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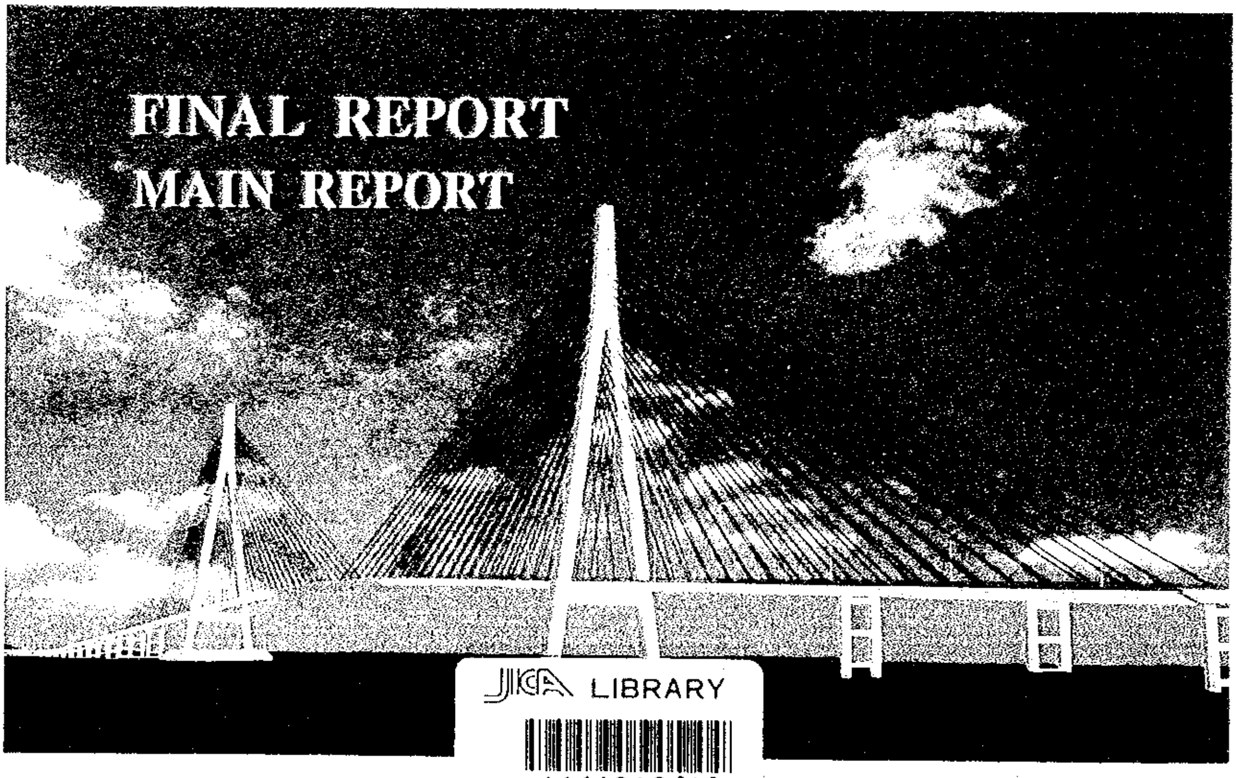
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
MINISTRY OF TRANSPORT
SOCIALIST REPUBLIC OF VIET NAM

THE DETAILED DESIGN ON THE CAN THO BRIDGE CONSTRUCTION IN SOCIALIST REPUBLIC OF VIET NAM



FINAL REPORT
MAIN REPORT

OCTOBER 2000

NIP[illegible] CO., LTD

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
MINISTRY OF TRANSPORT
SOCIALIST REPUBLIC OF VIET NAM

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NIPPON KOEI CO., LTD.

1161218 [1]

1 US Dollar = 108 Japanese Yen = 14,100 Vietnamese Dong

PREFACE

In response to the request from the Government of Socialist Republic of Viet Nam, the Government of Japan decided to conduct a detailed design study on the Can Tho Bridge Construction Project and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Koji Enomoto of Nippon Koei Co., Ltd. to Viet Nam 3 times between April 1999 and August 2000.

The team held discussions with the officials concerned of he Government of socialist Republic of Viet Nam and conducted field surveys at the study area. Upon returning of Japan, the team conducted further studies and prepared this final report.

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

Finally, I which to express my sincere appreciation to the official concerned of the Government of Viet Nam for their close cooperation extended to the Team.

October 2000

Kunihiko Saito
President
Japan International Cooperation Agency

Mr. Kunihiko Saito
President
Japan International Cooperation Agency (JICA)
Tokyo, Japan

Letter of Transmittal

Dear Sir:

We are pleased to submit you the Final Report on the Detailed Design on the Can Tho Bridge Construction in Socialist Republic of Viet Nam.

Based on the contract with your agency (JICA), the Study was implemented from April 1999 to October 2000. Considering the present condition of the Socialist Republic of Viet Nam, the basic design, the detailed design, and the planning of the implementation programme were confirmed in the report.

We wish to take this opportunity to express our sincere gratitude to your agency (JICA), the Ministry of Foreign Affairs, the Ministry of Construction of the Government of Japan, Japan Bank for International Cooperation (JBIC), and Infrastructure Development Institute of Japan.

We also wish to express our deep gratitude to the Ministry of Transport, Project Management Unit My Thuan, other concerned agencies of the Government of Viet Nam, JICA Vietnam Office, JBIC Representative Office in Hanoi, and the Embassy of Japan for the close cooperation, assistance, and advice extended to us during our study.

We do hope this report will contribute to the improvement of the traffic conditions and the development of not only Mekong Delta, but also Viet Nam.

Very truly yours,

October, 2000

Koji Enomoto

Team Leader
The Detailed Design
on
The Can Tho Bridge Construction
in
Socialist Republic of Viet Nam

SYNOPSIS

National Highway No.1 is an arterial road running about 2,300 km through Viet Nam from China in the north to Nam Can in the south. The rehabilitation and improvement of Highway No.1 is the top priority project in the infrastructure development strategy of Viet Nam from now to the year 2010. At present, upgrading work being carried out on this road includes the World Bank (WB) and the Asian Development Bank (ADB) funded road rehabilitation and improvement projects and the Japan Bank for International Cooperation (JBIC) funded bridge improvement and rebuild projects. There still remains one unsolved large river-crossing in the southern section of Highway No.1: the Can Tho crossing of the Hau River. My Thuan Bridge striding over Tien River that is the another large river was completed in May 2000, mainly with grant aid by the Government of Australia.

For the smooth traffic flow for the whole of highway No.1 before 2010, as in the Transport Development Strategy, and to meet the transport demand for promoting socio-economic development of Cuu Long (Mekong) Delta and Indochina, it is now necessary to construct the Can Tho Bridge.

Can Tho City, the study area of the project is located at the center of the Mekong Delta, and about 167km from Ho Chi Minh City in the southwest direction. The farm products harvested from Mekong Delta are gathered and transported through this city.

Considering the possibility of the economical and social improvement of Mekong Delta, the construction of Can Tho Bridge is regarded as one of the national project for not only the surrounding area but also the whole nation.

1. Outline of the Study

Given this situation, the Government of the Socialist Republic of Viet Nam (hereinafter referred to as "GOV") made a request on December 1996 for conducting the Feasibility Study for Can Tho Bridge.

