MINISTRY OF TRANSPORT
THE SOCIALIST REPUBLIC OF VIETNAM

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR INPROVEMENT OF RURAL BRIDGES IN NORTHERN MOUNTAINOUS PROVINCES
IN
THE SOCIALIST REPUBLIC OF VIETNAM

JANUARY 2007

JAPAN INTERNATIONAL COOPERTATION AGENCY

ORIENTAL CONSULTANTS CO. LTD.

PREFACE

In response to a request from the Government of the Socialist Republic of Vietnam, the Government of Japan decided to conduct a basic design study on the Project for Improvement of Rural Bridges in Northern Mountainous Provinces and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Vietnam a study team from February 27 to March 23 and from May 22 to July 10, 2006.

The team held discussions with the officials concerned of the Government of Vietnam, 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 Vietnam 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 Socialist Republic of Vietnam for their close cooperation extended to the teams.

January, 2007

Masafumi Kuroki
Vice-President
Japan International Cooperation Agency

January, 2007

Letter of Transmittal

We are pleased to submit to you the basic design report for the Project for Improvement of Rural Bridges in Northern Mountainous Provinces in the Socialist Republic of Vietnam.

This study was conducted by Oriental Consultants Company Limited, under a contract to JICA, during the period from February, 2006 to January, 2007. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Vietnam 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,

Hideki Yoneyama
Project Manager,
Basic design study team on
the Project for Improvement of Rural Bridges
in Northern Mountainous Provinces
Oriental Consultants Company Limited

SUMMARY

Since 1975, the Government of the Socialist Republic of Vietnam (hereafter referred to as the "GOV") has been rehabilitating rural bridges that were mainly damaged by war with temporary bridges. The temporary bridges, however, are insufficient for heavy vehicles and their lower elevations sometimes result in the bridges being closed during the rainy season. This situation has been hampering rural development in Vietnam and should be remedied.

Given the above, the Government of Japan (hereafter referred to as the "GOJ") has been providing Grant Aid to support the improvement of these temporary rural bridges via the projects listed below.

- "The Project for Reconstruction of Bridges in the Northern Area (1995-98)": Consists of 8 material procurement type bridges and 21 facility construction type bridges.
- "The Project for Reconstruction of Bridges in the Mekong Delta Area (2001-03)": Consists of 17 material procurement type bridges and 20 facility construction type bridges.
- "The Project for Reconstruction of Bridges in the Central District (2002-)": Consists of 23 material procurement type bridges and 21 facility construction type bridges.

Except for 7 facility construction type bridges, all the above-mentioned bridges were completed by March 2006. Note that during the implementation of the Grant Aid projects the GOV established in 2001 the "Strategy for Socio-Economic Development (2001-2010)". One of the goals stipulated in the strategy is "poverty reduction". In line with this strategy, the GOV announced in 2002 the "Comprehensive Poverty Reduction and Growth Strategy (CPRGS)", which intends to reverse the trend of the widening social/economical gap between urban and rural areas.

Based on the above-mentioned strategies, the GOV made a request to the GOJ for the improvement of 52 bridges in areas close to the border of China or Laos, which have a larger number of minorities and higher levels of poverty as compared to former areas that have received Japanese Grant Aid. This project is known as "The Project for Improvement of Rural Bridges in Northern Mountainous Provinces" (hereafter referred to as "the Project"). The overall goal of the Project is to help reduce poverty by narrowing the gap between rural and urban areas as stated in the above national plans and strategies. The target of the Project is therefore to improve accessibility between poor rural areas and district centers via the provision of new bridges on rural roads in the northern mountainous provinces. According to the application, all the requested bridges are of the material procurement type.

In response to the request, the GOJ dispatched a preliminary study team in September 2005 in order to assist with the Initial Environmental Examination (IEE) to be executed by the execution agency (PMU18, Ministry of Transport). After confirming the results of the IEE report, JICA decided to dispatch a basic design study team for the Project from February 27 to March 23 (the first field survey) and from May 22 to July 10 2006 (the second field survey).

Based on the results of the first field survey and on discussions between the Study Team and the GOV concerning the Interim Report, it is agreed by both sides that the following criteria be applied in evaluating the requested bridges to be selected for further examination in the second field survey: (1) Potential Attractivity & Magnitude of Benefits, (2) Urgency & Necessity, (3) Impact Lag, (4)

Necessity for Steel Bridge, (5) Impact on Ethnic Minorities, (6) Economic Condition, and (7) Current Traffic Volume. The bridges selected for further study, which total 43, are as shown in the table below.

Bridges Selected for Detailed Field Survey

Province	Br. No.	Bridge Nsme	Width planned m	Length Planned (m)	Span Arrangement (m)	Superstructure Type
Son La	2	Ban Sai	4.5	42	21+21	Composed Simple Girder
	3	Ban Tum	4.5	60	18+18+24	Composed Simple Girder
	4	Na Do	4.5	33	33	Composed Simple Girder
	5	Na Tra	4.5	42	21+21	Composed Simple Girder
	6	Ban Pang	4.5	30	30	Composed Simple Girder
Dien Bien	7	Na Phat	4.5	66	21+24+21	Composed Simple Girder
	8	Pa Bat	5.5	90	30+30+30	Composed Simple Girder
	9	Su Lu	5.5	99	33+33+33	Composed Simple Girder
	10	Ban Bung	5.5	54	27+27	Composed Simple Girder
	11	Pac Nam (DB)	4.5	42	24+18	Composed Simple Girder
Lai Chau	12	San Thang	4.5	30	30	Composed Simple Girder
	14	Nam Puc	4.5	66	21+24+21	Composed Simple Girder
	15	Huoi Dit	4.5	21	21	Composed Simple Girder
	16	Nam Ham	4.5	60	30+30	Composed Simple Girder
	17	Nam Cum	4.5	72	24+24+24	Composed Simple Girder
Yen Bai	18	Ngoi Thap	5.5	48	24+24	Composed Simple Girder
	20	Lao Chai	4.5	84	15+54+15	Steel Truss and Composed Simple Gieder
	21	Pu Trang	5.5	72	24+24+24	Composed Simple Girder
	22	Ta Tiu	5.5	99	33+33+33	Composed Simple Girder
	23	Ben Cao	5.5	81	27+27+27	Composed Simple Girder
Lao Cai	25	Thanh Phu	5.5	99	49.5+49.5	Steel Truss
	26	Ban Xeo	5.5	60	15+30+15	Composed Simple Girder
	27	Muong Hum 2	5.5	72	24+24+24	Composed Simple Girder
	28	Den Sang	4.5	24	24	Composed Simple Girder
	29	Soi Chat	4.5	54	27+27	Composed Simple Girder
Tuyen Quang	30	Ban Nghien	4.5	63	21+21+21	Composed Simple Girder
	31	Trinh	5.5	81	27+27+27	Composed Simple Girder
	32	Na Nham	5.5	99	33+33+33	Composed Simple Girder
	33	Sung	5.5	33	33	Composed Simple Girder
Ha Giang	36	Na Lan	4.5	54	54	Steel Truss
	37	Ta Lang	4.5	54	18+18+18	Composed Simple Girder
	38	Suoi Dau	4.5	54	27+27	Composed Simple Girder
	39	Diec	4.5	48	24+24	Composed Simple Girder
	40	Lien Hiep	4.5	33	33	Composed Simple Girder
Bac Can	42	Pac Nam (BC)	5.5	42	21+21	Composed Simple Girder
	43	Khuoi Nung	5.5	33	33	Composed Simple Girder
	44	Nga Ba	5.5	42	21+21	Composed Simple Girder
	46	Don Phong	5.5	75	24+24+27	Composed Simple Girder
	47	Quang Chu	5.5	99	33+33+33	Composed Simple Girder
Cao Bang	48	Dong May	5.5	81	27+27+27	Composed Simple Girder
	49	Binh Long	5.5	99	33+33+33	Composed Simple Girder
	50	Ban Sac	5.5	63	21+21+21	Composed Simple Girder
	52	Keo Ai	4.5	33	33	Composed Simple Girder
Total Bridge Length				2586 (m)		

A detailed survey was then executed for the above-mentioned 43 bridges during the second field survey. Note that the GOJ is to procure superstructure materials, such as steel girders, bearings, expansion joints, and drain pipes, as well as the tools and equipment necessary for the erection of

these bridges. All the bridges are simple girder type, except for three truss bridges for which the GOJ will provide technical assistance as Vietnam has little experience with this type of bridge.

The implementation process for the Project is about 34 months, with the first phase being 17 months that will erect 28 bridges in 6 provinces and the second phase being 17 months that will erect 15 bridges in 3 provinces. Note that this work will include detailed design review and tendering. In the case of the Project being implemented with Japan's Grant Aid, total Project cost is estimated at about 4,044 million Japanese Yen (JPY), with the GOJ to bear 1,368 million and the GOV 2,676 million of this cost.

At the time of completion, the 43 bridges will be transferred from the MOT to each province. Given that the northern provinces are located in the poorest area of Vietnam, atmospheric corrosion resistant steel (hereafter referred to as "weathering steel") will be used to minimize maintenance costs. There are few maintenance requirements for the proposed bridges, unlike a normal steel bridge that needs re-painting every 20 to 30 years. Although the operation and maintenance cost for the proposed bridges is expected to be small, the following "full-scale maintenance" activities are needed at the proper intervention levels: (1) replacement of expansion joints approximately every 15 years, (2) replacement of bearings approximately every 30 years, (3) re-painting of girder edges with epoxy resin approximately every 30 years, and (4) replacement of deck slabs on superstructure approximately every 50 years. The financial burden of these "full-scale maintenance" activities amounts to only 2-3% of the maintenance budget of a provincial DOT, meaning that it is possible for provincial DOTs to execute these important and necessary activities for the upkeep of the bridges.

The direct and indirect positive impacts of the Project are described in below.

1) Direct Positive Impacts

a) Improvement of Access to Social Services for Poverty Areas

The problem of river crossings that are impassable from 2 to 6 months of the year due to the rainy season will disappear with the proposed bridge site improvements and all-weather access to social services will be realized for residents in areas with high poverty levels. In addition, for those river crossings that are impassable for a few hours per day from 60 to 80 days of years, they also will become all-weather crossings and provide year-round access to social services for residents of poor areas.

b) Alleviation of Vehicle Restrictions & Strengthening of Transport Capacity for Bridges

For those crossings that can handle only pedestrians or bikes, or only light vehicles (i.e., vehicles weighing 2t or less), their transport capacity will be strengthened and they will be capable of handling trucks up to 16t.

c) Improvement of Traffic Safety

With the improvement of the bridge sites the problem of automobiles and bikes crossings riverbeds, which has resulted in the past in these vehicles and/or people sometimes being washed away, will be prevented.

d) Reduction in Crossing Times

Even in the dry season it takes from several minutes to half an hour to cross the bridge sites under consideration, with the planned improvements this time will be shortened to only 1 to 2 minutes.

