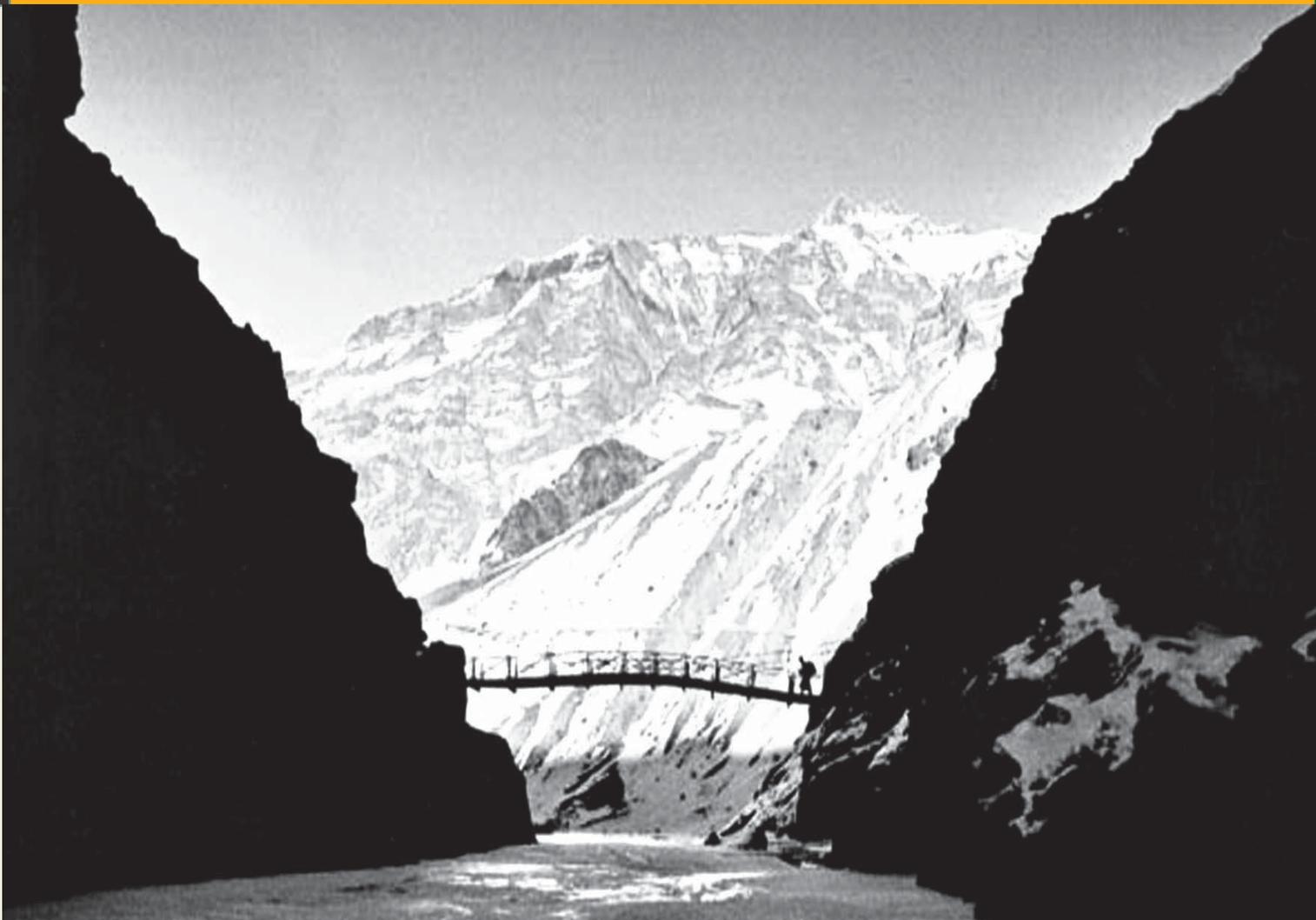


TRAIL BRIDGE BUILDING IN THE HIMALAYAS

Enhanced Access, Improved Livelihoods

5

EXPERIENCE AND LEARNING IN INTERNATIONAL CO-OPERATION



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Experience and Learning in International Co-operation Helvetas Publications, No. 5

TRAIL BRIDGE BUILDING IN THE HIMALAYAS

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This Helvetas publication no. 5 describes Helvetas' involvement in one of its working areas, namely, infrastructure in rural areas and in this context, Trail Bridge Building in the Himalayas embracing the two almost neighbouring countries, Nepal and Bhutan. Four decades of Helvetas' involvement and the Swiss Agency for Development and Co-operation's (SDC) financial contribution has yielded 4,000 trail bridges in the region that provide safe and all time access to 10 million people, transforming their lives and livelihoods for posterity. Trail bridge building in these two countries is regarded as one of the most important and most successful programmes of Helvetas anywhere in the world; so much so that the word '*suspension bridge*' is used as a metaphor for Swiss / Helvetas co-operation with communities and people of the developing world. Experiences and learning gained over time have evolved the science and art of pedestrian trail bridge building in Nepal to the extent where the country can claim to be a global leader in this sector! The learning is being successfully replicated in west Asia and Africa.

Experience and Learning in International Co-operation (Helvetas Best Practice Publications).

Brochure No. 5 : Trail Bridge Building in the Himalayas, February, 2007

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Helvetas, Swiss Association for International Co-operation, works towards the elimination of the causes of marginalisation and promotes solidarity with the poor in the south and the east. Its mission is to actively contribute to the improvement of the living conditions of economically and socially disadvantaged people in Asia, Africa and Latin America. Currently, Helvetas runs programmes of co-operation in 22 countries. Helvetas was founded in 1955 as the first private Swiss development organisation. Through such publications, Helvetas contributes to the process of learning through sharing in international co-operation. For more details or comments, please contact:

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Abbreviations and Acronyms

ADB	Asian Development Bank
BBLL	Bridge Building at the Local Level
BMC	Bridge Maintenance Committee
BYS	Balaju Yantra Shala (mechanized workshop) (Nepal)
CARE	Co-operation and Relief Everywhere
CBR	Central Bridge Register
CSM	Central Service Map
DANIDA	Danish International Development Assistance
DFID	Department for International Development
DTMP	District Transport Master Plan
PMIS	Planning and Monitoring Information System
CTP	Construction Turn-Key Package
DC	District Council (Nepal)
DDC	District Development Committee (Nepal)
DMBT	Demonstration Model Bridge Training
DoLIDAR	Department of Local Infrastructure Development and Agricultural Roads (Nepal)
DoR	Department of Roads
DRILP	Decentralized Rural Infrastructure and Livelihood Project
DUDES	Department of Urban Development and Engineering Services (Bhutan)
DWH	Department of Works and Housing (Bhutan)
DWH&R	Department of Works, Housing & Roads (Bhutan)
DYT	Dzongkhag Yargay Tshogdu (Dzongkhag Development Committee) (Bhutan)
EI	Educational Institutions
GYT	Gewog Yargay Tshogchung (Gewog Development Committee) (Bhutan)
Helvetas	Swiss Association for International Co-operation
IoE	Institute of Engineering
JICA	Japan International Co-operation Agency
KAAA	Kadoorie Agricultural Aid Association (Nepal)
LBR	Local Bridge Register
LIDP	Local Infrastructure Development Policy (Nepal)
LSGA	Local Self Governance Act (Nepal)
LSTB	Long Span Trail Bridge (> 120 meters, previously known as SBD bridges)
MoC	Ministry of Communications (Bhutan)
MTM	Main Trail Map
NGO	Non-Government Organisation
NTBF	Nepal Trail Bridge Forum
NTBR	Nepal Trail Bridge Record
Nu	Ngultrum (Bhutanese currency)
PHED/PHES	Public Health Engineering Division/Section, Department of Health (Bhutan)
PTB	Power Tiller Bridge (bridges suitable for small power tillers on farm roads)
PWD	Public Works Division (earlier Public Works Department) (Bhutan)
RAIDP	Rural Access Improvement and Decentralisation Project
RBIT	Royal Bhutan Institute of Technology
RGoB	Royal Government of Bhutan
RISD	Rural Infrastructure Services Division (Bhutan)
SBD	Suspension Bridge Division, (Nepal)
SBS	Suspension Bridge Section, (Bhutan)
SDC	Swiss Agency for Development and Co-operation
SOS	Social Organisational Support
SSTB	Short Span Trail Bridge (up to 120 meters, previously known as BBLL bridge)
TBS	Trail Bridge Section (Nepal)
TBSSP	Trail Bridge Sub-Sector Project (Nepal)
TIM	Transport Infrastructure Map
UC	Users Committee (Nepal)
UNCDF	United Nations Capital Development Fund
VDC	Village Development Committee (Nepal)
WB	World Bank

Statistics	Nepal	Bhutan
Land area in sq km	147,181	38,398
Total population	25,342,638	672,425
Average household size	5.44	5.50
% of rural population	85	69
Total no. of bridges built (2006)	3,600	425
Average beneficiaries per bridge	3,000	1,500
Currency equivalent (2006)	1.00 SFr = Rs. 56.00 1.00 US \$ = 74.00 Rs.	1.00 SFr = 32.00 Nu 1.00 US \$ = 45.00 Nu

Nepalese words used

Dalits People of occupational castes, poor and marginalized, considered *untouchables* in Hindu caste hierarchy.

Jana Sramadan Voluntary free labour contribution of the people

Bhutanese words used

Bazaam Covered wooden cantilever bridge

Chathrimis Decentralisation by-laws

Chimi Elected member of the National Assembly representing his or her constituency

Dzongkhag District

Genja Handing/taking over agreement paper

Gewog Block

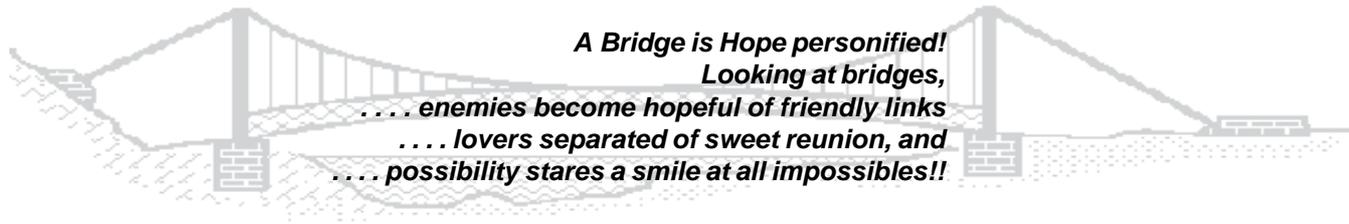
Gup Elected head of the Gewog

Lajab Work supervisor at the bridge site

Mangmi Elected representative of the Gewog (equivalent to deputy-Gup)

Tshogpa Representative of a village, or a cluster of villages

Zhapto Lemi Voluntary free labour contribution



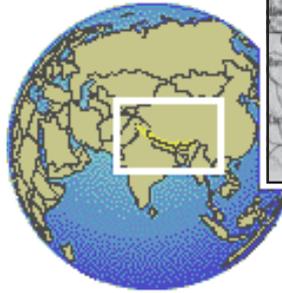
*A Bridge is Hope personified!
Looking at bridges,
. . . . enemies become hopeful of friendly links
. . . . lovers separated of sweet reunion, and
. . . . possibility stares a smile at all impossibles!!*

THE CONTEXT

Himalayan Geography and the Monsoon Water Cycle

THE HIMALAYAS, literally meaning the 'abode of the snows', Earth's youngest and highest mountain range, comprising of a series of parallel and converging ranges, extends in an arc of about 2,410 km from the river Indus in northern Pakistan eastwards across Kashmir, forming parts of southern Tibet and almost all of Nepal and Bhutan. The system covers an area of about 594,400 sq km.

In the context of this paper, the focus is on the two almost neighbouring countries Nepal and Bhutan nestled in the middle of the Himalayan arc, and whose boundaries in the south barely exceed the mountainous terrain.



The monsoon climatic system originating from the Indian Ocean inundates the southern slopes of the Himalayan arc with an average annual precipitation of 2,000 mm, 80% of which falls within the four months of June to September. The monsoon rains virtually transform the rugged, jagged Himalayan topography into a myriad of un-fordable streams, rivulets and rivers flowing down the slopes of the mountains and the hills to confluence into major rivers, from West to East: the Mahakali, Seti, Karnali, Bheri, Gandaki, Narayani, Bagmati, Koshi and Mechi of Nepal and the Amo Chu, Wang Chu, Puna Tshang Chu, Mangde Chu, Chamkhar Chu, Kuri Chu, Dangme Chu, Baranadi and Zomri Chu of Bhutan. These major rivers in turn confluence with the bigger, larger Ganges and the Brahmaputra rivers in India to flow back into the Indian Ocean - thus completing the water cycle.

In the aftermath of the monsoons, the streams, rivulets and rivers retain considerable flow for a couple of months more. Thereafter, almost 75% of the streams and rivulets – the smaller tributaries - begin to dry up or contain negligible flow. Only rivers originating from glacial melt retain considerable flow in their beds.

Settlement Pattern

The geography of the Himalayas dictates 80% of its predominantly agrarian population to live in small scattered settlements – the terrain and the soil can sustain only so much. Some 22 million people scattered in about 102,370 settlements in rural settings live in families averaging 5.5 to a household. On an average, a settlement comprises of about 40 households in Nepal and 25 in Bhutan. Settlements may range from a cluster of fewer than five households to over 300 households. Topographically, some 14 million people of the two countries scattered in about 64,740 settlements live in the hills and mountains.

Importance of Mobility

Human beings are mobile entities. In mobility lies their strength. Mobility ensures their superiority, sustains their livelihood and fosters their development. Transport is a means to facilitate mobility and access, to stimulate economic activity and efficiency that help reduce poverty. Trail networks with safe crossings ensure all time access to farmlands, schools, health centres, market venues, employment centres, cultural and religious locations, neighbours and kin. Safe crossings are an existential need of the people living in the scattered settlements in the hills and mountains of the Himalayas.



When will the river subside?

But, with the onset of the monsoons, travel in the mountains and hills comes to a virtual standstill for 4 to 6 months limited within spaces demarcated by the over 6,500 rivers and rivulets that crisscross the terrain of the two countries. While commuting in the mountainous terrain of the Himalayas, it was and still is not uncommon for a traveller to wait for hours, even days at the banks of a torrential river for it to subside – that he may cross it, still waist deep, still very risky, to reach his destination on the other bank. Fatalities went uncounted.

Far removed from any form of mechanized transport and virtually 'river-locked' to as little as a few hundred meters, restricted mobility of the people bars their access to the basic necessities of life and service centres. In equal measure, it restricts poverty-targeted interventions such as schools, health facilities, nutrition programmes and social services to reach them in any significant proportion.

Transport Infrastructure

Nepal, with 17,182 km of roadways (all categories) winding alongside rivers, hill contours and atop ridges still has 15 out of its 75 district headquarters unconnected by any form of vehicular transport. Bhutan on the other hand with just 4,153 km of roadways (all categories) has only one Dzongkhag headquarter unconnected, out of twenty.

It is inconceivable that vehicular transport will link all the rural settlements in the near future because the investment and maintenance costs in a landslide, erosion and seismic activity prone region are prohibitively high. Besides, the effects of vehicular roads on the fragile mountain ecology, environment and socio-economic and cultural life of the inhabitants can yield negative results. Walking along foot trails is the main, and often the only, mode of transport for more than 2.2 million hill dwellers on the move any time of the day. And for all of them, every day, safe river crossings are an acute need not just for growth and development but for their very existence and survival.



Hazardous log crossing over Kunnalo Gad, Bajura, Nepal

Helvetas' Involvement in the Trail Bridge Sector

Enhanced mobility is the bottom line not just for sustaining livelihoods but also for infusion of new knowledge into the remote communities and access to modern amenities and facilities that foster growth and development. Transport is also an excellent entry point for democracy and good governance because it facilitates participation in the political processes and reduces the marginalisation caused by rural isolation. Assuring safe and all time access to rural settlements is akin to empowering the people with the gift and power of mobility.



*Necessity leads to Innovation
An old Chinese painting*

Swiss national Tony Hagen, after extensive travels in Nepal in the 1950s expressed the importance of safe and all time access to and from settlements in the following words:

“To have the use of suspension bridges is the overwhelming wish of the whole population. The government would be well advised to give top priority to this programme. There is really no other development project which so directly effects so many people using so little money and in such a short time.....”

Nothing could have been truer!

The Past

Dire necessities lead to innovation. In the context of safe river crossings, first among them were simple single log crossings that got upgraded to raised bamboo and wooden cantilevers across short spans. These were and still are fairly common as individual effort and neighbourly assistance sufficed to put them up.



Hanging upside down! Nepal

The longer spans were more challenging. The first crossings to span wider rivers came in the form of twine and reed (grass) crossings, community built, still used in the remotest regions of Nepal – a hair raising risky contraption only the boldest and the bravest could venture across. Made entirely of grass and fibres, these rope crossings decomposed and had to be re-erected from scratch, time and again.



Bamboo and wood contraption, Nepal

Dugout boats are used in Nepal at certain places for crossing big rivers for 7 to 8 months in the dry season. In



Dugout boats operate only in the dry season, Nepal

the wet season the current is too strong for the dugout boats to operate.

Then came iron and with it iron chains, some crafted so skilfully that the link joints are not readily visible. Tibetans even nicknamed saint Thangton Gyelpo as the 'Iron Bridge Builder' for his ability and zeal to build iron chain bridges to alleviate the suffering of the people.

Iron chain bridges are more sturdy crossings with single/double plank walkways hung on suspenders hooked to two not exactly parallel chains fastened to dry stone masonry blocks on either bank of a river. The chains took a long time to fabricate, the bridge was costlier, often swayed dizzily but was more safe and durable and served entire communities around the clock. The skills were replicated in many parts in both countries but got lost over time.



Takes an eternity to cross this one! Reed bridge, Nepal.



Thangton Gyelpo - The Tibetan Saint known as the Iron Bridge Builder

With the advent of wire ropes, at places, wider rivers were spanned by a single/double wire rope twine contraption. On the line so stretched, various types of hooks, pulleys and strapping were used to secure a crossing. The twine contraption, though, in no way matches the utility and convenience of a bridge.

From time immemorial, bridge building was considered an act of piety, of social service and recognition as it eased much suffering of all the people within its ambit of influence. Short span bridges began to be built locally, using locally available materials, by the rich and the poor, dedicated to 'heavenly' ancestors, children and kin. Many such bridges still stand and serve pedestrians. As such, both Nepal and Bhutan have a long tradition of building pedestrian trail bridges.



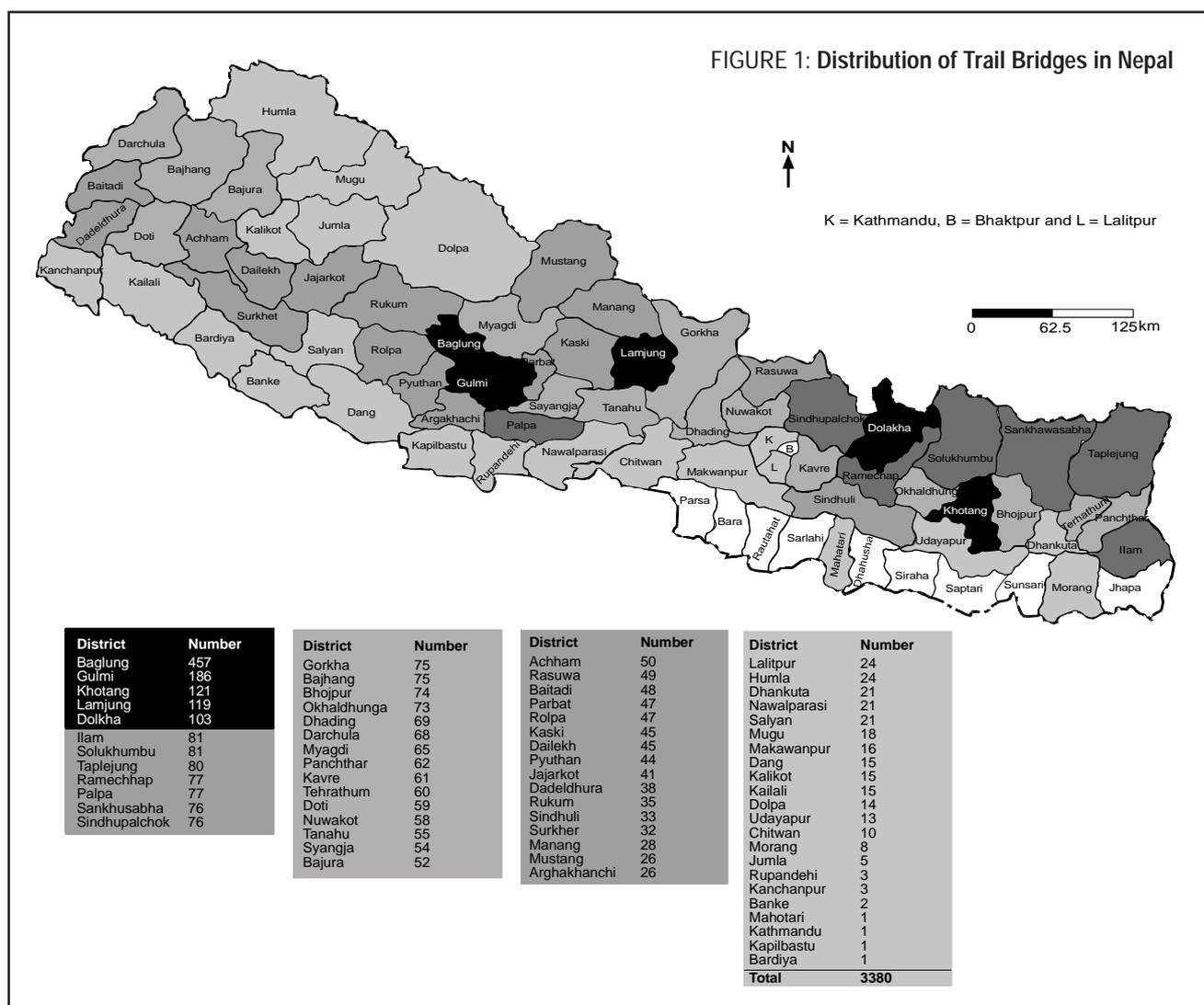
A traditional Bazaam bridge - roofed wooden cantilever bridge, Bhutan

NEPAL CHAPTER

Political and Institutional Context

A decade long political conflict that in the previous half disturbed and in the later half disrupted the functioning of elected bodies and local governance has recently been put to rest with the signing of a peace treaty between the government and the Maoists. They now visualize elections to a constitutional assembly that will promulgate an altogether new constitution for the country.

