Public Works (PW)
Ministry of Construction
Republic of the Union of Myanmar

PREPARATORY SURVEY REPORT

ON

THE PROJECT FOR PROVISION OF ROAD CONSTRUCTION AND MAINTENANCE EQUIPMENT IN KAYIN STATE

IN

REPUBLIC OF THE UNION OF MYANMAR

February 2013

JAPAN INTERNATIONAL COOPERATION AGENCY

(JICA)

YACHIYO ENGINEERING CO., LTD

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to Yachiyo Engineering Co., Ltd.

The survey team held a series of discussions with the officials concerned of the Government of Republic of the Union of Myanmar, and conducted field investigations. As a result of further studies in Japan, 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.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Myanmar for their close cooperation extended to the survey team.

February, 2013

Kazunori MIURA
Director General,
Economic Infrastructure Department
Japan International Cooperation Agency

SUMMARY

① Overview of Myanmar

Republic of the Union of Myanmar (hereinafter referred to as "Myanmar") shares borders with China, Thailand, Laos, India and Bangladesh and is a multiethnic country with a population of 62.42 million people (IMF estimate value in 2011). Myanmar's land area is 680 thousand square kilometers and is approximately 1.8 times larger than Japan. The Ayeyarwady river runs through their central area. Myanmar is situated in the monsoon belt and it has three distinct seasons, namely the dry season from the end of October to March, the very hot season in April and May, and the rainy season from June to the middle of October.

The GDP growth rate is more than 10% per year according to the government and more than 5% according to the IMF, however, per capita GDP is still less than USD800. The market exchange rate of the national currency the kyat has appreciated in recent years due to ① foreign currency revenue resulting from exports of natural gas and precious stones, ② large-scale investment from China and Thailand, etc. in the energy sector and special economic zones, and ③ speculative flows of private sector funds into land and other assets. There is concern that this will adversely affect the export competitiveness of farm products and thus lead to reduced value of exports, however, as of the first half of 2011, the impact has been limited to some fisheries products only (according to the Institute of Developing Economies, Yearbook of Asian Trends 2011).

② Background and Outline of the Project

Having more than 135 ethnic groups, Myanmar is one of the most ethnically diverse countries in the world. Following independence in 1948, various ethnic groups launched armed struggle against the government seeking more active assistance, greater self-rule and complete autonomy and so on, however, the government promoted reconciliation with the armed groups from the 1990s, and the current administration that came to power in March 2011 has actively sought to reach ceasefire and peace agreements with ethnic minorities with a view to realizing national unification.

After Myanmar gained independence in 1948, the Kayin National Union continued a struggle against government forces until both sides reached a ceasefire agreement in January 2012. However, the long years of conflict impeded development, and the repatriation and resettlement of refugees and internally displaced people is the most pressing issue that faces Kayin State today. In these circumstances, roads that are vital to enabling access to various infrastructure following repatriation and resettlement are not in good condition. Even though the construction and maintenance of trunk roads (approximately 53,000 kilometers) is basically conducted as a directly managed activity by Public Works of the Ministry of Construction (hereinafter referred to as the "PW"), the poor state of equipment means that it cannot conduct efficient road construction and maintenance.

In view of these conditions, the Government of Myanmar submitted the official request in August

2012 for grant aid concerning the supply of equipment for road construction and maintenance in Kayin State, where there are especially high numbers of repatriated citizens.

③ Outline of the Survey Findings and Contents of the Project

Japan International Cooperation Agency (hereinafter referred to as the "JICA") dispatched the study team to Myanmar from 10th July to 7th August 2012 as a first field survey and from 23rd to 28th October 2012 as a second field survey. The study team confirmed contents requested by Myanmar side for the project and conducted field surveys at target sites where the PW which is the implementation agency of Myanmar government plans roads and bridges construction by its own budget in Kayin State. After being back in Japan, the study team analyzed their survey result, conducted the outline design and cost estimation of the project. Based on their result, the study team conducted the survey in Myanmar for explanation of the outline design to the PW from 8th to 19th December 2012.

The equipment to be procured in the project will comprise items needed to construct and maintain 146 kilometers of the north-south road and bridges by the PW (the project target road, see the site map at the beginning of the report) connecting Waboetaw, Kamamaung and Phapun in Kayin State.

Furthermore, the project will conduct a Soft Component (Technical Assistance) to introduce a database control system so that the PW can acquire the method to control equipment to be procured in the project more efficiently.

The contents of equipment procurement in the project are described below.

Table-1 Contents of the Assistance

	Equipment	amount	remarks
1	Bulldozer (crawler)	2	
2	Excavator (crawler)	2	
3	Wheel Loader	2	
4	Motor Grader	2	
5	Sheep foot Compactor	2	
6	Plate Compactor	5	
7	Asphalt Kettle	1	
8	Bitumen Distributor	3	
9	Chip-spreader	3	
10	Rough Terrain Crane	1	
11	Dump truck	20	
12	Water Bowser (Tanker)	4	
13	Cab-back Crane	1	
14	Low bed Semi-trailer(with Tractor Head)	1	
15	Mobile Workshop	1	

16	Inspection Vehicle	1	
17	Generator	2	
18	Equipment ledger control system	3	Desktop PC and Database software

④ Project period and cost estimation

The project period is approximately 18 months including the detailed design, bidding and equipment procurement. The project cost to be borne by the Myanmar side is estimated to be 25.94 million Japanese yen for the road and bridge construction targeted in Kayin State and the banking commission.

⑤ Project Evaluation

- **Relevance**

Japanese government set the major support fields for Myanmar to assist to spread the result of democracy, reconciliation within the country and economic revolution to all nationals living in Myanmar.

1. Improve quality of life for all nationals. (including ethnic minorities, poverty households and development of urban and rural area)
2. Capacity development for human resources and maintenance of regulations for economic and social development.
3. Infrastructure and regulation for sustainable economic growth

The project covers 1 and 3 mentioned above, and it is suitable for directions of Japanese major support fields

According to state minister of Kayin state, the target road along with Thanlwin river is part of construction and renovation of north – south road planed in regional development strategy of Kayin state. Besides, state minister mentioned to have a future design of construction reaching to Baw Ga Li/ Thandaung from Phapun. Thus, this project can be major part of backbone of Kayin state development.

Also, some part of the target area is suitable for paddy fields where can be the center of farming in Kayin state.

As points mentioned above, the project is highly relevant for development strategy in Kayin state.

- **Effectiveness**

According to statistical data provided by Kayin state, around 40,000 peoples living along the target road. The project can provide direct benefit to those peoples.

If renovated the target road, it is expected that driving speed will improve 60km/hr. from 20km/hr.

as current state. And, for example, it will take three or three and half hours from Hpa-an-Kamarmaung- Phapun, it is possible to go and back in a day.

Quantitative effects of the project are shown in the table below.

Table-2 Quantitative effects of the project

Indicator	Baseline,2012	Target, 2017
Average travelling speed on the target road（km/h）	Approx. 20km/h	Approx. 60km/h
Total length of road improvement on the target road（km）	0km	Approx. 100km
Maximum weight of vehicle on bridges (ton)	5 ton	60 ton

In addition to abovementioned quantitative effects, after developing the target road, various qualitative effects are expected, such as making goods transportation more efficient, improving traffic in rainy season and traffic safety, improving accessibility to medical services in an emergency, reducing transportation costs, increasing of job opportunities lead by developing the local industry, promoting development of repatriation village and so on.

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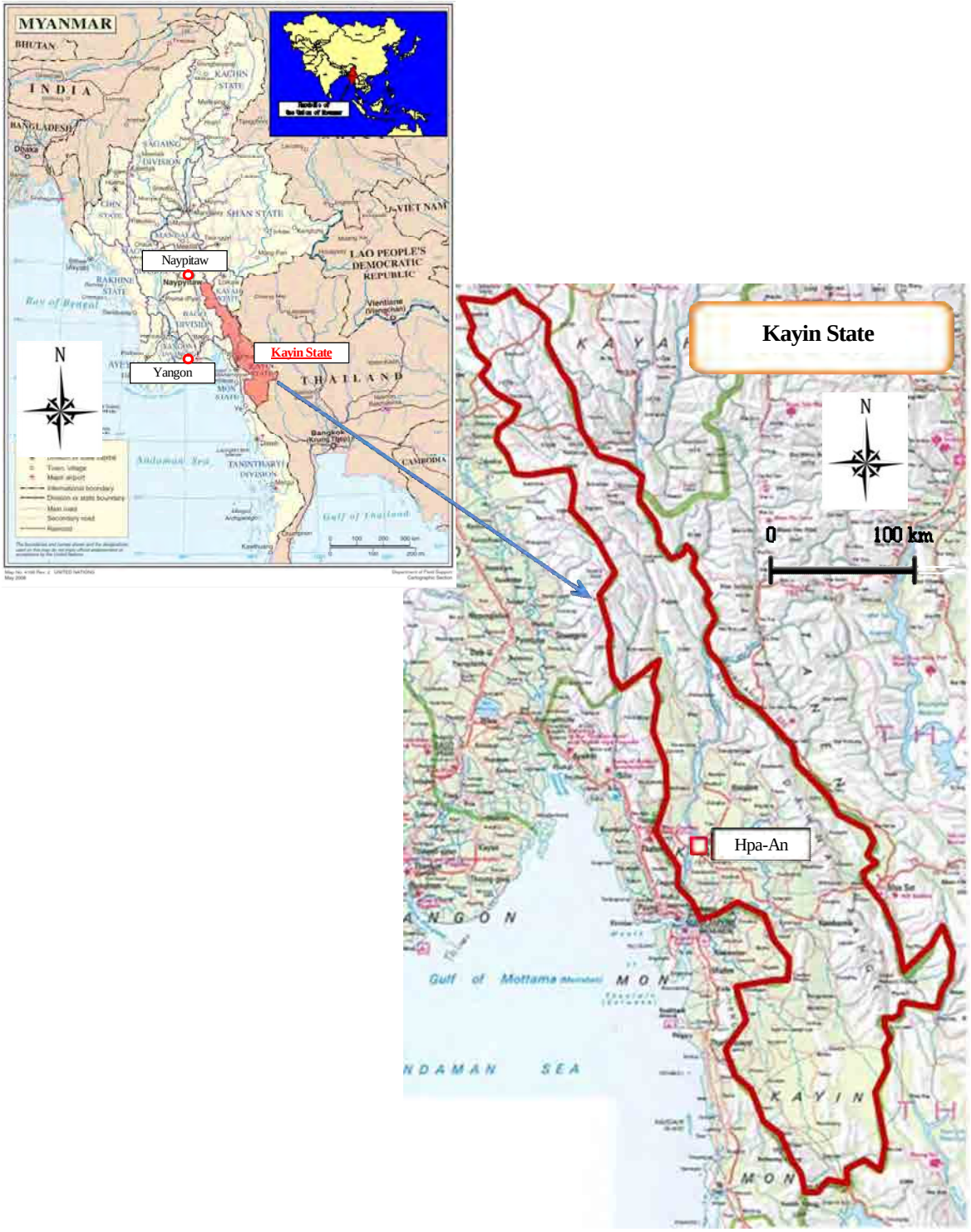
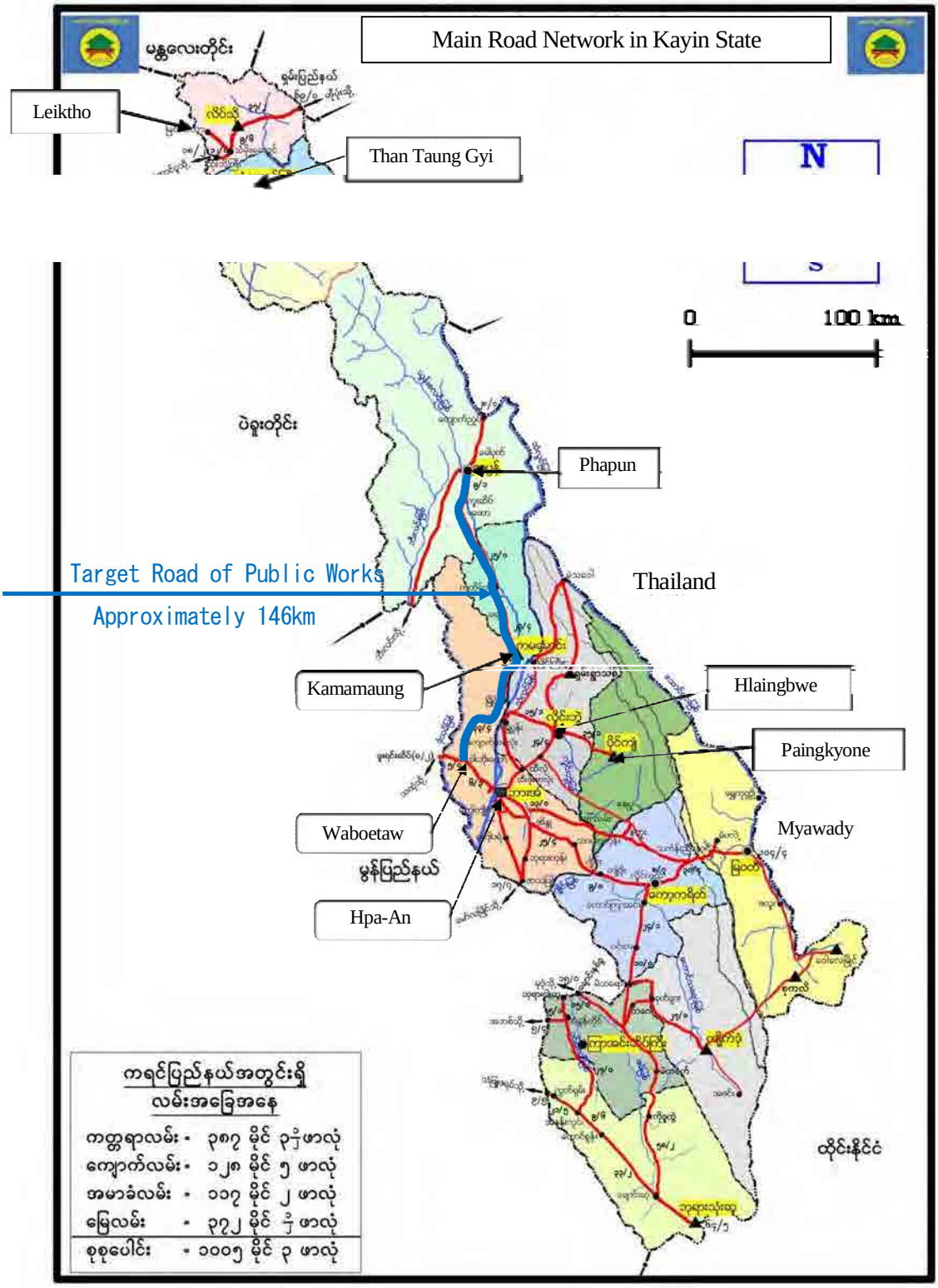
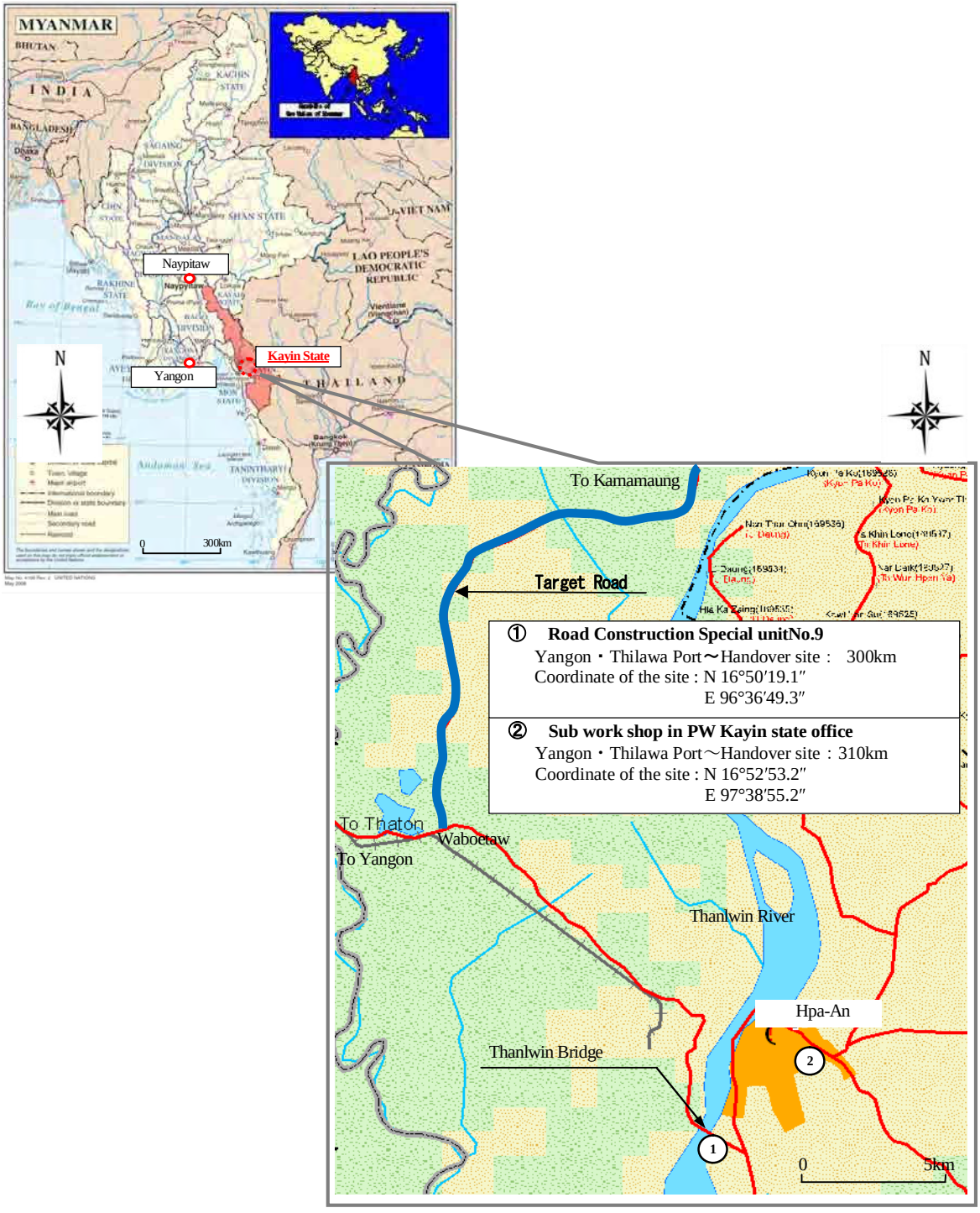


