No.

BASIC DESIGN STUDY REPORT
ON THE PROJECT
FOR
IMPROVEMENT OF MACHINERY AND EQUIPMENT
FOR
CONSTRUCTION OF RURAL AGRICULTURAL ROAD
IN
THE KINGDOM OF BHUTAN

NOVEMBER 2004

JAPAN INTERNATIONAL COOPERATION AGENCY
CONSTRUCTION PROJECT CONSULTANTS, INC.

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PREFACE

In response to a request from the Government of the Kingdom of Bhutan, the Government of Japan decided to conduct a basic design study on the Project for Improvement of Machinery and Equipment for Construction of Rural Agricultural Road in the Kingdom of Bhutan and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Bhutan a study team from July 6th to August 2nd, 2004.

The team held discussions with the officials concerned of the Government of Bhutan, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Bhutan in order to discuss a draft basic design, and as this result, the present report was finalized.

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

I wish to express my sincere appreciation to the officials concerned of the Government of the Kingdom of Bhutan for their close cooperation extended to the teams.

November, 2004

Seiji KOJIMA
Vice-President
Japan International Cooperation Agency

November, 2004

Letter of Transmittal

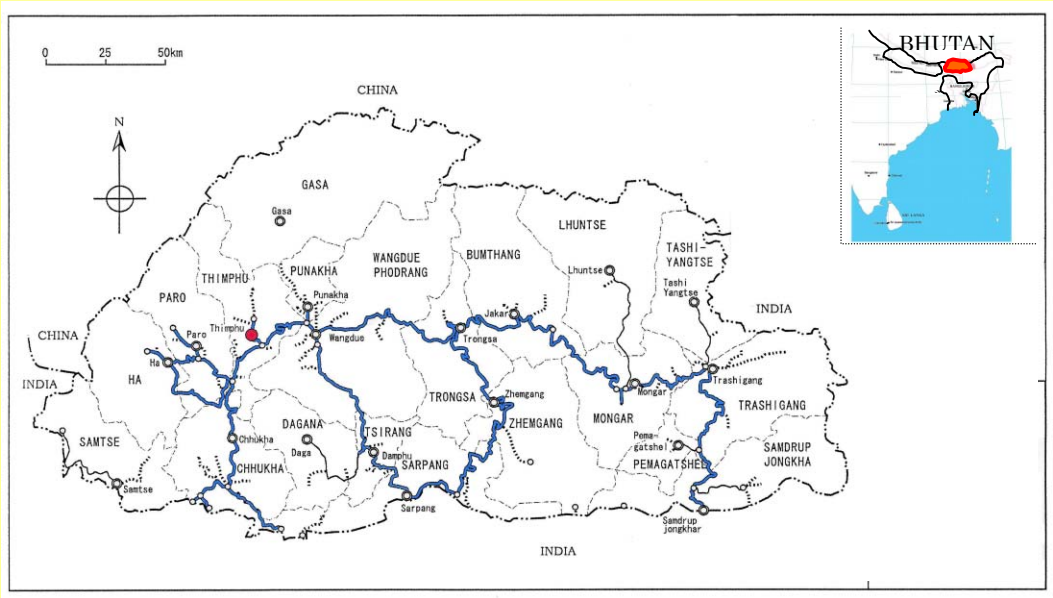
We are pleased to submit to you the basic design study report on the Project for Improvement of Machinery and Equipment for Construction of Rural Agricultural Road in the Kingdom of Bhutan.

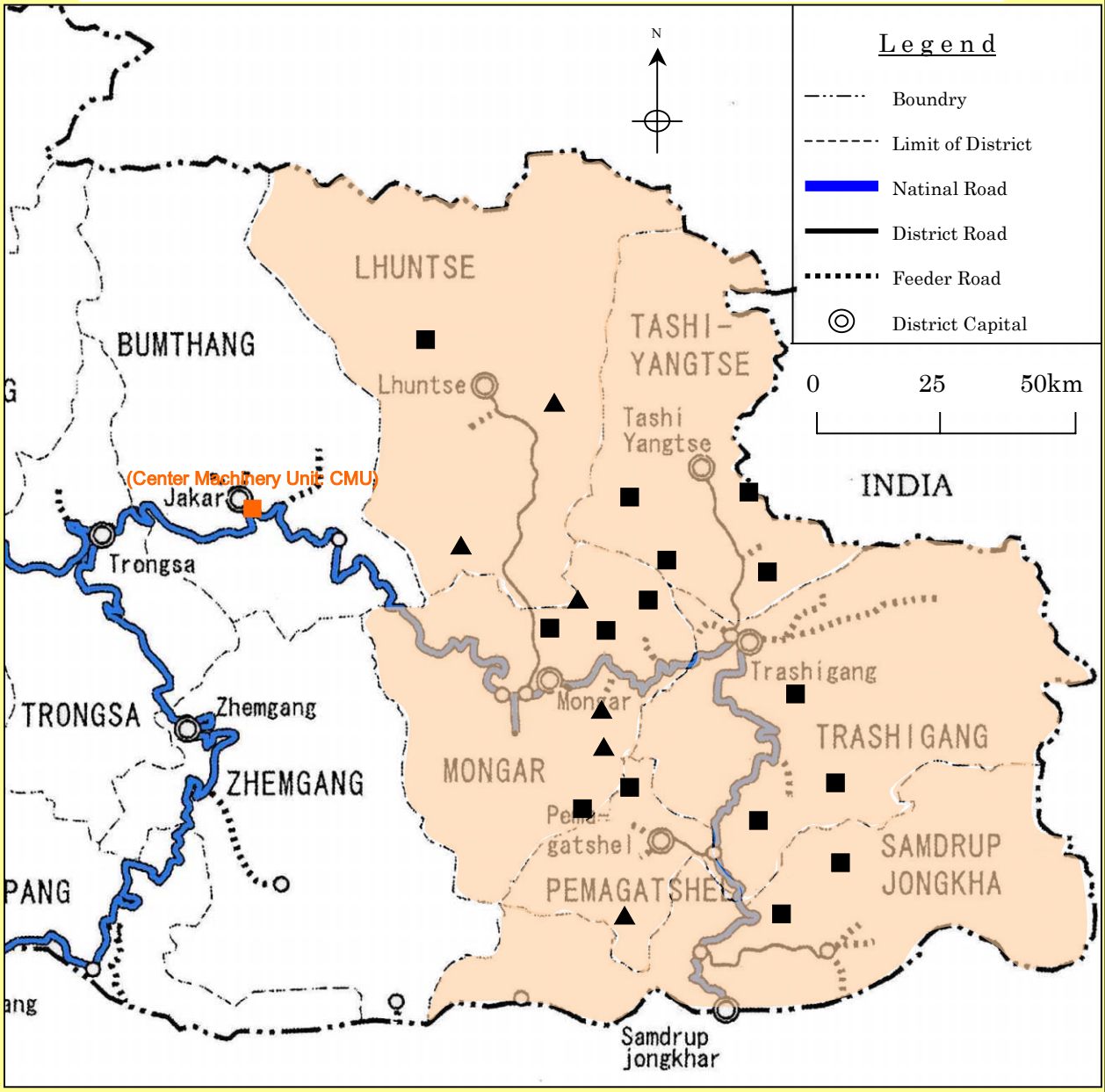
This study was conducted by Construction Project Consultants, Inc., under a contract to JICA, during the period from June, 2004 to December, 2004. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Bhutan and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Shozo Inoue
Project Manager,
Basic design study team on the
Project for Improvement of Machinery
and Equipment for Construction of
Rural Agricultural Road in the
Kingdom of Bhutan
Construction Project Consultants, Inc.





■ : Farm Road
▲ : Power Tiller Track

Location Map of the Project

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Abbreviations

A/P	Authorization to Pay
ATEPP	Agriculture, Trade and Enterprise Promotion Programme
B/A	Banking Arrangement
CMU	Central Machinery Unit
DAC	Development Assistance Committee
DOA	Department of Agriculture
ECR-ADP	Eastern Central Region Agriculture Development Project
EFRC	Enviromental Friendly Road Construction
E/N	Exchange of Note
FR	Farm Road
GDP	Gross Domestic Product
GNI	Gross National Income
GTZ	Deutsche Gesellschaft fur Technische Zusammenarbeit GmbH
IFAD	International Fund for Agricultural Development
JICA	Japan International Cooperation Agency
KRII	Kennedy Round II
MOU	Memorandum of Understanding
MR	Mule Tracks
MTBF	Means Time Between Failure
NEC	National Environment Commission
OJT	On-the-Job-Training
PM	Preventive Maintenance
PTT	Power Tiller Track
RCSC	Royal Civil Service Council
ROPS	Roll Over Protective Structure
SDC	Swiss Development Cooperation
SEZAP	Second Eastern Zone Agriculture Programme
SNV	Stichting Nederlandse Vrijwilligers
WFP	World Food Programme
WWMP	Wang Watershed Management Project

SUMMARY

Summary

Bhutan is a mountainous country, with farmhouses and isolated villages distributed on steep slopes. Cereals and vegetables are cultivated and animals are bred on reclaimed land using traditional methods under harsh natural conditions. Eighty-five percent of the population of Bhutan live in rural areas and agricultural produce amounts to 32.7 percent (2003) of the GDP of the country. However, Bhutan's food self-sufficiency ratio has declined during the last two decades from 95 percent to the current level of approximately 65 percent due to the nation's geographical constraints as well as the underdeveloped cultivation techniques used by the farmers. The Bhutanese Government recommends production of horticultural crops for the purpose enhancing the people's nutrition standards and increasing the cash earnings of farmers. Efforts to increase their productions are however hampered mainly by the difficult access to markets because of the local transport conditions, which remain to be developed.

It is in this context that the Ninth Five-Year Plan (Period: July 2002 to June 2007) was worked out by the Bhutan government in order to reduce poverty by drastically improving the Kingdom's infrastructure especially by constructing rural agriculture roads as one of the ftop priority actions to be taken by the government for development and enhancement purposes. Thus, the demand for the construction of farm roads is high not only for ameliorating the access to the many scattered and isolated rural communities during the rainy season especially for the purpose of agricultural management, but also, as expected by many people, for the purpose of facilitating the population's access to social services, such as medical treatment and education of the villagers, among others.

The six eastern districts of the target area, the subject of the present Study, lack trunk roads, and the natural conditions are harsher than in the Eastern and Central zones. Therefore, the social and economic situations leave much to be desired .

The Ministry of Agriculture, which administers and develops rural agriculture roads in Bhutan, has established the Central Machinery Centre (CMU), under the Department of Agriculture, at Jakar in the Bumthang district to accelerate the construction of farm roads and power tiller tracks. However, construction equipment belonging to DOA are obsolescent and unsuitable for the work in the target area. Due to their low maneuverability and workability it is very difficult to meet the requirements of the target roads. For this reason, new construction equipment and machinery are essential and constitute a top priority in the development of the nation.

Under such circumstances, the Kingdom of Bhutan made a formal request to the Japanese Grant Aid for the supply of equipment required for the construction and repair of the machinery to contribute to the effective development of farm roads .

In response to this request, the government of Japan decided to carry out a basic design survey and

entrusted the task of its execution to the Japan International Cooperation Agency (JICA), which dispatched from 6th July to 2nd August 2004 a basic design survey team to the site. The project originally covered, in August 2002, only farm roads but subsequently the construction of narrower 'power tiller tracks' of 1.5m width was additionally introduced into the Project taking into consideration the advantages in terms of limitations of geographical features and cost anticipated in the case of adoption of the narrower tracks. Based on this idea, the Ministry of Agriculture of Bhutan made a modified request for the supply of new construction machinery and equipment, needed to execute the prior construction of farm roads (total length = 251 km) as well as the newly added power tiller roads (total length = 74 km), out of the targeted total of 325 km.

The team held discussions regarding the contents of the request with the officials concerned of the Government of Bhutan and conducted the site survey and data collection. After returning to Japan, the team examined the justification of the Project on the basis of the field survey results and made the basic concept of the Project such as the selection of required construction equipment and the planning of procurement, etc. The results were compiled in the draft report of the basic design which was presented to the Government of the Kingdom of Bhutan by the draft report explanation team dispatched between 1st and 11th October 2004. The Government of the Kingdom of Bhutan agreed on the results of the basic design.

Regarding the target roads of the Project, the high priority roads (161 km of farm roads and 74 km of power tiller tracks) were elaborated as the target roads of the Project among the target roads in the request (251 km of farm roads & 74 km of power tiller tracks).

As for the required equipment plan, the necessary equipment to be procured under the Project has been broken down, using a fleet configuration, and specified based on the nature of the construction work to be carried out. The necessary number of equipment fleets has been calculated, based on the work volume of each item, and proved to be five for both the construction of farm roads and the construction of power tiller tracks.

The outlines of the present Project are as follows:

Construction and Maintenance & Repair Equipment Plan

Construction Equipment for Farm Roads			
Name of Equipment	Outline of Specification	Unit	Purpose of Use
Bulldozer	170~190HP	5	Cutting, digging, dozing, leveling, compacting, ripping work, etc.
Hydraulic Excavator (Middle class)	135~150HP, 0.8m3	5	Cutting, digging, loading, etc.
Hydraulic Excavator (Small class)	75~85HP, 0.35~0.45m3	5	Cutting, digging side ditches and wall, loading, slope information, etc.
Dump Truck	8tons	5	Transportation of surplus soil and construction materials such as soil and gravel
Vibration Roller	Approx.7tons	5	Vibration compacting work on the soil and gravel road

Hand Breaker	(1) Pick hammer (Handle type) 20kg	10	Crashing hard rock after using hydraulic breaker
	(2) Jack hammer (Handle type) 20kg	10	Drilling work for blasting hard rock
Air Compressor (Middle class)	Approx. 80~85HP	1	For pick hammer and jack hammer at rocky job site
Wheel Loader	80~90HP,	5	Loading and carrying of soil, gravel, etc.
Safety Miscellaneous	1 set	1 set	For safety work of worker at the job site
Tent	1 set	1 set	For accommodation of operators, mechanics and helpers at the job site
Portable rock drill	With gasoline engine 25kg	10	Drilling work at the job site where is far away from the base of the compressor station
Spare Parts	For above equipment	---	To maintain the machine
Construction Equipment for Power Tiller Tracks			
Hydraulic Excavator (Mini small class)	28~36HP, 0.10~0.14m3	5	Cutting, digging, loading, leveling, etc.
Wheel Tractor	Approx.28HP, 4x4	5	Transportation of soil and stone at narrow job site
Hand Breaker	(1) Pick hammer (Handle type) 20kg	10	Crushing hard rock after using hydraulic breaker
	(2) Jack hammer (Handle type) 20kg	10	Drilling work for blasting hard rock
Air Compressor (Small class)	Approx. 700kg	5	For pick hammer and jack hammer at rocky job site
Hand Guide Roller	Approx. 900kg	5	Vibration compacting work at narrow job site
Safety Miscellaneous	1 set	1 set	For safety work of worker at the job site
Portable rock drill	With gasoline engine, 25kg	5	Drilling work at the job site away from the base of the compressor station
Spare Parts	For above equipment	---	To maintain the machine
Supporting Equipment			
Cargo Truck with Crane (Middle)	8tons, Crane: 3tons 4x2, Min. 230HP	1	Transportation of small machine and materials of construction
Cargo Truck with Crane (Small)	4tons, Crane: 3tons 4x2, Min. 170HP	1	For maintenance and repair of engine and chassis at the job site
Fuel Tanker	3,000Lit, 4x2	1	For supplying fuel at the job site
Survey Equipment	Auto level, Portable GPS	Each 6	Surveying works in the sites
Pick-up Truck	Double cab, 4x4	1	For supervising and inspecting at the job site, and transporting service parts for maintenance and repair of machine
Self Loading Truck	14tons, 6x4	1	Transportation of construction machine
Spare Parts	For above equipment	---	To maintain the machine
Maintenance and Repair Equipment			
Workshop Equipment & Tool	1 set	1 set	Maintenance and repair of the machine
Equipment & Tool for Service Track	1 set	1 set	For maintenance and repair of machine at the site

In the case of the application of non-reimbursable grant aid to this Project, an estimation of total cost of 521.9 million yen (Japanese financing portion: 521.9 million yen, Bhutanese financing portion:

635 thousand yen) must be financed. The Project will require 12 months for completion after the conclusion of E/N.

After implementing the construction, all the local residents of the six eastern districts will benefit from the fruits of the Project, corresponding to one third of the total population of the Kingdom of Bhutan, i.e. approximately 200,000 inhabitants (about 25,000 households). In addition to the effects produced by the construction, over a period of three years, of 161 km of farm roads and 74 km of power tiller tracks, it is also expected that, since access to national roads and prefecture roads will be reinforced considerably, the distribution of agricultural products will be improved. And it will lead to promotion of the cultivation of commercial crops and thus increased farmers' revenue eventually. Also, the basic living standard of the rural area will be reinforced, and at the same time, the improvement of the economic and social regional imbalance can be expected.

The study team has concluded that the implementation of the Project, subject to the bilateral cooperation based on grant aid by the government of Japan, is judged relevant, taking into account the contents of the Project, the degree of the expected effects, the executing capabilities of the counterpart in terms of equipment operational management and maintenance and control systems.

Furthermore, the study team recommends the following items for maintaining the sustainability and favorable results of the Project.

- In addition to the dispatch of senior volunteers and the training programs for Bhutanese counterparts in Japan, the support of technology and know-how in the field of rural agricultural road construction under the specific local conditions of the eastern region of the Kingdom of Bhutan will be needed.
- Budgetary arrangements will be needed to ensure the proper maintenance of the procured machinery of the Project and operation of the construction works.
- A long-term rural agriculture road development plan will be established.

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Chapter 1 Background of the Project

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The Ninth Five-Year Plan (Period: July 2002 to June 2007) was worked out by the Bhutan government in order to reduce poverty by drastically improving the Kingdom's infrastructure especially by constructing rural agriculture roads as one of the top priority actions to be taken by the government for developing and enhancing its agricultural sector. Thus, the demand for construction of rural agriculture roads is keen not only for ameliorating the access to many scattered and isolated rural communities for the purpose of agricultural management, but also, as expected by many people, for the purpose of facilitating population's access to social services, such as among others medication and education of the villagers.

Compared to the other parts of the country, the eastern region of Bhutan, the subject to this Project, embraces a very poor population, representing 75 percent of the stratum of the impoverished people earning an income of 0.5 US dollar/day or even less due to the backwardness in the agricultural development and industrial promotion. For this reason, the eastern part is designated as the most support-necessitating region of the country. The road construction in this region is therefore considered as the first priority action especially to tackle poverty and geographical inequity existing in Bhutan.

The six eastern districts of the target area, the subject of the present Study, lack trunk roads, and have harder natural conditions than the Eastern and Central zones, and therefore the social and economic situations still leave much to be desired.

The Ministry of Agriculture, which administers and develops rural agriculture roads in Bhutan, has established the Central Machinery Centre (CMU), under the Department of Agriculture, at Jakar in the Bumthang district to accelerate the construction of farm roads and power tiller tracks. However, the construction equipment belonging to the DOA is obsolescent through aging and is not suitable for the work in the target area due to low maneuverability and workability. It is very difficult to meet the requirements of the target roads. For this reason, new construction equipment and machinery are essential and constitute the top priority for the development of the nation. In this context, in August 2002 the Kingdom of Bhutan made an official request to the government of Japan for assistance in supplying equipment and machinery necessary for the construction work relating to the farm roads mentioned above. The equipment and machinery originally requested are shown in the following Table 1.1.

