MINISTRY OF WORKS,
TRANSPORT AND INFRASTRUCTURE
THE INDEPENDENT STATE OF SAMOA

No.

BASIC DESIGN STUDY REPORT

ON

THE PROJECT

FOR

CONSTRUCTION OF INTER-ISLAND FERRY

IN

THE INDEPENDENT STATE OF SAMOA

May 2008

JAPAN INTERNATIONAL COOPERATION AGENCY

FISHERIES ENGINEERING CO., LTD.

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PREFACE

In response to a request from the Government of the Independent State of Samoa, the Government of Japan decided to conduct a basic design study on the Project for Construction of Inter-Island Ferry and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Samoa a study team from November 13 to December 1, 2007.

The team held discussions with the officials concerned of the Government of Samoa, 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 Samoa 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 Independent State of Samoa for their close cooperation extended to the teams.

May 2008

Masafumi Kuroki
Vice-President
Japan International Cooperation Agency

May 2008

LETTER OF TRANSMITTAL

We are pleased to submit to you the basic design study report on the Project for Construction of Inter-Island Ferry in the independent State of Sama.

This study was conducted by Fisheries Engineering Co., Ltd., under a contract to JICA, during the period from November, 2007 to May, 2008. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Samoa 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,

Toyonori Watanabe
Project manager,
Basic design study team on
the Project for Construction of Inter-island Ferry
Fisheries Engineering Co., Ltd.

SUMMARY

(1) Outline of the Country

The Independent State of Samoa (hereinafter referred to as Samoa) is a small volcanic island country composed of nine islands of varying size situated in the South Pacific Ocean, 2,300 km north of New Zealand and 3,700 km south of Hawaii. Savaii (area 1,700 km^2), the largest island, and Upolu (area 1,115 km^2), where the capital city is located, account for 96% of the national land area of 2,935 km^2. The two islands are separated by the 13-mile-wide Apolima Strait.

Both islands have precipitous terrain with 1,000m-high mountains in the center and their undeveloped interiors are covered by tropical rain forests. Mt. Silishili, the country's highest peak, is located on the island of Savaii among a volcanic mountain range running east to west. With its tropical rainforest climate, the weather is hot and humid throughout the year. The average temperature is 27℃ and there are two seasons, the dry season which lasts from May to October and the rainy season which lasts from November to April.

Samoa has a population of 184,955 (according to the 2006 census), 90% of whom are Samoans of Polynesian descent. 73% of the population lives on the island of Upolu and 24% on the island of Savaii. The economy is based on agriculture, fishing and money transfers from islanders living abroad and approximately two-thirds of the working population are employed in agriculture, forestry and fishing, the country's main industries. Samoa produces various fruits and marine products, but industry is hard to develop due to the long distance to international markets and the small scale of the domestic market. The economic structure is typical of a small island country with its dependence on imports for most consumer goods. As a result, Samoa suffers from a chronic trade deficit, but as the deficit is covered by cash transfers from abroad and tourism revenue, the current balance of payments is relatively healthy.

The nominal GDP in 2006 was 1,017.2 million US dollars (real GDP of 356.4 million US dollars, 2,015 US dollars per capita) and average annual growth of 4.3% (2002 fixed base) was achieved for 10 years from 1997. Although the Samoan economy is expanding steadily, 48% of households live in poverty, rising to 55% on Savaii where development is lagging.

(2) Background, Circumstances and Outline of the Requested Project

Savaii Island is the main producing area for agricultural products which are Samoa's principal products, but as the production is low and educational institutions are limited, most residents seek employment and educational opportunities on the island of Upolu. The ferry link between the two islands plays an important role in stimulating the economy of Samoa as a major artery for human exchange and distribution of goods. For the residents of Savaii in particular, the ferry is a vital lifeline that not only enables them to obtain the basic necessities of life, but provides a means of commuting to work or returning home for a visit. In 2006, the ferries carried a total of 576,000 passengers and 57,000 vehicles. As a result, the Samoan Government included the upgrading of international and domestic transport services as one of the key strategies in "Strategy for the Development of Samoa"

(2005-2007).

Samoa Shipping Corporation Ltd. (SSC) which is responsible for maritime transport in Samoa has four ships, two of which, MV Lady Samoa II (867 tons, hereafter called LS2) and MV Fotu-o-Samoa II (299 tons, hereafter called FOS2), provide transport between the two islands. The MV Samoa Express (340 tons, hereafter called SE) provides a temporary backup service when LS2 or FOS2 is under repair or at busy times as a measure to cope with demand for sea transport. LS2 takes approximately 1 hour and 10 minutes to sail between the two islands, while FOS2 and SE take approximately 1 hour and 20 minutes. The departure times and number of services vary according to day of the week, but normally LS2 leaves Salelologa wharf and FOS2 leaves Mulifanua wharf at 6:00am and they each make 1 to 3 return crossings a day.

A distinctive concentration of passengers is seen on LS2 at the end of the week and at the beginning of the week. The average boarding rate on these particular services is more than 80% of the 480-passenger capacity (300 seated and 180 standing) and is increasing annually. Furthermore, there is a particularly conspicuous concentration of passengers at Christmas time and around important public holidays with passenger numbers in excess of 800. In 2006, the boarding rate exceeded 100% 85 times. On the other hand, although the total volume of vehicle transport has increased 60% over the past 10 years, the annual transportation volume on LS2 remains at around 31,000 vehicles. This is because the vehicle transportation capacity has reached its limit, with the particular services always fully booked.

LS2 which came into service in 1988 under Japanese Grant Aid is the main inter-island ferry. In 2006 it carried 66% of all passengers and 58% of all vehicles. However, it is now 19 years old and deteriorating. On average, services had to be cancelled 8.5 times a year due to unexpected problems, totaling approximately 30 days. Repair costs are rising year by year and, though the service is operable, there are safety issues, making it an increasingly unstable means of inter-island transport. Transportation demand is expected to go on growing in the future in conjunction with the development of Savaii and an important task is to ensure a stable solution to this growing demand.

Against this background, the Samoan Government formulated the “Project for Construction of Inter-Island Ferry” aimed at securing a lifeline between the islands of Upolu and Savaii and promoting the economy of Samoa by providing safe, stable and economical passenger transportation, and presented a request for Grant Aid to the Government of Japan in June 2005.

(3) Outline of the Study and Details of the Project

In response to the request, the Government of Japan decided to conduct a basic design study and the Japan International Cooperation Agency dispatched a basic design study team to Samoa from November 13 to December 1, 2007 and sent a team to explain a draft basic design report from March 31 to April 5, 2008.

As a result of the study, it was found that LS2 not only lacks adequate transportation capability, but at the same time, continued service will be difficult as it has a remaining life expectation of about 5 years. It was judged that, in order to maintain inter-island transportation, a substitute vessel is urgently required. The basic policy in planning the Plan Vessel is consideration for lowering maintenance costs.

The appropriate scale and details were determined based on predicted demand in the target year of 2020, taking into account the background of the project, the transport situation, the natural conditions and conditions of the sea route, maintenance and management system, applicable regulations, etc. obtained through the field study and analysis in Japan. The Plan Vessel is outlined below.

Number of vessels	One
Kind of vessel	Inter-island ferry
Length overall	46.70 m
Length between perpendiculars	42.00 m
Breadth, molded	13.00 m
Depth, molded	3.90 m
Draft, molded	2.35 m
Gross tonnage, international	About 1,000 tons
Service speed	12 knot
Complement on board	Total 752 persons (Seated economy class 460, standing economy class 232 p, business class 48 p and crew 12 p)
Vehicle deck	Width 10.90 m x Length 44.00 m x Height 3.80 m
Main engine	Medium speed diesel 880 kW (1,200 ps) x 2 sets, low NOx emission
Propeller	4 blade solid, about 2.0 m diameter
Tank capacity	Fuel oil110 m^3, Fresh water 10 m^3
Bow thruster	Diesel driven, fixed pitch, about 750 mm diameter, 1 set, 18 kN thrust
Main generator	150 kVA, 445V, 50Hz x 2 sets (130 kW x 1,500 rpm diesel driven)
Lifesaving apparatus	Liferaft 550 persons, buoyant apparatus 220 person, FRP rescueboat, lifejacket, etc.
Fire fighting equipment	Fire hydrant, CO2 fixed fire extinguisher, vehicle deck sprinkler, portable fire extinguisher, fire detector, etc.
Navigation equipment	Magnetic compass, GPS compass, radar, GPS, etc.
Radio apparatus	VHF radio telephone, MF/HF SSB radio telephone, EPIRB, SART, Walkie talkie, etc.

(4) Work Schedule

If this project is implemented with Japanese Grant Aid, the overall construction period will be 20.5 months including the bidding process (4.5 months for detailed design and 16.0 months for construction and transporting the vessel to Samoa).

(5) Project Implementation and Ferry Operation

The main government department involved in the project is the Ministry of Works, Transport and Infrastructure and the implementing agency responsible for operation and maintenance/management of the vessel is the wholly Samoan Government-funded SSC. In the more than 30 years since it was founded in 1974, the SSC has been in charge of marine transport in Samoa and in 1998 its International Safety Management system was certified by Lloyd's Register of Shipping. Furthermore, with a competent workshop in the South Pacific that keeps its ships in good condition and with sound corporate management, the SSC is adequately capable of managing ferry operations. From estimations of income and expenditure for the Plan Vessel, the balance of payments in 2011 (after one year of service) is expected to improve due to reduced repair costs and lower fuel consumption. And in 2020 when it is assumed that revenue from services will steadily increase, further profit is anticipated, enabling continued sound management and proficient maintenance.

(6) Verification and Appropriateness of the Project

Implementation of the project is expected to have the following effects on the problems facing inter-island sea transport on which the local economy of Samoa and the livelihoods of the residents rely. As Samoa's entire population of 184,955 people will benefit, it is concluded as appropriate to implement the project with Grant Aid.

Current status and problems	The existing island link ferry MV Lady Samoa II, despite being an indispensable means of transport infrastructure for Samoan nationals, is unstable in its operation due to breakdown and frequent voyage cancellation. Therefore, there is a risk of major disruption in the event of voyage cancellation for several days. Besides, the capacity of MV Lady Samoa II is insufficient to cope with the increased demand for passenger and vehicle transport.
Measures taken in the cooperation Project	Building of a new island link ferry
Direct effects and degree of improvement	(1) The existing ferry will be difficult to maintain services in the first half of 2010's due to ageing, but introduction of a new ferry which can serve 25 years or more will secure necessary capacity for island link transport thereafter. (2) Unforeseeable voyage cancellation due to breakdown has been frequent, about 14 days or about 67 voyages per annum average in recent years, but such cancellation will be decreased to only few days or few voyages, so that the ferry service will become stable. (3) There has been frequent overloading of passengers, e.g. 85 times in 2006, but such overloading will be eliminated by increasing passenger capacity on board from 480 people to 740 people, and in

	future, ferry services will be possible to cope with increased passenger transport demand. (4) Vehicle deck area is increased by 26%, so that vehicle transport capacity will be increased from 30 to about 37 (number equivalent to small cars)
Indirect effects and degree of improvement	(1) Trunk line of Samoa linking islands as lifeline is secured. (2) Development of industry, tourism, etc. on Savaii Island is promoted, so that increase of cash earning opportunities and improvement of living level are expected.

(7) Recommendation

To ensure that the proposed vessel in this project is fully utilized and provides smooth inter-island transport, it is recommended that the following points are duly considered.

1）Implementation of service to meet demand

As the vessel to be constructed in this project will have a capacity of 740 passengers and the area of the vehicle deck will be 26% bigger than the LS2, it will become easy to cope with high transport demand at the beginning and end of consecutive holidays. However, as concentrated demand in excess of capacity can be expected at peak times, appropriate measures will be necessary, such as backup by another vessel and additional services, to ensure smooth operation without disruption and with minimal congestion, and efforts must be made to disperse demand through advance publicity to users.

2) Implementation of Preventive Maintenance Policy (PMP)

To minimize unexpected breakdown of the project vessel and cancellation of services and to reduce repair costs over the long term, a preventive maintenance policy (PMP) should be implemented. Under PMP, components are replaced at given periods regardless of malfunction or degree of wear and the replaced components are reconditioned and stored. The SSC already implements PMP for its vessels, but the Plan Vessel should use the replacement parts procured by this project in an attempt to further promote thorough PMP.

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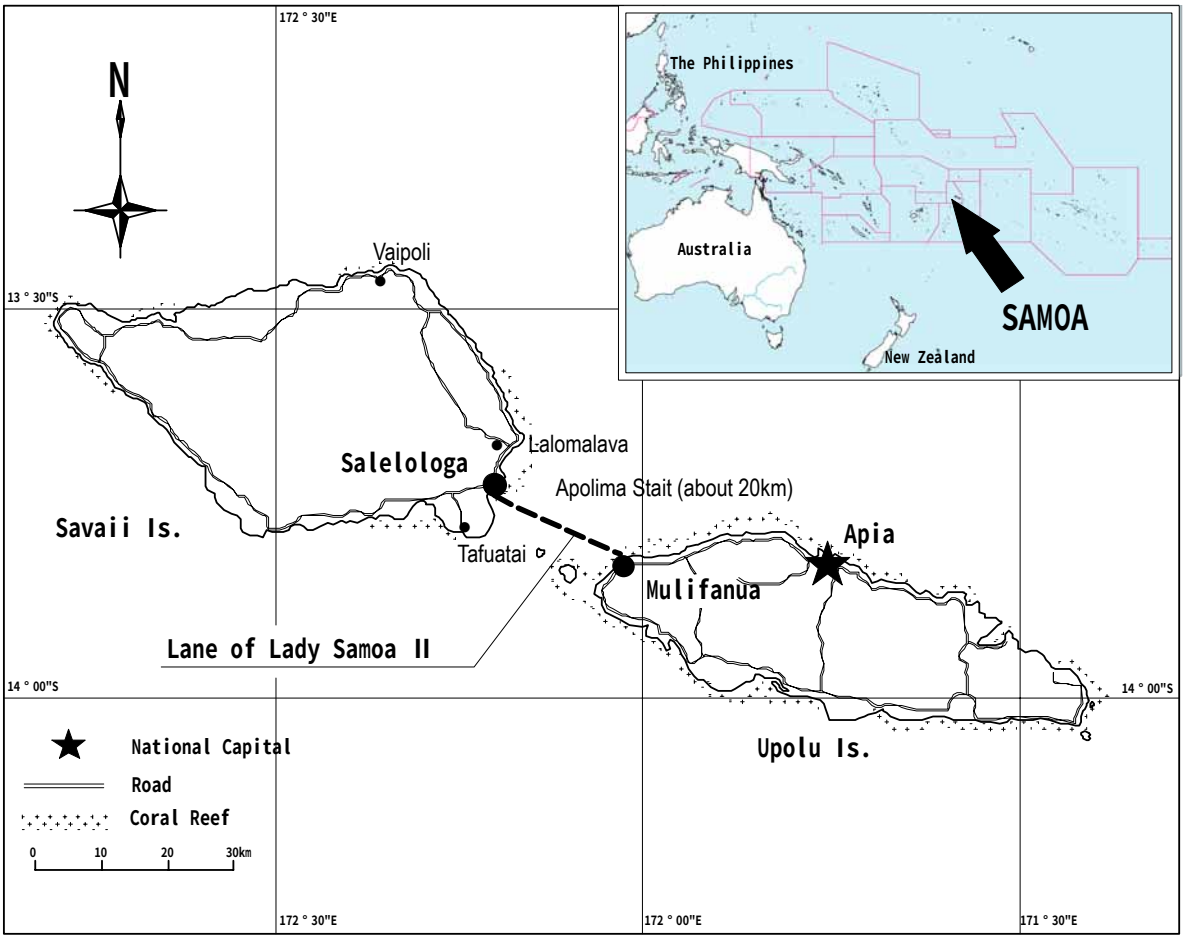

172 ° 30"E
N
The Philippines
Australia
SAMOA
New Zealand
Vaipoli
13 ° 30"S
Lalomalava
Salelologa
Apolima Stait (about 20km)
Savaii Is.
Apia
Tafuatai
Mulifanua
Lane of Lady Samoa II
14 ° 00"S
14 ° 00"S
National Capital
Road
Coral Reef
0 10 20 30km
Upolu Is.
172 ° 30"E
172 ° 00"E
171 ° 30"E

SITE MAP

PERSPECTIVE

LIST OF FIGURES AND TABLES

ABBREVIATIONS

AC	Alternating current
AC	Anti-corrosive (paint)
AF	Anti-fouling (paint)
CO_2	Carbon dioxide
CPU	Central processing unit
DC	Direct current
DSC	Digital selective calling
EMR	Engine monitoring room
EPIRB	Emergency position indicate radio beacon
FO	Fuel oil
FOS2	MV Fotu-o-Samoa II
GDP	Gross domestic product
GHz	Giga Hertz (1 GHz = 1 x 10^9 Hz)
GMDSS	Global Maritime Distress and Safety System
GPS	Global positioning system
HF	High frequency
HFC	Hydro fluoro carbon
HK	Nippon Hakuyohin Kentei Kyokai (The Ship Equipment Inspection Society of Japan)
HT	High tensile strength steel
IMO	International Maritime Organization
ISM	International Safety Management
ISO	International Organization for Standardization
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standards
kN	Kilo Newton (1,000 kgf = 9.80665 kN)
KT	Knot (v = 1,853 m/h)
kVA	Kilo volt-ampere
kW	Kilo Watt (1 kW = 1.359 ps)
LCD	Liquid crystal display
LN	MV Lady Naomi
LO	Lubrication oil
LRS	Lloyd's Register of Shipping
LS2	MV Lady Samoa II
MARPOL	International Convention for the Prevention of Pollution from Ships
MF	Medium frequency
MPa	Mega Pascal (1 kgf/cm^2 = 0.098 MPa)
MV	Motor vessel
MWTI	Ministry of Works, Transport and Infrastructure
NiAlBz	Nickel aluminum bronze
NK	Nippon Kaiji Kyokai
NOx	Nitrogen oxide
ph	Phase

PMP	Preventive Maintenance Policy
PS（ps）	Pferdestärke (1 ps = 0.7355 kW)
ROM	Read-only memory
RH	Relative humidity
Ro/Ro	Roll-on roll-off
SART	Search and rescue transponder
SAT	Samoa Tala
SE	MV Samoa Express
SOLAS	International Convention for the Safety of Life at Sea
SPA	Samoa Port Authority
SPC	South Pacific Commission
SSB	Single side band
SSC	Samoa Shipping Corporation Limited
SUS	Stainless steel
UNDP	United Nations Development Programme
VHF	Very high frequency
VRF	Vessel Replacement Fund
WC	Water closet

CHAPTER 1 BACKGROUND OF THE PROJECT

Chapter 1 Background of the Project

1-1 Background of the request

The Independent State of Samoa (hereinafter referred to as Samoa) is an island country in the central part of the South Pacific. Samoa comprises two large islands, Upolu and Savaii, and seven small islands, and the livelihood of Samoans and their economic activities, domestically and internationally with neighboring countries, rely greatly on sea transport. The Government of Samoa urges the upgrading of infrastructure services, especially international and domestic island link transport services, as one of the nine key strategies in its national development plan "Strategy for the Development of Samoa 2005-2007". 97% of all Samoans live on Upolu Island and Savaii Island, and the island link ferry connecting Upolu Island, which is economically active and where the capital city Apia is located, and Savaii Island, which produces coconuts and copra, Samoa's main products, plays an important role as the main artery for movement of people and economic development. In 2006 the island link ferries carried 576,000 people and 57,000 vehicles.