Location Map（1/3）



Location Map（2/3）



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Abbreviations

CE	Chief Engineer
CTC	Central Training Center
DCE	Deputy Chief Engineer
DMD	Deputy Managing Director
DSE	Deputy Superintending Engineer
EE	Executive Engineer
LBT	Labor Based Technology
MD	Managing Director
MES	Myanmar Engineering Society
MoC	Ministry of Construction
MoBA	Ministry of Border Affairs
MTC	Mechanical Training Center
PW	Public Works
RRL	Road Research Laboratory
SRL	Soil Testing and Research Laboratory
SE	Superintending Engineer

CHAPTER 1

BACKGROUND OF THE PROJECT

Chapter 1 Background of the Project

1-1 Current Conditions and Issues in the Sector

1-1-1 Current Conditions and Issues

Out of a total 146,000 kilometers of roads in Myanmar, paved roads account for just 20% (approximately 30,000 kilometers) of the total, and the country has been slow in constructing and maintaining arterial roads which act as lifelines for refugees following repatriation and resettlement.

Out of the said 146,000 kilometers of roads in Myanmar, approximately 25% are under the jurisdiction of the Ministry of Construction, and approximately 46% of those roads are paved (asphalt basic paving or concrete paving). Moreover, asphalt paving is not commonly seen on roads in Myanmar; rather, roads mainly have basic paving comprising a surface layer over the sub-base. Table 1-1.1 shows the length of road under jurisdiction of the Ministry of Construction according to the type of paving.

Table 1-1.1 Length of Roads under Jurisdiction of the Ministry of Construction (as of May 2011)

Type of Pavement	Road length（km）			Percentage
	Union Highway	Provincial Road	Total	
Bituminous Road	11,084	5,442	16,526	42%
Concrete Paved Road	586	49	635	2%
Crushed Rock Road	2,960	2,644	5,604	15%
Gravel Road	2,595	2,935	5,530	15%
Earth Road	1,304	6,552	7,856	21%
Others	103	1,313	1,416	4%
計	18,632	18,934	37,566	100%

Source: Public Works

The Project target area of Kayin State is located in the east of the country adjoining the border with Thailand, and Thanlwin River, which is one of the major rivers in the country, flows through it. In addition, Yunsalin River and Hlaingbwe River also flow through the state. Every year during the rainy season, these rivers overflow causing serious flood damage to surrounding roads and bridges. Moreover, due to the uncertain conditions of public order in the state up until recently, it has not been possible to conduct appropriate maintenance of roads and bridges, leading to further deterioration of access to surrounding areas. Therefore, the repair of existing roads and bridges in the state is an issue that demands urgent attention.

1-1-2 Development Plans

The Government of Myanmar has been advancing road construction and development based on the 30-year Road Development Plan for 2001 to 2030.

Within the Project, based on the understanding that road and bridge development makes a direct contribution to national development, Public Works of the Ministry of Construction (hereinafter referred to as the "PW") is implementing road development geared to the target year of 2030 assuming six phases of five years each.

PW aims to realize a road network made up of international trunk roads that comprise width of 48 feet and four lanes, key trunk roads that comprise width of 24 feet and two lanes, and single lane roads that comprise width of 12 feet, by the end of the 30-year Road Development Plan. It also intends to replace all the many wooden bridges that can be seen in Myanmar within the period of the 30-year Road Development Plan. Table 1-1.2 shows the future length of road development and budget plans within this development plan.

Table 1-1.2 30-year Road Development Plan

Item	Upper row: Developed length (miles/furlong), Bottom row: Budget (million Kyat)			
	Phase 3 2011 – 2015	Phase 4 2016 – 2020	Phase 5 2021 – 2025	Phase 6 2026 – 2030
International trunk road network	5,665/0	-	5,970/0	-
	375,333.99	-	1,821,153.80	-
Road repair works	4,482/5	2,772/1	-	3,323/5
	1,108,794.39	401,661.62	-	1,113,801.52
New road construction	1,052/6	-	-	-
	350,764.81	-	-	-
Total	11,200/3	2,772/1	5,970/0	3,323/5
	1,834,893.19	401,661.62	1,821,153.80	1,113,801.52

Remarks: (1) 1 kyat ≒0.095 yen (as of November 2012, according to the JICA conversion rate)
(2) 1 mile = 8 furlongs (approximately 1.609km)
The accounting year in Myanmar is from April 1 to the following March 31, as is also the case in Japan.
Source: Thirty year National Plan of Public Works (Road and Bridges), 26 June, 2012

The target road in Kayin State is a primary access road connecting to international trunk roads such as the Asia Highway, and it is regarded as an important route for securing a stable physical distribution network in the area. Against this background, the central government of Myanmar and the local government are in agreement that priority should be given to the development of this road in the Project.

1-1-3 Social and Economic Conditions

(1) Myanmar in General

1) Population and minorities

The following table shows population movements of Myanmar according to the Central Statistical Organization.

Table 1-1.3 Population Movements of Myanmar

	2003	2004	2005	2006	2007	2008
Population (million people)	53.22	54.30	55.40	56.52	57.50	58.38
Rate of increase (%)	—	2.0	2.0	2.0	1.7	1.5

Source: Central Statistical Organization, *Statistical Year Book 2009*

Myanmar is a multiethnic country. Bamar people comprise two-thirds of the population, while the remaining third is made up of more than 100 ethnic groups (9% Shan, 7% Karen, 3.5% Rakhine, 2.5% Chinese, 2% Mon, 1.5% Kachin, 1.25% Indian, 0.75% Kayah, 4.5% others) (according to Minorities in Burma, Minority Rights Group International, etc.). However, it is said that the population of each ethnic group is underestimated. Moreover, there are groups such as the Rohingya who are not completely recognized as citizens of Myanmar (the UNHCR refers to them as stateless people). Almost 90% of people in Myanmar are Buddhists, while Christians and Moslems each account for 4% of the population, and other religions and Hindus account for 1% each.

The history of Myanmar also happens to be the history of the rise and fall of peoples who moved into the Ayeyarwady Plain from the North Tibet Plains and from southern China via Thailand. It is guessed that the indigenous natives of Myanmar were the Negrito who today live in the Andaman Islands. After that, people of the Pyu, Mon and Barma races and so on moved into the Ayeyarwady Plain from the North Tibet Plains, while the Shan and Karen races moved in from southern China and Thailand, and these peoples built city states and royal dynasties. In addition to these movements, the western and southern advances of Khubilai Khan and so on forced the minority races to seek complex migration routes and many people, assimilating with the Bamar race, remained in the Ayeyarwady Plain and practiced agriculture, so each race did not remain concentrated in just one area. Some ethnic groups such as the Kachin have remained in mountain areas to the northwest, while the Rakhine originally inhabited the mid-western part of the Ayeyarwady Plain but were forced to migrate along the cost in Rakhine State as the Bamar moved south (according to Proceedings of Myanmar Two Millennia Conference, The Traveler's History of Burma, etc.).

Following independence in 1948, the ethnic minorities, seeking self-rule, assembled and reached agreement (the Panglong Agreement) concerning revision of the 1947 constitution aiming for establishment of a federal state. However, this process was cut short as a result of the coup d'état led by General Ne Win in 1962. The ethnic minorities that had campaigned for quality and self-rule after independence continued activities mainly in the border regions, however, the military government clamped down on them via its "Four Cuts program" (policy aimed at destroying solidarity between anti-government villages and ethnic groups in the four main links of food, funds, intelligence and recruits). The military regime continued its oppression even after concluding a ceasefire agreement with the leaders of ethnic groups, and its forced ethnic minorities to migrate to areas where agriculture couldn't be practiced and where there was no access to food or medical care. Moreover, from 2004 onwards, the junta continued hostilities against armed forces that it had signed ceasefire agreements with in the

1990s, in an effort to force ethnic armed groups to join with border security forces prior to effecting transition to civilian rule. However, the military junta ceded power to the new government that was established as a result of the general elections held in 2010. The new government has strived to conduct political reform, establish legislation and promote activities geared to achieving peace with minority armed groups, and these efforts are starting to pay off (according to the Institute of Developing Economies, Yearbook of Asian Trends 2011).

2) Economy

Table 1-1.4 shows the main economic indicators of Myanmar. The GDP growth rate is more than 10% per year according to the government and more than 5% according to the IMF, however, per capita GDP is still less than USD800. The market exchange rate of the national currency the kyat has appreciated in recent years due to ① foreign currency revenue resulting from exports of natural gas and precious stones, ② large-scale investment from China and Thailand, etc. in the energy sector and special economic zones, and ③ speculative flows of private sector funds into land and other assets. There is concern that this will adversely affect the export competitiveness of farm products and thus lead to reduced value of exports, however, as of the first half of 2011, the impact has been limited to some fisheries products only (according to the Institute of Developing Economies, Yearbook of Asian Trends 2011).

Agriculture is the central industry of Myanmar and, although its share of GDP is steadily declining, it still accounts for almost 40%. Conversely, manufacturing is becoming increasingly important and is approaching 20% of GDP. The share of transportation and telecommunications is also increasing (14% in fiscal 2010), while the share of commerce is holding at 21% of GDP.

Table 1-1.4 Main Economic Indicators of Myanmar

Item	2007	2008	2009	2010	2011[*1]
Nominal GDP (1 billion kyat)	3,336	28,778	32,351	36,436	39,805
Nominal GDP (US$1 million)	20,182	31,367	35,225	45,380	51,925
GDP growth rate (government announcement) (%)	12.0	10.3	10.6	10.4	
GDP growth rate (IMF estimate) (%)	5.5	3.6	5.1	5.3	5.5
Per capita GDP ($)	351	537	575[*2]	705[*2]	768[*2]
Exchange rate (real) (US$=Kyat)	1,110	992	1,004	861	810
GDP breakdown[*3]					
Agriculture	44%	42%	40%	38%	
Mining	1%	1%	1%	1%	
Manufacturing	15%	16%	17%	19%	
Electricity, gas, water	0%	0%	0%	0%	---
Construction	4%	4%	4%	5%	
Transport and communications	12%	13%	14%	14%	
Finance	0%	0%	0%	0%	

Item	2007	2008	2009	2010	2011*1
Administration	1%	1%	1%	1%	
Commerce	22%	21%	21%	21%	
Others	2%	2%	2%	2%	

Remarks: *1: Estimate value, *2: Figures for 2009~2011 are estimated assuming that population from 2008 onwards grows at a rate of 1.5%, *3: Ratio based on fiscal 2005 production prices
Source: IMF Country Report Myanmar 2011, ADB Key Indicators 2011

3) Administration

Myanmar is divided into seven regions and seven states. The regions are primarily located in areas predominantly inhabited by the Bamar, while the states are inhabited by other minorities. The target state is Kayin. This state is predominantly inhabited by Karen people, but it is also home to other ethnic groups.

