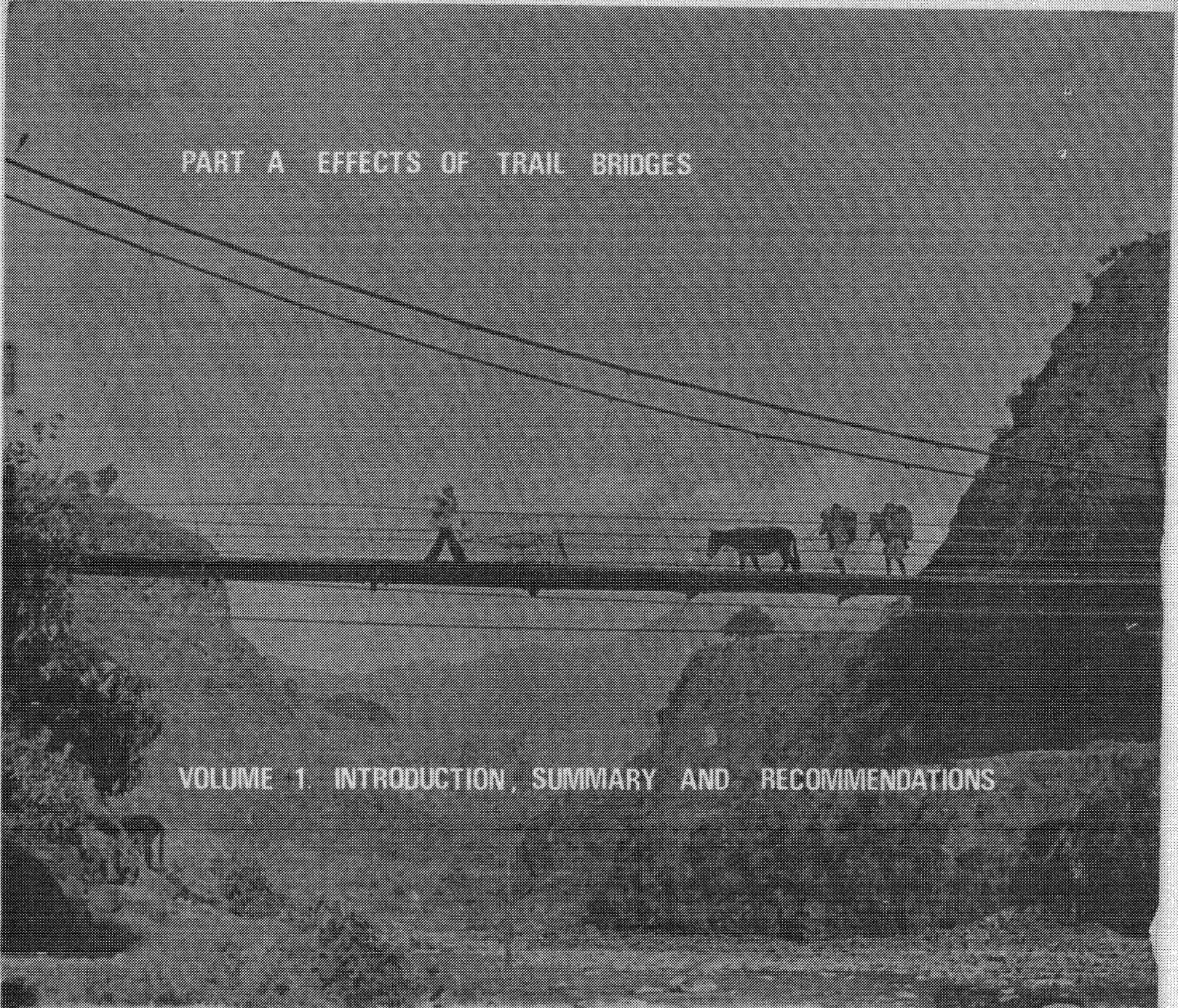


# TRAIL SUSPENSION BRIDGE STUDY

CONDUCTED FOR

PN-AGG-446

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT, NEPAL



PART A EFFECTS OF TRAIL BRIDGES

VOLUME 1. INTRODUCTION, SUMMARY AND RECOMMENDATIONS

FINAL REPORT

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JUNE 1978

No. 16 of 90

 EAST

CONSULTING ENGINEERS, KATHMANDU

P.O. BOX 1192

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PREFACE

Of late, there has been a growing concern in Nepal voiced by politicians, academicians, and financing agencies, including aid donors and planners, that the goal envisaged in rural development projects, like the Trail Suspension Bridge, Rural Water Supply, and Rural Health Projects has not been achieved in its true sense.

Development is a complex process, and embraces a host of social, economic, political, administrative and technological considerations. The problems that accompany development need to be attacked on all fronts. No isolated project, especially when it is considered from only one angle, can be expected to deliver results, let alone help in the overall development of the area.

In Nepal, the suspension bridge project has been an isolated project, one without a conscious effort towards integrating it with other development projects, and usually without giving enough thought to the social and political aspects of development. This has resulted in a lack of complete success, and sometimes, even resulted in the misplacement of bridges with the inevitable consequences of minimal benefits.

The absence of a systematic method for assessing the need for a bridge in a specific area and, for allocating priorities to all the requests for bridges has created a variety of problems over the years. Some of the bridges under study were constructed upon commands issued by His late Majesty, in response to petitions from the local people. Other bridges were constructed, after local people, with the support of influential persons, lobbied in the Ministries and Departments of the Central Government in Kathmandu.

This study tries, in a modest way, to make available a set of criteria, under the existing environment, to help develop a process by which requests for bridges can be effectively dealt with by identifying the needs and priorities for the construction of such bridges. It is hoped that this will help the decision-makers and administrators to judiciously select and implement future trail bridge projects and avoid bowing

to pressures from different corners. These criteria have been derived after studying thirteen out of the total of twenty-three trail bridges constructed under former USAID projects, between 1956 and 1975. It may be that the sample size of thirteen bridges for this kind of study is not sufficient, but the research group has tried to formulate the desired criteria with the help of their past experiences on such rural projects, and the knowledge of the decision-making system present in Nepal today.

This study was divided into two phases. Phase I consisted of 4 trail bridges studied during the wet season in 1977 along with the study of traditional suspended bridges, built with local initiative and technology, in the District of Baglung, and terminated in an Interim Report which was submitted to USAID/Nepal in November 1977. Phase II consisted of the study of 8 trail bridges and one cableway along with the dry season study of the four Phase I bridges. The study also includes the findings of the application of selection criteria developed in Phase I on the other four bridge sites studied by the German Consult under an UNDP program in 1976.

This report is the culmination of the whole project and includes the findings and recommendations of the study.

The report has been presented in three parts: A, B, and C. Part A contains five different volumes, whereas the other parts contain one volume each. The total number of volumes is seven.

- PART A: Effects of Trail Bridges
- VOL.1 Introduction, Summary and Recommendations
  - VOL.2 Case History, Analysis and Findings on Bridges studied in the Central Development Region.
  - VOL.3 Case History, Analysis and Findings on Bridges Studied in the Western Development Region.
  - VOL.4 Case History, Analysis and Findings on Bridges Studied in the Far Western Development Region.

VOL.5 Case History, Analysis and Findings on Bridges studied in the Eastern Development Region.

PART B: Baglung District Bridge Construction Study.

PART C: Annotated Bibliography and General Information on Trail Bridges and Trails in Nepal.

We feel the report will make a useful contribution if it stimulates further discussions and studies; thereby helping to bring about recognition of the fact that the selection of rural development projects should always be made within the political and socio-economic context of the rural area, and that when this is not done the project and the rural area both suffer.

This study has been funded by USAID/Nepal and we at EAST CONSULTING ENGINEERS, sincerely thank USAID/Nepal who entrusted us, a local firm, to undertake this important study. We have made a sincere and conscientious effort to conduct this study, in a manner suited to the needs of Nepal.

EAST CONSULTING ENGINEERS

ACKNOWLEDGEMENT

We acknowledge the valuable information provided, and the keen interest shown, during the course of the study by Mr. David F. Tiedt, Mr. John A. Bishop, and other officials of USAID/Nepal, and express our sincere thanks to them.

We also thank the honourable members of the Rastriya Panchayat, who have been very helpful in answering our questions which helped us immensely to generalize our subjective judgement. Two members deserve an added note of thanks, these are: Mr. Omkar Prasad Gauchan and Mr. Jit Bahadur Nepali.

Thanks are also due to the following gentlemen for their patience in answering our questions and contributing to a better understanding of the project. They are: Mr. S. B. Rai, Director General of the LDD; Mr. C. B. Pradhanang, Superintending Engineer of the SBD; Mr. J. Krachenbuehl of SATA; Mr. K. B. Bista of CEDA; Mr. L. K. Malla, Superintending Engineer of the DOR.

Also, thanks are due to the honourable members of National Planning Commission Mr. Govinda P. Lohani and Dr. Mohan M. Sainju for their kind interviews which contributed to a useful understanding of the project. We must also mention, Dr. M. Kulesa former Resident Representative of the UNDP, Mr. Douglas R. Pickett and Mr. John Daurio of the US Peace Corps in Nepal, who gave us access to all their records and materials on suspension bridges. Our thanks are also due to Prof. D. B. Bista, our adviser, for sharing his rich experience with us, and initially guiding our socio-anthropological group.

We sincerely thank various local government officials, bridge users and the local leaders (Panchas) from the Districts of Nepal, which our study group visited. Without their active support, this study could not have been completed.

Lastly the EAST administrative personnel for this project are worthy of our appreciation for the support they have given to the study.

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OBJECTIVE OF THE STUDY

The United States Agency for International Development in Nepal, wishing to finance the construction of more trail bridges, has decided to carry out an impact study, with more emphasis on:

- social benefits accrued to the local population
- the socio-economic effects on the area
- an evaluation of such effects and benefits to develop criteria for future bridge site selection.

The main objectives of the study are as follows:

- To complete a study of the effects suspension bridges, constructed under former USAID Projects, have had on people served by the bridges, and to derive to what extent these effects may influence the selection of future bridge sites.
- To study the processes and procedures involved in an apparently successful Baglung suspended bridge program and determine the methods employed in that area which may be applied to a future USAID Trail Suspension Bridge Program.

During deliberations on this study, the decision-making process for selection stood out pre-dominantly, and therefore the study on the decision process has been given due attention in the study.

## METHODOLOGY

Approach: The approach to this study has been qualitative and has broadly followed the procedure outlined in the guideline methodology more explicitly explained in the Appendix O-A-7. A detailed case study of each bridge, starting from the history of its establishment, covering past selection methods, its derived benefits, and its effects on the socio-economic environment of the area, has been made to develop a reasonable process of selecting proper bridge sites in future bridge construction programs.

Field studies were conducted with a view of getting more valuable information from knowledgeable persons in relevant areas. Efforts were concentrated more on opinion polling rather than trying to get quantitative data. Hence, opinion polling has been extensively used and most of the conclusions have been drawn on the basis of these opinion surveys. Questionnaires were administered in the field to knowledgeable persons, such as local panchayat people, school teachers, local government officials, porters, traders and common rural folk, whose interests are directly linked with the proposed project. The average sample size has been fifty persons, and the average number of days spent at a particular site by our research assistants to collect information, was 5 to 6 days, supplemented by 2 to 3 days visits by our consultants. This gave the consultants an opportunity to become familiar with the actual site conditions, and helped them to form a more realistic idea of the problems during analysis of the field findings, and therefore, allowed them to draw better conclusions.

The objective of the study demanded the assessment of the social benefits; an assessment of any changes in the quality of life of the rural population around the bridge sites, such as access to and from the administrative centers, medical, school and educational facilities. Since this is generally non-quantifiable in nature our approach has deviated from the more conventional techno-economical methodology which tends to accentuate productive objectives only. We have concentrated our efforts more towards the treatment of non-quantifiable socio-economic benefits that introduce new factors of change in the quality of life of the people of the study areas.

After completion of the first four case studies, along with the study on the local bridges of Baglung District, it became very evident that bridges had contributed towards a positive socio-economic change, though limited in nature in the absence of the introduction of other required non-transport inputs. Thus, in the second phase of our study we started to observe in detail the contribution that bridges have made towards the change in the quality of life of the people in the study areas. This helped us to identify the specific aspects of the benefits which the bridges have made. This in turn has been helpful in evaluating the importance of such benefits in the development of selection criteria. During the course of the second phase of the study, case studies provided other, more specific information which was directly related to the formulation of the selection criteria. This information generated some new parameters for consideration, such as the trails, river system, remoteness of the areas, existing crossing facilities during wet and dry seasons, etc.

Before arriving at our final conclusions, we always kept in mind that it is not practical to indulge in objective model formulations only. In such a subjective and politically delicate problem as bridge site selection, it is necessary to try to devise a mechanism, or a system based on a subjective approach, by making use of a framework which explicitly incorporates the social, economic and political factors as a whole. To achieve these ends and to supplement our findings from the field we have had extensive interviews, discussions and exchanges of ideas with people directly connected with policy formulation and implementation. This included members of the Rastriya Panchayat, members of the National Planning Commission, academicians, HMG officials concerned with the building of suspension bridges, and with some ministers. This has widened our understanding of the dynamics of operations by which objectives are achieved through the present channels.

Limitations: The nature of the study had in it two inherent limitations. These were: the limitation of time, and the wide geographic area over which were scattered the project sites under study; this was compounded by the uncertainties surrounding logistics in Nepal.

Since it was not possible to accurately describe the situation before the bridge came into existence except through hearsay, in the absence of baseline socio-economic data, clear impact assessment was not always possible.

The number of bridges which were studied to formulate the Interim Selection Criteria were not sufficient. As a result, the interim selection criteria proved to be too narrow in scope. We also found the number of bridge sites where Interim Selection Criteria were to be applied, were not sufficient enough to generalise the findings in a more precise way. This, however, helped the study team to formulate specific modifications which have hopefully improved the final selection criteria.

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1. KARAMBOT BRIDGE



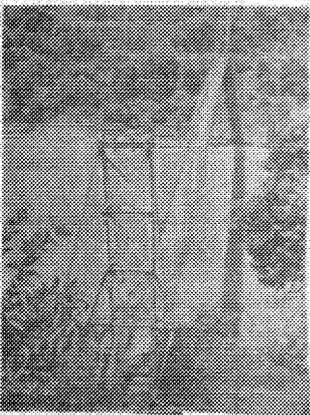
2. SYABRUBESI BRIDGE



3. KAGUNE BRIDGE



4. PACHUWARGHAT BRIDGE



5. DARONDI BRIDGE



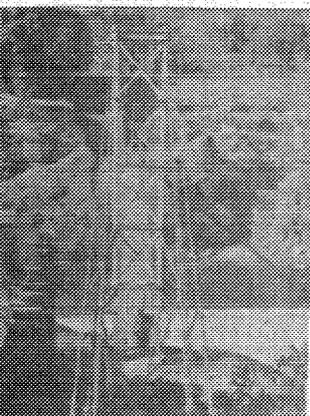
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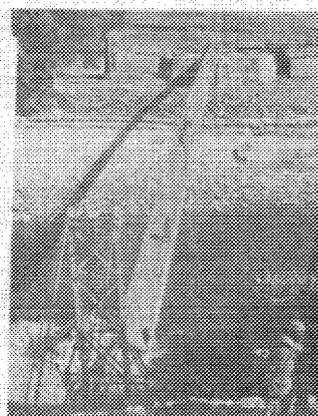
7. BAGLUNG TRAIL  
SUSPENDE BRIDGE



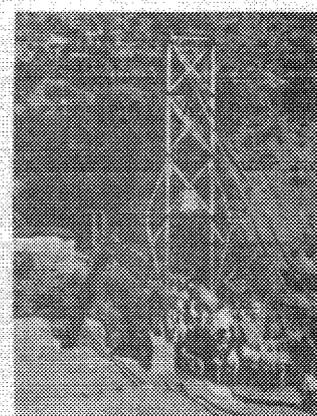
8. JHAPREBAGAR BRIDGE



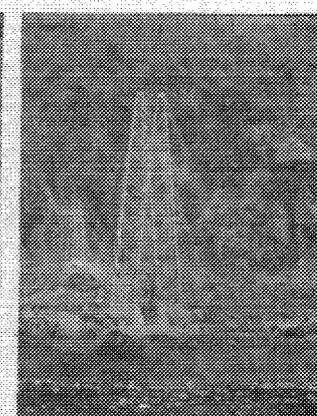
9. BHINGRI BRIDGE



10. SANFEBAGAR BRIDGE



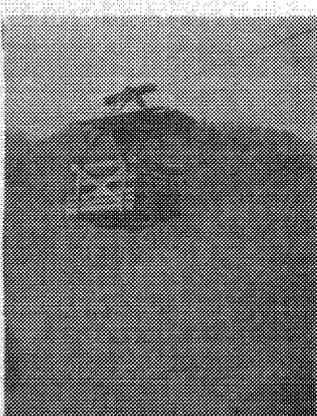
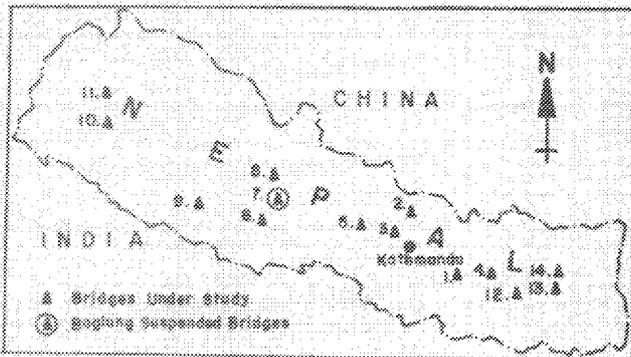
11. MALUMELA BRIDGE



12. TOXELGHAT BRIDGE



13. TURKEGHAT BRIDGE



14. LEGUWAGHAT CABLEWAY

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## INTRODUCTION

### 0.1 TRAIL BRIDGE CONSTRUCTION IN NEPAL

#### 0.1.1 Terrain and Transport Situation

The major orientation of Nepal's land mass, is east to west, and nearly two-thirds of the total land area consists of rugged hills and mountains. Numerous rivers and streams cross the land mass and join the Ganges River System of India in the south. Some of the rivers and streams carry snow melt throughout the year, others dry up during the dry season but become turbulent and fast flowing during the monsoons. This rugged terrain presents a tremendous problem for inter-regional transport and communication and has been one of the main reasons for the slow economic growth in the large rural areas of Nepal. An effort has been made to gain access to remote regions by air transport through the use of STOL technology. The development of an adequate road network, consisting of primary, secondary and feeder roads, remains the ultimate goal, but this goal may not be reached for a considerable time to come mainly because of the cost factor for a country like Nepal. Nepal embarked on road building activities only 25 years ago, and now has only 2568 miles of road, of which 455 miles lie in the Far Western Development Region, 518 miles in the Western Development Region, 1,004 miles in the Central Development Region, and 591 miles in the Eastern Development Region. The road density, vis a vis the area of the country, is 0.047 miles/sq. miles. <sup>1/</sup>

The present mode of transport in most of the mountainous regions is trekking over trails. The pattern of these trails, as they thread their way through the valleys, across the rivers, and over the hills, is similar to a system of veins and arteries running through the body. Only a few trails were planned and built. Most of them have just been created, gradually appearing where people generally walked (See photo C-P-1). All goods and materials must be carried out of and into regions by porters, and sometimes by pack animals, over these trails. The most hazardous obstacles for the smooth movement of goods and people

<sup>1/</sup> Source: Planning Section of DOR

on these mountain trails are the numerous ravines, swift flowing rivers (See photo O-P-2), and streams. Countless lives have been lost in the past, and will continue to be lost in the future, if nothing is done to make the crossing of these rivers and ravines safe.

