

No. 1

Study Report
on
The Project for Equipment Supply for
River Training and Road Protection
in
The Kingdom of Nepal

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PREFACE

In response to a request from the Government of the Kingdom of Nepal, the Government of Japan decided to conduct a basic design study on the Project for Equipment Supply for River Training and Road Protection and entrusted the Japan International Cooperation Agency (JICA) to conduct the study with the assistance of the Japan International Cooperation System (JICS).

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 Nepal for their close cooperation extended to the team.

January 1996

Kimio Fujita
President

Japan International Cooperation Agency

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Chapter 1. Background of the Project

Because the Kingdom of Nepal is a mountainous country, so it has little inhabitable land. In spite of this, it has a population of approximately 20 million. Because of this, in recent years, in mountain districts, forests are being felled, and on the plains, areas flooded by rivers are being developed as farmlands. As a result, flood damage and earth and sand disasters are increasing. In particular, the floods, landslides, bank erosion, and cyclic changes in the course of rivers repeatedly occurring during the monsoon season are causing loss of many lives and greatly damaging personal property and arable land. The damage to farm products as a result corresponds to human and economic damage on a scale of 6,000 ha of farmland and 1 billion rupees (around ¥ 2 billion at the current exchange rate) a year during the past 11 years (1983-1993).

Also, because of the country's distinctive geography which is rich in undulations, Nepal requires large amounts of development funds in order to develop the country. In addition, the investment targets are widely dispersed in the country so the efficiency of investment is very low. For these reasons, the development of infrastructure such as road networks has inevitably and markedly been delayed. This has not only hampered distribution of goods and economic development, but regional differences have not been reduced at all.

To cope with this situation, and under the control of the Department of Irrigation, the Nepalese government has implemented river bank and road protection works through tabion works for the past 20-some years. Bank protection works are required throughout the country. However, river improvement works on a national scale are impossible due to the country's budgetary shortage. Therefore,

there is a great necessity for tabion works which excel in the areas of execution and durability and which are relatively cheap.

The tabions are being manufactured through cooperation by local residents using locally gathered stones. However, in making the tabions, 85% of the budget consists of the cost of materials and personnel expenses for the manual work for making the tabions. To reduce these costs and promote the bank protection works, during the six years from FY1987 to FY1991 and in FY1993, the country procured around 20,000 tons of iron wire, five knitting machines, and vehicles such as transportation trucks to manufacture tabions for a total bank length of 254 km.

Based on the above mentioned background, and due to completion of the previous plan, the Nepalese government is planning to manufacture tabions for bank and road protection works using iron wire by dividing the country into five regions for the coming five years. On this basis, it has requested the Japanese government for grant aid for procuring iron wire for making tabions and construction machinery for bank protection works.

Chapter 2. Contents of the Project

2-1. Objectives of the Project

This project is to be implemented for the purposes of protecting the main roads constructed throughout the country and protecting farmland and structures from floods and river erosion. Landslides, collapse, and river erosion are progressing on all of the roads except those on the Terai plains. On the Terai plains, loss of farmland due to river flooding is marked.

The tabions are to be installed to prevent frequently occurring natural disasters only by procuring the material iron wire and construction machinery and by utilizing the abundant stones and the local residents' labor force.

In order to eliminate the nation-wide loss of life and economic infrastructure which is being repeated every monsoon season, this project is designed to procure the equipment and materials needed in executing bank and road protection works.

2-2. Basic Concept of the Project

This project is designed to procure iron wire for making tabions and construction machinery during the five years from FY1994. This time marks its second year. The volume of galvanized iron wire used by Nepal during the past six years has far exceeded the volume procured from Japan (Table 2-1). This shows that the iron wire for making tabions procured so far has been completely used up. Also, by taking account of the fact that the Department of Roads joined the project in addition to the Department of Irrigation as the project's executing agencies, the cost of purchase of galvanized iron wire which Nepal had been bearing will be reduced. At the same time, in order to

effectively utilize the budgets of the Departments of Irrigation and Roads, the plan should be prepared so that the country can procure as much galvanized iron wire for making tabions as possible.