2) Indirect Positive Impacts

a) Contribution towards Narrowing of Socioeconomic Gap between Residents Living in Mountainous and Urban Areas

With access to regional centers to be improved for residents living in mountainous areas, there will be a reduction in the socioeconomic gap between these areas as people from mountainous areas will have more opportunities to use social services such as schools, hospitals and to increase their cash income.

The expected beneficiaries of the Project are the people who live in the poor areas beyond the 43 objective bridges. The population for these locales is about 330,000 people and the area about 2,000km^2 with 840 villages.

As the Project is expected to produce considerable benefits, the utilization of Japan's Grant Aid for Project implementation is meaningful. It has also been confirmed that the Vietnamese counterparts will have no problems in terms of personnel and funds for the operation and maintenance of the Project. To maximize and sustain the positive impacts of the Project, due attention should be paid to the following points:

① Prompt Superstructure Erection

Both the Japanese and Vietnamese sides confirmed that all the bridges shall be completed within one year after receiving their superstructures from Japan. In addition, the Vietnamese side must allocate a budget for the construction of the 43 bridges in a timely manner, taking into consideration that all the bridges are of the material procurement type and that the construction cost of these bridges is more than that of former Grant Aid projects.

② Improvement of Access Roads

Some of the bridge sites that have been selected do not have suitable approach roads. In order to quickly realize the positive impacts of the improvements for these sites, it is necessary that these roads be either widened and/or rehabilitated.

③ Execution of Proper Maintenance for New Bridges and Access Roads

Weathering steel was adopted for all the superstructure materials of the 43 bridges in order to minimize the maintenance costs to be borne by the northern provinces, which are the poorest areas in Vietnam. However, even weathering-steel bridges require periodic inspection and proper maintenance. The surface of the weathering steel must be kept clean without any stains in order to generate a stabilized rust layer, which will protect the inside of the steel from rusting.

The Socialist Republic of Vietnam

The Project for Improvement of Rural Bridges in Northern Mountainous Provinces

Basic Design Study Report

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Project Location Map

CHINA

LAOS

CHINA

Legend

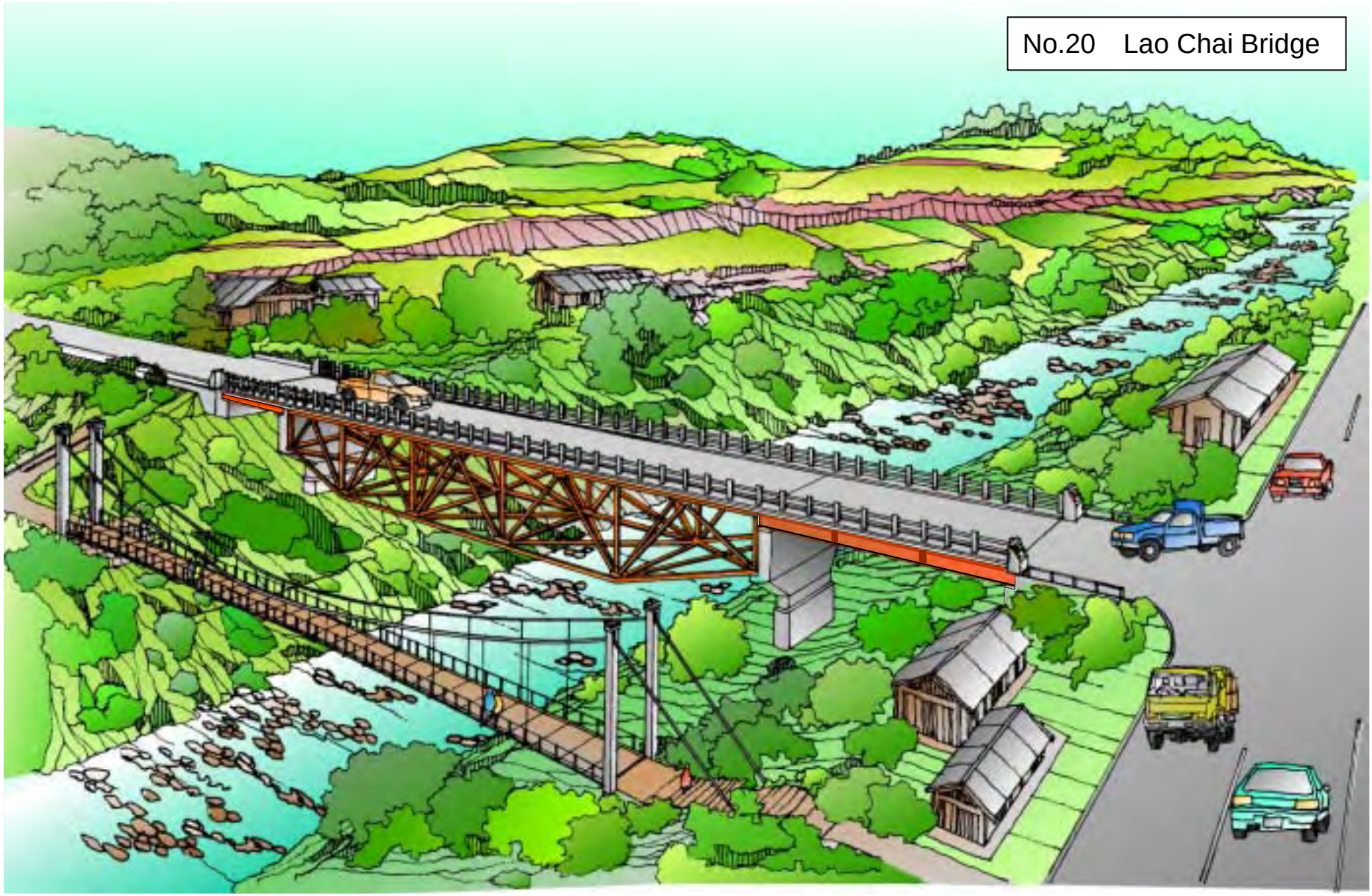
- 20 Objective Bridges of this Project
- 13 Bridges Not Selected
- ● Facility Construction 21 Bridges
- ▲ Material Procurement 8 Bridges

（Previous Project for Reconstruction of Bridges in the Northern District 1995～1998）

1 National Road ○ Provincial Capital

Ha Giang
HA GIANG Prov.
Cao Bang
CAO BANG Prov.
Lao Cai
Lai Chau
LAI CHAU Prov.
LAO CAI Prov.
DIEN BIEN Prov.
BAC CAN Prov.
Bac Can
TUYEN QUANG Prov.
Tuyen Quang
Lang Son
YEN BAI Prov.
Yen Bai
THAI NGUYEN
Phu Tho
Dien Bien
Son La
SON LA Prov.
Bac Giang
HA NOI
Hai Duong
HAI PHONG
Hoa Binh
Thai Binh
NAM DINH
Gulf
0 50 100km

No.20　Lao Chai Bridge



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Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
CPRGS	Comprehensive Poverty Reduction and Growth Strategy
DBST	Double Bituminous Surface Treatment
DD	Detailed Design
DOT	Department of Transport
F/S	Feasibility Study
GOJ	Government of Japan
GOV	Government of Vietnam
HWL	High Water Level
IEE	Initial Environmental Examination
IMF	International Monetary Fund
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
MOT	Ministry of Transport
ODA	Official Development Assistance
PAPs	Project Affected Persons
PC	Prestressed Concrete
PCU	Passenger Car Unit
PMU	Projects Management Unit
RC	Reinforced Concrete
TC	Torque Control
WB	World Bank

CHAPTER 1

BACKGROUND OF THE PROJECT

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Since 1975, the Government of the Socialist Republic of Vietnam (hereafter referred to as the "GOV") has been rehabilitating rural bridges that were mainly damaged by war, with temporary bridges sometimes being used due to the lack of a sufficient budget. The temporary bridges, however, are insufficient for heavy vehicles and their lower levels sometimes result in the bridges being closed during the rainy season. Consequently, this situation has been hampering rural development in Vietnam.

Given the above, the Government of Japan (hereafter referred to as GOJ) has been providing Grant Aid to support the improvement of these temporary rural bridges via the projects listed below:

- "The Project for Reconstruction of Bridges in the Northern Area (1995-98)": Consists of 8 material procurement type bridges (steel girders supplied) and 21 facility construction type bridges.
- "The Project for Reconstruction of Bridges in the Mekong Delta Area (2001-03)": Consists of 17 material procurement type bridges and 20 facility construction type bridges.
- "The Project for Reconstruction of Bridges in the Central District (2002-)": Consists of 23 material procurement type bridges and 21 facility construction type bridges.

Except for the 7 facility construction type bridges, all the above-mentioned bridges were completed by March 2006. Note that during the implementation of the Grant Aid projects the GOV established in 2001 the "Strategy for Socio-Economic Development (2001-2010)". One of the goals stipulated in the strategy is "poverty reduction". In line with this strategy, the GOV announced in 2002 the "Comprehensive Poverty Reduction and Growth Strategy (CPRGS)", which intends to reverse the trend of the widening social/economical gap between urban and rural areas.

Based on the above-mentioned strategies, the GOV made a request to the GOJ for the improvement of 52 bridges in areas close to the border of China or Laos, which have a larger number of minorities and higher levels of poverty as compared to former areas that have received Japanese Grant Aid. This project is known as "The Project for Improvement of Rural Bridges in Northern Mountainous Provinces" (hereafter referred to as "the Project").

Connectivity between the areas of the Project, which are mountainous, poor areas in the north provinces with a high proportion of minorities, to district centers (or a city with a population of more than 20,000) that have adequate social facilities such as hospitals, schools and markets are usually very poor. For example, only 4 out of the 52 requested bridges have sufficient load capacity for light vehicles. At the other 48 bridges, they are adequate for pedestrian and motorbike traffic only and all 4-wheeled vehicles have to pass directly through the river. In the rainy season, which is from April to September, vehicles sometimes cannot pass through a river because of the high water level. This situation hampers access to hospitals, schools and markets, and worsens the social and economical disadvantages of people living in these areas.

Note that the total length of the 52 bridges for which improvement has been requested is about 3300m, from which the Study Team will select high priority bridges to be considered by the Project. Also, according to the application for Grant Aid prepared by the GOV in 2005, all the requested bridges are of the material procurement type.

CHAPTER 2

CONTENTS OF THE PROJECT

CHAPTER 2 CONTENTS OF THE PROJECT

2-1 Basic Concept of the Project

2-1-1 Overall Goal and Target of the Project

The Socialist Republic of Vietnam (hereafter referred to as "Vietnam") has a population of 82 million, with about 8 million people being minorities. Most minorities live in mountainous areas bordering China, Laos, or Cambodia. Recently, the social and economic gap between rural minorities and the majority of the population, who are of the Kinh ethnic group and mainly live in developed urban areas, has substantially widened. The "Sixth Five Year Socio-economic Development Plan (1996-2001)" highlighted the problem of this gap and consequently the Ministry of Transport (MOT) has focused on narrowing it by proposing to improve the road network in its "Strategy for Transport Development in Vietnam till 2020" for three regions; namely, the Northern Mountainous Area, Central Mountainous Area and Mekong Delta Area. The Government of Vietnam (GOV) has also stated that the widening gap between rural mountainous and urban plain areas must be corrected and established poverty reduction in May 2002 as one of its national policies in the "Comprehensive Poverty Reduction and Growth Strategy (CPGRS)".

