement is a step that is required to satisfy resident needs in EIA Guideline for Industries (2021), implementing Public Involvement in the EIA process is the responsibility of the Project Proponent, and an overview of the selection of eligible persons for Public Involvement, methods to implement discussions, prepare minutes of discussions and entry in EIA report are described. • EIA Guideline for Industries (2021) states	No significant gaps were identified.

Items	JICA Guidelines for Environmental and Social Considerations	Relevant laws and regulations in Bangladesh	Gaps and Policy for the Project
	minorities. Such vulnerable social groups are susceptible to environmental and social impacts and may have little access to decision-making processes within society.	that the starting period for Public Involvement is the idea stage of the project, and that it is necessary to perform a series of EIA processes (scoping, screening, etc.) from this stage.	
Biodiversity	1. Projects must not involve significant conversion or significant degradation of critical habitats or critical forests. 2. Illegal logging of forests must be avoided. Project proponents need to obtain logging permits from regulatory agencies, and are encouraged to obtain forest certifications for forestry projects, in order to ensure the prevention of illegal logging.	• EIA Guideline for Industries (2021) indicates selection criteria for suitable sites. This includes "Ecosystem: Avoiding unique habitats (as sites)".	No significant gaps were identified.
Involuntary Resettlement and Loss of Livelihood	1. Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. If avoidance is not possible even after such examination, effective measures to minimize impacts and to compensate for losses must be taken upon agreement with the affected people. 2. Project affected people, such as people to be resettled involuntarily and/or people who may lose their livelihoods by the project, must be provided sufficient compensations and supports by the project proponents in a timely manner. Compensations must be calculated at full replacement cost as much as possible, and provided in advance. Project proponents must make efforts for the affected people to improve or at least restore their standards of living, income opportunities and production levels to the pre-project levels. Measures to achieve this may include: Providing land or monetary compensations for losses of land or assets, supporting for alternative sustainable livelihood, supporting for expenses necessary for relocation, and supporting for re-establishment of communities at resettlement sites. 3. Compensation standards are disclosed and consistently applied. The project affected persons need to be aware of the compensation standards. In principle, the contents of the individual compensation to be agreed are explained to the project affected persons in writing, and the project affected persons can confirm the contents at any time. 4. Appropriate participation of the project affected people and their communities must be promoted in the	• Checklist of issues commonly encountered in industry projects attached to EIA Guideline for Industries (2021) includes land acquisition, property damage, displacement of homes and livelihood as items. • The Acquisition and Requisition of Immovable Property Act, 2017 specifies provisions concerning acquisition/ compensation/ support for private property. Persons to be compensated are land owners (registered).	No significant gaps in particular were identified, but there was a difference in the scope of persons subject to be compensated. Persons to be compensated are land owners in partner country system, but in JICAGL, persons other than land owners are included. Furthermore, does not apply for this project since there is no resettlement.

Items	JICA Guidelines for Environmental and Social Considerations	Relevant laws and regulations in Bangladesh	Gaps and Policy for the Project
	planning, implementation and monitoring of measures against involuntary resettlement and loss of livelihood. 5. For projects that result in large-scale involuntary resettlement, a Resettlement Action Plans (RAP) must be prepared and made available to the public prior to the resettlement and provision of compensation and support. In preparing the RAP, consultations must be held with the project affected people and communities, based on sufficient information made available to them in advance. When consultations are held, explanations must be given in languages and forms that are understandable to the project affected people. It is desirable that the RAP includes elements laid out in the Environmental and Social Standard (ESS) 5 of the World Bank's environmental and social policies.		
Indigenous Peoples	1. Any adverse impacts that a project may have on indigenous peoples are to be avoided when feasible by exploring all viable alternatives. If avoidance is not possible even after such examination, effective measures for indigenous peoples must be taken to minimize the impacts and to compensate for the losses. 2. When projects may have adverse impacts on indigenous peoples, all of their rights in relation to land and resources must be respected in accordance with the spirit of the relevant international declarations and treaties, including the United Nations Declaration on the Rights of Indigenous Peoples. Efforts must be made to obtain the Free, Prior, and Informed Consent (FPIC) of the affected indigenous peoples. 3. Measures for the affected indigenous peoples must be prepared as an Indigenous Peoples Plan (IPP), which may constitute as a part of other documents for environmental and social considerations, and must be made public in compliance with the relevant laws and ordinances of the host country. In preparing the IPP, efforts must be made to obtain the FPIC of the affected indigenous peoples based on sufficient information made available to them in advance. When consultations are held, explanations are given in languages and forms that are understandable to the indigenous peoples concerned. It is desirable that the IPP includes the	• Checklist of issues commonly encountered in industry projects attached to EIA Guideline for Industries (2021) includes indigenous people rights and/or minority rights issues. • There is the Chittagong Hill Tracts Peace Accord (1997) and other legislation for indigenous people issues.	No significant gaps were identified. Furthermore, does not apply for this project since there are no indigenous people residents.

Items	JICA Guidelines for Environmental and Social Considerations	Relevant laws and regulations in Bangladesh	Gaps and Policy for the Project
	elements laid out in the ESS 7 of the World Bank's environmental and social policies.		
Monitoring	1. During the project implementation, project proponents monitor whether any unforeseeable situations occur, and the performance and effectiveness of the planned mitigation measures. Project proponents take appropriate measures based on the results of such monitoring. 2. In cases where sufficient monitoring is deemed essential for appropriate environmental and social considerations, such as projects for which mitigation measures should be implemented while monitoring their effectiveness, Project proponents must ensure that the project plans include feasible monitoring plans. 3. Project proponents should make efforts to make the monitoring results available to local stakeholders involved in the project. 4. When third parties point out specifically that environmental and social considerations are not being fully undertaken, project proponents should make efforts to reach an agreement on the procedures to resolve the problems, through forums for discussions and examinations of the countermeasures with participation of stakeholders involved in the projects, based on sufficient information disclosure.	• EIA Guideline for Industries (2021) states that monitoring of complaints, etc. is necessary for one of impact items.	No significant gaps were identified.
Grievance Redress Mechanism	1. A mechanism for handling concerns and grievances from people and communities affected by the project's environmental and social impacts must be in place. 2. The grievance redress mechanism needs to be easily accessible for the project affected people and communities. Project proponents disseminate the information about the grievance redress mechanism through consultations with local stakeholders. The project affected people and communities must not be disadvantaged by filing a grievance. 3. Project proponents should make efforts to respond promptly to the grievances they receive, taking into account the concerns and needs of the project affected people and communities.	• Article 8 of Bangladesh Environmental Conservation Act (BECA) and Article 5 of Bangladesh Environmental Conservation Rules (BECR) have provisions for application for relief by people who are affected.	No significant gaps were identified. A complaint handling system will be established by the executing agency of this project.
information disclosure	・EIA reports (which may be referred to differently in different systems) must be written in the official language or in a language widely used in the country in which the project is to be implemented. When explaining projects to local	• Information Disclosure and Public Access to EIA Documents are prescribed in EIA Guideline for Industries (2021).	No significant gaps were identified.

Items	JICA Guidelines for Environmental and Social Considerations	Relevant laws and regulations in Bangladesh	Gaps and Policy for the Project
	residents, written materials must be provided in a language and form understandable to them; ・ Environmental assessment reports are required to be made available in the host country, including for local residents. The environmental assessment reports are required to be available at all times for perusal by stakeholders such as local residents, and to be allowed to photocopy （Appendix 2）.		

1.2.4.2. Comparative Review of Alternative Proposals (Including proposal to not implement project)

It has been confirmed from the Minutes of Discussions that temporary resettlement to an alternative site will not be performed during the construction period for this project. Since plans call for the CXB FLC site to be divided into a construction area and a fish landing area during the construction work period, and facility users to continue fish landing activities in the work space in the fish landing area, the alternative proposal will be considered when the zero option is implemented under which the project is not implemented. Furthermore, the CXB FLC continues to be in a dangerous condition due to a collapse of the foundation floor of the fish handling area (north side), the floor surface is inclined due to cracks in the pillars for the fish handling area, and there is the concern that there may be more collapses.

（1） When this project is not implemented (Zero option)

• Collapses in the fish handling area will deteriorate, making it impossible to ensure the safety of the work environment. In addition, the fish handling space will be decreased, further lowering the functionality of the location as the only fish landing infrastructure.

• A portion of the parking lot (with no roof and confluence of people and vehicles) is being used as fish handling space, and damage to the fish catch due to contamination and direct sunlight will continue.

• Due to the positional relationship between the fish landing area (existing pontoon and slope revetment) and fish handling area, the work flow lines of people, fish catch and vehicles are currently tangled. These flow lines and the working environment will not be improved, and the safety of the fish catch (food) will decline.

• A waste water treatment facility (septic tank) will not be installed, and the problem of waste water discharge from CXB FLC into the Bakkhali River will not be solved.

• There will not be facilities (toilets, etc.) for women who use the CXB FLC, continuing the status of the facility being inconvenient for women.

• Usage of the current fish handling area (planned reconstruction area) will continue in the current status.

(2) When this project is implemented

• The building of a new pontoons and gangways will create a fish handling area where fish can be directly landed, organizing the work flow lines, reducing the fish landing time, reducing chances of the fish catch being contaminated, and reducing the time the fish catch is exposed to direct sunlight.

• The collapsed fish handling area will be removed, and a safe and efficient work space will be secured.

• The work environment for facility users will be improved by increasing the shady area under the roof.

• Installation of waste water facilities will decrease the effluent load on the Bakkhali River.

• Supplying the needed volume of fresh water for washing fish catch and increase the opportunities for workers to wash their hands, reducing the chance of contamination.

• Construction work by the project will be performed in the fish handling area, parking lot, trader's office, public toilets, canteen, shops, administration building and a residential building (two-stories) on the construction area. Facility users will continue to perform fish landing work in the fish landing area provided on the South side inside CXB FLC.

When the situation of if this project is not implemented (Zero option) is compared to if it is implemented, it can be presumed that it will considerably improve the situation by restoring the functionality of the CXB FLC, securing a safe work environment for facilities users and reducing damage to the fish catch by improving the work environment.

1.2.4.3. Scoping

The scoping draft and selection reasons regarding the impact on the natural/social environment of this project based on the JICA Guidelines for Environmental and Social Considerations (April 2010) are described in the table below.

Table 1-24 : Draft Scoping for the proposed project

Environmental Item	No	Item	Rating		Reasons
			Before/during work	When placed in service	
Pollution	1	Air pollution	✓	✓	**During work:** Generation of dust due to construction work is expected. **When placed in service:** Generation of dust due to increase in number of trucks resulting from higher fish landing efficiency is expected.

Environmental Item	No	Item	Rating		Reasons
			Before/during work	When placed in service	
	2	Water pollution	✓	—	**During work:** It is expected that a portion of the river will be temporarily muddied during slop revetment work. **When placed in service:** It is not expected that this project will result in water pollution.
	3	Waste	✓	✓	**During work:** It is expected that there will be residual construction waste. **When placed in service:** Waste handling methods within the project site will be confirmed with a field survey.
	4	Soil contamination	—	—	**During work/When placed in service:** It is not expected that this project will result in soil contamination.
	5	Noise and Vibration	✓	—	**During work:** It is expected that noise and vibration will be generated by work vehicles. **When placed in service:** Negative impact due to this project is not expected.
	6	Ground subsidence	—	—	**During work/When placed in service:** Activities during this project that cause ground subsidence are not expected.
	7	Odor	—	—	**During work/When placed in service:** Activities during this project that cause bad odors are not expected (there are no processing related facilities).
	8	Bottom sediment	—	—	**During work/When placed in service:** Activities during this project that have an impact on bottom sediment are not expected.
Natural Environment	9	Protected areas	✓	—	**During work/When placed in service:** ECA zone surrounding site will be confirmed by field survey.
	10	Ecosystem	✓	—	**During work/When placed in service:** It is expected that a portion of the ordinary trees within the site will be cut (cost to be borne by Bangladesh side) for this project.
	11	Hydrological phenomena	—	—	**During work/When placed in service:** It is not expected that this project will have an impact on hydrological phenomena.
	12	Topography and Geographical features	✓	—	**During work:** It is expected that a portion of the river bank under the fish handling shed will be back filled during slope revetment work, changing the topography slightly due to grading. **When placed in service:** It is not expected that this project will have an impact on the topography and geographical features.

Environmental Item	No	Item	Rating		Reasons
			Before/during work	When placed in service	
Social Environment	13	Land Acquisition/Involuntary Resettlement	✓	—	**Before work:** Land acquisition is expected in the event of a temporary move outside the CXB FLC to a site that is not owned by the BFDC. Confirmation by field survey is needed. **When placed in service:** Since there will not be temporary resettlement, activities that require land acquisition or resettlement are not expected.
	14	Impact for Poor people	—	—	**Before work/When placed in service:** It is not expected that this project will have a negative impact on poor people.
	15	Impact for Indigenous and Ethnic people	—	—	**During work/When placed in service:** It is not expected that this project will have an impact on indigenous or ethnic people.
	16	Local Economy such as Employment and Livelihood	✓	✓	**During work/When placed in service:** It is expected that this project will have a positive impact by facilitating ongoing employment by the CXB FLC.
	17	Land Use and Utilization of Local Resources	—	—	**During work/When placed in service:** It is not expected that this project will have an impact on land use or utilization of local resources.
	18	Water usage	—	—	**During work/When placed in service:** An impact on water usage due to this work is not expected.
	19	Existing Social Infrastructures and Services	✓	✓	**Before work:** There is a mosque that was built with charitable contributions based on the wishes of the users of the facility. This is a religious facility, and since it is used every day, the possibility of demolishing it and changing to a temporary space should be confirmed through stakeholder meetings. **When placed in service:** If a new mosque will be secured, it is not expected that this project will have an impact when placed in service, but this will be confirmed in a field survey.
	20	Social Institutions such as Social Infrastructure and Local Decision - making Institutions	—	—	**During work/When placed in service:** It is not expected that there will be an impact on social infrastructure, local decision-making institutions or other social institutions.
	21	Misdistribution of Benefit and Damage	—	—	**During work/When placed in service:** This project consists of the reconstructing of the CXB FLC, and it is not expected that it will cause unfair damage or benefit to the regional economy.

Environmental Item	No	Item	Rating		Reasons
			Before/during work	When placed in service	
	22	Local Conflicts of Interest	—	—	**During work/When placed in service:** Since this project consists of the reconstructing of the CXB FLC operated by the government, local conflicts of interest are not expected.
	23	Cultural heritage	—	—	**During work/When placed in service:** It is not expected that this project will have an impact on cultural heritage sites.
	24	Landscape	—	—	**During work/When placed in service:** It is not expected that this project will have an impact on the landscape or scenery.
	25	Gender	✓	✓	**During work/When placed in service:** It is not expected that this project will have a negative impact on a gender, but a field survey will be conducted to confirm this is true.
	26	Right of Children 子どもの権利	—	—	**During work/When placed in service:** It is not expected that this project will have a negative impact on the rights of children.
	27	Hazards (risk) Infectious Diseases such as HIV/AIDS	✓	—	**During work:** It can be foreseen that the inflow of construction workers from other regions may bring infectious diseases. **When placed in service:** It is not expected that the implementation of this project will have a negative impact.
	28	Working environment, including safety for Labor	✓	✓	**During work:** It is expected that considerations are required for the working environment for the construction workers. **When placed in service:** It is expected that reconstructing of the CXB FLC will improve the working environment for facilities users (positive impact).
Others	29	Accidents	✓	—	**During work:** It can be foreseen that there may be accidents during construction work on land and the river. **When placed in service:** It is not expected that this project will have an impact on accidents.
	30	Cross-border impact and Climate change	—	—	**During work/When placed in service:** It is not expected that this project will have an impact on cross-border activity or climate change.

1.2.4.4. TOR for Survey of Environmental and Social Considerations

The TOR for the survey of environmental and social considerations are shown below.

Table 1-25 : TOR for Survey of Environmental and Social Considerations

Environmental Item	Survey Item	Survey Method
Examination of Alternatives	Possibility of temporary transfer to site other than CXB FLC	• Discussed with executing agency (BFDC headquarters), CXB FLC
Air pollution	Confirmation of environmental standards	• Survey of environmental standards • Collection of related documents
Water pollution	・Water quality of river ・Water quality of tube wells	• Survey of environmental standards • Collection of related documents • Water quality survey (River in front, existing well within CXB FLC)
Waste	Confirmation of Solid waste treatment	• Confirm waste treatment methods/system
Noise and Vibration	Confirmation of environmental standards	• Survey of environmental standards • Collection of related documents
Protected area	Confirmation of Ecologically Critical Area	• Collection of related documents • Interviews of Department of Environment
Ecosystem	Confirmation of trees inside the project site	• Field survey
Topography and Geographical Features	• Natural condition survey • Review of impact during work	• Field survey
Land Acquisition/Involuntary Resettlement	• Land ownership of CXB FLC • Confirm users of existing facilities • Confirm possibility of alternative site	• Collect cadastral maps and other related • • Field survey • Field survey
Local Economy such as Employment and Livelihood	• Confirm current status of CXB FLC	• Field survey
Existing Social Infrastructures and Services	• Usage status of mosque • Usage status of existing facility • Securing of space for landing and other activities during work	• Field survey. • Confirm intentions of executing agencies regarding possibility of changing usage space, and intentions of users by means of stakeholder meetings and interview surveys.
Gender	• Confirm usage status of CXB FLC by women	• Confirm working situation of women at CXB FLC
Hazards (risk) Infectious Diseases such as HIV/AIDS	• Current status of infectious diseases	• Collection of related documents
Working Environment	• Work environment for workers at CXB FLC	• Field survey
Accidents	• CXB FLC facility usage status • Status of boat traffic on river	• Field survey
Implementation of the local stakeholder meetings	① Scoping stage ② Draft outline design report stage	① Group/individual interviews ② Group interviews

1.2.4.5. Results of the Survey of Environmental and Social Considerations

The results of the survey, based on the above TOR, are shown below.

Table 1-26 : Results of the Survey of Environmental and Social Considerations

Environmental Item	Results
Examination of Alternatives	It is stated in the minutes of discussions that the executing agency (BFDC headquarters), CXB FLC and facility users do not intend to temporarily transfer to another alternative area during construction work. The CXB FLC site will be divided into a construction area and fish landing area, construction work will be performed in the reconstruction area, allowing fish landing activities to continue in the fish landing area. In the event the project is not implemented, collapses will proceed in the handling area on the north side, resulting in a continuation of the dangerous situation.
Air pollution	It was confirmed that there is a low possibility of a rapid increase in large trucks into the CXB FLC due to the time limit for the entrance of large trucks into the city (can enter city after 10:00 at night) and controls on the number of trucks that can enter the CXB FLC. Furthermore, it is expected that public notice of construction work plans when a high volume of dust will generate due to work and mitigation measures (sprinkling of water, etc.) will be needed since there are shops and residences in the surrounding area.
Water pollution	• Water pollution of the Bakkhali River due to domestic drainage, factory effluent and garbage disposal from city areas, as well as other causes was confirmed from existing documents. A septic tank system will be installed by this project. • It is expected that a portion of the river will be temporarily muddied during slope revetment work.
Waste	A waste disposal system needs to be established for waste generated within the site in cooperation with the municipality office.
Noise and Vibration	Measures to mitigate noise/vibration caused by work vehicles is needed during work since there are shops and residences in the surrounding area.
Protected area	• The CXB FLC is within an ECA zone designed by BECA (Bangladesh Environmental Conservation Act), but CXB FLC activities are not included in activities prohibited in an ECA. Therefore, it was confirmed that additional permission from the Department of Environment does not need to be obtained. In addition, no fauna, flora or ecosystems requiring protection were found in the CXB FLC or adjacent areas. • There are mangroves at the mouth of the Bakkhali River (Naniar Char Upazila) (mainly *Avicennia* sp.*1), but this is approximately 3km away from CXB FLC, and since no cutting or other such direct work in the mangroves is required for this project, it is expected that there will not be significant impact.
Ecosystem	Ordinary trees within the site are used to create shady areas. It is expected that the Bangladesh side will cover the cost of cutting trees in the reconstruction area.
Topography and Geographical Features	• Since large-scale filling or excavation will not be performed, significant changes to the topography and geographical features will not be made. Furthermore, a portion of the topography will be changed when grading is performed to align the shape of the slope

Environmental Item	Results
	revetment with adjacent areas to the south/north, although this will not be significant.
Land Acquisition/Involuntary Resettlement	Land acquisition is not expected since construction will be performed within the CXB FLC, without temporarily transferring to another alternative area during construction work. There will be no resettlement since there are no residents living on the site.
Local Economy such as Employment and Livelihood	Employment will continue during construction work for this project since facility users will continue to conduct fish landing activities within the CXB FLC. After it is placed in service, new facilities will be secured by this project, contributing to the local economy.
Existing Social Infrastructures and Services	The existing mosque located in the reconstruction area was built with contributions from the facility users of CXB FLC. Prayer time is an important part of daily life for Muslims. It was confirmed that BFDC will secure a temporary mosque during the construction work due to strong wishes by the users of the mosque as a result of stakeholder meetings that were implemented for the mosque management committee and distributors etc. A new mosque will be secured by Bangladesh side at their own budget after completion of the construction of the Project.
Gender	It was not expected that women would work at the site when the CXB FLC was opened, and there are no toilets, prayer space or other such facilities for women. Gender considerations are needed for the plan for the new facility.
Hazards (risk) Infectious Diseases such as HIV/AIDS	The rate of infection with HIV is currently low, but infectious disease measures are needed during the project period. The use of local workers needs to be considered.
Working Environment	Considerations for the working environment for the construction workers are needed.
Accidents	• Since the reconstruction area and fish landing area coexist within the same site, a physical fence should be provided to prevent the entrance of persons other than construction workers into the working area, and personnel should be reminded to observe this regulation. • Since boat traffic on the river will continue during slope revetment work, the range of work shall be clearly separated in order to prevent accidents. • The wearing of work gloves, work shoes, helmets and other basic safety management shall be thoroughly enforced to secure the safety of workers.

*1: Temporal and spatial distribution of fish and shrimp assemblage in the Bakkhali river estuary of Bangladesh in relation to some water quality parameters, Md. Rashed-Un-Nabi and others, 2011

1.2.5. Environmental Impact Assessment

According to the field survey of environmental and social considerations in July to August 2022, the impacts of the Project are analyzed as shown below.

Table 1-27 : Impact assessment

Class	No	Environmental Item	Impact assessment during scoping		Impact assessment based on survey results		Reasons for assessment
			Before/ during work	When placed in service	Before/ during work		
Pollution	1	Air pollution	✓	✓	B-	D	**During work:** It is expected that dust will be generated by construction work and work vehicles. **When placed in service:** It is expected that the number of trucks will increase as a result of higher fish landing efficiency. However, there are limits on trucks entering the city (can only enter after 10:00 at night), and when CXB FLC manages trucks entering, a large increase in the number of trucks is not foreseen.
	2	Water pollution	✓	—	B-	N/A	**During work:** It is expected that a portion of the river will be temporarily muddied during slope revetment work for this project. **When placed in service:** New septic tank system will be used to treat waste water before discharge instead of directly discharging it into the river.
	3	Waste	✓	✓	B-	D	**During work:** It is expected that there will be construction waste. **When placed in service:** A waste collection system will be established in cooperation with the municipality office for the waste generated within the facility.
	4	Soil contamination	—	—	N/A	N/A	**During work/When placed in service:** It is not expected that this project will result in soil contamination.

Class	No	Environmental Item	Impact assessment during scoping		Impact assessment based on survey results		Reasons for assessment
			Before/ during work	When placed in service	Before/ during work		
	5	Noise and Vibration	✓	—	B-	D	**During work:** It is expected that the use of construction machines and work vehicle traffic will create noise. **When placed in service:** Regarding the increase in trucks due to higher fish landing efficiency, there are limits on trucks entering the city (can only enter after 10:00 at night). If the CXB FLC continues to manage entrance of trucks into the site, a large increase is not expected.
	6	Ground subsidence	—	—	N/A	N/A	**During work/When placed in service:** It is not expected that this project will result in ground subsidence.
	7	Odor	—	—	N/A	N/A	**During work/When placed in service:** It is not expected that this project will result in the generation of bad odors.
	8	Bottom sediment	—	—	N/A	N/A	**During work/After placed in service:** It is not expected that this project will have impact on bottom sediment.
Natural environment	9	Protected areas	✓	—	D	N/A	**During work/When placed in service:** The CXB FLC is within an ECA zone, but CXB FLC activities are not included in activities prohibited in an ECA. Therefore, it was confirmed that additional permission related to an ECA does not need to be obtained. No **ecosystems** requiring protection were found in the CXB FLC or adjacent areas. The mangroves in Naniar Char at the mouth of the Bakkhali River are an ECA, but this is approximately 3km downstream from CXB FLC, and it is not expected this project will have a direct impact.

Class	No	Environmental Item	Impact assessment during scoping		Impact assessment based on survey results		Reasons for assessment
			Before/ during work	When placed in service	Before/ during work		
	10	Ecosystem	✓	—	D	N/A	**Before work:** It is expected that a portion of ordinary trees within the site are used will be cut to secure a safe working area, and that the counterpart will cover the cost, but this will not have an impact on the ecosystem. **When placed in service:** No impact from this project is expected.
	11	Hydrological phenomena	—	—	N/A	N/A	**During work/When placed in service:** It is not expected that this project has the potential to change hydrological phenomena.
	12	Topography and Geographical features	✓	—	C-	N/A	**During work/When placed in service:** Large-scale excavation is not expected during this project, but a portion of the topography will be modified during slope revetment work, changing the topography slightly due to grading.
Social Environment	13	Land Acquisition/ Involuntary Resettlement	✓	—	D	N/A	**Before work/When placed in service:** It is not expected that this project will involve land acquisition or resettlement.
	14	Impact for Poor people	—	—	N/A	N/A	**Before work/When placed in service:** It is not expected that activities will have a negative impact on poor people.
	15	Impact for Indigenous and Ethnic people	—	—	N/A	N/A	**During work/When placed in service:** It is not expected that activities will have a negative impact on indigenous or ethnic people.
	16	Local Economy such as Employment and Livelihood	✓	✓	B+	B+	**During work:** It is expected continued fish landing activities will facilitate ongoing employment by the CXB FLC. **When placed in service:** It is expected that this project will facilitate ongoing employment by the CXB FLC.

Class	No	Environmental Item	Impact assessment during scoping		Impact assessment based on survey results		Reasons for assessment
			Before/ during work	When placed in service	Before/ during work		
	17	Land Use and Utilization of Local Resources	—	—	N/A	N/A	**During work/When placed in service:** This project consists of the reconstruction of the CXB FLC, it is not expected that this project will have an impact on land use or utilization of local resources.
	18	Water usage	—	—	N/A	N/A	**During work/When placed in service:** An impact on water usage due to this work is not expected.
	19	Existing Social Infrastructures and Services	✓	✓	D	D	**During work:** BFDC will provide temporary mosque during the project period. **When placed in service:** No impact is expected since a new mosque will be secured by Bangladesh side at their own budget after completion of the construction of the Project.
	20	Social Institutions such as Social Infrastructure and Local Decision - making Institutions	—	—	N/A	N/A	**During work/When placed in service:** It is not expected that there will be an impact on social infrastructure, local decision-making institutions or other social institutions.
	21	Misdistribution of Benefit and Damage	—	—	N/A	N/A	**During work/When placed in service:** This project consists of the construction of the CXB FLC, and it is not expected that it will cause unfair damage or benefit to the regional economy.
	22	Local Conflicts of Interest	—	—	N/A	N/A	**During work/When placed in service:** Since this project consists of the construction of the CXB FLC, local conflicts of interest are not expected.
	23	Cultural heritage	—	—	N/A	N/A	**During work/When placed in service:** There are no cultural heritage sites in the project site or surrounding area.
	24	Landscape	—	—	N/A	N/A	**During work/When placed in service:** It is not expected that this project will have an impact on the landscape or scenery.

Class	No	Environmental Item	Impact assessment during scoping		Impact assessment based on survey results		Reasons for assessment
			Before/ during work	When placed in service	Before/ during work		
	25	Gender	✓	✓	D	B+	**During work:** It is not expected that this project will have a negative impact on a gender. **When placed in service:** It is expected that this project will create a facility that is easy to use for women due to the building of toilets for women and other gender considerations.
	26	Right of Children	–	–	N/A	N/A	**During work/When placed in service:** It is not expected that this project will have a negative impact on the rights of children since no children work on the project site.
	27	Hazards (risk) Infectious Diseases such as HIV/AIDS	✓	–	B-	N/A	**During work:** It can be foreseen that the inflow of workers from regions outside Cox's Bazar may bring infectious diseases. **When placed in service:** It is not expected that this project will have an impact on infectious diseases.
	28	Working environment, including safety for Labor	✓	✓	B-	B+	**During work:** Considerations for the working environment for the construction workers are needed. **When placed in service:** It is expected that reconstruction of the CXB FLC will improve the working environment for fish landing/ packing work by users of the facility (positive impact).
Other	29	Accidents	✓	–	B-	N/A	**During work:** It can be foreseen that there may be accidents during work on the site and the river. **When placed in service:** An increase in trucks due to higher fish landing efficiency is expected, but there are limits on trucks entering the city (can only enter after 10:00 at night), so an increase in accidents is not foreseen since the time on the roads differ from other vehicles.

Class	No	Environmental Item	Impact assessment during scoping		Impact assessment based on survey results		Reasons for assessment
			Before/ during work	When placed in service	Before/ during work		
	30	Cross-border impact and Climate change	－	－	N/A	N/A	**During work/When placed in service:** It is not expected that this project will have an impact on cross-border activity or climate change.

Note: Evaluation categories:

A+/-: Serious positive/negative impacts is expected

B+/-: Some positive/negative impact is expected

C+/-: Extent of positive/negative impact is unknown (Examination is needed. Impacts may become clear as study progresses.)

D+/-: No impact is expected. IEE/EIA is not necessary.

N/A: An impact assessment will not be performed since the project was classified as category D at the scoping stage.

1.2.6. Mitigation measure and cost

The mitigation measures for the expected impact items have been compiled in the table below from discussions with local related organizations and analysis of the related documents.

Table 1-28 : Mitigation measure and cost

No.	Environmental Item	Mitigation	Implementation agency	Responsible agency	Cost
【Construction phase】					
1	Air pollution (general dust)	Water will be sprinkled as a dust mitigation measure. A work plan will be informed for demolition work that creates a large volume of dust in the surrounding area.	Contractor	BFDC	Water resource within CXB FLC will be used.
2	Water pollution	A membrane or other device will be installed to prevent the dispersion of muddy water.	Contractor	BFDC	Included in construction costs.
3	Waste	The waste disposal method will be clarified before work is started. The contractor will dispose of waste with	Contractor	BFDC	Included in construction costs.

No.	Environmental Item	Mitigation	Implementation agency	Responsible agency	Cost
		the verified method.			
		After placed in service, a waste collection system will be established with the municipality office.	CXB FLC	BFDC	－
4	Noise and Vibration	The time and plan for the construction work will be posted and other means will be used to notify area residents. The project plan shall be within the time for which resident have been informed.	Contractor	BFDC	Included in construction costs.
5	Topography and Geographical features	A membrane or other device will be installed to prevent the dispersion of muddy water.	Contractor	BFDC	Included in construction costs.
6	Infectious Diseases such as HIV/AIDS	Posters will be put up and other enlightenment activities will be performed for construction workers.	Contractor	BFDC	Included in construction costs.
7	Working environment (including safety for Labor)	A suitable working environment (work/break time, break area, etc.) will be secured for construction workers.	Contractor	BFDC	Included in construction costs.
8	Accidents	• The reconstruction area and fish landing area shall be clearly divided with safety steel sheets that are effective to ensure safety. • Signs indicating "No Entry" areas and night lights will be installed. • Traffic control personnel will be posted during times work vehicles enter/exit site. • The wearing of work gloves, work shoes, helmets and other	Contractor	BFDC	Included in construction costs.

No.	Environmental Item	Mitigation	Implementation agency	Responsible agency	Cost
		basic safety management shall be thoroughly enforced. • The work area shall be divided so that small boats other than those related to slope revetment work do not enter.			
[When placed in service]					
1	Water pollution	Catch basin boxes will be provided to remove solids (scales, etc.) from waste water from the fish handling area before it is discharged into the river. When fish are cut up, the area shall be separated, with waste water cleaned in a septic tank before it is discharged into the river.	Contractor (Catch basin will be planned in the project)	—	Included in construction costs.

1.2.7. Monitoring Plan (Draft)

The Monitoring Plan (Draft) is shown in the table below.

Table 1-29 : Monitoring Plan (Draft)

Monitoring item	Confirmation item	Location	Frequency	Responsible agency	Inspection agency	Cost
[During work]						
Air pollution	Number of complaints about dust	Reconstruction area	Once/month	Contractor	BFDC	Included in construction costs.
Water pollution	Muddy water (measured with transparency meter)	Slope revetment work area	Once/month during slope revetment work	Contractor	BFDC	Included in construction costs.
	Set within Bangladesh drinking water inspection items	New well boring location	Once when new boring is performed	Contractor	BFDC	Included in construction costs.
Waste	Brought to specified location (visual)	Specified location	Once/month	Contractor	BFDC	Included in construction costs.
Noise and Vibration	Measured with noise	Reconstruction area	Once/month	Contractor	BFDC	Included in construction

Monitoring item	Confirmation item	Location	Frequency	Responsible agency	Inspection agency	Cost
	meter, Number of complaints verified					costs.
Infectious Diseases such as HIV/AIDS	Health monitoring	—	Before work	Contractor	-	Included in construction costs.
Working environment, including safety for Labor	Labor time management of construction workers	—	During work period	Contractor	-	Included in construction costs.
Accidents	Checking of safety gear	—	Before work	Contractor	BFDC	Included in construction costs.
	Posting of signs with work plans	Entrance	Placed before work is started	Contractor	BFDC	Included in construction costs.
[After placed in service]						
Water pollution	Waste water discharge into river (pH,SS, COD, T-P, No. of Coliform)	1 location near discharge, 1 upstream	Twice/year (rainy season /dry season) (To be done for a year after placed in service)	CXB FLC	BFDC	BFDC headquarters
Waste	Bring to specified location	Specified location inside CXB FLC	Once/month (To be done for 6 months after placed in service)	CXB FLC	BFDC	BFDC headquarters

The monitoring system shall be implemented by the contractor during the project, and the contractor shall report the results to the CXB FLC and to the full-time resident engineer of the consultant. The frequency shall be as indicated in the monitoring plan (draft). In addition, when there is an abnormality in the monitoring results, a report shall be made in the monthly report.

The cost of monitoring after the delivery of the facilities to Bangladesh side shall be covered by the BFDC headquarters, and the CXB FLC shall take water samples, bring them to a laboratory, and receive the results. The CXB FLC manager shall report the inspection results to the BFDC headquarters. The frequency shall be as indicated in the monitoring plan (draft).

1.2.7.1. Results of the meetings with local stakeholders of the Project

(1) Identification of local stakeholders of the Project

The stakeholders of the Project are the users of CXB FLC, such as fishing boat owners, crews, fish traders, various workers, janitors of public toilets, shop owners, truck drivers, mosque committees, etc., and women.

（2） Results of the meetings and interview surveys with local stakeholders

The stakeholders' meeting were held in order to ,1) confirm the wishes of the stakeholders concerning the work space during the construction period in the CXB FLC, changing of the space used as temporary mosque space and other issues, and 2) obtain feedback for the project. The meetings were held as the following table. Since the users of the facility have various occupations, six stakeholder meetings were held for each group. Publicity of the stakeholder meetings was performed to workers within CXB FLC, by local surveyors and persons involved with the CXB FLC.

Table 1-30 : Status of Stakeholder Meetings

No	Date	Occupation of the attendants	No. of attendants
1	2022/7/26	Fish trader	8
2	2022/8/1	User of CXB FLC	15
3	2022/8/2	Crew of artisanal fishing boat	23
4	2022/8/8	Boat owner	5
5	2022/8/9	Truck drivers association	14
6	2022/8/11	Mosque committee, fish trader	14

The number of attendants does not include JICA mission members and local survey staff.

The CXB FLC has an existing fish handling area, parking lot, fish trader's office, mosque, shops, public toilet, BFDC administration buildings, BFDC staff residential buildings and other facilities. Space is allocated for the fish trader's office, canteen and public toilet based on certain conditions agreed upon between the BFDC and users, and usage fees are paid.

In addition to the holding of stakeholder meetings, individual interviews of users who rent space from the CXB FLC, as well as interviews of fishing companies, shops, public toilet users, female users of facilities (retail personnel, consumers) were conducted.

（3） Suggestions and feedback for the Project from local stakeholders

As a result of the stakeholder meetings and individual interview surveys of stakeholders, including all the space users, they agreed to change the work spaces inside CXB FLC and agreed to the proposed project for their own future benefit and also for the sake of development of the country. The suggestions from stakeholders are as follows.

Table 1-31 : Suggestions and feedback for the Project from local stakeholders

Occupation of the Attendants	Suggestions and feedback for the Project
Mosque committee and fish trader	・Agreed to relocation of the mosque but want BFDC to construct a temporary mosque so they can continue praying during the construction period. ・They also want an independent new mosque in the CXB FLC.

Occupation of the Attendants	Suggestions and feedback for the Project
Fish trader	The rented space is not enough. Provide a minimum 12' X 12' space in a room with adequate facilities.
	Provide a common chilling facility with small independent compartments for periodical preservation of fish;
	Provide a potable water supply for drinking, washing and cleaning activities; and the necessary nos. of hose-pipe points with water connection for cleaning and also for firefighting;
	Provide sufficient toilets and showers in the new fish landing facility.
	Provide a suitable rest room or space for the workers to rest.
	Provide a temporary auction shed with a tent and brick soling floor coated with cement to enable business to continue.
Various workers	Frequent accidents, hand and leg injuries; hands cut off by the crushing machine, back injuries due to slipping from the boat and falling in the river during fish unloading. Provide training and awareness campaign on safety at work for the workers to avoid accidents. Provide hand gloves, gum boots, and aprons for the workers to avoid occupational health hazards. Provide separate walkways for the workers who unload fish catches and the workers who load ice onto the fishing boats.
	Provide a dormitory facility for workers from outside Cox's Bazar District which will help poor, low paid workers to maintain their livelihood;
	Enlisted workers at CXB FLC should have some sort of incentives or allowances like the fishers receive from the government during fishing ban periods.
	Provide separate fish packaging space or area to avoid unnecessary crowding; installation of CCTV camera monitoring system can also help control poaching.
Crew of artisanal fishing boat	No specific police station for skippers to make complaints about accidents. Need specific police station or instructions for the skippers due to ambiguity of jurisdiction of the law enforcing agency.
	ID card or license for the skippers is necessary.
	Some anchoring facility like a jetty or pontoon near CXB FLC should be demarcated for fishing boats that need emergency engine repair service.
	Need fishing net and gear repair yard for the fishing boats.
Truck driver association	Provide parking space for at least 8-10 vehicles/trucks in CXB FLC.
	Provide some resting places with toilets and showers for the truck drivers.
	Provide common canteen facilities.
Boat owner association	Some pontoons/jetties are required for easy berthing and quick unloading of fish catch within shortest possible time.
	Provide some modern communication devices like RADAR system so that the skippers of fishing boats at sea can communicate.
	Provide office space in the new facility for the boat owners association.
	Facilitate dredging work at the mouth of Bakkhali River opposite existing Nazirertek fish landing yard by BIWTA.
Women (Retailers, customers)	Some spaces such as toilets, mosque and rest space for women only.

(4) Actions of BFDC on the suggestions and feedback from local stakeholders

Strong requests were made by users during the stakeholder meetings to secure working space and temporary mosque space for the facility users during the construction work. The BFDC confirmed in the minutes that the BFDC will be responsible for the cost and work needed to perform the preparations.

1.2.7.2. Complaint Handling Mechanism

The CXB FLC will receive complaints related to the project, and make reports to BFDC headquarters.

1.2.7.3. JICA Environmental Checklist

JICA Environmental Checklist (Fishery) is attached in appendix of the Minutes of Discussion.

1.2.8. Gender Considerations

(1) Status of women working at CXB FLC

An overview of the work content at the CXB FLC is described below.

1) Landing/packing/shipment work for hilsa and other main fish (mainly to Dhaka) and fish to be processed (mainly to Chattogram)
2) Landing/packing/shipment work for fish shipped within Cox's Bazar district
3) Sales of fresh fish to local buyers

The field survey conducted did not find any women working in the areas described in 1) and 3) above. An interview survey within the CXB FLC found that there were women vendors working in area 2). There were 4 women that were interviewed during the five-day period between July 31 and August 4, 2022[14]. The breakdown consists of 1 woman who lives in Ramu Upazila adjoining Cox's Bazar Sadar Upazila who comes to purchase fish from fishing boats landing in CXB FLC and shops in CXB FLC to sell in neighboring markets, and 3 women who live in Khuruskul and Somiti Para on the coast (approx. 3km from CXB FLC) who sell fresh fish door-to-door. In addition, CXB FLC staff informed that there is another woman who comes to purchase fish 3 times a week. The fish handling shed that was newly built by the BFDC in January 2022 handles a lot of small fish, and it was confirmed that there are a number of women engaging in cleaning and sorting works.

(2) Female consumers, university students and other people who visit CXB FLC

The number of women who visit the CXB FLC as consumers is larger than the number of

[14] Almost no fish were landed from August 5 – 15, 2022 due to stormy weather, and there was very little work being done inside CXB FLC.

women who work in fish related jobs, with a total of 25 female consumers verified when a count was taken at the gate for 15 minutes in the morning on a weekday. It was confirmed that quite a few women come on foot or by rickshaw to buy fish 2 – 3 times per week. In addition, it was clarified that many university professors and students (including women) visit the facility for their study.

(3) Gender considerations related to project implementation

It was not expected that women would work at the facility when the CXB FLC was opened, and there is no space for women only. There is a public toilet, but according to the janitor of the toilet, it is only for men and cannot be used by women.

During this field survey, requests were received during interviews of female users to provide toilets for women, praying space, rest area and sales space for women that shall be separate from the spaces for men. The reason for this is that space for men and women shall be separated for Muslims. Since the percentage of the Muslim population of Cox's Bazar Sadar Upazila is 92%, so a high percentage of the people who come to the CXB FLC are Muslim.

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CHAPTER 2. Outline Design of the project

2.1. Design policy

2.1.1. Facility sanitation standards

The key issues for CXB FLC are to develop facilities that secure the hygienic handling of fresh fish and to establish and institute hygienic handling mechanisms. In designing the facility, Level 1 of the *Hygiene Standards for Fishing Ports* set out by the Japanese Fisheries Agency is referred to as the project goal to meet.

Hygiene Standards for Fishing Ports is established to ensure that fishing ports (landing sites)—the starting point of the supply chain of fishery products stretches from landing to consumption—can supply safe fishery products. Level 1 of the standards, which all fishing ports that engage in the landing of fishery products shall be fulfilled, is defined as "fishing ports where absolutely necessary measures are taken against hazards, in order to prevent contamination with food-poisoning bacteria."

Hygiene Standards for Fishing Ports is set out from three viewpoints: water environment, fishery product quality control, and working environment. The following is a list of evaluation items that can be adapted to the project under the evaluation criteria of Level 1 of *Hygiene Standards for Fishing Ports.*

Table 2-1 : Checklist for achieving Level 1 of *Hygiene Standards for Fishing Ports*

Item			Level 1
1. Water environment (water/ice supply, wastewater treatment) items	1.1 Berthing environment items	Conservation of berthing environments, proper treatment of wastewater	To prevent inflow of refuse and wastewater ・Wastewater management from landing berth and handling space (construction of drain ditch)
	1.2 Water supply items	Appropriate use of washing water to ensure good working environments	As water used for cleaning fishing gears and aprons for securing good working environment ・Use of potable water
		Appropriate use of washing water for facilities, equipment, and the like Appropriate use of water for fish and shellfish	As water used for washing sorting tables, fish containers, and other facilities and apparatus that come into contact with fish and shellfish, and for cleaning and cooling fish and shellfish during handling and storage: ・Use of potable water
	1.3 Ice supply items	Use of clean ice	・Use of potable water
2. Fish product quality control items	Quality control of fish products through temperature control and the like	Temperature control	As fish product temperature control: Temperature control with clean ice (See 1.3) (use ice)
			To prevent exposure to direct sunlight: Install light shielding tarps and the like
		Time management, damage prevention	Ensure optimal working configurations to reduce handling time and prevent damage to fish and shellfish
3. Work environment (facility layout, landing to shipping	3.1 Items for landing and handling	Proper disposal of waste and the like	・Separate waste from fish and shellfish ・Rigorously prevent waste exposure
		Wind proofing, rainproofing, and dustproofing measures	Use tarps etc .for outdoors to protect fish from exposure to the elements
		Measures to prevent	Regularly wash feces, feathers, feed

Item			Level 1
area) items		invasion by birds and animals	residues, and the like from the floors of aprons, fish handling area, and the like
		Measures against vehicle intrusion	Control working vehicle flow lines (prevent intrusion into landing and handling areas during working hours, notify relevant people)
		Maintaining the cleanliness of landing and handling environments	・Ensure adequate ventilation and illuminance ・Control landing and handling flow lines (determine and control the main flow lines) ・Thoroughly wash containers, floors, and the like using clean water (See 1.2) ・Properly manage wastewater after washing containers, floors, and the like ・Rigorously enforce the prohibition against washing and storing fishing gear and the like on landing piers
	3.2 Loading and transport items	Maintaining the cleanliness of loading and transport environments	・Thoroughly clean containers, equipment, and the like using clean water (See 1.2) ・Separate loading and transport areas from landing and handling areas
		Maintaining the cleanliness of transport vehicles	Clean transport vehicles in fish handling area
	3.3 Items for maintaining the cleanliness of relevant people	Managing people	・Thorough handwashing ・Encourage clean clothing ・Separate smoking areas
		Management of toilets and the like	Sanitary layout of toilets

Source : *Hygiene Standards for Fishing Ports*

2.1.2. Basic policy for all facilities

(1) Basic policy

1) Facility design policy

Since landing activities must continue during construction period, the site will be divided by the road within the CXB FLC, with the construction area to the north and the fish landing area to the south; the plan locates the project facilities in this construction area. The project facilities comprise a revetment, pontoons, gangways, and other civil engineering facilities (e.g. drainage, parking lot) and a total of seven buildings: a fish handling building, a trader's office building (trader offices and a rest area with toilets for women, a residential building (two-stories) , public toilets, a gate post / electrical room, a toll station, and a garbage depot.

