No.

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR CONSTRUCTION OF KIRUMBA FISH MARKET IN MWANZA
IN
THE UNITED REPUBLIC OF TANZANIA

AUGUST, 2003

JAPAN INTERNATIONAL COOPERATION AGENCY

OVERSEAS AGRO-FISHERIES CONSULTANTS CO., LTD.

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PREFACE

In response to a request from the Government of the United Republic of Tanzania, the Government of Japan decided to conduct a basic design study on the Project for Construction of Kirumba Fish Market in Mwanza and entrusted the study to the Japan International Cooperation Agency (JICA).

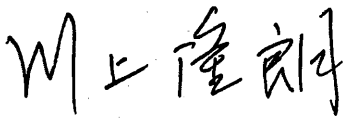
JICA sent to Tanzania a study team from 16th day of February to 14th day of March, 2003.

The team held discussions with the officials concerned of the Government of Tanzania, and conducted a field study at the study area. After the team returned to Japan, further studies were made. then, a mission was sent to Tanzania in order to discuss a draft basic design, and as this result , the present report was finalized

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

I wish to express my sincere appreciation to the officials concerned of the Government of the United Republic of Tanzania for their close cooperation extended to the teams

August, 2003



Takao Kawakami
President
Japan International Cooperation Agency

August, 2003

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Construction of Kirumba Fish Market in Mwanza in the United Republic of Tanzania.

This study was conducted by Overseas Agro-Fisheries Consultants Co., Ltd., under a contract to JICA, during the period from February, 2003 to August, 2003. In conducting the study, we have examined the feasibility and rationale of the project with due to consideration to the present situation of Tanzania and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

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

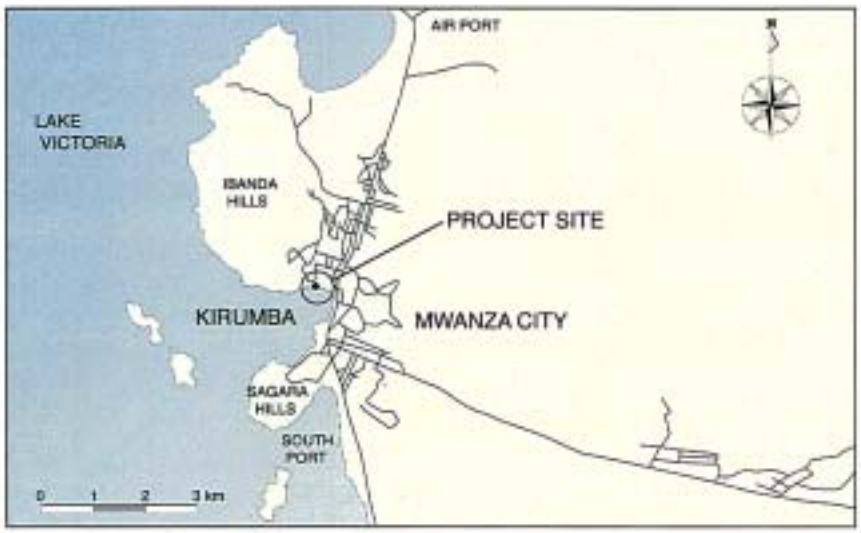
Very truly yours.

Nobuo Itoi
Project Manager,
Basic design study team on the Project for
Construction of Kirumba Fish Market in Mwanza.
Overseas Agro-Fisheries Consultants Co.,Ltd.

Location Map (1)

Location Map (2)

MWANZA AND LAKE VICTORIA



MWANZA CITY

PROJECT SITE

Anticipated Perspective for Kirumba Fish Market

CONTENTS

LIST OF FIGURES AND TABLES

(Figures)

(Tables)

ABBREVIATIONS

Abbreviation	Formal Name
AEP	Acryl Emulsion Paint
BOD	Biological Oxygen Demand
BS	British Standard
CDL	Chart Datum Level
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
EL	Elevation Level
E/N	Exchange of Notes
EU	European Union
GDP	Gross Domestic Product
FRP	Fiber glass Reinforce Plastic
HWL	High Water Level
IEC	International Electrotechnical Commission
JIS	Japan Industrial Standard
JASS	Japan Architect Structure Standard
LWL	Low Water Level
M.W.L	Mean Water Level
N-value	N-value
NPES	National Poverty Eradication Strategy
pH	Potential of Hydrogen
PP	Preserve Paint
PRSP	Poverty Reduction Strategy Paper
PVC	Polyvinyl chloride
RC	Reinforced Concrete
SMB	Sverdrup, Munk, Bretschneider
SS	Suspended Solids
TAS	Tanzanian Assistance Strategy
Tshs	Tanzania Shillings
TPC	Tons per cm immersion
UNDP	United Nations Development Programme
WL	Water Level

SUMMARY

SUMMARY

Tanzania, situated in the southeastern part of the African Continent, faces onto the Indian Ocean and is bordered by Kenya and Uganda to the north, Rwanda, Burundi and the Democratic Republic of Congo to the west, and Malawi, Mozambique and Zambia to the south. The national land area is approximately 945,000 km^2, roughly 2.5 times that of Japan. According to proximity to the coast and altitude, climate is broadly divided into tropical climate in low-lying coastal areas, an arid belt over the central high plains, mountainous climate in the inland mountain belt, and temperate climate in the south.

Mwanza, situated inland in the northwest of the country, belongs to the savannah climate zone where rainfall tends to increase the further north one moves from Lake Victoria. Rain falls throughout the year, but is largely concentrated in the rainy seasons from October to December and March to May. Depending on the amount of rain that falls each year in the rainy seasons, the water level of Lake Victoria varies by 1.8 m over long cycles of between 3-5 years.

Initiation of a socialist economic policy in 1967 marked the beginning of a rapid economic decline in the late 1970s, and this culminated in complete economic collapse characterized by export recession, increasing external debt, deterioration of the fiscal balance, and high inflation in the 1980s. From 1986 onwards, Tanzania implemented a structural adjustment program under guidance from the World Bank and IMF, and it further promoted full-scale political and economic liberalization from the 1990s. However, still confronted by fragile government functions inherited from the socialist era, declining social services (education, public health, water supply, etc.), under-development of the economic infrastructure, an agricultural sector (key industry) at the mercy of natural elements and international prices, a high proportion of artisanal farming, and low productivity caused by lack of infrastructure, etc., Tanzania is confronted with serious poverty.

Tanzania has a population of 33,580,000, a population growth rate of 2.9% (1988-2002), average life expectancy of 45 years, and per capita GDP in 2001 of US $ 264. It has an external debt of US $ 7,603 million, a debt-servicing ratio of 20.9%, inflation of 5.2% (2001), and is classified among the least among less-developed countries (LLDC) following application of the Highly Indebted Poor Countries (HIPC) Initiative (2000). Agriculture, forestry and fisheries account for approximately 90% of the working population, 70% of export value, and 45% of GDP.

Four state development programs have been compiled and are currently in effect in Tanzania: they are Vision 2025, the National Poverty Eradication Strategy (NPES), the Tanzania Assistance Strategy (TAS), and the Poverty Reduction Strategy Paper (PRSP).

As the long-term plan of poverty reduction and social and economic development, Vision 2025 stipulates the vision, mission, goals and targets to be achieved with respect to economic growth and poverty eradication by the year 2025. To operationalise Vision 2025, the Government formulated the NPES, which provides overall guidelines and framework for coordination and supervision of the implementation of policies and strategies of poverty eradication over the medium term up to 2010. Moreover, the TAS has been compiled as a medium-term plan of socioeconomic development by the government and donor agencies.

Issues common to all of these superior development plans are reduction of poverty and realization of food security. Since approximately 80% of the population living in poverty dwells in rural farming villages, poverty is far more serious in rural areas than urban areas. Moreover, since increase of food production is essential in order to improve food and nutrition conditions and achieve self-supply of food for citizens, the development of primary sectors including fisheries in regional areas is regarded as the most pressing issue currently facing Tanzania. Concerning development plans for the fisheries sector, the Ministry of Natural Resources and Tourism compiled the National Fisheries Sector Policy and Strategy Statement, 1997. In this, "securing of the sustained benefit of citizens now and in the future through the protection and effective development of fisheries resources" has been adopted as the ultimate target.

The fisheries sector accounts for 3% of GNP and annual fisheries production is approximately 330,000 tons, of which 99.6% derives from artisanal fisheries and only less than 1% from industrial fisheries. There are approximately 103,000 full-time fishermen and 30,000 fishing boats, and roughly 80% of fishermen and boats are engaged in inland water fisheries. Fisheries are divided into ocean fisheries and inland fisheries with the former accounting for around 20% of total production and the latter more than 80%. Main inland fishing grounds are Lake Victoria, Lake Tanganyika, and Lake Nyasa, etc. Lake Victoria accounts for about 50% of total production. Nile perch, which is the main species caught in Lake Victoria, accounts for approximately 10% of total exports and has played an important role in the economic development of the country. The next main product is Dagaa[1], for which annual catches amount to approximately 10,000 tons.

[1] Dried Dagaa Mwanza (Rastineobola argentea: a small demersal fish of the carp family like sardine)

Other important products are fresh fish such as Tilapia, etc. and approximately 200 tons per year of dried products which provide a cheap source of animal protein for citizens and a vital source of income for artisanal fishermen who live in poverty in the local area. The present potential yield estimate in Tanzania is 730,000 tons in total, breaking down as 100,000 tons in coastal waters (exclusive economic zone), 200,000 tons in Lake Victoria, 300,000 tons in Lake Tanganyika, 100,000 tons in Lake Nyasa, and around 30,000 tons in other water bodies, so there is still enough room to increase production.

However, many of the fishing villages that comprise the major centers of internal fisheries production are scattered along lake shorelines or on remote offshore islands and they do not possess basic infrastructure such as landing beaches, collection and landing facilities, fishing harbors and fish markets, etc. In particular, due to the poor development of transportation routes linking the producing fishing villages to collection centers, urban areas and consumer centers in surrounding countries, it is not possible to raise productivity or transportation efficiency. Fisheries activities in Tanzania are also hampered by the small scale of production among artisanal fishermen, slow development of fishermen unions and joint operations, lack of funding necessary to adopt powered fishing gear and methods, expand operations and establish union organizations, etc., and slow development of administrative guidance and support setups. As a result, fisheries production in recent years has struggled to grow after peaking at around 350,000 tons in 1996-1997.

Against this background the Ministry of Natural Resources and Tourism compiled the plan for construction of Kirumba Fish Market in Mwanza (the main internal fisheries marketing center in Tanzania) in order to resolve some of the issues affecting development of the sector and requested Japan's Grant Aid for its implementation.

In response to the request, the Government of Japan decided to implement a basic design study and dispatched a study team to Tanzania as follows:

Basic design study : February 15 to March 16, 1993
Draft basic design explanatory : June 23 to July 4, 1993

In the Study, survey and analysis were carried out via site investigations and work in Japan on the background and contents of the Project, natural conditions, the operation and maintenance setup, and conditions in the local building sector, etc. As a result, it was confirmed that the Project is deeply linked to top-level development policy in Tanzania and is necessary for promoting development of the target sector. Judging that appropriate components for Japanese assistance in the Project are construction of the market building and auxiliary facilities, floating jetty, salt-drying facilities, restaurant and offices, etc., basic design was carried out according to the summary indicated below.

Type of Facility	Facilities	Contents
Construction facilities	Market building	Single story structure, metal sheet roof, iron truss, steel pillars (no walls) Dagaa handling space: concrete-paved floor, floor area approximately 2,600 m^2 (7.2 m x 3.6 m x 100 stalls) Vegetable and cereal handling space: floor area approximately 850 m^2 (536 m^2 under roof) Market passageways: approximately 2,760 m^2 (under roof)
	Management office buildings	Single story structure, tile roof, concrete block wall, mortar Market management office: floor area 100 m^2 (4.2 m x 24.0 m) x 1 building (4 rooms) Union office of fish products: floor area 100 m^2 (4.2 m x 24.0 m) x 1 building (4 rooms) Union office of forest products: 26 m^2 (3.6 m x 7.2 m) x 1 building (1 room) Union office of restaurant: 26 m^2 (3.6 m x 7.2 m) x 1 building (1 room) Union office of processed fish: 6 m^2 (3.6 m x 7.2 m) x 1 building (1 room)
	Dry-salted fish storage and retail store	Single story structure, tile roof, concrete block wall, mortar Total floor area: 93 m^2 (6.0 m x 15.6 m) x 1 building (storage floor area 36 m^2) Sales table: 12 m long (2 m x 6 booths)
	Restaurant building Wastewater facilities	Single story structure, tile roof, concrete block wall, mortar Floor area 730 m^2, 4.5 m x 5.4 m x 30 stalls Target users: 193, septic tank capacity 20.5 m^3
	Guard posts	Single story structure, tile roof, concrete block wall, mortar Floor area 9 m^2 (4.2 m x 2.1 m) x 2 buildings
	Garbage depots	Single story structure, tile roof, concrete block wall, mortar Floor area 60 m^2 (6.0 m x 10.0 m) x 2 sites (outdoors)
	Charcoal shed	Floor area 180 m^2: under roof 72 m^2 (7.2 m x 3.6 m), tile roof
	Public toilets	Single story structure, tile roof, concrete block wall, mortar East side x 1 building: floor area 72 m^2, target users: 330/day Men (urinals 6, closet bowls 2, showers 2), women (closet bowls 4, showers 2) West side x 1 building: floor area 42 m^2, target users: 170/day Men (urinals 3, closet bowl 1, shower 1), women (closet bowls 2, shower 1)
	Processing area processing tables Wastewater treatment facilities	Processing tables: concrete (total length 42.5 m x width 1.7 m) Drying tables: concrete (total area 270 m^2) Dissolved-air flotation system treatment capacity 0.5 m^3/day
	Market paving and landscaping	Motor road paved area 2,700 m^2 (concrete paving), rainwater drainage channels
	Electric equipment	Lighting equipment 3.5 KW, other 5.5 KW, emergency generator 10 KVA x 1
	Water supply equipment	Water receiving tank 20 m^3, lift pumps 1.5 KW x 2, overhead water tank: height approximately 15 m x capacity 4 m^3
Civil facilities	Retaining wall Rubble stone revetment	For strengthening and corrosion prevention of the lakeside edge of the market buildings Concrete gravity-type retaining wall: total length approximately 150 m For banking reinforcement, slope covering and corrosion prevention on the lakeside of the restaurant facilities Approximately 200 kg rubble stone: length approximately 40 m
	Access jetty	For linking the market building to the access jetty Concrete floorboard + steel pile structure: length 14.5 m x width 5 m
	Gangway	For linking the floating jetty and access jetty on the landside, and capable of absorbing lake water level fluctuation of approximately 1.8m Steel: length 18 m x width 5 m
	Floating jetty	For mooring of trading boats and landing of loads Steel: length 32 m x width 12 m x depth 1.0 m Capable of mooring 4 trading boats simultaneously (total length approximately 14 m x 2 boats x both sides)

In the event where the Project is implemented under Japan's Grant Aid, an overall works period of 15 months, consisting of 4 months for detailed design and 11 months for construction including approval of drawings, construction and inspection, etc., will be needed. The rough Project cost is estimated as 646 million yen (643 million yen by the Japanese side, and 3 million yen by the Tanzanian side).

Since Kirumba Fish Market, the target facility of the Project, is a public market under the jurisdiction of Mwanza City, Mwanza City is responsible for operation of the Project facilities, under supervision and guidance of the Ministry of Natural Resources and Tourism's Fisheries Division. The fish market facilities are to be administered, maintained and controlled under the supervision of the Markets Section of the Economy and Commerce Division. With respect to specific administration and activities of individual stalls at the market, the Fishery Products Union will be under guidance and supervision of the Fisheries Division, the Agricultural Products Union and the Forest Products Union will be under the Agricultural Division and the Eating Facility Union will be under the Healthcare and Sanitation Division. Of the routine administrative operations of the facilities, budgetary measures and actual work concerning disposal of garbage collected at the garbage depots, regular cleaning of drainage tanks, toilet septic tanks and drainage tanks at the processing area, and maintenance and repair, etc. of all buildings will be assigned to the Market Section with City finances. Other routine administrative operations such as collection of handling charges, cleaning inside the market, security at the market, collection of toilet charges and cleaning of toilets will be performed by contractors selected by tender. Operation costs for the Project facilities following completion shall continue to be paid from the City's market administration budget in the same way as before.

Items of revenue are three, namely, ① market area charges to be directly paid to the City, ② handling charges to be paid through private operators consigned with partial operations, and ③ toilet charges. Concerning ①, charges shall be set according to each product in units of stalls, and each union shall collect annual charges according to the number of stalls used and pay them as a lump sum to Mwanza City at the start of the year. As for ②, charges established by ordinance based on the product and amount of trading shall be collected two times – once when sellers carry products into the market and again when buyers carry them out. And finally concerning ③, charges shall be set separately and collected each time somebody uses either the urinals, closet bowls, or showers, etc. The handling charges and toilet charges (① and ②) shall be collected and paid to Mwanza City every month by market management organizations selected in a tender process implemented by the City.

As for items of expenditure, the Markets Section of Mwanza City shall confirm all the items and directly make payments, with approval of the City Director, to persons requesting payments from the City's budget. Trial estimation of the operating balance indicated that expenditure of Tshs. 17,173,120 accounts for just 7.4% of total revenue of Tshs. 230,640,000, thereby showing that there will be no problem in operating and maintaining the projected fish market under the present operation and maintenance setup and charge collection system.

In view of the following anticipated effects of Project implementation, the Project is deemed to be appropriate and significant as an undertaking under Japan's Grant Aid.

Direct Effects:

Implementation of the Project will have the following effects for approximately 12,000 artisanal fishermen engaged in Dagaa production in Mwanza, Mara and Kagera, as well as approximately 550 union members and 2,000 laborers engaged in wholesaling and distribution work, 60 restaurant staff, and some 2,000 restaurant users at Kirumba Fish Market every day.

- Restrictions caused by approximately 120 interrupted days and more than 30 days of complete closure as a result of rainfall will be relieved, leading to improvement of market distribution efficiency and greater stability in product prices and distribution quantities.

- Post-harvest loss of approximately 1,000 tons, equivalent to roughly 10% of the annual handled volume of Dagaa and with a value of some 67,000 Tshs., will be reduced, thereby enabling higher income for fishermen, unions and wholesalers.

- The harsh landing work environment and poor worker safety will be improved and higher efficiency of landing and loading work will be realized.

- Work will be improved in terms of studying the actual state of fisheries, collecting information and conducting statistical management with a view to promoting artisanal fisheries and effectively utilizing fisheries resources in Lake Victoria. As a result, it will be possible to offer suitable and effective information and guidance, etc. to fishermen.

- By constructing sanitary facilities such as public toilets, garbage depots and wastewater treatment facilities, etc. inside the market, pollution of the surrounding area will be prevented and a sanitary environment will be provided for market users.

- With the introduction of landing facilities and different handling zones according to product, collection rates of facility charges and product handling charges, which provide revenue for Mwanza City, will be increased.

Indirect Effects:

- Reducing post-harvest losses will help stabilize and improve the income and living standard of approximately 50,000 persons comprising artisanal Dagaa fishermen, market workers and their families, and this will contribute to the reduction of poverty in Tanzania.

- By reducing post-harvest loss, it will be possible to effectively utilize limited resources and thereby contribute to higher nutrition levels by realizing food self-sufficiency and the cheap supply of protein.

- The Project will contribute to higher acquisition of foreign currency through increased exports to nearby countries and help improve the trade balance.

- By enabling appropriate treatment of wastewater from the market, the Project will reduce the environmental load placed on Lake Victoria.

- Information management and statistical work will become possible in the market, thereby contributing to the formulation of future fisheries promotion policy and promotion of managed fisheries.

The following recommendations are given for the smooth and effective implementation of the Project.

Improvement of Information Processing Functions:

The accurate and rapid grasping of transaction information concerning incoming loads, handled quantities, and prices, etc. will play an important role in the smooth and efficient running of market facilities, achieving a supply and demand balance between the domestic market and markets in surrounding countries, and stabilization of prices, etc., and this will contribute to the effective utilization and stable supply of fisheries products in Tanzania. Moreover, statistical data at the market is important for understanding environmental changes in Lake Victoria and changes in fisheries resource reserves, and such data will provide indispensable materials and information for formulating and implementing medium and long-term fisheries promotion plans in Lake Victoria. Until now, however, due to the inadequate development of market facilities, it has been

difficult to implement proper information processing work and no effective information collection or processing has been carried out. From this point of view, it is hoped that the opportunity of Project implementation is taken to improve the information processing functions of Mwanza Fisheries Section (the agency in charge of market administration) and thereby enhance functions as an information center via consolidation.

Reduction of Post-harvest Loss and Improvement of Product Quality:

Installation of roofs and ground paving inside the market will help reduce the post-harvest loss, which has long been a big problem at the market. However, Dagaa re-drying work has conventionally been conducted on plastic sheets spread out on the floor, but drying efficiency by this method of natural ventilation is poor. Moreover, because there is not enough floor area to spread the fish out, it becomes difficult to carry out sufficient drying before and after the full moon when incoming quantities are largest. Therefore, as a measure for resolving these problems, it is desirable that tiered drying shelves made from netting with good ventilation be made and introduced in order to raise drying efficiency by natural ventilation and to effectively use the limited floor area. Moreover, by thoroughly cleaning the floor and maintaining a sanitary environment in the sorting area, generation of insects shall be prevented and losses inside the market shall be minimized. As a result of such measures, it is hoped that the quality and added value of Dagaa will be further raised.

Effective Utilization of Market Facilities:

The handled quantity of Dagaa, which accounts for more than 90% of total handling volume, greatly varies and the overall market operating efficiency also changes according to the phase of the moon and whether it is the rainy or dry season. Since the size of variation has some degree of regularity and can be forecast to a certain extent, it is possible to gauge fluctuations in handling quantity in advance. Accordingly, by using the Dagaa handling spaces to handle increased quantities of other products during periods when incoming Dagaa quantities are small, it is desirable to raise the market operating efficiency and increase quantities handled by the market overall. As a result, it will be possible to increase the market operating efficiency and boost revenue going to Mwanza City. In this way it is desirable to construct a flexible and planned market operating and management system.

Introduction of a User Charge System for Market Operating Expenses:

Concerning the cost of utilities such as electricity and water supply for which consumption levels can be clearly distinguished between users at the market, it is

desirable to introduce and implement a charge system applied according to each user or using body. Introducing such a system will clarify the rights and obligations of each user and lead to a higher sense of responsibility concerning the careful use of electricity and water, etc., and it will also eliminate any sense of unfairness between users. Moreover, such a system will reduce the cost burden of Mwanza City and will be effective in helping secure the sound and appropriate running of market facilities.

CHAPTER 1 BACKGROUND OF THE PROJECT

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In relation to the top priority issues in national development planning of poverty reduction and food security promotion, fisheries development is an important policy objective for Tanzania because this sector employs roughly 100,000 workers, many of whom live in poverty, provides 30% of the national animal protein supply, and secures more than 10% of Tanzania's foreign currency. However, whereas the present potential yield estimate is 730,000 tons, annual production since 1994 has struggled at between roughly 300,000-350,000 tons. The following have been pointed to as impediments to development of the fisheries sector and there are strong calls for improvement in all these areas: 1) non-construction of fisheries infrastructure, 2) under-development of fisheries technology, 3) inefficient production, and 4) sluggish government guidance and administrative systems, etc.

It was under such circumstances that the Government of Tanzania in January 2000 issued a request to the Government of Japan for implementation of a development study, selection of priority issues, and a feasibility study on priority issues concerning preparation of a comprehensive action plan for fisheries development including administrative improvement in Tanzania.

In response to the request, the Government of Japan narrowed the content down to formulation of a master plan focusing on the action program and in September 2000 implemented the Preliminary Survey (S/W) for the Master Plan Study of Fisheries Promotion in Tanzania.

As a result of the S/W, the following basic policy was indicated (S/W: signed on October 5, 2000):

- The M/P to be compiled in the development study will have the status of action program for the specific realization of the National Fisheries Sector Policy and Strategy Statement, 1997 (target year 2025).
- In addition to simply compiling a master plan, project design and rough cost shall be presented for priority projects.

Based on this policy, the Master Plan Study of Fisheries Promotion in Tanzania was carried out between January 2001 and June 2002, when the main report of the study was presented. The main report is composed of three parts: Basic Concept for Promotion of the Fisheries Sector, Development Strategy, and Priority Programs. As for the role that can be played by

the fisheries sector in reducing poverty, a national development strategy and 15 priority programs have been formulated and proposed with the following five areas set as basic components: 1) securing of the stable domestic supply of fisheries products, 2) sustained utilization of fisheries resources, 3) sustainable development of fisheries exports, 4) reduction of poverty and improvement of the living environment in fishing villages, and 5) efficient administrative and financial operation. The focus of these components is directed towards food security, fishing village development, fisheries exports in the macro economic picture, and environmental preservation.

The Project for Construction of Kirumba Fish Market in Mwanza was assessed as a short-term planning top-priority project (Project to Improve Distribution of Fish Resources in Lake Victoria).

The goals, status and outline of the Project for Construction of Kirumba Fish Market in Mwanza are indicated below:

- Ultimate objective : securing of sustained and stable domestic supply of fisheries products through the effective utilization of products and reduction of losses

- Project goals : construction of facilities at Kirumba Fish Market, improvement of wholesale marketing functions, reduction of economic loss and expansion of the distribution flow of Dagaa – the main product handled at the fish market.

- Status

  National level : reduction of poverty and improvement of the standard of living for citizens, maintenance of self-sufficiency and securing of stable food supply, improvement of citizens' nutrition, securing of foreign currency

  Fisheries development policy : effective utilization of fish resources, increased supply of fish products (food), higher income for fishermen and distributors, increased employment opportunities in local fishing villages, higher revenue for Mwanza City

- Current conditions and problems:

  Current conditions : the existing Kirumba Fish Market has no roofing and the floor is situated on gently sloping earth ground. Therefore,

fisheries products cannot be handled in an efficient or sanitary manner during distribution activities.

Problems : the major product handled at the market is dried Dagaa, but when this gets wet in the rain, the economic loss is great because the commodity value (price) is halved and food value is lost. The chain of work from landing through to sorting, packing, storage, negotiation and shipping, etc. is interrupted by rain, meaning that work efficiency declines and making it difficult to increase handling and distribution volumes, maintain an appropriate supply and demand balance, or implement appropriate distribution activities. As a result, economic loss in distribution is large.

Countermeasures : construct market facilities on an appropriate scale. In particular, construct roofing to give protection against rain and direct sunlight, and pave the ground to enable the proper handling and storage of products. In addition, construct facilities and prepare a safe and efficient working environment to remedy the dangerous, difficult and inefficient landing and loading work of products carried in by trading boats. In particular, by constructing roofs over the wholesaling, sorting, storage and loading areas of the market, the number of market operating days will be increased by at least 30 days per year; moreover, by clearly demarcating work zones in the market, the annual handling volume will be increased and post-harvest loss (economic loss) in the facilities will be reduced.

Against this background, in order to resolve the various problems caused by the under-development of artisanal fisheries market facilities mainly handling Dagaa, the Government of Tanzania prepared the Project for Construction of Kirumba Fish Market in Mwanza, which mainly aims to construct market buildings, a floating jetty, dry-salt processing facilities, and a restaurant, and it requested Japan's Grant Aid for the implementation of this. Table 1-1 shows the results of surveying, confirming and examining the requested contents via the basic design study site surveys.

Table 1-1 Results of Confirming the Request Contents in Site Surveys

Facilities and Contents of Request	Scale of Request	Results of Confirmation	Results of Examination and Outline of Facilities
(1) Market facilities			
Market building	1,200 m^2 x 2 buildings	Necessary	Based on the scale of existing union activities and handling quantities
Guard post	10 m^2 x 2 posts	Necessary	Basically at exits and entrances
Gate (exit/entrance)	1 place	(Removed)	Item to be borne by the local side
Parking space	1 place	Necessary	Targeting quantities loaded onto existing trucks, and the number and size of vehicles used
(2) Market management facilities			
Office	69 m^2 x 1 building	Necessary	Assuming the City Fisheries Section, Fisheries Division and number of unions
Water tank and water tower	18 m^2 x 1 tower, water tower and water tank	Necessary	Based on the required water supply
Power distribution (generation) equipment	36 m^2 x 1 building Emergency generator x 1	Necessary	Based on the necessary electric capacity. However, it is assumed no night work will take place in the market.
Public toilet	75 m^2 x 1, 50 m^2 x 1	Necessary	1 building, based on the current number of users
Garbage depot	75 m^2 x 1, 50 m^2 x 1	Necessary	Based on the scale of existing facilities
Parking space	7 m x 30 m x 2 m x 1	(Removed)	Combined with the market facilities parking space
Septic tank	3 m x 8 m x 2 m x 1	Necessary	According to the wastewater treatment flow
(3) Landing facilities			
Floating jetty	(25 m x 15 m x 2)	Necessary	Targeting the existing number of trading boats and volume of landed products
(4) Salt-drying facilities			
Storeroom	75 m^2 x 2 buildings	Necessary	Based on current handled volumes
Work area, work tables	64 m^2 x 4 buildings 5 m x 10 m	Necessary	Based on current handled volumes Including a small fish sales stall. Including wastewater treatment equipment
Public toilet	50 m^2 x 1	Necessary	1 building, based on the current number of users
Gate (exit/entrance)	2 places	(Removed)	Item to be borne by the local side (combined with market facilities)
(5) Restaurant facilities			
Restaurant	90 m^2 x 6 buildings 4 water taps, 1 point	Necessary	Based on the number of current active union members and users.
Gate (exit/entrance)		(Removed)	Item to be borne by the local side

CHAPTER 2 CONTENTS OF THE PROJECT

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2-1 Basic Concept of the Project

(1) Overall Goal and Project Objective

Tanzania has placed top priority on reduction of poverty and development of agriculture in its medium and long-term national development plan comprising Development Vision 2025, the National Poverty Eradication Strategy (NPES), the Tanzania Assistance Strategy (TAS) and the Poverty Reduction Strategy Paper (PRSP). Above all, special emphasis is placed on the development of food security as a means of directly combating poverty. Concerning development of the fisheries sector, the National Fisheries Sector Policy and Strategy 1997 was formulated with the ultimate purpose of developing fisheries by "imparting sustainable benefits to the people of today and tomorrow by preserving and efficiently developing fish resources". The policy stipulates development guidelines aimed at: 1) increasing supply sources of animal protein and employment opportunities for citizens; 2) enhancing the export of fish products; 3) activating, nurturing and developing the fisheries sector through sustainable utilization of fish resources; and 4) expanding productivity and income of artisanal fishermen.

As of 2000, Tanzania's fisheries sector accounted for 2.7% of GDP, the number of artisanal fishermen totaled about 62,000, and annual total output was around 320,000 tons, of which inland water fisheries accounted for about 270,000 tons (84.4%). Main inland fishing grounds are Lake Victoria, Lake Tanganyika, and Lake Nyasa, etc. Lake Victoria accounts for about 50% of total production. About 90% of fish products produced in Lake Victoria are landed in Mwanza. In particular, concerning dried Dagaa (hereinafter referred to as Dagaa), almost 100% is marketed throughout Tanzania and neighboring countries via the existing fish market in Mwanza, and this contributes to the supply of animal protein throughout Tanzania and neighboring countries.

The existing fish market in Mwanza City has traditionally played an important role as a landing site for not only fish products but also agricultural, forest and other products from the Lake Victoria area. In recent years, the main export item, Nile perch, has been hit by severe sanitary inspection standards imposed by European nations. Therefore, in an effort to improve marketing conditions, the Ministry of Natural Resources and Tourism in 1999 installed an exclusive landing barge at the Mihama Landing Beach, about 5 km away from the existing fish market, under financial assistance from the EU. In contrast, development of the basic fisheries infrastructure, such as fish market and

landing facilities for handling fish products other than Nile perch intended for consumption in Tanzania and neighboring countries, is lagging. In particular, the existing fish market is neither roofed nor paved and necessary market facilities for landing Dagaa and carrying out post-landing work such as primary storage, trading, re-drying and cleaning, re-packing, and secondary storage etc. are totally non-existent. This greatly hampers the smooth marketing of products, especially because the market is unable to function on rainy days. Indeed since post-harvest losses incurred in the marketing process of Dagaa amount to about 10 to 15% of total turnover, there are strong calls for the development and improvement of facilities.

The Project for Construction of Kirumba Fish Market in Mwanza intends to resolve problems relating to artisanal fisheries marketing in Mwanza area by developing the existing fish market, securing market functions that are unaffected by the weather, enhancing the efficiency of landing, loading and handling operations and commercial activities, and improving the work environment and sanitary situation for market users. Moreover, the Project aims to stabilize and increase the supply of animal protein to Dagaa consumer areas in Mwanza City, Tanzania and surrounding countries.

(2) Project Components

With a view to achieving the above-mentioned objectives, the Project is designed to improve functions of the fish market, and at the same time, to reinforce and establish systems for fisheries support and management in Mwanza City as well as the Fisheries Division of Tanzania by developing market buildings and related facilities as well as landing facilities, dry-salted fish processing facilities, management office-related facilities and restaurant facilities. The Project components cover construction of the following facilities:

Market facilities:

a. Market building	b. Floating jetty	c. Restaurant (Mama-lishe)
d. Office	e. Parking space	f. Water supply facilities
g. Supply of electric power (Emergency power generator)	h. Guard post	i. Garbage depot
J. Public toilet	k. Septic tank	

Processing facilities:

a. Processing area b. Storage c. Public toilets d. Septic tank

Implementation of the Project is expected to realize the following improvements:

① Increase in the annual number of operating days of the fish market
② Increase in the income of fishermen and marketers due to reduction in the amount of degraded Dagaa at the fish market
③ Increase in the supply of Dagaa as food
④ Improvement of the work environment at the fish market
⑤ Improvement in sanitary conditions of persons related to fish market operations
⑥ Improvement in the efficiency of collection of fish market utility fees
⑦ Improvement in efficiency and accuracy of statistical survey at the fish market

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

(1) Basic Concept

With respect to the Project target facilities, examination shall be conducted on respective facilities by functions based on the "The Project for Construction of Kirumba Fish Market in Mwanza" formulated by the Tanzanian side in conformity with the contents of Japan's Grant Aid.

1) Improvement of Wholesale Market Facilities

The existing fish market is not roofed and the ground is natural soil. Thus, rainfall greatly impacts all market activities and causes the following specific problems:

- Interruption of trading activities (appraisal of products, pricing, negotiation), sorting, re-packaging in bags and loading
- Deterioration in quality of dried Dagaa because it becomes wet, is affected by humidity, and attracts pests, etc.
- Suspension of re-drying of insufficient in drying and wet Dagaa

Main causes for post-harvest loss of Dagaa are as follows:

① Deterioration in quality occurs because Dagaa is brought into existing fish market as an insufficiently-dried product.
② The Dagaa gets wet while being transported to the existing fish market.

③ Wetness, humidity and pests occur during the primary storage period after landing and the secondary storage period up to handling, re-packing and loading in the existing fish market.

Humidity is especially high in the rainy season and Dagaa covered by sheets to for protection from rain is especially prone to deterioration.

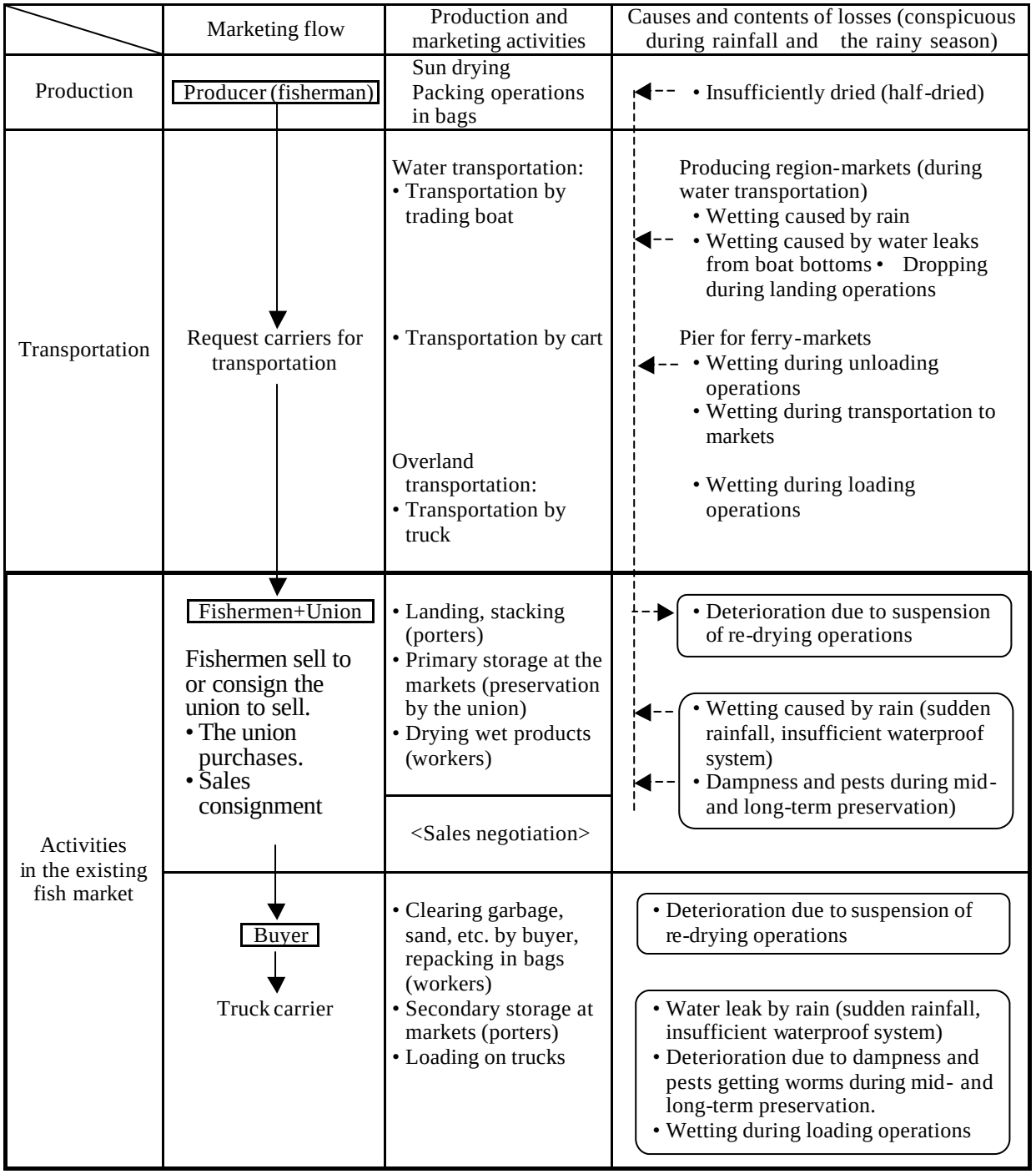


Figure 2-1 Relation between the Marketing Route and Losses

In Mwanza region, since there is no appropriate and sufficient site for landing and conserving products other than fish products from areas surrounding Lake Victoria, the entire existing fish market is an important basis serving for landing and wholesaling local agricultural products, etc. As is specified in Figure 2-2, agricultural and forest products as well as stone, etc. are traded at the existing fish market and the union has already acquired trading rights to deal with each product.