In response to the request by the Government of Viet Nam, the Government of Japan (hereinafter referred to as "GOJ") decided to implement the Feasibility Study on the Can Tho Bridge Construction in the Socialist Republic of Viet Nam in accordance with the relevant laws and regulations in force in Japan.

Accordingly, Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for implementation of technical cooperation programs of the GOJ, undertook the Feasibility Study, in close cooperation with the authorities concerned of the GOV. Project Management Unit My Thuan (hereinafter referred to as "PMU My Thuan") of the Ministry of Transport (hereinafter referred to as "MOT") acted as the counterpart agency to the Study Team of JICA, and also acted as the coordinating body with other relevant organizations for the smooth implementation of the Feasibility Study on behalf of MOT. The Feasibility Study was implemented from August 1997 to September 1998.

Following the implementation of the Feasibility Study in response to a request of GOV, GOJ decided to conduct the Detailed Design of the Can Tho Bridge Construction Project in the Socialist Republic of Viet Nam.

JICA undertook the Detailed Design Study again in close co-operation with the authorities concerned of GOV from March 1999 to October 2000.

In the future, pre-tendering, tendering, and construction will be scheduled to be implemented funded by JBIC (JAPAN BANK FOR INTERNATIONAL COOPERATION).

2. Survey of Natural Condition

The following surveys for the Detailed Design were studied based on the results of the Feasibility Study:

(1) Geotechnical Survey

- Boring with SPT
- Cone Penetration Test (CPT)
- Pressure Meter Test
- Laboratory Soil Test
-

(2) Topographical Survey

- Primary Control Survey
- Secondary Control Survey
- Detailed Survey as follows:
    - Bridge & ROW
    - Major Structures
    - Service Areas
    - Interchanges
    - Resettlement Areas
    - Cross Sections

(3) Material Survey

Capacity of Supply, Quality of the following material were surveyed and tested in the laboratories:

- Earth Material for Embankment
- Aggregates for Concrete
- Aggregates for Pavement

(4) Hydrological and Hydraulic Survey

The following surveys were studied:

- Hydrographic and Hydrological Data Collections
- Hydrographic and Hydrological Surveys
- Hydrological and Morphological Studies including Numerical Modeling of the Hau River around the bridge site
- Riverbed Material Sampling and Analysis

(5) Environmental Impact Assessment (EIA)

Natural and Socio-Economic Impact Assessments as shown in the following were field-investigated or studied, and the Mitigation Measures for the Negative Impacts were proposed:

<Natural Impact Assessment>

- Land and Soil
- Water Resources and Hydrological System
- Water Quality
- Terrestrial and Aquatic Ecology
- Noise
- Vibration
- Air Quality
- Excavation and Transportation of Construction Material
- Wastes
- Environmental Health and Safety
- Excavated Soils and Mud for the Construction of the Bridge Foundations

<Socio-Economic Impact Assessment>

- Land Acquisition and Resettlement
- Schools and Other Public Facilities
- Increase in Prices of Land and Construction Materials
- Public Health and Others
- Local Economic Activities
- Hazards and Risk

3. Basic Design

(1) Design Criteria and Specification

Basically, the Vietnamese Standards and AASHTO Specifications were utilized for the design, and the Japanese Standards were also applied for the items not defined on the former two standards in detail.

(2) Basic Design Condition for Road Alignment

Design Vehicle Speed	:	80km/hr
Arrangement of Road Cross Section	:	4 traffic lanes and paved shoulder for the light vehicles and pedestrian
Water Level for the Navigational Clearance	:	5% frequency (20 years return period)

(3) Basic Design of Highway

- Based on the results of the field and topographic surveys, the final alignment was decided, and the effects on the present social conditions were tried to be mitigated.

- At the beginning point, the connection with the expressway from Ho Chi Minh City to Can Tho city in the future scheme was considered in the design of alignment.

- The vertical alignment of the bridges including the connecting portion of the earthworks was decided based on the Vietnamese Standard, TCVN 4054-1998.

- Four intersections were planned and design in the project road, and the types & the structures of these intersections were decided based on the results of the discussion with Vietnamese side as follows. Semi-Y type and Diamond Type of interchanges were applied because of the fewer earthworks.

N.H. No. 1 at the Beginning Point	:	Interchange (Semi-Y Type)
N.H. No. 54	:	Interchange (Diamond Type)
N.H. No. 91B	:	Interchange (Diamond Type)
N.H. No. 1 at the End Point	:	Intersection (3 branch Intersection)

(4) Basic Design of Main Bridge

- The center span length of Main Bridge was decided as 550m based on the annual change and movement of riverbed, and the navigational clearance.

- Based on the required center span length (550m), the comparison of the bridge type was studied. Consequently, "Hybrid (PC and Steel) Cable Stayed Bridge" was adopted.

- As the construction method of superstructure, precast segmental method was adopted to reduce the construction period and to maintain the high quality and accuracy.

- For the type of foundation for the pylon of Cable Stayed Bridge, the comparison of the "Open Caisson Foundation (Dia. 10.0m)" and the "Cast in Place Concrete Piles (Dia. 3.0m)" was studied. Considering the facility of construction, the Cast in Place Concrete Piles was adopted.

- Based on the designed structure, the wind tunnel test was studied. Under the experimental conditions, no serious flutter or vortex-excited vibration was observed.

(5) Basic Design of Minor Bridges (Bridges in the Approach Roads)

- The following three types of superstructure types were adopted based on the present condition of the construction in Viet Nam, and the construction cost. The span lengths of these bridges were mainly decided based on the required navigational clearance of the rivers or canals.

  - PC I beam : (Span Length: 24.5m ~ 37.0m)
  - PC Box Girder : (Center Span Length: 57m & 75m)
  - PRC Hollow Slab : (For the Interchange Viaducts)

(6) Basic Design of Resettlement Areas

- Resettlement Areas for the residents who will lose their dwellings were planned and designed on both of Vinh Long and Can Tho side, based on the results of EIA surveys, and the discussions with local agencies, residents, and counterparts.

- 1 area was planned on Vinh Long side, and 2 areas on Can Tho side.

4. Detailed Design

The Project Outline decided in the Detailed Design was as shown in the following:

- Project Route: 3.2km downstream from the navigation of Can Tho Ferry.
- Total Project Length: 15,850m including total 2,750m length of "Main & Approach Span Bridge".
- Cross Section: 4 traffic lanes and paved shoulder for the light vehicles and pedestrian.
- Main Bridge: Hybrid Cable Stayed Bridge with 550m of center span length, and 1,090m of total bridge length, to stride over the Hau River (1km width at the crossing point).
- Approach Span Bridge: PC I beam with Cast in Place Concrete Piles were adopted for the Approach Span Bridges connected to the Main Bridge at the both sides.
- Minor Bridges: 10 bridges were planned and designed to stride over the crossing rivers at both of Vinh Long and Can Tho sides. The maximum bridge length was 316m for Large Tra Va Bridge.
- Intersections:

Intersections:	Interchange:	Vinh Long side:	2 points
		Can Tho side:	1 point
	At grade Intersection:	Can Tho side:	1 point

- Service Area:

Service Area:	Vinh Long side:	1 area
	Can Tho side:	1 area

- Construction Packages:

  Package-1: Approach Road on Vinh Long side (ICB)

  Package-2: Main and Approach Span Bridges (ICB)

  Package-3: Approach Road on Can Tho side (ICB)

Package-4: Resettlement Area on Vinh Long side (LCB)

Package-5: Resettlement Area on Can Tho side (LCB)

- Project Cost: (Package-1 ~ 3)

Construction Cost:	28,726 million J. Yen
Other Expenses *:	9,905 million J. Yen
Total Project Cost:	38,631 million J. Yen

* Other Expenses includes, "Engineering Cost", "Land Acquisition and Compensation Cost", "Contingencies", etc.