For the Upolu-Savaii link, Japan provided Grant Aid cooperation to upgrade domestic sea transport: upgrading of Mulifanua wharf on Upolu Island and Salelologa wharf on Savaii Island in 1984 – 1985 (construction of new terminal buildings, upgrading of wharves, and dredging of turning basins and water channels), and construction of a new ferry, MV Lady Samoa II (867 gross tons, hereinafter called LS2), in 1987.

Under the management of the Samoa Shipping Corporation Limited (a government-owned public enterprise, hereinafter called SSC), LS2 started service in 1988 and has greatly contributed to island link services, but she is now close to 20 years old and suffers from frequent breakdowns despite regular maintenance work by the SSC. Normally, the island link is served by LS2 and Fotu-o-Samoa II (owned by SSC, 299 gross tons, hereinafter called FOS2), but when LS2 cannot work, MV Samoa Express (owned by SSC, 340 gross tons, hereinafter called SE), works with FOS2 to cover the absence of LS2, but SE and FOS2 only have a capacity of about 1/4 of LS2 and are unable to cover for LS2. The island link capacity is getting poorer and adversely influencing economic activity.

In 2003 and 2007 overhaul and technical servicing of the main engines and gearboxes were conducted under JICA's follow-up cooperation for LS2, and the main engines were restored to working order, but still the safety systems remain in a faulty condition.

Considering the situation, the Government of Samoa requested the Government of Japan for Grant Aid cooperation for a new ferry to replace the existing LS2.

Table 1-1 shows the main particulars of the requested vessel submitted by Samoa, together with those of the existing LS2. In Samoa, the contents of the request were discussed and studied,

and it was confirmed that the contents of the request generally remain unchanged.

Table 1-1 Main particulars of the requested vessel and LS2

Item	The requested vessel	LS2
Length overall	46.70m	43.30 m
Length between perpendiculars	42.00 m	38.60 m
Breadth, molded	13.00 m	11.50 m
Depth, molded	3.90 m	3.90 m
Gross tonnage [1]	990 tons	867 tons
Passenger capacity	508 persons	480 persons
Crew	12 persons	12 persons
Main engine	880 kW (1,200ps) x 2	883 kW (1,200ps) x 2
Service speed	12 knots	12 knots

1-2 Natural conditions of the project site

Figure 1-1 shows the accumulated probability of wind speed in Apia derived from wind statistics obtained from the Samoa Meteorological Office. It shows that the accumulated probability for a wind speed of 20 knots (10.3 m/s), which is normally the maximum wind speed allowed for vessels to maneuver in port by its own power, and over is only 2.7%, which is considered moderate when compared with a probability of about 5% in Japan.

Wave height in the Apolima Strait is not measured, but it is obviously lower than that in the open sea. According to the captain of LS2, the wave height in the strait is about 4ft (1.2m) maximum, which is quite moderate compared with an average 2.0m wave height in coastal sea-lanes around Japan.

Under such wind and sea conditions, LS2 has continued to provide satisfactory island link transport. Therefore, the design of LS2 is considered suitable to ensure adequate seaworthiness. It is reported, however, that the bow thruster of LS2 is not strong enough as it can only withstand a wind force of up to 17.5 knots. The capacity of the bow thruster for the Plan Vessel should be suitable for moving the vessel laterally towards the wharf under a 20-knot wind speed.

[1] A value obtained from aggregate enclosed part of a vessel multiplying a coefficient. The gross tonnage is not a scale of weight but represents scale of external hull. In the plan Vessel, vehicle space is excluded from the gross tonnage measurement as an open space.

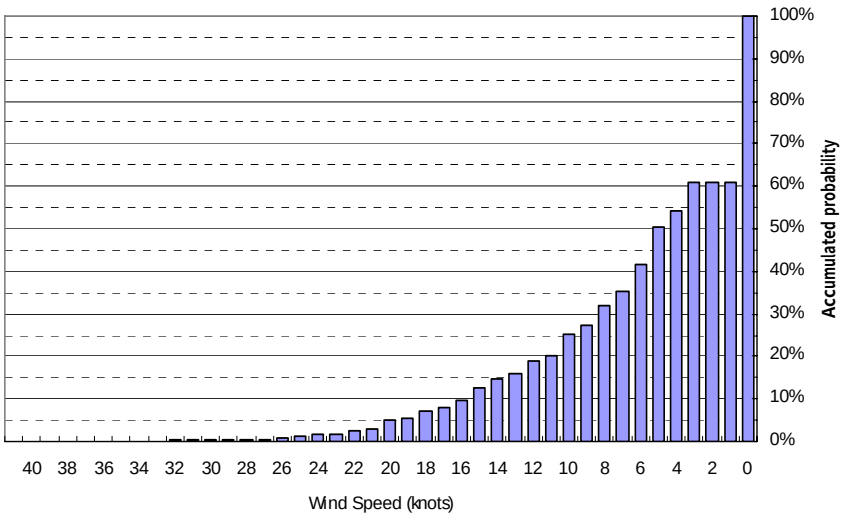


Figure 1-1 Accumulated probability of wind speed in Apia

1-3 Environmental and social conditions

The International Convention for Preventing Pollution from Ships (known as MARPOL) was already in effect when LS2 was built in 1987, but MARPOL has been revised, so some of the machinery on board the Plan Vessel must satisfy the latest MARPOL requirements. Table 1-2 shows the MARPOL requirements for LS2 and the Plan Vessel.

Table 1-2 MARPOL requirements for LS2 and the Plan Vessel

Target	LS2	The Plan Vessel
Measures against oil pollution	Required (must have oily bilge separator on board)	Same
Control of sewage discharge	Not required	No discharge in coastal waters (installation of sewage collecting tank)
Control of air pollution	Not required	NOx emission control (adoption of a diesel engine that satisfies the latest requirements)

CHAPTER 2 CONTENTS OF THE PROJECT

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

The total population of Samoa is 184,955 (2006) with 135,387 (73%) living on Upolu Island, where the capital city of Apia is located, and 44,759 (24%) living on Savaii Island. Although the economy of Samoa has been growing satisfactorily by 4.3% per annum, poverty is high at 48% in Samoan families and particularly high at 55% on Savaii Island, where development is relatively slow.

Savaii Island produces coconuts and copra, which are Samoa's main products, but industries other than agriculture are very poor and education facilities are limited, so many people on Savaii look for work and education in Upolu. This situation makes the ferry service linking the two islands a main artery which plays an important role in providing people and material transport between the islands, thus promoting the economy of entire Samoa. In particular for Savaii Island people, the island link ferry service is an indispensable lifeline as a means of traveling and commuting as well as getting essential commodities. In 2006, the island link ferries transported 57,600 people and 5,700 vehicles.

The ferry LS2, introduced in 1988 by the Grant Aid cooperation of Japan, is working as the main ferry in the island link service, and it carried 66% of all the people and 58% of all the vehicles transported by the island link ferry services in 2006. However, while the demand for island link transport is greater than the available capacity of LS2, LS2 is 19 years old and suffers from frequent breakdowns, resulting in voyage cancellations about 8.5 times per annum for about 30 days per annum on average due to docking and breakdown in recent years, and it also suffers from expanding repair costs. SSC makes every effort to maintain operation, but island link transport is now in an unstable and unreliable situation.

Understanding that the demand for island link transport is expected to grow steadily in the future, enhanced further by the national policy for the development of Savaii Island, and that solving the abovementioned problems of LS2 is indispensable, the Government of Samoa urged the upgrading of its international and domestic shipping services in its national development plan "Strategy for the Development of Samoa 2005-2007" as one of the important key strategies, and considered a plan to replace the existing inter-island ferry in order to secure stable island link sea transport. The plan is targeted at activating the economy of Samoa by securing stable island link transport to cope with growing demand.

In response to the request from Samoa, hoping to achieve the abovementioned target, this Grant Aid cooperation Project intends to procure a new ferry of about 1,000 gross tons linking Upolu Island and Savaii Island, in place of the existing ferry MV Lady Samoa II.

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Fundamental Functions of the Plan Vessel

To build a new vessel in place of aged inter-island vessel, under the intention to improve current unstable island link transportation, the new Plan Vessel should be designed satisfying fundamental functions as follows.

(1) Passenger and vehicle carrying capacity

Studying passenger and vehicle transport statistics of MV Lady Samoa II, capacity for the Plan Vessel should be so determined as to be adequate to cope with increased transport demand at the target year of 2020 when MV Samoa Express and MV Fotu-o-Samoa II are aged and to be replaced with new tonnages.

(2) Vessel size

The Plan Vessel should be of length, breadth and draft, which are suitable in the existing wharf facility, water channel and turning basin dimensions without modifications.

(3) Safety

Vessels must be designed and built by applying the safety regulations of the flag administration, or other appropriate safety regulations as recognized by the flag administration. It was decided by the Samoan Maritime Administration that Japanese maritime regulations, such as subdivision regulations, stability regulations, fire protection regulations, fire fighting regulations and lifesaving regulations, should apply to the Plan Vessel as non-international passenger vessel operating in coastal waters.

(4) Environment friendliness

MARPOL regulations (International Convention for the Prevention of Pollution from Ships, 1973) ratified by the Samoan Government should apply. An oily water separator to clean oily bilge water, and low NOx emission diesel engines should be installed on board of the Plan Vessel.

(5) Economical operation

The new island link ferry should be of the same design as the existing ferry LS2, limited in length, with wide beam and shallow draft to pass through narrow and shallow water channels dredged through the coral reef. Beamy, shallow draft hull has little room to improve water resistance, but propulsion efficiency should be improved by adopting a slower spinning large diameter propeller. The main engines should be selected considering economic fuel oil consumption.

(6) Passenger facilities

As the sailing time is short, about 1h 10min, the seats should be arranged in the passenger space like the existing ferry. Apart from Tourist Class (ordinary passenger space), Business Class space, a little wider than Tourist Class, should be provided. Business Class passenger seats should be about 10% of total passenger seats.

Passenger and crew accommodation should be air-conditioned. As the vessel hull and superstructure must maintain watertightness by closing all doors and windows at sea, air conditioning is indispensable for vessels sailing in a tropical climate.

In the existing vessel LS2, passengers embark and disembark via the vehicle ramp, mixed with vehicles. This is dangerous for passengers and also inefficient. In the Plan Vessel, access for passengers allowing embarkation and disembarkation separate from vehicles should be considered.

Passengers include aged, handicapped and obese people, who find it difficult or are unable to use the long stairway to the passenger deck. Necessity of countermeasures for these disabled people have been recognized. In the Plan Vessel, installation of an elevator between the vehicle deck and passenger deck should be considered. Besides, in the passenger areas, wheelchair-friendly design should be considered.

(7) Durability and maintenance

Durability of vessels depends on the material itself and/or on maintenance.

Rusting of seawater pipes represents the former case. In the Plan Vessel, all seawater cooling pipes (steel) should have plastic coating on the inside surface, preventing rusting of seawater pipes.

Diesel engine represents the latter case. In the Plan Vessel, Preventive Maintenance Policy (PMP) should be adopted. PMP carries out overhauling and maintenance regularly without waiting for breakdown or malfunction, which is expected to bring a decrease of machinery breakdown and longer life. Machinery parts necessary for PMP should be procured by the Project.

2-2-1-2 Capacity of the Plan Vessel

(1) Logic in determining the capacity

Island link ferry services from Mulifanua are busy from Friday evening to Saturday morning with people who are living in Upolu, apart from their families in Savaii, and tourists in addition to daily commuters. Next, from Sunday evening to Monday morning, ferry services from Salelologa become busy with the same people who return to Upolu for work.

At the beginning and end of consecutive holidays, e.g. Christmas, many Samoan people travel and ferries are exceedingly crowded.

Weekdays from Tuesday to Thursday, island link ferries are lightly loaded.

The Plan Vessel should meet passenger demand reasonably on ordinary weekends, without extra voyages, without adding backup, with most pax seated, and further should cope with big demand at the ends of holidays, even with extra voyages as necessary, and adding backup as necessary.

As demand to carry vehicles does not significantly change on weekends and holidays, unlike passenger demand, the Plan Vessel capacity to carry vehicles should be appropriate, corresponding to projected demand in a certain year after the Plan Vessel is commissioned.

Demand for passenger and vehicle transport will keep growing. In future, SSC will have to review demand and ways to cope with that projected demand, at a time when replacement of MV Samoa

Express and MV Fotu-o-Samoa II with new tonnages is planned, i.e. in about 2015 – 2020[2]. In this Project, therefore, demand for the year 2020 (10 years after the Plan Vessel is commissioned) should be set as the target year. The capacity of the Plan Vessel should satisfy the projected demand in 2020.

(2) Correlation between Socioeconomic index and transport

Analyzing transport statistics from 1996 to 2006 for the Mulifanua – Salelologa link ferry services in correlation with socioeconomic indexes, positive correlation was found between the economy of Samoa and transport, particularly on the growth of GDP. Following regression formula were obtained through the analysis, of which detail is shown in the Appendix-5.

Regression-1 GDP = 33,402 x Year – 65,988

Regression-2 Annual Total Pax = 0.393017 x GDP + 127,391

Regression-3 Annual Total Vehicle = 0.12476 x GDP – 1.14232 x Population + 132,902

(3) Passenger transport

Annual total demand projection Table 2-1 and Figure 2-1 show past and projected passenger demand for all SSC vessels, calculated by the Regression-2 formula. Data up to 2006 are actual numbers and data from 2007 are projected.

The regression-2 formula uses regression-1 formula to obtain projected GDP. Past and projected GDP are shown in Figure 2-2.

Table 2-1 Pax demand (for all SSC vessels)

Year	GDP	Pax projection	Increase*
2001	869,061	448,511	
2002	885,000	465,399	
2003	912,562	396,247	
2004	943,256	466,377	
2005	991,844	563,868	
2006	1,017,151	576,433	Base year
2007	1,048,543	539,486	-6.41%
2008	1,081,945	552,613	-4.13%
2009	1,115,346	565,741	-1.85%
2010	1,148,748	578,868	0.42%
2015	1,315,756	644,505	11.81%
2020	1,482,764	710,142	23.20%
2025	1,649,772	775,779	34.58%
2030	1,816,780	841,416	45.97%

*Rate of increase: Year 2006 as unity

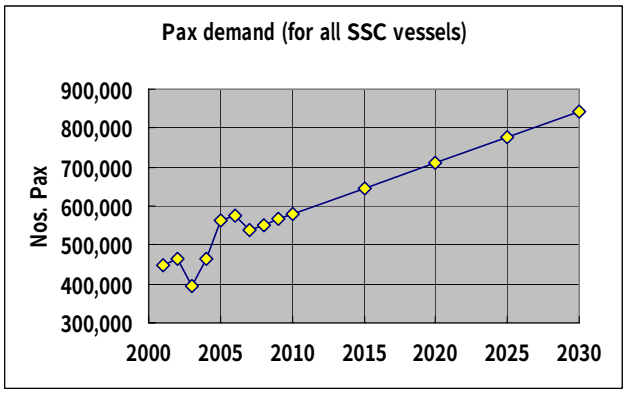


Figure 2-1 Pax demand (for all vessels)

[2] FOS2 and SE were both built on 1995. It is estimated that two vessels will be replaced with new tonnages on about 2015 – 2020 when vessels get to 20 – 25 years old.

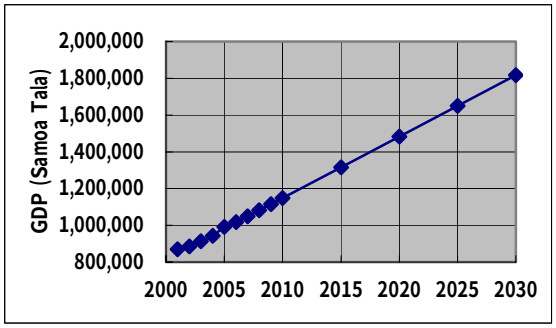


Figure 2-2 GDP projection

(4) Projection of passenger demand on weekend

At the beginning of the weekend many people move from Upolu Island to Savaii Island, and then at the end of the weekend the same people return to Savaii Island. The following are the particular voyages with high concentrations of people on weekends.

Voyage no.	Route	Day	Departure
MF16 FR	Upolu →Savaii (voyage from Mulifanua)	Friday	1600
MF12SA		Saturday	1200
SL14SU	Savaii → Upolu (voyage from Salelologa)	Sunday	1400
SL06MO		Monday	0600

Table 2-2 and Figure 2-3 show no. of passengers as an average of all the particular voyages in a year. Nos. of passengers in 2007 and later are projected figures using increase rate as shown in Table 2-1.