Table 1.1 Requested Equipment and Machinery (Original Request)

1. Farm Road Construction Equipment (5 Fleets)		2. Supporting Equipment	
Equipment	Specification	Equipment	Specification
Bulldozer	15 t	Cargo Truck with Crane	3 t
Hydraulic Excavator	135～145 HP	Bulldozer	6 t
Hydraulic Excavator	80～90 HP	Fuel Tanker	3,000 litter
Dump Truck	8 t	Mobile type Concrete Mixer	
Vibration Roller	3～5 t	Topographic Survey Station	Topographic Survey Instruments
Compactor	60～100 kg	Automatic 2-Wheel Type	
Hand Breaker	Pick Hammer, Jack Hammer	Spare Parts	
Air Compressor	80 HP		
Wheel Loader	80～90 HP		
Spare Parts		3. Workshop Equipment	1 set
Others	Safety equipment, Tent, Portable rock drill	4. Other Supporting Equipment	

In August 2002 the project originally covered only farm roads, but subsequently the construction of narrower "power tiller tracks" was additionally introduced into the Project, taking into consideration the advantages in terms of construction period and cost anticipated in the case where the narrower tracks are adopted. Based on this idea, the Ministry of Agriculture of Bhutan made a modified request, including the supply of newly added construction equipment needed to execute the construction of farm roads (total length = 251 km) as well as the newly added power tiller roads (total length = 74 km).

In response to this request, the government of Japan decided to carry out a basic design survey and entrusted the task of its execution to the Japan International Cooperation Agency (JICA), which dispatched in July 2004 a basic design survey team to the site. The team held discussions about the contents of the request with the officials concerned of the Government of Bhutan and conducted the site survey and data collection. The team selected the highly prioritized routes of farm roads and power tiller tracks, among the above mentioned roads in a total length of 325km to study the number and types of equipment. After returning to Japan, the team examined the justification of the Project on the basis of the field survey results and made the basic concept of the Project such as the selection of required construction equipment and the planning of procurement etc. The results were compiled in the draft report of the basic design was presented to the Government of the Kingdom of Bhutan by the draft report explanation team dispatched in October 2004. The Government of the Kingdom of Bhutan agreed the results of the basic design.

Chapter 2 Contents of the Project

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2-1 Basic Concept of the Project

The Ninth Five Year Plan (July 2002~June 2007) in Bhutan has highlighted the improvement of the farmer's living condition as one of major national targets. In the eastern region, the target area of the Project, the rural access is limited; there are many isolated villages and farmland at slope areas and the access problem hampers the various agricultural and social activities. Since development of rural access in the targeted area enables to connect the isolated villages and farmhouses to the trunk roads and the feeder roads leading to improve the living standard and the local economy, there are great demands of rural access roads from the viewpoint of poverty reduction as well as agricultural development.

The Ministry of Agriculture has tried to effectively utilize the currently available items of machinery for farm road construction. However, it is economically and physically infeasible to meet the entire requirements of farm roads with the limited machinery resources and the farm roads involve problems relating to construction cost and period to benefit the settlements thinly spread over the whole country. Thus, the Ministry of Agriculture has focused on "power tiller tracks", the lower category roads, to complement farm roads in order to achieve the agricultural development of the country.

The target road of the Project has been technically prioritized by the team from the past achievement the target road of the Project as 161 km of farm roads and 74km of power tiller tracks in six districts in the eastern region in response to the original request, 251km of farm roads and 74km of power tiller tracks. Therefore, the Project is designed as a grant aid to procure the machinery for the construction of 235km of farm roads and power tiller tracks.

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

(1) Basic Policy

Department of Agriculture with the Ministry of Agriculture of Bhutan made a modified request including the supply of new construction machines and equipment to execute the construction of farm roads (total length 251km) as well as the newly added power tiller tracks (total length 74km).

The basic design team held analysis and prioritized proposed rural agricultural roads in the request during the survey period in Bhutan. After returning back to Japan for the domestic work, the team examined conditions of those roads, and evaluated the appropriateness of types and numbers of machines and equipment for maintenance of machineries.

Then, the team has examined and considered the following items, and decided the design policy of construction machinery of the Project to carry out the construction of farm roads and power tiller tracks smoothly.

－Present Condition of Machinery of MOA:

Construction machineries and equipment of "the Paro Valley Agriculture Development Project", which were donated by the Japanese Government, are already aged for working and the size of the machines is not suitable for the work in the target area. Additionally, as the MOA machines are in general use for farm road construction everywhere, it is hard to deploy these machines to the target area.

－Consideration to Environmental Aspect:

To prevent the disposal of excavated earth materials away to valleys from the construction site on steep slopes in the target area, it is necessary to transport these materials to disposal places. Therefore, much excavating and loading work is required during the construction period.

Therefore, construction machines need to be chosen to mitigate the environmental effects of the work.

－Suitable combination of machines

Natural and environmental conditions in the target area differ from the construction work for farm roads or power tiller tracks. Therefore, combination of construction machines has to be considered and chosen suitable for the conditions.

－Suitable machines for work

Medium and small size machines are suitable for farm road construction in the road width of 4.6m (3.0m for carriage way width). As power tiller tracks in road width of 1.5m are small and narrow, and human power works are required for construction, small and light weight machines are appropriate for maneuvability.

－Adoption of fleet configuration

Conditions of access route from existing road to proposed construction sections are poor, and contents and contents of construction work are limited for small sized earth work. It needs to be adopted various kinds of construction conditions and for select machines immediately.

To carry out the construction work effective in scattered proposed routes, it is suitable to work in a group of machines, so called a fleet configuration, with limited numbers of machines for mobilizing and constructing. Additionally, rental charges of CMU's machines are charged in a operating hour, not a hired period. It is easy to save the charges of hired machines.

(2) Policy on Natural Condition

The specification of machinery should be examined in accordance with the natural conditions such as rainy seasons and dry seasons, icebound surface condition in winter, machinery workability in high land, space for the construction site in the narrow mountainous area and rock excavation. For example, the hydraulic excavator should be specified the rock buckets for hard rock cutting. The conditions are summarized as bellows.

- Temperature -10℃～+35℃
- Altitude 200～4,000m
- Geology Hard rock such as a weathered rock and andesine etc.

(3) Policy on Local Special Condition

The environmental consideration described as follows is necessary in Bhutan for the implementation of the Project.

- Air pollution
- Machinery selection for friendly environmental construction method
- Wasted oil disposal of the machinery

ROPS (Roll Over Protective Structure) devices will be equipped with the necessary machinery for safety reason in mountainous site condition. Although there is no special regulation on exhaust gas in Bhutan, the double fuel filter should be attached for high surfer content fuel in Bhutan to decrease the engine trouble and air pollution.

As environmental aspect is high lightened in Bhutan recently, the following restrictions are considered to select machines.

+ As excavated earth materials is prohibited to throw away a valley, a construction machine, which utilizes excavating and loading, needs to join for the work.
+ Slope Vegetation

(4) Policy for Machinery Selecting

Taking into consideration the above conditions and contents of the construction work, necessary machines and specifications are examined and selected.

Necessary items of construction machinery are selected for the work purposes and reasons described in Table 2.1.

Table 2.1 Necessary Construction Equipment on Contents of Work

Purpose of Works	Name of Equipment	Farm Road	Power Tiller Track	Reason for Selecting Specification of Equipment
Cutting, digging, dozing, leveling, ripping work, compacting,	Bulldozer	O	X	1) Angled and tilting type is better for blade 2) Medium size is suitable for farm roads construction
Cutting, digging side ditches and walls, loading, side information	Hydraulic Excavator	O	O	1) Medium, small sizes are suitable for farm roads, smallest or light weight type is good for power tiller tracks. 2) For environmental consideration, excavating and loading works are increasing.
Transportation of surplus soil and construction materials	Dump Truck	O	X	1) Work volume of hydraulic excavator and wheel loader should be considered for this machinery
Vibration compacting work on the soil and gravel road	Vibration Roller	O	X	1) For farm road construction, medium size is properly.
Crushing hard rock after using hydraulic breaker: Pick hammer	Hand Breaker	O	O	1) Light weight type is suitable
Drilling work for blasting hard rock: Jack hammer				
For using pick hammer and jack hammer	Air Compressor	O	O	1) Medium size for farm road and small size for power tiller track are suitable to construction. 2) CMU has medium ones.
Loading and carrying soil and gravel	Wheel Loader	O	X	1) Workability of narrow and small road should be considered.
Transportation of soil, gravel and small stones at narrow road	Wheel Tractor	X	O	1) Workability of narrow and small road should be considered.
Drilling work at the site far away from a compressor	Portable Hand Drill	O	O	1) Light weight type with a gasoline engine.
Vibration compacting work at narrow road	Hand Guide Roller	X	O	1) Workability of narrow and small road should be considered.
Compacting narrow place, etc	Tamper	X	X	1) CMU possesses. (Delete)
For safety work of worker at the job site	Safety Miscellaneous	O	O	Helmet, leather groves, goggle, etc. are selected.
For accommodations of operators, mechanics and helpers at the job site	Tent	O	O	Water proof type for 4 to 5 persons. is selected.
For keeping high machine availability of above equipment	Spare parts	O	O	For periodical and routine maintenance, spare parts for 2 years use.

c.f) O: good for the work, X: Not suitable

(5) Policy for Spare Parts

Spare parts are prepared for the periodical maintenance and consumable parts, etc for increasing the ratio of operation of new construction machineries.

Regarding to the work plan of farm roads and power tiller tracks construction, as annual working day and daily working hour are 240days per year and 6 to 6.5 hours per day, then, the total operating hour comes around 1,500 hours.

Spare parts are prepared for the initial 3,000 hours (2 years) of operation. During these 2 years, Bhutan side confirms conditions of usage of machineries, and the supply route of spare parts has to be established for the 3rd year and later.

（6） Policy for Management and Maintenance Control Ability of the Execution Agency

The Management and Maintenance of existing machinery procured in “the Basic Design Study on the Paro Valley Agricultural Development Project” has been under the control of CMU since 2002. Since the engineer and mechanic of the above mentioned Paro Project are in charge of management for CMU machinery, there is no difficulty of the management and maintenance by the executing agency. Moreover, the CMU has already completed the construction of the workshop in 2003 according to the initial plan of 2002 and has started to employ new mechanics for repairing. Thus, the new repairing machinery procured by the Project helps to improve the performance of maintenance. The Japanese side will consider on–the–job training and the JICA training course in order to realize the proper use of new machinery in the Project. The Japanese side also will recommend the communication system between CMU and local agents for proper maintenance.

（7） Policy for Time Schedule

The Project will be implemented in the Japanese fiscal year 2005. The handover time will be expected on March 2006.

2-2-2 Basic Plan

（1） Overall Plan

The machinery will be used for construction works for the prioritized farm roads (road width 4.6m) and power tiller tracks (road width 1.5m), which are selected by the team, in the eastern 6 districts. The construction machineries are required to consider the various conditions such as construction site, size of work, geographical and geological conditions, and fleet configuration is adopted, too.

（2） Selection Plan for Construction Machinery

Specification of construction machineries is selected to match two categories of fleets; the fleets for farm roads construction and for construction of power tiller tracks. The number of fleets is decided to achieve the target workload.

1） Identification of Target Roads

The target roads requested for the Project confirmed in the Basic Design Study are described in Table 2.4 with characteristics of numbers of house hold, geographical features, farming condition, emergency agriculture products, , and the summarized length of prioritized rural agricultural roads for each district are shown on the following table.

Table 2.2 Length of prioritized road in each district

District	Farm road		Power tiller track	
	route	Length (km)	route	Length (km)
Lhuntse	1	15	2	50
Mongar	3	26	3	9
Trashigang	3	39	0	0
Tashi-Yangtse	4	40	0	0
Pemagatshel	2	14	1	15
Samdrup Jongkhar	2	27	0	0
Total	15	161	6	74

The total length of selected farm roads and power tiller tracks is shown in the following table.

Table 2.3 Total Length of Prioritized Farm Road and Power Tiller Track

Priority	Farm road	Power tiller track	Total (km)
high	161	74	235
low	90	0	90
total	251	74	325

Table 2.4 Characteristic and Priority of Requested Rural Agricultural Roads

Name of district	No. of Road	Distance (km)	Road Category	Characteristic of Roads				Priority of Roads				Remarks
				Number of House Hold	Topographic Condition	Geological Condition	Farming Condition	Workability (Validity)	Degree of Request (Necessity)	Accessibility to the existing (Emergency)	Priority A: High B: Low	
Lhuentse	1	15	F.R.	170	Mountain	Soil/Rock	Vegetable, Fruit	Good	High	High	A	
	2	15	F.R.	111	Mountain	Soil/Rock	Vegetable, Fruit	Good	High	High	B	
	3	30	P.T.T.	330	Mountain	Soil/Rock	Vegetable, Fruit	Good	High	High	A	
	4	20	P.T.T.	230	Mountain	Soil/Rock	Vegetable, Fruit	Good	High	High	A	
Mongar	5	10	F.R.	401	Mountain	Soil/Rock	Potato, Cereals	Good	High	High	A	
	6	10	F.R.	272	Mountain	Soil/Rock	Potato, Cereals	Good	High	High	A	Mule Track
	7	6	F.R.	262	Mountain	Soil/Rock	Vegetable, Fruit	Good	High	High	A	
	8	15	F.R.	214	Mountain	Soil/Rock	Cash Crop in future	Poor	High	Low	B	
	9	3	P.T.T.	50	Mountain	Soil	Vegetable	Good	High	High	A	
	10	3	P.T.T.	80	Hill	Soil	Paddy	Good	High	High	A	
	11	3	P.T.T.	70	Mountain	Soil/Rock	Potato, Cereals	Good	High	High	A	
Trashgang	12	4	F.R.	200	Mountain	Soil	Potato	Excellent	High	High	A	
	13	25	F.R.	86	Mountain	Soil/Rock	Potato, Cereals	Poor	High	High	B	
	14	20	F.R.	398	Mountain	Soil/Rock	Potato, Cereals	Good	High	High	A	
	15	15	F.R.	237	Mountain	Soil/Rock	Potato, Cereals	Poor	High	High	A	
Tashi Yangtse	16	10	F.R.	216	Mountain	Soil/Rock	Potato, Cereals	Good	High	High	A	
	17	10	F.R.	300	Mountain	Soil/Rock	Potato, Cereals	Good	High	High	A	
	18	5	F.R.	Over 100	Mountain	Soil/Rock	Potato, Cereals	Good	High	High	A	
	19	15	F.R.	170	Mountain	Soil/Rock	Potato, Cereals	Good	High	High	A	
Pemagatshel	20	7	F.R.	57	Mountain	Soil/Rock	Vegetable, Fruit	Good	High	High	A	
	21	7	F.R.	52	Mountain	Soil/Rock	Vegetable, Fruit	Good	High	High	A	
	22	10	F.R.	190	Mountain	Soil/Rock	Vegetable, Fruit	Poor	High	High	B	Tseri land
	23	15	P.T.T.	297	Mountain	Soil/Rock	Vegetable, Fruit	Good	High	High	A	
Samdrup Jongkhar	24	15	F.R.	861	Mountain	Soil/Rock	Vegetable, Fruit	Good	High	High	A	
	25	12	F.R.	594	Mountain	Soil	Vegetable, Fruit	Good	High	High	A	
	26	25	F.R.	581	Hill	Soil	Vegetable, Fruit	Good	High	Low	B	

F.R.(Farm Road) : Priority A 161km Priority B 90km

P.T.T(Power Tiller Track). : Priority A 74km

2） Estimation of the Standard Work Volume of a Fleet

① Works Conditions

Works conditions are as follows.

－Annual workable days: 240 days (Exclude 1.5 month of rainy period, 1 month of extensive farming period and all Sundays)

－Construction works will be started from the accessible point of existing roads.

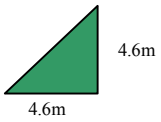
－Environmental Friendly Work: reuse cutting material at site as much as possible and extra material will be deposited near sites (not in the slope) properly.

－Construction period will be estimated 3 years based on the achievement work

② Analysis of Works Speed

The results of interview concerning the daily estimated work speed of a fleet for the different soil conditions are given in Table 2.5.

Table 2.5 Daily Works Speed of a Fleet with the Different Soil Condition

Item	**Soil**	**Soft Rock**	**Hard Rock**
Mongar District Engineer	60～80	30～40	3～4
CMU Mechanical Engineer	80～100	40～50	5～7
Average	80m/day	45m/day	5m/day
Works Volume	Bulldozer	Bulldozer	Hydraulic Excavator*
Quantities of Earth Moving 	80mx4.6mx4.6mx0.5= 846m3/day 846/ 6hours= 141m3/hour	45mx4.6mx4.6mx0.5= 476m3/day 476/ 6hours= 79m3/hour	5mx4.6mx4.6mx0.5= 52.9m3/day 52.9/ 6hours= 8.8m3/hour
Standard Work Volume: guideline of earthwork issued by JCEA**	120m3/ hour	73m3/hour	7m3/hour
Compared to Standard Work Volume	Reasonable	Reasonable	Reasonable

*) with Hydraulic Breaker

**) JCEA: Japanese Civil Engineering Association

③ Standard Work Volume of a Fleet based on the Result of Pilot Works of Farm Road Construction

Based on Yongkola～Tsamang route (farm road) in Mongar, the typical case of construction works, the standard work volume of a fleet is estimated. Cutting item is

considered to be critical for roads construction and the required days per 1km for cutting works in the different soil conditions is calculated as below.

	unit	Soil	Soft Rock	Hard Rock	Total
Construction Machinery		Bulldozer	Bulldozer	Hydraulic Breaker	
Distance	m	620	350	30	1,000
Work Volume per day	m	80	45	5	
Required Day	day	8	8	6	22

The standard works volume of a fleet is 11km/ fleet.

i.e. 240day/ 22day/ 1km = 11km/ fleet

④ Work Volume in the Project

The standard work volume of a fleet for the farm road construction is decided 11km/fleet/ as shown in the above paragraph.

As for power tiller tracks construction, the 5km/fleet/year is adopted in this Project; the amount has been estimated to be the average workload in the experimental execution of the Development Study.

⑤ Required Number of Fleet Based on the Standard Work Volume of a Fleet

Required Number of Fleet is described in Table 2.6.

Table 2.6 Required Numbers of Fleet

Item		Farm Road	Power Tiller Track
Annual Standard Work Volume	a	11 km/ fleet/ year	5 km/ fleet/ year
Work Volume per fleet for 3 years	b=3a	33 km/fleet	15 km/fleet
High Priority Roads	**c**	**161km**	**74km**
Required Number of Fleets	**c/ b**	**5**	**5**
Targeted Roads length by Bhutanese Side		251km	74km
Required of Fleets by Bhutanese Side		5	6

Regarding to the above consideration, numbers of fleet for the construction of farm roads and power tiller tracks are 5 fleets each.

Based on the past references related to the budgetary system applied to the agricultural road construction planning, it is reasonable to select high priority roads for the present Project. Furthermore, in view of the past references concerning the road construction management

systems applied in the eastern six districts subject to the Project, it is assumed that in the eastern region of Bhutan the road construction management capability is approximately 50 km/year. The total length of the farm roads to be executed, 161 km, over a period of three years, i.e. 54 km/year is justifiable as reasonable from the viewpoint of construction management capability of the authorities concerned. As for the power tiller tracks, there should be few problems related to project management, taking into account the fact that the work execution management system will be configured in cooperation with WFP. Consequently, the number of fleets of equipment required for carrying out the present Project, based on priority, is determined to be five (5) for the construction of farm roads and for the construction of power tiller tracks respectively.

For details of the roads and tracks, covered by the Project, please refer to Annex 5 attached at the end of this document.

3) Plan for Construction Equipment

Plan for construction equipment is shown in Table 2.7.