In fact, some areas are entirely cut off during the monsoon season. The people of these areas, are forced to rely on stored food supplies, and are unable to obtain medical help if needed. Therefore, one of the immediate needs for the rural population in the hills are bridges over these rivers and streams. There is, however, no immediate need for bridges over ravines. The bridges would considerably increase the mobility of most of the rural population of Nepal, bring about faster socio-economic changes in rural areas, and create a greater sense of national integration.

#### 0.1.2 Trail Bridges: History and Assessment

The hill people of Nepal, out of necessity, have always built trail bridges, and have shown great skill in doing so. River crossings were built across narrow gorges or at points where huge boulders in the stream could be used as support. Many wooden cantilever and simple log bridges can be seen in Northern Nepal (see photo O-P-4, O-P-5). Such bridges have had to be rebuilt about every 3 years or so, or sooner if they happened to be washed away by floods. For this reason, many local bridges are partially dismantled before the monsoon season and are built again shortly afterwards. These bridges generally have a span of up to 75 ft.

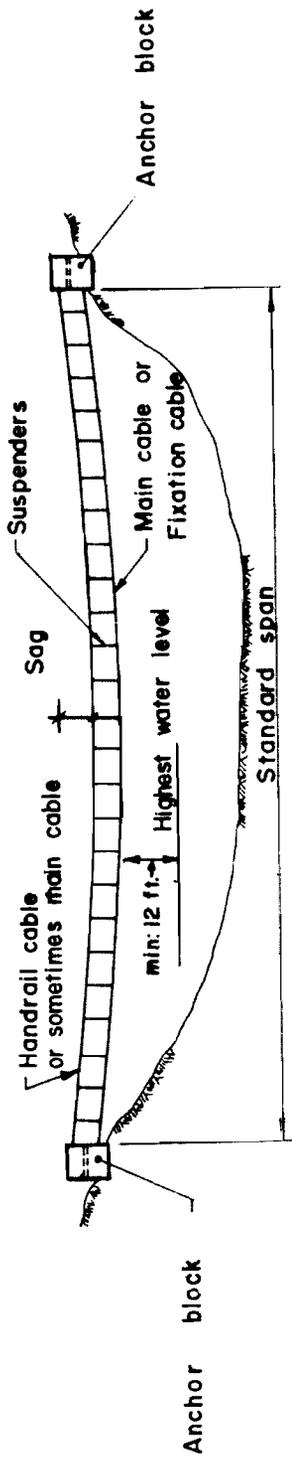
For spans greater than 75 ft., suspended bridges were used. Bamboo ropes, twisted vines or even matted fibers, were often used as a construction material and if iron was available, chains would be made and used as carrying cables (see photo O-P-6, O-P-7). Such bridges have spanned up to 240 ft. wide rivers. Chain bridges are found in different places in Nepal, especially near old iron mines. Two examples are, Those (The Say) Bazaar in the east, and Baglung in the west (see photo O-P-8).

However, most of these simple local suspended bridges can not be crossed by animals as they are either too narrow or sway too much. However, a striking feature of these bridges is that they are invariably built at ideal places, where the course of the river runs through a gorge and is straight, and where the banks are stable.

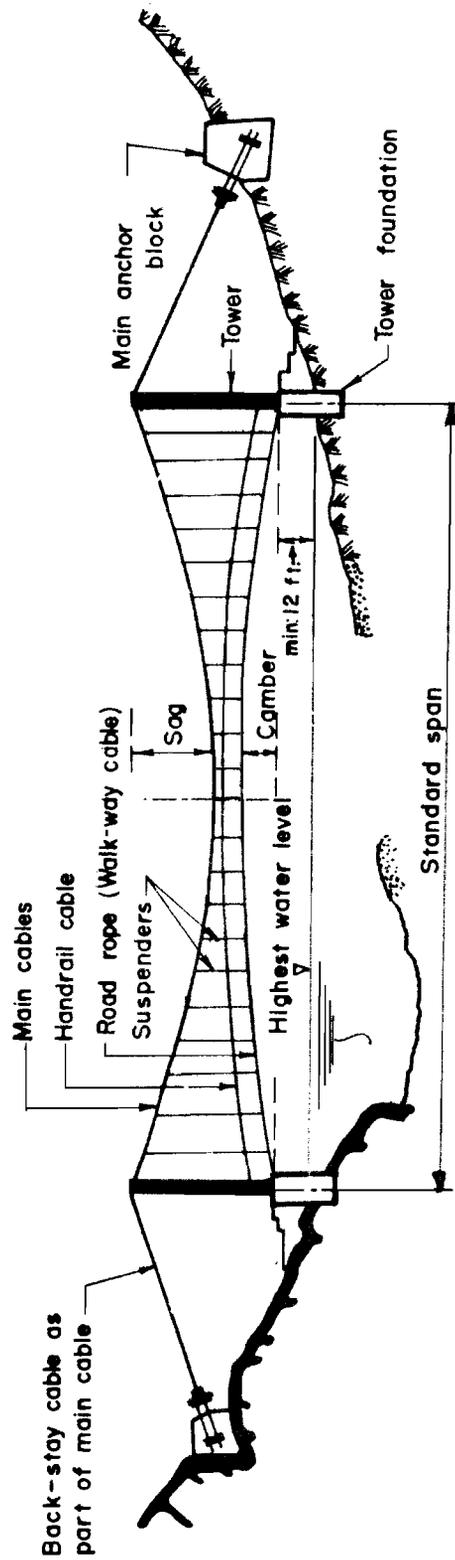
Recently, in the district of Baglung, many improved traditional suspended bridges (see photo O-P-9) have been, and are being built by local people with the financial assistance of the Local Development Department (LDD) of HMG. (for details see Part B of this study report).

New Dimension: Some sophisticated trail suspension bridge technology was introduced to Nepal by Scottish Engineers around 1903. The first bridge built by them was in 1907, in Khurkot, over the Sunkosi River, between the Districts of Sindhuli and Ramechhap. Since then, and intermittently, over many years, such suspension bridges (for example see photo O-P-10) were built on main postal routes with a view to increasing the efficiency of the government machinery. However, very little attention at this time, was given to the needs of the rural people.

After the dawn of democracy in 1951 a keen interest in rural bridge building was shown by Dr. K. I. Singh, then Prime Minister of Nepal. Some old cables were flown to Pokhara from Kathmandu during his term of office, in 1957, and USOM of Nepal, was asked for assistance in building some bridges. USOM, in turn, asked Toni Hagen, the famous Swiss geologist who had travelled extensively in the Kingdom, to provide a list of about one hundred urgently needed crossings. He marked twelve sites which most urgently needed bridges on a 1:250,000 scale map, and a new dimension of this very important project started to take shape.



TYPICAL TRAIL SUSPENDED BRIDGE



TYPICAL TRAIL SUSPENSION BRIDGE

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TRAIL SUSPENSION BRIDGE STUDY

UNITED STATES  
AGENCY FOR INTERNATIONAL DEVELOPMENT  
NEPAL

TYPICAL TRAIL  
SUSPENSION & SUSPENDED BRIDGE

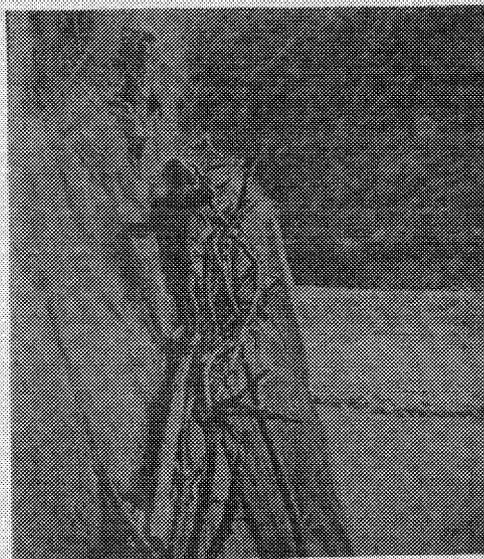
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KATHMANDU



\*O-P-1: Fording such rapidly flowing rivers is a way of life in the Nepalese hills.



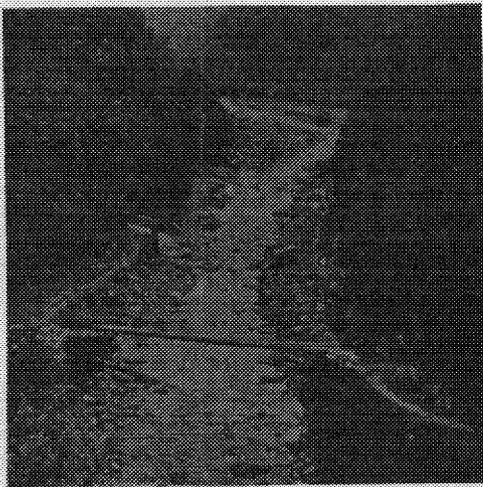
\*O-P-2: Risks are involved in crossing turbulent river in dug-outs



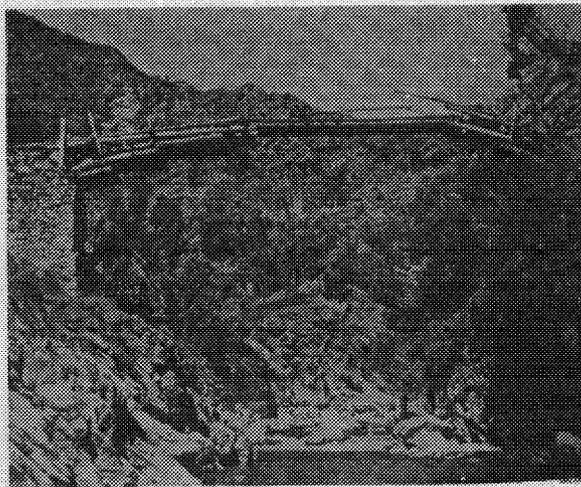
\*O-P-3: People have no choice but to walk over such trails.

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\* Reproduced from Toni Hagen's - Observations on Certain Aspects of Economic and Social Development Problems in Nepal 1959. Fig. 68, 69 and 61.



O-P-4: A simple cantilever log bridge.



\*O-P-5: A cantilever timber bridge.



\*O-P-6: A chain bridge

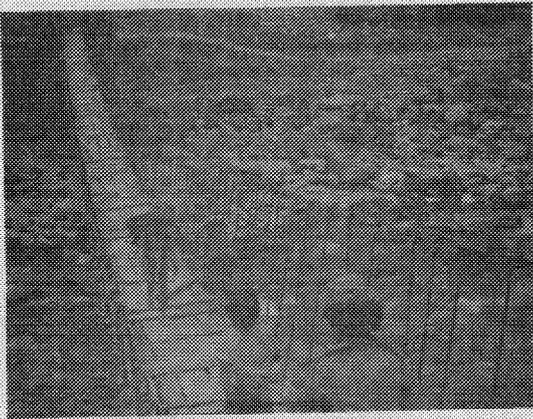


\*\*O-P-7: Traditional rope bridge

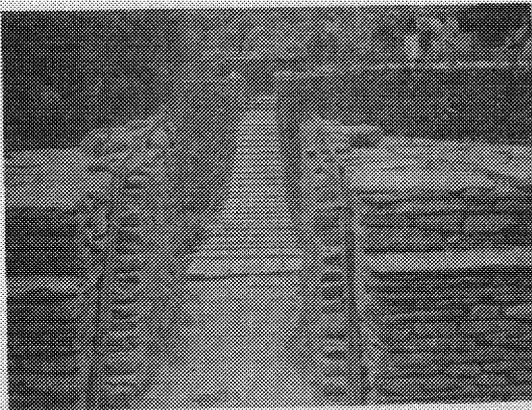
Some bridges showing local know-how of bridge buildings

\* Reproduced from: Trail Suspension Bridge Feasibility Study, Nepal  
German Consult Report 1975 Vol. 3. Fig 3.2, 3.5 and 3.10.

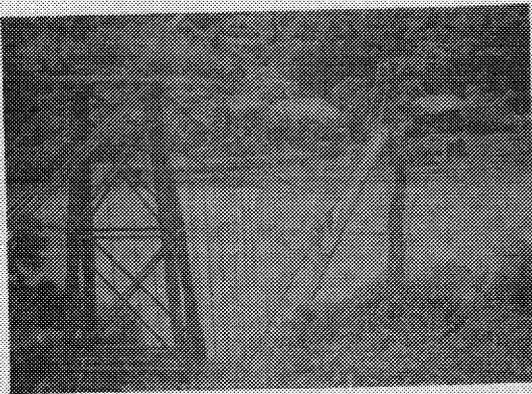
\*\* Reproduced from Toni Hagen's - Observation on Certain Aspects of Economic and Social Development Problems in Nepal, Fig 60.



O-P-8: Traditional Chain Bridge  
of Baglung.



O-P-9: Improved Traditional  
Suspended Bridge of Baglung.  
This bridge was constructed  
in 1976 under Pilot Project. \*



O-P-10: A sophisticated Suspension  
bridge over Riri Khola near  
Riri Bazaar.

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\* Refer Part B of this study, p.33.

A Review of USAID Suspension Bridge Program: A planned suspension bridge program, to cater for the needs of the rural people was started in 1958, under the USOM-Suspension Bridge Program. An agreement was signed on May 30, 1958, between GON and USOM. A target of 25 Trail Suspension Bridges was projected, with almost equal funds being contributed by the two signing parties. GON had the following responsibilities: to determine bridge sites, to transport all construction materials to the site, to organize and arrange for construction labor, and to construct the bridges.

USOM proposed to implement the agreement by obtaining a contract for the design, material supplies and erection supervision of the bridges. The site-selection procedure was based on 300 letters, received by the Public Works Department of the GON, from District Governors, Bada Hakims, requesting the construction of suspension bridges in their districts. The, then Ministry of Transport and Communications indicated a preference towards a modest program, involving the training of Nepalese erection crews rather than using contracted labor from outside the country. It was estimated that it would take about 2 to 3 years to train enough crews to construct 10 to 15 bridges a year. This meant that during the first few years few bridges would be constructed, but later on, with a large number of trained crews working, the number of bridges constructed would fit the goals set by the GON and USOM. With this in mind, a revision was made in the Project Agreement, signed on May 24, 1959, and the contractual element of the program was dropped.

Under this program the first suspension bridge was completed in 1960 at Boxi Khola, about 22 miles east of Kathmandu. In 1960, there was also a revision in the Project Agreement to include the purchase of short-span steel truss bridges, and materials for cable-car and cableways for spans of over 300 ft.

Under a 1962 Project Agreement, 72 bridges and cableways were planned for construction, but this figure had to be re-evaluated because of delays in the training of construction crews. It was also agreed to seek

the assistance of Peace Corps Volunteers (PCVs) as resident engineers with liaison duties to increase construction efficiency. GON tried to encourage local help for bridge erection activities and, agreed to maintain bridges with funds made available under this project.