2) Site selection

Given the impossibility of site expansion, no substitute site, and factors such as the aging of existing facilities, it is difficult to expand the facility with existing facilities intact. Therefore, as a result of discussions with the counterpart for securing landing activities during the construction period, the plan calls for CXB FLC to be divided into a construction area and a landing area, with the existing facilities removed and the

land cleared at the counterpart's expense, and the necessary facilities will be redeveloped.

3) Scale plan

An appropriate scale with the current numbers of boats, sellers and users and volume of fresh fish handled in CXB FLC at peak times shall be applied for design conditions.

(2) Policy for natural environmental conditions

Cox's Bazar is in a tropical monsoon climate zone, with a mean temperature of 25°C and humidity in excess of 70%; the region is hot and humid throughout the year. The rainy season lasts from mid-May to mid-October, with monthly precipitation reaching 900 mm from June to August, and annual precipitation exceeds 4,000 mm. Since flooding is foreseen in the area where the site is located, the revetment height and facility floor level are set to ensure safety even at floods.

Although the site is roughly 3 km away from the mouth of the river, building materials will be selected with consideration for salt damage because the river water contains salt.

For cyclone, measures shall be taken to ensure safety by limiting damage to buildings.

(3) Policy for socioeconomic conditions

Consideration will also be taken to reduce negative gender and environmental impacts to accommodate female users of the facilities, although number of them is small.

Given that Cox's Bazar is a major tourist destination of Bangladesh, the site's proximity to Cox's Bazar International Airport, and the roaring trade at the landing site, the facilities are designed to meet tourism demand.

(4) Policy for construction/procurement conditions

The facilities design under the project shall comply with the technical standards and building permit system set out in Bangladesh National Building Code 2020 (herein after referred to as "BNBC 2020") under the Building Construction Act (herein after referred to as "BCA") of Bangladesh.

Because the project is funded by grant aid from Japan, efforts will be made to shorten the construction period and strictly adhere to the schedule while taking steps to reduce costs, in consideration of the structure, materials, equipment, and construction method appropriate for the construction and site conditions of the project site.

(5) Policy on utilization of local contractors

BNBC 2020 requires that building permits be obtained from the Building Official prior to the start of construction, and that a local qualified engineer apply for building permit and co-work for site management during the construction period. The project will be carried out in collaboration with local qualified architects.

(6) Policy on utilization of Japanese companies

For construction and procurement under the project, to ensure that the project is carried out smoothly, as there are several construction companies and trading companies of Japan with ripe experience in the region; the policy is to take advantage of these experiences via pre-qualification evaluation prior to the bidding.

(7) Policy for operation and maintenance

The project facilities shall be simple, robust, easy to maintain after completion, and have low management costs. Revenue from landing sites is an important source of cash income for many facility users; therefore, steps will be taken to allow the users of CXB FLC to continue operating at low fees.

In the process of selecting facilities and equipment, the policy is to reduce the financial burden of operation and maintenance by selecting items easy to procure locally and do not require sophisticated management.

(8) Policy for grades of facilities and equipment

The basic policy is to select facilities and equipment easy to maintain on a daily basis, durable, and made of materials that are easy to procure locally; grades are assigned in line with the similar facilities. Additionally, in the process of considering materials and construction methods, consideration will be given to local construction capabilities, procurement conditions, reduction of negative effects on the environment, and the like.

(9) Policy for construction methods/procurement methods, construction schedules

The policy is to apply the construction method as simple as possible, mainly using methods commonly used in the region. Because multiple facilities will be constructed, the project plan will include efficient divisions and procedures for construction work.

The construction period is planned in consideration of hot, rainy, humid weather and religious events (e.g. time off for Ramadan and Eid). When considering imports in the process of procuring industrial products, the procurement and transportation periods and the suppliers will be sufficiently considered.

The project will be carried out after formulating a work process that accounts for various risks and clearly stating the respective responsibilities of Bangladesh and

Japan and the estimated costs and deadline for implementation thereof, and with monitoring on a regular basis.

(10) Policy for construction supervision

To facilitate the construction work, the consultant will maintain close contact with Bangladesh officials and JICA from the detailed design phase to the procurement and construction phases with the aim of completing the facilities without delay according to the implementation schedule.

To facilitate the construction, the consultant will hold meetings with the contractor and relevant people on the Bangladesh side and provide appropriate recommendations and guidance. Additionally, to carry out the work indicated in the construction supervision plan properly, the Japanese designers and engineers will participate in regular meetings via online conferencing and other means as appropriate. As for the construction supervision system, a Japanese full-time resident engineer(s) will be assigned during the construction period, and a structure engineer and specialists will be assigned for spot supervision for structures, facilities, and other key supervision points as well as interim and final inspections.

(11) Policies for safety measures

Given that the site is confined, the surrounding area is residential, and the construction work must be performed without disrupting landing activities, safety considerations are a top priority. Specific safety measures to be taken include erecting temporary partition walls and the like to ensure safety near the site entrance on the west side and at the boundary between the landing area and the construction area, where landing workers and construction workers can cross paths.

A safety plan for construction work will be formulated in accordance with the JICA publication *The Guidance for the Management of Safety for Construction Works in Japanese ODA projects.* During the construction period, a cycle of planning, implementation, verification, and improvement will be implemented, with ongoing reviews and improvements as needed.

Efforts will be made to obtain Overseas Travel Safety Information from the Japanese Ministry of Foreign Affairs and the latest safety and security information about Bangladesh and neighboring countries from the government to Bangladesh, and to reflect such information in safety measures as needed.

Up-to-date information on the status of, and preventive measures against COVID-19 and other infectious diseases will also be gathered and used to guide necessary infection control measures. For emergency response, an emergency contact system with the JICA Office and the Embassy of Japan will be maintained.

2.2. Basic plan

2.2.1. Site and facility layout

1) Shape of the site, and surrounding environment

As shown on the site diagram and GF floor plan, the site is nearly rectangular in shape—measuring roughly 80–100 m east to west and 120 m north to south, with an area of about 11,200 m² (6,800 m² construction area, 3,750 m² fish landing area, and 650 m² of paved road within the CXB FLC)—and is located in a developed area of Cox's Bazar Sadar. The site abuts the Bakkahali River to the east and a road to the west, and a paved road through the site connects the road to the revetment. The neighborhoods to the north and south are residential. The site is mostly flat, although there is a slight slope toward the river.

2) Composition of project facilities by sector

As a result of field surveys, the counterpart's requests, and discussions with the counterpart, the facilities to be constructed under the project are broadly classified into four sectors. The figure below shows the composition of the facilities by sector.

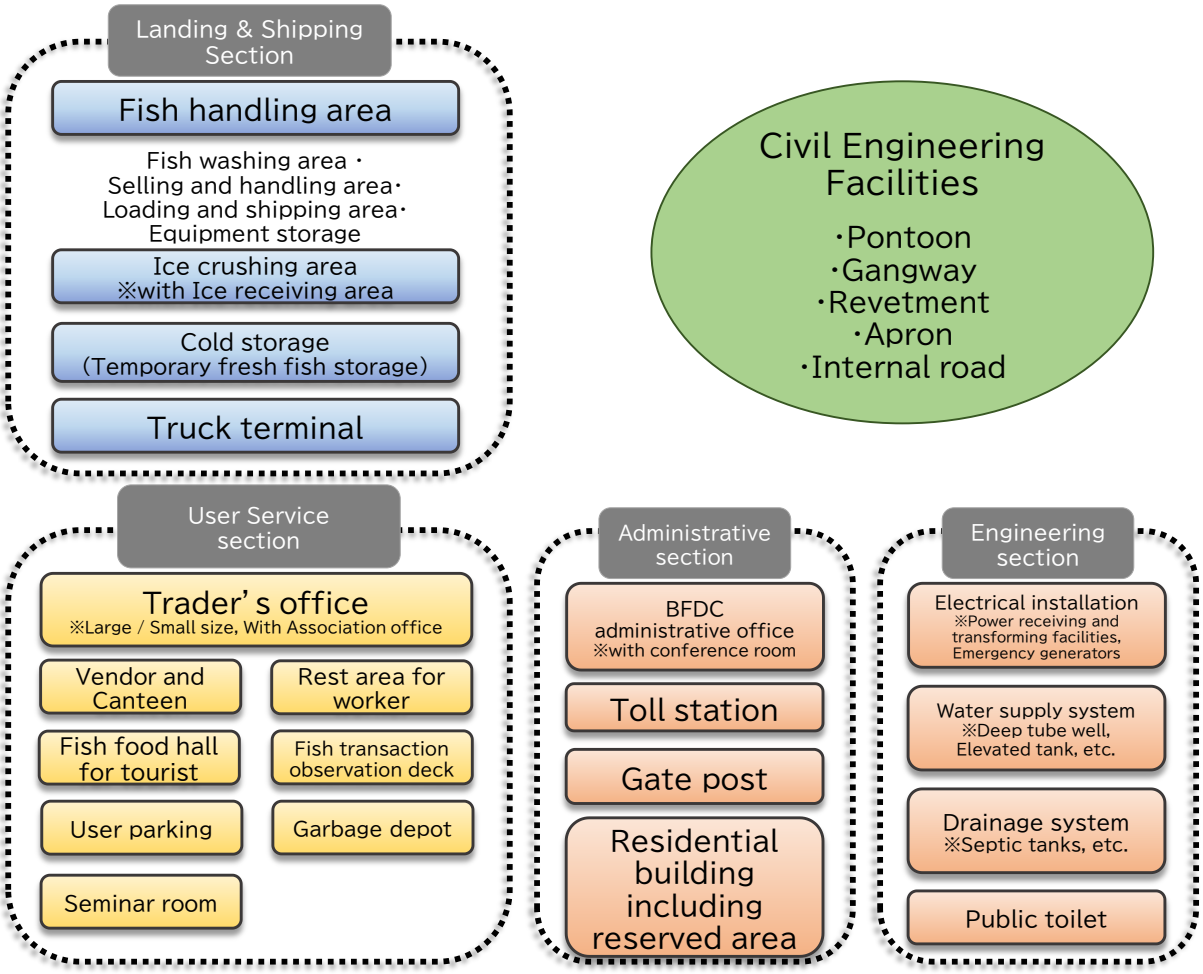


Figure 2-1 : Composition of project facilities by sector

3) Facility layout and flow line plans

As a result of field surveys and discussions with the counterpart, the layout of the facilities is set as follows.

◆Since the functions required for each facility differ by sector, among them landing and shipping, user services, and administrative, of the buildings will be distributed or consolidated according to the respective requirements of the functions in the layout plan.

◆For the landing and shipping sector, fish handling area will be constructed on the river side of the site to provide smooth flow lines from the landing to the shipping of each catch, and a fish washing area, selling and handling area, and loading and shipping area will be constructed in line with the process from landing to shipping. Additionally, the site will be effectively utilized with multi-story facilities and consolidating offices for ensuring sufficient loading and shipping areas and simple vehicle flow lines, and streamlined operations shall be facilitated in the flow line and zoning plan.

◆In pursuit of comfortability, the reserved area for residential building constructed by Bangladesh side, will be located on the west side (road side) of the site to separate it from the landing and shipping area. The reserved area for new mosque will be located near the gate on the road side because it will be used by many residents near the site in addition to users of the facilities.

◆To ensure calm environment, the trader's office building will be located between the reserved area for mosque and residential building and the bustling fish landing center building.

◆The administrative and facilities sectors will be located in easy-to-manage places in connection with their functions and characteristics.

◆The figure below shows the flow lines of project facilities based on the above.

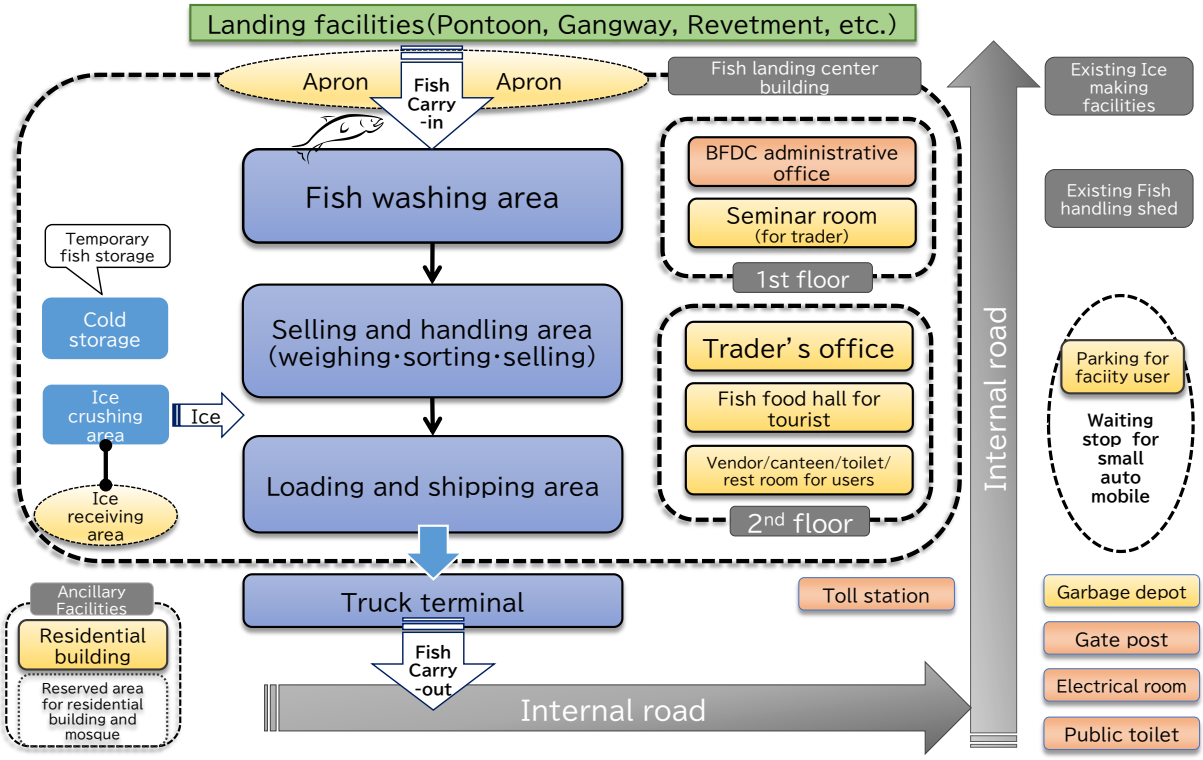


Figure 2-2 : Flow lines of project facilities

Because of the project budget, construction of new mosque, a residential building excluding the project and renovation of the ice factory are excluded from the project, although they are both high-priority requested components. Existing mosque and residential buildings are located on the construction site and the buildings must be demolished for construction work for the project; thus, it is drown in the figure above to secure a space for future. New mosque and another residential building will be secured by Bangladesh side at their own budget. Additionally, the ice factory is included in the figure above because rehabilitation is recommended due to its degradation.

2.2.2. Building construction plans

2.2.2.1. Floor plans

1) Basic policy

The table below shows the basic policy for the development of building facilities by sector.

Table 2-2 : Basic policy for development of building facilities

Name		Basic policy for development
A. Landing and shipping sector		
A-1	Fish handling area	Developed to shorten the distance and simplify flow lines between pontoons and gangways on one side and fresh fish receiving on the other. In an effort to maintain cleanliness and streamline operations, the interior of the fish handling area will be clearly divided into a pre-cleaning area (before washing) and a clean area (before shipping) with a distinct flow line proceeding in order from the fish washing area to the selling and handling area to the loading and shipping area. Water supply, drainage, and other necessary facilities will be installed in each area, and the design will provide visual (e.g. colored floors) and physical (e.g. level differences) cues as to the different operations in each area. Storage will be attached to the fish handling area to store the apparatus for use in it. Eaves will be constructed on the aprons to prevent exposure to direct sunlight from damage to the quality of fresh fish.
A-2	Ice crushing areas	Ice in the handling area is mainly used for packing fresh fish into boxes for shipping, so ice crushing areas will be located in consideration of shipping flow lines and distribution of ice supply as short as possible. Ice is brought in from nearby private ice factories with ice trucks and the like, so temporary parking spaces for ice transport vehicles and unloading areas will be attached to the ice crushing areas.
A-3	Refrigerators	Cold storage featuring chest cooler will be used for keeping fresh fish overnight. Refrigerators (chilled zone temperature of -5°C) with shelves on which these chest coolers with locks to be stored in the handling area will be installed.
A-4	Truck terminal	The truck terminal will allow fresh fish packages to be loaded directly from the shipping areas of the landing center. the platform of shipping areas will be at the same heights as the truck beds. The truck terminal will feature a roof for preventing rain and exposure to direct sunlight.
B. User service sector		
B-1	Trader's offices	Presently, existing trader's offices of different sizes are scattered throughout the project site, with a mix of small offices for administrative work only and relatively large offices accommodating refrigerators and freezers for storing fresh fish. The plan trader's office will be located close to the fish handling area to facilitate distributors' activities. The location will also make it easy to confirm the situation of the fish handling area and boats for landing. Small offices for distributors for engaging administrative work are required. The size and number of office units will remain as the current ones, but a slight increase of number is anticipated for accommodating new entrants, reflecting expansion of the center's activity. Rest area with toilets for women will be constructed at the corner of fish trader's building.

Name		Basic policy for development
B-2	Shops and canteen	Presently, general stores and small cafeterias serving light meals are operating on the project site. The project calls for the development of facilities for these operations.
B-3	Rest areas for workers	There are no rest areas exclusively for workers on the project site. The plan is to improve working conditions by providing resting place for workers of landing operations (e.g. ice crushing, ice and fish transport, weighing) to take breaks and have a rest after work. The rest areas are not divided into small rooms, but facilities to be used jointly by various workers. Benches and the like for rest in open space for well ventilation are required.
B-4	Fish food hall for tourists	Given that Cox's Bazar is a major tourist destination of Bangladesh, the site's proximity to Cox's Bazar International Airport, and the robust operations at the landing site, the counterpart requested a fish food hall for accommodating future increases of tourists. The project calls for food court-style restaurants with a simple kitchen to be leased to private companies to serve the seafood handled at the center as well as beverages, mainly to tourists. The food court will also have men's and women's toilets exclusively for tourists. The flowlines that provide access for tourists will not interfere with landing and transport operations, and the food court will provide views of the river and the landing activities of fishing boats on the river.
B-5	Fish transaction observation deck	Fish transaction observation deck will be a viewpoint from which tourists and visitors can observe handlings and transactions of the fresh fish in the center. The observation deck will be situated in the food hall, above the fish handling area.
B-6	Small vehicle stations	Most of the site users (CXB FLC staff members, distributors, workers, and tourists) use rickshaws (bicycles) and electric three-wheeled taxis to access CXB FLC; few visitors to the offices use passenger cars. Space will be set aside for rickshaws and taxis because the drivers stay at the site to wait for customers.
B-7	Garbage depot	A garbage depot to provide temporary storage of garbage generated at the facilities is required. The garbage will be collected by the municipal government; therefore, the depot will face the road in the premises, taking into consideration access and removal flow lines of the collection trucks.
B-8	Seminar room	A seminar room for distributors, workers, and others is required. Training on the handling of fresh fish, the use of facilities, and more will be conducted in the room with the aim of improving and enhancing activities at the center. Considering the use of the seminar room as a shelter in the event of a cyclone or other disaster, windows and doors will be robustly constructed and located on the top floor, which will not be flooded. The emergency stockpile storage will be arranged with it.
B-9	Residential building	There are one residential building for officers and another residential building for staffs, totally 12 housing units, and five living rooms inside office building. Construction and reserved area for residential buildings will be on the west side of CXB FLC. One residential building (two-stories) will be constructed under the project and another residential building will be secured by Bangladesh side at their own budget.

Name		Basic policy for development
C. Administrative sector		
C-1	BFDC office	The configuration and size of the room shall retain the same as the existing facility. However, the manager's office is presently being used for staff meeting from time to time due to lack of staff meeting room, a smaller conference room for interdepartmental staff meetings and visitor meetings is required.
C-2	Toll station	The existing toll station is a gazebo-like facility from where several officials on duty keep watch entrance and exit of vehicles for collecting fees. A small toll station equivalent to the existing facility to be installed in a suitable location.
C-3	Gate post	CXB FLC plans to collect tolls from vehicles using the facility. The plan is to install a gate at the vehicle entrance and collect tolls by vehicle type. For avoiding queueing on the public road, the gate will be located in the premises to allow several vehicles to queue.
D. Facilities sector		
D-1	Electrical equipment and systems	An electrical room will be constructed to install a transformer and electric main panel on the site to receive power from the high voltage lines along the road in front of the site. The site experiences frequent power outages; therefore, an emergency generator shall be installed next to the electrical room. The emergency generator will be of the minimum capacity necessary for landing operations (lighting, water supply pumps) and the emergency shelter. To minimize commercial electricity consumption, steps will be taken to incorporate natural lighting and LED lighting to the extent possible. .
D-2	Water supply system	Deep wells on the site are required. A gravity-type water supply system, with clean water sourced from the wells, pumped up to an elevated tank for storing is required.
D-3	Sewage system	Sewage from toilets and other outlets will be treated in a septic tank and discharged into the river in front of the center.
D-4	Toilets	The existing public toilet with showers is small for workers on the CXB FLC (men only). An attendants collects fees and do chores Based on the overall size of the facility, the project calls for a similar function facility for workers and the fishers berthing at the center. The women's toilet will be separated from men's restrooms.

2) Required areas and basis for planning

The table below shows the required area of each room within the scope of the project and the basis for its planning.

Table 2-3 : Area of each room and basis for calculation

Room name	Area	Basis for planning	Remarks
Total area of the fish landing center building	**6149.0 m²**		
(1F)	2,957.5 m²		

Room name	Area	Basis for planning	Remarks
Fish handling area	1,950.0 m^2	The area per worker in the existing fish handling sheds is 1.88 m^2; however 2.78 m^2 to reduce congestion and ensure efficient flow lines is required.	
Truck terminal	1,007.5 m^2	Presently, roughly 10 trucks loading and/or waiting to load at the site at a time; in light of the expansion of the facilities, parking spaces for 12 trucks (6.5 m lengthwise) is projected. A turning/driving space with an effective width of 8.4 m is required.	
(2F)	2489.5m^2		
Trader's offices	616.75 m^2	Trader's offices of the same size as the small existing trader's offices (9.7–11.3 m^2) are required. Presently, there are 43 offices; though a total of 58 offices in anticipation of new entrants due to the expansion of the center are required. The trader's offices will also be used to house the existing store that sells bamboo baskets and Styrofoam boxes.	Each existing office is used by three to five staffs, and contains one desk, storage, benches, and the like for administrative work and space for taking breaks.
Association office	24.00 m^2	The existing office is too small with overflowing documents, materials, and apparatus. It requires expansion of the space, 2.5 m^2 for eight staffs and 4 m^2 for storage.	The CXB FLC's fisher's association will use the office for administrative work and meetings.
Storage	15.00 m^2	To be same as the existing storage space.	
Toilet A	78.0 m^2	This toilet will be for traders. ・9 urinals for men ・9 toilets ・6 shower stalls ・Attendant room One urinal and one toilet are provided for every 30 people. (58 trader's offices x 5 traders = 290 traders, 290 ÷ 30 = 9.6 toilets)	Since all the traders are men, the plan calls for a men's toilet only for traders. The existing public toilet used by fishers have one urinal and three toilets; the toilets are used more frequently than the urinals. The existing number is not enough for the number of users. In addition to the above, there are two shower stalls and an attendant room.
Small shops and canteen	45.5 m^2	Two locations in the same size as the existing small	The existing small shops and canteen are congested with

Room name	Area	Basis for planning	Remarks
		shops and canteens to alleviate congestion are required.	fishers; the space are inadequate.
Rest areas for workers	146.25 m^2 (87.75 m^2, 58.50 m^2)	Rest areas to be situated on the first floor adjacent to the small shops and canteens with roof and benches are required.	Presently, fishers take breaks in the shade around the handling area and the BFDC office.
Fish food hall for tourists (including fish transaction observation deck)	317.4 m^2	Envisioning three groups of 15 tourists each. 45 people x 3.3 m^2 x 2 = 297 m^2, including the small shops, dining space, and toilets are required	Tourist traffic will be directed to the upper floor of the landing center, where they can view the fish handling area and the landing activities on the pontoons and gangways without crossing paths with the fishers.
Food Vendor	27.00 m^2	Three small (9 m^2) vendors offering seafood and other dishes for tourists are required.	
Toilet B	18.00 m^2	Separate men's and women's toilets for tourists, at least one toilet for every 30 people are required.	
Others (corridors, stairways)	1201.6 m^2	The effective width (2.0 m) and slope of the stairs are based on the Japanese law on universal accessibility. Handrails will also be installed.	
(3F)	702 m^2		
Manager's office	78.00 m^2	A manager's office roughly 20% larger than the existing manager's office is required.	The existing manager's office is 60 m^2 including the toilet, but requires expansion to provide more storage space and to accommodate large meetings.
Offices for each sector	155.6 m^2	The plan calls for differently sized offices for each sector. (13–39 m^2) The area per person will be 2.1–6.25 m^2.	The number of staff, scale of storage, and type and layout of desks are different for each sector.
Maintenance staff room	13.00 m^2	The plan calls for an paper work/waiting room for nine staff members.	
Conference room	39.00 m^2	To be used by the BFDC administrative staffs. The room will accommodate roughly 20 people with tables arranged in a square around the room. (20 persons x 2 m^2)	
Toilets	14.4 m^2	Separate men's and women's toilets for the administrative	

Room name	Area	Basis for planning	Remarks
		staffs, roughly one toilet for every 30 people is required.	
Seminar room	156.00 m²	A seminar room for fishers (including traders). The room will be roughly 150 m² with a capacity of 116 people when tables are arranged in a school-style layout.	・116traders (58 rooms x 2 people) ・Area: 156 m² ÷ 116 people = 1.34 m²/person. To be used as a shelter during emergencies.
Ante room	78.00 m²	An ante room for the seminar room, approximately 50% of the size of the seminar room, is required. .	To be used as a shelter during emergencies.
Stockpile storage for disaster	39.00 m²	The plan calls for 0.025 m²/person for 3 days (the standard of Shibuya Ward, Tokyo) for the maximum number of fishers (1,500).	The storage will be used to store drinking water, food, blankets, and other supplies for emergencies.
Other (Corridors, stairways, storage)	129.00 m²	The effective width (2.0 m) and slope of the stairs are based on the Japanese law on universal accessibility. Handrails will also be installed.	For emergency purposes, stairs will be placed in two locations.
Total area of the trader's office building	**195.00 m²**		
Trader's offices	177.5 m²	Some traders use large offices to handle large quantities of fish for export. Trader's offices of the same size as the existing facilities are required. ・Large: 30 m² x 3 offices ・Medium: 17.5 m² x 5 offices	These offices will be used for administrative work in addition to washing, storing, packaging fresh fish for export etc.
Rest area for women	17.5 m²	17.5 m² x 1, two toilets	
Total area of the residential building	**376.8m²**		
Residential building (two-stories)	**376.8m²**	Size of each unit will be 62.8m², same as the existing residential building for officers. 62.8m² x 6 units	
Total area of the public toilet	**47.25 m²**		
Toilets	27.90	The number of toilets was increased 80% over the existing number to alleviate the capacity shortage.	The existing public toilet used by fishers has one urinal stall, three toilet stalls, two shower stalls, and an attendant room; the

Room name	Area	Basis for planning	Remarks
			existing number is not enough for the number of facility users.
Attendant room	3.60	The attendant room will be the same size as the existing one	Staff members are always on duty to collect fees and do chores.
Pump room	15.75	The pump room stores the pumps that supply water to buildings except the fish landing center building. Maintenance space of 800 mm width shall be provided around the pressurized water supply pump.	
Total area of the gate post / electrical room	**52.50 m²**		
Generator room	15.75	Maintenance space of at least 800 mm width shall be provided around the 100-kVA generator.	
Gate post	10.50	A window and counter will be installed for collecting tolls. An alarm panel will be installed on an interior wall.	
Electrical room	26.25	Overhead lines connected to the power lines along the road lead-in through an underground conduit to the electrical room. A main electric panel will be installed in the room.	
Total area of the toll station	**7.45 m²**		
Toll station	7.45	The plan toll station will be the same size as the existing one. Around five staffs are on duty during office hour.	
Total area of the garbage depot	**6.25 m²**		
Garbage depot	6.25	The area is calculated according to the domestic waste storage area calculation table in Japan.	
Total area of the project facilities	**6834.25m²**	**(Total floor area of buildings 6,311m²)**	

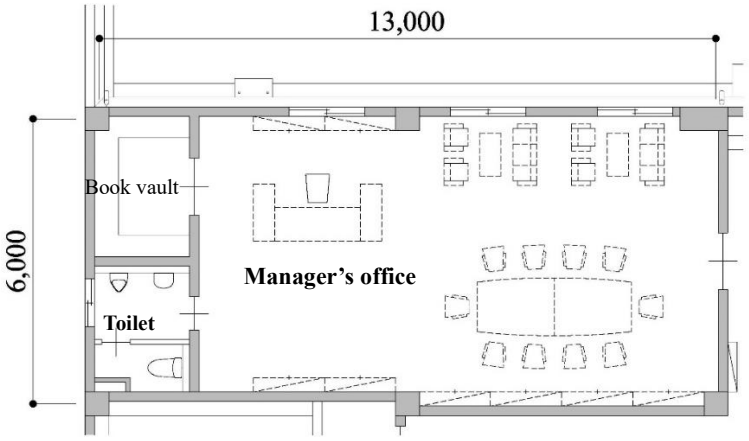
3) Floor plans of individual rooms

The following are the main rooms of the project.

Fish landing center building

1) Manager's office

The existing manager's office is equipped with the manager's desk and a small table and chairs for visitors and a toilet; it has no storage of documents and is too small for staff meetings. The plan office will be large enough for a conference table and chairs, lounge suites, cabinets for storing documents, as well as a book vault and a toilet.

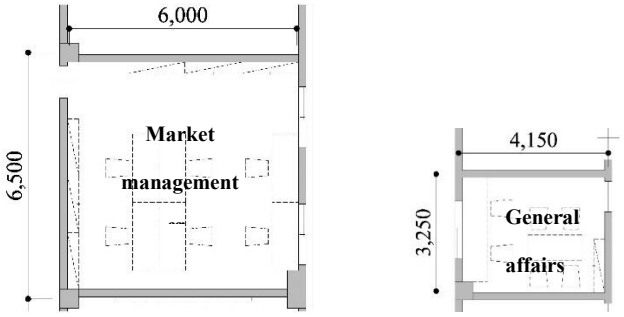


Room name	Planned size	Number of rooms	Furniture
Manager's office	78 m²	1	The items parentheses are for layout planning purpose only and are not to be provided under the project.

Figure 2-3 : Floor plan and planned details of the manager's office

2) Marketing office

The marketing office of BFDC will have space for the functions corresponding to the marketing functions of the center, and number of staff.

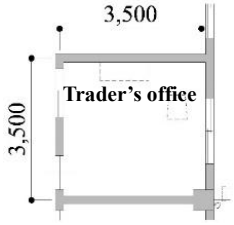


Room name	Planned size	Number of rooms	Furniture
Marketing office	39.0 m²	1	The items parentheses are for layout planning purpose only and are not to be provided under the project.
Attendant Room	13.4 m²	1	Same as above

Figure 2-4 : Floor plan and planned details of the Marketing office

3) Trader's offices

Similar to the existing trader's offices, there will be enough storage for one person's work.

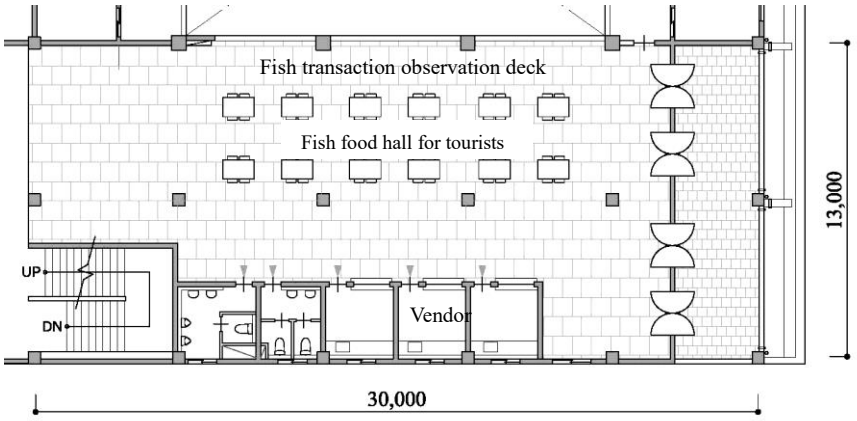


Room name	Planned size	Number of rooms	Furniture
Trader's office (small)	9.75–11.3 m²	58	The items parentheses are for layout planning purpose only and are not to be provided under the project.

Figure 2-5 : Floor plan and planned details of trader's offices

4) Fish food hall for tourists

Estimating around three groups of 15 tourists each (45 people) at any time. Space for eating will be provided between the fish transaction observation deck and the food vendors.

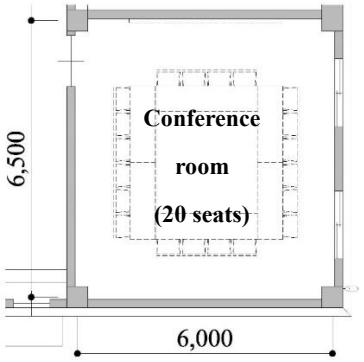


Room name	Planned size	Number of rooms	Furniture
Fish food hall for tourists including observation deck	317.4 m²	1	The items parentheses are for layout planning purpose only and are not to be provided under the project.

Figure 2-6 : Floor plan and planned details of the fish food hall for tourists

5) Conference room

The conference room will be used on internal meetings in the CXB FLC, ; the space can accommodate a total of 20 people.

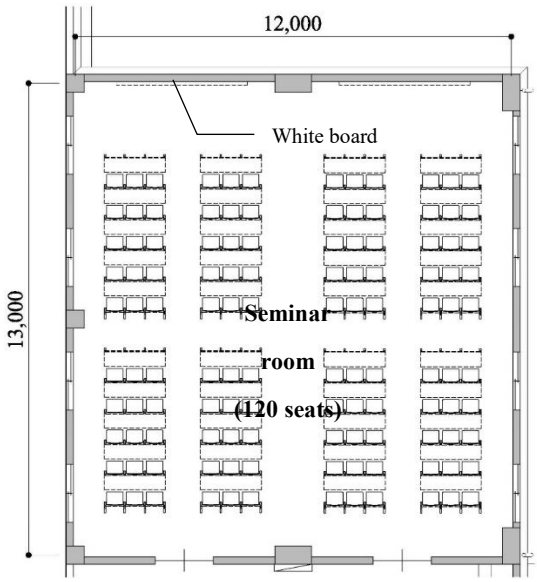


Room name	Planned size	Number of rooms	Furniture
Conference room	39 m²	1	The items parentheses are for layout planning purpose only and are not to be provided under the project.

Figure 2-7 : Floor plan and planned details of the conference room

6) Seminar room

The seminar room will be used as a venue for training, seminars and workshops of traders and fishers. The space can be arranged in a school-style layout; accommodate a total of 116 people. It can be sed as a cyclone shelter during emergencies.



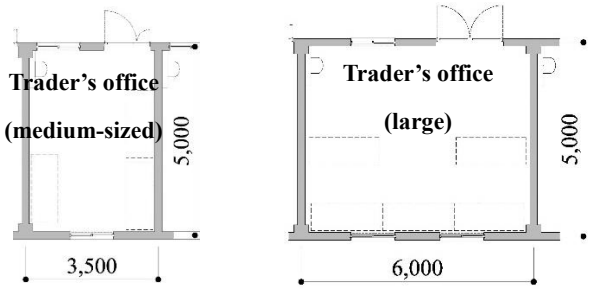
Room name	Planned size	Number of rooms	Furniture
Seminar room	156 m²	1	The items parentheses are for layout planning purpose only and are not to be provided under the project.

Figure 2-8 : Floor plan and planned details of the seminar room

Trader's office building

1) Trader's offices

As with the existing facility, the space is provided for traders handling large volumes of fresh fish. Each office can accommodate a sink and space for a chest freezer.

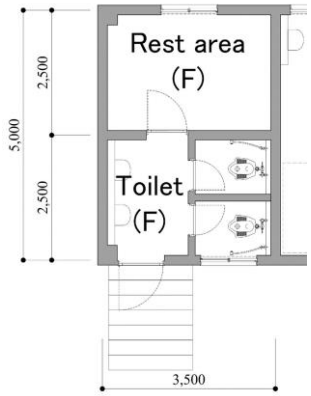


Room name	Planned size	Number of rooms	Furniture
Trader's office (large)	30.0 m²	3	The items parentheses are for layout planning purpose only and are not to be provided under the project.
Trader's office (medium-sized)	17.5 m²	5	Same as above

Figure 2-9 : Floor plan and planned details of trader's offices

2) Rest area for women

Rest room with two toilets for women only, which separated from public toilets.

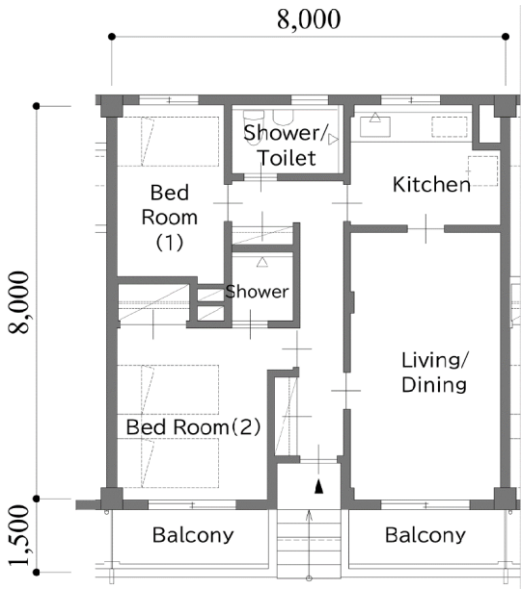


Room name	Planned size	Number of rooms	Furniture
Rest area for women	17.5 ㎡	1	No furniture.

Residential building (two-stories)

1) Residential building

Size of each unit will be 62.8m², same as the existing residential building for officers.



Room name	Planned size	Number	Furniture
Residential building	62.8 ㎡	6	The items parentheses are for layout planning purpose only and are not to be provided under the project.

4) Other considerations for planning

The project plan will take the following matters into account.

1) Evacuation and safety plans

In the course of planning the three-story fish landing center building, given the large number of users, sufficient consideration is given to evacuation plans and fire extinguishing system, and floor plans are designed to accommodate bidirectional evacuations in principle as well as stairways can be visually recognized.

2) Universal accessibility

For allowing tourists' smooth walking in the fish landing center building, stairways of the building shall conform to the standard on universal accessibility to facilitate the movement of people in buildings, in the relevant Japanese law

3) Design plans

As a building located in an existing urban area, proper consideration is given to the landscape in terms of design, exterior, and equipment and systems planning.

4) Limitation of the height of buildings around the air port

The Civil Aviation Authority of Bangladesh confirms that the area in which the site is situated shall have the limitation of the maximum height of buildings as 111 feet (about 33.8m).

2.2.2.2. Sectional plans

Ceiling height

The sectional plan accounts for the natural conditions of the area, the surrounding environment, and the conditions of similar facilities to ensure that the ceiling height, facility pipes in ceilings, natural lighting, ventilation, and air flow are suitable for the functions of the rooms.

Ground level and floor level

Flooding is foreseen in the area where the project site is located. According to interviews with relevant people, the water level has risen to a maximum of about three feet above the local ground level (SOB 3.2 m) during past floods; to prevent flooding, the floor level of the facility shall be SOB 4.2 m.

The pre-cleaning area where fresh fish are handled before washing and the clean area (after washing) are clearly separated from each other by a 600 mm difference in the floor level and differently colored floor finish.

Number of floors and floor height

The fish landing center building will have three stories above ground. The fish handling area on the ground floor will be 4.8 m tall, the first floor (mainly trader's offices) will be 3.8 m tall, and the second floor (mainly the BFDC office) will be 3.5 m tall with an elevated water tank installed on the upper floor.

Flat roofs

Flat-roofed project facilities will have a drainage slope of 1/50 to 1/75 on the frame, and the parapet walls will rise high enough to allow for sufficient waterproofing rise above the water level.

High sidelights will be installed on the roof of the fish landing center building to provide natural lighting to the ground level where the ceiling is vaulted.

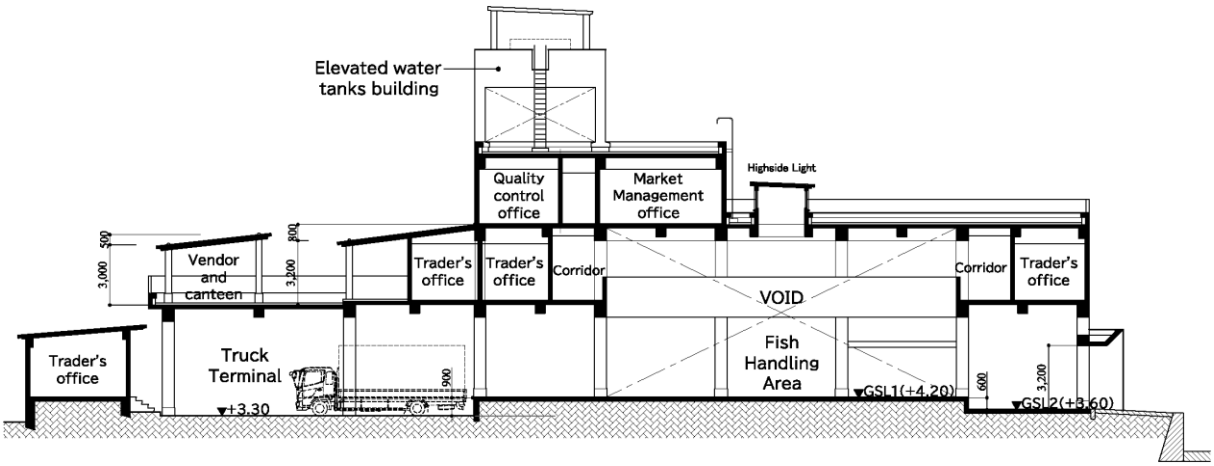


Figure 2-10 : Sectional view of fish landing center building

2.2.2.3. Structural plans

・Structure type: In consideration of fireproofing, rust-proofing, and insulation, a reinforced concrete structure with an economical span of roughly 6.0–6.5 m based on the room arrangement. Local contractors have sufficient experience with RC structures; contractors and concrete materials can be procured locally.

・Foundation structure: In light of the building plans and limitation of the site area, the fish landing center building shall be a three-story building. As the soft soil layer backfilled with soft soil has been found at the depth of 2–3 m in the soil survey, a pile foundation on the hard sand layer as the load bearing layer will be considered. Pile construction (cast-in-place piles) is a common choice in the area; machinery and engineers can be procured locally.

Spread foundations will be employed in other low-rise buildings, and the sand layer under the soft soil shall be considered as the bearing layer.

・Structures of buildings

Fish landing center building

Three-story RC rigid frame structure will be employed. A stratum with a large bearing capacity for supporting a large axial force per column near the surface of the ground, the decision was made to drive piles foundation extending to the sand layer of N50 or over distributed around 7–15 m depth. In total, 192 cast-in-place piles with a diameter of 800 mm and a length of roughly 8 m to 17 m will be used along the presumed contour of the bearing layer. For minimize the size of the footing beam, the floor mold slab shall be supported with the ground, and volumes of the footing beam, the floor mold slab and the piles shall be minimized. Because soft soil had been backfilled on the site, for supporting the floor mold slab, the ground surface shall be improved by replacing the soft soil with sandy soil to a depth of 2.3 m.

Trader's office building

One-story RC frame structure with an independent spread foundation will be applied. The soft soil found under the ground to a depth of 2.7–3.7 m below shall be replaced with sandy soil.

Toilet / garbage depot

One-story RC frame structure with an independent spread foundation will be applied. The soft soil found under the ground to a depth of 2.2 m below shall be replaced with sandy soil.

Gate post / electrical room

Two-story RC frame structure with an independent spread foundation will be applied. The sufficient bearing capacity on the ground surface is expected with the result of the

Plate load test; therefore, the decision was made to make the ground surface as the bearing layer.

Toll station

One-story RC frame structure with an independent spread foundation will be applied. The soft soil found under the ground to a depth of 1.0 m below shall be improved by replacing with sandy soil

Residential building (two-stories)

Two-story RC frame structure with an independent spread foundation will be applied. The sufficient bearing capacity on the ground surface is expected with the result of the Plate load test; therefore, the decision was made to make the ground surface as the bearing layer.

・Loading standards

Dead loads

According to actual loads set out in BNBC 2020.

Live loads

The following loads are planned as set out in BNBC 2020.

Application	Live load (kN/m^2)
Offices, toilet	2.40
Corridors, stairways, meeting rooms	4.80
Fish handling area	4.80
Roofs	1.00
Parking lots / roads	12.00

Seismic loads

In BNBC 2020 Bangladesh is divided into four zones according to the magnitude of ground motion anticipated; and the project site is located in Zone 3, the second-largest with a seismic zoning coefficient Z of 0.28. The seismic layer shear coefficient C0 calculated based on the standard is 0.067; this value is applied in the project.

Wind loads

According to the Bangladeshi national standard, the baseline wind speed for the project site is 80.0 m/s (3-second mean), which is the highest value in the country; to be applied in the project.