Table 2-2 Nos. of pax on board the weekend particular voyages (all SSC vessels)

Year	SL06MO	MF16 FR	MF12SA	SL14SU
2003	345	326	341	391
2004	402	340	356	391
2005	411	357	393	389
2006	423	354	399	401
2007	396	331	374	376
2008	406	339	383	385
2009	416	347	392	394
2010	425	355	401	403
2015	473	396	447	449
2020	522	436	492	494
2025	570	476	538	540
2030	618	516	583	586

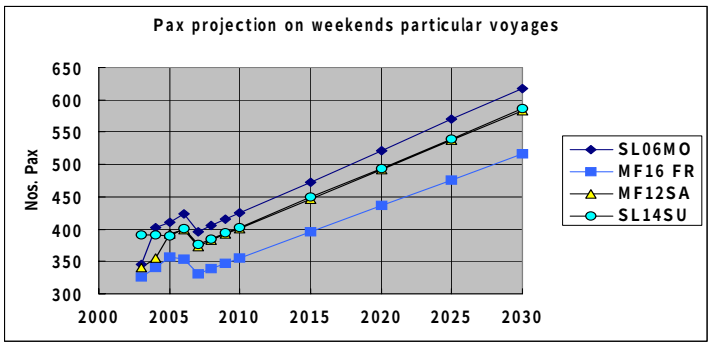


Figure 2-3 Nos. of pax on board the weekend particular voyages (all SSC vessels)

Projected nos. of passengers shown in Table 2-2 and Figure 2-3 are the average of all weekend particular voyages, and actual number of passengers varies each week. Standard deviation from 2006 data, projected range of deviation in 2020, and number of voyages in which 508 seats (as requested by Samoa) will cover boarded passengers in % are shown in Table 2-3.

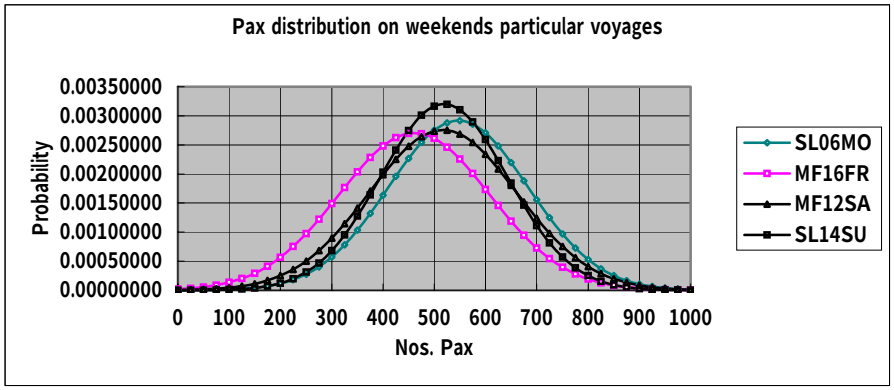
As all data of passenger transport in the preceding paragraphs do not include number of drivers (about 25 persons), the Table 2-3 shows number of passengers added with 25 drivers to the number shown in the Table 2-2.

Table 2-3 Range of passenger nos. in 2020

Voyage no.	Standard deviation (% in relation to mean value)	No. of pax deviation in 2020			No. of voyages where 508 seats covers boarded pax3
		Mean	High	Low	
SL06MO	25%	522+25	684	410	53%
MF16 FR	32%	436+25	609	313	72%
MF12SA	28%	492+25	662	372	60%
SL14SU	24%	494+25	644	394	58%
				Mean	61%

The passenger capacity of the Plan Vessel, 508 seats as requested by Samoa, will be reasonable, without standing passengers in 61% of the weekend particular voyages, even on 2020 after steady increase of passengers.

[3] Assuming that no. of pax varies along normal distribution, accumulated percentage of probability up to 508 persons is calculated. (Area of 508 person line and left / entire area)



(5) Coping with big peak demand on consecutive holidays

Island link ferries have a big number of passengers on consecutive holidays: Easter, Mother's Day, White Sunday and Christmas + New Year. People working or studying in Upolu go to their home island of Savaii.

In ordinary weeks LS2 and FOS2 work 3 round trips a day, but in peak times 3 ferries, including SE, work together, sometimes 4 round trips a day. The biggest passenger peak occurs among others at White Sunday and Mother's Day time. Figure 2-4 shows graphs of passenger records of in October 2005 – 2007. The graphs show clearly that on Friday and Saturday just before White Sunday people move from Upolu to Savaii, and then on the next Monday and Tuesday people return to Upolu.

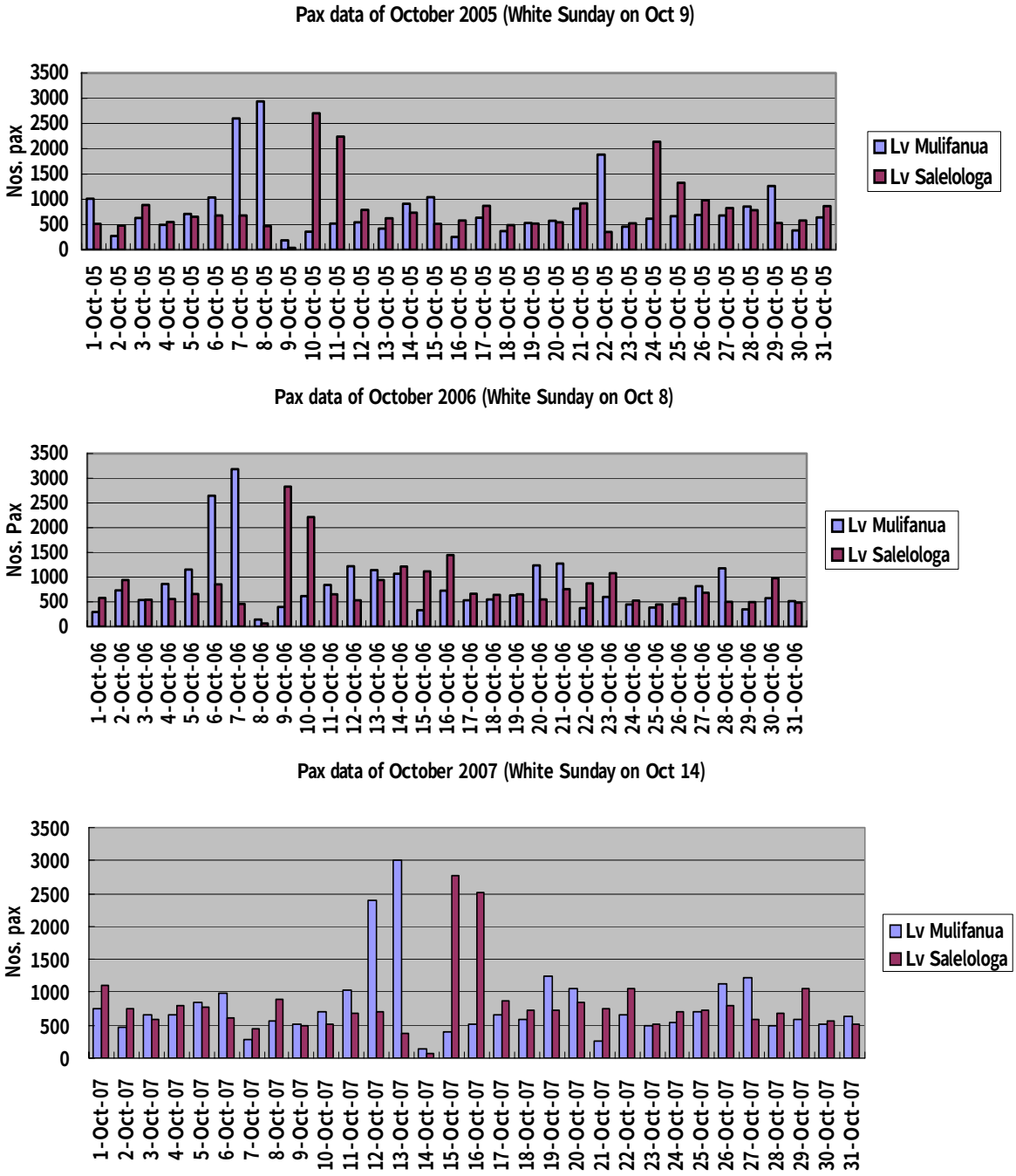


Figure 2-4 Passenger record in October 2005 – 2007 (total for LS2, FOS2 and SE)

Table 2-4 below shows the number of passengers on board each vessel the day before and after White Sunday.

Table 2-4 No. of pax before and after White Sunday, by vessel and by voyage

	Before White Sunday				After White Sunday			
	LS2	FOS	SE	Total	LS2	FOS	SE	Total
2005	Oct. 8	Oct. 8	Oct. 8		Oct. 10	Oct. 10	Oct. 10	
Voyage #1	633		356		425		89	
Voyage #2	622		388		744		294	
Voyage #3	529		412		675		267	
Total	1,784		1,156	2,940	1,844		650	2,494
Mean 1 voyage	595		385		615		217	
+side deviation	6.4%		6.9%		21.0%		35.7%	
2006	Oct. 7	Oct. 7	Oct. 7		Oct 9	Oct 9	Oct. 9	
Voyage #1	491	251	320		358	148	159	
Voyage #2	642	324	356		633	212	302	
Voyage #3	473	328			508	316		
Total	1,606	903	676	3,185	1,499	676	461	2,636
Mean 1 voyage	535	301	338		500	225	231	
+side deviation	19.9%	9.0%	5.3%		26.7%	40.2%	31.0%	
2006	Oct. 13	Oct. 13	Oct. 13		Oct 15	Oct 15	Oct. 15	
Voyage #1	660	177	219		360	187	101	
Voyage #2	610	211	238		499	201	248	
Voyage #3	649	220			602			
Voyage #4					533			
Total	1,919	608	457	2,984	1,994	388	349	2,731
Mean 1 voyage	640	203	229		499	194	175	
+side deviation	3.2%	8.6%	4.2%		20.8%	3.6%	42.1%	

3,185 passengers on October 7th 2006 from Mulifanua is the maximum passenger number in the past three years, and the estimated future number of passengers by multiplying the rate of increase for years 2010, 2015 and 2020 is shown in Table 2-1.

Table 2-5 shows a study to cope with the peak numbers of passengers in 2010, 2015 and 2020 by the three vessels: new vessel, FOS2 and SE.

In this table, the necessary pax capacity of the Plan Vessel is calculated as:
((Projected pax demand a day - Pax capacity of FOS2+SE) / No. of voyages a day) x (+side deviation)

Table 2-5 Projected pax demand and transport by the SSC fleet

	2006	2010		2015		2020	
Rate of increase from 2006	—	0.42%		+11.81%		+23.20%	
Pax demand a day	3,185	3,198		3,561		3,924	
FOS2 pax capacity	903	Same		Same		Same	
SE pax capacity	676						
Pax demand for Plan Vessel a day	(LS2) 1,606	1,619		1,982		2,345	
No. of voyages of Plan Vessel a day	3	3	4	3	4	3	4
Mean pax demand for Plan Vessel	535	540	405	661	496	782	586
Above pax demand x (+side deviation 20%)	642	648	486	793	595	938	703
Standing pax on board the Plan Vessel (Above –508)	—	140	—	285	87	430	195

The Plan Vessel capacity requested by the Samoan side is 508 seats, but 508 seats cannot cover the projected demand in 2020, even with three vessels working four voyages a day. As Japanese Maritime Regulation allows, passenger vessels for short distance service (sailing time within 1.5 hours) may

assign standing passengers at a standard of 0.3m^2 per person. In the Plan Vessel, there are sufficient free areas around passenger seats which can be assigned for standing passengers.

In the target year 2020 for determining the Plan Vessel capacity, 195 standing passengers must be assigned, allowing for a total of 703 passengers on board and assuming 4 voyages a day.

As the above-mentioned data do not include the number of drivers, 37 drivers (=maximum number of small Corolla class cars) must be added.

Accordingly, it is concluded that the passenger capacity of the Plan Vessel should be about 740 persons (=703 + 37 drivers).

Increasing passenger capacity by adding standing passengers is possible by increasing the number of lifesaving appliances (life jacket, liferaft/buoyant apparatus) on board without influencing the size of the hull.

(6) Vehicle transport

Table 2-6 and Figure 2-5 show vehicle transport demand, projected using the formula of regression –3 based on projected GDP and population. In 2020, vehicle transport demand is projected at 79,000, increasing by 39% from the year 2006.

Table 2-6 Projected vehicle transport demand (all SSC vessels)

	GDP	Population	No. of vehicles	Increase rate*
1996	717,086	161,081	35,439	
1997	711,078	164,207	34,934	
1998	728,104	167,395	35,847	
1999	750,401	170,646	33,946	
2000	803,989	173,963	34,177	
2001	869,061	176,710	36,098	
2002	885,000	177,516	38,938	
2003	912,562	178,327	40,825	
2004	943,256	179,141	46,032	
2005	991,844	179,960	51,423	
2006	1,017,151	180,741	56,705	
2007	1,048,543	181,547	52,493	-7.43%
2008	1,081,945	182,357	54,509	-3.87%
2009	1,115,346	183,172	56,526	-0.32%
2010	1,148,748	183,990	58,542	3.24%
2015	1,315,756	188,146	68,623	21.02%
2020	1,482,764	192,408	78,703	38.79%
2025	1,649,772	196,780	88,784	56.57%
2030	1,816,780	201,265	98,865	74.35%

*Increase rate: year 2006 as the base

GDP is projected by Regression-1（y = 33,401x - 65,988,447）and population is projected by the Samoan Government (0.5391％ and 0.1493％ per annum for Upolu and Savaii respectively).

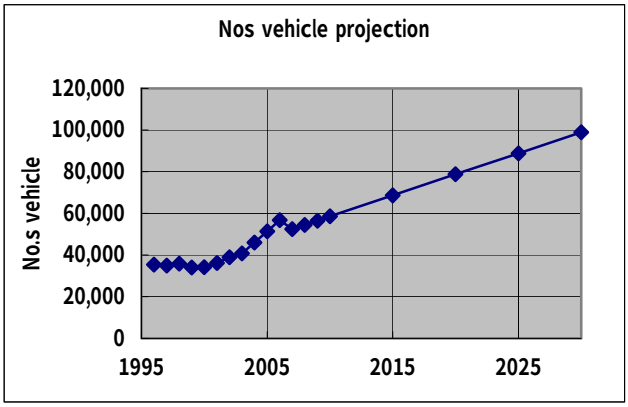


Figure 2-5 Projected vehicle transport demand (all SSC vessels)

The record for January – October 2007 shows that the mean number of vehicles per voyage on board FOS2 and SE was 11.27. FOS2 and SE have a capacity of 14 vehicles of category-C equivalent (small trucks of up to 6.1 m length), but these two vessels mainly carry large trucks. This means that the two vessels are mostly full. On the other hand, LS2 is also full always and leaves vehicles at the wharf. Therefore, it is understood that future increase in demand must be covered completely by the

Plan Vessel capacity.

The capacity of the Plan Vessel to carry vehicles is proportional to the area of the vehicle deck, i.e. approximately Length x Breadth of the hull. In the design of the Plan Vessel, its length is already maximized within the restriction of the narrow turning basin, and its breadth is also maximized from the speed performance, and therefore the vehicle deck area of the Plan Vessel is 26% wider than the existing vessel LS2.

As shown in Figure 2-6 right, vehicle deck area of 26% more will cover projected demand up to 2016, but after 2016 the Plan Vessel will have to cope with vehicle demand by means of extra voyages.

It is concluded that the Plan Vessel vehicle deck area increase of 26% is considered adequate.

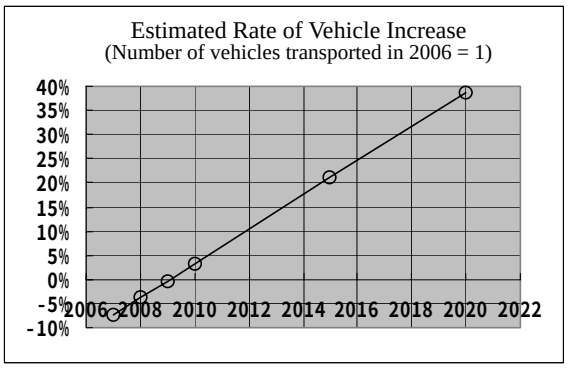


Figure 2-6 Rate of vehicle increase

2-2-2 Basic Plan

2-2-2-1 Rules to Apply and Classification Society

(1) Rules to apply

For vessels engaging in international voyages, various international convention rules including the SOLAS Convention are imposed. For vessels in domestic service, no such international convention rules are imposed (except for certain rules, e.g. COLREG and MARPOL), but safety regulations laid down by the individual national administration apply instead. The Samoa Administration specifies Safety Regulations for Non-Convention Vessels, developed by the Secretariat of Pacific Community (SPC) and adopted by South Pacific countries in 2002, but the said SPC Regulations are applicable only to vessels of less than 24 meters in length. Consulting with the Samoa Administration, it was concluded that the Japanese Maritime Regulations should apply to compensate the SPC Regulations.

The Government of Samoa is a member of IMO and ratifies various international maritime conventions, some of which must be applied to the Plan Vessel. Including the IMO Conventions, the following rules and regulations should apply to the design and construction of the Plan Vessel.

1) Samoan Maritime Regulations
2) Safety Regulations for Non-Convention Vessels, 2002, SPC
3) International Convention on Tonnage Measurement of Ships, 1969
4) International Convention for Load Lines, 1966
5) International Conference for Preventing Collision at Sea, 1972
6) International Convention for Preventing Pollution from Ships, 1973
7) Japanese Maritime Regulations (to supplement the above-mentioned rules and regulations)

8) Rules of the Classification Society

(2) Classification

The Samoan Government entrusts inspection of the Plan Vessel during construction on behalf of the Samoan Government to NK Classification Society as a third party authority. When the Plan Vessel is completed, a classification certificate must be obtained from the NK Classification Society. The Samoan Government will confirm the classification certificate, accept registry in Samoa and issue a Certificate of Nationality.

Even after completion of the new ship inspection, Classification should be maintained through periodical inspection, to maintain and ensure the safety level of the vessel.

If the Samoan side considers it necessary to change the classification of the Plan Vessel from NK to Lloyd's Register of Shipping (LRS) as other SSC vessels are classed, such reclassification should be made under the responsibility of the Samoan side after the turning over of the Plan Vessel.

2-2-2-2 Improvement based on Feedback from MV Lady Samoa II

The following items were found necessary to be improved in the Plan Vessel design and construction.