5. Construction Planning

- Construction Period for Package-2 (Main and Approach Span Bridges) was estimated as 55 months and 47 months for Package-1, 52 months for Package-3, respectively.
- Most of the construction materials were planned to be procured domestically, however, some of the specific materials, namely, PC steels, Reinforcement steel bar with large diameters, and some of the structural steels, etc. were planned to be imported.
- Several construction yards were planned for each package. Mainly, the construction yards were planned for the production of the precast segment of superstructures. 2 yards for Package-1, 3 yards for Pacakge-2, and 1 yard for Package-3 were planned, respectively.
- Temporary access roads and bridges were necessary for the construction works, because of the lack of exiting roads that are available for the transportation of materials and equipment.

6. Financial Analysis

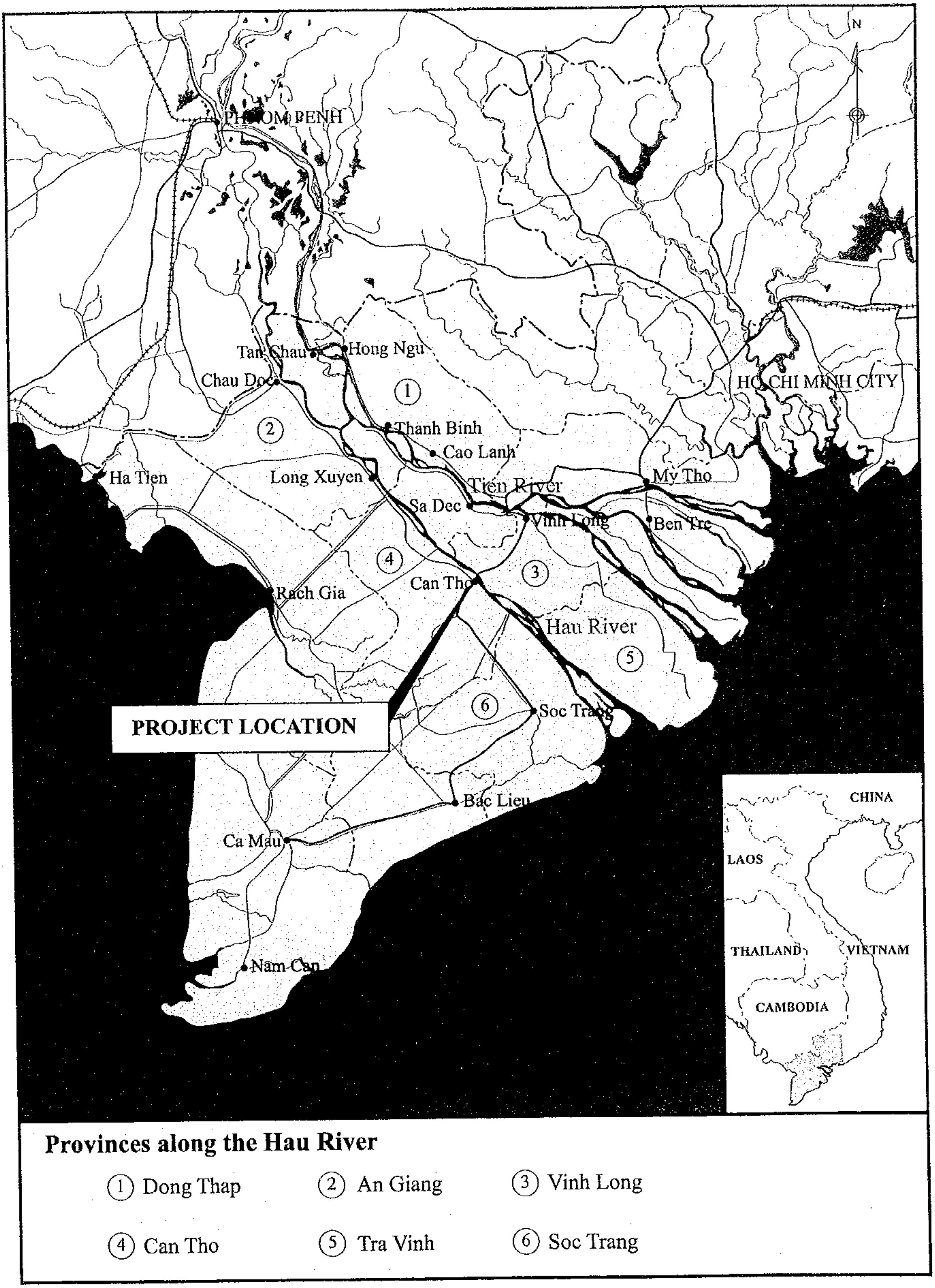
The financial analysis proved that the Project is feasible under the long term loan and governmental subsidy. It was assumed that the long-term loan covers 85% of the project costs of packages 1,2, and 3 with an interest rate of 1.8% per annum and 30-year repayment period including 10-year grace period. The subsidy was assumed to apply to the costs of package 4 and 5 and the remnant costs of packages 1,2, and 3. The calculated pay back periods are as following.

- 20 years (1.5 times higher charge level than Can Tho Ferry)