2.2.2.4. Facility planning

2.2.2.4.1. Electrical equipment and systems

(1) Trunk line connection, power receiving and transforming

The electrical mode in Bangladesh is 220 V, 50 Hz. The plan is to draw power from the power lines along the road in front of the site with overhead lines to a transformer (presumably 400–450 kVa) in the electrical room and then to the individual facilities via an underground conduit.

(2) Lighting and outlets

The illuminance of indoor lighting fixtures is based on the following table to suit actual conditions. Natural lighting will be used as much as possible, and the illuminance of artificial lighting will be the minimum level suitable for actual conditions. For safety and security reasons, exterior lighting (exterior lights) will be installed at the site entrances and in the courtyard. The plan calls for energy-saving, long-lasting LED lighting fixtures.

Table 2-4 : Planned illuminance of indoor spaces

Room name	Planned illuminance
BFDC office, conference room, trader's offices, seminar room for workers	Roughly 250 lux
Fish Food hall for tourists	Roughly 250–300 lux
Corridors, toilets, etc.	Roughly 150 lux
Electrical room, pump room, etc.	Roughly 50–100 lux

(3) Emergency lighting and guide lighting

A seminar room for workers will be constructed on the second floor of the landing center; which may be served as a cyclone shelter. Emergency lighting fixtures with built-in storage batteries will be installed in corridors and stairways to ensure the minimum required illumination during power outages. Additionally, evacuation guide lighting will be installed in stairways and at evacuation exits.

(4) Emergency generator

An emergency generator with the minimum required capacity of 100kVA (load about 65kVA, power factor 80%) will be installed to power the necessary facilities (lighting, water pumps) for the fish handling area and the area to be served as an emergency shelter. Power from the emergency generator covers operation of the refrigerators in the fish handling area, well pumps, feed water pumps, fire pumps, the septic tank, the seminar room and the emergency stockpile storage, the gate post and the electric room.

(5) Broadcasting system

A broadcasting system will be installed to provide instruction broadcasting during disasters and emergencies, announcements during outdoor meetings and the like, and for business communication. Amplifiers will be installed in the manager's office, and the electrical room in the landing center.

(6) Lightning arrester

BNBC 2020 requires the installation of a lightning rod on the fish landing center building. The materials of the lightning rod and cables and the location and method of installation described in detail in BNBC 2020 shall be observed.

(7) Fire detection system

Smoke detectors will be installed in the required rooms in accordance with BNBC 2020 and connected to the alarm panel in the gate post.

(8) Firefighting system

Indoor fire hydrant facilities will be installed at the required locations in the fish landing center building in accordance with BNBC 2020. The indoor fire hydrants feeding well water by pump to the tank for firefighting set on the roof top. Fire extinguishers will be installed in the fish landing center building and the electrical room in accordance with the Standard for Portable Fire Extinguishers of Bangladesh.

2.2.2.4.2. Air conditioning system

Generally, ceiling fans will be installed in the rooms. Air conditioners will be installed in the conference room and the seminar room, where many visitors and people gather.

2.2.2.4.3. Sanitation equipment and systems

(1) Water supply system

Cox's Bazar does not have a water supply system; therefore, wells will be drilled on the project site. P Power outages are common in the area; therefore, the pumps will be connected to the emergency power supply to make them available even during power outages. The capacity of the elevated water tank will be 10 tons, which is about 8% of the 128.1 tons of water supplied to the fish handling area each day.

The other facilities and reserved area (trader's office building, staff residential building, toilets and reserved area for mosque,), required water volume is 49.5tons in total, are low-rise; therefore, the plan calls for a pressurized pump water supply system, in which well water is stored in an underground tank in the foundation and fed by pumps.

Contamination and saline substance of all well water have been confirmed in the Water quality tests of existing wells, therefore the plan calls for deep wells (roughly 200 m depth)

given the need to supply a sufficient quantity of clean, fresh water. Under the present plan, pumped well water will be filtrated passed through spool filters for purification and under ultraviolet light for disinfecting. To verify that this configuration provides sufficient purification, in the detailed design stage one trial well to be drilled, and the results will be reflected in the design as needed.

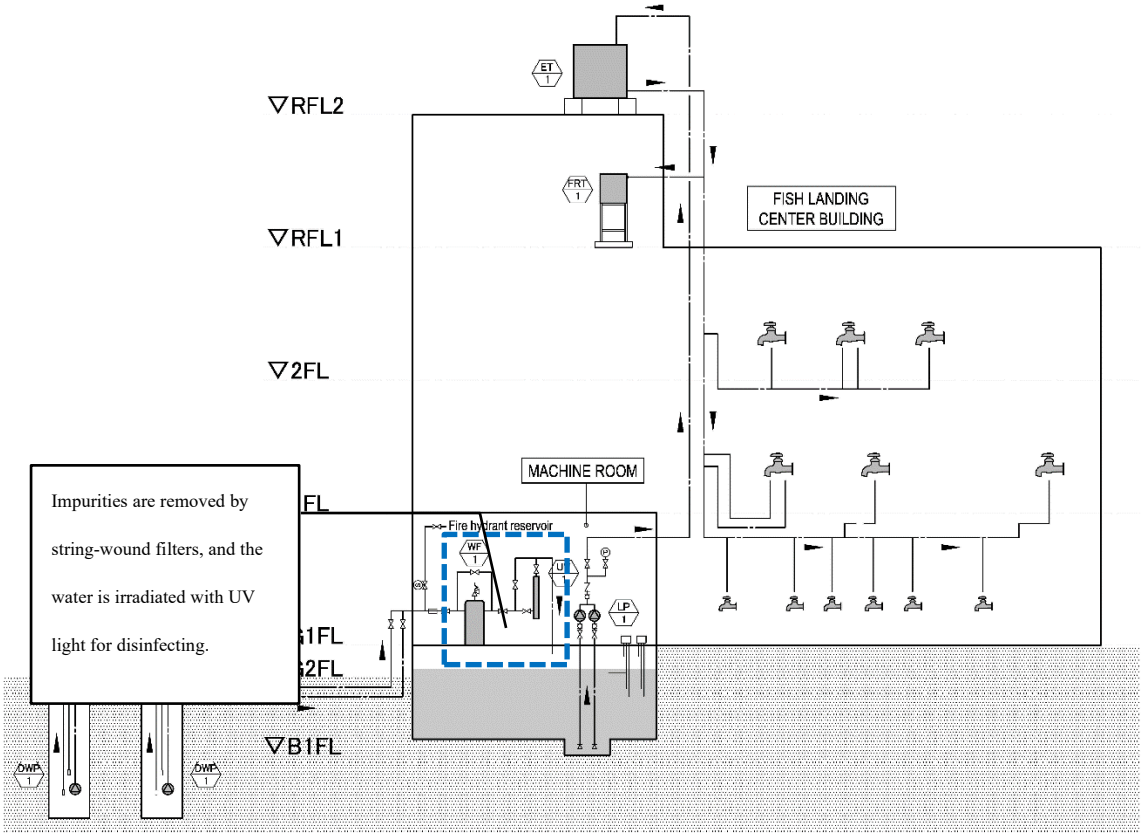


Figure 2-11 : Schematic diagram of the water supply system (1)

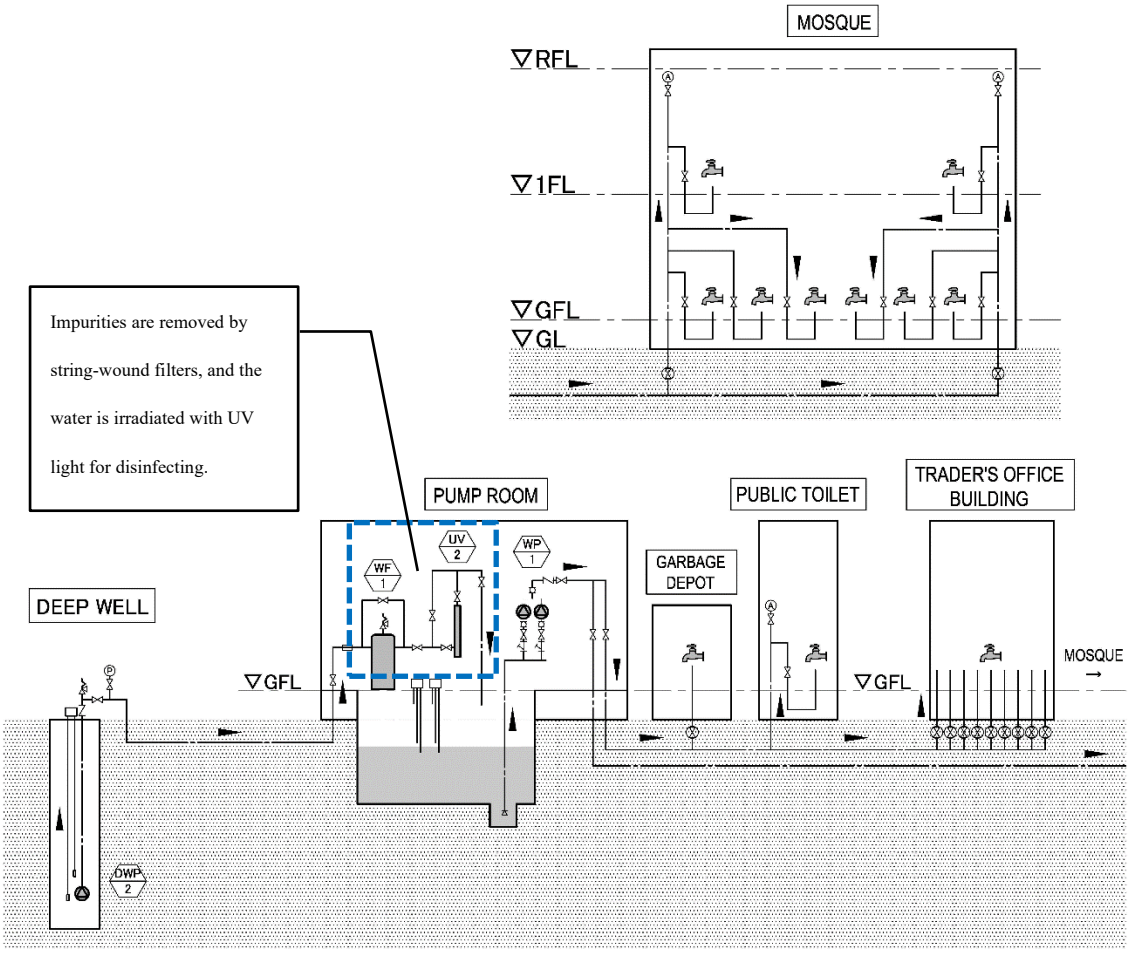


Figure 2-12 : Schematic diagram of the water supply system (2)

(2) Sanitary fixtures

Generally, the toilets will feature squat (Turkish-style) toilets and ordinary urinals. The plan also calls for vanities, showers, mirrors, handheld shower attachments, and the like. The BFDC office and tourist toilets will be Western-style toilets and ordinary urinals. The faucets in the toilets will be automatic faucets designed to conserve water by shutting off after a set volume of water has been discharged.

(3) Sewage and septic tank facilities

Cox's Bazar does not have a sewer system; the project site also does not have a sewer system. Therefore, the project calls for the installation of a mechanical aeration septic tank and the discharge of after treatment wastewater into the river.

2.2.2.4.4. Telecommunications equipment

(1) Communication system

Presently, the BFDC office connect to the internet, and Wi-Fi is available. A similar communication environment is required in the plan A telephone system is considered unnecessary, as it is now.

2.2.2.4.5. Fire extinguishing equipment

Fire-fighting equipment, installation locations, specifications, and others shall be subject to the local fire department approval.

2.2.2.4.6. Other facilities

(1) Ice-making facilities

Ice-making facilities will be under the responsibility of Bangladesh side, so the plan calls for appropriate space and systems for supplying water and electricity.

2.2.2.5. Building material planning

The structural and interior and exterior finishing materials used in the construction shall be locally available to shorten the construction time and improve maintainability. Because fresh fish is handled at the facility, finishing materials shall be easy to clean, wash, and maintain in good hygienic conditions to reduce the burden of maintenance. The table below shows the main interior and exterior finishing materials.

Table 2-5 : Exterior finishing materials

Area	Materials	Basis for selection
Fish landing center building		
Flat roofs	Asphalt waterproofing	Local workability, durability
Exterior walls	Trowel-finished mortar with multiple layers of coating	Workability, economic efficiency
Floor (fish transaction observation deck)	Porcelain tile	Ease of cleaning, durability
Ceiling (fish transaction observation deck)	Trowel-finished mortar	Workability, economic efficiency
Trader's office building		
Single-pitched roof	Urethane coating	Workability, economic efficiency
Exterior walls	Trowel-finished mortar with multiple layers of coating	Aesthetics
Stairway floors	Trowel-finished mortar	Workability, economic efficiency
Residential building (Two-stories)		
Flat roof	Asphalt waterproofing	Local workability, durability
Wall surfaces	Trowel-finished mortar with multiple layers of coating	Aesthetics
All areas		
Exterior door/window frames	Aluminum or stainless steel	Security, durability, resistance to chloride damage
Toll station		
Roof	Waterproof mortar	
Exterior walls	Trowel-finished mortar with multiple layers of coating	
Floor	Trowel-finished concrete	

Table 2-6 : Interior finishing materials

Area	Room name	Materials	Basis for selection
Fish handling building			
Floors	Manager's office, BFDC administrative office, trader's offices, seminar room, fish food hall for tourists, fish transaction observation deck, stairways, corridors, toilets	Porcelain tile	Ease of cleaning, durability, aesthetics
	Fish handling area	Epoxy resin coating	Ease of cleaning, durability
	Truck terminal	Concrete pavement	Durability
Walls	Fish handling area, truck terminal, manager's office, BFDC administrative office, trader's offices, seminar room, fish food hall for tourists, fish transaction observation deck, stairways, corridors	EP coating	Ease of maintenance
	Toilet	Porcelain tile, EP coating in some parts	Ease of cleaning, durability
Ceilings	Fish handling area, truck terminal	EP coating	Ease of maintenance
	Manager's office, BFDC administrative office, trader's offices, seminar room, fish food hall for tourists	Decorative sound-absorbing panels	Sound absorption, aesthetics
	Vendor, canteen, corridors, toilet	Calcium silicate sheets	Water resistance
Trader's office building			
Floor	Trader's offices, rest area for women	Porcelain tile	Ease of cleaning, durability
Walls	Trader's offices	EP coating	Ease of maintenance
	Rest area for women	Porcelain tile, EP coating in some parts	Ease of cleaning, durability
Ceilings	Trader's offices	Decorative sound-absorbing panels	Sound absorption, aesthetics
	Rest area for women	Calcium silicate sheets	Water resistance
Residential building			
Floor	Living room, shower, toilet, kitchen	Porcelain tile	Ease of cleaning, Durability, aesthetics
Walls	Shower, Toilet, Kitchen	Semi- porcelain tile EP coating	Ease of cleaning, Durability
	Living room	EP coating	Ease of maintenance
Ceilings	Shower, Toilet, Kitchen	Calcium silicate sheets, EP coating	Water resistance
	Living room	Decorative sound-absorbing panels	Sound absorption, aesthetics

The plan shall also take the following matters into account.

・Groundwater may contain salt at certain times of year; the salinity of well water using for mixing concrete shall be cared for.

・Outdoor fittings shall be made of stainless steel (SUS304), and in case steel fittings were employed, they shall be applied with rust-preventive agent or grease coating.

2.2.3. Plans for civil engineering facilities

2.2.3.1. Basic policy

- Restore the safe and smooth fish landing capacity of CXB FLC for the artisanal fishers using the facility.
- To avoid hindering the river flow, consider the section profile and alignment of the river bank both upstream and downstream sides, the plan revetment will not protrude into the river any farther, and will not be altered the gradient and normal lines.
- For steep slope due to scouring, use riprap, rubble or other stone materials to restore the original slopes, and measures against erosion, placing armor stones or concrete blocks, will be taken to prevent scouring.
- Set appropriate conditions that are neither excessive nor insufficient to counter the risks of cyclones, torrential rains, and other natural disasters.

  Plan mooring facilities will be planned not to interfere with the flow section of the river; to be stable against waves, currents, and the like; and to be economically efficient with low-maintenance structure type, positioning, and size, in consideration of the present riverbed topography, water level, tidal range, and other natural conditions.
- Specifications, structure types, and a mooring system of the pontoons and gangways will be prepared ensuring easy construction, and maintenance, and local repairing.
- To avoid generating waste, debris from the collapsed fish handling shed and armor concrete blocks of the revetment will be used as the filling material of the slope of the new revetment for reducing the environmental burden.

2.2.3.2. Revetment

(1) Design policy and major considerations

- Revetment improvement area: The area of the riverbank to be improved is from the downstream end to the upstream end of the existing fish handling shed (total 70 m in length)., out of about 110 m in length shore line of the site. The remaining area of slope revetment from the upstream end of the site to the above, about 40 m in length) will be used continuously for landing operation during construction under the project. For the 40m section at the upstream end, which is not covered by the project, the natural condition survey confirmed that the riverbank contours are gentle and stable with no scouring of the riverbed.

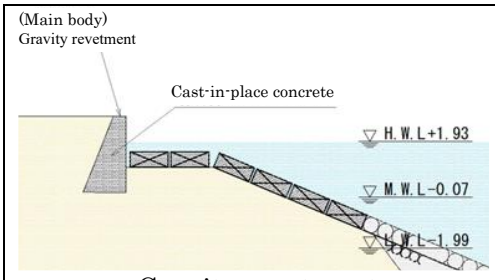
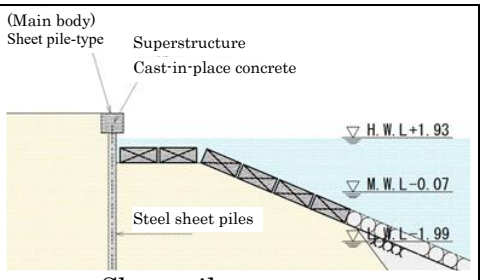
- Front alignment of the revetment: The front alignment of the plan revetment will be same as the top of the slope at riverbank so that the structure will not interfere the river flow even the water level rises.
- Scour prevention measures: As the revetment in front of the center has been scoured, it shall be restored to the original slope with foundation riprap to prevent scouring.
- Covering method: To prevent the formed slope from scouring again and to ensure stability against currents and waves during floods, the slope above the mean low water level (MLWL) will be covered with flat concrete blocks to allow fishers landing with their small boats, and the slope below the MLWL will be covered with armor stone to prevent scouring.
- Slope gradient: A gentle slope (1:4.0) same as the existing gradient of the upstream and downstream riverbanks will be maintained. The width of the crown of the rubble foundation will be altered to fit with the cross-sections of respective riverbanks.

(2) Outline of main structure

(i) Main body

Crown height The revetment crown height will be +3.40 m (MSL), which is same as the existing ground level of the top edge normal of the revetment.

Structure type The main body of the revetment must serve to retain the soil behind it; the gravity and sheet pile revetments shown below are compared for selection of the applicable structure type in this area.

	
Gravity revetment	Sheet pile revetment
The type of work is limited to concrete placement only; workability is good and corrosion control after construction is not required.	Steel sheet piles must be placed in addition to concrete placement for the superstructure; workability is lower than that of the gravity revetment, and proper corrosion control is required given the use of steel. The main body of the revetment is small (H = 2.40 m), and ground conditions are relatively good, making the gravity revetment advantageous in terms of both economic efficiency and maintenance.
✔applicable	× Not applicable

Foundation and back-filling material　A rubble foundation (1.00 m thick) will be placed under the main body of the gravity revetment to flatten the formation level and disperse the edge and toe pressure loads. Additionally, back-filling stones will be placed and geo-fabric will be laid behind the main body to reduce earth pressure and prevent sucking out.

Apron　The plan calls for concrete pavement roughly 6.0 m wide to serve as a paved apron between the revetment and the fish handling building.

Stairs　In consideration of landing operations using small transportation, stairs will be installed to provide access to the riverbank. The stairs will be cast-in-place concrete, and a width of 1.5 m will be ensured so that people can pass each other.

(ii) Scour prevention works

Rubble foundation　A riprap foundation will be used to form a new slope to restore the scoured riverbank slope.

The gradient of the slope will be 1:4.0 to fit with the existing upstream and downstream riverbank cross-sections.

A portion of the existing riverbank slope will be excavated to a depth of roughly 1.0 m to form the riprap foundation slope.

Covering material　The slope formed by the riprap foundation will be protected with covering material to prevent scouring again.

The covering material will be a product or material that remains stable against waves and currents.

Armor concrete blocks will be used to facilitate access to areas above the MLWL—where work can be done on land while the tide is low—and armor stone will be used below the MLWL for protection in view of workability.

A flat-surfaced type of the armor concrete blocks with good stability proven in revetment construction in rivers and coasts, will be selected to facilitate accessibility (assuming that people will be walking on the blocks).

Geo-fabric (Suction prevention sheet)　Geo-fabric will be laid under the armor concrete blocks above the MLWL—where work can be done on land while the tide is low—in order to proactively prevent sucking out of sand.

Crown width　On the downstream side, the width of the crown will be two armor concrete blocks to cope with the existing downstream riverbank cross-section. On the upstream side, the width of the crown will be six armor concrete blocks to cope with the slope meets the existing downstream riverbank cross-section.

Existing concrete blocks　To reduce industrial waste, the concrete blocks placed in front of the ground floor of the handling shed as an emergency measure to prevent scour will be utilized as fill material under the riprap foundation.

2.2.3.3. Mooring facilities

(1) Design policy and major considerations

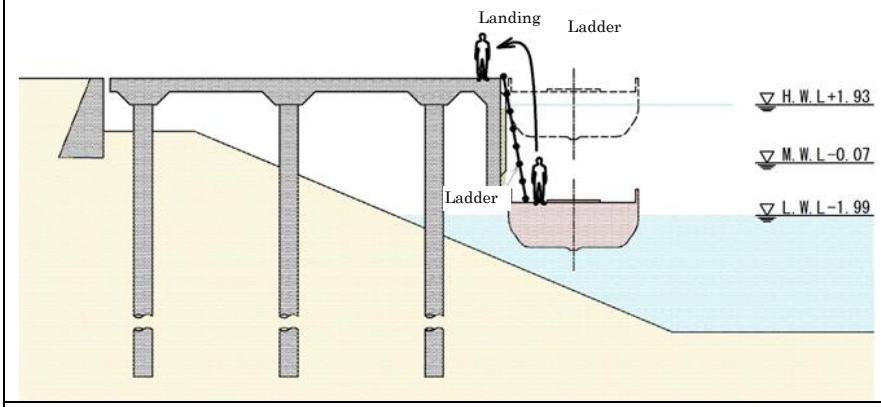
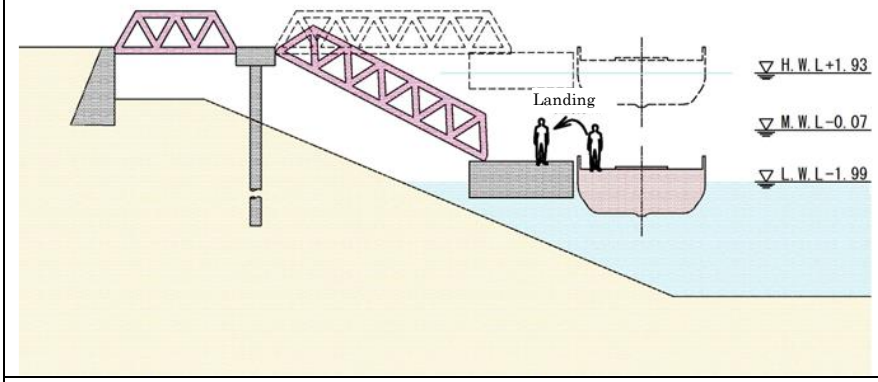
- Type of mooring: Pontoon-and-gangway-type applicable for a large tidal range (roughly 4.0 m).
- Structure type: Steel pontoon-and-gangway moorings, which is are easy to repair., can be constructed by local contractors
- Mooring berth length: Based on the large fishing boats operating in the center (Length: 17.6 m, Width: 3.0 m, Draft: 1.9 m, Freeboard: 0.8 m), the required berth length is 26 m.
- Number of floating pontoon-and-gangway: Although it is technically possible to construct one 56-m (26 m x 2 berths) pontoon-and-gangway, the mooring anchors and cables would need to be enormous to counter the substantial resistance on the pontoon during floods. Additionally, considering maintenance and the risk of damage during disasters, it would be more reasonable to construct two 26-m pontoon-and-gangway moorings. Since the length of the riverbank to be improved under the project is limited to roughly 70 m; two pontoon-and-gangway moorings with a berth length of 26 m can be installed in the 70-m section. As the fish landings have to operate in a short time, the plan pontoons will be earmarked for fish landing operations only; the fishers shall leave their boats off the pontoons after completion of their landing.
- Mooring system: Mooring chains extend at roughly 45° and secured with anchor blocks. As a measure to prevent gangways from collapsing when the pontoons move horizontally, auxiliary chains and anchors will be installed to restrict the movement of the pontoons off the river bank.
- Distance from the riverbank: The pontoons will be positioned not touching the slope of the riprap foundation at the lowest low tide level. Given the maximum gangway gradient (1/5), the pontoons will be positioned roughly 38.0 m off the top edge normal of the revetment.
- Piers: The pontoons must be installed roughly 38.0 m off the top edge normal of the revetment, making the gangways quite long; the piers will be constructed and fitted with fixed gangways on the landside, and ramps will be erected to move up and down with the water level of the river.

(2) Selection of structure type

After considering the following three structure types of the mooring facilities, the third one (pontoon-and-gangway type) was selected.

Table 2-7 : Comparison of mooring types

Type of mooring	Advantages and disadvantages
Proposal 1: Stair-type	Landing is inefficient and hazardous because sometimes it requires descending submerged stairs. Additionally, if

Type of mooring	Advantages and disadvantages
	boats get too close at low tide, their bottoms hit the stairs, causing damage.
Evaluation: Difficult to ensure safety for fishing boats, does not satisfy performance requirements	Not suitable
Proposal 2: Fixed pier-type  	Given the large tidal range, if the height of the crown of the mooring wharf shall be set to allow landing at the HWL, the work is impossible to perform at low tide without a ladder or stairs, making the work inefficient and dangerous.
Evaluation: ,It does not satisfy performance requirements for landing operations	Not suitable
Proposal 3: Pontoon-and-gangway-type  	The pontoons rise and fall in accordance with the tidal level, allowing safe mooring, and landing operations where the tidal range is large.
Evaluation: Allows safe mooring, landing operations, satisfies performance requirements	✔ Highly suitable

(3) Main structure

(i) Pontoons

Despite the need for proper corrosion control to prolong service life, the pontoon shall be made of steel, in consideration of ripe experiences by the local shipyards, simple repairs and cost effectiveness.

Size of pontoons

- The maximum number of fishing boats berthing at the existing pontoon observed during the field survey was 12 boats per day, with a landing time of just over one hour. When fishing boats could not berth at the existing pontoon, their catches were transferred into small boats and landed on the slope revetment in front of the facility. The maximum number of fishing boats using small boats in a day was roughly 30.

- The landing volume of fish per fishing boat calculated based on field survey results was 1.63 tons per boat, and the daily landing was estimated to be roughly 20 tons on the existing pontoons and roughly 50 tons with small boats. The landing hours was typically six hours, from 6:00 in the morning to noon.

- Fishing boats utilizing CXB FLC can be broadly categorized into large, medium-sized, and small boats with average lengths of 17.6 m, 16.0 m, and 12.0 m, respectively. Since the margin per boat at berthing required for planning is 15% of the boat length, the required pier length for each type of boat is 20.24 m, 18.4 m, and 13.8 m, respectively. However, since 20% of the boats are small, 54% are medium-sized, and 26% are long, the weighted average required pier length per boat is 17.6 m.

- Interviews during the field surveys revealed that during the peak fishing season, the daily landing volume can reach at 100 tons and landing activities extend into the afternoon. Assuming a landing volume of 1.63 tons per fishing boat, a total of 61 boats during the peak season is using the center. Assuming a daily landing operation of nine hours (6:00–15:00), the maximum number of fishing boats that can berth the existing pontoons in one day is 18. Therefore, if 61 fishing boats land a total of 100 tons per day, and only 18 boats can use the existing pontoons, the remaining 43 must transfer their catch to small boats for landing.

- Assuming that 61 fishing boats landing a total of 100 tons per day at CXB FLC, the capacity of plan pontoons shall be calculated to allow berthing of 43 fishing boats currently transferring their catches to small boats for landing.

- Number of pontoons required = (Number of fishing boats) / (Number of rotations per day) / (Number of boats that can moor simultaneously per pontoon)

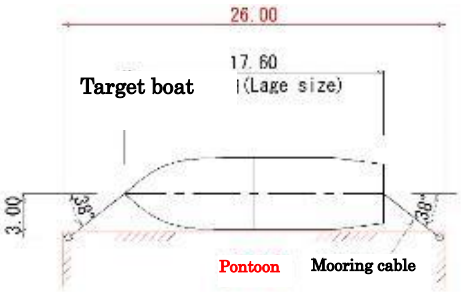
- The number of boats that can moor simultaneously is calculated based on the total length of a pontoon and the average lengths of the fishing boats. Given that the pontoons are 26.0 m long and the average required berthing length per fishing boat is 17.6 m, an average of 1.48 boats can moor at each pontoon simultaneously. Therefore, three new pontoons are required as shown below.

Number of pontoons required N = 43 boats ÷ 9 rotations ÷ 1.48 pontoons/unit = 3.2 pontoons

However, given that the riverbank at the project site is about 70 m long, the total length of each pontoon (26.0 m) as described below, and the need to maintain a certain amount of space (14 m in the project plan) between the pontoons to allow small non-powered boats to move in, space limitations make it difficult to install three pontoons. Therefore, the plan calls for two pontoons—the number that is possible to install—to be installed in front of the riverbank.
Accordingly, on a day in which 100 tons were landed, 27 out of the 43 boats that previously using small boats for landing will be able to berth along the pontoons, and the remaining 16 will continue to use the small boats.

Total length

Given the length of the target boats and the arrangement of mooring ropes (bow and sternropes), and calculating the required length of the pontoons when the ropesare extended at the general extension angle for large fishing boats of 30° to 45° (mean of 38°) shown below, the (total) length of the pontoons will be 26.0 m as shown in



the following figure.

Total length = 17.6 m + 3.0 m / tan 38° x 2 ≈ 26.0 m

Figure 2-13 : Mooring cable extension and pontoon length

Total width — The total width of the pontoons must be wider than the existing pontoon (3.7 m) to provide stability and to reduce congestion during landing on the existing pontoon; thus, it will be 4.0 m.

Freeboard — The freeboard of the existing pontoon is about 0.8 m, measured in the field survey, and does not impede landing work; therefore, the freeboard of the pontoons will be 0.8 m, same as the existing pontoon.

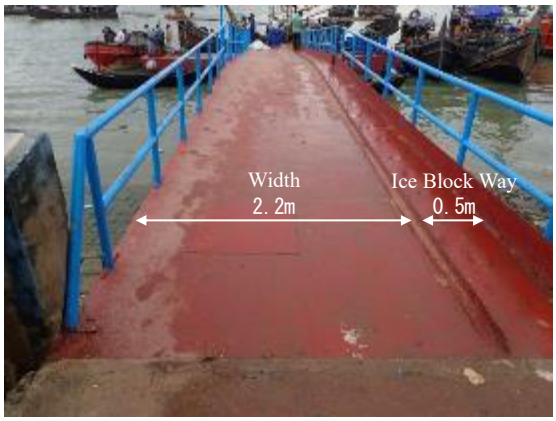
(ii) Gangways

Gangway length and slope

The length of the gangways will be set based on the distance from the revetment to the pontoons and the slope of the gangways at LWL, which shall not be exceeded 1/5.

Width — The width of the gangways will be 2.5 m in consideration of actual conditions, including congestion during landing and preparation work on the existing pontoon and gangway, width 2.7 m, of which 0.5 m is the ice block way.

The preparation work, loading block ice onto fishing boats, will be only done on the existing pontoon and gangway near the ice factory, separating the flow lines of ice from the new pontoons. There will be no ice block way on the gangways of the plan pontoons.



Photograph 2-1: Width of existing gangway

Cong reparation (existing pontoon and gangway)

Ice block way on the existing gangway in use

Piers and bridges — In case gangways were fitted between the revetment and the pontoons

directly, their spans would be at least 30 m long, the weights of main girders and other members with large cross-sections would be too heavy and the load on the support members would be increasing whenever the pontoons move. Therefore, as shown in the figure below, a pier and bridge will be constructed so that the gangways will not be too long.

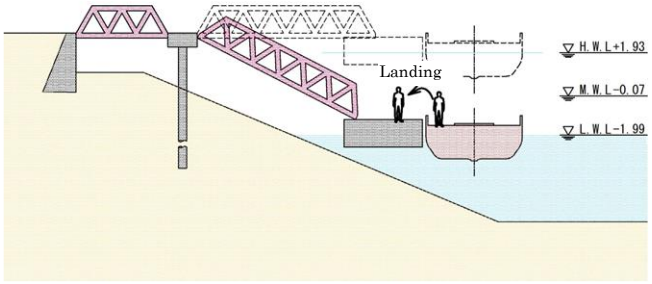


Figure 2-14 : Image of pier and (fixed) gangway

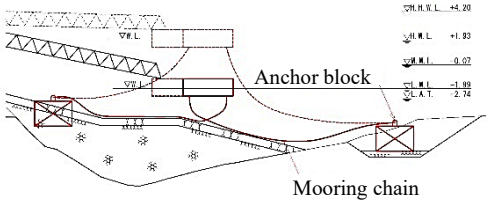
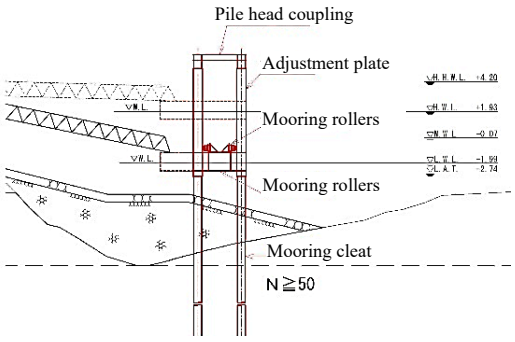
Structure type The structure type of the gangways and bridges will be plate girder, which is commonly used for gangways to pontoons and available locally.

(iii) Anchor mooring

Mooring system Mooring systems are generally sorted into chain mooring and pile mooring systems.

The following table shows each mooring system as well as a comparison of the advantages and disadvantages (e.g. workability, durability, accessibility), including their applicability to the project site. Pile moorings are difficult to construct and would require special methods to drive the piles into the hard ground at the project site, while chain moorings can be repaired onsite; therefore, chain mooring system is selected.

Table 2-8: Comparison of mooring systems

	Chain mooring	Pile mooring
Schematic diagram		
Overview	➢ A system in which a pontoon is moored by mooring chains and anchor blocks. ➢ After the anchor blocks are placed in position using a deck barge-mounted	➢ A system in which a pontoon is moored by steel pipe piles and mooring gear. ➢ After the steel pipe piles are driven to the specified depth by a pile driving boat, the

	Chain mooring	Pile mooring
	crane, the mooring chains are anchored and secured to the pontoon.	pile head couplings are welded and secured with mooring gear.
Workability	➢ Workability is good because the types of work are limited to riverbed excavation, anchor block installation, and chain anchoring.	➢ Driving piles requires precision and involves many complicated types of work, including the installation of pile head couplings, adjustment plates, mooring cleats, and mooring rollers. ➢ The riverbed at the planned location of the pontoons is hard ($N \geq 50$ throughout); piles cannot be driven without using special methods (e.g. lead drilling system).
Durability	➢ Damage can be avoided when floating debris or the like collide with pontoons, swaying to the side.	➢ Pontoons, and mooring gear, and the like are sturdy and secured in place, and thus are susceptible to damage when floating debris or the like collide with the pontoons.
Accessibility	➢ The pontoons range a great distance between high and low tides.	➢ Pontoon movement can be kept to a minimum.
Maintenance	➢ If a chain broken, it can be repaired onsite.	➢ Mooring gear is susceptible to damage, but replacement parts are not easy to source locally.
Other	➢ This mooring method is commonly used on pontoons in the region.	➢ Given the depth of the water at the location of the pontoons and the required length of pile , the pile cross-section is quite large.
Overall evaluation	✔ Highly suitable	△ Fair

The figure below shows the layout of the revetment and mooring facilities based on the above considerations.

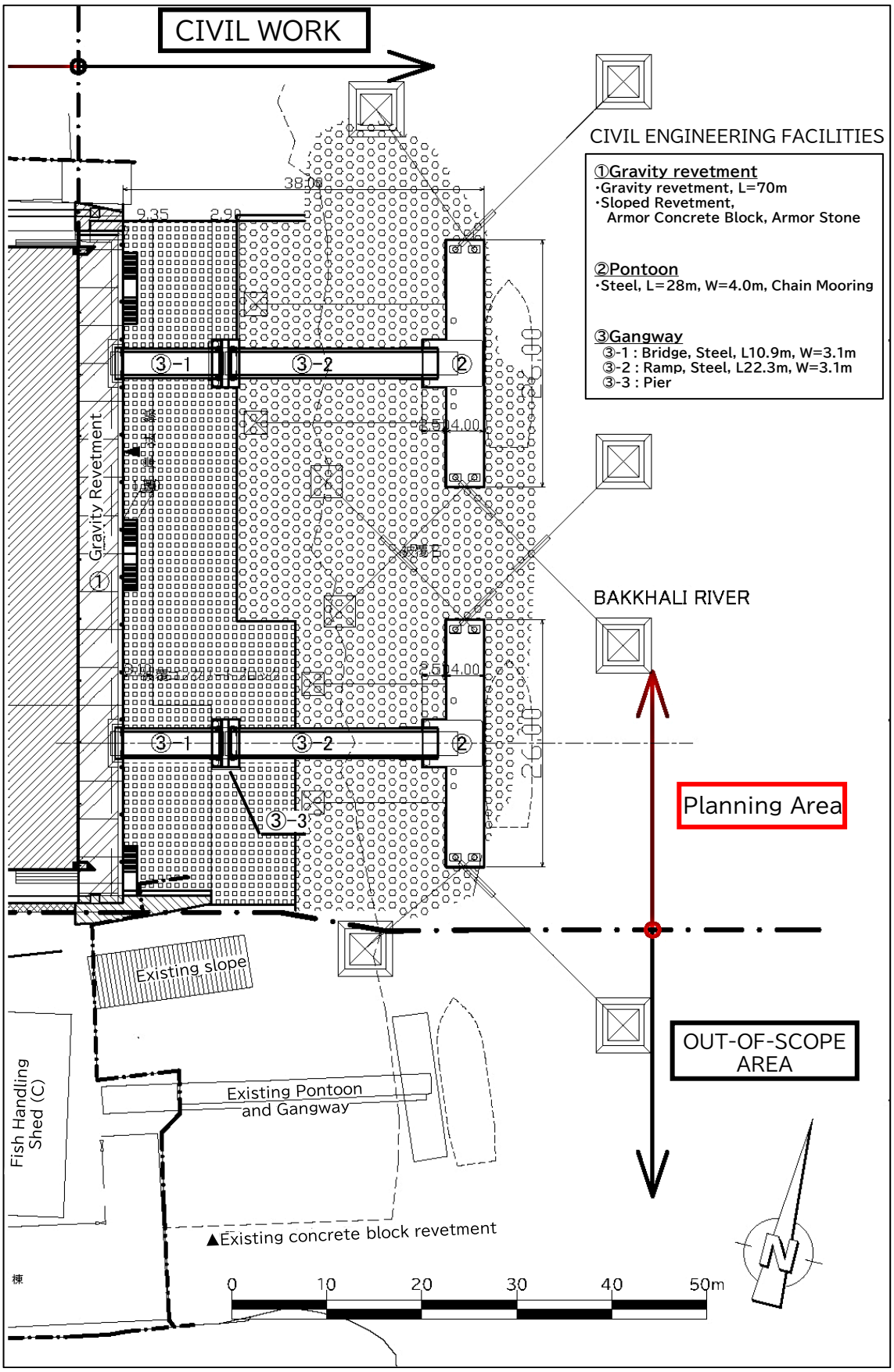


Figure 2-15 : Layout of revetment and mooring facilities

2.2.3.4. Design conditions for civil engineering facilities

(1) Applicable standards

In Bangladesh design standards for civil engineering facilities specifically in fisheries sector have not be established; therefore, the following Japanese standards are applied.

・*Gyoko/gyojo no shisetsu no sekkei sanko tosho 2015 nenban* (Reference book for the design of facilities for fishing ports and grounds, 2015 edition), National Association of Fisheries Infrastructure

・*Kowan no shisetsu no gijutsujo no kijun/dokaisetsu Heisei 30 nen 5 gatsu* (Technical standards and commentaries for port and harbour facilities in Japan, May 2018), The Ports & Harbours Association of Japan

・*Kaigan hozen shisetsu no gijutsujo no kijun/dokaisetsu Heisei 30 nen 8 gatsu* (Technical standards and commentaries for coastal conservation facilities in Japan, August 2018), National Association of Fisheries Infrastructure

Additionally, the following standards will be used as a reference for the design of the pontoons.

・*Futaishiki keisengan sekkei seko manual (an) Heisei 27 nen 3 gatsu* (Floating mooring wharf design and construction manual (draft), March 2015), Association for Innovative Technology on Fishing Ports and Grounds

(2) Design service life

The design service life will be the general value of 50 years for civil engineering facilities in accordance with *Gyoko/gyojo no shisetsu no sekkei sanko tosho 2015 nenban* (Reference book for the design of facilities for fishing ports and grounds, 2015 edition). However, to avoid placing an undue burden on pontoon corrosion prevention and measures to prevent the corrosion and wear of mooring chains, and in consideration of the local track record and other factors, the target service life will be 30 years.

(3) Target boats

The powered fishing boats that use CXB FLC are generally classified by the local fisheries administration as large, medium-sized, and small, and the specifications and averages for each size are shown below and in the following table. Figure 1-17 shows the percentages of fishing boats by size.

Table 2-9 : List of powered fishing boats that use CXB FLC by size

Type	Large size	Medium-size	Small size
Length (average)	17.6 m	16.0 m	12.0 m
Photograph			

The target boat in the design is the average length (mean) of the large size boats among the above.

Particulars of the Target boat:
Length: L = 17.6 m
Breadth: B = 4.9 m
Draft: d = 1.3 m (at fully loaded)
0.6 m (at no load)
*Type of the boat : the lower end of the propellor does not go below the bottom of it, and grounding on the sandy beach is possible.
Gross tonnage 26 G.T.

(4) Natural conditions

Natural conditions for planning civil engineering facilities are set out as shown below based on the results of field surveys.

◆Tidal conditions

The design tide levels were set based on three years' data from the BIWTA tidal observation station located about 1 km downstream of the project site.

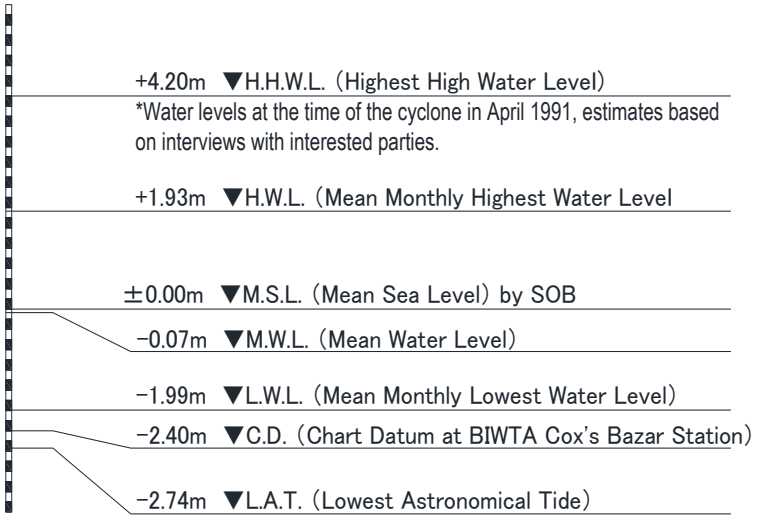


Figure 2-16 : Design tide levels (provisional)

◆Highest high water level (HHWL): +4.20 m (sob M.S.L.Datum)

The highest high tide level is set based on interviews with facilities users of CXB FLC about the cyclone in April 1991.

Reference: BIWTA tidal observation station

The observation station, is situated about 920m downstream from CXB FLC, north side, uses an ultrasonic tide gauge to acquire water level data at five-second intervals. The data is transmitted to BIWTA's Dhaka headquarters via GSM in real time.

Data transmitted to BIWTA's Dhaka headquarters from observation stations across the country is automatically input into a program of the Water Analysis Department to calculate the water levels.

Tidal observation station	River name	Latitude	Longitude	Reference heights		
				MSL	PWD	CD
Cox's Bazar	Bakkahali	21°27'38.60" N	91°58'0618" E	3.10151	Cox's Bazar	Bakkahali
MSL = Mean Sea Level (SOB reference height) PWD = Public Works Datum CD = Chart Datum						

Figure 2-17 : Location of the BIWTA tidal observation station

The following table shows the highest and lowest tides for each year from August 2019 to July 2022.

Table 2-10 : Annual maximum and minimum water levels for the last three years

Year/Month	WL (m in MSL)	
	Max	Min
August 2019–	+2.23	-2.25
2020	+2.36	-2.51
2021	+2.48	-2.32
–July 2021	+2.60	-2.28

Source: BWDB Cox's Bazar Station

◆Design wind speed

The design wind speed is set in BNBC 2020 with regional distributions as shown in the following figure. From this figure, the design wind speed in the project area falls in the region of V = 80.0 m/s (50-year return period). However, because this value corresponds to the instantaneous maximum wind speed, the 10-minute mean maximum wind speed will be calculated separately, taking into account the gust factor.