No.	To be improved	Countermeasures
1	Passengers and vehicles embark and disembark simultaneously using the same shore ramp, which is dangerous for passengers and also inefficient as it takes time to complete embarkation and disembarkation.	Two passenger access ports should be provided on the vessel portside, allowing separate access for passengers and vehicles. Adjustable platform should be fitted to suit tide change and draft change.
2	Aged or handicapped people have difficulty going up to the passenger deck by the stairway about 4 meters high.	Elevator should be provided between vehicle deck and passenger deck. Elevator should be of a size suitable for a wheelchair and a nurse.
3	Bow thruster can only withstand wind force of about 17.5 knots, which is rather low in capacity.	The bow thruster should withstand 20-knot winds, which is the common criterion for berthing without tug assistance.
4	Two main generators must always run in parallel to feed the large electric motor for the bow thruster. Overhauling or maintenance by stopping one generator is not possible.	The bow thruster should be driven directly by a self-sustained diesel engine without relying on the main generator. Overhauling or maintenance of the main generator will be possible anytime.
5	In the night, LS2 connects to shore electricity, and the harbor generator is very seldom used.	Harbor generator need not be installed.
6	Ageing of lubricating oil for the main engines is fast and lubricating oil cost is high.	Lubricating oil purifier of centrifuge type should be installed for each main engine.
7	Mechanical type sterntube seal (adopted in MV Lady Naomi) has better sealing performance than gland packing system but it is difficult to ensure practical maintenance in Samoa.	Gland packing system as adopted in LS2 should be maintained.
8	Engine room bottom is single bottom structure, where accumulated bilge water can cause	Engine room bottom should be double bottom structure.

No.	To be improved	Countermeasures
	corrosion of the bottom shell plates.	
9	Engine room seawater pipes are easily corroded.	Insides of engine room seawater pipes should be coated with plastic.
10	Several female crew members are working on board but they have no female cabin and don't stay overnight on board.	A separate two-bunk cabin for female crew members should be provided.
11	Flushing water of toilets is seawater, which causes corrosion of the piping system.	Toilet flushing water should be fresh water. About 5 tons of seawater should be stowed on board.
12	No space for crew to eat.	Mess facility should be provided.
13	Hinge equipment at base of ramp is difficult to change.	Spherical bearing type allowing easier positioning should be adopted.

2-2-2-3 Basic Plan

One inter-island ferry in place of the existing ferry MV Lady Samoa II is requested by the Government of Samoa. Table 2-7 shows the particulars of the Plan Vessel design, the requested design, and MV Lady Samoa II.

Table 2-7 Plan Vessel design, requested design, and LS2

Item		Draft Plan Vessel design	Requested design	MV Lady Samoa II
Length overall		46.70m	46.70m	43.30 m
Length bp		42.00 m	42.00 m	38.60 m
Breadth, molded		13.00 m	13.00 m	11.50 m
Depth, vehicle deck		3.90 m	3.90 m	3.90 m
Deadweight		190 t	190 t	160 t
Gross tonnage		About 1,000 ton	990 ton	867 ton
Pax capacity		740 pax (508 seats+232 standing pax)	508 pax (seated)	480 pax
Crew		12	12	12
Vehicle deck	Breadth	10.90 m	10.70 m	9.20 m
	Height	3.80 m	3.80 m	3.80 m
	Length	44.00 m	44.00 m	40.60 m
Main engine		880 kW (1,200 ps) x 2	880 kW (1,200 ps) x 2	883 kW (1,200 ps) x 2
Service speed		12 knot	12 knot	12 knot

Although the gross tonnage of the Plan Vessel (as a parameter to express vessel scale) is greater than LS2 by 15% only, the number of pax seats and vehicle deck area are increased. This is because the vehicle deck space is open, excluding most of the vehicle deck space from gross tonnage measurement, resulting in small gross tonnage compared with the scale of the hull.

(1) Gross tonnage

Some flag administrations specify the number of deck officers and their license depending on gross tonnage. It was confirmed by the Samoan Maritime Administration that in Samoa the crew manning

scale does not change at a gross tonnage of 1,000 tons and therefore the Plan Vessel gross tonnage need not be below 1,000 tons.

(2) Length

Adjacent to the Mulifanua and Salelologa wharves, the coral reef sea has been dredged for turning basins 120m in diameter. Ferries turn there and enter the wharf or sail out to the opposite island. It was confirmed that reasonable allowance is still left in the turning basins for safe turning of the Plan Vessel, which is by 3.4 meters longer than LS2. The Captain and deck officers of LS2 found no problem in the length of the Plan Vessel.

(3) Breadth

It was confirmed on board LS2 that the vessel breadth is not restricted.

(4) Draft

Turning basins and seaway channels are dredged for a vessel draft of about 2.35 meters. The water depth is regularly maintained by a dredger of the Samoa Port authority and the situation of sea depth and vessel draft is kept unchanged. Accordingly, the design draft of the Plan Vessel should be 2.35 meters, the same as LS2.

(5) Main engine power

The number of engineer officers and their license can change depending on the main engine horsepower, but the nearest threshold is 3,000 kW, which is far above 1,760 kW, the intended engine power of the Plan Vessel. Therefore, there will be no problem regarding the license and number of engineer officers on board the Plan Vessel.

(6) Accommodation

1) Passenger capacity

When LS2 started service, she was working with a passenger license of 300 persons (same as the number of seats), but soon due to increase of passengers, the license was changed to 480 persons, adding the number of liferafts and lifejackets. Passenger transport license had to include 180 standing passengers, but this was not a favorable situation. Seats should have been given to all passengers as much as possible in the ordinary services from view of safety.

It is intended that the Plan Vessel is fitted with 508 seats to cope with ordinary passenger demand, and further that 233 standing passengers are assigned to cope with special peak demand on consecutive holidays, e.g. White Sunday and Christmas. As a standard for assigning standing passengers, Japanese Maritime Regulations should be referred to, i.e. $0.30m^2$ per person in free areas around passenger seats. The size and design of the hull are not influenced by the assignment of standing passengers, but lifesaving appliances (liferafts/buoyant apparatus and lifejackets) should be increased equal to the number of passengers to obtain the passenger license from the Samoan Maritime Administration.

2) Passenger facility

On board the island link ferry, about 20 % are business passengers and about half of them prefer more comfortable space by paying the extra fare. Considering such needs, business class passenger space will be planned separating about 10% of the total number of passenger seats for business class. The business class fare will serve for better operating revenue. In the business class space, seats and table will be provided for reading and writing on board.

For tourist class, indoor seat space and outdoor seats under a sun awning will be provided.

For transporting sick persons, mainly from Savaii to hospital in Upolu, a sick bay will be provided.

A canteen selling snacks and drinks will be provided

3) Wheelchair friendliness

Realizing the necessity to help aged or handicapped people, installation of an elevator between the vehicle deck and passenger deck is planned. Besides, on the passenger deck, consideration will be paid to wheelchair friendliness, i.e. omission of doorsill, toilet for handicapped, etc.

4) Crew accommodation

LS2 is now manned by 12 crewmembers including 2 female crews. As the work on board the Plan Vessel will be almost same as LS2, the number of crew for the Plan Vessel should be the same as LS2.

(7) Vehicle deck

The width of the vehicle deck must be suitable for cars parked with suitable side-to-side space in-between. In the design request from Samoa, the width of the vehicle deck was 10.7 meters, but in the Plan Vessel design, the width is made wider to 10.90 meters for better space between cars parked 5 rows abreast.

The height of the vehicle deck should be 3.80 meters, keeping the height unchanged from the height of LS2, understanding that the height is suitable for stowing tall vehicles, e.g. container trailers and buses.

(8) Shore ramp

Driving on and off the ferry is performed by each driver. For easy driving, vehicles drive on and off only in forward gear, and LS2 has shore ramps fore and aft of the vehicle deck. Also in the Plan Vessel, shore ramps should be installed fore and aft of the vehicle deck, avoiding reverse-gear driving off.

The width of the ramp and supported vehicle weight should all be equivalent to those for LS2.

(9) Fuel oil tank

The fuel oil necessary to run the island link services for one week will be about 11 klit, but the fuel oil tank must cover fuel consumption in different cases, i.e. (1) sailing to repair dock at Pago Pago, (2) sailing to repair dock in New Zealand for major repair work, and (3) sailing from Japan to Samoa for delivery Voyage. Case (3) is the longest, requiring a fuel oil tank capacity of about 110 klit.

Such space is available in the double bottom space, without influencing the size of the entire hull.

(10) Fresh water tank

Fresh water consumption of LS2 is about 10 m^3 consumed by toilet flushing, crew shower and cooking. Water to drink is supplied by drinking water fountains. No drinking water need be served for passengers. The fresh water system and drinking water supply of the Plan Vessel should be the same as LS2.

For hot water supply to crew showers, a solar heater should be installed. A standard solar heater, about 230 lit. capacity, will suffice.

(11) Speed

The request from Samoa sets the speed of the new ferry at 12 knots, the same as LS2. LS2 could run 12 knots when she entered service, but now her speed has dropped to 11 knots mainly due to ageing of the main engines. LS2 can maintain the current timetable of the island link ferry at 11 knots, i.e. 4 hours for one round trip, but allowance for rough weather or for recovery of delay in departure is lost.

The Plan Vessel can only be of a hull shape similar to that of LS2, with a beamy and shallow draft design, and thereby similar water resistance. Therefore, considering the same situation as LS2, the Plan Vessel should also be designed with a service speed of 12 knots, but should run actually at 11 knots, leaving 1 knot allowance for future ageing, rough weather, etc.

LS2's propeller is small in diameter (1.60 m), restricted by the shallow draft, resulting in low propeller efficiency. In the design of the Plan Vessel, a tunnel stern shape allowing a larger propeller (2.0 m in diameter) should be adopted, resulting in better efficiency by 10% or less fuel oil consumption by 10%. Refer to Figure 2-7 for the tunnel stern hull shape of the Plan Vessel.

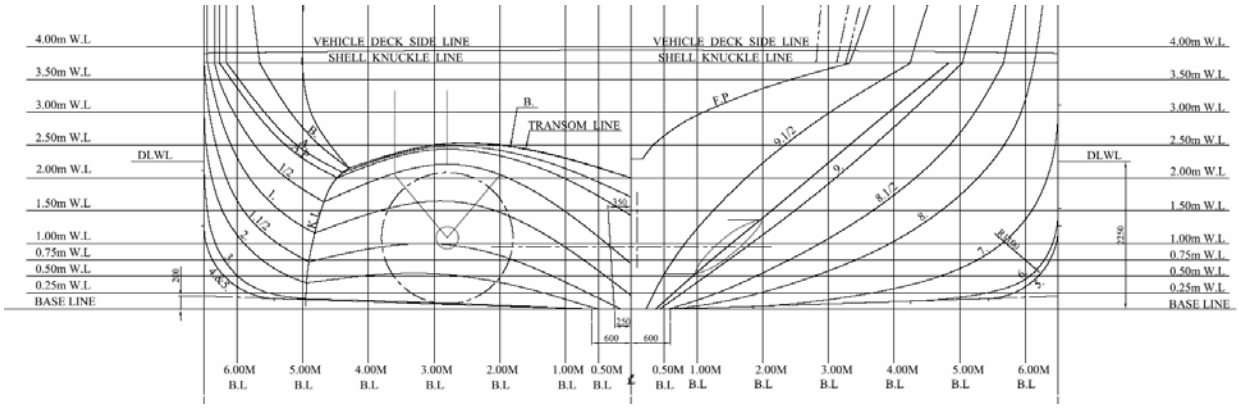


Figure 2-7 Tunnel stern hull of the Plan Vessel (stern in the left half and bow in the right half)

(12) Main engine

Main engine, suitable for 12 knots, lightweight medium-speed type, good fuel oil consumption and low NOx emission should be selected.

(13) Maneuvering

Passage through the narrow water channel off Mulifanua and Salelologa, 180-degree turning in the turning basin, and quick berthing requires better island link ferry maneuvering performance than ordinary vessels. LS2's maneuvering performance depends on a twin-engine twin-propeller system and a bow thruster.

Point-turning possibility in the narrow turning basin is, especially in strong wind, important. Normally vessels turn, occupying a turning diameter of about 3 times the ship's length (about 140 m for LS2 hull), which is more than the diameter of the 120m turning basin.

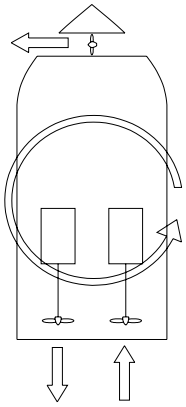


Figure 2-8 Point turning using bow thruster and two propellers

LS2 can only turn in the narrow turning basin by operating the two propellers in different directions, one ahead and the other astern and at same time operating the bow thruster (refer to Figure 2-8).

The bow thruster must be of sufficient thrust to withstand strong wind.

Vessels not requiring tug assistance are generally required to maneuver with the bow thruster in up to 20-knot winds. LS2 bow thruster can only withstand 17.5-knot (9 m/s) winds. The bow thruster of the Plan Vessel should be of adequate capacity against 20-knot winds. Bow thrusters driven by electric motor require a very large electric generator. In the Plan Vessel, the motor for the bow thruster should be a diesel engine, keeping the electric generator in the engine room compact.

(14) Navigation equipment

The Plan Vessel should be fitted with a magnetic compass, GPS compass, radar, GPS, echo sounder, Doppler speed log, etc., all as required by the rules and as normally fitted in coastal ferries. There are no special requirements for the island link service.

(15) Radio apparatus

Vessels are fitted with safety radio apparatus working on VHF, MF or HF frequency, and used for daily business communication. GMDSS (Global Maritime Distress and Safety System) regulations specify the details of the radio apparatus on board vessels for different sea areas and shore stations. The shore station of Samoa is, however, still the conventional system and not compatible with GMDSS. Therefore, the radio system on board the Plan Vessel could not be decided only in accordance with GMDSS regulations. As a result of discussion with the Samoan Maritime Administration, it was decided that the Plan Vessel be fitted with VHF radio (without DSC), MF/HF radio (without DSC), EPIRB, SART, and two-way VHF radio telephones.

(16) Electric generator

There should be two electric generators to avoid blackouts and not-under-command situations. The capacity of the main generators should be determined based on all electric consumption during navigation, cargo handling, etc. The electric generation system should be 445V and 50 Hz, the same as

LS2.

Shore power is available at night when the Plan Vessel is resting at the wharf, therefore harbor generator will not be installed on board.

(17) Anti-Pollution Measures

The Samoan Government has ratified the MARPOL Convention (International Convention for Preventing Pollution from Ships, 1973). Therefore the Plan Vessel should install the following.

Against oil pollution:	Oily water separator to stop discharging oily water
Against air pollution:	NOx emission controlled diesel engines
Against sewage pollution:	Sewage collecting tank to keep sewage from toilets

(18) Separate access for passengers and vehicles

Sequence of pax and vehicle boarding had to be the following order:

Arrival – Vehicle disembarkation – Pax disembarkation – Cleaning – Pax embarkation – Vehicle embarkation – Departure

Actually, however, immediately after arrival and opening of the shore ramp, passengers start to disembark without waiting for completion of vehicle disembarkation, as shown in the picture right.

Figure 2-9 Pax hurry to disembark

In the Plan Vessel, access doors for passengers should be fitted on the shipside (two positions on portside) to allow passenger access separate from vehicle access.

Tide difference of 1.0 m, draft difference of 0.3 m, and the fact that the Salelologa wharf is lower than Mulifanua by 0.25 m create a 1.55 m wharf height change relative to the vehicle deck. Therefore, an adjustable platform to compensate for such height change should be fitted to the access door of the Plan Vessel. Refer to Figure 2-10 for a sketch of the boarding platform and gangway.

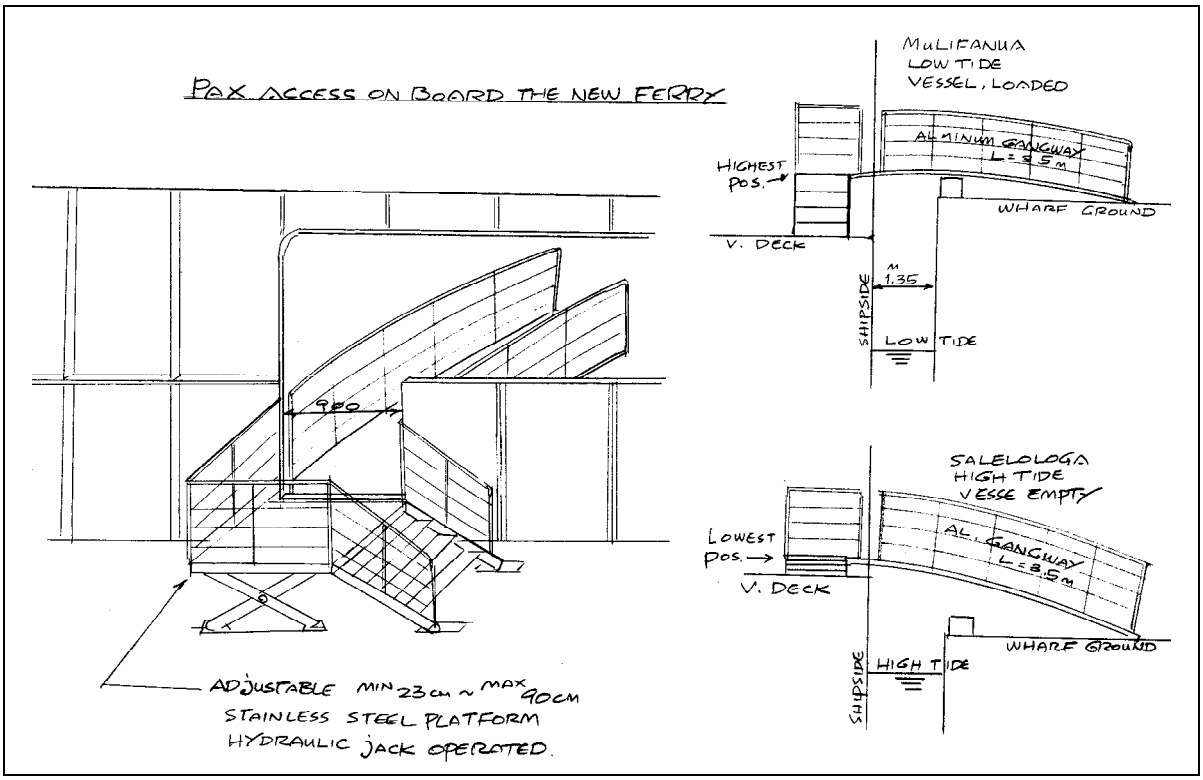


Figure 2-10 Boarding platform and gangway

The platform inside the vessel will be adjustable in height by 23cm – 92 cm, powered by a hydraulic system. The platform structure should be made of stainless steel. The gangway will be 3.5 m in length and made of aluminum to enable handling by two men.

Figure 2-11 shows the height of the wharves relative to the vehicle deck and gangway.

