

PREFACE

The topography of the Kingdom of Nepal is very harsh and diverse. As a result, communication in the hilly regions, bounded by plain terrain and Tibetan plateau is extremely complicated. The large number of rivers and rivulets flowing through the country's landscape are of great threat to a smooth and proper movement of pedestrians in the trails. Those taking risk to cross these rivers manually are very vulnerable for loss of life, livestock and property. Days of waiting at the riverbank for the river to subside or arduous uphill and downhill detours cause much waste of time and energy. In spite of this, the people in the hills are establishing and maintaining a traditional trail network for centuries. There are many ancient trade routes linking India and Tibet through Nepalese hills. Many regional routes and minor trails, which links up places of local importance and join these North –South trails. Footpaths and mule trails are the lifelines of local inhabitants for the exchange of their goods, for the sick going to health posts and for the children going to the school. Harsh accessibility to remote areas is one of major constrains in the delivery of essential services, markets and in all aspects of developmental work proposed by the government and private organizations.

To overcome such hardships, Nepal is making use of some forms of traditional trail bridges from the last few centuries. The earliest ever recorded forms of suspension bridges are the rope and bamboo supported bridges of the Eastern Himalayan and South America. It is guessed that the origin of suspension bridge is from the eastern part of the Tibetan massif. Many types of catenaries deck right from the simplest forms to the most advanced ones exist in this area. In Nepal, chain bridges seem to have been developed at the beginning of the 18th century. Iron chain suspension bridges still exist in Nepal today. Despite great efforts made by the government in the development work a large part of the hill population still shall have to depend on the traditional trail network for some decades to come.

In 1972 Swiss Government started its involvement in Trail Bridge building on the request of His Majesty's Government of Nepal. Since then the Swiss Government, through Helvetas is providing technical as well as financial support in planning, construction and maintenance of trail bridges. In Nepal the BBLL (Bridge Building at the Local Level) is very popular. With the support of BBLL, the communities (users) themselves have constructed thousands of trail bridges in the country within a decade. Recently the government of Nepal with the collaboration of Swiss government has started Trail Bridge Sub-Sector Project (TBSSP). From the last 12 years there is a good linkage between Helvetas and the Institute of Engineering (IOE). In these years IOE is producing engineering manpower in the planning, design, construction and maintenance of trail

bridge. The TBSSP/Helvetas in June 2002 requested IOE, Department of Civil Engineering for the development of curriculum and preparation of course manuals on **Trail Bridges** for Bachelor of Civil Engineering course, Diploma Level Regular Course and Training manuals for Practitioners (engineers and Overseers). Research and Training Unit of the Department of Civil Engineering provided its consent for the preparation of the manuals. Accordingly an agreement was signed on 8th July 2002 between the TBSSP and Head of the Department of Civil Engineering. The RTU of Department of Civil Engineering formed manual preparation team immediately after the agreement and the team worked very hard to prepare these manuals. The manual preparation team of the RTU is very hopeful that the manuals provide the users and local government authorities to facilitate the bridge construction program right from the request from the local users up to the time of its implementation.

This course manual has been written with a minimum of jargon so that the students in Bachelor of Civil Engineering can readily absorb it. The manual provides synthesized knowledge of different disciplines essential in Trail Bridge Building. Due emphasis has been given for the presentation of the complex mathematical expression as clearly and concisely as possible in this manual. The information is drawn largely from the available literature but not entirely.

The manual preparation team of the Department of Civil Engineering, IOE is indebted to the staff of the TBSSP for their continuous support and encouragement during the preparation of the course and training manuals. The team is particularly grateful for the guidance given by Mr. Jan S. Roukema (P. Eng.) Program Coordinator TBSSP/Helvetas, Mr. S. C. Kantha deputy Program Coordinator TBSSP and Senior Engineers Mr. Bhuvan Devkota and Mr. Gyanendra Rajbhandari of TBSSP. Acknowledgement is due to some staffs of the TBSSP for their kind cooperation in various aspects. The team further wishes to acknowledge to those, who have given their time, assistance, information and support to prepare this training manual on Trail Bridges.

The Department of Civil Engineering, Institute of Engineering, wishes to express its sincere gratitude to Prof. Dr. J. R. Pokharel (Dean), Prof. Dr. M. P. S. Pradhan (Campus Chief) and Mr. P. R. Panta (Asst. Dean) of the Institute of Engineering for their continuous support during the preparation of the training manual. The team also extends thanks to the staff of the Department of Civil Engineering for their sincere work.

**Research and Training Unit
Department of Civil Engineering
Institute of Engineering
Pulchowk, Lalitpur**

THE MANUAL PREPARATION TEAM

1. Prof. Dr. Ram Krishna Poudel	Curriculum Expert
2. Dr. Indra Raj Humagain	Coordinator
3. Dr. Narendra Lal Joshi	Content Expert
4. Mr. Mahesh Bhattarai	Institutional Facilitator (Dept. Civil Pulchowk)
5. Mr. Khem Nath Dallakoti	Facilitator
6. Mr. Bishwa N. Khanal	Institutional Facilitator (IOE, Thapathali Campus)
7. Mr. B. Koirala	Institutional Facilitator (CTEVT)
8. Mr. Padma Bahadur Khadka	Resource Person
9. Mr. Jagat K. Shrestha	Resource Person
10. Mr. Kamal Jaisi	Resource Person
11. Mr. Gyanendra Rajbhandari	Content Expert
12. Mr. Tulasi R. Nepal	Content Expert
13. Mr. Bhuvan B. Devkota	Content Expert