

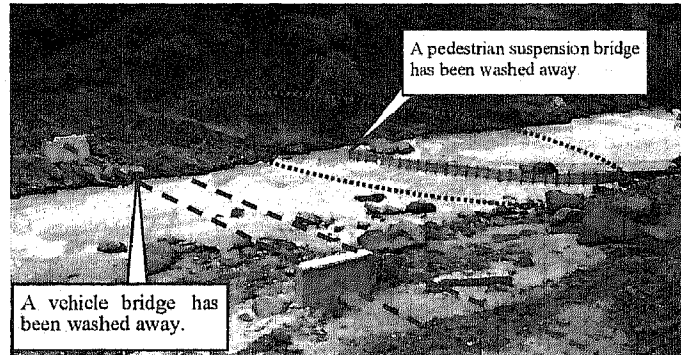
Chapter 1 Background of the Project

1-1 Current State and Problems of the Sector Concerned

1-1-1 Current State and Problems

(1) Current State of the Survey Area

Cyclone Aila formed in May 2009 brought heavy rain to Bhutan. The heavy rain caused severe damage, including washing away of bridges, to the nine bridge-construction areas surveyed in this study. In some of these areas where reconstruction has been slow, the residents are still suffering severely from the damage in their daily lives and economic activities. The Mandechhu



Photograph – Bridges damaged by Cyclone Aila

(Reotala) Bridge (Bridge No. 9), the Kela Bridge (Bridge No. 19) and the Jangbi Bridge (Bridge No. 20) are constructed on farm roads on extremely steep slopes. Vehicles cannot reach these bridges because construction of farm roads to those bridges has not been completed. Instead, only pedestrian suspension bridges are constructed for pedestrian and livestock traffic. However, even these bridges are essential lifeline roads for many people living in the more remote sides of the bridges. In fact, the 10th Five-Year Plan recognizes the Mandechhu (Reotala) Bridge (Bridge No. 9) and the Kela Bridge (Bridge No. 19) as the most important routes among the farm roads evaluated in the Plan. Meanwhile, alleviation of poverty on the more remote side of the Jangbi Bridge (Bridge No.20) is recognized as a target to be achieved. The Government of Bhutan intends to replace these three pedestrian bridges with road bridges in near future. The government also has a plan to construct farm roads for vehicle traffic on both sides of these bridges up to the bridges.

The government also recognizes the importance of the National Highway No. 5, on which the Dolkhola Bridge (Bridge No.17) and Jigmiling Bridge (Bridge No. 18) are constructed, as a supply route to the Punatshangchu Hydropower Project and as a part of the planned Second East-West Highway, which is to traverse the southern part of the country. However, both of the above-mentioned bridges are temporary bridges with the vehicle load on them limited to 18 t. (Only one vehicle is allowed to cross the bridge at a time.) Because of the possibility of a natural disaster causing damage to these bridges and the absence of alternative routes, their replacement with permanent bridges is urgently required. At present, a project which is expected to contribute greatly to the economic development of Bhutan, the Punatshangchu Hydropower Project, is being implemented at a location along the Route 5 in Wangdi Phodrang Dzongkhag (District). Successful implementation of this project will require development of infrastructure between Gelephu City on the border with India, which has a customs office, and Wangdi Phodrang. The National Highway No. 4 which runs through Sarpang Dzongkhag and Trongsa Dzongkhag is also regarded as a trunk route road of high significance.

(2) Conditions of Roads in Bhutan

The total length of roads in Bhutan is 4,545 km, of which 1,556 km are national highways. The rest is classified into district roads, feeder roads, urban roads, farm roads and forest roads.

The domestic road network controlled and managed by the Department of Roads (DoR) under the Ministry of Works and Human Settlement (MoWHS) consists of five main routes, one in the east-west direction (National Highway No. 1) and four in the north-south direction (National Highway No. 2 to 5).