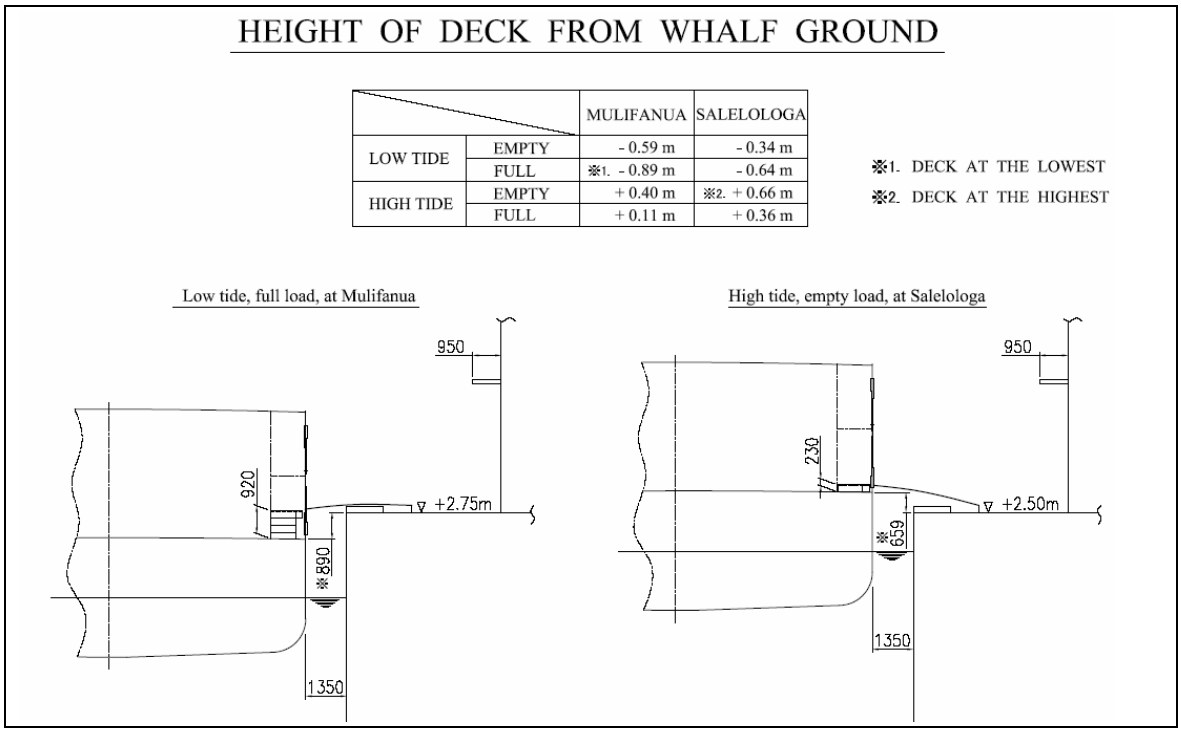


Figure 2-11 Height of deck relative to wharves

(19) Long life policy

1) Preventive maintenance policy (PMP)

Samoa is remote from industrial countries and it takes a long time to get spare parts and engineer servicing, therefore vessels are obliged to stop working once important machinery is out of order.
For stable operation of the Plan Vessel, honest implementation of periodical maintenance is important. It is vital that the PMP (Preventive Maintenance Policy) be carried out for the Plan Vessel. According to the PMP, overhauling and maintenance must be carried out regardless of the condition of the machinery (i.e. whether it is in order or out of order) at a time planned in advance according to the PMP. Working parts will be removed from the machinery and replaced with stowed spare parts. The removed parts will be cleaned, reconditioned and stowed on the workshop shelf. In the next maintenance for the same part, reconditioned and stowed parts will be used and the same work will be repeated. This procedure requires initial investment to procure a set of spare parts, but reduces breakdown due to e.g. wearing and prolongs the life of the parts.

Figure 2-12 below shows the periodical working procedure, for example, to change all the cylinder heads.

By changing all the cylinder heads of the main engine on one side every 12 months, the cylinder heads of all main engines are maintained every two years. Similar parts exchange will be done for the piston, attached pump, bearing, etc. according to the PMP manual.

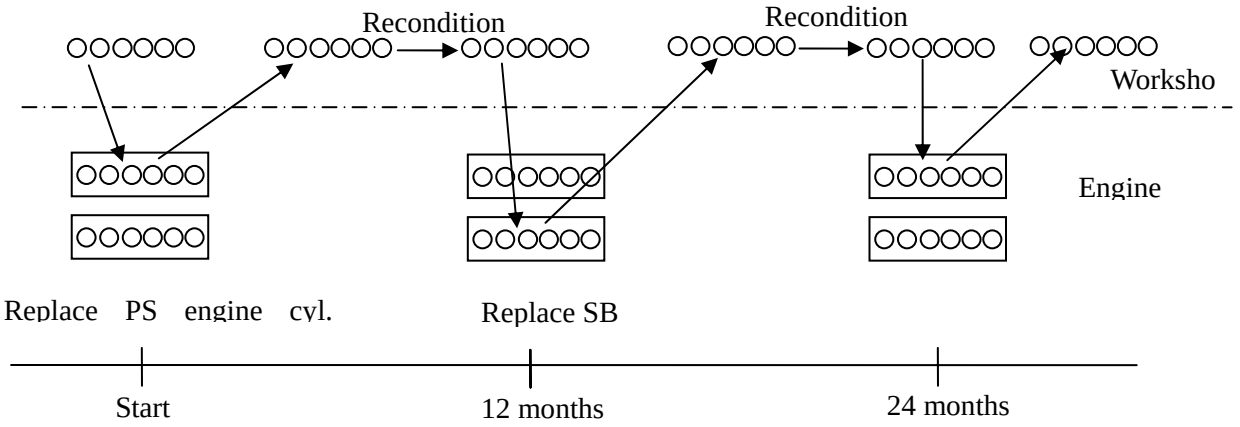


Figure 2-12 Exchange of cylinder heads according to PMP procedure

SSC head office in Apia has its own workshop, which has sufficient ability and facilities to implement PMP. Until 2007, engineer experts were dispatched to the SSC workshop from JICA and raised the technical level of the SSC workshop.

Spare parts necessary to carry out PMP should be procured by this Project.

2) Countermeasures against corrosion

Consideration should be given to make the hull and outfitting of the Plan Vessel maintenance-friendly and durable against corrosion or wearing.

In the daily maintenance of steel parts, prevention of corrosion (rusting) by contact with seawater is

important. To minimize difficulty of maintenance, the following considerations / countermeasures should be taken.

- Cooling seawater pipes in engine room are coated with plastic inside
- Bottom of the engine room is of double bottom construction, instead of adopting single bottom, for easy de-rusting
- Minimizing narrow parts where de-rusting is difficult

3) Spare parts

Spare parts as a part of the PMP in the preceding paragraph should be procured by the Project.

Outline of the spare parts for PMP as well as spare parts for contingency is as follows. (Refer to 2-2-2-4 Particulars of the Plan Vessel for details.)

PMP spare parts: Cylinder head assembly, suction and exhaust valves, pistons, cylinder liners, fuel injection valves, fuel injection nozzles, turbochargers, governor, etc.

Contingency spare parts: Propeller, propeller shaft, etc.

2-2-2-4 Plan Vessel Design

Basic design of the island link vessel was developed according to the preceding section and derived from the original design as agreed preliminarily in Samoa at the time of the basic design study.

Table 2-8 Particulars of the Plan Vessel

Item		Specification
(1) Main particulars		
	Type of vessel	Inter-island ferry
	Navigation area	Coastal area of Samoa Temporary voyage to foreign dock is possible by special temporary voyage certificate issued by the Samoan Administration.
	Object of transport	Passengers and vehicles (cars, trucks, buses, etc.)
	Flag	Independent State of Samoa
	Classification	Nippon Kaiji Kyokai (NK) SSC shall undertake re-classification to Lloyd's Register after turning over.
	Rules and regulations to apply	Samoa Maritime Rules and Regulations
		Safety Regulations for Non-Convention Vessels, 2002, SPC
		International Convention on Tonnage Measurement of Ships, 1969

Item		Specification
	Rules and regulations to apply	International Convention for Load Lines, 1966 (as applicable)
		International Conference for Preventing Collision at Sea, 1972
		International Convention for Preventing Pollution from Ships, 1973 (against oil pollution and air pollution)
		Rules of the Classification Society
	Length overall	46.70 m
	Length between perpendiculars	42.00 m
	Breadth, molded	13.00 m
	Depth, molded	3.90 m
	Design draft, molded	2.35 m (same as LS2)
	Gross tonnage	About 1,050 tons
	Deadweight	190 t
	Service speed	12.0 knots (same as LS2)
	Main engine	880 kW (1,200 ps) x 2 (same as LS2)
	Complement	Total 752 persons
	Tourist class pax	Seated 460 + Standing 232
	Business class pax	48
	Crew	12
	Tank capacity	
	Fuel oil	110 m^3 to cover fuel oil consumption of 90 m^3 from Japan to Samoa with allowance Fuel consumption for island link service is about 11 m^3/week.
	Fresh water	10 m^3 for galley, canteen, wash basin, toilet flushing, shower and cooling fresh water for diesel engines
	Vehicle deck	Area of vehicle deck is 126% of LS2.
	Width	10.9m
	Length	44.0m
	Height	3.80 m (Same as LS2)
(2) Accommodation		
	Business class	48 seats
	Tourist class	280 seats
	Under sun awning	180 seats
	Standing passengers	232 persons
	Captain	Single berth cabin

Item		Specification
	Chief engineer	Single berth cabin
	Officers	2 person cabin (1 x 2 tier bunk)
	Engineer officers	2 person cabin (1 x 2 tier bunk)
	Ratings	5 person cabin (2 x 2 tier bunk + 1 x 2 tier bunk)
		2 person cabin (1 x 2 tier bunk, for female crew)
	Crew mess	6 seats (same room as galley)
	Galley equipment	1 x Electric range (3 x hotplate @5kW) 1 x Electric water boiler (10 lit. 1kW) 1 x Fridge (about 500 lit.) 1 x Sink 1 x Cupboard, food locker
	Canteen equipment	1 x Electric water boiler (10 lit. 1kW) 1 x Glass-door fridge (about 300 lit.) 1 x Chest freezer (about 300 lit.) 1 x Counter with sink 1 x food locker
	Toilet for tourist class	Gents：WC x 2 + Urinal x 3 Ladies: WC x 3 For handicapped: WC x 1
	Toilet for business class	Gents x 1 and ladies x 1
	Toilet for crew	Gents x 1 (WC + shower) Ladies x 1 (WC + shower)
	Sick bay	Bed and settee
	Hot water supply	Solar heater on compass deck to supply hot water to crew shower
	Accommodation lining and ceiling	Non-combustible according to the safety rules
	Deck sheathing	Crew space, wheelhouse, and passenger space: Vinyl flooring on deck composition Toilet and galley: Ceramic tiles
	Furniture	Wooden
	Passenger chairs	Business class: padded chairs and tables
		Tourist class: Plastic chairs
	Elevator	For handicapped, size suitable for one wheelchair and one nurse, between vehicle deck and pax deck

Item		Specification
	Water cooler	For 19 lit water bottle 1 in wheelhouse and 1 in crew mess
	Pax boarding equipment	Port door: 900mm width for separate access from vehicles x 2 Wharf ladder: portable, aluminium, 3.5 m, with handrail x 4 (2 in Mulifanua and 2 in Salelologa) Liftable platform: Hydraulic operation, stainless steel x 2
(3) Anchor, anchor chain, etc.		
	Anchor	1290 kg x 2 JIS type
	Anchor chain	U2 32 mmD x 385 m (14 shackles@27.5m) Total 2,704 kg
	NK class mooring rope	Polypropylene multifilament 32 mmD x 140m x 4 (breaking strength 98kN)
	NK class towing line	6x24 SWR 24 mmD x 180 m x 1(breaking strength 250kN)
(4) Deck machinery		
	Windlass	Hydraulic winch x 2 Each with 1-chain wheel for 32mm chain, 1-rope drum and 1-warping head Duty of 40 kN x 9m/min at chain wheel or 25 kN x 15m/min on rope drum
	Mooring winch	Hydraulic winch x 2 Each with 1-rope drum and 1-warping head Duty of 25 kN x 15m/min on rope drum
	Shore ramp	At bow x 1 and at stern x 1 Gate width 4.00m x height 3.80m Ramp width 4.20 m x length 5.50m (including flap section of 0.85m in length) Ramp weight 4.36t x 2 (as LS2) With rubber packing at sides Operated by steel wire rope by hydraulic jigger winch (2 jigger winches for 1 ramp: in total 4) Hydraulic clamp stopper at sides and turnbuckle stopper at top 20 seconds to open or close Strength to allow passage of 10t weight truck Double plate construction Robust hinge with spherical bearing

Item		Specification
	Hydraulic power pack	Power pack of about 22 kW elec. motor driven x 2 Emergency pipe connection between fore and aft power packs SUS piping on weather deck, steel piping inside and minimum rubber hoses
	Rudder	Hanging spade rudder@2.3m^2 x 2
	Steering gear	Electro-hydraulic x 1 Hydraulic pump x 2 (each 1.5 kW) With emergency hand pump P+S rudder to move simultaneously
	Bow thruster	Diesel driven, fixed pitch, about 750mmD x 1 Thrust about 18 kN Start, stop and speed control from bridge Designed to withstand 20-knot wind force Driving diesel motor of about 116kW, with reversing clutch
	Air conditioning	Comprising 3 systems: #1: Bridge and crew areas 5.5kW compressor and 1.5kW fan #2: Passenger area 7.5kW x 2 compressors and 5.5kW fan #3: Engine monitor room 3kW compressor and 0.4 kW fan A/C for pax area to comprise 2 x 60% compressors: 2 run in parallel normally but 1 can run at reduced capacity when the other is out of order. Work condition (except for #3): 32ºC/80%RH -> 27ºC/50%RH, recirculation 70%, 10 times/hr air change HFC refrigerant
	Watertight sluice door	Fitted on watertight bulkhead between main engine room and generator room, clear opening 1.80mH x 0.60mW Hydraulic operation
(5) Lifesaving appliances		
	Liferaft	SOLAS coastal use, total 550 person capacity (25 person raft x 22)
	Buoyant apparatus	@22 person x 10 (total 220 person)
	Rescue boat	FRP 4.5m, about 18.4 kW outboard x 1
	Rescue boat launching davit	Single arm, slewing, launching and recovery by vessel main AC power (i.e. elec. winch)
	Life jacket	Adult pax x 740, + crew 12 + duty crew 4 + children 74 All with life jacket light About half in pax space and the rest near muster station

Item		Specification
	Life buoy	4 (2 at bridge wings with 30m lifeline, and 2 aft)
	Self igniting light	2
	Self igniting smoke signal	2
	Parachute signal	4
	Thunder light	2
(6) Fire fighting equipment		
	Fire hydrant, fire hose, nozzle and spanner	40A JIS type total 15 (main engine room x 2, generator room x 2, vehicle deck x 4, pax deck x 5, bridge deck x 2)
	Fire hose	40mmD x 15m x 15 dual purpose nozzle, stored in fire locker
	Water fog applicator	9 (Vehicle deck x 3, main engine room x 2, generator room x 2, firefighter's equipment locker x 2)
	Fixed CO2 fire extinguisher	Main engine room and generator room CO2 cylinders @55kg x 4
	Fixed pressure water-spraying system	For cargo hold, exclusive drenching pump and spraying nozzles, 54 nozzles, necessary seawater supply of 194m^3/h
	Pump for above	214m^3/h x 55mH Driven by the bowthruster engine through on/off clutch With 100 lit pressure tank (pressurized by fresh water hydrophore)
	3.5kg powder fire extinguisher	Total 16 (vehicle deck x 16, main engine room x 2, generator room x 2, bowthruster room x 1, bridge x 1, galley x 1, pax space x 3) Spare charges for 4 extinguishers
	Portable foam fire extinguisher 45 lit	1 in main engine room
	Fireman's outfit	2 sets (self contained breathing apparatus, firefighter clothes, safety belt, de-smoke helmet, safety lamp and axe)
	Fire detector	Smoke ionized type for 3 zones (main engine room x 5 points, generator room x 3 points and vehicle deck x 20 points)
(7) Ventilation		
	Main engine room	3.7kW fan x 2
	Generator room	2.2kW fan x 1
	Galley	0.2kW fan x 1
	Tourist class toilet	0.4kWfan x 1
	Business class and crew toilet	Pipe fan
	Bowthruster room	0.4kW fan x 1
	Air conditioning	Crew area, bridge, pax area, and engine monitor room

Item		Specification
(8) Windows		
	Window frame	Steel frame welded to sidewall or aluminum bolted to sidewall
	Bridge windows	1.5mW x 0.75mH x 3 (fixed), 0.75mW x0.75mH x 4 (fixed) 1.1mW x 0.75mH x 8 (6 fixed and 2 openable) 1.5mW x 0.75mH x 2 (fixed)
	Crew cabin windows	0.35mW x 0.50mH x 10 (fixed)
	Pax area windows	1.30mW x 0.60mH x 24 (fixed), 0.60mW x 0.60mH x 1 (fixed), 0.70mW x 0.60mH x 6 (fixed)
	Toilet scuttles	Aluminum frame 250mmD x 5
(9) Engine room machinery		
	Main engine	Medium speed diesel 880 kW (1200 ps) x 850 rpm x 2 sets Cylinder bore 210mm x Stroke 290mm Low NOx
	Gearbox	Wet type multi clutch gear ratio of 1/2.78
	Propeller	4 blades solid, NiAlBz x 2, outward rotation, Dia. = 2.0 m
	Sterntube bearing	Seawater lubrication
	Sterntube sealing	Gland packing
	Bulkhead seal	Rubber
	Shaft stopper	Claw type
	Main generator	150kVA x 445V x 50Hz x 2 130kW x 1,500rpm diesel prime mover
	Harbor generator	Not installed
	Main air compressor	3.7kW electric motor driven 12.5m3/h x 2.94MPa x 2
	Emergency air compressor	6.3 m3/h (FA) x 2.94 MPa 4 ps diesel driven x 1
	Main cooling seawater pump	5.5kW electric driven 35m3/h x 0.176MPa x 2
	Main cooling fresh water pump	Main engine driven 32m3/h x 0.225MPa
	Bilge/Fire/GS/Ballast pump	11kW electric driven 40/25m3/h x 0.196/0.49MPa x 2
	FO transfer/service pump	1.5m3/h electric driven 5m3/h x 0.196MPa x 2
	Main engine LO pump	Main engine driven 16.3m3/h x 0.78MPa
	Standby main engine LO pump	Complete spare pump is carried
	Gearbox LO pump	Gearbox driven 4m3/h x 2.16MPa
	Gearbox standby LO pump	Complete spare pump is carried
	LO priming pump	1.5kW electric driven 3m3/h x 0.196MPa x 2
	Fresh water pump	3.7kW electric driven 4m3/h x 0.44MPa x 2 (1 as spare) To fill hydrophore tank
	AC cooling seawater pump	7.5kW electric driven 50m3/h x 0.25MPa x 1