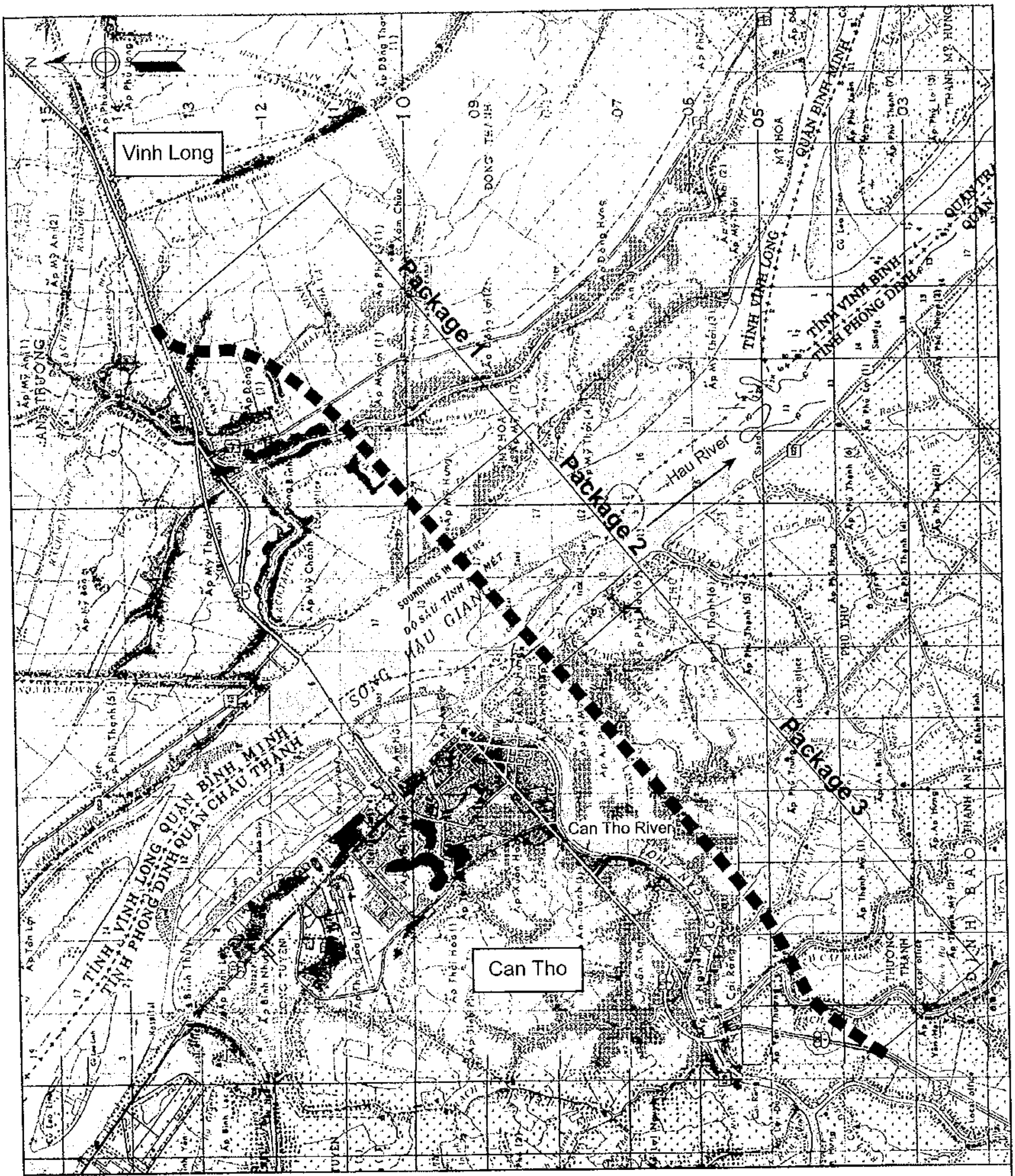
- 23 years (60% of the forecast traffic volume, 1.5 times higher charge level than Can Tho Ferry)

7. Recommendation

- At the end of the Detailed Design Stage (September and October 2000), a flood occurred at the Mekong Delta, and large areas including the Project site were affected. The review of this flood data at the beginning of the next stage is strongly suggested. Moreover, if necessary, the design works will be amended after considering this flood data before the pre-construction procedures.



PROJECT LOCATION



0 1 2 3 4 5 km

Project Briefing

Project Length : 15.850 km

Bridge: Total Length 2.750 km
- Main Span Bridge(PC Hybrid Cable-Stayed) 1.090 km
- Approach Span Bridge(Vinh Long side) 0.480 km
- Approach Span Bridge(Can Tho side) 1.180 km

Approach Roads: Total Length 13.10 km
- Vinh Long side 5.41 km
- Can Tho side 7.69 km

Infrastructures:
- Vinh Long side
- Can Tho side

STUDY AREA

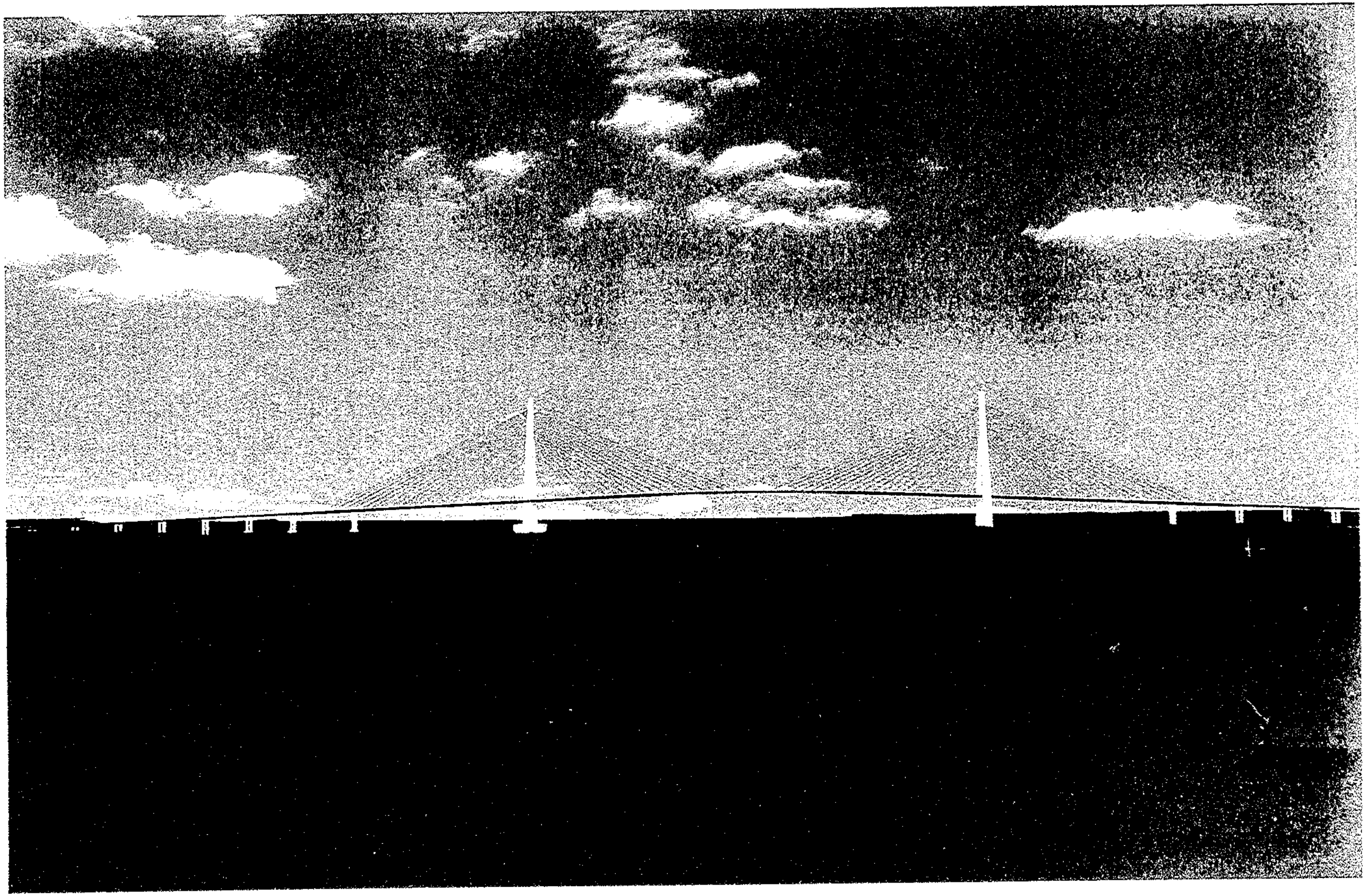


IMAGE OF MAIN BRIDGE

Abbreviations and Acronyms

AASHTO	American Association of State Highway and Transportation Officials
ADB	Asian Development Bank
ASTM	American Society for Testing and Materials
BOD	Biochemical Oxgen Demand
CBR	California Bearing Ratio
Cc	Compression Index
CCLA	Committee of Compensation for Land Acquisition
CCP	Cast-in-place Concrete Pile
CLA	Committee of Compensation for Land Acquisition
COD	Chemical Oxgen Demand
CPT	Cone Penetration Test
Cs	Coefficient of skewness
CSU	Colorado State University
CU	Consolidated, Undrained
Cv	Coefficient of variation
DCF	Discounted Cash Flow
D/D	Detailed Design
deg.	Degree
DO	Dissolved Oxgen
DOSTE	Department of Science, Technology and Environment
DWT	Dead Weight Tonnage
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EPC	Environmental Protection Center
FM	Fineness Modulus
F/S	Feasibility Study
GOJ	Government of Japan
GOV	Government of Viet Nam
GPS	Global Positioning System
ha.	Hectare
HCMC	Ho Chi Minh City
HWL	High Water Level
Hz	Hertz
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
LRFD	Load and Resistance Factor Design (AASHTO 1998 Code)
MDD	Maximum Dry Density
MM	Modified Mercalli Seismic Intensity Scale
MOC	Ministry of Construction
MOSTE	Ministry of Science, Technology and Environment
MOT	Ministry of Transport