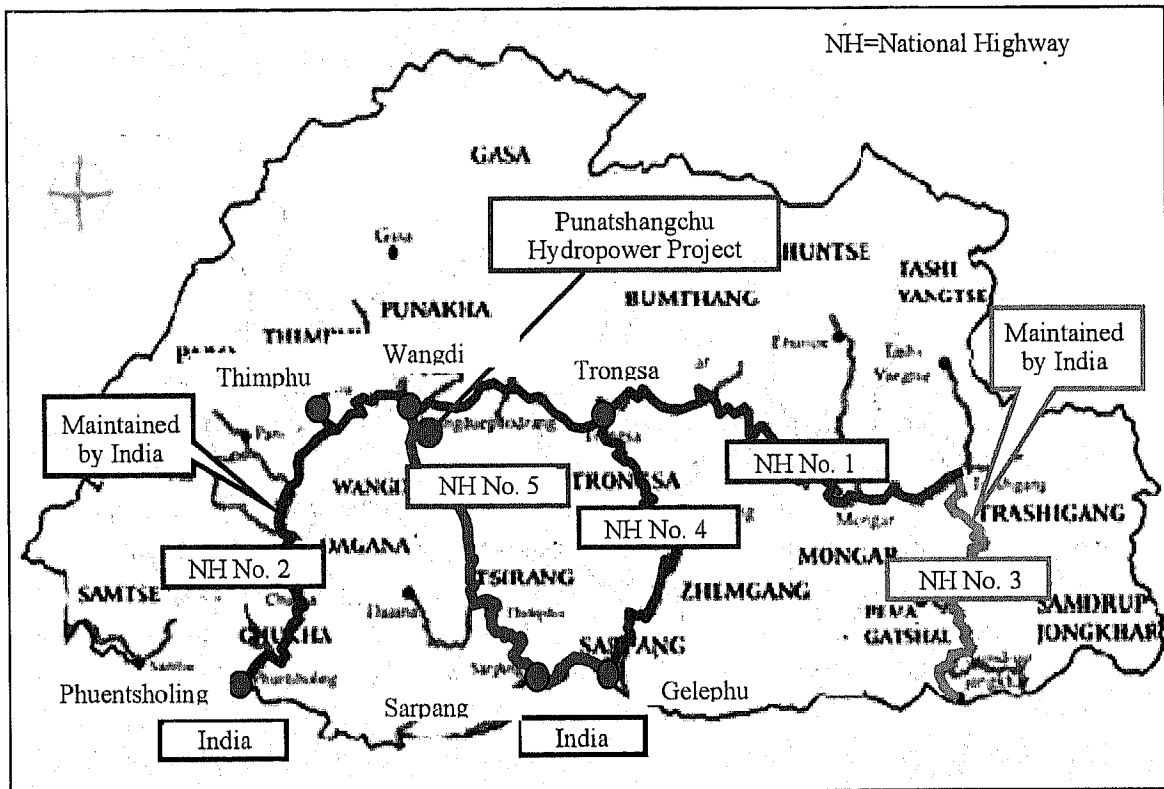


Figure 1-1 Major Roads in Bhutan

A study on traffic flow found the largest traffic volume on the National Highway No. 2. This route is being used for the international physical distribution of goods between Bhutan and India. Since this is the shortest route between India and the capital, Thimphu, the increase in the traffic volume on this route is expected to continue in future. The National Highway No. 4 and 5 are also considered important as the routes supplementary to National Highway No. 2.

Farm roads and forest roads managed and controlled by the Department of Agriculture (DoA) under the Ministry of Agriculture (MoA) are used for transporting logged wood and agricultural materials and products and serve as links between areas of agricultural production and markets for agricultural products. Since poverty reduction is the issue of the highest priority in Bhutan, the Government of Bhutan has a plan to construct and improve farm roads to make poverty-stricken areas more accessible.