Item		Specification
	Sewage discharge pump	1.5kW electric driven 10m3/h x 0.196MPa x 1
	Sludge discharge pump	1.5kW electric driven 1m3/h x 0.39MPa x 1
	Emergency fire/sprinkler pump	Bowthruster diesel engine driven 240m3/h x 0.539MPa x 1
	Engine room bilge pump	0.4kW electric driven 1.0m3/h x 0.2MPa x 1
	LO purifier	Centrifuge 700 lit/h x 2 with 3kW heater
	Oily water separator	0.5 m3/h x 15ppm x 1
	Flow meter	For main engines x 2 (digital, direct and remote reading >25A) For gen. engine x 1 (digital, direct and remote reading >15A)
	Engine monitor room	Main switchboard and engine monitor Engine monitor to comprise CPU x 1, LCD monitor x 2, keyboard x 1, keyboard x 1, printer x 1
	Machine tools	Electric drill 13mmD x 0.4kW electric
		Two-head grinder 200mmD x 0.4kW
		E.welder AC220V x 250A x 1, 50m cable x 2
		Gas welder portable type x 1
		Chain block 0.9t x 2
(10) Engine room tanks		
	FO service tank	3,500 lit. x 1 (hull)
	FO sedimentation tank	30 lit. x 1 (supplied by main engine maker)
	LO sump tank	2,000 lit. x 2 (hull)
	LO storage tank	2,600 lit. x 1 (hull)
	LO purifier sludge tank	100 lit. x 2 (self standing)
	LO service tank	50 lit. x 1 (self standing)
	FO drain tank	100 lit. x 1 (self standing)
	LO drain tank	100 lit. x 1 (self standing)
	Sludge tank	2,600 lit. x 1 (hull)
	Sewage collecting tank	$10m^3$ x 1 (hull)
	FW expansion tank	150 lit. x 2 (self standing)
	FW hydrophore tank	150 lit. x 1 (self standing)
	Bowthruster engine FO tank	200 lit. x 1 (self standing)
	Washing oil tank	50 lit. x 1 (self standing)
	Main air reservoir	150lit.x 2.94MPa x 2
	Generator engine air reservoir	45lit.x 2.94MPa x 1
	Bowthruster engine air reservoir	45lit.x 2.94MPa x 1

Item		Specification
(11) Electric distribution		
	Generator	2 x 150kVA x 50Hz x 3ph AC generator
	Feed power	AC: 440V 3ph, 220V 3ph, 220V 1ph DC: 24V
	Main switchboard	2-gen. panel, 1-synchro. panel, 1-feeder panel, 1-starter panel
	Transformer	440/220 3ph, step down 50kVA x 2
	Shore power	440V 3ph 40kVA
	Charging and discharging board	Placed on the bridge deck
	Storage battery	1 x general use and 1 x radio use
(12) Internal communication		
	Engine order telegraph	2 systems between engine room and bridge and indicator in EMR
	Common battery telephone	Bridge, engine room, EMR, steering gear room, captain, chief engineer and canteen
	Public addressor	Amplifier and speakers Talkback at fore and aft winch decks, fore and aft ramp gates
	Alarms	As required by safety rules
(13) Navigation equipment		
	Magnetic compass	1 Reflector type
	GPS compass	1
	GPS compass repeater	2 (1 at steering stand and 1 at bridge front)
	Steering control stand	1
	Radar	1, 9GHz, about 10kW, about 15” monitor
	Echo sounder	1
	Speed log	1, Doppler type
	GPS	1, with plotter, about 10” LCD monitor, course display, chart display, Samoa sea area RAM
	Wind meter	1, relative display
	Air horn	1
	Search light	500 W
	Projector	400 W x 4, halogen
	Helm indicator	1：2 (EMR and bridge)
	Engine tachometer	2：6 (EMR, bridge wall, bridge console)
	Window wiper	2 (swing type)

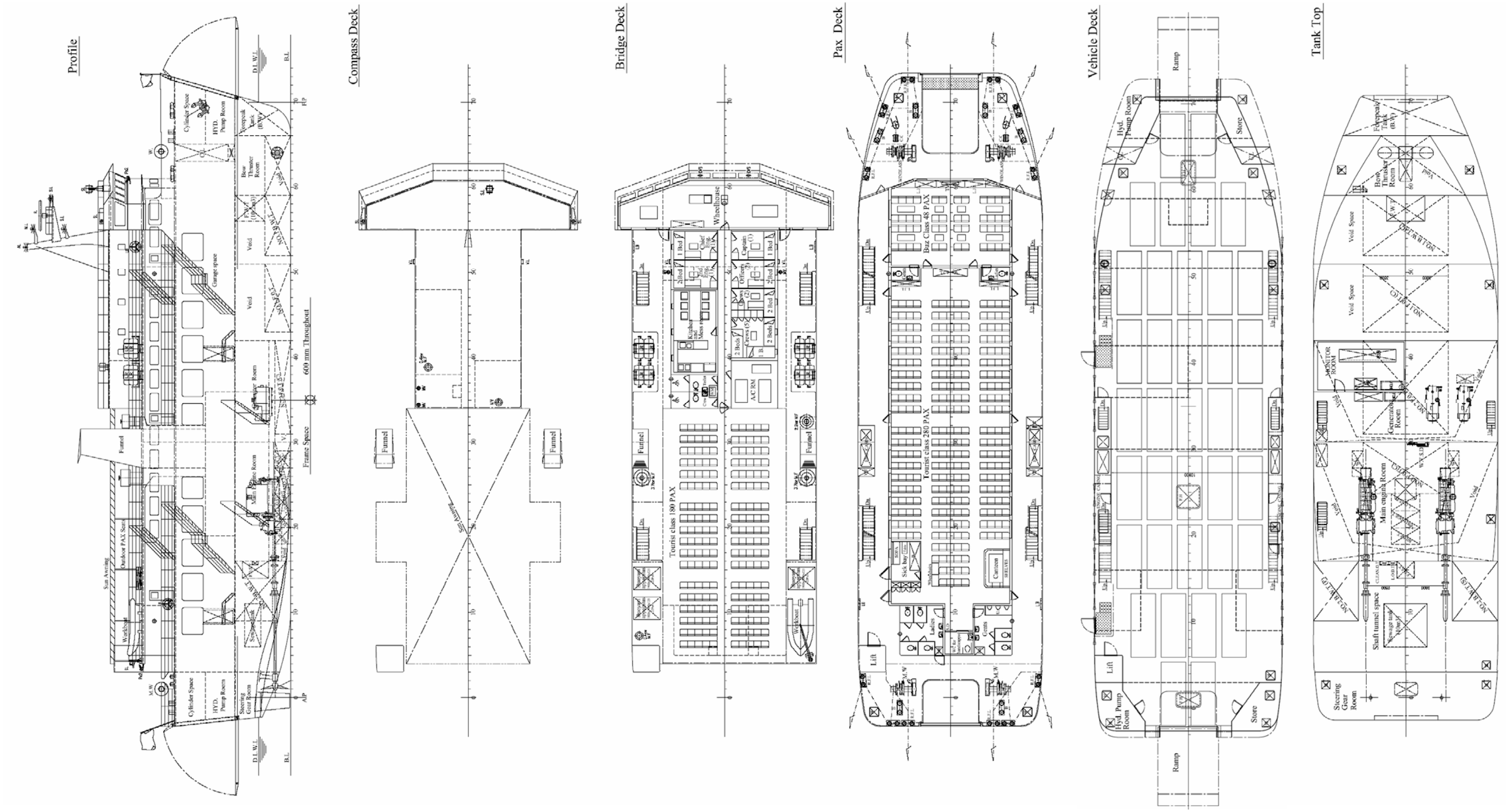
Item		Specification
	Bridge console	Placed at portside: Main engine controls and alarms Bowthruster controls Telephone Public addressor microphone Engine order telegraph Steering control
(14) Radio apparatus		
	VHF radiotelephone	1 (no DSC required)
	MF/HF SSB radiotelephone	1 (no DSC required)
	Two-way VHF radio telephone	2, with battery charger
	EPIRB	1
	SART	1
	Walkie talkie	4, with battery charger
(15) Materials		
	Hull	Steel (high tensile steel for the vehicle deck)
	Piping	
	Seawater	Steel lined with polyester inside
	Fresh water	SUS or plastic
	Hydraulic oil	SUS (exposed part), steel (inside)
	Engine room piping	Flange joints at suitable interval for easy dismantling
	Paint	
	Bottom	Epoxy AC + Tin-free SPC, 2.5 years spec.
	Shipside	Epoxy
	Vehicle deck	Epoxy
	Superstructure	Modified epoxy
	Exposed deck	Modified epoxy for deck
	Engine room bottom	Epoxy
	Accommodation area	Oleoresinous
	Fresh water tank	Epoxy for drinking water tank
	Ballast water tank	Epoxy
	Sacrifice anode	Aluminum anodes, 2.5 years spec.
(16) Spare parts		
Main engine		
Cylinder head assembly		1 engine

Item	Specification
Piston and connecting rod assembly (with crank pin metal)	1 engine
Piston ring	1 engine
Cylinder liner assembly (with seal, ring, etc.)	1 engine
Main bearing (base and center) and thrust bearing metal	2 engines
Crank pin metal	2 engines
Connecting rod bolt	1 engine
Fuel injection pump complete	1 engine
Fuel injection valve	2 engines
Nozzle assembly	2 engines
Fuel oil injection pipe	1 engine
Suction valve, valve seat and valve guide	1 engine
Exhaust valve, valve seat and valve guide	1 engine
Governor	1 engine
Turbocharger	1 engine
Gasket for turbocharger	1 engine
Engine driven pumps (FW, SW, FO, LO)	1 engine
Cooling fresh water thermostat and seal	1 engine
Engine attached cooling seawater pipes (steel and rubber)	1 engine
O ring and seal packing for special survey overhaul	4 engines
LO and FO filter element (in case of paper filter)	12 engines
Pressure gauge	2 engines
Thermometer	2 engines
Pressure switch and temp switch	2 engines
Tachometer	2 engines
Tie down bolt and nut for cylinder block	1 engine
Cooling fresh water chemical and test kit	1
Cylinder head overhauling turntable	1
Tool for piston ring insert	1
Cylinder liner withdrawing tool	1
Zinc anode	2 engines
Gearbox	
LO pump	1 engine
LO cooler side cover	1 engine
Pressure gauge	2 engines
O ring, seal packing for special survey overhaul	4 engines
Zinc anode	2 engines

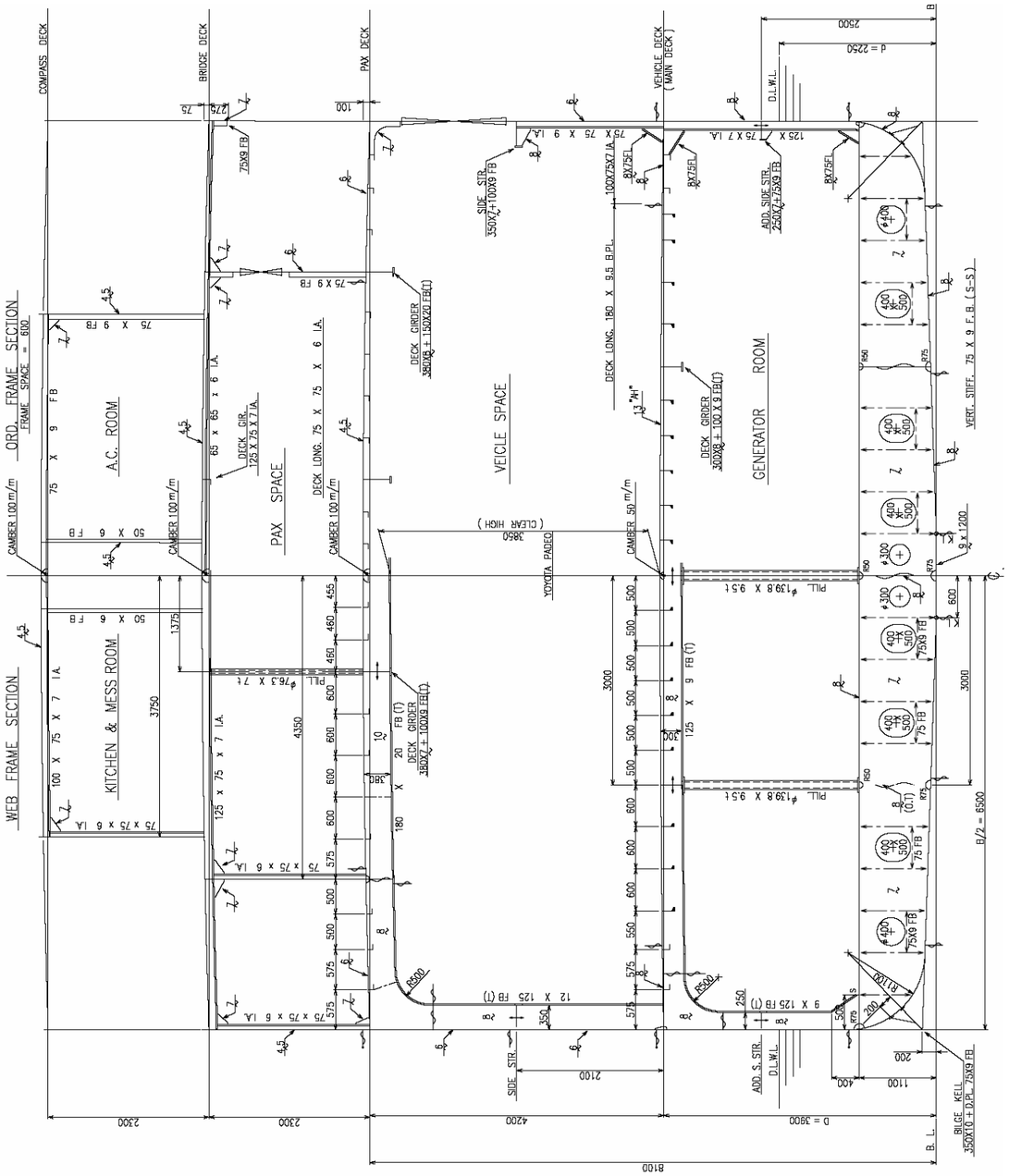
Item	Specification
Shafting	
Propeller (port and starboard, no cap required)	1 ship
Propeller shaft (port and starboard, no nut required)）	1 ship
Propeller shaft bearing	1 ship
O ring for propeller	1 ship
Main generator	
Cylinder head assembly	1 engine
Piston ring	2 engines
Main bearing (base and center)	2 engines
Crank pin metal	2 engines
Fuel injection pump complete	1 engine
Fuel injection valve	2 engines
Nozzle assembly	2 engines
Governor	1 engine
Turbocharger	1 engine
Gasket for turbocharger	1 engine
Engine driven pumps (FW, SW, FO, LO)	1 engine
Cooling fresh water thermostat and seal	1 engine
Engine attached cooling seawater pipes (steel and rubber)	1 engine
O ring and seal packing for special survey overhaul	4 engines
LO and FO filter element (in case of paper filter)	12 engines
Pressure gauge	2 engines
Thermometer	2 engines
Pressure switch and temp switch	2 engines
Tachometer	2 engines
Zinc anode	2 engines
Shell and tube cooler	
O ring and seal packing	2 ships
Generator	
Ball bearing	1 ship
Diesel engine for bowthruster	
Generator engine part will be used as same engine is adopted	