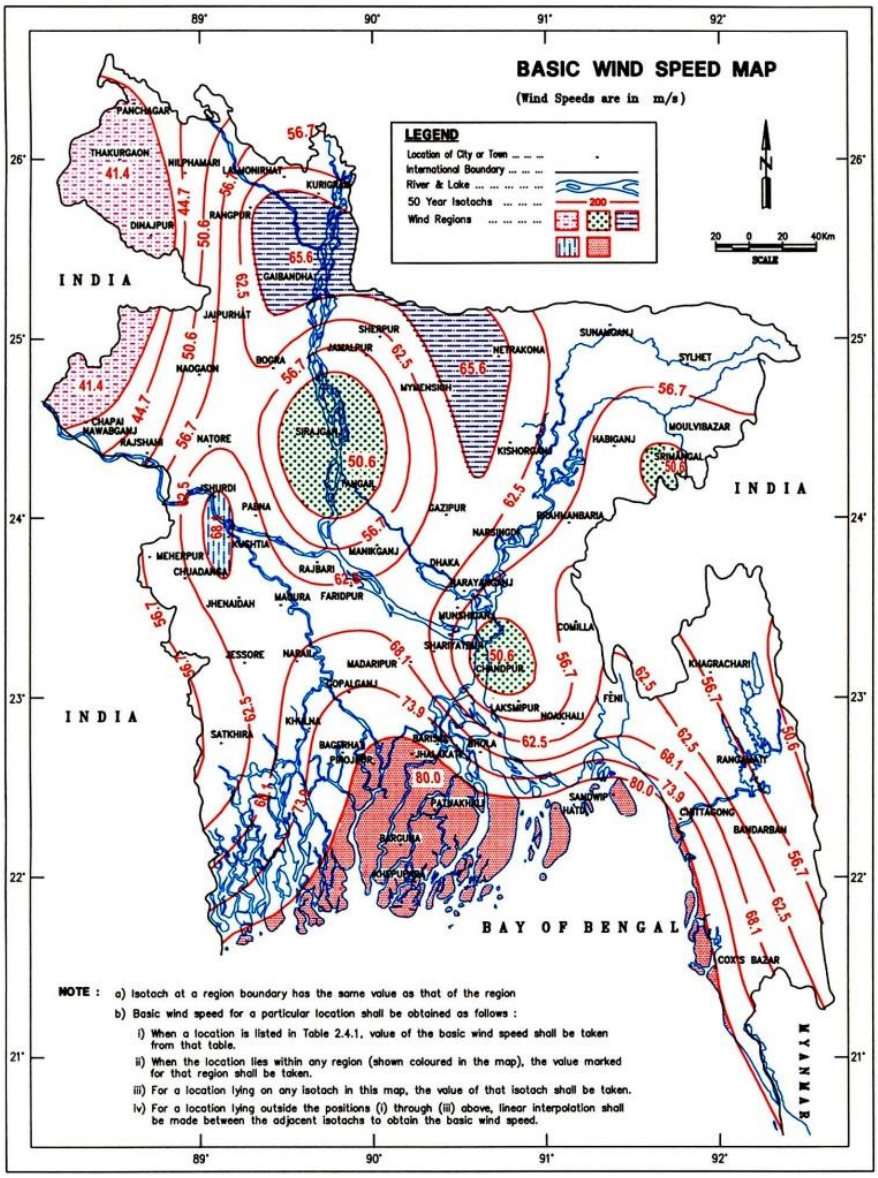


Figure 2-18 : Basic wind speed in Bangladesh (V, m/s)

The ratio of the maximum instantaneous wind speed to the 10-minute mean maximum is correlated by the gust factor as shown below.

$G = \mu / U$

G: Gust factor
μ: maximum wind speed during a given observation time
U: mean wind speed during a given observation time
Normally, the observation time for wind speed is 10 minutes.

According to the *Gyoko/gyojo no shisetsu no sekkei sanko tosho 2015 nenban* (Reference book for the design of facilities for fishing ports and grounds, 2015 edition), the gust factor is generally between 1.2 and 1.8 as shown below; however, here, the 10-minute mean maximum wind speed is set to G = 1.5 in reference to the value provided by the Ministry of Construction (merged in to the Ministry of Land, Infrastructure, Transport and Tourism in 2001) and the Japan Weather Association.

U = u / G
= 80.0/1.5
= 53.3 m/s ∴ <u>10-minute mean maximum wind speed U = 53.3 m/s</u>

Table 2-11 : Examples of observed gust factors

Observation group and observation point	Gust factor	Remarks
Committee for Wind Damage Prevention on Power Lines (1986)	1.2~1.8	During Ise Bay Typhoon (1923)
Ministry of Construction and Japan Weather Association (1977)	1.45~1.60	Average≒1.5
Itoman Fishing Port, Okinawa Prefecture	1.32 (sea side)	Stormy coast with flatland conditions
Fukuda Fishing Port, Shizuoka Prefecture	1.26 (sea side)	straight coast with windbreak forest
Eguchi Fishing Port, Kagoshima Prefecture	1.42 (sea side)	Hilly coast
Miyanoura Fishing Port, Miyazaki Prefecture	1.61 (sea side)	Rias coastline

◆Wave conditions

Records of the past 57 years (a list of typical cyclones) indicate that southeast to southwest winds prevail during cyclones. Waves are unlikely to develop from the south of the site due to the short distance to the opposite shore; however, when waves are calculated based on the aforementioned design wind speed of 53.3 m/s, the wave height is roughly H = 0.60 m.

<u>Design wave height H = 0.6 m</u>

◆Flow conditions (flow speed, flow rate)

Under cyclones

The maximum flow speed near the project site was set according to the results of a simulation of a cyclone and a large low-pressure system commissioned to Institute of Water and Flood Management (IWFM) of Bangladesh University of Engineering and Technology (BUET).

The maximum flow speeds (mean of the section 1 km upstream and downstream of the site) on the left bank, on which the project site is located, is shown as follows: set at the design maximum flow speeds

Table 2-12 : Results of flow condition analysis of the river in front of the project site in cyclone and large low-pressure system scenarios

Case	Year	Duration	Event	West bank Flow speed (m/s)	River center Flow speed (m/s)	East bank Flow speed (m/s)	Direction
(1)	1990	10/25-11/8	Cyclone	1.45	1.40	1.48	Upstream to downstream
(2)	2010	9/28-10/12	Monsoon Depression	3.00	2.00	2.20	Downstream to upstream

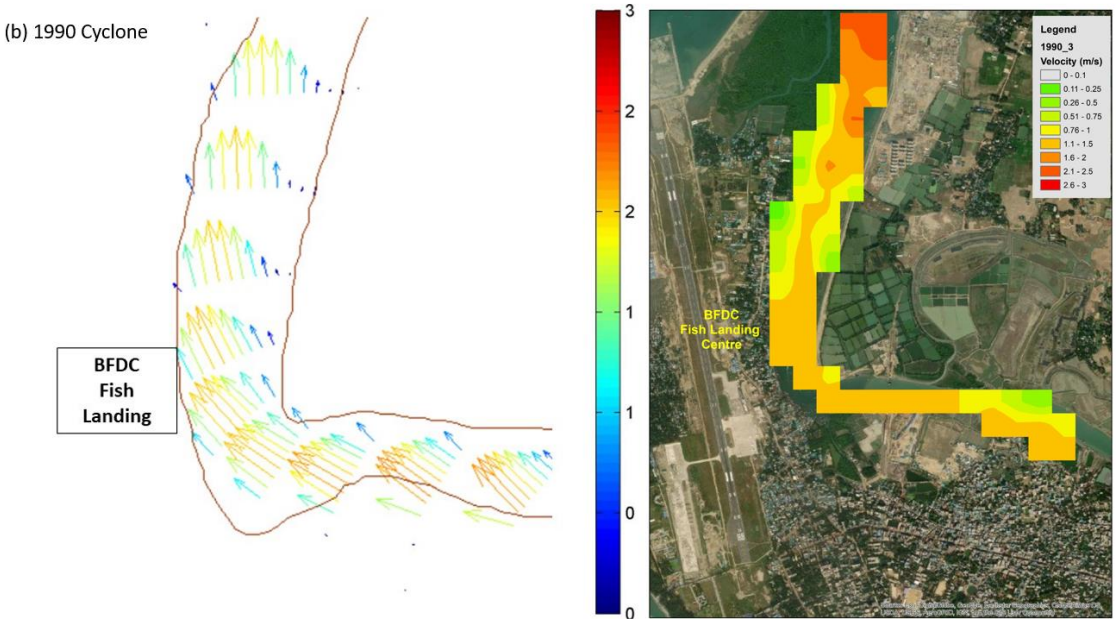


Figure 2-19 : Simulation results (flow speed and direction) in Case 1: 1990 Chittagong Cyclone

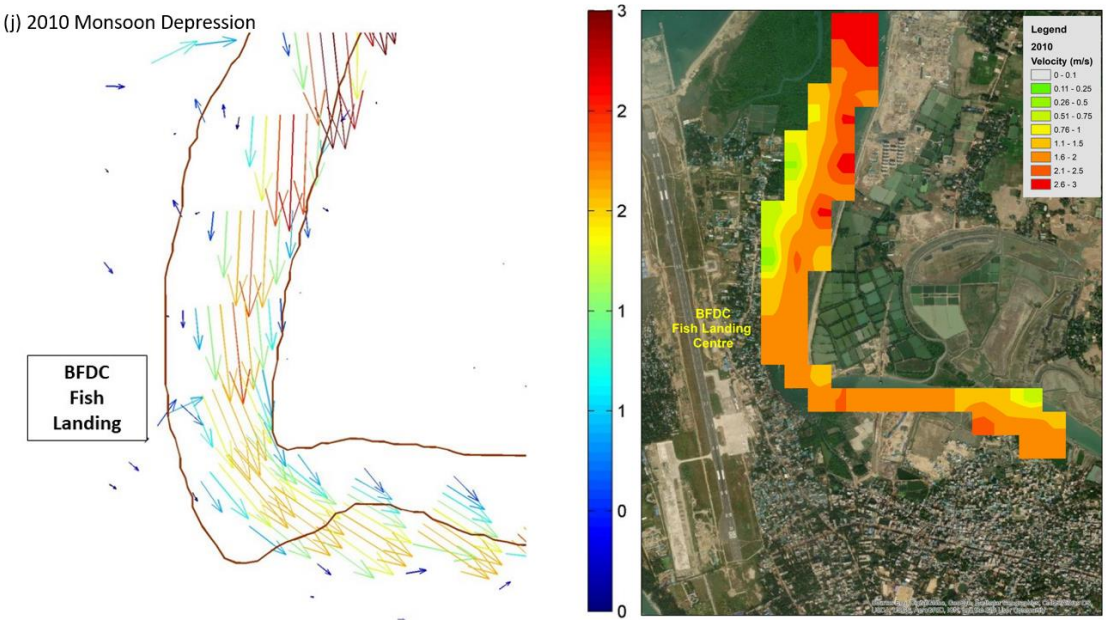


Figure 2-20 : Simulation results (flow speed and direction) in Case 2: 2010 Monsoon Depression

Normal spring tides

The following maximum flow speeds (sectional mean) during normal spring tides were observed in surveys of flow conditions during the field surveys using an Acoustic Doppler Current Profiler (ADCP).

0.55 m/s from downstream to upstream

0.75 m/s from upstream to downstream

◆Design horizontal seismic coefficient

The design seismic coefficient is set in BNBC 2020 with regional distributions as shown in the figure below. Based on this figure, the project area has a seismic coefficient of 0.28 in Zone-III. In BNBC, design seismic coefficients are calculated using the following coefficients and formula corresponding to the structure type and the soil type of the project site; this is the basis for the way the design seismic coefficients are calculated in this design, as follows.

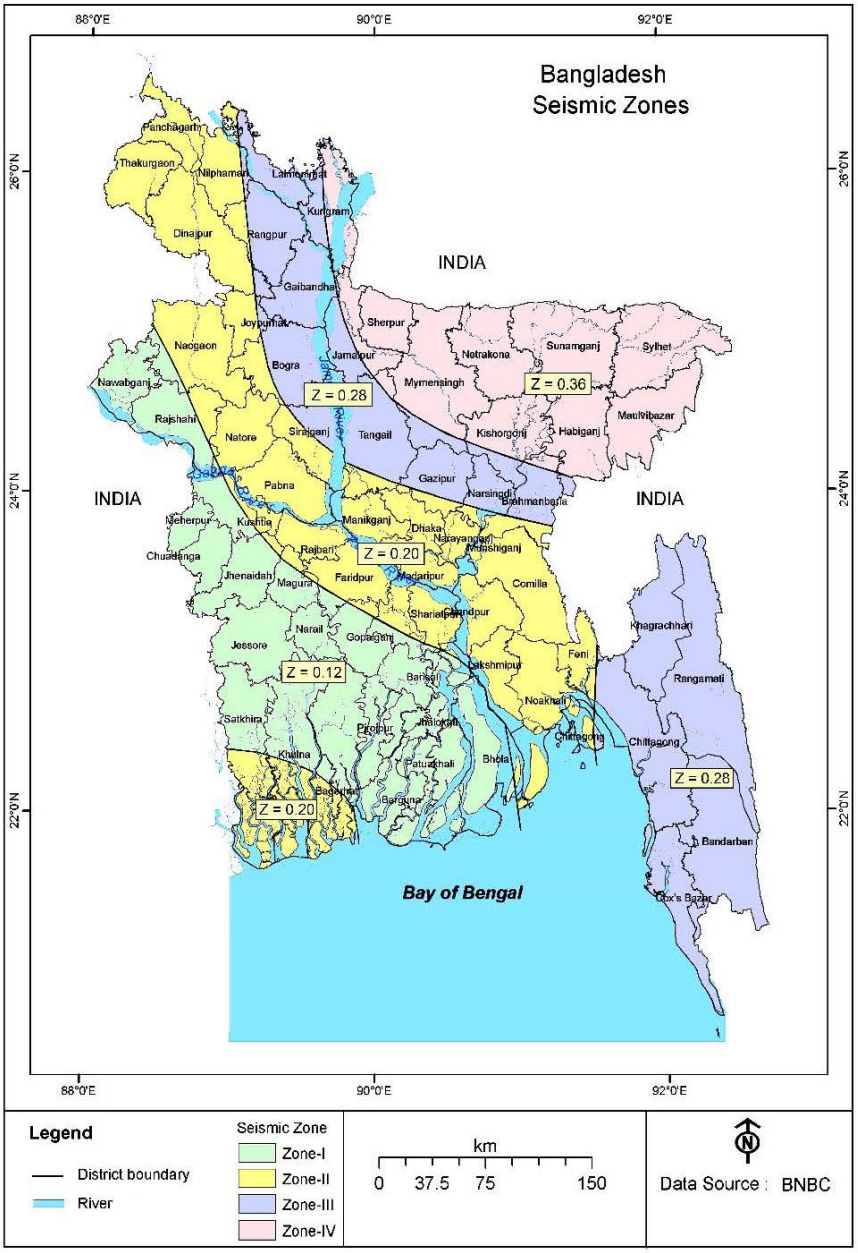


Figure 2-21 : Distribution of seismic coefficients by region

The design seismic coefficients for structures are determined by the following formula.

$$S_a = \frac{2}{3}\frac{ZI}{R}C_s \qquad (6.2.34)$$

Where,

S_a = Design spectral acceleration (in units of g) which shall not be less than $0.67\beta ZIS$

β = Coefficient used to calculate lower bound for S_a. Recommended value for β is 0.11

Z = Seismic zone coefficient, as defined in Sec 2.5.4.2

I = Structure importance factor, as defined in Sec 2.5.5.1

R = Response reduction factor which depends on the type of structural system given in Table 6.2.19. The ratio $\frac{I}{R}$ cannot be greater than one.

C_s = Normalized acceleration response spectrum, which is a function of structure (building) period and soil type (site class) as defined by Equations 6.2.35a to 6.2.35d.

$$C_S = S\left(1 + \frac{T}{T_B}(2.5\eta - 1)\right) \text{ for } 0 \le T \le T_B \qquad (6.2.35a)$$

$$C_S = 2.5S\eta \text{ for } T_B \le T \le T_C \qquad (6.2.35b)$$

$$C_S = 2.5\,S\eta\left(\frac{T_C}{T}\right) \text{ for } T_C \le T \le T_D \qquad (6.2.35c)$$

$$C_S = 2.5\,S\eta\left(\frac{T_C T_D}{T^2}\right) \text{ for } T_D \le T \le 4\ sec \qquad (6.2.35d)$$

C_s depends on S and values of T_B, T_C and T_D, (Figure 6.2.25) which are all functions of the site class. Constant C_s value between periods T_B and T_C represents constant spectral acceleration.

S= Soil factor which depends on site class and is given in Table 6.2.16

T= Structure (building) period as defined in Sec 2.5.7.2

T_B= Lower limit of the period of the constant spectral acceleration branch given in Table 6.2.16 as a function of site class.

T_C= Upper limit of the period of the constant spectral acceleration branch given in Table 6.2.16 as a function of site class

〈Bangladesh National Building Code〉 2020 P.3193〉

Based on the formula, the design horizontal seismic coefficient for each structure are as follows.

【Gravity revetment】

The design horizontal seismic coefficient of the gravity revetment is Kh = 0.12 as shown below.

Height of revetment from base: hm = 2.40 m (= crown height + 3.40 m - base height ± 1.00 m)

Base period: $T = C_t (h_n)^m = 0.0488 \times 2.40^{0.75} = 0.094$ (s)

Assuming that $\eta = 1$

$C_s = S\{1 + T/T_B(2.5\eta-1)\} = 1.15 \times \{1 + 0.094/0.20 \times (2.5 \times 1 - 1)\} = 1.96$

Therefore, the design horizontal seismic coefficient is

S_a = 2/3 x ZI/R x C_s = 2/3 x 0.28 x 1.00/3 x 1.96 = <u>0.12</u>

This value is judged to be reasonable compared to the range of 0.10 to 0.20 (for mooring facility B general sand and clay ground thickness of 25 m or more) given in the Japanese national standard *Gyoko/gyojo no shisetsu no sekkei sanko tosho 2015 nenban* (Reference book for the design of facilities for fishing ports and grounds, 2015 edition).

<u>【Gangway pier】</u>

The design horizontal seismic coefficient of the gangway pier is Kh = 0.17 as shown below.

Height of revetment from base: hm = 6.10 m (= crown height + 3.40 m - design ground level -2.70 m)

Base period: $T = C_t (h_n)^m = 0.0488 \times 6.10^{0.75} = 0.189$ (s)

Assuming that $\eta = 1$

$C_s = S\{1+T/T_B(2.5\eta-1)\} = 1.15\times\{1+0.189/0.20\times(2.5\times1-1)\} = 2.78$

Therefore, the design horizontal seismic coefficient is

$S_a = 2/3\times ZI/R\times C_s = 2/3\times0.28\times1.00/3\times2.78 =$ <u>0.17</u>

This value is judged reasonable compared to the range of 0.10 to 0.20 (for mooring facility B general sand and clay ground thickness of 25 m or more) given in the Japanese national standard *Gyoko/gyojo no shisetsu no sekkei sanko tosho 2015 nenban* (Reference book for the design of facilities for fishing ports and grounds, 2015 edition).

◆Soil conditions

Four boreholes were drilled in the river and eight on the land to investigate the soil conditions. The figure below shows the locations of these boreholes.

In designing the civil engineering facilities, a total of eight boreholes (BH-1, BH-2, BH-3, BH-4, BH-5, BH-6, BH-7, BH-11) located near the planned revetment and pontoons were used to list and analyze soil conditions.

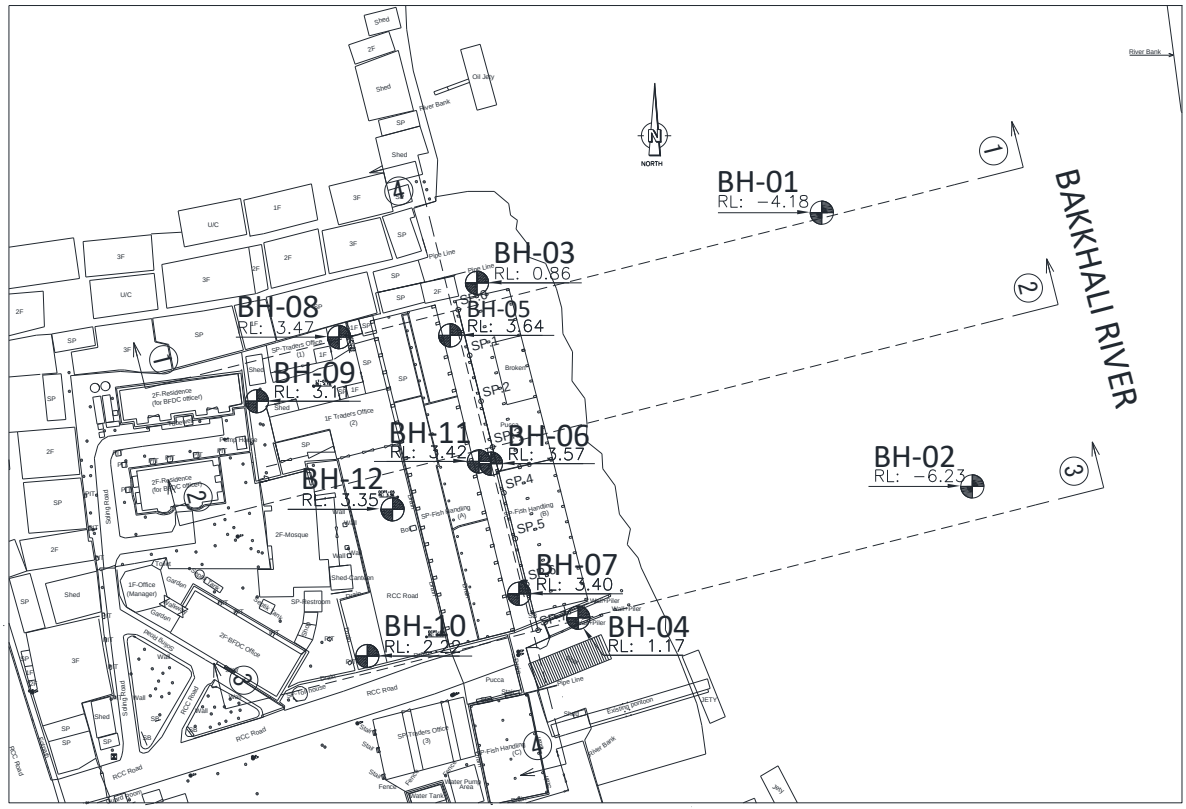


Figure 2-22 : Location of survey boreholes

The figure below shows the presumed cross-sections of the strata in the center of the project site and the soil constants for each soil layer.

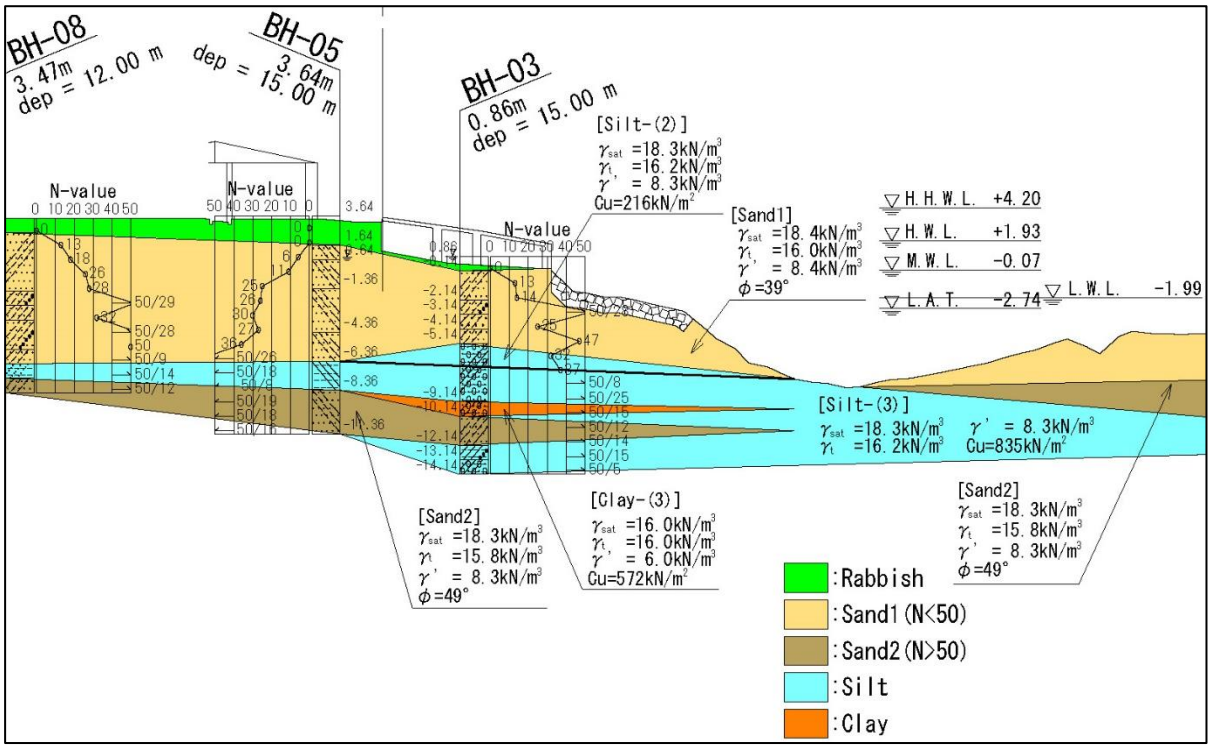


Figure 2-23 : Presumed cross-sections of strata (3)

(5) Usage conditions

◆Vertical load (revetment)

The vertical load acting on the apron behind the revetment is set to 5 kN/m^2, the figure for revetments and levees given in *Gyoko/gyojo no shisetsu no sekkei sanko tosho 2015 nenban* (Reference book for the design of facilities for fishing ports and grounds, 2015 edition).In case of earthquake, the value is set at half of the normal value.

Table 2-13 : Vertical loads (normal, excluding snow loads)

Classification	Load (kN/m^2)	Classification	Load (kN/m^2)
Landing pier	10	Landings	5
Launch preparation pier	10	Revetments and levees	5
Docking pier	5		

◆Vertical load (pontoons)

Based on *Futaishiki keisengan sekkei/sekisan seko manual (an) Heisei 27 nen 3 gatsu* (Floating mooring wharf design and summation manual (draft), March 2015) and the actual usage of the existing congested pontoon, and given the standard value (load of 2.6 people/m^2), the vertical load acting on the pontoons is as follow.

Vertical load (pontoons): 2.0 kN/m^2

◆Vertical loads (gangways)

Based on *Gyoko/gyojo no shisetsu no sekkei sanko tosho 2015 nenban* (Reference book for the design of facilities for fishing ports and grounds, 2015 edition), the vertical loads acting on the gangways are as follows.

Table 2-14: Vertical loads on gangways

Consideration	Load (kN/m^2)
Main girders of gangway bridges	3.5
Deck slabs/floor boards of gangway bridges	5.0

(6) Major material conditions

◆Unit volume weight

Based on *Gyoko/gyojo no shisetsu no sekkei sanko tosho 2015 nenban* (Reference book for the design of facilities for fishing ports and grounds, 2015 edition), the general values of the unit volume weights of the major materials are as follows.

Table 2-15: Unit volume weights of materials

Material	Unit volume weight (kN/m^3)	Material	Unit volume weight (kN/m^3)
Steel, cast steel	77.0	Asphalt pavement	22.6
Cast iron	71.0	Stone (granite)	26.0
Reinforced concrete	24.0	Stone (sandstone)	25.0
Plain concrete	22.6	Sand, gravel, cobblestones (wet, in air)	18.0
Cement mortar	21.0	Sand, gravel, cobblestones (saturated, in air)	20.0
Lumber	7.8	Seawater	10.1

◆Concrete

The allowable stress of concrete is as follows.

Table 2-16: Allowable stress of concrete

Material	Allowable compressive stress intensity
Plain concrete f'ck = 18	18 N/mm^2
Reinforced concrete f'ck = 24	24 N/mm^2

◆Steel

The allowable stress of steel is as follows.

Table 2-17: Allowable stress of steel

Material	Allowable stress intensity
Structural steel (SS400)	140 N/mm^2
Structural steel (SUS304)	120 N/mm^2
Steel tubular pile (SKK400)	140 N/mm^2
Reinforcement steel (SD345)	196 N/mm^2

The cutting test load for the mooring chains is as shown below.

Table 2-18: Cutting test load for mooring chains

Type	Cutting test load: Ts (N)
JIS F 3303 : 2010 Ships and marine technology-Flash butt welded anchor chain Class 2 chain with studs (ST2)	$Ts = 13.7 \cdot d^2 \cdot (44-0.08 \cdot d)$ d: Nominal diameter of chain (mm)

The steel corrosion rate will be the following general value, which is indicated in *Gyoko/gyojo no shisetsu no sekkei sanko tosho 2015 nenban* (Reference book for the design of facilities for

fishing ports and grounds, 2015 edition).

Table 2-19: Mean steel corrosion rate (one side)

Corrosive environment		Corrosion rate (mm/year)	Value used
Ocean side	HWL or higher	0.3	⇒0.30
	HWL to LWL - 1 m	0.1-0.3	⇒0.20
	LWL - 1 m to seabed	0.1-0.2	⇒0.15
	Seabed mud layer	0.03	⇒0.03
Land side	On land, exposed	0.1	⇒0.10
	Underground (above residual water level)	0.03	⇒0.03
	Underground (below residual water level)	0.02	⇒0.02

Additionally, the corrosion wear rate of the mooring chains will be 1 mm of diameter per year in accordance with *Gyoko/gyojo no shisetsu no sekkei sanko tosho 2015 nenban* (Reference book for the design of facilities for fishing ports and grounds, 2015 edition).

2.2.4. Equipment

2.2.4.1. Policy for planning of Equipment

The equipment in the project plan corresponds to the equipment listed on Table 1-14. The followings are the respective basic policy for the equipment sorted into four groups: temperature and hygiene management equipment, ice-making facilities, solar power generation system, and gate.

(1) Temperature and Hygiene Management Equipment

Temperature and hygiene management equipment is essential for preventing contact between landed fresh fish and contaminants and to keep fresh fish cool at project facilities.

The equipment includes: equipment to prevent fresh fish landed and washed with well water at project facilities from coming into contact with contaminants and to facilitate its handling in the series of processes (e.g. sorting, mooring, packaging, shipping), and cold storage equipment to keep fresh fish, except those fish shipped on that day, cool after landing. While respecting the existing fresh fish landing and handling processes, equipment necessary for hygienic control will be selected, and quantities will be determined in consideration of the scale of the present volume of landed fresh fish.

The following are the equipment in detail.

1) Fish wash basins and fish baskets for cleaning fresh fish
2) Pallets for keeping fish and handling equipment off the floors, sorting trays for grouping

fish, and fish containers for shifting fish over short distances in the area, in sorting and handling operations in the handling area

3) Hanging scales for weighing
4) Cooler boxes and prefabricated cold storages for overnight stock for fish
5) High-pressure washing machines for cleaning the handling area and handlifts

The quantities and sizes of the aforementioned equipment are listed below. However, an additional 15% to 20% of these quantities will be procured as a reserve for immediate needs.

Fish wash basins are to be used as washing tanks for fresh fish transported from fishing boats to the handling area in bamboo baskets. The fish wash basins will be filled with water, and fresh fish will be transferred from the bamboo baskets to the fish baskets set in the basin for cleaning. Therefore, the fish wash basins shall have a large enough capacity for the cleaning work with the fish baskets inside, will be made of plastic, and will be roughly 40 cm depth, 90 cm width, and 130 cm length. The basin shall have a drain valve to facilitate draining. The basins will be installed in the handling area on the river side of the building where the floor is the same height as the apron. and quantity is 16 pcs, to accommodate the peak-season landing at CXB FLC of 15 tons per hour assuming 50 kg of fish contained can be cleaned in each basin in three minutes.

Fish baskets are to be used to clean fresh fish in the wash basins and to shift fish to the handling area. The mesh-type plastic containers is planned for easy water drain out after washing. The containers is about 35 cm depth, 55 cm width, and 80 cm length so that they can fit into the fish wash basins and be carried by hand. Fishes are transacted at a maximum of 20 locations in the handling sheds at the same time, observed in our field survey; and there are average eight bamboo baskets and metal bowls are employed at each transaction, so 160 pcs of fish baskets are necessary, which is corresponding to, 10 for each fish wash basin.

Sorting trays are to be used for sorting fish by species, size, and other criteria as needed, after brought in the handling area, The sorting tray shall be plastic container, of the dimensions about 20 cm depth, 90 cm width, and 1,500 cm length, to be able to contain sufficient volume of sorted fish and not too deep for easy identification of sorting. 20 sorting trays are necessary on the raised-floor areas of the handling area, corresponding to 20 transaction locations.

Fish containers are for shifting in the handling area after cleaning and sorting and before packaging. As 100 tons of fish are handled manually per day during the peak fishing season, the fish containers shall hold a sufficient amount of fresh fish (at least 30 kg) and will be carried manually, it shall be made of plastic and stackable when fish is in it. For hygienic

purpose, fish containers shall be handled on pallets, and shall not be placed on the floors of the handling area directly. Fish containers shall be about 32 cm depth with a base size that fits onto the pallets about 40 cm width and 60 cm length. As with the sorting trays, they shall be used on the raised-floor areas of the handling area. For handling of 100 tons of fish per day at the peak season, assuming three turnovers a day, about 36 tons of fish shall be handled in the fish containers, 36,000kg/30kg=1,200, number of fish containers necessary for it shall be 1,200 pcs..

Pallets are for keeping fish and handling equipment off the floors, so as to prevent contamination. Fish containers shall be handled on the pallet during shift of fish until packaging.

Pallets shall be light enough to be carried manually by one person, shall have a base size suitable for the fish containers. The pallets shall be made of plastic, about 15 cm height, 120 cm width, and 100 cm length. They will be put on the raised-floor areas of the handling area. Assuming two containers stacking with 5 each put on a pallet side by side, each pallet can have a total of 300 kg in the form of 10 fish containers loaded with 30 kg each, 36,000 kg/300kg=120, 120 pallets are necessary.

Hanging scales shall replace the balance scales presently in use at the existing facility. The balance scales take up a lot of space due to the length of the balance beams, and weighing requires long time; therefore, hanging scales, which is compact and require less time for weighing—are required for the project. The scales will be dial type in consideration of the frequent blackout in the area.

As fish are weighed at each stage after washed, sorted, and sold, the hanging scales are expected to be used throughout the handling area. In the existing facility, six balance scales are set in a row in the handling shed and fresh fish must be brought for weighing; hanging scales shall be installed at several locations throughout the plan handling area to facilitate access to them from anywhere in the handling area. Hooks will be suspended from the beams in the handling area where the hanging scales are installed so that the scales can be movable.

For weighing, the fish will be placed in the metal bowls using at the existing facility and suspended from the hanging scales. The maximum weighing weight of the hanging scales shall be 120 kg, 11 hanging scales are necessary, nearly twice the number of existing balance scales, to allow easy access from anywhere in the handling area and to shorten the time required for weighing,

Cooler boxes are containers for keeping fresh fish, which was not able to ship within the landed day, in the cold storages in the handling area. It shall be capacity of about 50 liters, storable about 30 kg of fish on clean ice, which is easy for workers to carry and place on the shelves in the cold storages. 340 cooler boxes are required to store about 10% of the 10 tons of

fresh fish after a good fishing day.

Prefabricated cold storage units will be used to store the cooler boxes. The prefabricated cold storage units shall have a capacity of keeping chilled zone temperature at -5°C, to be set for storing fresh fish, and the storage capacity and number of units shall be able to accommodate the cooler boxes on the shelves, two prefabricated type cold storage units of 5.4 m width and 5.45 m length capable of storing five tons of fresh fish in 165 cooler boxes in each unit. The two units can store total 10 tons of fresh fish, or 10% of the maximum daily landing fish of 100 tons. One unit will be installed on the north side of the handling area, and the other unit will be installed on the south side as a part of building utilities.

Four high-pressure washers shall be allocated to wash the floors and apparatus in the handling area, assuming that four cleaning staffs will be engaging in such chores.

Handlifts will be used to shift a pile of pallets in the handling area during cleaning on the floor. The handlifts will be made of rust-resistant stainless steel, and four units will be provided for four cleaning staffs.

The following shows an instance of the arrangement of equipment and materials described above, from fish cleaning, to shifting, sorting, weighing, and transitory storage in the handling area.

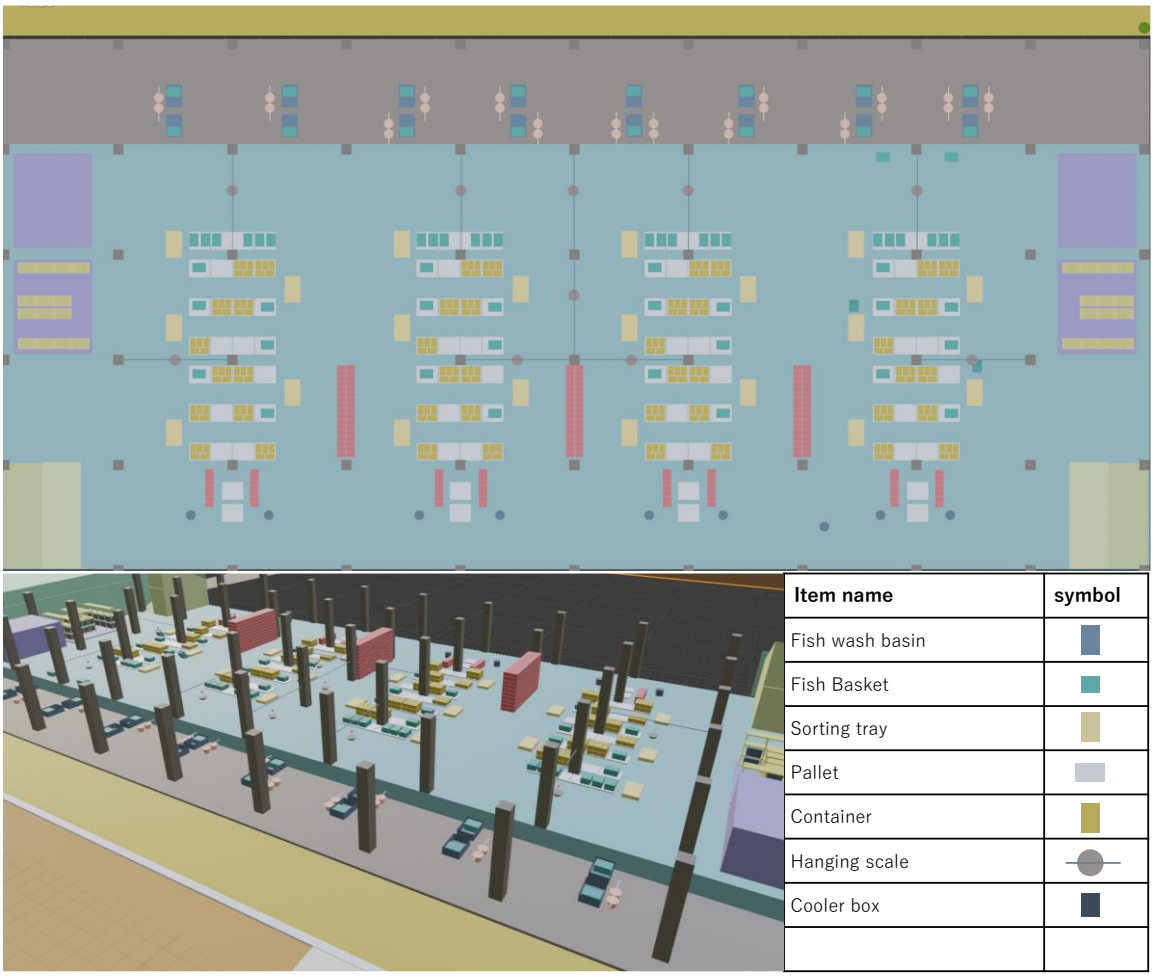


Figure 2-24 : Instance of arrangement of equipment and materials in the handling area

2.2.4.1.1. Ice-making facilities

Existing ice factory have a nominal daily production capacity of 30 tons of block ice. The equipment in it has been aged. Although the ice cans and tanks were designed to produce 100-kg block ice, they are actually used to produce block ice weighing 60 kg following the normal 60-kg block ice produced by local ice makers and widely distributed in the area due to easy manual handling. Since there is only one aging compressor for the ice-making facilities, the facilities cannot operate during periodic maintenance or machine troubles.

It is recommended to rehabilitate the ice making facilities to modify the facilities to be able to make the 60-kg block ice by BFDC, and to prepare a spare compressor for fear of suspension of operation during maintenance and troubles.

2.2.4.1.2. Solar power generation system

Regarding the solar power generation system, the Bangladesh Power Development Board has a regulation that the maximum output of solar power generation is limited to 7% of transformer capacity of the facilities.

As the transformer capacity for the project facilities, 300–500 kVA is being planned, so the

maximum solar output of 7% of transformer capacity will be about 21–35 kVA, with electricity consumption of 16.8–25.6 kVA.

Based on the track record of solar power systems of comparable size, the annual available electric energy will amount to just 7% of the CXB FLC ice factory's annual power consumption of 400,000 kWh.

High hurdles also exist in terms of operation and maintenance; maintaining a solar power generation system requires replacing the power conditioner, converting from DC to AC, in about 10 years as well as attached batterie, which are deemed to be low cost-effective.

Therefore, exterior lights with built-in compact solar batteries and solar panels for generating relatively small amounts of electricity are planned as a part of building utilities.

2.2.4.1.3. Toll Gate

Tolls corresponding to the loading volume of fish of the vehicle exiting from CXB FLC are collected by staffs in visual recognitions. CXB FLC, has requested to install a toll gate for establishing more efficient toll collecting system.

The gate shall be a simple mechanical mechanism, installed at the entrance/exit of the premises as a part of building utilities.