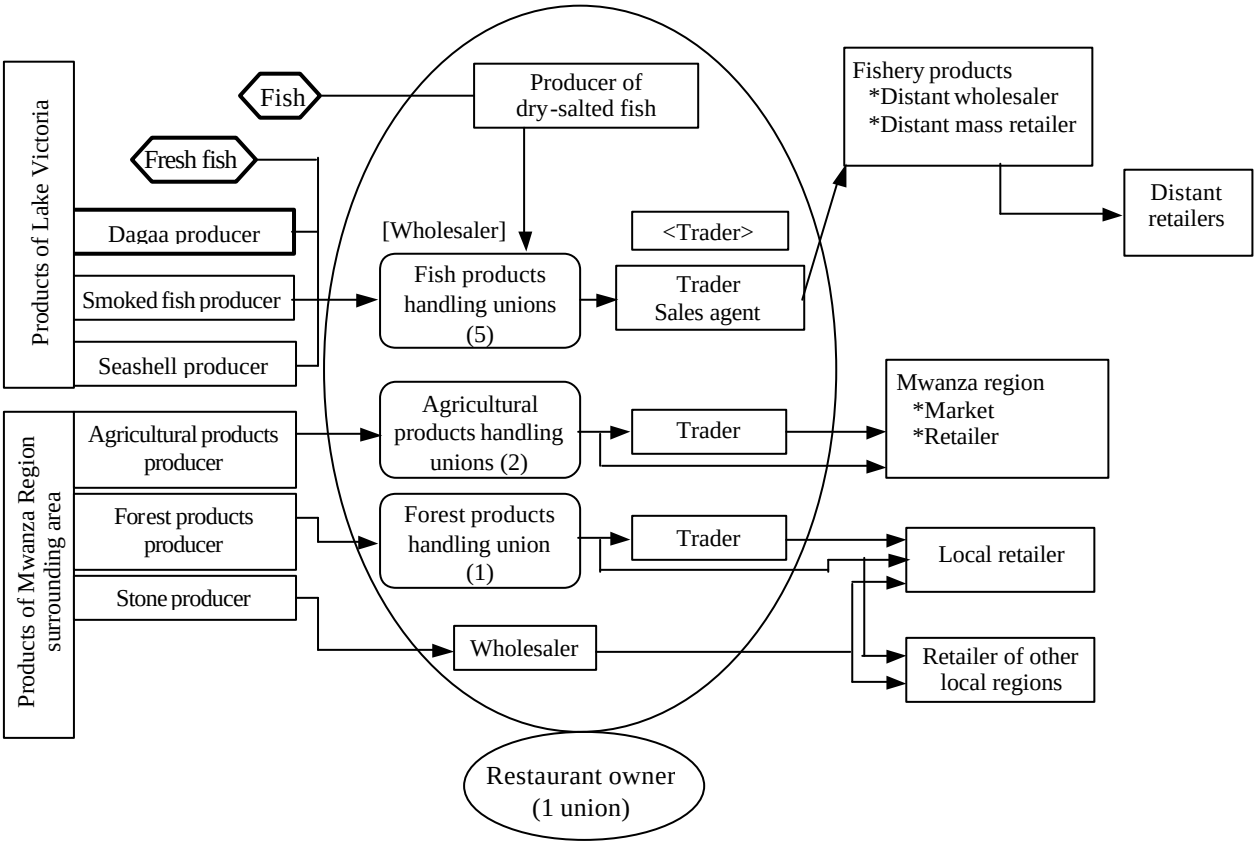


Figure 2-2 Structure of the Existing Fish Market and Distribution Channels

In view of conditions of use at the existing fish market, it is considered appropriate that the Mwanza Fish Market Development Plan target the following facilities as targets for cooperation:

① Dagaa Handling Facilities

Contents and procedure of goods processing work in the existing fish market are as follows:

A. Carrying-in : Primary storage (stacking) conducted by fishermen or union members for each boat or goods container. Depending on conditions, insufficiently dried and wet products are re-dried.

Display : Products are displayed in the primary storage (stacked) state. Checking of contents, partial extraction / inspection of sample products is conducted.

B. Deals : Negotiation and buying

C. Screening : According to wholesaler instructions, unpacking → re-drying of insufficiently dried or wet products and cleaning → weighing (partly)

D. Packing : Screening and re-packing → secondary storage (stacked) and loading → carrying out

To achieve the objectives of the Project, it will be necessary to install roofs and pave the ground to secure space for goods handling work and to construct passageways for people, carts and goods. Loading and waiting spaces and routes for vehicles will make it possible to eliminate suspension due to rain across a series of marketing activities and to reduce post-harvest loss by preventing deterioration during handling of fish products.

② Vegetable and Cereal Handling Facilities

Installation of roofs and paving of the ground in sales areas for corn, rice, dry cassava, cereals such as beans, charcoal, etc, which are likely to deteriorate due to rain, direct sunlight, etc. is necessary to guarantee trading activities during rainfall and to maintain quality of products, thus contributing to the securing, maintenance and improvement of market functions.

③ Other Facilities for Handled Products

Marketed items other than those mentioned in ① and ② above include bananas, firewood, logs (construction materials), stone (construction materials), and sea shells, etc. Bananas are covered by leaves in bunches and kept under the sun to some degree for ripening. Accordingly, they don't require roofed areas. However, it is necessary to pave the ground to protect bananas from dirt, and to keep the floor clean and to make it easy to be cleaned.

Products other than bananas are not considered likely to have their sales deteriorated or impacted by rainfall. Therefore, it is considered appropriate and reasonable to ensure space for their sale and preservation in natural conditions without roofing or paved floors.

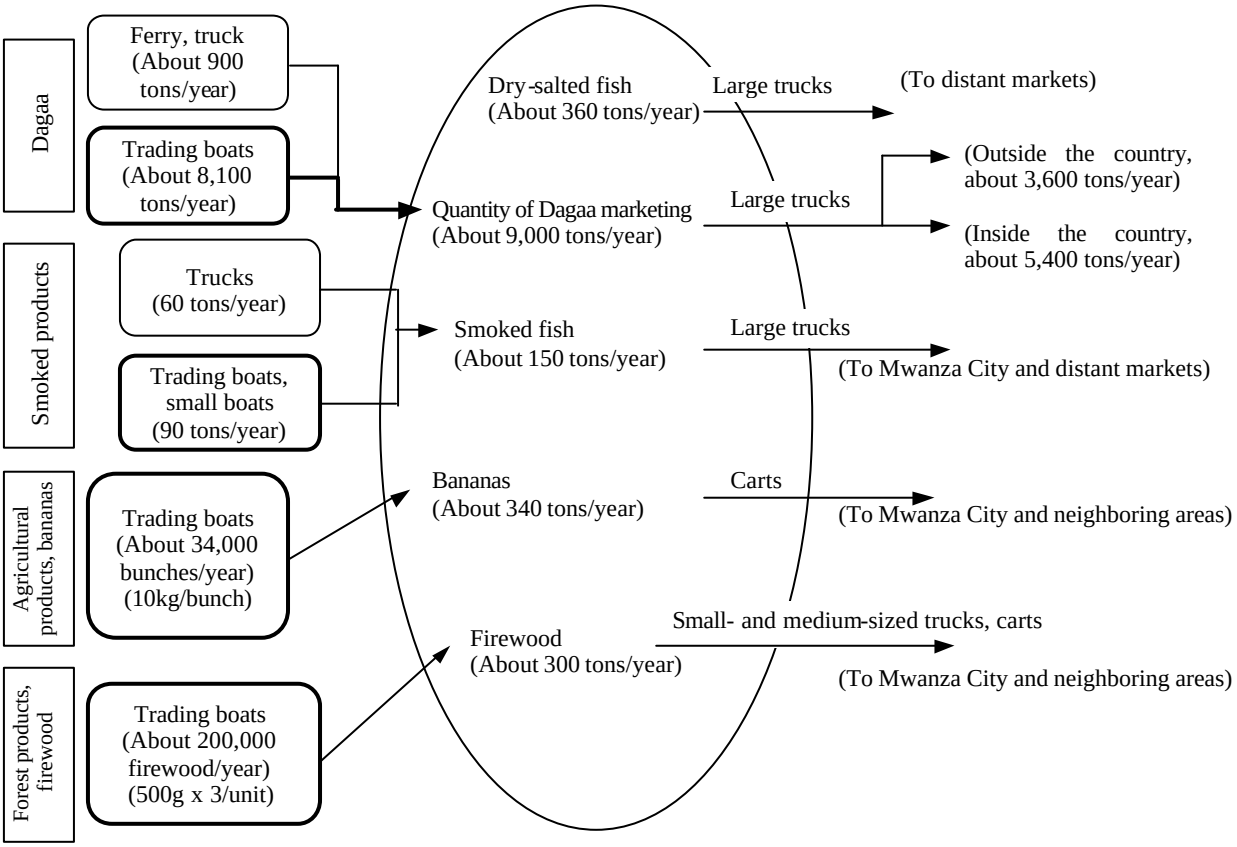


Figure 2-3 Supply Flow Chart at the Existing Fish Market[2]

2) Construction of Landing Facilities

As the existing fish market is not equipped with landing facilities such as a pier, jetty, etc., products brought in by trading boats must be carried in by workers from 7 to 10 meters away from shore at a water depth of about 1 meter to the primary storage space which is located about 40 to 50 meters inland.

However, workers have to do this work in their bare feet and immersed in water up to their waist or chest. Most products are packed in polyethylene bags. Each bag is heavy, weighing 30 to 60kg and unloading operations from boats must be conducted manually. Due to the lack of mechanical loading equipment, landing operations are extremely inefficient.

In addition, the lake bottom is slippery and dangerous to walk on, and besides, the shore area of Lake Victoria provides habitat for a number of blood-sucking flukes

[2] Based upon the calculation basis for the lowest bid price of Fish Market Management Work in the year 2003 (January – December of 2003) and the handling amount in 2001.

and workers operating with bare feet are constantly faced with the danger of infection to their skin, mucous membranes and open wounds. Therefore, it is considered essential to construct landing facilities at the existing fish market from the viewpoint of enhancing distribution efficiency of the market, improving the work environment, and to improve inefficient and dangerous landing and unloading operations

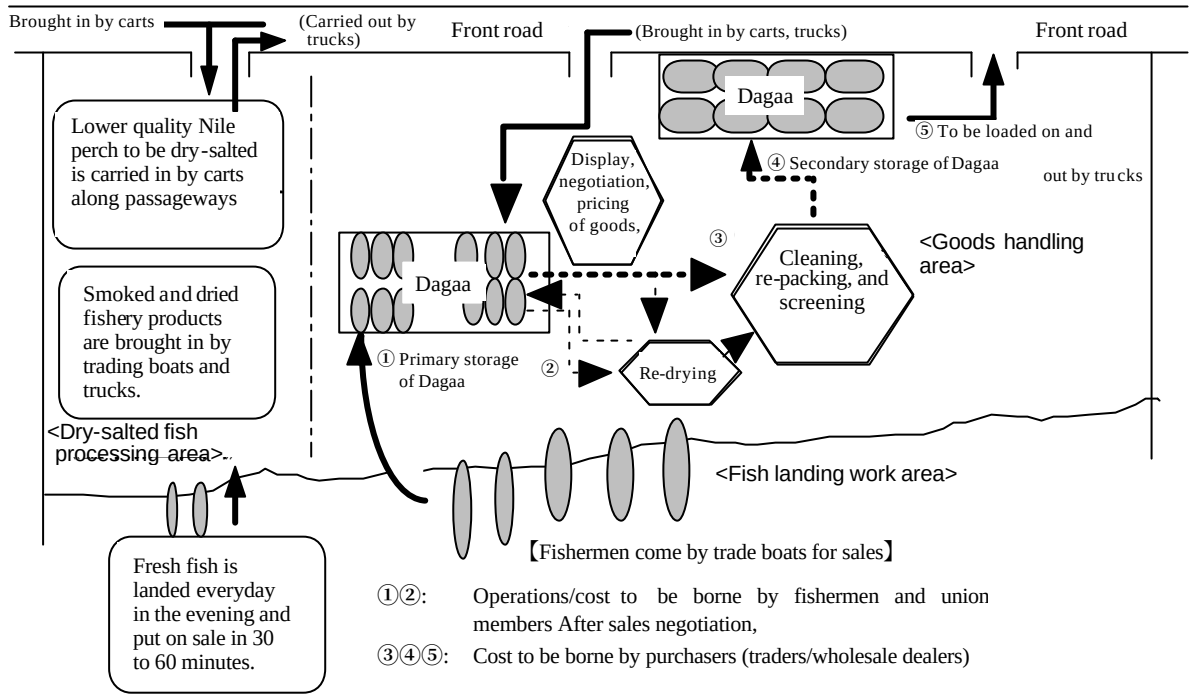


Figure 2-4 Fish product Handling Situation at the Existing Fish Market

3) Construction of Fish Processing Facilities

In Mwanza, since there is no other appropriate site for processing of lower grade Nile perch for export, lower grade fish is dry-salted and wholesaled in the processing area located on the west side of the existing fish market. Also, in light of the fact that as much as 360 tons of dry-salted Nile perch is handled a year, making it the second most important product behind Dagaa, construction of dry-salted processing facilities will improve work environment and sanitary conditions, secure weather-proof storage, and improve trading functions. All of the above will contribute to more efficient utilization of fish resources, food supply to the people, provision of job opportunities, and enhancement in the morale of neighboring fishery workers.

4) Improvement of Restaurant Facilities

The total number of officers, union members, workers, etc. engaged in activities at the existing fish market every day exceeds 4,000 to 5,000 persons, many of whom are manual laborers. The existing restaurant facilities play an important role in providing food and drinks to those using the market – serving more than 1,000 persons a day. However, these facilities are a meager set of huts, simply built with wooden pillars directly on dirt floors and covered with vinyl-sheet roofing. Additionally, there is only one hydrant in these facilities, creating sanitary concerns and adding increased water supply to a list of necessary improvements including, wastewater treatment facilities, ventilation, natural lighting, well drained kitchen and service room, etc.

5) Construction of Market Management Facilities

Public agencies managing the existing fish market include the Markets Section and Fisheries Section of Mwanza City, the Mwanza Region Fisheries Division of the Ministry of Natural Resources and Tourism, and the Tanzania Revenue Authority. At the market, 9 union organizations are operating, of which 2 are currently entrusted by Mwanza City through contracts for collection of market utility fees and charges, cleaning and safety control operations. However, the public agencies do not have offices at the existing fish market and are operating from their respective offices in distant locations, making it difficult to exchange information, conduct publicity operations for market users, statistical surveys and appropriate supervisory operations, etc. Unions are operating from their own offices renovated from old containers or meager wooden offices located near their respective places of activity but they are not built in an orderly manner at the market and are not adequate when considering requirements for ventilation, natural lighting, lighting equipment, wall sockets, etc. Therefore, it is judged reasonable to construct management facilities for the entire market and office facilities to support union activities after the implementation of the Project.

(2) Concept with Respect to Natural Conditions

1) In consideration of weather conditions, or more specifically, high temperature in the dry season and high humidity in the rainy season, maintain a sufficient level of natural ventilation and light shielding from direct sunlight inside buildings, minimize the humidity steaming of Dagaa packed in bags and piled high and other impacts due to high temperatures.

2) As the planned site faces Lake Victoria and the direct impact of wind coming off the lake is unavoidable where there is no shielding, pay careful attention to winds blowing upward and over large rooftops and winds blowing down to the surrounding areas.

3) In light of changes in the water level of Lake Victoria in the past 30 years, formulate a facility plan taking fully into consideration a differential in water level of about 1.8m, which appears in a long cycle.

4) As Lake Victoria is an international lake jointly managed by Kenya, Uganda, etc. under intensifying environmental regulations, formulate a plan with consideration for the maintenance of natural features and environmental conditions.

(3) Concept with Respect to Social Economy

1) At the existing fish market various activities including landing, wholesaling, processing, sale of foods are conducted primarily by 9 unions and the rights and interests of each union and respective utility areas have almost been established. In light of this situation, formulate a plan with consideration for the maintenance and continuation of the existing systems in terms of content and size of facilities.

2) In view of social losses in surrounding areas resulting from jams caused by market traffic, large trucks for transportation, etc., formulate a plan with consideration for the minimization of traffic jams.

3) As the existing fish market provides a large opportunity for employment creation and its appropriate management enables more efficient economic activity, propose concrete measures to that end.

(4) Concept with Respect to Construction Conditions

1) Most construction materials used in Mwanza depend on ground transportation from Dar es Salaam about 1,400 km away. Design facilities by employing construction methods and selecting materials with full consideration of process planning restrictions.

2) Adopt a construction method and appropriate process planning with due consideration for two rainy seasons having total duration of a half year.

3) With respect to the design of building facilities and civil engineering facilities, Tanzania is in the process of establishing relevant laws and regulations based on the British Standard (BS), but the country currently lacks unified standards for the entire nation. Accordingly, for technical standards for the Project, Japanese specifications and standards shall be adopted based on the British Standard. With respect to facility-related standards for electric equipment, mechanical appliances, etc., BS, Japanese specifications and standards or International Electro-technical Commission (IEC) standards shall be adopted as required.

With respect to the planning of the Project, basic standards are as follows:

- Calculation standards for reinforced concrete construction :
  Architectural Institute of Japan
- Steel structure construction standards:
  Architectural Institute of Japan
- Construction standards for construction of basic structure design:
  Architectural Institute of Japan
- Common specifications for building operations:
  Public Buildings Association
- Japanese Industrial Standards:
  Japanese Standards Association
- Pavement designing operations guidelines:
  Japan Road Association
- Technical guidelines for fish port:
  National Fishing Port Association
- Technical standards for port facilities and descriptions:
  National Fishing Port Association
- Design and operation manual for the floating piers:
  Fishing Port New Technology Research and Development Association

4) By selecting local methods as much as possible, increase opportunities for participation by local construction workers and building contractors.

(5) Concept with Respect to Utilization of Local Contractors

1) In view of operation and maintenance as well as economic efficiency, plan to use materials and parts mainly procured locally or from the neighboring countries for floating jetties.

2) In view of operation and maintenance as well as repair of buildings and equipment, to the extent possible, employ local materials and construction methods with a view of reducing labor after delivery.

(6) Concept with Respect to the Operation and Maintenance Capacity of Implementing Agencies

The existing fish market facilities are maintained and governed by the Market Section and Fisheries Section of Mwanza City but because more than 90% of products handled are fish products, maintenance and control is actually under the direction and supervision of the Fisheries Section. At the same time, operations relating to products dealt at the existing market, such as collection of charges and fees, cleaning, security, and collection of toilet charges have been conducted in the 5 years since 1998 in accordance with service contracts concluded with the City, by the "Market Management Organization", selected through bidding carried out by the City Finance/Management Committee. Management as well as maintenance and control of the fish market after the implementation of the Project will be conducted under the above-mentioned current structure and systems. Therefore, it is judged not necessary to establish a new management structure or to increase personnel.

The Project components consist of structurally simple construction facilities and civil engineering facilities and they do not include facilities and equipment that are technically difficult to manage and maintain. Besides, with regard to costs for sustainable management and maintenance of facilities, it is planned to adopt a simple structured sewage treatment facility for toilet septic tanks and wastewater treatment for restaurant facilities, as recommended and approved by the Health Department of Mwanza City. As much as possible, it shall also be planned to select for wastewater treatment generated in the processing zone, specifications and types that are simple-structured and have inexpensive maintenance. It is, therefore, judged that the above-mentioned management system can sufficiently handle the management as well as operations and maintenance of facilities under the Project, thereby needing no consideration of soft components related to the Project. It is also judged with respect to operation and maintenance costs for the water supply system as well as electric and emergency power-generation facilities, etc. that costs are low and revenue in the City's annual budget, including market charges and

fees, toilet charges, business license fees for respective businesses, registration fees, etc. will enable sufficient and sustainable maintenance.

(7) Concept with Respect to the Grade Setting of Facilities and Equipment

[1] Basic Terms for Setting Scale

Calculation of scale is performed based on usage conditions of the existing fish market, unit consumption such as the annual handled volume for each product, the number of users, the number of vessels and vehicles using the existing fish market, fishery statistics reports from 2000 to 2002 and results from the onsite survey.

Specifications related to the target facilities and the equipment shall be based on necessary and appropriate standards with durability in mind, taking into consideration ease of management and maintenance after construction and using equipment and materials available in Tanzania and neighboring countries as much as possible.

[1]-1 Concept for Scale and Grade Setting of Market Facilities

The most important and basic facility among the existing fish market facilities is the place for handling works and storage for Dagaa. At the handling space, a series of progressive activities are performed, including temporary storage of the Dagaa unloaded from the trading boats, sorting, re-drying, trading negotiation, cleaning, re-packing, secondary storage, loading and dispatch. Also, the stock created during the time between entry to and exit from the market is appropriately stored within the handling space mentioned before, but handling work would come to a halt if the stock grew too large. Further, because the space gets crowded with union members, traders and cargo workers, it is necessary to plan layout which adequately addresses traffic lines including those for people, products and vehicles. Accordingly, quality preservation of the products and preservation of the working environment must be ensured by paving the floor in the spaces needed for handling and storage of goods and installing a roof to protect the products from rain and direct sun. Concerning the size of the overall market facilities, the plan shall ensure the scale of the current area as much as possible in stalls where the unions currently hold vested rights and operate, because the objective of the Project is improvement and development of the existing fish market. Correspondingly, the necessary areas of the workspaces for each product are planned based on the current work areas as shown in Figure 2-5 and Table 2-1.

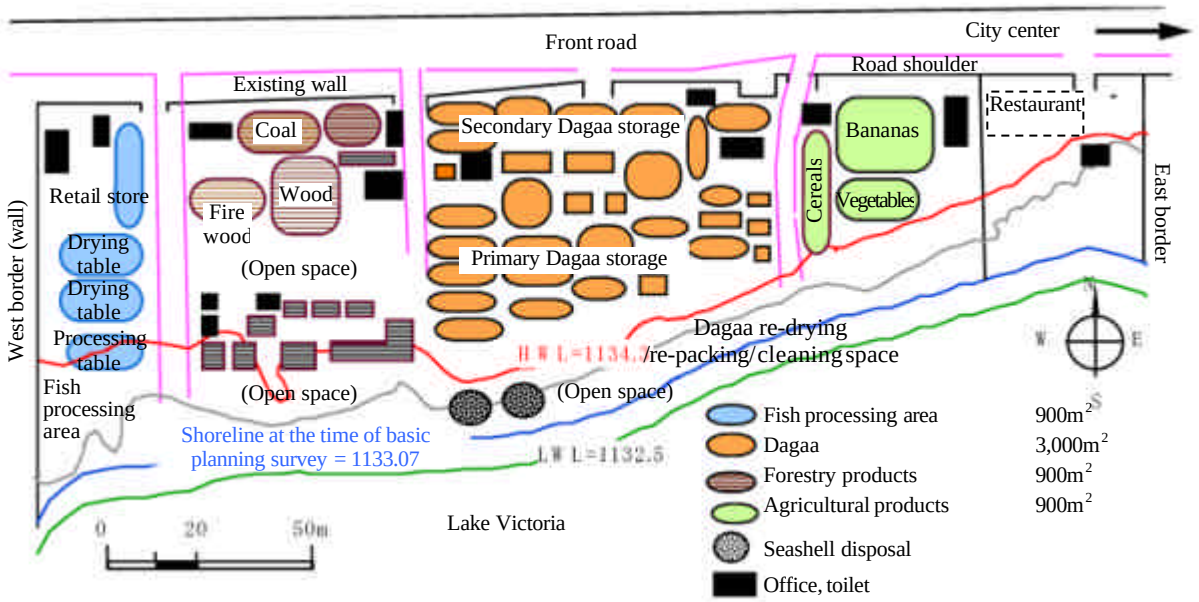


Figure 2-5 Current Usage Map

Table 2-1 Current Number of Stalls and Stall Areas in the Market

	Product name	Stall area (m^2)	Number of stalls	Unit stall area (m^2)	Current usage conditions
Fish products	Dagaa	3,000m^2	148	20.7	Complex usage and about 100 users. Wooden pallets are used for the floor.
	Dried fish	900m^2	25	36.0	Only Dry-salted Nile perch. Wooden tables are used.
	Fresh fish	400m^2	10	40.0	Fresh fish such as Tilapia in small amount is sold. Partly wooden sales tables are used.
Agricultural products	Banana	600m^2	6	100.0	Ripening activity is performed as well. Wooden pallets are used.
	Cereals	200m^2	20	10.0	Beans, rice, potatoes are sold. Mostly in bags. Wooden pallets are used.
	Fruits and vegetables	100m^2	4	25.0	Pineapples etc. Wooden pallets are used.
Forestry products		900m^2	10	90.0	Products include coal, firewood, logs for foothold and rocks.
Restaurant		600m^2	30	20.0	One stall is used by two people. There is roof made of sheet.
Total number of stalls		6,700m^2	250	(average) 26.8	

Note: Collection of usage fees is calculated based on the number of stalls, and unit stall area is set depending on different products.

[1]-2 Volume of Fish Products in Circulation

Main fish products in circulation in the existing fish market are Dagaa, dry-salted Nile perch, smoked Nile perch, and smoked Tilapia. In each case, large-scale wholesaling to traders is performed but there are no retail sales to general consumers. Fresh fish is landed by small outboard motor fishing boats in late afternoon every day and is sold to local fish stores and partly to general consumers, but quantities are small. The circulation volume of the main fish products at the existing fish market confirmed and counted by the management contractors and Mwanza City Fisheries Section is shown in Table 2-2.

Table 2-2 Volume of Handled Fish Products (2001)

Unit: kg

2001	Dagaa (dried)	Dry-salted fish (Nile perch)	Smoked fish (Nile perch)	Smoked fish (Tilapia)	Fresh fish (estimate) (mainly Tilapia)	Total
Annual total	8,536,590	352,079	111,864	39,429	55,000	9,094,962
Monthly average	711,383	29,340	9,322	3,286	4,583	757,914
Daily average	23,713	978	311	110	152	25,264

Source: Mwanza City, Fisheries Section

[1]-3 Validation of the Handled Volume by Main Product

The estimated circulation volume of the main products in 2003 can be calculated as follows, based on the calculation of the scheduled tender price (minimum allowable tender price) related to the usage fees and charges of the existing fish market. Incidentally, the market usage fees and charges of the existing fish market are based on a price table by products and by trading volume set forth by law, and are collected twice – when entering the market and when exiting the market. The scheduled tender price is set at 70% of the scheduled income from actual usage fees and charges, while the contracting party (market manager) takes the remaining 30%. As shown in Table 2-3, 90% of market usage fees and charges derive from the handling of Dagaa. From the estimated circulation volume of 9,180 tons/year, the actual circulation volume of Dagaa in 2003 is estimated at 9,180 tons/year ÷ 70% = 13,100 tons/year. This value is 108% of the annual Dagaa production volume in 2001 and 80% of the volume in 2002 shown in Table 2-4, and is therefore a realistic estimate of the circulation volume.

Table 2-3 Basis for Calculation of the Minimum Allowable Tender Price

Unit: Tshs.

	Scheduled tender price/month	Legal commission	Estimated circulation volume (kg)
1. Fish products (dried Dagaa)	15,300,000 (90%)	Commission: 300/Tshs:30kg/bag (conversion) 15,300,000÷300÷2＝25,500 bags 25,500 bag×30kg/bag＝765,000kg	25.2 tons/day 765 tons/month 9,180 tons/year
2. Agricultural products (banana conversion)	850,000 (5%)	Commission (average)150/Tshs: per bunch 850,000÷150÷2＝2,830 bunch	94 bunches/day 2,830 bunches/month 33,960 bunches/year
3. Forestry products (firewood conversion)	680,000 (4%)	Commission: 50/Tshs: firewood (1 bundle of 3 pieces), per log 680,000÷50÷2＝6,800 pieces	227 pieces/day 6,800pieces/month 204,000pieces/year
4. Others (sea shells conversion)	170,000 (1%)	Commission: 300/Tshs: per 100kg 170,000÷300÷2＝570kg	
Total	17,000,000		

[1]-4 Fish Catches and Handled Volume of Dagaa

1) Annual Fish Catches in Lake Victoria

Table 2-4 shows the fish catches by main species of fish in the Tanzanian region of Lake Victoria in the past 5 years.

Production of Nile perch decreased in 1998 and 1999 due to an import ban by the EU but shows a trend of increase from 2000 following the resumption of imports. In 2002, fish catches of all species including Nile perch, Dagaa, and Tilapia increased over previous years due to among other reasons enhanced removal of waterweed, which drastically grew around 2000. In particular, Dagaa was a bumper yield of 18,000 tons, equivalent to 1.5 to 1.8 times that of previous years.

Table 2-4 Movements in Production Volume and Value in Lake Victoria

(Production value unit: 1 million Tshs)

		1998	1999	2000	2001	2002
Nile perch	Production volume (ton)	5,320	32,000	45,203	60,580	75,600
	Production value	345	3,200	4,520	6,050	7,550
Dagaa (*)	Production volume (ton)	7,128	8,138	10,335	12,101	18,225
	Production value	2,210	2,200	2,530	2,710	3,500
Tilapia	Production volume (ton)	113	89	75	42	60
	Production value	62	49	35	23	57
Others	Production volume (ton)	13	13	8	4	10
	Production value	3	4	4	1	5
Total	Production volume (ton)	12,574	40,240	55,621	72,727	93,895
	Production value	2,620	5,453	7,089	8,784	11,112

Source : Mwanza Region, Fisheries Division, Note: Weight and price of Dagaa is for dried fish (beach price at the existing fish market)

2) Handled Volume of Dagaa by Month

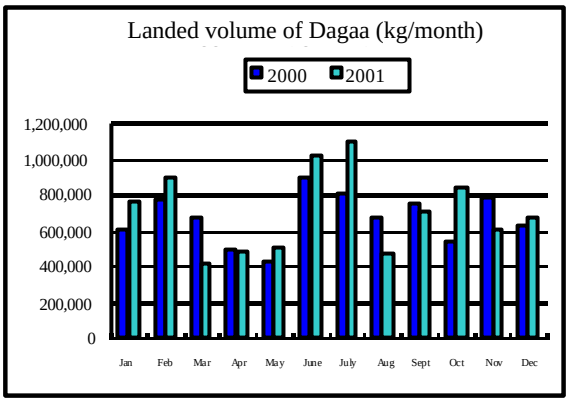
Handled volumes of Dagaa at the existing fish market by month in 2000 and 2001 are shown in Table 2-5 and Figure 2-6. The handled volume tends to decrease in the rainy season from March to May, and increase in the dry seasons from June to July and from January to February. In 2001, the handled volume from June to July exceeds 1,000tons/month. Also the volume of Dagaa transported by trading boats and landed at the front beach is calculated to be about 93% of the total handled volume, which would give an estimate of about 880 tons per month to be landed at the front beach during the peak season of June and July.

Table 2-5 Handled Volume of Dagaa

(Unit: kg)

	2000	2001	Average of the two years
January	606,400	768,930	687,665
February	772,000	902,520	837,260
March	678,000	425,730	551,865
April	496,375	490,500	493,438
May	434,000	513,150	473,575
June	894,900	1,012,740	953,820
July	808,150	1,101,360	954,755
August	681,800	469,530	575,665
September	755,300	715,980	735,640
October	541,700	850,830	696,265
November	785,150	607,050	696,100
December	635,450	678,270	656,860
Total	8,089,225	8,536,590	8,312,908
Monthly average	674,102	711,383	692,742
Daily average	22,470	23,713	23,091

Figure 2-6 Handled Volume of Dagaa by Month



Source: Mwanza City, Fisheries Section

3) Surveyed Volume of Dagaa

Handled volume of Dagaa is affected by factors including distinction between the rainy and dry seasons, and the phase of the moon. Table 2-6 shows the results of surveying market operations for 10 days during the site survey from February 25 to March 6, 2003.

Because Dagaa fishing is performed at night using fish lamps and requires a drying period of several days in the sun, the handled volume increases monthly around the time of a new moon. In annual terms, the handled volume increases during the dry season. The above-mentioned survey period coincides with the end of the dry season, when the Dagaa catch is relatively high.

Table 2-6 Results of the Survey of Incoming Dagaa

Results of the survey of incoming Dagaa

Transportation method		Direct carrying-in from waterborne transport (front sand beach)							Carrying-in by cart from nearby ferry terminal			Carrying-in by trucks from inland transportation (neighboring fishing villages)			
Collection area		Fishing villages around Mwanza where land access is difficult, and distant main production fishing villages and campgrounds							Distant fishing villages and campgrounds on the west shore of Lake Victoria			Fishing villages near Mwanza city where land transportation is possible			
Date	Phase of moon	Trading boat (standard)	Incoming volume	Trading boat (small)	Incoming volume	Trading boat (large)	Carrying volume	Incoming volume	Ferry	Carrying volume	Incoming volume	Truck	Carrying volume	Incoming volume	Total incoming volume
		Number of vessels	Ton	Number of vessels	Ton	Number of vessels	Ton	Ton	Number of vessels	Ton	Ton	Number of vehicles	Ton	Ton	Ton
2/25		7	53	2	3			0			0	2	2	4	60
2/26		8	60	2	3	1	15	15			0				78
2/27		5	38	2	3			0	1	20	20	2	2	4	65
2/28		6	45	2	3			0			0				48
3/1		10	75	1	2			0			0	2	2	4	81
3/2		3	23	1	2	1	15	15	1	20	20	1	2	2	61
3/3	New moon	12	90	1	2			0			0	1	2	2	94
3/4		7	53	2	3	1	24	24			0				80
3/5		15	113	2	3			0			0				116
3/6		13	98	2	3			0			0				101
Total (10 days)		86	645	17	26	3		54	2		40	8		16	781
Average (one day)		8.6	64.5	1.7	2.6	0.3		5.4	0.2		4.0	0.8		1.6	78

Trading boat specification : Boat length is 11 to 14 meters and not powered (sails), carrying volume per vessel is about 5.0 to 7.5 tons (200 to 300 bags, 25 kg per bag). There are also small outboard motor boats with a carrying volume of 1.5 tons (about 50 bags, 25 kg per bag). The proportion of each type of boat is 80% standard non-powered boats and 20% small boats.

Trading boat (large) specification : Recently adopted in operation, boat length is 17 to 19 meters with two outboard motors (50ps), and can carry between 12.5 and 20 tons in 500 to 800 bags (25 kg/bag).

Ferry specification : Operated by a private ferry company located on the south side of Kirumba Market (commonly called North Port). Large ferry is 35 meters long and has a total tonnage of about 600 tons, and the small type is 25 meters long with a total tonnage of about 200 tons. Both types carry about 20 tons in around 800 bags (25 kg per bag).

Truck specification : 20 foot type truck with loading capacity of about 10 tons, but actual Dagaa loading weight is about 4.5 tons.

The above survey result confirmed that the volume carried into the existing market consists of 93 % landed from trading boats at the front beach, 5% by ferry and 3% by trucks. Also the total number of trading boats which landed at the front beach during the 10 days is 106, daily average is 10.6 vessels, and the highest number of vessels entering the port and landing was recorded on March 5, two days after the new moon, and totaled 17 vessels, consisting of 15 standard type boats and 2 small boats.

(5) Number of Trading Boats Using the Port

Approximately 90% of the volume of Dagaa carried into the existing fish market is by trading boats, and the number of boats using the port averages 10.6 per day and tends to increase for a few days after the new moon. Also, Dagaa is sometimes transported mixed with other products but because the volume of Dagaa is overwhelmingly larger, fluctuations in the estimated number of the boats using the port, as shown in Table 2-7 and Figure 2-7, were confirmed to show a similar trend as those recorded in the survey.

Table 2-7 Number of Trading Boats Entering the Port

	Day	Month, day	Estimate value	Recorded value
	1		0	
	2		0	
	3		0	
	4		0	
	5		1	
	6		1	
	7		2	
	8	25 th Feb.	3	9
	9	26 th Feb.	4	11
	10	27 th Feb.	7	7
	11	28 th Feb.	8	8
	12	1st Mar.	9	11
	13	1st Mar.	11	5
New moon	●14	2nd Mar.	13	13
	15	3rd Mar.	11	10
	16	4th Mar.	10	17
	17	5th Mar.	9	15
	18	6th Mar.	8	
	19		7	
	20		5	
	21		4	
	22		3	
	23		1	
	24		1	
	25		0	
	26		0	
	27		0	
	28		0	
	Total		118	
Total of 10 days around the time of new moon			93	106

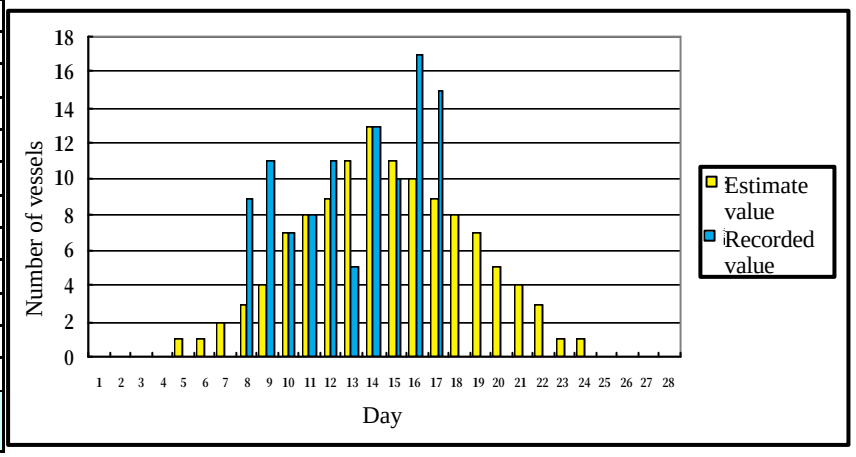


Figure 2-7 Change in the Number of Trading Boats Entering the Port (model)

[2] Determining Size and Grade of Each Component

[A] Consideration of Scale for the Construction Facilities

[A]-1 Determining the Scale of the Market Building

Products that require roofing, for example, Dagaa, cereals and vegetables, etc. (not including bananas) shall be handled inside the market building, whereas products whose commodity value is not affected by rain such as forestry products (not including bananas and charcoal) shall be handled outside. Also, a roof is necessary for charcoal because its commodity value decreases when it becomes wet, although it is preferable to handle this

away from foods. Moreover, since charcoal makes the floor dirty, a separate building with a simple roof shall be provided. For size setting of the market building, appropriate scale is determined based on changes in the circulation volume of Dagaa (main product), seasonal changes, and characteristics of expected work content and flow of products.

(1) Determining the Size of Dagaa Handling Space

Handling work of Dagaa is as follows: 1) Primary storage, 2) Trade negotiation, 3) Re-drying and packing, 4) Secondary storage, and 5) Loading in trucks. To complete this continuous work, it takes a minimum of 3 days in good weather, but can sometimes take up to between 7~10 days. Since Dagaa fishing is usually performed around the new moon, incoming quantities are concentrated over a few days after the new moon, when activities 1) to 5) above are unable to keep up. In particular, since 3) Re-drying and packing of Dagaa is performed in a limited working area by certain groups of workers, it is difficult to improve amount of work and efficiency, and working hours are heavily affected by rain. For this reason, during the period of peak carrying-in, Dagaa that cannot be processed is held as stock in the primary storage state.

