STUDY REPORT
ON
THE PROJECT FOR EQUIPMENT SUPPLY FOR RIVER TRAINING AND ROAD PROTECTION
IN
THE KINGDOM OF NEPAL

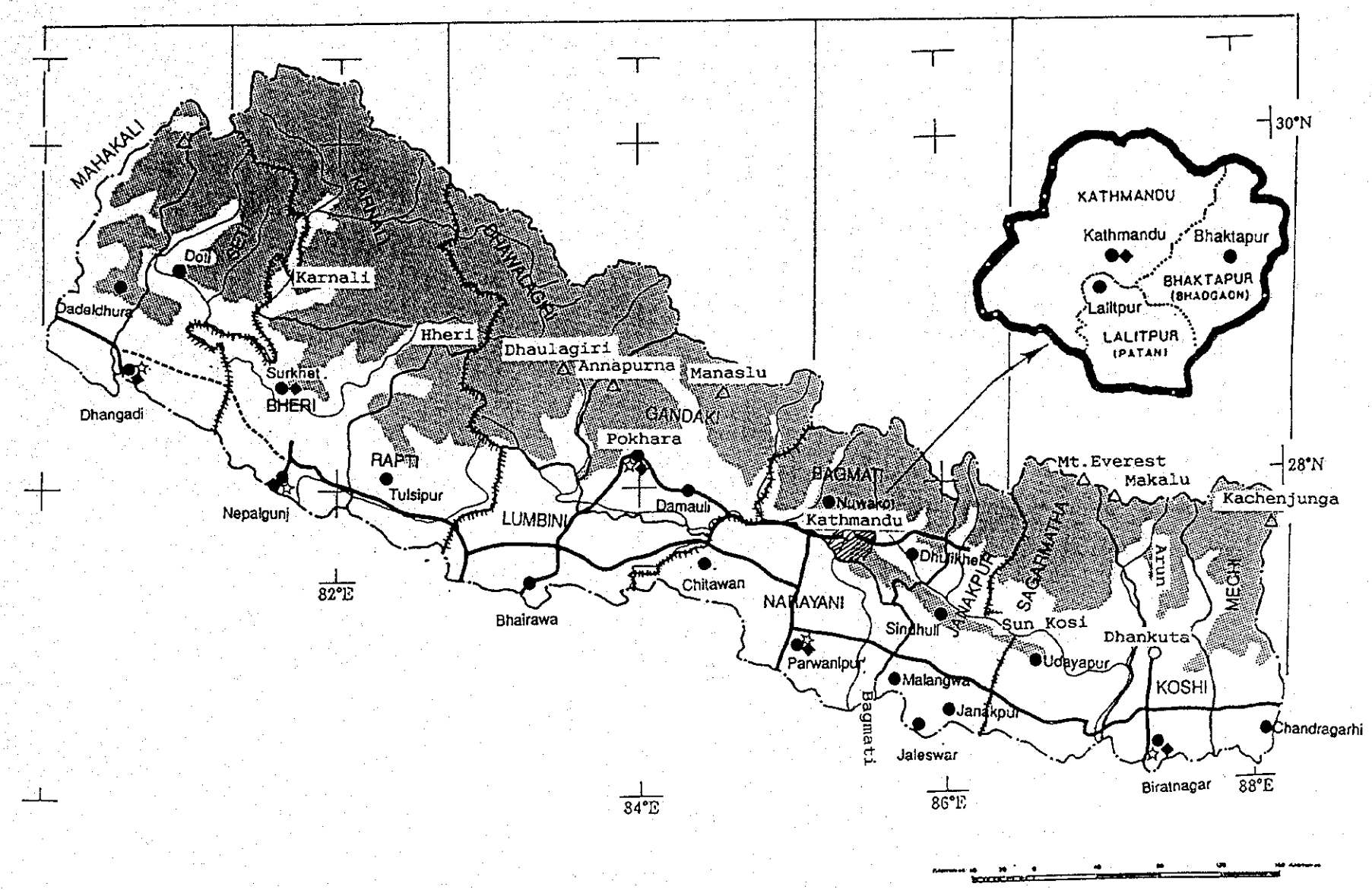
February 1995

Japan International Cooperation Agency (JICA)

STUDY REPORT
ON
THE PROJECT FOR EQUIPMENT SUPPLY FOR RIVER TRAINING AND ROAD PROTECTION
IN
THE KINGDOM OF NEPAL

February 1995

Japan International Cooperation Agency (JICA)