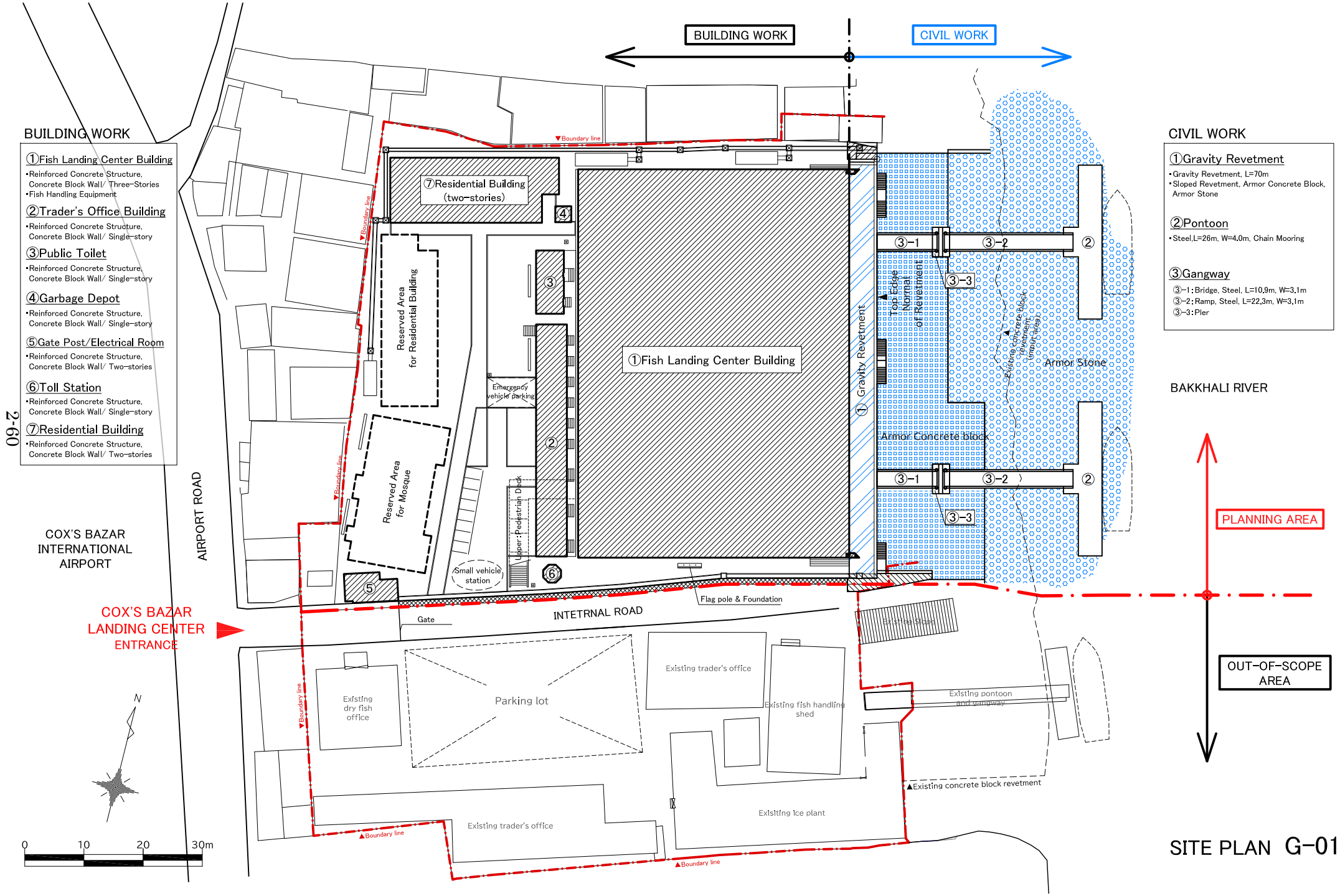
2.2.4.2. List of Equipment

Table 2-20 : List of plan equipment

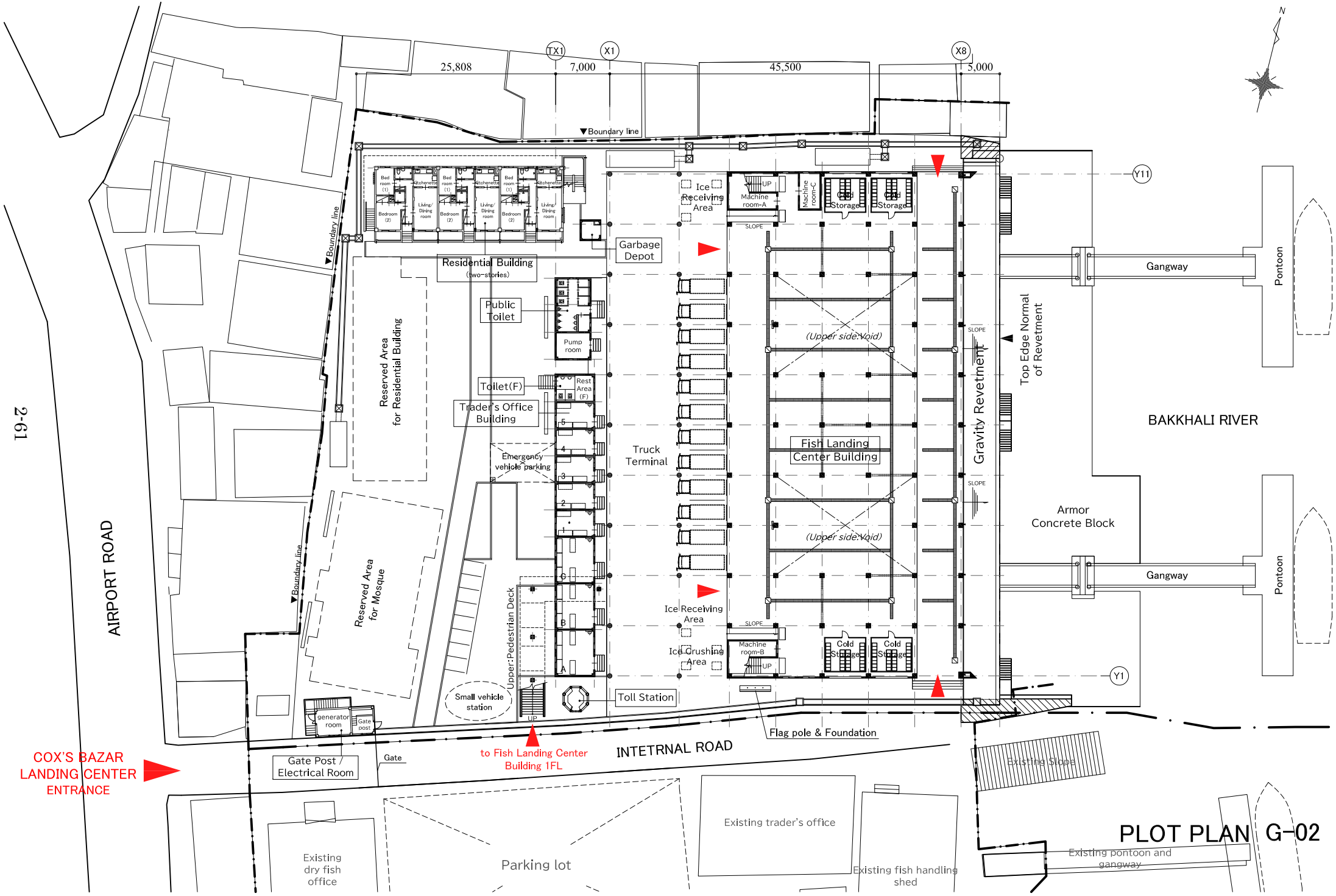
Item No.	Item name	Quantity	Unit
1-01	Fish wash basin	18	PCS
1-02	Fish basket	180	PCS
1-03	Sorting tray	24	PCS
1-04	Pallet	140	PCS
1-05	Fish container	1,400	PCS
1-06	Hanging scale	12	PCS
1-07	Cooler box	360	PCS
1-08	High pressure washer	5	Set
1-10	Handlift	2	Set

2.3. Outline Design

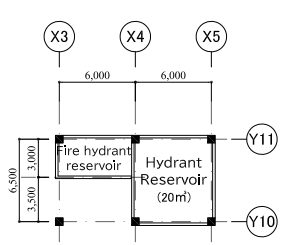
Drawing Number		Title
General Plan	G-01	SITE PLAN
	G-02	PLOT PLAN
Building Facilities	AF -01	FISH LANDING CENTER BUILDING (1)
	AF -02	FISH LANDING CENTER BUILDING (2)
	AF -03	FISH LANDING CENTER BUILDING (3)
	AF -04	FISH LANDING CENTER BUILDING (4)
	AF -05	FISH LANDING CENTER BUILDING (5)
	AT -01	TRADER'S OFFICE BUILDING
	AW/G -01	PUBLIC TOILET / GARBAGE DEPO
	AE -01	GATEPOST / ELECTRICAL ROOM (1)
	AE -02	GATEPOST / ELECTRICAL ROOM (2)
	AP -01	TOLL STATION
	AR -01	RESIDENTIAL BUILDING (TWO-STORIES)
Civil Engineering Facilities	C -01	GIVIL ENGINEERING FACILITIES LAYOUT PLAN
	C -02	STANDARD SECTIONS AND GANGWAY GENERAL PLAN
	C -03	PONTOON GENERAL PLAN



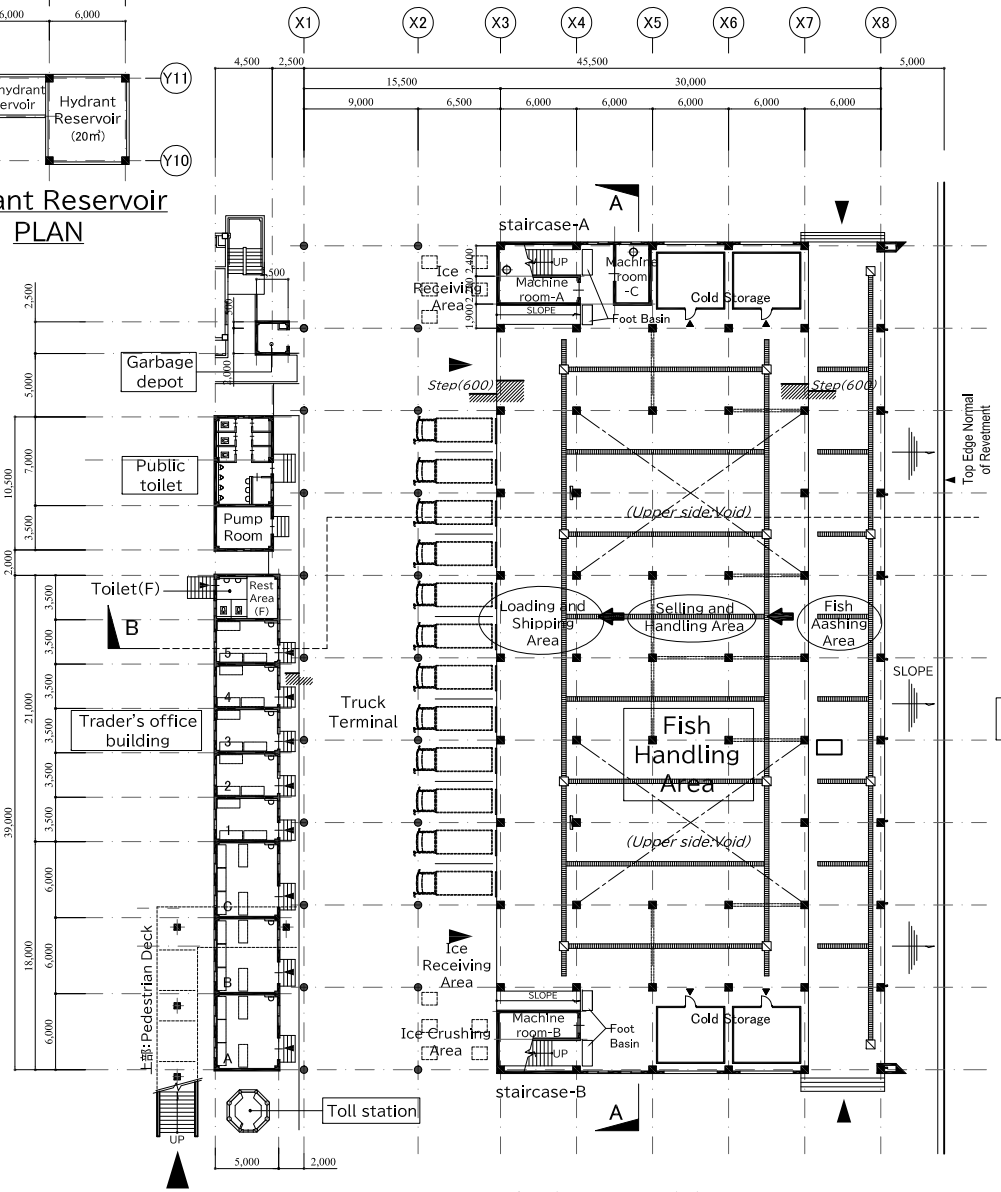
SITE PLAN G-01



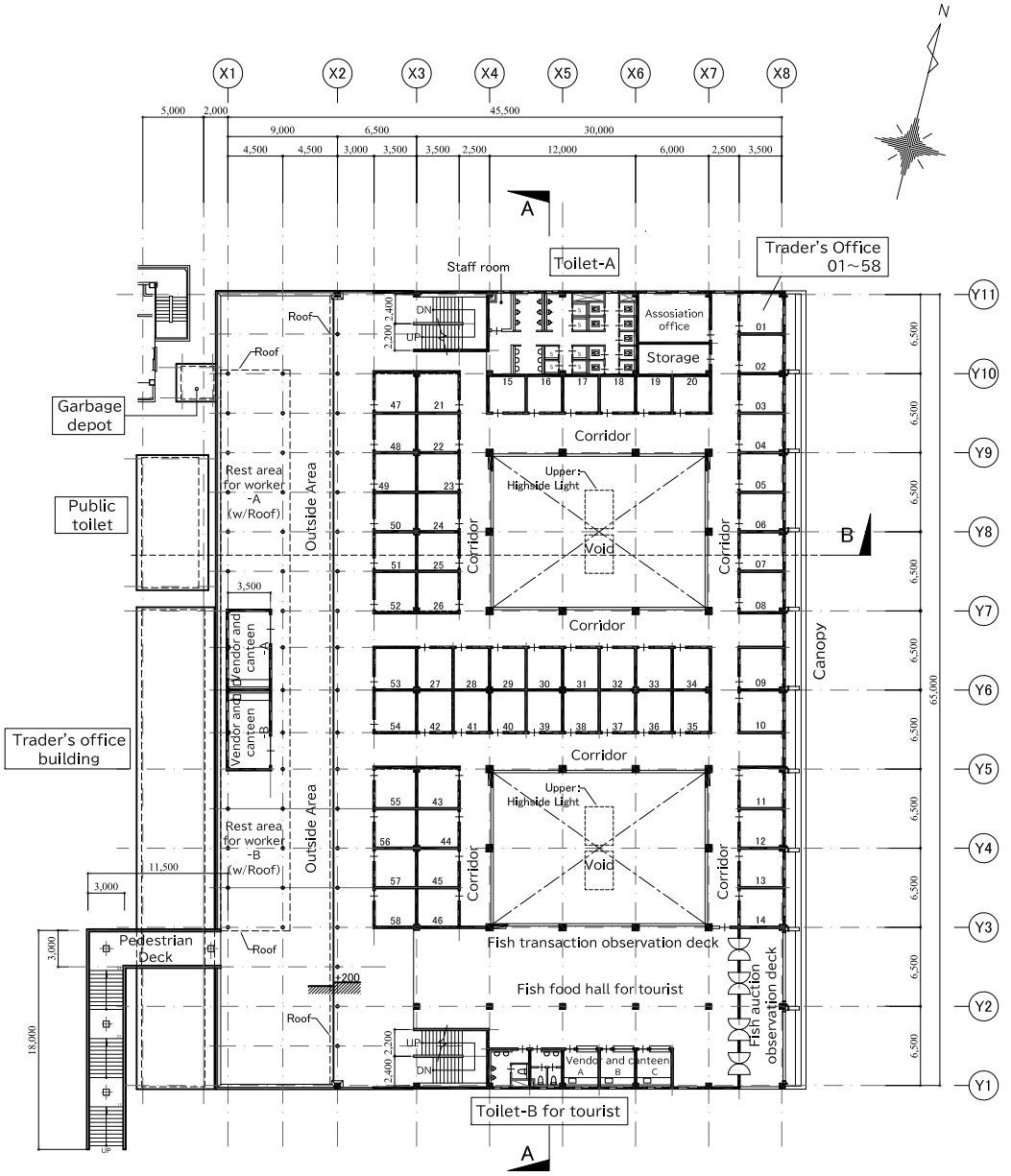
PLOT PLAN G-02



Hydrant Reservoir PLAN

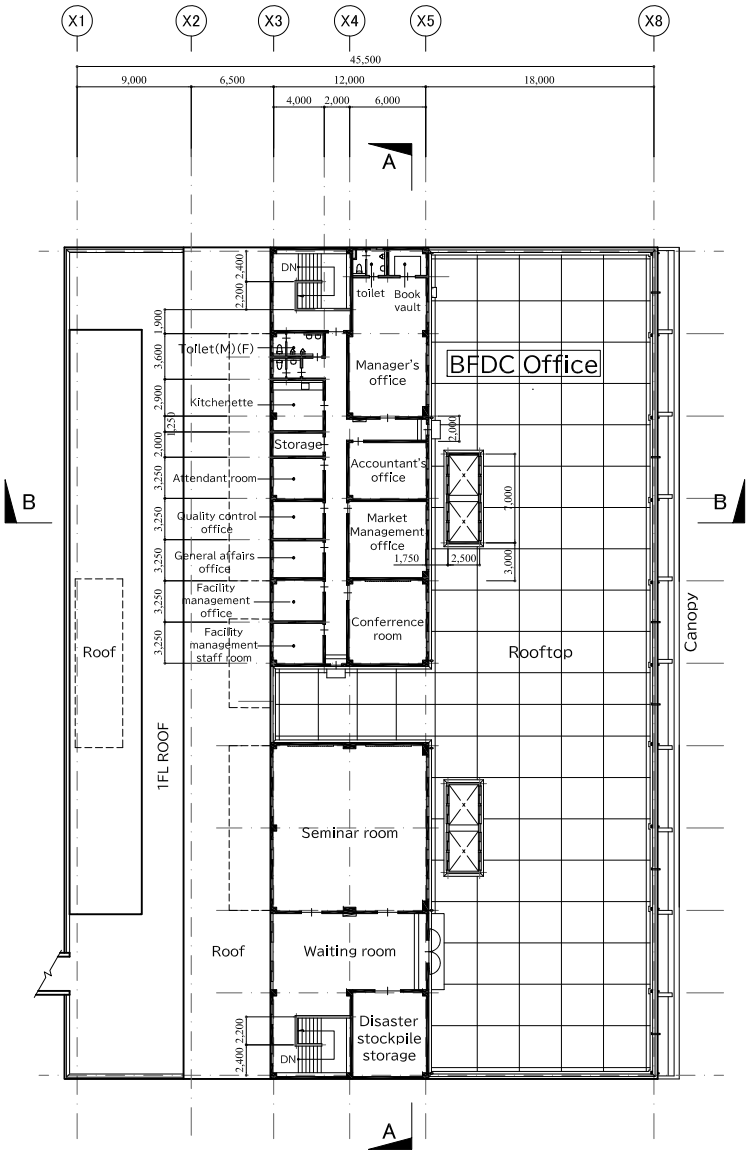


GROUND FLOOR PLAN

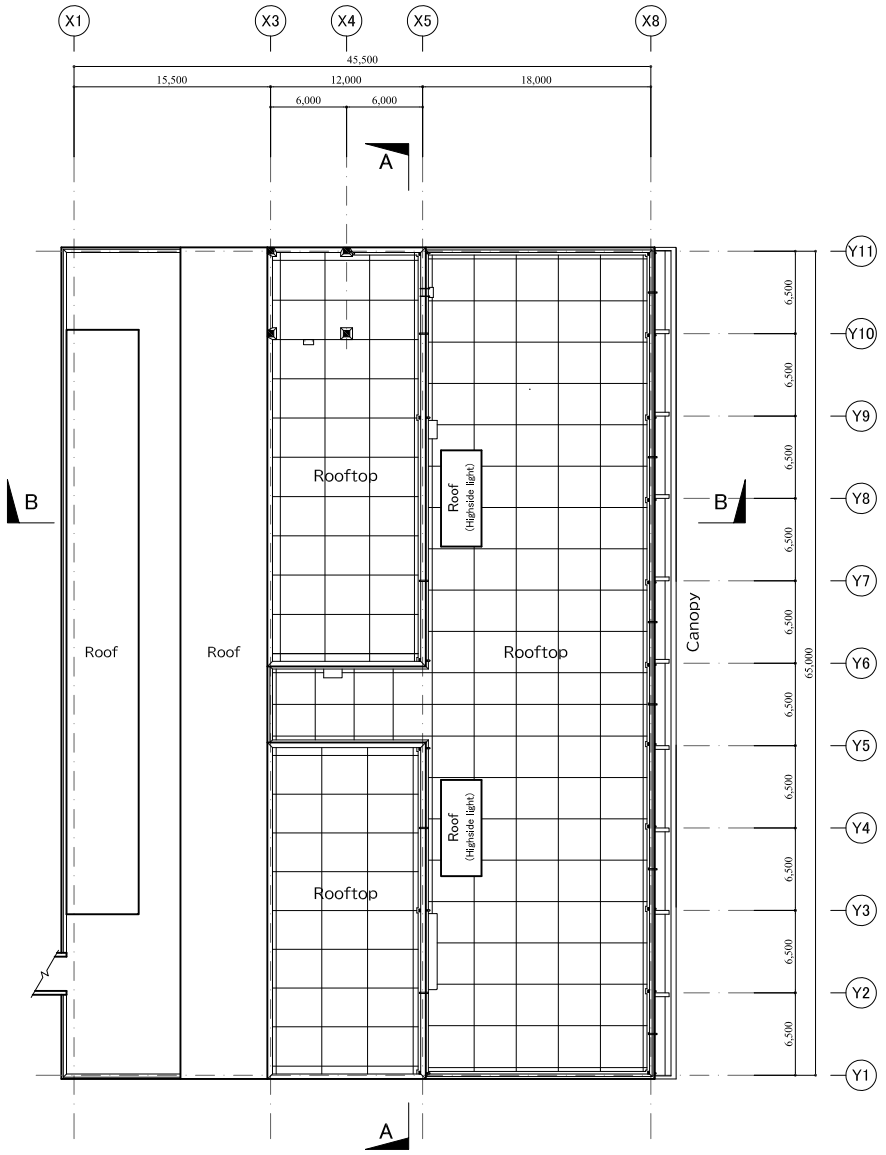


FIRST FLOOR PLAN

FISH LANDING CENTER BUILDING(1) AF-01



SECOND FLOOR PLAN



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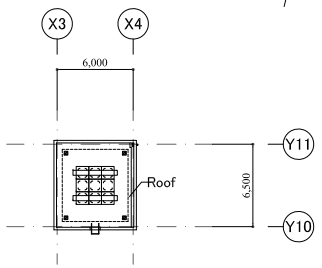
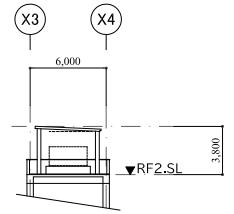
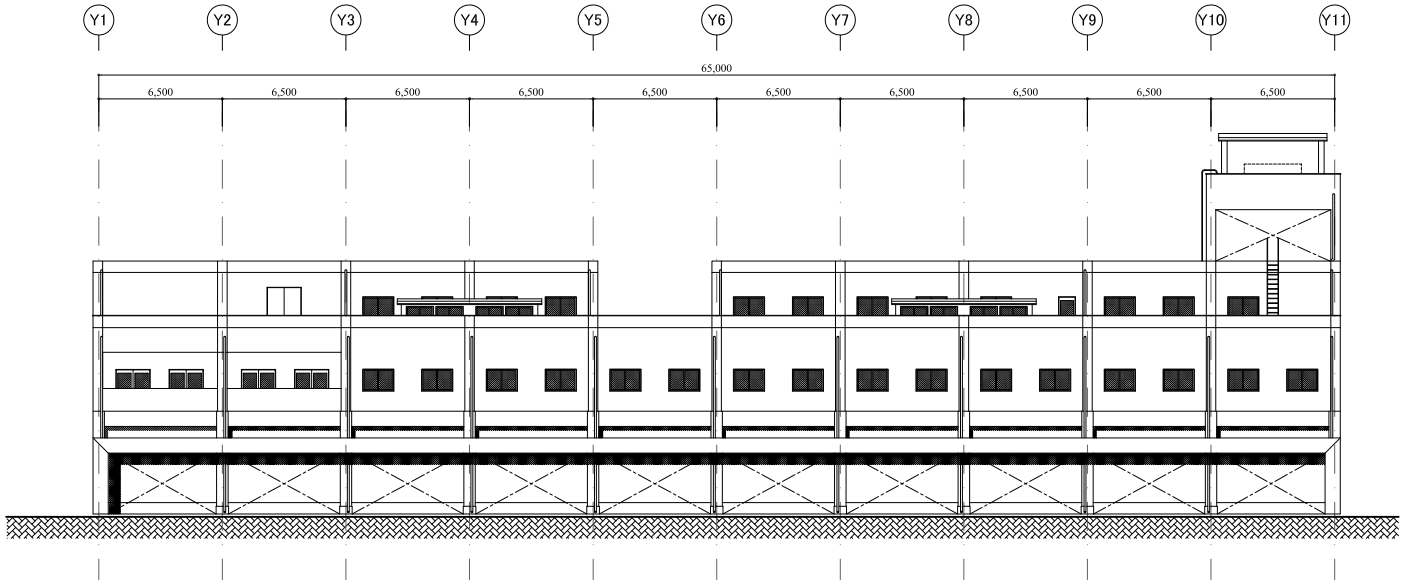


RF2 PLAN



RF2 PLAN

FISH LANDING CENTER BUILDING(2) AF-02



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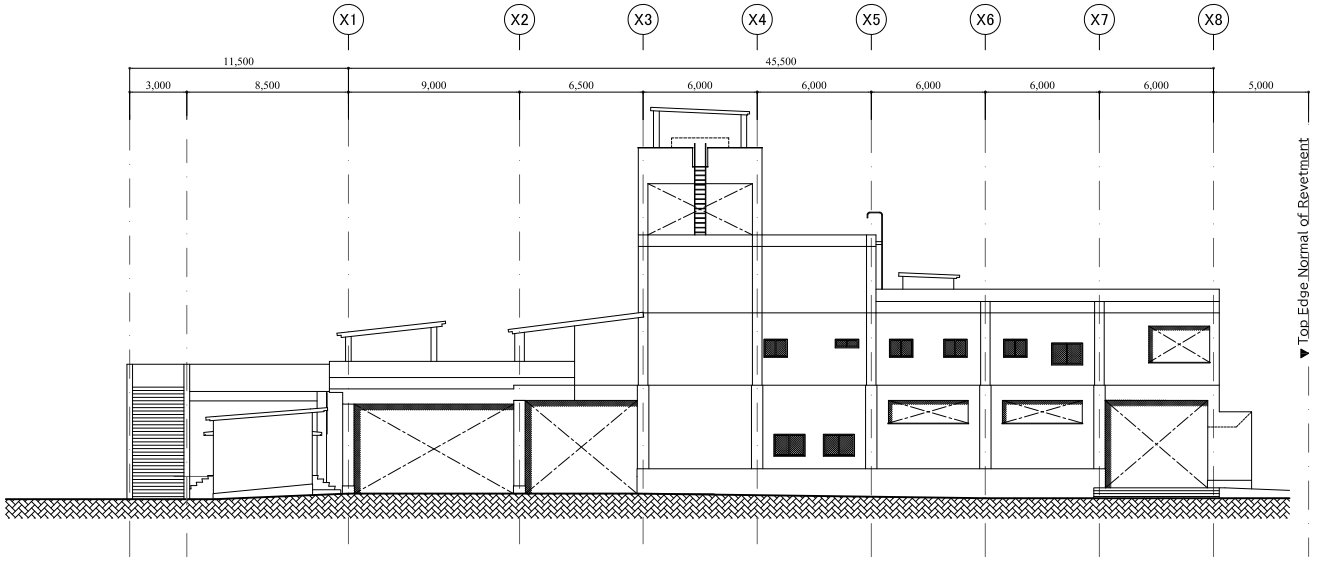
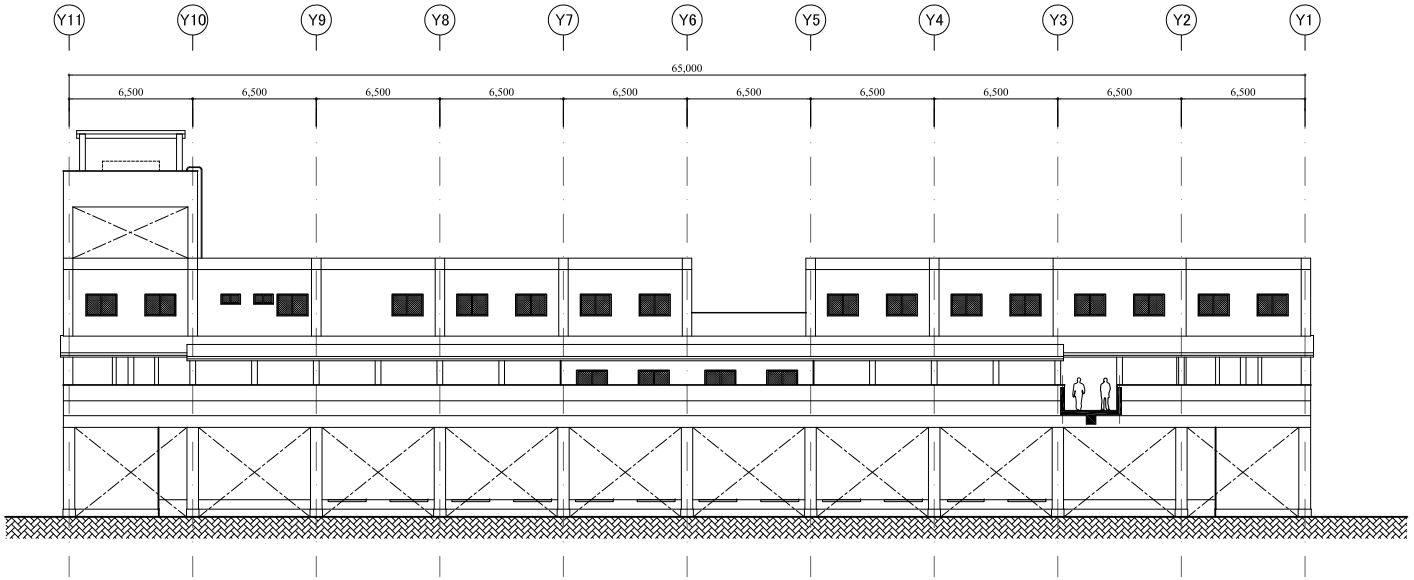


SOUTH ELEVATION

FISH LANDING CENTER BUILDING(3) A_F-03



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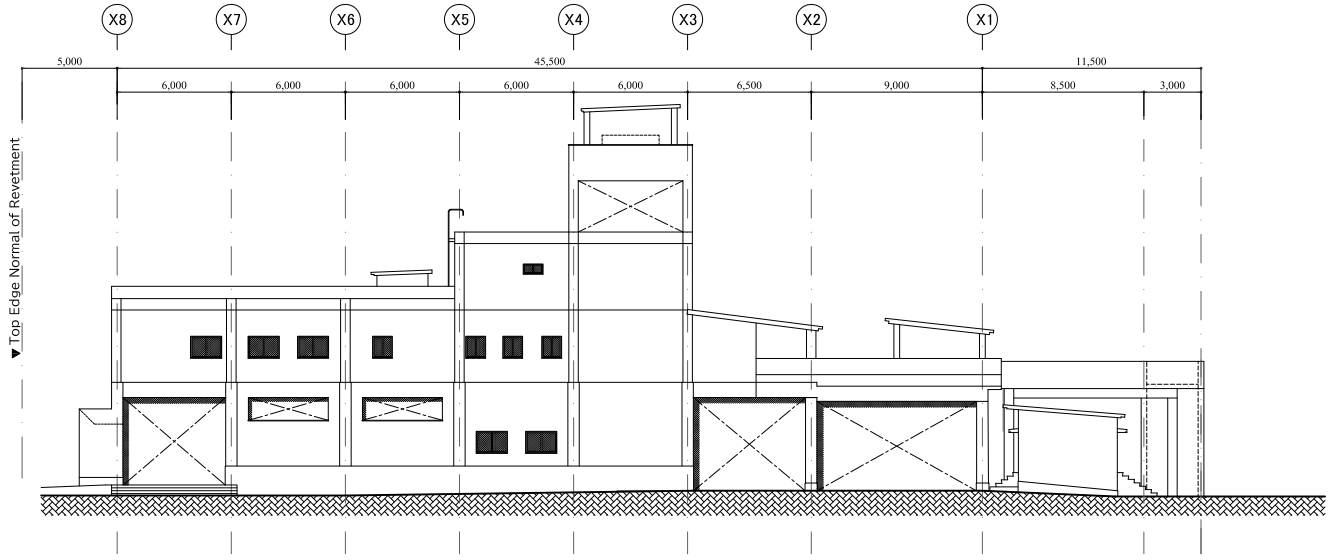
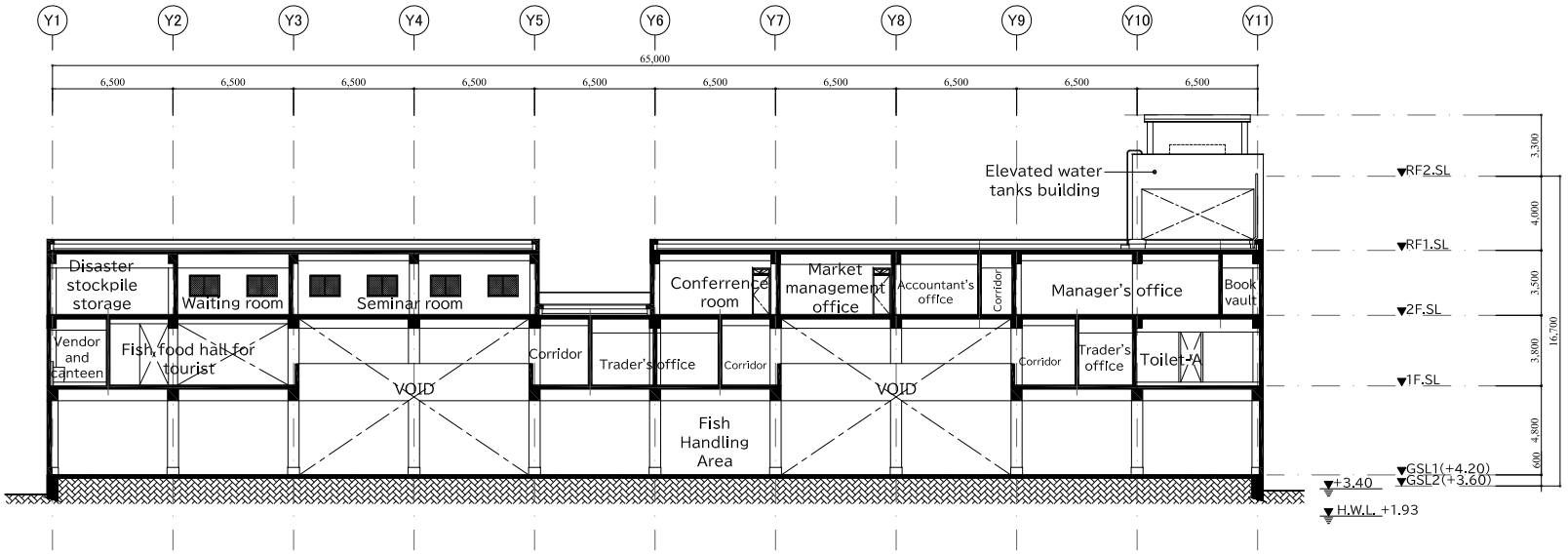
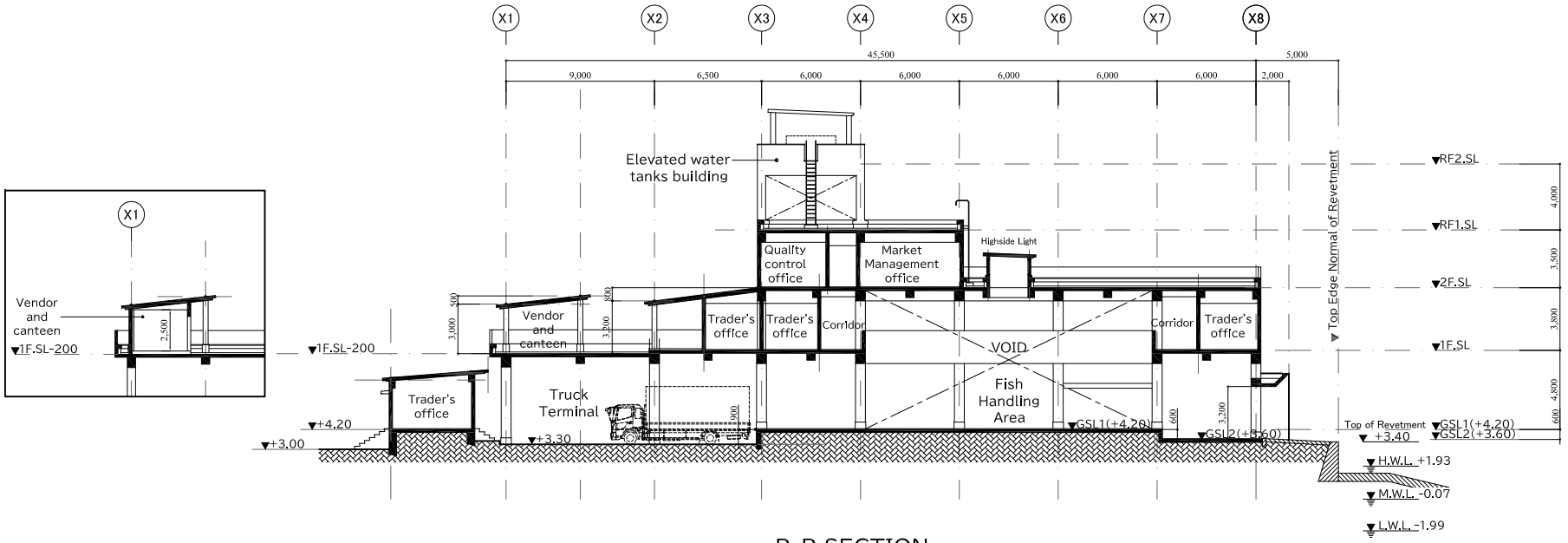


NORTH ELEVATION

FISH LANDING CENTER BUILDING(4) A_F-04

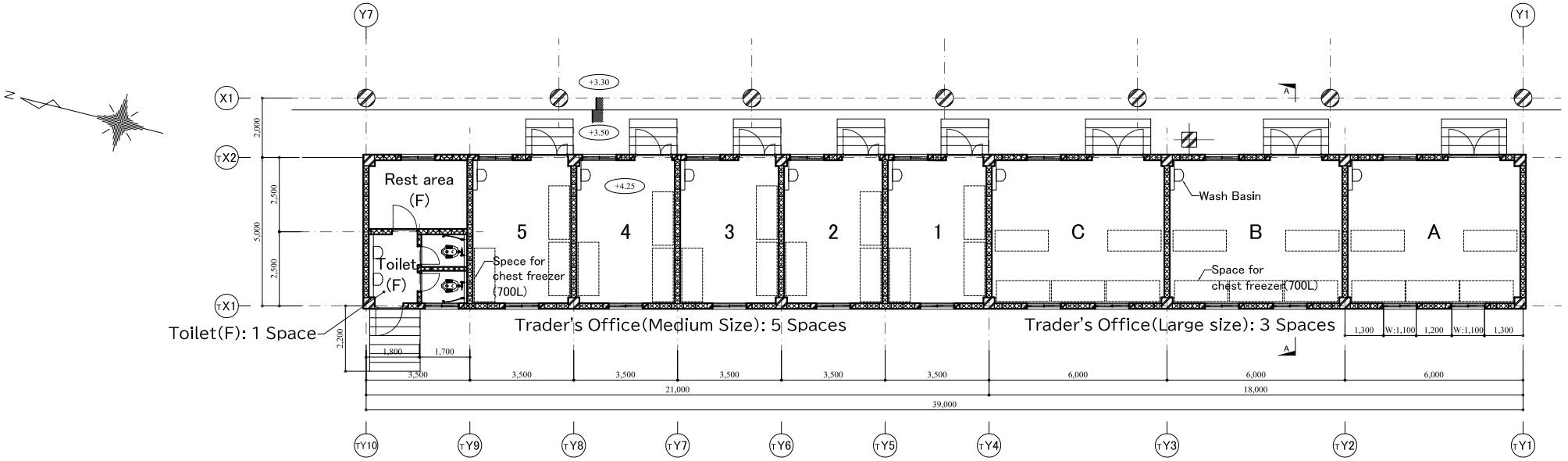


A-A SECTION

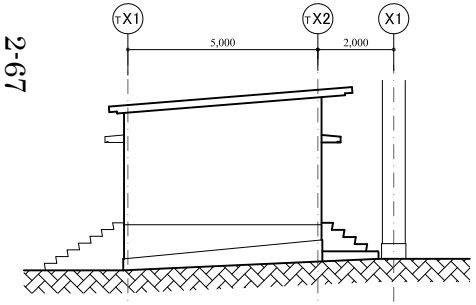


B-B SECTION

FISH LANDING CENTER BUILDING(5) AF-05



GROUND FLOOR PLAN



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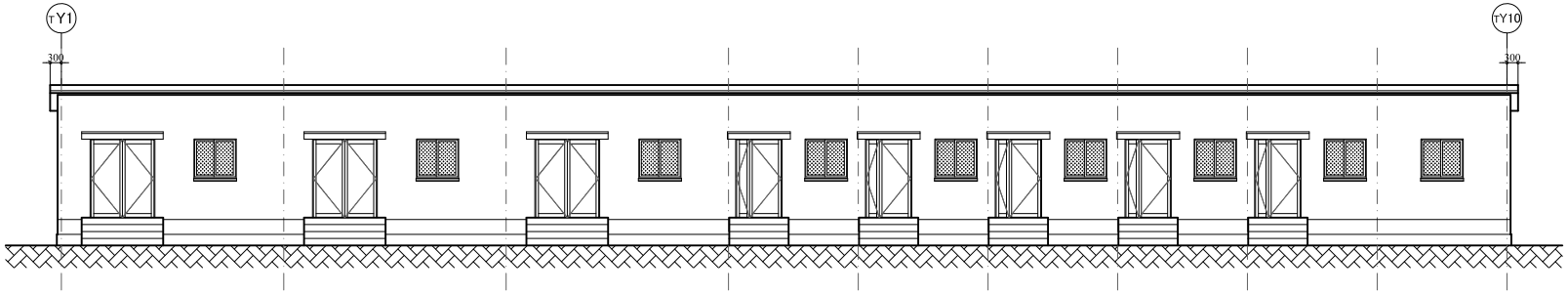

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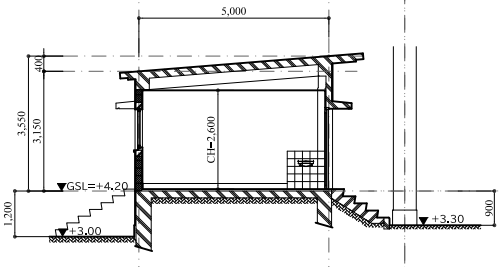

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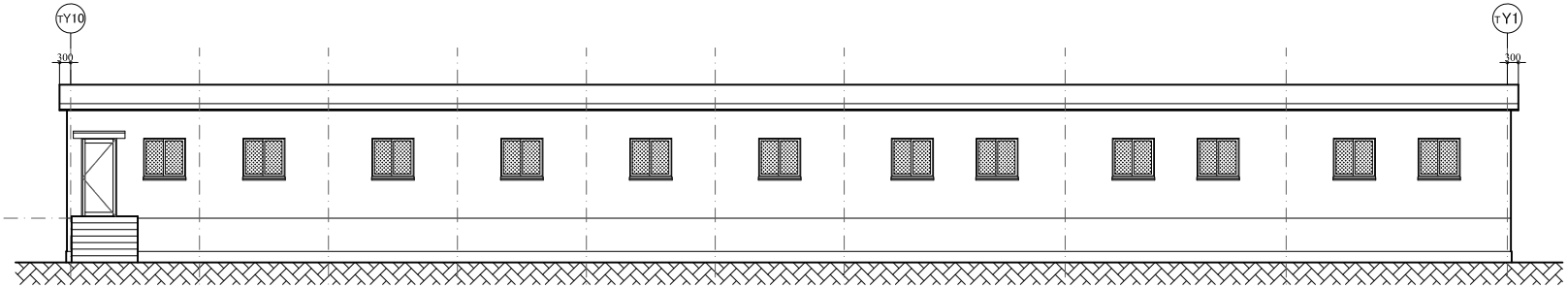
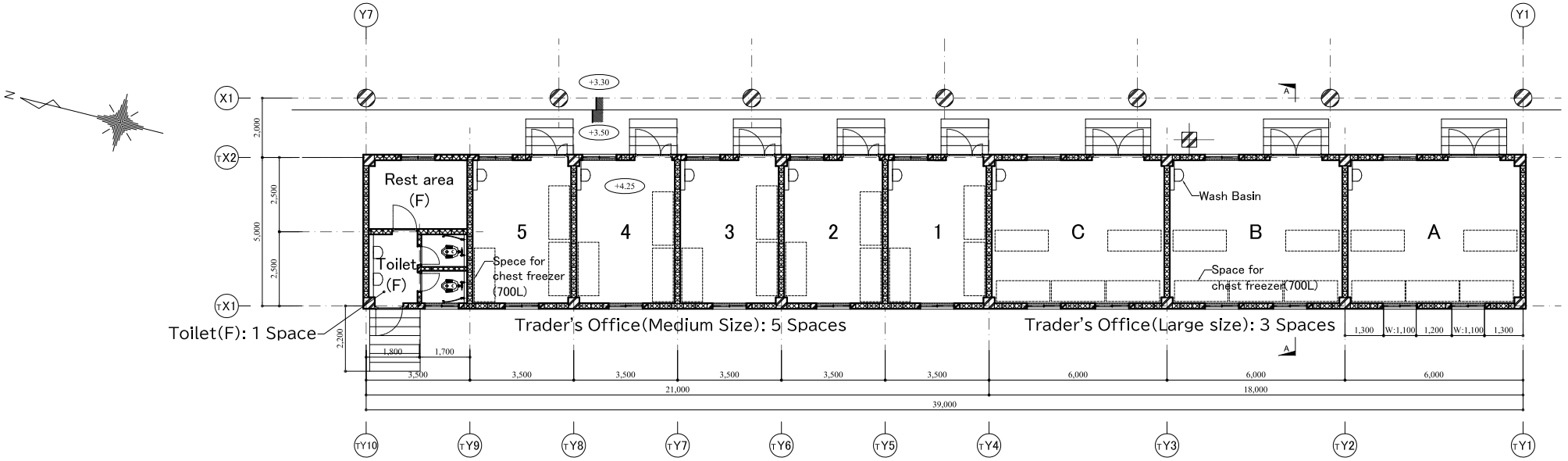
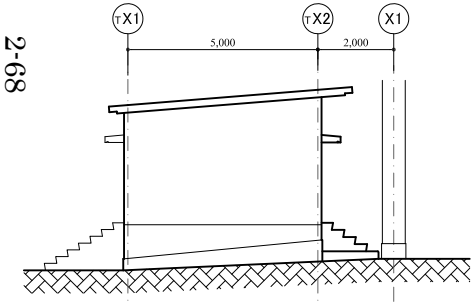


WEST ELEVATION

TRADER'S OFFICE BUILDING AT-01



GROUND FLOOR PLAN



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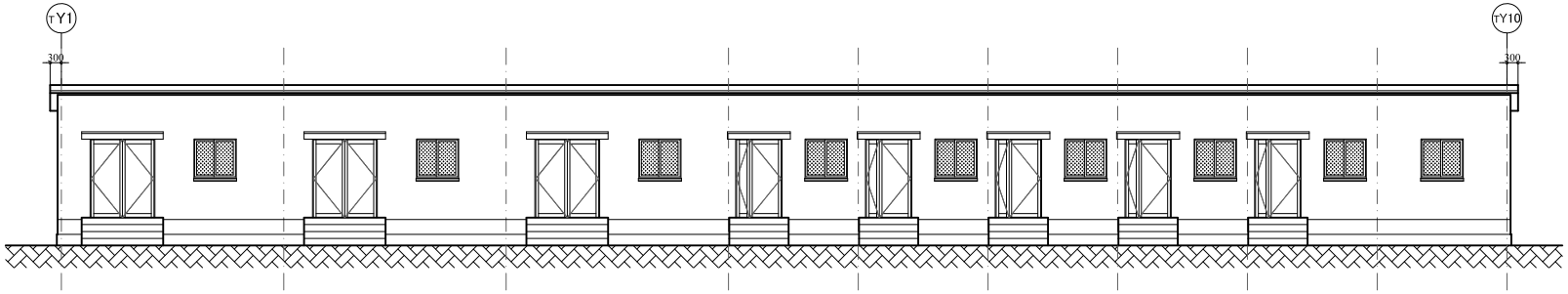

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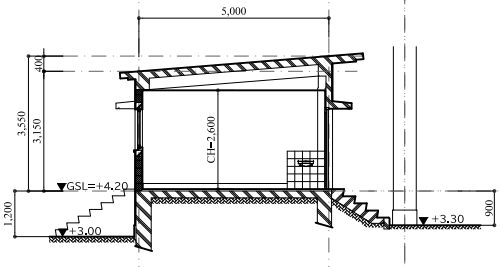