The current usage condition of the Dagaa handling space is shown in Figure 2-5; utilizing the lake shore side for re-drying and re-packing of Dagaa, the middle space for primary storage of Dagaa unloaded from trading boats, and the area close to the front road for secondary storage before loading of re-packed Dagaa. Of these activities, re-drying is performed mainly before and during re-packing activities. A roof will be installed in the stock storage space and handling space to reduce loss during storage periods and to allow drying and re-packing activities at all times.

The area near the lake shore is used for removing grass and sand in addition to the drying and re-packing of Dagaa, storing sea shells which become feed for chickens, and for packing space. A roof will not be installed here and the current functions will be retained in the space arrangement plan. Furthermore, shipping trucks are a major cause of traffic congestion around the market as they wait outside, enter the market when it opens at 8 am, and use the entrance road and open space west of the storage space as a main loading space. For this reason, efficiency of loading activities will be improved by establishing a motor road and parking and loading spaces in the market. By including areas needed for these handling activities and stock storage in the Dagaa handling space, necessary scale of the required area will be calculated.

1) Determining the Volume of Dagaa Stock

Because there is no survey statistical record related to Dagaa stock, the model of seasonal stock volume fluctuation shall be estimated and used as the basis for calculating the required stock space. The following values are used for the fluctuation model calculation.

① Incoming volume of Dagaa: based on the two-year average of handled Dagaa volume shown in Table 2-5

- Incoming volume during the dry season is the average of the highest two months = (954.755 + 953.820) kg ÷ 2 months 954 tons per month
- Incoming volume during the rainy season is the average of the lowest 6 months = (474 + 493 + 552 + 576 + 657 + 687) tons ÷ 6 months 573 tons per month

② Number of trading boats entering the port: Estimate of 118 vessels from Table 2-7

③ Loading volume per one trading boat

To calculate the carrying-in volume per trading boat for use in calculation of the stock volume, keep the same number of boats entering the port estimated in (2) (118 vessels, for both dry and rainy seasons), and divide the incoming volume per month in both dry and rainy seasons calculated in (1) by the estimated number of boats entering the port.

- Dry season 954 tons/month ÷ 118 vessels = 8.80 8.0 tons/boat
- Rain season 573 tons/month ÷ 118 vessels = 4.86 5.0 tons/boat

Additionally, the number of days required to complete the above mentioned work 1) through 5) is set at 4 days, one extra day added to the three days stated at [A]-1(1) in the previous page, showing the required days to complete the work in good weather.

According to the estimate of incoming volume, outgoing volume and stock volume by the fluctuation model based on the above, the maximum stock volume during the dry season is 360 tons, one week after the peak incoming volume, and 225 tons during the rainy season, as shown in Table 2-8.

Table 2-8 Fluctuation of Stock Size by Season (model)

Calendar day	Dry season model				Rainy season model			
	Number of boats entering the port (8 tons per boat)	Incoming (tons)	Outgoing (tons)	Stock (tons)	Number of boats entering the port (5 tons per boat)	Incoming (tons)	Outgoing (tons)	Stock (tons)
1								
2								
3								
4	1	8	0	8	1	5	0	5
5	1	8	0	16	1	5	0	10
6	1	8	0	24	1	5	0	15
7	2	16	0	40	2	10	0	25
8	3	24	8	56	3	15	5	35
9	4	32	8	80	4	20	5	50
10	7	56	8	128	7	35	5	80
11	8	64	16	176	8	40	10	110
12	9	72	24	224	9	45	15	140
13	11	88	32	280	11	55	20	175
●14	13	104	56	328	13	65	35	205
15	11	88	64	352	11	55	40	220
16	10	80	72	360	10	50	45	225
17	9	72	88	344	9	45	55	215
18	8	64	104	304	8	40	65	190
19	7	56	88	272	7	35	55	170
20	5	40	80	232	5	25	50	145
21	4	32	72	192	4	20	45	120
22	3	24	64	152	3	15	40	95
23	1	8	56	104	1	5	35	65
24	1	8	40	72	1	5	25	45
25			32	40			20	25
26			24	16			15	10
27			8	8			5	5
○28			8				5	0
Total	118	944	944		118	590	590	

●: New moon, ○: Full moon

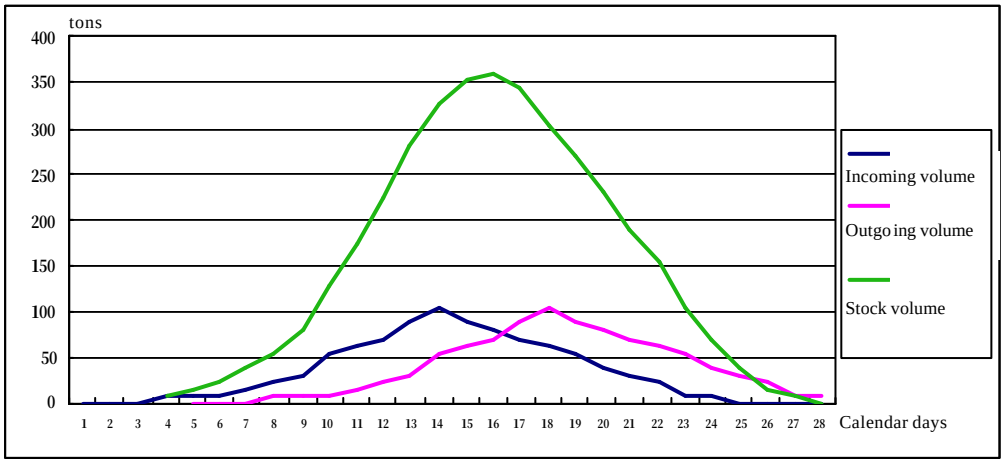


Figure 2-8 Fluctuation of Incoming, Outgoing and Stock Volumes in the Dry Season

Because the total market area is limited and Dagaa handling work must be performed in the designated area, the space available for handling work becomes smaller during the period of the largest stock volume as the stock storage area expands. Accordingly, it is necessary to ensure an area large enough for Dagaa handling work during the period of the largest stock. Required area for Dagaa handling work is calculated in two separate spaces, i.e. the Dagaa stock storage area and handling work area (primary storage, drying, packing, secondary storage).

2) Calculation of Required Area for Stock Storage

Dagaa is usually stored in bags stacked up to about 2 to 3 meters high. Density of the bag with Dagaa is 0.138 tons/m^3, volume per 1 m^2 when stacked up to 3 meters is 3 m x 1m^2 = 3m^3/m^2 and the weight is 3 m^3/m^2 x 0.138 tons/m^3 = 0.414 tons/m^2.

<<Required area of Dagaa stock storage space>>

- Dagaa stock storage area needed in the dry season = 360 tons ÷ 0.141 tons/m^2 = 869 m^2
- Dagaa stock storage area needed in the rain season = 225 tons ÷ 0.141 tons/m^2 = 543 m^2

3) Required Area for the Handling Space

After unloading, Dagaa goes through the following sequence of handling procedures: primary storage, (partial drying), price negotiation/sales, drying/cleaning, re-packing, secondary storage, and loading. Of these procedures, the drying of Dagaa by spreading out on sheet requires the largest area. From the onsite survey, the height of Dagaa during drying is confirmed to be about 1 cm, frequency of drying per day is about 5 to 9 times (average of 7 times) during the rainy season, and 8 to 12 times (average of 10 times) during the dry season. Incidentally, the required area for re-packing work is included in the required handling area since re-packing is performed in a corner of the drying/cleaning space.

Since the number of workers and space available for handling work are limited regardless of changes in the incoming volume, only a certain amount can be processed in a day. Incoming quantities to the market differ according to the phase of the moon and boat operating conditions, etc., however, since Dagaa is a dried product, handling work can be carried over to the following day if

things get too busy. For this reason, the simple average of incoming volumes in one month shall be used to determine the daily incoming volume as the basis for calculating the necessary area of the handling space for both the dry and rainy season.

<<Required area of Dagaa handling space>>

Average incoming volume during the dry season = 944 tons ÷ 30 days = 31.5 32 tons/day

From the density of approximately 0.138 tons/m^3 and the volume of 32 tons ÷ 0.138 tons/m^3 = 231m^3,

- Required area = incoming volume ÷ drying height ÷ frequency = 231 m^3 ÷ 0.01 m ÷ 10times/day = 2,310 m^2

Average incoming volume during the rainy season = 590 tons ÷ 30 days = 19.7 20 tons/day

From the density of approximately 0.138 tons/m^3 and the volume of 20 tons ÷ 0.138 tons/m^3 = 145 m^3,

- Required area = incoming volume ÷ drying height ÷ frequency = 145 m^3 ÷ 0.01 m ÷ 7times/day = 2,071 m^2

4) Calculation of Required Area of the Dagaa Handling Space

Area of the Dagaa handling space is calculated by adding the stock storage area and handling area calculated above.

In the dry season:

The total required area is: the stock storage area + the handling space = 869 m^2 + 2,310 m^2 = 3,179 m^2. Because it is possible to use outside areas for handling work during the dry season, the combined area of outside and inside can be used to meet the required area for handling work, without interfering with facility use and work efficiency.

In the rainy season:

The total required area is: the stock storage area + the handling space = 543 m^2 + 2,071 m^2 = 2,614 m^2. During the rainy season, the outside Dagaa drying space cannot be used as handling space as in the dry season, necessitating the securing of about 2,600 m^2 for this purpose. According to statistical data, there is a period when more than the incoming volume used in this plan is processed, and it is estimated that there are periods when the

required space is not filled. In such cases, the height of the stacks will rise to 4 m from 3 m to reduce the stock storage area, although extra labor is temporarily needed. At any rate, some forms of adjustment are considered possible such as using passageway area as a temporary storage area at the expense of work efficiency. A conceptual diagram for detail of the activities performed in the Dagaa handling space of the market building, work area, and flow of Dagaa, is shown in Figure 2-9.

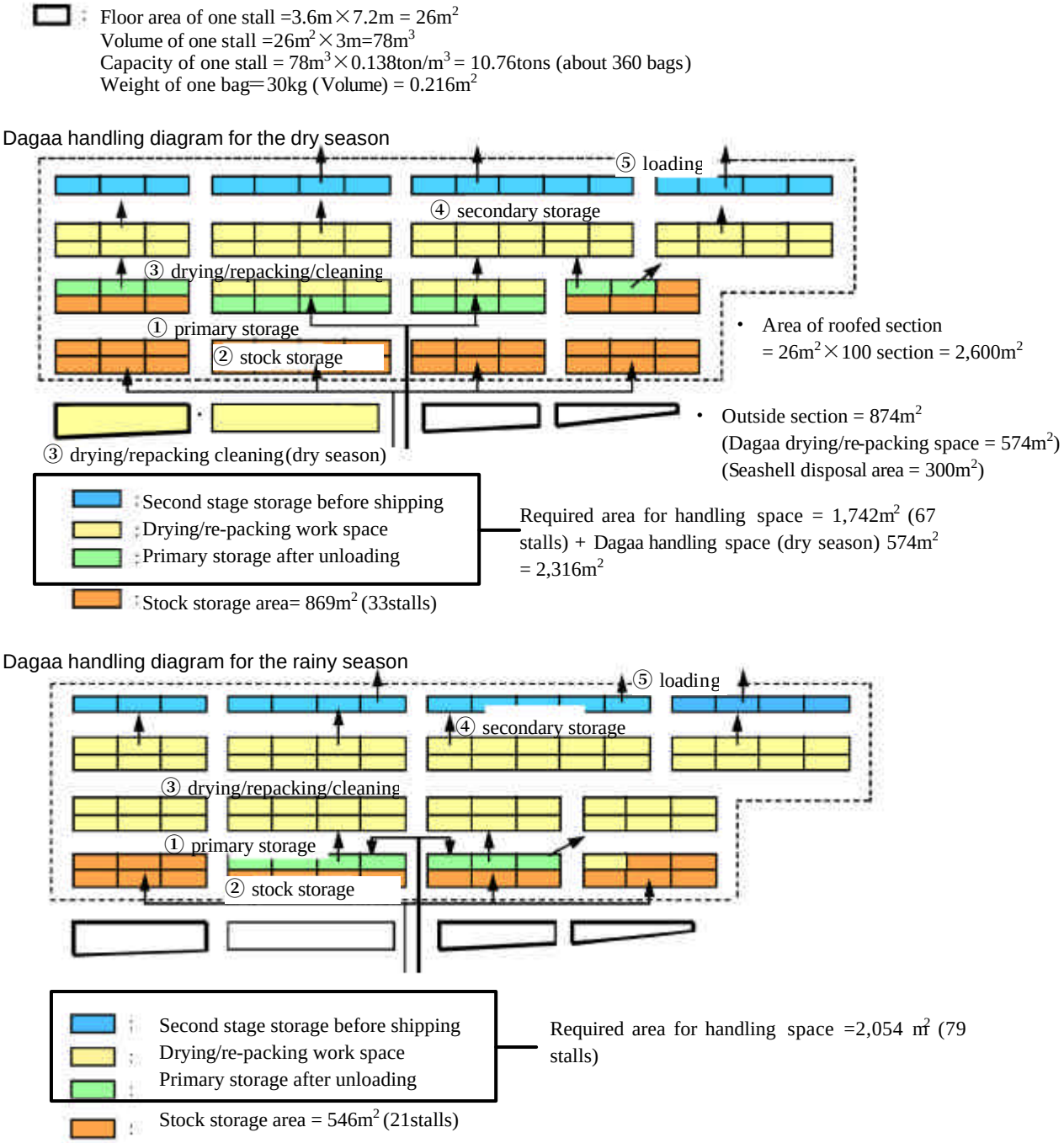


Figure 2-9 Operation Conceptual Diagram of Dagaa Handling Space

5) Determining the Scale of the Loading Space and the Motor Road

Trucks carry out most of the products handled in the market. Survey results showing the number of trucks by different time of day from February 28 to March 6 are shown in Table 2-9.

Table 2-9 Results of Truck Shipping Survey

	Morning (8 am to noon)	Midday (noon to 2 p.m.)	Afternoon (2 p.m. to 6 p.m.)
Feb 28	15 (30)	8 (0)	5 (0)
Mar 1	13 (32)	3 (0)	2 (0)
Mar 2	8 (21)	1 (1)	0 (0)
Mar 3	10 (25)	3 (0)	0 (2)
Mar 4	9 (14)	6 (5)	3 (3)
Mar 5	16 (25)	4 (1)	1 (1)
Mar 6	10 (26)	3 (5)	3 (0)
Average	11.6 (24.7)	4.0 (1.7)	2.0 (0.6)

Note: Number of trucks waiting inside the market is shown in the brackets ( ).

As the existing fish market is focused on wholesale functions, loading activities of Dagaa are concentrated in the morning. The average time for unloading is about 3 to 5 hours for each truck and 4 to 6 hours are necessary if the bags are weighed. Since Project implementation will have no significant effect on the Dagaa circulation volume or circulation system, the number of trucks loaded per day is 10 – the average number of trucks observed in the morning of the survey, and sufficient loading area needs to be ensured as well as marking of traffic lanes indicating loading, waiting, and driving.

6) Determining the Scale of Passageways within the Market

For shipping and loading activities of products such as Dagaa in the existing fish market, trucks enter and are parked in the open space close to each product space, and products are carried in and loaded by hand. However, passageways in the middle of the market are narrow and unpaved, making the use of carts impossible, thus reducing work efficiency. To improve this current manual transporting pattern (transporting one item per person), passageways large enough for carts will be ensured in the Project, and each space is to be arranged facing the passageways.

7) Determining the Scale of Dagaa Handling Space along the Lakeshore (dry season)

The open space along the lakeshore is used as an effective and essential shared space for the temporary storage of products other than Dagaa and processing (re-drying and packing) of Dagaa on sunny days. As the area of this open space will be reduced with installation of passageways connecting the unloading facility and the market building, it is necessary to ensure space for the above activities outside of each space, as much as environmental conditions will allow. In addition, the floor surface will have concrete finish, in consideration of Dagaa drying efficiency and ease of cleaning.

<< Calculation of the Dagaa Handling Space (dry season) >>

For the Dagaa handling space (dry season), 3,179m^2 is necessary for the Dagaa stock storage/handling, but since 2,600m^2 of this will be under the roof of the market building, it is necessary to secure 3,179m^2 – 2,600m^2 = 579m^2.

Also, based on the onsite survey, about 300 m^2 is required at all times for temporary storage of seashells. For passageways, a total of 685m^2 is necessary, including passageways wide enough to allow use of carts for transporting products (width of 2.5 m) parallel to the shoreline, and connecting passageways within the market building (width of 2.0 m). Thus, the required area for Dagaa drying space amounts to 1,564 m^2 as shown in Table 2-10. Placing a retaining wall at the 1133.5 m elevation line, which creates about 1,150 m^2 available area, can ensure the required area for the outside drying space.

Table 2-10 Required Areas for the Outside Dagaa Handling Space (dry season)

Space	Area	Calculation
Passageways	685m^2	Backside of retaining wall, width 2.5 m x length 170 m = 425 m^2, inside passageways, width 2.0 m x 130 m = 260 m^2, total of 685 m^2
Dagaa handling	579 m^2	From the calculation of required handling area in the dry season
Seashell storage	300m^2	Based on the results of onsite survey
Subtotal	1,564m^2	

(2) Determining the Size of the Cereals and Vegetables Wholesale Space

Since the product value of cereals, vegetables and fruits, except for bananas, is affected by rain, the wholesale space shall be placed in a corner of the market building as in the case of Dagaa. To permit wholesale activities without interference by weather, about 200 m^2 for cereals and about 100 m^2 for vegetables and fruits, totaling about 300 m^2, based on the current space areas, is provided under roof in the market building.

[A]-2 Fish Processing Facilities

In the current fish processing area, there are 25 groups of users processing and selling dry-salted Nile perch. The average handled volume of raw fish is 3 tons/day, which is reduced to roughly one-third by the drying process, making the production of dry-salted products about 1 ton/day. In the fish processing area, processing tables are installed for each user, and the tables are used to perform a series of activities, including opening fish (inner parts are mostly already removed at the export fish processing plant), salting, and drying (average of 6 days). During these activities, oily body fluid and wastewater with salt are generated and discharged toward Lake Victoria, causing significant environmental impact to the lake.

Salting activities, which have a high environmental impact, are performed on shared special tables so they should be planned to include a treatment system for the waste fluid. The existing wooden drying tables are used for both drying and opening of fish so they are built large, 3.6m by 3.6m, requiring the workers to get up on the tables to spread the fish and thereby decreasing work efficiency. Therefore, in the Project, the tables will be refined so that workers don't have to mount them. Oil coming from the bodies of fish being dried shall be removed together with other wastewater from the shared tables by special drainage pipes. The fish processing area shall be paved with concrete and designed so that it can be washed and maintained in a sanitary state appropriate for a food processing area.

1) Scale of Processing Tables

Calculation of processing table extension:

Incoming volume of raw fish per day	:	3 tons/day
Weight per fish	:	Average weight 1 kg/fish
Number of processed fish per group	:	30 fish/group/time
Work hours	:	From noon to 4 p.m. (unloading is around noon)

Number of processing tables = Incoming volume of raw fish ÷ Weight per fish ÷ processing hours per group ÷ work hours
= 3,000kg/day ÷ 1 kg/fish ÷ 30 fish/group/per time ÷ 4 hours
= 25 groups/day

Processing activities are performed face to face as shown in the diagram on the right. Extension of each processing table per group is set at 0.7 m deep x 2 rows and horizontal width of 0.7 meters and additional 1 meter for raw fish stock, salt, and temporary storage after salting, totaling 1.7m wide. Therefore, the total extension of the processing tables crossways will be 25 pairs x 1.7 m = 42.5m.

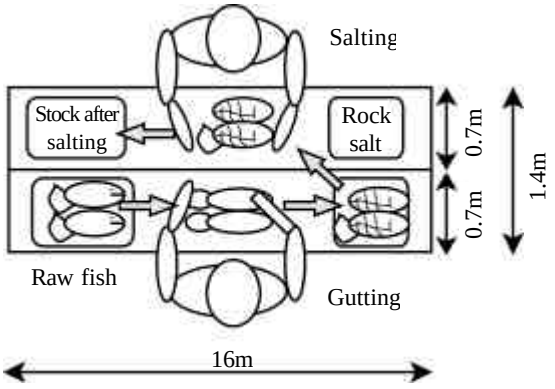


Figure 2-10 Processing Table Diagram

2) Calculation of the Area of Nile Perch Drying Tables

The Nile perch drying tables are used for drying fish that have been processed at the processing tables. Drying activities are performed for a total of 6 days, and salting is done at the same time in the first three days. The last three days are just used for sun drying. Necessary area for the drying tables is planned as follows.

Incoming volume of raw fish per day	:	3 tons/day
Weight per fish	:	Average weight 1 kg/fish
Surface area per fish	:	$0.03m^2$ (diamond shape, perimeter lengths of 0.3m x 0.2m x 0.5m = $0.03m^2$)
Average drying days	:	6 days
Overlapping rate	:	0.5 (laid flat at beginning of drying, laid vertically after that)

Area of the drying tables = Weight of raw fish ÷ Weight per fish ÷ Surface area per fish ÷ drying days ÷ overlapping rate
= 3,000 kg/day ÷ 1kg/fish x 0.03m^2/fish x 6 days x 0.5 = 270 m^2

3) Dry-salted Nile Perch Storage and Retail Store

① Dry-salted Nile Perch Storage

Some of the dry-salted products are sold in small quantities at a retail store made of boards, and the rest is kept in storage for large purchasers such as traders. The existing storage is a steel container with shelves installed, but there are problem such as rapid degradation of products caused by the heat. For this reason, storage possessing high heat capacity not affected by outside temperature will built and the plan employs a local structure type using a concrete block building frame with a roof. The capacity of fish products storage is determined as follows.

Production weight per day	:	1 tons/day
Bulk specific gravity when loaded	:	0.14 tons/m^3
Days in storage	:	4 days (turnover rate at the time of survey)

Stowage capacity = Production weight per day ÷ Stowage bulk density x Days in storage

= 1 ton/day ÷ 0.14tons/m^3 x 4days = 28.5m^3

Capacity of the existing old container storage is about 24 m^3, which is close to the above capacity value. Issues for this container storage include insufficient workspace, which slows down loading and unloading of products, lack of room to bring the products inside when it starts to rain during processing, and lack of roofed space to pack the processed products, which causes problems during the rainy season.

For packaging of processed products, smoked products are first bundled with string in bunches of around 10 fish, and are then stacked on a vinyl sheet spread on the ground to form a package which is about 1 meter wide, 1.5 meters long and 0.5 meters high. Thus, it is necessary to ensure an area of about 3 m x 4 m when performing these activities.

② Dry-salted Nile Perch Retail Store

Currently, sale of dry-salted Nile perch is conducted at a very simple retail store comprised of a wooden table with poles and a sheet attached to the top of the poles. Roof protection of the retail store is not adequate so sales activities are hindered during the rainy season. Thus, sales inactivity caused by rain is the main factor for unstable income by artisanal processing workers. Bases on these conditions, the planned facilities shall allow sufficient sales activities of dry-salted Nile perch during the rainy season. The existing facility contains six small booths, about 2 meters in width and 1.3 meter deep each. The size of the retail store is determined by multiplying the width of one booth of the current scale by the number of selling booths generally used. The calculation is as follows.

Frontage of retail store = Number of selling booths x Average width
= 6 booths x 2.0 m/booth = 12 m

[A]-3 Restaurant Building

Mwanza City leases the existing restaurant site to users with each restaurant operated by a team of two restaurant workers using one booth each (with 30 teams in operation). Structure of the facility is simple; a sheet is held between log posts for protection from rain. The floor is bare ground and becomes muddy during the rainy season. The tables are made of split log and are about 30 cm deep, and the chairs are similarly made. A charcoal stove is placed in the middle of the booth for cooking, and tables and chairs are arranged to form a U shape, creating one restaurant. Because aisles are only 40 to 50 cm wide, there are some restaurants that can only be reached by passing through other restaurant booths. The floor space of each booth is small, roughly 20 m^2, thus forcing customers to eat shoulder to shoulder during lunchtime. The number of restaurant users during the onsite survey period was on average about 1,423 daily, and a maximum of 2,287 people was recorded. On average, there are about 50 to 80 people in each booth, and most of the customers are market workers.

Because the ground level of the current site is about 1 meter lower than the front road, the Project includes augmenting to a height of +1136 meters, including additional height needed during the high water level times of Lake Victoria and taking into account some gradient for drainage channels, to prevent flooding to the premises. For drainage from the street, the space between the existing wall and the banking is utilized as a drainage ditch.

Currently, the water needed for cooking is supplied by one shared hydrant, and the water charge is distributed evenly among the union members from the total usage. Because of this, there is concern that water charge distribution for each member is not clear. To address this problem, a water faucet and a meter will be installed in each booth to clarify the water charge share. Moreover, since restaurant conditions are unsanitary due to the fact that almost none of the users can wash their hands, the design shall also include shared faucets for washing hands before and after eating. Wastewater from the restaurants is currently discharged directly to Lake Victoria, but because of the environmental impact pointed out by Mwanza City Health Department, wastewater will be treated by a septic tank + underground percolation as adopted by households and restaurants in Mwanza.

[A]-4 Offices

In the existing fish market, there are offices for public institutions such as Mwanza City Fisheries Section which manages the market, Mwanza Region Fisheries Division, Tanzania Revenue Authority, and offices for unions that use the market. These existing offices are built in various ways ranging from steel container based offices to simple wooded structures, and each office is located randomly close to the space each union uses or in open spaces. These offices will be removed in the Project because they interfere with the overall facilities arrangement plan. The average floor space of each office is about 20 to 25 m^2 and the main office is often separated from the reception and secretary room. Also there are some offices which have electricity fed in to supplement the work environment. As these offices are essential for management and maintenance of the market and work such as product inventories and budget management are expected to become more complex and more diverse than at present, the plan should give adequate consideration to building specifications for smooth operation of these administrative and managerial activities.

[A]-5 Public Toilets

There are a total of three toilets in the existing facility: the middle toilet was constructed by Mwanza City in 1992; and the east and west toilets were constructed by the City under assistance from the UNDP in 1997. The scale of the east and west toilets was set based on the findings of a survey of the number of people using the middle toilet in 1995. Each toilet is divided by sex and includes a shower. It was determined that the current location of toilets conflicts with the facilities arrangement in the Project in terms of traffic lines and placement of other facilities. Thus, the existing toilets in three locations will be removed, and rearranged at two locations on the restaurant side and on the processing side.

The number of toilet users is about 2000 persons per day (male 1700 and female 300), according to the survey conducted by Mwanza City in 1995. Based on the "Construction Design Resource Corpus: page 80 from the chapter on unit space, Architectural Institute of Japan", the number of toilet fixtures needed is as follows:

- Men's (1700 persons) : 8 hand washing basins, 7 toilets, and 10 vertical urinals
- Women's (300 persons) : 8 hand washing basins, 6 toilets

By comparing these numbers with the number of existing toilets, as shown in Table 2-11, although the number of existing toilets is less than the numbers calculated according to the Architectural Institute standards, the number of existing toilet facilities should be adequate for current needs. Thus, the plan shall ensure the same number of toilets. Concerning the size of toilets, those on the restaurant side will be larger because of more human movement in this area. Allocation to the restaurant side (the Project) and the processing side (the Project) is shown in Table 2-11.

Table 2-11 Number of Toilet Facilities

	Existing facilities scale				The Project facilities scale		
	Existing toilet A	Existing toilet B	Existing toilet C	Total	Architectural Institute calculation	Restaurant side (the Project)	Processing side (the Project)
Men's (urine)	3	3	3	9	10	6	3
Men's (solid)	1	1	1	3	7	2	1
Men's shower	1	1	1	3		2	1
Basin (with mirror)	1	1	1	3	8	2	1
Women's	2	2	2	6	6	4	2
Women's shower	1	1	1	3		2	1
Basin (with mirror)	1	1	1	3	8	2	1

Note : Men's urinal is a wall type simple structure, and the capacity was estimated from the wall extension. The existing toilet C is the oldest.

[A]-6 Garbage Depots

There is only one existing garbage depot, located on the north side of the Project site, facing the front road. It is an open type, surrounded by concrete walls on three sides, and the accumulated garbage is collected by the city garbage collection vehicle. Because the Project facilities arrangement plan will widen the entrance, the existing garbage depot needs to be removed. Accordingly, new garbage depots will be established in two

locations near the east and west entrances, in consideration of waste output from the market. Also, according to the usage condition survey, the existing structure (10 meter wide x 7 meter deep x 2.5 meter high) is normally adequate, although overflows if garbage collection is late. Thus a garbage depot facility of about the same level of capacity as the existing structure is needed.

[A]-7 Guard Posts

There are four gates at the existing fish market and guards are placed there to control entering of trucks and loiterers but there is no guard post. Guard posts will be included in the plan because it is an important facility for managing market operations onsite and is considered an essential facility as the market is operated during the rainy season. Entrances are placed apart on the east and west sides, so one guard post for each entrance will be established at these two locations.

[B] Setting of Scale of Civil Engineering Facilities

[B]-1 Scale of Floating Jetty

The landing beach area of the existing fish market has a gently sloped bottom with an inclination of about 5-10/100 and there are no structures such as piers affecting courses for cargo vessels, ferries, fish boats, etc. The most frequently traded Dagaa is intensively landed in the morning from 8 to 12 o'clock. 13 to 17 boats a day are used on busy days and the landing quantity is large at a maximum of 100 tons a day. At present, landing from boats to the beach and transportation to the market are performed by manpower only but when landing facilities are completed, transportation to the market will mainly use carts.

(1) Selection of Mooring Facility Structure

In terms of structure, landing wharves are commonly categorized into two types; namely, fixed type wharves such as gravity type wharves, sheet pile wharves, jetties, step wharves, etc. and floating type piers (floating jetty). The fixed type wharves mainly target large boats and they are adopted when fluctuations in water level have no effect on the deck mooring height of boats and ease of loading and unloading work. On the other hand, the floating jetty maintains the relative height of wharf and boats, thereby providing advantages of smooth landing operations and boarding and departing. Accordingly, the latter is good for mooring and landing of small boats at calm shores with few waves and currents.

The water level of Lake Victoria is influenced annually by rainfall during the rainy seasons, which come twice a year. Accordingly, the fluctuation cycle is long, at several months to several years, and the change in water level in the past 20 years is about 1.8m, which is not small. The average size of the target trading boats is; average length about 14m, breadth 3.4-3.7m, total depth 1.1-1.7m (average, 1.4m), draught (Dd=0.8-1.1m), freeboard (Df=0.3-0.8m), and difference of draught between full load and light condition 40-60cm. If a fixed type wharf is adopted, loading and unloading operations from trading boats become difficult without loading equipment, making it difficult to use and decreasing cargo work efficiency. In contrast, the floating jetty enables easy loading and unloading operations because the jetty height changes in line with the water level. In addition, as the planned site is at the back of Kirumba Bay, an area with a gentle wave direction and current speed, constant wave height at about 20cm (95cm in abnormal times) and calmness at 99.5% throughout the year, and waves cause few problems, it is considered appropriate that a floating type jetty be adopted in the Project

(2) Construction Method for Floating Jetty

There are three main construction material choices for the floating jetty, namely FRP, concrete and steel.

FRP requires yard facilities and experienced technicians for appropriate quality control and schedule control. In terms of use, because of the low specific gravity of FRP, which is likely to cause inclination and rolling, this material is inappropriate for the Project. Concrete makes the construction cost high because of the need to secure a flat-floored and dry building yard, and supply of high quality cement and aggregate is difficult and high-density, reinforced concrete is necessary. Furthermore, concrete is weak against impact force and once it is broken or soaked in water, repair is difficult.

Steel is rather easy to obtain because there are boatbuilding facilities and boat repair facilities around the project site and there are many examples of floating jetties made of steel. With respect to corrosion that poses concern for maintenance and control, Lake Victoria is fresh water and thus, damage from salt water and corrosion is slow compared to an ocean environment and it is considered possible to enhance durability and minimize operation costs by securing appropriate corrosion allowance and using anticorrosive paint. Upon considering these points, a floating steel jetty is planned in the Project.

(3) Location to Establish Floating Jetty

The floating jetty will be used for loading and unloading of goods from trading boats and small fishing boats as well as loading of a small quantity of daily commodities and sundries to trading boats and small fishing boats. Since there is plenty of cheap local labor and it would be costly to install and maintain powered equipment such as a crane, loading and unloading operations shall be carried out manually and transportation to the market shall be limited to manpower and carts, i.e. vehicles shall be prohibited. Accordingly, in view of traffic lines with the Dagaa processing and storage spaces as well as short distances for transportation of landed goods and smooth access to respective spaces, the floating jetty shall be located at the end of the central passageway in the market. As indicated in Figure 2-11, the lake bottom in the location of the planned floating jetty is gently inclined at about a gradient of 6/100 from the point of CDL=0.00m, and a point where the maximum draught of 1.10m may be secured for trading boats at the time of low water based on actual measurement is about 18m or more offshore from the point of CDL=0.00m. Therefore, the floating jetty shall be located 18m offshore from the point of CDL=0.00m of the revetment at the front of the market facilities where a mooring depth (maximum draught) of 1.10m (CDL=-1.10m) is guaranteed for trading boats.

On the other hand, to establish a floating jetty closer to land, it is also possible to secure a mooring spot at a water depth of 1.1m by dredging an area shallower than the point at 18m. However, as there is concern over subsidence of the surrounding earth and sand after dredging and it is expected that it would become costly to maintain the depth, dredging shall not be conducted

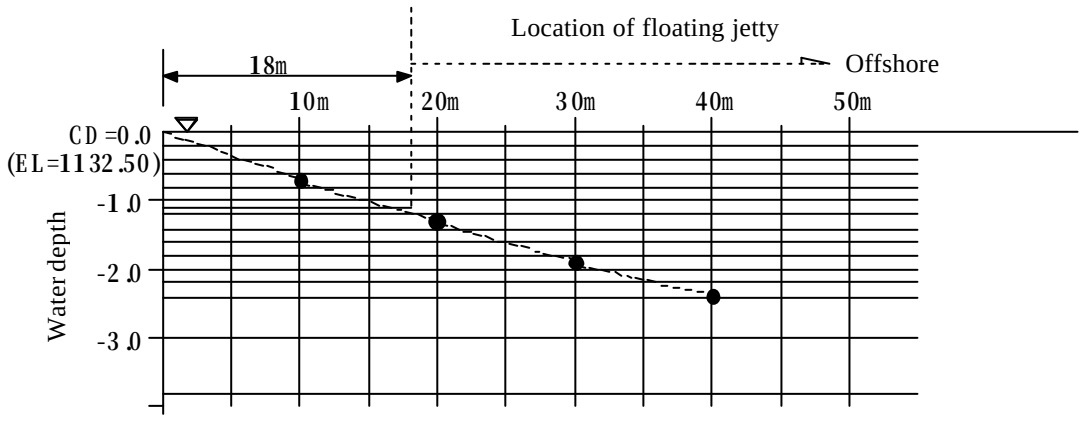


Figure 2-11 Water Depth by Actual Measurement
(Point 96m from the West Side Outer Wall of the Site)

(4) Orientation of the Floating Jetty

Two possible orientations can be considered for the floating jetty, namely parallel to the shoreline (horizontal orientation) and perpendicular to the shoreline (vertical orientation). Waves by nature roll at a right angle to the shoreline. Accordingly, in order to prevent boats being affected by transversal waves, it is desirable, when mooring, that boats are tied up perpendicular to the shoreline.

The water area to establish a floating jetty is a calm area with a wave height of 0.2m when calm and there is almost no concern over chances that the barge type floating jetty will sway with the impacts of waves. However, trading boats are likely to sway left-and-right even with small waves when they come from the side, making it difficult to perform loading and unloading operations alongside. On the other hand, when boats are swayed by waves from the bow side and aft peak, the middle part of boats does not sway greatly, making cargo handling operations easier than when boats are tied alongside. Landing of goods is normally performed manually by a few crewmembers from the middle part of a boat. Given the fact that landing operations for an average 30 kg of Dagaa for one boat, which are packed in 250 bags (7,500 kg), take about 1.5 hours, it is important to realize easy cargo handling operations. In consideration of the above-mentioned relationship between waves and boats and cargo handling operations, it is desirable that trading boats be tied up at a right angle to the shoreline. Therefore, the floating jetty shall be established perpendicular to the shoreline.

(5) Size of Floating Jetty

The number of boats using the jetty per year listed by products is estimated to be 1,200 boats for Dagaa, 227 for agricultural products, 200 for forest products and 60 for smoked products – totaling 1,687 boats. As for handling of Dagaa, landing operations normally start at 8 o'clock in the morning and finish at noon, corresponding to the hours the market is open; and cargo handling operations including discussion of merits of goods, sales negotiations and selection and repacking of goods take place in the afternoon. Furthermore, as the production volume of Dagaa greatly fluctuates depending on the time of month, landing frequency tends to concentrate in the 10 days around, before and after, the new moon. In contrast, landing frequency of goods other than Dagaa is relatively free from sales operations and there is not much fluctuation throughout a month or year.

Table 2-12 Registered Number of Target Boats

Kind of registered boats	Registered number
Fishing boat (small-sized) Total length less than 11m	1,000
Trading boat, fishing boat Total length more than 11m	400 (of which 382 boats are registered at Kirumba Port)

Table 2-13 Various Measurements of Trading Boats

Unit: (m)

Dimensions	Total length: L	Total breadth: D	Total depth (Dm)	Draught (Dd)	Freeboard (Df)
11m type	11.50	3.40	1.10	0.80	0.30
12m type	12.50	3.50	1.20	0.80	0.40
13m type	13.50	3.60	1.40	0.90	0.50
(Standard boat) 14m type	14.50	3.70	1.40	0.90	0.50
17m type	17.50	3.70	1.60	1.10	0.50
19m type	19.50	4.35	1.70	1.10	0.60

The number of trading boats using the existing fish market per year:

(According to the handling volume of 2001 and the estimated handling volume of 2003 based on market fees and charges.)

Dagaa trading boat

9,000 ton/year÷7.5 ton/boat=1,200 boats(standard type boat)

Agricultural products carrier

340 ton/year÷1.5 ton/boat=227 boats(standard type boat)

(Bananas 150 bunches/boat : conversion)

Forest products carrier

300 ton/year÷1.5 ton/boat=200 boats (standard type boat)

(Firewood 500 g×3 pieces/unit)1,000 units/converted to boats)

Smoked products trading boat

90 ton/year÷1.5 ton/boat= 60 boats (converted to small boats)

Total 1,687 boats

Calculation of the average number of boats using the market per day

Necessary extension of the mooring lot of the jetty shall be calculated by estimating the average number of Dagaa trading boats that use the lot based on ① the average number of boats landed during 10 days around the new moon and ② the average number of boats landed during 10 days confirmed by an on-the-spot survey conducted when the basic design was drafted (an average number of boats using the lot per day) out of the results of two months during two years from 2000 to 2001 when the landing volume peaked. An average time required for landing operations by one Dagaa trading boat is about 2 hours for a standard boat and 3.5 to 4 hours for a large-sized boat. Each trading boat has 3 to 4 crewmembers including a captain and 2 or 3 crew engaged in landing operations. Landing operations from boats are performed by crewmembers and in order to keep transportation costs low, the number of crewmembers is to be maintained at the same level. Therefore, the time required for these operations is not likely to be cut short even after the establishment of the jetty. Cargo is piled up in the boat as high as 1.5m above the gunwale from the bottom of the boat fully from fore to aft and left to right and landing operations take place alongside at the lowest point of the gunwale, prolonging the time required for landing operations. By simple calculation, supposing it takes a minute to land three bags, the time required for landing 250 bags is 250 bags ÷ 3 bags/minute=83 minutes (1hour 23 minutes). In addition, by estimating a boat's required time for mooring and casting off operations at about 10 minutes, the required time for landing operations per boat is set at 1.5 hours.