Table 2.7 Construction Equipment Plan

Construction Equipment for Farm Roads			
Name of Equipment	Outline of Specification	Unit	Purpose of Use
Bulldozer	170~190HP, Angle dozer, ROPS canopy, Multi-shank ripper	5	Excavating, digging, dozing, leveling, compacting, ripping work, etc.
Hydraulic Excavator (Middle class)	135~150HP, 0.8m3 Rock bucket Steel cabin, Option: Hydraulic breaker	5	Excavating, digging, loading, etc.
Hydraulic Excavator (Small class)	75~85HP, 0.35~0.45m3, Steel cabin, Rock bucket	5	Excavating, digging side ditches and wall, loading, slope information, etc.
Dump Truck	8tons, 4x2, Min.185HP	5	Transportation of surplus soil and construction materials such as soil and gravel
Vibration Roller	Approx.7tons, Awing (Front) Drum Vibration & Drive (Rear) Tire x 2 (Drive)	5	Vibration compacting work on the soil and gravel road
Hand Breaker	(1) Pick hammer (Handle type) Vibration isolation type Weight: Approx. 20kg Air consumption: Approx. 1.4m3/min. Hose adapter: 20A(3/4")	10	Crashing hard rocks after using hydraulic breaker
	(2) Jack hammer (Handle type) Vibration isolation type Weight: Approx. 20kg Air consumption: Approx. 1.4m3/min. Hose adapter: 20A(3/4")	10	Drilling works for blasting hard rock
Air Compressor (Middle class)	Approx. 80~85HP, Mobile type: 2 wheels Air delivery: Approx. 7.5m3/min. Hose adapter: 20A(3/4") x2	1	For pick hammer and jack hammer at rocky job site
Wheel Loader	80~90HP, ROPS canopy Approx. 1.3m3	5	Loading and carrying of soil, gravel, etc.
Safety Miscellaneous	1) Safety belt, 2) Goggle, 3) Safety cap, 4) Dust & mist respirator, 5) Leather	Each 50	For safety work of worker at the job site

	gloves		
Tent	Water proof Size: For 4 persons	Each 25	For accommodation of operators, mechanics and helpers at the job site
Portable hand drill	With gasoline engine Approx. 25kg	10	Drilling work at the job site where is far away from a compressor
Spare Parts	For above equipment	---	To keep high machine availability
Construction Equipment for Power Tiller Tracks			
Name of Equipment	Outline of Specification	Unit	Purpose of Use
Hydraulic Excavator (Mini small class)	28~36HP, 0.10~0.14m3 Steel cabin With front blade	5	Cutting, digging, loading, leveling, etc.
Wheel Tractor	Approx.28HP, 4x4, with trailer: (Stationary type) Approx. 1.0~1.5ton	5	Transportation of soil and stone at narrow job site
Hand Breaker	(1) Pick hammer (Handle type) Vibration isolation type Weight: Approx. 20kg Air consumption: Approx. 1.4m3/min. Hose adapter: 20A(3/4")	5	Crashing hard rock
	(2) Jack hammer (Handle type) Vibration isolation type Weight: Approx. 20kg Air consumption: Approx. 1.4m3/min. Hose adapter: 20A(3/4")	5	Drilling work for blasting hard rock
Air Compressor (Small class)	Approx. 35HP, Stationary type Air delivery: Approx. 3.5m3/min. Hose adapter: 20A(3/4") x1	5	For pick hammer and jack hammer at rocky job site
Hand Guide Roller	Approx. 900kg Tandem type both drum drive	5	Vibration compacting work at narrow job site
Safety Miscellaneous	1) Safety belt, 2) Goggle, 3) Safety cap, 4) Dust & mist respirator, 5) Leather gloves	Each 25	For safety work of worker at the job site
Portable rock drill	With gasoline engine Approx. 25kg	5	Drilling work at the job site where is far away from the base of the compressor station
Spare Parts	For above equipment	---	To maintain high machine availability
Supporting Equipments			
Name of Equipment	Outline of Specification	Unit	Purpose of Use
Cargo Truck with Crane (Middle Class)	8ton, Crane: 3ton 4x2, Min. 230HP	1	Transportation of small machine such as hand guide roller, hand breaker and materials of construction such as steel pipes, cement, steel bars, etc.
Cargo Truck with Crane (Small class)	4ton, Crane: 3tons, 4x2, Min. 170HP	1	For maintenance and repair of engine and chassis at the job site
Fuel Truck	3,000Lit, 4x2 Approx. 120HP	1	For supplying fuel at the job site
Survey Equipment	(1) Auto level, (2) (2)Portable GPS	Each 6	Surveying works in the sites
Pick-up Truck	Double cab, 4x4, Diesel engine, White color	1	For supervising and inspecting at the job site, and transporting service parts for maintenance and repair of machine
Self Loading Truck	Payload: Approx.14tons 6x4, Min.290HP, with winch	1	Transportation of construction machine such as bulldozer, hydraulic excavator, etc. between job site and workshop
Spare Parts	For above equipment	---	To maintain high machine availability

4) Maintenance and Repair Equipment Plan

Since CMU workshop has little maintenance and repair equipment at the moment, the following equipment for repair and maintenance are necessary to realize the effective maintenance of the machineries procured in the Project. Service truck is selected 4ton cargo truck with crane considering narrow, steep and curved roads at the job site area. The details are shown in Table 2.8.

Table 2.8 Maintenance and Repair Equipment Plan

(1) Workshop Equipment & Tools				
1	Portable Gantry Crane			
No	Name of Equipment	Outline of Specification	Unit	Purpose of Use
1-1	Portable gantry crane	Lifting capacity: 3tons Max. Lift: Approx. 3,180mm Trolley travel: Approx. 3,600mm With manual chain block	1	Use for removing and installing heavy components such as engine, transmission, etc. from chassis of construction equipment
1-2	Sling Chain Set	For 1ton, 2tons, 3tons	1 set	Lifting tools
1-3	Wire Rope Set	6mm x2m, 8mm x2m, 12mm x3m, 16mm x4m	1 set	Lifting tools
1-4	Shackle	Diameter: 9mm, 12mm, 16mm, 19mm, 22mm, 25mm	1 set	Lifting tools
1-5	Eye-bolt	M10, M12, M16, M20, M24, M30	1 set	Eye-bolt for lifting components
2	Electric Welder & Accessories			
2-1	DC ARC Welder	Welding current: 10~300A Input capacity: Approx. 16kVA Input capacity: 3-phase, 380V, 50Hz	1	Use for welding
2-2	Welding Shield	Hand holding type	1	For using welder
2-3	Secondary Earth cord	Capacity: 300A Length: 10m	2	
2-4	Earth Clip	Capacity：300A	1	
2-6	Chipping Hammer	Double end	1	Tool for welding
2-7	Leather Glove	---	1	For using welder
2-8	Apron	Leather	1	
2-9	Screw Clamp	L type, 150mm, 300mm	Each 2	
2-10	Grip Plier	Straight jaw type, 10mm, 20mm	Each 2	
3	Gas Welder Set			
3-1	Gas Welder Set	Pressure gauge and hose: For oxygen & acetylene Torch with tips: For welding and cutting Igniter, Welding glass, Wrench for cylinder	1 set	For cutting and welding
3-2	Cylinder Carrier	For 2 cylinders	1	For carrying cylinders
4	Air Compressor and Impact Wrench			
4-1	Air Compressor	3-phase 380V50HZ, 7.5kW 9.5kg/cm2, 7.5kW, 850Lit/min. Air outlet: 1/4", 3/8", 1/2"	1	For using impact wrench
4-2	Air Hose	6mmx10m, 9mmx10m, 12mm x10m (with quick coupler)	Each 2	
4-3	Hose Band	13~20mm, 18~25mm,25~35mm	Each10	
4-4	Air Impact Wrench	Sq. drive：1/2", 3/4", 1"	Each 1	For disassembling repairing and assembling
4-5	Socket Set	1/2" sq. drive, Socket set (mm) 1/2" sq. drive, Socket set (inch) 3/4" sq. drive, Socket set (mm) 3/4" sq. drive, Socket set (inch) 1" sq. drive, Socket set (mm) 1" sq. drive, Socket set (inch)	Each 1	
5	Mechanic Tool Set for Construction Machine			
5-1	Tool Set with Cabinet	For set (size: mm & inch)	3 set	

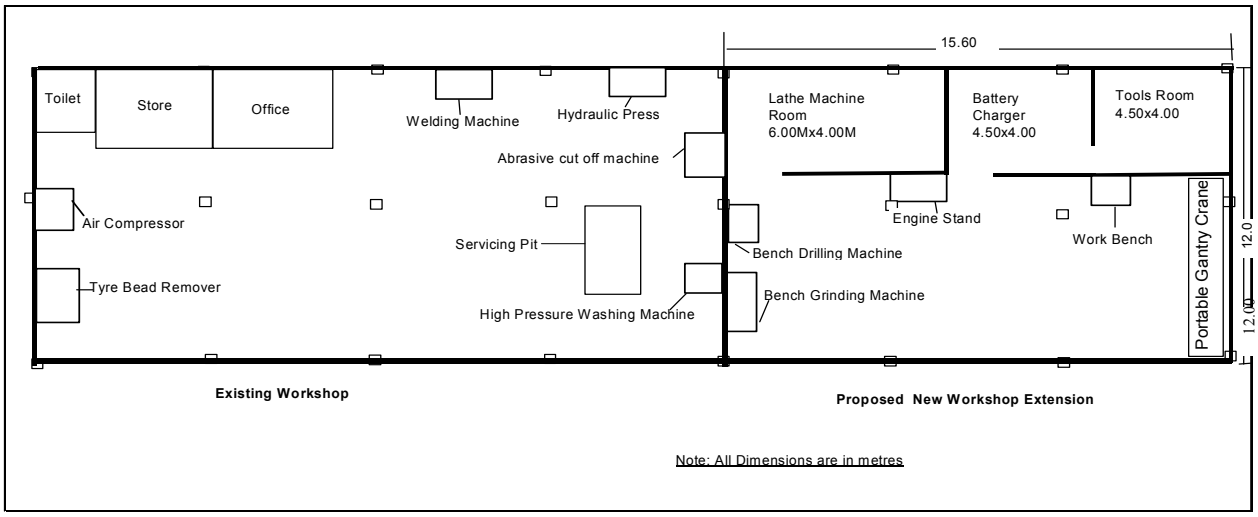
5-2	Socket Wrench Set	1" sq. drive, Set (mm) 1" sq. drive, Set (inch)	Each 1 set	For disassembling, repairing and assembling
5-3	Open End Wrench	Size: mm	2 set	
5-4	Adjustable Wrench	Opening: 38~76mm, 70~120mm	Each 1	
6	Measuring Tools			
6-1	Torque Wrench	10~45, 40~180, 80~560, 100~850Nm	Each 1	Measuring tools for tightening torque of bolts
6-2	Surface Plate	1,000x1,000 x125mm	1	For measuring dimensions
6-3	V Block Steel Compass Straight Rule Measuring Tape Thickness Gauge Magnet Stand	- - -	Each 1	
6-4	Dial Gauge	0~10mm	1	
6-5	Cylinder Bore Gauge	50~100, 100~180mm	Each 1	
6-6	Micrometer	0~150mm	1	
6-7	Tachometer	0~1,200/ 6,000rpm	1	
6-8	Blow-by Checker	0~5kPa	1	For checking blow-by gas
6-9	Compression Gauge	For diesel engine, With dial gauge	1	For measuring compression of diesel engine
6-10	Hydraulic Gauge Set	Pressure: 2.5, 6.0 40, 60Mpa With hose & adapters	1	For measuring hydraulic pressure
6-11	Circuit Tester	Digital type	1	For measuring current and voltage
7	Engine Service			
7-1	Engine Stand	2tons, Manual type	1	Stand for disassemble, adjustment and assemble of engine
7-2	Mechanic Tool Set	Set (mm & inch), With cabinet	2	For mechanic
7-3	Tools for repairing engine	Valve spring pusher, Cylinder liner pusher Piston ring tool, Air valve lapper & rubber cap set	1 set	For repairing engine
7-4	Part Cleaner	Tank capacity: 70litters	1	
8	Jack & Lifting Device			
8-1	Hydraulic Garage Jack	15ton	2	For lifting construction equipment
8-2	Portable Hydraulic Jack	10ton、50tons	Each 2	
8-3	Blocking Tool	10ton、30tons	Each 2	
9	Wheel type Vehicle Service Tools			
9-1	Tire Service Tool Set	Tire bead remover Tire service tool set Tire lever set Wheel nut wrench Tire pressure gauge	Each 1	For repairing tire
9-2	Cold Patch	For tube repair	2 set	For repairing tube tire
9-3	Earth Stick	For tubeless repair	5 set	For repairing tubeless tire
9-4	Quick Riveter	Manual	1	For brake lining
9-5	Hydraulic Tire Removing Tool	For OR tire	1 set	For repairing OR tire
10	Master Pin Remover & Installer for Bulldozer			
10-1	Hand Hydraulic Pump	Manual operation	1 set	Special tool for exchanging undercarriage of bulldozer
10-2	Master Pin Service Tool Set	For medium size bulldozer	1 set	
11	Battery Service			
11-1	Battery Quick Charger	4kVA, 80A With booster cable	1	For charging battery
11-2	Battery Service Set	Battery filler, Battery syringe, Battery hydrometer set	1 set	
12	Lubricating Service			
12-1	Portable Lubricator for Grease	Air operation, Container: 16kg	1	For grease
12-2	Portable Lubricator for Oil	Air operation Container: 200Lit (drum can)	1	For oil
12-3	Grease Pump	Manual operation, Capacity: 16kg	1	For grease
12-4	Oil Bucket Pump	Manual operation, Capacity: 20Lit	1	For oil
12-5	Lubricating Service Set	Grease gun, Oil filter wrench,	1 set	For lubricating service

		Drum pump, Portable fuel can		
13	Electric Power Service			
13-1	Disc Sander	Grinding wheel: 100mm, 220V	1	For repairing and rebuilding construction equipment
13-2	Electric Drill	Capacity: Max.13mm, 220V	2	
13-3	Abrasive Cut-Off Machine	Cutting wheel: Approx. 300mm, 220V	1	
13-4	Etc.	Electric cord reel, Garage lamp	1 set	
14	Cleaning Equipment			
14-1	Hot Water High Pressure Washer	Water discharge: 800Lit/h Temperature: Max. 80℃ 3-phase 380V, 50Hz, 1.5kW	1	For cleaning construction equipment
15	Miscellaneous			
15-1	Hydraulic Shop Press	Manual operation Capacity: 55tons, With accessories	1	For repairing and rebuilding construction equipment
15-2	Spray Gun	Suction type	1 set	
15-3	Cleaning Pan Set		1 set	
15-4	Consumable Parts for Repair	Lubricant for screw, Seal tape, Locking agent, Abrasive paper, Liquid gasket, etc.	1 set	
15-5	Lathe	Swing over bed: 600mm Center distance: 2,000mm Spindle speed: 25~1,500rpm 3-phase 380V, 50Hz, 7.5kW With accessories	1	
15-6	Portable Welder	With gasoline engine: 13PS Welding current: 50~190A	1	
15-7	Bebch Grinder	Grinding wheel: Approx. 200mm With bench	1	
15-8	Engineers Vise	Stationary base & Swivel base With mobile work bench	1	
15-9	Bench Drill	220V, 400W Capacity: Max. 23mm Swing: Approx. 430mm With accessories	1	
15-10	Drill Press Vise		1	
(2)	**Equipment & Tools for Service Truck (4ton Cargo Truck with Crane)**			
No	Name of Equipment	Outline of Specification	Unit	Purpose of Use
1	Diesel Engine driven Generator Welder Set	Diesel engine: 17.5PS 3-phase, 380V, 50Hz, 10kVA, Current: 30~270A, With welder accessories	1 set	For welding
2	Gas Welder Set	Pressure regulator & Hose: Oxygen and acetylene Torch with tips: Welding & Cutting Igniter, Welding glass, Wrench for cylinder	1 set	For cutting and welding
3	Cylinder Carrier	For 2 cylinders	1	For cylinder of gas welder
4	Air Compressor	3-phase 380V 50Hz Motor: 2.2kW With air hose with quick coupler	1 set	For repairing construction equipment
5	Air Impact Wrench	For Sq. drive 1/2" & 3/4"	Each 1	
6	Impact Socket Wrench Set	Sq. drive 1/2" socket set (mm) Sq. drive 3/4" socket set (inch)	Each 1	
7	Tool Set	With tool cabinet	1 set	
8	Socket Wrench Set	Sq. drive 1" socket set (mm) Sq. drive 1" socket set (inch)	1 set	
9	Adjustable Wrench	Opening:38~70mm, 70~120mm	Each 1	
10	Hydraulic Gauge Set	Pressure: 2.5, 6.0 40, 60Mpa With hose & adapters	1	For measuring hydraulic pressure
11	Circuit Tester	Digital type	1	For measuring current and voltage
12	Tacho Tester	0~1,200/6,000rpm	1	For measuring current and voltage
13	Portable Jack	10ton	2	For lifting construction equipment
14	Tire Service Tool Set	Tire bead remover, Tire service tool set Tire lever set, Wheel nut wrench Tire pressure gauge	Each 1	For repairing tire
15	Cold Patch	For tube repair	2 set	For repairing tube tire

16	Earth Stick	For tubeless repair	5 set	For repairing tubeless tire
17	Battery Service Set	Battery filler, Battery syringe Battery hydrometer set	1 set	For service of battery
18	Grease Pump	Manual operation, Capacity: 16kg	1	For grease
19	Oil Bucket Pump	Manual operation, Capacity: 20Lit	1	For oil
20	Lubricating Service Set	Grease gun, Oil filter wrench, Drum pump, Portable fuel can	1 set	For lubricating service
21	Disc Sander	Grinding wheel: 100mm, 220V	1	For repairing and rebuilding construction equipment
22	Electric Drill	Capacity: Max.13mm, 220V	2	
23	Cleaning Pan Set		1 set	
24	Consumable Parts for Repair	Lubricant for screw, Seal tape, Locking agent, Abrasive paper, Liquid gasket, etc.	1 set	
25	Engineers Vise	Swivel base, With mobile work bench	2	
26	Wire Rope Set	6mm, 8mm, 12mm: Each 4pcs 16mm: 2pcs	1 set	For repairing construction equipment
27	Nylon Sling Set	Width x Length: 25mm x 4m Width x Length: 50mm x 4m	Each 2	
28	Lever Block	1.5tons	2 set	
29	Chain Block	3tons	1	
30	Tool Cabinet	For truck mount, Plastic	1	

2-2-3 Basic Equipment Plan

The new construction machinery and maintenance and repairing equipment are stationed in CMU Workshop at Jakar in Bumthang. CMU Workshop has the expansion plan of the scale of three million Nu. It is progressing and is to be completed by June in 2005. The drawing of the final plan is shown in Fig. 2.1.



Source : CMU

Fig. 2.1 The second expansion plan of CMU workshop

2-2-4 Procurement Plan

2-2-4-1 Procurement Policy

(1) Project Implementing Agency

In case the Project under Japan's Grant Aid is implemented, the relationship among the organizations concerned shall be as illustrated in Fig. 2.2.

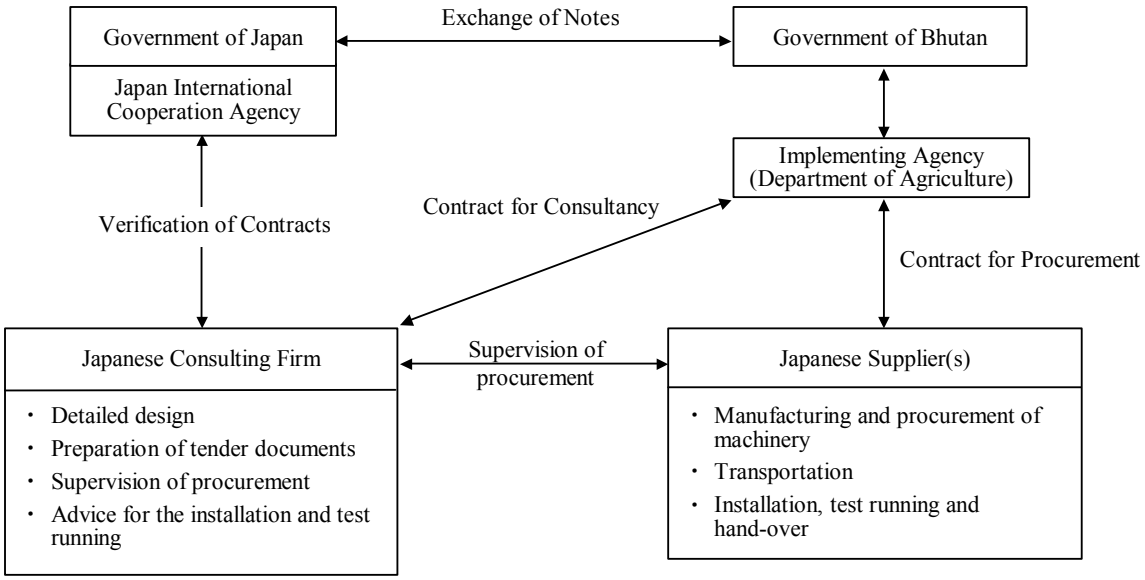


Fig. 2.2 Mechanism of Project Implementation

Implementing agency of the Project in Bhutan is the Department of Agriculture under the Ministry of Agriculture.