The regions and states are further subdivided into districts, townships, sub-townships, village groups and villages. Villages are the smallest administrative division. The townships and sub-townships are subdivided into wards that are different from the village groups.

The central government of Myanmar is composed of 32 ministries as shown in Table 1-1.5. PW, which is the implementing agency for the Project, is a department in the Ministry of Construction. In fiscal 2009, the budget of PW accounted for 8.5% of the overall budget of the Ministry of Construction. The ministry's budget was reduced by 17% over the previous year in 2007, however, it increased by 15% over the previous year in fiscal 2008-2009.

THAIN

1.Ayeyarwady

2.Sagaing

3.Tanintharyi

4.Bago

5.Magwe

6.Mandalay

- Nepitaw, the capital city since Nov.2005 located southern part of Mandaley.

7.Yangon

STATES

1.Kachin

2.Kayah

3.Kayin

4.Shan

5.Chin

Figure 1-1.1 Administration division in Myanmar

6.Mon

7.Rakhine

Table 1-1.5 State Budget of Myanmar

(price unit/billion kyat)

	2005	2006	2007	2008	2009	
	billion kyat	billion kyat	billion kyat	billion kyat	billion kyat	%
Ministry of Defense	170.3	331.4	356.4	364.1	672.9	41.4%
Ministry of Education	56.1	155.6	170.9	176.8	210.2	12.9%
Ministry of Agriculture and Irrigation	92.6	119.9	137.1	203.6	158.6	9.7%
Ministry of Construction	117.9	124.2	102.9	117.8	138.3	8.5%
(Rate of increase)		(5.3%)	(-17.1%)	(14.5%)	(17.4%)	
Ministry of Electric Power (1) (2)	49.6	88.8	107.7	141.5	108.1	6.6%
Ministry of Home Affairs	19.0	47.5	48.5	54.4	64.1	3.9%
Ministry of Health	21.0	44.7	44.5	47.2	57.1	3.5%
Ministry of Transportation	97.0	44.5	42.6	29.3	44.6	2.7%
Ministry for Progress of Border Areas and National Races and Development Affairs	17.9	21.3	34.4	20.9	30.0	1.8%
Ministry of Science and Technology	15.0	28.5	42.6	29.0	25.6	1.6%
Ministry of Forestry	5.6	11.1	14.4	15.3	19.4	1.2%
Ministry of Finance and Revenue	2.5	6.2	21.3	23.0	16.0	1.0%
Ministry of Social Welfare Relief Resettlement	2.4	4.0	5.8	48.5	15.5	0.8%
Ministry of Information	3.2	12.1	11.5	11.3	12.8	0.6%
Ministry of National Planning and Economic Development	2.7	5.7	7.1	7.5	10.3	0.5%
Ministry of Livestock and Fisheries	2.9	5.5	6.0	5.3	7.5	0.5%
Other ministries*	2.9	5.5	6.0	5.3	7.5	0.5%
Total	689.6	1,077.9	1,185.1	1,320.5	1,627.0	100.0%
(Rate of increase)		56.3%	9.9%	11.4%	23.2%	

Remarks: * Ministry of Immigration and Population, Ministry of Sports, Ministry of Cooperatives, Ministry of Culture, Ministry of Rail Transport, Ministry of Religious Affairs, Ministry of Commerce, Ministry of Mines, Ministry of Foreign Affairs, Ministry of Labor, Employment and Social Security, Ministry of Industry (1), Ministry of Industry (2), Ministry of Hotels and Tourism, Ministry of Communications, Posts and Telegraphs, Ministry of Energy
Source: Myanmar Official Gazette (annual)

(2) Target Area

The Project aims to procure construction equipment so that PW can implement road and bridge construction using procured equipment on the target road in Kayin State.

Outline information on Kayin State is given below.

Table 1-1.6 Outline of Kayin State

Population	Approximately 1.8 million
Area	30,383km^2
Ethnic groups	Karen, Mon, Barma, Shan, Kayah, Rakhine, Chin, etc.
Literacy rate	Male: 93.4%, Female: 88.8%
Main industries	Agriculture, border trade
Villages for accepting repatriated citizens[1] / Planed sub-township[2]	Pho Stikhu, Myainggyingu,, Paingkyon, Shwe Koak Ko, Myawaddy[1] Kamarmaung, Shanywarthit, Wallae, Sukali, Kyeikdon, Hpayarthonesu, Paingkyon, Leik Tho, Baw Ga Li[2]

Notes[1]:Interviewed to NATALA
Notes[2]: Interviewed to UNHCR Hpa-an
Source: Prepared by the Study Team based on the following:
Data tracking file as of 30 Nov, MIMU
http://en.wikipedia.org/wiki/Kayin_State, Wikipedia
Hearing survey

A lot of IDPs are living in Kayin state due to a long conflict between Myanmar national army and ethnic minorities. Currently, any organizations working in Kayin state couldn't count exact number of IDPs. Kayin State is located on the border with Thailand and prosperous trade is carried out via the Myawaddy Mae-sot border point. Moreover, a road is currently being constructed northeast from Myainggyingu to the town of Mae Thawaw on the border with Thailand, and this is scheduled for completion in 2014.

1) Current status of Returnees/ IDPs

The government is preparing villages and sub-township for returnees from Thailand and IDPs with support by international organizations and NGOs. According to NATALA, five villages mentioned the table 1-1-6 are preparing, and moreover according to the state minister in Kayin state, more four villages between Kamarmaung – Phapun is eager to plan. It is out of our target area, but the village in Myainggyingu accepts IDPs between Phapun – Mae Thawaw to re-settle initiated by famous monk in Myainggyingu. The government and NGOs are supporting IDPs living in the village such as construction of home and schools and distribution of foods. With such a supportive situation, 5,043 residents were identified in Myainggyingu area as of September 2011.

On the other hand, the plans along Waboetaw – Kamarmaung – Phapun were not in progress as of December 2012. The target road is located in western side of Thanlwin river. The road condition becomes awful in rainy season and security situation is still unstable in some places. Therefore, the renovation of the target road, at first, is urgent and starting point for regional development in Kayin state considering IDPs and returnees.

Even those situations in the target area, the government and local NGOs are working on supporting people living in the area, including IDPs, as much as possible. For instance, NGO and immigration department is cooperating to provide ID card to people, who don't have it. Construction of primary school and health center, education of sanitary and undermine risk are high priority support for them and implemented by the government and NGOs.

Those important and effective supports with facilitation by mastering the area need

understandings by not only the government, but also ethnic minority organizations.

(3) Target Roadside

In the primary survey, field survey was carried out on the target road connecting Waboetaw, Kamamaung and Phapun in Kayin State. The target road is situated on the west side of Thanlwin River, which bisects the state, and it is also situated close to Mon State. It straddles the two townships of Hpa-An and Phapun (including Kamamaung Township), and the section between Waboetaw and Kamamaung is also relatively close to Hpa-An (the state capital) and covers a stretch of lowland. The road gradually enters mountain territory between Kamamaung and Phapun, and it no longer continues beyond Phapun.

1) Ethnic Composition and Religion

(a) Waboetaw-Kamamaung

Roadside population: 13,508 (according to survey by the Study Team in July 2012)
Karen people comprise 13,422 of this.

Almost all residents living alongside the road are Karen. The start point of Waboetaw forms a T-junction with the road that leads from Hpa-An to Thaton in Mon State, and shops, eateries and bike taxis can be found here.
From the target road, churches and pagodas can be seen, indicating a mixture of Christians and Buddhists.

(b) Kamamaung-Phapun

Roadside population: 26,956 (according to survey by the Study Team in July 2012)
Of these, 14,972 are Karen people living in Kamamaung sub-township. Numbers for Phapun are unclear.

From Kamamaung, there is a mixture of Karen, Mon, Barma and Shan, but the majority of the population is Karen.
Around Kamamaung, numerous large pagodas can be seen alongside the road and Buddhism is the main religion, however, more churches can be seen and there is thought to be more Christians as the road moves north.

2) Main industries and cash income opportunities

The main industry is agriculture and there is prosperous cultivation of rice, sugar cane, rubber and vegetables. Livestock animals are also reared. Cattle and goats were observed during the site survey. Figure 1-1.2 shows the agricultural calendar that is followed by residents.

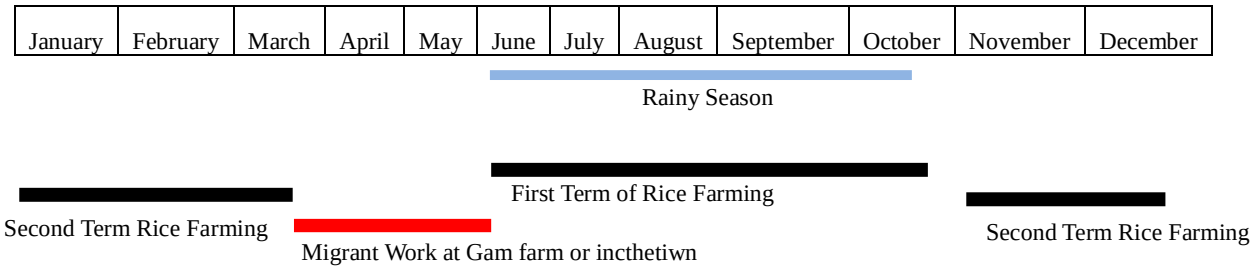


Figure 1-1.2 Agricultural Schedule of Residents

Source: Prepared by the Study Team based on hearing surveys around Waboeta-Kamamaung

Farmers work away from home during the agricultural off-season, and young people frequently go to work in Thailand throughout the year.

In Myanmar, depending on the characteristics of land, rice yield of approximately 2,600~3,300 kg (with husks) can be obtained per acre. However, in the first cropping phase that coincides with the rainy season, yields of only around 830 kg can be expected due to the effects of heavy rainfall.

Cash incomes from agriculture basically range between 150,000~200,000 kyat per year, however, it is very difficult for farmers to live on this amount even if they are fully self-sufficient in the staple food of rice. Accordingly, many young people especially move to towns to earn extra money and send it back home. In addition, during the busy farming season, farmers in the same village help with each other's fields and share rice and vegetables in return.

3) Welfare services

(a) Schools

Between Waboetaw and Kamamaung, elementary schools exist in almost all villages alongside the road. One junior high school and senior high school each are established in each village group.

Between Kamamaung and Phapun, elementary schools, junior high schools and senior high schools are established at least in every village group.

Elementary schools are located within walking distance from almost every village. As for junior high schools and senior high schools, even the most distant students can reach them by bicycle in 30 minutes to an hour.

(b) Medical care facilities

Sub-health centers, which provide elementary medical care, are established in almost every village group. The sub-health centers mainly conduct general treatments, malaria shots, simple surgical procedures and child deliveries.

In cases where more advanced medical care is required, it is necessary to visit main health centers or hospitals that are established in townships and the state capitals. Along the target route, a main health center is located in Phapun. The town of Kamamaung is situated a little to the east of the

target road and has a sub-township hospital.

Sub-health centers are permanently staffed by medical assistants (employees who are not doctors but are able to conduct simple medical care) and nurses who work for the medical care of local communities. However, some health centers in rural parts of the target area have been forced to close down due to poor access and non-payment of salaries.

4) Means of transport

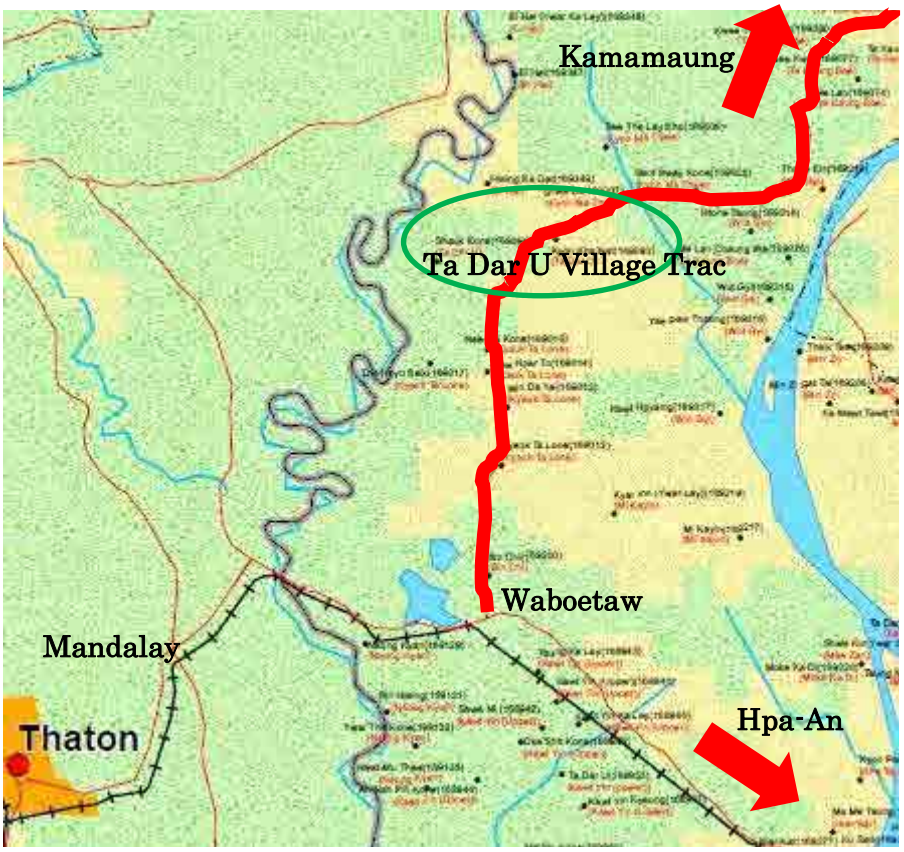


Figure 1-1.3 Map of the Area around the Target Road (around Waboetaw)

Due to the poor road conditions, it seems that residents along the target road planned by the Public Works do not travel to the state capital or townships except when necessary.