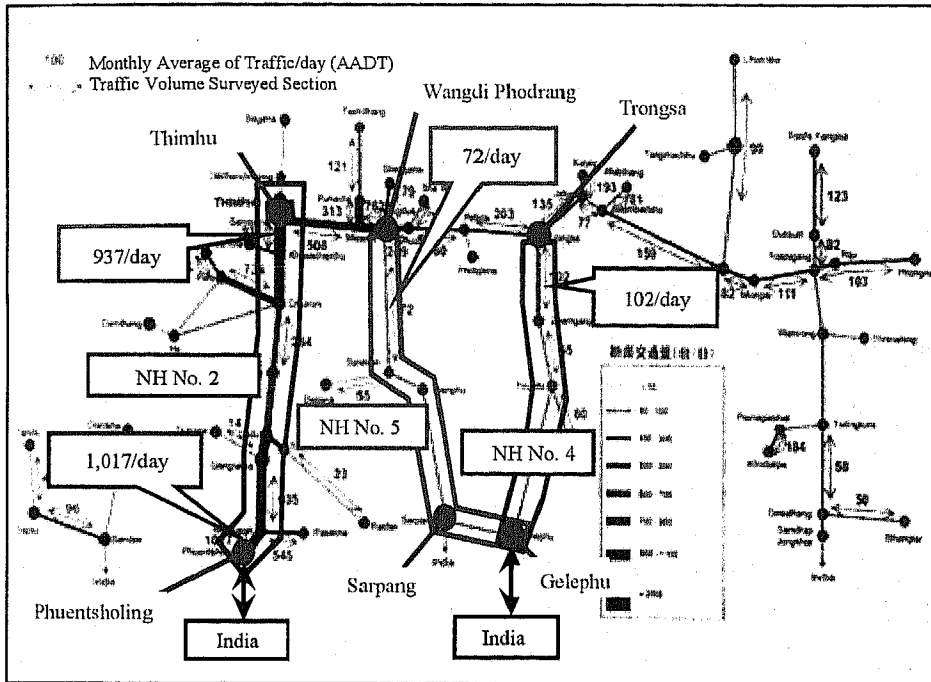


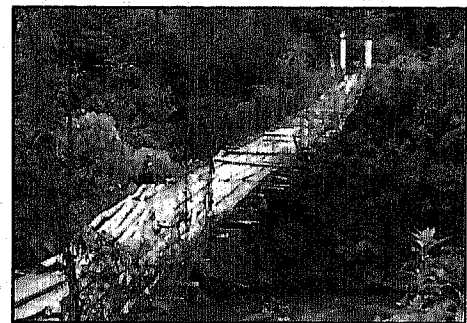
Figure 1-2 Traffic Volumes on Major Roads

(3) Conditions of Bridges in Bhutan

Bhutan is located at the foot of the Himalayas and has steep terrain. Bridges in Bhutan play a very significant role of linking various areas on such steep terrain with roads.

Many of the bridges on the national highways and district roads are temporary (Bailey) bridges constructed in the 1970's and 1980's.

A project supported by Japanese Grant Aid of replacing Bailey bridges with permanent bridges at important locations in the road network is in progress. Although some of the Bailey bridges on farm roads and forest roads can be used by vehicles, most of them are pedestrian bridges which cannot be used by vehicles. Therefore, it is a huge task for the Bhutanese to find ways to handle the increase in the traffic volume and the increase in loads on trucks expected from the development of rural economy mainly in agriculture. Achieving such a task requires construction of bridges for vehicle traffic for transporting a large number of people and large amount of goods.



Photograph – An existing pedestrian bridge



Photograph – An existing Bailey Bridge

1-1-2 Development Plans

The three plans mentioned below are the pillars of the national development in Bhutan.

- i) Bhutan 2020 (prepared in 1999)
- ii) Road Sector Master Plan (2007 – 2027)
- iii) 10th Five-Year Plan (2008 – 2012)

1) Bhutan 2020

“Bhutan 2020,” which depicts expected image of Bhutan in 2020, covers a wide range of sectors, including economy, industry, education, culture, human development and the environment. The following are the main targets in the Road Sector in “Bhutan 2020.”

- i) By 2007, trunk roads will have been renovated so that 30-ton trucks can run on them.
- ii) By 2012, a road network will have been created which allows 75% of the population of the country to reach a road within a half-day’s walk.
- iii) By 2017, construction of the Second East-West Highway (a 794 km highway connecting Jomotshangkhar in the southeast and Sipsoo in the southwest) will have been completed.

2) Road Sector Master Plan (2007 – 2027)

This master plan on road development established in May 2006 has the following main targets.