The overall goal of "The Project for Improvement of Rural Bridges in Northern Mountainous Provinces" is to help reduce poverty by narrowing the gap between rural and urban areas as stated in the above national plans and strategies. The target of the Project is therefore to improve accessibility between poor rural areas and the district centers via the provision of new bridges on rural roads (provincial, district and commune roads) in the northern mountainous provinces.

2-1-2 Objective Bridges

To achieve the Project's target, 43 bridges in the northern mountainous provinces were selected. The Government of Japan (GOJ) shall procure the superstructure materials for these bridges, and the GOV shall secure the land for the facilities, construct the bridges and access roads, and carry out maintenance work after completion of the Project. The procedures for selecting the objective bridges are described below.

2-1-2-1 Confirmation of Contents of the Application Form

The contents of the application form submitted by the GOV in September 2005 were confirmed at the time of the first field study and are as follows:

- The original request for 52 bridges was included in the application form.
- All the bridges were of the material procurement type.
- Request for handrails to be withdrawn by the GOV if the number of bridges to be procured is reduced.

The list of requested bridges is as shown in Table 2.1.2.1.

Table 2.1.2.1 List of Requested Bridges

Province	Br. No.	Bridge Name	Existing Bridge				Proposed Length of Bridge (m)
			Length (m)	Width (m)	Bridge Type	Loading Capacity (t)	
Son La	1	Ban Khong	8.2	4.6	RC Slab	for light vehicle only	30
	2	Ban Sai	43.0	1.5	Suspension	pedestrian, bike only	45
	3	Ban Tum	52.0	1.4	Suspension	pedestrian, bike only	55
	4	Na Do	50.0	1.5	Suspension	pedestrian, bike only	50
	5	Na Tra	30.0	1.5	Suspension	pedestrian, bike only	40
	6	Ban Pang	-	-	-	No bridge	30
Dien Bien	7	Na Phat	65.0	1.5	Suspension	pedestrian, bike only	65
	8	Pa Bat	100.0	3.0	Suspension	10t	99
	9	Su Lu	90.0	1.5	Suspension	pedestrian, bike only	90
	10	Ban Bung	40.0	1.5	Suspension	pedestrian, bike only	40
	11	Pac Nam (D.B.)	47.0	1.2	Suspension	pedestrian, bike only	50
Lai Chau	12	San Thang	-	-	-	No bridge	90
	13	Pa Tan	86.6	4.5	Suspension	2.5t	90
	14	Nam Puc	-	-	-	No bridge	55
	15	Huoi Dit	6.0	3.0	Wooden	pedestrian, bike only	45
	16	Nam Ham	-	-	-	No bridge	65
	17	Nam Cum	80.0	1.5	Suspension	pedestrian, bike only	65
Yen Bai	18	Ngoi Thap	-	-	-	No bridge	60
	19	Ngoi That	45.0	2.0	Suspension	pedestrian, bike only	60
	20	Lao Chai	50.0	2.0	Suspension	pedestrian, bike only	60
	21	Pu Trang	65.0	2.5	Suspension	pedestrian, bike only	80
	22	Ta Tiu	69.0	2.5	Suspension	pedestrian, bike only	80
	23	Ben Cao	78.0	3.0	Suspension	for light vehicle only	90
Lao Cai	24	Trung Do	-	-	-	No bridge	60
	25	Thanh Phu	66.0, 54.0	2.2	Suspension	pedestrian, bike only	90
	26	Ban Xeo	20.0	1.5	Bamboo	pedestrian, bike only	40
	27	Muong Hum 2	-	-	-	No bridge	50
	28	Den Sang	25.0	1.5	Suspension	pedestrian, bike only	30
	29	Soi Chat	54.0	2.0	Suspension	pedestrian, bike only	60
Tuyen Quang	30	Ban Nghien	20.0	1.5	Suspension	pedestrian, bike only	90
	31	Trinh	70.0	2.5	Suspension	pedestrian, bike only	70
	32	Na Nham	-	-	-	No bridge	90
	33	Sung	-	-	-	No bridge	40
	34	Ngoi Lien	30.0	1.5	Bamboo	pedestrian, bike only	40
	35	Dong Ach	50.0	2.0	Steel Girder	pedestrian, bike only	40
Ha Gian	36	Na Lan	40.0	2.5	Suspension	pedestrian, bike only	40
	37	Ta Lan	46.0	1.5	Suspension	pedestrian, bike only	50
	38	Suoi Dau	40.0	2.5	Suspension	pedestrian, bike only	40
	39	Diec	40.0	2.5	Suspension	pedestrian, bike only	40
	40	Lien Hiep	43.0	1.5	Suspension	pedestrian, bike only	40
	41	Ban An	60.0	1.5	Suspension	pedestrian, bike only	80
Bac Can	42	Pac Nam (B.C.)	34.0	-	Bamboo	pedestrian only	40
	43	Khuoi Nung	30.0	1.6	Bamboo	pedestrian, bike only	40
	44	Nga Ba	43.0	1.6	Bamboo	pedestrian, bike only	40
	45	Na Leng	19.0	1.6	Bamboo	pedestrian, bike only	50
	46	Don Phong	85.0	1.6	Suspension	pedestrian, bike only	85
	47	Quang Chu	96.0	1.4	Suspension	pedestrian, bike only	99
Cao Bang	48	Dong May	76.5	2.4	Suspension	pedestrian, bike only	80
	49	Binh Long	68.5	1.6	Suspension	pedestrian, bike only	70
	50	Ban Xac	-	-	-	No bridge	60
	51	Nam Mon	-	-	-	No bridge	99
	52	Keo Ai	-	-	-	No bridge	30

2-1-2-2 Selection of Objective Bridges

2-1-2-2-1 Evaluation Criteria

Based on the results of the first field survey and on discussions between the Study Team and the GOV concerning the Interim Report, it is agreed by both sides that the criteria listed below be taken into account in evaluating the requested bridges to be selected for further examination in the second field survey (which includes a geological survey).

(1)-1 Potential Attractivity

Compare bridges by focusing on the socioeconomic gaps between the poor areas and the closest main towns these bridges would connect, in order to determine the degree of attractiveness that these towns would have for the poor areas.

(1)-2 Magnitude of Benefits

Compare the magnitude of benefits produced by the bridges under consideration by determining the areas, populations and numbers of villages they would have a positive impact on.

Further criteria to evaluate the validity of a bridge to be financed as a Japan Grant Aid project are described in items (2) to (6) below.

(2) Urgency & Necessity

Evaluate the urgency and necessity of a bridge based on area flooded during the rainy season, existing bridge conditions (i.e., “Is there an existing bridge?” and “What is the loading capacity?”), and availability of alternative routes (i.e., “Does an alternative route exist?” and “If so, how much longer is it?”).

(3) Impact Lag

Evaluate the time lag in benefits being realized after the construction of a bridge by taking into account present access road conditions.

(4) Necessity for Steel Bridge

Taking into account the constructability and designs of concrete and steel bridges for a given site and the conditions for establishing a construction yard and seismic stability, determine the suitability of erecting a steel bridge.

(5) Impact on Ethnic Minorities

Determine the ratio of ethnic minorities for the areas a bridge would provide access to.

(6) Economic Condition

Evaluate the average monthly income per person in the areas that a bridge would provide access to.

(7) Current Traffic Volume

Evaluate the number of PCU (passengers car unit) for existing brides and crossings.

The maximum number of points for each criteria and the weight to reflect the relative importance of these criteria are shown in Table 2.1.2.2.

Table 2.1.2.2 Maximum Points and Weight

Evaluation Criteria	Maximum Points	Weight	Maximum Points after Weighting
(1)-1 Potential Attractivity	5	4	20
(1)-2 Magnitude of Benefits	5	4	20
(2) Urgency & Necessity	5	4	20
(3) Impact Lag	5	3	15
(4) Necessity for Steel Bridge	5	2	10
(5) Impact on Ethnic Minorities	5	1	5
(6) Economic Condition	5	1	5
(7) Current Traffic Volume	5	1	5
TOTAL			100

2-1-2-2-2 Scoring

(1)-1 Potential Attractivity

The scoring for this criterion is based on the results of a bridge comparison that focuses on the socioeconomic differences between poor areas and the nearest main regional towns that the bridges are to connect and the attractivity these towns would have for the poor areas. Potential attractivity is calculated applying the equation below and points allocated based on their relative numerical order.

1) Equation to Calculate Potential Attractivity

$$X_1 = a \times b / (c)^{1/4}$$

a: Social gap evaluated based on the difference in the number of service facilities such as schools, hospitals, markets, etc. (based on answers to questionnaire) between poor areas and the closest main town a bridge is to connect.

b: Economic gap evaluated based on the difference in the monthly income per person

for poor areas and the nearest main town a bridge is to connect (based on answers to questionnaire)

c: Distance expressed in time required by car from a bridge site to the nearest main regional town (based on answers to questionnaire)

2) Scoring of Potential Attractivity

Scoring of "Potential Attractivity" is shown in Table 2.1.2.3.

Table 2.1.2.3 Scoring for Potential Attractivity

Scoring Order for Potential Attractivity (X_1)	Points
1st to 5th	5.0
6th to 10th	4.5
11th to 15th	4.0
16th to 20th	3.5
21st to 25th	3.0
26th to 30th	2.5
31st to 35th	2.0
36th to 40th	1.5
41st to 45th	1.0
46th or under	0.5

(1)-2 Magnitude of Benefits

The scoring for this criterion is based on the results of a bridge comparison that focuses on the areas, populations and numbers of villages in poor areas that would benefit with the provision of a bridge. The benefits produced by each bridge are calculated applying the equation below and points allocated based on their relative numerical order.

1) Equation to Calculate Magnitude of Benefits

a: Benefiting area (based on 1/50,000 map)

b: Population in benefiting area (from the answer on questionnaire)

c: Distance expressed in time required by car from a bridge site to the nearest main regional town (based on answers to questionnaire)

Equation to calculate benefits (X_2):

$$X_2 = (a \times b \times c)^{1/3}$$

2) Scoring of Magnitude of Benefits

Scoring of "Magnitude of Benefits" is shown in Table 2.1.2.4.