As for the number of trading boats dealing products other than Dagaa, the annual total number of average size and small size boats is not many at 487 boats in total (average is 40 boats monthly and 1.4 boats daily). As it is considered possible to conduct landing operations without duplicating the hours for landing operations of Dagaa, the average number of boats does not include this number.

Required length of the jetty = $\Sigma (N \div r) \times L$

① 9.3 boats According to Table 5, (total of 93 boats from 10^{th} to 19^{th} day ÷ 10 days: estimated value)

② 10.6 boats According to Table 5 (actual measured value)

N = Average number of boat to use = (9.3＋10.6)/2 10 boats

r = Mooring (berth) turnover = Possible time for landing ÷ required time for landing per boat = 4 hours ÷ 1.5 hours/boat=2.67

L = Length of berth = Total length of boat + extra = 14.5 m + 2.5 m (extra length from bow and stern and extra space for mooring when dismasted) = 17.0 m/boat

Required extension of the floating jetty = Σ (N ÷ r) × L= (10 ÷ 2.67) × 17.0 = 63.7 m

As the floating jetty enables landing operations on both sides, the total length of berths down the jetty is projected to be 63.7m ÷ 2 32 m.

(6) Examination of Operational Zones over Floating Jetty

The jetty requires space for a landing operations site, a temporary storage site, a loading site and passageway for carts. Necessary floor space for landing operations of Dagaa shall be secured.

① Examination of Temporary Storage Site

Necessary space on the jetty for temporarily piling up of cargo from an entire boat, namely, a landing volume per boat of 7,500 kg (30 kg/bag × 250 bags) and a 54m^3 cubic volume calculated based on a cubic volume of a bag as 0.216 m^3 is 54 ÷ (width of 1.2 m × height of 1.5 m) = 30 m. Landing operations from boats to the floating jetty and transportation of landed cargo to the market are simultaneously performed. However, in light of a possible backlog of landed cargo on the jetty due to the number of carts in operation and the time required for coming and going, a storage site shall be secured on the jetty for about 30% at the maximum of a landed cargo per boat, namely a space with a width of 1.5 m (+ extra 0.3 m is included) by 9 m equaling 13.5 m^2. Within a temporary storage space for landed cargo, a loading site for carts shall be established. It shall be 1.8 m wide to accommodate carts.

② Examination of Frequency of Carts and the Width of Passageway

Average loading volume of a cart: 30 kg × 12 bags = 360 kg

Number of carts required for transportation of the cargo per boat: 7,500 kg ÷ 360 kg 21 carts

Total number of carts required for completing transportation within 90 minutes (frequency): 21 carts = 4.3 minutes/cart

Accordingly, when landing operations are performed simultaneously for 4 boats, the number of carts required for transportation from the floating jetty to the market shall be one cart per minute based on the calculation, 90 minutes ÷ (21 carts × 4 boats) = 1.07.

Based on the calculation that it takes one minute for a cart loaded with 360 kg to pass the access jetty of about 14 m, from the bottom end of a dry Dagaa zone to CDL = 0.0 m (EL = 1132.50 m) and the gangway (about 18 m), from CDL = 0.0 m to the floating jetty totaling to 32 m at a speed of about 0.5m/second, at lest one cart is projected to constantly pass the space from the gangway and the access jetty.

At the same time, as it is impossible to maintain a fixed distance among carts coming and going and in view of congestion during busy rush hours, it is necessary to establish at least two traffic lanes (1 up lane, 1 down lane) with a width of 4 m for smooth passage of carts.

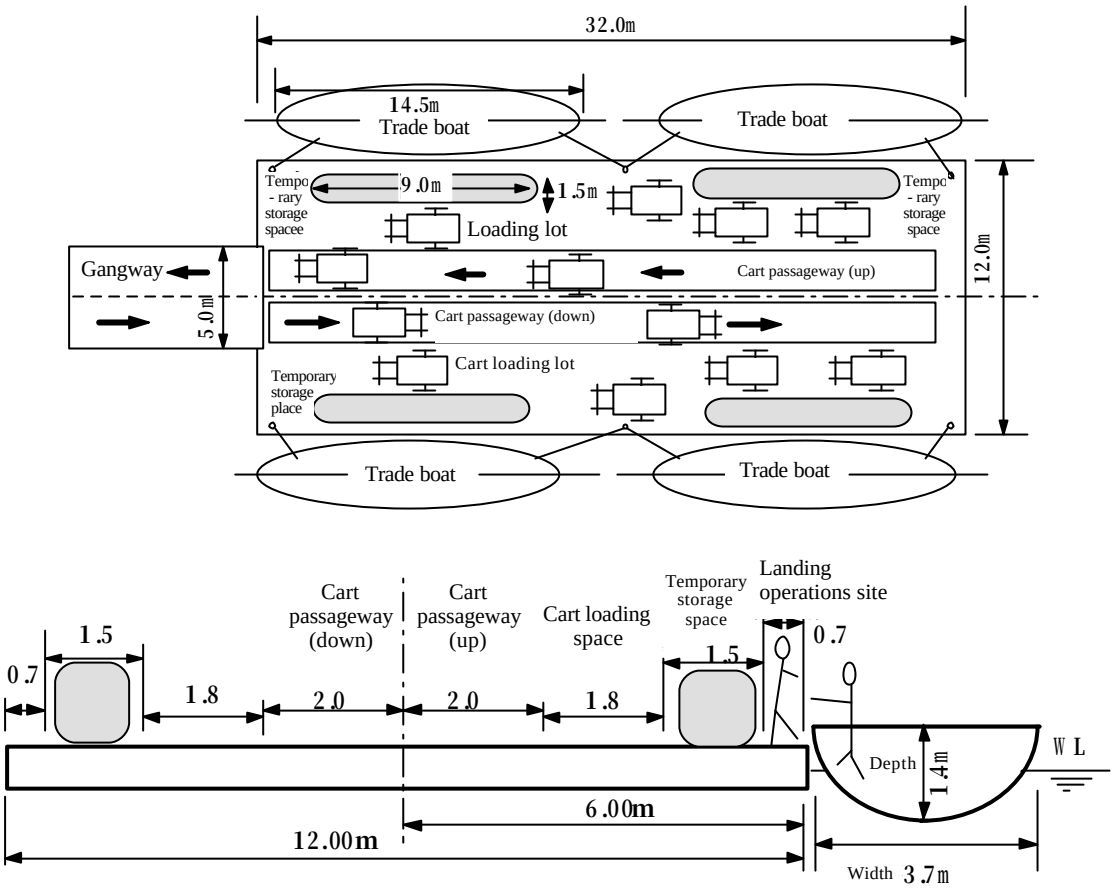


Figure 2-12 Operational Zone of the Floating Jetty

In the case the berth length of the gunwale of the floating jetty is designed at 32m, the number of standard type of trading boats, which are tied up to the shore for landing operations simultaneously shall be 4. Figure 2-18 indicates relations between the number of boats that can be accommodated simultaneously and required time for landing operations, which start at 9 o'clock in the morning. In this case, it is possible to complete landing operations for an average of 10 boats that enter the port during the 10 days around a new moon by 12:30 p.m. At the same time, it is also possible to complete landing operations for a maximum landed volume per day of about 100 tons within about 5 hours and to complete landing operations for 17 boats, the maximum number of boats entering the port per day based on the actual result of survey within about 6 hours, indicating that the scale of the floating jetty is appropriate for the number of boats entering the port and the landed quantity.

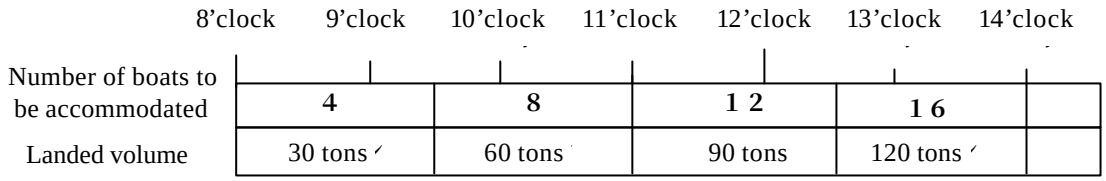


Figure 2-13 Relation between Time Necessary for Landing and Landing Quantity

The required freeboard (height above the water surface) of the floating jetty shall be set at 0.7m in consideration of a freeboard of targeted trading boats of 0.3 m - 0.8 m, an estimated regular wave height of 0.2 m (which causes no splash on landed goods), and some allowance (approximately 0.5 m) to protect goods on the jetty from waves generated by large passing vessels (ferries, etc.).

(7) Examination of Weight and Loading Weight of Floating Jetty

In the case the surface area of the floating jetty is 32 m×12 m = 384 m^2, T.P.C (tons per centimeter) displacement shall be 384 m^2×0.01 m = 3.84 ton/cm.

- Empty weight of the floating jetty = Supposing a depth of 1.0 m, the total weight of the floating jetty is about 85.0 tons (rough estimate).
- Supposing two standard boats, the maximum loading weight = 7.5 tons/per boat ×2 boats = 15.0 tons
- Weight on the gangway (one side) = about 10.0 tons (rough estimate).
- Balance load against the weight on the gangway = about 18.0 tons (to be established at the point of about 3/4 on the opposite side)
- Based on other accessories (bollard, fender, etc.) = about 10 tons, it is calculated that draught at lightweight = 114 tons÷3.84 tons/cm = 29.7 cm and draught at loaded times = 129 tons ÷ 3.84 tons/cm = 33.6 cm.

Therefore, the total height of the floating jetty shall be 0.7 m+0.29.7 m 1.0m.

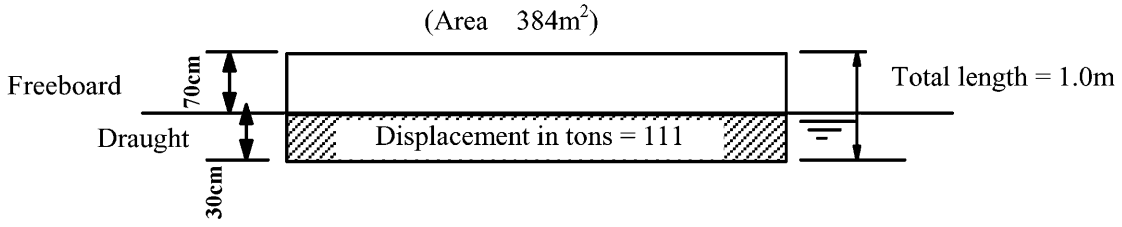


Figure 2-14 Relations between Draught of Floating Jetty and Displacement in Tons

(8) Mooring Method for Floating Jetty

There are two mooring methods for the floating jetty, namely, an anchor system for mooring by chain tied to an anchor or a heavy stone placed on the bottom of the lake and a system to fix the position of the floating jetty by studs to adapt to changing water levels up and down. Generally, a system of anchors with chain, and a system of studs with rope are adopted to rather small-scale floating jetties of a total length of less than 10m, and combination of bob weights with chain, or studs with sliding equipment are adopted to rather large-scale floating jetties.

Table 2-14 Comparison of Mooring Methods

	Chain/Anchor system	Stud system
Characteristics	• Good for deep water and soft ground • Floating jetty greatly moves horizontally where water is shallow and tide level gaps are large. • Caution is required for placement of chain and an anchor when boats travel nearby.	• Good for shallow water and where ground is not soft. • Appropriate in case horizontal shift of the floating jetty is not desirable.
Characteristics when used	• Horizontal movement is large.(especially at low water time) • Chain is hindrance to boats when getting to and leaving the shore • Easy to move • Maintenance and exchange of chain is necessary	• No horizontal shift • Studs are not hindrance to boats when getting to and leaving the shore • Difficult to move • Maintenance of sliding parts is necessary
Structural elements	Anchor and chain/spindle and chain (concrete block)	Stud and sliding equipment/stud and rove are fixed
Construction Cost index	70/100	120/100
Total evaluation	△ Not suitable	○ Suitable

A number of carts and porters, etc pass by the gangway between the floating jetty and land facilities and entire cargo handling operations are performed by manpower. Therefore, it is desirable that the floating jetty does not greatly move or sway on the water surface in order to provide stable work environment. The planned floating jetty is a rather large-scale floating jetty of 32m in total length so it is desirable to adopt either bob weights with chain system or studs with sliding equipment. Since the construction cost of a stud system would be only 1.2 times more than bob weights with a chain system, and also the location for establishment has good conditions of shallow water and ground, a stud system will be adopted for the Project.

[B]-2 Examination of Gangway

From the floating jetty to the market facilities, cargo is carried by manpower mainly using carts. For smooth transportation, it is necessary to keep the degree of gangway's inclination at low water below 1/10 at the maximum. On the other hand, the crown height of the front wall of the access jetty on the shore side should be kept at 0.5m from the high water surface. Figure 2-15 indicates relations between the floating jetty and access jetty in this case.

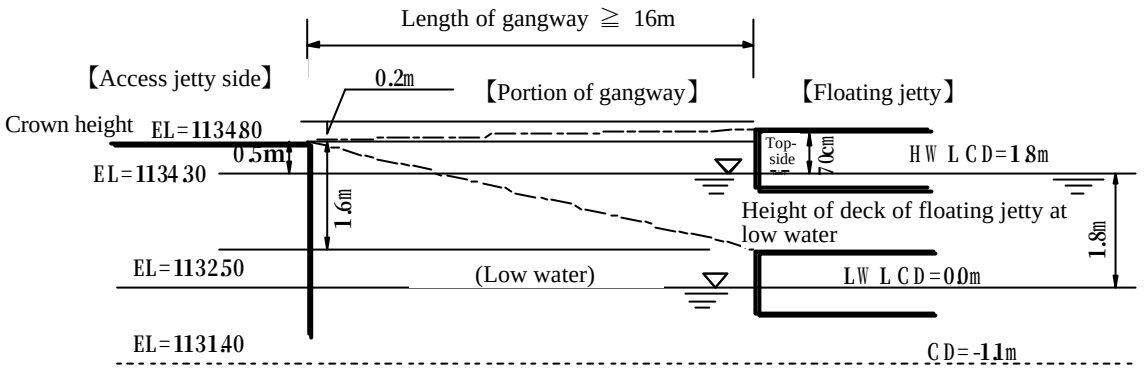


Figure 2-15 Height Relations between Access Jetty and Floating Jetty

The height of floating jetty is 20cm higher and 160cm lower than the crown height of the access jetty at high water and low water respectively. Accordingly, in order to secure the degree of inclination of the access jetty at 1/10 or below at the maximum at low water, the gangway should be at least 16m or more. Therefore, supposing the empty weight of the jetty increases by aging, the total length is planned at 18m in view of a slight extra inclination degree. The gangway shall be fixed on the side of the access jetty and equipped with rollers and flaps (floor board of moving part of the gangway) in order to secure smooth and uninterrupted floor surface.

Width of road is planned to accommodate two lanes to enable simultaneous passage of two carts and it shall be calculated by paying attention to transportation on inclined planes.

a) Width of Up Lane

Working width of cart	1.6m	1.5m~1.6m depending on kind
Required width for workers pushing from the side	0.8m	40cm x 2(both sides)
Excess width for running	0.2m	
Total	2.6m	

b) Width of Down Lane

Working width of cart	1.6m	1.5m~1.6m depending on kind
Excess width for running	0.2m	Road shoulder
Width of central reserve	0.2m	
Total	2.0m	

The total width is planned to be 5.0 m to secure 20 cm on each side for building guardrails to safeguard against tumbling.

[B]-3 Size of Access Jetty

a) Width of the access jetty is planned to be 5.0 m as the above-mentioned gangway.

b) Consideration of Structural Types

It is determined that the front part of the location for establishing the access jetty has a water depth of CDL ± 0 m and the current water level is CDL + 0.5 m and that the level is not likely to change significantly in several years. For this reason, even though underwater engineering works partially involve occurrence of rubble stone or grading armor stone, difficulty of works is considered not likely to change whatever structural form is adopted. While it is considered most suitable and economical to employ a so-called rubble mound structure composed of spread-out rubble stone to build an access jetty with a working width of 5 m and a length of about 14 m near the shoreline, it is necessary to take into consideration changes in coastal topographic features. For an access jetty connecting a floating jetty and a gangway, there are many examples of jetties with pile foundations, and this structure may be considered standard.

Cost comparison of a rubble stone structure and a pile structure differs depending on the availability of a pile driver. It is planned to conduct pile driving by spat installation and the cost is compared assuming the cost to bring in a pile driver is excluded. Other than these two structural types, base rubble stone and gravity-type revetments are available but they are not used for comparison due to inferiority in cost and building efficiency.

c) Comparison of Pile Structure and Rubble Stone Structure

Table 2-15 Comparison of Pile Structure and Rubble Mound Structure

Structural type	Pile structure	Rubble stone structure
Scale: about 14m x 5m	If a pile driver can be used, the cost would be low.	Execution can be done in a short term. Affects on coastal waters are small.
Characteristics of structure ① Tip parts ② Retaining wall attaching portion ③ Road part ④ Occurrence of reflected waves	① Because the pile structure makes subsidence low, it is suitable for bearing gangways. ② It is constructed prior to retaining wall, and retaining wall can be executed by using its sidewall. ③ Deck slab is paved so that surface smoothness is ensured. ④ Waves are transmitted and reflected waves don't occur.	① There are worrisome points such as subsidence of foundation, disaster-striking on armor stones, etc. ② Execution is to put it onto the constructed retaining wall. Subsidence of foundation, compressive subsidence of rubble stones, etc. would occur. ③ Gaps of joints, etc. occur at tip parts and attaching portions. ④ 1:1.5 inclination of armor banking also generates reflected waves.
Effects of other structures ① Retaining wall ② Floating jetty	① There are no reflected waves, and uplift of wave forces is received by deck slab. ② Combination with floating jetties is well adopted (with many examples) and it corresponds well to changes in height of the landside.	① Reflected waves hit retaining wall. Waves converge at retaining wall attaching portion. ② Some reflected waves occur at the front but their effects are small.
Landscape	It has a sense of incongruity of an artificial structure in a way, but suits to floating jetties and gangways.	Since local materials are used, it fits to surrounding environment. There is a similar structure in the same bay.
Effects on natural environment	It would not give any changes to surrounding water area.	Tidal current in the local area is small. However, it is possible sedimentation of sands occurs over a long period of time, which may affect the mooring lot of the floating jetty.
Workability	Special skills are not required	It generates rubble stone or grading armor stone in the water, making it difficult to handle on the spot.
Economy (Construction Cost index)	(Under the condition of pile hammer to be used) Direct construction cost: 95	Direct construction cost: 100
Total evaluation	◎ : Excellent	○ : Excellent but inferior to the pile structure

For these reasons, the pile structure is considered most appropriate.

[B]-4 Retaining Wall

In order to secure a drying lot for dry Dagaa, a retaining wall shall be built in between the Dagaa handling space and the shoreline to prevent waves from rising up at high water and to protect the mound at the back as well. The retaining wall shall be covered with foot protection stones to avoid possible scouring by waves at the foundation.

[B]-5 Rubble Stone Revetment

The retaining wall shall be established in between the restaurant building and the shoreline in order to prevent mounded earth and sand within the site from collapsing and to secure safety of building facilities on the premises. For river edges at the scheduled site for restaurant facilities, rubble stone (unspecified stone materials) shall be mounded and backed with earth from inside to secure the required height for the scheduled ground level. The lakeside shall be covered with cover stone to safeguard against erosion by waves.

2-2-2 Basic Plan

Comparison of requirement confirmation results from the site survey and contents of the requested Japanese assistance based on results of the site survey and work in Japan is shown in Table 2-16. Comparison of the existing fish markets and the scale and number of stalls for planned facilities is shown in Table 2-17.

(1) Requirements and Comparison of the Facility Scale and Requested Japanese Assistance Projects

Table 2-16 Comparison Between the Contents and Scale of the Request and the Project Contents

Facility Name	Contents / Scale of Request	Project	Main Reason for the Variance
Market facilities	Market building : 1,200m^2 x 2 = 2,400 m^2	Market building: 5,350m^2 x 1 note: Dagaa handling space = 2,600 m^2	Estimated from the current scale of activity
	Guard post : 10m^2 x 2	Guard post x 2	
	Gate (entrance)	Entrance (east)	
	Parking space	Loading space, traffic lane, waiting space	Place within market facilities
Management facilities	Office building : 69m^2 x1	Office x 6	A management office and a union office are judged to be needed.
	Water tank, water tower	Water tank, water tower	
	Power distribution installation	Power incoming unit, emergency power generating unit	Frequency of blackout is high
	Public toilet : 75m^2 x 1 Public toilet : 50m^2 x 1	Public toilet (east) & septic tank x 1	Integrate the 3 existing toilets into 2.
	Garbage depot x 2 spots	Garbage depot x 2 spots	
	Parking space		(Unify with the roads of market facilities)
	Septic tank	Wastewater treatment facilities for wastewater from toilet and restaurant	
Fish landing facilities	Floating jetty (25m x 15m x 2)	Floating jetty (32 x 12m) x 1 Gangway (18 x 5m) x 1	
Processing facilities	Storage : 75m^2×2 buildings	Processed fish storage, processed fish retail store	Estimated from the current scale of activity
	Working area (256 m^2)	Drying table	Estimated from the current scale of activity
	Working table : 5m x 10m	Dry-salted fish processing table	Estimated from the current scale of activity
	Public toilet : 50m^2 x 1	Public toilet (west) & septic tank x 1	
	Gate (entrance)	Gate (west)	Integrate the current scale
Restaurant facilities	Dining house : 90m^2 x 6	Dining house x 1	
	Gate (entrance)	Gate (entrance) x 2	Install in the front road side and the market side

(2) Comparison of the Existing Fish Market with the Planned Facilities in Scale and Area

Table 2-17 Comparison of Scale of Facilities and Number of Stalls

		Used area of existing fish market		Planned facilities		
Product name		No. of stalls	Area of stalls	No. of stalls	Area of stalls	Notes
Fish products	Dagaa	145	3,000m^2	100	*) 2,600m^2	*) Except for 574 m^2 of Dagaa drying space (outside)
	Dried fish	25	900m^2	25	900m^2	
	Fresh fish	10	400m^2	10	270m^2	
Farm products	Bananas	6	600m^2	6	600m^2	
	Cereals & vegetables	20	200m^2	20	250m^2	
		4	100m^2	4		
Forest products		10	900m^2	10	800m^2	
Restaurant		30	600m^2	30	*) 730m^2	*) Plot area of whole Restaurant: about 1,350 m^2
Total No. of Stalls		250	6,700m^2		6,150m^2	

Note: Unit lot area differs according to the product.

2-2-2-1 Facilities Layout and Traffic Lines Plan

Since the stalls used for Dagaa, fish products, farm products, bananas, charcoal, timber, etc. are mixed in the existing fish market, the stalls in this plan shall be clearly divided by product item. Loading of Dagaa into trucks is the most intense work so it is planned to carry products from each lot and load into trucks at a truck loading station. Also, the three current entrance gates shall be integrated into one and the course shall be one way so that the direction of truck traffic becomes clear. The standard of roads for vehicles shall be as wide as three traffic lanes so trucks can pass. The lane on the south side shall be loading space, the center lane shall be passing zone for vehicles to be parked, and the north lane shall be used for extra loading space for rush hours, and waiting or parking spaces for regular cars and carts.

The union offices that are currently dispersed at 9 spots shall be integrated into 4, 1 per management lot, and an administration management office with total management functions shall be installed. Since the management offices have administrative functions, they shall be located on land between the road in the fish market and the outside wall on the front roadside, thereby enabling market activities to be easily monitored without getting in the way of market functions. The dispersed three public toilets shall be relocated at two spots at both ends of the site.

To ensure traffic lines from the floating jetty to each stall, an open space on which carts can pass shall be secured as a Dagaa drying space which can be used for the work of re-packing bags. It is necessary to install a small-scale retaining wall because grade difference will occur between the space for drying Dagaa and the existing grade. However, there will be many trading boats moored at the sand beach after they finish landing work so routes shall be secured by partially arranging steps.

Since people must exit the market to use the existing restaurants, the direct connecting route between the market and the restaurant shall be newly established.

2-2-2-2 Building Facilities Plan

(1) Floor Plan

1) Market Building

It is planned to cover the dried Dagaa with a roof for protection from rain. Each stall area for the handling of Dagaa shall be set at 3.6m x 7.2m = 26m^2 based on the average area of existing stalls as shown in Table 3-1. In the existing fish market, Mwanza City is currently lending 145 stalls to users. According to results of the site survey, it has been confirmed that about 70% of the total stalls are actually in use. Therefore, the plan shall target 145 stalls x 0.7 = 101.5 100 stalls. As a result of this reduction of the site area, the whole area for stalls handling Dagaa will be decreased 10% from 3,000m^2 to 2,600m^2. However, because goods handling work will be possible when it rains, as was calculated in the Scale Setting space, the size of area will be enough to handle all work. In this fish market, Dagaa is handled the most so the loading space for Dagaa shall be kept close to the goods handling space.

It is necessary to protect vegetables and cereals such as rice, beans, corns and dried cassava from rain because they become damaged if wet and losses are incurred. The area for storage and sales of these products is taking up about 100m^2 in the existing fish market so it is planned to roof the same scale area. Also, it is planned to arrange a loading space for trucks on the north side of the market building and stretch eaves over the parking space for trucks and loading space in order to reduce the effect from rain during work.

To ensure efficient carriage, two-way traffic of carts shall be assumed for the width of passageways inside of the market building. As the width of an average cart's rear carrier is 1.1m and a wheel is 0.25m, the total width for a cart is 1.1m +

0.25m x 2 = 1.6m. Therefore, enough width to allow two-way passage of rear cars with an extra 0.4m for passing and Dagaa handling shall be secured.

Required width of the passageway = width of a cart (1.6m) x 2 + 0.4m = 3.6m

The passageway's structure shall not differ in grade and have a pitch less than 10%, in consideration of the transporting of heavy items.

2) Public Toilets

Public toilets is planned according to the number of toilet fixtures shown in the previous Table 2-11. The floor plan shall be to separate toilets for men and women, following the existing facilities, and to set up management windows at both entrances to collect charges. The men's urinal in the existing public toilets employ a system with an oblong ditch set along the bottom of a wall, but in this Plan, individual urinals shall be used, in consideration of maintenance, management and wastewater treatment.

3) Offices

For operation of the planned fish market, there will be stationed public offices for the Market Manager (Mwanza City Markets Section), Mwanza City Fisheries Section (3 personnel), Mwanza Region Fisheries Division (2 personnel), and Tanzania Revenue Authority (2 personnel). There will also be union representatives for organizations using the market stationed including: processing union, fish products unions (four unions), agricultural products unions (two unions) forest products union, and restaurant union.

Table 2-18 Required Number of Rooms for Offices

Name	No. of rooms	Name of related organization
Market Management Offices	4	Market Manager, Mwanza City Fisheries Section, Mwanza Region Fisheries Division, Tanzania Revenue Authority
Processing Union's Office	1	Fish Processing Union - alone
Fish Products Unions' Offices	4	Related 4 unions
Agricultural Products Union's Offices	2	Related 2 unions
Forest Products Union's Office	1	Forest Products Union - alone
Restaurant Union' Office	1	Restaurant Union - alone

The area for one room will be divided into common space for reception and secretary, and a main office. The reception and secretarial room is for 2-3 people and general work such as sorting slips, keeping accounts, etc. is done there. According to the architectural plan, area for one person in offices is 4-6m^2. However, by calculating the number of people using the reception and secretarial rooms, in this plan the smallest office area would be 8 m^2 and the largest office area would be 18 m^2, with an average of 12 m^2.

Since union chiefs or responsible personnel using the main office rooms will have many visitors for petitions and consultation, a large table and chairs will be required for each main office room. Taking this into consideration, the required area for a main office room will be about 12 m^2. Therefore, the area of each office is planned with a reception and secretarial room + a main office room = 12 m^2 + 12 m^2 = 24 m^2. Each of the existing offices is about 20-24 m^2, so the planned offices are about the same scale. Except for the processing union and forest products union offices, the main management office and other offices are planned to be located in a dangerous area next to the loading space where trucks and other vehicles will pass. Thus, entrances for those offices shall be located on the north side.

4) Dry-salted Fish Storage and Retail Store

The dry-salted fish storage needs to have capacity for storage of 28m^3 of processed products – equivalent to 4 days of production. Also, indoor space of about 3m x 4m for packing work during rain will be needed. In order to ensure workability and to prevent products absorbing moisture from the ground, shelves are planned with the first, second and third shelves set at 10cm, 0.9m and 1.6m above the floor. Storage capacity per 1m of shelves shall be 2.6 m^3. The length of the shelves is calculated to be 28 m^3 ÷ 2.6 m^3/m = 10.8 11 m. Further, to ensure packing space and passage space in the room, a building 6m x 6m will be required.

The existing dry-salted fish retail store is arranged with sellers and buyers facing each other over wooden shelf showcases. This planned facility shall utilize the same face-to-face sales style. Also, in order to allow trading activities when it rains, the facility shall be roofed. The required length of the planned frontage is 12 m and is secured by arranging product display tables in a large U shape. This fish retail store will be next to the storage, according to the layout plan, so the space between these two buildings shall be roofed to unite them together and will be used as a shelter in times of rain or as a temporary storage space for dried products.

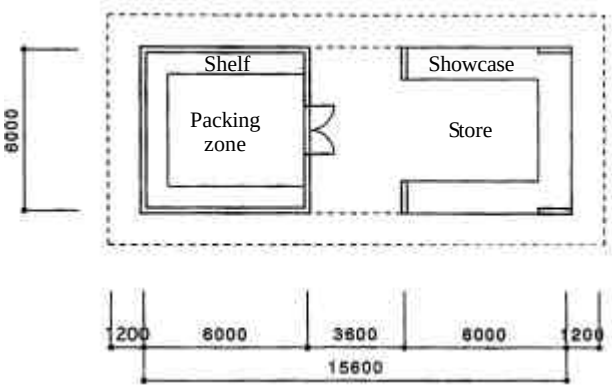


Figure 2-16 Floor Plan for Dry-salted Fish Storage and Retail Store

5) Restaurant Building

The site for the restaurant building will be surrounded with a wall on the west side and a fence on the east side. Since the roadside will be sheltered against dusty air from busy traffic, layout shall be in a patio style for the purpose of ventilation and natural lighting. Each booth shall face the inner court beyond the passageway. Dividing walls between booths are planned waist-high so that people can look around and enjoy an open atmosphere. Furthermore, because it gets so busy during lunchtime, there is plan to ensure waiting spaces where orders can be taken and people can wait for their tables. Although the existing area for one booth is 20m^2, as far as the current usage is concerned, it is overcrowded. Therefore, by arranging a sink for each lot of booths, the layout shall be planed in consideration of the necessity for ensuring safe and efficient workspaces.

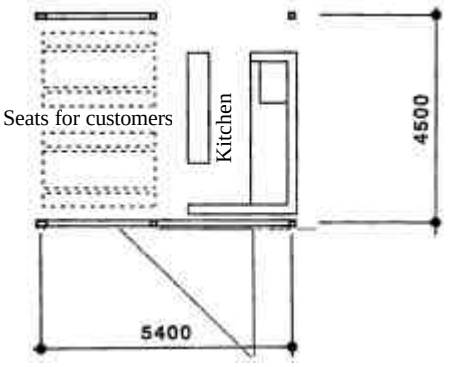


Figure 2-17 Floor Plan of One Restaurant Booth

For floor planning, a sink and working table shall be arranged at the back of a booth, and before them, a counter shall be established. The counter shall be suitable for serving and receiving meals, and will have a space below for storing dishes, etc. As for tables and chairs, those shall be the responsibility of the booth users.

6) Guard Posts

Guard posts shall be located at 2 positions – entrance and exit of loading space – in order to conduct management of vehicles that use the motor road, users, etc. Considering actual current use, it is assumed that the amount of work will be doubled because the gates will be condensed into 2. Therefore, the plan shall utilize a formation whereby 1 guard is continuously stationed and 1 guard does on-site guidance so that 1 guard post shall be divided into a continuously stationed booth and a standby booth. In the continuously stationed booth, since communication work shall be conducted via a glass window and a simple bed for nighttime duty shall be located at the back, the booth requires a depth of 2.4 m. The width requires 2.1 m for the space of the width of the bed and chair to be placed behind the counter. Therefore, the size of a continuously stationed booth shall be 2.1 m (depth) x 2.4 m (frontage). In a standby-booth lot, a guard usually sits on a chair and moves whenever necessary. Its width shall be 2.1 m, in accordance with a continuously stationed booth, and its depth shall be 1.8 m in consideration of the opening and shutting of the door. Therefore, the size of a guard post is planned to be frontage 4.2 m (2.4 m + 1.8 m) x depth 2.1 m.

7) Garbage Depots

These are required for dry garbage generated in the market. The garbage depots shall be surrounded with walls on three sides – just like the existing facility (width 10 m, depth 7 m, height 2.5 m, estimated stockpile of garbage: 10 m x 7 m x 2.5 m ÷ 2 = 87.5 90 m^3). At the existing facility, when garbage collection is delayed, garbage sometimes overflows. Also, if the pile becomes high, collection work becomes hard as well, so the height of the walls shall be lowered down to 2m. The planned garbage depots shall have capacity 30% larger than the existing facility considering that overflows sometimes happen at the existing facility. 90 m^3 x 1.3 = 117 120 m^3. Since 2 garbage depots will be placed at 2 spots, capacity of 1 garbage depot will be 60 m^3. Assuming width is 10m and depth is 6 m, capacity is calculated to be frontage 10 m x depth 6 m x height 2 m ÷ 2 places = 60 m^3.

8) Charcoal Shed

In a corner of the forestry related products space, a roofed shed dedicated only for storage of charcoal shall be established. If charcoal gets wet during rainy season, prices fall and local producers see their profits battered. Currently, an area of 80 m^2-100 m^2 is used for charcoal and stowage height ranges from 1-3 m. Although the stockpile fluctuates between 60 m^3-300 m^3 depending on stowage height, the average stockpile is about 200 m^3.

To avoid seepage of moisture from the ground, a concrete finish is planned for the floor. Capacity is planned to be 200m^3 based on the average size confirmed in the site survey. Although a stowage height of up to 3m is available for charcoal, the outer edges do not get fully loaded. So, capacity is assumed to have 5% extra room. Therefore, its area can be calculated to be 200 m^3 ÷3m= 67m^2, 67 m^2÷0.95 = 71 m^2. In accordance with the building plan, a width 6 m x 12 m = 72 m^2 is planned.

Required areas of main building facilities are shown in Table 2-19.

Table 2-19 Required Areas for Building Facilities

Facility / name of lot	Work space, name of room	Rough floor area (m^2)	Calculation details (wall, center to center)
Market building	Dagaa handling space	2,600	7.2m x 3.6m x 100 stalls
	Passageways in market building	2,760	Under roof 536m^2, Dagaa handling space 2,590m^2
	Bananas & cereals handling space	850	Under roof 250m^2
	Charcoal shed	180	Under roof 7.2m x 3.6m = 72 m^2 + concrete floor 108 m^2
	Market management offices	100	4.2m x 24.0m
	Fish products union office	100	4.2m x 24.0m
	Forestry products union office	26	3.6m x 7.2m
	Guard post (east)	9	4.2m x 2.1m
	Guard post (west)	9	4.2m x 2.1m
	Public toilets (east)	72	6.0m x 12.0m
	Dagaa drying space (outdoor)	1,410	Drying space: about 670m^2, passageways 740 m^2
	Garbage depot (east) (outdoor)	60	6.0m x 10.0m
	Garbage depot (west) (outdoor)	60	6.0m x 10.0m
	Motor road (outdoor)	2,700	
Restaurant building	Restaurant	730	4.5m x 5.4m x 30 shops
	Passageways & waiting space	520	
	Restaurant office	26	3.6m x 7.2m
Fish processing area	Processing union office	26	3.6m x 7.2m
	Processed fish storage & retail store	93	6.0m x 15.6m
	Public toilets (west)	42	6.0m x 7.0m
	Total	12,373	

(2) Section Plan

1) Section Plan of the Overall Site

The planned site is located at the bottom end of Ibanda Hill which faces south and leads down to Lake Victoria, and the front road is, compared to the contour line, slightly sloped upwards a little to the west. The inclinations of the overall site are as follows: from the front road toward the lake is about 4%, and the west side is rather steeper at 5%. The inclination of the east-west roads for vehicles is planned at about 1%, which is gentler than the front road in view of ease and safety for loading into trucks. As for the stalls within the market building, the floor shall be terraced in accordance with the site figuration. The passageways on the premises connecting these unevenly leveled stalls are planned as ramps without steps so that carts will have no trouble moving around.

A Dagaa drying space will be located at the south side of the market building and will be used extensively. If this drying space's floor level were to match the market building's floor level, the height of retaining wall would be high, linkage with the existing sand beach would be bad, and the high wall would give a feeling of oppression. Therefore, it shall be kept to a low level.

2) Section Plan of the Motor Road

Since the target vehicles that will use the road vary from regular trucks to trailers, the road shall employ a structure that will present no problems with passing or parking of those vehicles.

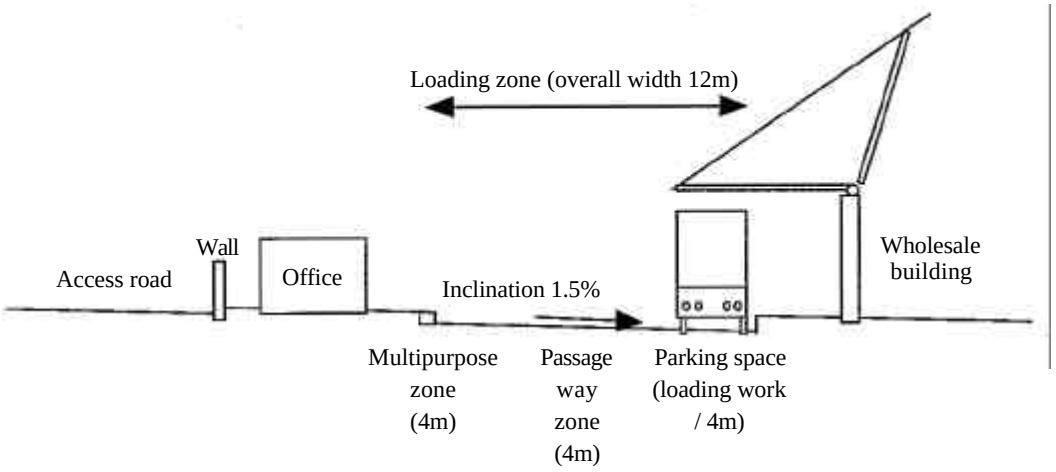


Figure 2-18 Section Conception Picture of Motor Road

As it was determined by results of the geological research that the roadbed condition is standard, assuming CBR4 or better can be obtained for roadbed design, it is planned that the thickness of the surface course (concrete plate) will be 20cm and the upper sub-base course (crushed stone) will be 25cm. As for the joints, metal gauze shall be applied at intervals of 8m along the regular part of the road. Also, reinforcements such as tie bars, etc. shall be applied around gates and loading areas, and dowel bars shall be installed around drainage ditches. Joints metal wire shall be spaced at 8 cm intervals on standard sections and reinforced with various shaped metal bars to prevent cracking.