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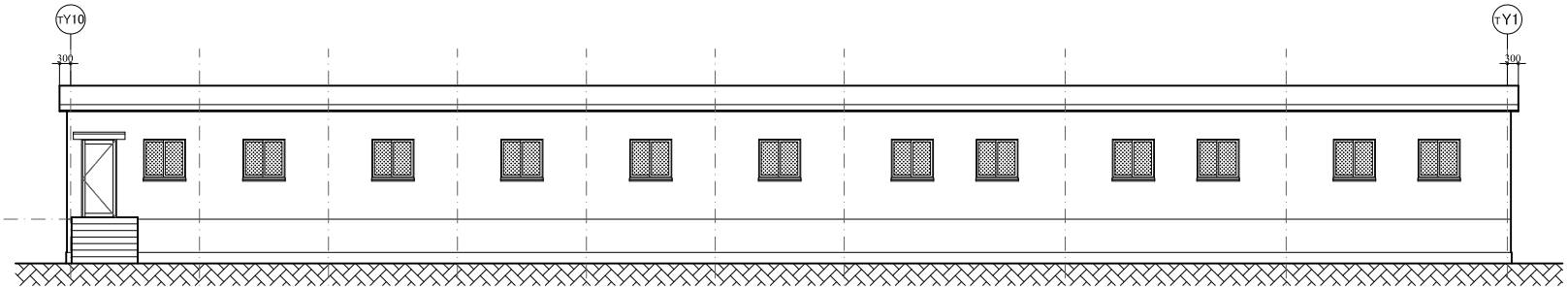

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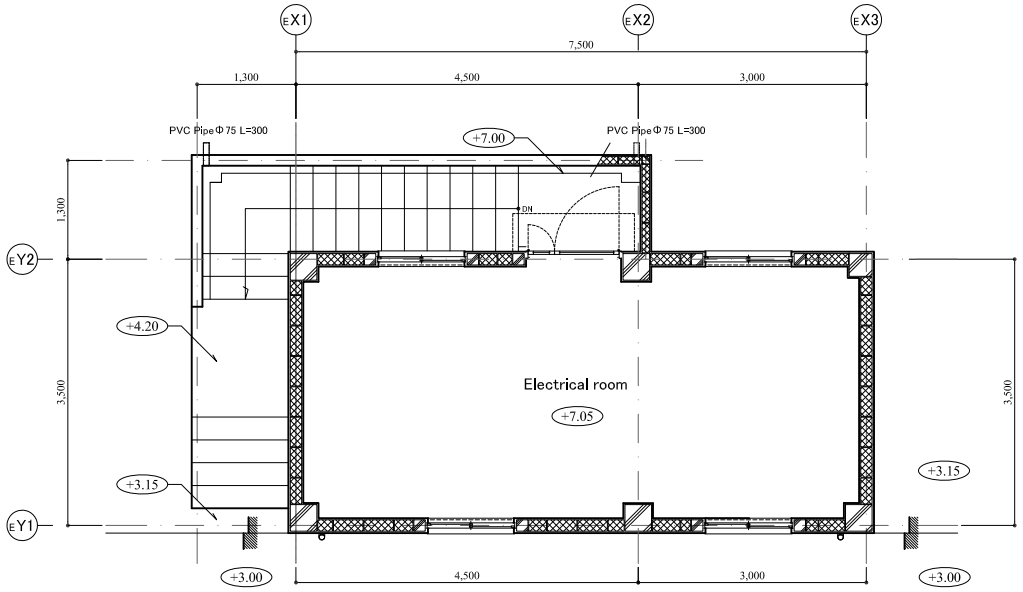
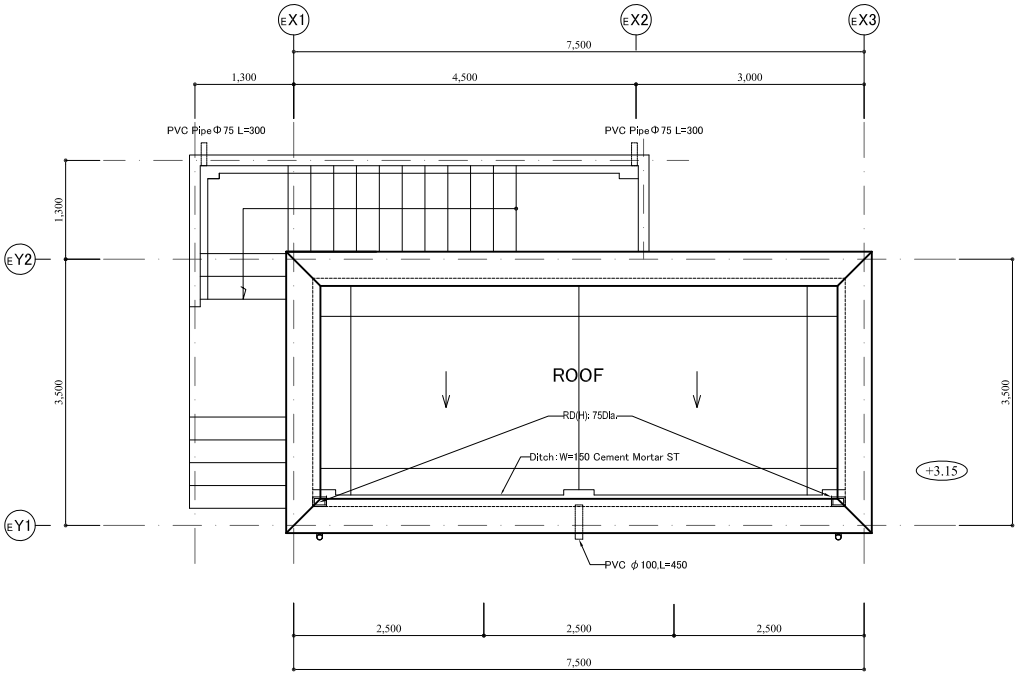
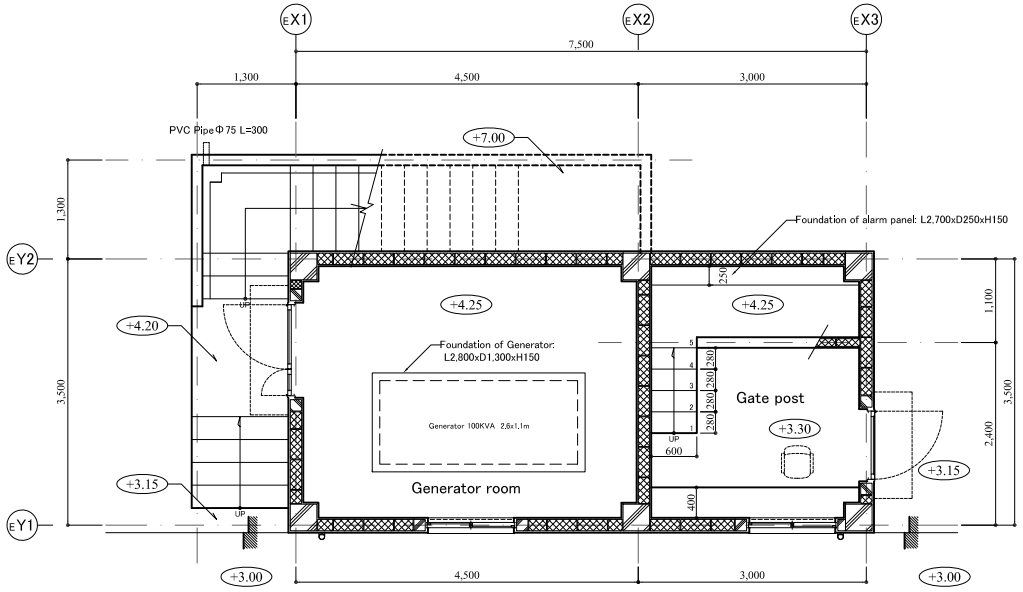
TRADER'S OFFICE BUILDING AT-01



FIRST FLOOR PLAN

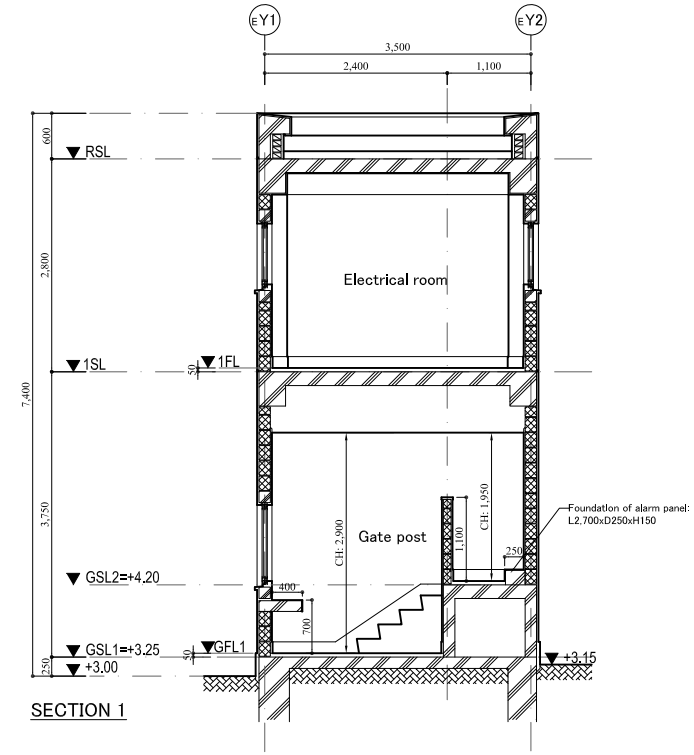


ROOF PLAN

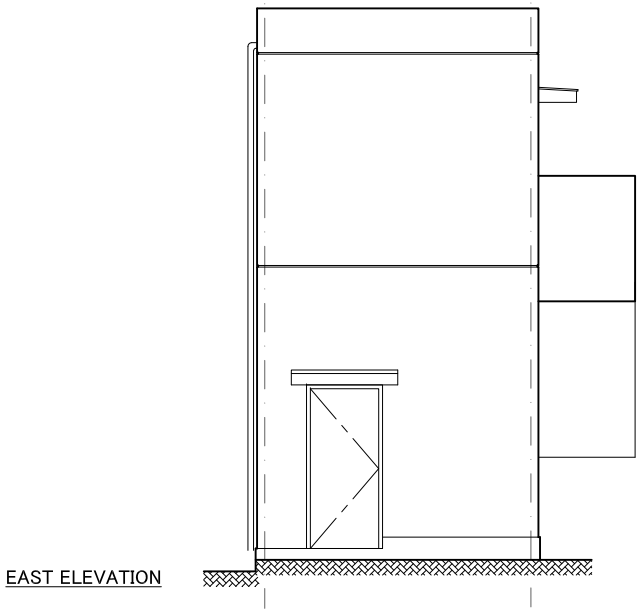


GROUND FLOOR PLAN

GATE POST / ELECTRICAL ROOM(1) AE-01



SECTION 1



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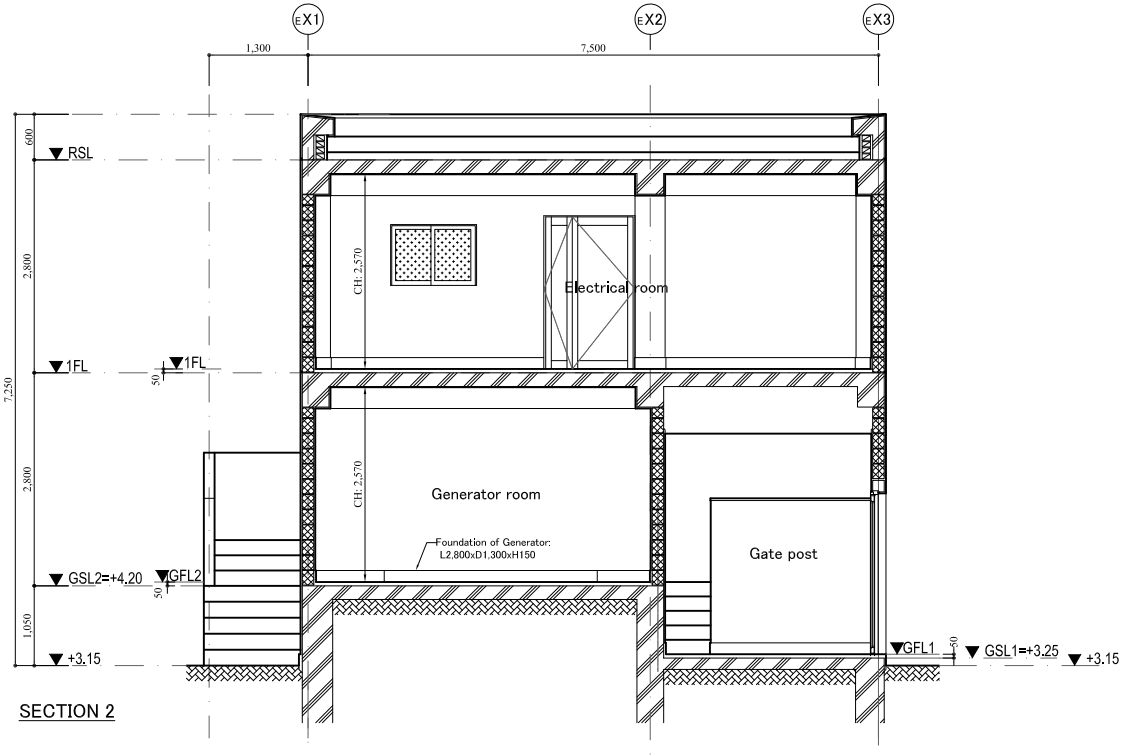

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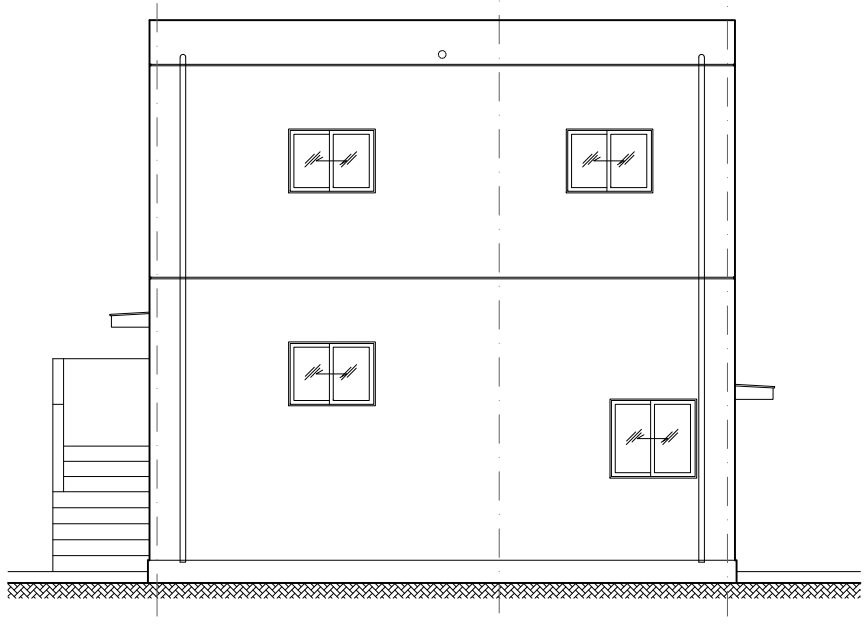
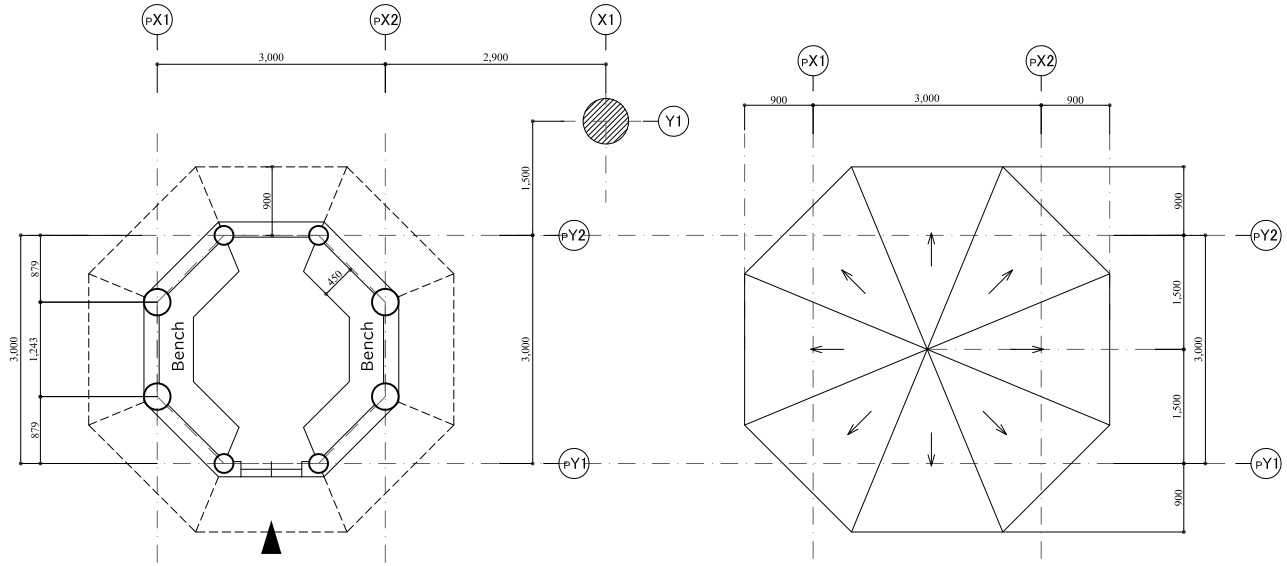


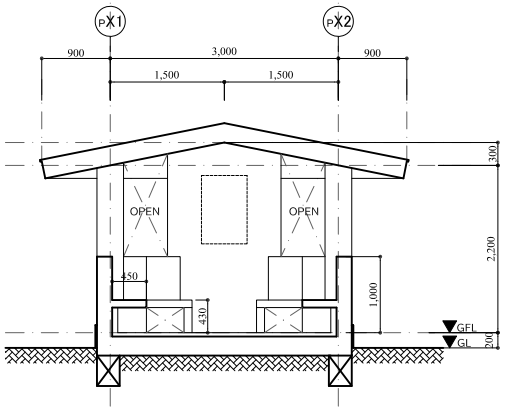
SOUTH ELEVATION

GATE POST / ELECTRICAL ROOM(2) AE-02

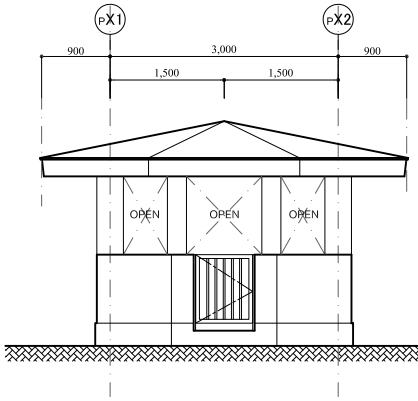


PLAN

ROOF PLAN



SECTION



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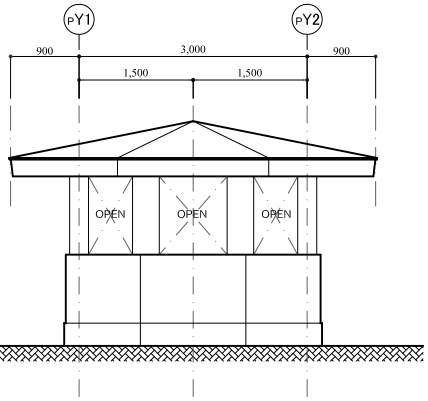
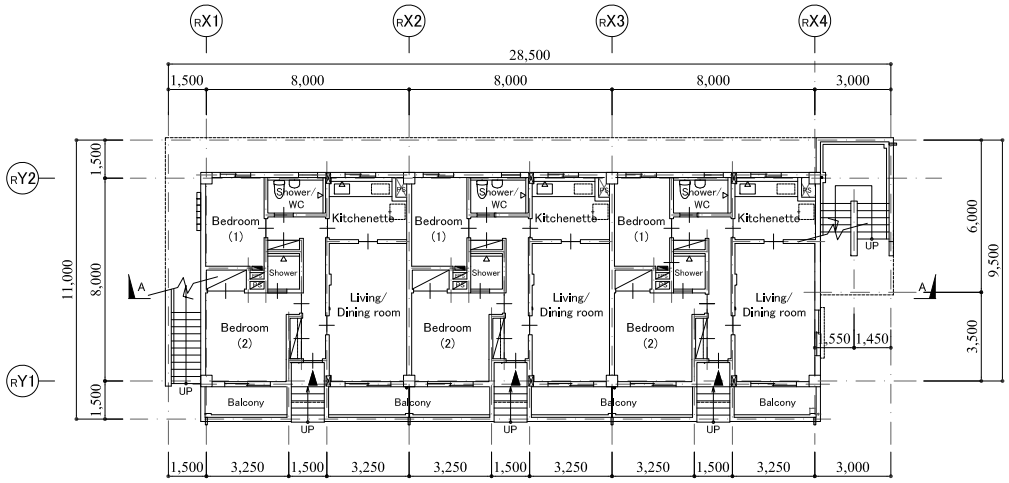
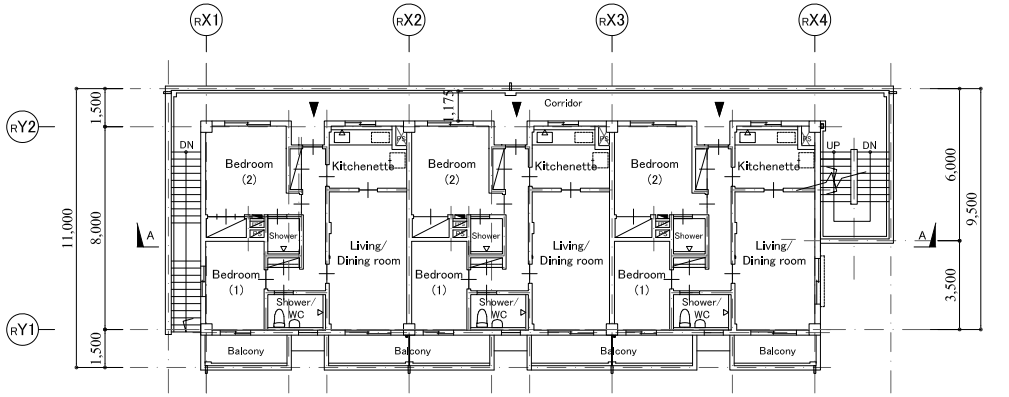


NORTH ELEVATION

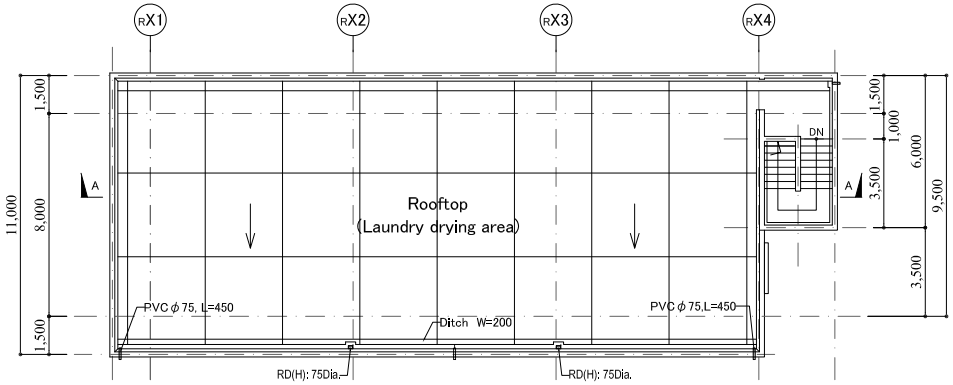
TOLL STATION AP-01



GROUND FLOOR PLAN



FIRST FLOOR PLAN



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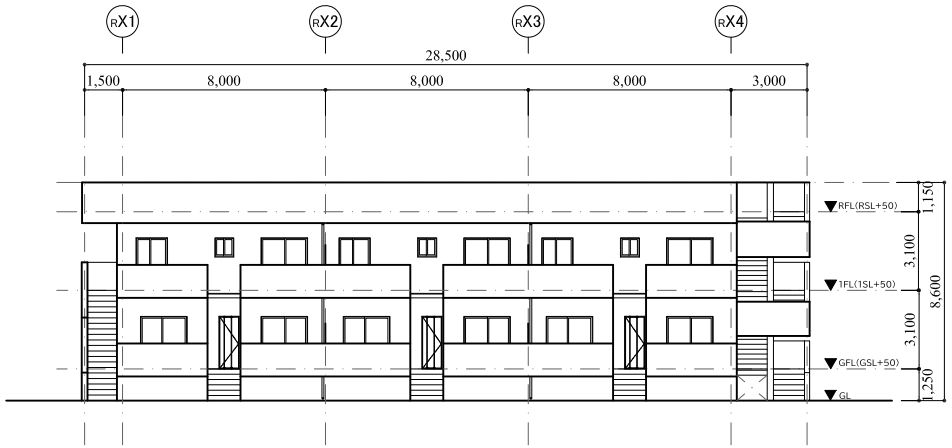
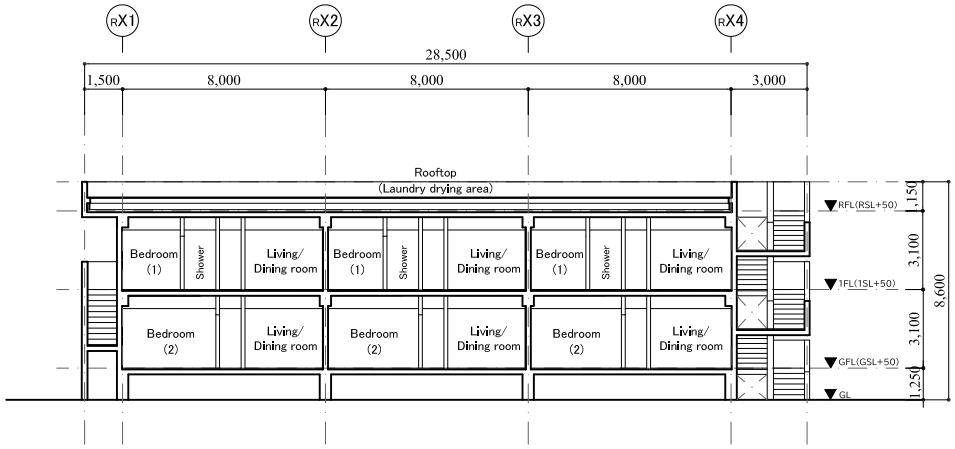
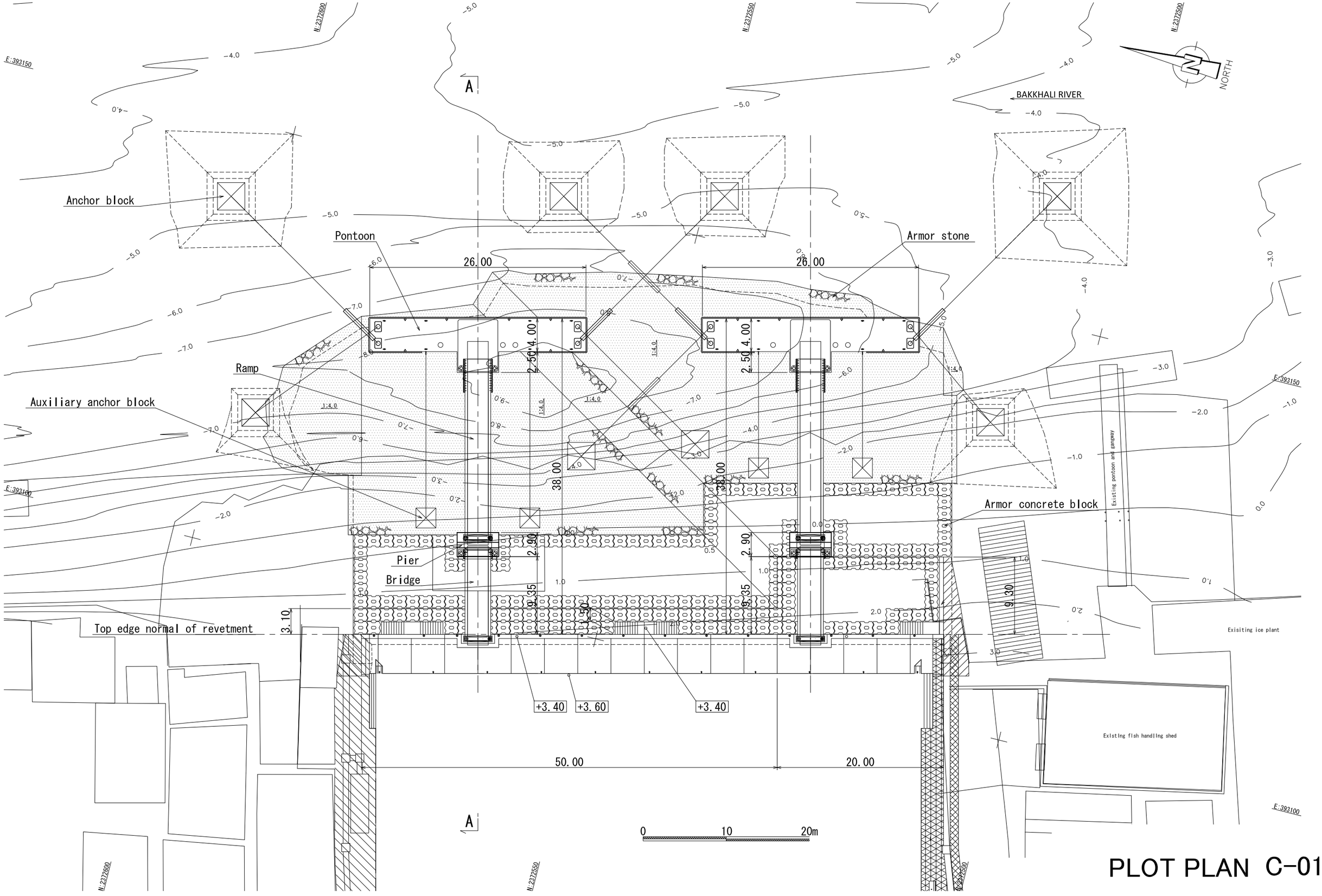


ELEVATION



A-A SECTION

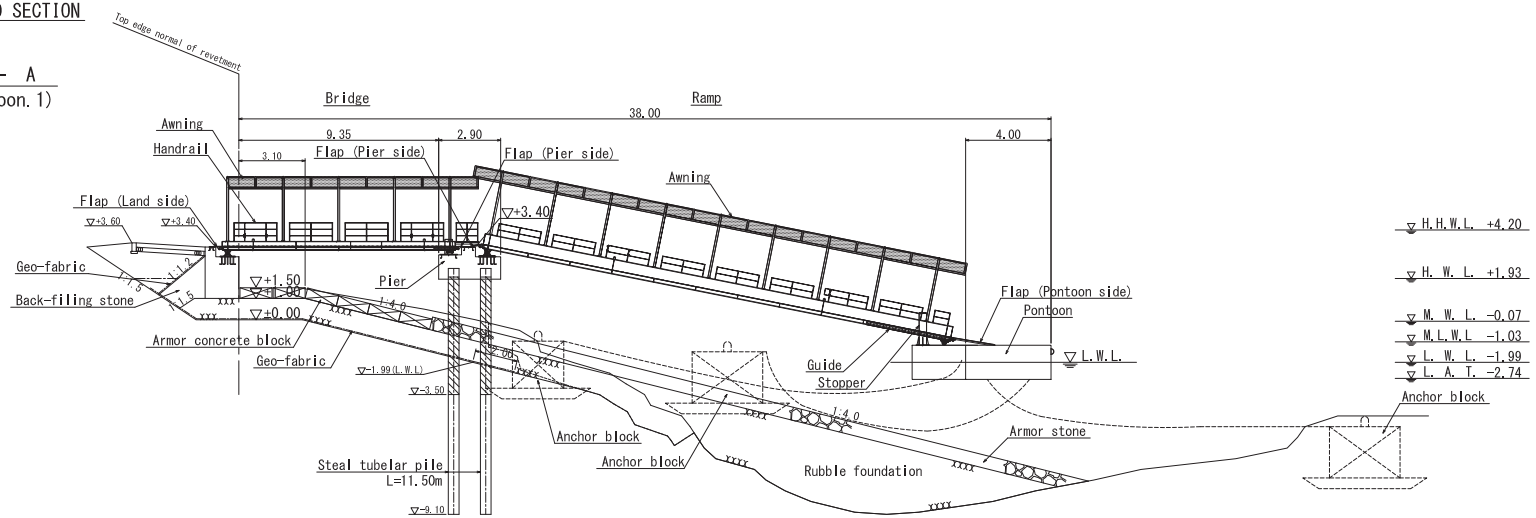
RESIDENTIAL BUILDING (two-stories) AR-01



PLOT PLAN C-01

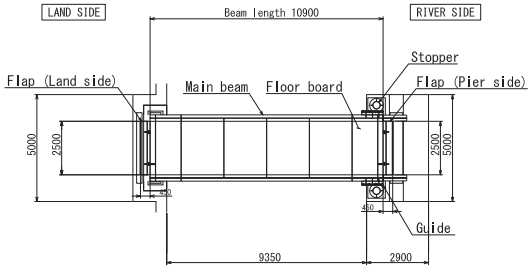
STANDARD SECTION

A - A
(Pontoon. 1)



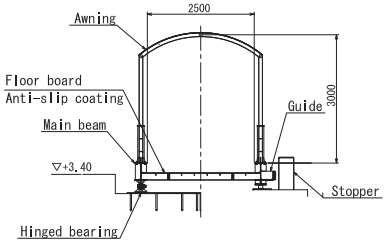
BRIDGE(GANGWAY) GENERAL PLAN

PLAN



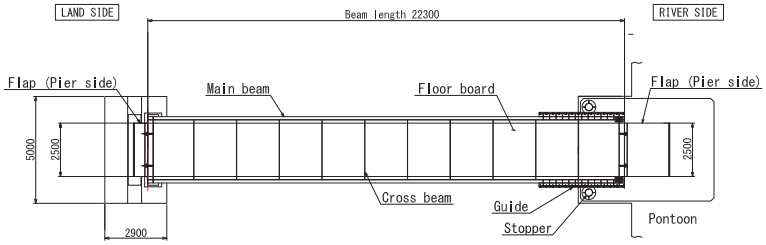
ELEVATION

(LAND SIDE) (RIVER SIDE)



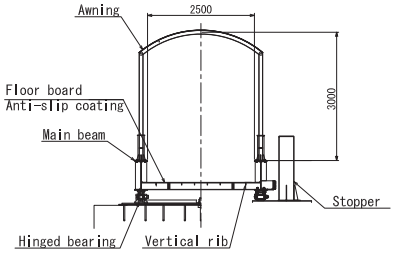
RAMP(GANGWAY) GENERAL PLAN

PLAN



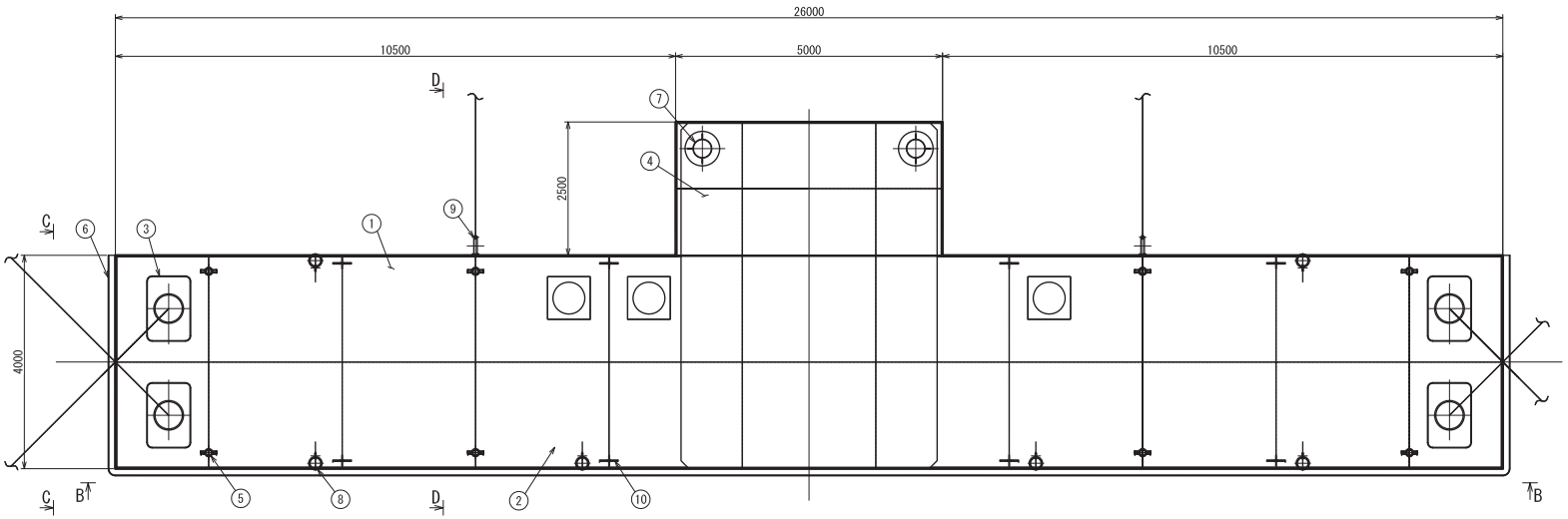
ELEVATION

(LAND SIDE) (RIVER SIDE)

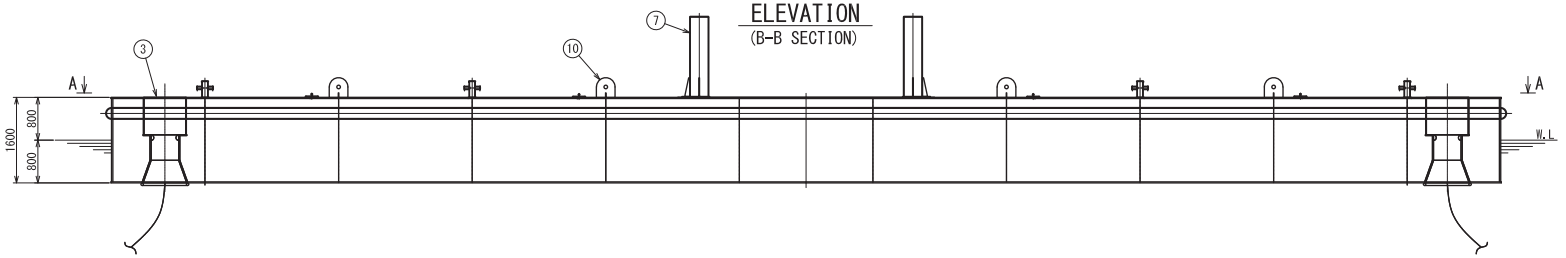


STANDARD SECTIONS AND GANGWAY GENERAL PLAN C-02

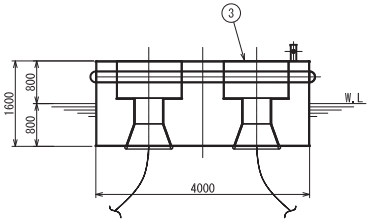
PLAN
(A—A SECTION)



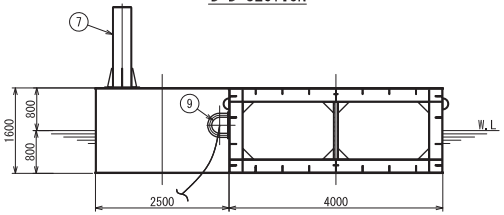
ELEVATION
(B-B SECTION)



C-C SECTION



D-D SECTION



ACCESSORIES TABLE

NO.	NAME
1	Anti-slip coating
2	Manhole
3	Chain hole
4	Steel floor board under ramp
5	Bollard
6	Semi-circular steal pipe fender
7	Ramp stopper
8	Mooring ring
9	Anchor ring
10	Hanging piece

PONTOON GENERAL PLAN C-03

(Blank)

2.4. Implementation plan/procurement plan

2.4.1. Implementation policy/procurement policy

① When this project is to be implemented under the grant aid program of Japan, strict control of a construction period shall be a precondition. Therefore, an appropriate construction schedule shall be prepared so that contractual conditions shall be met within the term of the Exchange of Notes.

② The implementation plan shall take into consideration the climate, sea conditions, and environmental conditions in the area of Cox's Bazar. Specifically, consideration is needed in construction schedule management because of the year-round heat and humidity conditions in the area.

③ BNBC 2020 requires that local qualified engineers shall be an applicant, and the construction supervision shall be collaborate with them, ; the project policy is to supervise construction in cooperation with them.

④ Considering there are many local contractors having ripe experiences of Japanese grant aid projects in Bangladesh, and they have technical capabilities, the plan shall be prepared to make good use of local contractors, engineers and workers effectively under a Japanese contractor, Upon hiring local contractors in Bangladesh, both financial and technical capabilities shall be examined.

⑤ The safety management level of local contractor depends on the capabilities of the respective contractor; therefore, it is necessary to establish a safety management system supervised by a Japanese contractor for local contractors.

⑥ The procurement of materials, equipment, and personnel accounts for a large portion of the construction cost; to make the implementation and procurement plan economical, the structure shall be prepared to minimize on-site construction works, and construction methods shall be selected in widely used in the area.

⑦ The scope of the project is rehabilitation of the facilities in operation; fish landing activities shall be maintained in a limited space during the construction period. To reduce the burden on activities of CXB FLC, construction areas and methods shall be established to make the overall construction period short.

⑧ Construction materials and equipment, either local products or imported products shall be procured locally as far as possible except any problems in terms of the quality and quantity were anticipated. However, for imported products, and aggregates from the northern inland region, and the like, the procurement plan shall take into account domestic inventories and procurement periods. Additionally, attention shall be paid to the timely transport of imported products from Japan and/or third countries on regular liners and bring in the products without interrupting the construction work.

⑨ The plan shall take into consideration in the accessibility to consumable supplies and the convenience of maintenance and repairs.

⑩ Given that the construction area is restricted and that the construction works are

complex—a mix of civil engineering facilities on the riverbank and building facilities on the land—the sequence of the work and each process shall be coordinated with safety in mind to ensure an efficient construction plan. The civil engineering work will be carried out primarily from the land, but also on the river.

⑪ For restoring landing functions as soon as possible, the landing area and other essential facilities for landing activities will be constructed first, followed by backyard facilities in phases. Therefore, the policy is to prioritize the civil engineering work—the construction of the pontoons, gangways, and revetment—and the construction of the minimum required landing facilities of the fish landing center building, so as to deliver these facilities before completion of the backyard facilities.

2.4.2. Cautions in implementation/procurement

Cement, gravel, sand, and concrete blocks are among the materials produced in Bangladesh for the project. Although locally produced materials for facility piping, electrical facilities, and the like are available, some seems to be of low quality and performance; to construct the facilities as a steady system, Japanese products would be procured for the crucial parts, while comparing costs. Imported equipment and materials always available in the local market are considered to be local products.

- Salinity in the well water around the site vary seasonally; therefore, regular salinity measurements and other quality control measures shall be taken for the mixing water used in concrete and plastering work.
- Because a portion of the construction materials and equipment must be procured from Japan, the procurement plan shall be planned with sufficient time.
- The construction area on the project site is confined; therefore, an offsite yard is needed for material storage and preparation for construction. The plan for the offsite yard could be a plot owned by BFDC in Tekpara. The yard is 3.5 km away from the project site; presumably, small and medium-sized vehicles will frequently transport goods over short distances and pass through the commercial district of the city. The construction plan shall reflect traffic safety measures, including stationing traffic controllers at major intersections and avoiding traffic jams.
- During the construction, it is essential to take sufficient safety measures to avoid interfering with landing operations outside the construction area, as well as with activities at neighboring facilities to the extent possible The plan shall be prepared the construction area to be clearly separated and delineated with robust protective fences, and that the methods, materials, and other properties of temporary works to follow Japanese industrial safety and health standards. In pursuit of safety, when the necessary materials for temporary works are difficult to procure consistently from local sources, the use of Japanese products shall be considered. Additionally, the

utmost consideration shall be given to ensure the safety of residents and users of roadside facilities in the vicinity; the construction plan shall focus on safety and shortening the construction period.

- There is only one entrance to the project site from the road in front. As a safety measure, the entry and exit of construction vehicles shall be restricted, by limiting their entry and exit when landing and shipping operations are busy.
- Plans for temporary works shall adhere to JICA safety guidance, and safety measures shall be taken. Specifically, the landing area and construction area shall be clearly separated by a provisional enclosure of steel plates to ensure safety, for fear of damaging ongoing landing and shipping operations.
- The construction work shall be carried out in close coordination with BFDC and relevant local authorities.
- The construction plan shall account for environmental and social considerations.
- Although none of the procured equipment (except building equipment) requires installation, the timing of its delivery will be upon provisional hand over of the part of the facilities; therefore, the process shall be managed in accordance with the progress of the construction work.

2.4.3. Scope of Works

The table below shows the scope of works in the project by Japanese side and by Bangladesh side.