Table 2.1.2.4 Scoring for Magnitude of Benefit

Scoring Order for Magnitude of benefit (X_2)	Points
1st to 5th	5.0
6th to 10th	4.5
11th to 15th	4.0
16th to 20th	3.5
21st to 25th	3.0
26th to 30th	2.5
31st to 35th	2.0
36th to 40th	1.5
41st to 45th	1.0
46th or under	0.5

(2) Urgency & Necessity

The scoring for this criterion is based on the area flooded during the rainy season, existing bridge conditions, and the availability of an alternative route. Table 2.1.2.5 shows the allocation of points for "Urgency & Necessity".

Table 2.1.2.5 Scoring for Urgency & Necessity

Evaluation Item	Criteria	Points
Area flooded during Rainy Season	More than 501 km^2	2.0
	151 to 500 km^2	1.5
	51 to 150 km^2	1.0
	50 km^2 or less	0.5
Existing Bridge Conditions	Closed by flooding (no existing bridge or a wooden or bamboo bridge easily submerged)	1.5
	Closed to vehicles but not to pedestrians and motorbikes (suspension bridge for pedestrians)	1.0
	Closed to trucks more than 3t but not to light vehicles (suspension bridge with about a 3t capacity)	0.5
	Closed to heavy trucks but not to light trucks (suspension bridge with about a 10t capacity)	0.0
Availability of Alternative Route	No alternative route	1.5
	Unimproved alternative route 10 or more km long	1.0
	Unimproved alternative route less than 10km long	0.5
	Improved alternative route 30 or more km long	0.5
	Improved alternative route less than 30km long	0.0

(3) Impact Lag

The scoring of this criterion is based on the present condition of access roads on either side of a bridge. Table 2.1.2.6 shows the allocation of points for "Impact Lag" after completion of the bridge.

Table 2.1.2.6 Scoring for Impact Lag

Evaluation Item	Criteria	Points
Condition of access road from poor area to bridge (when access road to town is improved and in fair condition)	Fair condition 10km or more	5.0
	Fair condition less than 10km	4.0
	Requires improvement for vehicles such as widening	3.0
When access roads on both sides are unimproved and in poor condition.	There is an improvement plan	2.0
	No improvement plan exists	1.0

(4) Necessity for Steel Bridge

The scoring for this criterion is based on bridge site conditions, such as construction yard availability and seismic stability, and reflects the difficulty of erecting a concrete bridge, or the suitability of a steel bridge. Table 2.1.2.7 shows the allocation of points for this criterion.

Table 2.1.2.7 Scoring for Necessity for Steel Bridge

Evaluation Item	Criteria	Points
Site Conditions for Bridge Construction (availability of land for fabricating concrete girders and erection yard)	Not available on either side	3.0
	Available only at rural side	2.0
	Available at town side	1.0
Site Condition for Bridge Design (height of piers related to seismic stability)	15.0 m or Higher	2.0
	12.0 m to 14.9 m	1.5
	9.0 to 11.9 m	1.0
	6.0 to 8.9 m	0.5
	Less than 6.0m	0.0

(5) Impact on Ethnic Minorities

The scoring for this criterion is based on the ethnic minority ratio in areas a bridge would connect. Table 2.1.2.8 shows the allocation of points for this criterion.

Table 2.1.2.8 Scoring for Impact on Ethnic Minorities

Evaluation Item	Criteria	Points
Ethnic Minority Ratio in Areas Connected by Bridge	80 to 100%	5.0
	60 to 79%	4.0
	40 to59 %	3.0
	20 to 39 %	2.0
	Less than 20%	1.0

(6) Economic Condition

The scoring of this criterion is based on monthly income per person in the areas the bridges would provide access to. Table 2.1.2.9 shows the allocation of points for the criterion "Economic Conditions".

Table 2.1.2.9 Scoring for Economic Conditions

Evaluation Item	Criteria		Point
	1,000VND	Roughly in US$	
Monthly Income per Person i.e. HCMC : 57$/month Hanoi : 39$/month Average in Vietnam: 22$/month	160 or less	10$ or less	5.0
	161 to 240	10 to 15$	4.0
	241 to 320	15 to 20$	3.0
	321 to 400	20 to 25$	2.0
	More than 401	More than 25$	1.0

(7) Current Traffic Volume

The scoring for this criterion is based on the number of PCU at existing bridges and river crossings. Table 2.1.2.10 shows the allocation of points for "Current Traffic Volume".

Table 2.1.2.10 Scoring for Current Traffic Volume

Evaluation Item	Criteria	Point
PCU (from the answer on questionnaire) Coefficient of conversion to PCU: Heavy truck (3 axles) 2.5 Light truck (2 axles) 2.0 Motorbike 0.3 Pedestrian, bicycle 0.1	1000 PCU or over	5.0
	700 to 999 PCU	4.0
	400 to 699 PCU	3.0
	100 to 399 PCU	2.0
	Less than 100 PCU	1.0

2-1-2-2-3 Prioritization

Based on the thinking in 2-1-2-2-1 and 2-1-2-2-2, weighted scores indicating the priority of each of the requested bridges were calculated and then categorized into four classes (A, B, C, and D). For Class C bridges (see 2-1-2-2-4), however, prioritization is reconsidered applying a benefit-cost ratio for the following reasons:

- Any of the Class C bridges can be considered the same in terms of priority given the uncertainty of the accuracy of the data from the questionnaires answered by each province.

- It is preferable to select as many bridges as possible since all of the requested bridges are located in poverty areas.

The equation to adjust the priority for Class C bridges is as follows:

- Adjusted Priority Score = Total Weighted Score/Cost

  Note: Bridge area can be used instead of "Cost", as the relationship between bridge area and cost is almost linear.

2-1-2-2-4 Classification Based on Priority

The requested bridges are classified as follows based on their total weighted score.

Class	Description
A	Total Weighted Score: 70 points or more
B	Total Weighted Score: 55 to 69 points
C	Total Weighted Score: Less than 55 points
D	Bridge to be eliminated from consideration

As for Class D bridges, they are determined based on following 4 criteria.

- Already constructed or to be constructed by the GOV or another donor.
- Requires special construction method that will not be applied in the future in Vietnam
- More than 100m
- Easy to construct as a RC bridge (steel bridge unnecessary)

As a result of the first field survey, the four bridges listed below were deemed to be Class D bridges and are to be removed from consideration.

1) Br. No.1 Ban Kong (Son La Province)

The site is in a plain area and suitable for a concrete bridge. The catchment area is small and stream velocity at the time of flooding also slow. These conditions allow for a small span of about 10m. Therefore, this bridge can be easily constructed by the GOV as a RC bridge.

2) Br. No.13 Pa Tan (Lai Chau Province)

Planned bridge length is 118m. In Vietnam, only small and medium size bridges (i.e.,

less than 100m long) have been in the scope of former Grant Aid projects. If a large size bridge is selected, some small to medium size bridges must be eliminated because of budget limitations. Therefore, this bridge is eliminated from further consideration.

3) Br. No.24 Trung Do (Lao Cai Province)

There is an on-going plan to construct a bridge 1km from the proposed site for the new bridge with provincial funding. As the Study Team could not find any strong reason for needing both bridges, the requested bridge should be dropped.

4) Br. No.51 Ban Mon (Cao Bang Province)

Planned bridge length is 159m and, as stated before, any bridge longer than 100m cannot be considered.

2-1-2-2-5 Selection of Detailed Survey Bridges

Bridges to be taken up in the detailed survey during the second field survey are selected in the following manner and listed by priority in Table 2.1.2.11.

1st Selection: Choose all Class A bridges (see Table 2.1.2.11).

2nd Selection: In order to maintain balance among the provinces, choose at least 4 bridges from each province using the final priority order.

3rd Selection: Choose 5 or fewer Class B bridges for each province.

Of the 52 requested bridges, 43 are selected for further study in accordance with the methodology described above and indicated in Table 2.1.2.12, with proposed bridge width, length, span arrangement and superstructure type shown.

Table 2.1.2.11 Final Priority Order & Ranking of 52 Bridges

	Province	Br. No.	Bridge Name (Revised in March 2006)	1.(1) Attractivity	1.(2) Benefit	2 Urgency	3 Impact Lag	4 Steel Girder	5 Minority	6 Income	7 Traffic	Total Point (Weighted)	Adjusted Point	Rank
1	**Ha Giang**	36	Na Lan	14	18	14	15	9	5	4	1	80	Apllyed only for rank C bridges	A
2	**Ha Giang**	38	Suoi Dau	16	18	14	15	6	5	4	2	80		
3	**Bac Can**	43	Khuoi Nung	16	16	16	15	6	5	4	2	80		
4	**Bac Can**	44	Nga Ba	18	18	16	15	2	5	4	2	80		
5	**Bac Can**	46	Don Phong	20	12	16	15	4	5	4	4	80		
6	**Cao Bang**	49	Binh Long	14	16	16	12	7	5	5	5	80		
7	**Son La**	4	Na Do	18	14	14	15	7	5	4	2	79		
8	**Bac Can**	42	Pac Nam (BC)	18	12	18	12	7	5	5	2	79		
9	**Dien Bien**	9	Su Lu	6	20	16	15	9	5	4	2	77		
10	**Lai Chau**	16	Nam Ham	4	20	16	15	10	5	5	1	76		
11	**Lai Chau**	14	Nam Puc	6	20	14	15	9	5	5	1	75		
12	**Dien Bien**	8	Pa Bat	4	20	14	15	10	5	4	2	74		
13	**Lai Chau**	17	Nam Cum	4	18	16	15	10	5	5	1	74		
14	**Yen Bai**	23	Ben Cao	20	10	14	15	5	5	3	2	74		
15	**Son La**	3	Ban Tum	20	8	16	15	4	5	4	1	73		
16	**Dien Bien**	10	Ban Bung	4	18	16	15	7	5	5	2	72		
17	**Son La**	5	Na Tra	16	12	14	15	3	5	4	2	71		
18	**Son La**	6	Ban Pang	16	12	14	12	6	5	4	2	71		
19	**Lai Chau**	15	Huoi Dit	4	20	14	15	6	5	5	1	70		
20	**Lao Cai**	26	Ban Xeo	8	16	14	15	10	5	2	3	70		
21	**Ha Giang**	37	Ta Lang	18	10	14	12	5	5	4	2	70		
22	**Ha Giang**	39	Diec	14	16	14	12	3	5	5	1	70		
23	**Lao Cai**	25	Thanh Phu	12	10	12	15	9	5	2	2	67		B
24	**Lai Chau**	12	San Thang	16	10	14	12	2	5	4	2	65		
25	**Cao Bang**	50	Ban Sac	10	14	10	15	4	5	5	2	65		
26	**Yen Bai**	20	Lao Chai	12	8	16	9	9	5	3	2	64		
27	**Ha Giang**	40	Lien Hiep	12	14	12	12	4	5	3	2	64		
28	**Son La**	2	Ban Sai	18	10	10	12	3	5	4	1	63		
29	**Yen Bai**	18	Ngoi Thap	20	6	14	12	3	3	3	2	63		
30	**Bac Can**	47	Quang Chu	8	8	18	12	6	5	3	3	63		
31	**Cao Bang**	48	Dong May	10	8	14	12	7	5	5	2	63		
32	**Lao Cai**	27	Muong Hum 2	6	14	16	9	8	5	2	2	62		
33	**Dien Bien**	11	Pac Nam (DB)	2	14	14	12	7	5	5	2	61		
34	**Ha Giang**	41	Ban An	2	16	16	12	5	5	4	1	61		
35	**Bac Can**	45	Na Leng	20	4	10	12	3	5	3	4	61		
36	**Tuyen Quang**	32	Na Nham	12	2	16	12	8	5	3	2	60		
37	**Cao Bang**	52	Keo Ai	14	4	14	9	6	5	5	2	59		
38	**Dien Bien**	7	Na Phat	2	12	14	15	4	5	4	1	57		
39	**Yen Bai**	21	Pu Trang	12	6	14	12	3	5	3	2	57		
40	**Lao Cai**	29	Soi Chat	10	6	14	12	6	5	2	2	57		
41	**Yen Bai**	22	Ta Tiu	10	6	14	15	3	3	2	2	55		
42	**Tuyen Quang**	30	Ban Nghien	12	2	18	9	4	5	4	1	55		
43	**Tuyen Quang**	31	Trinh	8	8	12	12	7	4	3	1	55		
44	**Lao Cai**	28	Den Sang	6	6	14	12	6	5	3	2	54		
45	**Yen Bai**	19	Ngoi That	14	4	14	9	4	3	3	2	53		
47	**Tuyen Quang**	33	Sung	6	4	10	12	4	5	3	2	46	25.3	C (arranged based on adjusted point)
48	**Tuyen Quang**	34	Ngoi Lien	8	2	10	12	2	4	3	1	42	23.1	
46	**Tuyen Quang**	35	Dong Ach	8	4	12	12	4	4	3	1	48	16.2	
49	**Son La**	1	Ban Khoang	0	0	0	0	0	0	0	0	0		D
50	**Lai Chau**	13	Pa Tan	0	0	0	0	0	0	0	0	0		
51	**Lao Cai**	24	Trung Do	0	0	0	0	0	0	0	0	0		
52	**Cao Bang**	51	Ban Mon	0	0	0	0	0	0	0	0	0		