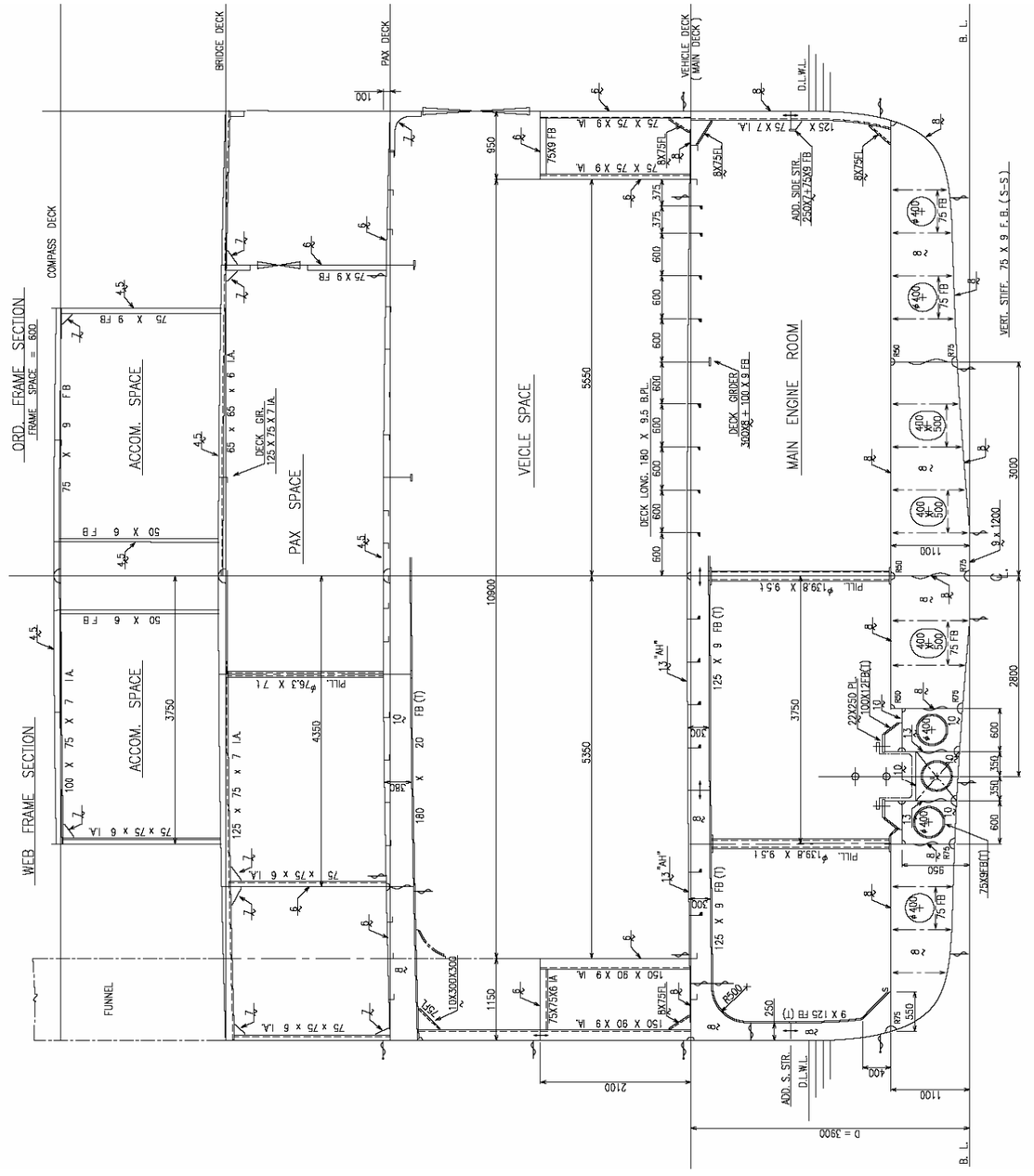
2-2-3 Basic design drawings

2-2-3-1 General arrangement

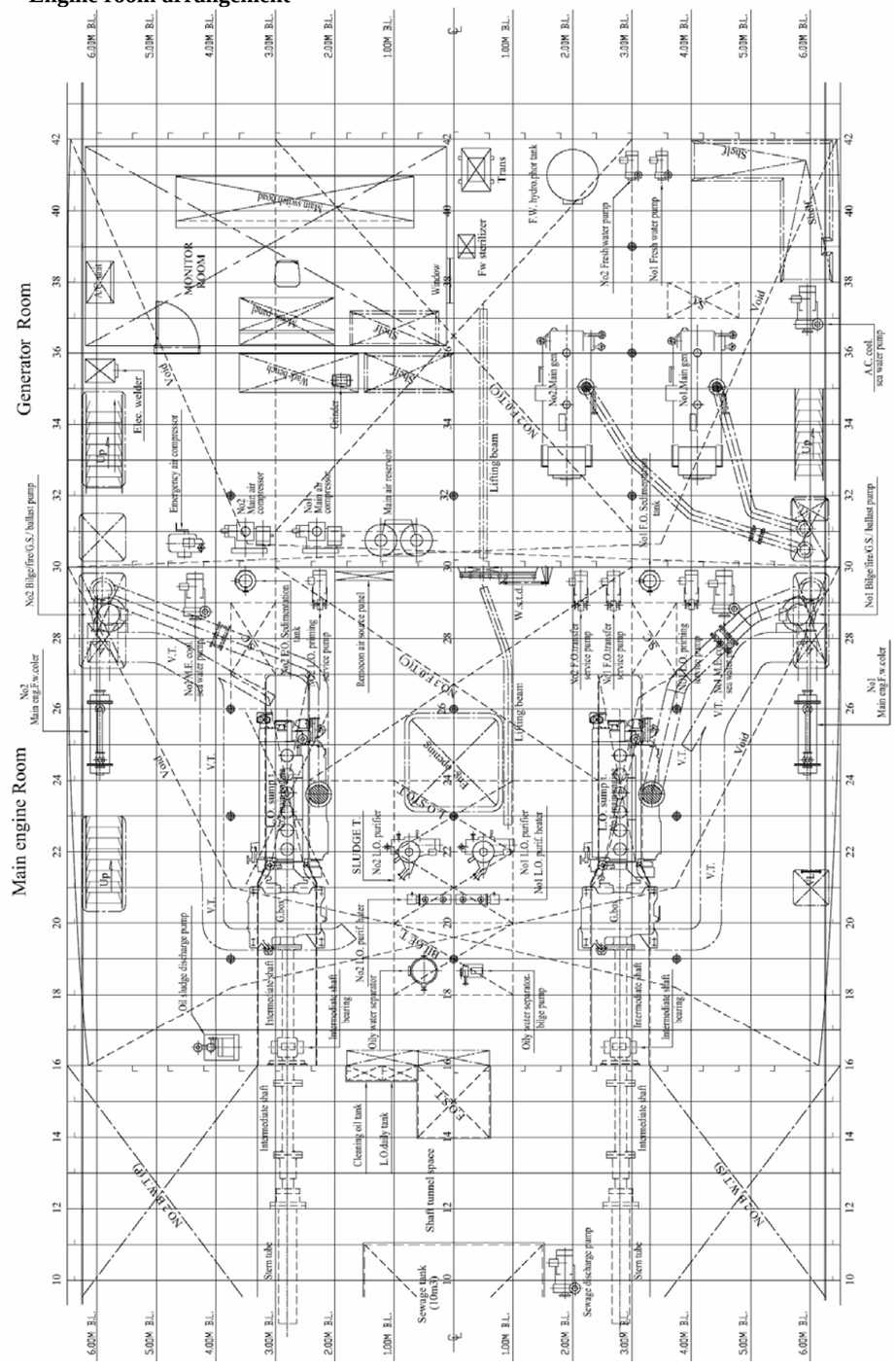


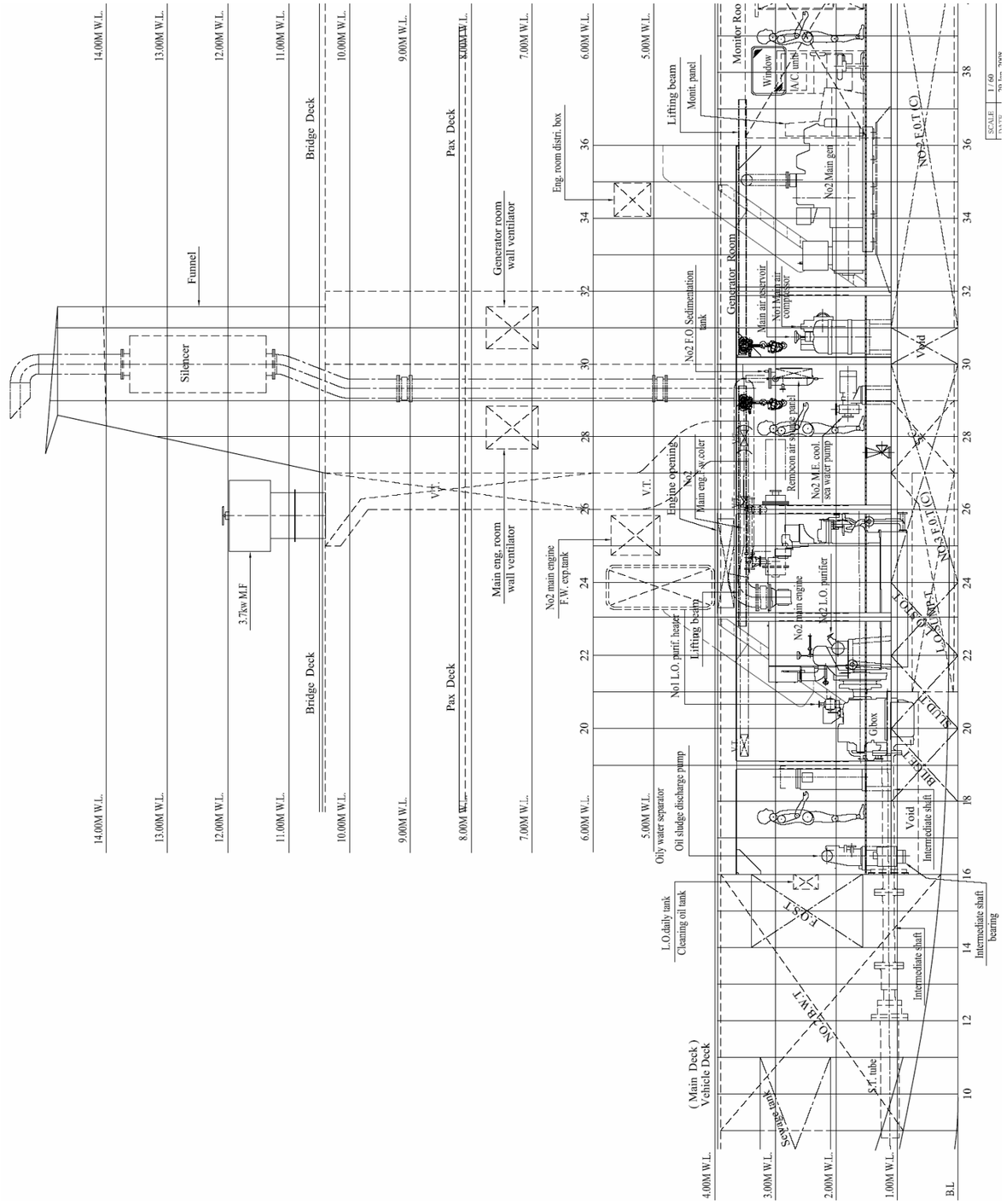
2-2-3-2 Midship section





2-2-3-3 Engine room arrangement





2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

(1) Procedure

The Plan Vessel will be planned, documented and constructed according to the following procedure under the Grant Aid program of the Government of Japan.

a) Exchange of Notes between the Government of Japan and the Government of Samoa for the implementation of the Project.
b) Conclusion of a Consultant Agreement between a Consultant recommended by the Government of Japan and the Project Implementing Body established by the Government of Samoa, for the Consultant's work to implement the Project.
c) Verification of the Consultant Agreement by the Government of Japan.
d) The Consultant prepares detail designs and draft tender documents, and obtains approval from the Government of Samoa. These include methods of pre-qualification, technical specifications, general arrangement plan, project cost estimates, and construction contract drafts.
e) Based on the approved Tender Qualification methods, the Consultant conducts Tender qualification examination, obtains the approval of the Government of Samoa, and selects the applicants.
The Applicant must be a Japanese corporate shipbuilder including joint ventures established by two or more Japanese shipbuilding corporate bodies.
f) The Consultant carries out the Tender process, in the presence of the Government of Samoa, and examines the Tender documents submitted by the applicants. Based on the results of the applicant evaluations, the Consultant recommends the intended contractor to the Government of Samoa.
g) The Consultant assists in contract negotiations with the Government of Samoa and witnesses the Contract.
h) The signed contract takes effect upon verification by the Government of Japan.
i) Based on the construction contract, the Contractor builds and conducts sea trials of the Plan Vessel, and hands over the Plan Vessel. The Consultant, in accordance with the Consultant Contract, provides construction supervision, conducts sea trials, and witnesses the hand-over of the vessel.
j) The Plan Vessel departs Japan for Samoa.

(2) Basic provisions related to the Project procedures

Basic items related to the Project procedures under the Grant Aid program are as follows.

1) Project implementation body

The agency responsible for the Project is the Ministry of Works, Transport and Infrastructure (MoWTI), Government of Samoa, and the implementing agency is Samoa Shipping Corporation Limited (SSC). With respect to the project implementation, MoWTI will generally deal with all documents and give approval, but SSC will deal with technical documents and drawings by the

authority of MoWTI.

2) Consultant

Following the Exchange of Notes, a Consultant contract will be concluded between the Government of Samoa and the Consultant (a Japanese firm recommended by the Government of Japan). As the proxy for the Government of Samoa, the Consultant will prepare tender documents, including technical specifications, and give assistance as necessary in the tender bidding and contractual phases, and further provide continuous supervision of the Plan Vessel construction. For purposes of carrying out this supervisory function, the Consultant will dispatch responsible engineers and outfitting experts to the shipyard, as necessary, during the construction process.

3) Plan Vessel building contract

For building the Plan Vessel, qualification data submitted by Japanese shipbuilding corporate bodies will be evaluated first, and those who pass the qualification appraisal will be allowed to participate in the tender bidding. Japanese shipbuilding corporate bodies who are eligible to participate in the tender may be either a single corporate body or joint venture established by two or more corporate bodies. The tender is conducted according to the procedure established in advance. The successful tenderer signs the contract for building the Plan Vessel. The Contractor builds the Plan Vessel, conducts sea trials, and transports the Vessel to Samoa for turnover.

4) Building plan of the Plan Vessel

To build the Plan Vessel, the Contractor, pursuant to the contract and technical specifications, designs the hull and outfittings for building in the Contractor's yard facilities. Following preparation of the construction design by the Contractor, the Plan Vessel is built according to the shipbuilding process: steel hull construction, outfitting (deck, machinery and electrical work), testing, and then transport to Samoa. The following areas must be given careful consideration when examining the Construction Plan.

a) As this Project is being implemented via Grant Aid from the Government of Japan, strict adherence to the construction schedule is the major premise. The building plan must be prepared so as to fulfill all contract conditions within the term validity stipulated in the Exchange of Notes.
b) With regard to the delivery deadlines for machinery and equipment, careful consideration must also be given to prevent disruption of the construction work flow by maintaining tight control of machinery and equipment procurement and linking the hull construction and outfitting program to the delivery schedules of the relevant machinery and equipment.
c) Various tests must be performed, as determined by the Classification Society, maritime regulations in the Samoa, and maritime regulations in Japan. The required sea trials must be performed upon completion of the construction phase to certify vessel performance.
d) In the final stage of construction, two engineers appointed to the Plan Vessel as senior officers are invited to Japan to participate in the final outfitting work and sea trials as well as receiving instructions from various makers, all for familiarization with the vessel systems and performance.

These engineers travel aboard the new vessel back to Samoa, for further familiarization.

e) After receiving the Provisional Certificate of Nationality from the Government of Samoa, the Contractor transports the Plan Vessel, at his own responsibility, from the Contractor's quay (wharf) to Apia, the Plan Vessel's homeport. After arrival at Apia, final inspection will be immediately conducted and thereafter the Vessel will be turned over to the Government of Samoa.

5) Dispatch of engineers

After turning over the vessel, two engineers (deck section and machinery section) will be dispatched by the shipbuilding Contractor to Samoa for 15 days to provide ongoing guidance in operation of the machinery, systems and maintenance.

2-2-4-2 Special Considerations with regard to Construction and Procurement

(1) Work schedule control

The following should be observed in building the Plan Vessel and reflected in control of the work schedule.

a) As the layout of the Plan Vessel differs from ordinary cargo vessels, procedures for hull assembly and outfitting should be established, taking into consideration the Plan Vessel layout and special features.

b) For those materials, machinery and equipment whose delivery is not very firm, delivery possibility should be followed up frequently and any change should be reflected in the work schedule promptly.

c) Quay tests for various machinery and equipment and sea trials should be planned in detail and included in the work schedule.

d) The work schedule should be regularly (at least once in a week) followed up and updated.

(2) Application of passenger safety regulations

The Plan Vessel falls under the passenger vessel category in applying safety regulations. For survival of innocent passengers who are not trained in onboard safety, safety regulations impose detailed stringent safety measures for passenger vessels.

The design department of the shipbuilder should study every line of passenger safety regulations (stability, sub-division, fire protection, fire fighting, lifesaving, etc.) and reflect them in the production design drawings.

(3) Weight control

Generally in passenger vessels, light ship weight occupies a major part of displacement at fully loaded draft. Increase in the light ship weight due to lax weight control decreases deadweight capacity considerably in greater percentage. In the production designs and at the shipbuilding site, weight control is important.

2-2-4-3 Scope of Works

The scope of works on the Japanese side and Samoan side is generally as follows.

a) Building of the Plan Vessel, procurement of the Equipment and their transport from Japan to Samoa are all undertaken by the Japanese side.
b) The Samoan side undertakes procedures in Samoa including arrangement of licenses necessary to build and transport the Plan Vessel and banking arrangements.

As above, Project implementation after the shipbuilding contract does not rely on the work to be shared by the Samoan side, except for the formalities e.g. Provisional Certificate of Nationality, which must be issued by the Government of Samoa.

Following is the further breakdown of the works on the Japanese side and Samoan side.

(1) Scope of works on Japanese side

Scope of works on the Japanese side as a Project under the Grant Aid Program of Japan.

a) Design and construction of the Plan Vessel
b) Transport of the Plan Vessel: The Plan Vessel sails from Japan to Samoa.
c) Consultant services for implementation designs, assistance in tender business and supervision during shipbuilding.

(2) Scope of works on Samoan side

Building of the Plan Vessel and procurement of the Equipment are the work of the Japanese side, but the Samoan side must undertake the following.

(Arrangements during implementation of the Project)

a) Banking arrangements (with an authorized foreign exchange bank in Japan), issuance of authorization to pay, and bearing of necessary commissions to the bank for the contracts verified by the Government of Japan in relation to this Project.
b) Acquisition of licenses and certificates from the Government of Samoa necessary for building and transporting the Plan Vessel, e.g. Provisional Certificate of Nationality.

(Arrangements when the Plan Vessel arrives in Samoa)

c) Exemption of the Plan Vessel and Equipment from customs duties, internal taxes and fiscal levies, and prompt customs clearance.
d) Exemption of Japanese nationals from customs duties, internal taxes and fiscal levies for their services in Samoa.

(Other)

e) Any other items which are not covered under the Project.

2-2-4-4 Consultant supervision

(1) Basic guidelines

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

1) Approval of drawings and specifications

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

2) Work schedule supervision

The Consultant should always grasp the progress of the work schedule, and order, whenever necessary, adjustment to the work schedule to ensure on-time completion.

3) Quality inspection

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

4) Turnover

After transporting the Plan Vessel to Apia, the Consultant should be present at all inspections at the wharf and issue the certification documents required for local turnover.

5) Construction report

The Consultant should make monthly reports on construction progress and scheduled work for the succeeding month, appending factory photos. These reports should be submitted to both the Samoan and the Japanese Government.

(2) Supervisory arrangement

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

2-2-4-5 Quality Control Plan

Quality control of raw materials and installed machinery / equipment for the Plan Vessel should be

conducted as follows.