In accordance with Japan's Grant Aid System, a Japanese consulting firm will undertake the detailed design and supervision of the Project and Japanese firm(s) will undertake the supply of machinery under the Project.

(2) Consultant

After Exchange of Notes (E/N) between the Government of Japan and the Government of Bhutan, the Ministry of Agriculture will conclude speedily a contract with a Japanese consulting firm for the procurement of consultancy services.

The said firm will provide engineering services for the procurement of machinery including detailed design, preparation of tender documents, assistance for tender(s) and contract(s), and supervision of procurement, in accordance with the contract until the completion of delivery of the machinery under the Project.

(3) Supplier(s)

The Ministry of Agriculture will conclude contract(s) for the supply of machinery under the Project with the Japanese trading firm(s) who has (have) been awarded the tender(s) after having passed successfully the examination of the quality being required at the international tender with limited qualification.

The said firm(s) has (have) the obligation to deliver the machinery requested by the Ministry of Agriculture and carry out its initial operation diligently within the delay stipulated in the contract.

2-2-4-2 Condition of Procurement

The unloading port of the machinery to be procured from Japan is Kolkata (India). After unloading, the machinery shall be transported to Phuentsholing as bonded cargo and shall clear customs there. Then the machinery shall be reloaded to the smaller trailer and retransported to the CMU at Jakar in Bumthang District. The machinery shall be handed over to the Bhutanese side at Jakar in Bumthang District under the Project. And after that, the machinery shall be transported to the places, where the six Districts will indicate to be unloaded, under the responsibility of the Bhutanese side.

The supplier(s) of machinery should take necessary measures for avoiding issues with the Bhutanese side with regard to the responsibilities for the damages or loss of cargoes, which may occur during inland transport.

2-2-4-3 Scope of Work

The cost of procurement of machinery including the cost of inland transport to CMU (Jakar) shall be borne by Japanese side.

2-2-4-4 Consultant's Supervision

(1) Principles of Procurement Supervision

In case the project is implemented under Japan's Grant Aid Scheme, the consultant shall carry out the detailed design and supervision of procurement with a thorough understanding of the following:

1) Background of the implementation programme
2) Contents of the basic design report
3) System of Japan's grant aid
4) Contents of the Exchange of Notes between the two governments

Based on the above understanding, the contents, division of responsibilities, and special notes for detailed design and supervision of procurement are explained below.

(2) Scope of Consulting Services

After Exchanges of Notes (E/N), the consultant concludes a contract for consulting services with the implementing agency within the scope of services specified in the Exchange of Notes (E/N).

The scope of services can be summarized as follows,

1. Detailed Design

    1) Consultancy agreement (in Bhutan) and verification (in Japan)
    2) Prompting the issuance of the Authorization to Pay (A/P) (Bhutan)
    3) Site survey, detailed design and preparation of tender documents (Bhutan, Japan)
    4) Obtaining approval of tender documents from Bhutanese side (Bhutan)
    5) Announcement of tender and distribution of tender documents (Japan)
    6) Execution of tender(s), evaluation of tenders, preparation of evaluation report, approval of the report (Japan)
    7) Witness of the contract(s) for the supply of machinery (Japan), and verification of the supply contract(s) (Japan)
    8) Confirmation of the obligations of Bhutanese side (Bhutan/Japan)

2. Supervision of the Procurement of Machinery

    1) Confirmation of the procurement order
    2) Follow-up of the procurement
    3) Ex-factory inspection/Inspection before shipment
    4) Progress report
    5) Witness of final hand-over
    6) Preparation of completion note and final report

3. Initial Operation of the Machinery

    It will be necessary for supplier(s) engineers to provide instructions for assembling of machinery, initial running, preventive maintenance and routine maintenance under the supervision of the consultant.

(3) Special Remarks

1) It is necessary to check whether the procurement conditions fixed by the basic design have not changed.
2) Tender and contract documents should be in accordance with Japan's Grant Aid System. It is necessary to discuss these documents fully with Bhutanese side during the field survey of the Detailed Design and get from Bhutanese side approval of the tender documents including the Detailed Design.

2-2-4-5 Procurement Plan

(1) Countries eligible for procurement

As a result of the discussion with the Ministry of Agriculture on countries eligible for procurement of this project, Bhutanese side prefers the Japanese products because of two following reasons.

- The high reliabilities on Japanese machinery supplied in 1990 and 1995 have been proved in the past Japan's grant aid project "the Paro Valley Agricultural Development"
- The operators and mechanics have enough knowledge on the Japanese machinery.

As the Ministry of Works and Human Settlement case, most machinery is to be procured from Japan.

The Basic Design Study confirmed that there is the after service condition and supply system of spare parts of the requested machinery in Bhutan. The procurement performance from the manufacturing to the delivery is also high for Japanese products. Therefore, the country eligible for procurement for most machinery is in principle Japan.

The major Japanese manufacturers have local agents in Bhutan as shown in Table 2.9. And the local agents have services on technical ability of maintenance and spare parts procurement system.

Table 2.9 List of Local Agents of Major Japanese Manufacturer

Name of Agent	Base	Related Manufacturer
Continental Bhutan Enterprises	Phuentsholing	Komatsu
TIL Limited	Phuentsholing	Caterpillar Mitsubishi
Druk Trading Equipment	Phuentsholing	Kobelco、Sakai
Reys consultancy & Marketing services	Phuentsholing	Hitachi
State Trading Corporation	Thimpu	Isuzu、Mitsubishi Fuso、Toyota
Syngye group of companies pvt. Ltd	Thimpu	Kubota
Chor, danchang ISEKI co.,Ltd	Thimpu	Iseki

As a result of examination in Japan, it is found that there is some machinery that cannot be secured the fair tender with more than 3 manufacturers. The third country procurement for such machinery shall be considered and the eligible manufacturer in third countries must have same or superior to Japanese product in quality. For example, even if the price shall be less, the Indian products are not eligible for procurement with following reasons.

- Many Cracks and damages could be occurred due to low quality of iron and minor strength.
- There is not enough endurance.
- Performance can be less than the specification.

(2) Spare Parts

The following spare parts required during initial two years shall be considered in the framework of the Project in order to level up of the productivity of the machines.

- Regular replacement parts: Fuel filter, Engine oil filter, Lubricant filter etc.
- Irregular replacement parts: Cleaner element, Gasket kit, Break horse, Break lining etc.
- Irregular consumable parts: V-belt, End pit, Point, Cooling horse etc.

2-2-4-6 Implementation Schedule

The project shall be implemented according to the following schedule based on Japan's Grant Aid System.

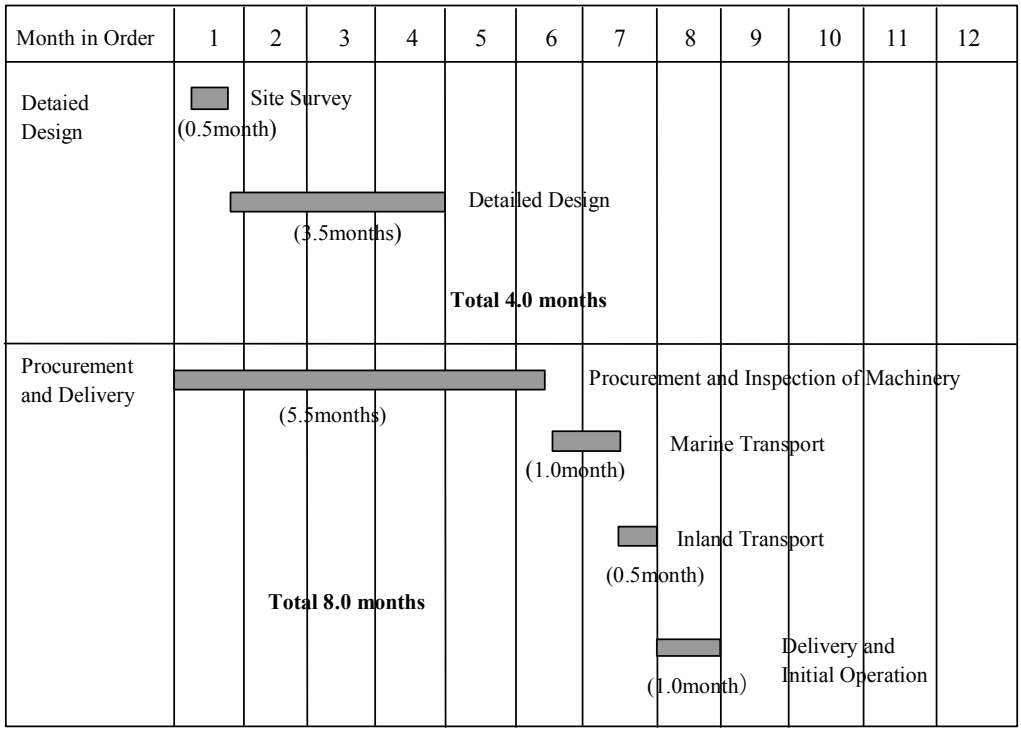


Fig. 2.3 Implementation Schedule

2-3 Obligations of the Recipient Country

In case the Project is implemented under Japan's Grant Aid Scheme, the following obligations are generally to be fulfilled by Bhutanese side.

(1) Payment of the following commissions for the banking services based on the banking arrangement (B/A) for the Project.

1) Commission for the advising of A/P
2) Commission for payments

(2) Speedy unloading and customs clearance of the machinery procured under the Project at Kalkota in India and Phuentsholing at the Bhutanese border.

(3) Obtaining permission for entering and staying in Bhutan and providing assistance to the Japanese personnel engaged in the Project based on the contract approved by the Japanese Government for the procurement of the Project.

(4) Exemption from customs duties and taxes in Bhutan for the Japanese firms and personnel engaged in the Project based on the contract approved by the Japanese government.

(5) Appropriate and effective use and maintenance of the machinery to be procured under the Grant Aid.

(6) Payment of all expenses for transport, installation, operation, maintenance and so forth of the machinery except those which are borne by the Japanese side under the Grant Aid for the Project.

In special case of this Project, the construction of foundation for the lathe that will be supplied as workshop equipment and tools will be undertaken by Bhutan.

2-4 Maintenance and Management Plan of the Project

CMU will improve the preventive maintenance service including daily inspection and periodical maintenance of construction machinery and establish the integrated communication system so that CMU grasp the real-time conditions of machinery.

(1) Construction Machinery

Maintenance and management procedure of construction machinery is as follows.

Table 2.10 Maintenance and Management Plan of Construction Equipment

No	Item	Contents of Implementation	Charge of
1	Daily Check	①Daily check of machinery shall be carried out according to daily check sheet to be prepared by equipment section manager based on the manual of the machinery maker. ②Operators record operating hours or distance on the check sheet every day, and the consumption volume of fuel and lubrication oil each time of their refilling. ③The result of check-up is reported daily to equipment section manager, and he reports to workshop section manager	Operators ↓ Equipment Section Manager ↓ Workshop Section Manager
2	Periodical Maintenance	①Periodical maintenance of machinery shall be carried out based on the daily check sheet submitted by equipment section manager. Engineer of job control & planning belongs to equipment section follows the condition and operating hours or distance of each machine, and decides periodical exchange parts, contents of maintenance work and periodical maintenance schedule. After that, he requests engineer of workshop section to keep man-hours of mechanics, and store officer to ship necessary parts. ② The result of periodical maintenance shall be recorded on machine history book and/or computer system.	Equipment Section Manager ↓ Engineer of job control & planning ↓ Workshop Section Engineer & Store officer
3	Repair & Adjustment	①In case of operators find abnormal conditions, they shall request a check-up through equipment section manager. ②Equipment section manager requests workshop section manager & CMU manager to dispatch mechanics for inspection. ③Mechanics investigate causes of trouble at the job site, and record the results of the investigation on the repair record sheet included causes of trouble, repair method, replaced parts and quantity, required man-hours and repair period. After that, they inform to workshop section manager and CMU manager. ④In case of the complicated accident and the trouble cannot be identified at the job site, machine out of order is carried to CMU workshop and repaired on the investigation of workshop engineer. ⑤Repair work at workshop is carried out according to the repair process sheet issued by the workshop engineer. Repair process sheet is to be filled with information such as machine user's number, date of failure, cause of trouble, required parts, staff in charge of repair, repair completion schedule, etc. ⑥Workshop engineer checks the items filled in the repair process sheet and keeps the repair process sheet after having filled in the repair cost and having registered the repair record on the machine history book and/or computer system.	Operators ↓ Equipment Section Manager ↓ Workshop Section Manager & CMU Manager ↓ Mechanics ↓ Workshop Section Manager ↓ Store officer
4	Management of spare parts	①Spare parts are managed by means of parts inventory card and/or computer system. Store officer shall stock only periodical replacement parts according to machine history book in order not to delay working schedule. ② However, in case of emergency parts, he requests CMU manager to buy these parts with parts order sheet. ③ In case of expensive parts, CMU manager requests to Technique Section to buy these parts after tendering in the Ministry of Agriculture.	Store officer ↓ CMU Manager ↓ Charge of Technique Section, The Ministry of Agriculture

(2) Policy of Operators and Drivers in CMU

At present, CMU has 57 staff in total. They are classified as operators cum drivers and they are sufficient to operate the existing machinery. However, in case that the new construction machinery is procured by the grant of the Project, the additional number of operators and drivers are necessary as shown in Table 2.11 If the newly employed operators and assistants promoted to be the operator cum drivers, number of operator and driver will be sufficient, or if the Royal Civil Service Commission should accept the increasing number of officials, CMU could have more staff. There is enough number of people who wants to be engaged in the operating works in Bhutan it is technically possible to hire the skilful workers in CMU.

Table 2.11 Number of Operators and Drivers in CMU

Name of Equipment	Present number	Necessary number
Bulldozer	5	8
Hydraulic Excavator	9	15
Wheel Loader	3	5
Vibration Roller	2	10
Air Compressor	5	10
Dump Truck, Self Loading Truck, Cargo Truck, etc.	10	13
Fresh Operator of Construction Equipment	9	−
Assistant	11	−
Total	57	58

2-5 Project Cost Estimation

2-5-1 Project Cost

The total cost of the Project by the Japanese Grant Aid is estimated as described in Table 2.12. The cost is the provisional estimate and would be further examined by the Government of Japan for the approval of Grant.

Approximate Project Costs : Japanese Yen 521.9 million

(1) Cost Estimate

Table 2.12 Approximate Project Costs

Item	Approximate Amount (million Japanese Yen)
Procurement of Machinery	498.5
Detailed design and Construction supervision	23.4
Total	521.9

(2) Costs estimate owned by the Bhutanese Side

An approximate cost of the construction of foundation for the lathe is estimated 37,050Nu. (J.Yen 93,000) as an obligation of recipient country.

(3) Condition of Estimation

- Exchange rate： 1 US$＝J.Yen 109.99 (August,2004)
- Project period：12 months
- Others ：・On condition that the Project is implemented under the Japan's Grant Aid Scheme
  ・The above-mentioned exchange rate is to be reviewed by the Government of Japan.

2-5-2 Operation and Maintenance Cost

The annual cost of fuel/oil and Operation/Maintenance of construction machinery are estimated as follows:u

Fuel and oil	10,078,003 Nu
Operation & Maintenance	1,739,100 Nu
Total	11,817,103 Nu

As annual total cost (11,817,103Nu) is within the approved budget of CMU in 2004 (15,180,000Nu), operation and maintenance cost of the Project is appropriate.

Table 2.14 Estimation of Annual Cost for Fuel, Oil, Maintenance and Repair

Cost ＼ Item	Fuel Consumption*			Maintenance and Repair		
	1 fleet (litter/ year)	5 fleet (litter/ year)	Sub total (Nu/year)	1 fleet (litter/ year)	5 fleet (litter/ year)	Sub total (Nu/year)
Farm Road （diesel）	67,603	338,015	7,950,022	¥689,200	¥3,446,000	
(gasoline)	192	960	32,582	275,680Nu	1,378,400Nu	1,378,400Nu
Power Tiller Track （diesel）	6,247	31,235	732,638	¥90,420	¥452,100	
(gasoline)	96	480	16,291	36,168Nu	180,840Nu	180,800Nu
Supporting Equipments	13,681	—	916,601	¥208,400 83,400Nu	—	8,400Nu
Other Supporting Equipments	17,947	—	420,869	¥241,200 96,480Nu	—	96,500Nu
Total (Nu/ year)			10,078,003			1,739,100

注） *) Price of Fuel, Oil and others (July 2004)

Diesel oil：23.45Nu/ litter, Gasoline：33.94Nu/ litter, Engine oil:167.0Nu/ litter, Grease：100.0Nu/ litter）

**) 1.00Nu=¥2.5

***) Coefficient of Fuel and Oil Consumption, Machine Life, Annual Working Hour and Coefficient of Maintenance and Repair are based on the standard of the Ministry of Land, Infrastructure and Transportation, of Japan.(Table 2.15)

Table 2.15 Detail of Estimation of Annual Cost for Fuel, Oil, Maintenance and Repair

No.	Name of Machinery＼	A	b	c	d	e	f (f=axbxcxd)	g (g=f x Price)	h	i	j	k (k=axhxi/ j)	l (l=k/ 2.5)
		Num.	kW	Coe. Fuel*	Annual Operating hour（h）	fleet	Fuel Consm. (litter/ year)	Amount (Nu)	Price (¥1,000)	Annual maintenance （%）	Machine Life (year)	Maintenance and Repair (¥1,000)	(1,000Nu)
(1)	**Farm Road**												
1	Bulldozer (with ripper)	1	134	0.175	850	5	99,662.5	2,337,086	18,600	9.0	9.0	930.0	372.0
2	Hydraulic Excavator （Medium type）	1	104	0.175	840	5	76,440.0	1,792,518	11,900	9.0	7.5	714.0	285.6
3	ditto （Small type）	1	63	0.175	840	5	46,305.0	1,085,852	6,810	9.0	7.5	408.6	163.4
4	Dump Truck	1	179	0.050	950	5	42,512.5	996,918	7,810	12.0	8.0	585.8	234.3
5	Vibration Roller	1	61	0.152	490	5	22,716.5	532,702	8,080	9.0	11.0	330.5	132.2
6-1	Pick hammer	2	—	—	—	5	—	—	228	7.0	5.0	31.9	12.8
6-2	Jack hammer	2	—	—	—	5	—	—	472	7.0	5.0	66.1	26.4
7	Air Compressor	1	59	0.189	480	5	26,762.5	627,581	3,100	7.0	11.0	98.6	39.4
8	Wheel Loader	1	63	0.153	490	5	23,615.5	553,783	6,000	9.0	11.0	245.5	98.2
9	Portable Rock Drill	2	1.5	0.200	(80dayX4h=) 320	5	960.0 *	32,582	500	7.0	5.0	35.0	14.0
(2)	**Power Tiller Track**												
1	Hydraulic Excavator	1	25	0.175	720	5	15,750.0	369,338	2,350	9.0	11.0	96.1	38.4
2	Wheel Tractor	1	18	0.050	700	5	3,150.0	73,868	2,800	12.0	12.0	140.0	56.0
3-1	Pick hammer	1	—	—	—	5	—	—	228	7.0	5.0	16.0	6.4
3-2	Jack hammer	1	—	—	—	5	—	—	472	7.0	5.0	33.0	13.2
4	Air Compressor	1	19	0.189	480	5	8,618.5	202,104	1,190	7.0	11.0	37.9	15.2
5	Hand Guide Roller	1	10	0.152	490	5	3,724.0	87,328	2,300	9.0	11.0	94.1	37.6
6	Portable Rock Drill	1	1.5	0.200	(80dayX4h=) 320	5	480.0 *	16,291	500	7.0	5.0	35.0	14.0
(3)	**Supporting Equipments**												
1	Cargo truck with Crane(8ton)	1	198	0.050	850	1	8,415.0	197,332	10,100	12.0	10.0	121.2	48.5
2	Fuel Tanker	1	88	0.040	710	1	2,499.2	58,606	4,990	12.0	10.0	59.9	24.0
3	Pick-up Truck (4x4)	1	81	0.047	740	1	2,817.2	660,633	2,730	8.0	8.0	27.3	10.9
(4)	**Other Supporting Equipments**												
1	Cargo Truck with Crane(4ton)	1	132	0.050	850	1	5,610.0	131,555	6,010	12.0	10.0	73.2	29.3
2	Self Loading Truck	1	235	0.075	700	1	12,337.5	289,314	14,000	12.0	10.0	168.0	67.2
							Total(5flees)	**10,078,003**				**Total(5flees)**	**1,739.1**

Chapter 3 Project Evaluation and Recommendation

Chapter 3 Project Evaluation and Recommendation

3-1 Project Effect

The development of road-related infrastructure in Bhutan has been conducted with technical and construction assistance provided by various donor countries and international organizations. In the field of agriculture in particular, Japan has played an important role. Most equipment and machinery in possession of the Ministry of Agriculture are those supplied within the framework of "Paro Valley Agricultural Development Project" (Phase I: 1987, Phase II: 1995) as part of the grant aid provided by the government of Japan. The rural road network in Paro Valley has thus been improved and developed considerably, which has transformed this part of the country into a rich agricultural region. The Bhutanese side highly evaluates the contributions made by Japan to the Kingdom in the agricultural sector. In this Project also, all parties concerned have great hopes in the possible direct and indirect effects and results, as described below.