Table 2.1.2.12 Selected Bridges for Detailed Field Survey

Province	Br. No.	Bridge Nsme	Width planned m	Length Planned (m)	Span Arrangement (m)	Superstructure Type
Son La	2	Ban Sai	4.5	42	21+21	Composed Simple Girder
	3	Ban Tum	4.5	60	18+18+24	Composed Simple Girder
	4	Na Do	4.5	33	33	Composed Simple Girder
	5	Na Tra	4.5	42	21+21	Composed Simple Girder
	6	Ban Pang	4.5	30	30	Composed Simple Girder
Dien Bien	7	Na Phat	4.5	66	21+24+21	Composed Simple Girder
	8	Pa Bat	5.5	90	30+30+30	Composed Simple Girder
	9	Su Lu	5.5	99	33+33+33	Composed Simple Girder
	10	Ban Bung	5.5	54	27+27	Composed Simple Girder
	11	Pac Nam (DB)	4.5	42	24+18	Composed Simple Girder
Lai Chau	12	San Thang	4.5	30	30	Composed Simple Girder
	14	Nam Puc	4.5	66	21+24+21	Composed Simple Girder
	15	Huoi Dit	4.5	21	21	Composed Simple Girder
	16	Nam Ham	4.5	60	30+30	Composed Simple Girder
	17	Nam Cum	4.5	72	24+24+24	Composed Simple Girder
Yen Bai	18	Ngoi Thap	5.5	48	24+24	Composed Simple Girder
	20	Lao Chai	4.5	84	15+54+15	Steel Truss and Composed Simple Gieder
	21	Pu Trang	5.5	72	24+24+24	Composed Simple Girder
	22	Ta Tiu	5.5	99	33+33+33	Composed Simple Girder
	23	Ben Cao	5.5	81	27+27+27	Composed Simple Girder
Lao Cai	25	Thanh Phu	5.5	99	49.5+49.5	Steel Truss
	26	Ban Xeo	5.5	60	15+30+15	Composed Simple Girder
	27	Muong Hum 2	5.5	72	24+24+24	Composed Simple Girder
	28	Den Sang	4.5	24	24	Composed Simple Girder
	29	Soi Chat	4.5	54	27+27	Composed Simple Girder
Tuyen Quang	30	Ban Nghien	4.5	63	21+21+21	Composed Simple Girder
	31	Trinh	5.5	81	27+27+27	Composed Simple Girder
	32	Na Nham	5.5	99	33+33+33	Composed Simple Girder
	33	Sung	5.5	33	33	Composed Simple Girder
Ha Giang	36	Na Lan	4.5	54	54	Steel Truss
	37	Ta Lang	4.5	54	18+18+18	Composed Simple Girder
	38	Suoi Dau	4.5	54	27+27	Composed Simple Girder
	39	Diec	4.5	48	24+24	Composed Simple Girder
	40	Lien Hiep	4.5	33	33	Composed Simple Girder
Bac Can	42	Pac Nam (BC)	5.5	42	21+21	Composed Simple Girder
	43	Khuoi Nung	5.5	33	33	Composed Simple Girder
	44	Nga Ba	5.5	42	21+21	Composed Simple Girder
	46	Don Phong	5.5	75	24+24+27	Composed Simple Girder
	47	Quang Chu	5.5	99	33+33+33	Composed Simple Girder
Cao Bang	48	Dong May	5.5	81	27+27+27	Composed Simple Girder
	49	Binh Long	5.5	99	33+33+33	Composed Simple Girder
	50	Ban Sac	5.5	63	21+21+21	Composed Simple Girder
	52	Keo Ai	4.5	33	33	Composed Simple Girder
Total Bridge Length				2586 (m)		

2-2 Basic Design for Requested Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Basic Concepts

The basic concepts for the Project are as follows:

1) The object of the Study is to carry out an evaluation and prioritization of bridge sites for which Japanese assistance was requested from perspectives such as poverty reduction, level of urgency, and necessity. Based on the results of that prioritization, 43 bridges sites were selected for further study.
2) The Japanese side will be responsible for the procurement of the superstructure components of the selected bridges (i.e., steel girders, bearings, expansion joints, drainage equipment, erection equipment, etc). On the other hand, the Vietnamese side will be responsible for the construction of substructure, approach roads, revetments, and the erection of superstructure.
3) Regarding decisions on the specifications for related superstructure materials, this is to be done after the determination of the bridge locations, spans, etc based on discussions and after reaching a consensus with the Vietnamese side. In addition, although the Vietnamese side is to design the substructure, access roads, revetment work for bridges, the Japanese side is to check and verify the content of this work.
4) In 2001, the Vietnamese side was responsible for constructing 23 bridges with materials that had been procured as part of "*The Project for Reconstruction of Bridges in the Central District*." However, this Project will require the construction of 43 bridges and the workload will even be that greater. Therefore, the procurement of superstructure materials is to be divided into two fiscal years.
5) As for the type of superstructure, after taking into account span length as determined essentially from on-site conditions, it has been decided to use a simple composite steel beam superstructure due to its economy and ease of transportation. Note that in regards to the construction of this type of bridge there was a "soft" component for the transfer of technology in the past, but this component will not be included in this Project as it has been deemed that the Vietnamese side has the capacity to do this work on its own.
6) Regarding the three bridges where the span is to be about 50m, which is based on the results of on-site surveys, a truss bridge to be adopted given the relative ease in transporting its elements and its erection as compared to other bridge types. On the other hand, given the lack of experience of the Vietnamese side with this bridge type, two Japanese experts will be dispatched to provide the necessary technical assistance.

7) After the completion of the selected bridges, they are to be handed over to each of the relevant provincial authorities. However, as the provinces of northern Vietnam are located in the poorest part of the country, weathering steel will adopted in order to reduce maintenance costs.
8) Steel truss beams will be built with Japanese weathering steel but will be constructed on site in Vietnam.

2-2-1-2 Policies Based on Natural Conditions

(1) Meteorological Conditions

In Northern Vietnam, the rainy season (from April to September) and dry season (from October to March) are clearly divided. During the rainy season, even trunk roads sometimes experience landslides, collapsing slopes or debris flows. Rural roads in mountainous areas are often closed during the rainy season because without bridges for vehicles traffic cannot pass through the rivers due to the high water levels. These meteorological conditions must be considered in the transportation of bridge girders and the impact it will have on scheduling.

(2) Hydrological Conditions

The results of the hydrological analysis must be considered in determining bridge locations, bridge length and structure type. That is, the design high water level for the 43 objective bridges will be set not only applying the results of hearings on flooding but also from the results of hydrological analysis for 50-year return period flooding. Note that the risk from debris flows taking into account the condition of the riverbed and the topology of the site to piers will also be evaluated when determining the setting of piers. In addition, if there is any plan for a dam upstream of a site, this too will be considered when establishing the design high water level.

(3) Topographical Conditions

For this Project, the GOV will be responsible for the bridge construction work, including the construction of approach roads. The alignment of bridges shall be set in consideration of construction costs, such as cut and fill work for approach roads, as this can have a large impact on these costs (especially in mountainous areas) and are to be borne by the GOV .

(4) Geological Conditions

Based on the topological survey, the Japanese Study Team will review the substructure design of the GOV and will consider seismic stability (see next item).

(5) Seismic Conditions

According to data from the Institute of Geophysics, which is a part of the Science and

Technology Academy of Vietnam, the maximum magnitude of an earthquake expected in the Red River area would be 6.1 to 6.5 on the Richter scale, which is equivalent to an earthquake with a seismic intensity of 4 to 5 according to the Japanese scale. Consequently, for bridges in Northern Vietnam, the effects of earthquakes in designing substructures and bearings shall be studied more carefully than that for bridges in Central Vietnam or the Mekong Delta area.

2-2-1-3 Policies Regarding Socioeconomic Conditions

When setting the alignment of a bridge, it shall be done in a manner so as to minimize resettlement. Also, in this Project, there are for the most part no alternatives routes to the existing bridges and crossing points. Therefore, routes shall not be closed and, even during the construction stage, traffic between urban and rural areas shall be allowed to flow.

2-2-1-4 Policies Regarding Construction & Procurement

As stated in 2-2-1-1, weathering steel shall be used for all 43 bridges (including the three truss bridges) and procured from Japan. Judging from the capacity of the Vietnamese steel fabrication factories, the three truss bridges (about 345 tons in total) can be fabricated in these factories, which are located close to Hanoi. As for the other 40 bridges (about 2000 tons in total), they shall be fabricated in Japan.

On the other hand, the construction work of the bridges shall be carried out by the GOV, with the GOJ providing technical assistance by dispatching two experienced engineers and procuring components of cable cranes, such as towers, winches and carriers that are difficult to obtain domestically.