3) Section Plan of Market Building

For the sectional plan of the market building, the highest stowage height of packed dried Dagaa in bags is assumed to be about 3-4m. As workers need to do stowage work on top of stacked Dagaa, the height up to the beams that support the roof requires at least 5m – calculated by adding the stowage height of Dagaa to an average worker height of about 1.8m.

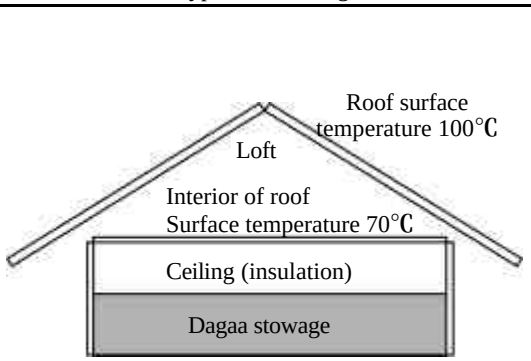
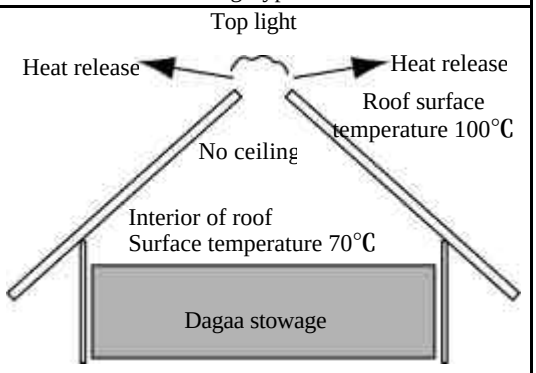
As Dagaa is stored in a dry form, high temperature and humidity generated by solar insulation in the rainy season may accelerate deterioration in quality. Therefore, it is necessary to consider a method to control natural ventilation at any time, and a method to minimize rises in temperature.

With these design conditions in mind, it is planned to make the central part of the roof high so that transfer of radiant heat can be avoided. Moreover, it is planned to establish ventilation opening at the crown of the roof, to let warm air out, providing natural ventilation in order to reduce the conduction of heat to Dagaa. It is planned to ensure a spread of natural light throughout the overall lot by having a top light at the crown instead of installing electric lighting.

① Type of Roof Frame

As to the structural type of roofs including that for the market building, it is necessary that the eaves extend low to prevent rain from blowing in during the rainy season. The two methods shown in Table 2-20 are assumed to be suitable.

Table 2-20 Comparison of Types of Roof Frame

	Interior Type with Ceiling Method	Releasing Type Method
Standard cross section		
Lighting	Needs to be installed.	Does not need to be installed.
Draft performance	Enough space has to be ensured between the top of stowage and ceiling.	Loft can be used as ventilation path
Maintenance	Electricity expense for lighting will be necessary	Basically unnecessary
Overall evaluation	△	◎

From the results of the comparison, it is decided that "Releasing Type Method" without a ceiling shall be adopted. Comparison of 10.8m (needed for the Project) roofing span forms shall be conducted for this releasing type method. If a pillar were used in the center, construction cost for this pillar would exceed construction cost for roof beams. Therefore, adopting a large roof will be more economical.

② Consideration of Roof Material

For the roof of the market building, a comparative review of galvanized sheet iron flat board and Galvanium steel plate (Al-Zn alloy plated steel plate / shingle board) that can be locally procured was carried out with consideration for maintenance, design, construction costs, etc. As a result of this comparative review, procuring Galvanium steel plate (shingle board) from neighboring country Kenya was judged advantageous when considering maintenance and price, and therefore shall be adopted as the roof material.

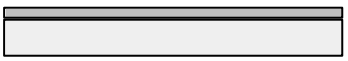
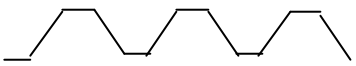
In comparison roof tile produced locally was considered and its cost is the most moderate among the three materials mentioned above. However, weight would increase by 50kg/m^2 when compared to steel materials. Additionally, with roof tile, strong scaffolding is needed on which to temporarily place tiles at the time of tiling – requiring extra temporary work. For this reason, roof tile was

removed from consideration. As for corrugated slate, it is possible to consider importing slate that does not contain asbestos from neighboring countries; however, it would be comparatively high in price in view of unit price and transportation cost (weight is threefold that of a steel roof). For these reasons corrugated slate was removed from consideration.

③ Setting of Roof Covering Method

Reviewing the characteristics of the roofing materials mentioned above, 3 possible cases have emerged for consideration: Case 1: galvanized sheet iron + roof board, Case 2: shingle board (made in Kenya, t = 0.7 mm), and Case 3: shingle board (made in Kenya, t = 0.5 mm) + roof board. As shown in Table 2-27, Case 3 "shingle board (product of Kenya, t = 0.5 mm) + roof board" shall be adopted because it would be the most advantageous type because it is equipped with the features of both other cases. With this type, roof board makes the adiabatic constant larger than the case of shingle board alone, but it is still necessary to reduce radiant heat and to ensure adequate ventilation by creating a loft space with an appropriate pitch of roof.

Table 2-21 Comparison of Roof Material Combinations

	Case 1 Galvanized sheet iron flat seam roofing	Case 2 Shingle board (Kenyan, t=0.7mm) Single use	Case 3 Shingle board (Kenyan, t=0.5mm) + roof board
Sectional structure	 GI sheet (galvanized sheet iron) t=1mm Roof board (local material) t= about 12mm	 Shingle board (galvanium) t=0.7mm	 Shingle board (galvanium) t=0.5mm + chip board 9mm
Economic efficiency	Material cost index 140 △	Material cost index 100 ◎	Material cost index 140 △
Use condition	Nothing special. ◎	At times of rain, raindrops hit surface and generate noise. △	Nothing special. ◎
Maintenance	Recoating is required every 7-8 years. △	Recoating is not necessary for about 20-30 years. ◎	Recoating is not necessary for about 20-30 years. ◎
Design requirement	Adiabatic constant is high and loft capacity can be small. ○	Adiabatic constant is small so that loft space needs to be big. △	Adiabatic constant is high and loft capacity can be small. ○
Overall evaluation	△	○	◎

④ Setting of Pitch of Roof

In the Project, air capacity for the loft space in the building span direction shall be determined by referring to the calculated air capacities of lofts in plans for the existing facilities. The result of the research on the facilities in the site survey is shown in Table 2-22.

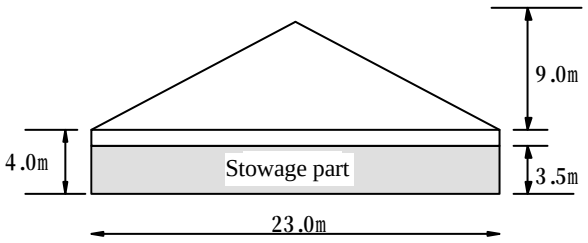
Table 2-22 Comparison of Loft Spaces at Existing Markets

Name	Mwanza Central Market (General miscellaneous goods wholesale space) Roof type: gabled roof, top light ventilating hole	Mwanza Central Market (Cereals wholesale space) Roof type: gabled roof, top light ventilating hole	Mwanza Central Market (Smoked fish) Roof type: hip roof, top light ventilating hole	Kariakua Market (Dried fish) Roof type: gabled roof, end panel ventilation
a. Building span	20m	14m	14m	30m
b. Eaves height	4m	5m	4m	5m
c. Central height	6m	8m	6m	8m
d. Average stowage height	1.5m	3m	1.5m	2.5m
e. Air capacity	$110m^3$	$84m^3$	$88m^3$	$195m^3$
f. Span average capacity	$5.5m^3/m$	$6m^3/m$	$5.5m^3/m$	$6.5m^3/m$

Note: Air capacity of e is calculated by "e = a×(b-d) + a×c×0.5". Span capacity of f is calculated by "f=e÷a".

In the existing similar markets, it was confirmed that average capacities in span direction are ensured in a range of 5.5-6.5m^2/m as shown in Table 2-22. In the Project, insulation effectiveness can be expected from the adoption of chipboard as roof board so 5.0m^2/m shall be ensured for average capacity in span direction. Based on the calculation formula shown in Figure 2-17, it is necessary to have 9m for central height to ensure this 5.0m^2/m. Pitch of roof for this case would be 38° .

- Adopted roof type:
  Type of roof: gabled roof, top light ventilating hole
  a. Building span 20m
  b. Eaves height 4m
  c. Central height 8m
  d. Average stowage height 2m
  e. Air capacity $120m^3$
  f. Span average capacity $6m^3/m$



Although the maximum stowage height is 4m, it shall be set at 3.5m by taking off the space under the eaves and above the passageways.

Figure 2-19 Capacity Under Roof

4) Section Plan of Restaurant Building

Some parts of the grade on the site submerge at times of high water and water also enters into the site from the front road. Therefore, the land shall be leveled at a ground height of +1136 m in consideration of drainage channels from the restaurant. As to the method for land leveling, instead of raising the ground level of the whole site, it is planned to leave the foundation of the existing walls and lay earth on the ground along the foundation on the inside of the site. Areas where ditches are created by this method shall be used as gutters.

In order to allow restaurants to remain open during rainy seasons, they shall be roofed. And to generate a sense of unity among the restaurants and to allow people to keep out of the rain while in passageways, the passageways shall also be roofed. In consideration of natural lighting and ventilation, the patio shall be left open.

5) Section Plan of Water Supply Building

The total annual electrical blackout time per year reaches as much as 500 hours and this sometimes results in stoppage of the public water supply. Therefore, a water-receiving tank shall be installed, water shall be pumped up to the elevated water tank, and water supply to the planned site shall be provided when needed by using water level difference. The level difference needed to supply water is generally about 10m estimated by adding the friction head at mid-flow of pipe and the required water level difference for devices such as faucets. In the Project, the setting height of the elevated water tank is planned to be 6m because faucets do not require high water pressure. The water-receiving tank shall be installed on the foundation in the basement level of the elevated water tank building, and the pump room and power receiving room is planned for the ground level.

6) Other Buildings

For the management office, toilets, processed fish products storeroom, and processed fish products retail store, local traditional methods of construction including that for one-story homes shall be adopted, and roof pitch of 21.8° shall be ensured in order to cope with rainwater leaks.

7) Section Plan of Dagaa Drying Space

The outside Dagaa drying space attached to the south side of the market building will be used for many purposes. The land of this site shall be leveled at a ground height of + 1135.00m by adding an extra 0.5m to the designed high water level of +

1133.49m. The difference of floor level against the market building on its north side shall be coped with steps, and incoming and shipping of dried products at the space are assumed to be handled by man power. However, the central part of the dried Dagaa space is planned with a smooth floor that will be connected to the passageway of the landing pier so that carts can pass through.

a) Usage of the Facility

Handling works of Dagaa (drying, sorting), and storage of shellfish are assumed to be the main purposes.

b) Problems with Current Conditions

Since the beach is a clay mixed sand beach, it gets muddy during rainy seasons. If it were left as it is, mud would be brought into the Dagaa storage and handling space that is supposed to be clean.

c) Targets for Improvement

As targets for improvement, surfaces shall be covered to prevent mud from being brought in. Also, it is planned to have no interference with the passage of carts used for products handling work.

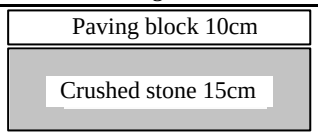
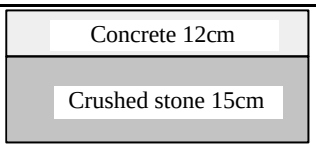
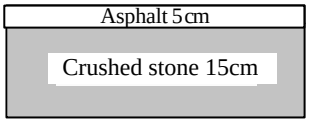
d) Evaluation Points

Based on the targets for improvement, comparative review of "paving block", "concrete pavement" and "asphalt pavement" was made with consideration for the points below.

- Economic efficiency : Allocate the initial construction costs and indicate construction costs in a cost index
- Workability : Shall be evaluated with consideration for usage
- Durability : Comparison shall be made with the view of durability as a facility and the situation of rain.
- Maintenance : Comparison shall be made with consideration for the handling of food and ease of disposal of organic material.

As results of the comparison shown in Table 2-23 show that concrete pavement is superior in all points except for maintenance, concrete pavement shall be adopted.

Table 2-23 Comparison of Ground Surface Finishes for Dagaa Drying Space

	Paving Block	Concrete Pavement	Asphalt Pavement
Standard cross section			
Economic efficiency	Construction cost index 140 △	Construction cost index 100 ○	Construction index cost 80 ◎
Workability	Because of the local execution accuracy, irregularities occur. ○	Almost perfect smoothness can be achieved to the finish. ◎	Because of the local construction method of spreading asphalt on top of crushed stone course, a small amount of irregularities occur. ○
Durability	Damaged part can be exchanged according to needs. However, paving blocks are not used so much locally. ○	No problem. ◎	Deformation etc. occurs because of heat. ○
Maintenance	There are problems such as when organic material gets into small joint niches and rots. Cleaning with a deck brush, etc. is required. △	Basically not necessary. Rinsing with water is enough. ◎	Organic material, etc. gets into the surface of the asphalt and rots. Cleaning with deck brush, etc. is required. △
Overall evaluation	○	◎	○

As an alternative, there is a method of replacing surfaces with sand. However, even though it is advantageous in terms of construction cost, it requires a long time to dry after rain and floor cleaning is difficult from a view for usability. Also, maintenance work such as replacing dirty sand is assumed to be a big burden on market users and steering organizations. Therefore, replacing sand is considered inappropriate for the outdoor facility of a food handling market.

(3) Structural Plan

As for the structural plan, standards shown in Table 2-24 shall be adopted based on the results of the site survey, etc.

Table 2-24 Design Standards Table

Item		Reference value, etc.	Note
Allowable bearing capacity of ground		Over 10ton/m^2	"Guideline for Designing Architectural Foundation Structure" from Architectural Institute of Japan
Wind pressure		q: 1640 N/m^2	Elevated water tank: 1840 N/m^2 Low-level buildings: 1430 N/m^2, design wind velocity 30 m/s
Live load		1000kg/m^2	Only for Dagaa storage, 300kg/cm^2 is for others.
Concrete	Slump	10-12cm	
	Strength	180-210kg/cm^2	
	Cement	Portland cement	Domestic brand
	Covering thickness	Standard of Architectural Institute of Japan	Thicker in water
Reinforcing steel		Same as BS	Product of South Africa is assumed
Steel frame		Same as BS	Product of South Africa is assumed
Structural wood		Compressive strength 90kg/cm^2	Standard of Architectural Institute of Japan

Note) Dagaa bag
(length 0.7m x width 1.2m, A = 0.84m^2, W= 80kg, ten-tiered, 80 x 10÷0.84 = 952 1000kg/m^2)

Because the market building will consist of continuous large spans, a steel column + steel roof truss structure will be used for each building. For the steel roof trusses, simple connections are adopted so that local workers are able to work on them. The height of the water tower is equivalent to more than a three story building and the tower needs to support heavy weight and thus will employ a steel frame, and the rest of the buildings are flat normal buildings so wooden roof trusses on top of concrete blocks will be adopted. This structure is used commonly in the region.

1) Structural Type of the Market Building

The market building will be structured with a large span, steel independent column + steel roof truss structure is adopted. Also, for steel independent columns and foundations, independent footing is installed below the independent columns and "underground beam + concrete floor" is adopted, in which the underground beam is connected only on the shorter direction (end panel direction of the building).

For general concrete buildings, the “underground beam method”, which connects footing by underground beams from four directions, is adopted. This “underground beam method” is economically advantageous compared to the method which connects the underground beams from four directions because there is no need for underground beams in the longitudinal direction. At the same time, the concrete floor slab is structurally essential for the market building because it replaces the said beams.

2) Examination of Floor Surface inside the Wholesale Building

There is no asphalt plant around Mwanza City. In the region a street pavement method is adopted by which pitch is spread over crushed stone and hardened without using commonly used composite materials manufactured in asphalt plants. Execution accuracy is not as good as when using an asphalt finisher. In the floor space within the market building, the site cross section has a grade difference, so it is necessary to plan stairs. For this reason, when asphalt is used, it is necessary to use concrete to build stairs and borders – accordingly asphalt will only be partially used.

Because application of asphalt pavement in the region is done by spreading pitch over crushed stones, it is difficult to ensure execution accuracy, resulting in a very rough finished surface. From a maintenance point of view, issues such as difficulty in cleaning arise because of the rough-finished surface and lack of accuracy. Because food products are involved, it is important to ensure ease of cleaning to keep the work environment clean. Considering the points above, as concrete is more suitable for ensuring accuracy in the finished surface and for maintenance, concrete will be adopted to cover the floor space.

Table 2-25 Comparison of Floor Covering Methods

	Concrete	Asphalt
Economic efficiency (index)	Assuming use of job mixed concrete (120)	Assuming use of small scale, local method (100)
Application	Application accuracy in mm scale is possible by use of trowel for concrete ◎	Local method cannot guarantee accuracy △
Maintenance	Cleaning is easy, using water, if dirt accumulates ○	Finished accuracy is rough and is easy to collect dirt, difficult to clean as well △
Total evaluation	◎	○

(4) Facility Planning

1) Water Supply Planning

Because water supply failure frequently occurs due to power outages, a water receiver tank will be installed to provide clean water continuously during such outages. Capacity of the water receiver tank is determined by calculating water usage in one day using the equations shown in Table 2-26.

Table 2-26 Water Receiver Tank Capacity Plan

Item	Maximum capacity		Subtotal (liter)
West side toilet	Washing basin	: 2 liter/time x 650 people/day	1,300
	Shower	: 40 liter/time x 20 people/day	800
	Toilet (U)	: 3 liter/time x 500 people/day	1,500
	Toilet (S)	: 15 liter/time x 150 people/day	2,250
East side toilet	Washing basin	: 2 liter/time x 650 people/day	1,300
	Shower	: 40 liter/time x 20 people/day	800
	Toilet (U)	: 3 liter/time x 500 people/day	1,500
	Toilet (S)	: 15 liter/time x 150 people/day	2,250
Restaurant	Cleaning dishes etc.	: 150 liter/booth x 30 booths/day	4,500
Restaurant washing basin	Washing basin	: 1 liter/time x 2,000 people/day	2,000
General cleaning	Estimated 500 liter for the market total		500
Drinking water	Estimated 200 liter among management		200
Total			18,900
Water receiver tank capacity	Rounding up		20m^3

From past experience, the necessary capacity of the elevated tank is considered to be about two hour's worth of water during active hours and is calculated at 20 m^3 / 10 hours (active hours) x 2 hours = 4 m^3.

2) Wastewater Treatment Facilities Plan

As a result of a meeting with the local management organization, wastewater generated from the planned site will be processed as shown in the Figure 2-20.

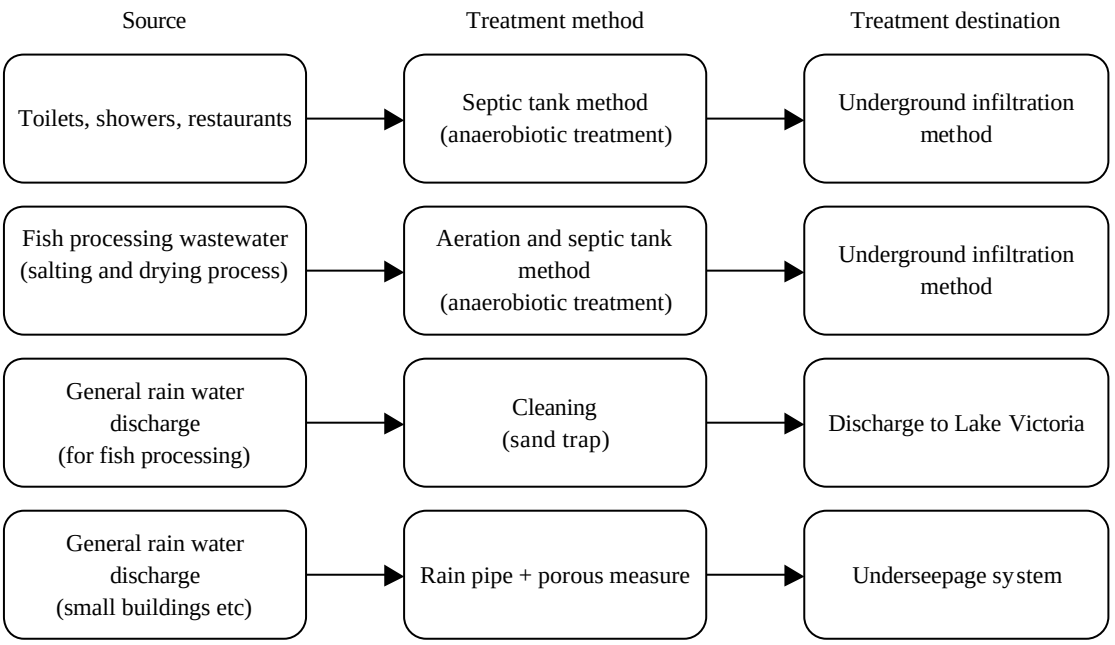


Figure 2-20 Wastewater Treatment Plan

a) Toilets

Wastewater from toilets will be processed through a septic room and soil filtering method, as suggested by Mwanza City Health Department. Capacity of the septic tank is calculated as follows.

Number of target people (n) = market area A (m^3) x 0.02 = 25000 m^3 x 0.02 = 500 people

The east side toilet is about twice as big as the west side toilet; thus the number of target people is distributed at 330 for the east side and 170 for the west side. Capacity of the septic tank is calculated by the equation $V \geqq n/10+1(m^3)$, which gives 330/10+1 = 34m^3 for the east side, and 170/10+1 = 18m^3 for the west side.

b) Restaurant Building

Washing water discharged from the restaurant building is estimated at 3 tons per day, based on the current usage of the restaurant area, and the number of users is expected to increase so the water usage rises to 30 booths x 150 liters = 4500 liters. This wastewater is, as directed by the Mwanza Health Department, filtered by basket to remove dirt, and then treated by the same method as the

toilet wastewater, shown in Figure 2-21. The number of restaurant target people is calculated as follows.

Number of target people (n) = Floor area A (m^2) x 0.55 x 0.5 = 700 x 0.55 x 0.5 = 193 people

Capacity of the septic tank is V $\geqq$ n/10+1 (m^3), and 193/10+1 = 20.5 m^3 is needed.

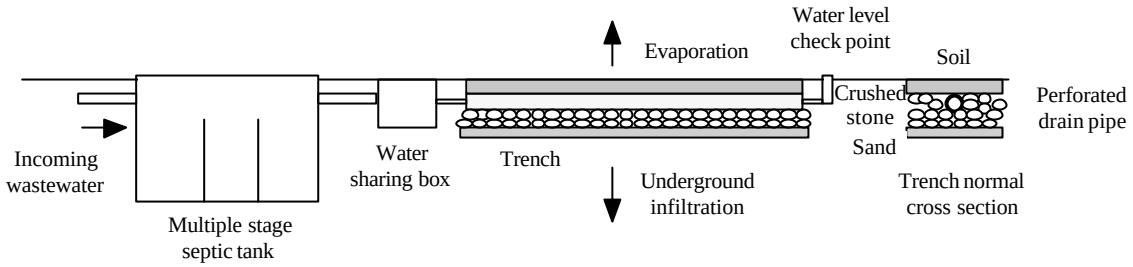


Figure 2-21 Restaurant Wastewater Treatment Process Diagram

Concerning drainage of water from the shared faucets in the restaurant facility, since the wastewater is not very concentrated and incorporating it into the septic tanks intended for the restaurant may reduce the concentration of raw water and lower the anaerobic treatment capacity, it shall be handled by the direct underground percolation method.

c) Rainwater Drainage

In the loading space, because of the height difference between the front road and the site ground elevation, street drainage water enters into the loading space. For this reason, a rainwater catch basin will be installed between the road and the loading area to prevent water from entering the site.

Further, the surface of the motor road is inclined approximately 1.5 % to the east, like the front road, and a drainage ditch will be made on the east side to process drainage. Mud holds are placed at intervals in the drainage ditch so foreign particles will settle there to be removed later. Rainwater from the roof surface is discharged similarly, and a gravel basin will be installed before draining to Lake Victoria to prevent foreign particles from entering the lake. Outlet to Lake Victoria will have a simple spillway to avoid washing away the beach during rainwater discharge. For small buildings and areas not covered by concrete, judging from the amount of rain, water is processed by ground

infiltration only. For the restaurant building, it is planned to mound from the current ground level, and the space between the existing fences and this mound will be used as a drainage way.

4) Other Drainage

a) General Drainage

Floor gradient is adjusted to direct wastewater generated from the wholesale building to flow into the outside rainwater drainage net. In the areas close to the water such as the Dagaa drying space and beach, management and maintenance such as cleaning is adequately performed, so wastewater will be discharged directly to Lake Victoria.

b) Fish Processing Area

In the fish processing area, wastewater contains salt and oil generated during salting of Nile perch, when rock salt is rubbed on, and also a small amount during drying. As this wastewater would have a negative impact on the environment if left untreated, it is planned to treat the wastewater by extraction. The treatment plan for wastewater is developed based on the amount generated from all of the processing tables. Moreover, wastewater from the Nile perch drying tables is also targeted for treatment, however, since it is expected that rainwater will infiltrate the wastewater during the rainy season, the two shall be separated according to the situation by installing a separation basin.

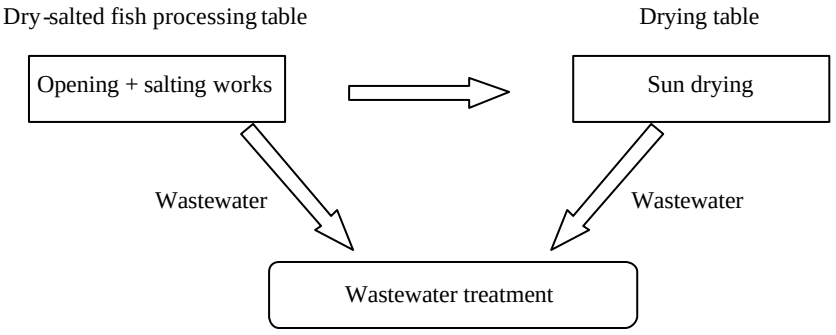


Figure 2-22 Conceptual Diagram of Treatment Method

Concerning salt content in waste fluids, it has been confirmed that processors do not use excessive salt during their work; moreover, salting is carried out frequently in small amounts during the processing stage. Therefore, it is thought

that almost all salt is absorbed into fish bodies and hardly remains at all in waste fluids. In view of this, no pre-treatment shall be carried out in particular.

Oil and fat content in the wastewater is separated using dissolved-air flotation system. This equipment generates air bubbles by applying pressure to the water to be treated, and the oil content sticks to the bubbles, separated from the water as they float.

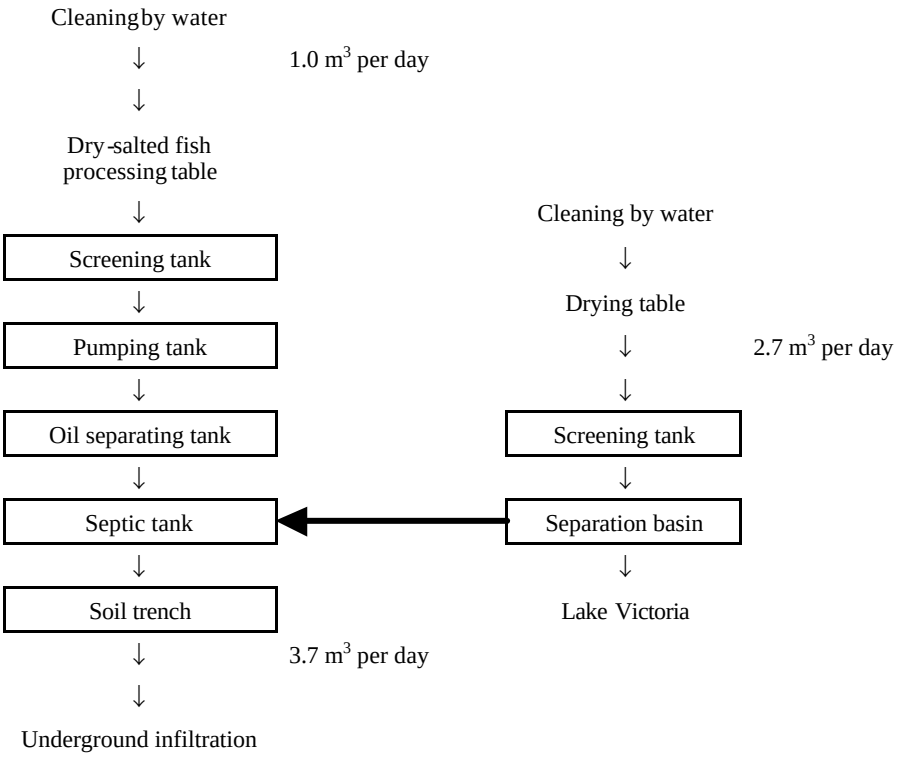


Figure 2-23 Conceptual Diagram of the Wastewater Treatment System

c) Washing Water inside the Market Building

As a facility for mainly handling dried fish, the market generally produces dry state garbage, and since there is a low possibility of floors becoming stained, brooms shall be used for routine cleaning. Concerning localized or stubborn stains, wet mops and so on will be used. However, in order to preserve the sanitary environment of the market, since it is expected that slow periods will be used to carry out wet washing too, it will be necessary to provide drainage channels.

Concerning the drainage channel plan, since the overall floor of the market building has a 1% incline going eastwards and water will only be used in small amounts when washing, small channels shall be put into the floor to collect water on the east side. Since wastewater from cleaning will arise following the wiping-up after drying, it shall be discharged into Lake Victoria as rainwater.

(5) Finishing Plan

1) Market Building

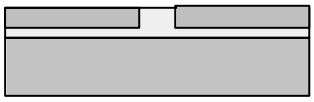
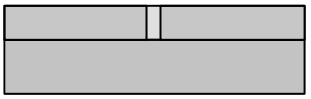
The market building is mainly used by vehicles such as trucks and carts so the facility needs to be adequately durable to withstand the use of these vehicles, and ease of cleaning and sufficient light is needed for the handling of food products. From these points, finishing as shown in Table 2-27 is planned.

Table 2-27 Table of Outside and Inside Finish (Market Building)

Section	Finish
Roof	Tile roof, wood bed Top light: wire glass
Roof truss	Steel truss
Gable, fascia board	Metal sheet, also as rain gutter
Post	AEP coating, OP coating
Base board	Mortar finish
Floor	Concrete finish + hardener, with dividing lines

For finish of the passageways built only for pedestrians, local stone patching method is adopted, based on results of the comparison analysis of methods shown in Table 2-28.

Table 2-28 Comparison of the Finishing Methods for the Passageways in the Market

	Local stone patching method	Crushed stone method	Pedestrian blocks
Standard cross section	 Local stone (chart) Mortar Crushed stone base	 Grading crushed stone	 Pedestrian block
Application index	130	100	200
Durability	Adequate for normal use, although cracks occur between stones and mortar.	Supplement is necessary due to mud splashes during the rainy season and surface is disturbed.	Adequate
Maintenance	Not necessary	Necessary	Not necessary
Evaluation	◎	△	○

2) Other Buildings

For the finish of the buildings other than the market building, considering the frequency of use and the users of the facilities, it is adequate to have the same level of finish commonly used on local buildings and similar existing structures. Finishing is planned based on these methods.

Table 2-29 Table of Outside Finish (General buildings such as offices and toilets)

Section	Finish
Roof	Metal sheet roof, wood base
Roof truss	Wooden simple truss
Gable, fascia board	Narrow board finish
Outside walls	AEP coating, mortar finish, concrete block base
Post, beam	AEP coating, concrete base
Outside door	Wooden door, CWP finish, with anti-theft lattice door
Outside fixtures	Glass louver, wire screen, lattice
Base board	Mortar finish

Table 2-30 Table of Inside Finish (Offices and toilets, etc.)

Room	Floor	Baseboard	Wall	Ceiling
General office	Terrazzo tile	AEP coating	Mortar substrate, AEP coating	Cement boarding substrate, AEP coating
Restroom	Tiling	Tiling	Tiling	Cement boarding substrate, AEP coating
Shower	Tiling	Tiling	Tiling	Cement boarding substrate, AEP coating
Toilet	Tiling	Tiling	Tiling	Cement boarding substrate, AEP coating
Guard post	Terrazzo tile	AEP coating	Mortar substrate, AEP coating	Cement boarding substrate, AEP coating
Processed products storage	Exposed concrete	Mortar finishing	Mortar finishing	Open loft

(6) Incidental Facilities Plan

1) Fish Drying Tables and Fish Processing Tables

The existing drying tables are made by placing simple wooden tables on the ground. During drying, fluid drips down from the fish onto the ground, causing foul odors. To avoid this, a concrete floor will be installed in the Project to allow frequent washing of drying tables with water. Structurally, posts are made of concrete, to match the floor, and a horizontal board is placed through the posts and

edge of round wood is used to form a simple duckboard, based on the existing method. The floor surface including the space below drying table will have a concrete finish for easy drainage and cleaning. Fish processing tables will be of a type that allows work from both sides of the table, and have a cross sectional shape for both opening of fish and salting activities. Waste fluid generated on the tables will be directed to a special discharging pipe from the edge of the tables by raising the center of the tables and making a narrow cut on the front side. The fluid in the pipe is then connected to the wastewater treatment system. Material for the fish processing tables could be metal, but concrete will be used, judging from economical and maintenance point of view. To smooth out the surface, grinding finish is applied to the concrete of the top surface where the fish will be processed. Depth of the processing tables is set at 70cm x 2 = 140 cm to allow face-to-face work.

2) Electric Installation

Power distribution in this facility will be directed from the aerial power line on the front road, and a power switchboard will be located on the ground floor of the water tower. Distribution of electricity to each space will be provided by underground power cable to prevent interference in the market with activities such as the loading of wood products. Moreover, since it is planned to install security lighting inside the market at the expense of the local side, a power line connection box shall be installed inside the market to make these connections possible.

a) Comparison of Overhead and Underground Power Lines:

Summary of comparison between the characteristics of underground and overhead wiring in Tanzania is shown in Table 2-31. "Underground burying" and "Overhead" is compared over several factors including durability, maintenance, view/space efficiency, and construction index. Both methods are similar in terms of construction index, but due to its superior performance in terms of durability and maintenance, the underground burying method will be adopted.

Table 2-31 Comparison of Construction Methods for Electric Wiring

	Underground burying	Overhead
Durability	Not affected by wind, sun, and corrosion as wiring is buried underground ◎	Not adequate for areas with strong wind or possible corrosion from salt damage etc. ○
Maintenance	Only requires basic checks such as electric leakage, and maintenance is easy with no high work required. ◎	Frequent maintenance checks of the overhead wiring at height are necessary. ○
View/space efficiency	Visually unobtrusive as buried underground. ◎	Both visual and spatial constraints are caused by power posts and wiring. △
Construction index	100	100
Evaluation	◎	○

b) Power Receiving Capacity

Amount of electricity used in the market is calculated in the Table 2-32.

Table 2-32 Calculation of Power Capacity

Item	Type	Total wattage	Load factor (D.F.)	Required capacity
Lighting fixtures	Single phase	2,920 W	@ D.F.0.80	2,336 W
Outside lamps	Single phase	1,070 W	@ D.F.1.00	1,070 W
Power outlet	Single phase	7,080 W	@ D.F.0.3	2,124 W
Pumps	Triple phase	3,000 W	@ D.F.0.50	1,500 W
Processing zone wastewater treatment facility	Triple phase	1,250 W	@ D.F.0.80	1,000 W
Total		15,320 W		8,030 W
Receiving volume (ratio delay is set at 20%)				9,636 W

c) Emergency Power Generator

Because of frequent power outages, an emergency power generator will be installed. Capacity of the generator is determined based on the necessary volume shown in the Table 2-32.

2-2-2-3 Civil Engineering Plan

(1) Overall Plan

The target facilities for civil works requiring design include ① retaining walls, ② rubble mound type sloping revetments, ③ access jetty, ④ gangway, and ⑤ floating jetty. Table 2-33 summarize the information for design conditions.

Table 2-33 Design Conditions for Civil Facilities

	Item	Design value	Remarks
Natural conditions	Water level	High water level (HWL) = CDL + 1.80m=EL1134.30m Mean water level (MWL) = CDL + 0.90m=EL 1133.40m Low water level (LWL) = CDL±0.00m =EL1132.50m Water level at the time of site survey on March,2003. = CDL +0.57m= EL 1133.07m	Based on data provided by the Entebbe water level observation station and water level observation records at the Mwanza South-Port.
	Tidal current (direction and velocity)	(Not subject to consideration)	Actual observation during the survey period
	Littoral drift	(Not subject to consideration)	Actual observation during the survey period
	Wave height (Calmness) (Design wave height for)	30cm or below (99.6%) Significant wave height $H_{1/3}$ = 0.95m, Period of waves $T_{1/3}$ = 2.9 seconds	Based on S-M-B method
	Earthquakes	Kh = 0.05 (1/20)	
Geological conditions	Surface soil	N value: Average 10 (range 5~25) Depth 0~0.5m	Silty sand
	Surface layer	N value: Average 10 (range 5~25) Depth 0.5~5.5m	Silty sand
	Middle layer	N value: Average 15 (range 10~25) Depth 5.5~10.0m	Cohesive soil
	Base layer	N value: Average 15 (range 10~25) Depth 10.0~15.0m	Cohesive soil

The water depth at the proposed site for the floating jetty is 3.3m at high water and 1.5m at low water. The wavelength is L=12.3m at high water (water depth: 3.3m) and L= 9.8m at low water (water depth: 1.5m).

Calmness at the proposed site was estimated analyzing wave hind-casting based on the wind data of two times at 6:00 and 12:00 each day from 1996 to 2002. The frequency of wave height at the proposed site is shown in Table 2-34, and the frequency of wave height less 30cm is 99.64% (364 days a year). The target trading boats to use mooring facilities are able to moor for loading and unloading cargoes at a wave height of less than 30cm and the workability rate for target boats is 99.64% (364 days a year).

Table 2-34 Wave Height Frequency in the Proposed Site

Wave height Wind velocity Year	Calm	10cm or below	10～20cm	20～30cm	30cm or more	Total	Reference
	270-180 Direction	Below 4 knots	5 knots – 8 knots	9 knots – 13 knots	Over 14 knots		
1996	578	6	15	9	1	609	11•12 non
1997	697	10	15	7	1	730	
1998	678	8	13	29	1	730	
1999	695	3	9	18	4	729	
2000	692	3	10	24	3	732	
2001	707	2	9	10	1	729	
2002	682	1	13	27	7	730	
Total	4729	33	84	124	18	4989	
%	94.79	0.66	1.68	2.49	0.36	100.00	

(2) Facilities Plan

1) Access Jetty

a) Design conditions

① Height description: Access jetty is a marine facility to be used as a transportation route for commodities and passengers and the height is described in Chart Datum Level (CDL). This is provided, however, that land facilities are described in elevation level (EL), and that the crown height of the jetty on the waterfront side is described in both EL and CDL. Relations between EL and CDL are as follows:

Elevation level (EL) m = 1,132.5m + CDL

② Loads : Surcharge of 0.3 ton/m^2 shall be equally distributed on deck

③ Position of jetty head: The floating jetty is designed for loading and unloading from boats, and the water depth in front of the mooring berths designated working basin shall be kept at the design depth (CDL1.1m) or more. When the water depth on the landside of the floating jetty is 1.1m (CDL－1.1m), it takes the length of the access jetty and gangway to minimize. The length of the gangway is planned as 18m length (L=18m). Then, the position of access jetty head is determined.