After completion, the local residents of the eastern six districts will benefit, directly or indirectly, from the fruitage of the Project, representing one third of the total population of the country, i.e. approximately 200,000 inhabitants (about 25,000 households).

(1) Direct effects

1) Over a 3-year period of time, a total 161 km of farm roads and a total 74 km of power tiller tracks will be constructed in the six eastern districts of Bhutan.
2) By introducing new equipment and machinery, the cost will be minimized in particular for such items as: repair parts cost, manpower cost, consumables cost (grease, oil, fuel, etc.)which are necessary for maintenance and repair work of actual machinery.
3) With the procurement of the repair and maintenance machinery that were not available at the Ministry of Agriculture up to the present, appropriate preventive maintenance can be conducted.

(2) Indirect effects

1) By construction of rural agriculture roads, the required time for replacement of the farmers will be reduced.
2) By amelioration of access to national roads and district roads, it is expected that the basic infrastructure of the rural communities will be reinforced and that the socioeconomic disparity among different areas will be reduced.
3) Distribution of agricultural products will be improved, leading to promotion of the cultivation of commercial crops and thus to increase of farmers' revenue eventually.

3-2 Recommendations

The following items will be recommended for keeping the sustainability and good results of the Project.

- In addition to the the dispatch of senior volunteers and the training programs of Bhutanese counterparts in Japan, the support of technology and know-how in the field of rural agricultural road construction under the specific local conditions of the eastern region of the Kingdom of Bhutan will be needed.

- The budgetary arrangement will be needed to ensure the proper maintenance of the procured machinery of the Project and operation of the construction works.

- The plan of rural agricultural development for long terms will be established.

Appendices

Appendix 1. Member List of the Survey Team

1.1 Field survey in Bhutan for The Basic Design Study

Mr. Mitsukuni SUGIMOTO	Leader	Resident Representative, JICA Bhutan Office
Ms. Yoko MAEDA	Project Coordinator	Officer, Rural Development and Environment Team, Project Management Group II, Grant Aid Management Department, JICA
Mr. Shozo INOUE	Chief Consultant / Farm RoadMaintenance Planner	Construction Project Consultants, Inc.
Mr. Hiroyuki SASAKI	Equipment Planner	Construction Project Consultants, Inc.
Mr. Tetsumi MASUI	Procurement Planner / Cost Estimator	Construction Project Consultants, Inc.

1.2 Explanation of Draft Basic Design Report in Bhutan

Mr. Mitsukuni SUGIMOTO	Leader	Resident Representative, JICA Bhutan Office
Mr. Shozo INOUE	Chief Consultant / Farm RoadMaintenance Planner	Construction Project Consultants, Inc.
Mr. Hiroyuki SASAKI	Equipment Planner	Construction Project Consultants, Inc.
Mr. Tetsumi MASUI	Procurement Planner / Cost Estimator	Construction Project Consultants, Inc.

Appendix 2. Survey Schedule

2.1 Field Survey in Bhutan for the Basic Design Study

Date			JICA		Consultants			Lodging
			Leader/JICA Bhutan office, Resident Representative	Cooperation planning	Chief Consultant/Farm road maintenance planning	Equipment Planner	Procurement Planner/ Cost Estimator	
			Mr.Mitsukuni SUGIMOTO	Ms.Yoko MAEDA	Mr.Shozo INOUE	Mr.Hiroyuki SASAKI	Mr.Tetsumi MASUI	
July	5	Mo.		Narita 11:00～TG 641～Bangkok 15:30				Bangkok
	6	Tu.	Bangkok 06:50～KB 127～Paro 11:10、PM、Courtesy call toJICA					Thimphu
	7	We.	Courtesy call to Donnor Organizations(DADM), Ministry of Agriculture(MOA) and (DOA)					Thimphu
	8	Th.	Discussion with DOA					Thimphu
	9	Fr.	Thimphu ～ Jakar					Jakar
	10	Sa.	Discussion with Central Machinery Unit(CMU)					Jakar
	11	Su.	Jakar ～ Thimphu					Thomza
	12	Mo.	Jakar ～ Thimphu (Blocage at Thomza due to land slide)					Thimphu
	13	Tu.	Discussion with MOA(DOA) on Minutes of Discussion(M/D)					Thimphu
	14	We.	Discussion with MOA(DOA) and Signing on Minutes of Discussion(M/D)					Thimphu
	15	Th.		Paro – Bangkok	Thimphu ～ Jakar			Jakar
	16	Fr.		Bangkok – Narita	Discussion with Central Machinery Unit(CMU)			Jakar
	17	Sa.			Discussion with Central Machinery Unit(CMU)			Jakar
	18	Su.			Jakar ～ Monar			Mongar
	19	Mo.			Courtesy call to Mongar Prefectural government , Farm Road site Survey			Mongar
	20	Tu.			Datum collection & arrangement			Mongar
	21	We.			Datum collection & arrangement			Mongar
	22	Th.			Mongar ～ Jakar			Jakar
	23	Fr.			Jakar ～ Thimphu			Thimphu
	24	Sa.			Datum arrangement			Thimphu
	25	Su.			Datum arrangement			Thimphu
	26	Mo.			Discussion with MOA(DOA)			Thimphu
	27	Tu.			Datum arrangement	huentsholing, Visit to Agency of Equipme		Thimphu/Phuentsholing
	28	We.			Discussion with MOA(DOA)	huentsholing, Visit to Agency of Equipme		Thimphu/Phuentsholing
	29	Th.			Discussion with MOA(DOA)	huentsholing, Visit to Agency of Equipme		Thimphu/Phuentsholing
	30	Fr.			Courtesy call to MOA , DOA and JICA			Thimphu
	31	Sa.			Visit to Paro Valley Agricultural Development(PVADP) site and Agriculture Machinery Centre			Thimphu
August	1	Su.			Datum arrangement			Thimphu
	2	Mo.			Paro 07:00～KB126～13:20 Bangkok			Bangkok
	3	Tu.			Bangkok 11:20～TG 640～Narita 19:30			

2.2 Explanation of Draft Basic Design Report in Bhutan

Date			JICA	Consultants			Lodging
			Leader/JICA Bhutan office, Resident Representative	Chief Consultant/Farm road maintenance planning	Equipment Planner	Procurement Planner/ Cost Estimator	
			Mr.Mitsukuni SUGIMOTO	Mr.Shozo INOUE	Mr.Hiroyuki SASAKI	Mr.Tetsumi MASUI	
Sep	30	Th.		Narita 11:00～TG 641～Bangkok 15:30			Bangkok
Oct	1	Fr.	Bangkok 06:50～KB 127～Paro 11:10、PM、Courtesy call toJICA, and MOA				Thimphu
	2	Sa.	Supplementation survey or Ministry of Agriculture(MOA) and (DOA)				Thimphu
	3	Su.	Datum collection and arrangement				Thimphu
	4	Mo.	Draft report explanation and Discussion with DOA				Thimphu
	5	Tu.	Draft report explanation and Discussion with DOA				Thimphu
	6	We.	Draft report explanation and Discussion with DOA				Thimphu
	7	Th.	Discussion with MOA(DOA) on Minutes of Discussion(M/D)				Thimphu
	8	Fr.	Signing on Minutes of Discussion(M/D)				Thimphu
	9	Sa.		Supplementation survey			Thimphu
	10	Su.		Datum collection and arrangement			Thimphu
	11	Mo.		Paro 07:00～KB126～13:20 Bangkok			Bangkok
	12	Tu.		Bangkok 11:20～TG 640～Narita 19:30			

Appendix 3. List of Party Concerned in Bhutan

1) Ministry of Agriculture (MOA)

Sangay Ngedup	Minister
Sangay Thinley	Secretary
Sangay	Policy and Planning Division, Chief officer, MOA
Sherub Gyaltshen	Department of Agriculture, Director, DOA
Ganesh B. Chettri	Agriculture Division, DOA, Joint Director
Dorji	Horticulture Division, DOA, Chief Officer
Kaylzang Tshering	Engineering Division, DOA, Superintending Engineer
Ugyen Chewang	Engineering Division, DOA, Executive Engineer
Nedrup Tshewang	Engineering Division, DOA, Section Officer
Penjore	Central Machinery Unit, (CMU), Officer In Charge
Jambay Yonten	Mechanical Section, CMU, Officer

2) Ministry of Finance (MOF)

Nima Wangdi	Department of Aid and Debt Management, (DADM) Director General
Phuntsho Wangyel	(DADM) Programme Officer
Gyettshen	Regional Revenue & Customs Office, Assitant Director
Chewang Jamcho	Regional Revenue & Customs Office, Superintendent(Customs & Excise)

3) Ministry of Works and Human Settlement,(MOWAHS)

Kinzang Dorji	Minister
Sonam Dorji	Department of Roads, Mechanical Division, Joint Director,
Phuba Gyeltshen	Mechanical Division, Executive Engineer
Tshewang Phuntsho	Eastern Regional Workshop, DOR, Lingmethang, Regional Manager
Parsuram Sharma	ERN, DOR, Lingmethang,, Executive Engineer

4) Mongar District(Dzongkhag)

Tappo	Assitant Dzongdag
Melam Zangpo	Dzongkhag Planning Officer
Pelden Norgay	District Engineer Director
Dorji Wangchuk	District Livestock Director
Tandin Dorji	District Agriculture Director

5) World Food Programme

Naoe Yakiya	Programme officer

6) JICA Bhutan Office

SugimotoMitsukuni	Resident Representative
Kubo Yusuke	Project Formulation Advisor
Tomiyasu Yuichi	JICA Expert

7) Private Company

M.Ravindran	Continental Bhutan Enterprises, Komatsu Agency, Executive Director
Lhatu Dorji	Singye Engineering Workshop , Kobelco Agency, General Manager
Karma Wangdi	Singye Construction Unit, Construction,Equipment Division (Dresser) Genneral manager
B.N.Sarkar	Tashi Group of Companies, TATA/HITACHI Agency, General Manager,(Mechanical Engineer)
Rahul Mukherjee	Til Limited, Caterpillar Agency, Sales Manager
Dawa Lham	State Trading Corporation , Isuzu,Mitsubishi,Toyota Agency, Asst. Finance officer
C.K Daga	Daga Carriers, General manager
Auth Signatory	Zambala Clearing Agent, General manager
M.K.Balan	Rabten Roadways, General manager

Appendix 4. Minutes of Discussions

4. 1 Field survey in Bhutan for The Basic Design Study

4. 2 Explanation of Draft Basic Design Report in Bhutan

MINUTES OF DISCUSSIONS
ON THE BASIC DESIGN STUDY
ON
THE PROJECT FOR IMPROVEMENT OF MACHINERY AND EQUIPMENT FOR FARM ROAD CONSTRUCTION IN THE KINGDOM OF BHUTAN

In response to a request from the Government of the Kingdom of Bhutan (hereinafter referred to as "Bhutan"), the Government of Japan decided to conduct a Basic Design Study on the Project for Improvement of Machinery and Equipment for Farm Road Construction (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA") .

JICA sent to Bhutan the Basic Design Study Team (hereinafter referred to as "the Team"), which is headed by Mr. Mitsukuni Sugimoto, Resident Representative, JICA Bhutan Office, and is scheduled to stay in the country from 6th of July to 2nd of August, 2004.

The Team held discussions with the officials concerned of the Government of Bhutan and conducted a field survey at the study area.

In the course of discussions and field survey, both parties confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Basic Design Study Report.

Thimphu, 14th July, 2004

Mr. Mitsukuni Sugimoto
Leader
Basic Design Study Team
Japan International Cooperation Agency

Dasho Sangay Thinley
Secretary
Ministry of Agriculture,
Royal Government of Bhutan

ATTACHMENT

1. Objective of the Project

The objective of the Project is to improve the accessibility in the eastern region of Bhutan by procuring the machinery and equipment for the targeted roads.

2. Project sites

The sites of the Project will be described in Annex -1.

3. Responsible and Implementing Agency

3-1.The Responsible Agency is Ministry of Agriculture, the Royal Government of Bhutan.

3-2.The Implementing Agency is Department of Agriculture, Ministry of Agriculture, the Royal Government of Bhutan.

3-3. Districts are responsible for submitting their proposals to Ministry for approval and for managing the construction works at the field level.

4. Items requested by the Government of Bhutan

The Bhutanese side has requested items to compliment the currently available machinery and equipment in Annex-2 for implementation of the Project described in Annex-3. JICA will assess the appropriateness of the request described in Annex-4 based on the results of the filed survey and discussion and will recommend the suitable machinery and equipment to the Government of Japan for approval.

5. Japan's Grant Aid Scheme

5-1. The Bhutanese Side understands the Japan's Grant Aid Scheme explained by the Team, as described in Annex- 5.

5-2. The Bhutanese Side will take the necessary measures, as described in Annex-6, for smooth implementation of the Project, as a condition for the Japanese Grant Aid to be implemented.

6. Schedule of the Study

6-1. The consultants will proceed to further studies in Bhutan until 2nd August, 2004.

6-2. JICA will prepare the draft report in English and dispatch a mission in order to explain its contents in October 2004.

6-3. In case that the contents of the report are accepted in principle by the Government of Bhutan, JICA will complete the final report and send it to the Government of Bhutan by December 2004.

7. Other relevant issues

7-1. The Bhutanese side will provide all information and data requested by the Team no later than 1st August, 2004.

7-2. The Bhutanese side recommended changing the Project title to "the Project for Improvement of Machinery and Equipment for the Construction of Rural Agricultural Roads" as per the justification provided in Annex-3.

ANNEXES:

Annex-1 List of Project Sites

Annex-2 Present Condition of Construction Machinery and Equipment

Annex-3 Background of the Project

Annex-4 Requested Machinery and Equipment

Annex-5 Japan's Grant Aid Scheme

Annex-6 Major Undertakings to be taken by Each Government

Annex-1

List of Project Sites

(Targeted Farm Road and Power Tiller Tracks)

District	Route	Length(km)	Category
Lhuentse	Gangzur - Jangchuling	15	Farm Road
	Autsho - Tsengkhar	15	Farm Road
	Bridge - Khoma	30	PTT
	Autsho - Ladrong	20	PTT
Monggar	Drametse - Narang	10	Farm Road
	Drametse - Balam	10	Farm Road
	Gangola - Challi	6	Farm Road
	Gyelposhing - Laptsa	15	Farm Road
	Monggar - Fosrong	3	PTT
	Highway - Ngatsang	3	PTT
	Chaskhar - Gyonpa	3	PTT
Trashigang	Kanglung - Yonphupam	4	Farm Road
	Kurichilo - Dungmanma	25	Farm Road
	Thrimshing - Kangpara	20	Farm Road
	Kangpara - Chhema	15	Farm Road
T/Yangtse	Lichen - Rapti	10	Farm Road
	Tongshang - Thrichugyonpa	10	Farm Road
	Ramjar - Bawoong	5	Farm Road
	Belling - Sep - Wominang	15	Farm Road
P/Gatsel	Gayzor - Resinang	7	Farm Road
	Kherigyonpa - Gyonpawoong	7	Farm Road
	Khar - Tsebar	10	Farm Road
	Tsebar - Yurung	15	PTT
S/Jongkhar	Tokarong - Tsangchillo	15	Farm Road
	Bangtar - Martshalla	12	Farm Road
	Nanglam - Norbugang	25	Farm Road

Annex-2

Present Condition of Construction Machinery and Equipment

(Note) ◎:Workable, ○:Under periodical maintenance, △:Waiting spare parts. ▲:Under repair
■: workable but sometimes, X: Scrap

Equipment	Machine Model / (User No)	Main Spec.	Delivery Year	Working hours or Distance (km)	Machine condition	Workability from 2004 (Place)
Bulldozer Standard life time: 9.9 years	D83E-1 (No.1)	205HP	1990	? (2002/10) --- (2004/07)	■ ■	1 year (Bumthang)
	D63E-1 (N0.2)	140HP	1990	5,450.6H(2002/10) --- (2004/07)	■ ▲	1 year (Bumthang)
	D63E-1 (No.3)	140HP	1990	5,350.3H (2002/10) 6,322H (2004/07)	■ ■	6 months (Bumthang)
	D63E-1 (No.4)	140HP	1990	4,890.6H (2002/10) --- (2004/07)	◎ ■	1 year (Bumthang)
	D63E-1 (No.5)	140HP	1990	5,980.5H (2002/10) 8,727.4H (2004/07)	■ ■	1 year (Bumthang)
	D85A-18 (No.6)	225HP	1995	4,970.5H (2002/10) --- (2004/07)	◎ ▲	2 years (Trashigang)
	D65E-12 (No.7)	180HP	1995	6,584.0H (2002/10) Abnormal wear (Sprocket, roller) 8,103H (2004/07)	◎ ■	2 years (Paro)
Dozer Shovel Standard life time: 9.9 years	D21S (No.8)	39.5HP	1990	3,225.8H (2002/10)	X	--- (Paro)
Hydraulic Excavator Standard life time: 7.1 years	PC200-5 (No.1)	123HP 0.8m3 (Heaped)	1990	--- (2002/10)	X	--- (Paro)
	PC200-5 (No.2)		1990	--- (2002/10) --- (2004/07)	■ ■	1 year (Bumthang)
	PC200-5 (No.3)		1990	? (2002/10) --- (2004/07)	■ X	--- (Bumthang)
	PC200-5 (No.4)		1990	? (2002/10) Under repair (Undercarriage unit exchange) --- (2004/07)	■ ■	1 year (Bumthang)
	PC200-5 (No.5)		1995	5,400.0H (2002/10) Boom cracked 6,812.4H (2004/07)	■ ▲	1 year (Bumthang)
	PC200-5 (No.6)		1995	? (2002/10) --- (2004/07)	◎ ■	1 year (Paro)
	PC60-5 (No.1)	54HP 0.28m3 (Heaped)	1990	11,360.2H(2002/10) --- (2004/07)	▲ ■	1 year (Paro)
	PC60-5 (No.2)		1995	11,360.2H(2002/10) --- (2004/07)	■ △	1 year (Bumthang)
	PC05-6 (No.1)	12.8HP	1990	--- (2002/10)	X	--- (Paro)