2-2-1-5 Policies Regarding Local Enterprise

There are two local factories capable of steel bridge fabrication near Hanoi with a monthly production of a few hundred tons. As stated previously, these factories will be responsible for the fabrication of the three truss bridges.

Regarding bridge bearings, there are two factories near Ho Chi Minh City. However, these factories only produce lubber bearings for concrete girders (including PC girders). Because greater allowance for expansion and rotation is required for steel bridge bearings, and because the local products do not consider the large deformation caused by earthquakes, the products of these local factories cannot be used for this project. Therefore, Japanese bearings will be utilized for all of the bridges in this Project.

Although steel handrails are mentioned in the GOV's application form, the GOV has agreed to withdraw this part of the request, as the Study Team explained that more bridges could be built if they did so. Note that the handrail (about 5,000m in total) can be procured locally and is almost of the same quality and cheaper.

2-2-1-6 Policies Regarding Maintenance by the Administering Agency

In Vietnam the Ministry of Transport (MOT) is responsible for the construction and maintenance of national roads, while provinces, districts and communes are responsible for the construction and maintenance of rural roads. However, in the case of Japanese Grant Aid projects, the MOT and Projects Management Unit 18 (PMU 18) are responsible for the construction of the objective bridges even though they are located on rural roads. These agencies have adequate experience from implementing "the Project for Reconstruction of Bridges in Northern Area of Vietnam (1995-1998)", "the Project for Reconstruction of Bridges in Mekong Delta Area of Vietnam (2001-2003)", and "the Project for Reconstruction of Bridges in the Central Area of Vietnam (2002- present)". The engineers of the executing agency, PMU18, are graduates of technical universities or in-house ministry training schools, and some have experience studying abroad in the former Soviet Union or Eastern Europe. They also have been engaged in the Japanese ODA projects for improving National Highway No. 1, No. 10 and No.18.

On the other hand, after the completion of these bridges, MOT will hand them over to the relevant provinces, with the maintenance work of these bridges to be done by the provincial Departments of Transport (DOT). Maintenance costs vary (see Figure 2.2.1.1) and are dependent on bridge length and width. In Figure 2.2.1.1, full-scale maintenance cost is calculated based on the following assumptions and on the premise weathering steel is utilized.

- Bearing replaced every 30 years
- Expansion joints replaced every 15 years
- Concrete slab replaced every 50 years
- Re-painting every 30 years (epoxy resin at end of girder due to weathering steel)

Note that the maintenance cost for a bridge will increase if it is wider, longer and has more spans. Considering this tendency and the procurement plan of each province, full-scale maintenance cost is calculated and the results shown in Table 2.2.1.1. In this table average annual cost was calculated based on the maintenance cost for a 90-year period, indicating that the total average full-scale maintenance cost for the Study bridges is only about 0.5 to 2.0 % of the budget for road maintenance for a province. (refer to Table2.5.1.3 for total maintenance cost which includes the cost for light maintenance)

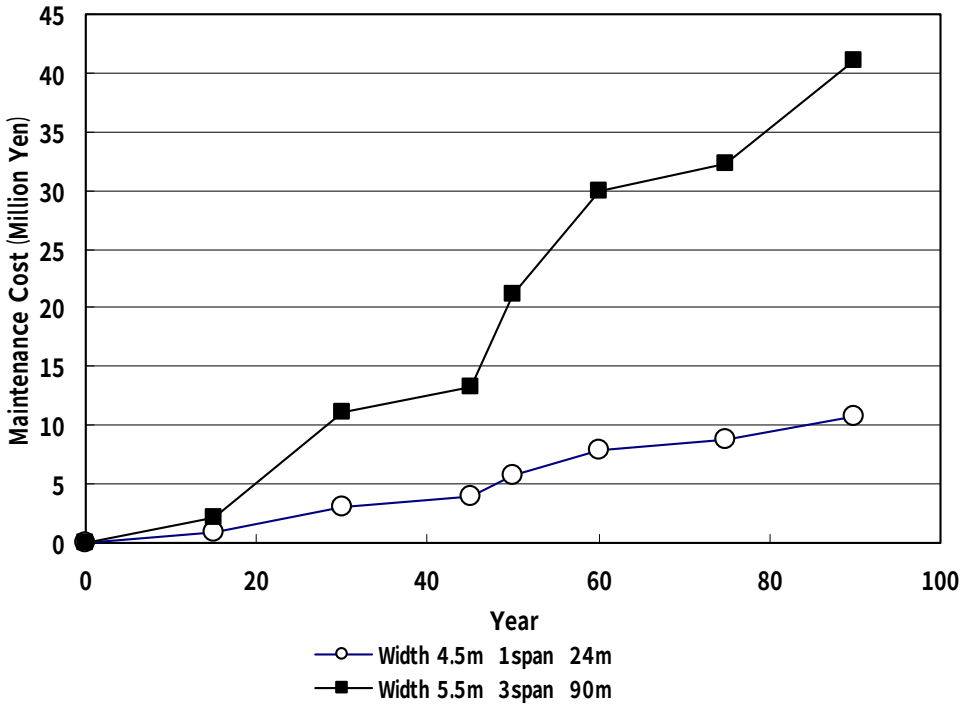

Figure 2.2.1.1 Example of Full-scale Maintenance Cost for Steel Bridge (Weathering Steel)

Table 2.2.1.1 Comparison of Annual Full-scale Maintenance Cost for Study Bridges & Provincial Road Maintenance Budget (Million VND)

Province	Son La	Dien Bien	Lai Chau	Yen Bai	Lao Cai	Tuyen Quang	Ha Gian	Bac Can	Cao Bang
Maintenance Cost/year	144	241	162	239	215	193	154	224	253
Budget for Road Maintenance	30,055	18,200	11,196	24,174	18,200	17,250	28,000	17,222	14,237
(Year)	(2005)	(2005)	(2005)	(2005)	(2006)	(2006)	(2006)	(2005)	(2006)
Ratio (%)	0.48	1.32	1.45	0.99	1.18	1.12	0.55	1.30	1.78

2-2-1-7 Policies Regarding the Grade of Facilities and Equipment

Road Design 22 TCN-273-01 and Bridge Design 22 TCN-272-05 specifications are basically applied for the design of this Project. The Road Design specification was introduced from 2001 and the Bridge Design specification from 2005; therefore, these specifications are different from those of previous ODA projects. In Road Design 22 TCN-273-01 roads are classified into 5 classes, with the rural roads where the objective bridges are located being Class III or Class IV roads (i.e., provincial or district roads). Some districts and commune roads are still classified as Category A in accordance with 22 TCN-210-92. According to 22

TCN-272-05, live loads shall be in accordance with AASHTO HL93. In this Project, the Study Team basically agreed with the GOV to use HL93 x 0.65 as the live load for designing superstructure, which is almost equal to H-13 used in other ODA projects.

In addition to the above, the GOV has requested to use HL93 x 0.80 or H-18, whichever is larger, for bridges located on provincial roads in line with "the Implementation Review Study on the Project for Reconstruction of Bridges in the Central District (Phase 2)". The design live loads for this Project were set as shown in Table 2.2.1.2, and are based on the above standards and to keep the design live loads consistent with that of the Central District Bridges project.

Table 2.2.1.2 Design Live Loads

Road Class	Conditions	Applied Live Loads
Based on 22 TCN-273-01 Class III (provincial roads with more than 1000 PCU/day)	Existing provincial roads already developed for H-18 live loads	Apply HL-93 x 0.80 or H-18 whichever larger
Class IV (provincial roads with less than 1000 PCU/day)	Provincial roads other than above.	Apply HL-93 x 0.65 or H-13 whichever larger
Based on 22 TCN-273-01 Class IV (rural roads with less than 1000 PCU/day)	Roads connecting district centers or trans-district roads (mainly district roads).	Apply HL-93 x 0.65 or H-13 whichever larger
Based on 22 TCN-210-92 Category A	Roads connecting commune centers & villages (mainly commune roads).	Apply HL-93 x 0.65

Weathering steel was adopted for all bridge members for the following reasons:

- The initial cost for the GOJ to supply weathering steel is almost the same as the cost to supply general steel with standard painting.
- On the other hand, the maintenance cost for the GOV will be greatly reduced (repainting cost for general steel during the service life amounts to around 70% of bridge fabrication cost).
- Since the Project area is far from the sea and the climate not so cold in winter, the weathering steel will not be affected by aerosol chloride from the sea or anti-freezing admixture used for roads in cold climates.
- Weathering steel girders for previous ODA project (Central Area Bridges project) were accepted by Vietnamese local people.

2-2-1-8 Policies Regarding Erection/Procurement Methods & Scheduling

(1) Policies for Bridge Erection Works

Bridge sites utilizing composed simple girders can use truck cranes by setting them on the riverbeds during the dry season, meaning that the truck crane and bent method can be applied.

On the other hand, if erection work must be done in the rainy season, the extruding method with temporary erection girders will be used. Note that erection work is to be implemented solely by the GOV, as domestic contractors have sufficient capabilities to do the work without Japanese technical assistance due to their experience with previous ODA projects. The GOJ will only procure the erection tools (wrench for TC bolt, etc), which are hard to obtain in Vietnam.

The site conditions of the two truss bridges No.20 and No.36 do not allow for the use of riverbed truck cranes even in the dry season as there are no access roads. For these bridges, the cable crane and bend method must be used. Also, as the GOV does not have sufficient experience with the of erection of truss bridges (existing truss bridges in Vietnam are mostly built by contractors from donor countries), the GOJ will dispatch two experienced Japanese engineers, as well as procure components difficult to obtain in Vietnam, such as winches, carriers, towers, etc). Note that the cable crane method will be useful for bridge erection in mountainous areas.

One of the three truss bridge sites, No.25, can utilize a riverbed truck crane by coming from the left bank and therefore the truck crane and bent method will be used for this side, with the cable crane or truck crane method with a temporary access bridge (made of gabion piers) to be used for the right bank side. During the erection work for this bridge, experienced Japanese engineers will also be dispatched.

(2) Policies for Procurement

All bridge members shall be made of Japanese weathering steel, except for some galvanized appurtenances such as the drainage system. Vietnamese factories can fabricate the three truss bridges (around 345 tons), as they have experience with truss bridge fabrication and adequate production capacity. On the other hand, composed simple girders (more than 2,000 tons) shall be fabricated in Japan as the Vietnamese factories have less experience doing this and also insufficient production capacity.

Regarding weathering steel girders, procurement from third countries will not allowed for this Project, as it is both time consuming and costly. In addition, it would contradict the conditions of procurement as described in JICA’s 2003 "Guidance for Consultants regarding Japanese Grant Aid Projects".