Because of the continued lack of trained staff to construct suspension bridges within the PWD, USAID proposed that there should be a separate suspension bridge organization, to be jointly administered by GON and USAID. A separate organization was set up in 1964, under the Roads Department of HMG, under the title of Suspension Bridge Division. Its goals were; to recruit and train at least 3 bridge erection crews; to encourage a local self-help system to contribute labor for the transport of materials and construction; and to build bridges with the use of direct labor.

The 1962 Project Agreement plan, which called for the construction of 72 bridges and cableways, was cut to 36. Funds were also to be contributed to procure tools and equipment necessary for the erection of the bridges.

In 1964, officials of GON's Ministry of Economic Planning and the Ministry of Transport and Communications, met with USAID officials to decide on the future course of action. USAID proposed that the construction of suspension bridges and STOL airstrips, should be combined under one project, since they have similar objectives, benefits and problems. This was agreed upon, and the combined project became known as the Rural Transportation Project. However, USAID expressed its unwillingness to continue support unless GON gave the project full-time priority attention.

A 1965 Project Agreement provided the services of 5 PCVs who had engineering experience, to assist in supervision and provide training. Project results up to 1968, as indicated in the following table, show that very little progress had been made towards the completion of the original target bridges.

Table Q-T-1: USAID Financed Bridges: Targets and Achievements

Year	Target (Numbers)	Achievements (Numbers)	Location
1958 (Pro-Agree)	25	1 (1960)	Boxi Khola
1962 (Pro-Agree)	72	-	-
1964 (Pro-Agree)	36	-	-
1964	4	1	Kaguno (Tubular Truss)
1965	8	3	Chepey, Darondi, Leguwa (Cableway)
1966	8	1	Bhingri
1967	8	4	Pachuwarghat, Karambot, Barighat, Manbagh
1968	8	2	Sanfobagar, Triveni (Tamura)
Total up to 1968	36	12	
1969	-	1	Malumela
1970	3	2	Toxelghat, Triveni (Arun)
1971	3	2	Turkeghat, Arughat
1971-73	2	4	Khinti Besi, Dhaneghat, Syabrubesi, Jkaprebagar
1974-75	2	2	Tatopani, Arbang (Under LDD/USAID Program)
Grand Total	46	23	

The above table gives a fair picture of the targets and achievements of the USAID-financed bridges between 1958-1975.

There were several factors affecting the progress of bridge construction which brought about the poor show in achievements. The 1958 Project Agreement, though well-defined and attracting a lot of attention, lacked many essential elements. These elements were later revealed by actual on-the-job experience and included;

- The logistics of transportation of materials, were one of the most complex and time-consuming tasks in suspension bridge construction.
- Each structure had its own unique problems.
- Lack of seasoned and experienced engineers. The remoteness of bridge-locations involved long treks and difficult living conditions which were not conducive to the interests of qualified engineers. Hardship allowances, though planned, were never implemented.
- Though technical and administrative difficulties were reported, little attention was given to these by GON and USAID.
- Local Panchayats, often could not organize free labor for the transportation of bridge parts.

The Swiss Association for Technical Assistance (SATA): Between 1960 and 1964, Swiss engineers built four bridges in the Marsyangdi Valley, outside of the GON Program, but with the close collaboration of the DOR's technicians. In 1971, GON requested SATA to provide the SBD with technical personnel and between 1972 and 1975, a team of Swiss engineers worked with the SBD. The main objective of HMG-SATA activity was to assist in the surveying, bridge design and to speed up construction work. In 1974, SATA took the initiative and imported 420 tons of structural steel, 130 tons of steel cable, and nuts and bolts from Japan, along with 1000 tons of cement from Thailand.<sup>2/</sup> These materials were to assist in the construction of 40 suspension bridges in different parts of the country. Recently, between 1976 and 1977, SATA provided Rs. 8 million worth of steel, cables, survey instruments and construction equipment, including their delivery, to the local workshops.<sup>3/</sup> SATA's contribution, between 1972 and 1977, is worthy of mention, and can be summarized as follows; they performed reconnaissance of new bridge sites; created a design section in the SBD; provided direct assistance and guidance in the construction works. They

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<sup>2/</sup> H. Aschmann, Swiss Engineer, Final Report, Kathmandu, SATA, 1975.

<sup>3/</sup> H. Pfaffen, Swiss Engineer, Trail Suspension and Suspended Bridges, Kathmandu, SATA, 1977.

also introduced the deep-foundation technique; tunnel anchorage; rock anchor and other cement saving methods; compiled a construction manual for the SBD; set standard designs for suspension and suspended bridges, and compiled a record of bridges for maintenance work.

World Bank and UNDP Assistance: In 1970, the World Bank financed the construction of five trail suspension bridges in different parts of the country. Sites were selected, and design, fabrication and steel parts were supplied by a Calcutta-based company, Martin Burn Ltd. The bridges were constructed between 1970 and 1975. A 666 ft. long bridge, supposed to be the longest Trail Suspension Bridge ever constructed in Nepal is one of these five bridges, and was built over the Kaligandaki River, in the Palpa District.

Until 1975, the location and selection of bridge sites seems to have been done without any reasonable and prior studies. The first study in this direction was carried out by a German consulting firm, German Consult, in 1975 to 1976, it was financed by the United Nations Development Program and executed by IBRD.

The study focused on techno-economic considerations and the report produced a priority list of suspension bridges to be constructed. These sites were selected on the criterion of internal rates of return (IRR). Out of a total of 42 bridges studied by them, 13 bridges showed an IRR of more than 18%.

The Study: USAID proposed to conduct a study which would look into the factors which surrounded the construction of bridges, especially in relation to the selection of bridge sites. It was hoped that the end result of the study would be a set of criteria which would allow for the judicious selection of bridge sites in the future. The basic part of the plan involved a study on the effects that of 13 bridges, previously built with USAID funds, have had on the people served by the bridges. From an analysis of the study findings, a set of standards were to be laid down which would aid future bridge site selection. This study report is the result of that plan.

### 0.1.3 Trail Bridges in the National Plan

Nepal has been in the process of planned development for the last 20 years. Ever since the beginning of the planning exercises in Nepal, the major thrust of the planning effort has been directed towards the development of a transport network. Apart from the major highways, feeder roads and STOL airfields, the various plan documents have increased the emphasis on the improvement of the hill trail system, with the aim of establishing transport and communication links with the remote hill areas of the country. A major element for improving this link with the remote areas of the country is the construction of suspension bridges.

The First Plan period, from 1957 to 1962, saw the completion of 7 suspension bridges, out of an unknown target figure.

The Second Plan period, from 1962 to 1965, ambitiously aimed for the construction of 30 suspension bridges at different areas of the country. However, the Plan document shows that it ended up with only 6 completed suspension bridges.

The Third Plan period, from 1965 to 1970, highlighted the need to construct suspension bridges in the hill areas with a view towards facilitating the basic transport needs of the rural people. Accordingly, it aimed for the construction of some 15 suspension bridges, 12 of which were completed. Apart from this, the Plan also included a program for the construction of low cost, short-span suspended bridges by the local village panchayats.

The Fourth Plan period, from 1970 to 1975, marked the beginning of a new approach to planning and the selection of bridge sites. In addition to the conventional practices, this Fourth Plan explained in detail the area location where the suspension bridges were to be built. The Fourth Plan made plans for the construction of 27 suspension bridges in 21 districts and 13 zones of the country. Those areas, designated to receive bridges, were considered to have the most desperate need in terms

of transportation facilities. An additional program for constructing 8 more bridges was later incorporated into the main plan; thus, making a total of 35 bridges that needed to be built during the Plan period. The Plan indicated that a project of this nature would meet the social as well as, the economic needs of certain hill populations. The Plan review document shows that of the 35 bridges earmarked for construction, only 17 bridges were completed. This number, however, does not include the local bridges built under financial assistance from the Local Development Department.

The current Fifth Plan period, from 1975 to 1980, has reinforced the government's desire to construct suspension bridges. Recognizing the fact that the construction of a full-scale road network system across the whole country would be almost impossible, the Plan has, more realistically, emphasized the need to construct suspension bridges over the rivers and streams that fall on the main trails in the hill districts. The strategy for suspension bridge construction in the Fifth Plan marks a major departure from the earlier plans, in terms of a new emphasis on the need to conduct detailed techno-economic feasibility studies before the programming of suspension bridges. Accordingly, the Plan has set as a goal, a minimum of 25 suspension bridges and a maximum of 50 to be constructed, on the basis of IBRD feasibility studies.

0.1.4 General Political and Administrative Set-up  
with Reference to Trail Bridge Construction

Nepal is a monarchical country. According to the 1962 Constitution of Nepal, and subsequent Amendments, the King is the source of all authority. To aid and advise the King, a Council of Ministers is provided within the terms of the constitution. There is also a provision for the National Panchayat, which is the legislative body composed of the people's representatives who are elected indirectly. The National Panchayat meets once a year and deliberates on the national policy and passes bills introduced by its members. The Constitution also has provisions for the Supreme Court, the Public Service Commission, Auditor General and Attorney General.

The administrative structure of Nepal can be grouped into three levels; the Central Administration, the Zonal Administration, and the District Administration.

The Central Administration: The Central Administration is organized into seventeen ministries as shown in Figure O-F-2.

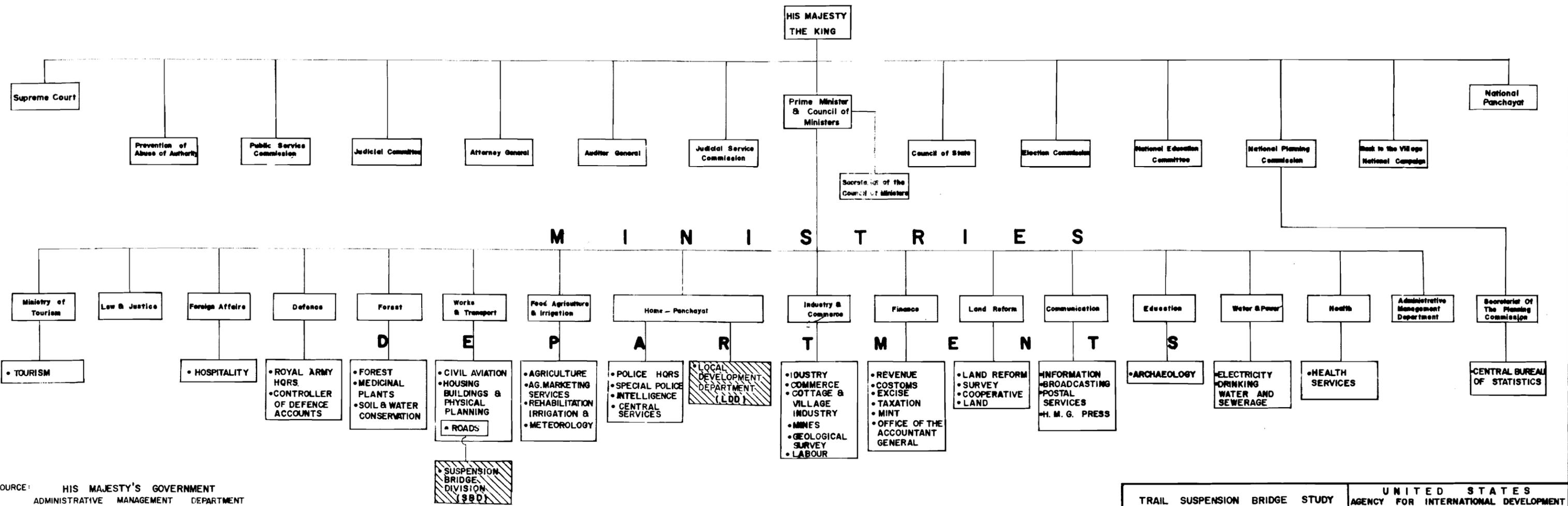
Two organizations, under the Central Administration, are directly linked with the construction of trail suspension and suspended bridges in the country, and they are, as shown in the organization chart (Fig. O-F-2), the Suspension Bridge Division (SBD) and the Local Development Department (LDD).

Suspension Bridge Division: In 1964, a separate unit, under the Roads Department, named the Suspension Bridge Division (see Fig. O-F-2) was formed. Its sole objective was to construct trail suspension bridges according to the targets set by the planning document of HMG and also to give technical advice, material support, etc. to different units involved in the construction of these bridges. It has also been coordinating the activities of different foreign financing agencies which are interested in these projects. Upto now it has worked with USAID, SATA, UNDP and IBRD.

The SBD is also responsible for project preparation, project implementation and maintenance. However, the SBD has not been able to give much attention to the project preparation process. The SBD works as a construction firm like NCCN,<sup>4/</sup> and its main job is to construct bridges rather than to select bridge sites, work on project planning, etc. Most of its time is spent in organizing construction management. Contractors are employed mainly for transportation of materials, and most of the construction work is directly done by an SBD construction crew, with the help of local labor. A new element was added to the SBD with the establishment of a Design Section, in 1972. The collaboration of SATA with SBD has helped

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<sup>4/</sup> NCCN: National Construction Company of Nepal. This company is wholly owned by HMG.



SOURCE: HIS MAJESTY'S GOVERNMENT  
ADMINISTRATIVE MANAGEMENT DEPARTMENT

NOTE:  
Central Agency Responsible For Construction  
of Trail Bridges.

TRAIL SUSPENSION BRIDGE STUDY	UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT NEPAL
CENTRAL ORGANISATION OF HIS MAJESTY'S GOVERNMENT	EAST CONSULTING ENGINEERS KATHMANDU

to investigate the problems of project preparation and project implementation. At present, the SBD has a number of standard designs for the construction of suspension and suspended bridges. The SBD, as yet, has not come out with a set of criteria for the selection of bridge sites. There are many different sources of influence which affect the SBD in the establishment of a bridge at a particular location and even the construction site of the bridge can be dictated by influential persons.

The SBD is not an separate department but is subordinate to the Roads Department. The dimension of the work required for the construction and maintenance of the bridges and the budget involved is enough of a reason to justify establishing the SBD as a separate department. If the SBD is to be strengthened at its center, skill and standards must be developed. Proposals are being put forward to create four units of the SBD at the four centers in the Development Regions. This proposal seems to be in the line with the decentralization and regionalization policy of HMG. But, the technical requirements of the SBD will not fit into such a proposition because this proposal will put a stop to the gradually growing technical competency and skill of the SBD. A technically well organized, and centralized SBD can easily cover the whole country. If the present group of people were grouped into 4 units, it would stunt the gradual growth of technical knowledge, and duplication of work would occur.

Being a subordinate unit of the Roads Department, which has broader responsibilities concerned with the constructing and maintaining of all the roads throughout the kingdom, the SBD's activities and problems are often over-shadowed and overlooked. It is surprising to note that, even the manual of the Administrative Management Department of HMG does not mention the name of this Division under the Roads Department.

Local Development Department: The other prominent organizational unit, which has been lending a helpful hand to trail bridge building activities since 1972, is the Local Development Department (LDD). In 1972, this department was established under the Home and Panchayat Ministry of HMG, (see Fig. O-F-2) to look after the local development activities of the country.

The Local Development Department has four regional offices in the four Development Regions, but it has very few engineers and overseers in all the regional offices, and as yet does not have adequate technical staff to carry out their job. However, the government has agreed to extend help to all village panchayats of Nepal, and at least one project per year is supposed to be undertaken in each village panchayat. The duration of the village's project is to be no more than three months. These village level projects are to be approved by the District Panchayat and the agreement should be signed on behalf of the government by the Panchayat Development Officer, with the District Panchayat Secretary, or the Pradhan Pancha of the village panchayat or a person authorized by him. The assistance to be given by the Local Development Department of HMG will be in materials and technical advice whereas the labor and other resources, are to be mobilized by the villagers themselves. Village level projects have been categorized as a project with an investment amounting to not more than Rs. 15,000/-, and District level projects have an investment of not more than Rs. 200,000/-.

The Zonal Administration: Nepal is divided into 14 zones, and the Zonal Administrations are headed by the Zonal Commissioners. They look after the overall administration of their respective zones.

The Local Administration Act provided the Zonal Commissioner with the following duties; to maintain peace, tranquility and security in his zone, and to supervise its general administration; to exercise general supervision, control and to bring about coordination of the work of the zonal offices of the different central ministries and departments.

The Zonal Commissioner's Office can be used by other agencies and departments, as a mechanism for implementing development activities in a zone.

The District Administration: The local government in Nepal exists on two main levels, the district and the Village. There are, a total of 75 districts, with each district being composed of an average of 50 village panchayats.

The district is the most critical level of the public administrative organization of the country to which most of the government powers and functions are deconcentrated. The governmental outfit, at the district level, is headed by a Chief District Officer (CDO), who is from the Home Panchayat Ministry. Other government ministries are also represented at the district level, such as; the Ministry of Education, Agriculture, Land Reform, Health, Forest; and Works and Transport.