④ The width of the access jetty: Based on an examination of the actual dynamic state of transportation operations by porters and carts, the total

width shall be designed at 5.0m, by multiplying by 2 the width of one lane 2.5m (+ clearance), giving two lanes.

b) Selection of Structural Types

It has been determined that water depth at the position of access jetty head is approximately CDL ± 0 m and the current water level is CDL+0.5 to + 0.6 m. The water level is not likely to change greatly over the next few years. For this reason, underwater works to spread rubble stone or grade armor stone are few, and there is little difference between the various structural types regarding the easiness of execution. While a rubble stone type groin is suitable and economical, a small access jetty with width of 5 m and length of about 10 to 15 m shall be constructed near the shoreline. Changes in coastal topographic features shall be taken into consideration. There are many examples for an access jetty connecting floating jetty through a gangway. An open-type jetty on vertical piles is the most popular and common structural types in and out of Japan.

Comparison between the rubble-mound type groin and an open-type jetty on vertical piles shows a little difference in construction cost because of the small scale. However, the execution of rubble mound type groin needs divers with high-skills of mason works. The mooring basin, in particular, is determined as the water depth without dredging. Therefore, any shoaling caused by littoral drift and siltation is not permissible. The rubble stone, in general, functions as a groin (it leads to accretion). Even though currents are small, sedimentation of sand may occur over a long period of time. An open-type jetty on vertical piles does not affect the surrounding water environment to change. This type is dependable as an abutment (bridge pier) for the gangway. The open type structure is more recommendable than other types.

d) Structural Design

① Scale of Access Jetty

Dimensions : Length: 14.3m, Width: 5m

Structural type : An open-type jetty on vertical piles (Reinforced concrete deck structure with steel pile foundation)

Jetty head : RC dolphin type

Land side : concrete gravity type abutment.

Design height	:	Crown height of jetty head	EL1134.6 m (CDL + 2.1 m)
		Crown height of land side	EL1134.9 m
		Inclination	2%

② External Force Conditions

Surcharge on deck : 0.3 ton/m^2 affects the entire deck.

Uplift : P = 2w$\mathbf{O}$H = 2 x 1.0 x 0.95 = 1.9 ton/m^2

e) Attention to execution works

After the abutment concrete for open type jetty is first constructed, retaining walls shall be connected on the sidewalls.

2) Retaining Walls

a) Design Conditions

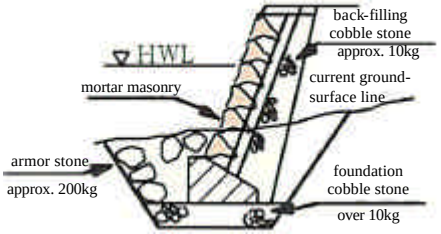
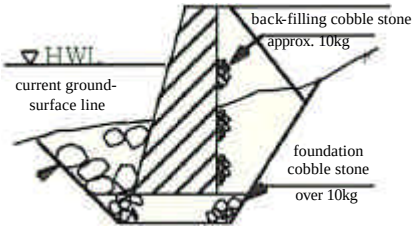
Retaining walls shall be constructed on the beach side of the Dagaa drying lot. There is a little difference in the ground level of the construction site but the plan is made for a location of EL1133.7m. The formation height of the Dagaa drying lot is projected at EL1134.9m and retaining walls shall be constructed with a vertical gap of about 1.2m to protect the filling area. For the purpose of efficiently utilizing limited usable ground area, this structure excludes a gabion with a gentle slope inclination, etc. Also, in light of the fact the water level reaches around the top part of the wall at high water, the retaining wall should employ a structure type that prevents the back filling from scouring by waves. As the water level reaches a higher position of the retaining walls at the terms of high water level, embedded length should be taken by 50cm below the existing ground level.

b) Selection of Structural Type

As the water level is always on the wall surface at the terms of high water level, structural type shore revetments should be applied.. An inclined retaining wall is more economical but concrete retaining walls of inclined type needs to lean on material. However, as the project site is banking area, structure of inclined type is not suitable. By comparing stone filling concrete type and gravity type concrete revetments, gravity type concrete revetments are slightly more expensive than stone type. However gravity type prevails for easiness of

execution, safe working schedule, quality management and durability. Gravity type concrete revetments shall be adopted here.

Table 2-35 Comparison of Retaining Wall Structures

Structure	Stone filling concrete type Retaining wall of	Concrete retaining wall
Type	Leaning retaining wall	Gravity type retaining wall
		
Quantity Concrete Back filling cobblestone Base cobblestone	 0.4 x 1.7 + 0.2 x 0.8 = 0.84 (0.2 + 0.37) x 0.5 x 1.7 = 0.48 (1.6 + 2.1) x 0.5 x 0.3 = 0.56	 (0.4 + 0.9) x 0.5 x 1.7 = 1.11 (0.2 + 0.37) x 0.5 x 1.7 = 0.48 (1.5 + 2.7) x 0.5 x 0.6 = 1.26
Construction cost	100	(0.32 x 0.5 + 1.25 x 0.2) = 105
Workability	There are a number of stones on the site. Although this is a kind of leaning retaining wall, masonry is carried out one level at a time so that it is possible to implement mounding, back filling and stone masonry one by one.	Use of a large volume of concrete is disadvantageous. Range of implementation is large including floor digging, requiring a large volume of construction. Implementation is speedy. Labor saving type.
Execution time	Take a lot of time △	Execution schedule is speedy ◎
Overall evaluation	○	◎

d) Structural Plan

The height of the retaining wall including embedded length is less than 2m so the slope inclination should be ten by three (1:0.3). Base rubble stone to be used should be 10kg to 20kg a piece to prevent scouring from the base materials.

For refilling the front part of retaining walls, armor stone of about 200kg should be used.

3) Rubble Stone Revetments on the Waterfront of the Restaurant Area

a) Design Conditions

The water depth in front of the restaurant area is approximately CDL±0.0**m**. Water depth at the time of the site survey in March 2003 was CDL +0.5 m. The designed high water level was CDL+1.8m and thus, the water depth of the revetment at high water level comes to 1.8m. The crown height of the revetments is +1136m (CDL +3.5m) and it is 70cm higher than the high water level. As 99.6% calmness is secured at the site, parapet facilities against wave overtopping are deemed to be unnecessary. Since wall height is low at 2.5 m above the ground and it is forecast that water level during the works will not be very different from that during the survey, wall height underwater will be no more than 1 m. Accordingly, the wall structure will be limited to either [Rubble mound type sloping revetment] or [In-situ concrete type composite revetment], where movement of rubble mound is restrained by the armor stone.. The size of armor stone shall be determined by the Hudson formula.

Necessary weight of armor stone

$$W = \frac{\gamma r \cdot H^3}{Kd(Sr-1)^3 \cdot \cot \alpha}$$

Here, γr : Unit weight in the air of rubble stone 2.6 t/m^3

H : Wave height to be used for designing calculation $H_{1/3}$ = 0.95 m

Kd : Kd value

Natural stone (smooth-surfaced stone) Kd=2.1

Sr : Ratio of rubble stone in water 2.6 t/m^3

W=2.6x0.95^3 / 1.5^3(2.6-1)$^{3-}$ = 2.23 / 2.1x 4.1 x 1.5 = 173kg < 200kg

200kg rubble stone will be used for armor stone.

b) Comparison of Structural Types

Figure 2-36 shows comparison of rubble mound type sloping revetments and in-situ concrete type composite

Table 2-36 Comparison of Revetments

		Rubble mound type sloping revetments	In-situ concrete type composite revetments
Material Used (per section)	Stone material Concrete Evaluation	13m^3 Rather many Non Stone material; To be produced locally ◎	7m^3 Base part 1.1m^3 Mold form on both sides Cement procurement possible ○
Construction cost (index)	Direct construction cost (per section)	100 – 120 ◎	110 – 130 ○
Wave overtopping	Overtopping waves, splash	To design the crown height 40cm higher above the finished ground. ○	The finished ground and the crown height are the same. Perpendicular groin ○
View from the lake surface		Good with natural stone all over. ◎	Concrete gives an impression of artificialness. ○
Structural credibility		The maximum size of rubble stone is the same as armor stone. Sucking out of stone unlikely. ◎	Upper part employs cast-in-place concrete. Unlike blocks, partial changes do not occur. ◎

Although there is no decisive difference between either type, the rubble mound type sloping revetments will be adopted for simple construction work and cost.

c) Structuring Plan

Crown height : EL 1136 m (CDL + 3.5**m**)

Crown width : 1.0 m

Rubble stone : 10 kg - 200 kg rubble stone; Front inclination 1: 1.5; Inclination at the back 1:1.2

Armor stone : About 200 kg rubble stone will be used. Standard thickness is 40cm.

4) Gangway

a) Material and Structure of Gangway

Gangway is designed to have half (1/2) of its weight supported by a floating jetty that is floating on the water. Thus, if its supporting point is away from the center of gravity of the floating jetty, trim momentum occurs and the floating jetty will tilt.

The center of gravity of a boxed type floating jetty is located at the center of its length and width and assuming the supporting point of the gangway is at the middle of the length, the length of the gangway should be extremely long or the overhanging portion of the access jetty should be very long. In this case, half of the working area of half of the length of the floating jetty will become dead space, hampering cargo-handling operations. Accordingly, it is necessary to make the supporting point of the gangway at the end of the floating jetty. In this case in order to stop inclination of the floating jetty, it is necessary to shape the underwater portion of the floating jetty asymmetrically against the inclined axis to give anti-trim momentum from the beginning or to make it a simple box shape to load ballast. Therefore, it is desirable that the gangway be as light as possible.

Materials for the gangway may be wood, steel, light alloy (aluminum base alloy), concrete, FRP, etc. Their respective physical characteristics are as follows:

Name	Specific gravity	Strength of tension /compression	Young's modulus
Wood	0.8	(About) 500 Kg/cm^2	0.1×10^6 Kg/cm^2
Steel	7.85	4100 Kg/cm^2	2.1×10^6 Kg/cm^2
Light alloy	2.7	2000 Kg/cm^2	0.7×10^6 Kg/cm^2
Concrete	2.3	500 Kg/cm^2	0.25×10^6 Kg/cm^2
FRP	1.6	1200 Kg/cm^2	0.14×10^6 Kg/cm^2

Supposing a gangway is a beam, it may be subject to flexural stress caused by its own weight or loading weight, and it may deflect as a result of compression from above and tension from below. The stress and deflection generated by such compression or tension may be calculated from the size and physical characteristics of the respective material – strength of tension or compression and Young's modulus. Comparisons of weight of each material having the same strength and the same amount of deflection based on the above-mentioned characteristics are as follows:

Name	Weight having the same strength as steel when steel is measured as 1	Weight having the same deflection as steel when steel is measured as 1
Wood	0.84	2.10
Steel	1.00	1.00
Light alloy	0.71	1.03
Concrete	2.40	2.46
FRP	0.69	3.05

Based on the examination of strength of respective material and considering that the material should be lightweight, easy to build, reasonably priced and easy to procure, and easy to maintain and control, steel is considered most appropriate. Accordingly, steel will be used for the longitudinal strength members of the gangway.

b) Structural Plan

It is desirable that the gangway be simple in structure because a complex structure and precise work would require a high level of skill, possibly causing errors in work on the site. The simplest structure consists of a piece of gangway footplate, while the most complex structure is a truss system to support the lengthwise bending momentum with combined pillars. A single board type is not good at all for heavily loaded large structures. While it is possible to minimize the weight of a truss system, it requires an extremely large amount of material, welding parts and a high level of welding skill. Therefore, the truss system is not suitable for local production. A common method for augmenting the defects of these two systems is to place web frame lengthwise but the Project will adopt a system of connecting longitudinal framings with steel angle horizontally attached on the upper and lower parts of steel plates which compose the overall structure. With this system, construction is comparatively simple and it is possible to efficiently gain moment of inertia of sections to restrain deflections of the gangway. The deck part adopts thick wood as an interior material for the upper parts of the above-mentioned longitudinal framings, to reduce weight and to realize usability and assisting movement of men and carts.

5) Floating Jetty

a) Structural Plan

There are two structuring systems for floating jetty, namely, a combined type composed of several units, and a monolithic type composed with one floating portion. A combined system makes level gaps in the surface of each floating unit and is good for passengers getting on and off as well as loading and unloading small cargoes. Therefore, it is adopted for floating jetties for small-sized pleasure boats, recreational fishing boats, etc. A monolithic system is adopted in cases where a large volume of landing and delivery operations are performed on the floating jetty and vehicles such as carts are involved. Under the Project, in light of the large volume of cargo to be handled both in bulk and

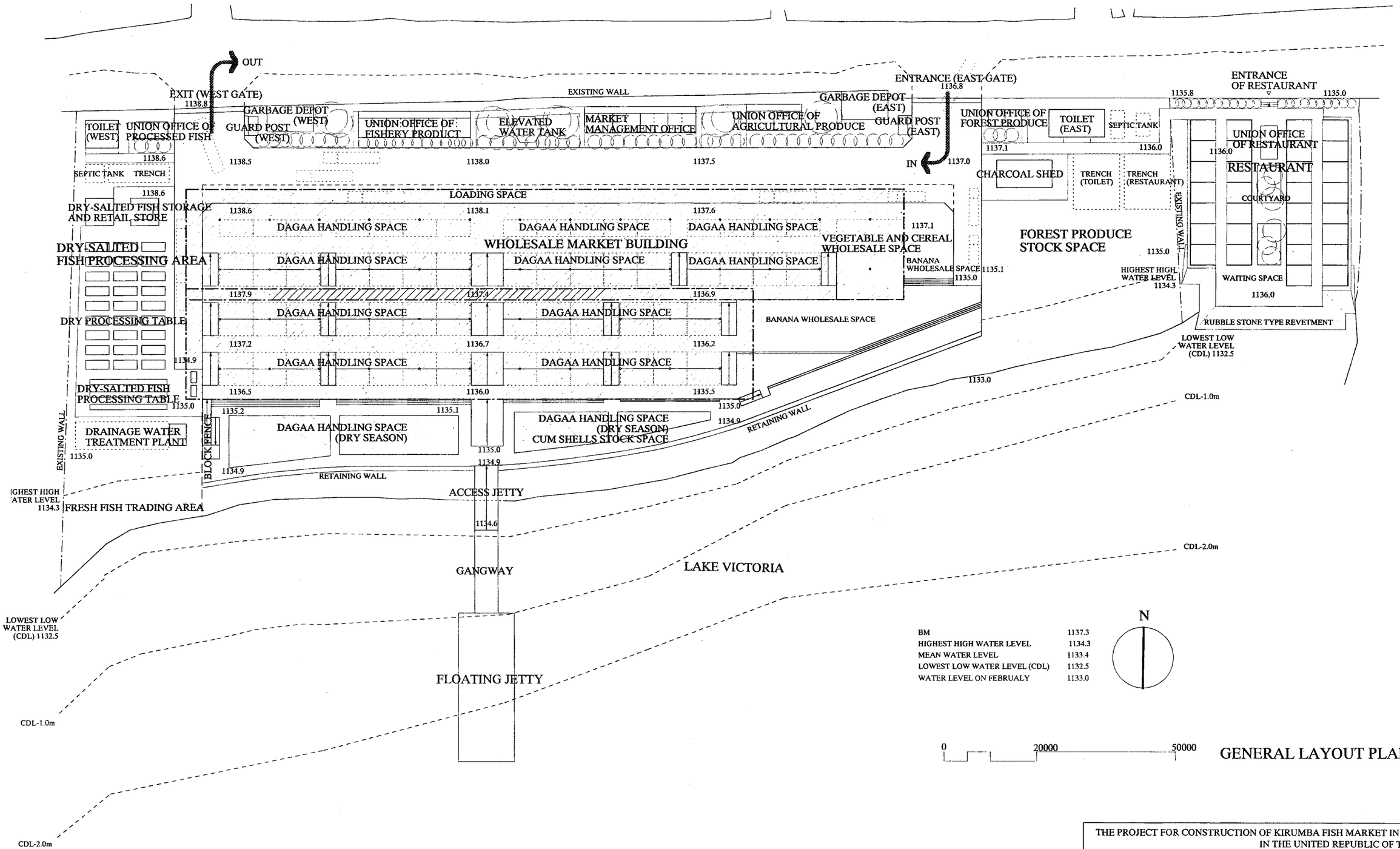
weight, a monolithic system will be adopted in order to secure space for smooth and safe operations.

A floating jetty made with a monolithic system is called a barge type and is generally simply shaped like a box for easy design and build. As the Project does not require specialized function, equipment, or strength, etc., it is planned to build a box type floating jetty with watertight deck.

The main floating body shall adopt a longitudinal framing system for the deck and the bottom and the sidewall shall use a transverse framing system, as the depth is shallow. A bulkhead shall be installed along the center line of the floating body; the bottom and the deck shall have transverse strength from the web framing and the structure shall be simple. The inside of the main floating body shall be equipped with a watertight bulkhead to secure sufficient buoyancy during accidental water immersions and a necessary number of watertight manholes shall be installed on the bulkhead and deck.

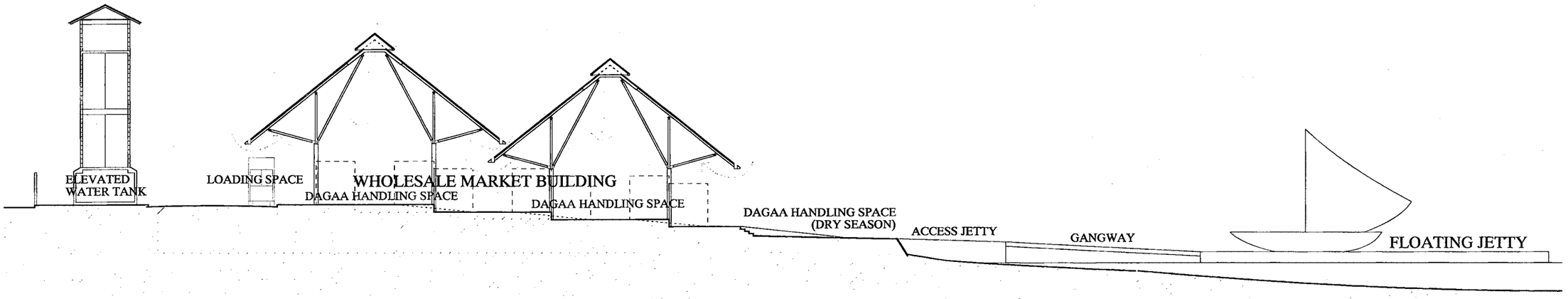
2-2-3 Basic Design Drawings

	DRAWING NAME
A-01	GENERAL LAYOUT PLAN
A-02	SECTION OF PROJECT SITE
A-03	FLOOR PLAN OF WHOLESALE MARKET BUILDING
A-04	SECT1ON OF WHOLESALE MARKET BUILDING
A-05	OFFICE BUILDING TYPE-1, FLOOR PLAN, ELEVATION AND SECTHON
A-06	OFFICE BUILDING TYPE-2, FLOOR PLAN, ELEVATION AND SECTHON
A-07	TOILET, FLOOR PLAN, ELEVATION AND SECTION
A-08	DRY SALTED FISH STORAGE AND RETAIL STORE
A-09	RESTAURANT, FLOOR PLAN
A-10	RESTAURANT, ELEVAT1ON AND SECT1ON
A-1l	ELEVATED WATER TANL CHARCOAL SHED, MACHINE ROOM, FLOOR PLAN, ELEVATION AND SECTION
C-l	FLOATING JETTY, GANGWAY, ACCESS JETTY, PLANE AND SECT1ON
C-2	RETAINING WALL AND RUBBLE STONE TYPE REVETMENT
C-3	GENERAL LAYOUT PLAN OF FLOATING JETTY AND GANGWAY



GENERAL LAYOUT PLAN 1:800

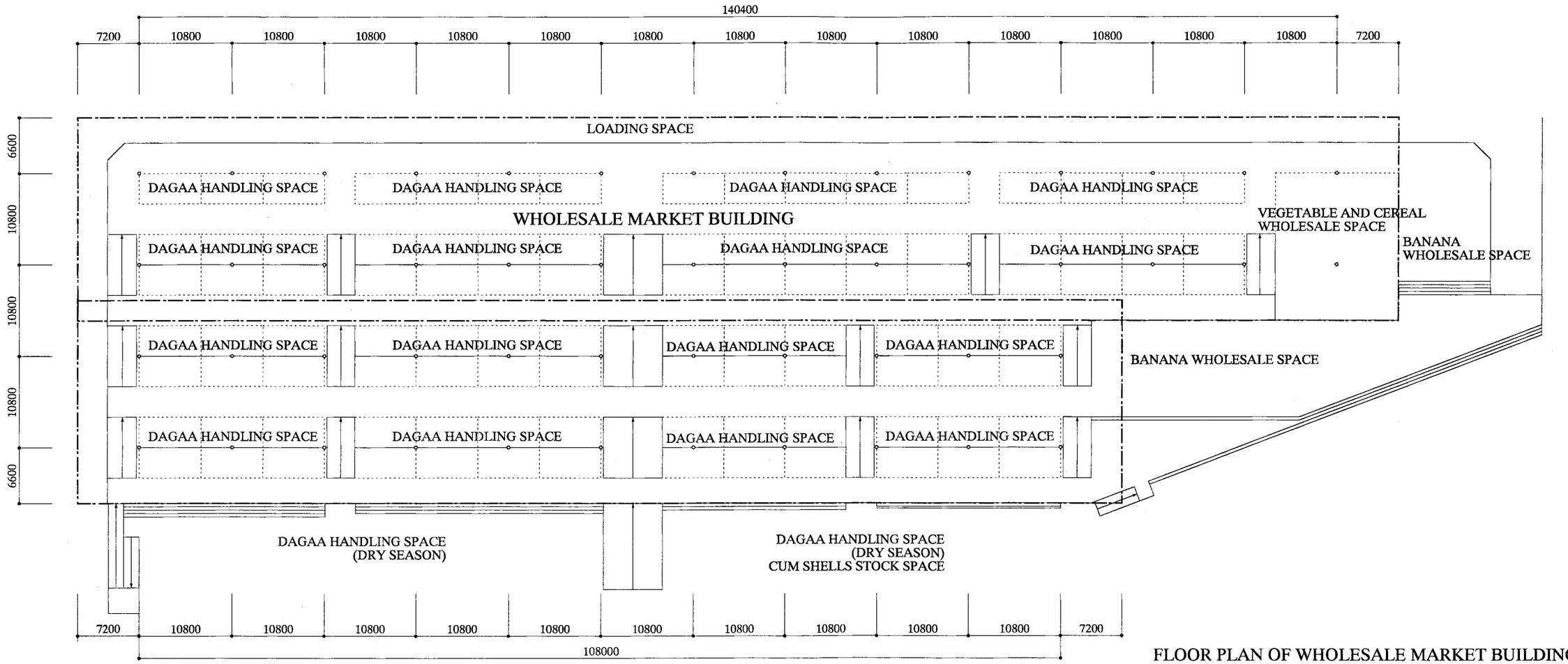
THE PROJECT FOR CONSTRUCTION OF KIRUMBA FISH MARKET IN MWANZA IN THE UNITED REPUBLIC OF TANZANIA		
GENERAL LAYOUT PLAN	Scale 1/800	A-01
	Date	



SECTION OF PROJECT SITE 1:400

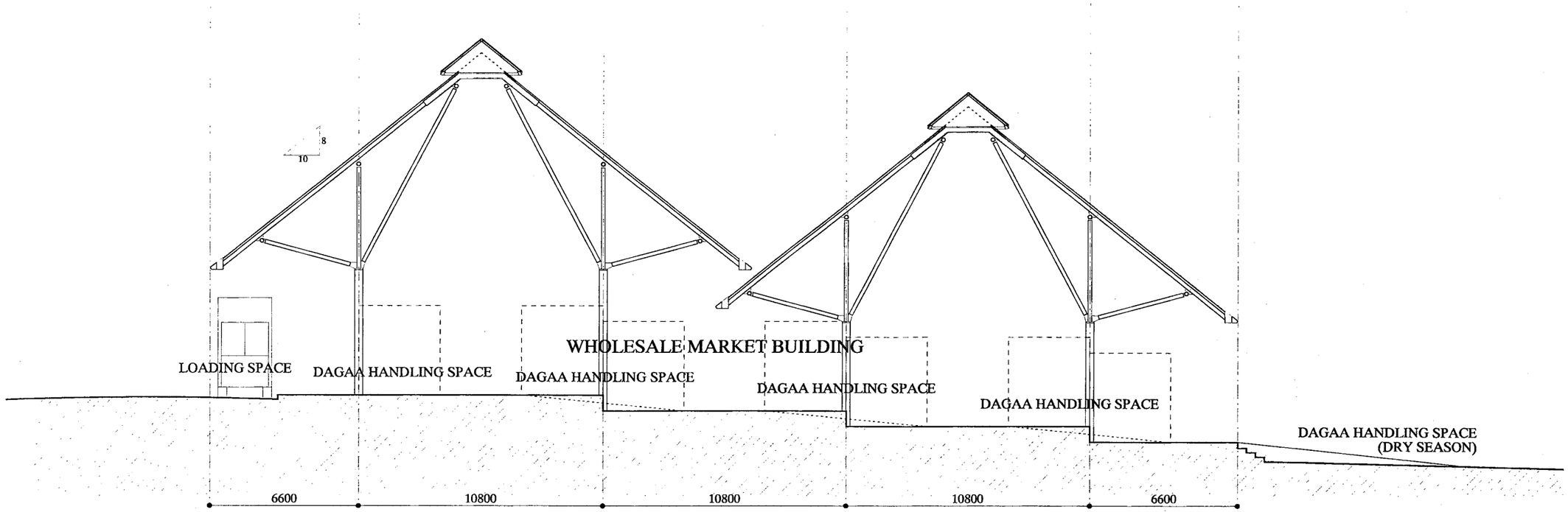
0 20000 50000

THE PROJECT FOR CONSTRUCTION OF KIRUMBA FISH MARKET IN MWANZA IN THE UNITED REPUBLIC OF TANZANIA		
SECTION OF PROJECT SITE	Scale 1/400	A-02
	Date	

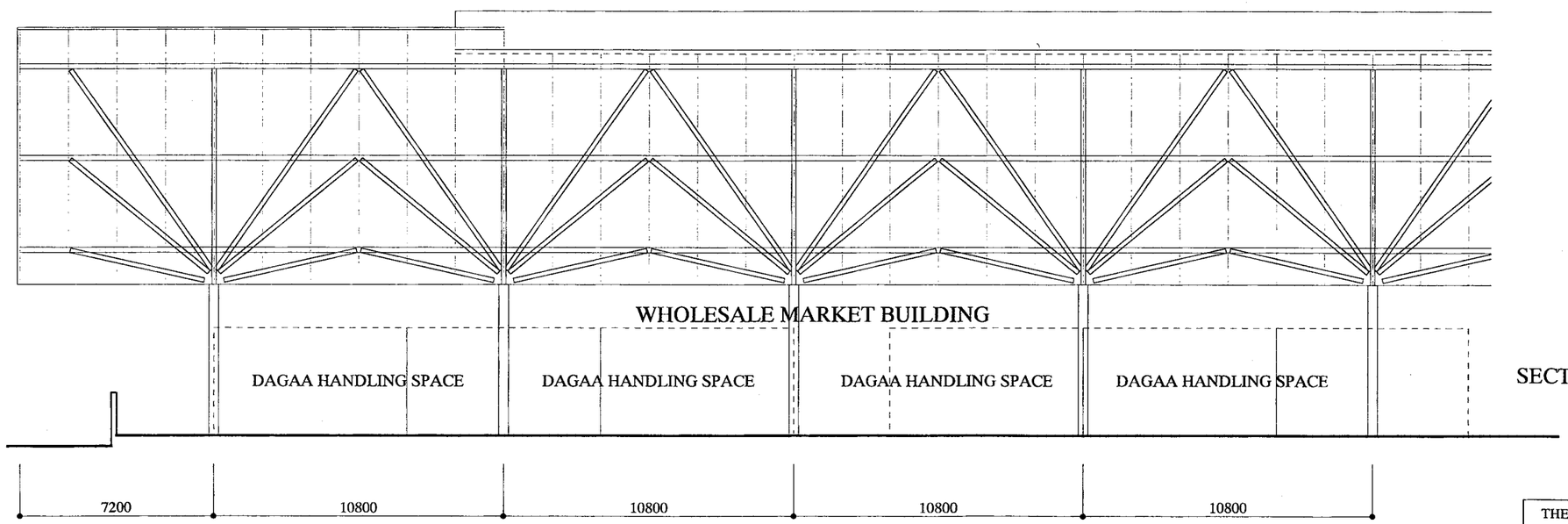


FLOOR PLAN OF WHOLESALE MARKET BUILDING 1:500

THE PROJECT FOR CONSTRUCTION OF KIRUMBA FISH MARKET IN MWANZA IN THE UNITED REPUBLIC OF TANZANIA		
FLOOR PLAN OF WHOLESALE MARKET BUILDING	Scale 1/500 Date	A-03

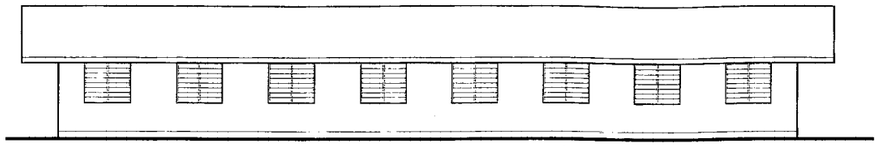


SECTION OF WHOLESALE MARKET BUILDING
(NORTH AND SOUTH) 1:200

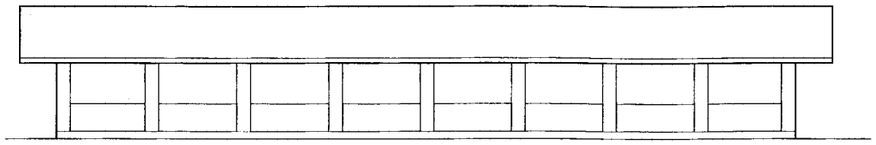


SECTION OF WHOLESALE MARKET BUILDING
(EAST AND WEST) 1:200

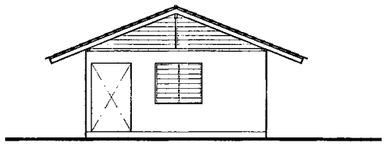
THE PROJECT FOR CONSTRUCTION OF KIRUMBA FISH MARKET IN MWANZA IN THE UNITED REPUBLIC OF TANZANIA		
SECTION OF WHOLESALE MARKET BUILDING	Scale 1/200	A-04
	Date	



SOUTH ELEVATION

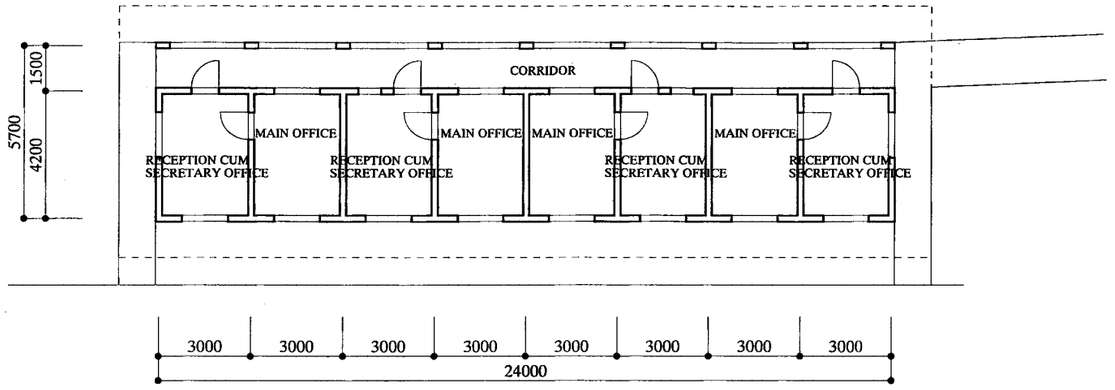


NORTH ELEVATION

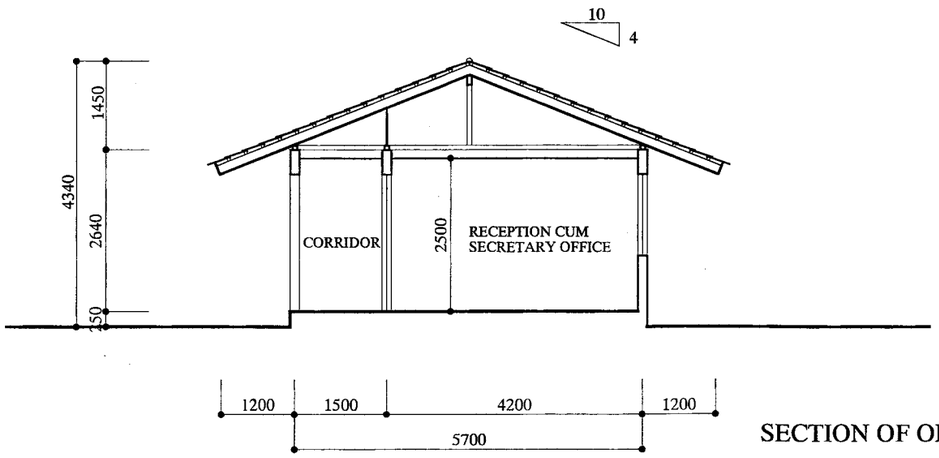


WEST ELEVATION

ELEVATION OF OFFICE BUILDING 1/200



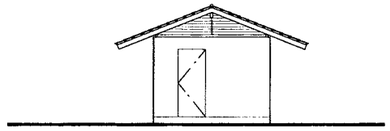
FLOOR PLAN OF OFFICE BUILDING 1/200



SECTION OF OFFICE BUILDING 1/100

MARKET MANAGEMENT OFFICE
UNION OFFICE OF FISHERY PRODUCT

THE PROJECT FOR CONSTRUCTION OF KIRUMBA FISH MARKET IN MWANZA IN THE UNITED REPUBLIC OF TANZANIA		
OFFICE BUILDING 1, FLOOR PLAN, ELEVATION AND SECTION	Scale 1/100,1/200	A-05
	Date	



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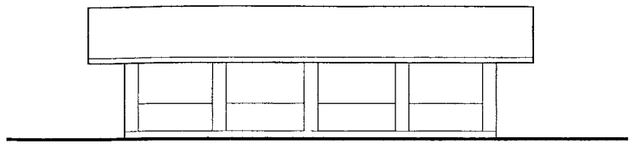
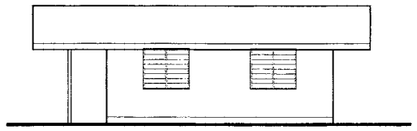
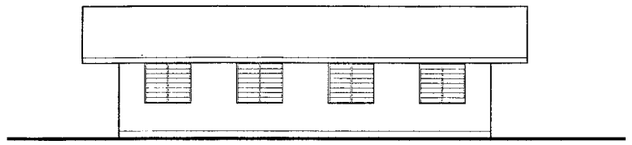


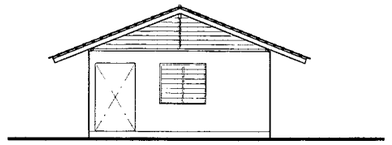
NORTH ELEVATION



SOUTH ELEVATION



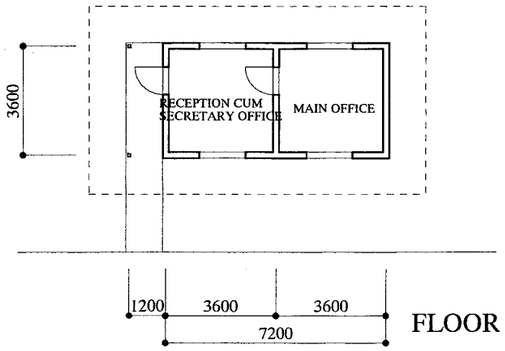
SOUTH ELEVATION



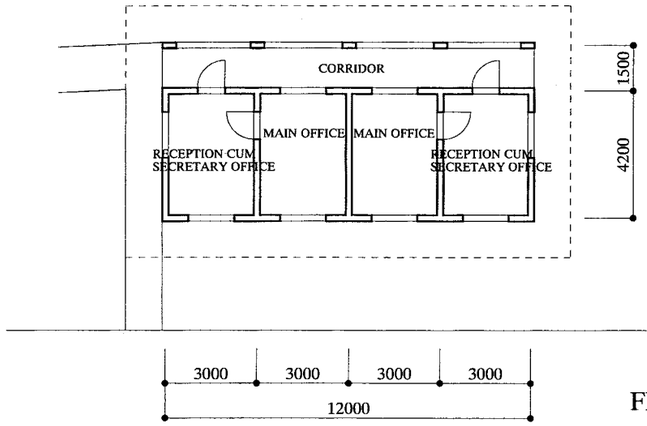
WEST ELEVATION

ELEVATION OF OFFICE BUILDING 1/200

ELEVATION OF OFFICE BUILDING 1/200



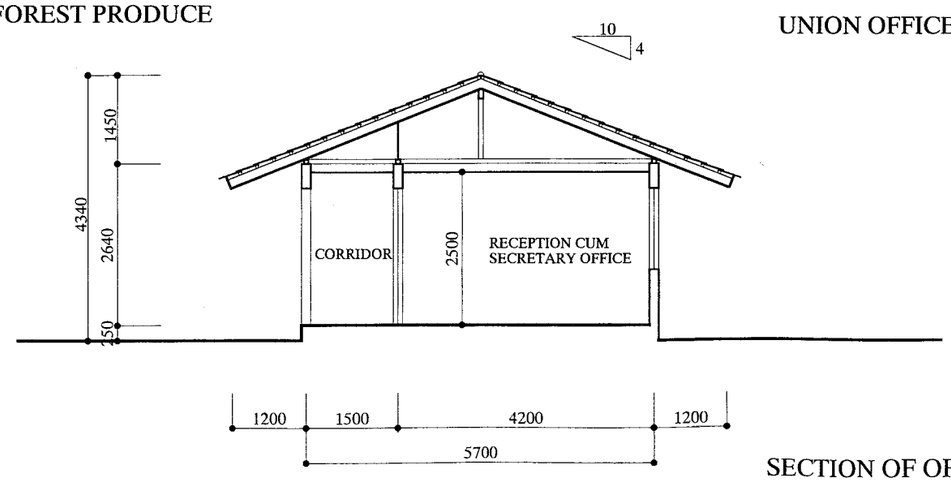
FLOOR PLAN OF OFFICE BUILDING 1/200



FLOOR PLAN OF OFFICE BUILDING 1/200

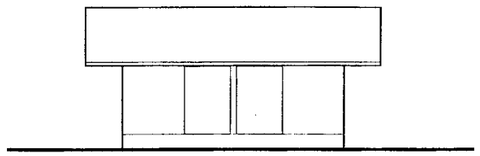
UNION OFFICE OF PROCESSED FISH
UNION OFFICE OF FOREST PRODUCE

UNION OFFICE OF AGRICULTURAL PRODUCE

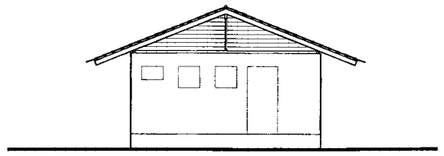


SECTION OF OFFICE BUILDING 1/100

THE PROJECT FOR CONSTRUCTION OF KIRUMBA FISH MARKET IN MWANZA IN THE UNITED REPUBLIC OF TANZANIA		
OFFICE BUILDING 2, FLOOR PLAN, ELEVATION AND SECTION	Scale 1/100,1/200	A-06
	Date	