MPI	Ministry of Planning & Investment
MSK	MSK Seismic Intensity Scale
MSL	Mean Seal Level
MWD	Maximum Wet Density
NEMS	National Environmental Monitoring System
N.H.	National Highway
NPV	Net Present Value
ODA	Official Development Assistance
OECF	Overseas Economic Cooperation Fund of Japan
OM	Operation and Management
OMC	Optimum Moisture Content
Pa	Pascal
PAP	Project Affected People
Pc	Preconsolidation Pressure
PC	Prestressed Concrete
PDA	Pile Driving Analyzer
PE	Polyethylene
PGA	Probability Maximum Ground Acceleration
pH	Potential of Hydrogen
PMU	Project Management Unit
PPC	Province People's Committee
PPID	Provincial Planning & Investment Department
PRC	Prestressed Reinforced Concrete
PTA	Provincial Transport Authority
PVD	Prefabricated Vertical Drain
R.A.	Resettlement Area
RAP	Resettlement Action Plan
RC	Reinforced Concrete
RCB	Radio Control Boat
RITST	Research Institute for Transportation Science and Technology
ROI	Return on Investment
R.O.W.	Right of Way
RRMU	Regional Road Management Unit
RS	Resettlement Site
SHB-JRA	Standard Specification of Highway Bridges of Japan Road Association
SPT	Standard Penetration Test
SS	Suspended Soils
TCVN	Vietnamese Standard
TDMA	Tri-Diagonal Matrix Algorithm
TSPM	Total Suspended Particulate Matter
UNPD	United Nations Development Programme
USA	United States of America
UU	Unconsolidated, Undrained
UXO	Unexploded Ordnance

VAT	Value Added Tax
VCL	Vertical Curve Length
VITTEP	Viet Nam Institute for Tropical Technology and Environment Protection
VFM	Value for Money
VOC	Vehicle Operation Cost
VRA	Viet Nam Roads Administration
WB	World Bank
W/C	Water Cement Ratio
W.T.P	Water Treatment Plant

FINAL REPORT
ON
THE DETAILED DESIGN OF THE CAN THO BRIDGE CONSTRUCTION
IN
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(MAIN REPORT)

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INTRODUCTION

CHAPTER 1 INTRODUCTION

1.1 Background

National Highway No.1 is an arterial road running about 2,300 km through Viet Nam from China in the north to Nam Can in the south. The rehabilitation and improvement of Highway No.1 is the top priority project in the infrastructure development strategy of Viet Nam from now to the year 2010. At present, upgrading work being carried out on this road includes the World Bank (WB) and the Asian Development Bank (ADB) funded road rehabilitation and improvement projects and the Japan Bank for International Cooperation (JBIC) funded bridge improvement and rebuild projects. There still remains one unsolved large river-crossing in the southern section of Highway No.1: the Can Tho crossing of the Hau River. My Thuan Bridge was completed in May 2000, mainly with grant aid by the Government of Australia.

For the smooth traffic flow for the whole of highway No.1 before 2010, as in the Transport Development Strategy, and to meet the transport demand for promoting socio-economic development of Cuu Long (Mekong) Delta and Indochina, it is now necessary to construct the Can Tho Bridge.

Given this situation, the Government of the Socialist Republic of Viet Nam (hereinafter referred to as "GOV") made a request to the Government of Japan (hereinafter referred to as "GOJ") in December 1996 for conducting the Feasibility Study for Can Tho Bridge.

In response to the request by GOV, GOJ decided to implement the Feasibility Study on the Can Tho Bridge Construction in the Socialist Republic of Viet Nam in accordance with the relevant laws and regulations in force in Japan. The Feasibility Study (F/S) was implemented by Japan International Cooperation Agency (JICA) under the technical cooperation programs of the Government of Japan.

1.2 Introduction

Following the implementation of the F/S, in response to a request of GOV, GOJ decided to conduct the Detailed Design of the Can Tho Bridge Construction Project in the Socialist Republic of Viet Nam (hereinafter referred to as "the Study" and "the Project") in accordance with the relevant laws and regulations in force in Japan.

JICA, the official agency responsible for the implementation of the technical cooperation programs of GOJ, will undertake the Study in close co-operation with the authorities concerned of GOV.

1.3 Scope of the Study

The detailed design was divided into three stages of work in Japan, including preparatory work, and two stages in Viet Nam as follows:

1.3.1 1st Year (1998/1999 Fiscal Year)

(1) Preparatory Work in Japan

- Collection and Analysis of Relevant Data
- Study Policy, Methodology, Work Schedule, etc.
- Preparation of the Inception Report

(2) 1st Stage Work in Viet Nam and 1st Stage Work in Japan

- Submission and Discussion of the Inception Report
- Preliminary Study
- Natural Condition Surveys
- Basic Design
- Environmental Survey
- Wind Tunnel Test
- Submission and Discussion of Basic Design Report
- Detailed Design
- Environmental Impact Assessment (EIA)
- Construction Planning
- Maintenance Programming
- Estimate of Project Cost
- Preparation of Tender Documents
- Submission and Discussion of the Progress Report

1.3.2 2nd Year (2000 Fiscal Year)

(1) 2nd Stage Work in Viet Nam

- Preparation of Tender Documents (continued from 1st Stage)
- Implementation Program
- Conclusions and Recommendations, including Financial Analysis
- Preparation of Draft Final Report
- Submission and Discussion of Draft Final Report