District Panchayat: At the popular level, there exists a District Panchayat which is comprised of eleven members, including its president and vice-president, all of whom are elected from among the members of the District Assembly, to which each village panchayat in the district sends one elected member known as District Assembly Member<sup>5/</sup>. But if the district has already come under the Second Amendment to the Constitution of Nepal (1975), which is to be operative in the entire Kingdom in four phases, of which two have been completed, the District Panchayat consists of thirteen members including the president and vice-president. Of the thirteen, nine of the members are elected from amongst the District Assembly members of nine different areas, to which the district is divided, and four are nominated by the "Zonal Back to the Village National Campaign Committee".<sup>5/</sup>

The District Administration Plan: At the end of 1975, HMG put forward the District Administration Plan; this provided for a unified district administrative set up for all the districts in the country. This brought together the decentralized agencies of the government, present in the districts, and the District Panchayat, and fused them together into a single structure. According to this plan all the district level offices were renamed as sections, and are part of one entity called the District Offices, headed by the Chief District Officer (CDO). The plan required that the District Office, comprised of all these sections, should function as a single unit and should annually develop the District Development Plan. This Development Plan is supposed to be an integrated program of action based upon the requests and needs of the village

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<sup>5/</sup> Zonal outfit of Back to the Village National Campaign.

panchayats. The Development Plan of one district should also be in step with the Development Plans of the other districts in the country, and should be accompanied by a sharing of ideas and development strategies among various districts. This coordination between sections within a district, and then, between the districts of the country has yet not become fully operative. The individual sections continue to be more responsive to the Central Ministries they are most closely associated with, and there is little collective alignment under the leadership of the CDO.

In the case of centrally decided projects which includes projects of the Suspension Bridge Division, demands are frequently made by the District Assembly, District Panchayats, or village panchayats, to the concerned ministries and departments. This results in each of the Ministries and Departments having a roster of different projects on hand, and it is out of these lists that a few projects are selected each year. The basis for the selection is: the intensity of demand, the Ministries or Departments own personal acquaintance with the proposed project, and survey reports of the projects and areas concerned. Another, non-official, influencing factor which affects the selection of development projects is that of external pressure which is brought to bear of the respective ministries by concerned persons or institutions.

The Village Panchayat: Ninety six percent of the total population of Nepal live in villages; these comprise over 3,000 village panchayats. The village panchayat is supposed to be an organization to channel the resources and energy of the people for the planned development of their villages. This new organization in the political structure of Nepal, was established to replace the political roles of the Zamindars, Patwaris and Zimawals.<sup>6/</sup> These traditional institutions did not have any responsibility to the villagers.

Each village panchayat is divided into 9 wards and each ward elects representatives. These ward representatives meet twice a year at the Village Assembly and formulate the general policy of development for the village panchayat, and approves its budget. The village panchayat then coordinates the efforts of the various wards to implement the policies of the Village Assembly.

<sup>6/</sup> The traditional land revenue collectors.

## 0.2 SOCIO-ECONOMIC BACKGROUND OF RURAL HILLS

### 0.2.1 Society and Socio-Cultural Values

"Nepal is a land of confluence of people, languages, cultures and religions. The topography of Nepal with its rugged relief and a wide variety of terrain has served as a physical setting for its people who deify the imposing mountains that divide them and sanctify the fertile rivers that unite them". <sup>7/</sup>

From the above quotation it should be obvious that it is not so easy to generalize about Nepal and her socio-cultural setting. For descriptive and analytic purposes it is useful to divide the country roughly into three regions, from north to south, i.e. the Mountain region, the Hill region and the Terai, or plains of the south. Within each stratum or region, there is some uniformity of social values, customs and institutions. This is mainly due to the geographic environment and the result of the interaction of various ethnic groups to produce a synthesis of culture for each region. The bridges dealt with in this report are situated in the Hill region of Nepal.

The Hill Region: In the Hill region there is a mixture of Indo-Aryan and Tibeto-Burman ethnic groups. Unlike the Tibeto-Burman society the structure of Indo-Aryan society is caste orientated. The process of sanskritization however, is common among the Tibeto-Burman groups, and in many cases, they have started to follow the Hindu Vedic traditions. There are four Varnas in the Hindu caste system: Brahmins, the Priests, Chhetris the rulers and warriors, Vaisya, the tradesman, and Sudras the untouchables. Each Varna is composed of number of castes, and there is a division of labor according to these castes. Brahmins are traditionally priests and perform the priestly services in religious ceremonies and rituals. Three types of Brahmins are known: Upadhyaya, Kumhain and Jaisi. Only the former two categories of Brahmins perform the priestly services. In social hierarchy after Brahmins come the Thakuris. Thakuris were Rajas in Far Western Nepal until their

<sup>7/</sup> Pashupati Shumshere J. B. Rana and Kamal P. Malla, (eds). Nepal in Perspective, p. 1 CEDA, Kathmandu, 1973.

kingdoms were absorbed into Greater Nepal in 1768. Chhetris are traditionally warriors and thus, even today, serve in the military and police services. There is another category of Chhetris in the Hill Region of Far Western Nepal. They are popularly known as Matwali Chhetris as they consume liquor. Brahmins, Thakuris and Chhetris wear the sacred thread, have endogamous marriage patterns, and usually claim superiority in cultural and social spheres. Along with their traditional caste occupations, they also farm, do some labor, and sometimes involve in clerical work in local administration offices. The Brahmins, Chhetris and Thakuris are collectively called the clean or pure castes or Chokho Jat. Newars are the predominant Vaisya group, and practice trade as their main occupation. Among the Newars there is a distinct caste hierarchy starting with priests at the top and ending with untouchables at the bottom. Both Hindu and Buddhist Newars are present. Each religious group has different religious values and socio-cultural traditions. The untouchables, i.e., the Kami, Damai, Sarki and Badi, practice their traditional caste occupations of iron-working, tailoring, leather-work, and dancing and singing, respectively. Water and food from these caste groups are not accepted by the higher-caste Hindu groups under their traditions. These untouchable castes also sometimes work under the traditional system of payment in grains, rather than cash, called, Bali. The Hindu caste system, the Nepalese language, the veneration of the cow, various social customs surrounding the family and marriage, the worshipping of the deities, and celebrating rituals, festivals and fairs, are basically common to all ethnic groups of an Indo-Aryan society.

The Tibeto-Burman groups, or Matwali, <sup>8/</sup> are traditionally liquor-consuming castes. Although they do not wear a sacred thread, they are also called Chokho Jat. These ethnic groups are Newar, Magar, Tamang, Thakali, Thami, Majhi, Jirel, Rai, Limbu, Jogis, Chepang, Kusunda, Raute, Bote, etc. Furthermore, each Matwali group is divided into several patrilineal exogamous clans. Each group retains its own culture, having its own native dialect, types of homes, festival cycles, fairs, shrines, deities, marriage practices, etc.

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<sup>8/</sup> Matwali: means liquor-consuming.

One remarkable feature is the role of women in these societies, they are the back-bone of the village community. Their daily tasks include, cooking, grinding corn, collecting firewood and fodder, caring for the children, looking after livestock, washing clothes, working in the fields, and in some cases portering. They also play a major role in the social, cultural, religious activities, and festivals and fairs. Women are commonly the focus of attention in the activities associated with these events. In contrast, the men of these societies have an easier life in terms of hours of labor per day.

Given below are some of the social institutions prevalent in the study areas which are more or less common to all groups.

Family: A family is understood to mean all the members of a household who eat in front of the same hearth and share in household affairs. In other words, a family is a unit of residence, worship, land-ownership and of production and consumption. There are two types of family structures in the hill areas, as well as, all over Nepal.

-The nuclear family; composed of a man, his wife and their unmarried children.

-The joint family; composed of a man, his wife; his brothers' wives and children; sons and their wives; children and unmarried daughters.

A joint-family is of large size (sometimes as many as 10 to 30 members), and maintains common property, residence and kitchen. Within the family there are mutual obligations in social and religious activities, and it can provide economic stability and cultural continuity. However, it also has disadvantages, such as lack of privacy, the often pitiable position of the daughter-in-law, and frequent squabbles. The result of this is that when the opportunity for mobility arises, members of the joint-family may move out of their common family residence and set up nuclear families of their own elsewhere.

Marriage: Marriage is a vital social institution amongst all Nepalese ethnic groups. It is not merely the physical union of man and woman, but also a socio-religious process approved by the society. A marriage links together a more or less, extensive group of people, the kinsmen and friends of the bride and groom, in new relationships and interactions.

Amongst the high-caste Hindu groups, it was compulsory to marry girls before they reached puberty. Otherwise, the parents would lose spiritual merit. This traditional concept has produced the problem of child marriages in societies influenced by Hinduism. Child marriages were also practiced because of the lack of a wide range of choice of prospective candidates for the girls.

Marriage is strictly prohibited between the members of the same clan or clans. Cross-cousin marriage however, is usually preferred among many Matwali groups like Magars, Tamangs, Gurungs and others. Polygamy is common in many ethnic groups and polyandry is still practiced among the Sherpas.

The marriage season starts with the month of Marg or November/December and ends with the month of Asad, June/July. This calendar is followed by high-caste Hindu groups, the lower-caste ethnic groups, especially untouchables, do not follow the Vedic rites or observe the prohibited months for marriages. Few intercaste marriages occur in rural Nepal.

Funeral Practices: Death involves a complex set of emotions, beliefs and activities among the various ethnic groups of Nepal. Specific care must be given to the dead body and correct burial procedures should be observed. This is done not merely for reasons of hygiene, but also out of spiritual consideration. It is the belief that proper burial leads to the peace of the soul of the dead person, and leaves the living persons spiritually, unharmed.

Hindus of the study area believe that the dead body should not be carried over a bridge, and they generally follow this taboo. Almost all Hindus cremate their dead and some Matwalis bury them.

The practice of mourning extends to all the relatives of the deceased, and they are morally obliged to assemble at the house of the deceased during the purification rituals. Married daughters and sisters, especially, are compelled to return to their natal homes on the occasion of the death of either a father, brother or mother.

Healing Practices: The traditional way of healing a sick person or preventing disease is to consult a local healer, Jhankri or Dhami, or to take herbal medicines. These shamans are active in all regions of Nepal and are found in almost every ethnic group. They cure their patients by charms and magical spells, and with the beating of drums, brass plates, and chants. Although modern health posts are being built all over Nepal, villagers prefer to consult a shaman first and only if his cure does not work, then they go to the nearest health post or hospital.

Religious Values: The religious values of the Nepalese ethnic groups are a combination of Hinduism, Tibetan Buddhism and hill Animism. Each religious value is itself complex in nature. There are many different gods and goddesses which must be worshipped, and rituals which must be performed.

Hindus derive their common deities from sacred Hindu scriptures such as the Ramayana, the Mahabharata, and the Vedas, Puranas and Upanishads. These texts list the names of hundreds of Hindu gods and goddesses, all with different powers and functions. There are temples and shrines where anthropomorphic forms of these gods and goddesses exist.

As the Nepalese Hindus are very conscious of sin or Pap and virtues or Punya, they worship all the gods and goddess in their temples and shrines, go on pilgrimages to religious places and also take ritual baths in holy rivers. In other words, the day to day life of many Hindu Nepalese ethnic groups is guided by the Hindu laws or values.

Buddhism is mainly followed by Newar Buddhists and by people of an ethnically Tibetan origin.

Animism is the worship of local gods and goddesses believed to exist in the countryside in certain stones, trees, or on a road. Most of the Matwali groups of Nepal practice Animism and worship spirits at their shrines at specific times.

The main reason for the worshipping of all the gods and goddesses is to earn spiritual merit, or to remove evils or bad happenings from day-to-day life; it is also done so as to lead a happy life in the world after death. The worshipping of these various gods and goddesses has given rise to many festivals and fairs which are attended with great joy by all of the Nepalese ethnic groups.

#### 0.2.2 Rural Hill Economy

A diagnosis of the rural hill economy around the study areas is essentially an inquiry into the poverty of the hill economy. The rugged geographical terrain has imposed serious constraints on the better use of the limited agricultural land. The presence of widespread soil erosion, as a result of indiscriminate deforestation, has been a major cause of the declining agricultural productivity in many areas of Nepal. In addition to this, a high man-to-land ratio on the marginal farm land of Nepal, has further intensified the problem for subsistence agriculture. The hill economy in the study basically presents a situation where the people desperately struggle for their subsistence against the unpredictable forces of nature.

Agriculture: It is the mainstay of the hill economy. The predominant characteristic of agriculture in the areas is marginal farm land accompanied by a grossly inadequate irrigation system. Agriculture production depends in large measure on the unpredictable nature of the monsoons. Due to the unique topographical features of the hill areas, a major proportion of the agricultural land consists of dry uplands, or Pakho, where the potential for irrigation is minimal. The proportion of wet land or Khet is limited, and lies mostly around the river banks in small strips and patches. There usually will be a rural irrigational canal network in the wet land, but

inevitably canals dry up during the dry season because the rivulets or streams which feed these canals normally dry up at this time, and the possibility of growing winter crops in most of these areas is limited.

The principal crops grown in the dry uplands are corn, millet and pulses, and in the wet lowlands; basically paddy and wheat are grown. In some of the hill areas under study, potato cultivation is another important farming activity. The agricultural calendar for most hill areas is essentially the same. In the low-lying wet lands, paddy is planted in the months of June or July and harvested in November or December. As soon as the paddy harvesting is over, wheat is cultivated and then harvested in June or July. In the dry uplands, millet, pulses and soyabans are sown simultaneously, normally in the months of July through late August, and harvested in November or December. Potatoes are grown mostly in the winter months of December or January, and the cultivation period lasts till the end of July. Altitude differences do not hinder potato cultivation for it can be grown both in the dry upland areas as well as in the low-lying wet areas.

Agricultural Technology: The agricultural technology of the hill areas is essentially traditional, but in recent years the application of modern farm inputs, such as chemical fertilizers and improved varieties of seed, is gaining more acceptance among the rural hill farmers. But, this generous use of modern agri-inputs is limited due to inadequate irrigation, and there is also a total lack of use of modern farm implements. Despite modest efforts to improve agriculture, the agricultural productivity in the hill areas has been declining over the years. This has a particular relationship with the way farming operations are carried out in the hills. The sloping hills are carefully carved into terraces for farming, but adequate measures for preserving the soil fertility are not being taken. Therefore, each monsoon washes away a good portion of the fertile top soil from the farm lands. This, accompanied by the indiscriminate use of forest resources for fuel wood, fodder and pasture is causing the problem of soil erosion to become very serious. This has already had a detrimental impact on the

scale of agricultural production. Hail storms in some hill areas, during harvest time, also destroy a large amount of food crops. All these forces of nature tend to perpetuate the present condition of hill poverty. The hill areas are also food deficient, and a large amount of food grains have to be imported from the food surplus areas of the Terai to sustain the hill economy.

Animal Husbandry: For all hill areas, as for other rural areas, animal husbandry is a sine qua non activity of farming. Most hill households, depending on their economic status, own cows, buffaloes and goats. Some ethnic groups also raise sheep, pigs and poultry, but on a limited scale. Animal husbandry is an integral part of farming in the rural hills, and is important because livestock manure is the main source of fertilizer, and it is also used for a variety of other purposes. Buffaloes are useful for milk which can be processed into clarified butter, Ghev. This constitutes an important commercial export item for generating cash income. A few rural hill families also raise livestock for commercial purposes, but most of the livestock is for domestic use.

Rural and Cottage Industries: Industries of the hill areas are essentially confined to households in both terms of production and consumption. There are no organized cottage industry units as such, and the scale of cottage industrial production is limited. This activity is mainly concentrated in the area of making bamboo goods, baskets, ropes, earthenware, coarse woolen cloth and variety of other items for household and farm use. A few households in the study areas wove cotton cloth but the cotton yarn, was imported due to the abandoning of cotton cultivation in these areas. Cotton cultivation was stopped because of the need to grow more food crops to cope with an increasing population. The declining trend of the cottage handloom industry is also associated with the soaring price of cotton yarn, which has gone beyond the reach of the rural poor. Along with this, the introduction of inexpensive manufactured fabrics and their plentiful supply has had a negative impact on the hill handloom industry. The single cottage

industrial product that has any commercial significance is the coarse woolen cloth made from sheep's wool. But this is confined to only certain areas and ethnic groups; mainly the Gurungs. Thus, due to the limited scope of activities and the unorganized nature of cottage industries, they have not been able to provide productive employment during the slack agricultural seasons.

Migration: Since neither agriculture nor cottage industries have been able to absorb the surplus labor force sufficiently, a phenomena of a seasonal labor migration from the hill areas exists. Generally agricultural activities completely engage the labor force for less than 150 days of the year; the raising of livestock, although a perennial job, is mainly performed by the women and children. The extent of seasonal migration to seek employment in low-wage earning occupations, such as porters, unskilled construction laborers or watchmen is accentuated by the need to earn a cash income to buy food grains which supplement the meager agricultural production. This wide-spread musclo drain from the area is associated with the all pervading push effect generated by underemployment, and the lack of paying employment opportunities at home. Not only do the people migrate to the various southern townships within Nepal, but they also migrate to Indian cities. While most of the labor force work as cheap laborers, some have enlisted in the armies of India and Great Britain. The earnings from this outside work constitute the cash income used to pay the ever increasing import bill.

While the state of seasonal labor migration is phenomenal, some permanent migration has also occurred in the last two decades, and this has mostly been directed towards the Terai districts. The migration from the hills to the Terai increased especially after the Malaria Eradication Program was successfully completed. The Terai, as compared to the rugged hill land, showed great promise for better farming and increased productivity. The overall migration phenomena is directly associated with the deteriorating economic condition in the hills, and this is being aggravated by the increasing population and declining agricultural yield.