The Department of Roads has workshops in various parts of the country and has also secured technicians. Therefore, there are no problems in the areas of execution and maintenance and control. The Department has assigned an excellent technical staff to its workshops. They can repair or remodel any kind of vehicle or construction machinery.

Table 2-1. Volume of Galvanized Iron Wire Used During the Last 6 Years and Volume Procured Through Japanese Grant Aid (Volume Used/Volume Procured)

(Unit: tons)

Name of district	88/89	89/90	90/91	91/92	92/93	93/94	Total
Eastern Region	1,044	1,066	655	600	700	659	4,724
	1,044	1,066	595	280	-	-	2,985
Central Region	1,046	1,067	600	639	1,122	1,100	5,574
	1,046	1,067	600	215	914	796	4,638
Western Region	1,044	1,067	500	500	400	400	3,911
	416	525	343	1,284	448	256	3,272
Mid Western Region	1,044	1,066	400	400	100	300	3,310
	635	343	496	154	-	-	1,628
Far Western Region	1,044	1,000	400	400	200	200	3,244
	545	682	295	100	-	-	1,622
Total	5,222	5,266	2,555	2,539	2,522	2,659	20,763
	3,686	3,683	2,329	2,033	1,362	1,052	14,145

2-3. Basic Design

2-3-1. Design Concept

As shown in Table 2-2, the regions' inventory of galvanized iron wire has been decreasing every year. In May of 1995, some regions will use up all the inventory. Therefore, it is very urgent and necessary to procure galvanized iron wire.

The policy in procuring galvanized iron wire is to be to procure

Nepalese products which are cheaper than when procuring from Japan and which are of the same quality. A survey report from Nepal shows that a monthly production of 1,000 tons is the limit of production of iron wire in Nepal. Therefore, at least three months will be needed in securing the necessary procurement volume of 3,000 tons.

In addition, the wheel loaders have high general applicability and can be used in diverse processes. They are to be procured by taking account of their great frequency of use and necessity in the various regions.

Table 2-2. Inventory of Galvanized Iron Wire (Unit: M/T)

Name of Region	Debember 1994	February 1995	May 1995
Eastern Region	498	354	119
Central Region	596	351	130
Western Region	161	86	0
Mid Western Region	240	165	35
Far Western Region	110	74	0
Total	1,605	1,030	284

2-3-2. Basic Design

The equipment and materials to be delivered to the end delivery sites through the five D R Is and D R Os located in various parts of the country are as follows.

1) Galvanized iron wire

3,000 tons (2,700 tons of a diameter of 3.2 mm and 300 tons of a diameter of 4.0 mm)

2) Construction machinery

Five wheel loaders (140 H.P., weighing 12 tons, capacity of 2.1m³, for river and road protection works)

3) Sites

The work sites are found throughout Nepal. The names of the main rivers are as follows.

The main rivers under the jurisdiction of the Department of Irrigation of the Ministry of Water Resources and which cause disasters are the rivers Mahakali, West Rapti, Bagmati, Kanakai, Rapti, Kamala, Melchi, Babai, Tirawe, Silsia, Ansumala, Mahanari, and Bandganga.

Tables 2-3 and 2-4 show the roads and bridges under the jurisdiction of the Department of Roads, Ministry of Works and Transport.

Table 2-3. List of Roads Requiring Works

Road reference number	Name of road	Length (km)	Length of road requiring works (km)
H1	Mahendra Rajmarg (East-West)	1,024.0	100
H2	Tribhuvan Rai Paru (Central Region)	159.2	-
H3	Amiko rajmarg (Central Region)	112.8	26
H4	Prithvi Rajmarg	173.4	100
H5	Marayanghat-Mugling Rajmarg	36.1	30
H6	Dhulikhel-Sindhuli-Bhittawod Rajwarg	198.0	-
H7	Mechi Rajmarg (Eastern region)	264.3	150
H8	Koshi Rajmarg (Eastern region)	111.5	70
H9	Sagarmatha Rajmarg (Eastern region)	265.0	100
H10	Siddhartha Reiwarg (Western Region)	181.2	150
H11	Rapti Rajmarg (Mid Western Region)	196.0	130
H12	Ratua Reiwarg Mid Western Region	113.0	78
H13	Kamali Rajmarg (Mid Western Region)	210.0	210
H14	Mahakali Rajmarg (Far Western Region)	319.7	300
H15	Seti Rajmarg (Far Western Region)	64.7	60
	Total	3,428.9	1,504