Although the Maoist insurgency has hardly affected the Trail Bridge Sub-Sector Project (TBSSP) activities, the consequences of the conflict can be clearly seen at the process, programme and institutional levels in that formulated policies and processes could not be properly institutionalised at the local level or were greatly hampered. During the present impasse, though bridge building activities are not likely to be hampered, institutionalising exercises will have to wait till such times when new elected bodies and corresponding local governments are formed under the new constitution.



Through Helvetas, the Swiss Government has been supporting trail bridge building since 1972. In 2000, the trail bridge sub-sector was organized under the institutional umbrella of the permanent Trail Bridge Section (TBS) within the Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR). The change from a project approach to a sub-sector approach with the consequent decentralisation of all operational bridge building activities to the district level represents the main institutional feature. Typically, central-level TBS functions include policy making, planning, monitoring and capacity building. At the local level, district technical offices are the focal points for planning, construction and maintenance of infrastructures, including trail bridges. As such, they are the main partners at the operational level.

Over the years, planning, design and construction procedures have been standardized to a high degree and impressive tools for strategic planning and decision-making have been developed. Whilst Long Span Trail Bridge (LSTB) building has largely been privatised, Short Span Trail Bridges (SSTB) are being implemented through the Bridge Building at the Local Level (BLL) approach – successfully combining a process with a product through substantial community participation.

Under the sub-sector arrangement, TBSSP combines Helvetas' previous Suspension Bridge Project and the BLL programme. TBSSP has become the main player in the bridge building sub-sector of Nepal, combining technical excellence with social competence.

Transport Infrastructure Settings

The mountains and the hills together comprise 80% of Nepal's landmass where the majority of the population live. However, initial construction costs, technical ease of construction and maintenance may have dictated planners to confine the only East West (EW) highway of the country to the southernmost plains that comprise but 20% of the land and pass through only 20 of the 75 districts of the country.

This singular feature of transport infrastructure dictates the length of all the North-South (NS) feeder roads and trails that branch out of/converge on to the EW highway linking valleys and settlement clusters that dot the hills and the mountains. In the hills and mountains of Nepal, to reach a destination parallel on the EW axis, vehicular traffic need first to travel South, then along the EW highway and then North again. The distances of the NS highways are long, winding and operationally very costly. Besides, they are few and far in-between. Therefore, mobility among the numerous rural centres and settlements North of the EW highway needs separate networks of transport links from centre to centre, to villages, to remote settlements and to the feeder roads. Innumerable pedestrian trails and mule tracks fulfil this need.

Trails and tracks sprint across hills and mountains, atop ridges, steep climbs and descents and across and along numerous rivers and rivulets as the only means of access. Yet geographical features of the Himalayas dictate to make detours of several hours to evade insurmountable obstacles - the most uncompromising of them all being a boulder strewn Himalayan river foaming in full flow. Therefore the voluminous need and demand in Nepal for sturdy, durable, convenient crossings that save lives, shortcut detours and ensure all time access.

Modern Trail Bridge Building

Aberdeen, Scotland merits first introduction of modern trail suspension bridges in Nepal. In the early 20th century, some 29 ‘Scottish’ bridges were built at important trade and administrative routes – one-of-a-kind, but a drop in the ocean!

The Americans launched the first pedestrian trail bridge building plan through United States Operation Mission (USOM) in 1958. From 1960 to 1964 Swiss (Helvetas) engineers worked in collaboration with the Americans but outside the government programme. In 1964, the government established the Suspension Bridge Division (SBD). Steel wire rope imports replaced iron chains. Bridge building got elevated to planned development intervention by the centre. The nature of USAID support to Nepal began to shift and with the re-introduction of the Swiss, the Americans phased out.



Bridge from Aberdeen, Scotland

Enter Helvetas Nepal

Helvetas Nepal re-started its involvement in 1972 with support from the Swiss Agency for Development and Co-operation (SDC). With this involvement, pedestrian trail bridge building in Nepal, which till then crawled *ad hoc* on a piecemeal basis, took on the form of an institutionalised development activity to be sustained into the future. Helvetas’ engagement from the 1970s to date can be broadly categorized into three distinct epochs of multiple dimensions that evolved through on the job learning - one lapsing into the next, i.e. the central, the community and the trail bridge sub-sector approaches.



Copper plaque at Tawa bridge entrance.

A. The Central Approach

A.1 In the Beginning

In the 1960s the unitary Panchayat polity held sway in the land. Development activities throughout the country was propounded, planned and executed by the centre.

Helvetas Nepal’s initial engagement in SBD began by accumulating know-how and setting up of technical norms and standards alongside improving and strengthening the institutional set up of SBD for administering and carrying out trail bridge building activities throughout the country.

A.2 Organisational Set up and Implementation Processes

Up to five Swiss technical experts, each responsible for one development region and one among them responsible for project co-management, staffed SBD as counterparts of a government project manager, a team of engineers and site in-charges, draftspersons, administrative and accounting staff.

Besides, on the policy and management front, Helvetas provided for several 'backstopping' missions to keep the project on track and to strengthen the institutional capacities of SBD. The backstopping missions introduced new concepts and undertakings, developed new approaches and strategies that not only helped to make administrative reforms but to give the project an altogether new dimension.



A stay cable bridge built in the early years of co-operation

Helvetas co-ordinated for providing massive technical inputs by way of geological expertise and training, structural analysis of designs, training on the use of blasting materials, development of various technical forms, formats and cost-estimates for streamlining administrative processes. Renowned Swiss experts were invited to provide training and to prepare corresponding manuals.

Helvetas introduced a system of allowances for government technical personnel doing survey, design and drawings of the bridges based on points for work performance. This system of 'topping up' was at best controversial with the non-technical personnel feeling completely left out and the technical personnel feeling 'inferior' when their points were deducted by Helvetas staff in case of sub-standard performance. The system was not sustainable and was later abandoned; compensated by granting of scholarships for higher education.

Request for bridges from village, district administration and various other sources were filtered through and handed down to SBD by the patron Ministry and Department for inclusion in the yearly programme.

A single bridge taken up in the programme entered a three year cycle - the first year for survey, design and drawings; the second for tendering and fabrication of steel parts and the third for civil construction.

Steel angles and channels were once imported all the way from Japan; later from India. Steel fabricators needed to be hand-taught for fabricating steel parts. Steel parts on erected bridges received a coat of red oxide primer and a double coat of enamel paint for rust prevention.

Wooden walkway decks spanned the length of the bridges. In the tropics where strong, robust *Sal* wood was available and used according to specifications, the planks lasted for about 5 to 7 years. Timber of other varieties needed replacement every two to three years.

The centre administered and managed a wire rope store and five regional stores each crammed with steel parts, tools, equipments, cement etc. Transportation to the bridge sites were managed and paid by the centre.

Petty labour contractors carried out civil construction work but all construction materials and tools were provided by the centre except those available at the bridge site (boulders, sand, stones). A civil overseer, an accountant and a bridge technician (fitter) on SBD's payroll camped at the bridge site to supervise construction and payments. All logistics for them including kerosene lanterns and sleeping bags were provided by the centre.

There was no people's participation - neither in the decision-making processes nor in construction. Bridges after completion were not handed over to any specific authority for care and maintenance.

A.3 Experiences and Learning

With respect to project administration, management and logistics, the processes and accompanying documentation had to be developed from scratch. Whereas project specific procedural and documentation could be regularized to some extent, rigid government rules and regulations, low compensation, facilities and benefits, frequent staff turnover and above all the red-tape fiscal administration did not allow the desired flexibility to cope with a project of this nature.

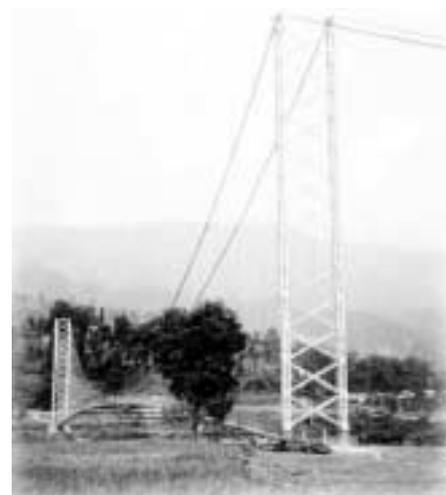
Relatively, the civil construction part was fraught with problems - basically emanating from the inability of the overseer, accountant, bridge technician and contractor to be at the bridge site at one and the same time. Various irregularities, unwarranted delays, unsettled advances, additional work, and poor quality work performance surfaced as regular issues.

Apart from development of some official amenities and facilities, efforts at institutional capacity building for an efficient fiscal and civil administration within the SBD met with little success because SBD needed to conform to the overall government bureaucracy that allowed very little flexibility. It was not conceivable for a single project to effect major changes in the overall civil and fiscal system of governance.

In the beginning, it was all too time consuming and expensive – about US \$ 800 per meter. The output was a mere 5 to 10 bridges a year.

Improvements in technology, tendering, fabrication, bulk procurement and civil contract modalities increased output and lowered costs. In the mid 1980s, SBD had the capacity to allot 5 bridges to each of the 5 development regions – a count of 25 new bridges a year plus rehabilitation and major maintenance work on another 5 to 8 bridges. The costs could be reduced to US \$ 500 per meter span.

The central approach established SBD as a bridge **'producing'** organisation. It built robust, sturdy bridges free of cost from the point of view of the local inhabitants and politicians. And was soon over-flooded with bridge demands running into the thousands!



The Madan-Ashrit bridge (Jugedi) is the longest suspension bridge (span 271 m)

A.4 Adaptation to Learning - Building Blocks of Decentralisation

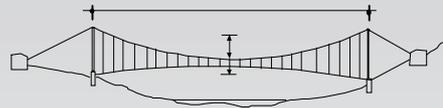
The volume and the *intensity* of demand for bridges is the single most important factor that reverberated in multiple changes in the trail bridge sector in terms of technology, planning tools and implementation modalities - all geared towards a decentralized approach. The building blocks of decentralisation were cast and progresses made in the respective fields are listed below.

A.4.1 Bridge Types, Technical Norms, Standards and Manuals

The volume of demand for bridges, not in the tens or hundreds, but in the thousands dictated the need to fix uniform technical norms and standards for engineering, fabrication and civil construction work that would help to mass produce the end product and reap benefits from cost effective design and economies of scale.

Suspension Bridge

The walkway of a suspension bridge hangs on vertical cables hung from the main cables stretched between lattice



Khaniya Ghat bridge Baglung

towers built on opposite banks of a river. On each bank the cable is anchored to a rocky wall if one is available or to a masonry block. The walkway is generally cambered upwards. To design and construct a suspension bridge requires higher degree of expertise and it costs more than a suspended bridge.

After several experiments and tests of different possible designs, SBD developed the basic technical norms, design parameters and standard designs for the suspension and suspended type of bridges suitable for mountainous terrain and the need of the users taking into consideration the capacity of the local workshops and fabricators, local craft persons and portaging requirements along difficult trails and terrain.

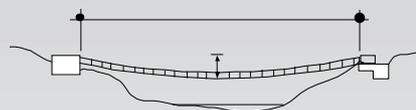
In 1984 the first pedestrian Trail Bridge Manuals known as “SBD Standards” were published in five volumes one each for Survey, Design, Construction, Standard Bridge Drawings and Costing and Contracting. Bridges built using these standard designs were called ‘hi-tech’ bridges.

With the advent of community involvement in bridge building, the demand for simpler ‘community executable bridges’ on local trails rose tremendously. Experience established that the robust SBD standard bridges designed to span wider rivers were neither necessary, nor cost effective, nor within the capacity of local communities to build.

In the 1990s Helvetas Nepal developed a ‘community executable’ bridge design inspired by the traditional ‘Baglung bridges’. This new design, known as “BLL Standard” focused on optimising the use of local skills and local materials while fulfilling all the engineering requirements in terms of durability and serviceability.

Suspended Bridge

This type of trail bridge is built without towers. The walkway of the bridge hangs on suspenders attached to the main



To achieve sufficient freeboard, the bridge foundations need to be placed at a sufficiently high position at both banks of the river. The suspended type bridge is more simple to construct and cheaper than the suspension type and therefore are to be found in large numbers throughout the country.



The longest suspended bridge (span 350 m) is in Khotang District at Bunwajor Ghat II over Sunkoshi River

A.4.1.1 Technical Demarcation: SSTB - LSTB

Based on the BLLL technology, an even more cost effective, technologically simpler SSTB standard was developed for bridges up to a span of 120 meters to cater to the voluminous demand for short span bridges on local trails that mostly, but not always, spanned seasonal streams and rivulets.

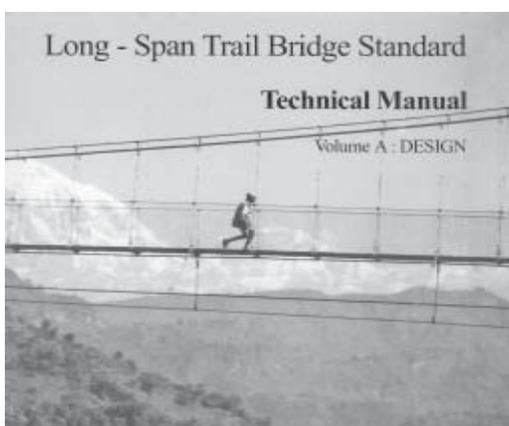
The rationale for the cut off mark of 120 meters is based on span requirements of community bridges, safety considerations, local capacities and optimum use of local materials and skills. Both SSTB and LSTB follow the same engineering norms and standards but the SSTB designs are more simplified to suit local needs, capacities and limitations. SSTBs are more easily fabricated, transported, constructed and fitted at site, thus saving costs and time. Costing about US \$ 175 per meter span, SSTBs are more than 50% cheaper than LSTBs.

SSTB Manuals are published in three volumes. What were known as 'BLLL standard' bridges are now called SSTBs. SSTBs are designed for construction through the "community approach".

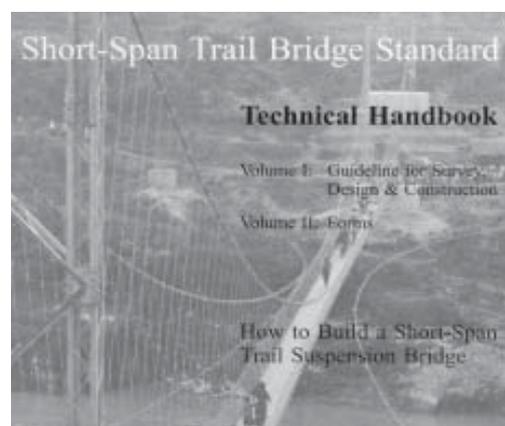
Experience gained during the development of the SSTB standard was also put to use for revising the SBD technology for LSTBs above 120 meter span and published in four volumes as LSTB Manuals. What were known as 'SBD standard' bridges are now called LSTBs. LSTBs are designed for construction through the private sector.

Both SSTB and LSTB manuals are tailored towards three kinds of professionals notably engineers, overseers, and sub-overseers. In addition, handbooks and manuals are also developed for Demonstration Model Bridge Training (DMBT) to train local bridge craft-persons. All these manuals facilitated the technology transfer of trail bridge building.

Simplification and standardisation of bridge technology saved much time for designing, drawing, fabricating, constructing and maintaining bridges. It led to bulk import of wire ropes, mass production of pre-fabricated steel components and bulk procurement of small construction items and tools, which due to economies of scale, reduced per unit costs. Standardisation very much helped to involve with ease local institutions and the private sector in the process of decentralising the technological aspects of trail bridge building.



The LSTB Manual



The SSTB Manual

A.4.1.2 Steel Walkway Deck and Galvanisation of Steel Parts

The weakest components of the early bridges were the wooden walkway deck and rust prevention work that necessitated periodic major maintenance work. Except for *Sal* wood, timber of other varieties did not last in the open for more than two to three years at the most. Dwindling forests, strict forest rules and rising costs of timber left gaping holes on the walkway decks risking life and limb of the users. Whereas a single tree or two served as log crossings for a couple of years, dozens of trees needed to be felled for changing a set of wooden decks every couple of years. Wooden walkway decks proved uneconomical and detrimental to the forest environment.

TABLE 1		Types of Pedestrian Bridges	
Span (m)	Type		
< 32	Steel Truss Bridge (ST)		
32 to 120	Short Span Trail Bridge (SSTB)		
> 120	Long Span Trail Bridge (LSTB)		

TABLE 2		Total Bridges Built	
LSTB	213	Suspension	521
SSTB	3,167	Suspended	2,483
Total	3,380	Steel Truss	140
		Other Types	236
		Total	3,380

Due to shortcomings in workmanship and quality of primer and paints used, rust sets in, in no time, weakening the bridge and giving it an unpleasant look. Wooden walkway decks and enamel painting meant high frequency of major maintenance and repair needs. There is no regulatory time table for maintenance nor budget provisions at the local level. Wooden deck replacement and a new coat of paint had to wait for decades till the bridge was taken up for total rehabilitation by the centre.

To do away with these shortcomings, Helvetas Nepal introduced galvanisation of all steel parts and steel walkway decks in 1995. Other bridge builders immediately replicated the good example! As and when worn wooden decks needed replacement, old bridges were retrofitted with shining galvanized walkway decks.

Galvanisation and steel walkway decks made trail bridges virtually maintenance-free except for routine maintenance tasks like tightening of nuts and bolts, fixing loose wire mesh netting, removing vegetation and debris from structures, steel parts and drains. It did away with bigger maintenance efforts that loomed as a heavy burden and an entirely separate undertaking.



Wooden walkway deck need changing every three to four years. Galvanized steel walkway deck is relatively 'maintenance-free'

A.4.2 Institutionalised Capacity Building and Knowledge Dissemination

Pedestrian trail bridge building requires specific engineering norms, design parameters and is not part of the standard course in civil engineering. Degree level scholarships at western universities in geology, structural engineering and construction management awarded to government engineers boosted the capacity of SBD engineers. By the mid 1990s they could accomplish their technical and project implementation responsibilities independently.

But accredited government technicians alone are not sufficient to fulfil the human resource need of the trail bridge sector. Capacity building needed to be institutionalised within the academic institutions of the country. Helvetas Nepal supported the Institute of Engineering (IoE) to introduce and run a trail bridge building course as an elective subject at the Bachelor of Civil Engineering level. About 30 students take the six-month long course annually of whom five/six students get the opportunity to take up project work.

Now there are 31 institutes (2 universities, 5 colleges and 24 vocational schools) imparting the know how through dedicated courses to practitioners of local governments, civic organisations and private sectors. These courses have been running for two years and about 300 such professionals are trained. It is envisaged that after another four years the practitioners in all 75 districts can be capacitated. Besides, the project has also imparted DMBT to more than 1,800 community members.

A.4.3 Strategic Planning and Decision Making

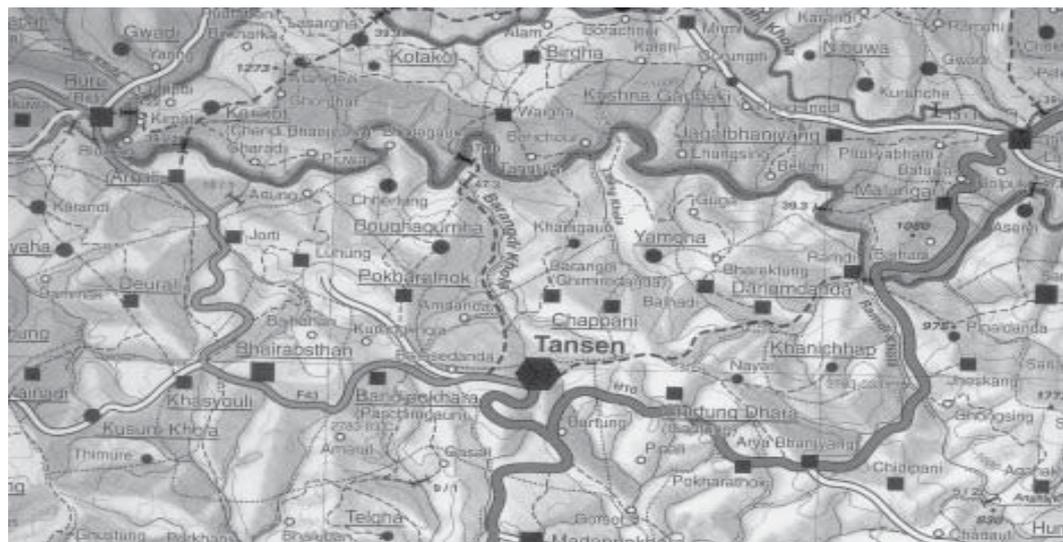
A.4.3.1 Main Trail Study and Transport Infrastructure Maps (TIMs)

SBD faced the problem of prioritising the bridge requests and realised the need for a strategic planning tool for promoting balanced growth and for avoiding bridges at vested locations.