NORTH ELEVATION



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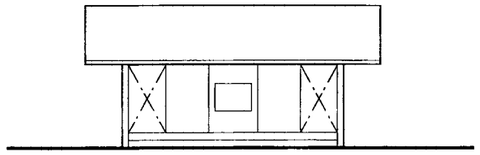

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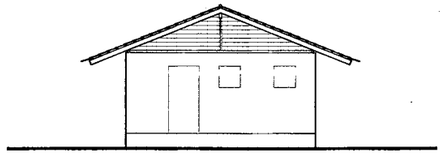
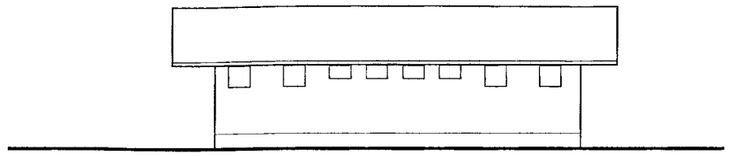
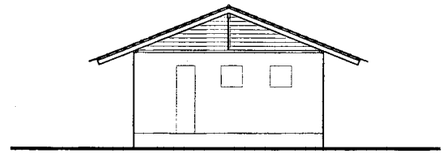


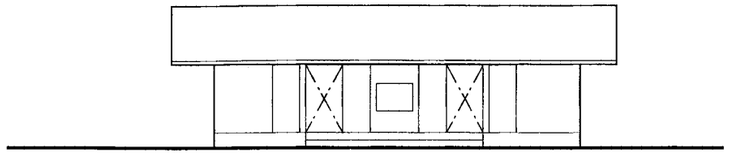
EAST ELEVATION



NORTH ELEVATION



WEST ELEVATION



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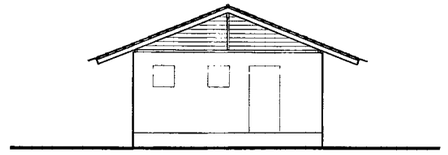
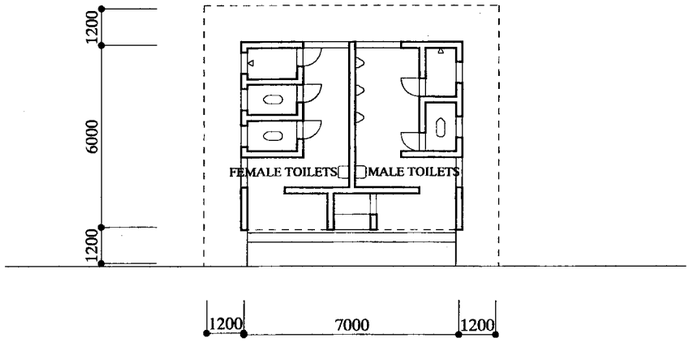
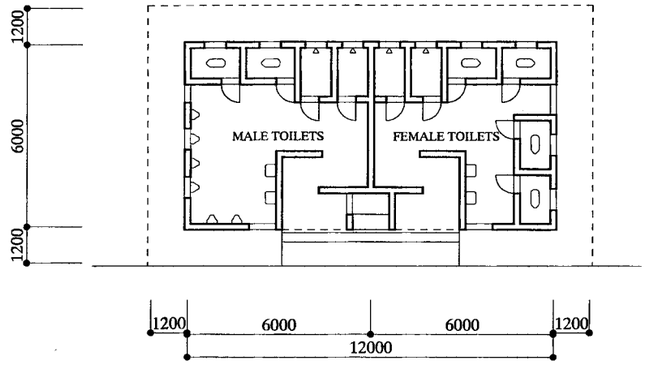


EAST ELEVATION

ELEVATION OF TOILET 1/200

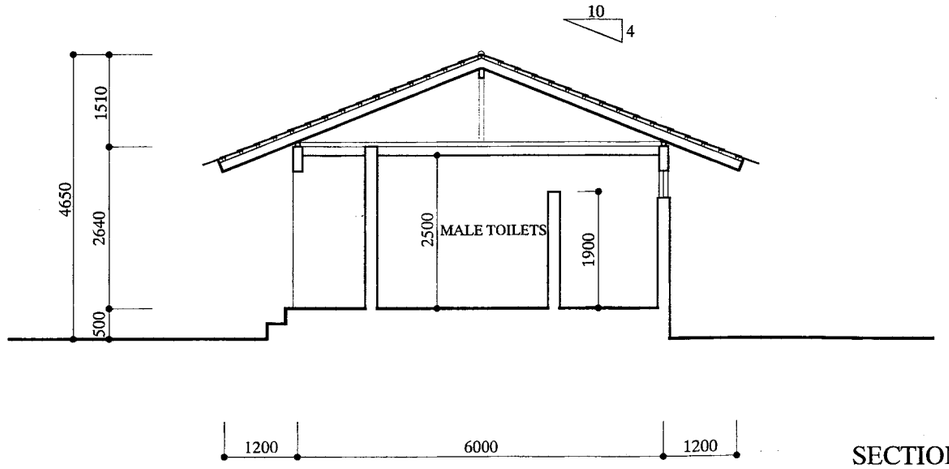


TOILET (WEST)



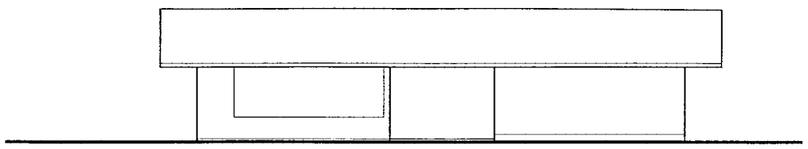
TOILET (EAST)

FLOOR PLAN OF TOILET 1/200



SECTION OF TOILET 1/100

THE PROJECT FOR CONSTRUCTION OF KIRUMBA FISH MARKET IN MWANZA IN THE UNITED REPUBLIC OF TANZANIA		
TOILET, FLOOR PLAN, ELEVATION AND SECTION	Scale 1/100,1/200	A-07
	Date	



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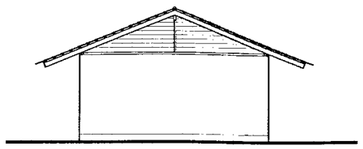
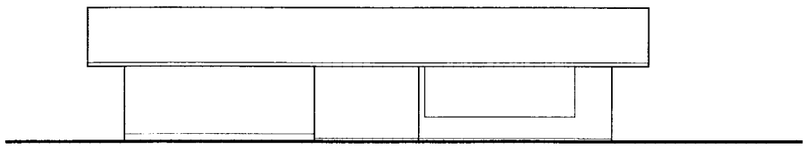
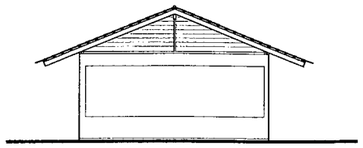


WEST ELEVATION

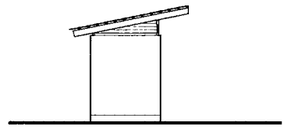


SOUTH ELEVATION



EAST ELEVATION

ELEVATION OF DRY-SALTED FISH STORAGE AND RETAIL STORE 1/200



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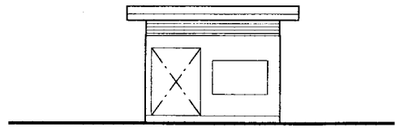
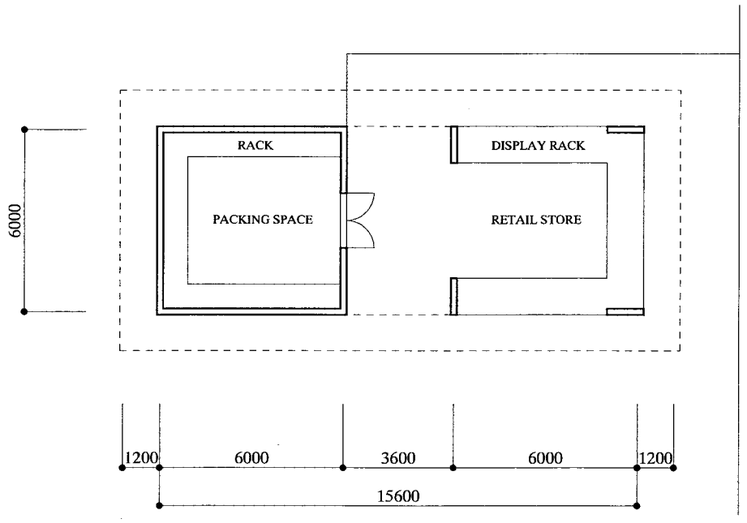
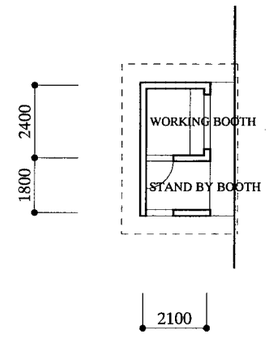


EAST ELEVATION

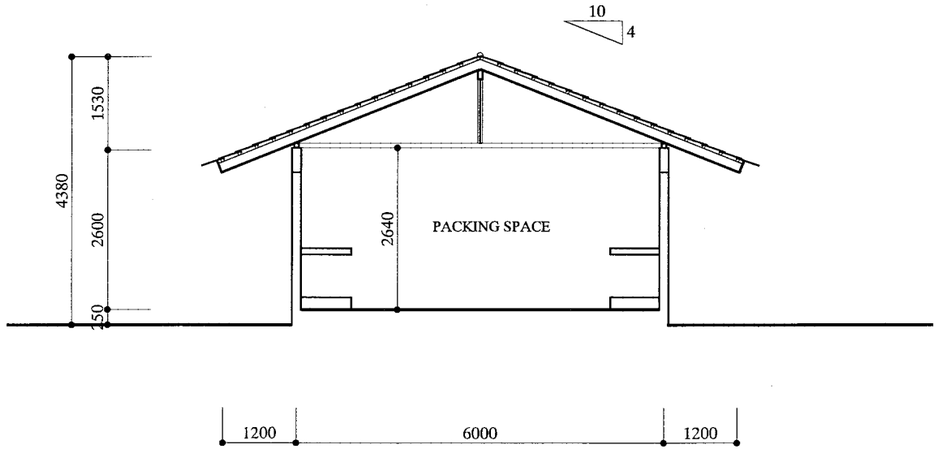
ELEVATION OF GUARD POST 1/200



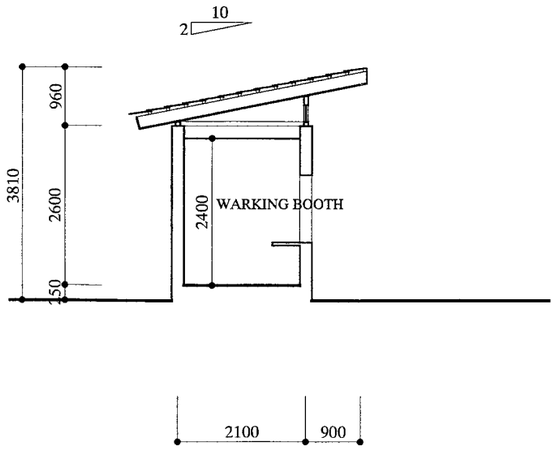
FLOOR PLAN OF DRY-SALTED FISH STORAGE AND RETAIL STORE 1/200



FLOOR PLAN OF GUARD POST 1/200

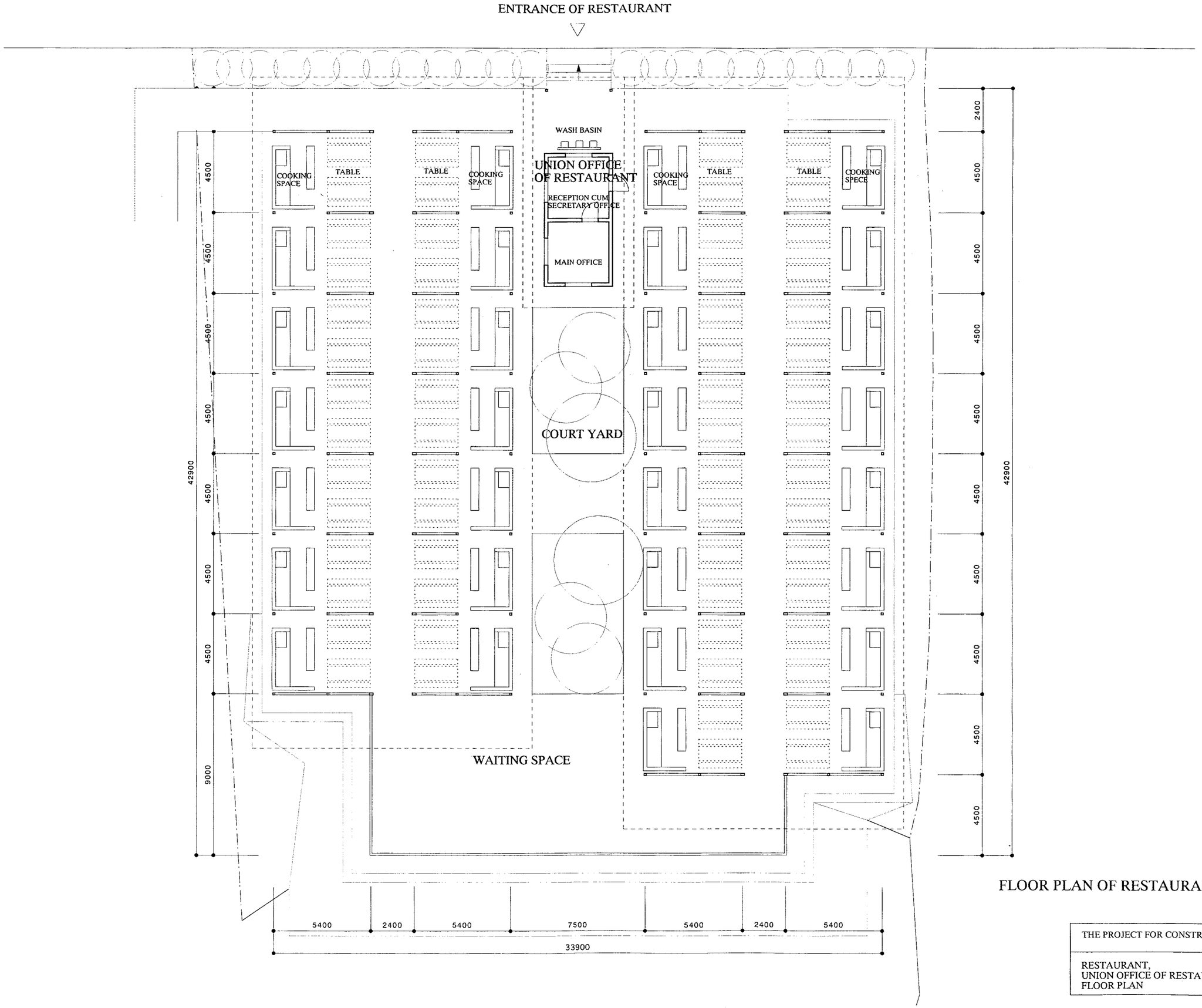


SECTION OF DRY-SALTED FISH STORAGE AND RETAIL STORE 1/100



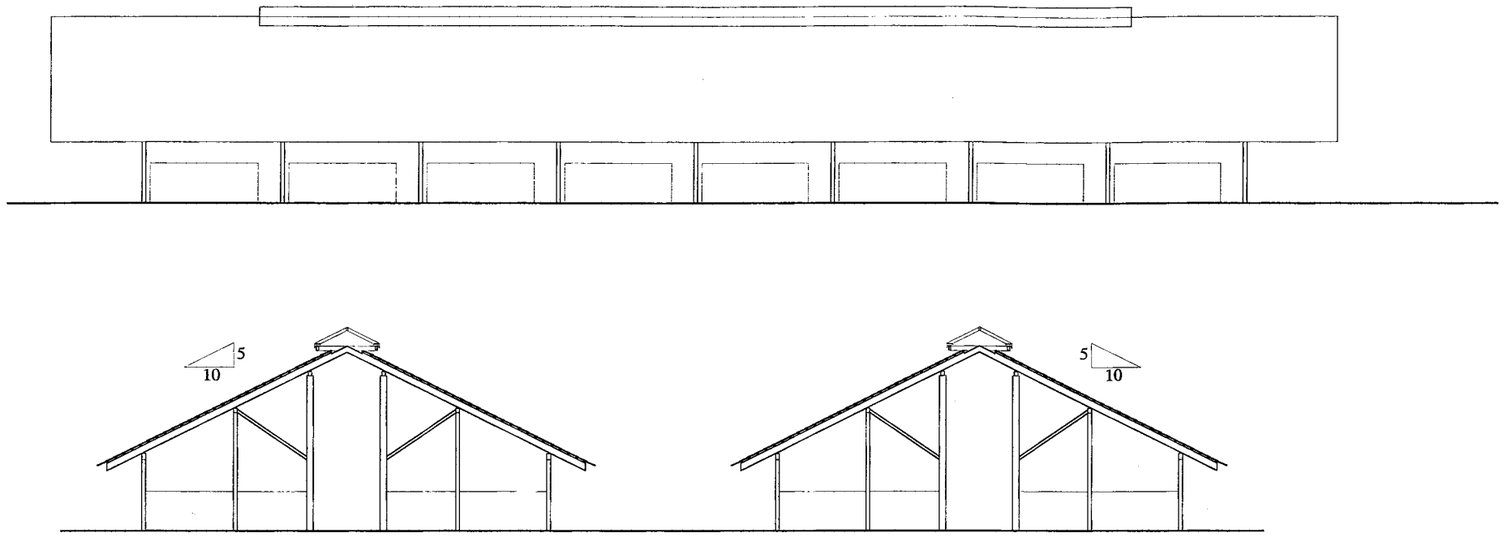
SECTION OF GUARD POST 1/100

THE PROJECT FOR CONSTRUCTION OF KIRUMBA FISH MARKET IN MWANZA IN THE UNITED REPUBLIC OF TANZANIA		
DRY-SALTED FISH STORAGE AND RETAIL STORE, FLOOR PLAN, ELEVATION AND SECTION	Scale 1/100,1/200 Date	A-08

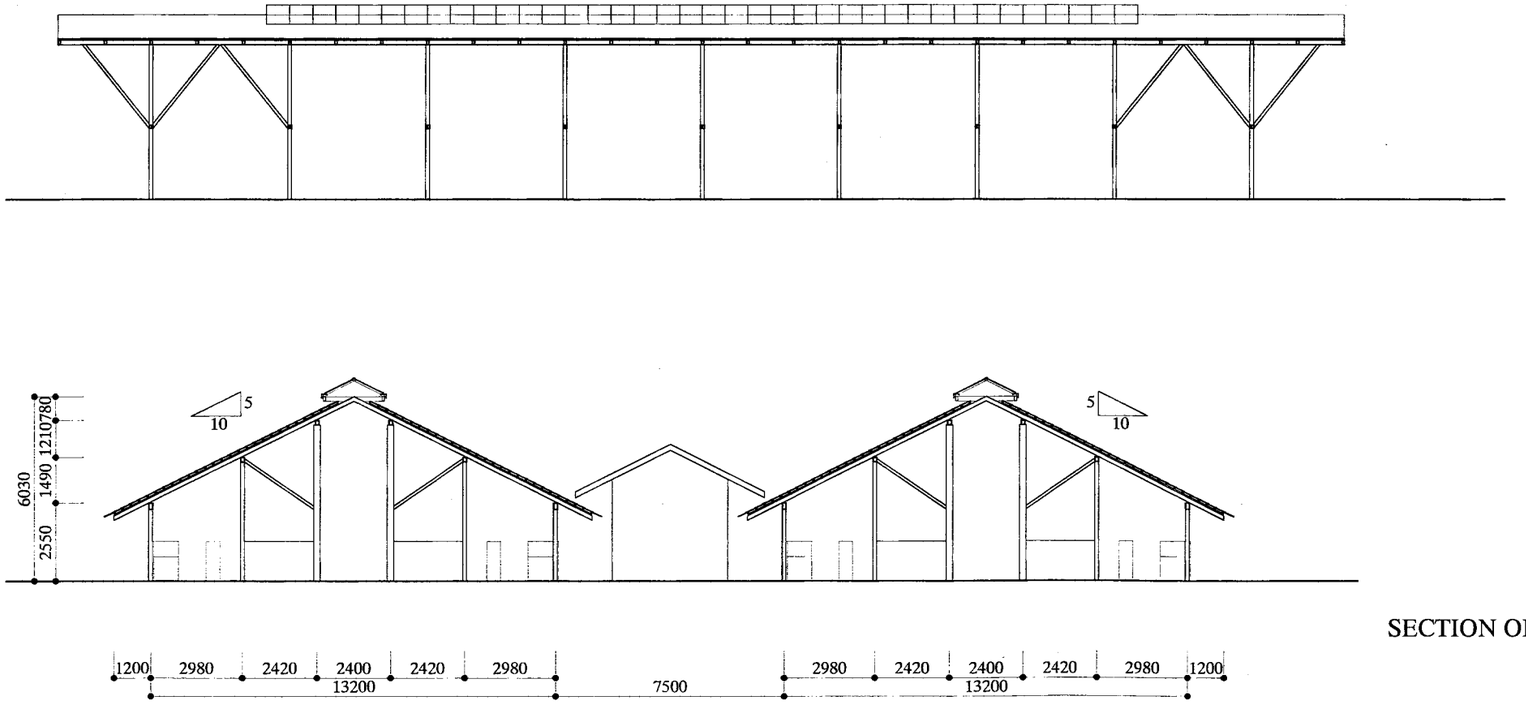


FLOOR PLAN OF RESTAURANT 1/200

THE PROJECT FOR CONSTRUCTION OF KIRUMBA FISH MARKET IN MWANZA IN THE UNITED REPUBLIC OF TANZANIA		
RESTAURANT, UNION OFFICE OF RESTAURANT, FLOOR PLAN	Scale 1/200 Date	A-09

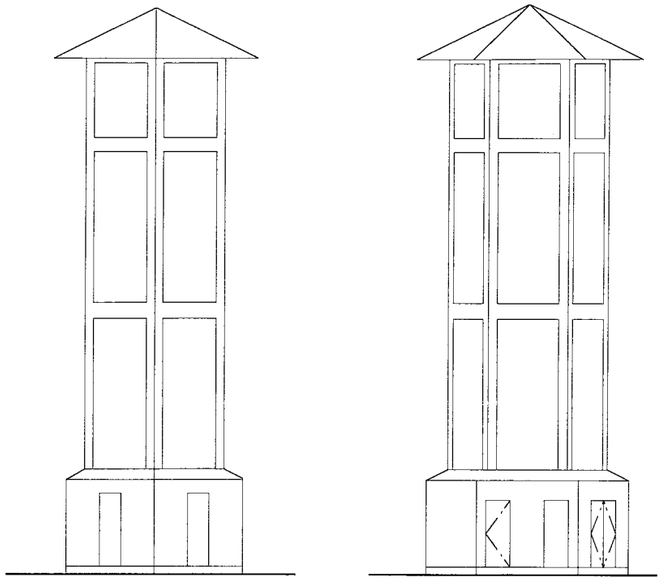


ELEVATION OF RESTAURANT 1/200

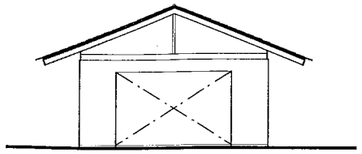


SECTION OF RESTAURANT 1/200

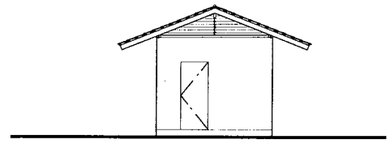
THE PROJECT FOR CONSTRUCTION OF KIRUMBA FISH MARKET IN MWANZA IN THE UNITED REPUBLIC OF TANZANIA		
RESTAURANT, ELEVATION AND SECTION	Scale 1/200	A-10
	Date	



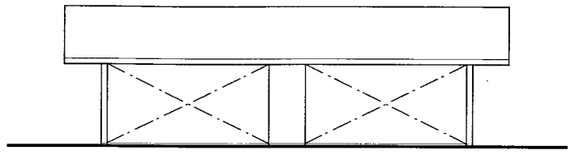
ELEVATION OF ELEVATED WATER TANK 1/200



EAST ELEVATION,WEST ELEVATION

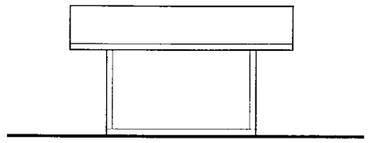


NORTH ELEVATION



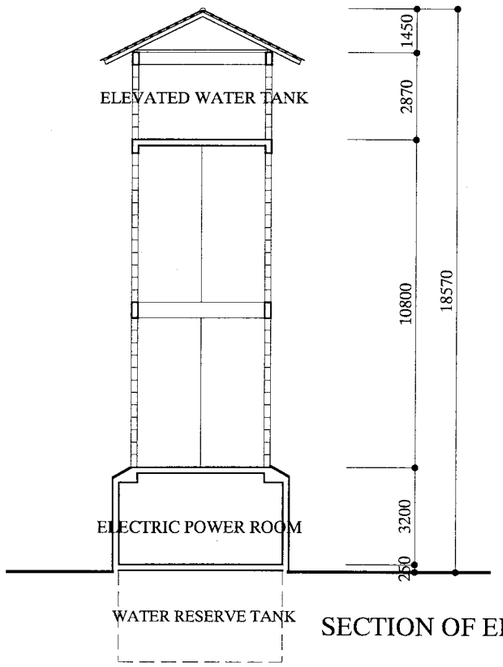
SOUTH ELEVATION,NORTH ELEVATION

ELEVATION OF CHARCOAL SHED 1/200

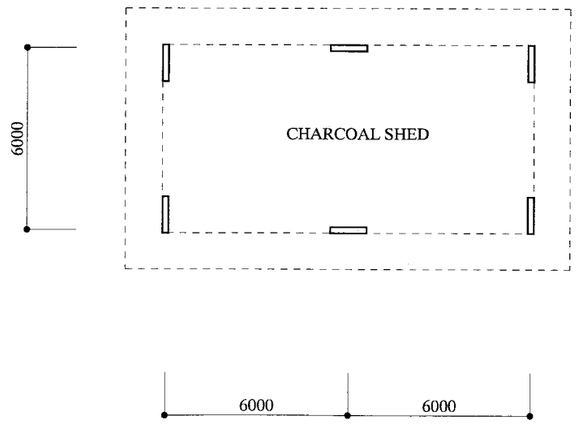


EAST ELEVATION,WEST ELEVATION

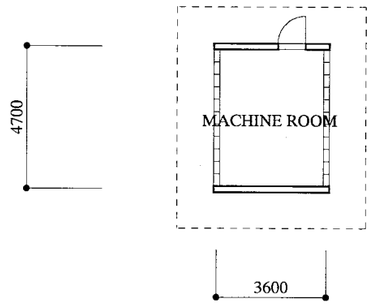
ELEVATION OF MACHINE ROOM 1/200



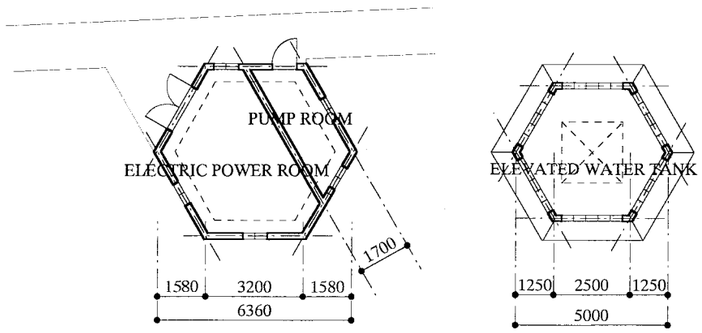
SECTION OF ELEVATED WATER TANK 1/200



FLOOR PLAN OF CHARCOAL SHED 1/200



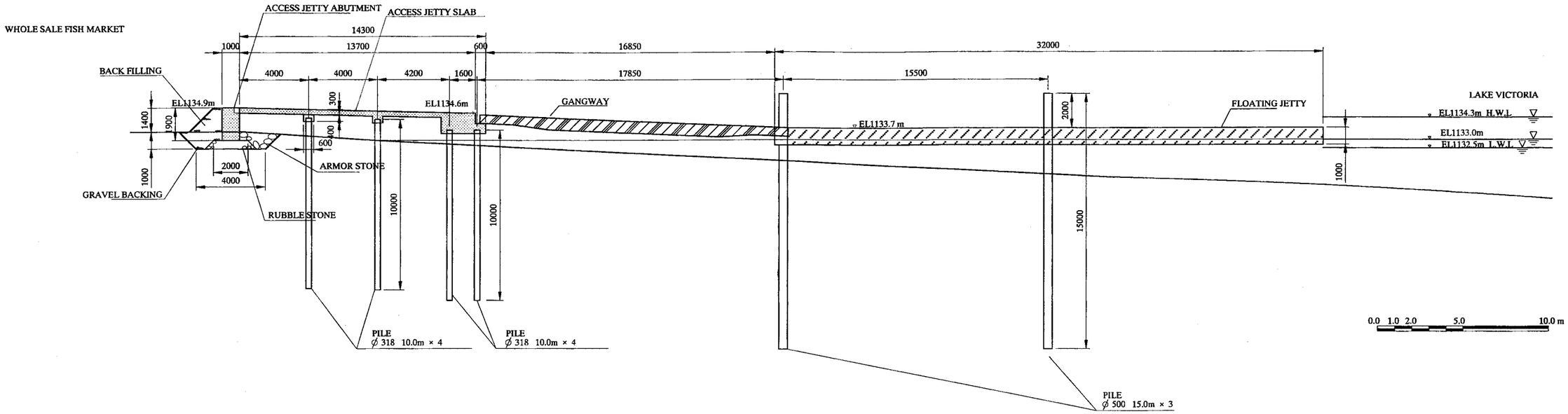
FLOOR PLAN OF MACHINE ROOM 1/200



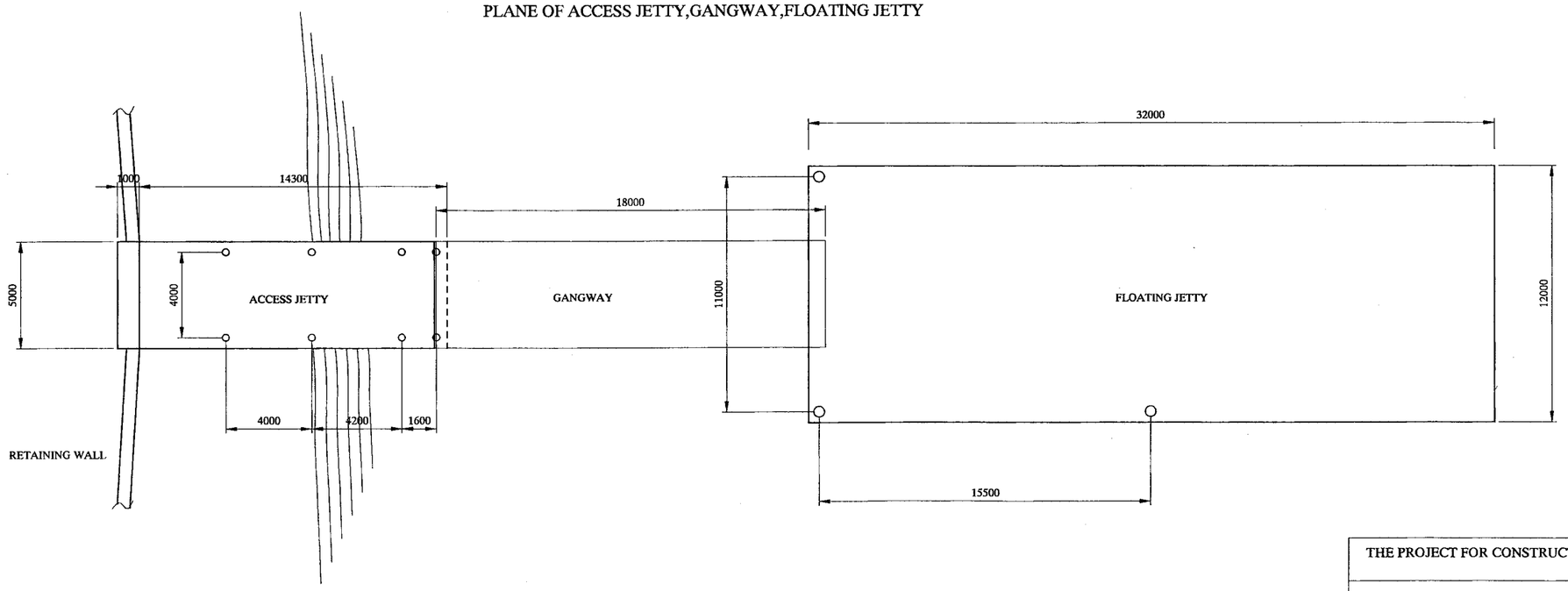
FLOOR PLAN OF ELEVATED WATER TANK 1/200

THE PROJECT FOR CONSTRUCTION OF KIRUMBA FISH MARKET IN MWANZA IN THE UNITED REPUBLIC OF TANZANIA		
ELEVATED WATER TANK, CHARCOAL SHED, MACHINE ROOM, FLOOR PLAN,ELEVATION AND SECTION	Scale 1/200 Date	A-11

SECTION OF ACCESS JETTY,GANGWAY,FLOATING JETTY



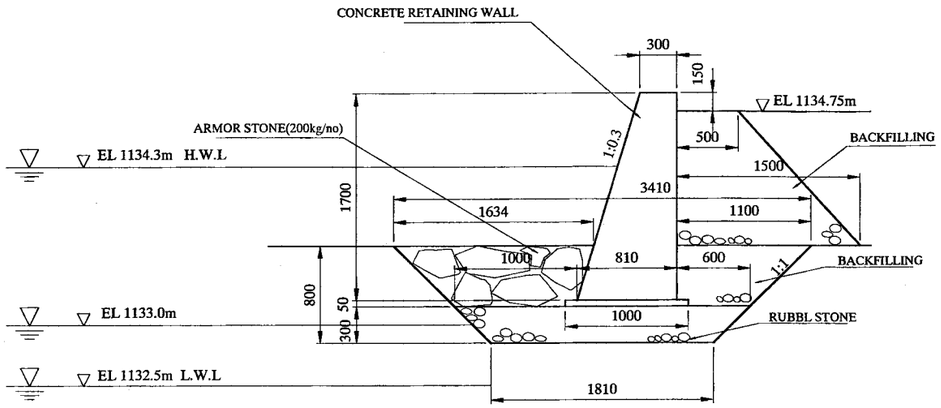
PLANE OF ACCESS JETTY,GANGWAY,FLOATING JETTY



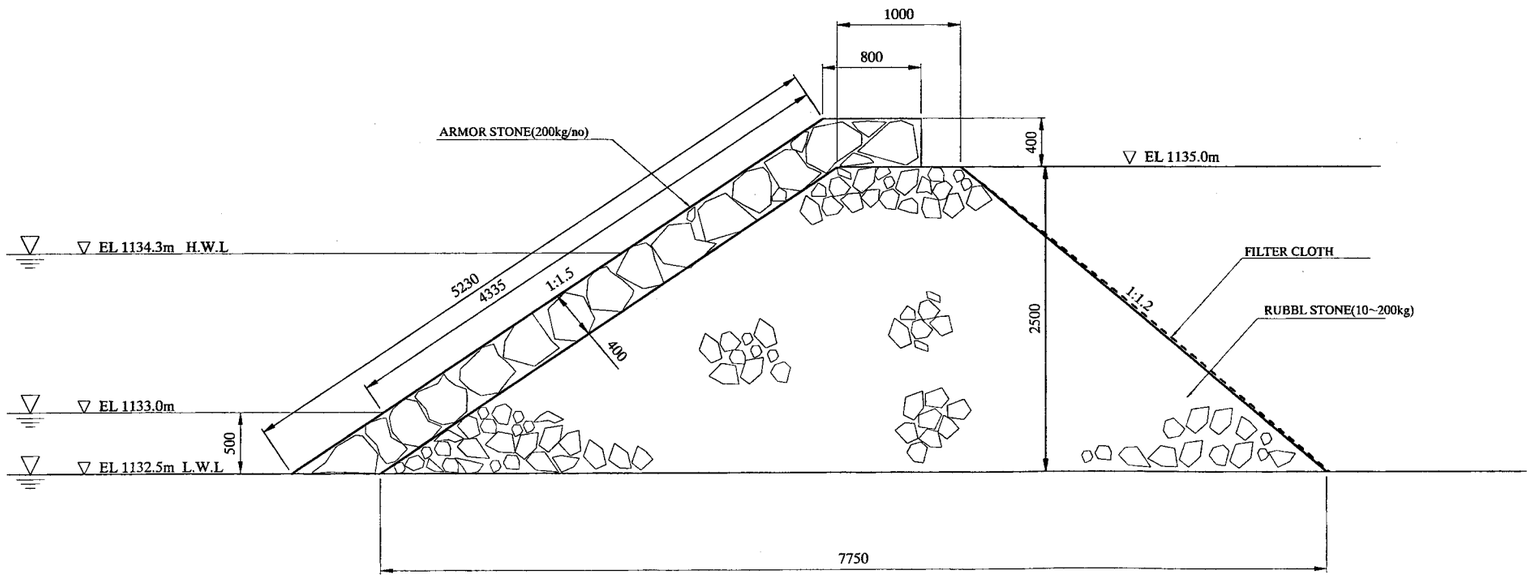
S=1/250

THE PROJECT FOR CONSTRUCTION OF KIRUMBA FISH MARKET IN MWANZA IN THE UNITED REPUBLIC OF TANZANIA		
ACCESS JETTY,GANGWAY, FLOATING JETTY	Scale 1/250	C-1
	Date	

SECTION OF RETAINING WALL



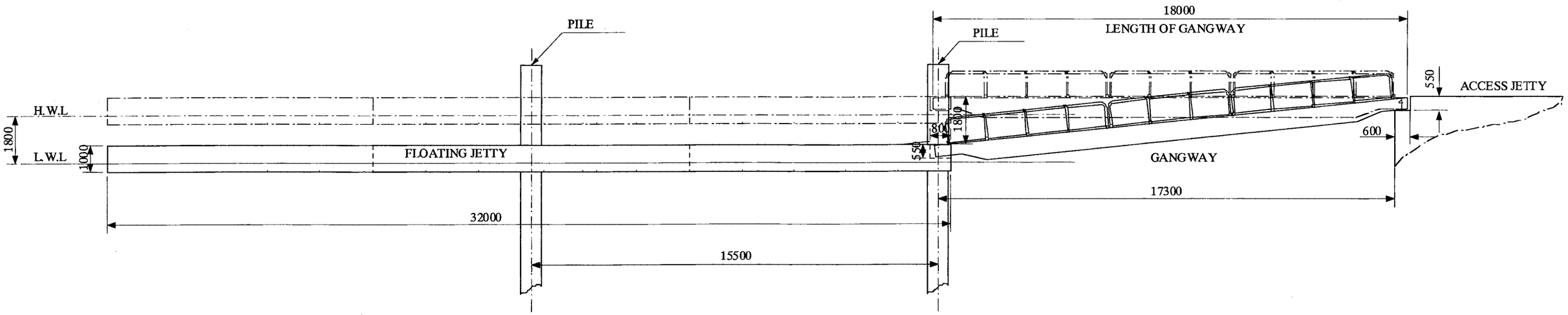
SECTION OF RUBBLE STONE TYPE REVETMENT



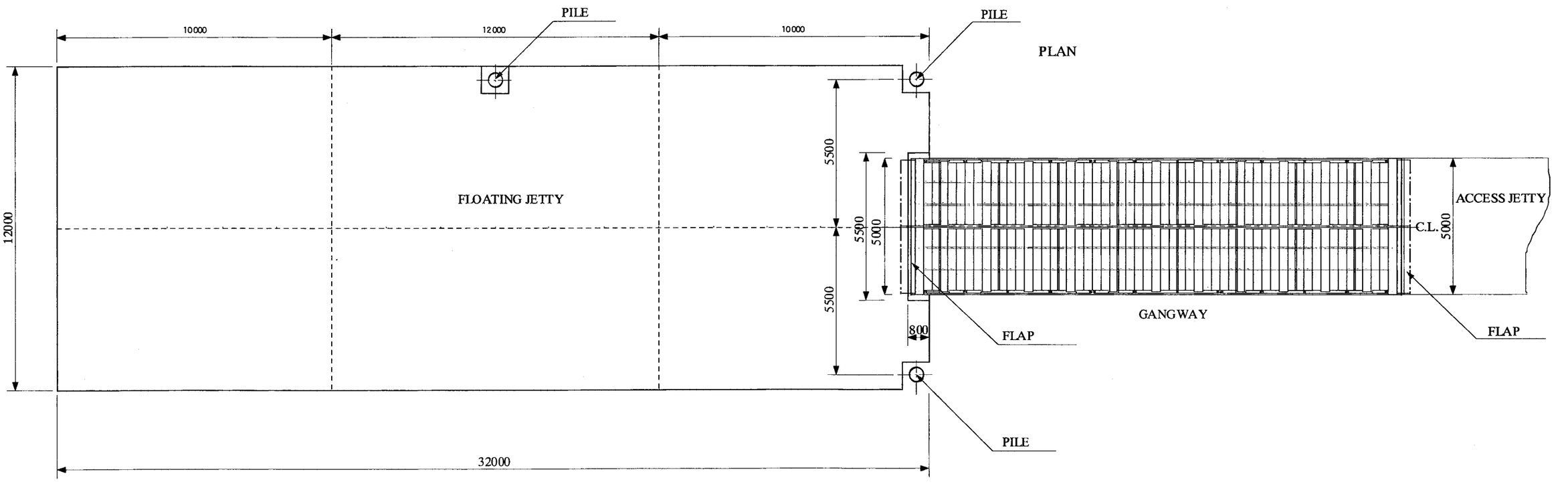
S=1/50

THE PROJECT FOR CONSTRUCTION OF KIRUMBA FISH MARKET IN MWANZA IN THE UNITED REPUBLIC OF TANZANIA		
RETAINING WALL& RUBBLE STONE TYPE REVETMENT	Scale 1/50	C-02
	Date	

SIDE VIEW



PLAN



Lake Victoria

THE PROJECT FOR CONSTRUCTION OF KIRUMBA FISH MARKET IN MWANZA IN THE UNITED REPUBLIC OF TANZANIA		
FLOATING JETTY,GANGWAY GENERAL LAYOUT PLAN	Scale 1/150 Date	C-3

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

(1) Basic Policy

The project shall be implemented under Japan's Grant Aid. Accordingly, in consideration of the need to complete the works within the specified period, the works shall be implemented under appropriate execution criteria and consultant supervision upon formulating an appropriate plan of construction methods, equipment and materials supply plan, and works schedule. Construction shall be implemented based on the following basic concept:

a. As it is planned to continue the wholesaling and retailing, etc. of goods at alternative sites near the existing fish market, take note to avoid possible obstruction of marketing activities in the area as much as possible.

b. As construction will take place in urban areas and the planned site faces Lake Victoria, take care not to affect living environment in the neighboring areas and not to affect the quality of water of the Lake Victoria with construction wastewater.

c. As the site is located in an area 1,400 km distant from the capital by land, it is necessary to establish an appropriate construction management system for procurement of construction materials and equipment by considering local arrangements and transportation conditions.

d. Keep close contact with related persons in the recipient country and take care to avoid any misinterpretations in obtaining a construction permit and procedures for electric and water supply, etc. by realizing sufficient mutual communication at each construction stage.

e. As the technical capability of local construction technicians is not always high and procurement of special construction machines is difficult, carefully evaluate situations and plan to realize the utmost potential from local construction conditions.