(3) Policies for Scheduling

There are 43 bridges in this Project, which is almost double the number compared to that of previous ODA projects. Therefore, the construction of the 43 bridges will be divided over a period of two fiscal years. According to the GOV’s schedule, bridges for Son La, Yen Bai,

Tuyen Quan, Ha Giang, Bac Can and Cao Ban provinces will be built in the first year, While bridges for Dien Bien, Lai Chau and Lao Cai provinces will be built in the second year. The number of bridges for the first year is 28 and 15 for the second year. The procurement plan of the GOJ will adhere to this schedule.

An extension of time is necessary as the planned duration of the Project is 16.5 months: 5 months to procure a consultant and contractors; 3.5 months for the procurement of weathering steel; 6 months for the fabricating of steel bridges; and 2 months for sea and land transport. Note that two of the three truss bridges are included in the first year and the third one in the second year. During the erection work of the truss bridges, two Japanese engineers will be dispatched for about 4 to 4.5 months.

2-2-2 Basic Plan

2-2-2-1 Design Concept

(1) Design High Water Level

The Study Team and the GOV agree that the high water level be set taking into account the results of on-site hearings and hydrological analysis for a 50-year return period. Table 2.2.2.2 shows a comparison of high water levels and the maximum value to be applied for bridges in this Project. Note that the difference in the hydraulic calculations of the Japanese Study Team and the GOV is due to the different application of roughness for rivers or whether the effects of abutments and approach roads are considered. For Bridge No.31 and No.32, the effect of the Na Hang Dam, which is located upstream of these bridges, is also considered in the setting of the design water level.

(2) Bridge Type & Dimensions

The basic dimensions and superstructure type of the 43 bridges are shown in Table 2.1.2.11. Three bridges with 50m spans are applied truss type superstructures based on the evaluation as shown in Table 2.2.2.1.

Taking into account Vietnamese standards for roads and bridges, current traffic volume (in PCU) and consistency with previous ODA projects, two bridge width formations are considered and are described below.

Table 2.2.2.1 Evaluation of Superstructure Type for 50m Span Bridge

	Plate Girder	Box Girder	Truss
Structural Characteristics	- More than usual applicable range (45m or less). - Height of girders must be around 3.2m.	- Within applicable range (40-60m). - Height of girders can be around 2.4m.	-Lower limit of usual applicable range (50-100m). -Height of truss around 7m, but section of each member smaller than 1m.
Construction Characteristics	- Applicable if truck crane and bent method can be used. - For cable crane, members require more capacity.	- Girders require welding work on site as they are divided into smaller parts for transportation.	- Each member is light in weight so cable crane method is applicable.
Transportation Characteristics	- Girder height may be too high to transport by truck (10 ton).	- Section (2.4m x 4.5m) must be divided for transportation.	- Easy to transport because of small sections.
Evaluation	△	×	○ (Easy to transport & erect)

Bridge Width Formation: 5.5m

This formation fulfils the minimum requirements of the Vietnamese Road Design Specifications (i.e., 3.0m lane width and 0.5m shoulders), and is comprised of a one-lane 3.5m carriageway with 1m shoulders. This bridge formation will enable heavy trucks (2.6m in width) to pass each other slowly, and is applied to bridges that satisfy any of the following conditions:

- Bridge is located on a provincial road or road connecting a district center.
- Present traffic volume is approximately 200 PCU.
- It is expected that a new bridge would generate an increase in traffic volumes.
- The proposed bridge is approximately 100m in total length and there is a relatively high possibility that heavy vehicles will pass by one another on the bridge.

Note that the above formation has been applied for many of the bridges constructed under previous Japanese Grant Aid schemes in Vietnam.

Bridge Width Formation: 4.5m

This formation fulfils the minimum requirements of the Vietnamese Road Design Specifications (i.e., 3.0m lane width and 0.5m shoulders), and is comprised of a one-lane 3.0m carriageway with 0.75m shoulders. This bridge formation will enable a heavy truck and motorbike to pass each other, and is applied to bridges that satisfy any of the following conditions:

- Present traffic volume is 100 PCU or less.
- The access road is a dead end.
- The width of the access roads to the proposed bridge is 3m or less.

Note that the 4.5m bridge width formation has also been applied in many previous bridge projects financed via Japan's Grant Aid scheme in Vietnam.

A bridge width formation of 7.0m was requested by the GOV for some bridges on provincial roads. However, this was not considered as current road width is less than that for a 2 lane road and the Study Team was unable to confirm whether there are plans for road widening.

Table 2.2.2.2 Comparison of High Water Level

Bridge		Historical HWL (m)		2% HWL (m)		Maximum (Recommended Design Water Level)	Remarks
		F/S		F/S	JICA Study Team		
No.	Name	Water Level	Year				
2	Ban Sai	(30.18)	1975	27.58	26.74	27.58	(30.18 is an exception value)
3	Ban Tum	20.64	1975	19.98	19.74	20.64	
4	Na Do	19.60	1995	20.22	20.22	20.22	
5	Na Tra	19.95	2005	20.18	20.43	20.43	
6	Ban Pang	28.57	1975	27.46	27.72	28.57	
7	Na Phat	897.08	1997	896.50	896.60	897.08	Span should be 21+24+21
8	Pa Bat	892.30	1975	895.20	895.19	895.20	
9	Su Lu	890.80	1992	890.75	889.98	890.80	
10	Ban Bung	895.77	1958	895.62	(897.52)	895.77	By cutting and grading river bed at the elevation of LWL, the HWL is going down from 897.52 to 895.77 or more
11	Pac Nam (DB)	895.64	1958	896.65	897.10	897.10	
12	San Thang	96.84	1963	100.08	100.04	100.08	
14	Nam Puc	66.70	1963	66.74	65.90	66.74	
15	Huoi Dit	85.00	1963	84.51	84.57	85.00	
16	Nam Han	81.80	1963	80.50	80.44	81.80	
17	Nam Cum	96.84	1963	95.65	95.09	96.84	
18	Ngoi Thap	196.80	2005	197.50	196.82	197.50	
20	Lao Chai	194.97	1992	195.50	195.60	195.60	
21	Pu Trang	252.72	2005	253.00	253.66	253.66	
22	Ta Tiu	101.55	2005	101.91	101.71	101.91	
23	Ben Cao	97.25	2005	98.84	98.83	98.84	
25	Thanh Phu	87.80	1986	88.43	88.70	88.70	
26	Ban Xeo	40.85	2001	41.72	41.06	41.72	
27	Muong Hum 2	194.62	2001	194.96	194.53	194.96	
28	Den Sang	94.52	2001	94.49	94.62	94.62	
29	Soi Trat	199.30	1984	199.40	199.68	199.68	
30	Ban Nghien	97.55	1971	97.08	95.73	97.55	
31	Trinh	(100.40)	1971	97.23	97.23	97.23	Considering the effect of Na Hang dam、no need to take 100.40
32	Na Nham	(96.05)	1971	91.48	92.88	92.88	Considering the effect of Na Hang dam、no need to take 96.05
33	Sung	49.70	1971	50.51	50.69	50.69	
36	Na Lan	195.76	1992	198.34	197.15	198.34	
37	Ta Lang	298.57	1993	299.05	298.63	299.05	
38	Suoi Dau	31.55	1966	31.87	(36.00)	32.79	By cutting and grading river bed at the elevation of LWL, the HWL is going down from 36.0 to 32.79
39	Suoi Diec	21.55	1989	22.45	23.20	23.20	
40	Lien Hiep	38.82	1987	38.65	38.97	38.97	
42	Pac Nam(BC)	38.60	1971	39.73	39.99	39.99	
43	Khuoi Nung	35.80	1971	36.20	36.15	36.20	
44	Nga Ba	43.90	1971	44.50	44.40	44.50	
46	Don Phong	45.84	1986	48.88	48.39	48.88	
47	Quang Chu	53.41	1992	53.94	52.90	53.94	
48	Dong May	47.10	1950	45.76	46.28	47.10	
49	Binh Long	51.84	1950	51.50	51.80	51.84	
50	Ban Sac	41.06	1968	41.33	41.54	41.54	
52	Keo Ai	42.22	2001	42.20	42.56	42.56	

2-2-2-2 Bridge Planning

(1) Summary of River Conditions

A summary of river conditions to be applied for bridge planning are shown in Table 2.2.2.3.

Table 2.2.2.3 Summary of River Conditions

Item	River Conditions Applied for Bridge Design
Cross-section of River	Planned to avoid disturbing river flow
Design High Water Level	See Table 2.2.2.2
Navigation Clearance	Confirmed that all 43 bridges do not require navigation clearance.
Freeboard Clearance	A distance of 1.0 m between the design high water level and the bottom of the bridge in order to prevent damage from floating debris at times of flooding.

(2) Type of Superstructure

The superstructure shall be either a composed simple girder or steel truss. H-shaped steel girders, which were applied in the former "Central Area Bridges project", will be used for girders less than 24m in length. Table 2.2.2.4 shows the superstructure type and number of spans for bridges of this Project.

Table 2.2.2.4 Superstructure type and Number of the Span

Material Name: Composed Simple Plate Girder

Material No.	Composition No.	Bridge Width	Structural Typer	Material	Span (m)	The First Year		The Second Year	
						No. of Span	Bridge No. to be applied	No. of Span	Bridge No. to be applied
1	1－1	5.5m (3 Main girders)	Composed Simple Girder	Steel Plate	33	14	No.22、No. 32、No.33、No.43、No.47 、No.49	3	No.9
	1－2	5.5m (3 Main girders)	Composed Simple Girder	Steel Plate	30	0		4	No.8、No.26
	1－3	5.5m (3 Main girders)	Composed Simple Girder	Steel Plate	27	10	No.23、No.31、No.46、No.48	2	No.10
	1－4	4.5m (3 Main girders)	Composed Simple Girder	Steel Plate	33	3	No.4、No.40、No.52	0	
	1－5	4.5m (3 Main girders)	Composed Simple Girder	Steel Plate	30	1	No.6	3	No.12、No.16
	1－6	4.5m (3 Main girders)	Composed Simple Girder	Steel Plate	27	2	No.38	2	No.29
		Total				30		14	

Material Name: Composed Simple H shaped Girder

Material No.	Composition No.	Bridge Width	Structural Typer	Material	Span (m)	The First Year		The Second Year	
						No. of Span	Bridge No. to be applied	No. of Span	Bridge No. to be applied
2	2－1	5.5m (3 Main girders)	Composed Simple Girder	H Shaped Steel	24	7	No.18、No.21、No.46	3	No.27
	2－2	5.5m (3 Main girders)	Composed Simple Girder	H Shaped Steel	21	7	No.42、No.44、No.50	0	
	2－3	5.5m (3 Main girders)	Composed Simple Girder	H Shaped Steel	15	0		2	No.26
	2－4	4.5m (3 Main girders)	Composed Simple Girder	H Shaped Steel	24	3	No.3、No.39	7	No.7、No.11、No.14、No.17、No.28
	2－5	4.5m (2 Main girders)	Composed Simple Girder	H Shaped Steel	21	7	No.2、No.5、No.30	5	No.7、No.14、No.15
	2－6	4.5m (2 Main girders)	Composed Simple Girder	H Shaped Steel	18	5	No.3、No.37	1	No.11
	2－7	4.5m (2 Main girders)	Composed Simple Girder	H Shaped Steel	15	2	No.20	0	
		Total				31		18	

Material Name: Steel Truss

Material No.	Composition No.	Bridge Width	Structural Type		Span (m)	The First Year		The Second Year	
						No. of Span	Bridge No. to be applied	No. of Span	Bridge No. to be applied
3	3－1	5.5m	Steel Truss	Lower Deck	49.5	0		2	No.25
	3－2	4.5m	Steel Truss	Upper Deck	54	2	No.20、No.36	0	
		Total				33		20	

(3) Summary of Design Conditions

The design conditions to be applied for bridge planning during the basic design stage are summarized below.