Equipment	Machine Model / (User No)	Main Spec.	Delivery Year	Working hours or Distance (km)	Machine condition	Workability from 2004 (Place)
	PC05-6 (No.2)		1990	--- (2002/10)	X	--- (Paro)
Dump Truck Standard life time: 7.5 years	BG-1 (0051) No.1	275PS 8m3 (12ton) 6x4	1990	53,926km (2002/10) --- (2004/07)	○ ◎	1 years (Bumthang)
	BG-1 (0052) No.2		1990	--- (2002/10)	X	--- (Paro)
	BG-1 (0053) No.3		1990	61,501km (2002/10)	○ X	--- (Bumthang)
	BG-1 (0054) No.4		1990	27,329km (2002/10) --- (2004/07)	△ ■	1 year (Bumthang)
	BG-1 (0055) No.5		1990	55,251.6km(2002/10) 67,812km (2004/07)	○ ■	1 year (Bumthang)
	BG-1 (0056) No.6		1990	76,756km (2002/10) 82,674km (2004/07)	○ ■	1 year (Bumthang)
	BG-1 (0236) No.7		1995	? (2002/10) --- (2004/07)	◎ ◎	1 year (Paro)
	BG-1 (0237) No.8		1995	68,689.9km(2002/10) --- (2004/07)	○ ◎	2 years (Paro)
	BG-1 (0238) No.9		1995	61,860km (2002/10) (2004/07)	△ ■	1 year (Bumthang)
	BG-1 (0239) No.10		1995	79,030km (2002/10) --- (2004/07)	◎ ■	2 years (Bumthang)
	BG-1 (0240) No.11		1995	59,978km (2002/10) (2004/07)	◎ ■	2 years (Bumthang)
Truck (Self Loader) Standard life time: 8.3 years	BG-1 (0059) No.1	315PS 6x4	1990	70,483km (2002/10) --- (2004/07)	△ ■	3 month (Bumthang)
Cargo Truck Standard life time: 8.3 years	BG-1 (0057) No.1	275PS Crane: 6t	1990	? (2002/10) 82,102km (2004/07)	■ ▲	1 year (Bumthang)
Mixer Truck Standard life time: 8.6 years	BG-1 (0060) No.1	160PS 4x2 3.4m3	1990	--- (2002/10) --- (2004/07)	▲ X	--- (Paro)
	BG-1 (0134) No.2		1994	? (2002/10) --- (2004/07)	▲ X	--- (Bumthang)
	BG-1 (0135) No.3		1994	? (2002/10) --- (2004/07)	▲ X	--- (Paro)

Equipment	Machine Model / (User No)	Main Spec.	Delivery Year	Working hours or Distance (km)	Machine condition	Workability from 2004 (Place)
	BG-1 (0210) No.4		1994	? (2002/10) --- (2004/07)	▲ X	--- (Paro)
Oil Tanker (3,000lit) Standard life time: 8.3 years	BG-1 (0061) No.1	158HP 4x2	1990	13,801.2km(2002/10) --- (2004/07)	◎ ◎	1 year (Bumthang)
Mobile Workshop Standard life time: 8.3 years	BG-1 (0058) No.1	160PS 4x2	1990	52,869km (2002/10) 64,220km (2004/07)	▲ ■	1 year (Bumthang)
Wheel Loader Standard life time: 7.1 years	WA70-1 No.1	55HP 0.8m3	1990	2965.5H (2002/10)	X	--- (Paro)
	WA100-1 No.2		1994	5,400H (2002/10) --- (2004/07)	△ ■	1 year (Bumthang)
	WA100-1 No.3		1994	? (2002/10) --- (2004/07)	○ ■	1 year (Bumthang)
	WA100-1 No.4		1994	5,859H (2002/10) Engine damaged --- (2004/07)	△ X	--- (Bumthang)
Vibration Roller Standard life time: 9.8 years	JV100WA-1 No.1	130HP 10.59t F: Smooth Roller R: Tire	1990	? (2002/10) Engine damaged --- (2004/07)	△ X	--- (Paro)
	JV100WA-1 No.2		1995	? (2002/10) --- (2004/07)	◎ ▲	1 year (Paro)
Air Compressor Standard life time: 10.2 years	PDS390	105PS 11m3/min	1990	2,080H(2002/10) --- (2004/07)	■ △	6 months (Bumthang)
Motor Grader Standard life time: 11.1 years	GD511-1 No.1		1994	957H (2002/10) --- (2004/07)	◎ ■	2 years (Bumthang)
Rough Terrain Crane Standard life time: 8.3 years	TR-250E	20t	1990	? (2002/10) Injection pump, starting motor, computer damaged --- (2004/07)	△ ▲	2 years (Paro)
Jack Hammer Standard life time: 4.3 years	Toyo TY16	17kg	1990	--- (2002/10)	X	--- (Paro)
Crusher Plant	Chiyoda	30ton	1990		△	1 year Paro (No.1 site)
Generator	Denyo	For 30ton	1990		△	
Crusher Plant	Chiyoda	10ton	1995		△	

Equipment	Machine Model / (User No)	Main Spec.	Delivery Year	Working hours or Distance (km)	Machine condition	Workability from 2004 (Place)
Concrete Bacher Plant	Chiyoda		1990		△	
Generator	Denyo		1990		△	1 year (Bumthang)
Pre-cast Plant	Chiyoda		1990		△	2 years (Paro)
Air Compressor	Airman		1990		△	6 months (Bumthang)
High-speed Straightening machine			1990		■	1 year (Paro)
Utilization Equipment			1990		■	1 year (Paro)
Concrete Test Machine			1994		■	1 year (Paro)
High Pressure Washer			1994		◎	(Bumthang)
Steel Bar Cutter Set			1990		X	--- (Bumthang)

Note: (1)* : Based on the standard coefficients of the Ministry of Public and Construction, Japan.
(2)? : Working hours or Distance (km) is unknown.
(3)---: Working hours or Distance (km) meter is damaged.

Annex-3

Background of the Project

Background

The Ministry of Agriculture (MoA) has adopted the Triple Gem concept towards revolutionizing agriculture development in Bhutan. These comprise Production, Accessibility and Marketing. Production must be enhanced to achieve food security for the country, through a shift in emphasis from subsistence farming to more commercial production. Accessibility is absolutely necessary to provide opportunities for better goods and services to the majority of the people who live in rural areas. Markets must be developed to encourage optimum production. Supportive policy measures coupled with adequate physical infrastructure are being promoted.

Present problem to be solved

Lack of adequate farm infrastructure has been recognized as a major disincentive for increasing farm productivity and production in rural Bhutan where 79% of the population live. The Royal Government's Guidelines for the formulation of the 9th Five Year Plan also highlighted the development of farm infrastructure as a priority area. Priority and emphasis in the 9th Plan is therefore to be given to the development of farm infrastructure, amongst which the most important is farm roads. This is clearly evident from the programme size with a target of about 600 km of farm roads for the 9th Plan.

Farm roads alone, however, cannot meet the entire requirement of rural access for our farmers as the settlements are thinly spread over the whole country. It would neither be physically possible nor economically viable. They are also relatively expensive, placing substantial demands on our limited resources. Thus, farm roads must be complimented by other forms of access, albeit of lower category, to establish a road network conducive to supporting agriculture development. Power tiller tracks will be the main focus for rural roads in the coming five year plan, which can serve the purpose of not only meeting the demand for rural roads but also promote farm mechanization.

Goals of farm roads construction

To establish a functional network of rural roads, with farm roads acting as the "spines" and lateral extensions in the form of power tiller tracks and foot-trails.

Accessibility will help to overcome one of the major constraints in Bhutanese farming; labour shortage by promoting farm mechanization. The mechanization programme which has been supported by the Japanese 2KR Grant, can achieve greater success and wider coverage through an increase in the number and length of rural roads.

Although there is potential for increase in agriculture production, it has not been realized because of a lack of markets for the surplus goods. The construction of roads will facilitate a greater movement of improved inputs into the community and a corresponding outflow of products to markets.

Lack of rural access is synonymous with isolation, remoteness and poverty. Roads will improve the living condition of the people by providing opportunities for better goods and services.

Review of Progress

From the recent experience on construction of farm roads, it has been observed that progress was rather slow. Less than a fifth of the planned target was completed in the last two years. The slow pace of construction has led to cost over-runs inflating the budget. Several factors such as inadequate technical capacity, aging construction machinery, etc. have contributed to the problem. Another key factor in the problem was the implementation system. Farmer beneficiaries were involved in construction and their limited experience in road building has led to delays. This was further exacerbated by having too many development programmes implemented with community participation placing undue demands on their resources. In order to overcome the problem, 251km of farm road construction in the six eastern districts for the 9th Plan will be executed through the special arrangement using machinery and equipment provided by the Project and the labor will be provided by the beneficiaries on the payment of wages or through labor contracts.

Grant Aid Project

With the limited available resources it will be difficult to achieve the planned targets for farm road construction, not to mention the addition of power tiller tracks. The project can therefore, help to reduce the costs as it has been observed that two-thirds of the road construction cost is incurred in machinery use. The availability of adequate construction machinery and equipment for the eastern region ensures that roads in the six districts can be executed as per plan. With the eastern districts (40% of the farm roads programme) adequately covered by the project, it becomes much easier for the rest of the country.

Having construction machinery is one of the ways of reducing construction costs. The savings from farm roads will permit inclusion of power tiller tracks as an additional programme. Introduction of power tiller tracks will help to offset the high demand for farm roads. MoA can also support community initiatives for road construction by providing machinery to interested farmer groups.

Upon completion of several hundred kilometers of roads, their maintenance will be huge task for the communities as this responsibility falls on them. While farmers can perform smaller tasks they will need machinery for moving huge quantities of earth and rocks. This is especially true during the rainy season when there is greater occurrence of floods and landslides.

Review of the original request

In the light of development that has taken place since making the original request, certain changes are foreseen. The components of a machinery fleet for farm roads construction remain basically the same. However, MoA has already procured some of the machinery in the original request such as excavator, backhoe loaders and air-compressors by using the counterpart fund of 2KR to meet high demands for ongoing road construction, also

revised into smaller the specification of some machinery for farm roads construction. On the other hands, following the introduction of power tiller tracks as a complimentary activity, will necessitate the use of a separate category of construction machinery. Due to the narrower road width for power tillers, the same machinery as for farm roads cannot be used. Smaller excavators, wheel-loaders, rollers and 4WD tractors will be suitable.

Objectives

The objective of the project is support the development of farm roads and power tiller tracks to improve accessibility of farmers to markets, goods and social services which will enhance their incomes and living conditions.

With adequate construction machinery, the ministry can fully support the six eastern districts in meeting their requirement of farm roads and power tiller tracks.

Short-term objective

To provide the Central Machinery Unit of MoA with sufficient construction machinery and equipment to construct 251km of farm roads and 74km of power tiller tracks in the six eastern districts.

Long-term objective

To fulfill the Ministry's goal of revolutionizing agriculture development through the Triple Gem concept of Production, Accessibility and Marketing, leading to accelerating the development of rural access roads along with the Tenth Five Year Plan (2007-2012).

Benefit and Effects

The project will benefit a rural population of about 200,000 inhabitants living in some 25,000 households in the six eastern districts relatively less developed than the rest of the country. Improving their accessibility will provide better opportunities to markets, employment, social services and other goods in an environmentally sustainable manner.

Annex-4

Requested Machinery and Equipment

1. Components of a Fleet for Farm Road (Total: 5 Fleet)			
No	Items	Specification	Purpose of Use
1	Bulldozer	170~190HP, Angle-tilt dozer Multi-shank ripper	Cutting, digging, dozing, leveling, compacting, ripping work, etc
2	Hydraulic Excavator	135~145HP, Bucket: 0.8m3 Rock bucket, Option: Hydraulic breaker	Cutting, digging, loading, etc
3	Hydraulic Excavator	80~90HP, Bucket: 0.4m3 Rock bucket	Cutting, digging side ditches and wall, etc
4	Dump Truck	8ton, 4x2	Transportation of surplus soil and construction materials such as soil and gravel
5	Vibration Roller	6~7ton Front: Sheep foot drum, Vibration Rear: Tire x2, Drive	Vibration compacting work on the soil and gravel road
6	Tamper (Delete)		Tamper is deleted because CMU has these machines
7	Hand Breaker	(1) Pick hammer (Handle type) Weight: Approx.16kg	Crashing hard rock after using hydraulic breaker
		(2) Jack hammer Weight: Approx.17kg Taper rod (3ft, 5ft, 8ft, 12ft)	Drilling work for blasting hard rock
8	Air Compressor (Delete)		It is deleted because CMU purchased four air compressor in 2004 by counterpart fund (KR2)
9	Wheel Loader	80~90HP, Bucket: 1.3m3	Loading and carrying of soil, gravel, leveling, etc
10	Safety Miscellaneous	Safety belt Goggle Safety cap Dust & mist respirator Leather gloves	For safety work of worker at job site.
11	Tent	Water proof, Cloth, Size: For 4 persons	For accommodations of operators, mechanics and helpers at the job site
12	Portable rock drill	With gasoline engine, Approx.26kg	Drilling work at the job site where is far away from the base of the compressor station
13	Spare parts	For the above machinery	For periodical maintenance and routine maintenance spare parts for 2,000 hours use

2. Components of a Fleet for Power Tiller Track (Total: 6 Fleet)			
No	Items	Specification	Purpose of Use
1	Hydraulic Excavator	Approx.40HP, Bucket: 0.1~0.15m3 Option: Front blade	Cutting, digging, loading, leveling, etc
2	Wheel Tractor	20~30HP, 4x4, With trailer: 1.5ton	Transportation of soil and stones
3	Hand Breaker	(1) Pick hammer (Handle type) Weight: Approx.16kg	Crashing hard rock after using hydraulic breaker
		(2) Jack hammer Weight: Approx.17kg Taper rod (3ft, 5ft, 8ft, 12ft)	Drilling work for blasting hard rock
4	Air Compressor	Stationary type, Weight: 50~100kg	For pick hammer and jack hammer at rocky job site
5	Hand Guide Roller	Approx. 1ton	Vibration compacting work
6	Safety Miscellaneous	Safety belt Goggle Safety cap Dust & mist respirator Leather gloves	For safety work of worker at job site.
7	Portable rock drill	With gasoline engine, Approx.26kg	Drilling work at the job site where is far away from the base of the compressor station
8	Spare parts	For the above machinery	For periodical maintenance and routine maintenance spare parts for 2,000 hours use

3. Supporting Machinery and equipment

No	Items	Specification	Purpose of Use
1	Cargo Truck with crane (6x4) ↓ Cargo Truck with crane (4x2)	Payload: 15ton, 6x4 Crane; 3ton ↓ Payload: 8ton, 4x2 Crane: 3ton	Cargo truck (6x4) is modified to (4x2), because 4x2 is suitable for narrow and curved road condition Transportation of small machine such as hand guide roller, hand breakers, and materials of construction such as steel pipes, cement, steel bars, etc.
2	Bulldozer (Delete)	75~85HP, Angle –tilt dozer	Excavator can form the same works such as spreading and leveling
3	Fuel Tanker	Capacity: 3,000Lit, 4x2	For supplying fuel at the job site
4	Concrete Mixer (Delete)	With engine: Approx. 1HP Capacity: 0.12m3, Trailer type	Concrete mixing can be done manually at the job site
5	Total Station		Equipment for surveying
6	Motor Bicycle ↓ Service car	Motor Bicycle ↓ Pick-up type (4x4)	For supervising and inspecting at the job site, and transporting service parts for repair and maintenance of machine
7	Spare parts	For the above machinery	For periodical maintenance and routine maintenance spare parts for 2,000 hours use

4. Equipment and Tools for Workshop

1	Workshop Equipment & Tools	1) Portable gantry crane 2) Electric welder included welder set 3) Gas welder set 4) Electric air compressor included air impact wrench 5) Mechanic tool set for construction equipment with cabinet 6) Measuring instrument & tool 7) Engine service equipment and tools included engine repairing stand 8) Jack and lifting device 9) Wheel type vehicle service tools and tire remover 10) Master pin remover & installer for bulldozer 11) Battery charger 12) Lubricating equipment and tools 13) Electric power tools 14) Cleaning equipment for engine and water high pressure washer 15) Etc (1.5m lathe, portable welder (40kg), grinder, vise, drill and so on)	For repair of engine and chassis included unit exchange of undercarriage in the workshop

5. Other Supporting Equipment

No	Items	Specification	Purpose of Use
1	Mobile Workshop ↓ Service Truck with crane	10ton, 4x2, With equipment & tools ↓ 8ton, 4x2, With equipment & tools	Mobile workshop is modified to service truck with crane, because service truck with crane is suitable for sharp slope, narrow and curved road condition For repair of engine and chassis at the job site
2	Truck Tractor & Low Bed Semi Trailer ↓ Self Loading Truck	Truck tractor 6x4 Low bed semi trailer: ↓ Short body truck, 6x4, Min.230HP Payload: Min.14ton GVW: Approx.26ton	Truck tractor & low bed semi trailer is modified to self loading truck, because self loading truck is suitable for sharp slope, narrow and curved road condition Transportation of construction machine such as bulldozer, hydraulic excavator, etc. between job site and workshop
3	Spare parts	For the above machinery	For periodical maintenance and routine maintenance spare parts for 2,000 hours use

Annex-5

Japan's Grant Aid Scheme

The Grant Aid scheme provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid procedures

Japan's Grant Aid scheme is executed through the following procedures:

Application	(Request made by a recipient country)
Study	(Basic Design Study conducted by JICA)
Appraisal & Approval	(Appraisal by the Government of Japan and Approval by Cabinet)
Determination of Implementation	(The Notes exchanged between the Government of Japan and the recipient country)

Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study), using (a) Japanese consulting firm(s).

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Scheme, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes (E/N) signed by the Government of Japan and the recipient country.

Finally, for the smooth implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

2. Basic Design Study

1) Contents of the Study

The aim of the Basic Design Study (hereinafter referred to as "the Study"), conducted by JICA on a requested project (hereinafter referred to as "the Project") is to provide a basic document necessary for the appraisal of the Project by the Government of Japan. The contents of the Study are as follows:

- Confirmation of the background, objectives, and benefits of the requested project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid scheme from a technical, social and economic point of view.
- Confirmation of items agreed upon by both parties concerning the basic concept of the Project.
- Preparation of a Basic Design of the Project
- Estimation of cost of the Project

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid Project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures is necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

2) Selection of Consultants

For smooth implementation of the Study, JICA uses (a) registered consultant firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA.

The consulting firm(s) used for the Study is (are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency.

3. Japan's Grant Aid Scheme

1) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

2) "The period of the Grant Aid" means the one fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed.

However in case of delays in delivery, installation or construction due to unforeseen factors such as natural disaster, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

3) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However the prime contractors, namely, consulting, contracting and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

4) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

5) Undertakings required to the Government of the Recipient Country

In the implementation of the Grant Aid project, the recipient country is required to undertake such necessary measures as the following:

① To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction,

② To provide facilities for the distribution of electricity, water supply and

drainage and other incidental facilities in and around the sites,

③ To secure buildings prior to the procurement in case the installation of the equipment,

④ To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid.

⑤ To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified contracts.

⑥ To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

6) "Proper Use"

The recipient country is required to operate and maintain the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

7) "Re-export"

The products purchased under the Grant Aid should not be re-exported from the recipient country.