At the planning level there existed very little information on the trail network of the country. Therefore as an important auxiliary to the main task of building bridges, in 1985 Helvetas undertook to conduct an extensive countrywide survey to identify the trail network of Nepal based on the principle of 'central places'. The study categorized 'central places' based on administrative units, population and the 'level' of 12 different types of central services available at a particular place. 'Central Places' were graded by a weighted point system and trails linking important central places were categorized as 'main trails'. Trails linking places of lesser importance were categorized as 'local trails'.

The study produced a set of district-wise Main Trail Maps and Service Centre Maps. These maps classified foot trails as **main trails** and **local trails** in view of their utility and the importance of the places they linked. River crossings on the identified main trails were automatically considered feasible for a central bridge. Bridges that did not fall on the main trails needed to pass a set of predefined socio-economic criteria thus ensuring that the envisaged bridge is a sound investment.

The Main Trail Maps (MTMs) and Central Service Maps (CSMs) were the first of its kind in Nepal. It was an acclaimed achievement of Helvetas Nepal. Besides SBD, it was widely used by development projects at all levels, cartographers and by the National Planning Commission.



Portion of Transport Infrastructure Map

With the passage of time due to the expansion of road networks, settlements and markets, re-location and or upgrading of central services, the trail network alignments and their importance kept changing. As a continuation of the Main Trail Study, based on requests from the districts, several piecemeal follow-up investigations, often trail specific or area specific, were carried out from time to time to assess the status of the local trails. Based on the set criteria of central places several trails previously designated as 'local' trails were upgraded to 'main' trails.

The Main Trail Study and the maps provide twin perspectives for the trail bridge programme – with regard to the Centre (SBD), for strategic planning emphasising on balanced growth and with regard to BBL, for supporting the community bridge programme. The several bridge requests from the districts could be verified in importance and prioritized against the backdrop of the MTS and the maps. Political pressures for 'central' bridges on 'local' trails could be logically diffused. The MTS was instrumental in shifting the focus of central planning (SBD) towards the most remote and least developed mid and far-western regions of the country.

The digitised and elaborated version of MTMs/CSMs, are called the Transport Infrastructure Maps (TIMs). TIMs are made Geographical Information System (GIS) compatible to be integrated into the District Transport Master Plans (DTMPs).

Using TIMs, likely crossings along long local trails can be identified. This facilitates local governments to be more efficient on the allocation of available resources within a district and vigilant on the issues of balanced growth and equity.

A.4.3.2 Central Bridge Register, Planning and Monitoring Information System, Local Bridge Register, Nepal Trail Bridge Record

As the number of bridges increased, need for proper records to monitor their condition for maintenance/rehabilitation led to the development of a computerized software package called Central Bridge Register (CBR) & Planning and Monitoring Information System (PMIS). It records all data of bridges from identification of sites to completion of construction and maintenance work and up-dated bridge condition with

photographic records. Each district maintains a Local Bridge Register (LBR) for community built bridges. Records from all districts on main trail and local trail bridges are compiled into a Nepal Trail Bridge Record (NTBR).

The TIMs, CBR, PMIS and NTBR combined allow logical and systematic planning at both the macro and micro levels. It enables the District Development Committees (DDCs) to keep track of the existing bridges and to fix the probable location of new ones in the mid and long term plans. Such plans form the basis for the DDCs to secure funds from central, local and/or foreign (donor) sources. With the help of these tools, selecting and prioritising bridges became a matter of consensus rather than conflict. It greatly helped to decentralize the planning and prioritising process and achieve balanced growth and equity.

A.4.4 Privatisation

Decentralisation walks wearing the shoes of privatisation. Political decentralisation alone makes little sense if the local bodies have to depend on the centre for skilled manpower, materials, tools, equipment etc. Development of required skills, capacities and products in the private sector is a pre-condition for local bodies to 'act out' decentralisation in practice. Trail bridge building and management basically comprises of four facets – engineering, fabrication, construction and maintenance.

A.4.4.1 Engineering

Helvetas Nepal's efforts at institutionalised capacity development for knowledge dissemination, regular conducting of training programmes for private sector professionals and publication of the standard bridge manuals have all contributed to capacitate private engineering firms for carrying out survey, design and supervision work of pedestrian trail bridges.

A.4.4.2 Steel parts Fabrication

Fabrication of steel parts within the country began with the establishment of the Balaju Yantra Shala (BYS) mechanized workshop and the Mechanical Training Centre (MTC), both with Swiss support. With chain effect, other new workshops began to emerge, at first run by former BYS staff.

Inspired by the trail bridge programme, workshops were established outside the capital including the least developed mid and far western regions. For many of the more than 30 established workshops throughout the country, the trail bridge programme was the platform to launch their businesses. The project provided input for their capacity building, especially relating to quality management and productivity.

A.4.4.3 Civil Construction

From the very beginning, construction works were carried out through private contractors. Different modalities of construction contracts were initiated, tested and modified before settling for the Construction Turn-Key Package (CTP) as the most suitable for civil contract work.



Steel parts being galvanized

The CTP approach avoided the cumbersome management of logistics vastly complicated by red tape bureaucracy. A one time pre-negotiated contract followed by periodic progress and quality monitoring saved much paperwork, time and effort. It allowed for a more efficient and lean institution.

Helvetas Nepal's incessant efforts at capacitating the private sector through knowledge dissemination and skill training to engineering consultants, fabrication workshop and civil construction firms has yielded in a competent and competitive private sector in all facets. The emphasis on simple standard designs also facilitated the process. Anyone wanting to build a trail bridge in Nepal can now avail of competent professional services in the private sector in all facets.

A.4.5 Maintenance

The initial steps at decentralisation began when SBD provided funds and technical support to the DDCs to carry out maintenance work. Maintenance was categorized into routine, minor and major maintenance. The concept of Bridge Warden, one for each bridge, was initiated to ensure routine maintenance of bridges built by the centre. Tools and training were provided by SBD and supervision and remuneration by the DDCs.

In the case of community bridges, maintenance is entrusted to a Bridge Maintenance Committee (BMC) formed at the community level after completion of the bridge. The community maintains the bridges with tools provided during construction and enlisting skills imparted during the DMBT training to local craft persons. Examples abound of private charities, local professional organisations, DDCs and Village Development Committees (VDCs) contributing for routine, minor and even major maintenance (e.g. changing of wooden walkway decks) with support of DMBT trained craft persons.



Major maintenance work: wooden decks of old bridges are replaced with steel decks

With the advent of steel walkway decks and galvanisation of all steel parts, the need for periodic major maintenance has been effectively abolished. Major maintenance needs to be carried out only in case of structural damage to the bridge due to floods or landslides.

However, though the provisions and the capacities are there, at a majority of bridge sites, routine maintenance is not carried out satisfactorily. The responsibility and 'will' factors are amiss. An awareness programme and follow up by local authorities and Non-Government Organisations (NGOs) / civil society is required to ensure routine maintenance. Major maintenance or rehabilitation when required is processed akin to new bridge construction.

A.5 Decentralisation

A.5.1 Political Decentralisation

Technological innovation, institutionalised capacity building and human resource development accentuating privatisation in an open market as building block of decentralisation can make desirable and decisive impact only if political decentralisation also moves alongside. As such, political decentralisation is also a building block of the overall decentralisation package.

Politically, initial steps towards decentralisation began when the then Panchayat government initiated the Decentralisation Act and Regulations in the early 1980s. The concept of decentralisation underwent many revisions within the framework of the unitary Panchayat polity. 'People's participation' was echoed for 'decentralisation' and 'participation', by and large, was considered to be synonymous with the contribution of labour, in many cases voluntarily, but in some cases through coercion.

The pace of change gathered speed after 1990, when the peoples' movement re-introduced the multiparty democracy. Nine years later the Local Self Governance Act (LSGA) was passed. The objective of the LSGA is to devolve power to local bodies, making them responsible and accountable by building their leadership and capacities. One major change that developed over a decade long exercise in multiparty politics is that decentralisation now no more meant mere free labour participation. It now meant 'no free labour' but decision making duties and responsibilities of the people and the people whom they elect for Self Governance.

The community approach to bridge building was implemented by Helvetas long before the LSGA came into effect. This bottom up strategy *compelled* local politicians and authorities to abide by the demands of the people and to contribute resources for the purpose. This process of decentralisation coupled to a rolling planning budgetary mechanism and technological innovation on the part of the programme, resulted in the making of plus 200 bridges per year as compared to the 20 / 25 bridges that could be built annually through the central approach. The bridge prioritisation process follows the basic tenets of the LSGA and is essentially a **political** process. The prioritisation criteria of the Trail Bridge Strategy help to diffuse the '*power play*' of politics to ensure a justified and balanced prioritisation.

The community bridge programme of Helvetas, with its emphasis on *mandatory* inclusion of the marginalized ethnic, *dalits* and womenfolk in decision making and by virtue of the programme reaching out to the remotest corners of the country, played a significant role in generating country-wide awareness and a sense of belonging among them. The hitherto voiceless could now hear their voices echoed in matters concerning their life and livelihoods.

In remote areas, the bridge programme was often the first development interaction with government administration, authority and outsiders for the isolated and socially downtrodden ethnic and *dalit* communities. The processes learned by the communities through the social organisational support accorded during the community bridge programme was successfully replicated for other local infrastructure and social development programmes. Development intervention from outside as such, not only developed infrastructures, amenities and comforts but also raised socio-political awareness among the communities for inclusive representation, balanced growth

and equity. It is to be believed that having found their footing, the people will continue to actively participate in all pertinent matters for a more vibrant exercise in freedom and democracy.

A.5.2 Initial Steps at Decentralisation of Trail Bridge Building

On more practical turf, initial steps at decentralising trail bridge activities began in the early 1990s when SBD provided funds and delegated routine maintenance responsibilities of main trail bridges to the DDCs. People selected by local bodies were oriented/trained and involved in routine maintenance. The concept of Bridge Wardens was introduced and tools required for routine maintenance were provided.

In a next step, SBD delegated major maintenance works to DDCs who executed the work, if required, with technical support from SBD. Costs were shared jointly. Main trail bridges were handed over to the DDCs after completion of major maintenance.

From mid 1990s, DDCs became responsible for constructing main trail bridges under the "District Co-ordinated" approach. Costs were shared jointly by the DDC and SBD. No new bridge construction is planned by SBD from fiscal year 2005/06. Main trail bridge construction today is totally decentralized to the DDCs.

B. The Community Approach

Nepal's scattered settlements do not cling alongside main trails only. Branching out from the main trails, gravelled roads and highways are numerous local trails that are breached at several places by perennial and non-perennial rivers and rivulets. Whereas main trails pertain access more to trading routes and administrative centres and services, local trails for its share pertain access more to agricultural land, water sources, neighbours, primary school, teashops and weekly market centres – in fact, access to the day to day existential needs of the people.



Drinking water is across the bridge!

The huge demand for bridges on local trails and the limited capacities at the centre necessitated an innovative approach to bridge building that would expedite construction of as many bridges as possible in the shortest possible time at minimum possible costs and make all of these a sustainable reality. The only and obvious option was to empower and capacitate on the spot local people – the true beneficiaries. The BLL programme was born!

Helvetas Nepal launched BLL as a pilot project in 1989 for testing various working modalities, support packages, approaches and the procedures of co-operation with the communities. The BLL programme, from the very beginning, institutionalised a decentralized approach to bridge building that involved the community long before the LSGA was promulgated. BLL dealt

directly with the communities shaped into User Committees (UCs) and therefore the BLL programme was also popularly known as the Community Bridge Programme.

BLL established branches in the Central, Western and Eastern development regions in 1994 during the pilot phase. A branch in the Far-Western region was established at the end of 1995.

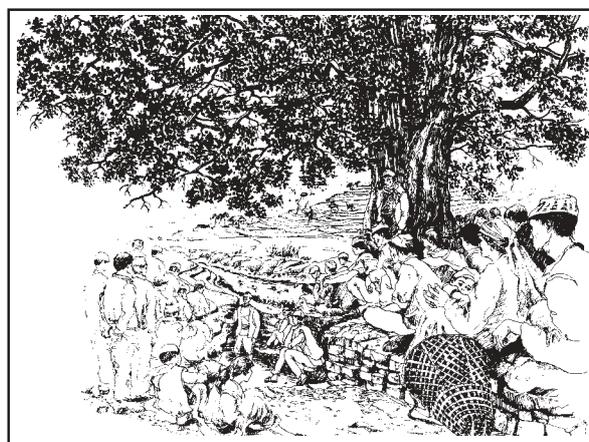
B.1 Organisational set up and Implementation Processes

Before the advent of modern wire rope bridges, Nepalese had been building wooden cantilever and iron chain bridges in numbers using indigenous technology developed from experience. BBLL pursued the strategies to support and reactivate people's problem solving ability for constructing trail bridges. The objective of BBLL was to enable communities to organize themselves to build modern wire rope bridges conforming to established norms and standards. BBLL never claimed itself to be a bridge building agency rather it presented itself as only a facilitator and supporting agency.

Communities requesting for bridges on local trails contact BBLL and in a first step a community gathering is organized to explain the steps of co-operation and the role and responsibilities of each stakeholder.

Once the community is ready to fulfil its share of commitment, a Users Committee (UC) is formed. The UC together with BBLL technicians ascertain the exact location of the bridge and a construction timetable is charted. A written agreement is signed and stamped.

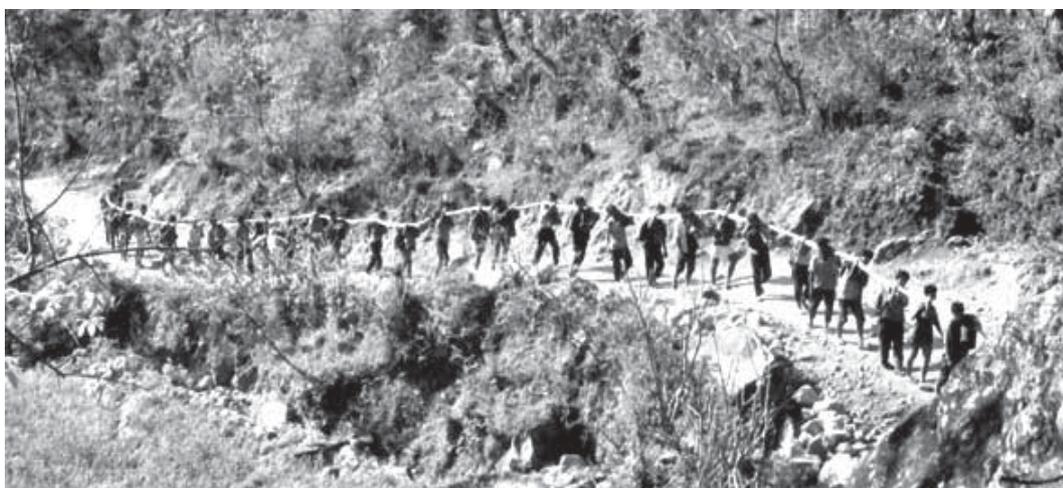
Following the agreement, UC selected beneficiaries are given a week long DMBT training that ends up in building a small model bridge, thus giving an ample preview of the technology, methods and processes involved in bridge building.



A typical community gathering!

Excavation for bridge foundation and collection of local construction materials is done by the UC whereupon BBLL transports the wire ropes, steel parts and tools to the nearest road head from where the UC carries them to the site.

BBLL procures wire ropes, steel parts and tools in bulk and has it stored at regional offices for easy delivery to the road heads.



Portaging wire rope is most difficult!

Civil construction and bridge erection is done by DMBT trainees with support of beneficiaries supervised by BBLL technicians at crucial stages of construction.

The bridge belongs to the community. On the day of inauguration, the UC sums up the details and the accounts in the presence of the community in a kind of public audit. A Bridge Maintenance Committee (BMC), emulating the UC, is formed and the remaining bridge parts and tools are handed over to the BMC.

BBLL adopted a rolling plan and budgeting mechanism to adapt to the uncertainties of demands and completion targets. Its response to community demands was limited only by its budget and/or field supervision capacity.

After an initial 3-year pilot period, BBLL entered into the implementation phase. Presently, the TBSSP regional offices are each lead by a regional co-ordinator, supported by a financial officer, a technical team comprising of 4/5 personnel, a social officer and support staff - in all 12 to 15 employees per regional office.

B.2 Experiences and Learning

Until mid 2001, SBD and BBLL were supporting trail bridges through two different approaches - SBD on main trails through the centre with the “contractor approach” and BBLL on the local trails under the ‘community approach’. Viewed from the community level, there is a stark difference. Often, communities aspiring to build a bridge on a local trail with their own resource inputs were thoroughly discouraged when next village neighbours close to main trails got a brand new robust bridge built by the centre virtually free of cost. The feeling of inequity hampered local initiatives.

Where options existed, the exact location of the bridge invited conflict among the beneficiaries and favoured the high caste upper echelons of the locality who dominated representation in the UC.

Free labour was never a concept advocated by the supporting agencies, but community participation essentially meant foundation excavation, local materials collection (sand, stone, boulders), portaging of wire ropes and bridge parts and helping technicians during construction, which in other words meant unskilled ‘free labour’ contributions.

Free labour was not as easily forthcoming when needed as when committed during a community meeting. In a settlement where a multiple of small infrastructure development activities is in progress at any one time, people hardly have time to attend to their agricultural and survival needs. Free labour contribution is a relatively inequitable taxation that weighs heaviest on the poor. Ownership and maintenance of a bridge more correlates with its ‘usefulness’ than the amount of actual ‘free labour input’ for the bridge.



The community at work - building their own bridge!

Working exclusively with the UCs had its drawbacks. For lack of authoritative legitimacy and retribution for non-commitment by individual beneficiaries, VDCs and DDCs, at a number of sites the UC chairman (or one

among the active members) ended up shouldering the whole burden of bridge building alone. In such cases, he often had to bear from his own purse for paying the free labour component that could not be mustered and other miscellaneous but, in sum, substantial costs. Mostly, but not always, poor quality bridges after long delays resulted at sites where these anomalies surfaced.

Through the BBL community approach, Helvetas Nepal took decentralisation to the very beneficiaries. For the existential need of a bridge, the people mobilized not just themselves, but *'pulled in'* the elected political leaders in the VDCs and DDCs to stand by their decisions and act on them. Beneficiaries organized into UCs could lobby and tap into the resources of the VDCs, DDCs and the Member of Parliament's development grant (MP's fund), to compensate for free labour and miscellaneous expenses. It was a truly bottom up approach and every bridge was an exercise in social cohesion and democracy. The beneficiaries replicated the BBL implementation model for executing small infrastructure work in other sectors as well.



Members of the 'all-women-users-committee' takes center stage on the bridge they built.

B.3 Adaptation to Experiences and Learning

In order to lend authoritative legitimacy for the local infrastructure undertaking, support UCs with budgetary and technical supervision and for institutionally sustaining bridge building and maintenance activities, it became imperative to involve local governments. Institutionalised roles for VDCs and DDCs were chalked out after several consultations with the stakeholders. The BBL approach essentially remained the same other than that VDCs and DDCs got more involved taking over the procedural tasks of BBL and providing funds to the UCs that were used for paying skilled labour and other miscellaneous expenses. The balance was distributed to free labour contributors.

Limited personnel capacities at the DDCs coupled with the advantages of the NGO approach created circumstances for DDCs to recruit the services of NGOs to fulfil their responsibilities pertaining to community bridge building. The DDC, on the basis of prescribed criteria, selects the NGO for assigning bridge building work on its behalf. NGOs extend social and technical support to the communities. Additionally, NGOs also support DDCs in preparing the bridge plan in an equitable manner. The involvement of NGOs keeps the local government lean. Local NGOs have also proved to be more conflict resistant and were in operation even at times of armed conflict.

The feeling of inequity arising out of the SBD contractor approach and BBL's community approach was neutralized when the two SDC supported projects were amalgamated into TBSSP and a technical demarcation and implementation modalities established between the LSTB and the SSTB based on the 120 meter mark. The TBSSP co-ordinates, supervises LSTB and SSTB bridge building by developing and supporting capacities at the central and district levels ensuring strict implementation modalities for the two types of bridges.

Social mobilisation was accorded due priority by reforming the steps of co-operation and establishing a social support mechanism compiled in the Social Organisational Support (SOS) Manual. Proportionate representation of all people, *dalits* and at least 30 percent women was made mandatory for UC formation.

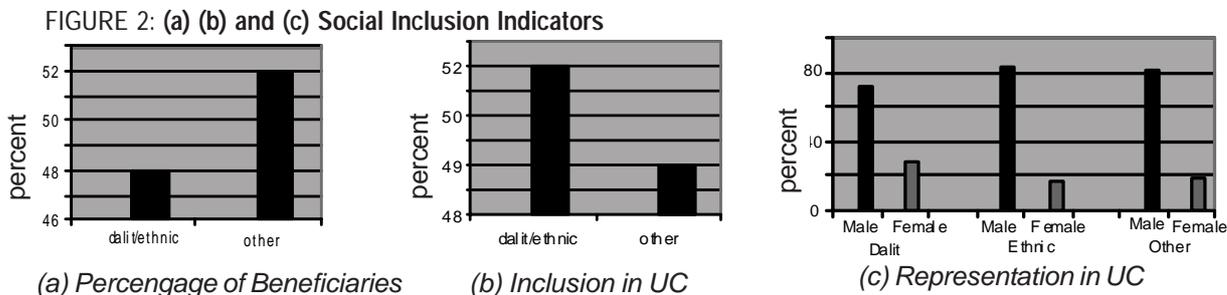


Figure 2 shows the ascending trend of *dalits* and ethnic communities in pedestrian trail bridge building. In an ethnically diverse country steeped in caste hierarchy, by virtue of social strata, the elite males dominate decision making. Ethnics, *dalits* and people of lower strata are marginalized leading to biases in favour of the elites. This not only hampered co-operation and participation from the lower castes but also aggravated social tension and disparity. The community approach to bridge building sought to neutralize elite male dominance by making *dalit*, ethnic and women representation *mandatory* in the UCs that they may have a fair say in decision making concerning their everyday life. Figure 2 (b) and (c) indicates an encouraging 52 percent inclusion of *dalits* and ethnic communities in bridge UCs - their female kind representing them on an average of 30 percent. An appraisal of the socio-political component of community bridge building states that every bridge is an exercise in democracy.