Table 2-21 : Scope of works by Japanese side and by Bangladesh side

No	Responsibility	Japan	Bangladesh
1	Securing and preparing a plot of land for project implementation (removing and clearing existing buildings, structures, plantings, and the like from the site)		
2	1. Removing and clearing existing facilities and structures （See following figure.）		●
	2. Relocating and providing relocated facilities (temporary handling sheds, trader's offices, shops and canteen, mosque, toilets) to sustain CXB FLC office functions and landing/shipping activities during the construction period		●
	3. Securing a temporary yard for the construction period		●
	4. Arrangement of temporary alternative residences for all staffs with their families moving from the existing residential buildings inside CXB FLC		●
	Constructing the following:		
	1. Civil engineering and building facilities related to landing and handling	●	
	2. One residential building (two-stories)	●	
	3. New mosque and residential building excluding from the Project		●
	4. Gate posts at the site entrance	●	
	5. Small vehicle station and pavement (partial)	●	

No	Responsibility	Japan	Bangladesh
3	Supplying electrical equipment and systems, water supply and wastewater systems, and other ancillary facilities needed for project implementation		
	1. Electricity		
	A Connection to the site (high voltage power receiving), electricity		●
	B Wiring on the site	●	
	C Installing main breakers and transformers	●	
	2. Water supply		
	A Drilling wells on the site, installing pumps	●	
	B Onsite water supply system (receiving tanks, elevated tanks, pumps)	●	
	3. Drainage		
	A Installing an drainage system in the site, storm drainage, and septic tanks	●	
	4. Landscaping and planting after completing construction		●
	5. Telephone and internet contracts and connections		
	A Connecting telephone and internet lines to the receiving panels of the buildings		●
	B Supplying receiving panels, telephone and LAN wiring downstream of the panels	(●)	(●)
	6. Furniture and equipment		
	A General furniture (e.g. curtains, desks, chairs), office equipment, and fixtures for the administrative office		●
	B Project-related equipment (fresh fish handling equipment)	●	
	7. Ice-making facilities		
	A Rehabilitation of the ice making facilities		●
4	Ensuring prompt unloading and customs clearance of products at ports of unloading in Bangladesh, smoothly transporting the products in Bangladesh		
	1. Transporting products from Japan to the recipient country by sea (air)	●	
	2. Transporting products from ports of unloading in Bangladesh to the project site	●	
	3. Import customs clearance procedures for materials and equipment necessary for project implementation		●
5	Ensuring exemption from customs duties, domestic taxes, and other tax liabilities on the purchase of products and services in Bangladesh, or having the authorities bear the cost without using grant aid.		●
6	Provision of convenience for the Japanese and third-country personnel to enter and stay in Bangladesh in conjunction with the implementation of the project.		●
7	Proper and efficient operation of the facilities and equipment to be provided under the project.		●
8	Covering the cost of project implementation outside the scope of grant aid.		●
9	Covering the following fees of a Japanese foreign exchange bank for financial services under banking agreements (B/A)		
	1. Banking agreements (B/A) with a Japanese bank., and bank commissions for the Japanese bank		●
	2. Issuance of Authorizations to Pay (A/P)		●
	3. Other bank charges		●

No	Responsibility	Japan	Banglade sh
10	Environmental and social considerations will be taken into account during project implementation and monitor the situation by the environmental monitoring form		●
11	Detailed design, preparing tender documents, bidding assistance, construction supervision, and other consulting services	●	
12	Applying for and acquiring all permits and licenses for the project in Bangladesh, assigning engineers (e.g. building certification, usage of electrical and water infrastructure, construction permits, construction supervision)		●

(B/A： Banking agreement： A/P： Authorization to pay)

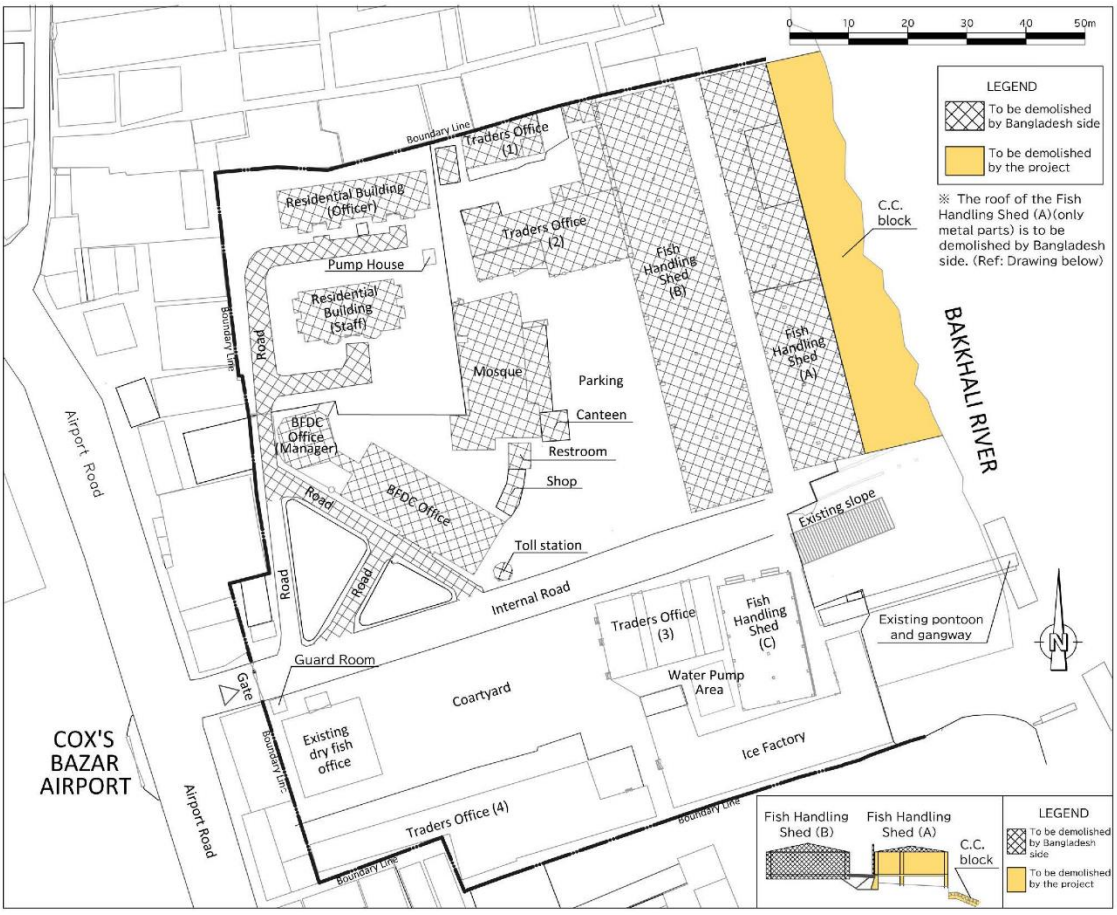


Figure 2-25：Scope of removing and clearing existing facilities and structures

2.4.4. Construction supervision plan/procurement supervision plan

(1) Basic policy for construction supervision plan/procurement supervision plan

Efforts toward sufficient exchange of opinions and communication between the line ministry (MoFL), the implementing agency (BFDC), the consultant, and the contractor shall be made to facilitate project implementation.

(2) Consultant's detailed design and bid management

In implementing the project, following the Exchange of Notes between the Government of Japan and the Government of Bangladesh and the Grant Agreement between JICA and BFDC, a Consultant Agreement will be concluded between BFDC and a Japanese consultant with regard to detailed design, construction supervision and soft components activities (Guidance and Training). In detail design and construction supervision, the following works will be implemented.

1) Detailed design work

On the basis of the results of the outline design survey, the consultant will conduct a survey fully and prepare a detailed design of the civil engineering and building facilities to be constructed. The detailed design shall cover the following items..

- Selection of design conditions and standards
- Preparation of design report
- Preparation of drawings
- Preparation of bill of quantities and estimation
- Preparation of implementation plan
- Preparation of equipment specifications
- Preparation of bid documents

2) Contractor selection

After completion of the detailed design documents for the construction work, BFDC will select, by bidding, a Japanese contractor who will undertake the works with the assistance of the consultant. The consultant shall assist BFDC in the following procedures.

- Pre-qualification notice
- Pre-qualification
- Explanation of bid documents
- Opening of bids
- Bid evaluation
- Contract negotiations

3) Cooperation in concluding procurement and construction agreements

The consultant will prepare a draft of the pre-qualification evaluation method, a draft of the bid documents consisting of a construction contract, technical specifications and drawings, and a bill of quantities for the project costs. The consultant will be present at the bidding and contract proceedings and will provide an explanation of the bill of quantities for the project costs and an evaluation of and advice on selection of the contractor and contract conditions.

4) Guidance for the contractor

The consultant will examine the implementation plan of the contractor and provide the necessary instructions on the construction methods and work schedule in a timely fashion.

The consultant will examine and approve the working drawings and shop drawings of the contractor, and the material and finishing samples.

5) Construction supervision

Through supervision by a resident supervisor(s) and spot supervisors, construction methods will be confirmed and controlled in quality.

Over the entire construction period for on-site civil engineering works and building works, supervision will be provided by a full-time resident civil engineer. Supervisors for civil engineering works and pontoon works will be dispatched as necessary during the main phase as spot supervisors for a relevant short term.

Similarly, over the entire construction period for building works and facility works, supervision will be provided by a resident construction engineer, and structural and facility engineers will be dispatched as necessary during the main phase as spot supervisors for a relevant short term.

6) Attendance at inspections

The consultant shall be present at and confirm the on-site inspections performed by the contractor at the interim stage of the construction, and the final inspection performed by the contractor upon completion of the construction.

7) Construction progress reports

The consultant will prepare reports on the progress of construction of the facilities, problems encountered, measures taken against the problems and the outcome of them, and submit the reports in a timely manner to BFDC and the relevant government organizations of Bangladesh, the Embassy of Japan in Bangladesh and JICA.

8) Witnessing handovers

The consultant shall be present at the handover of documents at the time of handing over the constructed facilities upon completion of the construction.

9) Cooperation with payment approval procedures

The consultant shall assist in confirmation and approval of the amount of work done, corresponding to the consulting service costs and construction costs payable in accordance with the contract, or completion of the work, and examination of the billing documents and payment procedures.

2.4.5. Quality control plan

The construction supervisor dispatched by the consultant shall verify that the quality and precision of the materials and equipment procured under the project and the completed part of construction are in accordance with the specifications, design drawings, and the like in the contract documents, and will make arrangements for discussions with the counterpart government agencies and JICA if needed.

- Sharing information about design concepts, points of attention in construction, and the like
- Identifying the necessary measures for ensuring construction quality
- Checking construction safety management measures by consultants and contractors, requesting necessary measures to the Bangladesh side
- Technical consultation on design changes
- Confirming and discussing handovers (including partial handovers) and completion inspections
- Verifying the progress of the performance of counterpart responsibilities and facilitation of their implementation as required

1) Main points of quality control in terms of natural conditions

The site is located along the Bakkhali River near the ocean, and the groundwater is saline, considerations for salt damage and corrosion protection for structures are necessary. Especially for the concrete structures of skelton, a system shall be established onsite to inspect surely the salinity of aggregates, mixing water, and the like; types of cement; concrete mixes and quality; and covering depth of reinforced concrete.

2) Pile work

Quality control for cast-in-place concrete pile foundation work, which is popular in the area, the earth drilling method will be performed by checking the following.

Table 2-22 : Quality control items for cast-in-place concrete piles

Steel reinforcement cages	Diameter, number, length, spacing, joint length, lateral reinforcement, spacers, welding
Construction work	Managing engineer qualifications, location, depth, diameter, embedding into the supporting ground (measuring and logging), joint overlap length and bonding status, slime treatment, liquid stabilizer quality, borehole perpendicularity
Concrete	Verification of materials and mix proportions, tremie pipe tip position, strength, crown position
Pile head treatment	Verification of pile head treatment

Test mixing	Verification of slump, strength, mix proportion, quality

3) Reinforced concrete construction work

For quality control of structural reinforced concrete construction work, the standard is to apply *Kenchiku koji hyojun shiyousho dokaisetsu JASS5 tekkin concrete koji* (Standard specifications for construction work and commentary: JASS5 reinforced concrete construction work), and the following confirmations and tests shallbe conducted and concrete strength control charts, graphs, and the like will be prepared for each mixed proportion in order to maintain and control quality.

Table 2-23 : Quality control items for concrete

Cement	Verification of type, standard, performance
Admixtures	Verification of test results
Mixing water	Hazardous substance content
Aggregates	Verification of grain size distribution, and specific gravity, water absorption; for fine aggregate, verification of chloride content
Test mixing	Verification of slump, strength, mix proportion, quality

4) Reinforced concrete block construction work

The concrete blocks to be used for building exterior walls and the like will be hollow and 100 mm and 150 mm thick, and their quality shall be ensured by conducting compressive strength tests on each material and mix proportion and checking their dimensions upon receiving them. Additionally, the position, precision, arrangement of reinforcement, mortar spacing, and other properties shall be managed during the construction work.

2.4.6. Material and equipment procurement plan

(1) Procurement policy

When procuring materials and equipment, the costs and quality will be thoroughly investigated and the costs of local procurement, procurement from Japan and procurement from third countries of materials and equipment of equivalent quality and availability will be compared. Those with the lowest costs will then be procured. Particularly for locally available materials and equipment, the quality and availability will be thoroughly investigated to determine their use.

(2) Procurement of construction materials

(ア) Local procurement

As a result of the field surveys, the following suppliers of construction materials in Bangladesh are identified, and procurement is categorized as follows.

- Regarding natural construction materials, nearly all crushed stone, cobblestones, rocks for riprap, and other stone materials have recently been imported from neighboring

countries (e.g. India, Malaysia, UAE, Vietnam, Oman).

- As for fine aggregate (coarse sand), river sand is procured from Sylhet and Durgapur in eastern Bangladesh. The supply is sufficient during the rainy season, but when the river level drops during the dry season, the barges cannot access the sand pits, resulting in a decrease in supply. Sand can be extracted near Cox's Bazar, but its fine grain size prevents its use as fine aggregate (though it can be used as fill and backfill material).
- Regarding factory-produced products, several Bangladeshi cement companies produce cement of sufficient volume and quality, importing all clinker and pulverizing it at their own plants. Nearly all projects use domestically produced ordinary Portland cement (OPC). Contractors deal directly with cement manufacturers; OPC is not sold on the market. In terms of quality, Ruby Cement and Diamond Cement are good; these two companies also produce sulfate-resistant cement.
- Reinforcement steel is also manufactured by a number of companies in Bangladesh; however, many plants use scrap steel as the raw material, and six or seven plants use imported burette (steel ingots). Only reinforcement steel produced by factories that use imported burette as the raw material are compliant with ASTM, JIS, and other international standards that satisfy the project requirements; the products manufactured in Bangladesh are sufficient in terms of both production volume and quality, and they are not imported.
- For mold steel, products equivalent to international standards are manufactured and procured in Bangladesh and are of good quality. Large or special cross-sections are fabricated and manufactured in plants in Bangladesh or imported. Steel sheet piles are imported.
- uPVC pipe materials and gabions and other steel wire materials are manufactured in Bangladesh, or are imported products procured in Bangladesh.

Table 2-24 : Procurement sources of major construction equipment and materials

Equipment and materials	Bangladesh*	Japan	Third country*	Remarks
Cement	○			Locally available, inexpensive
Coarse aggregate for concrete	○			〃
Fine aggregate for concrete	○			〃
Reinforcement steel	○	○		Comparison in terms of price, supply, quality
Broken stone			○	
Formwork materials	○			Locally available, inexpensive
Concrete blocks	○			Locally available, inexpensive
Lumber, plywood	○			〃
Fuel	○			〃
Lubricants	○			〃
Paint and coating	○			〃

Equipment and materials	Bangladesh*	Japan	Third country*	Remarks
Section steel, steel pipes	○			〃
Steel pipe pile		○		Heavy duty corrosion-resistant lining: Difficult to procure locally
Door/window frames	○		○	Comparison in terms of price, supply, quality
Electrical system equipment and materials	○	○		Local products are inconsistent in terms of quality and quantity; therefore, these products will be procured from Japan except when they are easy to procure locally
Water supply and wastewater system equipment and materials	○	○		
Temporary scaffolding materials		○		

*Including locally produced products, and products that are imported but can be procured locally

(3) Procurement of major construction machinery

Regarding the leasing of construction machinery owned by local private construction companies for the project, all but special machinery can be procured in Bangladesh.
The table below shows the major construction machinery procurement categories based on the following policies.

- Construction equipment owned by local contractors will be leased. If the machinery is difficult to procure locally, it will be procured from Japan or a third country. Suppliers will be determined in consideration of ease of procurement, transport costs, and leasing costs.
- Major contractors in Bangladesh have their own machinery departments and own nearly all types of general machinery for land-based construction.
- Because most foundation work is now contracted to specific companies, contractors do not own pile-driving machines (diesel pile hammers and vibro-pile drivers), but lease them within Bangladesh. companies specific in foundation works, having full-circumference rotaries for cast-in-place piles and accompanying large cranes.
- Major contractors own cranes up to the 75-ton class, but 100-ton and 200-ton cranes are leased from other Bangladesh company.
- Major contractors also own asphalt and concrete plants, and set and operate them at construction sites.
- Both pump- and bucket-type dredgers, a tugboat, anchor boats, flat barges, crane barges, and other types of boats are available in Bangladesh.
- Flat barges, tugboats, anchor boats, crane barges, dive boats, earth movers, and dredgers can be leased within Bangladesh.
- Floating cranes up to the 300-ton class can also be leased within Bangladesh, but may

not always be available depending on bookings for other projects.

Table 2-25 : Procurement sources of major construction machinery

Name of machine	Standards, specifications, etc.	Source		
Machinery for land-based construction		Bangladesh	Japan	Third country
Bulldozer	3-ton to 21-ton	○		
Backhoe	0.28 m^3–1.6 m^3	○		
Clamshell excavator	0.6 m^3–1.2 m^3	○		
Wheel loader	2.1 m^3	○		
Crawler excavator	1.8m^3–1.9 m^3	○		
Grader	3.1 m	○		
Road roller	Macadam, 10–12 tons	○		
Vibration roller	0.5–0.6 tons, 0.8–1.1 tons, 2.4–2.8 tons	○		
Tire roller	8–20 tons	○		
Tamper	40 kg–100 kg	○		
Concrete mixer	1,800 L, 5,500–6,000 L	○		
Concrete pump truck	Boom-type	○		
Concrete breaker	20 kg–1,300 kg	○		
Compressor	3.5 m^3–5.0 m^3	○		
Dump truck	4–11 tons	○		
Truck	4–11 tons	○		
Forklift	1–5 tons	○		
Semi-trailer	15–30 tons	○		
Truck crane	11–25 tons	○		
Crawler crane	50–120 tons	○		
Vibro-pile driver, jet unit	45KW–90 KW	○		
Diesel hammer	3.5–6.0 tons	○		
Generator	45kVA–200 kVA	○		
Welder	300A–500 A	○		
Simple mixer	0.3 m^3–0.6 m^3	○		
Concrete plant	10 m^3/h, 20 m^3/h, 30 m^3/h	○		
Submersible pump	Diameter: 100mm, 150 mm	○		
Air compressor	3 m^3/min	○		
Machinery for construction on the ocean				
Barge	50–300 tons	○		
Earth mover	100 m^3	○		
Backhoe dredger	1.0 m^3, 2.0 m^3	○		
Winch	1.0-ton, 2.0-ton	○		
Tugboat	300 PS, 500 PS, 1,000 PS	○		
Workboat with outboard engine	30 PS–60 PS	○		
Dive boat	30 PS, Winch: 3–5 tons	○		

Name of machine	Standards, specifications, etc.	Source		
Anchor boat	90-250 PS, Winch: 5-15 tons	○		
Crane barge	Mounted crane: 50 tons, 100 tons	○		
Floating crane	300 tons	○		

(4) Procurement of equipment

The table below shows the procurement sources of equipment.

Table 2-26 : Procurement sources of Equipment

Number	Name of equipment	Japan	Bangladesh	Third country	Reason on selection
1-01	Fish wash basin	○			Cannot be procured locally
1-02	Fish basket	○			Cannot be procured locally
1-03	Sorting tray	○			Cannot be procured locally
1-04	Pallet		○		Locally available.
1-05	Fish container		○		Locally available.
1-06	Hanging scale	○			Not available locally
1-07	Cooler box		○		Locally available.
1-08	High-pressure Washer	○			Not available locally
1-09	Handlift	○			Not available locally

(5) Labor

General laborers and skilled workers can be found in Cox's Bazar and other nearby areas. The unit labor cost is set according to the following conditions. Working hours are 8:00 to 16:00, Saturday through Thursday. Fridays are off days. Labor laws require an eight-hour workday. There will be no skilled workers dispatching from Japan.

(6) Transport plan

The equipment procured in Japan will be delivered to the Port of Yokohama. The materials and equipment will be transported by sea from the Port of Yokohama to the Chattogram Port, and then over land to the project site. The ocean transport is expected to take 45 days. The distance from the Chattgram Port to the project site is 150 km; the land transport portion is expected to take 60 days, including unloading and customs clearance. The transport plan is formulated based on a total of 105 days.

1) Building construction materials

Considering the construction processes, transport of materials and equipment are divided into each construction work.

①Interior finishing materials: Transport to be synchronized with the completion of frame construction.
②Electric apparatus equipment: Transport to be synchronized with the start of interior fittings
③Machinery and equipment: Same as the above

However, the portion pertaining to the provisional handover of the fish handling area will be planned independently from the above.

2) Civil engineering construction materials

Materials procured in Japan will be delivered to the Port of Yokohama and transported by sea. Considering the construction processes, transport will be divided into two batches.

Batch 1: Filter fence for pollution control, steel mold for revetment armor concrete blocks, large sandbags

Batch 2: Pontoon riggings, gangway bearings, steel pipe piles, geo-fabric, etc.

(7) Site for the temporary yards and potential for soil dumping site

The temporary yard located within the construction site is desirable, but given the limited space of the construction area, a nearby plot owned by BFDC in Tekpara will be considered as a alternative potential site. As for the soil dumping site and debris disposal, surplus soil shall be disposed of in designated areas within city limits, subject to approval of local authorities.

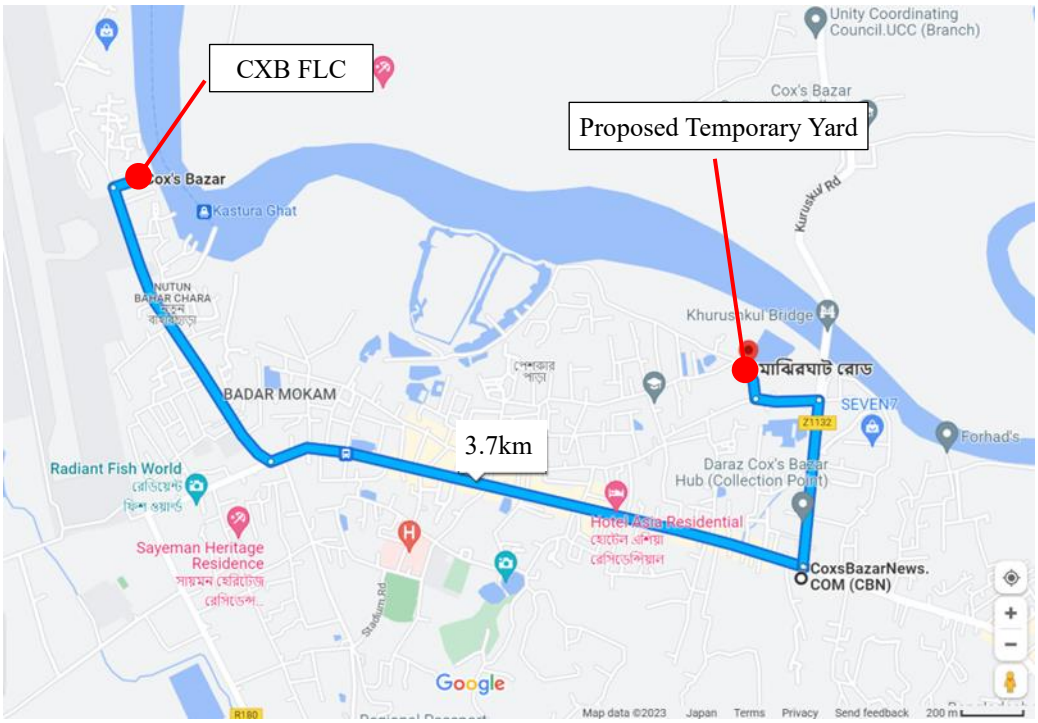


Figure 2-26 : CXB FLC and the temporary yard and routes

(8) Fabrication yard for concrete anchor blocks for pontoon moorings

Given that the concrete anchor blocks for the pontoon moorings weigh about 60 tons each, fabricating them on land would require the use of a large floating crane (hoisting capacity of 800 tons) to cover the large distance between the barge and the fabrication site (the crane's operating radius); arranging such a crane is difficult in Bangladesh. Therefore, the plan is to fabricate concrete anchor blocks on a 300-ton flat barge. When the concrete will be placed on the barge, the revetment work at the construction site may be on-going, so that the two processes overlap; as shown in the figure below, the concrete will be transported to the revetment near the Bakkhali Bridge on the upstream side of the construction site, and the blocks will be fabricated on the barge.

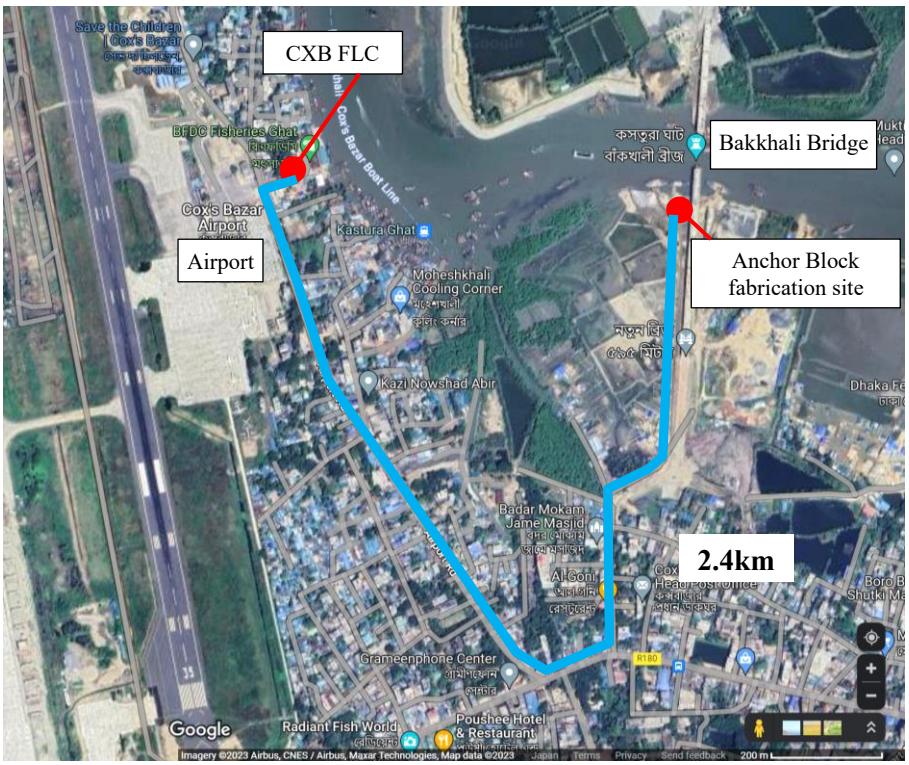


Figure 2-27 : CXB FLC and the CXB FLC and anchor block fabrication site and routes

(9) Pontoons and gangways

The construction of the steel pontoons and gangways will be subcontracted to a shipyard in Bangladesh equipped with facilities for fabricating, assembling, welding, and coating steel plates and section steel for ships, located in the adequate area to transport the pontoons to the project site by sea after fabrication.

1) Shipbuilders in Bangladesh

To decide where to outsource the steel structure fabrication, economic efficiency and the technical level of the shipbuilders must be investigated. As for economic efficiency, it is extremely expensive to tow the pontoons to the facility construction site; shipyards with shorter tow distances to the facility construction site are at an advantage. Therefore, the survey was conducted assuming local fabrication in Chattogram, where many Bangladeshi shipbuilders are located.

As for the technical level of Bangladesh's maritime industry, the Cooperative Association of Japan Shipbuilders and the Japan Ship Technology Research Association published a research report on the Bangladeshi logistics infrastructure and maritime industry for the years 2015 and 2021 stating that, with support from Scandinavian countries (Denmark in particular), the Bangladeshi shipbuilding industry is at a level that satisfies Scandinavian shipbuilding standards, and that some shipyards have ISO 9001 certification.

Photograph for reference: Steel pontoon constructed by BFDC Chattogram Dockyard (Photo by survey team)

2) Technical capability of the shipyard

The survey team investigated the shipyard operating steel plate cutting and fabricating facilities as well as painting and coating facilities, and confirmed that the shipyard is capable of constructing steel pontoons and gangways.

3) Products procured in Japan

According to the local shipyard, some stainless steel bearings and rigging for the gangways and highly durable special anti-slip coating are difficult to procure locally; so the Japanese contractor may procure these materials in Japan for them.

4) Building schedule

The delivery for pontoons and gangways by the local shipyard will be 5.5 months after the conclusion of the agreement.

The consultant will dispatch a engineer to the shipyard during construction to witness inspections and conduct on-the-spot supervision.

2.4.7. Construction supervision plan

(1) Consultant's design and construction supervision plan

1. Implementation system

After the Cabinet decision on the project, an Exchange of Notes (E/N) between the governments of both countries and a Grant Aid Agreement (G/A) between JICA and the BFDC will be concluded. Afterward, the executing agency and the Japanese consulting firm will

conclude a design and supervision agreement, and the project will be implemented within the framework of grant aid from the Japanese government. With the consultant's assistance, the executing agency will hold competitive bidding for Japanese bidders and conclude construction and equipment procurement agreements with the successful bidder.

(1) Bangladesh side implementation system

The line ministry of Bangladesh for the project is the Ministry of Fisheries and Livestock (MoFL). The Bangladesh Fisheries Development Corporation (BFDC)—the implementing agency under MoFL—will manage the project and execute Bangladesh side responsibilities under the G/A. BFDC will conclude a design and supervision agreement with a Japanese consultant and construction and equipment procurement agreement(s), execute the necessary procedures as the procuring entity, and take charge of overall coordination and promotion of the project.

(2) Japan International Cooperation Agency (JICA)

The Japan International Cooperation Agency (JICA) will conclude a G/A and guide the project to ensure that it is implemented in accordance with the Japanese grant aid scheme. JICA will approve the design and supervision agreement between the government of Bangladesh and the Japanese consultant, and the construction and equipment procurement agreement(s) with the Japanese contractor(s).

(3) Japanese Consultant

The consultant will implement the detailed design, bidding support, and construction and procurement supervision for the project in accordance with the design and supervision agreement concluded with BFDC upon the recommendation of JICA. During the bidding phase, the consultant will prepare the bidding documents, assist the BFDC to conclude the construction agreement, and to witness it.

Construction stage

During the construction supervision phase, Japanese engineers will be stationed at the project site throughout the entire construction process to execute their construction supervision duties. Additionally, local engineers familiar with quality and local conditions will be utilized. A system in which civil, structural, electrical, and mechanical engineers provide support from Japan will be established, and on-the-spot inspectors will be dispatched to the project site at critical inspection points.

(4) Japanese Contractor(s)

The contractor(s) will be selected through a competitive bidding process for companies registered in Japan, and will perform their duties in accordance with the contract documents based on the construction and procurement agreements with BFDC. The project comprises the

construction of facilities and the procurement of equipment, and the contractor will utilize Bangladeshi sub-contractors to carry out the works matching with the nature of the work.

2.4.8. Soft components plan

2.4.8.1. Background

This project aims to improve the quality of fish catches and reduce waste at CXB FLC by upgrading the landing center and related facilities, thereby improving the livelihoods of the fishers in the district and contributing to poverty alleviation.

In order to improve the quality of fish catches and reduce waste, it is necessary to maintain the quality of the fish at the landing stage and to supply fish as safe and secured food by improving the safety and efficiency in handling, optimizing the work environment in a hygienic environment as a distribution center.

The main challenges facing CXB FLC include the following.

(1) Long waiting times for landing and prolonged landing hours due to shortage of landing facilities
(2) Rapid loss of freshness of the fish due to landing operations in hot, rainy weather
(3) Use of unhygienic fish containers
(4) Disorder and congestion of worker and material flow lines in the fish handling area
(5) Floor contamination due to people walking around the fish handling area
(6) Handling of fresh fish on contaminated floors
(7) Inadequate quantity and quality of water supply and drainage facilities
(8) Contaminated Bakkhali River water used to clean fresh fish
(9) Lack of knowledge of "proper handling of fish as food" among workers and employees
(10) Insufficient control of BFDC staff in the facility's fish handling activities and landing facility operations

BFDC, the executing agency, recognized the current situation regarding hygiene and freshness management of fresh fish and the handling of fresh fish at the planned facility in the project and agreed to take the necessary measures to improve the fresh fish handling conditions at CXB FLC. It was also agreed that BFDC staff would monitor and control the safety of landed fish as food and the suitability of packaging materials in order to achieve management of landed fish that addresses food safety in the center.

Based on the background above, the following guidance and trainings as soft components shall be planned.

2.4.8.2. Objectives

The purpose of the soft components under this project is to improve the level of hygiene and freshness management in the handling of fresh fish at the landing center.

Therefore, through the soft components plan, action will be taken to ensure that fishery-related personnels in various job categories who use the facilities have a proper awareness of hygiene and freshness management, and that fresh fish are handled appropriately in the provided facilities. In addition, action will be taken to develop an environment in which CXB FLC, the facility management entity, can appropriately monitor and manage the hygiene, freshness, and handling of fresh fish in the facility.

2.4.8.3. Outcomes of Soft component

The outcomes required to achieve the above purposes are as follows.

Table 2-27 : Outcomes of Soft Components

Activity No.	Outcome	Target group	Indicator	Methods of checking achievement of results
Activity No. 1 Awareness of proper hygiene and freshness management	Facility users of all job categories will acquire knowledge of sanitation and freshness control.	as shown in the following table	Hold seminars on hygiene and freshness control for all types of facility users. Create posted materials for facility users to confirm correct knowledge of hygiene and freshness management. Ensure that the posted materials are accessible to facility users.	Check the list of seminar attendees. Check the posted materials for sanitation control.
Activity No. 2 Appropriate use of fish handling area	Facility users of all job categories will learn how to properly use the fish handling area.	as shown in the following table	Prepare a manual that can be understood by facility users in each job category on the proper way to handle fresh fish in the fish handling area. Ensure that the manuals are accessible to facility users. Hold training sessions for facility users on the correct way to handle fresh fish in the fish handling area at temporary handover part.1.	Check the status of the manuals that show the correct way to handle fresh fish in each process by using diagrams, etc. Check the list of attendees at the training sessions.
Activity No. 3 Appropriate management of fish handling area usage	Personnel monitoring and controlling fresh fish handling conditions, including BFDC staff, will learn correct hygienic and proper fresh fish handling methods, as well as how to instruct facility users.	as shown in the following table	Prepare seminar materials for BFDC staff and other personnel monitoring fresh fish handling conditions. Organize seminars. Ensure the availability of the seminar materials for management and human resource development at BFDC.	Confirmation of the status of sharing and viewing management of seminar materials within BFDC. Confirmation of the list of seminar attendees.
Activity No. 4 Continuous improvement of fish handling area usage	Fish handling area utilization is reviewed and continually improved.	as shown in the following table	Workshop about fish handling activities area and monitoring of fresh fish handling status at temporary handover part.2 and complete handover stage. Share the review results and improvement plans with	Confirmation of the status of sharing of review contents and improvement plans within BFDC. Confirmation of the list of seminar attendees (if any).

Activity No.	Outcome	Target group	Indicator	Methods of checking achievement of results
			BFDC staff. Hold seminars for facility users as necessary, reflecting the proposed improvements.	

The following table shows the number of the target group for BFDC's staff and facility users for each outcome,

Table 2-28 : Target groups for outcomes 1~4

Job category	Outcome 1	Outcome 2	Outcome 3	Outcome 4
BFDC staff	5	5	19	19
Fishers on fishing boats	30	30	-	20
Fish transporters for loading	10	10	-	-
Fish Traders	30	30	-	20
Fish sorters	10	10	-	-
Ice Crusher and carriers	5	5	-	-
Fish Weighers	5	5	-	-
Fish Packing Worker	5	5	-	-
Truck drivers	5	5	-	-
Total number of workers	105	105	19	59

2.4.8.4. Method of checking achievement of results

Table 2-27 shows the method of checking achievement of result of the soft components.

2.4.8.5. Soft components activities (Guidance and Trainings)

The soft components activities (Guidance and Training) are shown in the following table.

Table 2-29 : Soft components activities (input plan)

Outcome	Target group	Implementation method	Required skills and knowledge for implementation resources	Implementation resources	Deliverables
Outcome 1 Facility users of all occupations will acquire knowledge of sanitation and freshness management. Facility users of all types of jobs will learn how to properly use the loading dock. Personnel monitoring fresh	As shown in the table above	Preparation of educational materials Discussion with BFDC Discussion with facility users Seminars on hygiene and	Expertise in sanitation and freshness management of fresh fish	Advance preparation Japanese:3 M/D Local : 3 M/D Field activities (1) Japanese: 13M/D Local: 12M/D	Educational materials on sanitation and freshness management of fresh fish

Outcome	Target group	Implementation method	Required skills and knowledge for implementation resources	Implementation resources	Deliverables
fish handling conditions, including BFDC staff, will learn correct sanitation and proper fresh fish handling methods, as well as how to instruct users.		freshness management for all types of facility users.		Preparation for field activities (2) Japanese: 2M/D Local: 6M/D	
Outcome 2 Facility users of all occupations will acquire knowledge of hygienic and freshness management. Facility users of all types of jobs will learn how to properly use the fish handling area. Personnel monitoring fresh fish handling conditions, including BFDC staff, will learn correct hygienic and proper fresh fish handling methods, as well as how to instruct users.	As shown in the table above	Preparation of manual Discussion with BFDC Discussion with facility users Holding of trainings	Experts with a detailed understanding of the current status and challenges of landing centers, seafood distribution, and food quality control in Bangladesh	Field activities (2) Japanese: 20M/D Local: 54M/D	Manual on handling fresh fish in each process
Outcome 3 Facility users of all types of jobs will learn how to properly use the loading dock. Personnel monitoring fresh fish handling conditions, including BFDC staff, will learn correct hygienic and proper fresh fish handling methods, as well as how to instruct users.	As shown in the table above	Preparation of seminar materials Discussion with BFDC Holding of seminars	Engineers who understand the fisheries administration of Bangladesh and the realities of fishers, and have experience in implementing fisheries sector projects that involve stakeholders.		Seminar materials
Outcome 4 The status of use of the fish handling area will be reviewed and continually improved.	As shown in the table above	Discussion with BFDC Monitoring Reviewing monitoring results and making recommendations for improvement to BFDC		Preparation for field activities (3) Japanese:2 M/D Local:2 M/D Field activities (3) Japanese: 13M/D Local: 12M/D Preparation for field activities (4) Japanese:2 M/D Local:2 M/D Field activities (4) Japanese: 13M/D Local: 12M/D	Monitoring report with review results and proposed improvement measures at the second partial delivery and at the time of complete delivery
Compilation				After field activities (4) Japanese: 3M/D Local: 2M/D	Final report

2.4.8.6. Procurement plan of implementation resource

The implementation resources are planned to be a combination of direct consultant support by dispatching Japanese personnel and use of local resources in Bangladesh for the reasons described below.

The Japanese personnel will oversee the entire soft component, directing, supervising, and leading activities of the local resources according to the working phase.

1) Dispatch of Japanese consultants

The flow lines of fresh fish, workers, ice, vehicles, , from the landing stage to the handling, packing, and shipping of fish in the fish handling area, and water maintenance in the planned facility were proposed by the Japanese consultant as a solution to the problems of hygiene and freshness of fresh fish in the existing facility, and the Japanese personnel will need to confirm the appropriate use of the facility. In addition, of the planned facilities in this project, the facilities with fish landing and handling functions will be handed over in advance of other facilities, and the Japanese personnel will need to confirm the areas available to BFDC and facility users at each handover stage.

2) Local consultant

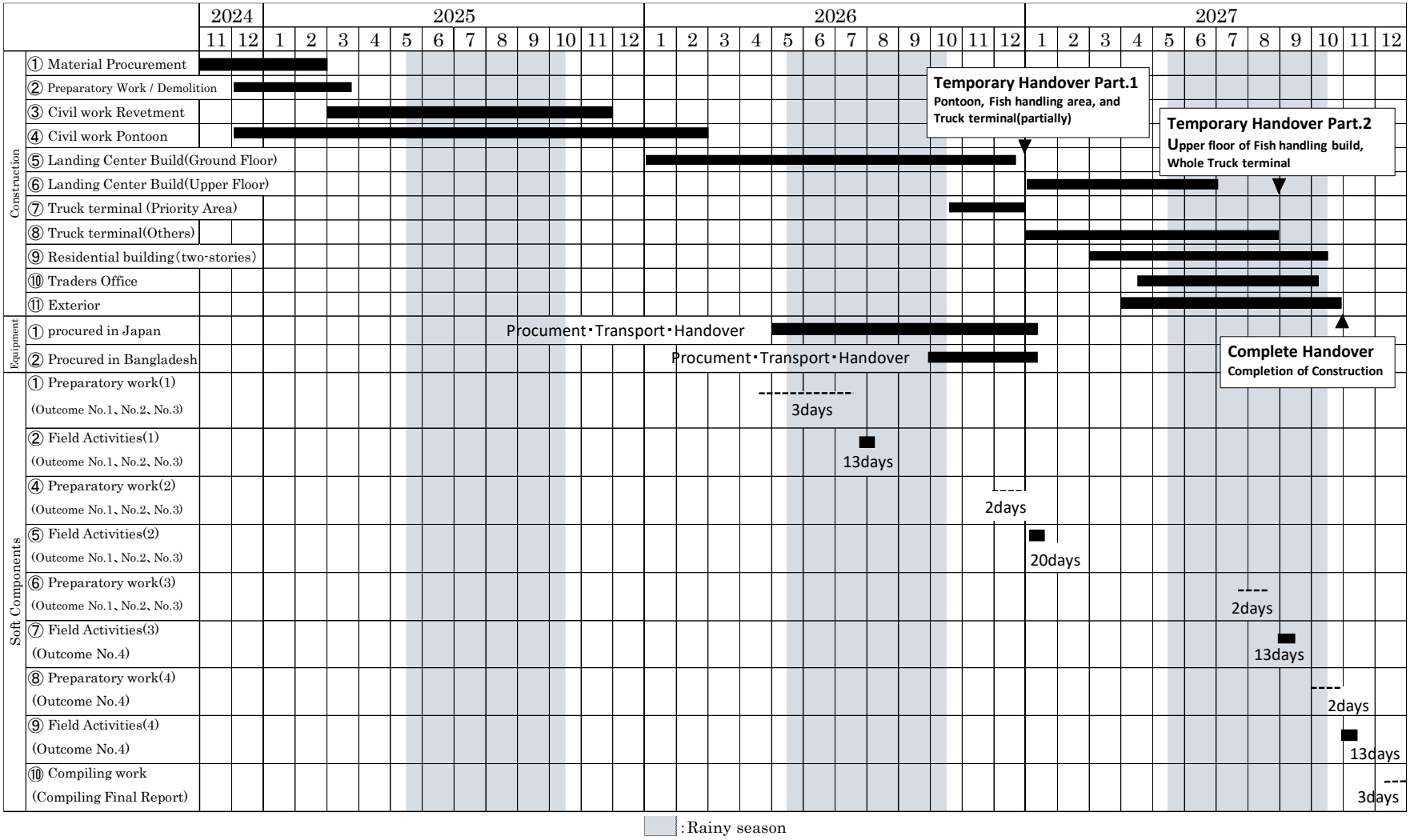
It is important to utilize local resources who have extensive knowledge of hygienic and freshness management of fresh fish, familiar with local customs and the current status and challenges of fresh fish handling and distribution with rich experiences of research and project implementations in the artisanal fishery sector in Bangladesh r.

Local resources should have many years of experience in conducting surveys for improving the local fisheries value chain in Bangladesh, including at CBX FLC, and recognize the shortcomings of the existing facilities and the fresh fish handling at the facilities.

2.4.8.7. Implementation schedule of the soft components

The soft component implementation schedule with the overall project schedule are shown below. The soft component is planned to be implemented in four phases: at equipment procurement before the partial handover of the handling area, at partial delivery of the ground floor of the handling area and truck terminal, at full delivery of the ground floor of the handling area and truck terminal, and upon completion of construction.

Table 2-30 : Soft component Schedule (Draft)



2.4.8.8. Reports and materials of soft components

・Soft Component Completion Report
・Teaching materials on fresh fish hygiene and temperature control
・Fresh fish handling manuals
・Seminar materials for BFDC staff and other personnel for monitoring and control of fresh fish handling
・Monitoring reports with review and proposed improvement measures at the second partial handover and upon the completion of handover of the facilities.

2.4.9. Implementation Schedule

If the project is implemented under the grant aid scheme of Japan, an Exchange of Notes （E/N） between the two countries and a Grant Agreement （G/A） between JICA and BFDC will be concluded, followed by a design and supervision agreement to be signed by BFDC and the Japanese consulting firm. Detailed design, preparation of the bid documents, bidding, conclusion of the contract(s) with the awarded contractor(s), and construction and procurement of equipment shall subsequently be carried out.

Under the grant aid scheme of Japan, the project shall strictly adhere to the set construction period in compliance with the national budget system in Japan, and an implementation schedule as well as a detailed progress plan shall be formulated based on consideration of the natural conditions and the procurement conditions for materials, equipment and manpower.

2.4.9.1.1. Detailed design

In the detailed design phase, the consultant shall prepare detailed design of each facility and equipment based on the preparatory survey report and shall prepare a set of bid documents including detailed design drawings, specifications, and bid requirements. This will take approximately 4.0 months.

The contractor(s)（Japanese company）of the project shall be selected by means of a competitive bid. The bidding procedure shall be carried out in the order of announcement of the bid, acceptance of expression of interest, pre-qualification, distribution of bid documents, bid opening, bid evaluation and contracting with the successful bidder(s). This will take approximately 4.0 months.

2.4.9.1.2. Construction work

The contractor will begin work immediately after signing the construction

agreement. It may take approximately two months to prepare for the project construction work, including procurement of construction machinery, ocean transport, customs clearance, and the like as well as local preparation work. The subsequent construction period at the project site is expected to last 35 months.

2.4.9.1.3. Procurement of equipment

It will take four months to procure equipment in Japan and roughly two months for ocean transport and customs clearance. It will take a total of nine months for the equipment to arrive at the Chattogram Port and inspection. The procurement and transport schedule will track the progress of the construction work.