- i) Construction of municipal roads (a total length of 2,654 km)
- ii) Construction of the Second East-West Road
- iii) Construction of district roads (a total length of ca. 537 km) for linkage and cooperation between districts

3) 10th Five-Year Plan

The 10th Five-Year Plan, which recognizes poverty reduction as the priority issue, states the following as the main targets in the road sector.

- i) To improve the current conditions in poverty areas by improving access to remote areas
- ii) To improve the lives of people in remote areas by improving access to education, health and transport
- iii) To strengthen the security and unity of the nation by improving and reinforcing the road network
- iv) To improve the reliability, cost-effectiveness, safety and comfort of the road network by reducing the time required for travel, transport costs and traffic accidents

1-1-3 State of the Society and the Economy

1) State of the Society

Bhutan has a population of 671,000 (in 2009, the Government of Bhutan). Approximately 80 % of the Bhutanese are Tibetan and the rest are Nepali and of other ethnicities. In 2008, with the election of the members of the lower house of the parliament by popular vote, the absolute monarchy which had reigned over the country for a hundred years was replaced by parliamentary democracy.

Growth of the gross national happiness (GNH), a concept of seeking spiritual satisfaction, is the central policy of the Government of Bhutan.

Dzongkha is the official language of Bhutan. The currency of Bhutan, ngultrum, and Indian rupee are in circulation. Many Bhutanese believe in Tibetan Buddhism.

2) State of the Economy

The per capita gross national income (GNI) of Bhutan is US\$ 2,020 (in 2009, the World Bank). Because of the healthy economic growth in recent years (a growth rate of 6.8 % in 2009; the Government of Bhutan) and the relatively low unemployment rate (4.4 % in 2009; the Government of Bhutan), the Bhutanese society has been stable. The primary, secondary and tertiary sectors of economy account for 18.2 %, 42.0 % and 39.8 %, respectively, of the national economy. Bhutan has a strong trade link with India as the trade with India accounts for ca. 80 % of the international trade of Bhutan. The largest export of Bhutan has been electricity generated by hydropower plants constructed with assistance from India in recent years and it accounts for ca. 60 % the total export of Bhutan, in terms of monetary value (in 2008, the Government of Bhutan).

1-2 Background and Overview of Grant Aid Cooperation

In Bhutan, with a majority of land consisting of steep mountainous areas, the major means of traffic and transportation are those via roads and bridges. However, more than 20% of the households are located at more than half a day's walking distance from roadways. The poor development status and absolute insufficiency of roads are preventing access to various social services and markets particularly in the rural area, posing the largest impediments to the development of Bhutan. Therefore, the development of efficient and safe road networks and bridges is indispensable to socio-economic development of Bhutan.

In fact, the Bhutanese government is addressing these problems in the 10th Five-Year Plan (2008-2013) that places importance on the development with a good balance between the urban and rural areas and the importance of strategic infrastructure improvement, proposing as priority issues the renovation and maintenance of trunk roads, improvement of regional access road networks, maintenance and repair of the existing roads and bridges, reconstruction of the existing bridges, etc.

Cyclone Aila that struck in May 2009 left the world's largest number of people (320) dead in the first half of the year and, including India and Bangladesh, more than 100,000 people evacuated and more than

100,000 houses were damaged. The cyclone brought a downpour also to Bhutan, giving severe damages to roads, bridges, etc. in various parts of the country. Although India, Denmark, Australia, UN, etc. announced assistance after the disaster occurred, only insufficient restoration has been made in nearly two years after the disaster, leaving the residents deprived of access to facilities that they need for daily life.

Under such circumstances, the Bhutanese government requested to Japan for the grant aid cooperation, the "Project for Restoration and Improvement of Vital Infrastructure for Cyclone Disaster" (September 2009). To verify the validity of the cooperation of Japan according to this request, the JICA Bhutan Office surveyed the content of the request, narrowed down the assistance target to the reconstruction of bridges, and performed screening of bridges with maximum urgency. Based on the result of this survey, JICA determined to implement a preliminary survey and conducted the "Preparatory Survey for Restoration and Improvement of Vital Infrastructure for Cyclone Disaster" from August to September 2010. Based on the result of this survey, the implementation of the survey in this project has been determined for the nine bridges with high necessity and urgency in Bhutan.