8) Banking Arrangements (B/A)

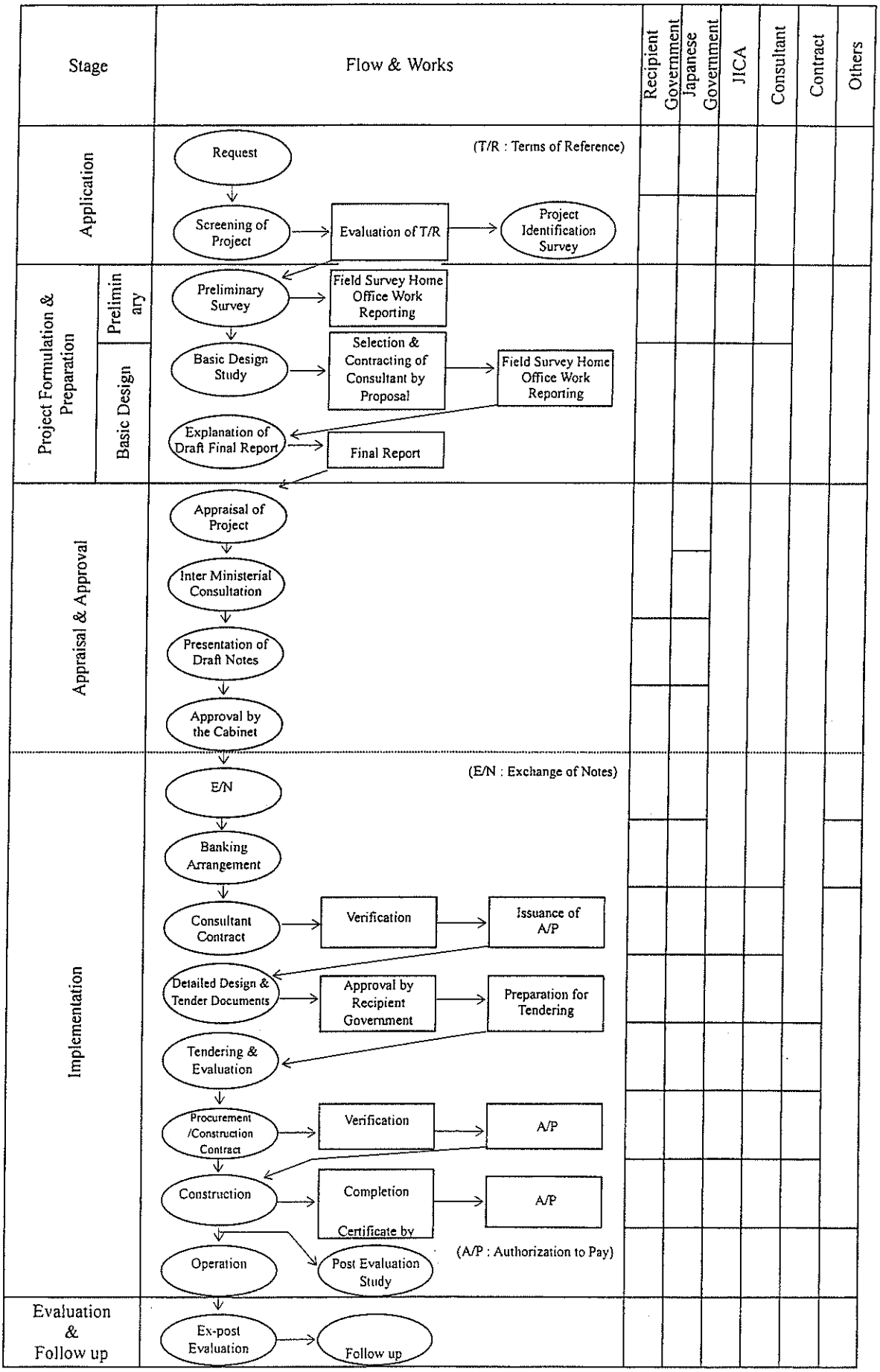
a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.

Flow Chart of Japan's Grant Aid Procedures



Annex-6

Major Undertakings to be taken by Each Government

NO	Items	To be covered by Grant Aid	To be covered by Recipient
1	To bear the following commissions to a bank of Japan for the banking services based upon the B/A		
1) Advising commission of A/P			•
2) Payment commission			•
2	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
1) Marine(Air) transportation of the products from Japan to the recipient country		•	
2) Tax exemption and custom clearance of the products at the port of disembarkation			•
3) Internal transportation from the port of disembarkation to the project site			•
3	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		•
4	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract		•
5	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		•
6	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for the transportation and installation of the equipment		•

4. 2 Explanation of Draft Basic Design Report in Bhutan

MINUTES OF DISCUSSIONS
ON BASIC DESIGN STUDY ON THE PROJECT FOR IMPROVEMENT OF MACHINERY AND EQUIPMENT FOR CONSTRUCTION OF RURAL AGRICULTURAL ROAD
IN THE KINGDOM OF BHUTAN
(EXPLANATION ON DRAFT REPORT)

In July 2004, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a Basic Design Study Team on the Project for Improvement of Machinery and Equipment for Construction of Rural Agricultural Road (hereinafter referred to as "the Project") to the Kingdom of Bhutan (hereinafter referred to as "Bhutan"), and through discussion, field survey, and technical examination of the results in Japan, JICA prepared a draft report of the study.

In order to explain and to consult Bhutan on the components of the draft report, JICA sent to Bhutan the Draft Report Explanation Team (hereinafter referred to as " the Team "), which is headed by Mr. Mitsukuni Sugimoto, Resident Representative, JICA Bhutan Office, from 1st October to 11th October, 2004.

As a result of discussions, both parties confirmed the main items described on the attached sheets.

Thimphu, 8th October, 2004

Mr. Mitsukuni Sugimoto
Leader
Draft Report Explanation Team
Japan International Cooperation Agency

Dasho Sangay Thinley
Secretary
Ministry of Agriculture
Royal Government of Bhutan

ATTACHMENT

1. Components of the Draft Report

The Royal Government of Bhutan agreed and accepted in principle the components of the draft report explained by the Team.

2. Japan's Grant Aid Scheme

The Bhutanese side understands the Japan's Grant Aid Scheme and the necessary measures to be taken by the Royal Government of Bhutan as explained by the Team and described in Annex-5 and Annex-6 of the Minutes of Discussions signed by both parties on 14th July, 2004.

3. Title of the Project

Title of the Project is revised as "The Project for Improvement of Machinery and Equipment for Construction of Rural Agricultural Road" in accordance with Annex-3 of the Minutes of Discussions signed on 14th July 2004.

4. Procurement Schedule

Both sides confirmed the procurement schedule as described below.

4-1. The Project will be implemented in the Japanese fiscal year 2005. The handover period is expected to be one year after the Exchange of Notes (E/N).

4-2. The machinery shall be delivered to the Bhutanese side at Jakar in Bumthang District under the Project.

4-3. After delivery the machinery shall be assembled, adjusted, tested and handed over with instructions for the operation and maintenance.

5. Other Relevant Issues

5-1. The Bhutanese side shall allocate staff and budget so as to effectively utilize and maintain the machinery and equipment procured by the Project. They will also ensure necessary budgetary allocations to complete the targeted rural agriculture roads (Annex I).

5-2. Construction Period

The Bhutanese side agreed the construction period for 3 years as shown in Annex II.

5-3. Length of targeted farm road

The Bhutanese side agreed to revise the targeted farm roads as shown in Annex II.

5-4. Spare part procurement plan

The project shall provide enough spare parts for the first two years after the initial delivery. Following this period the Bhutanese side will make their own arrangements.

5-5. Countries eligible for the procurement

The Bhutanese side understands that the country eligible for the procurement is in principle Japan like the case of the Ministry of Works and Human Settlement. However the procurement from a third country should be considered to permit fair and competitive tendering.

5-6. Workshop extension and foundation for the lathe machine

The Bhutanese side shall complete the required extension of the workshop and the foundation for the lathe machine prior to the delivery of machinery and equipment.

5-7. Counterpart training

The Bhutanese side requested for JICA training for the construction machinery management.

5-8. Reporting

The Bhutanese side will submit a report to the Embassy of Japan in India regarding the progress of the construction of the targeted roads, the procurement plan of spare parts and condition of the machinery and equipment at least once a year.

ANNEXES:

Annex-I IFAD Project Cost and Financing (Components Cost Summary) Table

Annex-II Additional Explanation on Basic Design Study Draft Report on the Project for Improvement of Machinery and Equipment for Construction of Rural Agricultural Road

provided as part of Appendix 7. The emphasis is on impact. It is anticipated that these suggestions would be further refined as part of start-up activities and that the process would continue during implementation. However, the newly established SEZAP procedures manual is a good starting point.

134. **Workshops, Studies and Reviews.** Start-up or inception workshops would be held at National and *Dzongkhag* level. These workshops would be used to introduce the PFO staff and other individuals concerned to AMEPP, its objectives, methods of operations, division of responsibilities, reporting and monitoring requirements. There would also be a system of annual planning meetings at *Geog* level. The primary purpose of these management workshops would be to review the past year, derive lessons from the experience and ensure that they are reflected in the up-coming annual work plan and budget. In addition, inter-*Dzongkhag* workshops would be organized annually, focusing on systems, gender aspects, participatory planning and monitoring and financial services to share issues of common interest and establish feedback. The process would be initiated and monitored by the system of high level annual meetings of PSC and PCC.

VII. PROJECT COSTS AND FINANCING

A. Project Costs

135. The costs summary by component is presented in Table 3. The total cost over six years of the IFAD/RGOB programmes, inclusive of contingencies, is estimated at BTN 918 million (USD 19.7 million) [21].

Table 3. Components Cost Summary

	(BTN'000)			(USD'000)			% Foreign Exchange	% Total Base Costs
	Local	Foreign	Total	Local	Foreign	Total		
INFRASTRUCTURE								
Access	173,675	196,827	370,501	3,859	4,374	8,233	53	48
Irrigation	11,300	7,023	18,323	251	156	407	38	2
Subtotal	184,975	203,849	388,824	4,111	4,530	8,641	52	51
ON-FARM PRODUCTION								
Crops	28,957	41,685	70,642	643	926	1,570	59	9
Livestock	5,619	15,721	21,341	125	349	474	74	3
Subtotal	34,576	57,406	91,983	768	1,276	2,044	62	12
MARKETING AND ENTERPRISES								
Marketing support	16,666	33,746	50,413	370	750	1,120	67	7
Entrepreneurship	19,904	27,652	47,555	442	614	1,057	58	6
Subtotal	36,570	61,398	97,968	813	1,364	2,177	63	13
FINANCIAL SERVICES	54,810	6,036	60,845	1,218	134	1,352	10	8
MANAGEMENT								
Dzongkhag offices	14,529	22,641	37,170	323	503	826	61	5
Programme facilitation /a	45,250	42,096	87,345	1,006	935	1,941	48	11
Subtotal	59,779	64,737	124,515	1,328	1,439	2,767	52	16
Total BASELINE COSTS	370,709	393,425	764,135	8,238	8,743	16,981	51	100
Physical Contingencies	29,083	32,864	61,946	646	730	1,377	53	8
Price Contingencies	39,208	52,905	92,113	570	770	1,341	57	8
Total PROJECT COSTS	439,001	479,194	918,194	9,454	10,244	19,698	52	116

\a Includes resource allocation for Micro-initiatives Fund and Business Opportunities Facility

[21] All amounts have been defined without taxes because consumption and income taxes are mostly insignificant in Bhutan. Also, simple and effective waiver procedures are applied by MOF.

Annex-II

Additional Explanation on Basic Design Study Draft Report on the Project for Improvement of Machinery and Equipment for Construction of Rural Agricultural Road

The following two points are concluded after the technical evaluation by the Consultant.

1.Setting up three years of construction period

2.Modification of farm roads target for the construction

1. Setting up three years of construction period

(1) Evaluation of the project conditions

The project conditions for the time scheduling are as follows;

1) Handing over the new machinery to the Bhutanese side is scheduled to be in early 2006.

2) The Ninth Plan in Bhutan will be ended in June 2007.

Although the targeted farm roads and power tiller tracks are scheduled to the completion within the Ninth Plan as given in the previous minutes of discussion signed in June 2004, the Consultant evaluates that one and half years of the construction period is too short and unrealistic.

(2) Past achievement of farm roads construction

Performance of farm roads construction up to June 2004 in the Ninth Plan is presented in Table 1.

Table 1 Performance of Farm Roads Construction up to June 2004 in the Ninth Plan

National	Plan			Achievement.	
	Length (km)	Approval budget (Nu. in millions)		Length (k m)	Expenditure (Nu. in millions)
	219.7 (Total length in Ninth Plan:548.63 km)	168.09		146.3 + 32.7 (Out of Plan) Total 179.0	97.671
		Type of donor	Amount (Million Nu)		
		KRII	105.000		
		SEZAP	34.085		
		WWMP	10.810		
		GTZ	7.132		
		SDC	6.000		
		ECR－ADP	5.062		
6 eastern districts	128.0	77.763		59.4 + 21.7 (Out of Plan) Total 81.1	59.754
		Type of donor	Amount (Million Nu)		
		KRII	44.000		
		SEZAP	33.763		

Source : Engineering Division, Department of Agriculture

On the basis of the past two years' performance of farm road construction within the Ninth Plan, the following points have been concluded.

1) Achievement of farm road construction is 180km for 2 years (90km per year) against 219.7km in the plan at the national level.

2) Achievement in the six eastern districts is 81km for 2 years (40km per year) against 219.7km in the plan.

(3) Appropriate construction period

Based on the above performance of 90km per year at the national level, the Consultant has decided that the targets of 251km farm roads and 74km power tiller tracks, can be constructed in 3 years with complete budgetary support by the Ministry for farm road construction. As mentioned in the minutes of the previous discussion, the development of rural access roads will spill over into the Tenth Five Year Plan. Therefore, it is reasonable to extend the construction period until the end of 2008 in the Tenth Plan.

2. Modification of farm roads target for the construction

(1) Required number of fleets for farm roads construction

Required number of fleets is described in Table 2.

Table 2 Required Number of Fleets

Item	Farm Road	Power Tiller Track
Targeted Roads	251km	74km
Required Number of Fleets	7	5
Requested Fleets by the Bhutanese Side	5	6
High Priority Roads	161km	74km
Required Number of Fleets	5	5

(2) Evaluation of targeted roads judging from the financial aspect(Refer to Table 1)

According to the past performance of budget for farm road construction, Nu. 140 million has been allocated to farm roads construction for two years, funded from KR2 and IFAD(SEZAP). That is to say Nu. 70 million per year has been allocated. Since the unit cost per km is estimated at Nu. 1.2 Million for this project, the total budgetary requirement is estimated in Table 3.

Table 3 Budgetary Requirement

Item	Length	Annual Budgetary Requirement
Targeted Roads	251km	Nu. 100 million
High Priority Roads	161km	Nu. 65 million

Judging from the past budgetary allocation to the farm road construction, it is more appropriate to put the high priority roads into the target for this Project.

(3) Evaluation of targeted roads judging from the institutional aspect

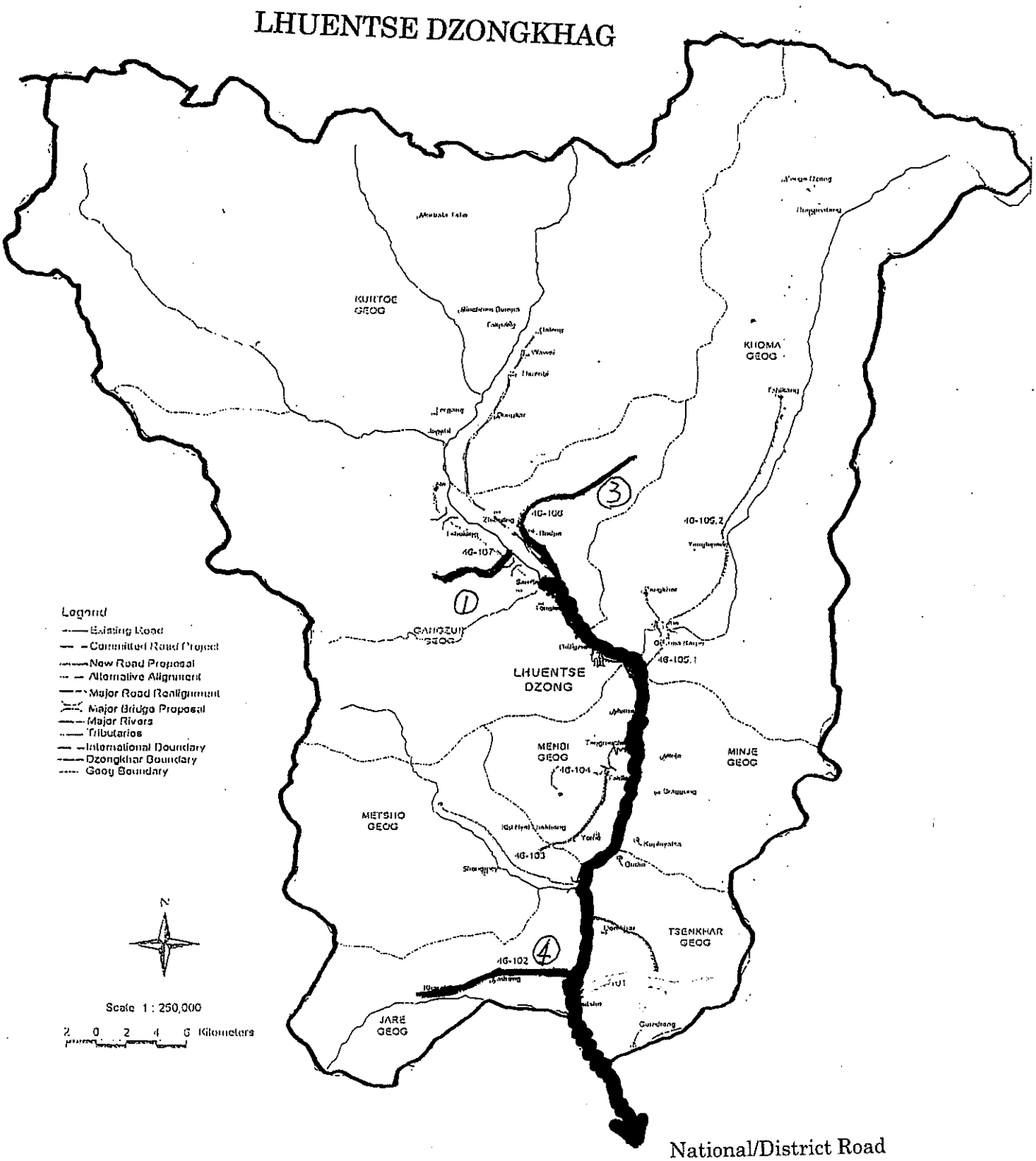
The implementation of works in this Project will be taken by the six eastern districts. And district engineers will manage the supervision of works. On the basis of 81km of constructed farm roads for two years, the capacity for supervising works is judged to be about 40~50km per year in the eastern districts. Thus, the length of high priority roads targeted in this Project is comprised of 161km of construction for three years (54km/year).

(4)Conclusion

Considering the past achievement and the actual management capacity for farm roads construction, it is much more appropriate to put 161km of the high priority roads instead of 251km, as the target for this Project.