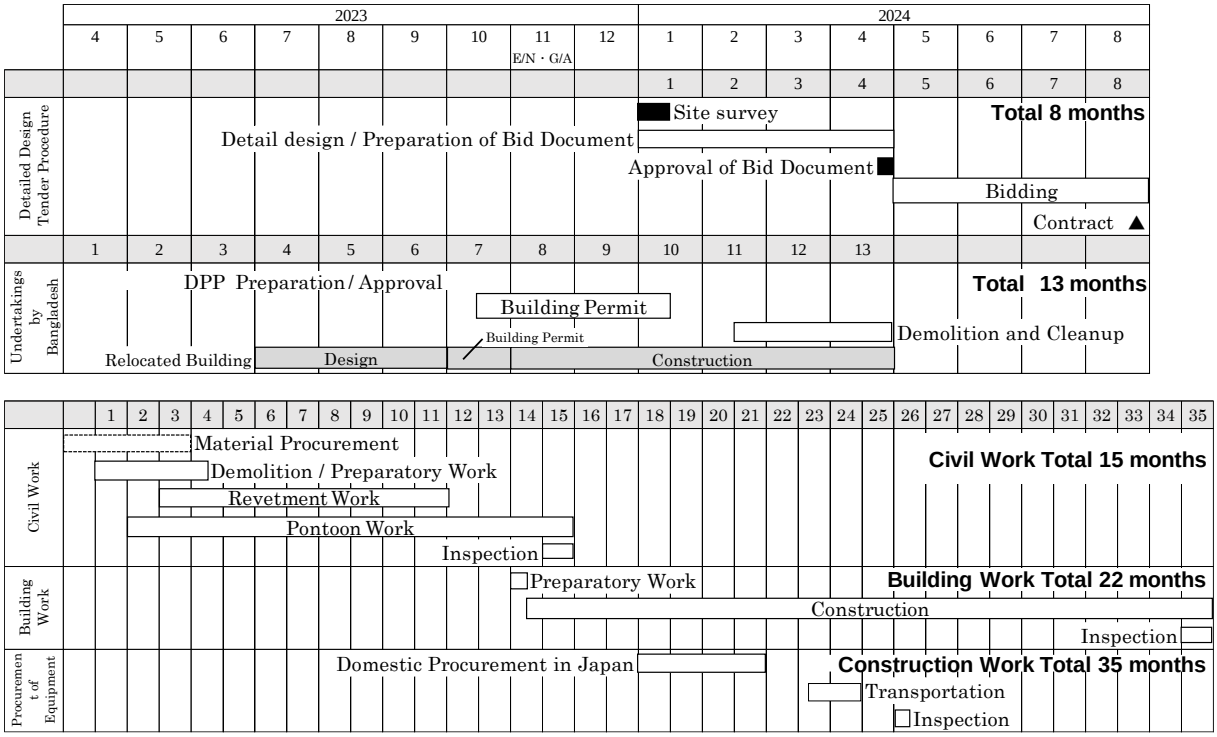


Figure 2-28 : Project implementation schedule

2.5. Safety plan

Regarding the safety for construction work, a safety plan and a safe construction plan for each construction process will be developed in accordance with *The Guidance for the Management of Safety for Construction Works in Japanese ODA Projects* published by JICA for the temporary construction plan, construction plan for each construction process, and working environment and labor safety. Additionally, a cycle of planning, implementation, verification, and improvement will be implemented, with ongoing reviews made during the construction.

The project site locates in an urban area with residences scattered throughout the vicinity, and CXB FLC will continue to operate during the construction period, with landing, handling, and shipping operations continuing. Therefore, during the construction period, the temporary yard for the construction site will be enclosed by a temporary steel fence measuring 2 m tall to thoroughly prevent trespassing in the construction area, and other safety measures will be taken, for example assigning security guards on day and night shifts to prevent vehicle collisions near the gate. After frame construction of the second floor of the fish landing center building is completed, the finishing work will be launched, starting with the ground floor and proceeding to the upper floors. The ground floor will be handed over upon completion of the finishing work on it, after which the fish handling operations will be commenced; thus, the void area of the first floor is a key point in securing safety. The following figures show the temporary construction plan for each phase of the building construction.

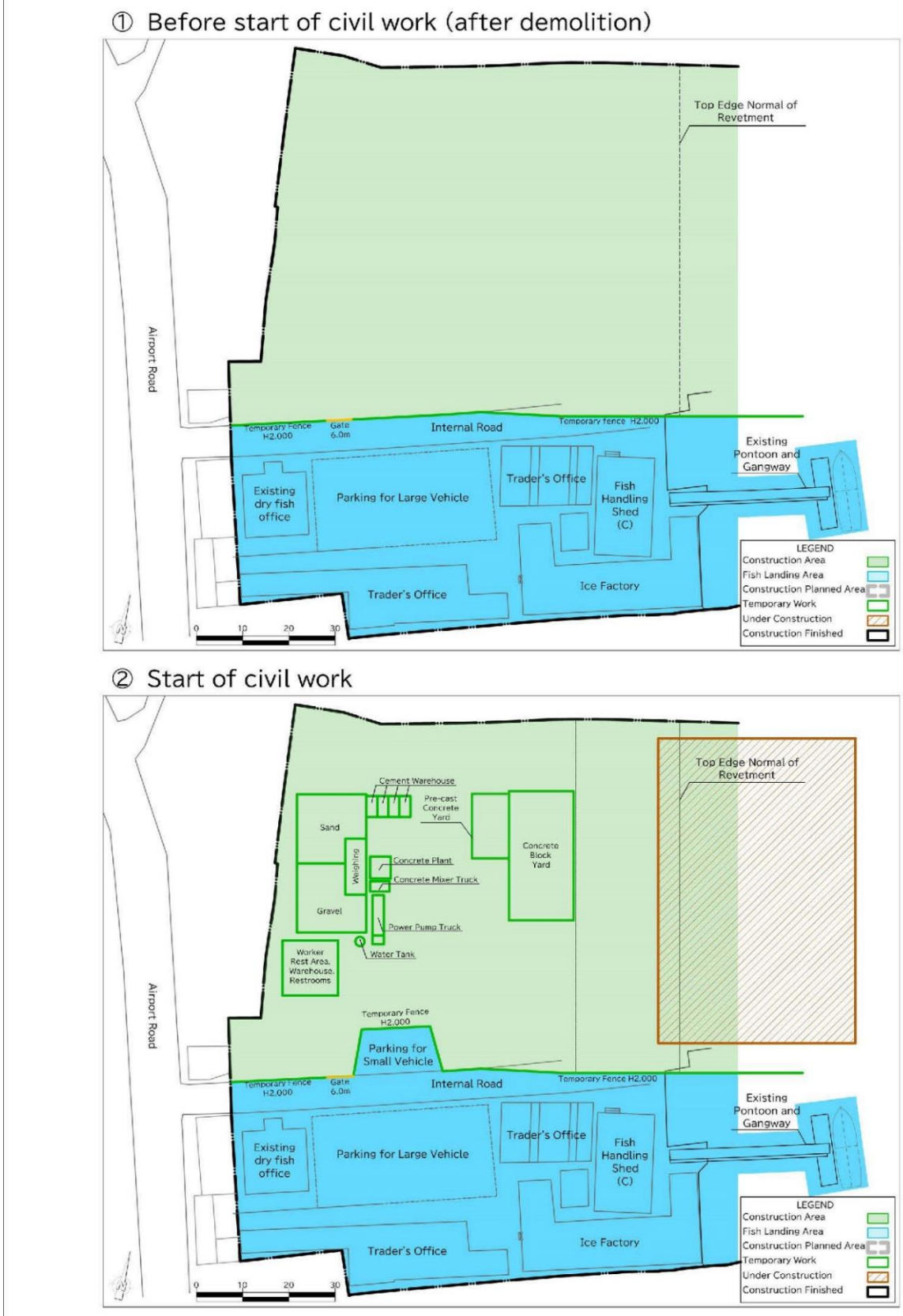
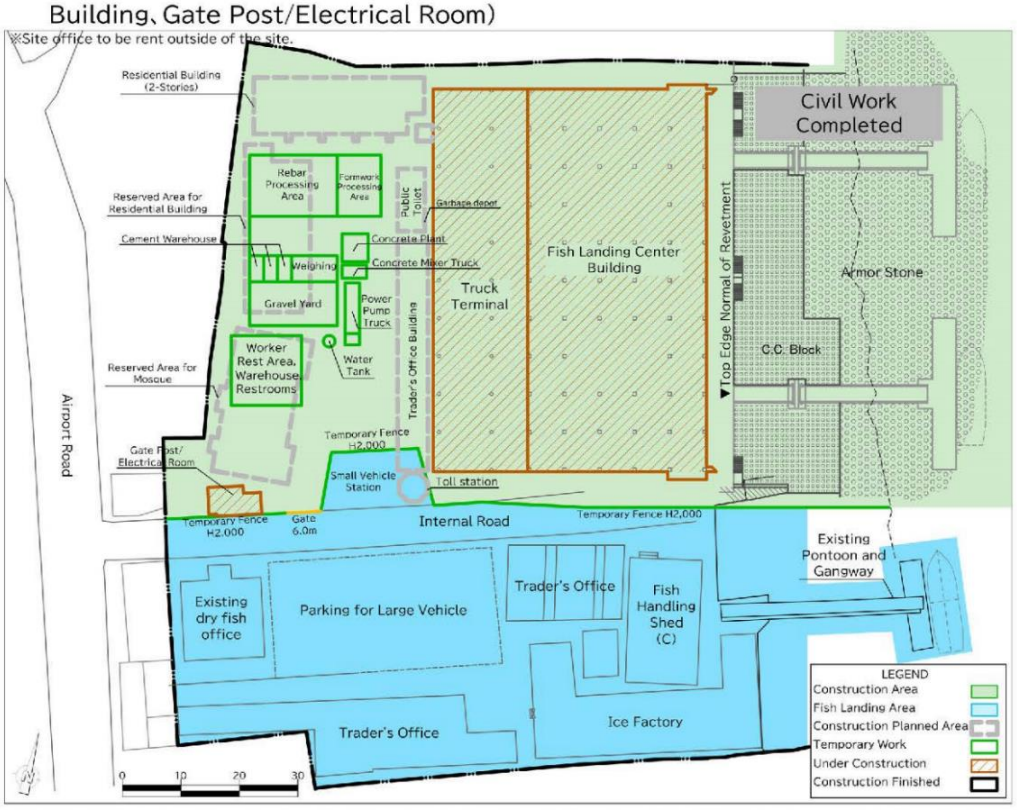


Figure 2-29 : Temporary construction plan for each phase of building construction, (1) and (2)

③ After civil work completion, the construction work starts (Fish Landing Center Building、Gate Post/Electrical Room)



④ GF of Fish Handling Center Building including Truck Terminal(Y1～Y3) is to be partialy handed over after completion of the GF construction. Finishing work continues on the upper floor.

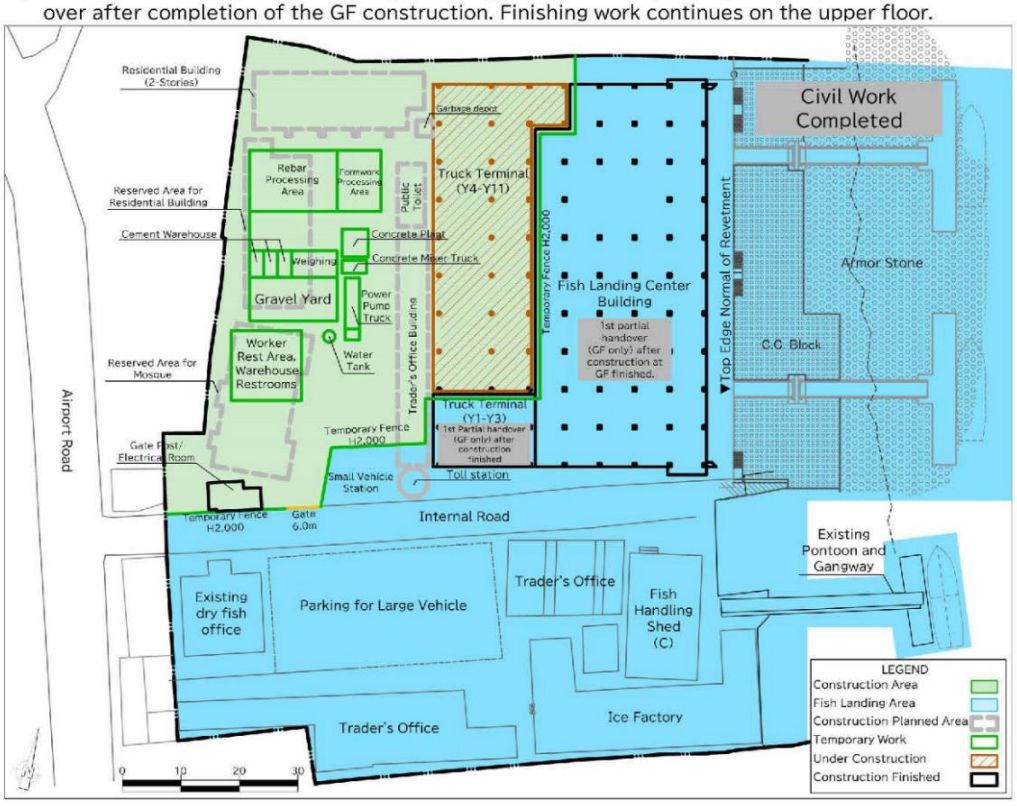


Figure 2-30 : Temporary construction plan for each phase of building construction, (3) and (4)

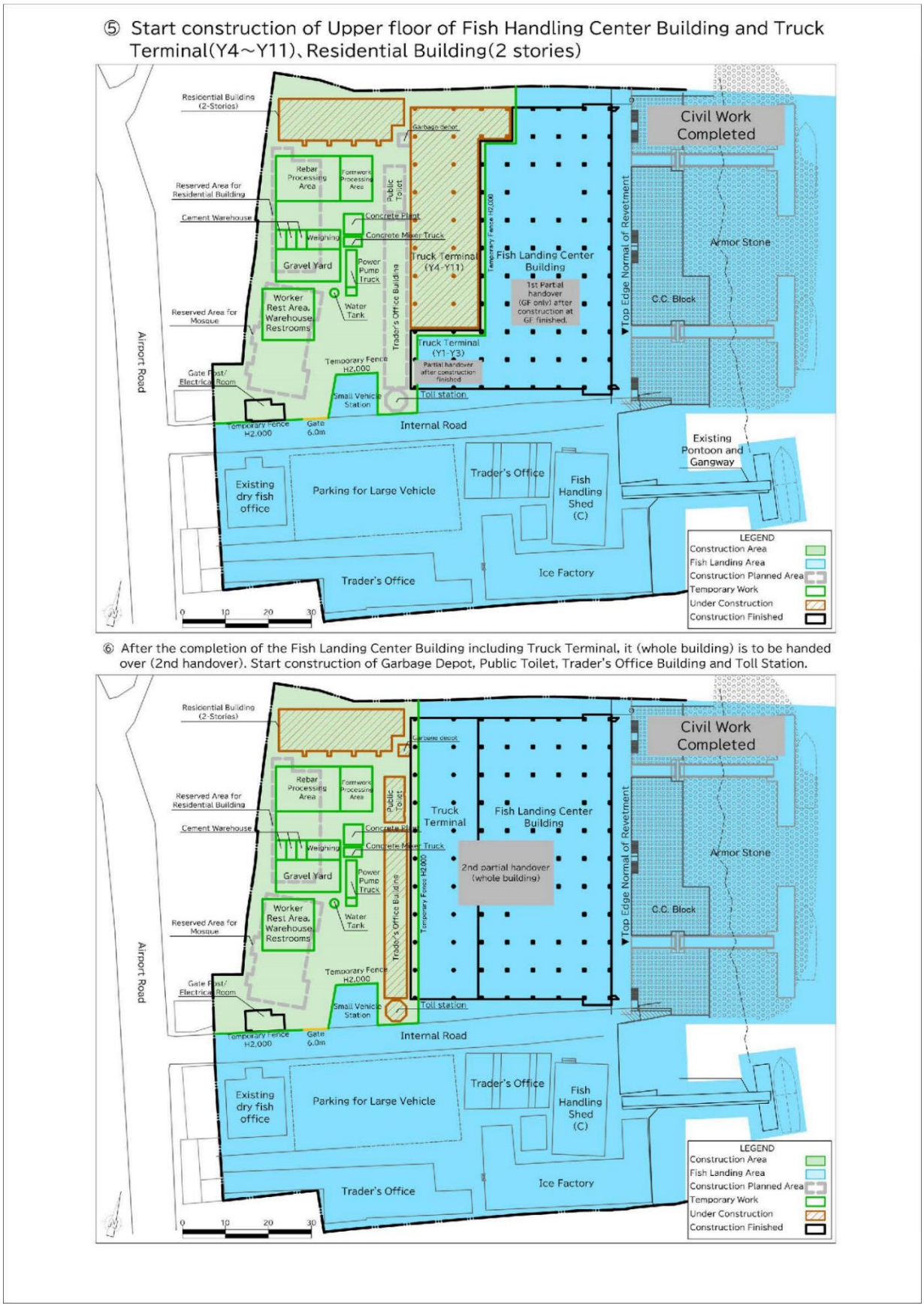


Figure 2-31 : Temporary construction plan for each phase of building construction, (5) and (6)

Other appropriate measures shall be taken, including measures to install fall prevention nets to prevent dust and sand (e.g. water sprinkling, installation of mesh nets), and to reduce noise (e.g. sound proof panels and sheet). Regarding transfers and accommodations for construction workers, they shall be instructed to take adequate security and safety measures to behave in a safe manner.

Additionally, infection prevention and emergency response shall also be included in the safety plan, and appropriate infection prevention actions and measures in the temporary construction plan will be taken. Conditions for measures such as suspending construction in the event of an outbreak will be discussed in advance with the Bangladesh side to prepare for the smooth implementation of measures in case an incident occurs.

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CHAPTER 3. OBLIGATIONS OF RECIPIENT COUNTRY

1) Securing and protecting the proposed construction site

   The planned facility construction site is secured by BFDC. it is necessary for the Bangladeshi side to continue to assume responsibility for dealing with the land issues.

2) Demolition, removal and clearing of existing structures

   The Bangladesh side shall demolish, remove, and clear buildings, exterior walls along the road, underground structures, trees, and other objects on the construction site. The Bangladesh side shall erect a temporary enclosure around the construction site for security.

3) Preparation of temporary handling facilities and other facilities, and securing all operation during the construction period

   The Bangladesh side is solely responsible for dealing with the construction of temporary fish handling and other facilities for maintaining the functions of the landing center during the construction period.

4) Securing of a temporary and new mosque

   1) Prior to the demolition of the existing mosque, the Bangladesh side is solely responsible for securing a temporary mosque inside CXB FLC.

   2) After completion of the construction under the project, the Bangladesh side is responsible for securing new mosque inside CXB FLC.

5) Arrangement of staff residence

   Before the removal and demolition of existing residential buildings on the construction area, the Bangladesh side is solely responsible for securing alternative staff housings.

6) Securing temporary sites

   The Bangladesh side will secure temporary sites in the area to serve as construction and material yards. The Bangladesh side will also obtain the local government's and residents' understanding in advance.

7) Connecting the site to power, telephone, and internet lines

   The Bangladeshi side must provide power cables, telephone lines and internet service to the project site at their own cost. These works must be completed by the start of the construction work in this project at the latest.

8) Application and acquisition of all permits for the project

   The Bangladesh side shall obtain the permits and licenses for construction work (e.g. building certification, usage of electricity, construction permits,

river usage) before the bidding process.

9) Application and acquisition of environmental clearance certificates and monitoring of environmental impact

The Bangladesh side will implement the necessary environmental impact assessment procedures in accordance with JICA's environmental guidelines and the environmental procedures of Bangladesh, and will implement and monitor measures for mitigating the impact of the project in accordance with JICA's environmental guidelines.

10) Tax exemptions, import customs clearance for materials and equipment, procedures for stays in Bangladesh

The Bangladesh side shall bear or exempt from customs duties on, and expedite clearance procedures for all materials and equipment imported into Bangladesh for the project in addition to providing exemptions from taxes and administrative monetary penalties assessed on the provision of materials, equipment, and services procured by the consultant and the contractor in Bangladesh. The Bangladesh side will also promptly issue permits and licenses for work and residence for Japanese and third-country nationals engaged in the project.

11) Maintenance and operation after completion of the facilities

The Bangladesh side will appoint, hire, train, instruct, and pay the new staff members needed to operate the plan facilities before the facilities enter into operation.

12) Dissemination of safety precautions and information to residents during construction

The Bangladesh side will disseminate safety precautions and information to residents around the project site, prohibiting entry into the construction area and restricting traffic, to ensure the safety of residents and traffic in the vicinity.

13) The Bangladesh side shall procure furniture, fittings, fixtures, equipment, and the like necessary for operations but not included in the project, or relocate and install them.

14) The Bangladesh side shall conclude banking agreements with a Japanese bank for payments to the Consultant and the Contractor(s) in line with the project agreement, promptly issue authorizations to pay based on the banking agreements, and pay bank charges at the time of issuance and for each payment.

15) The Bangladesh side shall bear the other costs (administrative expenses) of implementing the project that are not among the responsibilities of the Japanese government.

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CHAPTER 4. PROJECT OPERATION PLAN

4.1. Maintenance and operation entity

The operation and maintenance entity for the project facilities is the Bangladesh Fisheries Development Corporation (BFDC).

CXB FLC, a business management unit of BFDC, is responsible for the maintenance and operation of the project facilities and equipment in accordance with BFDC's plan.

Since CXB FLC has generated operating income in the last five fiscal years from the existing facilities, it would be possible to generate sufficient funds to cover the costs for the maintenance and operation of the project facilities.

4.2. Operation plan

(1) Operational status of existing facilities

The operation of landing and handling fresh fish at existing facilities is relied on the boat owners' and distributors' associations that use the facilities (including control of berthing of fishing boats at the existing pontoon); there is little involvement of BFDC staff members.

BFDC does not charge any fees for use of the pontoon by fishing boats or for the handling or packaging for shipping of landed fish in the handling area; the fish baskets and other containers, ice crushers, container boxes, and the like in use in the handling area belong not to BFDC, but to the users.

Distributors and workers in various occupations using the facilities have organized into unions, and although they are working on the BFDC's landing infrastructure, they are self-disciplined in their landing and handling operations.

(2) Post-improvement operation plan

Improvements and developments in the handling and distribution of fresh fish at the new facilities will continue to be primarily made by the facility users, but will also require the active involvement of BFDC as the owner and management body of the infrastructure.

In order to achieve the proper handling of fresh fish once the project facilities are in operation, BFDC staff members are required to understand and familiarize themselves with the proper ways to use the facilities, to supervise and control activities within the facilities in cooperation with fishers and users. Notably, the soft components plan for the handling of fresh fish at project facilities will be provided

BFDC staff members with training in management and control know-hows through seminars and workshops. Details are described in the chapter on the soft components.

Regarding the management structure, the policy of BFDC headquarters, a quality control managers to monitor control the handling of fresh fish at the landing center will be posted, has been confirmed. Regarding insufficient staffing structure in current operation of the center, the minimum required number of personnel for operating project facilities should be assigned.

The figure below is a proposed organizational chart for the operation of the improved facilities.

The office names on the chart are the offices for each department assigned to the project facilities.

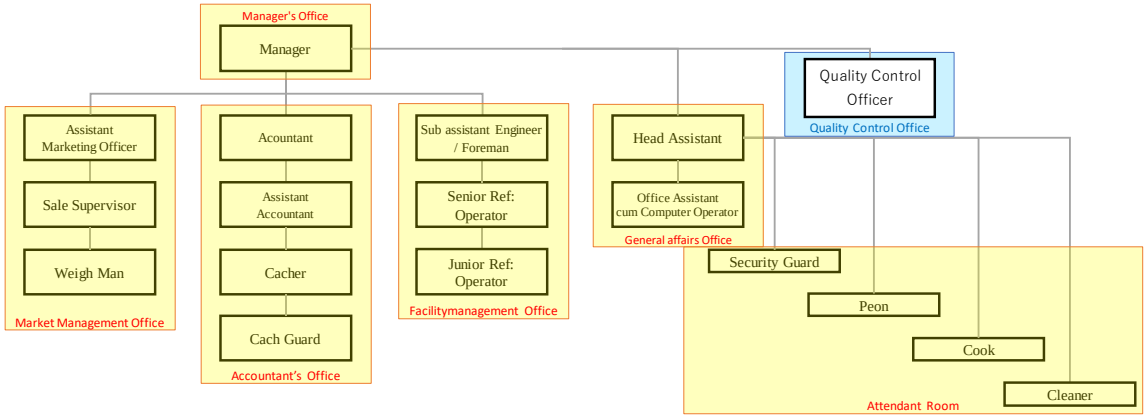

Figure 4-1 : Proposed staffing structure for improved facility operation

The table below shows a breakdown of the staff members needed to operate the improved facilities. The present number of staff members for existing facilities is shown for comparison.

Table 4-1 : Breakdown of staff members required to operate improved facilities

	After facility improvement	No. as of the field survey
Manager	1	1
Marketing manager	1	1
Sales manager	3	3
Sales assistant	1	1
Accounting	1	1
Accounting assistant	1	0
Cashier	0	0

	After facility improvement	No. as of the field survey
Cashier assistant	0	0
Engineer	1	1
Facility operator	3	2
Ice factory staff	1	1
Administrative director	1	1
Administrative staff	1	1
Quality control manager	1	-
Security guard	2	2
General affairs staff	1	0
Kitchen staff	1	1
Cleaning staff	3	3
Total	23	19

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CHAPTER 5. PROJECT COST ESTIMATION

5.1. Initial cost estimation of the project

The following is an estimate of the breakdown of expenses borne by Bangladesh side based on the conditions outlined in (2) below. These amounts do not represent the maximums to be granted under the E/N.

(1) Costs to be borne by Bangladesh

The costs to be borne by Bangladesh in case the plan is implemented under the grant aid is estimated to be about 142.61 million BDT (about 207.33 million yen) breakdown as follows.

Table 5-1 : Costs to be borne by Bangladesh

No.	Item	Description	Amount (million BDT)	Amount (million yen)
1	Demolition and clearing	Removal and relocation of existing facilities at the proposed construction site Securing temporary yard	3.7	5.3
2	Permits and licenses	Application for construction and river usage permit	3.5	5.0
3	Office furniture, etc.	Procurement of equipment, furniture, and the like outside the scope of Japanese cooperation	3.0	4.3
4	Administrative expenses	Project monitoring expenses, grant account opening and maintenance fees (e.g. transfer fees), fees for issuing authorization to pay, other bank charges, and the like	2.1	3.0
5	Temporary fish handling facility and temporary	Construction of a temporary fish handling facility, temporary mosque and other facilities	72.4	105.3

No.	Item	Description	Amount (million BDT)	Amount (million yen)
	mosque and other facilities	shifting from construction area for continuing the functions of the fish landing center during the construction period		
6	Arrangement of alternative residences	Arrangement of alternative staff residences for all staffs and their families moving from existing residential buildings before demolition work on construction area	20.91	30.43
7	Residential building excluding from the project	Residential building will be secured on reserved area inside CXB FLC	24	35
8	New Mosque	Securing new mosque inside CXB FLC	13	19
Total			142.61	207.33

(2) Conditions of Estimation

1) Time of estimate: September, 2022

2) Exchange rate: US$1.00 = 136.27 Japanese yen
BDT 1.00 = 1.4557 Japanese yen

3) Construction period: The time schedule for carrying out the detailed design and construction is shown on the project Implementation Schedule.

4) Others: The project will be implemented in accordance with the grant aid scheme of the Japanese Government.

5.2. Operation and maintenance expenses

5.2.1. Income and expenditures

(1) Composition of income of existing facilities

Regarding the finances of CXB FLC, a fund management system in which income is deposited to BFDC headquarters and necessary expenditures are paid by BFDC headquarters has been adopted. This is the same method as all business owned by BFDC.

Sources of income for the operation of existing facilities comprise royalty & commission fees, ice sales, rent & lease fees, and other income. The following is a breakdown.

・Royalty & commission fees are fees for fishery products shipped from CXB FLC. They are assessed on each packaging container at prices set by BFDC.

Royalty & commission fees are classified by the containers into which the fresh fish are packaged, but there are no detailed fee classifications by species, there are only three classifications as hilsa shad, shrimp, and mixed packages.

Although the fee varies slightly by classification, it is roughly 1 BDT per kilogram of fish.

・Ice sales are income from the sale of block ice produced at the ice factory at CXB FLC. The selling price is variable, subject to concurred price with the local private ice factories owners.

The selling price is set for a unit of block ice (equivalent to 60 kg). The price is typically 100 BDT, but fluctuates depending on supply and demand—when supply cannot keep up with demand, the unit price of ice inflate to roughly twice.

The selling price of ice is uniform in the area; thus, there are no price advantages among ice factories. However, the private ice factories offer more flexibility in terms of payment schedule than CXB FLC, for example private ice factories may load ice onto fishing boats before fishing and may collect payments after the boats return; CXB FLC only accepts cash payments upon delivery. Thus, the private ice factories are more attractive in terms of payments than CXB FLC.

・Rent and lease fees are paid to BFDC by users of the facilities who establish their installation of operations at CXB FLC as a form of rent.

Those fees are levied on distributors, ice crushers, and the operators at CXB FLC, which CXB FLC has secured space for their operations.

・Other sources of income include parking fees for trucks transporting fresh fish over long distances and fees for ice brought in from local private ice factories.

The table below shows these sources of income as percentages of actual annual income.

Royalty & commission fees, ice sales, and rent & lease fees account for the largest shares, with royalty & commission fees and ice sales together accounting for roughly 80% of the total. In fiscal 2021–2022, they were 43% and 35% of total income, respectively, with rent & lease fees accounting for just over 10% of the total.

Table 5-2 : Annual Income of CXB FLC

(unit : BDT)

Annual Income	2019-2020	2020-2021	2021-2022
Royalty & Commission	8,667,942	7,074,170	6,478,112
Ice Sales	6,505,673	6,787,867	5,257,145
Rent & Lease	1,962,124	2,195,838	2,213,158
Miscellaneous Income	683,785	956,902	1,226,195
Total	17,819,524	17,014,777	15,174,610

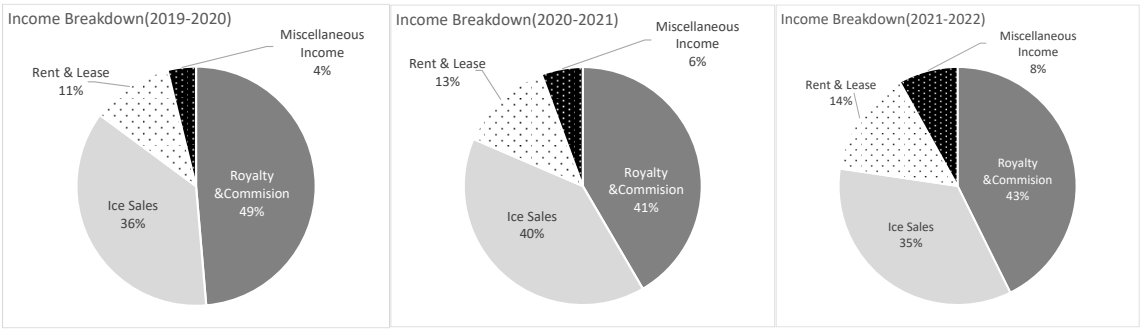

Figure 5-1 : Percentage of the annual income

(2) Composition of expenditures of existing facilities

The BFDC's expenditures for operating existing facilities is divided into three categories: general administrative expenses, operating expenses, and miscellaneous expenses. Utilities and personnel expenses are sorted in both general administrative and operating expenses. Electricity fees, repairs, telephone charges, and the like for the CXB FLC administrative building, staff residence, and other buildings of CXB FLC as well as personnel expenses for staff members in facility management are included in general administrative expenses, while electricity fees and maintenance costs for ice machines and personnel expenses for operation staffs are included in operating expenses.

The table below shows these expenses as percentages of actual annual expenditures.

Personnel expenses (including salaries and bonuses) account for roughly half of the total and are the largest, followed by electricity fees for ice-making facilities at

30%–35% of the total. The ice-making facilities also require maintenance costs (roughly 5%–6%); as the personnel expenses for engineers and the workers shall be included, expenditures for ice-making facilities are quite high.

Table 5-3 : Annual expenditure of CXB FLC

(Unit : BDT)

Annual Expenditures	2019-2020	2020-2021	2021-2022
Personnel expenses	5,953,305	5,951,871	6,735,339
Electricity (Ice making facility)	3,827,764	3,998,899	3,638,643
Maintenance costs (Ice making facility)	546,042	616,360	678,892
Tax	258,500	277,000	138,500
Electricity (Office building, etc.)	190,826	148,234	113,635
Facility repair expenses	77,096	92,138	67,516
Communication expenses	11,942	17,113	11,902
Miscellaneous expenses	194,172	203,278	260,173
Total	11,059,647	11,304,893	11,644,600

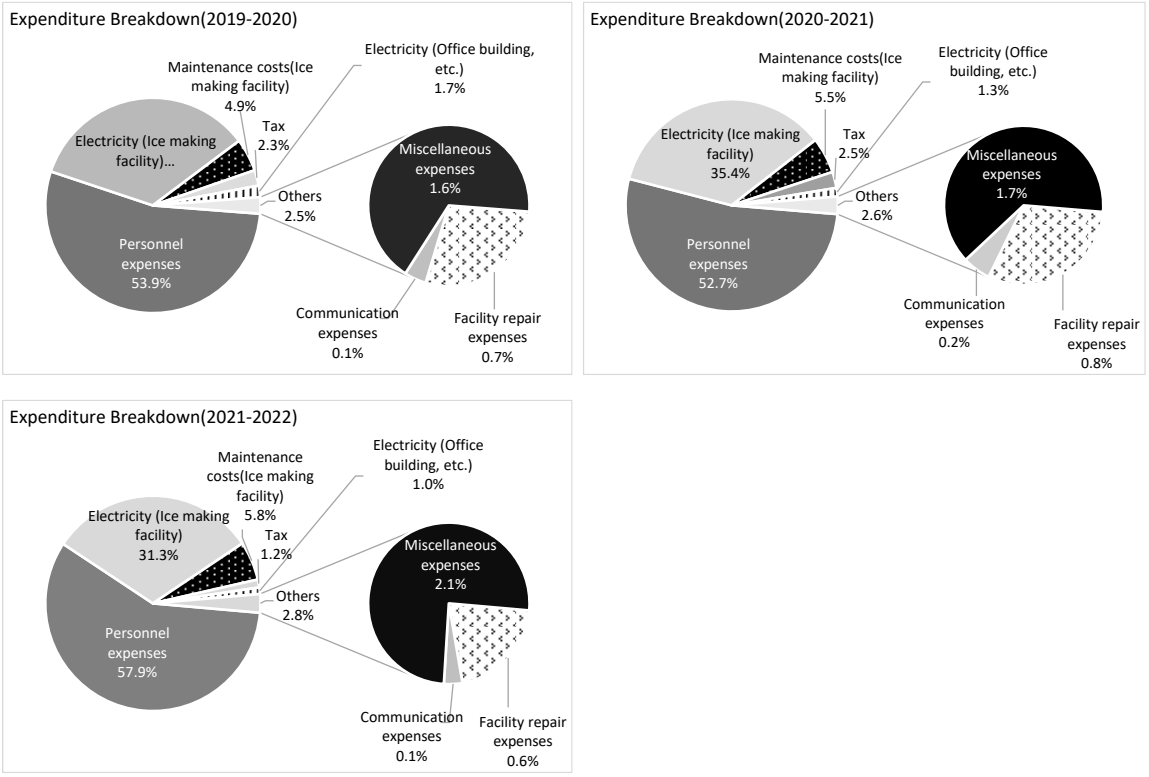

Figure 5-1 : Percentage of the annual expenditure, CXB FLC

5.2.2. Operation and maintenance costs of project facilities

The plan facilities will operate on income and expenditures separately, with operating income from the existing royalty & commission fees, ice sales, rent & lease

fees, and the like covering operating and administrative expenses and facility and equipment maintenance costs.

Royalty & commission fees—the main source of income from the operation of existing facilities—must cover the maintenance costs of the handling area, and rent & lease fees must cover the maintenance costs of the trader's offices, vendors, and the like.

As for royalty & commission fees, it may not be necessary to revise the fees because income should increase on the strength of the improved efficiency of landing, handling, and shipping operations at project facilities.

As for rent & lease fees, it may not be necessary to revise the fees if the cost of maintaining the facilities is the same as for existing facilities—which it should be, given that the plan calls for roughly the same number of trader's offices, storage, and vendors as in the existing facility. However, funds for maintaining lighting with built-in solar power generation systems and the consumables of other facilities shall be secured.

On the other hand, fish containers and other equipment for handling fresh fish are consumable and must be replaced after they wear out. The cost of purchasing additional equipment should be paid by the facility users who use the equipment; however, it is possible to grant the right to use the equipment to a relevant association (e.g. distributors' association) on a lease contract basis and to use the lease income to cover equipment maintenance costs.

Because ice selling prices are based on agreements of the local private ice factory owners, it is difficult for BFDC to set its own price.

The cost of maintaining the toll gate must be defrayed by establishing new sources of income, for example collecting tolls from vehicles as they enter CXB FLC.

Based on the above, income from project facilities is listed as follows.

・Royalty & commission fees will increase 20% due to the increase in the volume of fresh fish handled. No rate revisions are anticipated.

・Income from ice sales will remain the same.

・Income from lease fees will increase in proportion to the number of leased spaces in project facilities (roughly 20%).

・Other sources of income—among them CXB FLC parking fees for trucks transporting fresh fish over long distances and fees for ice brought in from local private ice factories—were assumed to be the same for project facilities as the existing facility.

Regarding income from tolls for trucks and other vehicles entering and leaving CXB FLC, the number of vehicles subject to toll collection was assumed to be the same as the current number given that roughly 20 vehicles per day enter and exit the facility. Expenditures for project facilities are listed as follows on the assumption that they will be budgeted on a case-by-case basis by BFDC headquarters.

- Salaries based on grade and other personnel expenses are expected to rise due to changes in personnel expenses and the number of staff members.
  Assuming the minimum required number of personnel for operating project facilities is 23 (including four supplemental positions) and accounting for the grades set out by BFDC, personnel expenses are expected to increase roughly 20% over the current figure.
- Taxes will remain the same.
- Regarding electricity fees for the fish handling area and the like, electricity consumption is assumed to be commensurate with the nature of usage of the project facilities (including refrigerators).
- Facility repair costs include the price of cleaning septic tanks, repainting exterior walls, and the like.

The table below shows the average actual income and expenditures for the past three fiscal years and the planned annual income and expenditures for the improved facilities.

Table 5-4 : Plan annual income and expenditure of CXB FLC

Annual income			Annual expenditures		
The breakdown of income	Average for past 3 years	Plan annual income	The breakdown of income	Average for past 3 years	Plan annual income
Royalty and commission	7,406,700	8,888,040	personnel expenses	6,213,500	7,456,200
Ice sales	6,183,600	6,183,600	Electricity expenses (ice factory)	3,821,800	3,821,800
Rent and Lease	2,123,700	2,548,440	Maintenance expenses for ice factory	613,800	613,800
Miscellaneous income	955,600	1,146,720	Tax	224,700	224,700
			Electricity expenses (Administration Bld.)	150,900	531,480
			Facility repair expenses	78,900	94,680
			Communication expenses	13,700	13,700
			Miscellaneous expenses	219,200	219,200
			Profit	5,333,100	5,791,240

Annual income			Annual expenditures		
Total	16,669,600	18,766,800	Total	16,669,600	18,766,800

(unit : BDT)

CHAPTER 6. Project Evaluation

6.1. Preconditions

The implementation of the project is predicated on ensuring that the following responsibilities are borne by the Bangladesh side.

・Completion of the preparation and approval process of the Development Project Proposal (DPP) by the government of Bangladesh prior to the conclusion of the E/N and G/A.

・Faithful execution of the responsibilities indicated in Overview of Partner Country Responsibilities and the Minutes of Discussion (M/D)—including but not limited to demolition, removal, and clearing of the existing facilities of CXB FLC, acquisition of construction permits, establishment of operation and maintenance systems, tax exemption procedures— by the government of Bangladesh at the appropriate time for each.

・Securing the budget required for operation and maintenance outlined in the Initial Cost Estimation.

6.2. Necessary inputs by the recipient country

The following are the responsibilities to be fulfilled by the Bangladesh side to achieve the overall plan of the project.

・Securing appropriate funds for maintaining and updating facilities, equipment, and machinery; proper monitoring of financial status.

・Informing users of the rules, ensuring proper usage of facilities and equipment, maintaining good sanitary conditions.

・Establishing a hygiene control system within CXB FLC to maintain good hygienic conditions at landing pontoons and in the handling area, packaging areas, vehicles, and the like; ensuring the safety of landed fish as edible food, the suitability of packaging materials, and the like.

・Working with the local government to establish a waste management system to dispose of the waste generated in the facilities and to clean up the facilities.

・Securing alternative staff residence before the removal and demolition of existing staff residence during the construction period and new residential building for staff excluding from the project after completion of the project

・After completion of the construction period of the project, securing new mosque.

・Refurbishing aging ice-making facilities.

6.3. Important assumptions

The following are important assumptions for realizing and sustaining the benefits of the project.

・Internal security and safety are assured in Bangladesh.

・The policy of the government of Bangladesh continues to emphasize the promotion of the marine fisheries sector.

6.4. Project evaluation

6.4.1. Relevance of the Project

(1) Current state and issues of the development of the fisheries sector in Bangladesh and the position of the project

In the People's Republic of Bangladesh, 11% of the total population (roughly 18 million people) works in the fisheries sector, second only to the garment industry in terms of exports (BBS, 2019). The district of Cox's Bazar, which locates in the southeastern corner of the country on the Bay of Bengal, has a thriving marine fishing industry and is home to nearly 40% of the nation's artisanal fishers (fishers who fish using traditional small fishing boats); however, most landing area infrastructure is underdeveloped, and even developed infrastructure is aging or being destroyed by natural disasters.

Although CXB FLC is the largest landing and distribution center in the district of Cox's Bazar Sadar, landing operations are inevitably inefficient and unsanitary because the BFDC has faced technical difficulties in restoring the landing jetties, fish handling sheds, and part of the revetment that collapsed due to riverbank erosion. Additionally, due to contamination in the center, ice shortages and inadequate cold storage facilities, the quality of the catches has deteriorated, leading to spoilage in the distribution process and lower selling prices; consequently, fishers are unable to secure income conforming to their catches.

In its Eighth Five-Year Plan (2020–2025), the government of Bangladesh promotes a blue economy based on marine resources with the aim of reducing the spoilage rate of catches and improving fishers' livelihoods. Additionally, the Japan-Bangladesh Comprehensive Partnership resulting from the Japan-Bangladesh Summit in May 2019 acknowledged the need to support host communities negatively impacted by the influx of refugees in the district of Cox's Bazar.

The project aims to improve the quality of catches and reduce the spoilage rate by improving the landing center, facilities, and related equipment at CXB FLC, thereby

contributing to the improvement of fisher's livelihoods and other goals; therefore, the project is positioned as a high-priority project in the country's national plan and agreements between the governments of Japan and Bangladesh.

(2) Japan's and JICA's cooperation policy for fisheries sector development and the position of the project (especially in relation to Free and Open Indo-Pacific (FOIP) and other major foreign policy)

The Country Development Cooperation Policy for the People's Republic of Bangladesh (February 2018) indicates the policy to contribute to poverty reduction by providing assistance to help improve living conditions and livelihoods in rural areas. Additionally, the JICA Country Analysis Paper for Bangladesh (March 2019) acknowledges the need for higher value-added agricultural and fishery products; improving the quality of shipped fresh fish through the project is expected to expand sales channels in the consumer market and enhance value-added. Therefore, the project is consistent with these policies and this analysis.

(3) Other donors' activities

USAID has already completed a project at CXB FLC to provide assistance with facility cleanup activities under Enhanced Coastal Fisheries in Bangladesh II (ECOFISH II). No assistance to CXB FLC is being provided by other agencies.

Though Sustainable Coastal and Marine Fisheries Project by World Bank is under implementation, the proposed sites for improving infrastructures have not been decided.

(4) Significance of the project

The project will contribute to the achievement of Goals 1 (No poverty), 2(Zero Hunger), and 14 (Conserve and sustainably use marine resources for sustainable development) of the SDGs. Additionally, given the apparent humanitarian need and urgency for projects that contribute to poverty reduction in host communities—areas where refugees shelter, and where many fishing boats that use CXB FLC are registered—and because it will also help strengthen bilateral relations with Japan, there is a strong need to support the implementation of the project.

6.4.2. Effectiveness

Because the following effects are expected, the project is judged to be sufficiently effective.

(1) Quantitative effects

(i) Improved berthing capacity for landing boats, reduced waiting time for landing

(ii) Improved handling and shipping capacity of fresh fish landed at the facilities (reduction of time spent at the landing center)

(iii) Reduction of fresh fish contaminants in the facilities (quality of cleaning water,)

Target item	Present value (2022 actual value)	Target value 2031 (Three years after project completion)
Berthing boats for landing (ship／day)	20	60
Time span of landed fish staying at the landing center from landing to shipping (hour)	4	2
Coliform count in water for cleaning (Total Coliform CFU／100ml)	River water : 88	Deep well water : 0

(2) Qualitative effects

(i) Improved working environment for artisanal fishers and fisheries workers who use the CXB FLC facilities by reducing waiting time for unloading from fishing boats and shortening unloading and handling fish. (roughly 80% of all fishing boats using CXB FLC are registered in Upazilas consist of host communities, and many host community residents are engaging in artisanal fisheries)

(ii) Decrease number of fishing boats opting for alternative landing sites (e.g. Chattogram) due to congestion of CXB FLC.