MAHAKALI
KARNALI
BHAWADGIR
Doti
Karnali
Dadeldhura
Kheri
Dhaulagiri
Annapurna
Manaslu
Surkhet
BHERI
Dhangadi
GANDAKI
Pokhara
RAPTI
Tulsipur
Nepalgunj
LUMBINI
Damauli
BAGMATI
Nuwakot
Kathmandu
Mt.Everest
Makalu
Kachenjunga
Dhulikhel
SAGARMATHA
ARUN
MECHI
JANAKPUR
Chitawan
NARAYANI
Sindhuli
Sun Kosi
Dhankuta
Bhairawa
Parwanipur
Udayapur
Malangwa
KOSHI
Janakpur
Bagmati
Jaleswar
Chandragarhi
Biratnagar
KATHMANDU
Kathmandu
Bhaktapur
BHAKTAPUR
(BHADGAON)
Lalitpur
LALITPUR
(PATAN)
30°N
28°N
82°E
84°E
86°E
88°E

Contents

CHAPTER 1. Background of the Project

1.1 Historical Background and Contents of the Request

1) Historical Background of the Request

(1) National Land and Natural Conditions

The Kingdom of Nepal is a long thin country stretching some 800 km from east to west and some 180 from north to south and it is situated on the southern side of the Himalayan Range, which separates the Indian sub-continent from the Tibet Plain. The national land area is slightly more than one-third that of Japan and approximately 80% of the national land is dominated by the Himalayas and the mountainous and hilly regions, which are a continuation of it. The rivers and the mountain ranges of the country are interwoven in a complex fashion and indeed the country possesses more than 6,000 rivers of various sizes which run for a combined length of more than 45,000 km.

The region that borders with India in the south is known as the Tarai Plain and is an expansive area of low land of 20 - 30 km in width stretching from the east to the west of Nepal. This region forms Nepal's biggest granary, has a low altitude of approximately 200 m and continues south into the Indian Plain. The north side of the Tarai Plain is a hilly zone known as the Siwalik Range, which is composed of a soft gravely layer and has an altitude of around 600 m. The Siwalik Range continues north into the Sub-Himalayan zone, which is dominated by mountains with altitudes of around 3,000 m, and this zone eventually continues into the Himalayan Range on the country's northern borders.

As Nepal is situated in a position where the Nepal Plate and the Eurasia Plate clash, the geological makeup of the land is weak, and with the country receiving the effects of the monsoon from the Indian Ocean it has an annual rainfall of between 1,000 and 2,500 mm, more than 80% of which falls in the summer.

(2) National Economy

The estimated total population of Nepal in 1992 was 19,890,000 with an average annual rate of increase of 2.6% (average annual rate of increase for the period between 1985 and 1992). The per capita GNP is approximately US $ 170. The real rate of growth of the GNP has averaged 2.1% over the last three years. Looking at the economic activities by region shows that agriculture is prominent in the south and that commerce and handicraft industries are well developed in the central urban centers and hilly zones.

Nepal is recognized as a least less developed country (LLDC) and its economy is heavily reliant on agriculture and agriculture-related sectors which account for approximately 60% of the GDP and more than 80% of the working population. A low level of irrigation diffusion means that farming in Nepal is easily affected by the weather and the absence of a consistent agriculture policy has

meant that the rate of growth of the agricultural sector has been low. In addition to these factors, Nepal is also faced with a disadvantage in geographical terms in that it is a landlocked country and as a result the rate of economic growth in the 1970s and the early 1980s was low at around 3%.
In March 1989 the trade and customs treaty that had existed between Nepal and India became ineffective and this resulted in extreme national economic difficulties as seen in shortages of daily necessities and spiraling prices, however, following the normalization of relations with India and other positive factors an economic growth rate of 5.5% was achieved in 1990/1991. The Coirara administration is showing a desire to actively promote a policy of economic liberalization and, in line with the economic liberalization measures already taken by India, the government announced new policies concerning the attraction of foreign investment in December 1991, it announced the liberalization of the Nepal Rupee for partial exchange with foreign currency in March 1992, and in May the same year it announced a new industrial policy designed to achieve privatization of the government sector, the abolition of the corporate licensing system, the integration departments in charge of licensing procedures and the setting up and development of export processing zones. Furthermore, the National Planning Commission in November 1991 announced the Eighth Five-year Socioeconomic Development Plan (1992-1997) with the fundamental aims of achieving sustainable economic growth, reducing poverty and correcting regional disparities, and this is currently under implementation.
As a result of the national election in 1994, the Nepal United Communist Party achieved victory and its president, Mr. Adi Kali was appointed as Prime Minister, marking the official start of the single party rule of the Communist Party. Unlike the other left-wing political parties, which are all in favor of overthrow of the monarchy, the United Communist Party has clearly stated that it will maintain the monarchy. Furthermore, in view of the fact that foreign aid is being relied upon to provide some 70% of the development budget, it is considered that the said administration will continue the policies of the previous administration by introducing more foreign capital and pursuing a market economy.