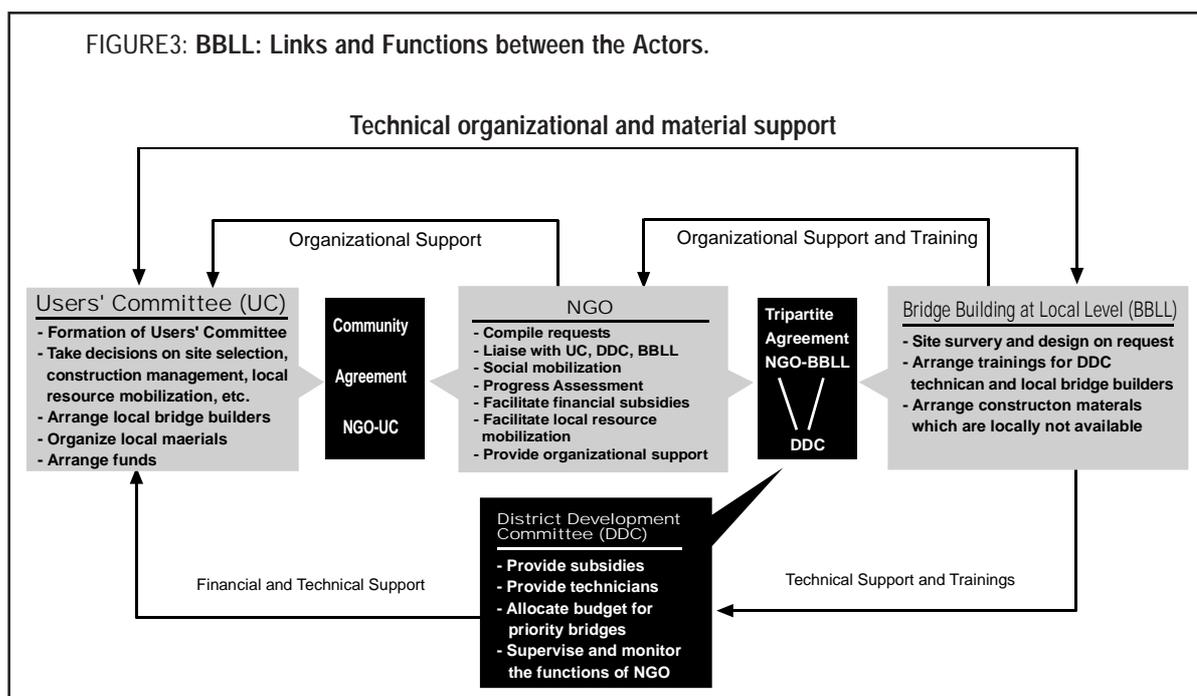
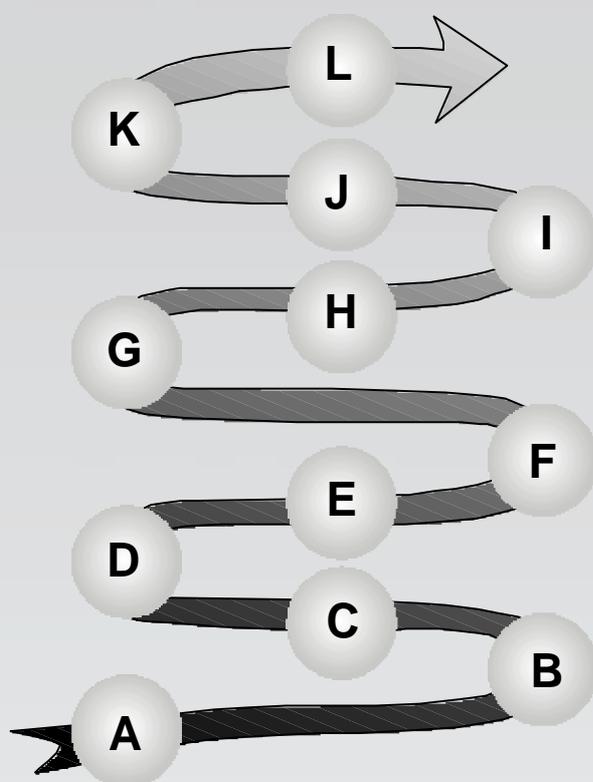
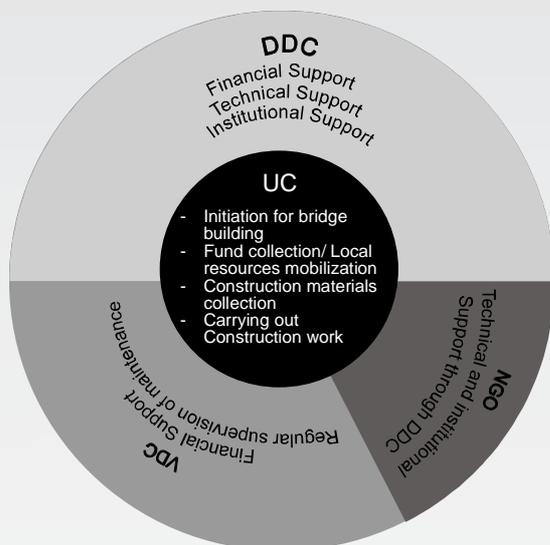


FIGURE 4: Step-wise Procedures/process of Community Bridge Construction



- A** A community takes the initiative to construct a bridge and submits its application to the DDC through the VDC.
- B** The DDC collects all requests and prepares a list of bridges to be constructed on the basis of a set priority. The list is then submitted to the District Council for approval. The Council discusses it and approves the request after making corrections (if necessary).
- C** Investment packages are prepared collectively by the DDC, VDC and a bridge Users' Committee (UC) on the basis of the DDC's community bridge summary form.
- D** The DDC prioritises the lists of bridges that are to be built. Background information about each community is attached to its request. A support agency may arrange to fund a proposal. The investment package will be reviewed by the VDC, the DDC, the UC and support agency.
- E** A UC is formed. Thirty percent of committee members must be women. The poor and the Dalit community must have proportional representation.
- F**
 - a) The DDC and NGO complete social assessment and conduct a detailed survey of the construction site.
 - b) The DDC and NGO check the site selected by the community and submit a report to the president of the UC. The DDC surveys, prepares design, drawings and cost estimates.
- G**
 - a) The UC collects the construction materials.
 - b) The DDC and NGO revise the design, drawings and cost estimates and approve it within one month after the detailed survey is completed.
- H** An agreement is made in the presence of representatives of the DDC, the VDC and the UC. The chairperson of the UC signs on behalf of the entire bridge users and representative of the DDC and the VDC sign the agreement on behalf of their respective offices.
- I** The UC digs the foundations of the bridge and collects all construction materials.
- J** The DDC and NGO hands over the request, locally unavailable materials to the UC at a road-head, from where the UC transports them to the site.
- K** The UC constructs the bridge. The DDC and NGO provide technical support and supervision. DDC monitors and supervises construction.
- L** After completion, a bridge maintenance committee is formed.

FIGURE 5: Role of Partners



An SOS component explaining procedures, methods and examples of social mobilisation is included in DMBT trainings to capacitate the beneficiaries both technically and socially,

TBSSP now implements community bridge building with a three dimensional support package, namely, Social Organisational Support (SOS), Technical Support and Material Support beyond the capacity of the communities.

The UC takes the lead role. The outsiders, viz, the project, NGO and local government personnel merely steer the processes to facilitate the UCs for keeping things moving ahead. The UCs make all decisions. Communities have a good deal of autonomy to undertake activities at their own pace.

Following the Trail Bridge Strategy, communities now submit their bridge requests to VDCs, from where they are forwarded to the District Council (DC) as per the procedures established in the LSGA. The DDC prioritises bridge requests following established criteria, allots funds and gets them approved by the DC for incorporation in the annual plan.

Simple and straightforward procedures are important elements of the programme. At the community level, trail bridge building came to be implemented not as a 'project' but as a 'social contract' among partners. Commitment, execution and reciprocity were the core ingredients of the 'social contract'. Execution of a set of pre-negotiated, pre-determined commitments by a partner obliged the other partner/s to reciprocate by executing their part of the commitment.



UN Habitat Best Practice Award

The initiative and the commitment of the immediate beneficiaries are at the core of the BBLL programme. Hence, from planning through construction to maintenance, users take the lead. In order to make this possible, the process is designed in a way that creates psychological ownership of the common good through social mobilisation.

With the involvement of UCs and partnership with the local bodies, community bridges are built in a cost effective manner. With SSTB technology and the community approach, the bridge costs could be reduced to US\$ 175 per meter and the output increased to a phenomenal 200 completed bridges a year!

This community programme is a widely accepted programme not only in Nepal but also outside the country. This programme was awarded the "Best Practice Award" in 2002 by the UN Commission for Habitat.

B.4 Conflict Sensitivity

In the 10 years of conflict that reigned in Nepal, about 20 trail bridges were either destroyed or severely damaged. On closer examination it is found that 19 of those were LSTBs facilitated by the centre and built by civil contractors. Only one community built SSTB was destroyed. It may be argued that by virtue of the LSTB's being built along main trails at militarily strategic locations they were targeted for destruction, but on the whole it also adequately highlights the conflict sensitivity and feeling of ownership of community built bridges.

The fact that community bridges are chosen and built with inclusive representation of the respective communities can be considered as the core reason for the conflict sensitivity of the bridges and the programme itself. TBSSP staff together with the local NGOs and the beneficiaries interacted with the insurgents at many sites and on many occasions where trail bridges were being planned and built, explaining the social processes, choices and contributions of the people. Inclusive participation in UC formation and decision making and transparency in execution were satisfactorily maintained. Many insurgents had themselves contributed to bridge building before joining the insurgency. They knew there were no strings attached to the community bridge programme of Helvetas and no funds channelled through authorities and political units. Besides, bridges are an existential need for the overall good of the people and not limited to the strategic advantages or disadvantages of the warring factions. All these factors combined imbued community bridges with a high degree of ownership and conflict sensitivity which do not accrue to bridges built by the centre with funds percolating through political units, authorities and contractors.



A LSTB bridge destroyed during the decade long conflict.

A rapid peace and conflict appraisal of TBSSP was carried out in early 2006 to assess the impact of the conflict situation and to identify ways and means for risk management. The appraisal recommended a two pillar strategy to diffuse the impact of the conflict on the project, which combined with the directives of SDC/Helvetas minimized the risk factor and lent continuity to bridge building activities albeit at a slower pace. However, absence of elected local bodies and weak local government stalled institutional development efforts at that level.

Funding mechanisms, sources and channels figured prominently as issues of contention. WB and Asian Development Bank (ADB) funds are loans channelled through the central government and DDCs and were, therefore, strongly resisted by the Maoists. Persistent efforts by TBSSP to diffuse this issue of contention ultimately resulted in the conversion of WB loans to grants. ADB's contribution still remains a loan. The funds continue to flow through government channels.

Box 1: Conflict Sensitivity

During the Bridge Condition Investigation conducted in 2003, one of the Bridge Maintenance Committee in Bajhang district reported:

“We saw a group of people gathered nearby our bridge. We thought they were going somewhere across the bridge. They did not move for about an hour. This made us curious to know their intention as to why they were staying over there. Through some of our neighbouring villagers, we came to know that the group was going to destroy our bridge. This message made us react quickly and some of us went to the bridge site. One of the persons from the group declared their decision to destroy the bridge”.

“In the meantime many villagers gathered around. We had a long debate on the importance of the bridge to us villagers. We also explained about our contribution for building the bridge, which we had been demanding since the last 20 years. Now that we have been able to construct it and you people are going to destroy it!”

Such effort on the part of the villagers saved the bridge. The group finally agreed not to destroy it, rather preached to keep it maintained for long term use.

C. Trail Bridge Sub-Sector Approach

Helvetas Nepal pioneered trail bridge building in Nepal and both SBD and BBL became established as central hubs for a number of other donor agencies who took up pedestrian trail bridge building as a part of, or as an *ad hoc* activity of their assistance for specific target populations or areas. All such donor agencies namely, USAID, World Bank (WB), ADB, DFID, SNV, GTZ, CARE Nepal, KHARDEP (UK), Kadoori Agricultural Aid Association (KAAA), in one way or another relied on the technical norms, standards, designs, drawings, planning tools, and in some cases even material support of Helvetas Nepal but implemented their programmes following their own planning, funding and implementation modalities.

TABLE 3 Trail bridge building agencies

Name	Programme	Nature
SBD	Construct and maintain bridges on main trails	Government
TBS/DoliDar	Local Trail Bridge Program	Government
Helvetas	TBSSP	INGO
KAAA BGN	Trail Bridge Program	INGO
CARE Nepal	Integrated Rural Development Programme	INGO
SNV Nepal	TBBP and KLDP	Netherlands Development Cooperation
RADC	Trail Bridges	Governmental Committee
DDCs/VDCs	Local Development	Local Government
USADP	Trail Bridges	Government
Others (GTZ/Gorkha Development Project, Redd Barna, USC Canada, ILO, Peace Corps, ACAP, Plan International, Red Cross and ActionAid)	Trail Bridges	I/NGOs

For reasons of duplication of effort, bridge construction at dubious locations, quality and cost differences of wire ropes and bridge parts, anomalies pertaining to implementation modalities coupled with concerns for spatial network planning compatible with other transport infrastructure and long term maintenance gave rise to the need for co-ordination at the centre.

The Government of Nepal formulated the Local Infrastructure Development Policy (LIDP) to translate the vision and spirit promulgated in the LSGA for the purpose of accelerating development at the local level. The LIDP identified seven sectors

under local infrastructure. Local Transportation is one among them. The trail bridge programme is a sub-sector of local transportation. The sub-sector approach as part and parcel of the overall LIDP lends support to the concept of self-dependence and sustainability irrespective of external agencies.

Having experienced the SBD central and the BBL community approach modalities, Helvetas Nepal with support from SDC amalgamated the synergies of both into the Trail Bridge Sub-Sector Project (TBSSP). TBSSP now supports construction of both LSTBs and SSTBs depending on the span of the crossing through established implementation modalities. Besides, TBSSP now encompasses a wider canvas – that of capacitating the TBS of DOLIDAR and the DDCs to plan, organise, implement and monitor this sub-sector by establishing the techniques and rules of engagement for all stakeholders.

TBSSP developed common policies and strategies into a binding national policy that accommodates all donor agencies engaged in this sector within the policy's ambit of technical norms, designs, standards and implementation modalities, so that communities building their own bridges would not feel any sense of inequity or unequal treatment. The sub-sector vision and rules of engagement for all stakeholders took shape in the form of a Trail Bridge Strategy.

C.1 Development of a National Policy: The Trail Bridge Strategy

The LSGA, 1999 and the Local Self-Governance Rules, 1999, together with the LIDP, 2004 devolves responsibilities for planning, implementing, operating, repairing and maintaining local infrastructure development programmes, previously operated by the central agencies, to the local bodies with the objective of making them more active, people-oriented and accountable under the local self-governance system.

In order to facilitate pragmatic decentralisation and avoid confusions and conflicts in a multi-donor, multi-stakeholder scenario, it became imperative to outline a national strategy for trail bridge construction. TBSSP supported the government to promulgate the Trail Bridge Strategy, 2006 that seeks not only to bring uniformity in technologies, standards, norms and specifications of bridges but also to ensure that all bridge builders follow a similar implementation approach. The strategies adopted for the trail bridge programme are:

- ⊙ To provide trail bridge facilities to the local people at convenient and feasible locations for their movement
- ⊙ To devolve the trail bridge programme to the local bodies
- ⊙ To select and use the right technologies for trail bridge construction
- ⊙ To adopt the right approaches for construction and maintenance of trail bridges
- ⊙ To enhance institutional capacities and development of trail bridge technology
- ⊙ To demark roles and responsibilities of all stakeholders

The strategy envisions trail bridges to be constructed at locations that would avoid the need for people to detour more than an hour to reach a safe crossing. Trail bridges are to be included in the DTMPs to lend perspective to equity and balanced growth. Trail bridge programme and resources are to be devolved from the central agencies to the local governments. On the basis of the grants to be made available by the centre, as well as their own internal resources, the local governments are to plan and implement construction, operation and regular and major maintenance of trail bridges.

Ownership of local trail bridges is to be vested in the concerned VDCs/Municipalities while ownership of main trail bridges is to be vested in the DDCs. The local body that owns the bridge is to be responsible for its maintenance. SSTBs are to be constructed under community approach and LSTBs under private contractor approach. NGOs are to be involved in community bridges for social and technical support.

The Trail Bridge Strategy serves as part of a national policy co-ordinating all trail bridge activities in the country. However, strategies have their drawbacks when it comes to enforcement. The Trail Bridge Strategy, with 16 procedural manuals at its core, can be elevated to a Code that is more binding. The technical manuals and handbooks that encompass 35 years of Helvetas Nepal's experience and form an integral part of the Trail Bridge Strategy/LIDP are listed in Annex-I.

C.2 Trail Bridge Sub-Sector Project: Changing Roles

With the building blocks of decentralisation now fully activated and the rules of engagement for every stakeholder clearly defined in the Trail Bridge Strategy, TBSSP's role as implementer and co-ordinator is lapsing into that of a facilitator for capacitating the centre and the DDCs to implement the Trail Bridge Strategy as co-ordinators, monitors and facilitators in their own right, for systematically channelling donor support into safe durable crossings at the right locations ensuring overall equity and balanced growth.

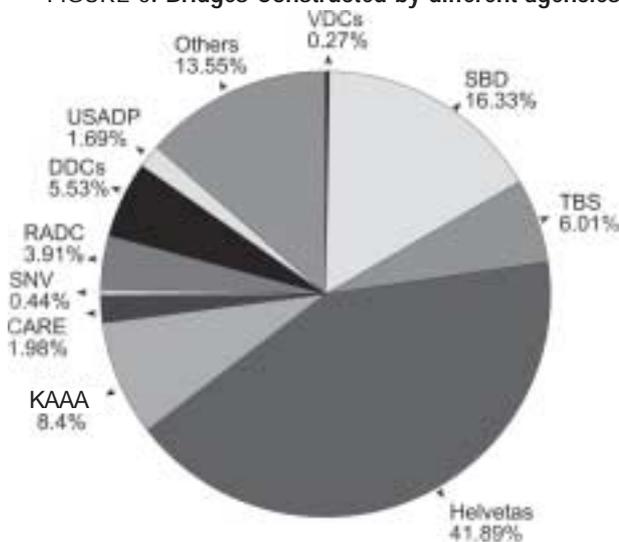
TBSSP's proximity is shifting away from the community UCs to the newly established TBS of DoLIDAR and to the DDCs. Once the centre and the DDCs assume their roles according to the Trail Bridge Strategy, TBSSP's present role as a facilitator will further lapse into that of a monitor of activities and as one among the funding agencies in this sub-sector. The overall monitoring and co-ordination responsibility is borne by TBS/DoLIDAR at the national level and the DDCs at the local government level.

C.3 Donor Participation

The trail bridge building programme initially supported through SDC funds alone attracted the Department for International Development (DFID) in 2001. A tangible output (the bridge) coupled to immediate enormous impacts and proliferation of demand paved the way for the WB and the ADB to recently join in through the Rural Access Improvement and Decentralisation Project (RAIDP) and the Decentralized Rural Infrastructure and Livelihood Project (DRILP) respectively.

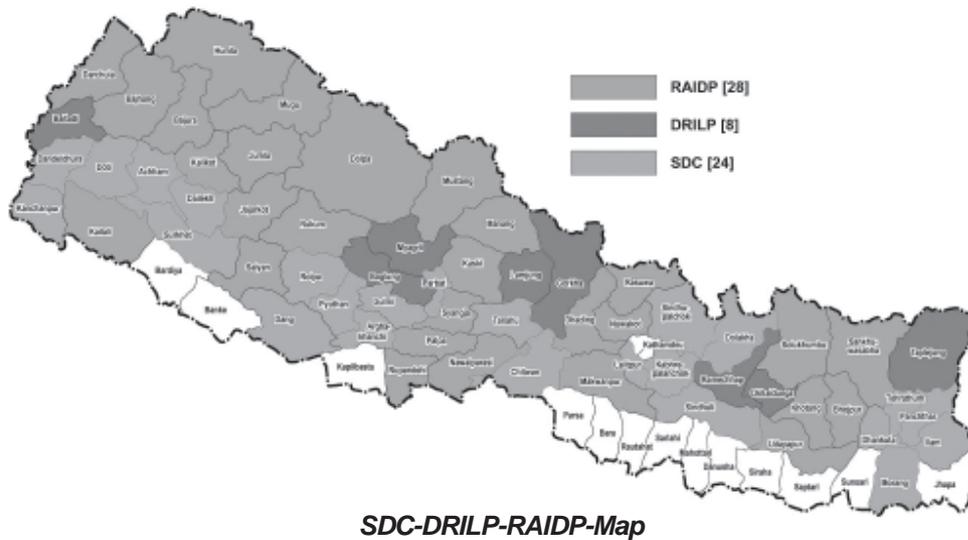
Out of the total 60 districts where trail bridge building support is accorded, SDC/ Helvetas lends direct technical and material support to 24 districts. Over a five year period from 2005 to 2010 the WB envisages to provide support for 350 bridges covering 28 districts. ADB on the other hand, without actually specifying the number of bridges, envisages supporting trail bridge building in 8 districts at the discretion of the DDCs. It is estimated that about 125 bridges will be built in the 8 districts supported by ADB. WB and ADB lend support with funds only.