Trade Pattern: The pattern of trade in the hill economy is characterized by the import of a sizable amount of basic consumer goods and manufactured items whereas the exports of the area are predominantly limited to a few agricultural products. The main imports of the hill regions are salt, kerosene, food grains, cloth, chemical fertilizers and several other manufactured goods. Exports are limited mainly to livestock, poultry, Ghev, coarse woolen blankets or mats, potatoes and tangarines; depending on the area and location. Imports far exceed exports thus causing the unfavorable condition of the trade balance. The Terai economy virtually sustains the hill economy and the inter-regional trade relationship based on resource endowment is essentially weak. Some of the hill areas have immense resource potential for horticulture development, but due to serious transport difficulties, the marketability of these products namely fruits like oranges, tangarines, etc. is limited. Due to a lack of easy access to large consuming areas, fruit farming has not yet received any sizable stimulus. Therefore, by and large, the increasing import bill has to be met through cash income earned outside the area by working in variety of manual and low wage jobs.

Environment: One of the striking features of the hill economy is widespread soil erosion, as already mentioned. This phenomenon is mainly aggravated by indiscriminate deforestation for fuel wood, fodder and pasture land without any active afforestation program. The settlement pattern seems to bear an inverse relationship with forest area. That is, the thinner the forest area, the closer it is to the population settlement. Only the hill tops, which are generally not accessible, have many trees and shrubs. In some of the areas there are periodic and recurring landslides. With the forest resources progressively thinning out, the problem of soil erosion and landslides seem to threaten the area even more. It has already negatively affected the state of agriculture in terms of declining productivity. Now, all these forces are being used in such a way as to endanger the environmental situation and ecological balance of the whole of Nepal.

S U M M A R Y   A N D   R E C O M M E N D A T I O N S

0.3        EFFECTS OF THE TRAIL BRIDGES IN THE RURAL SOCIETY AND ECONOMY

0.3.1    Social Effects

Women's Activities: It has been observed that one of the major effects of the trail bridges has been in bringing changes in the activities of women, the backbone of Nepal's rural society. They perform a wide range of household chores as well as work on the farms. A little time saved from such chores as collection of firewood or fodder, enables them to socialize more frequently and gives them a greater opportunity to undertake activities which contribute to the enhanced welfare of the household. The bridges have facilitated people, especially the womenfolk, by enabling them to participate with greater frequency and numbers in religious festivals, fairs and many other social activities across the river. Thus the bridges have enhanced the process of social interaction among the women of the study area.

Marriage: Marriage is an important social institution of the Nepalese society. A bridge opens up a wider area, beyond the immediate village location, in which to look for a suitable bride or groom. Further, the study has also revealed that bridges, such as those at Sanfebagar and at other places, have greatly promoted cross-river marriages, since they enable daughters, who have married men living on the opposite side, to be present at the many social occasions at their natal homes. This is a major consideration for both the parents and the daughters when arranging marriages. In the past, areas like Karambot indicated that without the bridge, married daughters living across the river were unable to even

attend their parents' funerals. Such tragic incidents naturally caused immense sorrow and torture and would make people unwilling to marry on the other side of rivers. The bridges, in general, have opened up a brighter dimension in the vital social institution of marriage, and contributed to greater happiness in the social relationship, between households in the area.

Education: With the advent of democracy in 1951, Nepalese society experienced many changes, one of the most important occurring in the area of education. People had started to realize the importance of giving education to their children, not only to enable them to find better employment, but also to raise the general quality of their lives. The hill regions, unlike the commercial areas, of Nepal, suffer from a serious lack of educational institutions. This is in part due to the underdeveloped nature of the country and the lack of accessibility to these remote areas. This often leads to a situation where school children not being able to cross rivers, are not able to attend schools. The bridges have been instrumental in increasing the enrollment and reducing absenteeism in schools. It has been observed that the bridges, particularly the ones at Bhingri and Manbagh, have enabled children to go to schools on the other side of the river.

Health: The bridges in the study have also had a positive impact on the health services available to rural people. While the rural masses continue to depend mainly on the local healers, Jhankri and Dhami as they are called, the bridges in many cases have helped the villagers make use of the benefits of the slowly expanding modern health and family planning services sparsely located in the hill regions of Nepal.

Religion: Religion is another important area in the lives of most of the Nepalese people. The entire landscape of the country side is dotted with important shrines, temples and other places of worship where people go to pay homage, and congregate for religious fairs. Until the bridges were built people were often unable to attend fairs and festivals because of the dangers involved in crossing the turbulent rivers and streams. But now, the people

in the areas which have bridges show an increased participation in the fairs, festivals, and other religious activities. Thus the bridges were found to be a means of increased spiritual satisfaction for the people of rural Nepal.

Safety in Travel: The study also revealed that before the construction of the bridges, animals and human beings were frequently swept away when crossing rivers, this was especially common during the monsoon season. Costly detours and fatal accidents occurred while fording the rivers; these were frequent phenomena especially for the cattle, which are important assets to this predominantly agricultural society. Safety in travel and the avoidance of loss of and damage to property by the rivers are obviously non-quantifiable, but nonetheless very tangible social benefits. The German Consult's report is also in agreement with this. The report asserts that two of the bridges which had revealed an IRR of less than 11% should be built anyway due to the aspects of safety that would be provided to the people and their livestock.

Indeed, while the fulfilment of these social values and social norms cannot be described in quantifiable terms, and are essentially qualitative in nature, it is nevertheless a very strong justification for undertaking the construction of trail bridges in rural Nepal.

### 0.3.2 Economic Effects

Agriculture: Agriculture is the main occupation for the majority of the people of Nepal, and economic development virtually depends on the development of the agricultural sector. The rural farmer has generally been very responsive to the thrust of action directed towards improving agriculture through the introduction of modern agri-inputs. This has been assisted to a great extent by the bridges' presence which enables the rural farmer to reach the agricultural institutions and cooperative stores where he can buy chemical fertilizers and improved varieties of seed, or receive agricultural loans. Also, some bridges have enabled the farmers to acquire and develop farmlands across the river.

Some of the bridges, for example, the one at Pachuwarghat, has helped in bringing about considerable changes in the traditional agricultural pattern. After the construction of this bridge, the farmers from one side of the bridge started to cultivate vegetables along with their traditional crops, since these produce could easily be brought, through out the year, to the markets in Kathmandu.

It needs also to be stated that the bridges have not been found to act as the critical variable in bringing about transformation in local agriculture practices. But, they have nonetheless contributed to the many a beneficial change mentioned above. They have also effected the establishment of agricultural institutions in some of the bridge study areas, which over time can be expected to effect improvements in the local agricultural practices of the rural areas.

Mobility and Accessibility: All the bridges, to varying degrees, have positively affected the general mobility pattern of the area through easier accessibility to trade centers, schools, health centers and government institutions. Local people indicate that there has indeed been an increase in mobility when compared to the situation which existed when there was no bridge. The time saved by people who use the bridges has been another positive aspect of some of the bridges in the study. This is mainly due to the fact that some have significantly reduced the time previously taken in detours, and in other cases they have yielded savings in time by cutting out the use of the traditional ferry.

Trade: All the bridges have facilitated the importation of basic consumer goods such as salt, kerosene, and food grains. This has also been accompanied by the importation of a wide range of necessary manufactured consumer goods. In some cases it has been observed that the bridge has played positive role in enabling the procurement of food grains from the food surplus areas of the Terai, and has thus helped in relieving some of the pressure in the acute food deficient areas in the hills of Nepal. As a result of uninterrupted

inflow of these basic consumer goods to the hill area, the prices of many basic items in the local markets have remained stable to a certain extent.

Local people indicate that when there were no bridges present, the ferry, which also ceased functioning for 3 months of the year, was the only alternative. One of the major contributions to the areas; as a result of the presence of the bridge, concerns the year around trade flow. It has been observed that some of the bridges have provided added stimulus to the growth of small business establishments, such as retail stores and tea stalls, in the areas around the bridges.

Cottage Industries: Cottage industries in the hill areas of the study are essentially household activities both in terms of production and use. While it is true that the bridges have not brought about any notable effects on cottage industries in terms of changes in the scale of production or production techniques, they have facilitated the import of materials such as cotton yarn, metals and leather, and have helped the marketability of finished products such as coarse woolen cloth or blankets, earthen vessels etc.

Employment: While the direct effect of the bridge on employment promotion is negligible, the bridges have contributed to the increased mobility of the surplus labor force, enabling them to reach the labor market centers for employment in usually low wage occupations. The need to earn a cash income to supplement the meager agricultural production, has forced many people to work in a variety of low-wage occupations such as porters, unskilled construction laborers, and watchmen.

The Environment: The major effect the bridges have had on the local natural environments concerns the depletion of forest resources caused by the increased demands for fuel wood, fodder and pasture. With the construction of bridges it has become easier for the people to cross the river and make use of the better forest resources there. However, a host of factors are responsible for deforestation, soil erosion and other ecological imbalances which are generally a major problem in the hills of Nepal. It is very

difficult to isolate the effects of a bridge from the web of circumstances which surround this environmental deterioration. It could be argued that those areas where the forest was otherwise inaccessible before the installation of the bridge have now been exposed to human assault. But, this does have a balancing effect in the local forest stands in the area. It is now possible to divert some of the demands for fodder and fuel wood from the seriously depleted areas, where further deforestation might have resulted in irreversible damage to the ecology of the area.

### 0.3.3 Institutional Effects

Growth of Services Centers: In some of the bridges in the study, their construction has resulted in the convergence of different services around the bridge, and thus contributing to the growth of a service center in the area. Examples of such bridges include Malumela, Sanfebagar, and Darondi. Their construction has been instrumental in the establishing such vital services as; agricultural offices, agricultural extension programs, forest offices, schools, veterinary services, cottage industry centers. In addition to these, other services such as; food and lodging places, retail stores, marketing centers, mills, tailor shops, etc., have become established and in some cases increased in number due to the presence of the bridge. The construction of the bridges lent a sense of **permanance** and encouraged local people to make investments in permanent **structures** and businesses.

When bridges are constructed at low traffic points like Karambot (which is actually located in Bandre) and Kagune, they have not been found to contribute to the development of such service centers. Bridges must be located in these places whose potential for developing into an important service center is evident.

Where bridges do not contribute to the creation of service centers directly, like those in Syabrubesi, Pachuwarhat, Turkeghat,

Jhaprebagar, etc. They are nonetheless useful in providing social benefits, such as giving these people in the hinterland, benefits of increased contact with government and development agencies and vice versa.

An Unsettling Effect: While the construction of bridges generally seem to be beneficial to the rural people, some of them were not without their negative effects. In two cases there were groups of people which were adversely affected. The Majhis or Botes professional ferrymen of Pachuwarghat and Bhingri found themselves suddenly unemployed when the bridges were constructed. The Majhis in Pachuwarghat were able to switch over to horticulture and road building, but the Botes of Bhingri had to leave Nepal to find employment in India. It is strongly felt that where such vulnerable population groups are found, a rehabilitation program for them be integrated with the bridge project itself.

#### 0.4 SUMMARY OF OBSERVATIONS ON PAST BRIDGE SITE SELECTION

##### 0.4.1 The Decision Making Process

The decision making process has stood out as the single and most important aspect, and needs to be thoroughly analyzed and resolved in a manner which will lead to a systematic and rational process of allocating monetary resources. Decisions, which resulted in the bridges under the study; being built have come from a variety of sources. When we analyzed the decision-making process of the bridges of Karambot, Kagune, Sanfobagar, Malumela and Loguwaghat, it was seen that they were constructed upon commands issued by His late Majesty King Mahendra, in a response to petitions from the local people. The bridges of Jhaprebagar, Bhingri and Turkeghat were built in response to local demands and the participation of the District Panchayats. Darondi, Sabrubesi and Manbagh bridges are cases where local participation in the demand, backed by influential personalities, resulted in their construction. Texelghat and Pachuwarghat bridges are cases where their construction seems to have come about due to three elements; HM 's command, local participation, and a follow-up by influential personalities.

The study has also revealed that except for Kagunc, Karambot, Loguwaghat (which was non-functional right from the beginning), all the other bridges have benefitted the people of the bridge area as well as distant travellers. Kagunc and Karambot are cases of incorrect bridge site selection. Loguwaghat is a case of a poor experiment in cheaper alternatives to a long span suspension bridges. Toxelghat is an example of the process of site selection being determined by the desire to construct a shorter span bridge, regardless of a traditional crossing point. Although, Pachuwarghat Bridge served its purpose, there was a trade-off on engineering considerations to fit an existing pre-fab span. This bridge later collapsed during a flood four years after its construction, and had to be completely rebuilt.

Although the remaining 9 bridges have been useful, it is not clear whether, from the national point of view, these bridges should have been given priority over other bridges which needed to be built in other areas of the Kingdom.

#### 0.4.2 Popular Participation in the Construction of the Bridge

There is a need to define the concept of popular participation in relation to the construction of a bridge. Firstly, it can be defined as the summation or collectivity of steps that go into identification of needs, organising for representation and other necessary action for getting favorable decisions made and to provide all organisational support leading to the final construction of the bridge. Secondly it can be defined as the contribution of local resources in terms of voluntary labor, cash and materials, to aid the construction of the bridge.

In the cases of almost all the bridges, there has been a great measure of popular participation in the first aspect of the concept. Only in the cases of Karambot (Bandre) and Kagunc, were such measures of participation not reported. As far as the second aspect of participation is concerned almost none of the bridges constructed made use of locally donated

materials or cash. A few bridges were constructed with volunteer labor, but this was not the rule. At Pachuwarhat, voluntary labor was contributed and Leguwaghat made use of both local labor and cash contributions; a token contribution of free labor was given for the construction of Sanfobagar. The construction of approach trails in Jhaprebagar and the construction of the airstrips at Sanfobagar and Bhingri are also cases where local contributions were made. However, the fact remains that mobilization of local resources was not very impressive. This was not due to the lack of will or capability of the local people but it seems to be the result of a lack of a unified program which outlines the use of local resources. From the point of view of maximizing resource investment in development projects, popular participation should be given adequate role in the planning and implementation of projects in the future.

#### 0.4.3 Locational Consideration for a Bridge Site Selection

Relationship with Trail Network: Economically, the geographic area and population served by a bridge is invariably associated with its locational relationship with the area's trail network. It has been observed that a bridge services a greater area and population if it is located on a major/medium or class A or B <sup>2/</sup> trail. It therefore is accessible to long-distance travellers, services a greater area and has a correspondingly high traffic. Bridges located on class C trails service primarily a local area and have a correspondingly low traffic.

Three bridges of the study were built at sites inappropriate with regard to the existing trail system. These are Karambot, Kagune and Toxelghat. As explained elsewhere in this study, Karambot is poorly situated because of the span limitation on prefabricated parts available. Toxelghat was placed off the main trail probably because of the higher cost and possible technical problems involved with the much longer span required for the main trail location. Kagune was mislocated due to a lack of thorough investigation by persons at the center and is the least excusable of the 3 wrongly placed bridges.

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<sup>2/</sup> See Appendix O-A-4 for Trail Classification.

Traditional Crossing Point: Whether or not a bridge is placed on the traditional crossing point has important implications on the bridge's use. In many cases if the bridge does not fall on the traditional river crossing point, people continue to use the traditional means, such as ferry services, even if it involves greater risk, higher ferry charges and more waiting time. In a situation like this, people normally avoid even minimum detours to use a bridge.

Of those 3 bridges wrongly situated, it was found that 2 (Karambot, Toxelghat) were not at traditional crossings. All properly placed bridges were on or close to traditional crossings. This illustrates a general rule to be followed; the bridges should be built at or near traditional crossings.

Class of River: The magnitude of traffic flow over a given bridge has a wide seasonal variation as well as being affected by the class of river <sup>10/</sup> over which the bridge spans. In general terms, the volume of traffic flow is higher during the dry season than during the monsoon as because dry season is a slack agricultural period. However, it has been observed that relative traffic density on some of the bridges located over unfordable rivers, (major rivers) increases during the monsoon. This is because the traffic, which would normally use shorter crossings such as ferries or log bridges, Phadke, during the dry season, would use the bridge at this time. For example, the bridges at Karambot, Toxelghat, Turkeghat, etc. are used by a greater area population when the ferry services cease operating during the monsoon season. Also, in the case of fordable rivers (medium rivers), traffic density increases during monsoon, as people generally ford such rivers at places convenient to them during dry season. For example, the bridges at Bhingri, Manbagh etc. are used more during monsoon season. Despite these seasonal variations the bridges over unfordable rivers have served the people of this hinterland in good stead.

10/ See Appendix O-A-5 for River Classification.

Alternate crossing facilities: The bridge also commands a larger service area in a situation where there are no other viable river crossings in the immediate neighborhood of the bridge. The frequency of bridge use appears to be greatly affected by the alternatives available in the area and its locational distance from the traditional crossing point. For example, the bridge at Turkeghat experiences a considerable decrease in traffic during dry season because of the availability of ferries at nearby places.

Bridge Use: The analysis of traffic flow over a given bridge for purposes of travel and by origin and destination provides interesting insights into the use of the bridge. It has been observed that the bridges which are essentially located on local access trails such as Karambot, Bhingri, Manbagh, etc. appear to be used by more local traffic for the purposes of social interaction, schooling and domestic work. In contrast to this, the bridges such as Jhaprebagar and Toxelghat, etc., located over major trails are used by more distant traffic for purposes of economic transactions such as buying and selling. Similarly, the origin and destination of traffic appears to be confined essentially to the neighboring village panchayats when a bridge falls on the local access trails, but in cases where bridges serve long distance travel, the origin and destination of traffic appear to extend far into the outlying areas.