(2) 2nd Stage Work in Japan

- Preparation and Submission of the Final Report

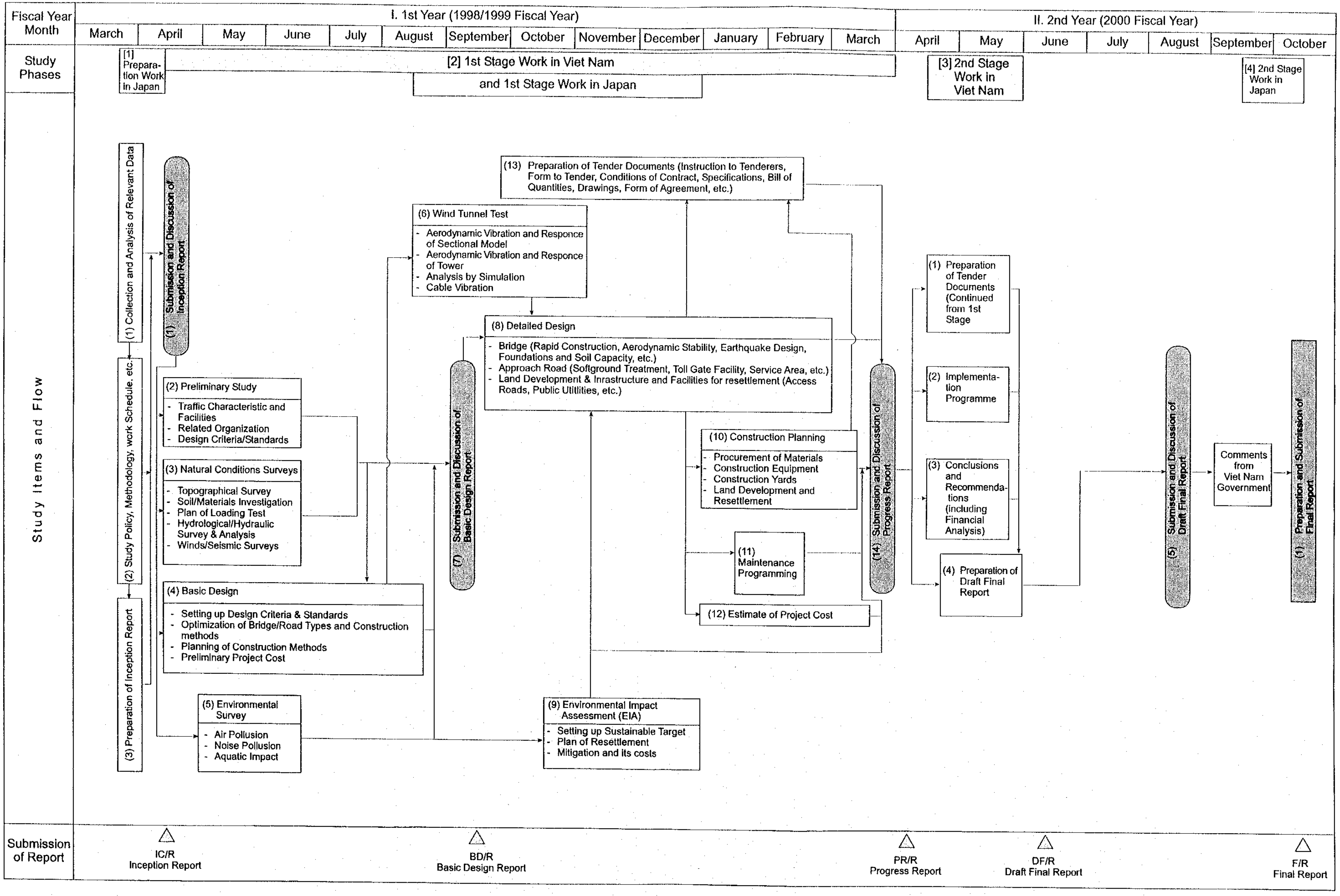


Figure 1-1 WORKING FLOWCHART OF THE STUDIES

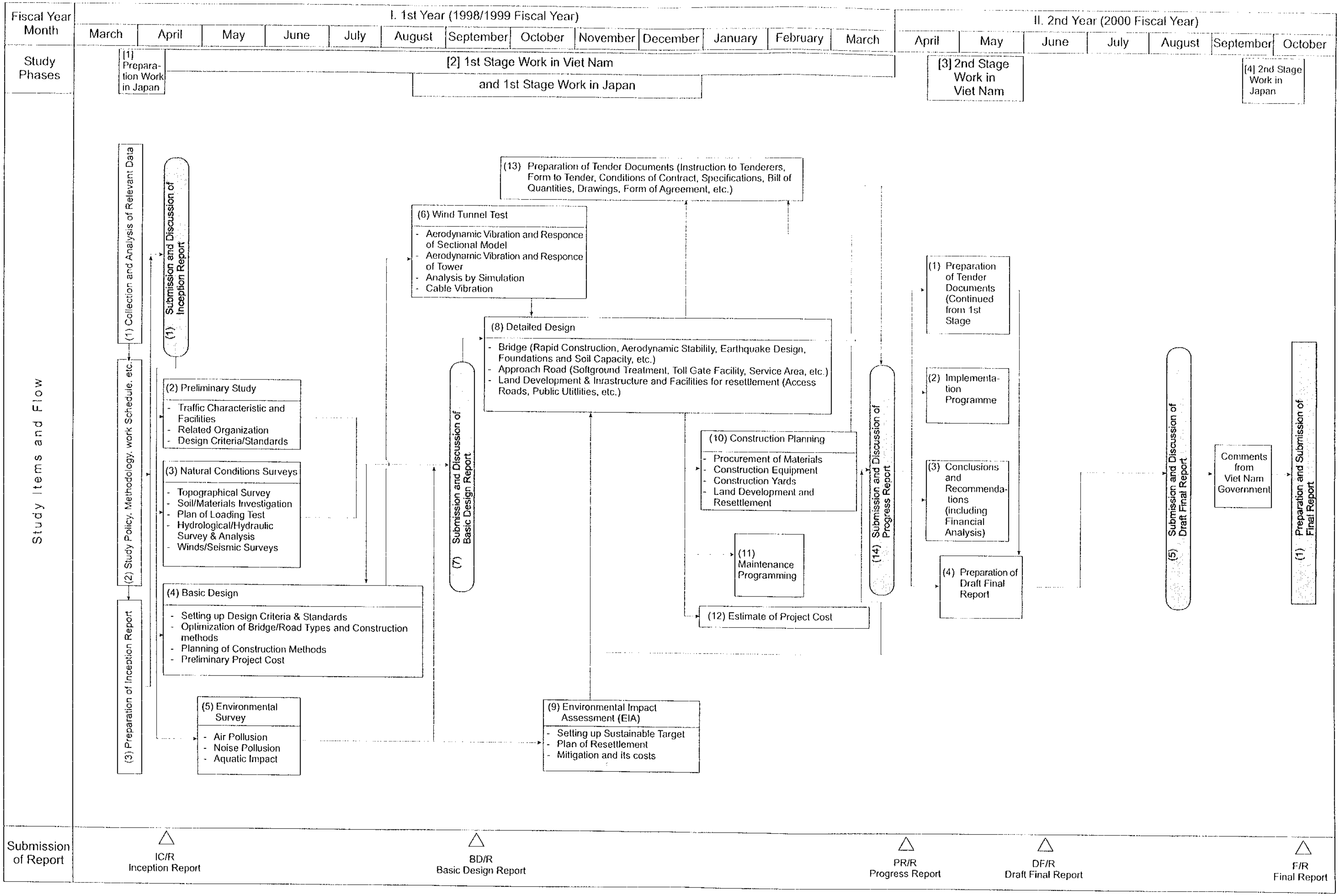
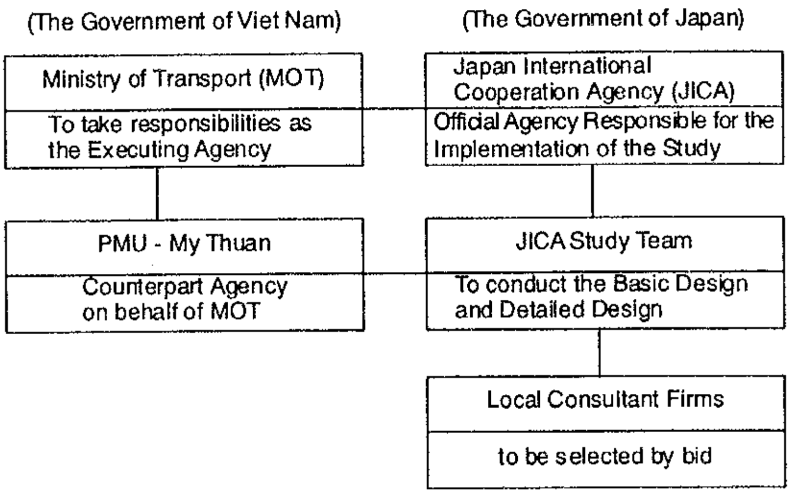