This project, aimed at the construction of bridges in Dolkhola and Jigmiling on National Highway No.5 and Mandechhu (Reotala), Kela, and Jangbi on farm roads connecting to National Highway No.4 in order to restore the bridges that have been destroyed by the cyclone in the hope of improving the local residents' access and securing the access in case there is another cyclone hit. The target projects of grant aid cooperation among them are the reconstruction of bridges in Dolkhola and Jigmiling as permanent ones and the making of substructures in the construction of temporary bridges in Mandechhu (Reotala), Kela, and Jangbi.

1-3 Trends in Japanese Assistance

Table 1-1 shows the status of assistance of Japan in the road sector in Bhutan.

Table 1-1 Status of Japanese Assistance

Type of assistance	Project name	Year of implementation	Amount (100 million yen)
Development study	Study on National Highway Bridge Construction	1997- 1998	-
Dispatch of experts	Dispatch of Long-term Experts	1998 - 2007	-
Technical cooperation project	Human Resources Development in Bridge Planning, Design, Construction and Maintenance	2004 - 2007	-
Grant aid cooperation	Improvement of Machinery and Equipment for Construction of Road	1987	4.12
	Improvement of Machinery and Equipment for Construction of Road (Phase 2)	1995	5.57
	Reconstruction of Bridges	2001 - 2003	17.13
	Improvement of Equipment for Road Construction and Maintenance	2003	6.03
	Reconstruction of Bridges (Phase II)	2005 - 2007	13.02
	Reconstruction of Bridges (Phase III)	2009 - 2012	-

1-4 Trends of Other Donors' Assistance

When asked about the recent assistance trend of other donors in the road sector, DoR answered that the major assistance organizations are World Bank (WB), Asian Development Bank (ADB), and Government of India (GOI) and that DoR has departments that collaborate with these donors. The assistance of these donors in the road sector mainly consists of road improvement including bridge improvement. The target routes of their assistance are the National Highways No. 2, 4, and 3, many of which are in the north-south axis in consideration of access to India.

Table 1-2 Trends in Other Donors' Assistance

	Name of Project	Budget	Location	Implementing Agency	Donor	Type of Aid	Special Note
1.	Rural Road Improvement Project (Phase 2)	10.01 M US\$	1-1 Wangdue	DoR	WB	Grant Aid	
			1-2 Dagana				
			1-3 Pemagatshel				
2.	Two Lane Widening Project from Thimphu to Phuentsholing	1,887 M Nu.	2. Thimphu - Phuentsholing	DANTAK	GOI	Grant Aid	
3.	Two Lane Widening Project from Chuzom to Paro	424 M Nu.	3. Chuzom - Paro	DoR	GOI	Grant Aid	
4.	Road Improvement Project from Gomphu to Panbang	15 M Nu.	4. Gomphu - Panbang	DoR	GOI	Grant Aid	Survey
5.	Road Improvement Project from Gyelpozhing to Nganglam	150 M Nu.	5. Gyelpozhing - Nganglam	DoR	GOI	Grant Aid	
6.	Road Improvement Project from Trongsa to Gelphu	11.0 M US\$	6. Trongsa - Gelphu	DoR	ADB	Loan	
7.	Feeder Road Improvement Project	14.0 M US\$	7-1 Mirchim - Bongo	DoR	ADB	Loan	
			7-2 Tekizham - Juna				
			7-3 Autsho - Garbatang				
			7-4 Khurutsungla - Kanpara				