This illustrates the fact that the bridges can be categorized into two different types; regional access bridges and local access bridges in terms of the nature of their use and the area of influence. Also an analysis of traffic shows that the traffic could be used as an indicator to categorize bridges, as regional access or local access.<sup>11/</sup>

#### 0.4.4 Technical Problems on Site Selection

Of the 13 crossing facilities constructed (12 bridges and 1 cableway), six can be regarded as free of questionable points in site

<sup>11/</sup> See Section 0.6.3 on Institutional Arrangement for Resource Allocation of this Volume.

selection and design. These are; Syabrubesi, Darondi, Manbagh, Bhingri, Malumela and Turkeghat.

A seventh bridge, Sanfobagar, might also be included in the above list except for the fact that there is some danger that the river might shift its course leaving the bridge spanning dry land. Periodic attention to protection work to control the river is essential at Sanfobagar. Certainly the technically undesirable features of the site are outweighed by the advantages of its central location and the site selected is the technically best one available under this condition.

Limitation of span length of prefabricated bridges caused the mislocation and/or the necessity for maintenance work at 3 bridges. These were Karambot, Pachuwarhat and Kagune. It is hoped that now with the establishment of Nepalese workshops for the fabrication of parts that the days of 'fabricate first, survey later' - are gone forever. For example, at Karambot there is landslide prone rock above one side of the bridge but there was no alternative site available given the span length limitation. At Pachuwarhat Bridge, which collapsed when one foundation was undermined by river scour, the placing of the foundation too close to the bank because of the limitation of span length for prefabricated bridge parts, plus failure to provide a deep foundation and protective work, were the causes for the collapse. The bridge was promptly repaired the season following it's collapse.

Excluding Pachuwarhat and Kagune, where a too short span length resulted in early high-cost maintenance, two other bridges, Jhaprebagar and Toxelghat, would have benefited from a longer span. The setting of the foundations further back from the river banks would provide protection against possible future damage from river scour. However, there is no immediate danger to these bridges.

The choice of the longer rather than the nearby shorter site at Leguwaghat merely served to aggravate the problems of inadequate design, which is the main factor for the failure of Leguwaghat Cableway.

## 0.5 OBSERVATIONS ON MAINTENANCE AND CHOICE OF TECHNOLOGY

### 0.5.1 Local Participation in Maintenance

As far as local participation for the maintenance of bridges, is concerned, the local village panchayats, the District Panchayats and the local people have done a fairly good job within their financial, technical and administrative means in carrying out proper maintenance. The fact that the village panchayats and District Panchayats have done the job of upkeep and maintenance for the bridges of Malumela, Jhaprebagar, Sanfebagar, Toxelghat, Turkeghat and Darondi, is proof that all bridges could be maintained by local authorities. This statement would appear to be questionable at first because most of the maintenance work is limited to changing the planks on the walkway and other minor repairs. However, the fact that they did not do more is owing more to a lack of knowledge than to a lack of desire on the part of local people to do the work. There is sufficient evidence that many of these panchayats have done their utmost in finding and allocating resources for this purpose. Therefore, given the necessary technical and, where needed, financial backup and adequate supervision from the government, these local institutions can be relied upon as adequate agents for most of the not-too-technical maintenance and repair work.

It has been observed that panchayats such as those around the Bhingri Bridge, for instance, are dependent upon the government for any repair and maintenance work need on the bridge. This is essentially due to the lack of an explicit policy which outlines the role of the central government, the district, and the village panchayats in the repair and maintenance work for the bridges.

### 0.5.2 Resources for Maintenance

While most of the bridges in the sample have gone through a period of toll collection, many of these attempts were later abandoned due to a variety of reasons. On some of the bridges, however, the District Panchayats have continued to collect a toll. The system has proved to be useful not only as a source of funds for the District Panchayat but also as a mechanism for obtaining information on the repair work needed on the bridge. The contractor who collects tolls for the District Panchayat, undertakes minor maintenance work on the walkway and also acts as the initiator for the larger maintenance needs of the bridge. If the government were to adopt a more explicit policy in this regard, many a bridge in the country could yield income which could be used for the upkeep and maintenance of the bridges. This would release other appropriated maintenance funds which could be used in other important development projects in the district.

Regarding manpower resources for this purpose; the availability of skilled people for doing repair work in the village has been a problem. Therefore, training some members of the local population during constructing the bridges would provide the skilled manpower required for future maintenance.

### 0.5.3 Choice of Technology

The choice of technology should be an important consideration in the construction of trail bridges in Nepal. Districts such as Baglung, Parbat, Gorkha and Ramechhap have been found to be endowed with traditional know-how for building suspended bridges. In a resource-scarce country like Nepal, a strategy of bridge construction, as well as for other forms of local development, should make use of such local traditional knowledge and skills. Indiscriminate application of any imported technology will not only make local adaptation much more difficult and costly, but sometimes also create funny situations like that of the cableway at Leguwaghat, which has remained drooping over the Arun River for the last fourteen years.

0.6 RECOMMENDATIONS ON RESOURCE ALLOCATION AND SELECTION PROCESS

0.6.1 Need for a Selection Process

There is hardly a requested bridge anywhere in Nepal that would not be beneficial in one way or other. The real question is whether or not to construct one bridge or to give priority to some other bridge from the long list of requested bridges. This difficulty arises because of the large number of requests versus scarce resources. This raises the complicated problem of selecting the bridges and ranking them in order of priority. It is indeed difficult to come up with a thoroughly objective and accurate system for the selection and ranking of the bridges in a priority order of 1, 2, 3, etc. This difficulty arises because resource allocations lie in the labyrinth of politics. Indeed, the nature of the subject of the selection and ranking is such that it cannot be a completely objective process and is inherently influenced by individuals in authority. But, it is possible to formulate a selection process (defined in Section 0.6.2) based on a sound qualitative approach supported by logical arguments.

It has been observed that no regular system for generating, collecting and analyzing demands for bridges at the national level exists, and currently decisions regarding bridge locations are done on an informal basis. Thus, there is a need for developing a mechanism at the macro level to collect demands, identify real needs country wide and allocate resources. Once this is done, actual decisions regarding the bridge locations should be done on the basis of priority derived through the application of a priority allocation criteria (defined in Section 0.6.4).

Keeping the above in view, it is recommended that a selection process be adopted which will, at various stages, accomplish the following objectives.

- The selection of bridges to be built should reflect the national needs as well as local priorities and should

be in keeping with resource availability in any given year or period of time.

- The identification of bridges and resource allocation for their construction should be done in such a way as to make optimum use of government resources and to mobilize a maximum amount of local resources in order to yield the maximum benefit to the local people as well as to the country.
- The selection of a site for the bridges should be done to make them maximally beneficial to the local people directly, by providing them with a convenient crossing facility and indirectly by making its immediate vicinity a center for other activities of social and economic importance.

The importance of trail bridges as part of a trail network system is well understood. Since trails form a very important part of the national network of transport and communication, the need for building trail bridges throughout the kingdom is immense. Given the resources of HMG of Nepal, it is understandable that a trail bridge construction program can only be launched in a selective manner and not as a crash program. In this process, the first step for the concerned authorities is to identify the location and quantify the number of additional bridges to be built throughout the Kingdom.

#### 0.6.2 The Selection Process

While we are of the opinion that there should be a major realignment <sup>12/</sup> in the institutional structure at the central level for an effective country wide trail bridge program, the selection process recommended here details the most efficient ways of decision-making within the institutional arrangements existing under HMG at present.

Involvement of Popular Participation in Demand Generation: It has been revealed that when a greater degree of local participation in the

<sup>12/</sup> The preferred institutional changes are more clearly expressed in Section 0.7.1 of this Volume.

identification, articulation and representation of needs is used, the more effective a bridge program becomes. This, therefore, indicates the need for popular participation in identifying needs and organizing effective representation. Involvement of the local people in an institutionalized manner, gives an opportunity to those affected by the proposed bridge projects to express their interests in a more systematic manner. These are the salient considerations emphasized and incorporated in the selection process described below.

The Ministry of Works and Transport (MWT) should be the main agency to organize the selection process for the identification of the trail bridge construction needs in the country. Since the village panchayats at the village level and the District Panchayats at the district level are the basic representative institutions for local development and administration in the political and administrative set-up of the country, it is only appropriate and logical to delegate to them an adequate role in the selection process. The District Panchayats should be asked to draw up their immediate and long term requirements based on the demands of the village panchayats and Village Assemblies. However, such demands, whose number will indeed be large, should be deliberated upon by the District Assembly which is comprised of the Pradhan Panchas and Uga-Pradhan Panchas of all the village panchayats in the district. Once this body has allocated priority on the basis of a priority allocation criteria (discussed in Section 0.6.4) the District Panchayat will approve it and present it to the MWT.

The District Panchayat, while making the demands, should clearly spell out the priorities set down by the District Assembly; this will be useful for working out a priority allocation at the national level. This will not only lighten work load at the national level but also make popular participation in decision-making truly meaningful.

### 0.6.3 Institutional Arrangement for Resource Allocation

There should be a coordinating committee in the Ministry of Works and Transport, composed of representatives of the SBD and the LDF to work out a mutual program in relation to the construction of trail bridges, and to establish a constant liaison with each other on all relevant matters.

Once the demands for bridges from the District Panchayat are received by the coordinating committee in the Ministry of Works and Transport, the coordinating committee should determine the number of bridges to be constructed by each agency, i.e. SBD and LDD, on the basis of the following bridge classification.

Bridge Classification Criteria: The bridges should be grouped into two categories: regional access bridges, and local access bridges. Study findings have revealed that most of the movements for social purpose are localized in nature, whereas long distance purposes of travel are economic in nature. Therefore, in order to make them operational and convenient, the bridges with the predominance of long distance travellers should be designated as regional access bridges, and those with local predominance as local access bridges. It has also been observed that regional bridges are usually situated on Class A and Class B trails, and local bridges on Class C trails. This is further discussed in the priority criteria later. It is believed that the task of making this bridge classification will not be difficult as all necessary information can be provided by the District Panchayats.

The need for classification of the bridges into regional and local access bridges is also to ensure rational distribution of bridges. It is likely that regional access bridges, which have more economic importance, would stand a greater chance of selection over local access bridges which have a primarily social importance. This will also mean a more equitable distribution of limited resources.

It is proposed that the SBD will undertake the construction of regional access bridges because they would normally entail longer spans, more sophisticated technology and no dependence on the mobilization of local resources. The last aspect results from the fact that they normally serve a large geographical area where generating local contributions would be simply unmanageable.

In the case of local access bridges, the LDD should undertake their construction for the following reasons. Firstly, this Department has been engaged in other small local self-help projects which includes small trail bridges. Secondly, local access bridges would normally involve a less sophisticated technology, a condition that would suit the limited number of technically trained personnel in the Department. Thirdly, such locally-used bridges are endowed with the potential to generate more local participation of both cash and kind, this being a part of the modus operandi of the LDD.

It must be added that while this should be the broad principle for the allocation of bridges between the SBD and LDD, it will be necessary, for reasons of span and technology involved in some specific cases, for either of the two agencies to undertake the construction of the bridges that would normally fall within the jurisdiction of the other. In order to provide for such situations, it will be necessary that the allocation of the bridges be done at the level of the coordinating committee.

Once this has been done the agencies will have the exact number of bridges requiring construction and therefore be able to decide the amount of money and materials needed to undertake their construction. Necessary requests for resources will be made to appropriate institutions such as the National Planning Commission and the Ministry of Finance of HMG through appropriate channels.

However, it goes without saying, that the resources that would be available will fall short of the volume of demands made, and this will then necessitate the short-listing of the bridges by both the agencies on the basis of the priority allocation criteria described in the following section.

It must further be added that once a priority has been allocated and construction work undertaken, regular surveys by the agencies should be undertaken on a continual basis to confirm the information provided on the bridges by the District Panchayats. Such surveys should be jointly undertaken by officials of the agencies, this will allow them to make their own assessment of the panchayats' requests which will contribute to making a judicious decision on the selection of the future bridge locations.

#### 0.6.4 Priority Allocation Criteria

The present study has established that a bridge location, if appropriately selected, contributes many social and economic benefits to the people living in the area of the bridge. Any trail bridge program in the future, should be guided by an intelligent set of criteria which would help in making the most judicious decisions for the allocation of priorities on the large number of request for bridges that potentially exist in the country.

Considering the institutional arrangements and the selection process previously recommended, priority allocation for the bridges in the country will have to be done at different levels.

At the District Level: The District Assembly, while allocating priority to bridges at the district level should take following points into consideration.

Traffic: The District Panchayat should institute a mechanism which would get an accurate traffic count for both the peak and slack seasons for each of the proposed bridge sites.

Origin and Destination of the Traffic: The traffic count should also provide information on the origin and destination of the travellers. This will assist in categorizing bridges as being of either the regional or local access type.

River type: It should be indicated whether the river is permanently unfordable, or fordable part of the year (see Appendix O-A-5 for river classification) with the consequent implication that bridges over the unfordable rivers will contribute more to the welfare of the people in the area.

Availability of Alternative Crossings: It should be indicated whether the proposed bridge location already has a safe alternative crossing facility, and if so, its location and type. Safe in this case is understood as the absence of recurrent accidents during crossings.

Remotely Located Bridge Sites: The state of being remotely located inside a district should be one of the considerations in the allocation of priorities by the District Assembly.

Kind of Trail: The trails in the hill areas of Nepal have different use and can be classified into different categories. This warrants a separate study to establish, on a long-term basis, the kinds of trails in the country. For the present however, the application of this criterion should be based on 'Indicative Classification of Trails' given in Appendix O-A-4 of this report, which classifies trails into classes A, B and C. According to the above scheme of classification, priority should be accorded to the bridges in a descending order in relation to the kind of trails present.

Access to Social and Service Institutions: The location of the schools, health posts, religious places, post offices, agriculture offices and forest offices around the proposed bridge location should be part of the consideration in allocating priority for the bridge. Sufficient attention should also be paid to the possibility of the establishment of these institutions following the construction of the bridge.

Trade Flow and Other Economic Activities: The construction of the bridge should be able to improve and possibly increased the flow of trade as well as other economic activities in the area. The District Assembly should ensure this, in their deliberations.

Social benefits: Bridges have been unequivocally found to yield many social benefits. The facilitation of women's chores such as; collecting fire wood and fodder, travelling across the river for social purposes, expanding the areas of spouse selection, and traveling to religious festivals and fairs etc., has resulted in improving the welfare of the people. This should be an important consideration in the selection of the future bridge sites.

Maintenance Responsibility: The District Assembly must see to it that the village panchayats requesting the construction of a bridge will be prepared to perform the proper maintenance and upkeep duties after the bridge construction.

After the District Assembly works out its order of priorities for bridges in the district, it is submitted in a predetermined format and sent to the Ministry of Works and Transport.

For this purpose a simple and standard format should be designed at an operational level which would incorporate all the basic information pertaining to the above criteria, along with the probable span (to be determined by the Engineering Section of MWT in the District).

At the level of the Coordinating Committee: The coordination committee mentioned earlier should meet and review the bridges requested by District Panchayat using the following guidelines.

Relationship with other transportation networks: The coordinating committee should study the relationship of the requested bridges, in context with the existing or planned transportation network, and eliminate those that are likely to be redundant in the near future.

Integration with other local development program: It is assumed that if the proposed bridges are integrated with other development programs in the area they will be more likely to yield greater benefits. The coordinating committee should use this principle whenever integrated rural development programs exist or are planned.

Identification of regional access or local access bridges: On the basis of information on the origin and destination of traffic provided by District Panchayats, the coordinating committee should classify the demanded bridges into either regional access bridges or local access bridges, the former would be constructed by the SBD and the latter by the LDD. This will be done on the basis of Bridge Classification Criteria, more clearly defined in Section 0.6.3.

At the SBD Level: After the coordinating committee hands down the bridges designated as regional access bridges to the SBD they should be further classified into remote area bridges and non-remote area bridges according to their location. For this purpose, the list of remote districts, delineated by Remote Region Development Board of HMG (given in Appendix O-A-6) should be applied. These two sub-groups should then be dealt with separately for priority allocation using following criteria.

Traffic Volume: A traffic count provided by the District Panchayat and later substantiated by SBD officials should be a major aspect of the criteria. A greater traffic volume should receive the higher ranking.

Trail System: It should be determined whether the proposed bridge would be part of a large trail system, or whether its construction would make the system more useful.

Development Regional Distribution: It should also be seen that there is judicious distribution of bridges on the basis of different development regions, the least endowed receiving the higher priority.

At the LDD Level: The LDD, after having received the list of local access bridges, should categorize them into remote area bridges and non-remote area bridges using same principles as the SBD. After this, these two sub-groups will be given priority separately according to the following criteria.

Traffic Volume: Traffic count provided by the District Panchayat and substantiated later by LDD officials should be a major aspect of the criteria. The greater traffic flow will receive a higher ranking.

Regional and District Development Considerations: In order to achieve judicious distribution of resources, the LDD should accord its priorities in such a way as to allot at least one bridge per District; thus equally distributing resources among regions.