The residents between Waboetaw and Kamamaung more frequently go to Thaton in Mon State rather than Hpa-An when they need to go to market to buy and sell goods, and they can ride a bus from Ta Dar U village group to Thaton for 1,500 kyat (one-way). When they require medical care, residents frequently visit the hospital in Hpa-An.

Figure 1-1.4 Map of the Area Around the Target Road (around Kamamaung)

The target road is located to the west of Thanlwin River, however, there is also a road on the east side of the river and the area is relatively well developed in economic terms. Accordingly, the residents who live around Kamamaung travel east and west across the river by ferry boat to Ondo a little to the north and Myainggyingu to the east. The boat fare is 500 kyat per person for a one-way ride, and it costs a further 2,000 kyat to reach Hpa-An by bus from the boat dock.

When transporting goods from Phapun, residents sometimes sail down Thanlwin River in order to limit costs. Stone materials can be carried down the river to Hpa-An in roughly two weeks.

1-1-4 Natural Conditions

Myanmar is situated in the monsoon belt and it has three distinct seasons, namely the dry season from the end of October to March, the very hot season in April and May, and the rainy season from June to the middle of October.

In the Project target area of Kayin State, the dry season is from October to March and the rainy season lasts from April to September. Since almost all the annual rainfall of 5,000 millimeters falls during the rainy season, areas not equipped with sufficient drainage become inundated and roads frequently become impassable.

1-1-5 Environmental and Social Consideration

The Project aims to procure equipment and it is deemed not to be linked to sectors or characteristics prone to causing impacts or areas prone to receiving impacts, and any undesirable environmental impacts are deemed to be minimal.

Road construction and maintenance work using the project equipment will be implemented according to the laws of Myanmar. The Government of Myanmar is currently preparing a law that describes environmental consideration study and so on when implementing projects. Meanwhile, as a result of the site survey, it was confirmed that the necessary road area has already been secured over almost the entire target section. In the event where farmland or residents' land is impacted by the road development, Public Works will request the state government to appropriate the necessary land.

1-2 Background to and Outline of the Grant Aid

Having more than 135 ethnic groups, Myanmar is one of the most ethnically diverse countries in the world. Following independence in 1948, various ethnic groups launched armed struggle against the government seeking more active assistance, greater self-rule and complete autonomy and so on, however, the government promoted reconciliation with the armed groups from the 1990s, and the current administration that came to power in March 2011 has actively sought to reach ceasefire and peace agreements with ethnic minorities with a view to realizing national unification.

After Myanmar gained independence in 1948, the Kayin National Union continued a struggle against government forces until both sides reached a ceasefire agreement in January 2012. However, the long years of conflict impeded development, and the repatriation and resettlement of refugees and internally displaced people is the most pressing issue that faces Kayin State today. In these circumstances, roads that are vital to enabling access to various infrastructure following repatriation and resettlement are not in good condition. Even though the construction and maintenance of trunk roads (approximately 53,000 kilometers) is basically conducted as a directly managed activity by Public Works of the Ministry of Construction, the poor state of equipment means that it cannot conduct efficient road construction and maintenance.

In view of these conditions, the Government of Myanmar submitted the official request in August 2012 for grant aid concerning the supply of equipment for road construction and maintenance in Kayin State, where there are especially high numbers of repatriated citizens.

1-3 Trends of Japanese Assistance

(1) Japan's Assistance Policy

Japanese economic assistance to Myanmar has so far been conducted on a case by case basis with emphasis on basic human needs (BHN) projects while watching closely for democratization and improvements in human rights. However, from 2011 onwards, in light of the release of political detainees, the realization of direct dialogue between President Thein Sein and Aung San Suu Kyi, the signing of ceasefire agreements between the government and armed minority ethnic groups, and

the realization of political participation by Aung San Suu Kyi and a wide array of other figures as a result of by-elections for the national diet on April 1, 2012, the Government of Japan decided to revise its policy of economic cooperation in April 2012.

Under the Government of Japan's new policy, it is intended to mainly implement assistance in the following fields to ensure that the benefits of democratization, national reconciliation and economic reform are widely imparted to the citizenry, while monitoring the progress of reform efforts. Japanese assistance thus aims to support reform efforts by Myanmar in a wide variety of fields geared to realizing democratization, national reconciliation and sustainable development.

① Assistance for improvement of the national standard of living (including support for ethnic minorities and impoverished people, agricultural development and local development)
② Assistance for capacity building of human resources and institutional development for supporting economy and society (including assistance of democratization)
③ Assistance for development of infrastructure systems required for sustainable economic growth

The Project is consistent with the first of the above policies, i.e. assistance for improvement of the national standard of living (including support for ethnic minorities and impoverished people, agricultural development and local development).

(2) Related Assistance Plans by Japan

Table 1-3.1 shows past projects that are similar to the one here. It can be seen that supply of road construction machinery has been implemented in regional outlying areas under Japan's general grant aid scheme.

Table 1-3.1 Past Similar Projects by Japan

Project Name	Procured Year (Procured Amount)	Implementing Agency	Project Outline	Remarks
Basic Design Study Report on the Project for Improvement of Kokang Living Environment in Notehrn Shan State (Grant Aid)	Fiscal 2001 (approx.. 584 million yen)	Progress of Border Areas and National races department (NATALA)	1) Procurement of road construction equipment (main items: motor graders, vibrating rollers, tire rollers, back hoes, dump trucks, wheel loaders, etc.) 2) Construction of equipment repair workshops 3) Pilot implementation of road repair works (approx. 10 km) 4) Soft component concerning improvement of operation and maintenance and execution supervision capacity for procured equipment	Total length of roads targeted for repair (71.64 km) Of this, the pilot works section by the Japanese side is 10.04 km, and the section by the Myanmarese side is 61.6 km

As assistance relating to Public Works, Ministry of Construction, Japan is currently examining implementation of non-project grant aid, technical cooperation project, grassroots technical cooperation project, emergency development survey and center project loan (see Table 1-3.2).

Out of the above, non-project grant aid is most similar to the Project in that it also intends to procure dump trucks, graders and road rollers, etc. However, since this non-project grant aid targets a different road from that targeted in the Project, and it is envisaged that the two projects will be implemented simultaneously, the procured equipment will not be redundant on the target road. Moreover, since the equipment currently owned by Public Works of the Ministry of Construction is deteriorated and has serious shortages, even if the Project and the non-project grant aid are both implemented, the procured equipment will be effectively utilized on the target routes.

Moreover, because target routes in other projects (emergency development survey, etc.) differ from the one in the Project, there will be no overlapping use of the equipment.

Table 1-3.2 Related Assistance Plans by Japan

Item	Non-project grant aid	Technical cooperation project	Grassroots technical cooperation	Emergency development survey	Sector project loan (SPL)	Grassroots human security grant aid
Project title	Non-project grant aid for flood countermeasures	Road technical improvement project in areas of frequent disaster occurrence	Human resources development project concerning labor-intensive road development (surface treatment) for promoting employment in Ayeyarwady	General development planning project in the southeast area	-	Bridge construction project in Kamokakyutong village, Hlinebwe in Kayin State
Implementation status	Survey completed. Handover of equipment by the end of the fiscal year (March 2013)	Detailed planning survey has been completed and the R/D has been concluded.	Under survey	Basic information collection survey under implementation	Preparations underway for the plan	Preparations underway for the plan
Project target area	Magway Region, Rakhine State, Kayin State, Bago Region, and Ayeyarwady Region. The project sites in Rakhine State and Kayin State are as follows. Rakhine State: Ann ~ Tattaung Kayin State: Hlinebwe ~ Pinekyon	Ayeyarwady Delta Region	Ayeyarwady Delta Region	Kayin State, Mon State	All states	4 areas in south of Kayin State
Project contents	Procurement of construction machinery for recovery from natural disasters and implementation of disaster prevention measures	Establishment of technical standards and training of engineers for road construction and maintenance	Transfer of technology for labor-intensive works	Regional development (roads, electric power, water)	Regional development (roads, electric power, water)	Small-scale bridge construction (4 bridges)
Implementing agency	Public Works, Ministry of Construction	Public Works, Ministry of Construction	Public Works, Ministry of Construction	State government	Public Works, Ministry of Construction	State government

Item	Non-project grant aid	Technical cooperation project	Grassroots technical cooperation	Emergency development survey	Sector project loan (SPL)	Grassroots human security grant aid
	Ministry of Health				Ministry of Electric Power, state government	

1-4 Assistance Trends of Other Donors

In the Project target area of Kayin State, assistance activities by other donors and aid agencies are limited, however, the following activities are being implemented in the road and transport fields.

Table 1-4.1 Contents of Activities by Other Donors and International Agencies (Roads and Transport Field)

Agency	Target Area	Outline
ADB (Asian Development Bank)	Kayin State	Road improvement project between Myawady near the Thai border and Kawkayeik. The road from Myawady to Thin Gan Nyi Naung along the way has already been finished, and this project intends to build a bypass to replace the existing section between Thin Gan Nyi Naung and Kawkayeik (approximately 40km). The works haven't been started yet, but survey work is currently in progress.
UNDP (United Nations Development Programme)	Kayin State	This aims to construct rural roads, culverts and bridges and assist the recovery of existing schools, roads, culverts, irrigation, wells and jetties in Hpa-An.

CHAPTER 2

CONTENTS OF THE PROJECT

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

2-1-1 Superior Objective and Project Goals

(1) Superior Objective

Out of a total 146,000 kilometers of roads in Myanmar, paved roads account for just 20% (approximately 30,000 kilometers) of the total.

Against this background, the Government of Myanmar has been advancing road construction and development based on the 30-year Road Development Plan for 2001 to 2030. Based on the premise that development of the nation is dependent on the development of roads and bridges, the Ministry of Construction, which is responsible for the Project, has made the repair of existing roads, construction of new roads and promotion of an international trunk road network its fundamental objectives, and PW of the Ministry of Construction has the central role to play until the target year.

However, because PW, which implements construction and maintenance of trunk roads (approximately 53,000 kilometers), faces problems due to the absolute shortage and deterioration of road construction and maintenance machinery, the level of progress regarding road development is inadequate.

(2) Project Goals

In order to attain the superior objective described above, the Project aims to provide road construction and maintenance equipment in Kayin State, which has many refugees and faces particularly slow development compared to the rest of the country. In doing so, the Project intends to promote the construction and maintenance of major roads (basic infrastructure for provincial areas) and contribute to the mitigation of poverty in provincial outlying areas. Through securing local major roads, which are an important element of infrastructure in these areas, it is anticipated the Project will lead to socioeconomic vitalization and improvement of living standards for citizens.

2-1-2 Outline of the Project

In order to achieve the aforementioned objectives, the Project aims to procure construction and maintenance equipment necessary for PW (the implementing agency in Myanmar) to execute works on roads and bridges targeted in Kayin State, and to implement the soft component activities that are described in detail in section 2-2-4-8 (Soft Component Plan) as part of the assistance to ensure the efficient operation and maintenance of equipment.

The equipment to be procured in the Project will comprise items needed to construct and maintain 146 kilometers of the north-south road (the Project target road, see the site map at the beginning of the report) connecting Waboetaw, Kamamaung and Phapun in Kayin State.

The contents of equipment procurement in the Project are described below.

Table 2-1.1 Amount of Construction Equipment to be Procured

	Equipment	amount	remarks
1	Bulldozer (crawler)	2	
2	Excavator (crawler)	2	
3	Wheel Loader	2	
4	Motor Grader	2	
5	Sheep foot Compactor	2	
6	Plate Compactor	5	
7	Asphalt Kettle	1	
8	Bitumen Distributor	3	
9	Chip-spreader	3	
10	Rough Terrain Crane	1	
11	Dump truck	20	
12	Water Bowser (Tanker)	4	
13	Cab-back Crane	1	
14	Low bed Semi-trailer (with Tractor Head)	1	
15	Mobile Workshop	1	
16	Inspection Vehicle	1	
17	Generator	2	
18	Equipment ledger control system	3	Desktop PC and Database software

2-2 Basic Policy

2-2-1 Design Policy

(1) Basic Policy

The equipment to be procured in the Project will comprise items necessary for PW to execute basic paving works on 146 kilometers of the north-south road (the Project target road, see the site map at the beginning of the report) connecting Waboetaw, Kamamaung and Phapun in Kayin State. The target section stretches from Waboetaw located in the outskirts of the state capital of Hpa-an to the north of the state, and because this road links with the road from the Thai border being constructed by NATALA across Thanlwin River, it is an important section for assisting the repatriation of refugees.

In examining the composition of procured equipment, the types, specifications and quantities of equipment will be determined in view of the local conditions in Kayin State based on the following conditions:

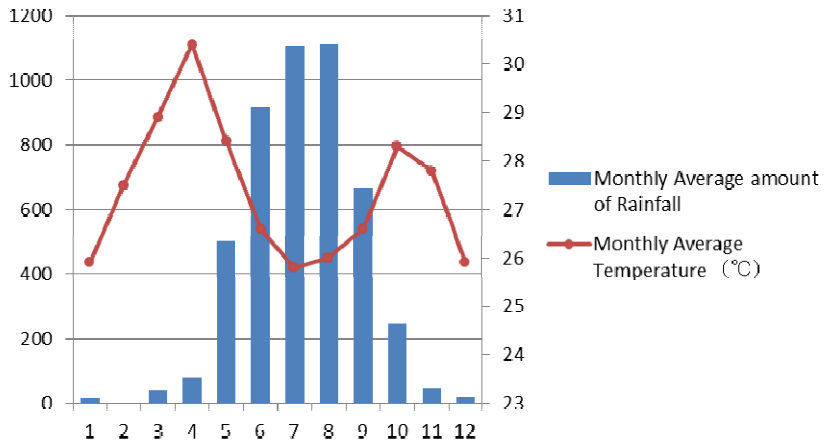
- Geographical conditions, soil quality and meteorological conditions in the area of the target road

- Current conditions of the target road
- Type, method and scale of works on the target road
- Situation regarding development of the equipment acceptance, operation and maintenance setup (organization, personnel, facilities, equipment, budget)
- Contents and conditions of the existing equipment owned by PW
- Plan for assignment of work parties by PW in the target road development
- Current conditions and setup of local private operators concerning post-delivery service for equipment
- Conditions of inland transportation of equipment, for example, transport routes and weight limitations, etc.