FIGURE 6: Bridges Constructed by different agencies



Overall, 90% of the costs are covered by the funding institutions and 10% through local contribution (DDC, VDC and Community). WB and ADB funds flow through government channels to the DDCs and are time-tied to budgetary mechanisms and lapses. SDC/Helvetas funds are utilized directly through TBSSP by way of technical support and material grants – wire ropes, steel parts, tools and equipments. SDC/Helvetas provide wire ropes as material grant for all bridges, which is calculated to comprise 15% of the bridge cost. In addition SDC/Helvetas through

FIGURE 7: Trail Bridge Program Districts (60), 2005



SDC-DRILP-RAIDP-Map

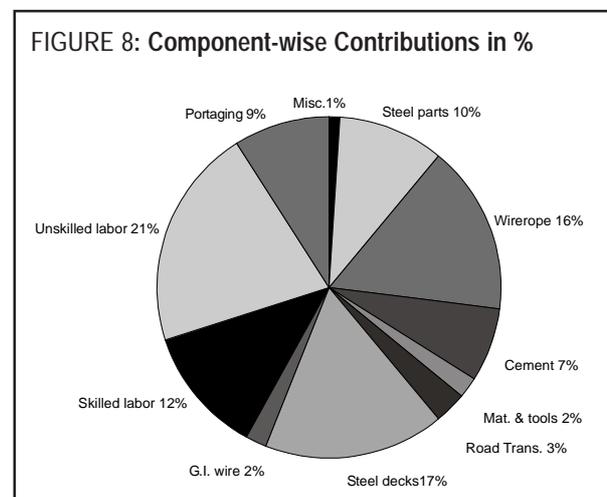
TBSSP provide technical and monitoring support in all districts. The technical support component is calculated to cost around 25%. Free labour contribution is effectively eliminated. All skilled and unskilled labours are paid.

It is still too early to be conclusive on the success of such a multi-donor approach as donors have their own impeccable approaches and strategies. However, all agencies working in the trail bridge sub-sector are to abide by the Trail Bridge Strategy and the technology and implementation modalities will apply to those projects as well. The Nepal Trail Bridge Forum (NTBF) is an effort towards synchronising the multiple experiences of all stakeholders for the overall benefit of this sub-sector.

D. Finances

In keeping with the changes in the implementation modality of the bridge programme, the financial and funds flow mechanism of Swiss contribution also underwent many changes. In the initial stages of co-operation when bridges were built piecemeal, funds were sanctioned by Swiss expatriates directly to SBD and field technicians without having to pass through the formal government channels.

As SBD institution building and government involvement in the bridge programme evolved, from 1981 on, Swiss funds for the programme to the Government flowed through the Offices of the Financial Comptroller General on to the District Treasury Offices before finally reaching the bank accounts of the individual bridge sites in the respective districts. The financial procedures made the government accountable and ushered in government audit by the Offices of the Auditor General, but together and in large measure also invited red tape bureaucracy that caused inordinate



delays and in some cases, conflict between the accounting staff on one side and the technical staff, fabricators and civil contractors on the other. With the introduction of turnkey packages, payment for miscellaneous staff logistics that usually caused contentions and the need to disburse funds to the district treasury offices, that took months on end, were effectively abolished.

With progress in decentralisation and handing over of central bridge construction to the government, a mechanism of pre-funding by the government was also developed and put into effect from 1995/96. Central bridges were paid for by the government following the terms of contract and were reimbursed by Helvetas in instalments tied to work progress and quality inspection. This post-financing model helped caution authorities to timely and quality execution of bridge building work and processes.

With regard to community bridges, since there is no component of monetary support to the communities, Swiss funds need not pass through government channels. Helvetas' share for procurement of materials as well as all other expenses relating to training and transportation to the nearest road-heads is directly borne by Helvetas. In the initial stages, custom designs and fabrication, air transportation of wire ropes and bridge parts, camp site overheads, quotation based procurement etc. all added up to a relatively high bridge cost – around US \$ 800 per meter span.

Design optimisation and standardisation leading to economies of scale, global tender procurement, competitive bidding processes based on turnkey packages etc. reduced bridge costs per meter span to the present standings of US \$ 350 for LSTBs and US \$ 175 for SSTBs.

Global fluctuations in prices of steel and steel products, increased wage rates, transportation costs and inflation aside, the value of the US \$ against the Nepalese currency rose by over 700% in the past four decades. This also plays a significant role while expressing costs in US dollar equivalent.

Various funding agencies - USAID, WB, ADB, SNV, GTZ, CARE Nepal, KHARDEP (UK), KAAA, DFID, Helvetas and the Swiss Government have supported Nepal in its endeavour to construct trail bridges. The government has been continuously allocating a significant amount to this programme over the last four decades. The Swiss government has contributed approximately SFr. 65 million as grants. At the current market price, the cost per linear metre of SSTB is about US \$ 175 and the cost per bridge US \$ 14,000. The average number of beneficiaries per bridge is 3,000 and the per capita cost is less than US \$ 5.

BOX 2: Ploughback Linkages

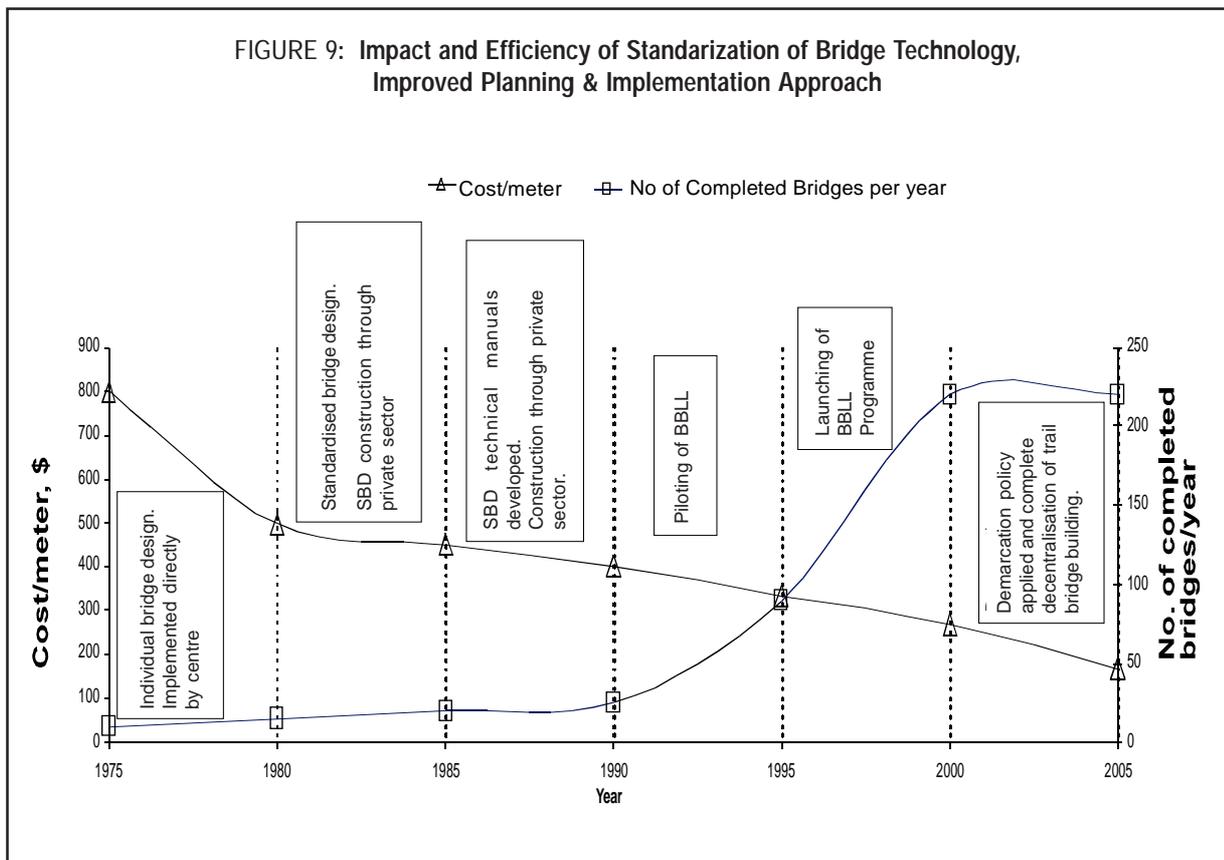
The involvement of local manufacturers in trail bridge building has fostered positive ploughback linkages. On the average, a trail bridge costs about 700 thousand rupees, and more than 80 % of this investment is ploughed back into the economy (see table).

TABLE 4 Percentage of Investment

Components of trail bridge	Per cent Share	Supply Source
Wirerope	16	India
Steel parts	29	Nepal
GI wire	2	Nepal
Cement	7	Nepal
Local manpower	43	Local community

E. Efficiency and Beneficiaries

Standardisation of technology leading to uniformity in design facilitated bulk fabrication and procurement of steel parts and reduced civil construction costs. Improved planning, tendering and contracting processes at the centre also helped to increase efficiency and reduce costs. With the advent of SSTB technology and community involvement in civil construction, irrespective of inflation effects, the cost line continued to dip. Proper facilitation of the social contract nexus among the DDC, VDC, NGO and UC combined with the free development grant by the central government to the DDCs and VDCs under the Build Your Own Village programme dramatically increased bridge output to over 200 completed bridges a year.

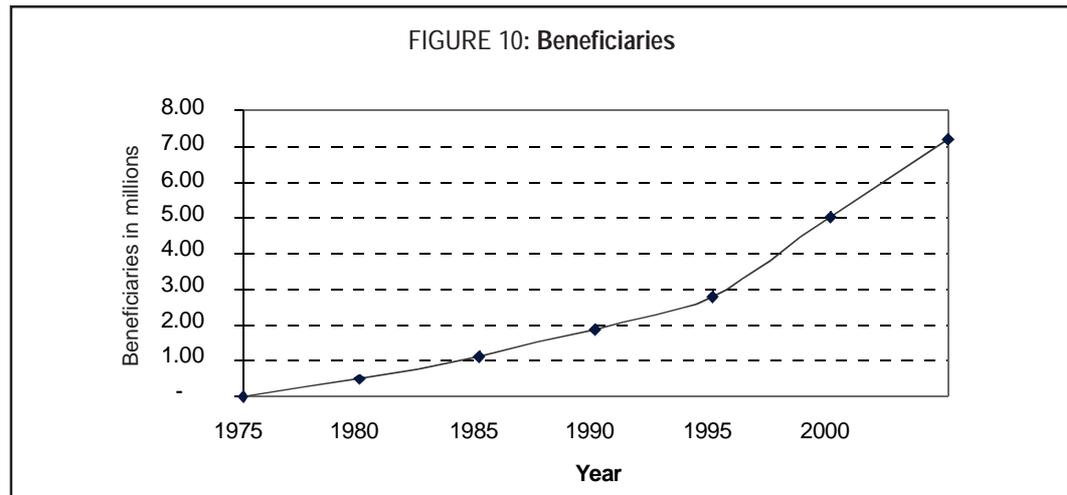


Bridge building in Nepal has been an exercise in cost sharing. From the very beginning during the central approach the government contributed a token share of 20% towards the costs of bridges, which gradually increased to 40%. From 1997 on LSTB costs have been shared on a 50/50 basis between the Government of Nepal and the external support agency.

With regard to community bridges, the support from SDC/ Helvetas by way of materials and tools support calculates to 60% of the total cost of the bridge. Contributions from other sources are given in Table 4. It is encouraging to note that contributions from other sources are an increasing trend.

TABLE 5 Contributions to BBLL Bridges

Agency	Contribution (%)
BBLL	60
DDC	10
VDC	14
Community	12
Others	4



A local trail bridge on an average serves around 10 clusters of settlements, i.e. around 400 households in its immediate ambit of influence. Bridges on main trails located near settlements, besides serving the immediate vicinity, are also used by non-local traffic. Therefore, on an average some 2,500 to 3,000 people can be regarded as beneficiaries of a single trail bridge.

BOX 3: Sustainability

With the norms, standards and technology of LSTB and SSTB established, the government rationalized its application and has now formulated and approved the Trail Bridge Strategy. The Trail Bridge Strategy encapsulates LSTB standards that will be mandatory for application on bridges with spans more than 120 m and SSTB standards for bridges up to 120 m.

Both LSTB and SSTB manuals reflect sound engineering practice in terms of safety, durability and serviceability. The basic design criteria, structural analysis and safety factors are identical. A Swiss engineering company performed the technical analysis of the dynamic behavior of these standard bridge designs. An SOS Manual has also been developed to address the social organizational support aspects of the SSTB community bridges.

With the introduction of steel walkway deck and galvanization of all steel parts, the need for periodic major maintenance by way of changing wooden decks and enamel repainting is effectively abolished. Availability of bridge craftsmen trained during DMBT as Bridge Wardens paid and supervised by local authorities should ensure routine maintenance work of cleaning debris, fixing loose wire mesh netting and tightening of nuts and bolts. BMCs fulfill the role of Bridge Wardens at community bridges.

With the tools so developed over the years and rationalized as LSTB and SSTB standards, the policies and directives formulated in the Trail Bridge Strategy, an independent Professional Forum formed, Trail Bridge courses inducted into the curricula of Educational Institutions, a Specialized Section established in the Department, this rural infrastructure programme can be considered as one of the most sustainable community-based programs in the country.

F. Achievements and Outputs

Other than the tangible outputs that can be attributed to the specific approach durations, the processes of decentralisation, development of manuals, dissemination of knowledge was given continuity all through the three approaches. All three approaches of Helvetas Nepal merit equal credit for the sustainable development of this sub-sector.

Bridge Building at the Local Level (BLL) Community Approach	Suspension Bridge Division (SBD) Central Approach	Trail Bridge Sub-Sector Approach (TBSSP) Sub-Sector Approach
<p>500 bridges on main trails in 61 hill districts, which has facilitated to make a network of 12,000 km of main trails functional throughout the year.</p> <p>Standardisation of Technology and publication of manuals: Survey Manual Design Manual Construction Manual Standard Design Drawings (two volumes) Costing and Contracting</p> <p>Planning Tools in the form of : Main Trail and Central Services Map of 57 hill districts District-wise and Regional Main Trail Maps District-wise Service Centre Maps Central Bridge Register of Crossings and Bridges along Main Trails Planning and Monitoring Information System (PMIS) Maintenance concept, routine maintenance through bridge warden Building blocks of Decentralisation Introduction of Trail Bridge courses in IoE diploma level Privatisation of Engineering, Fabrication and Civil construction work Delegation of maintenance responsibilities to the DDCs</p>	<p>1,500 community bridges on local trails in 52 hill districts.</p> <p>Standardisation of Technology in the form of Technical Handbooks Technical Handbooks on Survey, Design and Construction Survey and Design Forms and Check Lists Standard Design Drawings</p> <p>Organisational Support and Capacity Building</p> <p>Development of the UC, VDC, DDC and NGO social nexus</p> <p>Step-wise reciprocal procedures and processes of co-operation</p> <p>Manual on Social Organisational Support (SOS)</p> <p>Local Bridge Register (LBR)</p> <p>Demonstration Model Bridge Training (DMBT) and Training Modules</p>	<p>Enhanced, institutionalised capacity at central level in policy making, developing and availing of planning tools, setting norms and standards, monitoring / evaluation and quality control.</p> <p>Institutionalised capacities at the local level (DDC, VDC and Communities) to construct new trail bridges and maintain existing ones.</p> <p>Formulation of Trail Bridge Strategy as part and parcel of the LIDP. Increased efficiency and cost effectiveness of trail bridge programme due to application of appropriate technology, planning and implementation processes formulated in the Trail Bridge Strategy.</p> <p>Development of technical, social, organisational, planning and monitoring tools, procurement manuals, training and course manuals.</p> <p>DDCs encouraged for delegating implementation role to the NGOs to support communities.</p> <p>Construction of bridges on main trails shifted to DDCs. Central agency SBD phased out.</p> <p>Institutionalisation of the sub-sector approach attracting other funding agencies.</p> <p>Introduction of poverty sensitive and social inclusion criteria for bridge prioritisation to ensure equitable distribution of bridges.</p>

G. Challenges Ahead

Technical as well as administrative and managerial procedures for a decentralized transformation of this sub-sector have been successfully put into effect. Further challenges, overall, comprise of capacitating local bodies to bear their respective responsibilities as outlined in the Trail Bridge Strategy, addressing new technological challenges and fine tuning policies, facilitation and monitoring tools. The “acuteness” of the need for a bridge and the “will” factor of the local bodies and communities are the primary energising and motivating factors that would ensure a bridge in the shortest possible time. In retrospect, the support packages, support tools and the well defined procedures and processes established in all those respects should heighten that “will” factor.

G.1 Donor Harmonisation and Technical Support

The tripartite agreement between SDC/Helvetas, WB and ADB and the Government of Nepal requires TBSSP to provide technical support and monitoring of WB and ADB funded bridge projects. Funds from both WB and ADB are channelled through the government and DDCs, which are also responsible for labour wage payments through the UCs and procurement of all construction materials according to established criteria of the WB and ADB. Implementation modalities and processes established in the Trail Bridge Strategy are to be followed in all cases.



Demonstration Model Bridge Training accomplished!

Providing technical support and monitoring all related activities from bridge prioritisation and planning through survey, design, social support, quality control, training, work progress and expenses reporting, fund disbursements etc. for WB and ADB loans looms as a big challenge for TBSSP. In principle the Trail Bridge Section of DoLIDAR is required to facilitate, supervise and follow up to ensure the execution of all relevant tasks and documentation processes through the DDCs down to the community level. But the centre and the DDCs are not able to fulfil the processes and the documentation requirements of the supporting agencies in time due to several lacks in the system of governance, administrative deficiencies, biased political sympathies and

institutional inadequacies. Such hardcore deficiencies coupled to time-tied budget disbursement rules and regulations of the government on the one hand and that of the funding institutions on the other threaten to stifle progress and implementation. Open communication, transparency and teamwork are emphasized in a multi-donor scenario.

Multiple training courses for capacity development at all levels are being carried out on a regular basis but it may still take quite some time before the processes, competencies and commitments are established among the stakeholders. Elected local bodies leading a responsible local administration are a definite pre-requisite. But the present political situation and future outlook do not guarantee a time frame when that will happen. Till such times, an altogether different multi-donor approach with a funding mechanism based on ‘rolling planning’ that harmonizes with the political realities will need to be developed.

G.2 Sustainable Institutional Development

The rules and responsibilities of engagement in the trail bridge sub-sector for all stakeholders are well established through the Trail Bridge Strategy, the LSGA and the processes set and defined in the different guidebooks and manuals approved and implemented by the government. The primary and important tasks of co-ordination, planning, supervision and monitoring are institutionalised at the central and district levels. However, for lack of logistics, personnel, adequate compensation etc. the administrative units at the centre and in the districts are not able to respond adequately with initiative and enthusiasm. The Centre and the DDCs are still very dependent on TBSSP in many respects.

The challenge ahead for TBSSP is to continue 'facilitating and monitoring' other stakeholders for executing their respective responsibilities without actually getting involved in the 'act of execution'. Such kind of 'facilitation and monitoring' will provide opportunities for the Centre and the DDCs to develop 'intrinsically' by adjusting and adapting to fit to their circumstantial limitations and possibilities for a truly sustained institutional development.

G.3 Steel Wire Rope Procurement

Steel wire ropes are one major component of a trail bridge, which are still not manufactured in-country and need to be imported. Quality specifications of the wire ropes need to meet design norms and standards for safety and longevity of the bridge. The economies of scale and transportation constraints require that the wire ropes be procured in bulk. At present both are not within the capacities of the local bodies. Making available pre-stretched, galvanized quality wire ropes in required lengths for a single bridge to a local body through commercial channels remains a challenge to be addressed. Procurement of wire ropes should be decentralized only when quality and transparency can be guaranteed.

G.4 Bridging the Terai

The Terai plains also need safe crossings but wider spans give rise to questions of costs and benefits and sustainability. However, there are features in the Terai terrain where LSTBs or altogether differently designed modular steel bridges can be built to alleviate the hardships of the people and increase their mobility. In any case, a thoroughly informed study and analysis will be a pre-requisite to bridge the Terai plains.

G.5 Rural Road Bridges

After 1990s, rural roads have proliferated into the hinterlands and have become a major sub-sector. Many agencies are involved and there is already a large road network. Four to six months in the rainy season many roads are closed and do not serve their purpose. Communities are now demanding for rural road bridges but there exists no agency that builds such bridges. There is an immediate need to develop cost effective norms, standards and technology for rural road bridges that can be built through the community approach.

G.6 Potential Support to Other Countries

In the UK based international magazine “Roads & Bridges”, it has been estimated that there are about 50 countries that need pedestrian trail bridges. In Africa alone the need is estimated at 100,000 bridges. As Nepal has excelled in trail bridge building, not surprisingly there are ad-hoc requests to TBSSP/Helvetas Nepal from different countries for support to build trail bridges.

Collaboration between the trail bridge programmes of Nepal and Bhutan began from the later half of the 1980s with the standardisation and publication of the first bridge technical manuals by SBD. SBD and BBL engineers at different times were deputed for imparting geological, engineering, fabrication and construction training to Bhutanese engineers and bridge technicians. Similarly, Bhutanese trainees regularly visited SBD and bridge sites in Nepal to gain first hand knowledge and experiences on bridge building.

Helvetas deputed a number of Swiss personnel as Chief Technical Advisor to Suspension Bridge Section (SBS), Bhutan after their tenure in Nepal. Such deputation facilitated a smoother transfer of bridge building knowledge, skills and experiences from one country to another. Duplication of effort was effectively eliminated. It also fostered closer relationship among the personnel of the bridge programmes of Nepal and Bhutan.