Local Resource Contributions: Priority should also be accorded to the village and District Panchayats which make an explicit commitment to contribute local resources in terms of cash, voluntary labor and materials.

Post-construction Repair and Maintenance: As a part of the criteria for priority allocation there should also be an explicit commitment made by the village panchayat or village panchayats, to undertake the necessary repairs and maintenance work on the bridge on a continual basis.

Conclusion: While the multi-stage priority allocation procedure would be a departure from the present way of doing things, we are convinced that its adoption would contribute to the making of judicious decisions concerning the allocation of resources in a country wide **trail** bridge program in Nepal.

#### 0.6.5 Construction Site Selection

The construction site selection of the priority bridges will be undertaken by an engineering team of the SBD and LDD.

The foremost thing to be done by the engineering team is to thoroughly study a recent topographical map showing the trail network and river systems. A good knowledge of the rivers and Kholas of Nepal is essential. This study could be carried out by using the existing 1 in. to 1 mile 'Survey of India' topographical maps of Nepal. Then armed with the information gathered from a through study of the map of existing trails and settlement patterns, the engineering team should survey a construction site taking into consideration the following points.

- The team should, in the first, place examine the present crossing facility and its alternatives in the area. Invariably, there will exist some kind of crossing facility in the near vicinity of the requested bridge location, and the team should look, in detail, at this existing crossing facility. The team should ascertain the degree of safety and year-round serviceability of such facilities, and the cost for regular replacement of these facilities. This factor is very sensitive to subjective judgement and should be the responsibility of the head of the organization concerned, once he gets the detailed survey-report.
- After examining the preceding aspect of the bridge site, the team should survey the site for the construction of the bridge. It has become evident from our study that the surveyor must select a bridge site as close as possible to the existing

traditional crossing point, especially in the case of unfordable rivers which have a ferry services. If the bridge gets situated off the traditional route it will result in only marginal use.

- The team should look into the possibility of using local know-how in the selection of bridge type. It may be possible to introduce the Baglung-Type of traditional trail suspended bridges in a situation where the span needed is not too long and the traffic is not unduely high. This should be looked into carefully, especially in the case of local-access bridges which fall under the jurisdiction of the LDD.

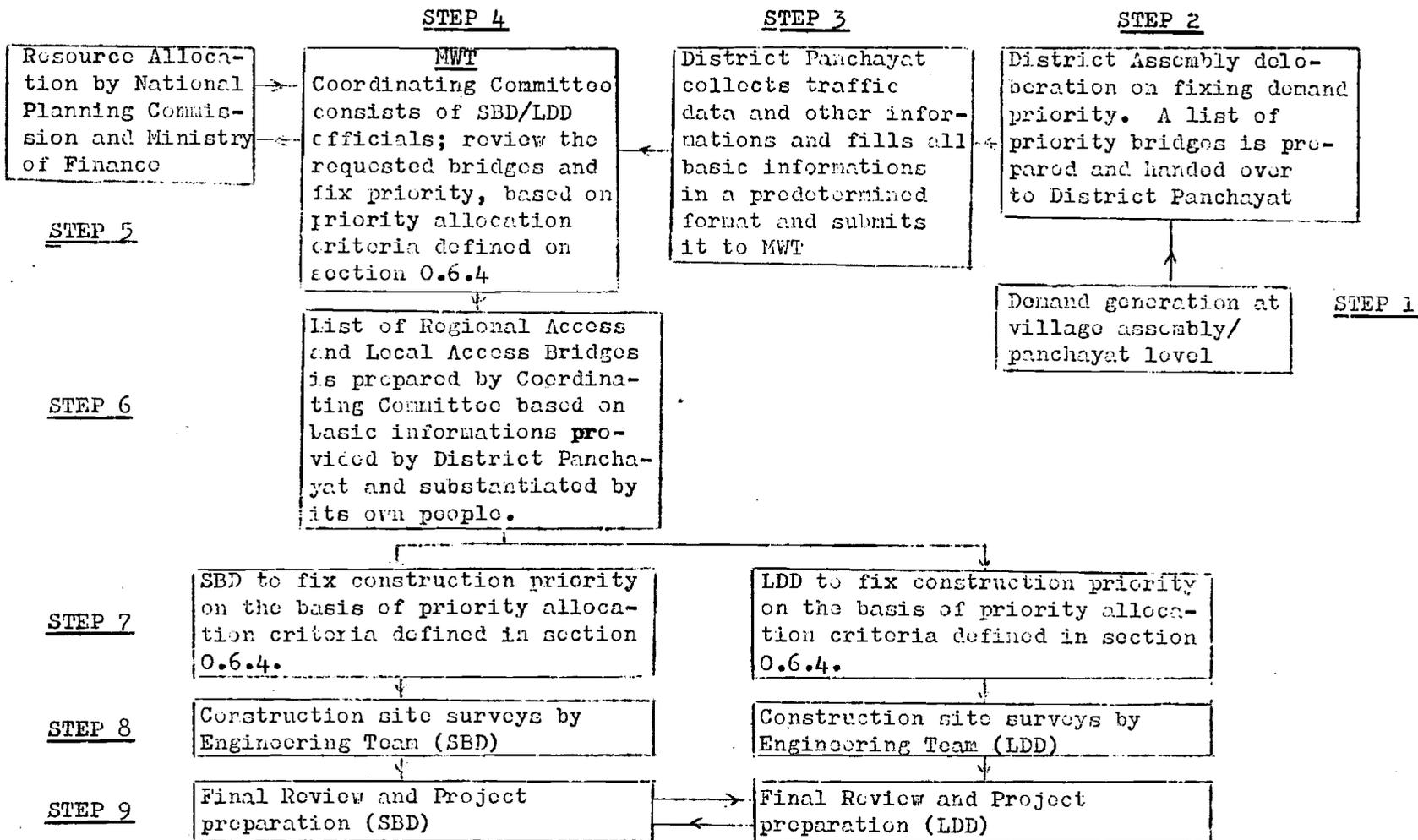
A flow chart shown in p.55 will present a graphical representation of the overall selection method described above.

#### 0.7 A BRIEF PROPOSAL FOR UNDERTAKING AN EXPANDED TRAIL BRIDGE PROGRAM

On the basis of the findings of this study, it is only appropriate to work out a brief proposal for implementation which recommends such provisions as the need for changes in present institutional structure, need for bridge and trail classification, central versus local participation projects and new arrangements for maintenance etc. which would be necessary for undertaking an expanded program of Trail bridge construction in the country. They are as follows:

##### 0.7.1 The Role of Different Departments and the Need for a Unified Agency for the Program.

At present there are two agencies mainly involved in the construction of trail bridges in the country; the Suspension Bridge Division (SBD) of the DOR under the Ministry of Works and Transport; and the Local Development Department (LDD) under the Ministry of the Home Panchayat. While the former attends to the construction of a limited number of trail bridges with costs entirely borne by the central government, the latter supports, in the form of cash and materials, the District and village panchayats in the country, enabling them to undertake, among other local projects, the construction of a



FLOW CHART\* SHOWING MAIN STEPS OF RECOMMENDED SELECTION PROCESS

\* Related to Chapter 0.6 of this Volume.

large number of small span trail bridges. Although this may seem to be a clear arrangement, the distribution of resources and responsibilities is often unbalanced. The SBD, apart from being a regular institution for the construction of trail suspension bridges within the framework of the central government, has access to a greater number of trained personnel and has over the years accumulated a pool of technical knowledge which the LDD does not have. The handicap of limited manpower, and the responsibility of providing resources to a large number of bridges spread over the entire kingdom has reduced the LDD's effectiveness.

One example of an LDD bridge program which would have benefited from resources available in the SBD, is the Baglung suspended bridge program. Although this program has resulted in the construction of a large number of suspended bridges each year, in the district of Baglung its efficiency and ability of work would have been enhanced if the project had been managed by one central agency. Such an agency would possess the necessary manpower, resources, and technical know-how which would be capable of responding to the specific needs of a local area and be able to supply both technical assistance and necessary materials for the construction and maintenance of trail suspended, as well as, suspension bridges. While commending the work being done by the LDD and the SBD, there exists a need for instituting a single agency in the government to deal with the construction of trail bridges throughout the country. It is to this end that we recommend that a unified central agency be established under the name of 'Department of Trail Bridges' within the Ministry of Works and Transport with the following responsibilities.

- to collect and assess demands for all trail bridges from all over the Kingdom, and to work out a priority list on the basis of a predetermined criteria and available resources.
- To develop standard designs and prepare estimates for the construction of trail bridges in the country.

- To undertake site surveys, and construction works.
- To test and develop different and alternative techniques of trail bridge building in the country with a view to developing the most economical and least sophisticated technology appropriate to the local technicians and people.
- To procure different construction materials within a scheduled time and to transport them to different bridge locations of the country to facilitate the timely construction of the bridges.
- To provide necessary manpower and other technical support to the District Panchayats and to draw up the plans for bridge construction and to implement them on time.
- To train the district and village panchayats in the task of maintaining the bridges in their areas.
- To mobilize local resources for the maintenance and up keep of bridges already constructed.

#### 0.7.2 Need for Bridge and Trail Classification

The study has revealed that the bridges are located on trails with differing significance. While some trails, and so the bridges on them, are of regional importance, other bridges have a significance which is relatively limited. It is logical to assume that the priority has to go to the bridges of regional significance because of the larger number of people which would be affected by it. However, it would be extremely unwise for the government to consider the allocation of all the resources to such bridges and to overlook the construction of other bridges which show only local and social importance. There is an essential need for evolving a procedure for the apportioning of resources for the construction of trail bridges between locations of different importance. It is therefore, suggested

that a research study be undertaken for; the classification and specific identification of trails in the country, and the relative magnitude of immediate and potential demands for the bridge sites located along different kinds of trails. Once this information is available, then a definite priority system can be introduced and policy guidelines spelled out.

### 0.7.3 Central Funding Projects versus Local Participation Projects

It is suggested that on the basis of the kind of trails, as well as of the span required by the rivers; two principles for funding be observed. For bridges which are of regional importance or involve high construction costs, which would make local matching contribution prohibitive, the principle of central funding of all the costs should be followed. In other bridges which are of importance to a limited area in a District, or between village panchayats, local contributions should be sought to supplement the grant provided by the government.

For the construction of both these kinds of bridges, a common procedure could be followed. The central funded bridges, as well as those which involve local contributions, could be constructed involving the services of the local technical office of the District. This will enhance the technical know-how of the local office and would be useful for the construction of future bridges as well as for repair and maintenance of present ones.

### 0.7.4 New Arrangements for Maintenance

The study has also revealed that repair and maintenance of the bridges at present is very scarce. One reason for this is that, aside from changing planks the local panchayats do not possess enough knowledge for the maintenance commonly needed on bridges. Secondly, the District Panchayats or the District Offices have not undertaken any regular supervision work. This has been primarily due to the lack of assigned responsibility and also the lack of required know-how. A system for delegating the responsibility for maintenance to the District or village panchayats, and for providing the necessary resources and technical skill should be a priority concern of the agencies involved in the construction of trail bridges in the country.

LIST OF ABBREVIATIONS

CEDA	Center for Economic Development and Administration
CDO	Chief District Officer
CDR	Central Development Region of Nepal
DOR	Department of Roads
DAP	District Administration Plan of 1975
DP	District Panchayat
EAST or ECE	East Consulting Engineers
EDR	Eastern Development Region of Nepal
FWDR	Far Western Development Region of Nepal
GON	Government of Nepal
HFL	High flood level
HMG	His Majesty's Government
IBRD	International Bank for Reconstruction & Development
IRR	Internal Rate of Return
JTA	Junior Technical Assistant of Department of Agriculture
LDD	Local Development Department
MWT	Ministry of Works and Transport
NCCN	National Construction Company of Nepal
NPC	National Planning Commission
PWD	Public Works Department
PCV	Peace Corps Volunteer
RNAC	Royal Nepal Airlines Corporation
SADP	Small Area Development Program
SATA	Swiss Association for Technical Assistance
SBD	Suspension Bridge Division
STOL	Short Take Off and Landing
USOM	United States Operation Mission
USAID/ Nepal or USAID	United States Agency for International Development, Nepal
UNDP	United Nations Development Program

LIST OF ABBREVIATIONS

WB	World Bank
WDR	Western Development Region of Nepal
3-A-1	Bridge Study Number - Appendix - Appendix Number
3-T-1	Bridge Study Number - Table - Table Number
3-F-1	Bridge Study Number - Figure - Figure Number
3-P-1	Bridge Study Number - Photograph - Photograph Number
0-A-1	Summary Volume - Appendix - Appendix Number
0-T-1	Summary Volume - Table - Table Number
0-F-1	Summary Volume - Figure - Figure Number
0-P-1	Summary Volume - Photograph - Photograph Number

GLOSSARY

- Asad - Nepalese month roughly corresponding to June/July.
- Badahakin - district governor
- Bali - a system in which laborers of certain castes are paid in grains rather than in cash.
- Chokho Jat - upper caste Hindus.
- Dhani - shaman, local magic healer.
- Ghew - ghee
- Jhankri - shaman, local magic healer
- Khet - wet farm land
- Khola - a stream or a small river.
- Matwali - liquor consuming; applied to certain caste or ethnic groups.
- Marg - Nepalese month roughly corresponding to November/December.
- Pakho - dry farm land
- Pancha - political workers of Panchayat System
- Pap - sin
- Patwari - land revenue collector
- Phadke - temporary log bridge
- Pradhan
- Pancha - head of the village panchayat
- Punya - virtue
- Rastriya
- Panchayat - National legislative body
- Turai - the southern plains of Nepal, borders India.
- Upa-Pradhan
- Pancha - deputy head of the village panchayat
- Varna - the four major classes of the Hindu caste system
- Zimindar - land revenue collector
- Zimawal - land revenue collector.

Interim Selection Criteria: Application and Findings

Objective: The application of bridge selection criteria developed in Phase I of the study was carried out on the four bridge sites studied by the German Consult. This exercise was mainly to test the practicality of the interim selection criteria and to make subsequent modifications in the final selection criteria proposed in this report, in the light of the new insights gained from the test results.

The following is the list of the bridges studied by German Consult to which the Interim Criteria was applied. Two of the bridges No. 3 and 27A justify the IRR criteria and are ranked as priority projects, the other two do not meet the IRR criteria and have the lowest priority rating.

German Consult Bridge No.	Bridge Site	Name of the River	District	IRR
3	Manthalignat	Tamakosi	Ramechhap	18%
22	Loguwaghat	Arun Rivor	Bhojpur and Dhankuta	3%
27A	Nabighat	Uttarganga	Baglung	above 30%
50A	Sheuli Bhatti	Modi <u>Khola</u>	Kaski	below 1%

A set of questionnaires, which included the critical variables from all four disciplines (sociology, institution, economics and engineering), was developed and written in the Nepalese language. The questionnaires were administered to the local panchayat office bearers and knowledgeable persons such as Pradhan Panchas, Upa-Pradhan Panchas, members of the District Panchayat, District Assembly members, etc.

Short Note on Bridge Sites

Manthalignat: There exist ferry services at Manthalignat which become inoperable during the monsoon season. Presently it services the long-

distance trail. During the dry season, however, it serves as the best alternative to the Karambot Bridge, located upstream, because the ferry point serves as a direct and shorter route to reach different destinations in Kavre, Sindhuli, Ramochhap and Okhaldhunga Districts. Long distant traffic over the Karambot Bridge occurs only during the wet season, and the time involved in this detour is approximately 3 hours. Accidents are occasionally reported at the Manthalignat crossing. A bridge in Manthalignat would certainly be beneficial, but at the same time it would make the Karambot Bridge even more useless than it is now.

Loguwaghat: A bridge at Loguwaghat would replace the ferry services. Although the long-distance traffic through this crossing facility will not be enormous, there will be an appreciable number of local people who will use this bridge, if constructed primarily to reach farm land on the opposite side of the river. It also lies on a postal route. Although its immediate benefits would go to the people in the local neighborhood, it holds promise of opening up a regional access trail originating from Dharan, Dhankuta to Bhojpur. At present, a crossing facility exists only at Raighat about 7 hours downstream, and at Turkoghat, about 6 hours upstream. The long distance traffic is diverted to one of these two facilities during the monsoon when the ferry stops running at Loguwaghat. The other ferry point at Khorsaneghat, 35 minutes upstream, is not dependable since it stops running during floods. This project is attractive since the economic and social benefits that might result are potentially immense with respect to the bridge's locational situation in the area trail network and the lack of reliable alternative crossing facilities in the local vicinity.

Nabighat: The Uttarganga River, over which the planned bridge was to be built, is fordable at many points during the dry season. There used to be a log bridge at Nabighat which used to be washed away during each monsoon. The need for a bridge is so immense that the local people successfully constructed a suspended bridge recently, using materials and assistance from the Baglung

District Panchayat. This local bridge connects the trail from Dolpa, to Palpa, to Tansen, to Baglung and to Pokhara. Apart from the usefulness of the bridge for economic purposes, it also provides access to better pastoral land. During the winter the pasture land across the river is covered by snow. This forces many people and their livestock to move to lower altitudes in Dhorpatan in search of better pastures. Its relationship with the area trail network as well as with the existing transportation system is also significant.