(2) Policy regarding Natural Environmental Conditions

In the Project target area, the dry season lasts from October to March and the rainy season is from April to September, and most of the annual rainfall of approximately 5,000 millimeters falls during the rainy season. In view of these natural conditions, since it is undesirable to conduct the main paving works during the rainy season in terms of quality control, the equipment procurement will be planned so that works can be commenced at the beginning of the dry season.

The following table shows average rainfall and average temperatures over the past five years (2007~2011) in Hpa-an, the capital of Kayin State



Source: Prepared by the Study Team based on meteorological data from the Department of Meteorology and Hydrology, Myanmar

Figure 2-2.1 Meteorological Data in the Target Area of Kayin State

(3) Policy regarding Construction and Procurement Conditions

In Myanmar, it is normal for the Ministry of Construction (the road manager) to directly conduct the construction and maintenance of roads. Concerning the Project target road too, since the implementing agency, PW, constructs and maintains roads through deploying its own budget, personnel and construction materials and so on, the relevance of the works components on the target

road will be confirmed upon considering the works performance and budget allocation of the PW Roads Department and Bridges Department, which are the direct implementing departments.

Moreover, to ensure that the target road works can be completed without delay, in the event where the equipment procured in the Project alone is deemed to be insufficient, existing equipment of PW will be deployed according to the number of executing parties.

(4) Policy regarding Utilization of Local Contractors

As was mentioned in the section on the policy regarding construction and procurement conditions, it is normal for the Ministry of Construction to directly conduct the construction and maintenance of roads. Meanwhile, although there are rock quarries in the target area, due to a lack of crushers for manufacturing roadbed rocks and so on, it is difficult for PW to procure sufficient materials using only its existing plant equipment. In view of these conditions, as a result of holding discussions with PW, the deficiency in crushed rock materials will be made up through purchasing from local private operators in the immediate area.

(5) Policy regarding Operation and Maintenance

Guidance concerning the initial operation and maintenance of the Project equipment will be conducted in OJT by instructors from manufacturers according to operation and maintenance manuals when handing over the equipment. In addition to this guidance, a soft component aimed at introducing a computerized and efficient equipment control system will be planned to ensure the sustainable operation and maintenance of the equipment after handover.

(6) Policy regarding the Grade of Equipment

In light of the above policies and results of site survey on the target road, the preconditions for configuring the Project equipment will be as indicated below.

- The total length of the target route is 146 kilometers.
- The target route predominantly consists of banking, while excavated sections account for around 30 kilometers.
- During the rainy season, since almost the entire area becomes inundated, it will be difficult to conduct works. Accordingly, the available works period is around six months in the year.
- Almost all the existing bridges on the target route are made from wood, and the allowable weight for passing vehicles on these bridges is 13 tons. Heavy machinery and works vehicles cannot pass over these bridges, however, since it will be possible to cross over rivers during the dry season, there will be no problem regarding passage by vehicles weighing more than 13 tons and heavy machinery.
- Since the target road mostly passes over plains with few rocky strata, it will be possible for general civil engineering machines to conduct works on the said route.
- Considering that the target route becomes inundated during the rainy season, since banking

works comprise the majority of the route, it will be necessary to consider the number of vehicles used for carrying banking materials.

- Many of the bridge abutments are low and since the bridge works will take place in the dry season, it will be possible for general civil engineering machines to execute the abutment foundation works. Also, it will be possible for the existing equipment of PW to conduct the concrete works.
- In consideration of the local road conditions and so on, it will be important for the road construction and maintenance equipment to comprise machines with total operating weight of 20~30 tons.
- In consideration of the facilities of Kayin State PW Hpa-an Office and the organization and personnel, etc. of the PW Equipment Department Lower Myanmar Office, which will be the central control setup following the actual supply of equipment, it is deemed that the setup for receiving, operating and maintaining the equipment in Kayin State is in place.
- PW plans to execute the works on the target route based on three teams. As a result of holding discussions with PW, two teams will use the Project equipment, and the remaining team will use the existing equipment owned by PW.
- The planned contents of works by PW in the immediate future are the repair and basic paving of existing road (12 feet wide), and it is intended to first complete basic paving over the entire target route. After that, the need for widening will be decided and implemented according to the local conditions and budget.

In light of the above conditions, the Project equipment will mainly comprise construction and maintenance equipment for general civil engineering works as well as basic paving equipment. Also, bridge works equipment, mobile workshop for maintaining equipment on sites, trailers necessary for moving equipment around sites, and other backup equipment will be added to ensure that the minimum required items for the target route works are provided.

(7) Policy regarding Implementation Schedule

After the Project equipment has been handed over, PW will implement the basic paving works over the 146 kilometers section of road between Waboetaw, Kamamaung and Phapun. The following table shows the plan of works in each year by PW.

Items \ Accounting year	2014	2015	2016	2017
Earthwork	(1,883 million Kyat) 0 - 40km	(5,622 million Kyat) 40 - 88km	(4,952 million Kyat) 88 - 146km	(4,831 million Kyat)
Double Bituminous Surface Treatment(DBST)	0 - 24km	24 - 64km	64 - 104km	104 - 146km

Note) The accounting year in Myanmar is from April to the following March, as in Japan.
Note) The pavement work not be implemented during the rainy season from May to October.
Note) Amount in Kyat in table indicates construction cost including earthwork and pavement work.
Source: Prepared by the Study Team according to the schedule planned by Public Works

Figure 2-2.2 Construction and Maintenance Schedule for the Target Road in Kayin State

The above table indicates the general schedule presented by PW at the time of the Study. In ascertaining the relevance of the schedule, since the process of spreading and compacting sub-base materials using a motor grader and sheep-foot compacter will be critical, the required lead-times are calculated as follows according to the estimated execution capacity.

Table 2-2.1 Sub-base Works Lead Time on the Target Road

Design Conditions and Calculation Item	Figure	Remarks
Work area on the target road	1,080,400 m^2	2 lanes (24 feet wide)
Lower sub-base work area	1,080,400 m^2	1 layer of roughly 20 cm thickness
Upper sub-base work area	1,080,400 m^2	1 layer of roughly 10 cm thickness
Total sub-base work area	2,160,800 m^2	
Daily work volume	833 m^2	Reduction in execution capacity is set at 75% in reference to the Japanese Ministry of Construction standard
Annual working days	180 days	Roughly 6 months in consideration of the rainy season
Total days required for spreading and compacting	2,596 days	
Required years in case of implementation by 1 party	14.4 years	
Number of assigned parties	3 teams	
Required years considering the number of assigned parties	4.8 years	

According to the above calculation, the work will take 0.8 months longer than planned by PW. Meanwhile, as is indicated in 2-2-1 Design Policy, (6) Policy regarding the grade of equipment, the planned contents of works by PW in the immediate future are the repair and basic paving of existing road (12 feet wide), and it is intended to first complete basic paving over the entire target route. The decision on whether to widen to two lanes will be made according to local conditions and budget,

however, it should be possible to at least finish works on the priority goal of repairing the existing road within the Project period. Meanwhile, design quantities of the target road should be finalized in accordance with a result from a topographic survey at site which will be conducted by PW.

In addition, there are 224 existing bridges of varying size on the target section. These comprise 204 bridges with length of 50 feet (approximately 15.2 meters) or less and 20 bridges of more than 50 feet, and PW intends to complete repair works on all the wooden bridges, etc. that require repair during the above schedule.

2-2-2 Basic Plan

(1) Overall Plan

In examining the location for handover of the Project equipment, consideration was given to the PW Kayin State Office or PW related facilities in the vicinity. As a result of holding discussions with PW and conducting field survey, it was concluded that the following locations would be ideal for handover.

1) Premises of PW Road Construction Special Unit No. 9 (location for handover of main equipment)

This PW facility is situated next to Thanlwin Bridge, which crosses Thanlwin River in the outskirts of Hpa-an in Kayin State. This unit has been permanently dispatched by PW Head Office in order to maintain roads under the jurisdiction of PW in Kayin State, and it will be the team that conducts the works on the target road in the Project.

The facilities of this unit are located approximately 20 kilometers from the start point of the target road in a site that offers good access. In consideration of the geographical merits of this location, it will be used as the site for handing over the major items of equipment.

2) PW Kayin State Office (location for handover of mobile workshop and spare parts)

This is an outpost agency of PW in Kayin State. Since it has a sub-workshop on its premises and it is in charge of the simple maintenance and repair of owned equipment in the area under jurisdiction, it will be used as the site for handing over the mobile workshop and spare parts.

Figure 2-2.3 shows the location of the above two facilities.

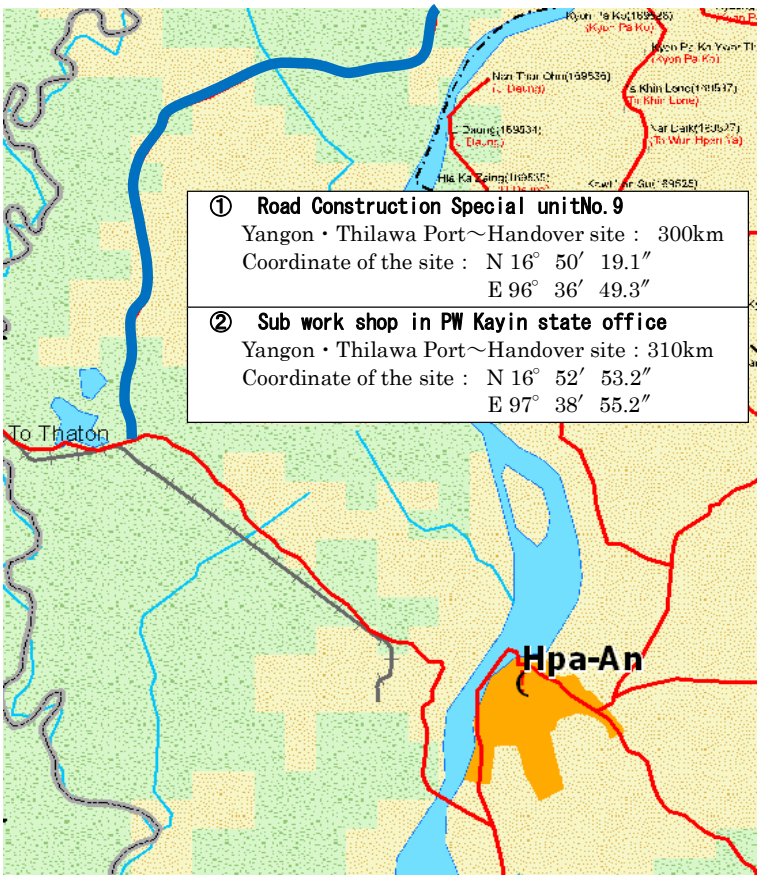


Figure 2-2.3　Location Map of Equipment Handover Sites

(2)　Equipment Plan

The procured equipment, intended to execute basic paving and bridge works on the target road in Kayin State, will mainly comprise bulldozers, excavators, asphalt sprayers, cranes and haulage vehicles for the civil engineering works, and the mobile workshop, etc. for conducting basic maintenance of equipment on sites. In examining the quantities and basic specifications of equipment, the following conditions are assumed:

- It will be possible to efficiently implement repair works on the target road.
- The fitments and size of equipment will be enough to allow the safe operation of equipment.
- Equipment maintenance costs will not become an excessive burden.
- The equipment has good mobility.

Table 2-2.2 indicates the contents (basic specifications, procured quantity, purpose of use) of the equipment deemed to be appropriate in view of the above points, and Table 2-2.3 indicates the reasons for selecting those specifications.

Table 2-2.2 Contents of the Procured Equipment in the Project

	Equipment	Specification	Amount	Purpose	
				Road Construction	Bridge Construction
1	Bulldozer (crawler)	Operation weight: 20-22t Rated output of Engine: 130kW Blade Width: not less than 3,300mm Blade Height: not less than 1,200mm	2	Scraping of earth, leveling of banking materials, earth removal, earth pushing, grading, compaction, etc.	Ditto For use on earth works before and after bridges
2	Excavator (crawler)	Operation weight: 19-26t Rated output of Engine: not less than 100kW Bucket size: not less than 0.8 m^3 (heaped capacity)	2	Earth excavation, loading, removal, slope forming, etc.	Ditto For use on substructure works and earth works before and after bridges
3	Wheel Loader	Rated output of Engine: not less than 120kW Bucket size: not less than 2.4m^3 (heaped capacity)	2	Loading of earth onto dump trucks in collection areas, collection and loading of rocks in quarries, etc.	Ditto For use in civil works locations
4	Motor Grader	Operation weight: not less than 14t (with scarifir) Rated output of Engine: not less than 130kW Blade length: 3,700-4,100mm Blade height: 500-800mm	2	Leveling and grading of subgrade and sub-base materials	—
5	Sheep foot Compactor	Operation weight: not less than 10t Rated output of Engine: not less than 80kW Vibration frequency : 28/30Hz and over Centrifugal Force: 150/200kN and over	2	Compaction and rolling of subgrade and sub-base materials	—
6	Plate Compactor	Operation weight: not less than 50-60kg Rated output of Engine: not less than 2kW Vibration frequency: not less than 95Hz Amplitude: not less than 8kN	5	Rolling compaction in areas that are inaccessible to large rollers, rolling compaction of foundation crushed stone in road drainage structures, etc.	Ditto Fine rolling compaction work on paving joints, etc. on bridges
7	Asphalt Kettle	Tank capacity: 3,000ℓ Transfer pump capacity: 150 ℓ／min or more	1	Heating and melting of asphalt blocks	—
8	Bitumen Distributor	Tank capacity : 4,000 ℓ Transfer pump capacity: not less than: 300ℓ／min	3	Spraying of asphalt and emulsion, etc.	—
9	Chip-spreader	Rated output of Engine: not less than 2.5kW Spreading Material Size: From under 50mm stone aggregate to sands Spreading width:200-2400	3	Spreading of stones and sand, etc. of unit particle size	—

		mm			
10	Rough Terrain Crane	Operation weight: not less than 26t Max lifting capacity: 30*t*	1	Loading and unloading of equipment and materials	Ditto For use mainly in loading and installation of reinforcing bars and formwork on concrete bridges
11	Dump truck	Operation weight: not more than 26t Max. payload：14t	20	Conveyance of excavated earth and crushed stone, etc.	Ditto
12	Water Bowser (Tanker)	Operation weight: not more than 23t Water tank capacity: 10,000 ℓ	4	Adjustment of water content in banking materials and sub-base materials, etc., cleaning by water sprinkling, sprinkling to prevent dust and so on	—
13	Cab-back Crane	Operation weight: not more than 10t Crane capacity: 3t	1	Loading, unloading and carrying of equipment and materials	Ditto For use in loading, unloading and carrying of relatively lightweight equipment and materials, for example, members for removal of wood bridges, equipment and materials for construction of new RC bridges and so on
14	Low bed Semi-trailer (with Tractor Head)	Max payload: 35t Carrier size: 8,000×2,900-3,200mm	1	Carrying of equipment	Ditto
15	Mobile Workshop	Drive type: 4×4 drive Crane capacity: 3t Accessories: machine and tool set for maintenance	1	Traveling repairs and periodic maintenance of equipment	Ditto
16	Inspection Vehicle	Drive type: 4 × 4 drive Double cab	1	Site patrols	Ditto
17	Generator	Rated output：125 kVA	2	Power supply to drainage pumps and other equipment	Ditto For use in power supply mainly to concrete vibrators and concrete mixers, etc.