Some notable collaboration with Bhutan:

- ⊙ Development of LSTB Manual, Bhutan version.
- ⊙ Training on geology, survey, design and construction of LSTB bridges for Bhutanese engineers and bridge technicians.
- ⊙ Development of Design and Quantity Calculation (DEQUA) computer software programme, Bhutan version and training for application of the programme.
- ⊙ Training on survey, design and construction of SSTBs. Introduction of SSTB will greatly benefit the Bhutanese bridge programme.
- ⊙ Exchange of know-how and experiences through study and exposure visits.

The collaboration with Bhutan continues. New developments and changes in technology and approaches are shared between the two countries.

In addition, TBSSP has provided technical support to DRSP/Tanzania, which is an SDC project, for building six trail bridges. TBSSP has also provided theoretical and on the job training to Tanzanian engineers and local bridge builders.

Similarly, TBSSP has provided technical support to an American Charity named “Bridges to Prosperity (BtP)” for piloting a trail bridge programme in Ethiopia. An engineer and a programme officer of BtP were trained in Nepal. Together with Helvetas Ethiopia, BtP has initiated the construction of eight bridges in Ethiopia.

In the meantime, Helvetas Ethiopia has taken over from BtP the support to trail bridge building in Ethiopia. Helvetas Ethiopia and Helvetas Nepal have signed a

three-year Memorandum of Understanding for an exchange and capacity building programme. Ethiopian professionals have been and will be trained by TBSSP in Nepal and TBSSP will provide backstopping services for the trail bridge programme in Ethiopia.

The project also provided technical support in designing some trail bridges for Mozambique.

G.7 The South-South Adage

The South-South co-operation adage - the advantages of which are often so enthusiastically voiced at international forums - can become a reality only if and when governments and INGOs play a conducive and collaborative role for its promotion. Sustainable development at an equitable 'cheap' price, as demonstrated by the trail bridge programme in Nepal, can and should be replicated along the lateral dimension without fanciful additives of commercial globalisation that caters to 're-inventions, discoveries and patent rights', which only make safe crossings from poverty to sustainable livelihood more costly and inequitable. The global challenge of mobility in remoteness pertaining to this sector of rural transportation is no more 'global'!

INGOs facilitate to replicate success stories of local NGOs not just at the local level but also across national borders. Examples abound. The trail bridge programme of Nepal has sufficiently matured as one such programme that can be replicated across borders – South to South without taking a costly detour to the North or the West. A positive attitude on the part of government authorities and facilitating INGOs can make this happen.



The deck of a bridge, especially the wider ones, are often a place for rendezvous and a place to relax and enjoy the mid-stream breeze

TABLE 6

PERIOD	Evolution and Milestones
1900	Introduction of wire rope, iron bridges fabricated in Aberdeen Scotland and assembled and erected in Nepal.
1958	First pedestrian trail bridge building plan by USOM
1960-1964	Swiss (Helvetas) engineers built pilot bridges in the Marsyangdi valley and at Jubing.
1975-1980	Central Planning Approach. Individual Bridge Design. Bridges constructed directly by SBD. Bridge cost US \$ 800. Output 5 bridges/year.
1981-1985	Central Planning Approach. Standardized bridge design developed for main trail bridges. Technical manuals developed. Construction through fabricator / contractor. Bridge Cost US \$ 600. Output 15 bridges/year. Initiation of Main Trail Study and Planning and Monitoring cell within SBD.
1986- 1990	Central Planning Approach. Construction through fabricator/contractor. Bridge cost US \$ 500. Output 25 bridges/year. Completion of Main Trail Study. Publication of Main Trail and Service Centre maps. Development of a strategic planning and management base. Development of Maintenance Concept. Decentralisation of routine and minor maintenance work to DDCs. Concept of Bridge Warden initiated for routine regular maintenance. Realisation of need of simpler technology, planning and implementation approach for local trail bridges. Pilot phase of BBLL programme.
1991 - 1995	Further optimisation of SBD bridge design. Initial experimentation with turn-key packages. Decentralisation of minor and major maintenance work to the DDCs. Bridge cost US \$ 400. Output 30 bridges/year. Introduction of virtually maintenance free galvanized steel walkway deck. Repeated felling of trees for wooden walkway decks and maintenance was eliminated Initial contacts with IoE to inculcate trail bridge course in curricula. Pilot phase of BBLL with involvement of communities, local bodies and civil organisations in full swing. Development of bridge technology suitable for local trails. Beginning of BBLL Implementation phase
1996 - 2000	Implementation Phase of BBLL. Promotion of decentralized planning processes Refining, adapting local bridge design technology and manuals. Refining procedures and processes of implementation. Promoting involvement of local government. Community bridge cost US \$ 175. Output > 200 bridges/year Main trail bridges constructed through contractor turn-key approach. Establishment of DoLIDAR Technical demarcation between LSTB (span > 120 meter) and SSTB (span up to 120 meter) and separate implementation modalities
2001 - 2005	Development and updating of technical manuals, handbooks, training modules and social support manual. Technical standardisation and pragmatic processes greatly facilitated the influx of new donors Formulation and implementation of sub-sector approach and Trail Bridge Strategy as an auxiliary to the Local Infrastructure Development Policy (LIDP). Full integration of local government, civil society in trail bridge building. Proliferation of EIs providing trail bridge education, training

INTERLUDE

The trail bridge programme in Nepal flourished in the backdrop of slow-paced economic growth coupled to fast-paced political changes after 1990. The programme initiated with the central approach (SBD 1964) transformed into the community approach (BLL 1989) and is presently being implemented as a sub-sector approach (TBSSP 2003). The synergies of the central and community approaches are positively reflected in the sub-sector approach demarcated by the technical standards and implementation modalities of the LSTB and SSTB.

After many trials and learning, the essential technical, planning, monitoring, evaluation and quality control tools of the programme have been inculcated at the central and local government levels as well as in the academia, private and NGO sectors. Among rural communities and VDCs, building a **BLL** bridge has become a community's **prestige** symbol portraying their ability for development work.

In other words, the trail bridge programme in Nepal reflects the many vicissitudes of small infrastructure development work in a developing country beset in volatile and changing political scenarios and systems of governance. In unambiguous terms it also reflects the strength and resilience of sustainability when projects are implemented not as projects, but as a reciprocal **social contract** among beneficiaries and the stakeholders. Decentralisation is the key.

Swiss involvement in the trail bridge sub-sector in Bhutan began in 1985, a full quarter century later than in Nepal and 13 years after SDC/Helvetas' entry in SBD Nepal. The Royal Government of Bhutan (RGoB) implements the bridge programme in a combination of the central and community-based approach and has all through endured fulfilling, more or less, all targeted physical goals fixed through a central planning mechanism. As such, the advantages of 'rolling' planning and donor interaction at the local government level and with the communities have not accrued. Though bridge requests originate from the people, for lack of a social support and 'preview' mechanism (refer to DMBT, SOS and NGO approach of Nepal) by 'middlemen', until recently the beneficiaries have perceived implementation as being done directly by the centre with voluntary labour contribution on their part.

A stable, centralized system of governance coupled to almost non-existent revenue sources at the Gewog and Dzongkhag levels and limited capacities in the private and academic sectors all combined to restrict efforts at decentralisation and devolution of development work. However, the current institutional and political environment is strongly influenced by the decentralisation reform 2002 and the respective by-laws (*Chathrims*) that are gradually being introduced in all Dzongkhags and Gewogs as well as by the forthcoming political and institutional changes of 2008. The *Chathrims* endow local authorities with more democratic legitimacy and political powers but also delegate more financial and operational responsibilities. With these new decentralized and democratic planning and decision-making processes, prioritisation of trail bridges has become more transparent and demand-oriented. However, at the local level there is still an undisputed lack of human capacities for planning, management and administration that often leads to unrealistic plans not only overloading the Dzongkhag Administrations, but also the communities alike.

The King of Bhutan announced to promulgate a new constitution and a two-party democratic system to come into effect in 2008. Already exercises are afoot to mobilize and test the capabilities of the people and their representatives for self-rule at the Gewog and Dzongkhag levels. As an experiment, selected Gewogs are being provided with development funds to utilize at their own free discretion. Restrictions on private media are lifted. The electorate is being carefully screened for the democratic exercise in the offing amid rising concerns for equity and ethnic inclusiveness.

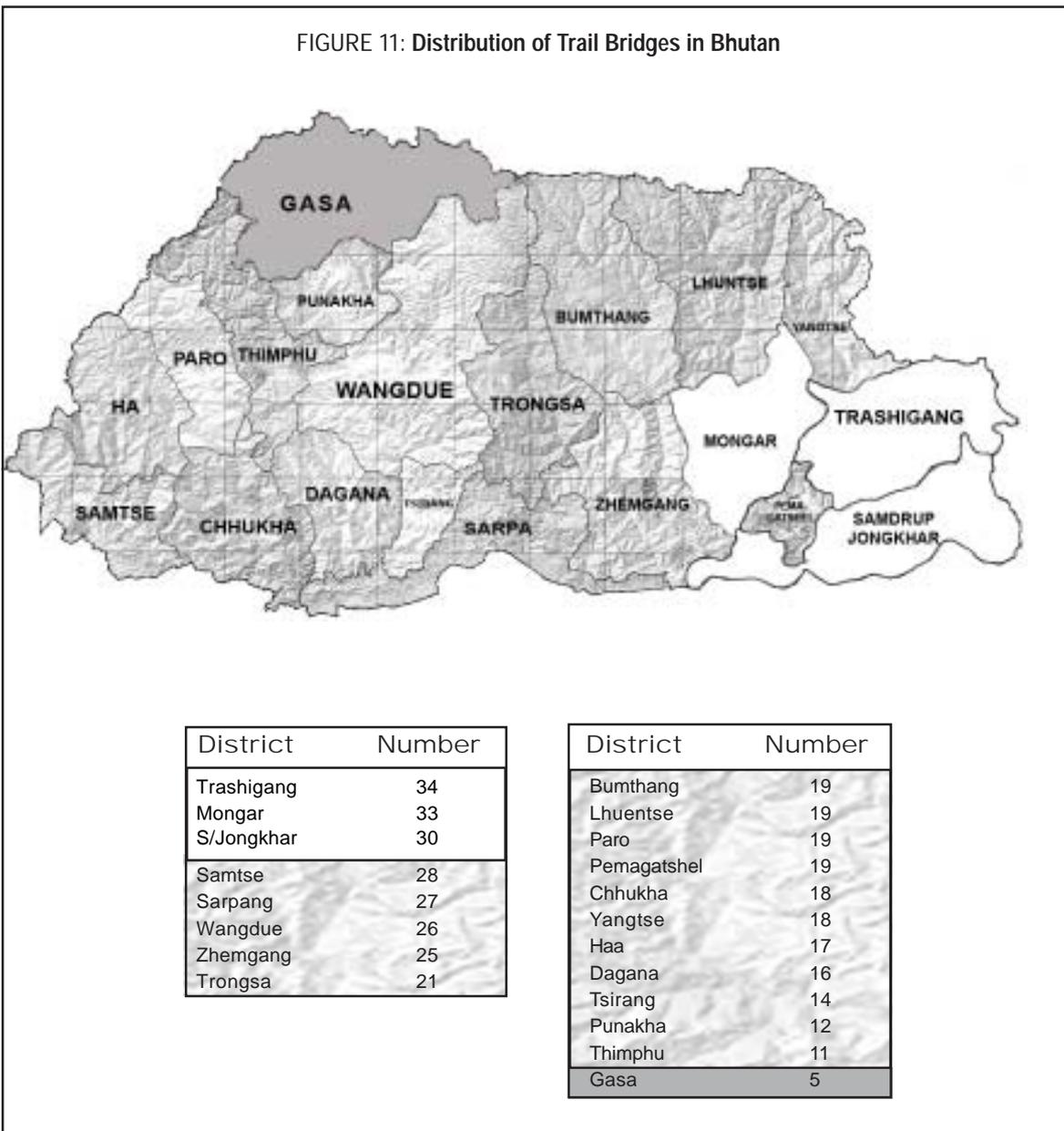
The bridge programme in Bhutan is similar to that of Nepal other than the differences that emerge due to implementation modality and the effects arising out of the system of governance.

BHUTAN CHAPTER

The Political and Institutional Context

Bhutan is a landlocked country in the eastern Himalayas covering 38,398 square kilometres bordered by the Tibet Autonomous Region of China in the north and by India in the west, south and east. The country has one of the most formidable mountainous terrains in the world, ranging from altitudes of 100 metres to 7,500 metres above sea level. About 72% of the land area is covered by forests of temperate and sub-tropical species. The country has one of the richest biodiversities in the world with more than 3,200 plant species per 10,000 square kilometres and thus has been declared as part of one of the ten global biodiversity ‘hotspots’.

FIGURE 11: Distribution of Trail Bridges in Bhutan





A traditional chain bridge replicated for access to the monastery.

The population of about 672,000 is largely rural with 70% still living in villages and hamlets, despite a growth in urban drift in recent years. The population density of Bhutan is among the lowest in Asia, and there still remain large tracts of unoccupied

Standard suspension bridges had been developed by SBD Nepal and in slightly modified form introduced in Bhutan in the mid-eighties. They are based on relatively sophisticated technology and follow high standards in terms of safety, durability and use. They need considerable technical expertise and are costly and therefore only justified for crossings on main trails and at locations of specific socio-economic importance.

Over the past two decades Bhutan's economy has seen relatively stable annual growth rates of 5-7% and the GDP per capita was US\$ 713 in 2001. Although the production of electricity, construction, manufacturing and services sectors have been dynamic reducing the importance of agriculture substantially, today still 70% of the Bhutanese live mainly on (subsistence) farm income. Administratively, the country is divided into 20 Dzongkhags composed of 201 Gewogs.

In 1999, the Government produced a comprehensive vision statement "Bhutan 2020: A vision for Peace, Prosperity and Happiness". The vision statement interprets modernisation in a cautious way, combining traditional values with modernity. The overarching goal is to ensure future independence, security and sovereignty of the Kingdom. The central development concept of "Gross National Happiness" stresses this goal in its development objectives.

The decentralisation reform in 2002 marked an important step in Bhutan's process of modernisation of its political system. The reform provides local and regional authorities democratic legitimacy and political powers and has introduced the system of direct elections of local leaders representing their constituency at the district level. The national planning system has been modified through a complementary bottom-up process and the administration has partly been decentralised.

Already back in the seventies RGoB realized that improved communication, access and mobility are an important precondition for the social and economic development of the population, particularly in rural areas where transport improves access to social and economic opportunities, including schools, clinics, employment, agricultural inputs and markets for produce, etc. Typically, poverty-targeted intervention such as schools, health facilities, nutrition programmes and school services depend on transport as a complementary input for their effective delivery.

Today, Bhutan is at the crossroads of an unparalleled constitutional, political and institutional reform process. The democratisation and decentralisation process represents a unique chance for the country. It opens new opportunities but also challenges, particularly at the local level.

Although the forthcoming changes of 2008 (introduction of new constitution, first democratic elections, i.e. introduction of a parliamentary democracy and resignation of the His Majesty the King and the handing over of powers to the Crown

Prince) have been carefully prepared by the Government, there exist justified fears whether the transition will work out well. In this time of hope but also uncertainty, Bhutan seeks reliable partners and partnerships that go beyond 2008.

However, with the newly decentralised and democratic planning and decision-making processes, prioritisation of infrastructure projects including trail bridges has become more transparent and demand-oriented. For the trail bridge sub-sector in Bhutan this gives hope that maintenance and thus sustainability might get more attention in the future.

In many communities trail bridges still represent an overwhelming development priority and can be used as an excellent entry point for community mobilisation, the promotion of good governance and the reduction of poverty through better access. As such the socio-economic benefits of pedestrian bridges for the development of the generally remote rural areas are undisputed.

Transport Infrastructure Settings

Similarities in geography, settlement pattern and socio-cultural lifestyles of the people of Nepal and Bhutan put these two Himalayan neighbours on an equal footing where rural transport networks, accessibility and mobility of the rural population are concerned.

The physical landscape of Bhutan is largely characterised by mountains, hills and valleys with a very high density of rivers and streams that separate settlements and its populations from essential services. Difficulties in transportation and communication have over the centuries hindered not only the socio-economic but also the political development of the country. As in most Himalayan countries, the topography presents extraordinary difficulties for the construction of a reliable road network. Bhutan's total road network measures only about 3,900 kilometres and the main routes largely consist of one east-west and four north-south highways. At the present time the national road network connects most of the major towns of the country.



The Danglo Zam bridge over Wang Chhu built in the 1980s by PWD

However, size matters and matters in a meaningful way. Bhutan's east-west highway cuts across eight Dzongkhags out of 20, through hill and mountain terrain almost bisecting the country in half. This one singular feature reduces the need for lengthy feeder roads and trails on the north-south axis. On the other hand, it vastly reduces the need to separately interconnect the rural centres and settlements with feeder roads and trail networks that would otherwise also run along the east-west parallel crossing the many rivers and rivulets, all of which flow from north to south. In short, Bhutan's east-west highway by virtue of it running across the centre of the country already covers and compensates for a substantial portion of the accessibility and mobility needs of its population.

The top northern quarter of Bhutan is very remote and sparsely populated. Economic activity is limited to subsistence agriculture. Bhutan's economically active zone hugs the settlements immediately north of the east-west highway and the southern half of the country.

Modern Trail Bridge Building

Bhutan stepped into the modern era of institutionalised bridge building programme with the assistance of engineers from the Government of India in the 1970s during the 4th Plan period. The Public Works Division (PWD) introduced improved suspension bridge designs that made use of wooden, concrete and steel towers with wire ropes anchored to stone masonry blocks.

Swiss involvement in the bridge programme began only in 1985 with SDC support. Helvetas introduced and adapted new standard bridge designs developed in Nepal to Bhutanese conditions that greatly improved the technical standard of the bridges. However, the nature of Swiss co-operation in Bhutan differed from that of Nepal. Whereas co-operation with Nepal facilitated development and successful application of different implementation approaches, the co-operation in Bhutan remained restricted to the central planning and community implementation approach all through. Within that framework Helvetas' involvement remained lean with just one Swiss implementation officer posted at the SBS for technical and co-ordination support.

Technical Norms, Standards and Manuals

Standard suspension bridges had been developed by SBD Nepal and in slightly modified form introduced in Bhutan in the mid-eighties. They are based on relatively sophisticated technology and follow high standards in terms of safety, durability and use. They need considerable technical expertise and are costly and therefore only justified for crossings on main trails and at locations of specific socio-economic importance.

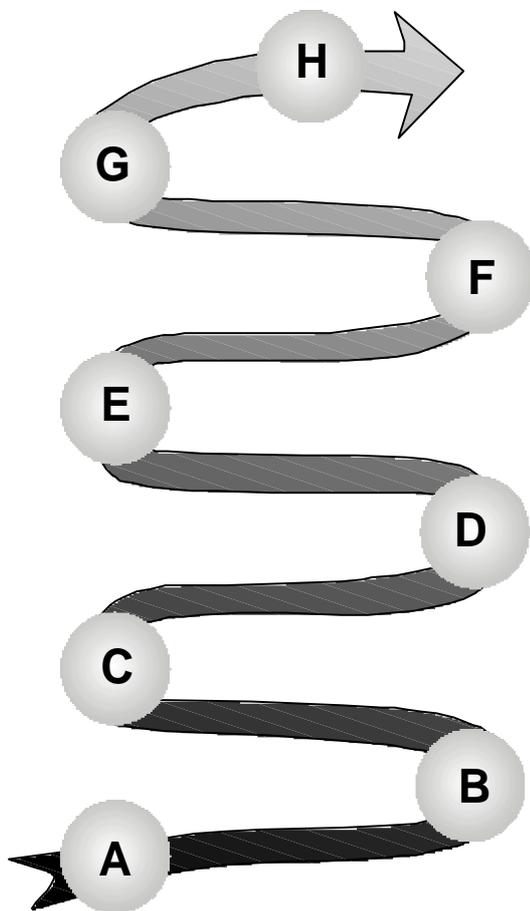
Appropriate technology for short span bridges, recently developed in Nepal, was introduced in Bhutan in July 2006. These bridges, called Short Span Trail Bridges (SSTB), are standard bridges that have been designed in such a manner that they can be designed and constructed at the Dzongkhag level.



Buddhist Prayer flags find their place in almost all pedestrian bridges in Bhutan

Planning and Implementation Processes

FIGURE 12 : Step-wise Procedures / process of Bridge Construction



- A. Request for a bridge originates from the community and is relayed to the Gewog through the Tshogpa.
- B. The Gewog submits requests through the Tshogpas. The requests are prioritised in the Gewog Yarge Tshogchung (GYT) based on set criteria. The prioritised list is sent to the Dzongkhag level.
- C. All prioritised requests are presented in the Dzongkhag Yarge Tshogdu (DYT). After debates and deliberations, a final list is prepared and sent to the line agency at the centre.
- D. Depending on policy and budget, the centre allots a specific number of projects for each Dzongkhag. The Dzongkhag distributes the projects to the respective Gewogs according to the prioritised list.
- E. The Gewog informs the respective Tshogpas to prepare the community for labour contribution and sends request to SBS for survey, design and drawings.
- F. SBS conducts survey, makes design, drawings, estimates and tender documents for fabrication. Relevant documents are sent to the Dzongkhag.
- G. Gewog together with Dzongkhag engineer, Tshogpa and community prepare work plan and schedules. Dzongkhag deputs paid skilled manpower for construction. Communities contribute free labour and build the bridge. The Lajab (work supervisor) is appointed as the supervisor and is paid for his role. The Lajab co-ordinates labour contribution, keeps attendance and accounts of construction materials and tools. Physical and financial progress and performance is monitored by the Dzongkhag's bridge engineer and the Gup/Mangmi.
- H. After completion, the bridge is final checked by SBS. A Genja (handing/taking over agreement paper) is prepared and the bridge is handed over to the Gewog for upkeep and maintenance. During the annual auditing, the auditors from the Royal Audit Authorities visit the bridge construction sites and verify the books of accounts.