Figure 1-1 WORKING FLOWCHART OF THE STUDIES

1.3.3 Study Organization

The Study Organization for the Detailed Design o the Can Tho Bridge Construction is shown below:



Chapter 2

PRELIMINARY SURVEYS

CHAPTER 2 PRELIMINARY SURVEYS

2.1 Traffic Characteristic and Facilities

2.1.1 Existing Transport System and Infrastructures

(1) Roads

The total length of road network in the Mekong Delta is approximately 30,000 km. These roads are classified into national roads, provincial roads, and rural or feeder roads. Provincial and rural or feeder roads connect provincial capitals with district centers, or link the district centers to the national roads. Judging from the current road network density of 0.77 km per sq. km, the road network is widely spread over the delta.

Generally, however, the road condition is poor with the exception of the national roads. Most of the rural or feeder roads in the flood prone areas are inundated during the wet season, resulting in the emergence of vast areas which are not accessible by vehicle. Out of the 30,000 km of roads in the Mekong Delta (compiled from 1994 statistics), only 1,600 km or 5% were asphalted.

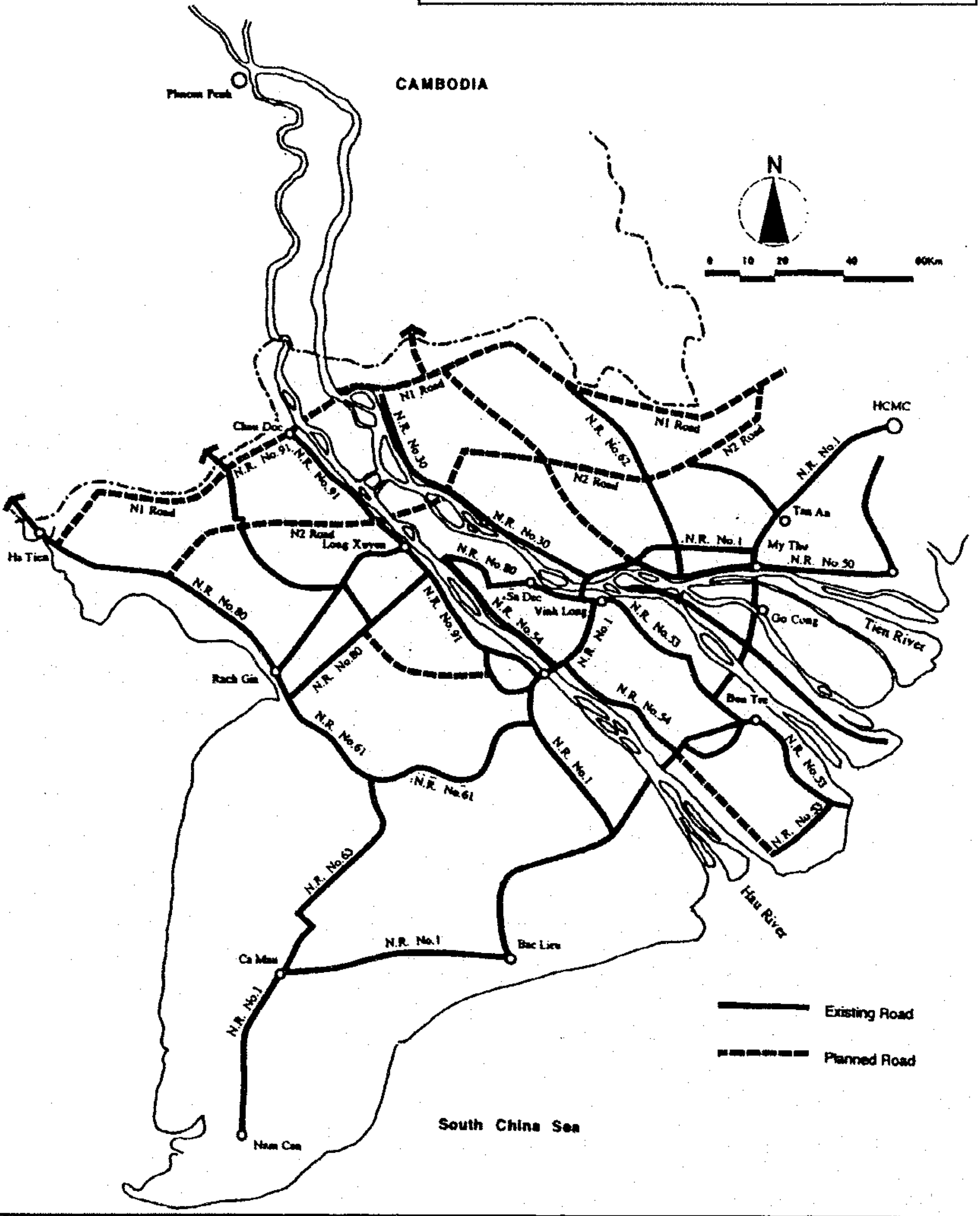
The total number of bridges in the Mekong Delta is about 20,000 due to the running waterways like net meshes and tributaries of the Mekong River. The gradients of the approach roads to bridges are generally steep for maintaining vertical clearances for the passage of boats and barges.

Thirty ferry sites are currently located in the delta, of which Can Tho, Vam Cong, An Hoa, and Chau Doc are along the Hau (Bassac) River.

The main national roads are National Road No.1 between Hanoi and Ca Mau (the primary trunk road connecting the north to the south in Viet Nam), National Road No. 80 between Vinh Long and Ha Tien, and National Road No. 30 along the Mekong River to the Cambodian border (Figure 2.1).

Source: "Summary of Development Plan on Transport and Communications inthe mekong River Delta, Period: 1997 - 2000 and 2001 - 2010"

Ministry of Transport, Mar. 1997



THE DETAILED DESIGN OF THE CAN THO BRIDGE CONSTRUCTION IN SOCIALIST REPUBLIC OF VIET NAM	Figure 2.1 Road Plan in the Mekong River Delta 1996 - 2010
	JAPAN INTERNATIONAL COOPERATION AGENCY

(2) Inland Waterways

There are many canals, waterways, and rivers in the delta. According to the Transport Infrastructure Survey in 1994, the navigable length is about 2,700 km out of some 5,000 km of waterways. The density of the waterway network is 0.68 km per sq. km. This figure is almost comparable to that of road. Waterways are still functioning as a major transport means for economic and the inhabitants' daily activities, due to the flooding in the rainy season. The waterway transport is concentrated on two principle corridors from Ho Chi Minh City to Ca Mau (320 km) and from Ho Chi Minh City to Kien Luong (330.3 km).