Table 2-4. Bridges Requiring Works

Name of Bridge	Length (m)	Name of Bridge	Length (m)	Name of Bridge	Length (m)
Mechi	583	Jagdar	103	Arjun	160
Ninda	327	Jalad	273	Sukear	106
Biring	406	Aurahi	326	Khairi	106
Kamal	128	Rato	208	Man	36
Ratuwa	535	Monaha	138	Bhada	72
Mawa	128	Lakhandehi	204	Kapali	500
Bakroka	319	Bagmati	364	Lekna	240
Chisang	131	Chaudi	172	Godavari	90
Lohaudra	385	Dhansar	183	Donda	180
Gachisang	150	Bakiya	356	Banara	240
Budhi	129	Pasaha	166	Chaudher	180
Koshi Barrage	1,150	Rapti	210	Inderabati	176
Mahuli	124	Manohari	240	Samari	149
Sundari-1	105	Lothar	150	Karra	108
Sundali-3	360	Narayani	420	Amlekhgunj	90
Mahuli-2	1,134	Binai	246	Agra	88
Kaado	186	Aurung	215	Belkhu	66
Kharak	124	Girbani	182	Charongodin	67
Balan	479	Linder	102	Trisuli	125
Gagon-2	128	Sharahi	120	Madi	270
Dhuni	158	Tinao	226	Kali Gandaki	92
Kamala	640	Bauganga	296	Mirdi	90
Chameru	328	Ranshila	106	Anradi	94
Balwa	616	Rapti	290	Total	17,374

Chapter 3. Implementation Plan

3-1. Implementation Plan

3-1-1. Implementation Schedule

The purpose of this project is to procure the equipment and materials necessary for executing river and road protection works in order to eliminate nation-wide human and economic damages repeatedly occurring every time disasters occur during the monsoon season. The specific equipment and materials were selected by taking account of the utilization of use of the equipment and materials so far procured, the contents of the request, and the equipment and materials currently owned by Nepal.

This project's implementation plan is shown in Table 3-1. Since around six months will be needed in procuring the wheel loaders, it is desirable for Nepal to bid for the loaders within April of 1996.

Table3-1 Implementation Schedule

	1	2	3	4	5	6	7	8	9	10	11	12
Detailed Design (3 months)			Preparation for Tendering									
				Tendering, Evaluation and Supply Contract with Japanese Firm								
Procurement (7.5 months)							Manufacturing & Procurement					
							Factory Inspection					
							Transportation					

3-1-2. Obligations of Recipient Country

His Majesty's Government of Nepal will be kindly required to take necessary measures as follows:

(1) to ensure prompt customs clearance and internal transportation in the Kingdom of Nepal of the products purchased under the Grant;

(2) to exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the Kingdom of Nepal with respect to the supply of the products and services under the Verified Contracts;

(3) 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 Kingdom of Nepal and stay therein for the performance of their work;

(4) to ensure that the products purchased under the Grant be maintained and used properly and effectively for the execution of the Project;

(5) to bear all the expenses, other than those covered by the Grant, necessary for the execution of the Projects;

(6) to bear commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement;

(7) to secure the sites for installation of gabion making machine and storage of G.I.wire; and

(8) to summon the participation of local people in installing boulders in gabion.

3-2. Operation and Maintenance Plan

1) River control

The procurement of iron wire will reduce the burden of the cost of

materials which accounts for 85% of the bank protection budget. This will promote the bank consolidation works using tabions. This will suppress landslides in mountainous areas, leading to protection of human lives and property. This will also reduce earth and rock avalanche damages in mountain torrents, enhancing the safety against flood damages in river basins. Moreover, in lowlands such as the Terai plains, installation of tabions can suppress loss of farmland and villages due to floods, contributing toward preservation of farmland, development of agricultural production amount, and safety life of local residents.