Institutionalized Capacity Building and Knowledge Dissemination

Pedestrian trail bridge building requires specific engineering norms, design parameters and is not part of the standard course in civil engineering. A number of government engineers have been trained in Nepal, Australia and western universities.

Accredited government technicians alone cannot fulfil the human resource need of the trail bridge sector. Capacity building needs to be institutionalised within the academic institutions of the country so that future Dzongkhag and Gewog engineers as well as those opting for the private sector will already be aware of the technology. A preliminary attempt is being made to inculcate trail bridge specific courses and skills in the Diploma and Degree level at the Royal Bhutan Institute of Technology (RBIT) and the vocational training institutes. With the introduction of the SSTB technology, knowledge dissemination at the Gewog level will be simpler.

Engineering: All survey, design and drawing work of trail bridges are done by SBS engineers. Capacities in the private sector remain unexplored.

Fabrication: The private sector has capacity to fabricate steel parts but there is no galvanizing plant in Bhutan. The government is reluctant to license out one due to environmental considerations. Galvanisation needs to be done in India, which in practical terms entails bureaucratic processes equivalent to an export-import scenario and accompanying cross-border hassles relating to custom and tax clearances. For this and for reasons of small quantities, the private sector is not forthcoming to participate in SBS's fabrication tenders. Wire ropes are procured from India on quotation basis.



Galvanization bath tanks just across the border

Construction: Civil construction is done with free labour contribution of the communities and skilled labour provided by the Dzongkhags and where available by the communities. Given the scale of on-going infrastructural development work in different sectors all over the country, Bhutanese contractors are capable of executing engineering, construction, fabrication and maintenance work of pedestrian bridges on a turnkey basis. But the capacities in the private sector remain largely unexplored. If the scale of work is very big, contracts are given out to joint ventures comprising of national companies or with the participation of international contractors. Supervision and quality inspection is required at crucial stages of construction.

As of now the idea of the project and the Royal Government is to develop the sense of ownership of the beneficiaries. Contract work for pedestrian bridge construction is not encouraged.



Fitting the steel walkway deck

Maintenance

Following the experiences of Nepal the wooden walkway decks of old bridges are systematically being replaced with galvanized steel walkway decks. Strict quality control of steel parts especially regarding galvanisation will ensure virtually maintenance-free bridges, except for the need to remove shrubs, vegetation and tightening of loose parts from time to time. A maintenance concept categorising maintenance into Routine, Major and Rehabilitation has been developed by SBS and is being implemented. In principle, the planning and implementation process of major maintenance and rehabilitation works follow the same procedure as for a new bridge.

There is neither budgetary provision for routine maintenance nor any formal instruction to the Gewogs to perform them. However villagers with or without the support of the Gewogs carry out minor repair work on bridges, usually replacing broken planks when it becomes an absolute necessity. With the advent of steel walkway decks and galvanisation, routine maintenance is best left at the discretion of the Gewogs who have several options to carry out routine maintenance through community members while adjusting for voluntary labour contribution. The Gewogs, with a little training and awareness input needs to be made formally responsible for routine maintenance and a system of compulsory yearly reporting by the Gewogs will need to be followed up by the Dzongkhag engineers.

Costs, Finances, Donor contributions

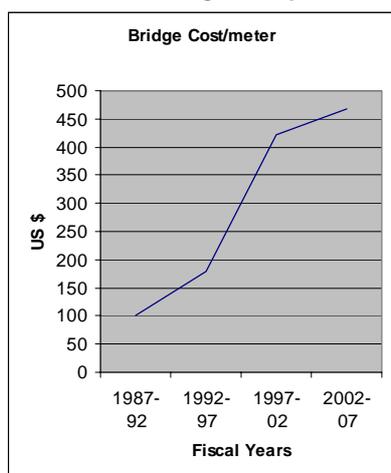
In all, Switzerland has granted SFr \$ 20 million for the trail bridge programme in Bhutan. The contribution ratio on actual bridge costs is in the order of RGoB 25%, SDC 50% and Community 25%. In case of bridges located more than a

days' portaging distance from the nearest road head, the percentage of donor's contribution is higher because the portaging costs are also borne by the donor.

TABLE 7 Overall averages 1987 to 2006 (20 years)

Cost per meter span	US \$ 294
Average span of bridge	70 m
Cost per bridge	US \$ 20,600
Number of beneficiaries per bridge	1,500
Per capita cost	US \$ 17.61

FIGURE 13: Bridge Cost per meter



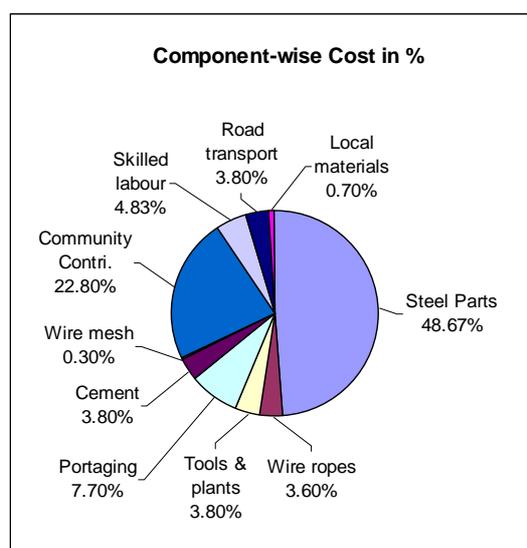
In the initial years of Helvetas' involvement, bridge costs per meter span hovered around US \$ 102. Bridges were fitted with wooden decks; wood for which was availed virtually free of cost. With the introduction of steel walkway decks and galvanisation during the 7th Plan (1992-97) bridge costs rose sharply and peaked during the 8th Plan (1997-2002) to US \$ 422 – an increase by 414% within a period of five years. Costs for 9th Plan (2002-07) are calculated at US \$ 467 per meter. Robust LSTB designs coupled to high costs for steel parts accounts for the rise in per meter costs.

With the introduction of the more economical SSTB designs, per

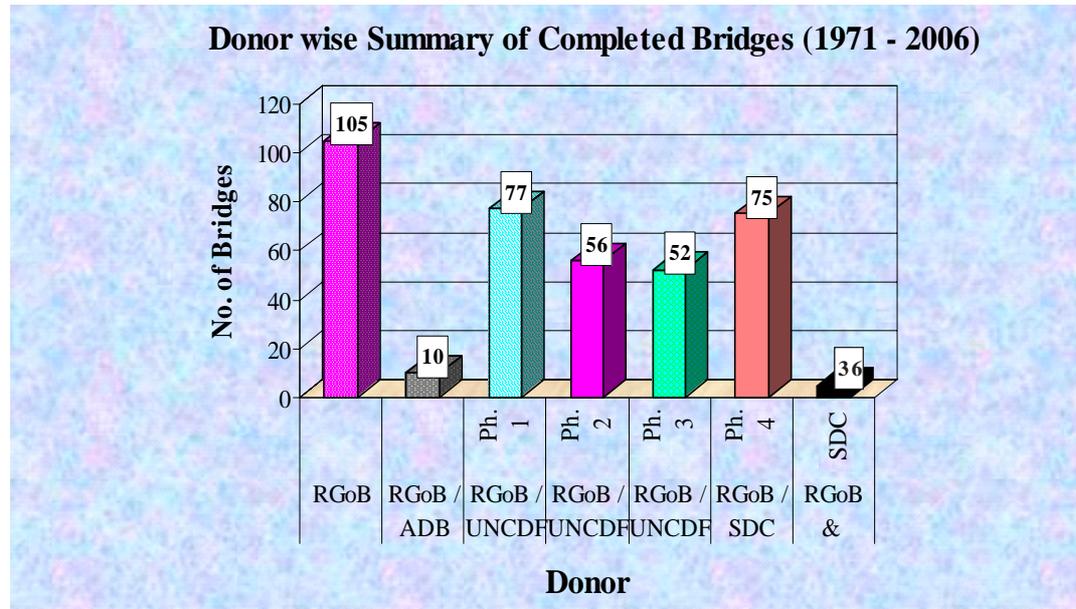
meter costs are expected to decline by 30 to 50%. The component-wise cost break down depicts steel parts as the largest expense representing almost half the bridge cost.

Important Note: The component-wise costs of Nepal and Bhutan will not lend to comparison, either in percentages or absolute values because of the many different variables relating to bridge designs, protection works, implementation modality, import-export regulations, degree of involvement of the private sector and the differences in the monetary value of the Rupee and the Ngultrum against the US \$ that would have fluctuated at different time periods.

FIGURE 14: Component-wise cost in percentage



The Government of India, ADB and the United Nations Capital Development Fund (UNCDF) contributed to RGoB's trail bridge programme on an ad hoc basis before SDC stepped in with Helvetas Bhutan in 1985. Bhutanese trail bridge building got uplifted to 'modern' technology with the introduction of Helvetas that facilitated transfer of know-how developed in Helvetas Nepal since the beginning of 1972. Danish International Development Assistance (DANIDA) and Japan International Co-operation Agency (JICA) supported RGoB for reconstruction of a number of bridges that were washed away by floods and for "Power Tiller bridges" on farm roads.



Future Outlook

Pedestrian Bridge Requirements

Bhutan records 411 pedestrian bridges as at mid 2006 of which 90% are considered functional. Besides, 14 different kinds of other crossings e.g. RCT Beam, RC Slab, Bailey, Arch-RCC, Steel Langer Arch, Wooden, MultiCell Box Culvert etc. - totalling 222 in number and with a combined span of 6,182 meters links crossings in Bhutan. 94 (40%) of them are Bailey bridges.

The total river length, major rivers and tributaries including, that may need crossings is calculated at 5,500 km. Projecting an hour's walking detour at the most to come across a safe crossing means that in total Bhutan would need about 1,200 crossings. More than half are already built.

The Road Sector Master Plan envisages some 132 new feeder roads with a total length of 2,655 km that will open up the hinterlands. This 20-year master plan (2007-27) does not include the farm / power tiller road project of the Ministry of Agriculture. With modest population growth and migration to urban centres on the increase, no appreciable increase in the number of rural settlements can be foreseen. Rather, semi urban and urban settlements are likely to grow along new highways and road-heads.

Hundreds of river crossings will be built along the 132 new feeder roads and along the power tiller farm roads. Therefore, with the vision of just an hour's detour at the most, the need for pedestrian trail bridges in Bhutan may not exceed 300 to 350 bridges at the most. With the introduction of the economical bridge design, pedestrian crossings will almost all be SSTBs.

Linking the Trail Bridge Programme to the Road Sector Master Plan

The demand for Power Tiller Bridges (PTBs) is on the rise and is likely to keep rising with the construction of the 132 feeder roads. PTBs are based on similar technical principles as pedestrian wire rope bridges, but have a deck width of 1.70 meter and accommodate small power tillers with 500 kg load capacity. SBS Bhutan is involved in the making of PTBs and therefore facilitates linking up of the planning of pedestrian trail bridges with PTBs. In view of the rising demand for PTBs, SBS is in the process of exploring the advantages / disadvantages and cost effectiveness of PTBs over pedestrian trail bridges while planning bridge locations at the macro level. An institutional link at the planning level is necessary between the Trail Bridge Programme and the Road Sector Master Plan.

Decentralisation and Implementation Modality

Political decentralisation and adequate capacities in the private sector need to go hand in hand for rapid and balanced development. Decentralisation accelerates development while retaining a lean government structure.

The 9th Plan envisages promoting private sector growth and employment generation as one among its five overall goals and is regarded as a prelude to the exercise of decentralisation. The road sector receives the largest share of the 9th Plan financial outlay with particular emphasis on feeder roads to improve rural access. The capital outlay at the Gewog level for suspension bridges and mule tracks amounts to US \$ 45,400 per Gewog per year.

Institutional capacities and amenities at the Gewog level are being strengthened with the construction of new Gewog office buildings equipped with computers and modern office equipments. It would be naïve to expect the existing generation of Gups and Chimis as also the bureaucracy at the Dzongkhag and Central level to adapt and adjust to a sudden change in the power equilibrium.

At the Gewog level there is still an undisputed lack of human capacities for planning, management and administration that often leads to unrealistic plans not only overloading Dzongkhag administrations, but the communities alike. The Gups will need support of an administrative and technical wing in their Gewogs and the autonomy to raise and utilize revenues and central grants as decided by the GYT.

With the central/community implementation approach, the government and the communities have been successfully meeting all targeted goals in this sub-sector. However, in the present system of governance, planning, budgeting and execution, a Gewog and its community that are in need of a particular development infrastructure cannot implement an undertaking on their own if not allotted, approved through the central planning mechanism.

Decentralisation and democracy is at an early stage in Bhutan. The link between Gewogs/Dzongkhags and the private sector remains largely unexplored, but the private sector should be capable of fulfilling the demands of small infrastructure development work at the Gewog and Dzongkhag levels.



Demand for bridges that can accommodate a power-tiller for transporting agricultural inputs and outputs is on the rise!

Communities are not used to assuming the lead role. This will need to be nurtured. How fast they will be able to do so will depend on how much the new constitution will decentralize and to what extent the people themselves will be politically conscious to take the lead role. The Gewogs and the Dzongkhags will need to be given untethered development funds and appropriate avenues for revenue collection to manage finances for their priorities. On the other hand they will also need to be protected from profiteering hawks and opportunists who may deceive with conceit and trample on the nation's resources, environment and tranquillity.

With a decentralized system of governance in the offing, the future implementation modality in the bridge sector will very much depend on capacities in the private sector, availability of external support and the autonomy accorded to the Dzongkhags and Gewogs to directly interact with them. Future programme implementation will need to tread a fine line which allows for adequate autonomy at the local level under the surveillance of a national strategy that would ensure uniformity in technical standards, implementation and financial processes.

Developing the Private Sector

The private sector is all set to flourish in Bhutan. Joint ventures with experienced Indian and Nepalese firms or by way of employment contracts are afloat. Public works once trusted to chosen consultants and contractors are now opening up for public bids and competition. The need is to nurture an unbiased, fair and corruption free system of competition with a keen eye on regular inspection for quality performance and timely execution. Human resource development in the academia, decentralisation and the private sector accentuate one another.

Evolution and Milestones

In Bhutan, pedestrian trail bridge building as an institutionalised activity began in 1971 when the then Public Works Department (PWD) started a country wide bridge construction programme. With the assistance of engineers from the Government of India, PWD introduced an improved suspension bridge design which used wooden, concrete or steel towers, wire ropes anchored to stone masonry blocks and a light wooden walkway deck

UNCDF as a major contributor began supporting the programme singularly from 1979 and jointly with the Swiss from 1985 onwards up to end of 1995. From 1996 on the programme is being run under a bilateral agreement between RGoB and the Swiss Government. ADB, DANIDA and other donors supported the programme on ad hoc basis.

Involvement of the Swiss facilitated transfer of technical know-how developed in Nepal. Technical norms, standards and designs of the bridges suited the terrain, topography and beneficiary needs of both countries. Bhutanese engineers and technicians received training in Nepal and on-the-job in Bhutan.

The reorganisation of RGoB line agencies and frequent transfer of SBS from one department to another – seven times in 16 years - appears as a prominent feature in the evolution of the bridge programme.

TABLE 8

PERIOD	Evolution and Milestones
1971-1982 (up to end of 4 th Plan)	<p>Public Works Department of RGoB started institutionalised bridge building programme with the assistance of engineers from the Government of India.</p> <p>The SBS was established with the introduction of UNCDF in 1979, Phase I with grant of US \$ 951,000 for the bridge programme.</p> <p>PWD introduced improved suspension bridge design which used wooden, concrete or steel towers, wire ropes anchored to stone masonry blocks and wooden walkway deck. Some 80 bridges of these types were constructed by PWD. Emphasis was on quantity rather than quality.</p>
1982-1987 (5 th Plan)	<p>Evaluation of bridge programme by UNCDF in 1983</p> <p>Beginning of UNCDF Phase II (1986-1992) from January 1984 for constructing 60 bridges. ADB supported 10 bridges in FY 1984/85.</p> <p>Swiss involvement in bridge programme in 1985. Government of Switzerland through SDC supported Phase II.</p> <p>Helvetas Implementation Officer posted at SBS of PWD of the Ministry of Social Services. New bridge designs developed in Nepal adapted to Bhutanese conditions that greatly improved the technical standard of river crossings in Bhutan.</p> <p>128 bridges were built.</p>
1987-1992 (6 th Plan)	<p>End of Phase II and beginning of Phase III.</p> <p>In March 1988 PWD reorganized. SBS was put under PHED of PWD of MoC.</p> <p>Again in April 1989, the PWD was split into DoR and DWH and PHED was put under DWH of MoC.</p> <p>Joint evaluation of bridge programme in 1988 by UNCDF and Swiss Government.</p> <p>In September 1991, DoR and DWH merged into DWH&R. SBS remained under PHES.</p> <p>Technical co-operation with Helvetas Nepal. Bhutanese engineers received training in SBD Nepal.</p> <p>54 bridges were completed under UNCDF Phase III.</p>
1992-1997 (7 th Plan)	<p>In October 1993, a joint mission from UNCDF, SDC/Helvetas and RGoB evaluated Phase III</p> <p>Engineering scholarships introduced in 1990 with Helvetas funding.</p> <p>In September 1994 the SBS was relocated under the Roads Sector of PWD.</p> <p>In June 1995, SBS was placed directly under the supervision of the Director, PWD.</p> <p>From 1996 the Swiss Government continued assisting the Suspension Bridge Programme with financial and technical Assistance on a bilateral basis. Helvetas was entrusted with the implementation of the programme.</p> <p>52 new bridges were constructed. Cost Nu 577,000 (US \$ 12,800) per bridge. 182 existing bridges were maintained. Maintenance cost Nu 2,912,000 (US \$ 64,700)</p> <p>Steel walkway decks introduced replacing un-durable wooden decks.</p>

PERIOD	Evolution and Milestones
1997-2002 (8 th Plan)	<p>In July 1999 PWD was reorganized. SBS was put under DUDES of MoWHS.</p> <p>14 bridges washed away by flash floods of 2000. Helvetas Bhutan supported reconstruction of 7 bridges.</p> <p>67 bridges were completed and 185 existing bridges were maintained.</p>
2002-2007 (9 th Plan)	<p>Construction planned for 50 new bridges and retrofitting of steel walkway deck on another 50 old bridges.</p> <p>DANIDA support for reconstruction of 6 washed away bridges.</p> <p>Helvetas Bhutan supported construction of a traditional wooden bridge (Baazam) in Thimphu. Cost Nu. 540,000 (US \$ 12,000)</p> <p>Digitisation of standard LSTB drawings was completed in 2004.</p> <p>In September 2005 SBS was placed under RISD of DUDES.</p> <p>Dissemination of maintenance concept at Dzongkhag and Gewog level and nomination of Bridge caretakers following bridge maintenance policy.</p> <p>Introduction of Power Tiller Bridges on farm roads in September, 2006</p> <p>In July 2006, introduction of economical SSTB technology to SBS and Dzongkhag Engineers with support from Helvetas Nepal.</p> <p>Process to introduce Maintenance concept launched, 2006</p> <p>50 bridges are completed (as at June, 2006)</p>

Impact Assessment

Impact assessment of Helvetas supported bridges in Nepal and Bhutan were done following different methodologies. In the Nepalese context the study was more focussed on impact in terms of **'learning'** while in the case of Bhutan the study concentrated more in terms of **'gains'**. 'Learning' and 'gains' of one country to the other apply with equal fervour.

Building a bridge makes an enormous impact in the life and livelihood of the people within its area of influence – some quantifiable but mostly unquantifiable. A bridge lends an identity, an address to the place where it is built. Like ripples in a pond, the impacts are most pronounced in the immediate vicinity but get diffused with distance.

Zone of Influence and Beneficiaries

The impact assessment in Bhutan records the following as an example of the zone of influence of 50 trail bridges spread over 18 Dzongkhags.

	Zone of Influence Gewogs	Zone of Influence Villages	Households	Population	Male	Female
30 bridges studied	42	202	4,737	39,208	18,688	20,520
20 bridges not studied*	26	150	3,500	28,000	13,440	14,560
TOTAL	68	352	8,237	67,208	32,128	35,080

* Estimated figures

The zone of influence of 30 bridges includes 202 villages under 42 Gewogs of 14 Dzongkhags. Total number of beneficiary household is 4,737. Approximately 39,208 people (52% women) are benefited. The children population of the zone of influence is about 15,600.

It is estimated that at the end of the project approximately 67,000 people living in 8,237 households of 352 villages under 68 Gewogs of 18 Dzongkhags will directly benefit from the project. It means that more than 10% of the total households in Bhutan will derive benefits from the 50 bridges.

The impact study in Nepal showed that the zone of influence of a bridge primarily depends on the importance of the places the trail links. All other impacts are to varying degrees, circumstantial and reciprocal. The reciprocity depends most importantly on the fordability of the river, distance to and type of the next nearest crossing facility, the lay of the land where the bridge is built, location of settlements, central services and the trail and road network in the vicinity.



Bridges link settlements, Bhutan

Making a durable bridge over a long span un-fordable river at strategic locations or potential growth centres make a very big and intense impact. The volume of traffic even in the wet season is found to increase by as much as 308%. The flow of goods across the bridge increased from a mere 2 tons to 27 tons – a phenomenal 1,350% increase.

However, making durable bridges over fordable rivers or as replacement for existing temporary crossings on established trails do alleviate risks and discomforts but durable crossings alone do not make a significant impact for changing the content and volume of traffic, the points of origin and destination and flow and type of goods moving along a trail. Therefore, each bridge is unique with respect to its impacts. Location is the governing factor.

Primary Impact and Time Savings

Safety, convenience and time saving are the three invariable, constant and **primary impacts** of durable bridges. Round the clock accessibility to the other bank at all times allows people to plan their work activities according to their convenience and enables them to respond to emergencies. This psychological advantage is immense but incalculable.