(3) Background of the Project

Successive Nepalese governments have been conducting river shore protection works and road preservation works through the laying of wire matting for some 20 years through the Irrigation Bureau. River shore protection works are carried out by the Irrigation Bureau based on plans that it compiles in response to petitions from citizens. Although the need for river shore protection works exists throughout the whole country, the implementation of river improvement on a national scale is impossible due to financial restraints, and this means that the necessity of wire matting, which is more durable and cheaper than stone embankments, is

extremely high.

The cooperation of the local citizens is obtained in making wire matting by using stones and boulders that are found locally. As 85% of the manufacture cost of wire matting is accounted for by the materials costs and the wages of the workers needed to perform the manual labor, approximately 20,000 tons of iron wire, five knitting machines and vehicles such as trucks for transportation purposes were provided with the aim of making enough wire matting to cover a total of 254 km of river shore protection works in the five years between 1987 and 1991 and also in 1993 (total of six years) in order to reduce costs and advance the diffusion of the said works.

In Nepal the expansion of arable land area in order to increase agricultural production yields is an important issue, and land reclamation and irrigation mostly on the Tarai Plain has been carried out with this aim in mind. Wire mat works, which do not require high levels of technology and can be performed through the participation of the local citizens, are necessary in the construction of irrigation water channels too, and as the repair and rebuilding of embankments through river shore protection projects and irrigation projects is something of vital importance, it can be said that the iron wire so far provided by Japan has been put to extremely effective use.

Furthermore, construction methods that utilize wire matting, which can be flexibly laid according to topographical conditions, are also best suited to road construction and road repair and maintenance works, and the iron wire that has been put to use in this area has also proven to be effective in terms of damage prevention and restoration.

With the aforementioned background in mind and following the end of the previous provision of iron wire, the Government of Nepal is planning to use more iron wire in order to manufacture additional wire matting to be used in shore protection works and road protection works over five years in five regions throughout the country.

2) Contents of the Request

The following table indicates the requested items.

Equipment Name	Spec.	Q'ty	Purpose of Use
Galvanized iron wire	3.2mm	3,600t	For making wire matting
	4.0mm	500 t	
Wheel-type tractor shovel	140H.P.	5 units	For river shore protection works and road works
Dump truck	200H.P.	5 units	For transporting wire matting and precious stones
Excavator	130H.P.	5 units	For river shore protection works and road works

CHAPTER 2. Contents of the Project

2.1 Objectives of the Project

There are two Project objectives, which can be described in the following way.

(1) In the area of river improvement, the provision of iron wire for making wire matting and vehicles, both of which are required for restoration works in disaster-struck areas, river shore protection works, embankments, water control, ground firming and irrigation channel improvement works.
(2) In the area of road protection, the provision of iron wire for making wire matting and vehicles, both of which are required for main road protection works, shore protection works around the foundations of bridges, and shore protection works for 400 m upstream and 200 m downstream of bridges.

2.2 Outline of the Project

1) Implementing Agencies and Operation Setup

The agencies responsible for the implementation and the operation of the Project are as follows.

a) Supervisory ministries: the Water Resources Ministry and the Public Works and Transportation Ministry

b) Operating agencies: the Water Resources Ministry, Department of Irrigation (DOI) and the Public Works and Transportation Ministry, Department of Roads (DOR)

2) Project Contents

The Government of Nepal is well aware of the effectiveness of wire matting in shore protection works and following the completion of the previous provision project, it plans to divide the country into five regions and use between 500 MT and 1,000 MT of iron wire each year for five years to make wire matting for shore protection works, and use a similar amount to make wire matting for road protection works.
The Department of Irrigation intends to conduct restoration works in disaster-struck areas, river shore protection works, embankment construction, water control, ground firming and irrigation channel preparation with the aims of preventing further disasters and reducing both human and economic losses.
The Department of Roads, on the other hand, requires a combined total of 3,603 MT of iron wire in order to conduct road protection works on 1,504 km of the country's combined main road length of

3,428.9 km, to perform shore protection works around bridge foundations (17,350 m) and to perform shore protection works for 400 m upstream and 200 m downstream of bridges.

3) Maintenance Plan

The above-mentioned DOI and DOR shall assume total responsibility for the maintenance of the provided equipment and shall carry out inspections and maintenance of the equipment on a daily basis. The said departments shall also coordinate the amounts of iron wire to be distributed to each final destination.

2.3 Design Concept

Examination of Each Equipment Item

- Iron Wire

(1) Ministry of Water Resources, Department of Irrigation

As the requested iron wire will be used for a wide range of purposes such as river shore protection works, water control and ground firming, etc., the Department of Irrigation calculated the required amount as the amount usable for execution based on past use. Moreover, as a result of partial observation of the local conditions by the Study Team, it is considered that the demand for the iron wire is limitless.