Note) According to the Guidelines for Preparing Grant Aid Reports (March 2011), the equipment ledger control system is omitted from this table because it is less than 1 million yen.

Table 2-2.3 Reasons for Setting Equipment Specifications

	Equipment	Specification	Precondition
1	Bulldozer (crawler)	Operation weight: 20-22t Rated output of Engine: 130kW Blade Width: not less than 3,300mm Blade Height: not less than 1,200mm	Since the main tasks will be digging up of existing sub-base materials (cobble stones with diameter of 20 cm or more) on the target road, ground excavation and earth pushing for road widening, the equipment specifications will provide sufficient output for conducting excavation and earth pushing work with a medium-size ripper. The equipment will also be used for earth removal, collection and compacting, etc. in temporary storage areas for excavated earth.
2	Excavator (crawler)	Operation weight: 19-26t Rated output of Engine: not less than 100kW Bucket size: not less than 0.8 m^3 (heaped capacity)	Since the main tasks will be ground excavation, banking earth collection, slope forming and abutment excavation for widening of existing road, a 20-ton excavator will be adopted in consideration of mobility and general versatility.
3	Wheel Loader	Rated output of Engine: not less than 120kW Bucket size: not less than 2.4m^3 (heaped capacity)	Since the main tasks will be collection of banking earth and loading into dump trucks, specifications will be selected to match with the size of the dump trucks.
4	Motor Grader	Operation weight: not less than 14t (with scarifir) Rated output of Engine: not less than 130kW Blade length: 3,700-4,100mm Blade height: 500-800mm	Since flatness is required in subgrade forming and leveling of sub-base materials, blade length that is suited to the target road width and output that is suited to the target work will be adopted in the specifications.
5	Sheep foot Compactor	Operation weight: not less than 10t Rated output of Engine: not less than 80kW Vibration frequency : 28/30Hz and over Centrifugal Force: 150/200kN and over	This will be used for compacting subgrade and sub-base materials. Originally a 25-ton macadam roller was requested, however, equipment that has sheep-foot and flat-roll functions and similar roll compaction performance to a 25-ton class macadam roller will be adopted.
6	Plate Compactor	Operation weight: not less than 50-60kg Rated output of Engine: not less than 2kW Vibration frequency: not less than 95Hz Amplitude: not less than 8kN	This is essential equipment for performing compaction in areas that cannot be reached by large roller. In view of functions and convenience, equipment in the 50~60 kg class will be adopted.
7	Asphalt Kettle	Tank capacity: 3,000ℓ Transfer pump capacity: 150 ℓ／min or more	This is essential equipment for heating and melting the bronn asphalt (asphalt blocks) for feeding to the asphalt distributor. Considering the asphalt conveyance efficiency and compatibility with the asphalt distributor, an installed type is good, however, a portable type with capacity suited to mobility will be adopted.
8	Bitumen Distributor	Tank capacity : 4,000 ℓ Transfer pump capacity: not less than: 300ℓ／min	In order to efficiently secure asphalt of uniform quality from the asphalt kettle, the spray width will be sufficient to allow one lane to be covered in two trips. Also, easy adjustment of the spray width and quantity and mobility will be considered in the specifications.

9	Chip-spreader	Rated output of Engine: not less than 2.5kW Spreading Material Size: From under 50mm stone aggregate to sands Spreading width:200-2400 mm	Following asphalt spraying, since stones or sand of uniform particle size will be sprinkled on the asphalt, surface damage and abrasion will be mitigated through securing efficient paving work and uniform sprinkling quantity and width and improving work quality. The dump truck-loaded tailgate type will be adopted since this allows the sprinkling width to be adjusted according to the asphalt distributor and is also better in terms of work efficiency.
10	Rough Terrain Crane	Operation weight: not less than 26t Max lifting capacity: 30*t*	Specifications that are suitable for loading and unloading asphalt kettle and generator, etc. and concrete or steel bridge members will be adopted. Moreover, in order to use for moving and hanging materials in bridge substructure works, specifications that allow for long boom, mobility and easy operation will be adopted.
11	Dump truck	Operation weight: not more than 26t Max. payload：14t	The main purposes of use will be carrying of excavated earth, sub-base materials and paving materials, and in consideration of the amount of earth works and site conditions, dump trucks in the 10 m^3 and 14 ton class will be adopted for the sake of higher efficiency.
12	Water Bowser (Tanker)	Operation weight: not more than 23t Water tank capacity: 10,000 ℓ	Since appropriate water content has an impact on work quality when compacting and rolling banking materials and sub-base materials, etc., tank capacity and vehicle specifications will be selected in consideration of the efficiency of water carrying, mobility and suitability to site conditions. Moreover, this road sprinkler will be used to carry water for kneading concrete on site.
13	Cab-back Crane	Operation weight: not more than 10t Crane capacity: 3t	Since this will mainly be used for loading and unloading members for removal of wood bridges, and loading, unloading and installation of equipment and materials for construction of new RC bridges, specifications will be selected with a view to securing mobility suitable for such work.
14	Low bed Semi-trailer (with Tractor Head)	Max payload: 35t Carrier size: 8,000×2,900-3,200mm	This will be used to rapidly conduct the carrying-in to sites, removal and transfer of construction machinery and carrying of bridge superstructure long members. Therefore, the trailer specifications will be selected to ensure the safe loading and transportation of such heavy objects. Accordingly, in consideration of the maximum load for existing bridges, specifications will be selected to allow safe haulage of trailers with tractor head load of 35 tons.
15	Mobile Workshop	Drive type: 4×4 drive Crane capacity: 3t Accessories: machine and tool set for maintenance	Since implementing visit repairs and periodic maintenance work on sites is essential for ensuring the efficient operation of equipment, this vehicle will facilitate such work. The vehicle will be a 4WD truck for better mobility, and it will be equipped with maintenance equipment and tools suitable for periodic maintenance work.

16	Inspection Vehicle	Drive type: 4 × 4 drive Double cab	In order to advance the target road repair works according to plan, it will be necessary to conduct site safety management and execution management efficiently. Accordingly, specifications will be suited to the local conditions and allow for smooth and safe running on works sites.
17	Generator	Rated output：125 kVA	Specifications will allow for sufficient power supply capacity necessary for the water drainage pumps, concrete vibrators, concrete mixers, maintenance equipment and other electrical equipment used in the road repair works.

The following section describes the basis for setting the quantities of equipment.

(3) Equipment Procurement Quantities

In deciding the quantities of equipment required to execute the works on the target road, basically the minimum required one or two units of each machine will be set for each work party.

However, on the Project target section which has a high ratio of banking works, the number of dump trucks used for carrying materials for the earth works (ground excavation and banking, etc.) and paving works will have a direct impact on the carried quantity. Therefore, the procured number of dump trucks will be calculated upon considering the existing equipment owned by PW in light of the rough quantities of earth and f crushed rocks that need to be carried.

Table 2-2.4 indicates the number of dump trucks to be procured in the Project and the number of existing dump trucks that PW needs to deploy in consideration of PW plans.

Table 2-2.4 Calculation of the Required Number of Dump Trucks

Setting Conditions and Calculation Items		Quantity	Remarks
Carried distance by dump trucks		20 km	Distance from site to earth quarry and rock crushing plant (return trip)
Running speed of dump trucks		20 km/h	
Amount carried per dump truck		10 m^3	
Operating days per year		150 days	25 days/year x 6 months (dry season only)
Amount carried per truck per day		80m^3	8 return trips/truck per day
PW planned work schedule		Approx. 4 years	Schedule following equipment procurement
Amount of earth that can be moved per day		1,600m^3	
Earth carrying	Rough volume of earth works	1,844,000m^3	Scheduled quantity following equipment procurement. In Kayin State, it will be possible to utilize materials obtained from cutting as banking earth.
	Period of earth works	3 years	
	Number of operating days required for completion of work	450 days	
	Amount of earth that needs to be moved per day	4,098 m^3/day	
	Number of trucks that need to be deployed **(A)**	52 trucks	

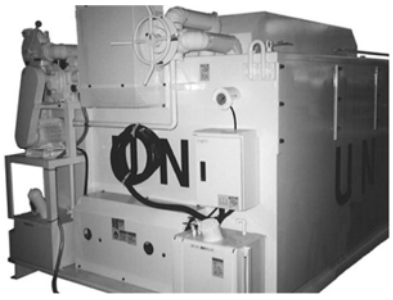
Crushed stone carrying	Rough volume of crushed rocks	380,000 m^3	Quantity scheduled following procurement of equipment
	Area constructed per day (no consideration of correction)	1,580 m^2	
	Area constructed per day (with consideration of correction)	1,185 m^2	Asian region 75%
	Executed volume per day	633 m^3	Considering deployment of 3 parties
	Number of trucks that need to be deployed **(B)**	8 trucks	
	Number of operating days required for completion of work	600 days	
	Work years	4 years	Work is possible within the PW planned schedule.
Required number of trucks calculated from earth carrying and crushed rock carrying **(A)+(B)**		60 trucks	
Number of dump trucks procured in the Project		20 trucks	
Number of dump trucks deployed by PW		40 trucks	Work period following equipment procurement

As is indicated above, it will be necessary to deploy a total of 60 dump trucks for the target road works in Kayin State, and roughly 30% of the required number will be procured in the Project. Meanwhile, it will be necessary to deploy 40 dump trucks to the Project works by the Myanmar side.

2-2-3 Outline Design Drawings

Reference drawings of the main construction machinery in the Project are indicated below. Incidentally, dimensions indicated in the reference drawings are reference values.

Table 2-2.5 Reference Drawings of Main Construction Machinery

1. Bulldozer (crawler)	2. Excavator (crawler)
	
3. Wheel Loader	4. Motor Grader
	
5. Sheep foot Compactor	6. Plate Compactor
	
7. Asphalt Kettle	8. Bitumen Distributor
	
9. Chip-spreader	10. Rough Terrain Crane
	

11. Dump truck	12. Water Bowser (Tanker)
	
13. Cab-back Crane	14. Low bed Semi-trailer (with Tractor Head)
	
15. Mobile Workshop	16. Inspection Vehicle
	
17. Generator	—
	—

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The Project will be implemented based on the Government of Japan's Grant Aid scheme. According to this, the Project will receive approval by the Government of Japan, and the two countries' governments will sign the Exchange of Notes (E/N) and the Grant Agreement (G/A). The Japanese Consultant, recommended by the Japan International Cooperation Agency (JICA), will bind a contract with the implementing agency in Myanmar concerning execution of work for the tender and supervision of construction and maintenance equipment procurement. The Consultant will supervise the main work component to ensure that the Project is executed smoothly and appropriately. Below is indicated the basic items and points that require particular consideration in the event of Project implementation.

(1) Project Implementing Entities

The responsible and supervisory agency on the Myanmarese side will be the Ministry of Construction, and the implementing agency will be PW under the said ministry. Also, following handover of the construction and maintenance equipment, PW will be in charge of the appropriate operation and maintenance of the said equipment.

(2) Consultant

In order to supervise preparation of the tender specifications and the procurement and installation of the construction and maintenance equipment in the Project, the Myanmarese side will bind a consultant supervision agreement with the Consultant that is recommended by the Japan International Cooperation Agency (JICA). Moreover, the Consultant will also implement the soft component in order to ensure the appropriate operation and maintenance of construction and maintenance machinery and strengthening of spare parts management.

(3) Procurement Agent

In accordance with the framework of Japan's Grant Aid scheme, the procurement agent that has been selected in competitive tender will implement the procurement, transportation, on-site assembly, initial operation and operating guidance, etc. of the Project construction and maintenance machinery.

Following completion of the Project, since it will be necessary to continue supplying spare parts and conducting post-installation service to resolve breakdowns and so on, it will be necessary for the procurement agent to conduct liaison and coordination after the handover of equipment.

2-2-4-2 Implementation Conditions

(1) Suppliers

Because the construction and maintenance machinery scheduled for procurement in the Project is not manufactured or produced in Myanmar, equipment made by Japanese manufacturers will be selected. However, since some Japanese machine and vehicle makers, etc. have suspended domestic manufacturing and transferred their production and manufacturing bases to overseas plants, machines that have been produced at domestic or overseas plants (Thailand etc.) by Japanese makers will be procured, and the port of lading will be determined appropriately. Table 2-2.6 shows the suppliers of the major items of machinery.

Table 2-2.6 Equipment Suppliers, etc.

No.	Equipment	Specification	Procured from		
			Japan	Myanmar	Thailand or other
1	Bulldozer (crawler)	Operating weight:20-22t	○		
2	Excavator (crawler)	Bucket size:0.8m^3	○		
3	Wheel Loader	Bucket size:2.4m^3	○		
4	Motor Grader	Blade length：3.7-4.1m	○		○
5	Sheep foot Compactor	Centrifugal force ：150/200kN	○		
6	Plate Compactor	Centrifugal force：8.0 kN	○		
7	Asphalt Kettle	Tank capacity：3,000 ℓ	○		
8	Bitumen Distributor	Operating weight：4,000 ℓ	○		
9	Chip-spreader	Spreading width:200-2,400 mm	○		
10	Rough Terrain Crane	Max lifting capacity：30t	○		
11	Dump truck	Max payload：14t	○		
12	Water Bowser (Tanker)	Water Tank Capacity：10,000 ℓ	○		
13	Cab-back Crane	Max operating weightMax payload：10t, 3t for crane	○		
14	Low bed Semi-trailer (with Tractor Head)	Max payload：35t	○		
15	Mobile Workshop	4 wheel drive, with machine and tools formaintenance	○		
16	Inspection Vehicle	4 wheel drive			○
17	Generator	Rated output：125 kVA	○		

(2) Implementation Planning Conditions

- The Project target area usually has its dry season from October to March and rainy season from April to September. During the period of heaviest rain in July and August, provincial access roads sometimes become impassable due to inundation. Therefore, it will be necessary to avoid this period when conducting inland transportation following the landing of equipment at Tirawa Port in Myanmar.
- Since parts of the inland transportation route have deteriorated paving, running speeds will fall on these parts. Moreover, there are numerous bridges that are subject to weight restrictions along the route. Therefore, since limitations will be imposed in terms of the transportation route and carrying capacity, it will be necessary to demonstrate caution when compiling the transportation plan and planning the schedule. Furthermore, when passing through built-up areas, because power lines and telephone lines and so on are low, it will be necessary to take steps to prevent lines from being severed. Therefore, it will be important to detach cabins from graders and bulldozers when transporting inland.