Crossing torrential Himalayan rivers on foot or by means of dugout boats is a risk-filled undertaking. People, animals get swept away and dugout boats overturned when least expected incurring loss of life and dismemberment of limbs. A bridge effectively abolishes such risks. The benefits are incalculable.

A bridge shortcuts long detours to the next nearest crossing where such exists, else diverts traffic towards the trail it connects and saves much time and effort. The bridge at Molung Dobhan in Nepal diverts traffic from the traditional main trail to the district headquarter saving as much as 4 hours for each traveller. Many bridges in the remote corners of Nepal and Bhutan abolish the need to make day long detours over rough trails and terrain.

Accounting only for time savings in pure value terms and in a very conservative manner (at US \$ 0.07 per hour), the **return on investment** of the three bridges surveyed in Nepal is found to be quite impressive – in the range of 18% to a phenomenal 169%.

In Bhutan traffic at 23 bridge sites (after construction) were found to increase almost by 100%. The time savings are recorded at 11,748 hours per day equivalent to 528,660 man days per year.

Socio-political and Cultural Impact

In Nepal, formation of an all-inclusive UC with representation of ethnic, dalit and 30% women is mandatory in the process of community bridge building. Direct facilitation by Helvetas staff in the initial phases and, as the programme widened, through local NGO staff reaching out to the remotest corners of the country has directly contributed to socially and politically activate the hitherto marginalized people to participate in the decision making processes affecting their lives and livelihoods. Community bridges in Nepal have not only bridged the banks of the Himalayan

rivers but also bridged the traditional social divide between the elites and the dalits and between men and women. Replication of such inclusiveness and representation in other development sectors has helped to transform Nepalese society and eased democratic and decentralisation processes overall.

During and after the construction of the bridge, socio-cultural exchanges and interactions multiply. Marked increases in nuptial links among villagers from opposite banks are observed. Ease of mobility lead to an appreciable increase in the frequency of social gatherings, village meetings and visits to friends and relatives and to places of religious and cultural importance. The socio-political and cultural impacts are incalculable.



Bride, Groom and party crossing the bridge. Nepal

Economic Impact

A bridge is not a destination in itself and therefore apart from the value of time savings as a primary impact, it is to be reckoned that all other quantifiable impacts



Uninterrupted flow of daily needs! Nepal

come adulterated. Socio-economic considerations, location of central services and other development activities invariably get entwined. Economic impacts are the result of integrated efforts of a number of development programmes which are inter-related and inter-dependent. The full impact is only likely to be realized over a number of years when other complimentary investment programmes in the fields of agriculture, irrigation, extension

services, health care, education, etc. are implemented. Trail bridges are nerves of economic prosperity that bring evolutionary changes to the formerly isolated parts in both countries.

The impact assessment in Bhutan records the following economic and other impacts and benefits brought about by the construction of bridges. The overall socio-economic impact is most marked at locations that facilitate increased accessibility to the road head, markets, and Dzongkhag headquarters.

Increase in Agricultural Production

With the construction of bridges, import of agricultural inputs to remote villages and export of outputs to markets are greatly facilitated. Villagers are able to develop backward and forward linkages with the markets. As a result some villagers have introduced new products for export.

The available data provide the following indications of increase in output.

	Production 1989 (before constr.) In 1'000 Nu	Production 1992 (after constr.) In 1'000 Nu	Increase in value in 1'000 Nu	Increase in value in %
Maize	15,568	16,835	1,267	8.1
Paddy	18,827	22,098	3,271	17.4
Wheat	11,573	13,442	1,869	16.1
Millet	3,316	3,520	204	6.2
Cash crops	13,443	15,354	1,911	14.2
Cheese	6,889	7,315	426	6.2
Cardamom	0	5,800	5,800	

In the zone of influence increased production of different agricultural crops (6 to 17%) and introduction of new crops (vegetables, large cardamom, mushroom etc.) is observed. Cash crops such as oranges, apples and chillies are commercialized. Improvement in livestock population is facilitated due to increased access to grazing lands and forests.

Increase in Household Income

Except for a few cases, increase in household income is substantial. Total value of domestic output has increased from Nu 49 million to 65 million. The average household income has increased from Nu 17,000 per year to Nu 22,500, representing an increase of 32% after the construction of new bridges. The most important reason for the increase in household income is the increase in marketable surplus of cash crops.

Development of Women and Children

In Bhutan, approximately 35,000 women (including girls) and 27,000 children (boys and girls) in 68 Gewogs are benefiting from the project; 14,875 women are benefiting directly. The bridges have strengthened their role at home as money makers and outside home as contributors to national development.

- a. **Agricultural products:** Women play significant role in cultivation, harvesting as well as in marketing of agricultural products. Construction of bridges facilitates easy access to markets for existing products and cash crops.
- b. **Weaving:** About 270 units are commercialized and more than 2,000 women are engaged in weaving and knitting activities. It is expected that the number of women in such activities will increase as the procurement of yarn and materials required and marketing of products are facilitated by the bridges.
- c. **Household prosperity:** Bridges improve access to and from remote villages and contribute in increasing women's income. Women's role in household has been enhanced and village communities have realized the importance of women's role in children's education, health, nutritious food, good clothing etc.

Impact on Health

Increase in access to health facilities through bridges has a two fold benefit:

- a. Bridge users are able to reach medical centres
- b. Department of Health and other health institutions have easy access to villages to provide medicines and medical facilities

People have become more health conscious in the project areas. Visits to medical services increased by 18% affecting long term impact on increase in the life expectancy of the beneficiaries.

Impact on Education

Bridges figure as one important reason for an increase in student enrolment in schools by 12%. Direct benefits of trail bridges on the education sector:

- a. Transport facilities to World Food Programme food stuff and educational materials
- b. Teachers do not hesitate to get transferred to villages which were previously considered quite remote
- c. Enrolment of student has increased

Other Benefits

Trade Sector

Increased access to and from markets has evolved changes in trading and marketing practices as well as in the development of entrepreneurship in the zone of influence.

- a) Access to and from 21 market centres to the remote villages has greatly improved
- b) After the construction of bridges, not only has the number of retail outlets increased but their turnover has also increased by 15% within a couple of years

Introduction of other Development Activities

Following are the development activities in the zones of influence of the bridges.

- | | |
|----------------------------------|-------------|
| a. Rural roads | 5 Sectors |
| b. Rural credit facilities | 11 Gewogs |
| c. Rural Water Supply | 17 Projects |
| d. Basic Health Units | 14 Units |
| e. Community/Primary Schools | 32 Units |
| f. Animal Husbandry Offices | 2 Units |
| g. Improved stoves | 1 Project |
| h. Agricultural extension office | 1 Unit |
| i. Irrigation channels | 1 Project |
| j. Mule-track project | 1 Project |

BOX 4: The Impact Factor

'Life saving, time saving, convenient and around the clock accessibility' briefly sums up the utility of a bridge. But the impact horizon of a safe crossing on the lives of its users and its vicinity is impossible to determine and evaluate in its entirety unless the evaluation norm is over-simplified to a count of time savings of the traffic that crosses it!

A bridge is not a destination in itself. But as a means for enhanced mobility to reach a destination, no sector of social, cultural, economic life, environment and development remains unaffected by a bridge. Counting doesn't work! How does one count the impact of regular attendance at school of a group of students, or that of a single teacher facilitated by a safe crossing? How does one count the emergence of an entirely new settlement, a market venue, a health post and a library at a bridge entrance? And still, how does one evaluate the changes in the lifestyle of a settlement of boatmen turned businessmen and farmers, their families and generations because of a single bridge?

All one can say is, the impact of a bridge is enormously positive in all respects. In that sense, accounting for costs (that can be counted) and benefits of a bridge (that defies estimation!) is naïve calculation! Location is the overriding important factor that multiplies, magnifies the impact of a bridge. A bridge contributes enormously towards alleviation of poverty, hardship, grief and sorrow. It generates safety, opportunities and hope. And the impact simply lasts for posterity!



BEFORE



AFTER

The impact of the bridge at Sitkaghat, Nepal. Settlement and market came up simultaneously with the construction of the bridge. The overall impacts are incalculable!

Learning

Many insights and learning can be derived from the Swiss experience in pedestrian trail bridge building in the Himalayas. They can be summarised as follows:

Institutional Aspects

From the very beginning the funding agency must be engaged in the development and exchange of know-how and must work together with local expertise. This will pave the path to decentralisation.

It is not conceivable to design a perfect institutional arrangement from the very beginning. An institution must be open to learning. Research and innovation must be a continuous practice and changes should be made to suit local requirements.

Technology must be simplified and standardized. Norms and specifications must be established. Dissemination of knowledge on a broader scale through established educational institutions and through direct training courses will ensure availability of required human resources and skills in the private sector.

Management tools for strategic planning and decision-making as well as monitoring and evaluation are key to decentralisation and consensus. It also diffuses undue influences. Such tools, and the skills to use them, need to be made available to local bodies. Pertaining information must be kept updated.

'Institutionalised capacity building' as opposed to 'institutional capacity building' needs adequate attention. Whereas the former relates to long term organized dissemination of knowledge and know-how, the latter relates to the development of physical amenities, systems, rules and regulations of an institution. Without adequate autonomy, the institution will remain governed by the law of the land, prevalent systems, rules and regulations that may not necessarily be conducive to the different approaches of development work.

Institutional continuity and stability linked to institutional memory are important. Frequent shuffling of the institution and employees from one department to another breaks continuity of purpose and creates a loss of institutional memory. Even if immediate execution work may not be perturbed, implementation of mid and long term strategies and policies will be hampered.

Community Work

Local people have the potential to develop leadership in development work. Identifying the right person with potential requires continued interaction with the local people.

Encouraging participation of minorities and women in decision-making is initially difficult, but with facilitating support *this must be and can be achieved from the **very beginning***. This helps to dilute the stagnant orthodoxy in the communities, ensures representative decisions and creates an open society. Inclusiveness ensures equity, wider participation and ownership preventing conflict situations and enhances stability.

Local initiatives and local commitment based on social capital is the key for ownership and sustainability. Community-led bridges are found to be highly conflict sensitive. Creating local initiatives and commitment requires rigorous efforts through social mobilisation. Without social organisational support, bridge building with community support becomes a matter of compulsion rather than spontaneous acts of commitment.

The combination of a process (decentralisation) with a product (trail bridge) is an ideal basis for successful and sustainable development.

Contribution of voluntary, free labour required from each household towards communal infrastructure projects called *Jana Sramadan* in Nepal and *Zhupto Lemi* in Bhutan bears the danger of creating social disparities during the implementation process - the poor contributing the most while the rich profiting the most. This because safe, easy, round the clock access to markets for agriculture and livestock products means the benefit from a bridge is relatively greater for the rich than the poor for the same amount of labour contribution.

The supporting agency must gain trust of the communities on reciprocal behaviour on its part. Transparency and clarity are all important. Pre-negotiated, pre-defined responsibilities must be fulfilled without excuses.

Different, often opposing, approaches and implementation modalities of donors can confuse and immobilize local communities and initiatives. Uniformity in approach and implementation modality helps participation and motivation of beneficiaries.

A public audit facilitated by a neutral third party after final inspection of the bridge is necessary to satisfy the community on transparency and to bolster the feeling of ownership.

Bridge Location and Impact

Location is the all-important factor that defines the utility and impact of a bridge. Building a bridge at a geologically sound location will ensure its longevity but if that place is not suitable in socio-economic respects, its use, utility and impact will be limited.

The impact of a bridge on its location is reciprocal in that socio-economic activities generated by a bridge will in turn enhance the utility and impact of the bridge – a kind of spontaneous multiplying effect. People's traffic and destination alignments can change due to the location of a bridge. A futuristic perspective of the surrounding area and settlement pattern has tremendous potential to enhance the utility and impact of a bridge and therefore must be well considered especially when fixing the location of LSTBs.

Political and Legal Framework

Decentralisation of development work cannot be effective without the political will and trust to let go into the hands of the people who are the ultimate beneficiaries. Irrespective of the system of governance, an open development policy that allows direct partnership between donors, local governments and the beneficiaries can abundantly accomplish simple and intermediate technology infrastructures without central government interventions.

Decentralisation works only with knowledge dissemination. Privatisation, too, can succeed only when there is an abundance of skilled manpower in the market. Building blocks of decentralisation are a pre-requisite for decentralisation to be effective.

In a democratic set-up, local governments being in proximity with the people who elect them can perform admirably in their interest provided there exists well defined and pragmatic guidelines and procedures for performance. The idea is to marry political energy to managerial efficiency.

In either country financial decentralisation has not devolved to the desired level. Revenues collected by local governments fall far short of requirements for infrastructure works and therefore decisions made by the communities and the local bodies without a financial foundation keep their decisions in a limbo till finances are disbursed from the centre or made available through external sources.

Transparency and ownership needs to be ensured by disseminating information on the roles and responsibilities of each stakeholder at the very beginning and by conducting a mid-term and a final performance audit in public.

Adequate legal rules and regulations conducive to decentralisation need to be framed to help people assert their rights to decision-making and development.



A Community meeting in progress, Bhutan

Looking Back

Trail Bridge Building in the Himalayas has bridged long lost people from 'formidable, forbidden' lands to modern civilisation. Bridges ensure access to basic necessities of life, education and health, safely, conveniently and round the clock. To and fro across the trail bridges and surrounding them, economic activities flourish to drive away isolation and poverty. Inclusive, democratic processes for bridging the people have contributed towards the improvement of the living conditions of the economically and socially disadvantaged. The impacts last for posterity. The technology and the social processes are being replicated by the people themselves ensuring many more bridges and other local infrastructures besides.

Mobility in the Himalayas has greatly increased in the past few decades. And it can only get better! SDC, Helvetas, patrons and partners can take satisfaction in a mission accomplished!



A crossing accomplished! Nepal

Looking Forward

Both Nepal and Bhutan are undergoing political transformation from monolithic, feudalistic societies and systems to a more democratic, representative and decentralized systems. Nepal is already committed towards an autonomous federal structure. Aid agencies aiming at the economically and socially disadvantaged will need to connect more and more with local governments and communities.

As vehicular transport makes inroads to the remote hinterlands, local governments and communities will increasingly prioritize and commit their resources for farm and feeder roads to connect the numerous settlements off the main highways. Agriculture being the mainstay of the rural economy, and the likelihood of it remaining so in the foreseeable future, the demand for short span bridges on rural roads with a width that can, at the least, accommodate small power tillers for bulk transport of agricultural inputs and outputs will increase. The trend is clearly evident in Bhutan! This demand in both countries will need to be addressed. As capacities for planning and execution of rural infrastructures become institutionalized in local governments and the private sector, following the example in Nepal, a support mechanism allowing 'foreign' material support and post-financing linked to quality and timely performance through an all inclusive, representative and democratic processes will need to be developed, sustained and monitored. At all times, care must be taken to ensure that the beneficiaries remain in the driver's seat!

ANNEX - I

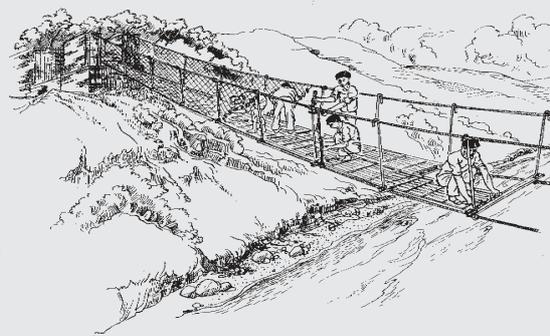
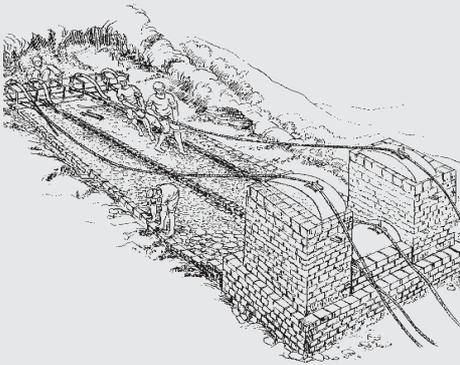
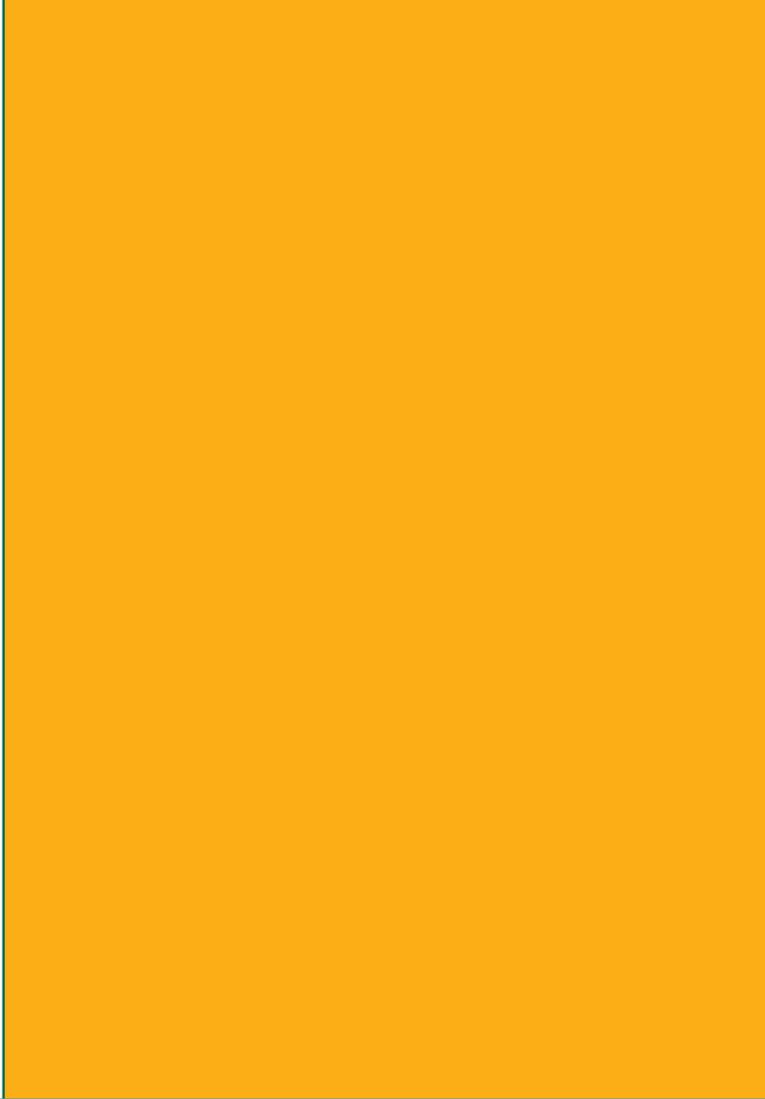
List of manuals that are an integral part of the LIDP, Trail Bridge Strategy, 2006

1. **Short Span Trail Bridge Standard**
Technical Handbook for Suspended Type Volume - I, II and III (2003)
2. **Shot Span Trail Bridge Standard**
Technical Handbook for Suspension Type Volume - I, II and III. (2003)
3. **Long Span Trail Bridge Manual**
Volume A : Design (2004)
Volume B : Survey (1983)
Volume C : Standard Drawings (2004)
Volume D : Construction (1990)
4. **Steel Truss Bridge Manual (2005)**
5. **Social Organisational Support Manual (2005)**
6. **Manual for Consulting Services (2004)**
7. **Manual for Contractors (2005)**
8. **Quality Control Manual (2005)**
9. **A Training Course Manual on Trail Bridges for Practitioner Engineers (2003)**
10. **A Training Course Manual on Trail Bridges for Practitioner Overseers (2003)**
11. **A Training Course Manual on Trail Bridges for Practitioner Sub-Overseers (2003)**
12. **A Course Manual on Trail Bridges for Bachelor of Civil Engineering (2003)**
13. **A Course Manual on Trail Bridges for Diploma in Civil Engineering (2003)**
14. **A Course Manual on Trail Bridges for Sub-Overseers (2003)**
15. **Routine Maintenance Manual (1999)**
16. **Demonstration Model Bridge Training Manual (2004)**

ANNEX – II

Technical Specifications

Norms/Standards	LSTB	SSTB
Designated Traffic	Human and Animals	Human and Animals
Live Load	Uniformly distributed load ~ 4.0 kN/m ²	Uniformly distributed load ~ 4.0 kN/m ²
Design Wind Speed	160 km/hr	160 km/hr
Walkway Type	Un-stiffened, steel cross beams and hangers / suspenders	Un-stiffened, steel cross beams and hangers / suspenders
Walkway Width	1.20 m for Suspension and 1.00 m for Suspended	1.06 m for Suspension and 0.7 or 1.0 m for Suspended
Walkway Deck	Galvanized steel deck using 40x40x3 Angles	Galvanized steel deck using 40x40x3 Angles
Tower (Pylon)	Steel structure hinged type construction	Steel structure hinged type construction
Rust Prevention	Hot-dip galvanisation	Hot-dip galvanisation
Suspenders in Suspension type	Made of 12 and 16 mm steel bars of chain links at the spacing of 1.20 m	Made of 12 and 16 mm steel bars of chain links at the spacing of 1.20 m
Wire Ropes	7x19 Pre-stretched Wire Ropes of Wire Strand Core. Heavy Galvanized having tensile designation of 1570 N / mm ²	7x19 Pre-stretched Wire Ropes of Wire Strand Core. Heavy Galvanized having tensile designation of 1570 N / mm ²
Wind Bracing System	Windguy Cables and Wind-ties in parabolic arrangement	Not Applicable in general
Freeboard	5.0 m (minimum)	5.0 m (minimum)
Anchorage Foundation	Concrete and Stone Masonry	Concrete and Stone Masonry
Design Life	>50 years	>50 years



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