(2) Concept with respect to utilization of local contractors, etc.

In Tanzania there are many construction companies but not many of them are capable of large-scale construction. Some of them are registered at the Ministry of Works, the competent authority, but all based in the capital region. Accordingly, although there is no problem in appointing them as local sub-contractors, there are worries as to whether they will strictly comply with construction schedules and quality guarantees. Besides, even though experienced technicians and engineers from the capital may make business trips to construction sites throughout the country and necessary arrangements are not difficult to make, their levels of skill are not necessarily high. By carefully considering these conditions, although the basic concept is to employ local technicians to the extent possible, it is planned to dispatch Japanese special technicians for facilities construction, etc.

(3) Implementation setup in the recipient country

The Tanzanian side has entrusted the Project to the Ministry of Natural Resources and Tourism and the Ministry is in charge of preparation for signing of the Exchange of Notes and banking arrangements. The Ministry will conduct an environmental impact assessment immediately following the conclusion of E/N. With respect to implementation of the Project, the Ministry's Fisheries Division is in charge of practical operations including signing of an Agreement for Consultant Services with a consultant, a construction contract with a construction company, undergoing procedures with related ministries and agencies, and performing examination of contents of operations, approval, application and acquisition of licenses. In addition, the Fisheries Division is in charge of receiving construction materials, equipment, etc. for the Project and relevant tax exemption procedures.

On the other hand, Mwanza City is in charge of securing the Project site, ground leveling, securing alternative sites for the existing fish market during the construction period, allocation of sites for activities, acquisition of construction licenses and installation of electric and water supply.

Upon implementation of the Project, the Fisheries Division and Mwanza City shall mutually confirm their respective roles, clearly communicate on the development and implementation conditions of operations and try to promote the smooth operation of the Project.

2-2-4-2 Implementation Conditions

a. During the construction period, wholesale and other activities shall be performed at the three neighboring alternative sites. Therefore, for the sake of safety during the construction period, entry to the construction site will only be permitted to persons authorized and related to the construction. Due attention shall be paid to the flow planning for construction vehicles, etc. and measures, such as assignment of security officers, shall be taken for safe management of the installation of materials and equipment.

b. As the planned site of the premises for the Project does not provide sufficient space for construction, it is necessary to carefully plan the use of temporary space for storage of construction materials, equipment and machines. Construction must be planned carefully and processes supervised as not to disturb traffic and the activities of local people.

c. As the construction site is facing the lake at the front and it is difficult to block entry to the site, it is necessary to establish an appropriate security system to protect construction materials, equipment, etc. against theft.

2-2-4-3 Scope of Works

In the event where the Project is implemented under Japan's Grant Aid, the scope of works to be implemented by both countries shall be as follows:

<Matters to be borne by the Tanzanian side>

a. Removal of toilets, union offices, restaurant facilities electric poles, etc. on the site
b. Bearing of costs for installing water and electric supply to the premises of the construction site and construction cost
c. Preparation of a temporary market site during the construction period and accompanying operations
d. Necessary engineering works such as paving outside the premises including access road to the premises
e. Acquisition of permission necessary in Tanzania for building works in the Project
f. Exemption of taxes and customs clearance procedures necessary in Tanzania for building works in the Project

<Matters to be borne by the Japanese side>

a. Provision of consultant services such as detailed design, auxiliary bidding operations and execution supervision

b. Procurement of all the materials and equipment as well as labor necessary for construction of facilities mentioned in the Basic Design Report

c. Implementation of quality inspection necessary for facilities construction and engineering work mentioned in the Basic Design Report

2-2-4-4 Consultant Supervision

Upon undertaking construction, establish a liaison system among related institutions of the Tanzanian government, the JICA office, the Japanese embassy, consultants and construction companies and make appropriate plans for necessary materials and equipment, for supervision of construction, vehicles, various proceedings for planning of offices, etc. and quality control as well as timing and supervisory methods. With respect to the personnel plan in terms of technical levels necessary for supervision of construction, assignment, the number, grouping etc., carefully investigate and make appropriate plans for on-site full-time supervising engineers, spot supervising engineers and assistants to be hired locally.

(1) Basic Concept

a. Following the conclusion of design and supervisory contracts with the Tanzanian government, consultants shall conduct on-the-spot investigation and hold a final briefing session with relevant persons of Mwanza.

b. Prepare drawings and documents necessary for bidding such as detailed design drawings, bidding specifications, structural calculation statements, numerical accounting statements, etc. in Japan. Obtain approvals of relevant persons in Tanzania

c. Following the completion of bidding documents, select contractors and equipment suppliers through examination of applicants' qualifications for participation in bidding, bidding evaluations, etc. by taking appropriate procedures with the approval of the client.

d. Following the conclusion of construction contracts between the Tanzanian government and contractors, etc., consultants shall undertake an embarkation inspection with the presence of third party institutions after checking drawings

provided by contractors, confirming specifications provided by equipment suppliers, factory inspections and trial operations within the country.

e. In the site, dispatch supervising engineers and execute overall supervisory operations related to construction, including making reports on selection conditions for local sub-contractors, regular meetings with related persons, construction management as well as quality control tests, presence at production inspection and management. Make necessary reports to the Japanese government agencies.

(2) Conditions for Supervision of Construction

a. Construction materials shall be procured mostly using inland transportation on an irregular basis. In order to avoid delay in construction due to procurement and transportation, thoroughly confirm approval documents and order schedules.

b. In light of the absence of concrete factories around the planned site and limited selection of aggregate, pay due attention to quality control of concrete.

c. As construction takes place in an urban district, fully take note of noise, neatness, cleaning as well as security control.

(3) Implementation Supervisory System

a. The Project Manager shall, in cooperation with the resident supervisor, check the implementation and management systems of the contractor and supervise procurement of materials and equipment as well as transportation plans, etc.

b. Materials and equipment to be procured in Japan shall undergo factory inspection and shipping inspection by the consultant in Japan.

c. Regular meetings shall be held with related persons of Tanzania to adjust implementation schemes and operations.

2-2-4-5 Procurement Plan

(1) Materials and Equipment for Construction

With the exception of specialized materials and equipment such as painting materials, sanitary ware and tools, etc., general construction materials and equipment are continually imported and are abundantly available. Those materials which are difficult to procure locally, are expensive even if obtainable through import, or are difficult to procure in sufficient quality, shall be procured from third countries or Japan.

Table 2-37 Procurement Sources of Construction Materials and Equipment

Name	Procurement Source (Concept)			Reason
	Local	Third countries	Japan	
Construction materials				
Concrete aggregate	○			
Cement			○	Economically preferable
Deformed bar			○	Local procurement is difficult.
Structural steel frame		○		Local procurement is difficult.
Wood for concrete forms, etc.	○			
Light weight concrete block	○			
Wood (structure and finish)	○			
Steel plate for floating jetty			○	Local procurement is difficult.
Roofing materials			○	Local procurement is difficult.
Ceiling materials	○			
Lighting equipment			○	Local procurement is difficult
Facilities piping materials			○	Local procurement is difficult
Floor paint		○		Local procurement is difficult
Electric facility material		○		Local procurement is difficult
Lifting pump		○		Local procurement is difficult
Fish processing wastewater treatment equipment		○		Local procurement is difficult
Emergency power generator	○			
Grease trap		○		Local procurement is difficult

2-2-4-6 Quality Control Plan

Quality control in the Project shall be implemented based on the following concept:

1) Specify normal standards or attributes for quality control in the drawings and specifications.

2) In order to secure quality, indicate in the drawings and specifications, management methods of the implementation scheme for each control item.

3) For the sake of confirmation of quality control at each implementation stage, confirm quality during the construction period using appropriate statistical methods.

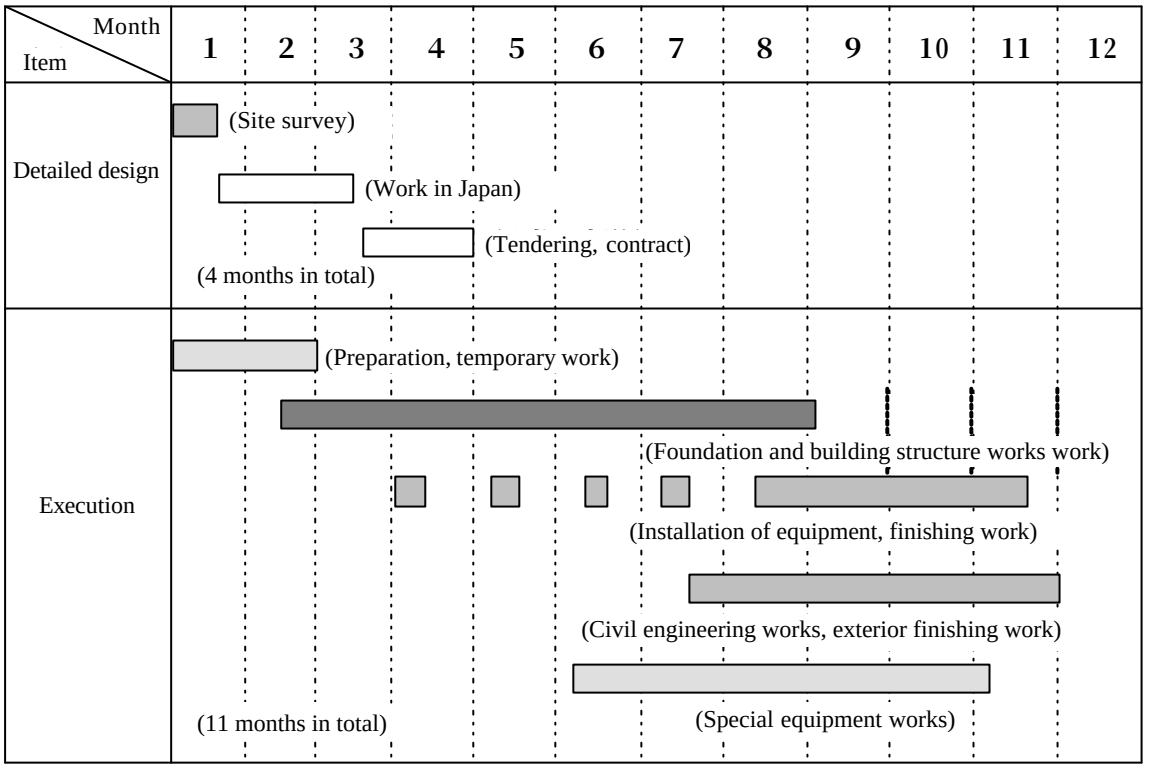
4) Even in case of minor changes in the drawings and specifications or in the implementation scheme during the construction period, make appropriate note and record in documents.

5) With respect to concrete, execute standard control and pay full attention to temperature control.

2-2-4-7 Implementation Schedule

The Project plans to require 4.0 months for detailed design including detailed design of facilities and tendering, and 11.0 months for construction including approval of drawings, construction, inspection, etc. following the signing of the contract with the construction company. Table 2-38 shows the Project implementation schedule.

Table 2-38 Project Implementation Schedule



2-3 Obligations of Recipient Country

(1) Leveling of Planned Sites for Construction of Facilities under the Project

1) Removal and transfer of facilities and structures needed to be removed or transferred from the existing fish market

2) Removal and transfer of the existing restaurant facilities

3) Removal of the existing water-supply pipes and electric equipment for lighting

4) Acquisition of prior approval from UNDP with respect to transfer and removal of facilities at the existing fish market built under cooperation between Mwanza City and UNDP

(2) Acquisition of all the permits required in Tanzania for the implementation and building operations of the Project

(3) Conclusion of banking arrangements necessary for the implementation of the Project and prompt issuance of authority to pay

(4) Prompt acquisition of tax exemption and customs clearance in Tanzania to be required for the implementation and building operations of the Project

(5) Measures for exemption of all taxes and other surcharges to be imposed on Japanese and Japanese companies in Tanzania upon provision of building operations, procurement of materials and labor

(6) Entry to and residency permits in Tanzania for Japanese required for the implementation of the Project

(7) Securing of temporary yards for building operations and land required for Project building works including sites for field offices, etc.

(8) Measures to prohibit entry of unauthorized persons to the site under construction

(9) Securing of alternative land for the existing market facilities and their appropriate allocation to the existing users during the construction period

2-4 Project Operation Plan

Mwanza City is responsible for operation of the Kirumba Fish Market, which is the target facility of the Project and the public market of the City, under supervision and guidance of the Ministry of Natural Resources and Tourism's Fisheries Division. The fish market facilities are to be administered, maintained and controlled under the supervision of the Market Section of the Economic and Trade Division. With respect to specific administration and activities of respective areas at the market, fish products unions will be under guidance and supervision of the Fisheries Section; the agricultural products unions and the forest products unions will be under the Cooperative & Agriculture Department; and the restaurant union will be under the Health Department.

Of the routine administrative operations of the facilities, acquisition of the budget and actual operations for disposal of garbage collected at the garbage collection site, regular cleaning of drainage tanks, toilet septic tanks and drainage tanks at the processing zone, maintenance and repair, etc. of all buildings are assigned to the Market Section with City finances. Other routine administrative operations such as collection of handling charges, cleaning inside the market, security at the market, collection of toilet charges and cleaning of toilets will be performed by contractors selected by tender.

Figure 2-24 shows the organizational chart for administration, maintenance and control structure of the Project.

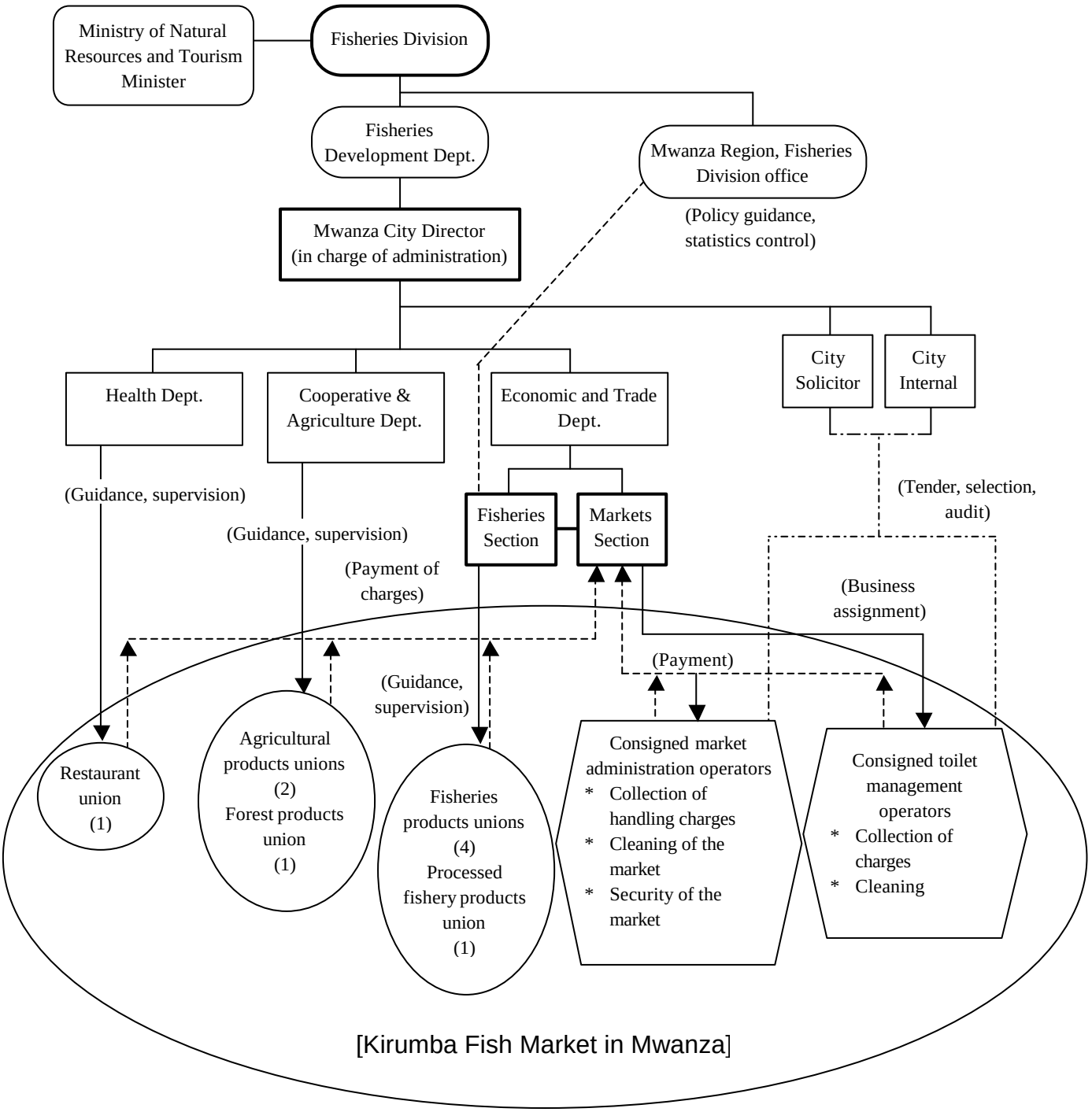


Figure 2-24 Organization Chart of the Kirumba Fish Market in Mwanza

Operation costs for the Project facilities following completion shall continue to be paid from the City's market administration budget in the same way as before.

Items of revenue are three, namely, ① market area charges to be directly paid to the City, ② handling charges to be paid through private operators consigned with partial operations and ③ toilet charges. Concerning ①, charges are set according to each product in units of stalls, and each union collects annual charges according to the number of stalls used and pays them as a lump sum to Mwanza City at the start of the year. As for ②, charges established by ordinance based on the product and amount of trading are collected two times – once when sellers carry products into the market and again when buyers carry them out. And finally concerning ③, charges are set separately and are collected each time somebody uses either the urinals, closet bowls, or showers, etc. The handling charges and toilet charges (① and ②)are collected and paid to Mwanza City every month by market management organizations selected in a tender process implemented by the City.

As for items of expenditures, the Markets Section of Mwanza City confirms all the items and directly makes payments, with approval of the City Director, to persons requesting payments from the City's budget. Table 4 shows the estimate operating balance of Kirumba Fish Market.

Estimation is based on the tender price statement for administrative operations of the existing fish market in fiscal 2003 and the current market price as of February 2003.

2-5 Project Cost Estimate

2-5-1 Project Cost Estimate

Total project cost in the event of implementation will be 646 million yen. The breakdown of costs to be paid by both sides based on the previously mentioned scope of works and the estimation criteria indicated below in (3) is estimated as follows.

(1) Cost to be borne by Japan

Project cost estimate: Approximately 643.8 million yen

Kirumba Fish Market: 1 market building, 1 restaurant building, 6 office buildings, etc. (total building floor area: approximately 7,600 m^2)

(Total floor area: approximately 7,600m^2)

Cost Item		Cost Estimate (million yen)		
Building facilities	Market building	344.7		
	Market management offices x 6 buildings	19.50		
	Dry-salted fish storage and retail store	2.36		
	Restaurant x 1 building and wastewater treatment facilities	30.27		
	Guard post x 2 rooms	1.35		
	Garbage depot x 2 sites	1.02		
	Charcoal shed	1.68		
	Toilets (including septic tanks) x 2 buildings	9.29		
	Processing area processing tables and wastewater treatment facilities	9.01		
	Electric and emergency generator facilities	8.46		
	Market road paving, fences, and landscaping	38.97		
	Water supply facilities (water receiving tank and supply tower)	18.31	484.89	
Civil engineering facilities	Retaining walls, rubble stone revetment	13.41		
	Access jetty	5.98		
	Gangway	13.34		
	Floating jetty	56.78	89.51	574.4
Detailed design, consultant supervision, technical guidance		69.4		

("This cost estimate is provisional and would be further examined by the Government of Japan for the approval of the Grant.")

(2) Cost to be borne by the Tanzanian side: 24,920.000 Tshs.
(approximately 3.01 million yen)

①	Clearing of project site land	7,000,000 Tshs. (approximately 0.85 million yen)
②	Cost to secure and prepare alternative sites during the construction period	15,000,000 Tshs. (approximately 1.81 million yen)
③	Construction period	100,000 Tshs. (approximately 0.01 million yen)
④	Cost to build and install walls and gate	2,820,000 Tshs. (approximately 0.34 million yen)

(3) Estimation Criteria

①	Estimation Point	End of February, 2003
②	Exchange rate	1 US$ = 122.16 Japanese yen 1 local currency (1Tshs.) = 0.1208 Japanese yen
③	Estimation period	Implementation over a single phase, with detailed design, construction works- as indicated in the Implementation schedule.
④	Others	The Project shall be implemented in accordance with Japan's Grant Aid.

2-5-2 Operation Cost

Operation costs for the Project facilities following completion shall continue to be paid from the City's market administration budget in the same way as before.

Items of revenue are three, namely, ① market area charges to be directly paid to the City, ② handling charges to be paid through private operators consigned with partial operations, and ③ toilet charges. Concerning ①, charges shall be set according to each product in units of stalls, and each union shall collect annual charges according to the number of stalls used and pay them as a lump sum to Mwanza City at the start of the year. As for ②, charges established by ordinance based on the product and amount of trading shall be collected two times – once when sellers carry products into the market and again when buyers carry them out. And finally concerning ③, charges shall be set separately and collected each time

somebody uses either the urinals, closet bowls, or showers, etc. The handling charges and toilet charges (① and ②) shall be collected and paid to Mwanza City every month by market management organizations selected in a tender process implemented by the City.

As for items of expenditure, the Markets Section of Mwanza City shall confirm all the items and directly make payments, with approval of the City Director, to persons requesting payments from the City's budget. Table 2-40 shows the estimate operating balance of Kirumba Fish Market under the Project.

Estimation is based on the tender price statement for administrative operations of the existing fish market in fiscal 2003 and the current market price as of February 2003.

Table 2-39 Estimate Operating Balance of the Kirumba Fish Market

(Unit: Tshs.)

Revenue/Item	Breakdown	Amount/Year	(%)
Direct revenue ①	Market charges	10,440,000	4.5
	100 Dagaa stalls, 24 processing stalls, 10 fresh fish stalls, 6 banana stalls 20 cereal stalls, 4 vegetable/fruits stalls, 10 forest products stalls Total: 174 stalls x @5,000/month x 12 months		
Indirect revenue②	Handling charges	204,000,000	88.5
	Dagaa @ 15,300,000/month x 12 months = 183,600,000		
	Agricultural products @ 850,000/month x 12 months = 10,200,000		
	Forest products @ 680,000/month x 12 months = 8,160,000		
	Others @ 170,000/month x 12 months = 2,040,000		
Indirect revenue③	Toilet charges	16,200,000	0.70
	Urine @ 50 x 300 persons/day x 30 days x 12 months = 5,400,000		
	Night soil @ 100 x 100 persons/day x 30 days x 12 months = 3,600,000		
	Shower @ 200 x 100 persons/day x 30 days x 12 months = 7,200,000		
	Total revenue	230,640,000	100.0
Expenditure /Item	Breakdown	Amount/Year	(%)
Electricity tariff	Daytime : 12kw x 30% x 9 hrs. = 32.4kwh/day Night : 1.4kwh×11 hrs. = 15.4kwh/day Pump/drainage treatment plant: 5.5kw x 2 hrs. = 11.0kwh/day @90 x 58.8kwh/day x 30 days x 12 months = 1,905,120	1,905,120	11.1
Water rate	Average water charge: $8m^3$x 30 days x 12 months x @250 = 720,000	720,000	4.2
Emergency power generator	2.8 LTR/hrs. x 300 hrs./year x @700／LTR = 588,000	588,000	3.4
Garbage disposal cost	@20,000 x 2 lots x 3 times/week x 52 weeks = 6,240,000	6,240,000	36.4
Toilet septic tank	@40,000 x 2 lots x 2 times/year = 160,000	160,000	0.9
Restaurant septic tank	@40,000 x 1 lot x 2 times/year = 80,000	80,000	0.5
Processing zone septic tank	@40,000 x 1 lot x 4 times/year = 160,000	160,000	0.9
Market building maintenance cost	@200,000/month x 12 months = 2,400,000	2,400,000	14.0
Restaurant building maintenance cost	@50,000/month x 12 months = 600,000	600,000	3.5
City personnel cost	Equivalent to 3 city staff: @120,000/month x 3 persons x 12 months = 4,320,000	4,320,000	25.1
	Total cost	17,173,120	100
	Balance	+213,466,880	

According to the results of estimating the operating balance, the expenditure is low at Tshs. 17,173,120, accounting for 7.4% of the revenue that is Tshs. 230,640,000. Therefore, there is judged to be no problem over the operation and maintenance of the planned fish market based on the current operation and maintenance setup and system for collecting fees and charges.

With respect to facilities newly developed under the Project, facilities for which users can be specified shall be paid for by the City in the conventional manner during the initial period. However, it is planned to investigate the possibility of installing a charge collection system for respective facilities in the future. Pricing of charges shall be determined after investigating and confirming conditions of use of respective facilities, establishing regulations necessary for charge collection and taking necessary procedures for enforcement, to the extent they do not impose any burden on users

By employing the principle of burden of payment by users, it is designed to encourage users efficient use of various facilities, electricity and water supply, clarify where responsibility lies and at the same time to promote saving of the City's resources.

- Unions office charges
- Electricity tariff for respective offices and the restaurant building
- Water tariff for the restaurant building and processing zone

CHAPTER 3 PROJECT EVALUATION AND RECOMMENDATIONS

CHAPTER 3 PROJECT EVALUATION AND RECOMMENDATIONS

3-1 Project Effect

The following effects can be anticipated as a result of Project implementation.

Current Conditions and Problems	Project Countermeasures	Project Effect and Extent of Improvement
Development of the fish market as a collection point for promotion of artisanal fisheries in Lake Victoria coastal area is slow. In particular, the existing fish market has no roofing and is unpaved. When rain falls, market functions stop, product values go down, distribution quantities decrease, and work opportunities are lost, i.e. the economic loss is great.	Construct roofs over the existing Kirumba Fish Market, pave the floor, and construct market facilities giving consideration to traffic lines for users, products, carts and vehicles. (Market buildings, guard posts, parking space, public toilets, septic tanks, garbage depots, water supply facilities, power distribution equipment and emergency generator)	Work interruptions caused by rain will be remedied, work efficiency in the market will improve, post-harvest and distribution losses will be reduced, and as a result supplies of fisheries products will increase. Income levels will increase due to increased employment opportunities for fishermen and market workers and reduced losses, and this will lead to a higher standard of living and reduced poverty.
The existing market has no landing facilities such as quay or jetty, etc. Therefore, currently dangerous and hard landing work cannot be improved and it is impossible to carry out safe and efficient landing of products.	Construct mooring and landing facilities and passageways for the safe and efficient landing and carrying-in to the market of products. (Floating jetty, gangway, access jetty)	The loading/unloading work environment will be improved, safety of workers will be secured, and hard and heavy labor will be mitigated. At the same time, efficiency of landing work will be improved and distribution work overall will be made more efficient.
There are no proper worktables, storage areas, or wastewater treatment facilities in the dry-salt processing area, so the work environment is highly unsanitary.	Improve the work environment and install wastewater treatment facilities in the dry-salt processing area. (Work area and wastewater treatment systems, storage, fresh fish selling tables, public toilets, septic tanks)	Improved quality and safety of processed items, higher added value, improvement of the work environment, and higher incomes will be possible. Also, proper wastewater and residue treatment will become possible, thereby contributing to environmental preservation.
The public agencies that manage the fish market have no offices on the site. Moreover, the nine union organizations operating at the market have no functional office facilities. Therefore, they are unable to conduct appropriate market management, information collection or statistical activities.	Construct office facilities for Mwanza City Markets Section, Fisheries Section, Mwanza Region Fisheries Division, Customs and nine union organizations. (Public agency management offices, union organization management offices)	Fish market management facilities will be constructed, resulting in strengthening of the public management setup and improvement in the provision of services. Moreover, smooth administrative work and management by unions will be possible, and more active union activities can be anticipated as a result.
Simple roof structures and earth floors. Cooking and food service facilities are insufficient, leading to unsanitary conditions due to the inability to treat wastewater and residue, etc.	Construct sanitary restaurant facilities fitted with wastewater treatment facilities. (Restaurant building: Mama-lishe)	Greater safety of cooked food, more customers, and higher income for restaurant workers can be expected as a result of improving sanitary conditions. This will help raise the work morale of people using the market.

(1) Direct Effects

Implementation of the Project will have the following effects for approximately 12,000 artisanal fishermen engaged in Dagaa production in Mwanza, Mara and Kagera, as well as approximately 550 union members and 2,000 laborers engaged in wholesaling and distribution work, 60 restaurant staff, and some 2,000 restaurant users at Kirumba Fish Market every day.

1) Restrictions caused by approximately 120 interrupted days and more than 30 days of complete closure as a result of rainfall will be relieved, leading to improvement of market distribution efficiency and greater stability in product prices and distribution quantities.

2) Post-harvest loss of approximately 1,000 tons, equivalent to roughly 10% of the annual handled volume of Dagaa and with a value of some 67,000 Tshs., will be reduced, thereby enabling higher income for fishermen, unions and wholesalers.

3) The harsh landing work environment and poor worker safety will be improved and efficiency of landing and loading work will be improved.

4) Work will be improved in terms of studying the actual state of fisheries, collecting information and conducting statistical management with a view to promoting artisanal fisheries and effectively utilizing fisheries resources in Lake Victoria. As a result, it will be possible to offer suitable and effective information and guidance, etc. to fishermen.

5) By constructing sanitary facilities such as public toilets, garbage depots and wastewater treatment facilities, etc. inside the market, pollution of the surrounding area will be prevented and a sanitary environment will be provided for market users.

6) With the introduction of landing facilities and different handling zones according to product, collection rates of facility charges and product handling charges, which provide revenue for Mwanza City, will be increased.

(2) Indirect Effects

1) Reducing post-harvest losses will help stabilize and improve the income and living standard of approximately 50,000 persons comprising artisanal Dagaa fishermen, market workers and their families, and this will contribute to the reduction of poverty in Tanzania.

2) By reducing post-harvest loss, it will be possible to effectively utilize limited resources and thereby contribute to higher nutrition levels by realizing food self-sufficiency and the cheap supply of protein.

3) The Project will contribute to higher acquisition of foreign currency through increased exports to nearby countries and help improve the trade balance.

4) By enabling appropriate treatment of wastewater from the market, the Project will reduce the environmental load placed on Lake Victoria.

5) Information management and statistical work will become possible in the market, thereby contributing to the formulation of future fisheries promotion policy and promotion of managed fisheries.

3-2 Recommendations

(1) Improvement of Information Processing Functions

Kirumba Fish Market is the largest fisheries distribution center in Tanzania, handling 10,000 tons of products every year. Accordingly, the accurate and rapid grasping of transaction information concerning incoming loads, handled quantities, and prices, etc. will play an important role in the smooth and efficient running of market facilities, achieving a supply and demand balance between the domestic market and markets in surrounding countries, and stabilization of prices, etc., and this will contribute to the effective utilization and stable supply of fisheries products in Tanzania. Moreover, statistical data is important for understanding environmental changes in Lake Victoria and changes in fisheries resource reserves, and such data will provide indispensable materials and information for formulating and implementing medium and long-term fisheries promotion plans in Lake Victoria. Until now, however, due to the inadequate development of market facilities, it has been difficult to implement proper information processing work and no effective information collection or processing has been carried out. From this point of view, it is hoped that the opportunity of Project implementation is taken to improve the information processing functions of Mwanza City Fisheries Section (the agency in charge of market administration) and thereby enhance functions as an information center via consolidation.

In specific terms, the following improvements are anticipated:

- Compile a unified ledger containing information on handled quantities by production area and item, trading prices, shipping destinations and so on, and at the same time

bolster the organizational setup of information processing in Mwanza Fisheries Section.

- Clearly indicate the role to be played in the above information collection by market contractors, unions and wholesalers operating in the market, and ensure thorough compliance by making it compulsory to collect and report information on handled quantities according to each product item.

- Offer guidance to related parties on recording contents and methods, and at the same time promote faster and more accurate information processing by specifying reporting deadlines. In particular, rather than counting products in terms of the number of bags or batches, it is thought necessary to measure and statistically process exact distribution quantities according to weights measured using scales.

(2) Reduction of Post-harvest Loss and Improvement of Product Quality

Installation of roofs and ground paving inside the market will help reduce the post-harvest loss, which has long been a big problem at the market. However, Dagaa redrying work has conventionally been conducted on plastic sheets spread out on the floor, but drying efficiency by this method of natural ventilation is poor and it becomes difficult to carry out sufficient drying before and after the full moon when incoming quantities are largest because there is not enough floor area to spread the fish out. Therefore, as a measure for resolving these problems, tiered drying shelves made from netting with good ventilation shall be made and introduced in order to raise drying efficiency by natural ventilation and to effectively use the limited floor area. Moreover, by thoroughly cleaning the floor and maintaining a sanitary environment in the sorting area, generation of insects shall be prevented and losses inside the market shall be minimized. By doing this and implementing other measures devised by market management agencies and users, it is hoped that the quality and added value of Dagaa will be further raised.

(3) Effective Utilization of Market Facilities

The handled quantity of Dagaa, which accounts for more than 90% of total handling volume, greatly varies and the overall market operating efficiency also changes according to the phase of the moon and whether it is the rainy or dry season. Accordingly, by using the Dagaa handling spaces to handle increased quantities of other products during periods when incoming Dagaa quantities are small, it is desirable to raise the market operating efficiency and increase quantities handled by the market overall. As a result, it will be possible to increase the market operating efficiency and boost revenue

going to Mwanza City. In this way it is desirable to construct a flexible and planned market operating and management system. In specific terms, products such as cereals, beans and dried cassava, etc., which are prone to the effects of rain and have a relatively long storage period, shall be carried into the market at times when the handled quantity of Dagaa is low. Also, concerning shells, which are used as fodder and are handled in increasing quantities in recent years, since these are not affected by the rain and also have a long storage period, it is relatively easy to increase the handled quantity around the full moon when Dagaa catches are down or to use for making other adjustments. In this way it is desirable to construct a flexible and planned market operating and management system.

(4) Introduction of a User Charge System for Market Operating Expenses

Concerning the cost of utilities such as electricity and water supply for which consumption levels can be clearly distinguished between users at the market, it is desirable to introduce and implement a charge system applied according to each user or using body. Introducing such a system will clarify the rights and obligations of each user and lead to a higher sense of responsibility concerning the careful use of electricity and water, etc., and it will also eliminate any sense of unfairness between users. Moreover, such a system will reduce the cost burden of Mwanza City and will be effective in helping secure the sound and appropriate running of market facilities.