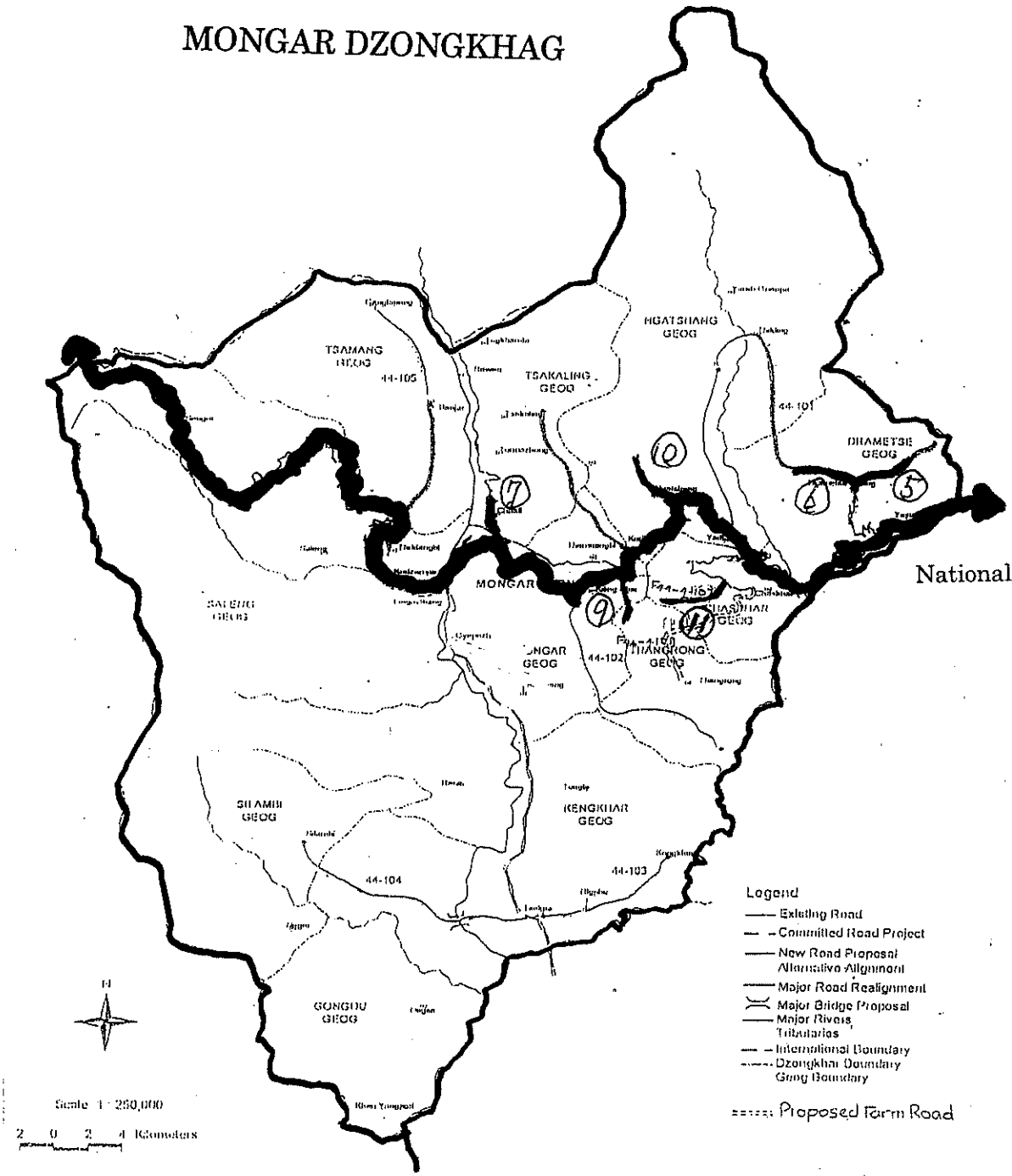
Appendix 5. Other Relevant Data

(Detailed location map of target roads)



District	No.	Route	Length(km)	Category
Lhuentse	1	Gangzur - Jangchuling	15	Farm Road
	3	Bridge - Khoma	30	Power Tiller Track
	4	Autsho - Ladrong	20	Power Tiller Track

MONGAR DZONGKHAG

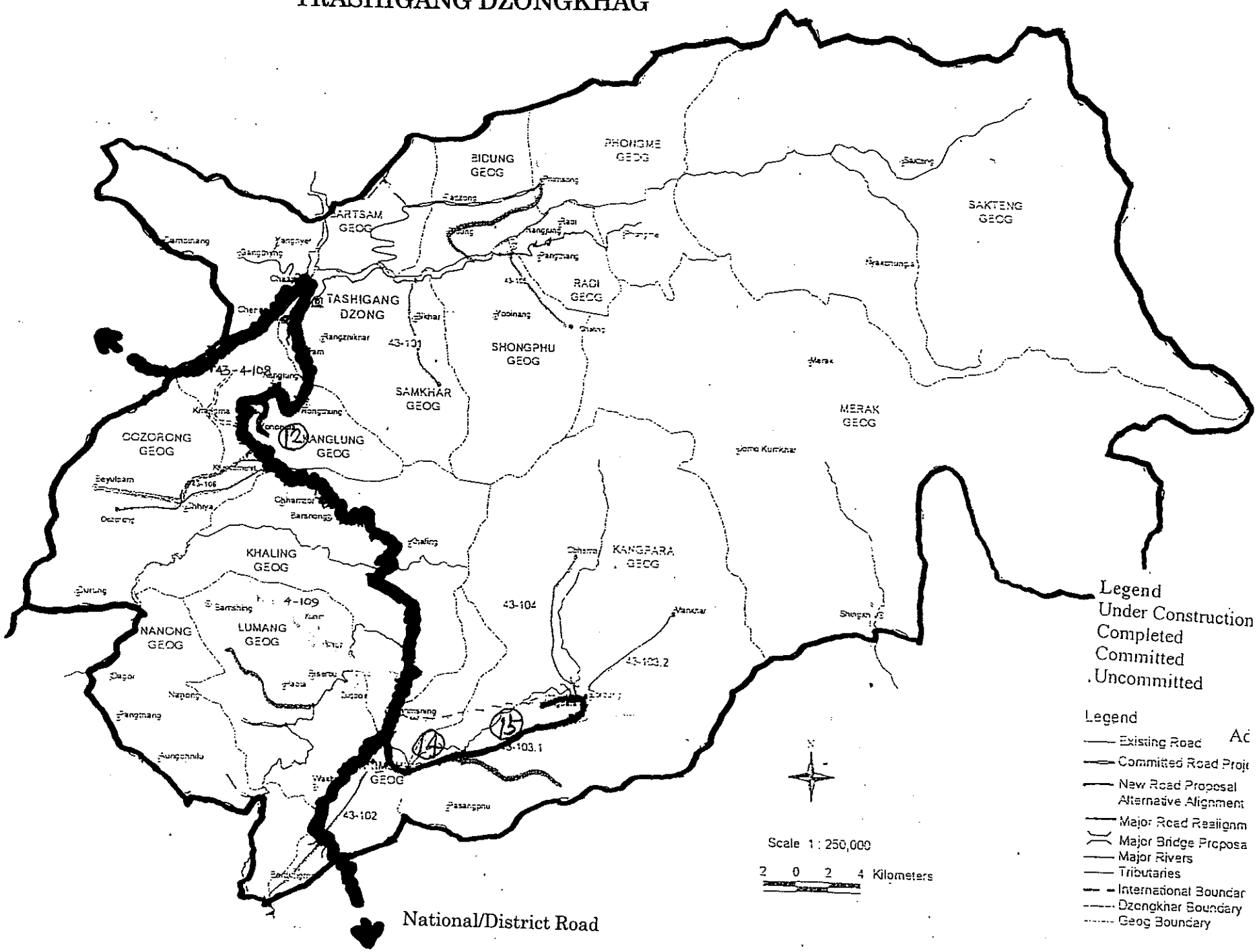


National/District Road

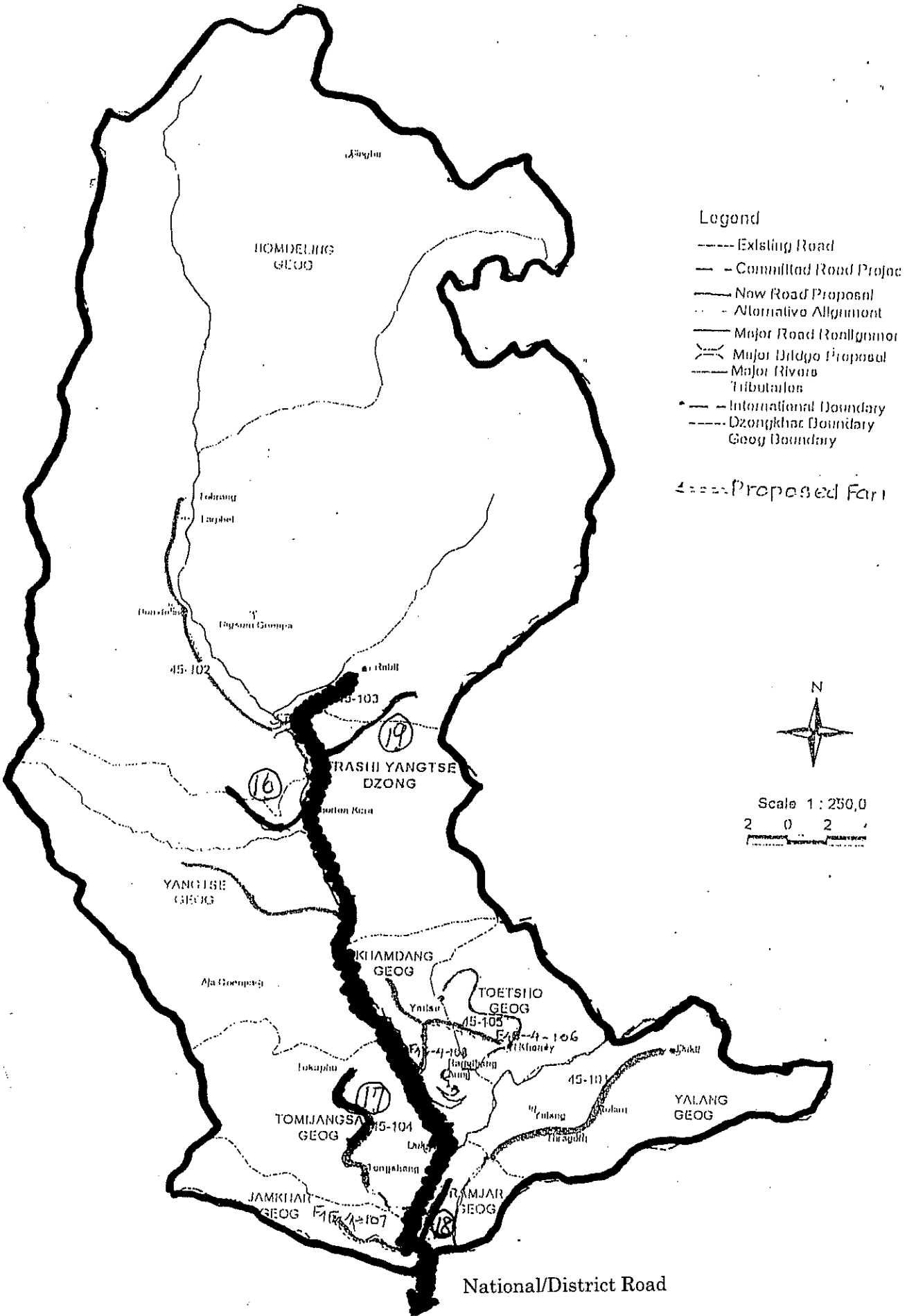
District	No.	Route	Length(km)	Category
Monggar	5	Drametse - Narang	10	Farm Road
	6	Drametse - Balam	10	Farm Road
	7	Gangola - Challi	6	Farm Road
	9	Monggar - Fosrong	3	Power Tiller Track
	10	Highway - Ngatsang	3	Power Tiller Track
	11	Chaskhar - Gyonpa	3	Power Tiller Track

TRASHIGANG DZONGKHAG

District	No.	Route	Length(km)	Category
Trashigang	12	Kanglung - Yonphupam	4	Farm Road
	14	Thrimshing - Kangpara	20	Farm Road
15	Kangpara - Chhema		15	Farm Road

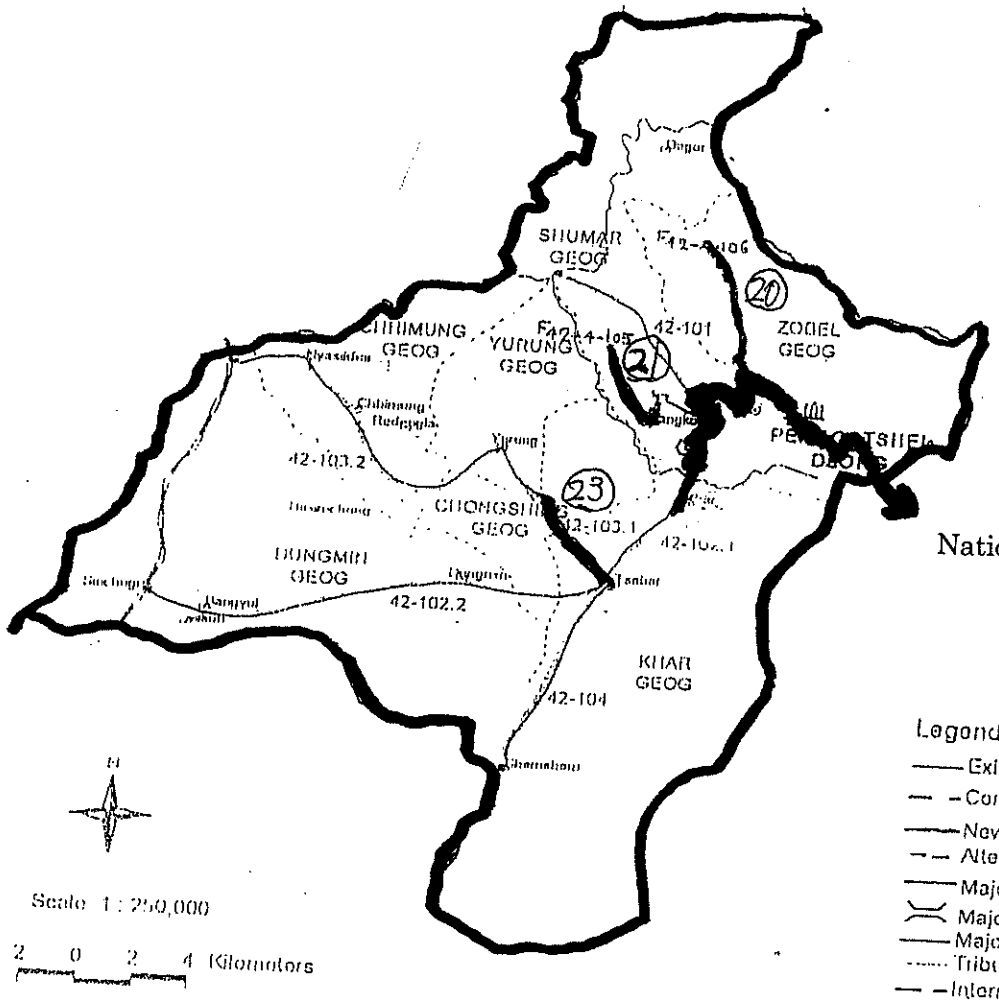


TRASHI YANDTSE DZONGKHAG



District	No.	Route	Length(km)	Category
T/Yangtse	16	Lichen - Rapti	10	Farm Road
	17	Tongshang - Thrichugyonpa	10	Farm Road
	18	Ramjar - Bawoong	5	Farm Road
	19	Belling - Sep - Wominang	15	Farm Road

PEMAGATSHEL DZONGKHAG



National/District Road

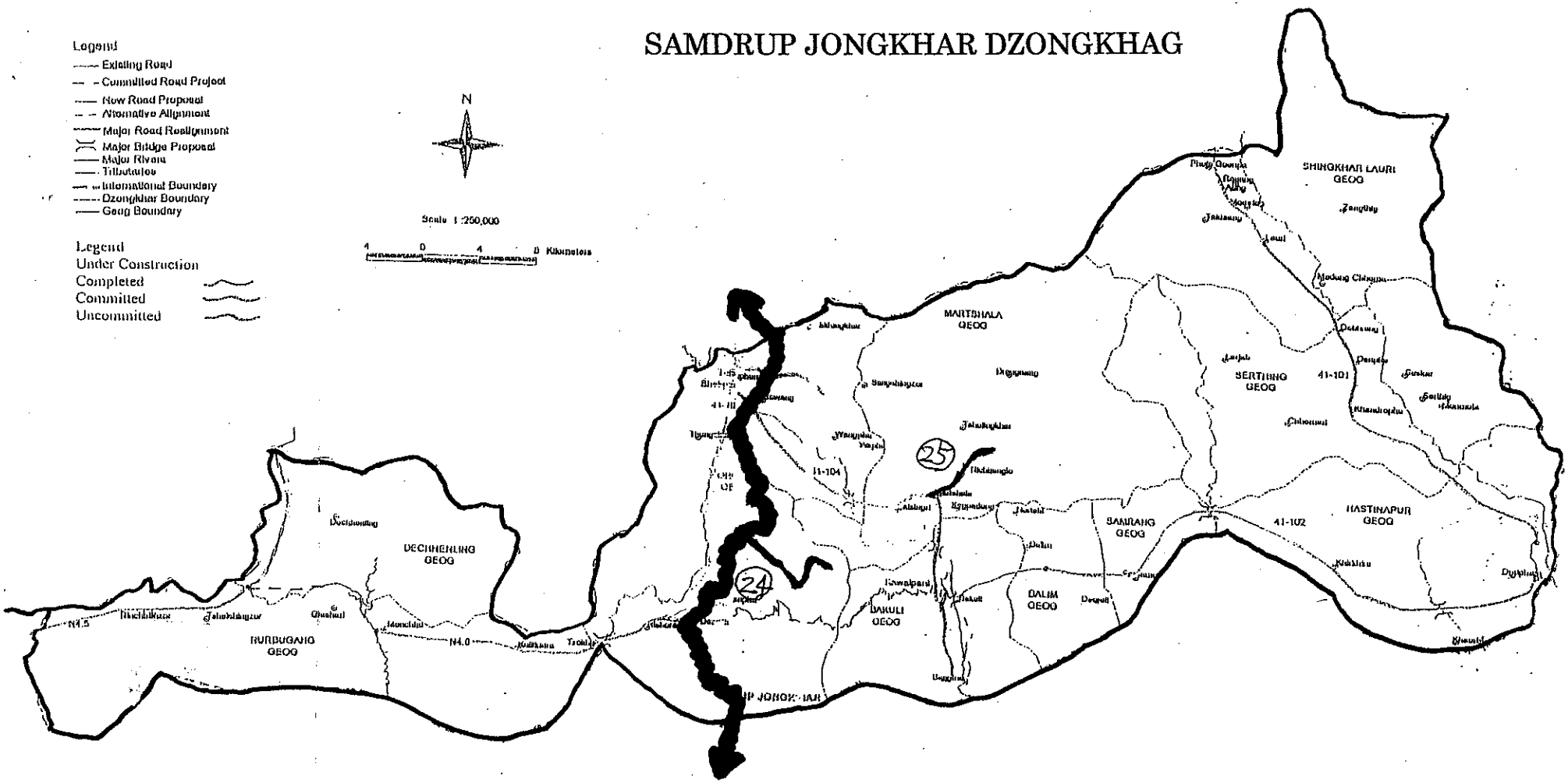
Legend

- Existing Road
- Committed Road Project
- New Road Proposal
- Alternative Alignment
- Major Road Realignment
- Major Bridge Proposal
- Major Rivers
- Tributaries
- International Boundary
- Dzongkhar Boundary
- Geog Boundary

Proposed Farm Road

District	No.	Route	Length(km)	Category
P/Gatsel	20	Gayzor - Resinang	7	Farm Road
	21	Kherigyonpa - Gyonpawoong	7	Farm Road
	23	Tsebar - Yurung	15	Power Tiller Track

SAMDRUP JONGKHAR DZONGKHAG



National/District Road

District	No.	Route	Length(km)	Category
S/Jongkhar	24	Tokarong - Tsangchillo	15	Farm Road
	25	Bangtar - Martshalla	12	Farm Road