Materials		Quality control
	Structural steel	To use steel materials with a certificate of inspection (mill sheet) for every plate and every bar section according to the Class NK standards.
	Pipes and valves	To use pipes and valves with a JIS certificate.
	Timber	Consultant to inspect the material on arrival.
	Fire protection	Fireproof bulkhead, lining, insulation, fire doors, etc. for structural fire protection to be of SOLAS and Class NK standards, for which prototype tests had been conducted and have type-approval.
Installed machinery and equipment		
	Diesel engine	Designed according to Class NK standards, prototype tests had been conducted, type-approved, and manufactured in a factory qualified by Class NK. Completed diesel engines to be load-tested including overload for necessary duration on test bench according to the standard program of Class NK.
	Auxiliaries	Designed according to Class NK standards, manufactured in a factory qualified by Class NK, and certified by Class NK.
	Fire fighting and lifesaving appliances	Designed according to SOLAS regulations, and with type-approval no. of HK (The Ship Equipment Inspection Society of Japan)
	Inventories	Designed according to SOLAS regulations, and with type-approval no. of HK (The Ship Equipment Inspection Society of Japan)
	Deck outfitting	Designed according to JIS, and the Consultant to inspect the equipment.

2-2-4-6 Machinery / Equipment Procurement Plan

As the machinery and equipment on board the Plan Vessel are not produced in Samoa, they will be, in general, Japanese products which are stable in quality, supply and price.

Procuring from third countries is possible for the following onboard equipment without binding procurement to Japanese products.

No.	Item	Specification	Procurement possibility
1	Lubricating oil purifier	Centrifuge about 700lit./h	Only one Japanese maker, but European products are imported and widely used.

2-2-4-7 Operational Instruction Plan

For about 15 days after turnover of the Plan Vessel to Samoa, the Contractor shipyard shall dispatch two engineers (one for deck section and the other for machinery section) to Samoa to instruct

in vessel / machinery operation and maintenance.

2-2-4-8 Soft Component Plan

No soft component is included in the Project.

2-2-4-9 Implementation Schedule

(1) Portion of work on Samoan side in building the Plan Vessel

Project implementation after the shipbuilding is contracted does not rely on the work to be shared by the Samoan side, except for the Provisional Certificate of Nationality, which must be issued by the Government of Samoa. Undertakings on the Samoan side are the works necessary for operation of the Plan Vessel after the turnover of the Plan Vessel to Samoa.

(2) Building schedule of the Plan Vessel

In building the Plan Vessel, the shipbuilding Contractor first carries out production designs of the steel hull structure and various outfittings based on the contract and associated technical specifications, and also based on the shipbuilder's own facility. With the completed production design drawings, hull construction, deck outfitting, machinery outfitting and electric outfitting follow as below.

a) Hull construction

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

b) Deck outfitting

This work is performed after completion of the hull work. It comprises mooring arrangements, steering system, accommodation work, lifesaving apparatus, fire fighting equipment, etc.

c) Machinery outfitting

This work comprises installation, piping and associated work of the main engines, diesel generators, pumps, etc.

d) Electric outfitting

This work involves installation of electric apparatus, control panels, etc. and electric cable installation to supply electric power to all electric equipment on board.

e) Transport

After completion of the construction work at the shipyard and necessary tests, the Plan Vessel will be turned over to the Government of Samoa. Transport of the vessel to Samoa is carried out under the responsibility of the shipbuilding Contractor.

The two engineers dispatched from Samoa are to return to Samoa on board the Plan Vessel sailing from Japan to Samoa for the purpose of familiarization with the new vessel.

Construction of the Plan Vessel is a long schedule taking 15 months from the shipbuilding contract to completion in Japan, and another month for transport to Samoa and final turnover to the Government of Samoa. In this building schedule, the Consultant assigns 6 supervisors including the project manager, i.e. project manager (naval architect), hull outfitting-I, hull outfitting-II, machinery expert, electric expert, and accommodation expert, to supervise the production designs and building site of the complex passenger vessel.

A detailed work schedule for production design, building at the site and onboard machinery / equipment procurement, submitted by the shipbuilder, will be regularly followed up and countermeasures will be taken whenever necessary to maintain the planned schedule.

The projected building schedule of the Plan Vessel is as shown on the next page.

IMPLEMENTATION SCHEDULE

Project title: The Project for Construction of New Ferry

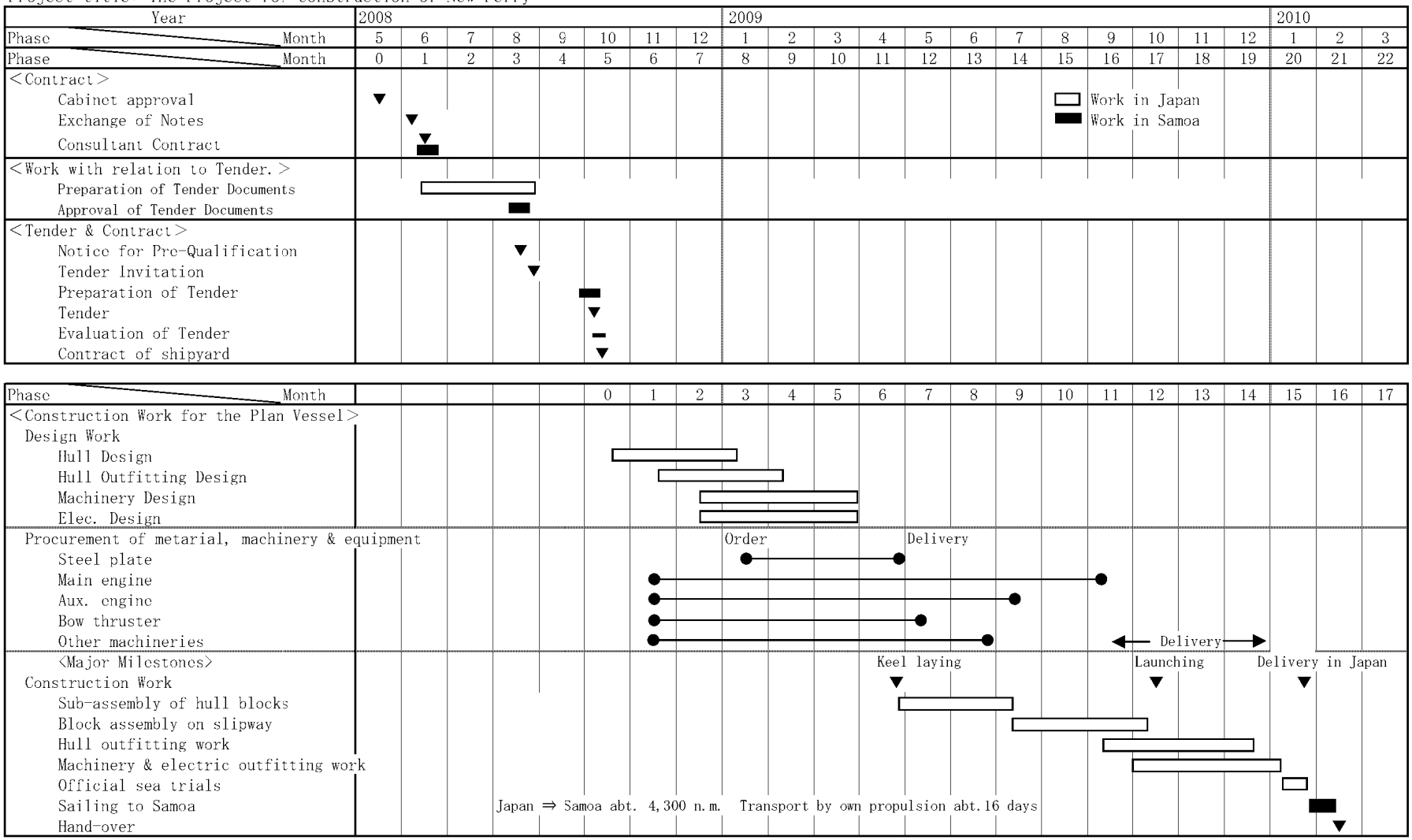


Figure 2-13 Implementation schedule

2-3 Obligations of the Recipient Country

As the building of the Plan Vessel and the procurement of the Equipment are all undertaken by the Japanese side, the Samoan side is not required to take part in shipbuilding work.

Mulifanua and Salelologa wharves, where the Plan Vessel is to berth, are well maintained in a good condition for the Plan Vessel operation.

The draft of the Plan Vessel is the same as the draft of LS2, and the sea depth of the wharves, adjacent turning basin and connected water channel need not be deepened.

Accordingly, the obligations of the Samoan Government are limited to the undertakings as mentioned in 2-2-4-3 Scope of Works.

2-4 Project Operation Plan

2-4-1 Credentials of the Vessel Operation Body

SSC is a shipping corporation founded in 1974 and it has been undertaking sea transport in Samoa and with neighboring countries for more than 30 years. In 1998, SSC together with its operating vessels obtained ISM[4] certification from Lloyd's Register of Shipping. Its safe and reliable ship operation was internationally recognized.

Now SSC owns and operates 4 vessels, and maintains sound corporate management, even under a limited fare basis as public transport for Samoan people. SSC is not subsidized by the Government.

SSC has its own workshop, which has a relatively high technical level in the South Pacific. The workshop implemented a Preventive Maintenance Policy (PMP) as part of ISM certification in 1998. MV Lady Samoa II did not have adequate maintenance in the first 10 years, but MV Lady Naomi could enjoy PMP from the beginning and maintains a good condition.

It is concluded that SSC's ability for safe operation and sound corporate management is satisfactory for operating the Plan Vessel.

2-4-2 Vessel Maintenance

Operation costs for the Plan Vessel procured under this project comprise direct running costs (fuel, crew, wharfage, etc.), and vessel maintenance and repair costs (paint, oils, timber, steel, machinery spare parts, machinery repair fees, dock fees, etc.). SSC manages these costs from sea transport revenues, and maintains self-supporting accounts without any subsidy from the Government.

The SSC workshop has 18 staff members and is well furnished with machine tools, e.g. lathe, welding machine, etc. Daily and periodical maintenance are carried out jointly by the SSC workshop and vessel crew. It was found that the SSC workshop has adequate capacity to undertake PMP maintenance and repair.

[4] ISM (International Safety Management) is a certification system for safe operation of ships and for pollution prevention adopted by IMO in 1993. Normally the Classification Society surveys shipping company's operation system and grants the ISM certificate.

In this Project, PMP is maintained to minimize breakdown of machinery and prolong the life of the machinery. In the PMP, overhauling and maintenance must be carried out regardless of the condition of the machinery (i.e. whether it is in order or out of order) at the time planned in advance according to the PMP.

Weekly, monthly and annual working plans will be prepared, and spare parts for the diesel engines, generator, and auxiliaries necessary for PMP are to be procured by the Project.

2-4-3 Vessel Replacement Fund

SSC launched a Vessel Replacement Fund (VRF) in 1999, and utilized the fund to purchase a barge (MV Samoa Express) in 2001. The fund was suspended from 2002 to 2004, when SSC could not afford VRF, but was restarted in 2005.

Apart from this VRF from 1999, the Samoan side started another VRF in fiscal year 2006 for the purpose of replacement of the Plan Vessel in future. The amount of the new VRF is decided annually by the SSC management board (chaired by the Minister of Works, Transport and Infrastructure) based on the annual accounts report. The new VRF is managed jointly by both the Government of Samoa and SSC.

Thus, two separate VRF systems are running in parallel.

2-4-4 Future of MV Lady Samoa II

2-4-4-1 Useful Life of MV Lady Samoa II

In 2004 and 2007, the manufacturer of the LS2 main engines conducted reconditioning of the main and auxiliary diesel engines as a JICA Follow-Up Plan and reported as follows.

In 2004: Main engine life of 5 – 8 more years, subject to appropriate maintenance (in 2004)
Auxiliary engine life of 4 – 7 more years, subject to appropriate maintenance (in 2004)

In 2007: Main engine life of about 5 more years

As for the condition of the hull, there was much local corrosion of the important structural steel members found in the onboard survey in this basic design study, and it was realized that replacement of the steel plates will be frequent, but the hull will remain useful at least until about 2012 subject to careful inspection during dry docking and repairs.

It is therefore concluded that LS2 will remain useful at least until about 2012, but it should be noted that the risk of sudden breakdown is getting higher.

2-4-4-2 Utilizing Lady Samoa II after the New Ferry Enters Service

As mentioned in the preceding paragraph, LS2 has too great a risk of breakdown to bear island link service duty as the main ferry. LS2 will, however, be able to undertake lighter duty for some time.

In the island link services, the transport peaks are at the beginning and end of weekends, and furthermore there are very high peaks at the beginning and end of consecutive holidays. It is desirable

that LS2 works to help the new ferry to clear such peak demand and also provides charter services on other sea routes.

Two vessels, i.e. the new ferry and LS2, need two gangs of crew, but LS2 currently has a total of 29 crew to allow working on alternate weeks. Therefore, with the new ferry working at the same time, LS2 can be manned by the crew on standby without employing any new crew.

2-4-5 Project Cost Estimation

2-4-5-1 Initial Cost Estimation

The total cost of the Project to be implemented in accordance with the Japan's Grant Aid scheme will be determined before concluding the Exchange of Notes (E/N) for the Project.

2-4-5-2 Operation and Maintenance Cost

Table 2-9 shows the balance of the Plan Vessel operation, projected for the years 2011and 2020 (1 and 10 years after starting operation respectively). Helped by lower fuel oil consumption and lower repair costs, a favorable balance is expected from the beginning. Due to increased transport demand, the balance will further tend to increase. With such favorable contribution by the Plan Vessel, SSC will be able to maintain sound corporate management, allowing due maintenance of the Plan Vessel and steady contribution to the VRF.

Table 2-9 Plan Vessel balance estimate

Unit in ST

Year	LS2 data	Plan Vessel		Remarks
	2007	2011	2020	
Nos. voyage	1,711	1,836	1,852	**52week x 36voyage/wk-1wk(for dock)+16(extra voyage, 2020 only)**
Nos. pax	100.0%	109.7%	131.6%	Projected by regression analysis
Nos. Vehicle	100.0%	115.3%	149.9%	Projected by regression analysis
A. Vessel revenue				
Pax	3,306,658	3,627,404	4,351,562	proportional to nos. pax in 2007
Vehicle	2,295,036	2,646,177	3,440,259	proportional to nos. vehicle in 2007
Cargo, etc.	21,232	21,232	21,232	Same as 2007
Total	5,622,926	6,294,812	7,813,053	
B. Vessel operating cost				
Fuel	1,110,943	1,037,131	1,046,169	proportional to nos. voyage in 2007 x 83%
Lub oil	59,791	55,818	51,775	proportional to nos. voyage in 2007 x 80%
Fresh water/store	24,333	26,111	26,338	proportional to nos. voyage in 2007
Maintenance/repair	453,303	155,000	155,000	Mean of 10 years
Dock		100,000	100,000	200,000/2 (dock of once in 2 years)
Crew food	51,199	54,939	55,418	proportional to nos. voyage in 2007
Crew wage	523,773	562,038	566,936	proportional to nos. voyage in 2007
Insurance	250,530	250,530	250,530	same as 2007
Wharfage	384,400	412,483	416,078	proportional to nos. voyage in 2007
Others	466,895	501,005	505,371	proportional to nos. voyage in 2007
Total	3,325,167	3,155,056	3,173,615	
C. Balance (A-B)	2,297,759	3,139,757	4,639,438	
Difference in balance		664,992	2,341,679	Plan vessel profit - LS2 profit 2007
Profit, all SSC before tax	1,131,100	1,796,092	3,472,779	2007 profit + "Differnce in balance"

- Number of voyages is equal to 52 (weeks in a year) x 36 (voyages in a week) – 36 (1 week off in dock) +

16 (extra voyages in consecutive holiday peaks for 2020)

- Pax and vehicle revenues are proportional to the number of pax and vehicle basing on the revenue of 2007.
- Fuel costs are proportional to the number of voyages and are reduced by 17% considering better efficiency.
- Lub oil costs are proportional to the number of voyages and are reduced by 20% considering less consumption due to lub oil purifier.
- Repair costs are based on the actual record of several vessels. The value is the average of 10 years after newbuilding.
- Dock fee is equal to the LS2 record divided by 2 (once in two years).
- Insurance premium is the same as LS2.
- Otherwise, costs are proportional to the number of voyages based on 2007.
- C. value (balance) is the value before deducting office costs and general charges.

2-5 Other Relevant Issues

Construction of the Plan Vessel will take 16 months from shipbuilding contract to delivery, which, however, does not include any allowance in the light of the deadline to deliver the Plan Vessel allowed by the Exchange of Notes. Samoan side is, therefore, requested to deal with their undertakings promptly without delay.

CHAPTER 3 PROJECT EVALUATION AND RECOMMENDATION

Chapter 3 Project Evaluation and Recommendation

3-1 Project Effects

Implementation of this Project is expected to give effects as shown in Table 3-1.

Table 3-1 Project effects

Current status and problems	The existing island link ferry MV Lady Samoa II, despite being indispensable means of transport infrastructure for Samoan nationals, is unstable in its operation due to breakdown and voyage cancellation is frequent, therefore there is a risk of big chaos in the event of voyage cancellation for long days. Besides, the capacity of MV Lady Samoa II has become insufficient in coping with increased demand of passenger and vehicle transport.
Measures taken in the cooperation Project	Building of a new island link ferry
Direct effects and degree of improvement	(1) The ferry service can be stabilized. (2) Transport capacity is so increased as to cope with transport demand.
Indirect effects and degree of improvement	(1) Inter-island traffic is enhanced so that range of people's activity is expanded across the Apolima Strait separating islands. (2) Development of industry and tourism in Savaii Island is promoted.

3-2 Recommendations

3-2-1 Problems to be addressed by Samoa and proposals to Samoa

To ensure that the proposed vessel in this project is fully utilized and provides smooth inter-island transport, it is recommended that the following points are duly considered.

(1) Implementation of service to meet demand

As the vessel to be constructed in this project will have a capacity of 740 passengers and the area of the vehicle deck will be 26% bigger than the LS2, it will easily cope with high demand at holiday times. However, as concentrated demand in excess of capacity can be expected at peak times, appropriate measures will be necessary, such as backup by another vessel and additional services, to ensure smooth operation without disruption and with minimal congestion, and efforts must be made to disperse demand through advance publicity to users.

(2) Implementation of Preventive Maintenance Policy (PMP)

To minimize unexpected breakdown of the project vessel and cancellation of services and to reduce repair costs over the long term, a preventive maintenance policy (PMP) should be implemented. Under PMP, components are replaced at given periods regardless of malfunction or

degree of wear and the replaced components are reconditioned and stored. The SSC already implements PMP for its vessels, but the Plan Vessel should use the replacement parts procured by this project in an attempt to further promote thorough PMP.