Sheuli Bhatti: There is a local bamboo bridge at Sheuli Bhatti, for use during the dry season, and it is usually washed away during each monsoon season. Thus, during the wet season the traffic is diverted to Birethanti, about 30 minutes downstream, where there is a suspended bridge lying on the major Pokhara-Jomoson trail. A bridge at Sheuli Bhatti would primarily benefit a small area population since it services a local access trail. The dry season benefit of erecting a suspension bridge is essentially insignificant since the dry season traffic uses the local bamboo bridge. Further, there are a number of alternative crossing facilities, the most significant being the suspended bridge at Birethanti, which are not too far away.

#### Findings

a. We feel that the relative priority for the three unbuilt bridges should be in the following order:

1. Loguwaghat
2. Manthalignat
3. Sheuli Bhatti

While the German Consult has accorded a low priority to Loguwaghat, to take just one instance, our assessment of the situation forces us to conclude that it should have been a priority bridge for the following reasons.

- This is a very high traffic point.
- This location falls on the main trail between Bhojpur and Dhankuta, the latter being the regional headquarters for the Eastern Development Region of which the District of Bhojpur is a part. This also happens to be a postal route, and also serves as an access to schools situated across the river. For political and developmental reasons, a bridge over Leguwaghat should have been a priority consideration.
- The alternative means of crossing in the immediate vicinity of the Leguwaghat crossing point, are either risky or inoperable for part of the year. However, there exist a better alternative of a ferry service at Khorsaneghat, which is a little far from the traditional crossing at Leguwaghat.
- Many people living on the Bhojpur side of the river own farm-lands on Dhankuta side across the river. A bridge over it would immensely relieve the hardship that the local people undergo every year in getting to their fields especially during monsoon when agriculture activities are highest.
- People living on the Bhojpur side of the river, have always had a difficult time traveling to Pakhribas where there is an agricultural demonstration station and an extension farm, as well as a local market center, and to Dhankuta which is another important market center.
- Social relationships such as marital relationship between families living in either side of the river have been fairly frequent, and a bridge over the river would further enhance social contacts between those people. It is very difficult to quantify the effects of these non-economic considerations, but these very considerations often make the construction of the bridge over at a site such as Leguwaghat a justifiable proposition, which it obviously is.

- b. The application exercise has reinforced the need to conduct traffic surveys ascertaining the origin, destination and purposes of travel. Such an exercise would not only be helpful for the assessment of the relative importance of the bridge, but also would be helpful in categorizing the bridges in terms of regional or local importance. Further, detailed traffic data would be helpful in assigning priorities to a number of bridges.
  
- c. Another important finding of the test exercise is that the area selection of a bridge should always be done on the basis of its relationship with the area trail network and existing alternative crossings in the immediate vicinities.
  
- d. While economic consideration is apparently helpful, it should not necessarily be the sole justification for a bridge program. It should be justified on the basis of social, as well as other developmental considerations, since it is basically an area development program.

List of the Bridges Under Study

Bridge Study No.	Bridge Site	Development Region	District	River	Remarks
1.	Karambot	Central	Ramechhap	Tamakosi	Suspension
2.	Syabrubesi	Central	Rasuwa	Bhotekosi	Suspension
3.	Kagune	Central	Nuwakot	Kagune	Steel Tubular Truss
4.	Pachuwarghat	Central	Kabhre	Sunkosi	Suspension
5.	Darondi	Western	Gorkha	Darendi	Suspension
6.	Manbagh	Western	Palpa and Gulmi	Riri	Suspension
7.	Baglung Trail Suspended Bridges*	Western	Baglung	Different <u>Kholas</u> and Rivers of Baglung District	Suspended
8.	Jhaprebagar	Western	Parbat	Modi	Suspension
9.	Bhingri	Far Western	Piuthan	Madi	Suspension
10.	Sanfebagar	Far Western	Achham	Buriganga	Suspension
11.	Malumela	Far Western	Bajhang	Setinadi	Suspension
12.	Toxelghat	Eastern	Okhandhunga and Udaipur	Sunkosi	Suspension
13.	Tuekeghat	Eastern	Bhojpur and Sankhuwasabha	Arun	Suspension
14.	Leguwaghat	Eastern	Bhojpur and Dhankuta	Arun	Cableway

\* A number of Trail Suspended Bridges recently built under a pilot project were studied, in the District of Baglung. The report is presented in a separate volume, Part B, of this study.

Calender of Festivals in the Study Areas

Name of Festival	Month of celebration in Chronological order	Related to Bridge Study No.
1. Mesha Sakranti or Bisu	Second/Third week of April	1,6,8,11,13
2. Baisakh Purnima	April - May	1,4,6,8,9,12,13
3. Akshaya Tritriya	April - May	5,6,8
4. Jestha Purnima	May - June	9
5. Dasahara (Ganga)	June	6,8
6. Harisayani Ekadasi	First week of July	5,8
7. Saune Sakranti	Second/Third week of July	1,5,6,8,12
8. Janai Purnima	First/Second week of August	All bridges except Syabrubesi
9. Gai Jatra	The day after Janai Purnima	3,6,8
10. Gai Tihar	August	9
11. Krishna Astami	August	All Bridges
12. Tij	Third/Fourth week of August	All Bridges
13. Tij Panchami	Two days after Tij	All Bridges
14. Sohra Shraddha	September	6,8,9,10,11
15. Dasain	September-October	All Bridges
16. Tihar or Dipawali	October-November	All Bridges
17. Thulo Ekadasi or Hari Bodhani	First week of November	5,6
18. Nwain	Last week of November	6,9
19. Balachaturdasi	December	12
20. Barda Devi	December	10
21. Pancha Pandava	January	11
22. Maghe Sakranti	Second/Third week of January	3,4,5,6,8,9,10,12,13
23. Shri Panchami	Last week of January	1,5,6,8,9,10,11,12
24. Shiva Ratri	Middle of February	3,4,5,6,9,10,11
25. Fagu Purnima or Holi	March	All bridges except Syabrubesi
26. Chaitra Dasain	March-April	All

Indicative Classifications of Trails

It can be inferred, after the study of bridges in this project, that the type of trail plays a dominant role in the overall impact of a particular bridge.

It should be recognized that the class of a trail will not remain static but will change over time with the changes in the overall road and other transport systems.

On the basis of the existing network of trails in the country, a plausible classification can be made which we feel should, in general, be as follows:

- Class A (Major Trails)
- Class B (Medium Trails)
- Class C (Minor Trails)

Class A Trails: Termed as major trails, they are to be considered in a regional context; these trails normally should constitute the dominant transportation network in the region over which the movement of people, as well as goods and services, take place. Such trails in the country are normally laid out with a north-south orientation. Although Class A trails carry high traffic in most cases, all high traffic trails are not necessarily major trails. The high traffic is also a function of the population concentration in a given area. Such trails usually carry major political significance in that they are indispensable links between several district headquarters as well as between several post offices. Economically, such trails have special significance in terms of the migration of people, seasonal and otherwise, and much of the economic activity, in terms of export and import, are carried over them.

Class B Trails: Termed as medium trails, they are to be considered in the context of a single district; in that these trails normally should constitute the main transportation network inside that district over which the movement of people, as well as goods and services, take place. Such trails normally connect the district headquarters, which is generally an important market and service center in the district, to other major towns and villages. Apart from this, Class B trails connect places of tourist attraction, religious places and post offices.

Class C Trails: Termed as minor trails, they are all other trails not falling within the definition of Class A or Class B Trails. Such trails mainly serve as local access between villages inside a district, or serve as a link with the Class A or Class B trails.

Indicative Classification of Rivers

Classifications of rivers have become important in deciding the appropriateness of the allocation of the scarce resources for a trail suspension bridge program. We have classified the rivers in three basic categories, depending upon whether they can be forded by human being and cattle in the immediate vicinity of the bridge site. The classification in general is as follows:

- Major River
- Medium River
- Minor River

A Major River: Major rivers are those rivers which are unfordable throughout the year, such as the Sunkosi, the Tamakosi and the Arun Rivers in the Eastern, Dhotekosi in the Central, and the Setinadi in Far Western Nepal.

A Medium River: Medium rivers are those rivers which can be forded during the dry season but not during the monsoon season; the Buriganga and Madi Khola in Far Western Nepal, and the Riri in Western Nepal.

A Minor River: Minor rivers are those rivers which are generally wet weather rivers and cannot be forded for small durations only during flash floods; for example, the Kagune River in central Nepal.

List of Remote Districts

A list of remote districts, delineated by the Remote Region Development Board of HMG and current as of March 1978, is given below. Some of the districts mentioned below have only a part of their district termed as remote.

S.No.	Name of the District	Development Region
1.	Taplejung	Eastern
2.	Sankhuwasabha	Eastern
3.	Solukhumbu	Eastern
4.	Dolakha	Central
5.	Sindhupalchok	Central
6.	Rasuwa	Central
7.	Dhading	Central
8.	Gorkha	Western
9.	Manang	Western
10.	Mustang	Western
11.	Dolpa	Far Western
12.	Mugu	Far Western
13.	Jumla	Far Western
14.	Humla	Far Western
15.	Kalikot	Far Western
16.	Bajura	Far Western
17.	Bajhang	Far Western
18.	Darchula	Far Western

Article II of Agreement: Scope of Work

A. Objectives

The objectives of this project are for EAST to:

1. Complete a study, as further described below and in attachment "A" which is made part of this contract, of the effects of suspension bridges constructed under a former USAID project have had on people served by the bridges, and to define to what extent these effects may influence the selection of sites for future bridges.
2. Study the processes and procedures involved in an apparently successful suspended bridge program in a particular area and determine the extent to which the measures employed in that area may be applied to a future USAID trail suspension bridge program.

B. Categories of Study

For the period set forth in Article V -"Reports", EAST shall perform the specified study(s) in the following general areas:

Social anthropological, institutional (government and administration), economics and engineering.

These general areas are each divided into two broad time segments as follows:

1. Phase I

This phase consisting of a detailed qualitative case study by EAST of Baglung District suspended bridge construction and four (4) bridges constructed under a former USAID project, shall be performed during the present monsoon season and will terminate with an interim report. The particular four bridges to be

studied will be selected in meetings between EAST and USAID. The interim report to be prepared by EAST and the resulting content analysis will:

- a) Describe the institutional, economic, sociological and technical processes that contributed to the site selection, construction and maintenance of the above bridges; special attention will be paid to the nature and level of local participation as well as the local benefits being drawn therefrom.
- b) Develop a generalized set of criteria which can be used by relatively unskilled personnel for future selection of bridge sites and their construction priority.
- c) Perform a detailed study of the processes and results of the suspended bridges being constructed in the Baglung District using local initiative and government resources. EAST will use the technical report "Traditional Trail Suspended Bridges in Baglung District" written by Mr. Robert Groeli in July 1977 and made part of this contract as attachment 'C', as the starting point for this portion of the interim report. Elements, methodology and personnel of the Baglung portion of the Interim Report are further described in Attachment 'B' which is made part of this contract.

2. Phase II

This phase, terminating in a final report, will concentrate EAST's efforts in the following areas:

- a) Resurvey the four bridges covered in Phase I with a view to expand the monsoon season data base into dry season coverage and refine the interim report findings.
- b) Select in conjunction with USAID and survey nine additional bridges using the analysis described in a) and b) in Phase I.

- c) Apply the criteria developed in Phase I and mentioned in Phase II to four bridges (two meeting the IRR criteria and if possible, the other two not meeting it) selected from the UNDP "Trail Suspension Bridge Study" and include the results obtained from the four bridges in the final report.
- d) Prepare an annotated bibliography of available materials and studies on trail networks, foot-bridge construction and use in Nepal.

C. Guideline Methodology

1. Collection and Review of Existing Data

Directly following mobilization of EAST's staff, a review of existing suspension bridge data will be carried out. The data to be reviewed will encompass all the disciplines of the study. As a starting point, USAID will provide a limited amount of relevant data to EAST. From time to time, USAID and EAST will engage in meetings to discuss progress, problems and any changes in the methodology.

2. Training and Monitoring Field Studies

Immediately after and during mobilization, the field staff will be trained by EAST's senior consultants and consultants on the different variants and methods of getting the required and desired information. The field staff will be experienced enumerators with basic education in respective fields of the study whose qualifications are based on standards satisfactory to the Contract Administrator.

Because of time limitations and nature of this study, continuous monitoring by EAST's senior consultants and consultants of the field studies will be required; therefore, a viable logistic system

will be developed and communications between the senior consultants/ consultants and field staff will be developed and maintained by EAST.

3. Social Anthropological Studies

The social studies will concentrate on determining the social changes contributed to the construction of the suspension bridges in question. Changes in social services, changes in social values and norms in cultural and educational fields, population migration, establishment of new institutions, the role of women, and the environmental impact will be analyzed.

Preliminary experiments of survey units of the objective of the study will be made and hypothesis of the survey will be prepared. Qualitative case study methods will be applied for each bridge.

a) Field Studies

Data will be collected from villagers, members of village panchayats, school teachers and members of other social institutions. Different methods viz schedule method, interview method, case study method, observation method and questionnaire method will be applied depending upon different variants such as place, person and time.

Data from villagers will be taken by observation methods and can be un-controlled non-participant or participant according to the character of data to be collected.

Data from travellers will be taken by interview methods. Questionnaire methods will be applied, if possible, to government officers.

b) Analysis of Data

In analyzing data, comparative methods will be applied as far as possible. Numerical data will be classified, tabulated, presented and generalized by statistical socio-matric methods viz logical methods of agreement, inductive and deductive methods.

4. Institutional Studies

a) Macro Political

The purpose of this section shall be to provide a description of the broad institutional framework of the central government and administration in Nepal within which local development activity is carried out. EAST will provide an analytical description of (a) local government and administration in Nepal with particular reference to local development and (b) a brief study on the planning process in Nepal which has relevance to suspension bridges.

b) Micro Political

EAST will provide the following information for each of the bridge sites to be evaluated: (a) The nature and extent of local participation in the process leading to the location, construction, and maintenance of the bridges. (b) The broad institutional benefits accruing to the area because of the bridge. (c) The attitudes and opinions of local people and authorities are regards their participation in location, construction and maintenance of the bridge.

The above qualitative data on the system of Nepal's (village, district and zone) government and administration and relationship

to the planning process will be identified by EAST using the best research methods available by studying the formal decisional structure (and persons) in the bridge site selection process.

c) Field Studies

Field research will be performed in the area of the bridge sites to supplement the above institutional information thereby identifying the informal decisional structure (and persons), to generate data on the micro political aspects of the subject area.

The questionnaire for the institutional study will be primarily open-ended so as not to inhibit respondents with a too structured and novel question pattern.

5. Economic Studies

a) General

The present study will be based on qualitative analysis and judgement rather than on quantitative approach. The study will include but not necessarily be restricted to:

- Processes of Nepal's economic and development planning in connection with trail bridge construction.
- Project planning especially in trail bridges which gives social benefits to local hill people.
- Effectiveness of bridge building on rural development and use of agricultural inputs.
- Definition of major, secondary and minor trail networks.
- Role of women in relationship to trails and trail bridges.

- Development of generalized criteria as a simplified guide for future bridge site selection.
- Environmental impact caused by bridges being built.
- Agricultural production increase or decrease because of bridges built.
- Necessary proposals for improving the planning processes for location, construction and maintenance of trail bridges.

b) Field and Desk Studies

The information required will be obtained through desk research and field study. In designing survey questionnaires, particular attention shall be paid to obtain information on the following variables:

- Influence area: Local and far reaching trails.
- Population: size, structure, activity rates, migration and social life.
- Agriculture: area under cultivation, irrigation facilities, cash crops, cereal grains and livestock.
- Forest: area under forest, use of forest and afforestation.
- Industry: cottage industry, trade and porters.
- Social Services: schools, health centers, banks and post offices.
- Trade: major trading centers, principal goods imported and exported.

- Transport: major, secondary and minor trails, suspension, suspended bridges and traffic volumes.
- Roles of women.
- Environmental effects.

Data code sheets will be developed for processing field information. Statistical tools shall be used as and when necessary.

## 6. Engineering Studies

### a) General

The study will determine criteria that was involved in locating existing sites to use in developing criteria for selecting future bridge sites.

The need of a bridge in relation to the volume of traffic will be analyzed; however, elaborate "traffic counts" are not part of this study.

The design parameters and selection of suspension bridge types and location will be studied and analyzed.

The construction methods of a particular bridge will be found by questioning the agencies and local people concerned. The degree of local participation during the construction of a bridge also will be sought. The contracting procedure will be analyzed in the process.

The method of maintaining the bridge in a usable condition will be found and analyzed.

b) Desk Research

EAST's desk research will involve locating the concerned agency responsible for selection of site, design, construction and maintenance of each bridge. If available, the particular site selection, designer and construction supervisor will be interviewed.

c) Field Studies

EAST field engineers will determine if there were other possible bridge sites, and if so, why were they abandoned. The desk research findings will be checked in the field.

If there are any changes or alternations in original designs, the necessity of change will be analyzed. The construction methods and construction soundness will be checked. The maintenance system will be found out. The condition of the bridge will be noted down and measurements made if necessary. The overall siting as well as details of the existing bridges under study will be fully documented with photographs.

d) Analysis

All desk research findings and field studies data will be analyzed. From which site selection criteria, design criteria, construction method criteria and maintenance systems will be developed.