2) Road maintenance

Implementing this project through tabion works will protect 1,504 km (44%) of the total main road length of 3,430 km, bridge foundations of the total length of 17,350 m, and 400 m on the upstream side of bridges and 200 m on the downstream side. In mountainous areas in particular, this project will reduce earth and sand disaster risky areas, leading to prevention of loss of bridges all over the country. As a result, while traffic on trunk roads has been disrupted every rainy season, the traffic will be ensured. This will activate physical distribution and human intercourse in Nepal, contributing toward the country's economic development.

3) Indirect benefits

In Nepal, discovery of dangerous spots and resident-participated repair works through execution of tabion works has been carried out on a national scale. Continuation of this type of project will conserve the national land, prevent disasters, and enhance people's awareness

regarding disaster rehabilitation. This will foster the entire country's awareness for disaster prevention.

Chapter 4. Project Evaluation and Recommendation

4-1. Project Effect

Procurement of the iron wire and construction machinery will protect the banks of rivers for which disaster prevention measures have not been taken, protect irrigation canals, rehabilitate damaged roads and bridges, and protect and maintain the functions of unpaved roads and bridge foundations. It will also enable systematic disaster prevention activities and emergency measures regarding disasters such as river flooding, collapsing and flooding of houses, traffic disruption, and landslides occurring every year. And it will be possible to take measure to conserve farmland and safety measures for the local residents. Moreover, in the execution phase, the tabion works have great merits as they do not require advanced technology and can be executed at low cost through participation by residents.

4-2. Recommendation

1) At present, the iron wire's inventory is checked based on reports of completion of works. Therefore, there are cases that the wire which has already been delivered to the sites is treated as inventory on the books. To solve this problem, the system should be changed to one for checking the inventory when delivering the wire. This will enable prompt grasp of inventory.

2) The Department of Irrigation has a workshop in Parwanipur in the mid development region constructed through financing by the World Bank. While it is gradually developing its organizational system, it requires further human and technical enrichment of the mechanical staff. Expectations are hence placed on personnel

exchange with the technicians of the Irrigation and Road Departments and holding of and participation in joint training meetings.

3) The quality of Nepalese iron wire is sufficient. The price is also lower compared to procurement from Japan. However, the capacity to produce is 1,000 tons per month at present. Therefore, in procuring wire in the future, the production period will have to be taken into account. If more than 3,000 tons becomes necessary, it will be necessary to reinvestigate the capacities of local manufacturers.

4) It has been reported that the construction machinery and vehicles procured for the Project for the River Training Project have been distributed as planned. However, the Department of Road and Irrigation will be the project's executing agencies from FY1994 and 1995. It is hence not certain how the equipment and machinery procured from Japan will be delivered to these departments' local offices. Therefore, in the future, it will be necessary to inquire the Nepalese side for the specific equipment and machinery distribution plan and for the already procured equipment and machinery, and have it reported to the Japanese side the state of use of the equipment and machinery and the volume of the galvanized iron wire used in the works.

5) In suppressing earth and sand disasters, it will also be necessary to implement afforestation projects such as tree planting.

6) The Water Induced Disaster Prevention Technology Center constructed through Japanese Grant Aid and carrying out activities since 1990 has been implementing diverse study and research on

natural disasters in Nepal. Therefore, in efficiently executing this project, cooperation from this Center is important.

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is crucial for ensuring transparency and accountability in the organization's operations.

2. The second part of the document outlines the various methods and tools used to collect and analyze data. It highlights the need for a systematic approach to data collection and the importance of using reliable sources of information.

3. The third part of the document describes the process of identifying and measuring the key performance indicators (KPIs) that are most relevant to the organization's goals. It stresses the importance of setting clear, measurable targets and regularly monitoring progress.

4. The fourth part of the document discusses the challenges and limitations of data collection and analysis. It acknowledges that there are many factors that can affect the quality and reliability of the data, and it provides suggestions for how to minimize these risks.

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