2-2-4-3 Scope of Works

The Japanese side will be responsible for the inland transportation of equipment from the port of landing to the PW facility where the equipment will be handed over, and the Myanmarese side will be responsible for transporting equipment from these to each target site. Moreover, the Myanmarese side will procure the construction materials necessary for constructing the target road.

Moreover, Table 2-2.7 shows the detailed scope of works on the Japanese and Myanmarese sides.

Table 2-2.7 Scope of Works

No.	Item	Scope		Remarks
		Japanese Side	Myanmarese Side	
1	Securing of storage area for construction and maintenance equipment and expendable parts		○	
2	Securing of site office		○	As the need arises
3	Manufacture and procurement of construction machinery	○		
4	Inland transportation of construction machinery	○		Between the port of shipping by the maker
5	Sea transportation, customs clearance procedure and handling of taxes			
	(1) Responsibility for sea transportation and air transportation of construction and maintenance equipment to Myanmar	○		
	(2) Tax exemption and customs clearance procedures at the port of discharge		○	
	(3) Inland transportation of construction and maintenance machinery from the port of discharge to the handover location	○		

No.	Item	Scope		Remarks
		Japanese Side	Myanmarese Side	
6	Appropriate operation and management of the construction and maintenance equipment and expendable parts		○	
7	Procedures and measures necessary for acquiring the following permits: ■ Permits necessary for the passage of heavy vehicles ■ Permission for access to restricted areas ■ Permission for entry by Japanese nationals		○	The vehicles procured in the Project will be registered and prepared for driving on public roads without delay after handover.
8	Assembly and adjustment of construction and maintenance equipment	○		
9	Handover inspection, machinery initial operating guidance and maintenance guidance	○		The Myanmarese side will secure and assign the personnel to participate in the said guidance.
10	Bearing of other costs not included in the grant aid		○	
11	Payment of the following commissions based on the Banking Arrangement: ■ Cost of opening an account in a Japanese certified foreign exchange bank ■ Bearing of payment commissions		○	

Note: ○: Indicates the scope of responsibility regarding each item

2-2-4-4 Consultant Supervision

Based on the Government of Japan's Grant Aid scheme, the Myanmarese side will bind a consultant supervision agreement with the Consultant that is recommended by JICA and strive to ensure the smooth implementation of implementation design and procurement supervision.

Moreover, where necessary, it will dispatch specialist engineers to witness the plant inspections and pre-shipping inspections of the construction and maintenance equipment that is manufactured in Japan, and conduct supervision in order to prevent the occurrence of troubles after the equipment has been brought onto sites.

(1) Basic Policy of Consultant Supervision

As the basic policy of supervision, the Consultant will supervise progress of the overall plan to ensure the Project finishes on schedule, and it will conduct supervision and guidance of the procurement agent under cooperation by the Myanmarese side to ensure that the quality specified in the contract is secured and the Project is safely implemented.

The major points to bear in mind in the procurement supervision are described below.

1) Schedule control

The Consultant will compare progress with the implementation schedule decided by the procurement agent in the contract every month or every week in order to adhere to the delivery deadline given in the contract. In cases where delays are predicted, the Consultant will warn the procurement agent, demand the submission and implementation of a plan of countermeasures, and offer guidance to ensure the Project is finished on schedule.

- Confirmation of work performance in manufacture and procurement of construction and maintenance equipment
- Confirmation of shipping arrangement and inland transportation methods for transporting the construction and maintenance equipment
- Confirmation of the assignment of personnel concerned with assembly of construction and maintenance equipment and guidance on initial operations, etc.

2) Quality control

The Consultant will implement supervision based on the following items to determine whether the quality of construction and maintenance equipment stated in the contract documents (technical specifications, approved design drawings, etc.) is secured by the procurement agent. In cases where doubts arise over quality, the Consultant will demand that the procurement agent make amendments, revisions or corrections.

- Checking of shop drawings and specifications of construction and maintenance equipment
- Attendance of plant inspections of construction and maintenance equipment and checking of plant inspection results
- Checking of construction and maintenance equipment assembly guidelines, and site test, adjustment and inspection guidelines
- Supervision of the site assembly of construction and maintenance equipment and witnessing of trial operation, adjustment and inspection

3) Safety control

Discussions will be held and cooperation will be sought with the procurement agent and supervision will be conducted during the Project implementation period in order to prevent the occurrence of industrial accidents or other incidents. Important points to consider in safety control on the ground are as follows

- Establishment of safety control regulations and appointment of manager
- Prevention of accidents through inspection of safety devices on work tools and equipment, etc.
- Planning of inland transportation routes, enforcement of slow driving and prevention of load collapse
- Wearing of safety gear (helmets, safety boots, gloves, etc.)

(2) Overall relationships for Project implementation

Figure 2-2.4 shows the relationships between the Project implementing parties including the consultant supervision.

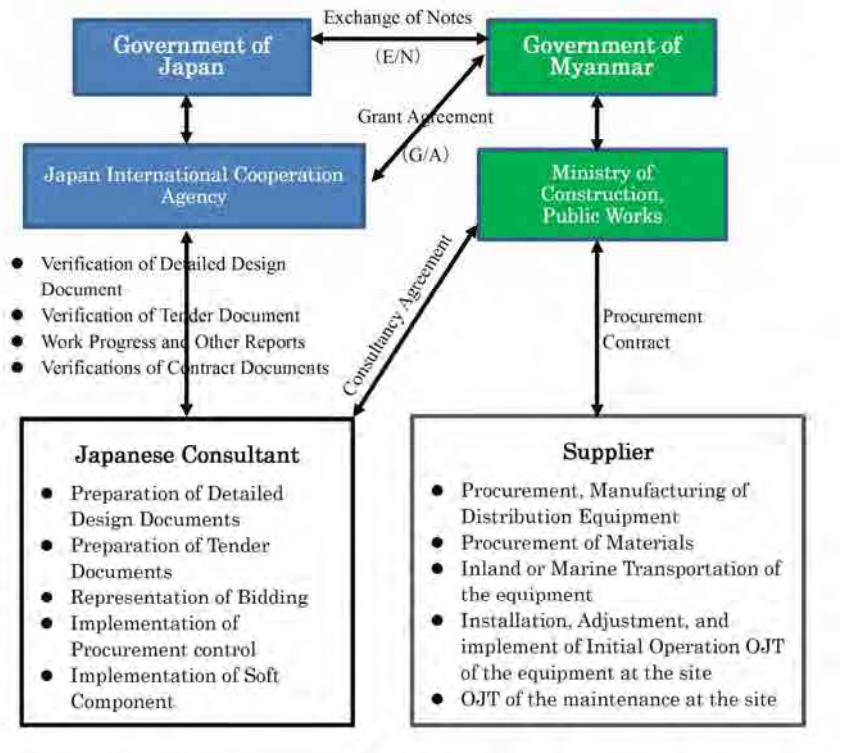


Figure 2-2.4 Project Implementation Relationships

(3) Procurement supervisor

The procurement agent will procure and assemble the construction and maintenance equipment and implement the initial operational guidance, etc. based on the contract with the Myanmarese side. It will also conduct schedule control, quality control and safety control during the work, although the Consultant's procurement supervisor will instruct and supervise the procurement agent.

2-2-4-5 Quality Control Plan

The Consultant will implement supervision based on the following items to determine whether the quality of construction and maintenance equipment stated in the contract documents (technical specifications, approved design drawings, etc.) is secured by the procurement agent. In cases where doubts arise over quality, the Consultant will demand that the procurement agent make amendments, revisions or corrections.

- Checking of shop drawings and specifications of construction and maintenance equipment
- Attendance of plant inspections of construction and maintenance equipment and checking of plant inspection results
- Checking of packing, transportation and temporary storage methods on site

- Checking of construction and maintenance equipment assembly guidelines, and site test, adjustment and inspection guidelines
- Supervision of the site assembly of construction and maintenance equipment and witnessing of trial operation, adjustment and inspection

2-2-4-6 Procurement Plan

Because the construction and maintenance machinery and expendable parts scheduled for procurement in the Project are not manufactured or produced in Myanmar, the main machinery will basically be procured in Japan. However, since some Japanese makers have suspended domestic manufacturing and transferred their machine, vehicle and parts production and manufacturing to overseas plants, the scope of procurement will be extended to include such overseas production facilities.

Irrespective of the country of procurement, all the procured equipment will have the Government of Japan ODA symbol applied either by paint or by sticker.

2-2-4-7 Soft Component (Technical Assistance) Plan

To ensure that the operation and maintenance of equipment procured in the Project, which is the responsibility of the local side, is implemented appropriately, the operation and maintenance setup of the implementing agency will be strengthened.

The existing road construction and maintenance equipment in Kayin State is centrally controlled by the Mechanical Equipment Compound (Mayangone Township in Yangon) of Public Works, Ministry of Construction. From here, equipment is allocated to states including Kayin under the Compound's jurisdiction. The Mechanical Equipment Compound also controls spare parts for equipment. Although the Compound conducts actual control, its ledgers are paper-based and there are numerous problems in the system, for example, due to the complicated procedure for deleting equipment from the ledger, equipment is discarded in the Compound yard until this is completed.

In view of these circumstances, the soft component will be implemented according to the following contents. See the Soft Component Plan in the appendices for detailed contents of the plan.

(1) Improvement and enhanced efficiency of operation and maintenance management (ledger control) for construction and maintenance equipment

1) Objective
   - Improvement of the equipment management system for equipment procured in the Project

2) Implementation method and contents
   - Soft component implementing party: Consultant
   - Implementation site: PW Mechanical Equipment Compound (Mayangone Township in Yangon) and PW Kayin State Office
   - Implementation period: 1.2 months practical guidance and 0.5 months evaluation and

follow-up

- Targets: Central equipment control personnel and Kayin State technical employees (roughly 30 members in total)
- Creation of the following manuals and plans
  - Construction and maintenance equipment operating record manual (operating log)
  - Construction and maintenance equipment operation and maintenance manual (spare parts control ledger)
  - Control software for the above (general-purpose software)
- Staging of workshops
  - Practical learning that utilizes the above manuals and PCs
- Practical learning equipment
  - 3 sets of desktop computer and database software will be procured and utilized as the practical learning equipment.
  - Allocation destinations of the procured practical learning equipment
    - Mechanical Equipment Compound (Mayangone Township in Yangon) [For general management]
    - PW Kayin State Office in the state capital Hpa-an [For management of equipment in Kayin State]

(2) Pilot execution utilizing the construction and maintenance equipment

1) Objective
   - OJT in the ledger control system via pilot execution utilizing the Project equipment
2) Implementation method and contents
   - Soft component implementing party: Consultant
   - Implementation site: Target road in Kayin State (section of approximately 200 meters from the road start point of Waboetaw)
   - Implementation period: 1.5 months
   - Targets: Central equipment control personnel and Kayin State technical employees (roughly 30 members in total)
   - Creation of the following manuals and plans
     - Construction and maintenance equipment operating record manual (operating log) (utilize the manual prepared above)
     - Construction and maintenance equipment operation and maintenance manual (spare parts control ledger) (utilize the manual prepared above)
     - Control software for the above (general-purpose software) (utilize the software prepared above)
3) Practical learning equipment
   - Procured equipment
   - The desktop computer and database software that were used in (1) will be utilized.

2-2-4-8 Implementation Schedule

The implementation schedule for the implementation design and procurement supervision to be conducted by the Japanese side is set as follows.

Table 2-2.8 Implementation Schedule

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
TENDERING STAGE	4 month														
Preparation of Tender Document															
Obtaining of Approvals for the Tender Document															
Tender Opening (in Japan)															
Tender Evaluation,Concluding the Contract with the Successful Tenderer															
PROCUREMENT / MANUFACTURING AND TRANSPORTATION	14 month														
Preparation for Manufacturing Drawings by the Supplier															
Procurement, Manufacturing, Transportation and set up of Equipment and Machinery															
OJT for Operation at the Site															
SOFT COMPONENT															

2-3 Obligations of Recipient Country

Following the conclusion of the E/N, the Myanmarese side will implement the following tasks based on cooperation of the responsible agency and each implementing agency.