(2) Ministry of Public Works and Transportation, Department of Roads

The Department of Roads originally requested iron wire amounting to approximately 17,000 MT for the works it has planned for the next five years. However, following the experience of the major disaster in 1993, the Department had changed its requirement to approximately 35,000 MT by the time of the study.
This represents a doubling of the original request and, even taking the 1993 disaster restoration works into account, when one considers the amount of iron wire purchased by the Department through its own budget in the past (2,500 MT per year at most), it is considered that the originally requested level (3,500 MT per year on average) is the more usable quantity.

- Wheel Loaders

Wheel loaders can be used at the quarries mainly in the digging and loading of gravel and stones and also in all work processes at the areas where the wire matting is to be laid, etc. Compared to track bulldozers, wheel loaders suffer from less abrasion breakage and possess faster work rates. Moreover, wheel loaders have a fast cruising speed and are thus very versatile in that they can independently travel along paved roads.

- Dump Trucks

  In the case of rivers on the plain, it is necessary to haul stones and boulders to be used for filling in the upstream wire matting, and the existing vehicles are insufficient for this purpose.

- Excavators

  Both the Department of Irrigation and the Department of Roads possess few excavators and are struggling to carry out excavation work. Excavators are necessary because they can be used for a wide range of work purposes in disaster-struck areas.

2.4 Basic Design

- Galvanized iron wire: Equivalent to JIS G3457 SWM-GS3 with diameters of 3.2 mm and 4.0 mm

- Wheel loaders: Approximately 130 HP - 145 HP with a bucket capacity of 2.0-3.0 ㎥

- Dump trucks: Approximately 150 HP - 200 HP

- Excavators: Approximately 110 HP - 140 HP with a bucket capacity of 0.6-0.9㎥ . Crawler type

CHAPTER 3. Project Evaluation and Recommendation

3.1 Project Effect

Implementation of the Project can be expected to bring about the following effects.

(1) River Maintenance

Provision of the iron wire will mitigate the burden of materials costs and personnel expenses, which account for 85% of the river shore protection works budget, and will expedite the promotion of the shore protection works that utilize wire matting. The said works will lead to the prevention of land slips and landslides in the mountain regions and will thus result in the protection of human life and property. Moreover, reduced rock and mud flows will improve the level of safety regarding water damage in areas situated around rivers. The laying of wire matting in the low-lying areas will enable farmland and communities to be protected from flooding and will thus contribute to farmland protection, the maintenance of agricultural productivity levels and the daily safety of citizens.

(2) Road Maintenance

The manufacture of wire matting will allow the progression of the planned road protection works on 1,504 km of the country's combined main road length of 3,430 km, strengthening works on 17,350 m of bridge foundations, and shore protection works in areas 400 m upstream and 200 m downstream of bridges. These works will lead to a reduction in the number of land slip-risk areas in the mountain regions in particular and will contribute to the prevention of bridges being lost in floods. This in turn will maintain main road traffic during the rainy season and will thus ensure the safe movement of people and goods between regions.

(3) Beneficial Effects

Nepal has a long history of receiving the cooperation of citizens in the detection of high risk areas and the carrying out of wire matting repair works through citizen participation, and the continuation of this style of project implementation will raise the level of public awareness with regard to land preservation, disaster prevention and disaster restoration. This in turn will lead to an increase in the awareness of people throughout all Nepal regarding disaster prevention.

3.2 Recommendation

a) The method used to calculate the iron wire inventory is currently one where the inventory is only reduced upon receipt of the report

of works completion, and it is often the case that, although iron wire has already been distributed to a works site, it is still recorded as being in the inventory. This system should be modified to one where the inventory is reduced at the point of distribution. By doing this, it is considered that it will become possible to promptly grasp actual inventory quantities.

b) The Department of Irrigation has constructed a workshop with funds from the World Bank in the central development district of Palwanipur and is gradually developing its maintenance setup, however, improvements still need to be made to the mechanical staff in terms of both actual numbers and their technical levels. Personnel exchange and joint training programs and so on with the staff of the Department of Roads would be desirable.

c) With regard to the iron wire, that produced in Nepal is of sufficient quality and is far cheaper than imported iron wire. However, when it comes to the issue of iron wire for use in machine knitting, that produced in Japan puts a lighter load on the knitting machines and would allow the frequency of breakdowns to be reduced.

d) If the contents of the Project could be coordinated with a reforestation project of tree planting, etc. designed to remove the fundamental threat of disasters, the effects to be gained would increase even more.

e) As the method of laying wire matting greatly affects the degree of durability against external pressure, it is necessary to further promote research into shore structures that use wire matting, in order to draw out the full effectiveness of the matting. For this reason, the cooperation of the Nepal Flood Control and Sand Control Technology Center is important.