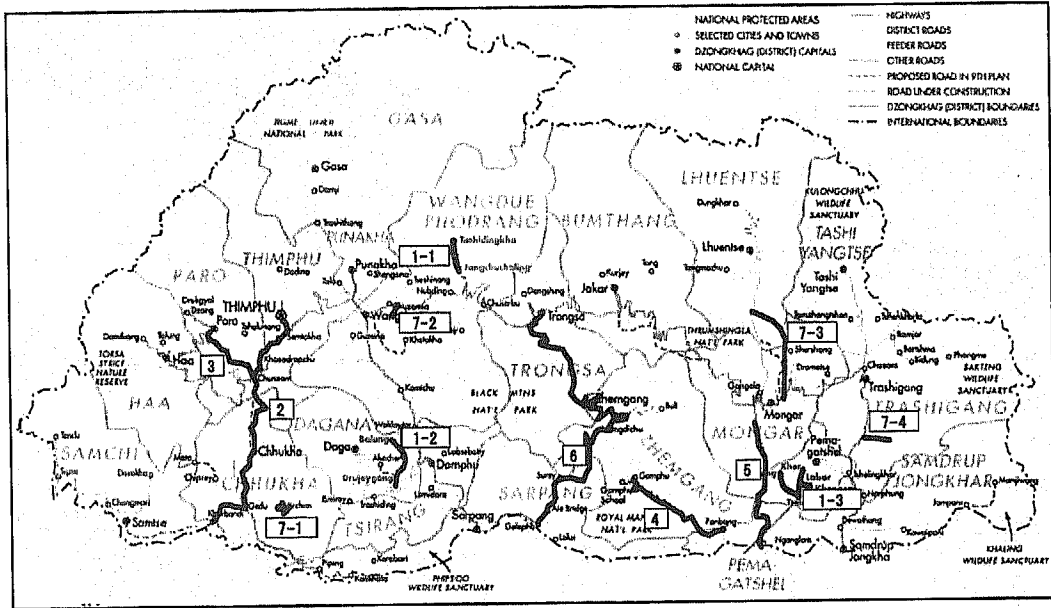


Figure 1-3 Project Sites of Other Donors

CHAPTER 2

CIRCUMSTANCES OF THE PROJECT

Chapter 2 Circumstances of the Project

2-1 Project Implementation System

2-1-1 Organization and Personnel

(1) Organizations

The implementation organizations of this project are the Department of Disaster Management (DDM), Department of Roads (DoR), and Department of Agriculture (DoA). These three organizations are represented by DoR, which applies for and ensures the budget for the target bridges in this assistance project.

(1)-1 DDM

DDM is an organization that performs disaster risk management throughout Bhutan by establishing guidelines and other rules regarding disasters, supplying information on disaster control measures to the regional governments, conducting educational activities on knowledge on disasters, etc. DDM has a staff of 22 persons in total (Bhutanese government in 2011). The figure below shows the organization chart of the Ministry of Home and Cultural Affairs.

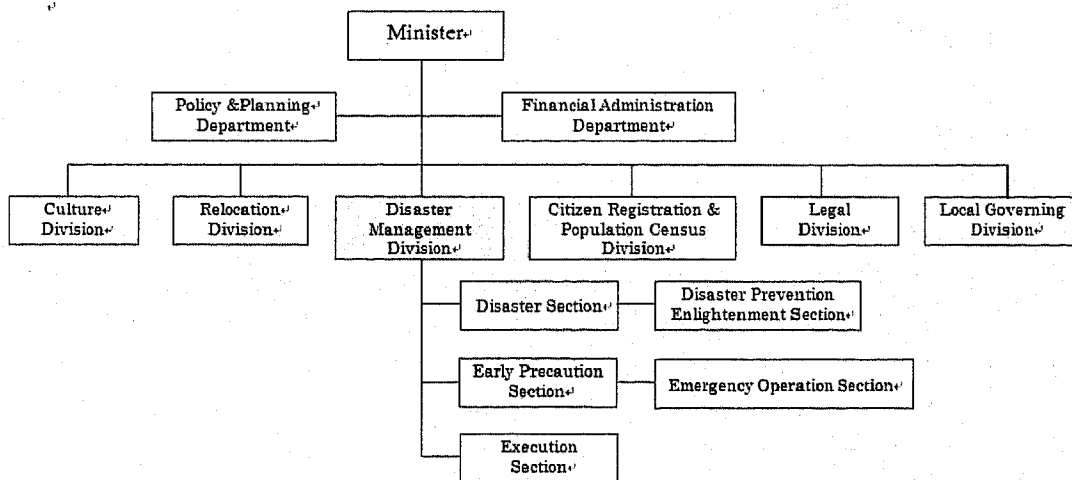


Figure 2-1 Organization Chart of Ministry of Home and Cultural Affairs

(1)-2 DoA

DoA is an organization with a staff of 835 persons in total (data supplied by DoA in 2010) that manages farm roads and forest roads throughout Bhutan as well as suspension bridges across rivers that intersect the farm roads and forest roads.