(3) Ports

For coastal and seagoing vessels, Tran Quoc Toan, Vinh Thai, My Thoi, Can Tho, Hon Chong, and Nam Can ports are located in the Mekong Delta. Of these ports, My Thoi and Can Tho ports are located on the Hau (Bassac) River. Can Tho port has been constructed with the status of an international port, and can accommodate 5,000 DWT capacity vessels and handle some 300,000 tons of cargo per year. However, only fully loaded 3,000 DWT vessels can reach the port due to the shallow depth at the mouth of Dinh An and larger vessels must wait during low tide.

Corresponding to the well developed waterway network, Long Xuyen (Hau River), My Tho (Binh Duc), Tra Cu, and Cao Lanh (Tien River) are located as river ports accessible by 1,000 DWT class vessels.

(4) Transport Modal Share

Transport modes in the Mekong Delta depend on inland waterways, road, sea, and air. The railway has suspended its operations. Roads act as the major means of transporting passenger, and the inland waterways are used for major freight transport.

According to 1995 official statistics, a cargo volume of some 18.8 million tons was transported in the Mekong Delta, of which 38% was transported by road and 60% by inland waterways. Since the share of road in cargo transport in 1991 was 33%, a gradual shifting from inland waterways to road can be recognized in the modal share for cargo transport in the delta.

Roads kept almost the same share between 1991 and 1995 for passenger transport. In 1995, roads accounted for 66% of passenger traffic in the delta.

2.1.2 Transport Plans

The most comprehensive development plan for the Mekong Delta to date has been the *Mekong Delta Master Plan* in 1993 funded by UNDP. The World Bank and the Mekong Secretariat acted as the executing agency with the State Planning Committee having the responsibility for overall coordination. In this plan projects were selected from a long list proposed by the various ministries. Water resource development, forestry, agriculture, water supply and transportation projects were contained in the Plan and the construction of the Tien (Mekong) River bridge, the Hau (Bassac) River bridge, extension of N.H. No.1 from Ca Mau to Nam Can, and dredging of the Dinh An river mouth were proposed. However, to date, only a few of these projects have reached the status of "Project" in the sense of funding has been promised or progress of the study.

2.2 Related Organization

The organization of the Ministry of Transport (MOT) consist of Bureau, Department, Institute, Corporation, Union, Enterprise and Project Unit. My Thuan Project Management Unit is acting as the counterpart agency to the Study Team of JICA (Figure 2.2)

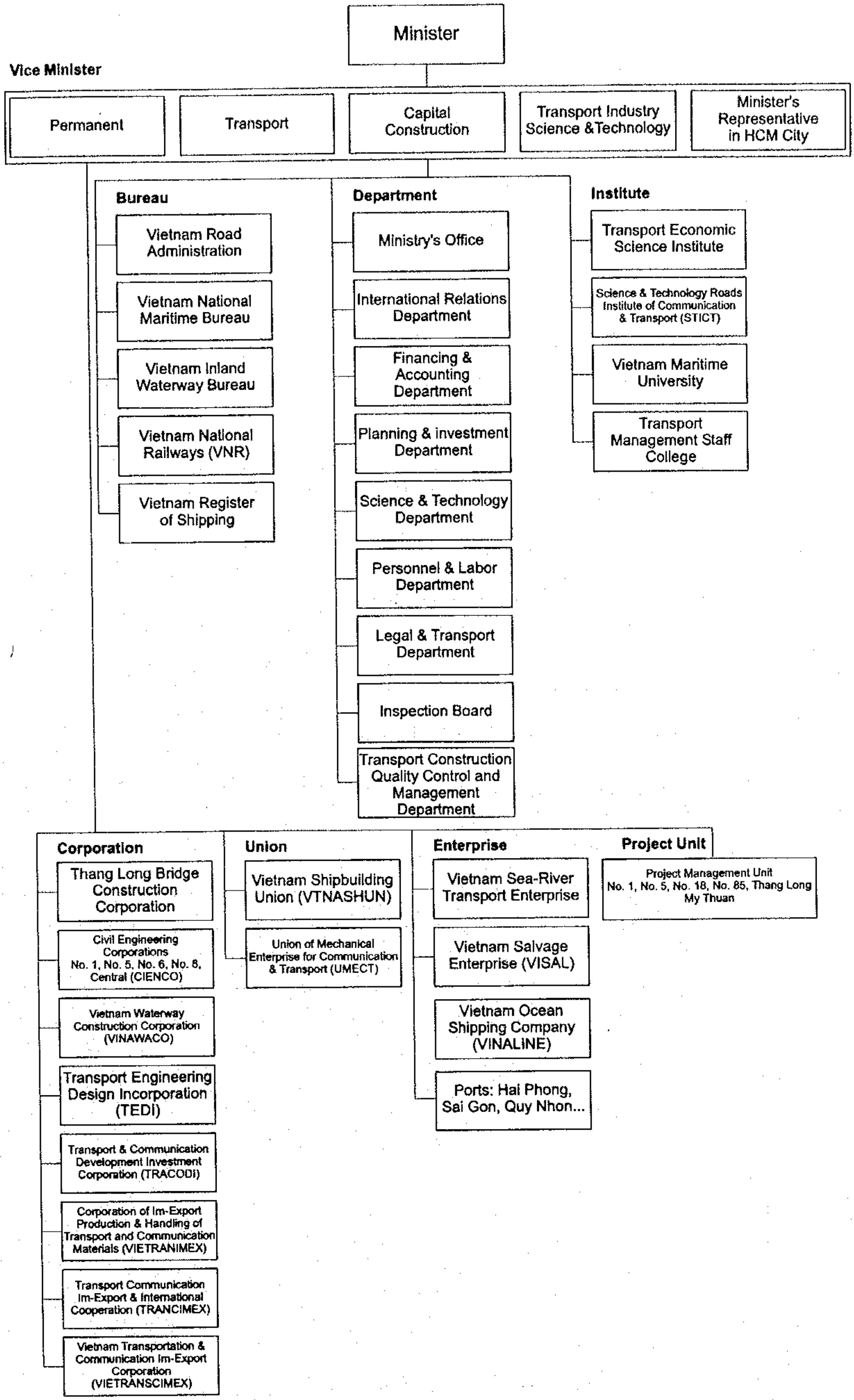


Figure 2.2 Organization Chart of Ministry of Transport

2.3 Design Criteria/Standards

2.3.1 Specifications and Standard

The design is to be based on the Vietnamese Standards and the AASHTO Specification for Bridge Design with reference to Japanese Standards, especially for the proof check.

The major references are:

- AASHTO LRFD Bridge Design Specification, Second Edition 1998 published by AASHTO (American Association of State Highway and Transportation Officials).
- Reference will also be made to the AASHTO Standard Specification for Highway Bridge, Sixteenth Edition 1996.
- Highway Design Standards (TCVN-4054-1998), Viet Nam
- Specifications for Bridge Structures (2057/QD-KT-1979- Viet Nam, Highways Bridge Specification
- AASHTO Guide for Design of Pavement Structures 1993.
- Japanese Highway and Bridge Standards
- Other related standards and specifications

2.3.2 Review of AASHTO LRFD 1998

The AASHTO LRFD 1998 Bridge Design Specification has been compared with the AASHTO LRFD 1994 Specification. The revised specification is a general update of the first edition rather than a major revision. There appears to be very little change to the general philosophy, although certain areas of the code have been expanded, some of which are relevant to the Can Tho Bridge project.