1) Design Standards

- Highway Specifications for Design, TCVN4054-98 (Old Standards)
- Design Criteria of Highway, TCVN4054-85 (Old Standards)
- Specification for Road Design, 22 TCN-273-01 (New Standards)
- Specification for Bridge Design, 22 TCN-272-05 (New Standards)

The old standard will be applied only if improvement work for a road has already started using this standard.

2) Design & Review Method

The allowable stress method shall be applied for superstructures in the basic design stage by the Japanese Study Team. The Study Team shall also review the GOV's substructure design by comparing its results with those derived applying Japan's "Specifications for Highway Bridges".

3) Design Load

Dead Load

Material	Unit Weight (kN/m^3)
Plain Concrete	24.0
Reinforced Concrete	25.0
Asphalt Pavement	23.0
Steel	78.5
Embankment	18.0

Live Load

The HL-93 live load of the new standard for bridge design (22 TCN-272-05) shall be appropriately reduced (65% for this Project) as shown in Table 2.2.1.2, in order to ensure consistency with the Central Area Bridges project, which applied the H-13 live load.

Other Loads

Other loads shall be in accordance with the new bridge standard (22 TCN-272-05), such as earthquakes, wind load, water and /or earth pressure, and buoyancy for substructure design.

4) Material Strength

The design strength of concrete shall be based on Vietnamese standards. Design and construction of substructures and deck slabs shall be implemented by the GOV.

Design Strength of Concrete

Description	Strength（N/mm^2）
Deck slab, Pier, Bearing support, Pile cap, Bored pile	30.0
Parapet, Abutment body wall, Abutment wing wall, Footings for pier and abutment, Transition slab	25.0
Sealing Concrete	15.0
Lean concrete	10.0

Yield Strength of Reinforcements

The following reinforcement materials will be used for this Project and are based on Vietnamese Standards.

Type	Yield Strength (N/mm^2)
Round bar（A-I）	190
Round bar（C-I）	240
Deformed bar（A-II）	240
Deformed bar（C-II）	300
Deformed bar（A-III）	300
Deformed bar（C-III）	400

Tensile Strength of Steel

Steel materials procured from Japan shall follow Japanese Standards. Other steel materials shall follow Vietnamese standards as shown in the table below.

Description	Tensile Strength（N/mm^2）	Remarks
SS400、SM400	400-510	General Steel
SMS490、SM490Y	490-610	General Steel
SM520	520-640	General Steel
SMA400W	400-540	Weathering Steel
SMA490W	490-610	Weathering Steel

(4) Summary Table for Bridges

Table 2.2.2.5 shows the summary of bridge design for this Project.

Table 2.2.2.5 Summary of Bridge Design (1)

Province	Son La				
Bridge No.	2	3	4	5	6
Name of Bridge	Ban Sai	Ban Tum	Na Do	Na Tra	Ban Pang
Existing Bridge	Suspension Br. for Pedestrian and motor bike	Suspension Br. for Pedestrian and motor bike	Suspension Br. for Pedestrian and motor bike	Suspension Br. for Pedestrian and motor bike	No Bridge
Designed Bridge Type	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder
Design Live Load	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65
Bridge Length(m)	42.15	60.2	33.1	42.15	30.1
Span Length(m)	20.5+20.5	17.5+17.5+23.5	32.5	20.5+20.5	29.5
Girder Length(m)	21+21	18+18+24	33	21+21	30
Clear Width(m)	4.5	4.5	4.5	4.5	4.5

Province	Dien Bien				
Bridge No.	7	8	9	10	11
Name of Bridge	Na Phat	Pa Bat	Su Lu	Ban Bung	Pac Nam (DB)
Existing Bridge	Suspension Br. for Pedestrian and motor bike	Suspension Br. Loading capacity 10t	Suspension Br. for Pedestrian and motor bike	Suspension Br. for Pedestrian and motor bike	Suspension Br. for Pedestrian and motor bike
Designed Bridge Type	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder
Design Live Load	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65
Bridge Length(m)	66.2	90.2	99.2	54.15	42.15
Span Length(m)	20.5+23.5+20.5	29.5+29.5+29.5	32.5+32.5+32.5	26.5+26.5	23.5+17.5
Girder Length(m)	21+24+21	30+30+30	33+33+33	27+27	24+18
Clear Width(m)	4.5	5.5	5.5	5.5	4.5

Province	Lai Chau				
Bridge No.	12	14	15	16	17
Name of Bridge	San Thang	Nam Puc	Huoi Dit	Nam Ham	Nam Cum
Existing Bridge	No Bridge	No Bridge	Wooden Br. for Pedestrian and motor bike	No Bridge	Suspension Br. for Pedestrian and motor bike
Designed Bridge Type	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder
Design Live Load	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65
Bridge Length(m)	30.1	66.2	21.1	60.15	72.2
Span Length(m)	29.5	20.5+23.5+20.5	20.5	29.5+29.5	23.5+23.5+23.5
Girder Length(m)	30	21+24+21	21	30+30	24+24+24
Clear Width(m)	4.5	4.5	4.5	4.5	4.5

Table 2.2.2.5 Summary of Bridge Design (2)

Province	Yen Bai				
Bridge No.	18	20	21	22	23
Name of Bridge	Ngoi Thap	Lao Chai	Pu Trang	Ta Tiu	Ben Cao
Existing Bridge	No Bridge	Suspension Br. for Pedestrian and motor bike	Suspension Br. for Pedestrian and motor bike	Suspension Br. for Pedestrian and motor bike	Suspension Br. for Light Vehicle only
Designed Bridge Type	Composed Simple Girder	Deck Type Simple Truss with Composed Simple Girder	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder
Design Live Load	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65
Bridge Length(m)	48.15	84.2	72.2	99.2	81.2
Span Length(m)	23.5+23.5	14.5+53.2+14.5	23.5+23.5+23.5	32.5+32.5+32.5	26.5+26.5+26.5
Girder Length(m)	24+24	15+54+15	24+24+24	33+33+33	27+27+27
Clear Width(m)	5.5	4.5	5.5	5.5	5.5

Province	Lao Cai				
Bridge No.	25	26	27	28	29
Name of Bridge	Thanh Phu	Ban Xeo	Muong Hum 2	Den Sang	Soi Chat
Existing Bridge	Suspension Br. for Pedestrian and motor bike	Wooden Br. for Pedestrian and motor bike	No Bridge	Suspension Br. for Pedestrian and motor bike	Suspension Br. for Pedestrian and motor bike
Designed Bridge Type	Through Type Simple Truss	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder
Design Live Load	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65
Bridge Length(m)	99.15	60.2	72.2	24.1	54.15
Span Length(m)	48.7+48.7	14.5+29.5+14.5	23.5+23.5+23.5	23.5	26.5+26.5
Girder Length(m)	49.5+49.5	15+30+15	24+24+24	24	27+27
Clear Width(m)	5.5	5.5	5.5	4.5	4.5

Province	Tuyen Quang				
Bridge No.	30	31	32	33	
Name of Bridge	Ban Nghien	Trinh	Na Nham	Sung	
Existing Bridge	Suspension Br. for Pedestrian and motor bike	Suspension Br. for Pedestrian and motor bike	No Bridge	No Bridge	
Designed Bridge Type	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder	
Design Live Load	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65	
Bridge Length(m)	63.2	81.2	99.2	33.1	
Span Length(m)	20.5+20.5+20.5	26.5+26.5+26.5	32.5+32.5+32.5	32.5	
Girder Length(m)	21+21+21	27+27+27	33+33+33	33	
Clear Width(m)	4.5	5.5	5.5	5.5	

Table 2.2.2.5 Summary of Bridge Design (3)

Province	Ha Giang				
Bridge No.	36	37	38	39	40
Name of Bridge	Na Lan	Ta Lang	Suoi Dau	Diec	Lien Hiep
Existing Bridge	Suspension Br. for Pedestrian and motor bike	Suspension Br. for Pedestrian and motor bike	Suspension Br. for Pedestrian and motor bike	Suspension Br. for Pedestrian and motor bike	Suspension Br. for Pedestrian and motor bike
Designed Bridge Type	Deck Type Simple Truss	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder
Design Live Load	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65
Bridge Length(m)	54.1	54.2	54.15	48.15	33.1
Span Length(m)	53.2	17.5+17.5+17.5	26.5+26.5	23.5+23.5	32.5
Girder Length(m)	54	18+18+18	27+27	24+24	33
Clear Width(m)	4.5	4.5	4.5	4.5	4.5

Province	Bac Can				
Bridge No.	42	43	44	46	47
Name of Bridge	Pac Nam (BC)	Khuoi Nung	Nga Ba	Don Phong	Quang Chu
Existing Bridge	Banboo Br. for Pedestrian only	Banboo Br. for Pedestrian and motor bike	Banboo Br. for Pedestrian and motor bike	Suspension Br. for Pedestrian and motor bike	Suspension Br. for Pedestrian and motor bike
Designed Bridge Type	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder
Design Live Load	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65
Bridge Length(m)	42.15	33.1	42.15	75.2	99.2
Span Length(m)	20.5+20.5	32.5	20.5+20.5	23.5+23.5+26.5	32.5+32.5+32.5
Girder Length(m)	21+21	33	21+21	24+24+27	33+33+33
Clear Width(m)	5.5	5.5	5.5	5.5	5.5

Province	Cao Bang				
Bridge No.	48	49	50	52	
Name of Bridge	Dong May	Binh Long	Ban Sac	Keo Ai	
Existing Bridge	Suspension Br. for Pedestrian and motor bike	Suspension Br. for Pedestrian and motor bike	No Bridge	No Bridge	
Designed Bridge Type	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder	Composed Simple Girder	
Design Live Load	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65	HL93 x 0.65	
Bridge Length(m)	81.2	99.2	63.2	33.1	
Span Length(m)	26.5+26.5+26.5	32.5+32.5+32.5	20.5+20.5+20.5	32.5	
Girder Length(m)	27+27+27	33+33+33	21+21+21	33	
Clear Width(m)	5.5	5.5	5.5	4.5	