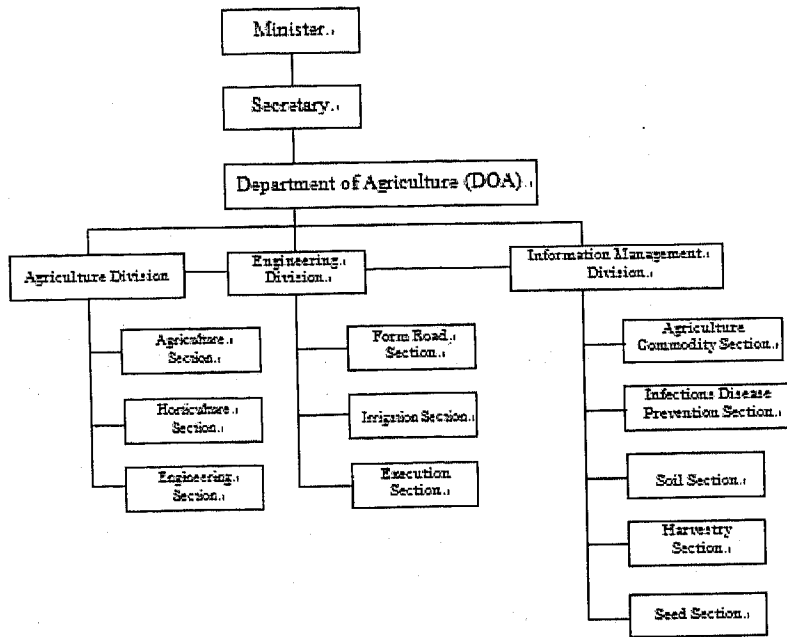


Figure 2-2 Organization Chart of Department of Agriculture

(1)-3 DoR

The predecessor of DoR that manages the major trunk roads was an organization founded for the construction of the National Highway No.2 that was initiated with the assistance from the Indian government in 1959. This organization was integrated into the Public Works Department (PWD) in 1979 and became a department in MoWHS in 2003. It has a staff of 324 persons in total (2009 Annual Report). The figure below shows the organization chart of the Ministry of Works and Human Settlement.

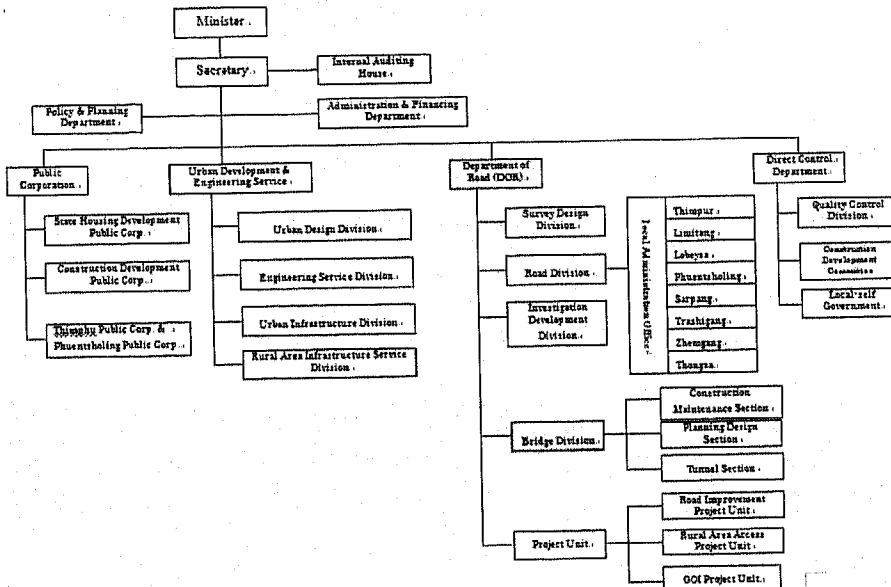
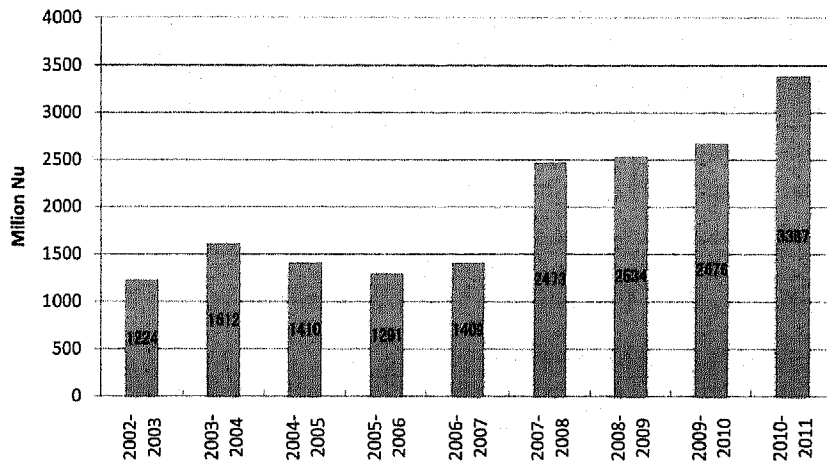