- Following conclusion of the E/N, it will immediately open an account with a Japanese bank. Moreover, the Myanmarese side will bear any costs incurred in opening the account.
- There should not be any additional import of equipment and materials in the Project, however, if import does become necessary, the Myanmarese side will promptly secure landing and take customs clearance steps.
- With respect to Project officials (Japanese and third country nationals), it will take steps to ensure the entry to Myanmar, stay therein and safety.
- It will exempt or bear any tariffs and domestic taxes that would otherwise be levied on the services, equipment and materials and Japanese nationals related to the Project.
- It will operate and surely maintain the roads and incidental facilities that are constructed under Japan's grant aid.
- It will bear any other costs that are necessary for the Project but are not included in the grant aid.
- It will secure sites to store the equipment and expendable parts procured in the Project

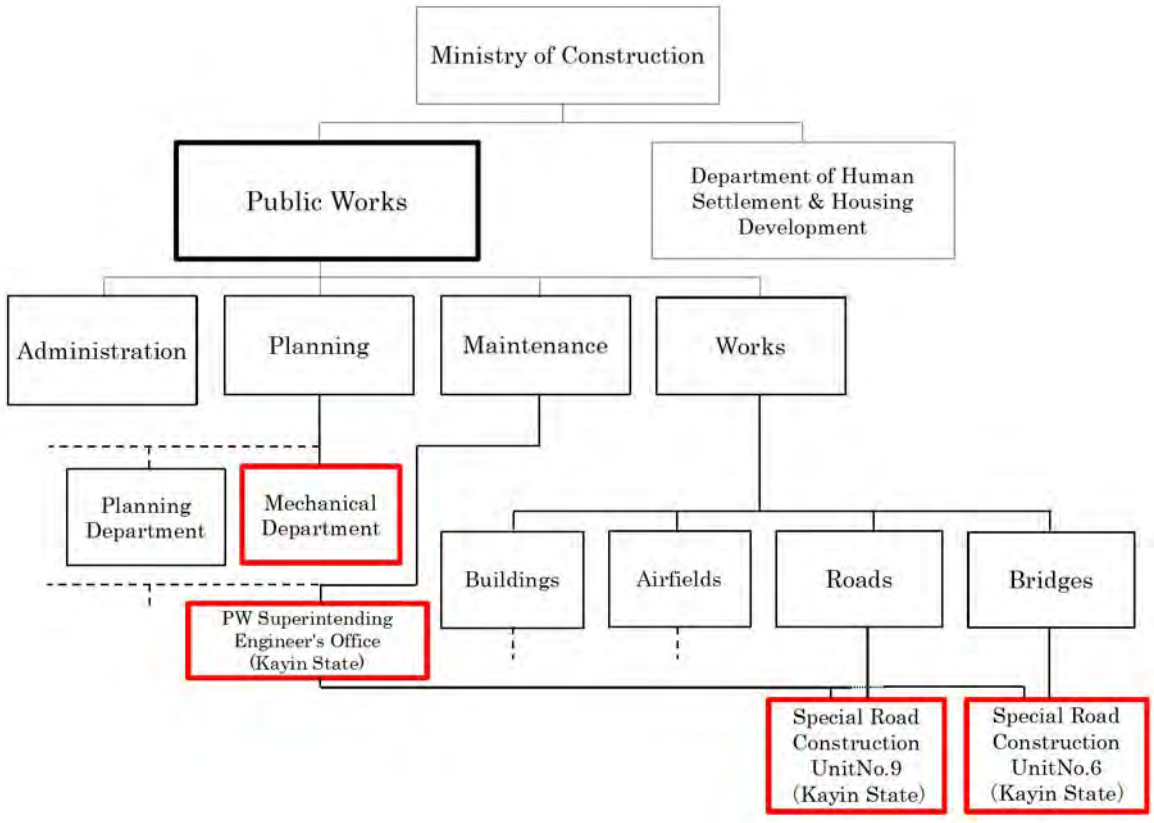
and implement appropriate operation and maintenance.

- It will secure the budget, personnel and materials needed to execute works on the target road and promptly start work following the handover of equipment.
- In the case where additional road area needs to be secured for constructing and maintaining the target road in the Project, it will certainly secure the necessary land according to Myanmarese laws to ensure that the works can be started without delay.
- In the case where authorization needs to be secured from government offices, it will apply for and secure the necessary authorization.

PW, the implementing agency, has the capacity to allocate budget and personnel to conduct road construction and maintenance following the handover of equipment. Moreover, since it has been confirmed in site survey that the storage site for the procured equipment has already been secured, it is deemed that the local side can fulfill its obligations.

2-4 Project Operation and Maintenance Plan

Following handover of the Project equipment, PW will implement works on the target road in Kayin State. The following figure shows the works implementation setup of PW.



Source: Public Works

Figure 2-4.1 Public Works Organization Chart

The construction and maintenance works on the road and bridges along the target route in the Project will be directly implemented by the Roads Department and Bridges Department of PW. The

Roads Department and Bridges Department have respectively assigned Road Construction Special Unit No. 9 and Bridge Construction Special Unit No. 6 as roads and bridges works teams in Kayin State, and these units will execute the road and bridge construction and maintenance works in the Project.

The Project equipment will be handed over and stored inside the premises of Road Construction Special Unit No. 9. Moreover, PW Kayin State Office will be in charge of the routine maintenance of the procured equipment, while expendable parts for the equipment will be stored in the sub-workshop located next to the office. PW Kayin State Office will periodically report on the operating condition and maintenance of equipment to the Lower Myanmar Mechanical Equipment Compound in Mayangone Township in Yangon.

Based on the procured equipment maintenance plans and reports from the PW Kayin State Office, the Mechanical Equipment Compound will prepare appropriate stores of expendable parts and conduct the efficient operation and maintenance of equipment.

PW basically has facilities for conducting maintenance work on equipment, however, it is intended to implement a soft component (technical guidance) of initial control and operational guidance on handover geared to realizing even more efficient operation and maintenance. Incidentally, spare parts and expendable items can be purchased via local agents and so on.

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

Myanmar side must pay costs shown in the following.

<table>
<tr><th colspan="2">Items</th><th colspan="2">Cost Amount（USD）</th></tr>
<tr><td rowspan="2">Road and Bridge construction of the project site in Kayin state</td><td>Road construction</td><td>21million</td><td rowspan="2">32 million</td></tr>
<tr><td>Bridge construction</td><td>11 million</td></tr>
<tr><td colspan="2">Commissions to the bank based on Banking Arrangement</td><td colspan="2">9,600</td></tr>
</table>

Note）PW plans to complete construction work of the project site by the end of fiscal year 2017.

Conditions of cost estimation are as follows.

1. Timing of cost estimation : August 2012
2. Exchange rate : 1USD = 81.06 JPY

2-5-2 Operation and Maintenance Cost

In order for PW to efficiently operated the Project equipment, it will be essential for PW itself to conducted sustainable maintenance. Therefore, it will be necessary for PW (the implementing agency) to take the necessary budget steps and conduct appropriate maintenance based on efficient operation and maintenance plans.

It generally costs between 2~5% of the original equipment cost for maintenance works (periodic maintenance such as overhaul works, and site repairing works and so on.) of construction equipment each year, and it is also necessary to purchase fuel for operation. In the case of the Project equipment, it is estimated that maintenance and fuel costs each year will be USD250,000 and USD 400,000 respectively on the target road, and it will be necessary to secure these funds.

The following paragraphs describe the estimated annual equipment maintenance cost and fuel cost.

No.	Item	Maintenance Cost/year			Consumption of Fuel/year		
		%	Par unit	Total	Quantity par a car	Cost par unit	Total cost
		(%)	(Japanese yen)	(Japanese yen)	(ℓ)	(Japanese yen)	(Japanese yen)
1	Bulldozer (crawler)	5.0	1,309,550	2,619,100	22,800	1,824,000	3,648,000
2	Excavator (crawler)	5.0	987,150	1,974,300	13,140	1,051,200	2,102,400
3	Wheel Loader	5.4	986,094	1,972,188	9,900	792,000	1,584,000
4	Motor Grader	2.5	495,375	990,750	7,380	590,400	1,180,800
5	Sheep foot Compactor	2.3	343,229	686,458	6,880	550,400	1,100,800
6	Plate Compactor	7.5	11,400	57,000	–	–	–
7	Asphalt Kettle	3.1	239,692	239,692	–	–	–
8	Bitumen Distributor	4.8	745,056	2,235,168	3,300	264,000	792,000
9	Chip-spreader	9.6	339,360	1,018,080	–	–	–
10	Rough Terrain Crane	2.3	756,194	756,194	15,600	1,248,000	1,248,000
11	Dump truck	5.0	539,800	10,796,000	17,100	1,368,000	27,360,000
12	Water Bowser (Tanker)	3.6	326,412	1,305,648	5,695	455,600	1,822,400
13	Cab-back Crane	3.8	377,112	377,112	9,720	777,600	777,600
14	Low bed Semi-trailer	2.9	803,474	803,474	11,520	921,600	921,600
15	Mobile Workshop	5.0	896,200	896,200	2,000	160,000	160,000
16	Inspection Vehicle	5.0	126,950	126,950	2,000	160,000	160,000
17	Generator	4.0	263,920	527,840	–	–	–

Note) Exchange rate: 1USD = 81.06 JPY (August, 2012)

CHAPTER 3

PROJECT EVALUATION

Chapter 3 Project Evaluation

3-1 Preconditions

Preconditions of this project are described below.

- To ensure that tax exemption, clearance, and smooth in-land transportation of the provided equipment.
- Myanmar government bears custom duties, internal taxes and other fiscal levies which may be imposed in Myanmar with respect to the purchase of the products and
- To accord Japanese nationals whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into Myanmar and stay therein for the performance of their work.
- To ensure that the facilities and the products be maintained and used properly and effectively for the implementation of the project.
- To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project.
- To bear the following commissions paid to the Japanese bank for banking services based on the B/A.
  - Advising commission of A/P
  - Payment commission

3-2 Necessary Inputs by Recipient Country

Necessary inputs by Myanmar government of this project are described below.

- Quick start of road renovation in target road as soon as the equipment is procured.
- The equipment conveyance by land to target site.
- Appoint engineers and operators for implementation of the project
- Land acquisition for implementation of the project.
- Proper Operation and Maintenance (O&M) of the equipment and appoint engineers for O&M.
- The equipment procured for soft component (desktop computers) and management system for road renovation equipment is properly and sustainably operated.
- Proper consideration for people living along the target road at the renovation stage.
- Proper explanation to residents about renovation planning, schedule, matters to be paid attention and etc.

3-3 Important Assumptions

Some parts of Waboetaw – Kamarmaung – Phapun are still unstable. Thus, it is precondition to ensure and keep safety for concerned workers of the project and proper operation of the equipment during the construction time and after the project. To complete the project, safety situation in Kayin state largely affects the overall conditions.

3-4 Project Evaluation

3-4-1 Relevance

Japanese government set the major support fields for Myanmar to assist to spread the result of democracy, reconciliation within the country and economic revolution to all nationals living in Myanmar.

1. Improve quality of life for all nationals. (including ethnic minorities, poverty households and development of urban and rural area)
2. Capacity development for human resources and maintenance of regulations for economic and social development.
3. Infrastructure and regulation for sustainable economic growth

The project covers 1 and 3 mentioned above, and it is suitable for directions of Japanese major support fields

According to state minister of Kayin state, the target road along with Thanlwin river is part of construction and renovation of north – south road planed in regional development strategy of Kayin state. Besides, state minister mentioned to have a future design of construction reaching to Baw Ga Li/ Thandaung from Phapun. Thus, this project can be major part of backbone of Kayin state development.

Also, some part of the target area is suitable for paddy fields where can be the center of farming in Kayin state.

As points mentioned above, the project is highly relevant for development strategy in Kayin state.

3-4-2 Effectiveness

3-4-2-1 Quantitative effectiveness

According to statistical data provided by Kayin state, around 40,000 peoples living along the target road. The project can provide direct benefit to those peoples.

If renovated the target road, it is expected that driving speed will improve 60km/hr. from 20km/hr. as current state. And, for example, it will take three or three and half hours from Hpa-an-Kamarmaung- Phapun, it is possible to go and back in a day.

Table 3-4.1 Quantitative effects of the project shows quantitative effects of the project.

Table 3-4.1 Quantitative effects of the project

Indicator	Baseline,2012	Target, 2017
Average travelling speed on the target road（km/h）	Approx. 20km/h	Approx. 60km/h
Total length of road improvement on the target road（km）	0km	Approx. 100km
Maximum weight of vehicle on bridges (ton)	5 ton	60 ton

3-4-2-2 Qualitative effectiveness

It is qualitative effects of this project.

Table 3-4.2 Qualitative effects of renovated the roads in Kayin state

Present state and Problems	Measures to be implemented by this project	Effects and Improvements
Though the target road is a primary road between Kamarmaung and Paphun, it is difficult to ensure safety vehicle transportation due to too narrow and non-paved situation. ＜ Residential environment＞ ・School zone Primary schools are located walking area from any villages but children should use bicycle to access upper level schools. However, road conditions and drainage in the rainy season are quite bad and it is too difficult to ride bicycles. ・Access to health centers/ hospitals Primary health care facilities, called sub health center, are completed in each village. It is primary cares, so if higher cares are necessary people should go to township health center or Hpa-an hospital. No public transportations are working due to bad road conditions, only a few motor bike taxies are working. But very limited people possess their own car. ・Access to basic infrastructure Most of target areas have no electricity by grid distribution lines and purified water supply. People are drinking well-water.	➢ Renovation of the road between Waboetaw- Kamarmaung- Phapun	After improvement of target road and bridges by this project, vehicle transport becomes easier for local people. Also, materials will be transported easily and it contributes to promote industrial development. 〈beneficiary population and facilities around the target road〉 Population along the road：40,842 Number of Schools along the target area.：41 (include elementary school~ high school) Number of Medical facilities along the target area：11 (include sub health center, main health center) ・After the road be paved, rut or paddle occurred in rainy season become few, and people living in the area can transport easier. For the students, also become easier and safer to go to school by walk and bicycle. ・The road renovation can improve accessibility to medical services in an emergency. ・The large trucks can access the road and heavy machines for construction of infrastructure can be transported.
＜Commerce and Industry＞ ・Crops and agriculture materials Crops and fertilizers are conveyed by land. But ordinary tracks cannot access due to bad road conditions and tricycle taxies are used for crops and fertilizers transportation. It takes huge time and it	Same as above	・Huge amount of foods, materials and fertilizers can be transported at one time efficiently. Fuel cost of transportation for materials which are unable to be transported by ship will be largely reduced. Furthermore, the mechanization of the agriculture may be promoted because heavy machines

Present state and Problems	Measures to be implemented by this project	Effects and Improvements
is quite costly. ・Woods and stones transportation Woods and stones are transported by Thanlwin river. It takes much time, around two weeks, and consumes huge fuels too. Rubbers are also transported by land, but there are not processing facilities nearby and goes to Hpa-an or Mon state. ・Migrant worker At the border point between Mae sot, Thailand and Myawaddy, Kayin state , 1000~2000 Myanmarese are passing.		are able to be transported. And it can lead better productivity. ・By the transportation of supplies become active, processing factory such as farm products or rubbers and woods expected to be constructed in the local village. It can generate the opportunities to develop the local industry. ・After the target road is paved, traffic of people living around the road easier. Residents are expected to have more opportunity for cash income. And if local industry develops as mentioned above, residents have more chance to reach good jobs and stay their village or town they were born.
＜A synergy effect of repatriation village construction and planned development projects＞ ・Along the Kamamaung and Papun, State government plans to develop four repatriation villages. 1 village is assumed 100 households of accommodation.	Same as above	・After the road maintenance of this project is completed, it is expected that IDPs can move easily and foods and materials which are necessary for their living also can be transported easily. It promotes smooth and quick preparation of repatriation village.