Figure 2-3 Organization Chart of Ministry of Works and Human Settlement

2-1-2 Finance and Budget

The table below shows the time-series variation of DoR budget from 2002 to 2011. The budget decreased from 2003/2004 to 2006/2007 but increased significantly in 2007/2008. The budget is generally on the increase in the past few years.



(Unit: Million Nu.)
(Source: DoR data)

Figure 2-4 DoR Budget

2-1-3 Technical Level

The civil engineers in Bhutan consist of "technicians" who learned at training schools and mainly conducts management in the field and "engineers" who learned at technical schools or universities and graduated from colleges. Many of the technicians have completed either of the electrical, mechanical, and automotive engineering, architecture, and technical drawing departments of "Royal Technical Institute" founded in 1965. This school has been split up to be reorganized as "Vocational Technical Institutes," which have been relocated to various parts of the country by now. Many of the civil, mechanical, and electrical engineers are graduates from the Royal Bhutan Polytechnic in Bhutan. A few of them learned at overseas universities such as those in India. The Royal Bhutan Polytechnic, established in Dewathang in the eastern part of Bhutan in 1974, was moved to Phuentsholing in the western part in 2000 and upgraded to the "Royal Bhutan Institute of Technology." Since the graduates of these schools are limited in number and have a preference for working at government-related organizations, private companies are faced with a shortage of engineers. Due to such circumstances, the constructors employ foreigners, particularly Indian engineers, to make up for the shortage.

2-1-4 Existing Facilities and Equipment

On the National Highway No.5 including the Dolkhola and Jigmiling Bridges, the target bridges in this study, the Wakleytar Bridge that used to be a temporary bridge has been reconstructed to a Langer bridge. As of July 2011, the Reconstruction of Bridges (Phase III) is in progress. The following shows the specifications.

Table 2-1 Specifications of Phase 3 Bridge Reconstruction Plan

Name	Lawakha Bridge	Basochu Bridge	Nyarachu Bridge	Burichu Bridge	Chanchey Bridge	Loring Bridge
Type	Steel simple composite I-girder bridge	PC simple box girder bridge	PC simple box girder bridge	PC simple box girder bridge	PC simple box girder bridge	Steel simple Langer bridge
Length	45.0m	40.0m	40.0m	50.0m	45.0m	70.0m
Span length	44.0m	39.0m	39.0m	48.9m	43.9m	68.6m
Width	6.0m	6.0m	6.0m	6.0m	6.0m	6.0m

2-2 Condition of the Project Site and Surrounding Area

2-2-1 Bridge Covered by the Project

(1) Field Survey

In this survey, a field survey was carried out for a total of nine bridges, in order to obtain basic information to be used in selecting the bridges to be covered by the project. The results of the field survey of each of the bridges are described in the following pages.

